Appendix E

Applicant's Environmental Report

Operating License Renewal Stage

Vermont Yankee Nuclear Power Station

Introduction

Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc. (hereafter referred to as "Entergy") submit this Environmental Report in conjunction with the application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating license for Vermont Yankee Nuclear Power Station (VYNPS) for twenty years beyond the end of the current license. In compliance with applicable NRC requirements, this ER analyzes potential environmental impacts associated with renewal of the VYNPS operating license. This ER is designed to assist the NRC staff with the preparation of the VYNPS specific Supplemental Environmental Impact Statement required for license renewal.

The VYNPS ER is provided in accordance with 10 CFR 54.23, which requires license renewal applicants to submit a supplement to the ER that complies with the requirements of Subpart A of 10 CFR 51. This report also addresses the more detailed requirements of NRC environmental regulations in 10 CFR 51.45 and 10 CFR 51.53, as well as the underlying intent of the National Environmental Policy Act, 42 U.S.C. §4321 et seq. For major federal actions, the NEPA requires federal agencies to prepare a detailed statement that addresses significant environmental impacts, adverse environmental effects that cannot be avoided if the proposal is implemented, alternatives to the proposed action, and irreversible and irretrievable commitments of resources associated with implementation of the proposed action.

Supplement 1 to Regulatory Guide 4.2, “Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses,” was used as guidance on the format and content of this ER. The level of information provided on the various topics and issues in this ER are commensurate with the environmental significance of the particular topic or issue.

Based upon the evaluations discussed in this ER, Entergy concludes that the environmental impacts associated with renewal of the VYNPS operating license are small. No major plant refurbishment activities have been identified as necessary to support the continued operation of VYNPS beyond the end of the existing operating license term. Although normal plant maintenance activities may later be performed for economic and operational reasons, no significant environmental impacts associated with such refurbishments are expected.

The application to renew the operating license of VYNPS assumes that licensed activities are now conducted, and will continue to be conducted, in accordance with the facility's current licensing basis (e.g., use of low enriched uranium fuel only). Changes made to the current licensing basis of VYNPS during the staff review of this application are to be made in accordance with the Atomic Energy Act of 1954, as amended, and in accordance with Commission regulations.

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Attachment B
U. S. Fish and Wildlife Service Correspondence

Attachment C
Vermont Division for Historic Programs (SHPO) Correspondence

Attachment D
VYNPS NPDES Permit VT0000264 (VDEC Permit No. 3-1199)

Attachment E
Severe Accident Mitigation Alternatives Analysis

Attachment F
Ecological Studies of the Connecticut River (2002)

ACRONYMS AND ABBREVIATIONS

ABWR	advanced boiling water reactor
ACE	U. S. Army Corps of Engineer
AEC	Atomic Energy Commission
ALARA	as low as reasonably achievable
AOG	advanced off-gas
BP	before present
Btu	British thermal unit
BWR	boiling water reactor
CaO	calcium oxide (lime)
CaSO4 2H2O	calcium sulfate dihydrate
CDEP	Connecticut Department of Environmental Protection
CDF	core damage frequency
CEQ	Council on Environmental Quality
CET	containment event tree
CFR	Code of Federal Regulations
cfs	cubic feet per second
CO	carbon monoxide
COE	cost of enhancement
CWA	Clean Water Act
DAW	dry active waste
DOE	U. S. Department of Energy

Acronyms and Abbreviations (continued)

DOT	U. S. Department of Transportation
DSM	demand side management
ECCS	emergency core cooling system
ECP	Environmental Compliance Services
EEI	Edison Electric Institute
EIA	Energy Information Administration
Entergy VY	Entergy Nuclear Vermont Yankee
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ER	environmental report
FERC	Federal Energy Regulatory Commission
FES	Final Environmental Statement
FIVE	fire induced vulnerability evaluation
ft	feet
ft^3	cubic feet
GE	General Electric
GEIS	Generic Environmental Impact Statement
GIS	geographic information system
gpd	gallons per day
gpm	gallons per minute

Acronyms and Abbreviations (continued)

hr	hour
IPE	individual plant examination
IPEEE	individual plant examination of external events
ISO	International Standards Organization
Kr	krypton
kV	kilovolts
kW	kilowatt
kWh	kilowatt-hour
lb	pound
LOCA	loss of coolant accident
LPCI	low pressure core injection
m^3	cubic meters
MA	Massachusetts
MACCS2	Melcor Accident Consequences Code System 2
mGy	milligray
ml	milliliter
MMBtu	million British thermal unit
mrad	millirad
mrem	millirem
MSL	mean sea level

Acronyms and Abbreviations (continued)

mSv	millisievert
MT	metric ton
MW	megawatt
MWD/MTU	megawatt day/metric ton uranium
MWe	megawatts, electric
MWh	megawatt hour
MWt	megawatts, thermal
NA	not applicable
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NESC	National Electric Safety Code
NH	New Hampshire
NHL	National Historic Landmark
NOx	nitrogen oxide(s)
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NRR	(Office of) Nuclear Reactor Regulation
NU	Northeast Utilities
NU-PSNH	Northeast Utilities - Public Service Company of New Hampshire
NUREG	U. S. Nuclear Regulatory Commission Document

Acronyms and Abbreviations (continued)

ODCM	Offsite Dose Calculation Manual
OL	Operating License
PCS	power conversion systems
PM10	particulate matter (particulate matter with a nominal size of less than 10 microns)
PSA	probabilistic safety assessment
PV	solar photovoltaic
RCRA	Resource Conservation and Recovery Act
rem	roentgen equivalent man
RPV	reactor pressure vessel
RRW	risk reduction worth
S	sulfur
SAMA	severe accident mitigation alternative
SAMDA	severe accident mitigation design alternative
SCR	selective catalytic reduction
SEIS	Supplemental Environmental Impact Statement
SER	supplemental environmental report
SHPO	State Historic Preservation Officer
SMA	seismic margin assessment
SOx	sulfur oxide(s)
SO_2	sulfur dioxide

Acronyms and Abbreviations (continued)

SRV	safety relief valve
TSP	total suspended particulates
TVA	Tennessee Valley Authority
USCB	U. S. Census Bureau
USDA	U. S. Department of Agriculture
USFWS	U. S. Fish and Wildlife Service
USWAG	Utility Solid Waste Activities Group
VAT	Vermont Agency of Transportation
VDEC	Vermont Department of Environmental Conservation
VDH	Vermont Department of Health
VDHP	Vermont Division of Historic Preservation
VELCO	Vermont Electric Power Company
VNNHP	Vermont Nongame and Natural Heritage Program
VPD	vehicles per day
VSA	Vermont Statutes Annotated
VT	Vermont
VYNPS	Vermont Yankee Nuclear Power Station
Xe	xenon
yr	year
ºF	degrees Fahrenheit

1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

For license renewal, the NRC has adopted the following definition of purpose and need, stated in Section 1.3 of NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*: "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) decision makers."

Nuclear power plants are licensed by the NRC to operate up to 40 years, and the licenses may be renewed [10 CFR 50.51] for periods up to 20 years. As stated in 10 CFR 54.17(c), "[a]n application for a renewed license may not be submitted to the Commission earlier than 20 years before the expiration of the operating license currently in effect."

The proposed action is to extend the operating license for VYNPS for a period of 20 years beyond the current operating license expiration date. For VYNPS (Facility Operating License DPR-28), the requested renewal would extend the existing license expiration date from midnight March 21, 2012, until midnight March 21, 2032.

2.0 SITE AND ENVIRONMENTAL INTERFACES

2.1 Location and Features

Vermont Yankee Nuclear Power Station is located in the town of Vernon, Vermont, in Windham County on the west shore of the Connecticut River immediately upstream of the Vernon Hydroelectric Station. The site contains approximately 125 acres owned by Entergy and a narrow strip of land between the Connecticut River and the east boundary of the VYNPS property to which Entergy has perpetual rights and easements from its owner. This land is bounded on the north, south, and west by privately-owned land and on the east by the Connecticut River [Reference 2-8, Section 2.2.1]. The nearest urban area within 10 miles of the site is the town of Brattleboro, Vermont, which is located approximately 5 miles upriver [Reference 2-8, Section 2.2.3]. The location of the site is shown in Figure 2-1 and Figure 2-2.

The immediate area around the station is completely enclosed by a fence with access to the station controlled at a security gate. Access to the site is possible from either Governor Hunt Road (main entrance), a local road or from a spur of the Central Vermont Railroad [Reference 2-8, Section 1.6.1.1.4]. The site is surrounded by a 0.17-mile radius exclusion area as shown in Figure 2-3 [Reference 2-8, Section 2.2.4]. The nearest residences lie outside the site boundary to the southwest at 0.26 miles [Reference 2-7, Table 1].

The nearest towns with populations of 25,000 or more are Northampton, Massachusetts, and Amherst, Massachusetts, located south of VYNPS at approximately 30 miles and 28 miles, respectively [Reference 2-8, Section 2.2.2]. The region within ten miles of the site includes the city of Brattleboro, the nearest urbanized area. The areas adjacent to the station are primarily farm and pasture lands. Downstream of the plant are the Vernon Hydroelectric Station and the town of Vernon, Vermont. The area within a 5-mile radius is predominantly rural with the exception of a portion of the town of Brattleboro, Vermont, and the town of Hinsdale, New Hampshire. Between 75% and 80% of the area within 5 miles of the station is wooded. The remainder is occupied by farms and small industries. [Reference 2-8, Section 1.6.1.1.5]

There are no Native American lands within a 50-mile radius of VYNPS [Reference 2-25]. State and federal lands within a 50-mile radius of VYNPS are shown in Figure 2-4.

VYNPS features include the containment building, auxiliary building, turbine building, intake structure, discharge structure, cooling towers, switchyard, and associated transmission lines. Figure 3-1 shows the general features of the VYNPS site. Section 3.2 describes key features of VYNPS, including reactor and containment systems, cooling and auxiliary water systems, radwaste system, and transmission facilities.

2.2 Aquatic and Riparian Ecological Communities

The Connecticut River and its riverine ponds are used by industry, chiefly for hydroelectric peak power generation, and, to some extent, by the general public for recreational purposes. Recreational uses include canoeing, boating, water skiing, swimming and sport fishing. There are no public water supply intakes located on the Connecticut River downstream of VYNPS. In addition, there are no commercial fisheries on the Connecticut River near VYNPS.

The lower Connecticut River (Vermont Planning Basin No. 13) at VYNPS meets the criteria and designated uses of Class B waters in Vermont (see Section 4-13 of the Vermont Water Quality Standards). Based on Section 3-04 of the Vermont Water Quality Standards, Class B waters include the following designated uses: aquatic biota, wildlife, and aquatic habitat; aesthetics; public water supply; irrigation of crops and other agricultural uses; swimming and other primary contact recreation; and boating, fishing, and other recreational uses. This reach of the Connecticut River is not an Outstanding Resource Water as defined by the Vermont Water Resources Board.

VYNPS is located 0.75 miles upriver of Vernon Dam on a reach of the Connecticut River known as Vernon Pool. Vernon Pool extends upstream about 25 miles to the foot of the Bellows Falls Dam in Bellows Falls, Vermont, and comprises 2,250 acres of water retained at a full-pond elevation of 220.13 feet behind the Vernon Dam and Hydroelectric Station. [Reference 2-15, Section 3.1.1]

Connecticut River flows are highly controlled by hydroelectric generation activities both upstream and downstream of VYNPS. There are nine hydroelectric dams and three storage dams on the main-stem Connecticut River upstream of Vernon Dam, and there are three hydroelectric dams and one pumped-storage facility downstream [Reference 2-15, Section 3.1.2]. Although storage in the Vernon head-pond provides some flexibility of flow release from Vernon Dam, independent of inflow, the upriver hydro stations and Vernon Station are generally operated more or less in unison to maximize power output during times of peak power demand. The hourly flow record for Vernon Dam provides direct evidence of the highly regulated nature of the entire river.

Vernon Dam, licensed by the Federal Energy Regulatory Commission (FERC) as Project No. 1094, is one of a series of dams constructed on the Connecticut River for hydroelectric and flood control purposes [Reference 2-8, Section 2.4.1]. The Vernon Dam and Hydroelectric Station is owned and operated by TransCanada. Since 1979, FERC has required the operators to maintain a minimum sustained flow of 1,250 cfs, or the inflow, if it is less than 1,250 cfs [Reference 2-8, Section 2.4.4]. The Northfield Mountain Hydroelectric Project is a pump-back storage facility located approximately 20 miles downstream from Vernon Dam. The Connecticut Light and Power Company owns and operates the facility. The nearest dam upstream from the VYNPS site is located at a distance of about 25 miles. Further upstream at distances of 150 and 260 miles are two large storage reservoirs. The drainage area upstream of Vernon Dam is 6,266 square miles.

Average and extreme stream flows at Vernon Dam for the period 1944-1988 are shown in Table 2-1 [Reference 2-8, Table 2.4.1.]. The highest recorded flow of the Connecticut River near VYNPS was 176,000 cfs, which occurred during the flood of March 1936 [Reference 2-2, Section II.E.2].

Water temperature as measured near VYNPS varies from 32°F to 84°F with the daily variations rarely exceeding 2°F. From December through March the water temperature averages 35°F, and from July through September it averages between 70°F to 77°F [Reference 2-2, Section II.E.2]. Based on a 316(a) demonstration conducted in support of a request for increased

discharge temperature limits, it was determined that thermal stratification was highly unlikely [Reference 2-15, Section 3.2.4].

Table 2-1
Connecticut River Average and Extreme Stream Flow Values Below Vernon Dam, 1944-1988

Month	Average Monthly Flow (cfs)	Highest Average Monthly Flow (cfs)	Lowest Average Monthly Flow (cfs)	Lowest Average Weekly Flow (cfs)
October	6,571	20,201	1,646	1,475
November	9,033	20,450	3,366	2,159
December	9,486	24,326	2,934	2,494
January	7,655	17,338	2,589	2,283
February	8,187	24,428	2,935	2,135
March	15,544	36,245	5,308	4,373
April	30,799	51,210	14,980	11,523
May	18,047	38,790	7,262	3,118
June	8,768	21,890	3,387	2,424
July	4,911	21,790	1,841	1,033
August	4,005	13,615	1,805	1,223
September	4,159	15,610	1,650	1,138

Source: Reference 2-8, Table 2.4.1

VYNPS has conducted extensive environmental studies at the site for over 30 years. Many of these studies have specifically addressed potential impacts to macroinvertebrates, larval fish, adult fish and anadromous fish populations. Summarized below is information which was obtained during studies conducted between 1968 through 2004.

2.2.1 Macroinvertebrate Communities

An important component of the aquatic environment is the population of macroinvertebrates, which are small animals without backbones that can be seen with the naked eye. Examples of macroinvertebrates include organisms such as aquatic insects, snails, worms and crayfish.

Macroinvertebrate populations in the Connecticut River upstream and downstream of Vernon Dam have been routinely sampled since 1988. Sampling is conducted in June, August and

October at four stations using both dredge and artificial substrate methods. During a monitoring period of 1988-1997, a total of 93,295 organisms were collected representing nine invertebrate phyla. These phyla included Crustacea, Diptera, Ephemeroptera, Gastropoda, Hydrazoa, Oligochaeta, Pelecypoda, Trichoptera and Tricladida. The major composition of the macroinvertebrate community consisted of dipterans (39%), oligochaetes (21%), and pelecypods (10%) [Reference 2-13, Section 2.0]. Although the abundance of each phyla varied throughout the year at each station, relative numbers of organisms were similar at stations located in pools above and below Vernon Dam.

In 2001, specific monitoring programs were implemented to detect the possible presence of Asiatic clams (*Corbicula fluminea*) and zebra mussels (*Drissenia polymorpha*) in the Connecticut River near VYNPS [Reference 2-14, Section 6.0]. These non-native mollusks are of interest due to their potential to foul water intake and piping systems. Monitoring of planktonic larval stages of Asiatic clams and zebra mussels was conducted by collecting filtered, 1000-liter samples of the river water between May and October. The presence of juvenile and adult stages of Asiatic clams was monitored by collecting river bottom substrate samples with a ponar dredge. Juvenile and adult zebra mussels were monitored using settling plates suspended in the water column. Through 2004, no Asiatic clams or zebra mussels have been detected in the Connecticut River near VYNPS.

2.2.2 Fish Communities

Few studies of resident fish populations in the Connecticut River near VYNPS were conducted prior to 1969 [Reference 2-2, Section II.F.7]. Based on preoperational studies conducted for VYNPS in 1969 and 1970, thirty-one species of fish were reported to occur in the river.

The most commonly sampled fish were smallmouth bass (*Micropterus dolomieu*), white sucker (*Catostomus commersonii*), yellow perch (*Perca flavesens*) and rock bass (*Centropristis philadelphica*).

During more intensive studies conducted for VYNPS from 1968 through 1989, 3,500 fish collections yielded nearly 83,000 juvenile and adult fish [Reference 2-4, page 35-1]. Collected fish were aged, weighed, measured and identified. During this period of monitoring, as required by the NPDES permit, thirty-nine species of fish were collected. Sampling stations were divided into two groups: upstream of Vernon Dam and downstream of Vernon Dam. Until 1981 when a fish ladder was constructed, the dam represented a barrier to the movement of fish between the upstream and downstream areas. Collections upstream and downstream of the dam revealed both warm-water and cool-water fish existed in both areas.

Sunfishes, including largemouth bass (*Micropterus salmoide*s) and smallmouth bass, represented approximately 30% of the total number of fish collected in both areas. White suckers, yellow perch and white perch were also important components.

Downstream of Vernon Dam, white suckers, smallmouth bass and rock bass were dominant taxa representing about 50% of the total fish collected. Yellow perch and white perch composed

about 5 to 10% of the total number of fish collected at downstream stations. Walleye (*Stizostedion vitreum*) represented less than 5% of the catch.

Upstream of Vernon Dam, yellow perch, white perch and white suckers were numerically dominant taxa. The relative abundance of the two populations of perch was cyclic and tended to be numerically out of phase with each other. Walleye and smallmouth bass were typically collected in low but consistent numbers, each representing about 5% of the total number of fish collected. After fish ladders were constructed at downstream dams in the 1980s, juvenile American shad (*Alosa sapidissima*) were abundant in upstream samples.

A summary report of the required NPDES monitoring of the fish communities between 1986 and 1997 indicated that fish sampling resulted in the collection of 30,302 fish representing 30 species. The most common fish collected were yellow perch (26%); rock bass (11%); pumpkinseed (*Lepomis gibbosus)* (10%); spottail shiner (*Notropis hudsonius)* (9%); and white sucker (9%) [Reference 2-13, Section 3.0]. The environmental monitoring program continues annually in cooperation with the U.S. Fish and Wildlife Service and the States of Vermont, New Hampshire and Massachusetts.

Two important anadromous species occur in the Connecticut River near VYNPS, American shad and Atlantic salmon (*Salmo salar*). Both were extirpated after dams were constructed on the Connecticut River in the 18th, 19th and 20th centuries. Both species are currently undergoing restoration as part of the Anadromous Fish Restoration Program. This program is a cooperative effort among the states of Connecticut, Massachusetts, New Hampshire and Vermont, as well as the United States Bureau of Sport Fisheries and Wildlife and the United States Bureau of Commercial Fisheries. The construction of fish ladders around these dams has facilitated the return of these important species in the upper Connecticut River. Studies have shown that American shad typically begin migrating up the Connecticut River from April through July and spawn in open water. Young shad migrate downstream to the sea in the late summer and fall. The migration and successful spawning of American shad in the vicinity of VYNPS has been monitored since 1981. [Reference 2-5; Reference 2-16]

Although Atlantic salmon have also benefited from the construction of fish ladders at dams on the Connecticut River, the current population is essentially maintained only by stocking of fry and smolts. Other anadromous species observed in low numbers near VYNPS include blueback herring (*Alosa aestivalis*), sea lamprey (*Petromyzon marinus*) and American eel (*Anguilla rostrata*).

Overall, the fish community of the Connecticut River has remained relatively stable during an extensive period of study since 1968 [Reference 2-4, page 35-1]. The community is typically dominated by species such as yellow perch, white perch and white suckers. Sunfishes, including *Lepomis* sp., largemouth bass and smallmouth bass, are also common.

2.2.3 Plankton Communities

Plankton is composed of microscopic free-living forms of plants (phytoplankton) and animals (zooplankton). Limited studies of the phytoplankton communities in the Connecticut River near

VYNPS showed the most abundant population occurred in August, September and October. The density of organisms ranged from 20,000 to 74,000 per liter. The ten most abundant taxa were *Microspora stagnorum*, *Pediastrum spp*., *Scenedesmus* spp., *Tribonema bombycinum*, *Dinobryon cylindricum*, *Melosira varians*, *Tabellaria* spp., *Fragillaria crotonensis*, *Asterionella formosa*, and *Ceratium hirudinella* [Reference 2-2, Section II.F.4].

Similar studies revealed forty-two genera of zooplankton in the Connecticut River. The highest diversity and density of organisms occurred in June through October. The lowest densities occurred in October and November. The most common groups of zooplankton were rotifers, daphnia and nauplii [Reference 2-2, Section II.F.5].

2.2.4 Vascular Aquatic Plants

Approximately 160 species of vascular plants are known to occur along the shoreline and marshes of Vernon Pond [Reference 2-2, Section II.F.3]. Two small marshes are located along the west bank of the river approximately one-half mile upstream and downstream from the VYNPS facility. The dominant flora in these marshes includes water horsetail (*Equisetum fluvaiatile*), bedstraw (*Galium palustre*), cattail (*Typha glauca*), sedge (*Carex crinita*) wool grass (*Scirpus pedicellatus*), water smartweed, (*Polygonum punctatum*) and sweet flag (*Acorus calamus*).

2.3 Groundwater Resources

VYNPS is situated on a glacially derived river terrace, located approximately 30 to 50 feet above the current floodplain of the Connecticut River. This terrace, comprised of glaciolacustrine and fluvial sediments deposited during the last glacial ice age, and have been subsequently incised by the river channel [Reference 2-6, Section 2.2.1]. Groundwater at the site occurs under unconfined conditions within both unconsolidated glacial overburden sediments and underlying fractured bedrock [Reference 2-6, Section 2.3.2].

The local water table level fluctuates differentially depending on the amount of precipitation and is affected by level changes in the Connecticut River. River flooding will cause a temporary reversal in the flow direction of groundwater, so that the local water table will be considerably higher than usual during periods when the river level is high. Natural subsurface drainage is over the rock surface [Reference 2-8, Section 2. 4.2.3.2].

Groundwater levels vary between about 5 feet to 18 feet below ground surface in the northern portion of the site. In the vicinity of the major plant structures, groundwater is approximately 20 feet below ground surface. Along the southern portion of the site, depth to groundwater is approximately 30 feet. Although these levels may vary throughout the year, they do provide a general indication of site area groundwater levels [Reference 2-8, Section 2.4.2.3.2].

Because the river is the natural low point and drainage channel for the region, the groundwater table can be expected to slope toward the river. Surface drainage also will flow toward the river. Thus, it is unlikely that any liquids discharged to the river from the site would mix with domestic water supplies in the area. [Reference 2-8, Section 2.4.8]

At VYNPS, potable water is supplied to various locations from four onsite wells as shown in Table 2-2. These wells are classified as non-transient, non-community public water systems and are permitted and regulated by the State of Vermont. Based on well rating capacity and assuming the wells operate simultaneously, groundwater pump rate could be as high as 123.2 gpm. However based on actual pump rate and measured water usage during 2002 and 2003, maximum rate from all wells was 8.54 gpm. In addition, an estimate of the groundwater demand that would be needed for 1,700 employees on the VYNPS site during a refueling outage was also calculated. Based on this calculation, the maximum groundwater demand would be 35.4 gpm as shown in Table 2-2 [Reference 2-21, Exhibit EN-SAS-7].

VYNPS also has a network of monitoring wells located on the site that are associated with the septic leach fields, existing and proposed landfarm and VYNPS septic spreading fields, and an underground diesel fuel oil release near the turbine building. However, none of these wells are equipped with a pump that withdraws groundwater.

Table 2-2
VYNPS Potable Water Wells

Well	Areas Served	Well Rating (gpm)[a]	Maximum Water Demand (gpm)
Construction Office Building	Construction Office Building	9	6.4
Southwest	Secondary/backup source for West Well	10.5	
West	Main Building complex, Gate House 1 & 2, South Warehouse, and Governor Hunt House	73.7	25.0
Plant Support Building	Support Building	30	4.0
	TOTAL GPM	123.2	35.4

[a] Reference 2-9, Table 1

2.4 Critical and Important Terrestrial Habitats

VYNPS and the New England transmission line right-of-way lies within the hemlock—white pine—northern hardwoods biome of the eastern deciduous forest. This biome ranges from forests of hemlock (*Tsuga* spp.), fir (*Abies* spp.), and white pine (*Pinus* spp.) to mixed deciduous habitat containing species such as maple (*Acer* spp.), beech (*Fagus* spp.), and birch (*Betula* spp.) [Reference 2-19].

Land cover at the site includes mixed softwood and hardwood, and disturbed and early successional habitat. Two small marshes are located along the west bank of the river approximately one-half mile upstream and downstream from the VYNPS facility. The New England transmission line rights-of-way cross the river and a number of small streams and wetlands in addition to forests and farmland.

Mammals in the local area and the New England transmission line rights-of-way include moose (*Alces Americana*), white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), American mink (*Mustela vison*), eastern gray squirrel (*Sciurus carolinensis*), red squirrel (*Sciurus hudsonicus*), eastern chipmunk (*Tamias striatus*), eastern coyote (*Canis latrans*), red fox (*Vulpes vulpes*), grey fox (*Urocyon cinereoargenteus*), black bear (*Euarctos americanus*) and a variety of mice and voles.

The open water of the Connecticut River and emergent wetland habitat supports a number of migrant waterfowl species, including mallard (*Anas platyrhyncos*), Canada goose (*Branta Canadensis*) and American black duck (*Anas rubripes*). In addition, osprey (*Pandion haliaetus*) and bald eagle (*Haliaeetus leucocephalus*) utilize the river areas near the VYNPS site [Reference 2-3].

2.4.1 State Listed Critical or Important Habitats

The Vermont Nongame and Natural Heritage Program (VNNHP) were contacted (see Attachment A) regarding any state-listed critical or important habitats within a 50-mile radius of VYNPS. Critical and important habitats are those areas managed by the state for species of interest. Examples include wintering areas for deer, areas near heron rookeries, and isolated habitats for black bear, amphibians and reptiles. Within Windham County, VNNHP has identified several forested areas within and near the Roaring Brook State Wildlife Management Area as important wintering areas for deer. The nearest area to VYNPS is located along Interstate I-91 approximately two miles west of the plant.

2.4.2 Federal Listed Critical or Important Habitats

As addressed in Section 2.5 below, eleven federally-listed threatened and endangered species potentially occur in the vicinity of VYNPS. Although critical habitat has been designated for the Indiana bat [Reference 2-27] and the gray wolf [Reference 2-28] in portions of the United States, no critical habitat for these species has been designated near VYNPS or any of the nine remaining federally-listed species based on consultation with the Vermont Department of Fish and Wildlife and the U.S. Fish and Wildlife Service (see Attachment A and Attachment B).

2.5 Threatened or Endangered Species

Eleven plant and animal species currently protected under the Endangered Species Act have geographic ranges that extend to the vicinity of the VYNPS site. Animal species are represented by two mammals, one bird, one reptile, one fish, one mussel, and two insects. These include the bald eagle, gray wolf (*Canis lupus*), Indiana bat (*Myotis sodalis*), bog turtle (*Clemmys muhlenbergii*), shortnose sturgeon (*Acipenser brevirostrum*), dwarf wedgemussel (*Alasmidonta heterodon*), Puritan tiger beetle (*Cicindela puritana*), and Karner blue (*Lycaeides melissa*

samuelis). Plant species include Jesup's milk-vetch (*Astragalus robbinsii* var. *jesupi*), northeastern bulrush (*Scirpus ancistrochaetus*), and small whorled pogonia (*Isotria medeoloides*). Of these species the bald eagle, gray wolf, bog turtle, Puritan tiger beetle and small whorled pogonia are listed as threatened; the remaining species are listed as endangered.

Bald eagles are known to occur throughout virtually the entire area near the VYNPS facility. The bald eagle is known to nest along the Connecticut River in New Hampshire and Massachusetts. The closest nesting pair of bald eagles is in New Hampshire, less than one mile south of the facility. The State of Vermont has no known nesting pairs of bald eagles, but the bald eagle is a winter transient throughout the three states [Reference 2-29]. Habitat for wintering bald eagles is generally described as large open waters, i.e., large rivers and lake suitable for foraging. Habitat near the facility would possibly support wintering bald eagles because of the location of the site being near the Connecticut River.

There are historic records of the gray wolf within the area near VYNPS. However, there are no recent records of this species within the area [Reference 2-29].

The Indiana bat is known to occur within Rutland and Bennington Counties, Vermont, which are about 30 miles northwest and west of the site, respectively. There are historic records for this species in Massachusetts and New Hampshire. However, there are no current listed occurrences in the remainder of the area within 50 miles of the plant [Reference 2-29].

Massachusetts lists the bog turtle as occurring within Berkshire County, which is located approximately 50 miles southwest of the VYNPS site. There are no element occurrences of the bog turtle elsewhere near the plant [Reference 2-29].

The shortnose sturgeon has been recorded from the Connecticut River and Merrimack River in Franklin, Hampden and Hampshire Counties, Massachusetts. This anadromous species enters large rivers, such as the Connecticut, to spawn during mid to late spring. Currently three populations are known, i.e., two from the Connecticut River, and one from the Merrimack River. These populations are located at least 20 miles south of the VYNPS facility, downstream of the Turners Falls Hydroelectric Station in Turners Falls, Massachusetts.

The Puritan tiger beetle is known to only occur along beaches of the Connecticut River and has been observed in Massachusetts, i.e., Hampshire County [Reference 2-29]. This species is possibly extirpated in Vermont and New Hampshire, where only historical records are listed. This species is found within the sand and clay cliffs associated with the Connecticut River, where little vegetation is present. As previously noted, only one active colony of the Puritan tiger beetle is known to occur in the region and it is located approximately 30 miles south of the VYNPS facility.

The Karner blue requires dry, sandy areas of open woods in oak savannas where wild lupine (*Lupinus perennis*) is known to occur. The only records for this butterfly near VYNPS are from Merrimack County, New Hampshire, which is about 40 miles northeast of the facility.

The dwarf wedgemussel exists in the Connecticut River in Hampshire and Franklin Counties, Massachusetts; Cheshire and Sullivan Counties, New Hampshire; and Windham and Windsor

Counties, Vermont. Suitable habitats for the dwarf wedgemussel are well-oxygenated streams and rivers with sandy or gravelly bottoms and slow to moderate current [Reference 2-11]. Negative impacts to the species in relation to the facility are unlikely since (1) recent surveys between the Bellows Falls Dam and Vernon did not discover any wedgemussels, and (2) the southernmost finding was in muddy habitat near Rockingham, Vermont, just north of Bellows Falls Dam, which is upstream of VYNPS by about 30 miles. [Reference 2-40]

Jesup's milk-vetch is only known to occur within the Connecticut River valley of both Vermont and New Hampshire, specifically Sullivan County, New Hampshire, and Windsor County, Vermont [Reference 2-29]. Only four individual populations of this plant are known and the total population is estimated to be less than 1,000 individuals. The entire population is known from a 15-mile stretch of the Connecticut River, of which the plants occupy a specific ecotome best described as a disturbed area, which is both ice covered and flooded during portions of the year [Reference 2-12]. Since these populations lie approximately 40 miles north of the VYNPS facility, the possibility of occurrence near the site is unlikely.

Northeastern Bulrush is known to occur in the following counties and states near VYNPS: Sullivan County, New Hampshire; Franklin County, Massachusetts; and Windham County, Vermont. Habitat for this species is described as open herb-dominated wetland areas [Reference 2-12]. Although this species is documented as occurring in Windham County, Vermont, there are only limited areas near the VYNPS facility that could contain suitable habitat for the species.

Small whorled pogonia is listed as occurring within Merrimack County, New Hampshire, and Hampshire, Hampden, and Middlesex Counties, Massachusetts [Reference 2-29]. This species is associated with rich, acidic soils and is often encountered in areas that also contain witch hazel (*Hamamelis virginiana*), beech (*Fagus grandifolia*), and red maple (*Acer rubrum*) [Reference 2-12]. Since there are no known records of this species within 20 miles of the VYNPS facility, the possibility of occurrence near the site is unlikely.

As discussed in Section 2.4, critical habitat has not been designated for any federally listed threatened and endangered species within the vicinity of VYNPS.

2.6 Regional Demography

2.6.1 Regional Population

The *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* presents a population characterization method that is based on two factors: "sparseness" and "proximity"

[Reference 2-17, Section C.1.4]. "Sparseness" measures population density and city size within 20 miles of a site and categorizes the demographic information as follows.

Demographic Categories Based on Sparseness

	Category	
Most sparse	1.	Less than 40 persons per square mile and no community with 25,000 or more persons within 20 miles
	2.	40 to 60 persons per square mile and no community with 25,000 or more persons within 20 miles
	3.	60 to 120 persons per square mile or less than 60 persons per square mile with at least one community with 25,000 or more persons within 20 miles
Least sparse	4.	Greater than or equal to 120 persons per square mile within 20 miles

Source: Reference 2-17

"Proximity" measures population density and city size within 50 miles and categorizes the demographic information as follows.

Demographic Categories Based on Proximity

	Category	
Not in close proximity	1.	No city with 100,000 or more persons and less than 50 persons per square mile within 50 miles
	2.	No city with 100,000 or more persons and between 50 and 190 persons per square mile within 50 miles
	3.	One or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles
In close proximity	4.	Greater than or equal to 190 persons per square mile within 50 miles

Source: Reference 2-17

The GEIS then uses the following matrix to rank the population in the vicinity of the plant as low, medium, or high.

GEIS Sparseness and Proximity Matrix					
		Proximity			
Sparseness		**1**	**2**	**3**	**4**
	1	1.1	1.2	1.3	1.4
	2	2.1	2.2	2.3	2.4
	3	3.1	3.2	3.3	3.4
	4	4.1	4.2	4.3	4.4

Low Population Area

Medium Population Area

High Population Area

Source: Reference 2-17

Entergy used 2000 census data from the U.S. Census Bureau (USCB) to determine demographic characteristics in the VYNPS vicinity. These data were processed at the state, county, and census block levels using ESRI ArcView® geographical information system (GIS) software.

The 2000 census data indicates that approximately 153,409 people live within a 20-mile radius of VYNPS, which equates to a population density of 122.1 persons per square mile. According to the GEIS sparseness index, VYNPS is classified as Category 4 sparseness (having greater than or equal to 120 persons per square mile within 20 miles).

The 2000 census data indicates that approximately 1,513,282 people live within 50 miles of VYNPS, which equates to a population density of 192.6 persons per square mile. According to the GEIS proximity index, VYNPS is classified as Category 4 proximity (greater than or equal to 190 persons per square mile within 50 miles).

According to the GEIS sparseness and proximity matrix, the combination of sparseness Category 4 and proximity Category 4 results in the conclusion that VYNPS is located in a "high" population area.

The area within 50 miles of VYNPS includes portions of four states and seventeen counties as shown in Figure 2-1. According to the 2000 census, the total population of these counties was approximately 4,141,377 as shown in Table 2-3. The total permanent population of these counties within 50 miles of VYNPS was estimated to be approximately 1,513,282 [Reference 2-10].

Projected populations for each county are shown in Table 2-3 through 2032, which is the end of the license renewal period. The total population (including transient populations) of these counties within 50 miles of VYNPS was projected to be approximately 2,347,880 [Reference 2-10].

Table 2-3
State and County Population – 50-Mile Radius Within VYNPS

State and County	2000 Population	2032 Projected Population
Massachusetts	**3,031,326**	**3,244,935**
Berkshire	134,953	111,566
Franklin	71,535	77,231
Hampden	456,228	458,216
Hampshire	152,251	171,085
Middlesex	1,465,396	1,525,102
Worcester	750,963	901,735
New Hampshire	**631,349**	**865,891**
Cheshire	73,825	96,895
Hillsborough	380,841	519,744
Merrimack	136,225	195,622
Sullivan	40,458	53,630
New York	**276,674**	**248,971**
Columbia	63,094	53,578
Rensselaer	152,538	134,620
Washington	61,042	60,593
Vermont	**202,028**	**213,687**
Bennington	36,994	38,106
Rutland	63,400	65,995
Windham	44,216	48,941
Windsor	57,418	60,645
TOTAL POPULATION	**4,141,377**	**4,573,304**

Towns near VYNPS include Brattleboro, Vermont (Windham County), Keene, New Hampshire (Cheshire County), and Greenfield, Massachusetts (Franklin County). According to the 2000 census, the populations of these towns were approximately 12,005, 22,563, and 18,168, respectively. In 2003, Windham, Cheshire, and Franklin Counties had a combined total population of approximately 191,548 (refer to Table 2-4).

From 1990 to 2000, the average annual growth rates for these counties were 0.6% for Windham County, 0.5% for Cheshire County, and 0.2% for Franklin County. All three counties had slower growth rates than rates of their respective states during the same period. From 1990 to 2000, the state-level average annual growth rates were 0.8% for Vermont, 1.1% for New Hampshire and 0.5% for Massachusetts [Reference 2-24].

Table 2-4 shows estimated total populations and average annual growth rates between each census for the three counties with the greatest potential to be socioeconomically affected by license renewal activities at VYNPS. Average annual growth rates for 2003 are based on comparison against 2000 population data and rates for 2032 are based on comparison against 2003 population data.

Table 2-4
Windham County (VT), Cheshire County (NH) & Franklin County (MA)
Population Growth, 1990-2032

	Windham County, VT		Cheshire County, NH		Franklin County, MA	
Year	Population	Average % Annual Growth	Population	Average % Annual Growth	Population	Average % Annual Growth
1990[a]	41,588	—	70,121	—	70,092	—
2000[b]	44,216	0.6	73,825	0.5	71,535	0.2
2003[c]	44,379	0.1	75,965	0.9	72,204	0.3
2032[d]	48,941	0.3	96,895	0.7	77,231	0.2

[a] Reference 2-22
[b] Reference 2-23
[c] Reference 2-24
[d] Reference 2-10

2.6.2 Minority and Low-Income Populations

2.6.2.1 Background

The NRC performs environmental justice analyses utilizing a 50-mile radius around the plant as the environmental "impact site" and the state as the "geographic area" for comparative analysis. This approach is presented below. Since VYNPS is located in close proximity to New Hampshire and Massachusetts, an alternative approach is also addressed which uses a geographic area of New Hampshire, Massachusetts, and Vermont. Both approaches were used for assessing minority and low-income population criteria.

NRC guidance suggests using the most recent USCB decennial census data. The 2000 census population data and TIGER/Line data for Massachusetts, New York, New Hampshire and Vermont were obtained from the USCB web site and processed using ESRI ArcView® GIS software (version 8.1). Population data at the census block level were used to identify the minority and low-income population data within 50 miles of VYNPS. A total of 1,253 census blocks groups were found in this area. The results were compiled and maps were produced showing the geographic location of minority and low-income populations in relation to VYNPS. Information for these block groups was then reviewed with respect to the Nuclear Reactor Regulation criteria [Reference 2-18] for minority and low-income populations.

2.6.2.2 Minority Populations

The NRC Procedural Guidance for Performing Environmental Assessments and Considering Environmental Issues defines a "minority" population as American Indian or Alaskan Native; Asian, Native Hawaiian or Pacific Islander; Black races; other; multi-racial; the aggregate of all minority races; or Hispanic ethnicity [Reference 2-18, page D-8]. The guidance indicates that a minority population exists if either of the two following conditions exists:

> Exceeds 50 Percent - the minority population of the environmental impact site exceeds 50 percent, or
>
> More than 20 Percentage Points Greater - the minority population percentage of the environmental impact site is significantly greater (typically at least 20 percentage points) than the minority population percentage in the geographic area chosen for comparative analysis.

The 2000 census data indicate that 3.2% of the population in Vermont and 12.9% of the population within the three-state area was composed of minorities as shown in Table 2-5. When Vermont is used as the geographic area, any census block group within a 50-mile radius of VYNPS with minority citizens equal to or greater than 23.2% of the total block group population would be considered a "minority population." Using this criterion, 164 of the 1,253 census block groups (13.1%) within 50 miles of VYNPS have minority population percentages which exceed 23.2%. These census block groups are located 30 to 50 miles south and southeast from the site in the areas of Springfield/Northampton and Worcester, Massachusetts, as shown in Figure 2-5.

When the three state areas are used as the geographic area, any census block group within a 50-mile radius of VYNPS with minority citizens equal to or greater than 32.9% of the total block group population would be considered a "minority population." Using this criterion, 115 of the 1,253 census block groups (9.2%) within 50 miles of VYNPS have minority population percentages which exceed 32.9%. These census block groups are located 30 to 50 miles south and southeast of the site in the areas of Springfield/Northampton and Worcester, Massachusetts, as shown in Figure 2-6.

Table 2-5
Minority Population Criteria Using Two Geographic Areas

Geographic Area	White Population	Minority Population	Total Population	Percent Minority	Minority Criterion
Vermont	589,345	19,482	605,553	3.2%	23.2%
Massachusetts New Hampshire Vermont	7,140,686	1,053,024	8,193,710	12.9%	32.9%

Overall, minority populations within the 50-mile radius "impact site" were a small percentage of the overall population. The percentage of census block groups exceeding the minority population criteria was 9.2% when a three-state geographic area was used or 13.1% when only Vermont was used as the geographic area. All minority populations were located between 30 and 50 miles from the site.

2.6.2.3 Low-Income Populations

NRC guidance defines "low-income" using USCB statistical poverty thresholds [Reference 2-18, page D-8]. The guidance identifies an area as a low-income population area if the percentage of households below the poverty level is significantly greater (at least 20 percentage points) than the low-income household percentage in the area chosen for comparative analysis. As addressed above with minority populations, two alternative geographic areas (Vermont and Massachusetts/New Hampshire/Vermont) were used in this analysis.

The 2000 census data indicate that 9.4% of the population in Vermont and 8.9% of the population within the three-state area was low-income as shown in Table 2-6. When Vermont is used as the geographic area, any census block group within a 50-mile radius of VYNPS with low-income population equal to or greater than 29.4% of the total block group population would be considered a "low-income population." Using this criterion, 82 of the 1,253 census block groups (6.5%) within 50 miles of VYNPS have low-income population percentages. Most of these census block groups are located in the area of Springfield/Northampton, Massachusetts, as shown in Figure 2-7. Most of the other low-income populations are dispersed across Massachusetts, while Vermont and New Hampshire each had one low-income population block.

When the three-state area is used as the geographic area, any census block group within a 50-mile radius of VYNPS with low-income populations equal to or greater than 28.9% of the total block group population would be considered a "low-income population." Using this criterion, 86 of the 1,253 census block groups (6.9%) within 50 miles of VYNPS have low-income population percentages which exceed 28.9%. These census block groups are also located in Springfield/ Northampton, Massachusetts, area, while one low-income population block occurred in Vermont and one in New Hampshire as shown in Figure 2-8.

Table 2-6
Low-Income Population Criteria Using Two Geographic Areas

Geographic Area	Total Number of Households	Number of Persons Below Poverty Level	Persons Below Poverty Level (Percent)	Low-Income Criterion
Vermont	240,634	22,619	9.4%	29.4%
Massachusetts New Hampshire Vermont	3,158,820	280,722	8.9%	28.9%

Overall, low-income populations within the 50-mile radius "impact site" were a small percentage of the overall population. The percentage of census block groups exceeding the low-income population criteria was 8.9% when a three-state geographic area was used or 9.4% when only Vermont was used as the geographic area.

As a general matter, there are relatively few low income populations in the geographic areas, most in the Springfield/Northampton area, and none in close proximity to the site.

2.7 Taxes

The Town of Vernon, with a population of 2,119, is the principal local jurisdiction that receives direct tax revenue from VYNPS. As shown inTable 2-7, Entergy pays approximately $1 million per year in property tax to Vernon. In fiscal year 2005, property tax from VYNPS contributed about 40% of Vernon's General Fund, which is utilized for police, fire, roads and other town services.

Little of the property tax paid by Entergy is utilized for the Vernon School District. Education taxes are paid directly to the State of Vermont (see Table 2-7), which funds much of the local school district budget. For the 2005 - 2006 school year, the State of Vermont contributed approximately two-thirds of the Vernon School District's budget of $5.5 million. Most of this education tax funding from the State is allocated by the town to the Vernon School District for the Vernon Elementary School, which is located across Governor Hunt Road from the entrance to VYNPS. A portion of the education tax fund is also allocated for Vernon students attending the

Brattleboro Union High School District #6, which includes the Brattleboro Area Middle School and the Brattleboro Union High School.

Real estate and personal property taxes (see Table 2-7) totaling approximately $150,000 per year are also paid to the local town of Brattleboro, Vermont. These taxes are paid on the assessed value of the Entergy corporate office and training facility located in Brattleboro and are distributed by the town into its general municipal and education funds. No taxes are assessed by Brattleboro on the VYNPS facility.

VYNPS also pays annual taxes to the State of Vermont. These taxes include an electric generation tax, electric generation education tax, income, franchise, sales, excise and use taxes. The electric generation and electric generation education taxes, totaling about $4.5 million in 2005, are assessed according to a rolling 3-year average of the annual net megawatt production at VYNPS. Both taxes are assessed on power plants with generation ratings over 200 megawatts. VYNPS is the only power plant in Vermont in this tax category.

Taxes paid by Entergy have a positive impact on the fiscal condition of Vernon, and continued operation of the plant would provide a significant continuing source of tax revenues to the local community.

Table 2-7
Entergy Estimated Tax Distribution, 2003-2005

Tax	2003[1]	2004[1]	2005[1]
State Electric Generation	2,577,328	2,600,000	2,600,000[2]
State Electric Generation Education	1,874,419	1,887,209	1,900,000[2]
State Income, Franchise, Sales, Use & Excise (Combined)	1,575,764	1,799,894	1,698,521[2]
Vernon Township Property Tax [3]	1,094,520	1,155,960	1,226,944
Brattleboro Township Real Estate & Personal Property Tax[4]	190,152	165,486	143,347
Total	**7,312,183**	**7,608,549**	**7,568,812**

1. Fiscal year extends from July 1st through June 30th of the subsequent year.
2. Projected tax based on mid-year estimates
3. Vernon taxes in 2003 were for calendar year. A property tax of $532,770 was paid for first 6 months of 2004. Town began fiscal year on July 1, 2004.
4. Taxes for Entergy Nuclear Vermont Yankee, LLC corporate office in Brattleboro.

2.8 Land Use Planning

Land use planning focuses on Windham County, Vermont, since the operation of VYNPS and its associated tax base is important to the economy of the county. In Cheshire County, New Hampshire, and Franklin County, Massachusetts, the plant has less influence on land use because the plant has relatively less economic and social affect and does not directly contribute to the tax base of these counties.

2.8.1 Existing Land Use Trends

Windham County occupies roughly 789 square miles (504,958 acres) and major land uses consist of woodland (56%), cropland (29%), pasture land (8%) and other uses (7%) [Reference 2-33]. Windham County is mountainous and hilly with elevations ranging from approximately 4,000 feet above sea level at Mt. Stratton in the northwestern corner of the county to approximately 200 feet above sea level along the Connecticut River in the southeastern corner of the county. Except for narrow alluvial valleys, the area is too steep for intensive farming and development so much of the county is used for woodland and pasture.

Land use trends in Vermont are similar to many areas of the United States where rural lands and farms are being converted to areas of residential, commercial and transportation development. The amount of developed land in Vermont increased 25% between 1982 - 1992, while the state's population grew by only 10%. Forty percent of this new development occurred on what had been cropland or pastureland [Reference 2-36].

Conversion of land to development is less intense in Windham County as compared to state-wide trends. According to the 2002 USDA Census of Agriculture, 397 farms were located in Windham County, which is a 3% increase since 1997. Land acreage associated with farms increased 21% during this period with a total acreage increasing about 20% to over 60,000 acres. The average size of farms also increased 17%, from 133 to 155 acres from 1997 to 2002. Farming commodities include truck crops (melons, potatoes and vegetables), berries and nursery products. The major crop in the county is hay and silage. The major farm commodities in Windham County are cattle and dairy products. [Reference 2-26]

The town of Vernon occupies 19.4 square miles (12,400 acres). Land use in the town has changed little over the last 20 to 30 years. From 1970 to 1990, approximately 425 acres of forest land was converted to non-forested land and 260 acres was developed for the other land uses. The town of Vernon has no zoning ordinances, subdivision ordinances, or a development review board. The town, however, has a Municipal Plan which is reviewed and approved by the Windham Regional Planning Commission. The purpose of the plan is to outline the community's plan for future growth and development. [Reference 2-33]

2.8.2 Future Land Use Trends

Urban sprawl and its associated conversion of forest and farm lands to commercial and residential development is an important issue in Vermont. Since 1970, land use and development in Vermont have been regulated by the State Land Use and Development Law, known simply as Act 250 [Reference 2-20, page 3]. This law created the Vermont Environmental

Board and nine District Environmental Commissions, which conduct a quasi-judicial review of proposed development plans that could have significant environmental, aesthetic, and/or community impacts. Act 250 was intended to provide a balance between economic development and the interests of citizens and government authorities in protecting the environment. Applicants for land use permits must address potential impacts of the project on ten specific criteria. These criteria include adverse affects on a wide range of potential issues including, but not limited to, water and air pollution, water supplies, soil erosion, traffic, education services, wildlife habitat, government services, aesthetics, wetlands and other issues. Act 250 Land Use Permits are required for commercial and industrial construction projects on more than one acre. In some communities, permits are only required for projects of 10 or more acres.

Windham County has experienced low-to-moderate population growth and land use changes in the last 10 years. Most land use changes have occurred in southeastern Vermont and have been associated with recreational facility, resort and vacation home development [Reference 2-35, page 4].

Taxes paid by VYNPS contribute in maintaining the tax rates in Windham County and the Town of Vernon lower than would otherwise be needed to fund the county and local government's current level of public infrastructure and services. This effect could enhance the area's attractiveness as a place to live and possibly influence overall growth and development trends in the county.

2.9 Housing

As of December 2003, VYNPS has a permanent staff of approximately 678 employees. The majority of the employees live in the three-county area of Windham County, Vermont; Cheshire County, New Hampshire; and Franklin County, Massachusetts. As shown in Table 3-1, 289 employees live in Windham County, 172 in Cheshire County and 114 in Franklin County. The remainder of the employees lives in outlying counties in the three-state area, and a few in towns located in Connecticut and New York.

Between 1990 and 2000, the total population of the three counties near VYNPS has increased (Table 2-4). The total population increased approximately from 41,588 to 44,216 in Windham County, from 70,121 to 73,825 in Cheshire County, and from 70,092 to 71,535 in Franklin County. During this same period, the number of housing units increased at about the same pace as the increase in population. In the three-county area near VYNPS, total housing units increased approximately 5% as shown in Table 2-8. Total housing units increased from 25,796 to 27,039 in Windham County, from 30,350 to 31,876 in Cheshire County, and from 30,394 to 31,939 in Franklin County.

The vacancy rates in the three counties changed little from 1990 to 2000 as shown in Table 2-8. Windham County had the highest vacancy rate of approximately 32% in 2000, an increase of 18.1% since 1990. The vacancy rate in Cheshire County decreased from 14.8 to 11.2% and the vacancy rate in Franklin County dropped from 9.1 to about 7.7%. The larger vacancy rate in Windham County was likely due to the larger percentage of units in the county which are designated as having seasonal, recreational and occasional uses.

With the exception of Cheshire County, median home values increased between 1990 and 2000 as shown in Table 2-8. Values increased 12.6% in Windham County and 4.3% in Franklin County. Cheshire County median home values decreased 4.8%. The median monthly rent (contracted) in Windham County increased 22.7% in the 10-year period, while the increase was lower in Cheshire County (12.6%) and Franklin County (14.9%).

Overall, little discernible change in housing availability has occurred in the three-county area near VYNPS since 1990. Vacancy rates have remained relatively stable and the number of available units has kept pace with the low to moderate growth in the area population. Home values and rental rates in the area have remained relatively stable as well.

Table 2-8
Windham County (VT), Cheshire County (NH) & Franklin County (MA)
Housing Statistics, 1990-2000

	1990[1]	2000[2]	% Change
Windham County, VT			
Total Housing Units	25,796	27,039	4.8
Occupied Units	16,264	18,375	13.0
Vacant Units	9,532	8,664	(9.1)
Vacancy Rate (%)	27.1	32.0	18.1
Median House Value ($)	97,200	109,500	12.6
Median Rent ($/month)	383	470	22.7
Cheshire County, NH			
Total Housing Units	30,350	31,876	5.0
Occupied Units	25,856	28,299	9.5
Vacant Units	4,494	3,577	(20.4)
Vacancy Rate (%)	14.8	11.2	(24.3)
Median House Value ($)	110,600	105,300	(4.8)
Median Rent ($/month)	449	523	12.6
Franklin County, MA			
Total Housing Units	30,394	31,939	5.1
Occupied Units	27,640	29,466	6.6
Vacant Units	2,754	2,473	(10.2)
Vacancy Rate (%)	9.1	7.7	(15.4)
Median House Value ($)	114,100	119,000	4.3
Median Rent ($/month)	402	462	14.9

1. U.S. Census Bureau. State and County Quick Facts: Windham County, VT; Cheshire County, NH; Franklin County, MA. Table DP-1 (General Population and Housing Characteristics: 1990).
2. U.S. Census Bureau. State and County Quick Facts: Windham County, VT; Cheshire County, NH; Franklin County, MA. Tables DP-1 (Profile of General Demographic Characteristics: 2000), QT-H1 (General Housing Characteristics:2000), GCT-H9 (Financial Housing Characteristics:2000), QT-H12 (Contract Rent and Gross Rent:2000)

2.10 Social Services and Public Facilities

2.10.1 Public Water Supply

VYNPS does not utilize public water supplies for plant operations but instead relies on surface water from the Connecticut River and groundwater from onsite potable wells.

Community water systems within 10 miles of VYNPS utilize both groundwater and surface water sources. Groundwater is the primary source for community water systems serving 60% of the population in the region [Reference 2-37, page 1]. Vermont's groundwater water quality is generally good, but contamination can and does occur locally. Major contaminants include bacteria and nitrates.

Table 2-9 lists source and capacity information on major community water supply systems within 10 miles of the site [Reference 2-8, Section 2.4.2.3.1]. Large areas of rural Windham County, Vermont; Cheshire County, New Hampshire; and Franklin County, Massachusetts, are not served by community water supplies. Private water supplies rely on groundwater and springs as sources. Within a 1-mile radius of the VYNPS site, over 50 wells, ranging in depth from approximately 15 feet to over 350 feet, supply water for domestic and farm use [Reference 2-8, Table 2.4.5].

Table 2-9
Major Community Water Supply Systems Within 10-Mile Radius of VYNPS

Public Water System	Source	Capacity (GPD)
Brattleboro, Vermont	Lake and Reservoir	3,000,000
Brattleboro, Vermont - Supplemental	Wells	3,218,400
Hinsdale, New Hampshire	Wells	1,036,800
Winchester, New Hampshire	Wells	600,000
Northfield, Massachusetts	Reservoir Wells	244,000
Bernardston, Massachusetts	Wells	1,121,200

In the vicinity of the site there is also a considerable amount of groundwater which several municipalities utilize as one source of water supply. [Reference 2-8, Section 1.6.1.1.8] However, there is sufficient groundwater in the area to provide wells for public as well as private use. [Reference 2-8, Section 2.4.2.1] As already discussed, VYNPS utilizes surface water from the Connecticut River and groundwater from onsite potable wells.

2.10.2 Transportation

2.10.2.1 Windham County

The major highway system in Windham County, Vermont, is Interstate I-91, which runs north and south along the Connecticut River valley (Figure 2-2). In addition, two-lane U.S. Highway 5 runs parallel to I-91. The primary state highways in Windham County include Highways 9 and 30. Highway 9 connects Brattleboro with Bennington, Vermont, to the west. Highway 30 winds northwest from Brattleboro through the Green Mountains and connects with U.S. Highway 7 in western Vermont. Access to the VYNPS site is from State Highway 142, which follows the Connecticut River between Brattleboro and the Massachusetts state line. Highway 142 provides access to the VYNPS site from two intersections with Governor Hunt Road (Figure 2-2).

The Vermont Agency of Transportation (VAT) provides biennial updates on traffic counts of state highways [Reference 2-32]. A summary of VAT estimates for average annual daily traffic counts on Highway 142 north and south of the VYNPS site is shown in Table 2-10.

Table 2-10
Average Annual Daily Traffic Counts on Highway 142 Near VYNPS, 1990-2002

Location	1990	1992	1994	1996	1998	2000	2002
State Hwy 142 between the north end of Governor Hunt Road and Tyler Hill Road	3,440	2,895	2,940	4,400	4,500	5,300	5,100
State Hwy 142 between the south end of Governor Hunt Road and Lily Pond Road	3,160	2,660	2,700	2,500	2,600	2,600	2,500

2.10.2.2 Cheshire and Franklin Counties

Cheshire County, New Hampshire, is not served by an interstate highway system but has ready access to Interstate I-91 to the west and Interstate I-89 to the east. Major roads in the county include State Highways 9, 10, 12 and 101. Highway 9 connects the Interstate 89/U.S. Highway 202 area near Concord, New Hampshire, with Keene, New Hampshire, and crosses the Connecticut River near Brattleboro, Vermont. Highways 10 and 12 connect Keene, New Hampshire, with Interstate I-91 near Northfield, Massachusetts, and Westminster, Vermont, respectively.

Franklin County, Massachusetts, is served by the north-south Interstate I-91 corridor, as well as U.S. Highway 5 which parallels the interstate highway. State Highway 2, the major east-west highway in the area, connects Greenfield, Massachusetts, with New York to the west and the Orange/Athol, Massachusetts, area to the east.

2.11 Meteorological and Air Quality

VYNPS is located in the town of Vernon, Vermont, in Windham County on the west shore of the Connecticut River immediately upstream of the Vernon Hydroelectric Station [Reference 2-8, Section 2.2.1]. The Connecticut River traverses the area near the site from north to south, along the eastern side of the Vernon area, geographically separating the states of Vermont and New Hampshire at this point. A strip of lowlands and terraces, about one mile in width, borders the river in the area. There are naturally dissected uplands with an average local relief of several hundred feet east and west of the lowlands. Wantastiguet Mountain, 0.5 mile east of Brattleboro, is the highest point in the area with an elevation of 1351 feet MSL. The lowest point is on the Connecticut River near Northfield, Massachusetts, with an elevation of 175 feet MSL. [Reference 2-8, Section 2.5.2.4.1]

Windham County is mild in the summer and extremely cold in the winter. Based on previous climatological records for the Vernon area, mean daily maximum temperatures range from about 34ºF in January to about 83ºF in July with mean daily minimum temperatures ranging from about 11ºF in January to about 56ºF in July [Reference 2-8, Table 2.3.2]. Precipitation averages 43 inches per year and is distributed rather evenly throughout the 12-month period [Reference 2-8, Section 2.3.5.2]. Although the Vernon area is subjected to a wide range of snowfall which may be as little as 30 inches or as much as 118 inches since it is located in the northeastern part of the United States, snowfall amounts typically average approximately 60 inches per year [Reference 2-8, Section 2.3.5.3]. Based on the "Index of Tornado Damage Potential," the probability of a tornado striking the site is small [Reference 2-8, Section 2.3.6.3].

Vermont is in attainment with the National Ambient Air Quality Standards [Reference 2-1]. The nearest non-attainment areas due to the one-hour ozone standard are Hillsborough County, New Hampshire, approximately 30 miles northeast of VYNPS, and the entire state of Massachusetts, approximately 5 miles south of VYNPS.

The Lye Brook Wilderness Area, which is the only wilderness area within a 50-mile radius of the VYNPS site and within the State of Vermont, is designated in 40CFR81.41 as a mandatory Class I Federal area in which visibility is an important value. The Lye Brook Wilderness Area is approximately 35 miles northwest of the VYNPS site.

VYNPS has house heating boilers, waste oil furnaces and diesel generators located on-site. Since emissions from the boilers and furnaces are less than 10 tons per year and the generators operate less than 100 hours per year, these sources are regulated under an Air Source Registration issued by the VDEC in accordance with the Vermont Air Pollution Control regulations. This registration limits the fuel usage and hours of operation of these emission sources.

2.12 Historic and Archaeological Resources

The Vermont Division of Historic Preservation (VDHP) reviews proposed projects for potential impacts to historic buildings and structures, historic districts, historic landscapes and settings [Reference 2-34] under three regulations:

- Section 106 of the National Historic Preservation Act of 1966. The VDHP reviews projects when a federal agency is involved with the project. It is the federal agency's responsibility to seek comments about the project from the VDHP.

- 22 V.S.A. 14, the Vermont Historic Preservation Act, on behalf of the Vermont Advisory Council on Historic Preservation. The VDHP reviews projects when a state agency is involved with the project. It is the state agency's responsibility to seek comments about the project from the VDHP.

- Criterion 8, 10 V.S.A., Chapter 151 (Act 250). The VDHP reviews Criterion 8 of Act 250 permit applications. If a project requires an Act 250 permit, the VDHP will review project information submitted directly by a permit applicant or will review the information contained in the original application submitted to the Agency of Natural Resources.

The VDHP is the primary contact for the two historic registers that track Vermont's historic resources. The National Register of Historic Places (NRHP) is the official federal listing of significant historic, architectural, and archaeological resources. The Vermont State Register of Historic Places is the list of significant historic and prehistoric resources throughout Vermont.

2.12.1 Prehistoric Era

The area around the VYNPS site has a long period of prehistoric and historic Native American and historic Euroamerican resources. The Connecticut River valley has an archaeological sequence that extends back about 12,000 years, although human use of the region was probably very limited during the first few thousand years of human presence [Reference 2-39]. Similar to much of the surrounding New England area, archaeological periods defined for this part of Vermont fall into several sequential cultural periods of Native American occupation: the Paleo-Indian era (about 12,000 BP to 9000 BP), the Archaic era (9,000 BP to 3,000 BP), and the Woodland era (3,000 BP to 400 BP).

Prehistory ends with the coming of Europeans in the 17th century (Contact Period) and the introduction to history in written documents. Initially, relations between Indians and Europeans were amicable. This situation was short-lived, as settlers encroached on Indian lands, resources and culture, and relationships thus deteriorated. Several altercations took place during the Contact Period. These include King Philip's War (1675-1676), Queen Anne's War (early 1700s), Father Ralle's War (1724), King George's War (1743-1748), the French and Indian War (1754-1763), as well as many others.

In time, the Europeans forced the Native Americans off their lands. After two centuries of battle, many Native Americans moved out of New England. They chose to live with other groups, less affected by European presence. Some Native Americans stayed closer to home and endured hardship at the hands of European settlers. In New England, descendants of these Native Americans may still be found living close to ancestral lands.

Evidence of prehistoric Native American sites in Vermont is typically located near an existing or relic water source. Models to accurately predict the location of these types of sites, however,

have not yet been developed and their locations are not easily predicted. Since the adoption of the National Historic Preservation Act, the VDHP deals with these sites on a case-by-case basis as they require consideration during proposed development and sometimes require protection.

The Vermont Archeological Society was contacted during the early stages of site construction for information related to any known archeological resources in the vicinity of the VYNPS site [Reference 2-2, Section II.D]. There were no known archeological surveys completed in the area and no published survey of resources was available. Extensive subsurface archeological excavation, however, was performed at the site before construction began. No significant archeological resources were identified at the site during construction.

2.12.2 Historic Era

Vermont has approximately 716 historic properties which are listed in or eligible for the NRHP [Reference 2-30]. Seventy-five of the NRHP properties are located in Windham County (Table 2-11) [Reference 2-30]. The property closest to the VYNPS site is the Pond Road Chapel located approximately 3 miles south of the site. Vermont has 17 sites on the register of National Historic Landmarks (NHL), which are also included on the above NRHP list [Reference 2-31]. Two of these NHL sites are located in Windham County. The Naulakha site, located approximately 15 miles north of VYNPS, is the historic 19th century residence of author Rudyard Kipling. The Rockingham Meeting House is located approximately 36 miles north of VYNPS.

The VDHP maintains Vermont's State Register of Historic Places, which includes archeological sites, historic buildings, structures, and landscapes. The Historic Sites and Structures Survey is the official list of all such sites that are significant for their historic, architectural, or engineering merit. Nominated sites are reviewed by the Vermont Advisory Council on Historic Preservation, which officially votes to enter it on the State Register of Historic Places. The Council is a review board appointed by the governor with expertise in architecture, architectural history, archeology, history, and related fields. Although not yet complete for many towns, the survey already contains over 30,000 properties.

The closest property to VYNPS of historical significance (or listed on the State Register of Historic Places) is the Governor Hunt House located near the entrance to the VYNPS site (Figure 3-1). This 18th century home was once owned by Jonathan Hunt. He was born in Northfield, Massachusetts, in 1738 and was elected Lieutenant Governor of Vermont in 1794 [Reference 2-2, Section II.D]. The Hunt house was constructed in the early 1780s near the Connecticut River. Mr. Hunt's wife suggested the name Vernon for the new town organized near their new home. The structure is currently owned by the VYNPS facility and used as a meeting facility. No other historical sites exist in the immediate vicinity of VYNPS.

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Table 2-11
National Register of Historic Places, Windham County, VT

Resource Name	City
Adams Gristmill Warehouse	Rockingham
Bartonsville Covered Bridge	Bartonsville
Bellows Falls Co-operative Creamery Complex	Rockingham
Bellows Falls Downtown Historic District *	Bellows Falls
Bellows Falls Neighborhood Historic District *	Rockingham
Bellows Falls Petroglyph Site (VT-WD-8)	Bellows Falls
Bellows Falls Times Building	Rockingham
Brattleboro Downtown Historic District *	Brattleboro
Brattleboro Retreat	Brattleboro
Brooks House	Brattleboro
Canal Street Schoolhouse	Brattleboro
Canal Street—Clark Street Neighborhood Historic District *	Brattleboro
Christ Church	Guilford
Crawford, Theophilus, House	Putney
Creamery Covered Bridge	Brattleboro
Crows Nest	Wilmington
District No. 1 Schoolhouse	Somerset
Dover Town Hall	Dover
East Putney Brook Stone Arch Bridge	East Putney
Estey Organ Company Factory	Brattleboro
First Congregational Church and Meetinghouse	Townshend
Follett Stone Arch Bridge Historic District *	Townshend
Gratton Congregational Church and Chapel	Grafton
Green River Covered Bridge	Green River
Green River Crib Dam	Guilford
Grout, Lewis, House	Brattleboro
Guilford Center Meetinghouse	Guilford
Hall Covered Bridge	Bellows Falls
Hall, William A., House	Rockingham
Harris, William, House	Brattleboro

Table 2-11
National Register of Historic Places, Windham County, VT
(Continued)

Resource Name	City
Holbrook, Deacon John, House	Brattleboro
Howard Hardware Storehouse	Rockingham
Kidder Covered Bridge	Grafton
Londonderry Town House	South Londonderry
Medburyville Bridge	Wilmington
Milldean and Alexander--Davis House	Grafton
Miss Bellows Falls Diner	Bellows Falls
Moore and Thompson Paper Mill Complex	Bellows Falls
Naulakha	Dummerston
Newfane Village Historic District *	Newfane
Oak Hill Cemetery Chapel	Bellows Falls
Old Brick Church	Athens
Park Farm	Grafton
Parker Hill Rural Historic District *	Rockingham
Pond Road Chapel	Vernon
Putney Village Historic District *	Putney
Rice Farm Road Bridge	Dummerston
Robertson Paper Company Complex	Rockingham
Rockingham Meetinghouse	Rockingham
Round Schoolhouse	Brookline
Sabine—Wheat Farm	Putney
Sacketts Brook Stone Arch Bridge	Putney
Saxtons River Village Historic District *	Saxtons River
Scott Covered Bridge	Townshend
Scott Farm Historic District *	Dummerston
Simpsonville Stone Arch Bridge	Townshend
South Londonderry Village Historic District *	South Londonderry
South Newfane Bridge	Newfane
South Windham Village Historic District *	Windham
Stratton Mountain Lookout Tower	Stratton
Townshend State Park *	Townshend

Table 2-11
National Register of Historic Places, Windham County, VT
(Continued)

Resource Name	City
Union Station	Brattleboro
West Brattleboro Green Historic District	Brattleboro
West Dover Village Historic District *	Dover
West Dummerston Covered Bridge	Dummerston
West Townshend Stone Arch Bridge	West Townshend
West Townshend Village Historic District *	West Townshend
Westminster Village Historic District *	Westminster
Wheelock House	Townshend
Williams River Route 5 Bridge	Rockingham
Williamsville Covered Bridge	Newfane
Wilmington Village Historic District *	Wilmington
Windham Village Historic District *	Windham
Worrall Covered Bridge	Rockingham
Wyatt, Arthur D. and Emma J, House	Brattleboro

*These sites are also listed as Vermont State Historic Districts [Reference 2-38].

2.13 Related Federal Project Activities

Entergy has applied to the NRC for a license amendment to allow an extended power uprate increasing the maximum thermal power at VYNPS from 1593 MWt to 1912 MWt. The NRC has issued a [draft] Environmental Assessment concluding that the uprate will not result in a significant environmental impact. The impacts evaluated in this environmental report consider extended operations at the increased power levels associated with this uprate.

During the preparation of this report, Entergy did not identify any other known or reasonably foreseeable federal projects or other activities that could contribute to the cumulative environmental impacts of license renewal at VYNPS.

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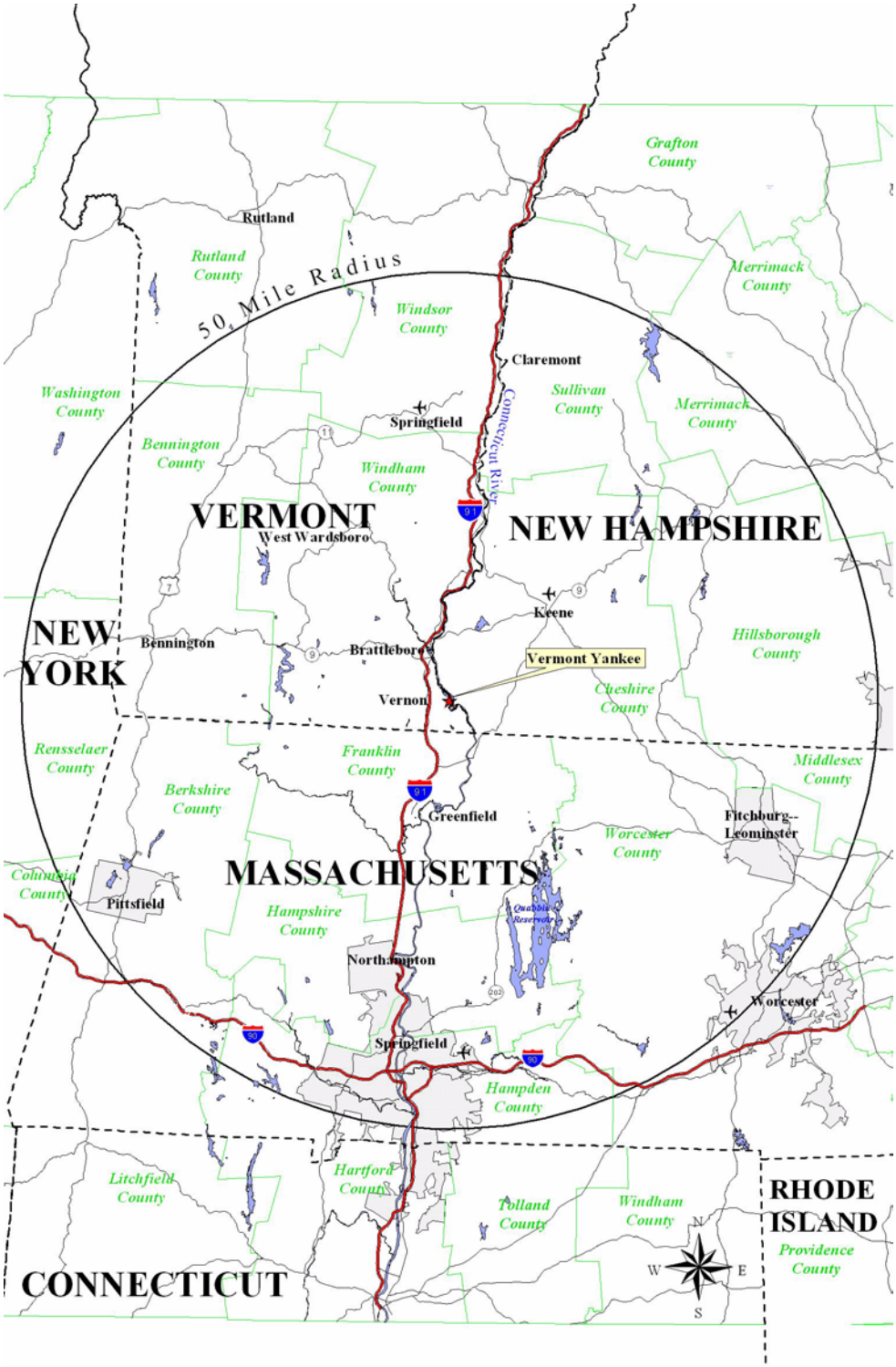

Figure 2-1
Location of VYNPS

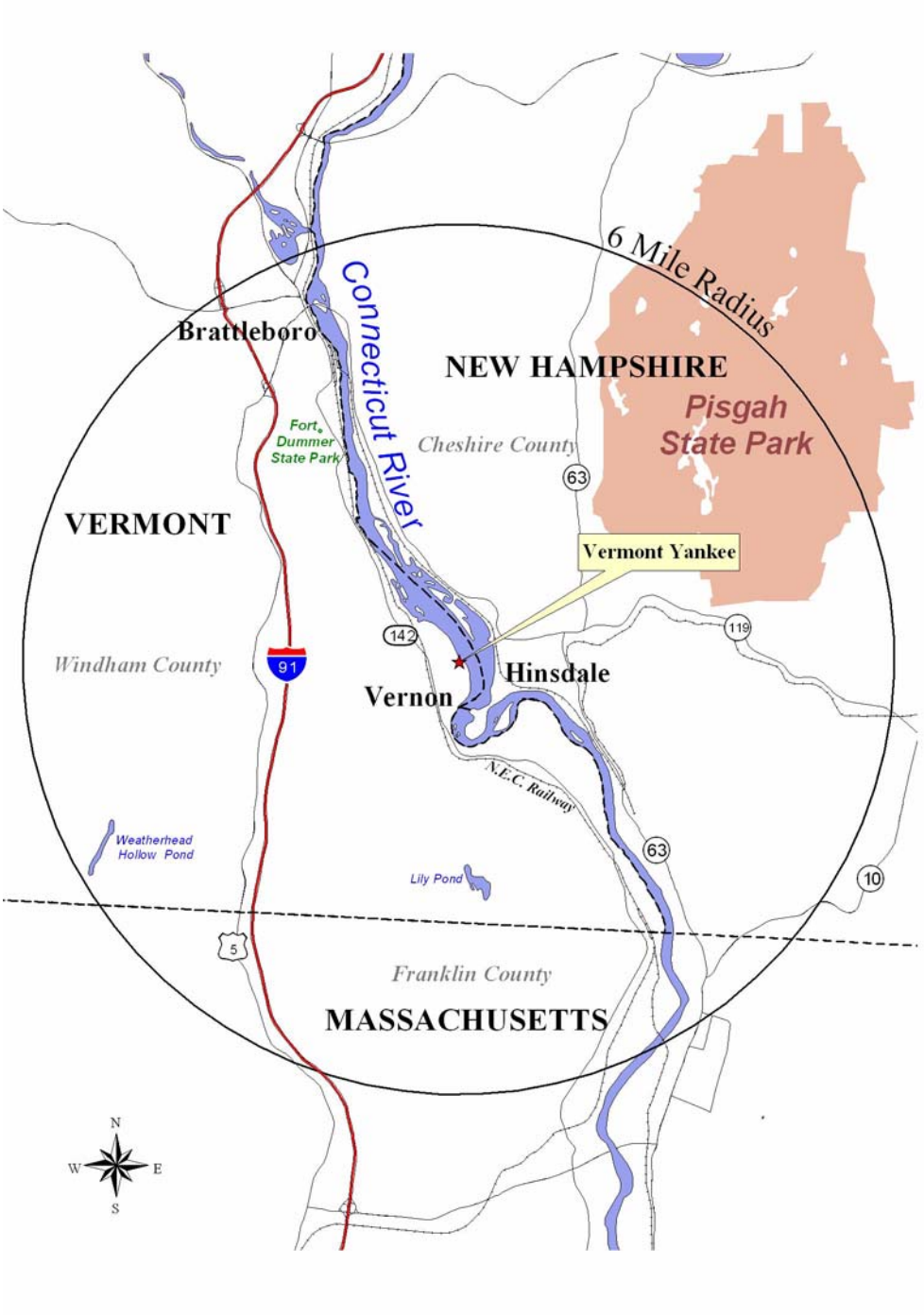

Figure 2-2
General Area Near VYNPS

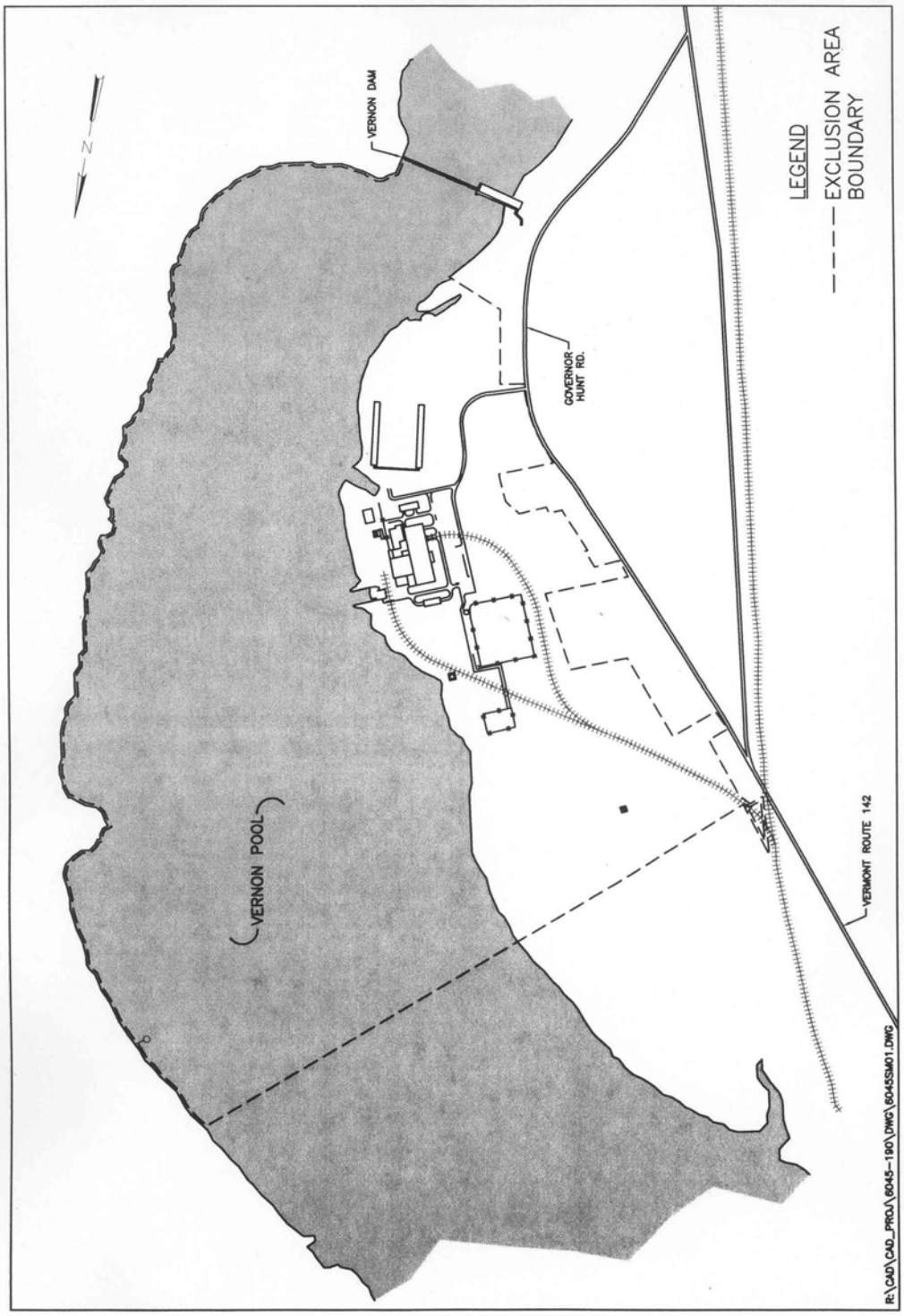

Figure 2-3
VYNPS Exclusion Zone and Features

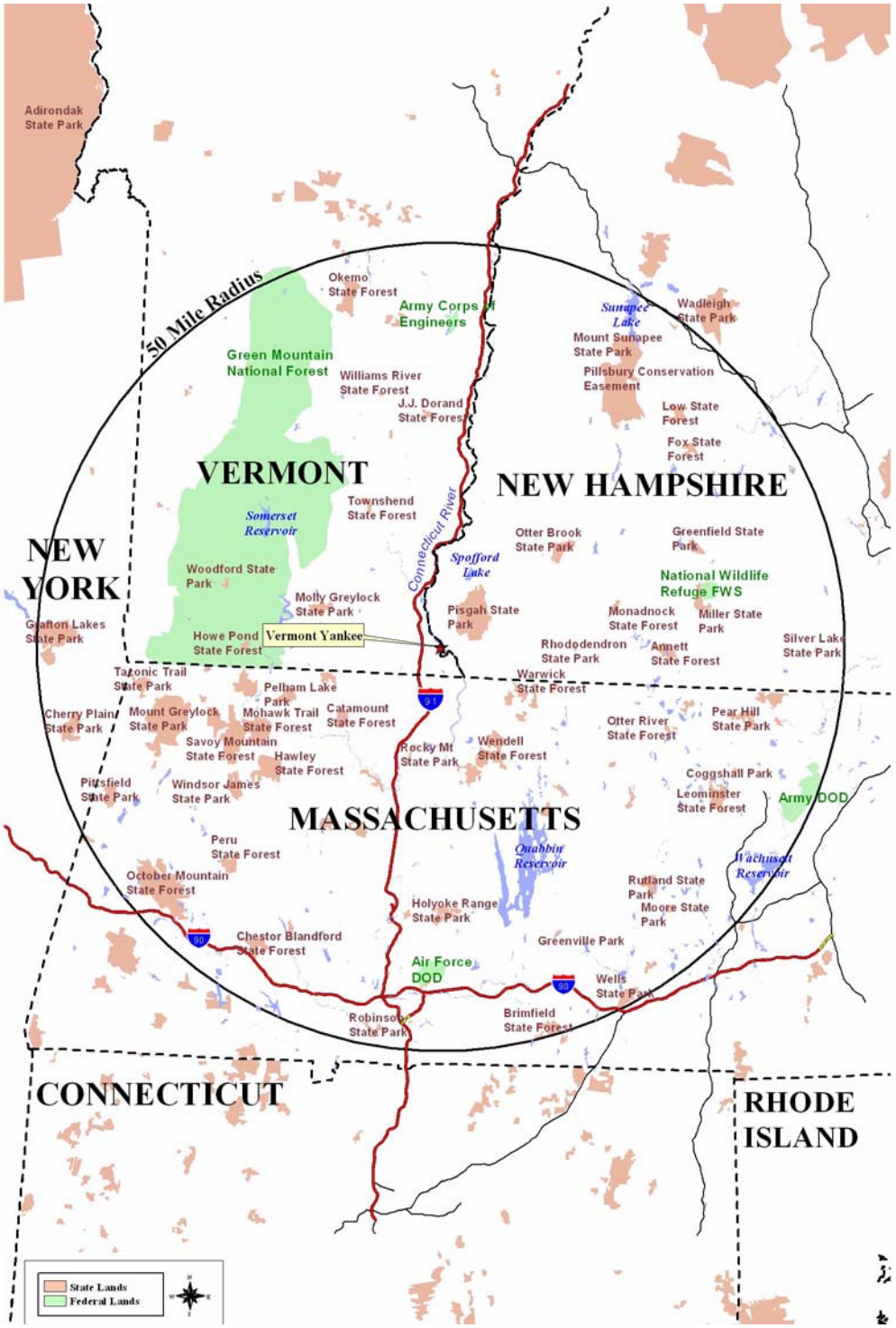

Figure 2-4
Major State and Federal Lands—50-Mile Radius

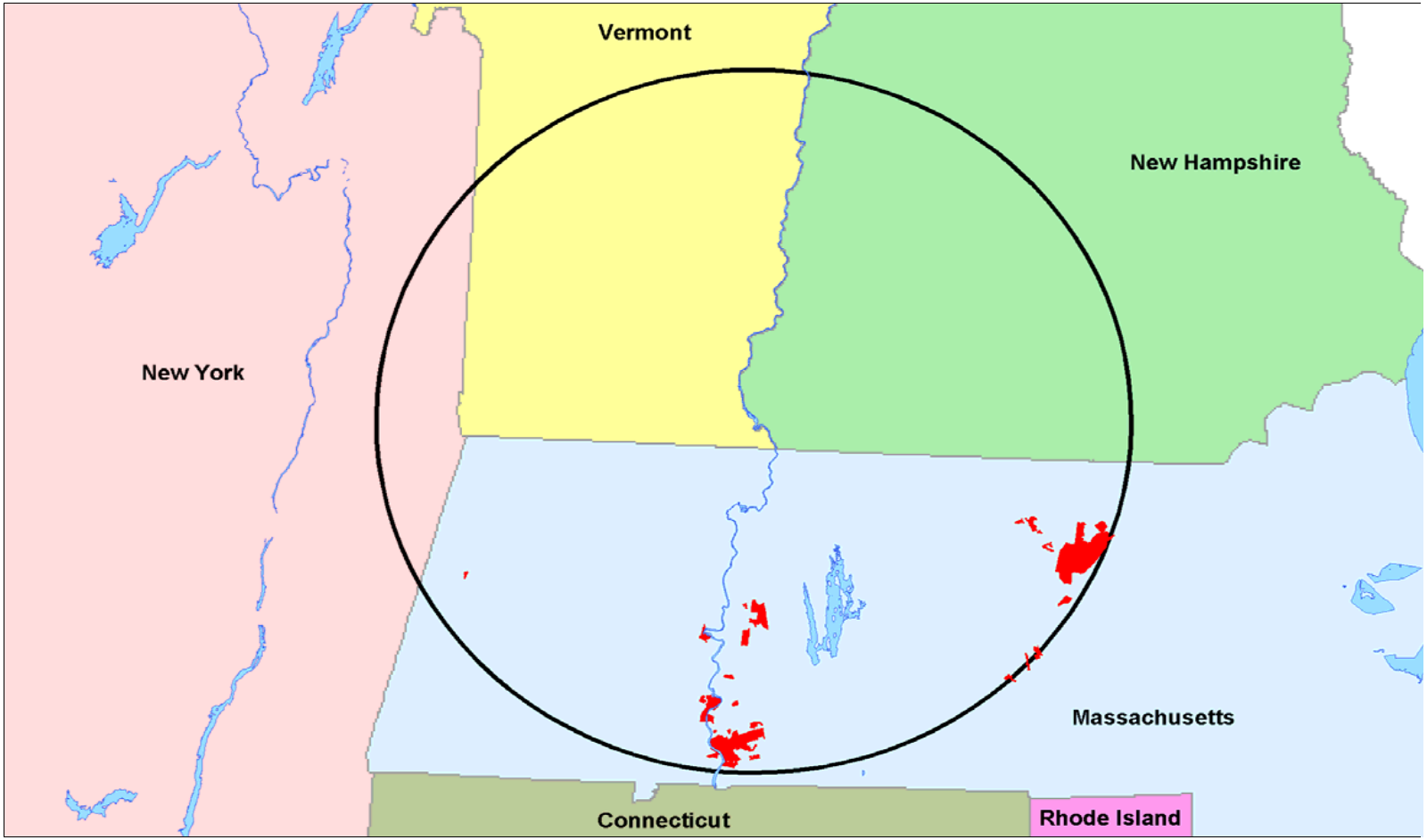

Figure 2-5
Census Block Groups - Minority Population Review
(Vermont Geographic Area)
Red areas indicate census block groups that meet the definition of a minority population.

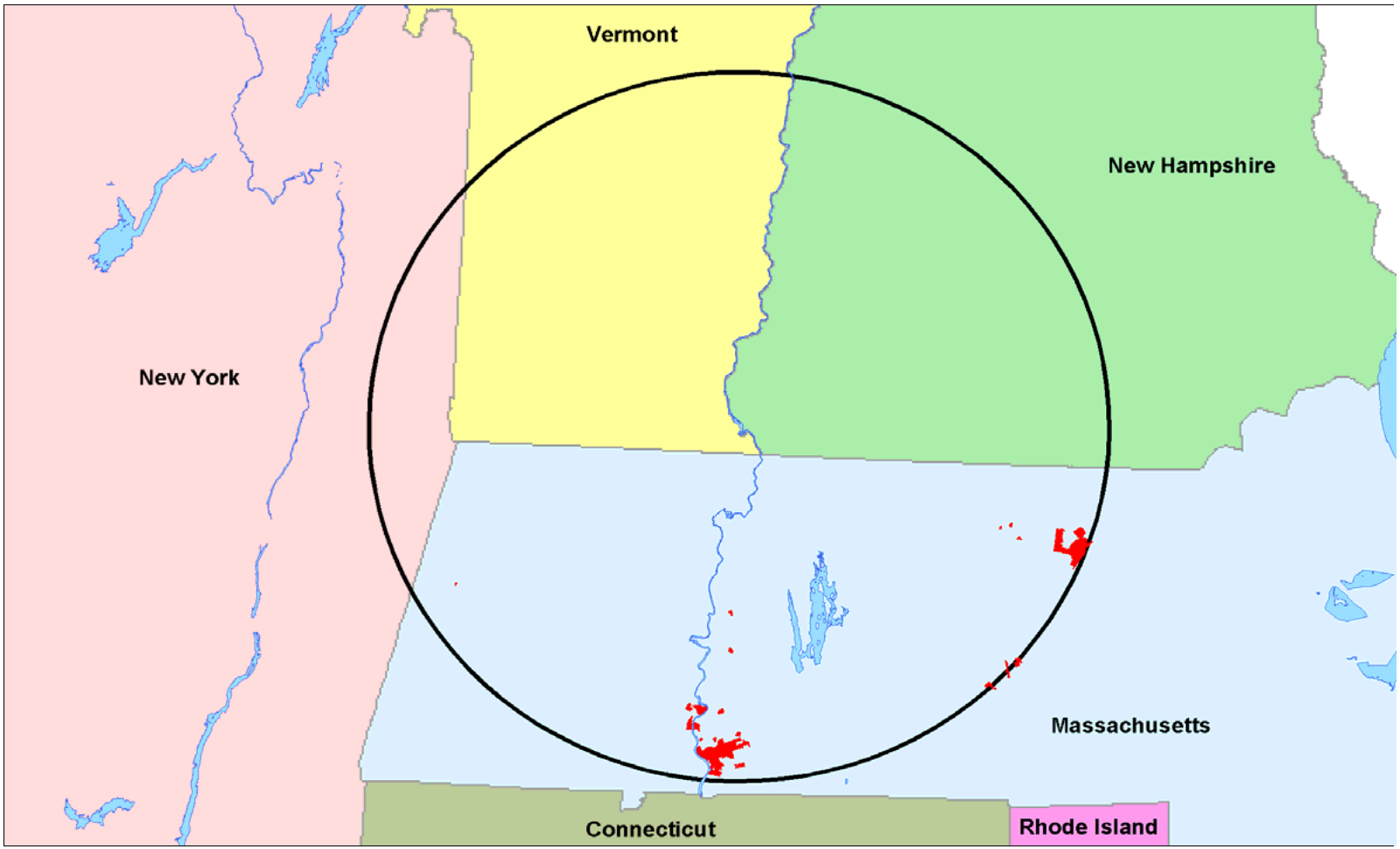

Figure 2-6
Census Block Groups - Minority Population Review
(Three-State Geographic Area)
Red areas indicate census block groups that meet the definition of a minority population.

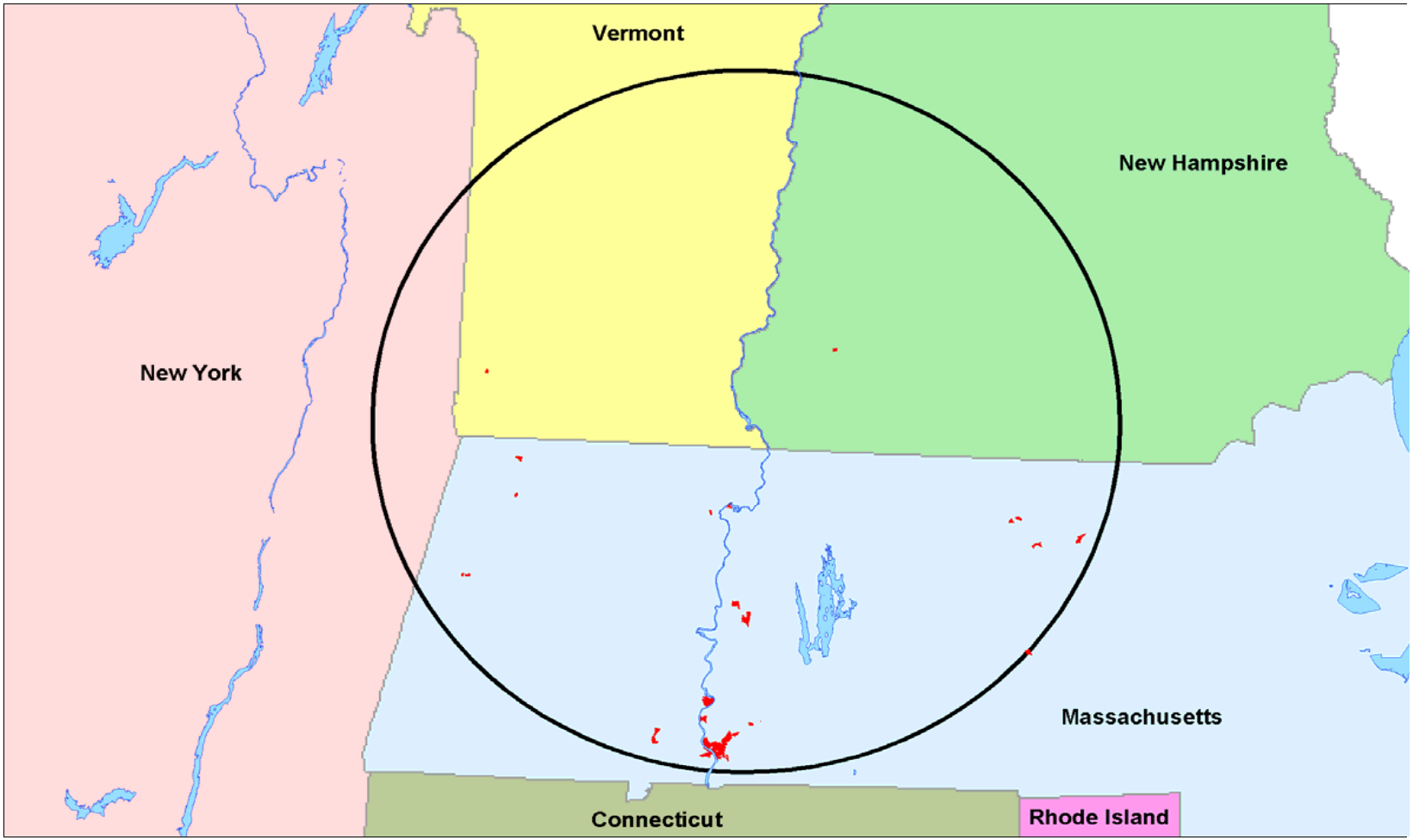

Figure 2-7
Census Block Groups - Low-Income Household Review
(Vermont Geographic Area)
Red areas indicate census block groups that meet the definition of a low-income population.

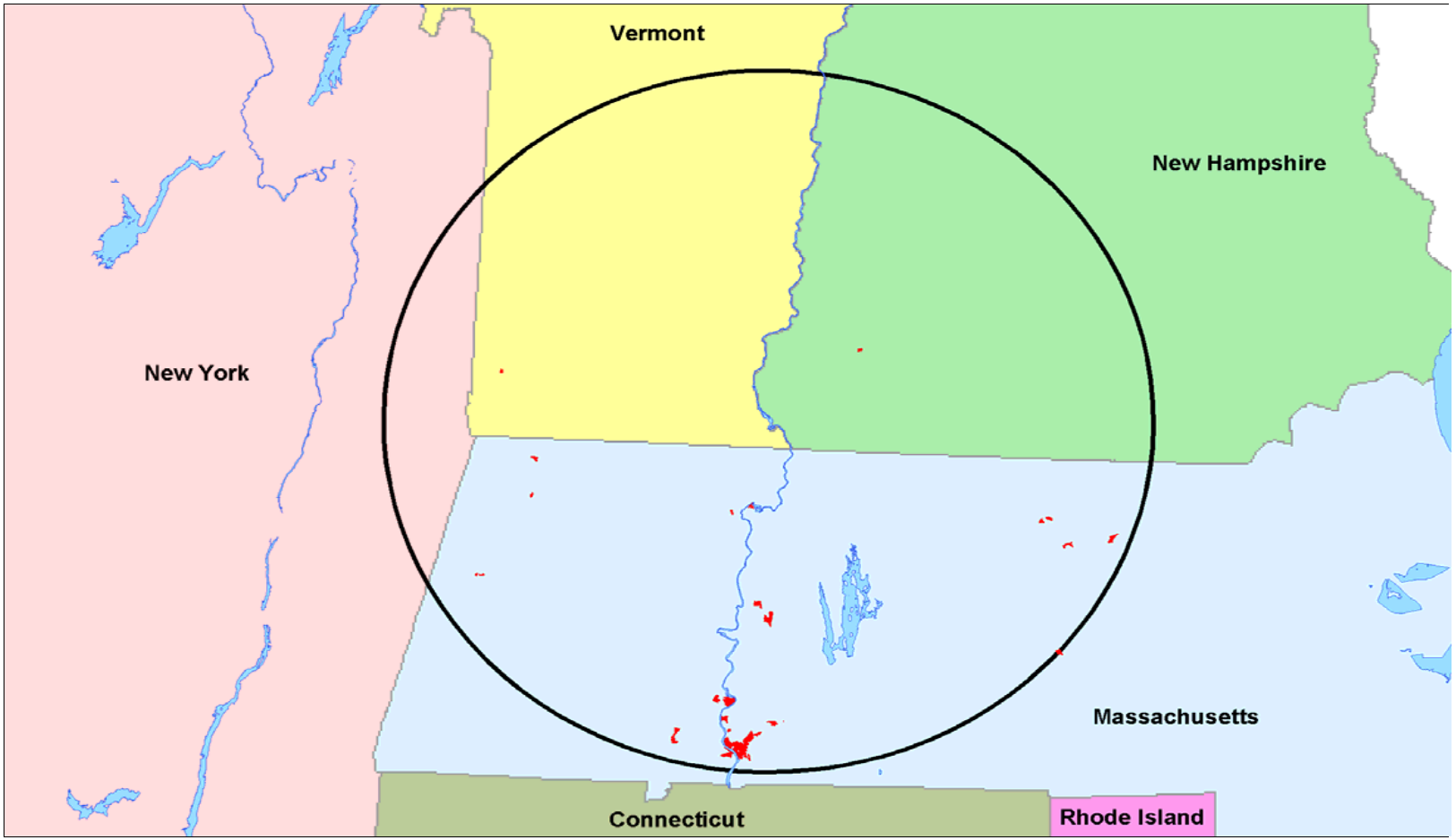

Figure 2-8
Census Block Groups - Low-Income Household Review
(Three-State Geographic Area)
Red areas indicate census block groups that meet the definition of a low-income population.

3.0 THE PROPOSED ACTION

3.1 Description of the Proposed Action

The proposed action is to renew the facility operating license for VYNPS for an additional twenty years beyond the expiration of the current operating license. For VYNPS (Facility Operating License DPR-28), the requested renewal would extend the license expiration date from midnight March 21, 2012, to midnight March 21, 2032.

There are no changes related to license renewal with respect to operation of VYNPS that would significantly affect the environment during the period of extended operation. The application to renew the operating license of VYNPS assumes that licensed activities are now conducted, and would continue to be conducted, in accordance with the facility's current licensing bases (e.g., use of low enriched uranium fuel only). Changes made to the current licensing basis of VYNPS during the staff review of this application would be made in accordance with the Atomic Energy Act of 1954, as amended, and in accordance with Commission regulations.

3.2 General Plant Information

The principal structures at VYNPS consist of a reactor building and primary containment, turbine building, control building, radwaste building, intake structure, cooling towers, and main stack [Reference 3-3, Section 12.1]. The reactor and nuclear steam supply system for VYNPS, along with the mechanical and electrical systems required for the safe operation of VYNPS, are primarily located in the reactor building. Figure 3-1 shows the general features of the VYNPS. Figure 2-3 shows the 0.17-mile radius exclusion zone. No residences are permitted within this exclusion zone.

3.2.1 Reactor and Containment Systems

VYNPS utilizes a boiling water reactor in the nuclear steam supply system and a two-loop reactor coolant system. General Electric supplied the nuclear steam supply system. The unit was originally licensed for an output of 1,593 megawatts-thermal (MWt). However, VYNPS has submitted a power uprate licensing request to the NRC requesting an increase of the maximum reactor core power level from 1,593 MWt to 1,912 MWt [Reference 3-2]. The gross electrical output corresponding to 1,912 MWt is approximately 650 megawatts-electric (MWe). VYNPS achieved commercial operation in 1972.

VYNPS fuel is made of low enrichment uranium oxide and is stacked in pre-pressurized tubes made from zircaloy, which form sealed enclosures. Under both current and uprated conditions, fuel enrichment will not exceed 5 percent uranium-235 by weight, and the average burnup to the peak rod (burnup averaged over the length of the rod) will not exceed 60,000 MWD/MTU. Sufficient margin is provided to ensure that peak burnups are within acceptable limits [Reference 3-3, Section 14.6.2.5.2].

The primary containment and reactor vessel isolation control system automatically initiates closure of isolation valves to close off all potential leakage paths for radioactive material to the

environs. This action is taken upon indication of a potential breach in the nuclear system process barrier. [Reference 3-3, Section 1.6.2.7] The secondary containment is a reinforced concrete structure completely enclosing the primary containment. Air leakage into the secondary containment structure is limited to within the flow capability of the standby gas treatment system so that should an accident occur, the fission products released from the primary to secondary containment can be filtered and released through the station main stack. A negative pressure of 0.15 inches-hg can be maintained in the secondary containment by the standby gas treatment system. The building can withstand an internal positive pressure of 7 inches of water [Reference 3-3, Section 1.6.2.8]. These safety features function to localize, control, mitigate, and terminate such events to limit exposure levels below applicable dose guidelines.

3.2.2 Cooling and Auxiliary Water Systems

3.2.2.1 Circulating Water System

The circulating water system includes an enclosed intake structure at the river bank. Three vertical, one-third capacity, removable element circulating water pumps, located in the intake structure, provide a total flow capacity of 360,000 gpm. If one pump should fail, the two operating pumps may be operated in the run-out condition to maintain station operation at a load consistent with turbine backpressure. Trash racks and traveling water screens protect the circulating water pumps from debris by straining intake water. During cold weather periods, recirculation of water from the discharge structure to the intake structure will prevent icing at the screens and intakes. [Reference 3-3, Section 11.6.3]

During hot weather periods, two cooling towers, 11 cells each, remove sufficient heat from the circulating water effluent to allow complete recirculation to the intake structure. Three vertical circulating water booster pumps, with 122,000 gpm flow capacity (each), provide the necessary head to permit cooling tower operation and the associated recirculation mode. [Reference 3-3, Section 11.6.3]. Following the extended power uprate, the cooling towers may also be required in the winter period. [Reference 3-4, page 6] Following the extended power uprate, the cooling towers may also be required in the winter period. [Reference 3-4, page 6]

In the closed cycle mode, blowdown from the deep basin is maintained to control water inventory and solids formation by controlling the level in the discharge canal. [Reference 3-3, Section 11.6.3]

Water from the main condensers is returned to the discharge structure where it is either discharged through an aerating structure to the river or is diverted to the cooling towers. Water circulated through the towers may be either discharged through the aerating structure to the river or recirculated in a closed loop path to the intake structure, or a combination of both, known as hybrid cycle mode. The discharge path is manually selected by the operator and is contingent upon seasonal variation in environmental parameters, particularly river water temperature and river flow [Reference 3-3, Section 11.6.3] and by the conditions outlined in VYNPS NPDES Permit VT0000264 (VDEC Permit No. 3-1199), included as Attachment D.

Water treatment equipment at the intake structure delivers chlorine and bromine to both the service water pump bays and the circulating water pump bays to minimize biological growth and bacteria in the system. Equipment to control pH during water treatment to maximize the effectiveness of the treatment chemicals and deliver target-specific biocides to both the service water pump bays and the circulating water pump bays is also present at the intake structure. [Reference 3-3, Section 11.6.3]

3.2.2.2 Intake Structure

Circulating water is drawn into the intake structure from the river. The intake structure is 114 feet long, 77 feet wide and 50 feet deep. It houses four service water pumps, two fire water pumps, two radwaste dilution pumps, three vertical one-third capacity circulating water pumps, three 12-foot by 22-foot roller gates and one 4-foot by 4-foot sluice gate. Intake gates A, B and C, the two discharge structure bypass gates, and the discharge structure recirculation gate are hydraulically driven and either remotely or locally operated. The sluice gate is motor-driven and remotely operated. [Reference 3-3, Section 12.2.6.1]

A differential pressure sensing instrument automatically starts the screen wash system. Recirculation of warm discharge water is provided to keep the intake bays and service bays free of ice. Recirculation is obtained by means of a 126-inch diameter concrete pressure pipe connecting the discharge structure to the intake structure. [Reference 3-3, Section 12.2.6.2.1]

Velocities through the trash racks at the pond of the intake are approximately 1.2 feet/second for the low water level of 215 feet MSL and 1.0 feet/second for normal water level of 220 feet MSL. Velocities through the intake traveling screens are 1.96 feet/second for extreme low water level of 212 feet MSL, and 1.73 feet/second for low water level of 15 feet MSL, and 1.57 feet/second for normal water level of 220 feet MSL. The intake has three pump bays for three 1/3 capacity vertical circulating water pumps and two service water bays for four service water pumps, and two fire water pumps. All bays are provided with trash rack and stop-log guides, traveling screens and fine screen guides. Interconnection of the three 13-foot 9-inch pump bays is provided by removing stop-logs in center walls. The circulating water pump head is calculated to give design flow at a summer low water level of 215 feet MSL. [Reference 3-3, Section 12.2.6.2.1]

Water from the pond also flows into two service water bays at the north end of the intake structure. These bays furnish water for the fire pumps and service water pumps. To ensure that the water in these bays does not freeze, a 48-inch diameter concrete (gravity flow) line branches out of the 126-inch diameter recirculation line near the structure and de-ices these two bays. Retaining walls are provided at the front face of the intake structure to retain fill. [Reference 3-3, Section 12.2.6.2.1]

The extended power uprate will not result in any change to the intake or to the flow rate of water withdrawn from the Connecticut River through the intake. [Reference 3-4, page 9]

3.2.2.3 Cooling Tower Water System

The cooling tower water system consists of two cooling towers, one cooling tower deep water basin, one shallow runoff basin, three circulating water booster pumps, and all piping, valving and instrumentation required for system operation. [Reference 3-3, Section 11.9.3]

There are three modes of operation for cooling tower water system operation. In the recirculation mode, circulating water is supplied by the circulating water pumps to the discharge structure where the bypass gates are closed. There are three circulating water booster pumps of 122,000 gpm capacity each, supplying the required head necessary to pump the water to the towers. The cooled circulating water then flows to the circulating water pumps where operation is the same as for the circulating water system. [Reference 3-3, Section 11.9.3]

In the hybrid mode, circulating water from the condenser is pumped from the discharge structure by the circulating water booster pumps, through the cooling towers with part of the flow directed to the river [Reference 3-3, Section 11.9.3]. The remainder is recirculated.

The discharge mode is the same as the recirculation mode, except after the cooled water leaves the cooling towers, it is discharged to the river. The mode in which the system operates is a function of river temperature and river flow. The switching of the different modes is accomplished manually. [Reference 3-3, Section 11.9.3]

The towers are of treated Douglas fir with plastic fill and drift eliminators. Each tower consists of 11 cells separated by fireproof partitions. The towers are separated by a distance of 300 feet center-to-center. [Reference 3-3, Section 11.9.3]

The deep basin beneath the cooling tower on the west side has a storage capacity of approximately 1.48×10^6 gallons and would act as a reservoir to replace the evaporative and other losses occurring during alternate cooling system operation. The shallow basin beneath the cooling tower on the east side is also of reinforced concrete but serves only as a runoff during system operation. [Reference 3-3, Section 11.9.3]

The three vertical circulating water booster pumps are of one-stage centrifugal design. Each has a 122,000 gpm capacity, and all are located in the discharge structure of the circulating water system. [Reference 3-3, Section 11.9.3]

3.2.2.4 Discharge and Aerating Structure

The discharge-aerating structure is located near the riverbank south-southeast of the station. It is approximately 188 feet long by 108 feet wide by 46 feet deep. An aerating spillway concrete structure, consisting of three rows of dissipating concrete blocks with approximately nine blocks per row, is adjacent and downstream of the discharge structure to provide air entrainment, energy dissipation, and warm water dispersion of the circulating water. Sheet piling is used to prevent scouring of the aerating apron.

Located in the discharge structure is an enclosed concrete pump chamber housing three one-third capacity vertical volute booster pumps. These pumps are used to supply water to the cooling towers. Water from these pumps discharges into a concrete tunnel within the discharge structure. A steel pipe connects the pump discharge and concrete tunnel. An expansion joint with stretcher bolts and a motor-operated butterfly valve are provided in the steel pipe. The cooled water from the towers is returned into a weir collection chamber in the discharge structure. By controlling the gate on the recirculation outlet line in the discharge structure, the water can be recirculated to the intake forebay or discharged to the river by overflowing the weir onto the aerating structure. [Reference 3-3, Section 12.2.6.3]

3.2.3 Radioactive Waste Treatment Processes (Gaseous, Liquid and Solid)

VYNPS uses liquid, gaseous, and solid waste processing systems to collect and treat, as needed, radioactive materials that are produced as a by-product of plant operations. Radioactive materials in liquid and gaseous effluents are reduced to levels as low as reasonably achievable. Radionuclides removed from the liquid and gaseous effluents are converted to a solid waste form for eventual disposal with other solid radioactive wastes in a licensed disposal facility.

The VYNPS waste processing systems meet the design objectives of 10 CFR 50, Appendix I, and control the processing, disposal, and release of radioactive liquid, gaseous, and solid wastes. Radioactive material in the reactor coolant is the source of most gaseous, liquid, and solid radioactive wastes in light water reactors. Radioactive fission products build up within the fuel as a consequence of the fission process. The fission products are contained within the sealed fuel rods; however, small quantities of radioactive materials may be transferred from the fuel elements to the reactor coolant under normal operating conditions. Neutron activation of materials in the primary coolant system also contributes to radionuclides in the coolant.

Solid wastes, other than fuel, result from treating gaseous and liquid effluents to remove radionuclides. Contaminated spent resins and filter sludges generated during the treatment processes are dewatered, packaged, stored, and ultimately shipped off-site for further treatment or disposal. Other types of solid waste consist of air filters, miscellaneous paper, rags, and shoe covers from contaminated areas; contaminated clothing, tools and equipment parts which cannot be effectively decontaminated; solid laboratory wastes; used reactor equipment such as poison curtains, spent control rod blades, fuel channels and in-core ion chambers; and large pieces of equipment. Some types of waste may be compacted to reduce their final disposal volume. [Reference 3-3, Section 9.3.3.3]

Reactor fuel assemblies that have exhausted a certain percentage of their fissile uranium content are referred to as spent fuel. Spent fuel assemblies are removed from the reactor core and replaced by fresh fuel during routine refueling outages, typically every 18 months. The spent fuel assemblies are then stored for a period of time in the spent fuel pool in the reactor building and may later be transferred to dry storage at an onsite interim spent fuel storage installation provided necessary regulatory approvals are obtained. VYNPS also provides for onsite storage of mixed wastes, which contain both radioactive and chemically hazardous materials.

Storage of radioactive materials is regulated by the NRC under the Atomic Energy Act of 1954, and storage of hazardous wastes is regulated by the U.S. Environmental Protection Agency (EPA) under the Resource Conservation and Recovery Act of 1976.

Systems used at VYNPS to process liquid, gaseous, and solid radioactive wastes are described in the following sections.

3.2.3.1 Liquid Waste Processing Systems and Effluent Controls

Although VYNPS operates as a zero discharge plant relative to radioactive liquids, very low levels of radioactivity in liquid effluents from VYNPS could be released to the Connecticut River in accordance with limits specified in the NRC regulations, VYNPS *Offsite Dose Calculation Manual* (ODCM), and the NPDES permit. The VYNPS liquid radwaste system collects, processes, stores and disposes of all radioactive liquid wastes. The radwaste facility is located in the radwaste building, with the exception of the cleanup phase separator equipment (located in the reactor building), the condensate backwash receiving tank and pump (located in the turbine building), and waste sample tanks, floor drain sample tank, and waste surge tank (located outdoors at grade level). [Reference 3-3, Section 9.2.4]

Included in the Liquid Radwaste System are the following:

- floor and equipment drain systems for handling potentially radioactive wastes;
- tanks, piping, pumps, process equipment, instrumentation and auxiliaries necessary to collect, process, store and dispose of potentially radioactive wastes.

This is a batch-type system wherein the wastes are separately collected and processed based on the most efficient methods. Cross-connections between subsystems provide additional flexibility for processing of the wastes by alternate methods. Treated wastes can be (1) returned to the nuclear system for reuse, (2) diluted and discharged from the station, or (3) if not suitable for either reuse or discharge, they receive additional processing. The liquid radwastes are classified, collected and treated as either high purity, low purity, chemical, or detergent wastes. The terms "high" purity and "low" purity refer to conductivity, not radioactivity. [Reference 3-3, Section 9.2.4]

High purity (low conductivity) liquid wastes are collected in the waste collector tank. The high purity wastes are processed by filtration and ion exchange through the waste collector filter or fuel pool and waste demineralizers as required. After processing, the liquid is pumped to the waste sample tank where it is sampled and either recycled for additional processing or transferred to the condensate storage tank for reuse in the nuclear system. Should discharge be necessary, wastes would be sampled on a batch basis and analyzed for water quality and radioactivity. If high purity requirements are met, the contents are transferred to the condensate storage tank. If high purity requirements are not met, the liquid wastes are recycled through the radwaste system, and although VYNPS is a zero discharge plant, the liquid wastes could be discharged. [Reference 3-3, Section 9.2.4.1]

Low purity (high conductivity) liquid wastes are collected in the floor drain collector tank. These wastes generally have low concentrations of radioactive impurities and processing consists of filtration and a combination with the high purity waste in the waste collector tank, with subsequent processing, as high purity waste. [Reference 3-3, Section 9.2.4.2]

Chemical wastes are collected in the chemical waste tank. When the chemical concentrations are low enough, these wastes may be neutralized and processed by filtration and dilution in the same manner and with the same equipment as the low purity wastes. When the chemical concentrations are too high, these wastes may receive additional processing. [Reference 3-3, Section 9.2.4.3]

Detergent wastes are collected in the detergent waste tank. These wastes are primarily from radioactive decontamination solutions which contain detergents. Detergent wastes are of low radioactivity concentration (<10-5 µCi/cc). Because detergents will foul ion exchange resins, their use is minimized in the plant. For initial cleanings, little or no detergent is used. The station uses an off-site cleaning laundry, thus minimizing the quantity of waste generated. Detergent wastes are normally dumped to the floor drain collector tank for processing with low purity waste. [Reference 3-3, Section 9.2.4.4]

Controls for limiting the release of radiological liquid effluents are described in the ODCM. Controls are based on (1) concentrations of radioactive materials in liquid effluents and projected dose or (2) dose commitment to a hypothetical member of the public. Concentrations of radioactive material that may be released in liquid effluents to unrestricted areas are limited to the concentration specified in 10 CFR 20, Appendix B, Table 2, Column 2, for radionuclides other than dissolved or entrained noble gases. The total concentration of dissolved or entrained noble gases in liquid releases is limited to 2×10^{-4} microcurie/ml [Reference 3-1, Section 3.2.1]. The ODCM dose limits during a calendar quarter are ≤ 0.015 millisievert (1.5 mrem) to the total body and ≤ 0.05 mSv (5 mrem) to any organ [Reference 3-1, Section 3.2.2]. During the calendar year, the ODCM dose limits are ≤ 0.03 mSv (3 mrem) to the total body and ≤ 0.10 mSv (10 mrem) to any organ [Reference 3-1, Section 3.2.2]. Radioactive liquid wastes are subject to the sampling and analysis program described in the ODCM.

3.2.3.2 Gaseous Waste Processing Systems and Effluent Controls

The gaseous radwaste system includes subsystems that dispose of gases from the main condenser air ejectors, the start up vacuum pump, and the gland seal condenser. The processed gases are routed to the plant stack for dilution and elevated release to the atmosphere. The various subsystems and the plant stack are continuously monitored by radiation monitors. [Reference 3-3, Section 9.4.5]

A new gaseous radwaste subsystem has been installed at the site to permit the incineration of slightly radioactive waste oil [Reference 3-3, Section 9.4.5] for comfort heating purposes. This incineration process will be performed in the north warehouse, which is an extension of the restricted area [Reference 3-3, Section 9.4.5]. The dose contribution to members of the public will not cause the total dose or dose rate from all effluent sources to exceed the dose or

concentration limits imposed by 10 CFR 20, 10 CFR 50, Appendix I, or Section 3.3 of the ODCM. [Reference 3-3, Section 9.4.5]

Gases routed to the plant stack also include gases from the standby treatment system and most station ventilation exhausts. The plant stack provides an elevated release point for the release of processed waste gases. Stack drainage is routed to the liquid radwaste collection system via loop seals. [Reference 3-3, Section 9.4.5]

Supporting systems to the gaseous radwaste system are as follows.

Air Ejector Advanced Off-Gas Subsystem

The basic function of the air ejector advanced off-gas (AOG) subsystem is to reduce the ejector radioactive gaseous release rates to the atmosphere to as low as reasonably achievable. The AOG system consists of a dual hydrogen dilution and recombiner subsystem, a dual moisture removal/dryer subsystem, a single charcoal adsorber subsystem and dual vacuum pumps prior to discharge to the stack. [Reference 3-3, Section 9.4.5]

Hydrogen Dilution and Recombiner Subsystem

The purpose of diluting the off-gas mixture with steam at the air ejector stage is to prevent a flammable mixture (4% hydrogen volume) of hydrogen from entering the downstream hydrogen recombiners. The off-gas is diluted at the second-stage air ejector with approximately 6,400 lb/hr steam, resulting in less than a 3% volume hydrogen concentration. [Reference 3-3, Section 9.4.5]

Recombiner Subsystem

The recombiner subsystem consists of a single path leading from the hydrogen dilution steam jet ejectors to two parallel flow paths for hydrogen recombination. Each recombination subsystem is capable of operating independently of the other and each is capable of handling the condenser off-gas at a startup design flow rate of 1,600 lb/hr air and the normal off-gas design flow rate of 371 lb/hr. The major components of each recombiner flow path are a preheater, a hydrogen-oxygen recombiner and a de-superheating condenser. [Reference 3-3, Section 9.4.5]

Preheater

The preheater is used to assure that the vapor entering the recombiner is heated to approximately 300°F. This will establish a constant recombiner inlet superheat, necessary for the initiation of hydrogen recombination, and prevent moisture accumulation and methyl iodide poisoning from inhibiting catalyst reactivity. [Reference 3-3, Section 9.4.5]

Off-Gas Moisture Removal/Dryer Subsystem

In the moisture removal/dryer subsystem, the moisture of the gas is reduced to increase the effectiveness of the charcoal adsorber beds downstream. The subsystem consists of two parallel cooler condenser and gas dryer units. Each condenser is cooled by a mechanical demineralized water refrigeration system that cools the off-gas to 45°F as it removes bulk moisture. The dryer is designed to remove the remaining moisture by a molecular sieve desiccant to a dew point of less than -40°F (<1% RH). There are two dryers per train and while one is adsorbing moisture from the off-gas, the other is desorbing moisture by circulating heated air through the bed in closed cycle. [Reference 3-3, Section 9.4.5]

Charcoal Adsorber Gas Holdup Subsystem

This subsystem consists of seven tanks of charcoal preceded by a smaller charcoal guard bed upstream in each train. The guard bed protects the seven main tanks from excessive moisture in the event of a malfunction upstream in the moisture removal subsystem and removes compounds which might hinder Kr/Xe delay. The seven tanks hold approximately 90,000 pounds of charcoal. [Reference 3-3, Section 9.4.5]

Gland Seal Off-Gas Subsystem and Startup Iodine Filter

The gland seal off-gas subsystem collects gases from the gland seal condenser and the mechanical vacuum pump and passes them to the stack through the same 1-3/4 minute holdup piping that is used for the startup vacuum pump system. One automatic valve on the discharge side of each steam packing exhauster is provided which closes upon the receipt of high level radiation signal from the main steam line radiation monitoring subsystem to prevent the release of excessive radioactive material to the atmosphere. The exhausters are shut down at the same time the valves close. In addition, the mechanical vacuum pump is automatically isolated and stopped by a main steam line high radiation signal. [Reference 3-3, Section 9.4.5]

VYNPS maintains gaseous releases within ODCM limits. The gaseous radwaste system is used to reduce radioactive materials in gaseous effluents before discharge to meet the dose design objectives in 10 CFR 50, Appendix I. In addition, the limits in the ODCM are designed to provide reasonable assurance that radioactive material discharged in gaseous effluents would not result in the exposure of a member of the public in an unrestricted area in excess of the limits specified in 10 CFR 20, Appendix B.

The quantities of gaseous effluents released from VYNPS are controlled by the administrative limits defined in the ODCM. The controls are specified for dose rate, dose due to noble gases, and dose due to radioiodine and radionuclides in particulate form. For noble gases, the dose rate limit at or beyond the site boundary is $\leq$ 5 mSv/yr (500 mrem/yr) to the total body, and $\leq$ 30 mSv/yr (3000 mrem/yr) to the skin [Reference 3-1, Section 3.3.1]. For iodine and particulates with half-lives greater than 8 days, the limit is $\leq$ 15 mSv/yr (1500 mrem/yr) to an

organ [Reference 3-1, Section 3.3.1]. The limit for air dose due to noble gases released in gaseous effluents to areas at or beyond the site boundary during a calendar quarter is ≤ 0.05 milligray (5 mrad) for gamma radiation and ≤ 0.1 mGy (10 mrad) for beta radiation [Reference 3-1, Section 3.3.2]. For a calendar year, the limit is ≤ 0.1 mGy (10 mrad) for gamma radiation and ≤ 0.2 mGy (20 mrad) for beta radiation [Reference 3-1, Section 3.3.2]. The radioactive gaseous waste sampling and analysis program specifications provided in the ODCM address the gaseous release type, sampling frequency, minimum analysis frequency, type of activity analysis, and lower limit of detection.

3.2.3.3 Solid Waste Processing

The solid radwaste system is a contiguous part of the liquid radwaste system and is an integral part of the radwaste building. The system processes wet and dry solid wastes. Because of physical differences and differences in radioactivity or contamination levels, various methods are employed for processing and packaging the solid radwastes. Wet solid wastes are packaged in appropriate liners or high integrity containers for transportation within licensed shipping casks. Dry compressible solid waste is compacted within 55-gallon Department of Transportation (DOT) specification drums or strong tight metal boxes. Each type of waste is kept segregated to reduce shielding requirements for storage. [Reference 3-3, Section 9.3.3.1] The system is designed to maintain radiation exposure ALARA for personnel who handle solid wastes and to minimize the quantities of solid waste generated at the plant.

Wet wastes consist of spent demineralizer resins and filter sludges. These are pumped from the phase separators or waste sludge tanks as a slurry to disposable liners pre-placed within the licensed transportation casks. The slurry is then dewatered from within the liner using a remote dewatering system located in the cask room. The dewatering system is kept in continuous operation as long as the cask liner is being filled. When the cask liner is full, a high-level trip recirculates the resin slurry to either the waste collector tank or to one of the condensate phase separators. The dewatering system and its associated controls are arranged for remote operation, which is manually initiated. [Reference 3-3, Section 9.3.3.2]

The radioactive wet wastes are transported in licensed steel/lead casks. The casks contain disposable steel liners or high integrity containers. Design and use of the cask are in accordance with 10 CFR 71 and 49 CFR 170-178 regulations of the Department of Transportation. All resin shipments are via sole-use vehicles. [Reference 3-3, Section 9.3.3.2]

Dry wastes consist of air filters, miscellaneous paper, rags, shoe covers, etc., from contaminated areas; contaminated clothing, tools, and equipment parts which cannot be effectively decontaminated; solid laboratory wastes; used reactor equipment such as poison curtains, spent control rod blades, fuel channels and in-core ion chambers; and large pieces of equipment. [Reference 3-3, Section 9.3.3.3]

The disposition of a particular item of waste is determined by its radiation level and type, and the availability of disposal space. Because of high activation and contamination level, used reactor equipment is stored in the fuel storage pool for sufficient time to obtain optimum radioactive decay before removal and final disposal. Most solid radwaste such as contaminated clothing,

rags, and paper can be handled manually because of low radioactivity or contamination levels. [Reference 3-3, Section 9.3.3.3]

A hydraulic box compactor is provided to compress and reduce in volume compressible wastes. A ventilation system with a high efficiency filter is provided as part of the compactor to control possible airborne particulate matter during waste compacting operations. As an alternative to onsite volume reduction of dry active waste (DAW) with the hydraulic box compactor, both compressible and non-compressible DAW can be collected into shipping containers to be sent to an off-site waste processor for volume reduction. [Reference 3-3, Section 9.3.3.3]

Provisions have been made to store temporarily radioactive waste on-site in the event that off-site disposal is unavailable. The facility is designed to store up to five years' inventory of low-level radioactive waste should offsite disposal not be possible. It is the intent to provide storage modules on an as-needed basis as storage requirements dictate. In addition to the low level waste storage pad, wastes may be collected and temporarily stored in approved on-site locations, such as the north warehouse, or in weather-tight shipping containers, until sufficient volume is accumulated to warrant shipping off-site for disposal or additional processing. [Reference 3-3, Section 9.3.3.4]

3.2.4 Transportation of Radioactive Materials

VYNPS radioactive waste shipments are packaged in accordance with NRC and DOT requirements. The type and quantities of solid radioactive waste generated at and shipped from VYNPS vary from year to year, depending on plant activities. VYNPS currently transports radioactive waste to either the licensed Barnwell, South Carolina, facility or to a licensed processing facility in Tennessee or Pennsylvania where the waste is further processed prior to being sent to the Barnwell facility or the Envirocare facility in Clive, Utah. VYNPS may also transport material from an offsite processing facility to a disposal site or back to the plant site for reuse or storage.

3.2.5 Nonradioactive Waste Systems

Nonradioactive waste is produced from plant maintenance and cleaning processes. Most of these wastes are from boiler blowdown, filter backwash, sludges and other wastes, floor and yard drains and stormwater runoff. Chemical and biocide wastes are produced from processes used to control the pH in the coolant, to control scale, to control corrosion, to regenerate resins, and to clean and defoul the condenser. Waste liquids are typically combined with cooling water discharges. Sanitary wastewater and laboratory wastewater from the facility are discharged to onsite septic systems covered under a permit (Indirect Discharge Permit ID-9-0036-1A) from the Vermont Department of Environmental Conservation (VDEC).

Non-radioactive gaseous effluents result primarily from operation of the oil-fired boilers used to heat the plant and from testing of the emergency diesel generators. Discharge of regulated pollutants is minimized by limiting fuel usage and hours of operation and is within Vermont air quality standards.

3.2.6 Maintenance, Inspection and Refueling Activities

Various programs and activities currently exist at VYNPS to maintain, inspect, test, and monitor the performance of plant equipment. These programs and activities include, but are not limited to those implemented to

- meet the requirements of 10 CFR 50, Appendix B (Quality Assurance), Appendix R (Fire Protection), Appendices G and H, Reactor Vessel Materials;
- meet the requirements of 10 CFR 50.55a, American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section XI, In-service Inspection and Testing Requirements;
- meet the requirements of 10 CFR 50.65, the maintenance rule, including the structures monitoring program; and
- maintain water chemistry in accordance with EPRI guidelines.

Additional programs include those implemented to meet Technical Specification surveillance requirements, those implemented in response to NRC generic communications, and various periodic maintenance, testing, and inspection procedures. Certain program activities are performed during the operation of the unit, while others are performed during scheduled refueling outages.

3.2.7 Power Transmission Systems

The only transmission lines constructed to connect VYNPS to the New England transmission grid are from the plant to the 345 kV and 115 kV switchyards. The transmission lines exiting the switchyards are part of the New England transmission grid that was constructed to supply purchased power to the State of Vermont even if the station had not been located at the Vernon site.

There are three transmission lines associated with the 345 kV switchyard that service the New England eastern New York area: the Coolidge 340 line, the Amherst 380 line and the Northfield 381 line. The one transmission line (N-186 Chestnut Hill Line) associated with the 115 kV switchyard interconnects with the 115 kV transmission systems in Keene, New Hampshire. There is also an underground 13.2 kV line used for station blackout purposes that runs from Vernon Hydro Station to VYNPS.

The owners of the 345 kV and 115 kV transmission lines are as follows:

- Vermont Electric Power Company (VELCO) for the 345 kV Coolidge line;
- Northeast Utilities - Public Service Company of New Hampshire (NU-PSNH) for the 345 kV Amherst and 115 kV Chestnut Hill line; and

- Northeast Utilities (NU) for the 345 kV Northfield line.

VELCO and NU right-of-way management practices involve mechanical clearing and hand-applied herbicides. NU-PSNH utilizes mechanical clearing with no herbicide usage. Ultimately, right-of-way maintenance practices are determined by the owners of the lines and this arrangement is not expected to change during the license renewal period.

3.3 Refurbishment Activities

10 CFR 51.53(c)(2) requires the following of a license renewal applicant's environmental report.

> The report must contain a description of the proposed action, including the applicant's plans to modify the facility or its administrative control procedures as described in accordance with Section 54.21 of this chapter. This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment.

The objective of the review required by 10 CFR 54.21 is to determine whether the detrimental effects of plant aging could preclude certain VYNPS systems, structures, and components from performing in accordance with the current licensing basis, during the additional 20 years of operation requested in the license renewal application. There are no plans associated with license renewal to modify the facility or its administrative control procedures other than those procedures necessary to implement the aging management programs described in the Integrated Plant Assessment. The proposed action does not include any modifications directly affecting plant effluents or the environment.

The evaluation of structures and components as required by 10 CFR 54.21 has been completed and is described in the body of the VYNPS license renewal application. This evaluation did not identify the need for refurbishment of structures or components related to license renewal.

Routine replacement of certain components during the period of extended operation is expected to occur within the bounds of normal plant maintenance. Modifications to improve operation of plant systems, structures, or components are reviewed for environmental impact by station personnel during the planning stage for the modification. These reviews are controlled by site procedures.

3.4 Programs and Activities for Managing the Effects of Aging

The programs for managing aging of systems and equipment at VYNPS are described in the body of the VYNPS license renewal application. The evaluation of structures and components required by 10 CFR 54.21 identified some new inspection activities necessary to continue operation of VYNPS during the additional 20 years beyond the initial license term. These activities are described in the body of the VYNPS license renewal application. The additional inspection activities are consistent with normal plant component inspections and therefore are not expected to cause significant environmental impact. The majority of the aging management programs are existing programs or modest modifications of existing programs.

3.5 Employment

The non-outage work force at VYNPS consists of approximately 678 persons. There are 508 Entergy employees normally on site. The remaining 170 persons are baseline contractor employees. Table 3-1 shows employee residences by county, state and city. The GEIS estimated that an additional 60 employees would be necessary for operation during the period of extended operation. Since there will not be significant new aging management programs added at VYNPS, Entergy believes that it will be able to manage the necessary programs with existing staff. Therefore, Entergy has no plans to add non-outage employees to support plant operations during the extended license period.

Refueling and maintenance outages typically last approximately 30 days. Depending on the scope of these outages, an additional 700 to 900 workers are typically on site. The number of workers required on site for normal plant outages during the period of extended operation is expected to be consistent with the number of additional workers used for past outages at VYNPS.

Table 3-1
Employee Residence Information, VYNPS, December 2003

County, State and City	Employees*
ADDISON COUNTY (VERMONT)	**1**
New Haven	1
BENNINGTON COUNTY (VERMONT)	**3**
Bennington	2
Readsboro	1
CHITTENDEN COUNTY (VERMONT)	**6**
Burlington	1
Colchester	1
Jericho	1
Milton	1
South Burlington	1
Williston	1
ORANGE COUNTY (VERMONT)	**2**
Williamstown	2
RUTLAND COUNTY (VERMONT)	**5**
Brandon	1
Pittsford	1
Proctor	1
Rutland	2
WINDHAM COUNTY (VERMONT)	**289**
Bellows Falls	9
Brattleboro	95
Brookline	1
Dummerston	8
East Dover	3
East Dummerston	3
Guilford	20
Jacksonville	3

Table 3-1
Employee Residence Information, VYNPS, December 2003
(Continued)

County, State and City	Employees*
WINDHAM COUNTY (VERMONT) Cont'd.	
Jamaica	2
Marlboro	1
Newfane	11
North Brattleboro	1
Putney	14
South Newfane	3
Townshend	4
Vernon	94
West Brattleboro	6
West Dover	1
West Dummerston	4
West Townshend	2
Whitingham	1
Williamsville	1
Wilmington	2
WINDSOR COUNTY (VERMONT)	**6**
Bridgewater Corners	1
Chester	5
CHESHIRE COUNTY (NEW HAMPSHIRE)	**172**
Alstead	3
Chesterfield	9
East Sullivan	1
East Swanzey	3
Fitzwilliam	2
Hinsdale	44
Jaffrey	2
Keene	31

Table 3-1
Employee Residence Information, VYNPS, December 2003
(Continued)

County, State and City	Employees*
CHESHIRE COUNTY (NEW HAMPSHIRE) Cont'd.	
North Swanzey	1
North Walpole	3
Richmond	5
Spofford	16
Stoddard	1
Sullivan	1
Surry	1
Swanzey	8
Walpole	3
West Chesterfield	23
Westmoreland	5
West Swanzey	6
Winchester	4
HILLSBOROUGH COUNTY (NEW HAMPSHIRE)	**3**
Hancock	1
Manchester	1
Peterborough	1
MERRIMACK COUNTY (NEW HAMPSHIRE)	**1**
Boscawen	1
STRAFFORD COUNTY (NEW HAMPSHIRE)	**1**
Strafford	1
SULLIVAN COUNTY (NEW HAMPSHIRE)	**2**
Charlestown	1
Langdon	1

Table 3-1
Employee Residence Information, VYNPS, December 2003
(Continued)

County, State and City	Employees*
BERKSHIRE COUNTY (MASSACHUSETTS)	**12**
Adams	3
Florida	2
North Adams	4
Savoy	3
FRANKLIN COUNTY (MASSACHUSETTS)	**114**
Ashfield	2
Bernardston	9
Buckland	1
Colrain	3
Deerfield	2
Erving	4
Gill	2
Greenfield	39
Hawley	2
Leverett	1
Leyden	2
Millers Fall	2
Montague	5
Northfield	9
Orange	3
Pittsfield	1
Rowe	4
Shelburne	3
Shelburne Falls	6
South Deerfield	4
Turners Falls	9
Wendell	1

Table 3-1
Employee Residence Information, VYNPS, December 2003
(Continued)

County, State and City	Employees*
HAMPDEN COUNTY (MASSACHUSETTS)	**8**
Chicopee	3
Holyoke	1
Springfield	3
West Springfield	1
HAMPSHIRE COUNTY (MASSACHUSETTS)	**11**
Amherst	2
Belchertown	1
Easthampton	2
Florence	1
Haydenville	1
Huntington	1
Northampton	1
Westhampton	1
Williamsburg	1
MIDDLESEX COUNTY (MASSACHUSETTS)	**4**
Billerica	1
North Reading	1
Stow	1
Winchester	1
NORFOLK COUNTY (MASSACHUSETTS)	**2**
Franklin	1
Weymouth	1
PLYMOUTH COUNTY (MASSACHUSETTS)	**1**
Marshfield	1
WORCESTER COUNTY (MASSACHUSETTS)	**18**
Athol	5
Barre	1

Table 3-1
Employee Residence Information, VYNPS, December 2003
(Continued)

County, State and City	Employees*
WORCESTER COUNTY (MASS.) Cont'd.	
Bolton	1
Boylston	1
Gilbertville	1
Northborough	1
Royalston	1
Shrewsbury	1
South Barre	1
Sturbridge	1
Sutton	2
Webster	1
Westborough	1
PLYMOUTH COUNTY (CONNECTICUT)	**2**
Glastonbury	2
MIDDLESEX COUNTY (CONNECTICUT)	**1**
East Hampton	1
NEW LONDON COUNTY (CONNECTICUT)	**1**
East Lyme	1
HERNANDO COUNTY (FLORIDA)	**1**
Spring Hill	1
MARION COUNTY (FLORIDA)	**1**
Ocala	1
FULTON COUNTY (GEORGIA)	**1**
Atlanta	1
ANDROSCOGGIN COUNTY (MAINE)	**1**
Durham	1
LINCOLN COUNTY (MAINE)	**1**
Alna	1

Table 3-1
Employee Residence Information, VYNPS, December 2003
(Continued)

County, State and City	Employees*
PRINCE GEORGE'S COUNTY (MARYLAND)	**1**
Adelphi	1
HOUGHTON COUNTY (MICHIGAN)	**1**
Houghton	1
LINCOLN COUNTY (MISSISSIPPI)	**1**
Brookhaven	1
ONONDAGA COUNTY (NEW YORK)	**1**
Tully	1
OSWEGO COUNTY (NEW YORK)	**1**
Fulton	1
WESTCHESTER COUNTY (NEW YORK)	**1**
White Plains	1
CUMBERLAND COUNTY (PENNSYLVANIA)	**1**
Camp Hill	1
HAMPSHIRE COUNTY (WEST VIRGINIA)	**1**
Augusta	1
TOTAL EMPLOYEES* =	**678**

* Entergy and baseline contractors

3.6 References

3-1 Entergy VY (Entergy Nuclear Vermont Yankee, LLC). 2002. Vermont Yankee Nuclear Power Station, Off-Site Dose Calculation Manual, Revision 30.

3-2 Entergy VY (Entergy Nuclear Vermont Yankee). 2003. Correspondence (BVY 03-80) from Entergy Nuclear Vermont Yankee, LLC, to the U. S. Nuclear Regulatory Commission, Vermont Yankee Nuclear Power Station License No. DPR-28 (Docket No. 50-271) Technical Specification Proposed Change No. 263 Extended Power Uprate, September 10, 2003.

3-3 Entergy VY (Entergy Nuclear Vermont Yankee). 2004. Vermont Yankee Nuclear Power Station, Updated Final Safety Analysis Report, Revision 19.

3-4 NRC (U.S. Nuclear Regulatory Commission) 2005. United States Nuclear Regulatory Commission, Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc., Docket No. 50-271, Vermont Yankee Nuclear Power Station Draft Environmental Assessment and Finding of No Significant Impact Related to the Proposed License Amendment to Increase the Maximum Reactor Power Level, November 3, 2005.

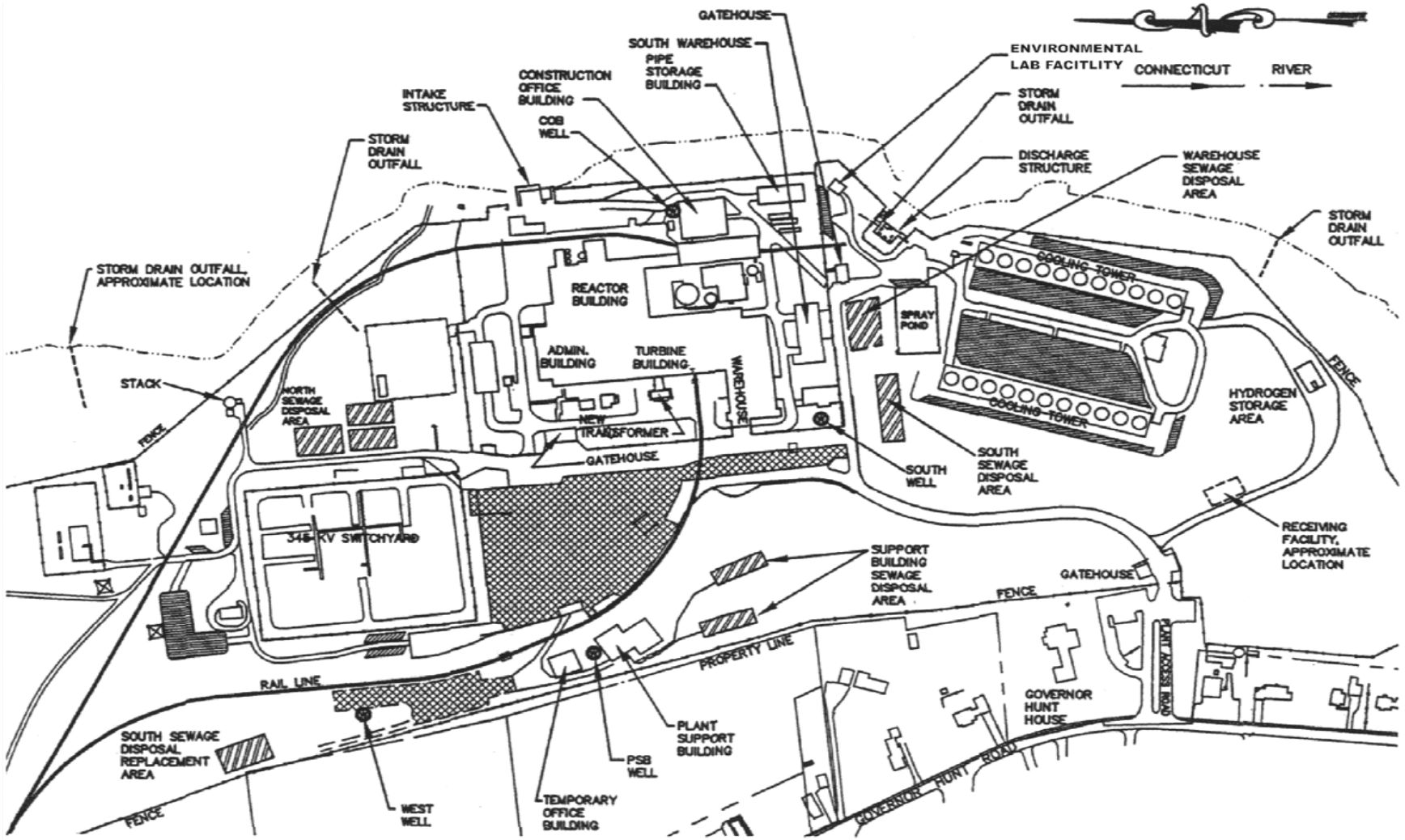

Figure 3-1
VYNPS Plant Features

4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

Discussion of GEIS Categories for Environmental Issues

The NRC has identified and analyzed 92 environmental issues that it considers to be associated with nuclear power plant license renewal and has designated the issues as Category 1, Category 2, or NA (not applicable). NRC designated an issue as Category 1 if the following criteria were met:

- 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 characteristic;

- a single significance level (i.e., small, moderate, or large) has been assigned to the impacts that would occur at any plant, regardless of which plant is being evaluated (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent-fuel disposal); and

- 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 to be not sufficiently beneficial to warrant implementation.

If the NRC concluded that one or more of the Category 1 criteria could not be met, NRC designated the issue Category 2. NRC requires plant-specific analysis for Category 2 issues. NRC designated two issues as NA, signifying that the categorization and impact definitions do not apply to these issues. NRC rules do not require analyses of Category 1 issues that NRC resolved using generic findings (10 CFR 51, Appendix B, Table B-1) as described in the GEIS [Reference 4-11]. An applicant may reference the generic findings or GEIS analyses for Category 1 issues.

Category 1 License Renewal Issues

Entergy has determined that, of the 69 Category 1 issues, 10 are not applicable to VYNPS because they apply to design or operational features that do not exist at the facility. In addition, because Entergy does not plan to conduct refurbishment activities, the NRC findings for the 7 Category 1 issues applicable to refurbishment do not apply. Table 4-1 lists these 17 issues and provides a brief explanation of why they are not applicable to VYNPS. Table 4-2 lists the 52 Category 1 issues applicable to VYNPS. Entergy reviewed the NRC findings on these 52 issues and identified no new and significant information that would invalidate the findings for VYNPS. Entergy has not identified any new and significant information concerning the impacts addressed by these findings.

Table 4-1
Category 1 Issues Not Applicable to VYNPS

Surface Water Quality, Hydrology, and Use (for All Plants)	
Impacts of refurbishment on surface water quality	No refurbishment activities planned.
Impacts of refurbishment on surface water use	No refurbishment activities planned.
Altered salinity gradients	VYNPS located on freshwater body.
Altered thermal stratification of lakes	VYNPS not located on a lake.
Aquatic Ecology (for All Plants)	
Refurbishment	No refurbishment activities planned.
Groundwater Use and Quality	
Impacts of refurbishment on groundwater use and quality	No refurbishment activities planned.
Groundwater quality degradation (Ranney Wells)	VYNPS does not use Ranney wells.
Groundwater quality degradation (saltwater intrusion)	VYNPS located on freshwater body.
Groundwater quality degradation (cooling ponds in salt marshes)	VYNPS located on freshwater body.
Human Health	
Radiation exposures to the public during refurbishment	No refurbishment activities planned.
Occupational radiation exposures during refurbishment	No refurbishment activities planned.
Terrestrial Resources	
Cooling pond impacts on terrestrial resources	VYNPS does not use cooling ponds.
Bird collisions with cooling towers	VYNPS does not use natural draft towers.
Power line right-of-way management (cutting and herbicide application)	All power lines at VYNPS exist on site property from plant to switchyard.
Floodplains and wetland on power line right of way	All power lines at VYNPS exist on site property from plant to switchyard and none cross regulated floodplains or wetlands.
Socioeconomics	
Aesthetic impacts (refurbishment)	No refurbishment activities planned.
Land Use	
Power line right-of-way	All power lines at VYNPS exist on site property from plant to switchyard.

Table 4-2
Category 1 Issues Applicable to VYNPS

Surface Water Quality, Hydrology, and Use (for All Plants)
Water use conflicts (plants with once-through cooling systems)
Altered current patterns at intake and discharge structures
Temperature effects on sediment transport capacity
Scouring caused by discharged cooling water
Eutrophication
Discharge of chlorine or other biocides
Discharge of sanitary wastes and minor chemical spills
Discharge of other metals in waste water
Aquatic Ecology (for All Plants)
Accumulation of contaminants in sediments or biota
Entrainment of phytoplankton and zooplankton
Cold shock
Thermal plume barrier to migrating fish
Distribution of aquatic organisms
Premature emergence of aquatic insects
Gas supersaturation (gas bubble disease)
Low dissolved oxygen in the discharge
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses
Stimulation of nuisance organisms (e.g., shipworms)
Aquatic Ecology (for Plants with Cooling Tower Based Heat Dissipation Systems)
Entrainment of fish and shellfish in early life stages
Impingement of fish and shellfish
Heat shock
Ground-water Use and Quality
Groundwater use conflicts (potable and service water; plants that use <100 gpm)
Terrestrial Resources
Cooling tower impacts on crops and ornamental vegetation
Cooling tower impacts on native plants
Bird collision with power lines

Table 4-2
Category 1 Issues Applicable to VYNPS
(Continued)

Terrestrial Resources (continued)
Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)
Air Quality
Air quality effects of transmission lines
Land Use
Land use (license renewal period)
Human Health
Microbiological organisms (occupational health)
Noise
Radiation exposures to public (license renewal term)
Occupational radiation exposures (license renewal term)
Socioeconomics
Public services: public safety, social services, and tourism and recreation
Public services, education (license renewal term)
Aesthetic impacts (license renewal term)
Aesthetic impacts of transmission lines (license renewal term)
Postulated Accidents
Design basis accidents
Uranium Fuel Cycle and Waste Management
Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high level waste)
Offsite radiological impacts (collective effects)
Offsite radiological impacts (spent fuel and high level waste disposal)
Non-radiological impacts of the uranium fuel cycle
Low-level waste storage and disposal
Mixed waste storage and disposal
On-site spent fuel
Nonradiological waste
Transportation

Table 4-2
Category 1 Issues Applicable to VYNPS
(Continued)

Decommissioning
Radiation doses
Waste management
Air quality
Water quality
Ecological resources
Socioeconomic impacts

Category 2 License Renewal Issues

NRC designated 21 issues as Category 2. Sections 4.1 through 4.21 address the Category 2 issues, beginning with a statement of the issue. As is the case with Category 1 issues, some Category 2 issues (2) apply to operational features that VYNPS does not have. In addition, some Category 2 issues (4) apply only to refurbishment activities. If the issue does not apply to VYNPS, the section explains the basis.

For the 15 Category 2 issues applicable to VYNPS, the corresponding sections contain the required analyses. These analyses include conclusions regarding the significance of the impacts relative to renewal of the operating license for VYNPS and, when applicable, discuss potential mitigative alternatives to the extent required. Entergy has identified the significance of the impacts associated with each issue as SMALL, MODERATE or LARGE consistent with the criteria that NRC established in 10 CFR 51, Appendix B, Table B-1, Footnote 3 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. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.

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

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

In accordance with NEPA practice, Entergy considered ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are small receive less mitigative consideration than impacts that are large).

"NA" License Renewal Issues

NRC determined that its categorization and impact-finding definitions did not apply to electromagnetic fields (chronic effect) and environmental justice. NRC noted that applicants currently do not need to submit information on chronic effects from electromagnetic fields (10 CFR 51, Appendix B, Table B-1, Footnote 5). For environmental justice, NRC does not require information from applicants, but noted that it would be addressed in individual license renewal reviews (10 CFR 51, Appendix B, Table B-1, Footnote 6). Entergy has included environmental justice demographic information in Section 2.6.2.

Format of Category 2 Issue Review

The review and analysis for the Category 2 issues and environmental justice are found in Sections 4.1 through 4.22. The format for the review of the Category 2 issues is described below.

- *Issue* - a brief statement of the issue.
- *Description of Issue* - a brief description of the issue.
- *Findings from Table B-1, Appendix B to Subpart A* - the findings for the issue from Table B-1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Appendix B to Subpart A.
- *Requirement* - the requirement from 10 CFR 51.53(c)(3)(ii) is restated.
- *Background* - for issues applicable to VYNPS, a background excerpt from the applicable section of the GEIS is provided. The specific section of the GEIS is referenced for the convenience of the reader. In most cases, background information is not provided for issues that are not applicable to VYNPS.
- *Analysis of Environmental Impact* - an analysis of the environmental impact as required by 10 CFR 51.53(c)(3)(ii) is provided, taking into account information provided in the GEIS, Appendix B to Subpart A of 10 CFR 51, as well as current VYNPS specific information.
- *Conclusion* - for issues applicable to VYNPS, the conclusion of the analysis is presented along with the consideration of mitigation alternatives as required by 10 CFR 51.45(c) and 10 CFR 51.53(c)(3)(iii).

4.1 Water Use Conflicts

4.1.1 Description of Issue

Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)

4.1.2 Findings from Table B-1, Appendix B to Subpart A

SMALL or MODERATE. The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations. See 10 CFR 51.53(c)(3)(ii)(A).

4.1.3 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than 3.15×10^{12} ft^3/year (9×10^{10} m^3/year), an assessment of the impact of the proposed action on the flow of the river and related impacts on instream and riparian ecological communities must be provided. The applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow.

4.1.4 Background

Consultation with regulatory and resource agencies indicates that water use conflicts are already a concern at two closed-cycle nuclear power plants (Limerick and Palo Verde) and may be a problem in the future at Byron Station and the Duane Arnold Energy Center. Because water use conflicts may be small or moderate during the license renewal period, this a Category 2 issue for nuclear plants with closed-cycle cooling systems. Related to this, the effects of consumptive water use on in-stream and riparian communities could also be small or moderate, depending on the plant [Reference 4-11, Section 4.3.2.1].

4.1.5 Analysis of Environmental Impact

Two factors may cause water-use and water-availability issues to become important for some facilities that use cooling towers. First, the relatively small rate of water withdrawal and discharge allowed some plants with cooling towers to be located on small rivers that are susceptible to droughts or competing water uses. Second, cooling towers evaporate cooling water, and consumptive water losses may represent a substantial portion of the flow in a small river.

4.1.5.1 Hydrology

VYNPS is located on Vernon Pool, an approximately 25-mile long 2,500-acre impoundment, which was created by the construction of Vernon Dam and hydroelectric station on the Connecticut River at River Mile 142. The dam was constructed in 1909 by the New England Power Company and is currently owned and operated by TransCanada. The facility has a rated

capacity of 44.4 MW and is required to maintain a minimum sustained flow of 1,250 cfs of inflow. The surface elevation of the pool fluctuates as much as 8 feet due to operations at upstream and downstream dams and runoff inflow. The maximum depth of the pool near Vernon Dam is approximately 40 feet. Based on flows from 1944 to 1988, the average daily flow is approximately 10,500 cfs. The average annual flow rate for the river at Vernon Dam is approximately 3.3×10^{11} ft^3/year.

4.1.5.2 Cooling Water Use

VYNPS uses a variable condenser cooling system which can be operated in a variety of configurations to maintain compliance with temperature discharge limits. The cooling system can be operated in a once-through configuration, a closed-cycle recirculating system utilizing cooling towers, or a combination of both, known as hybrid cycle mode. The plant withdraws cooling water from Vernon Pool at a maximum rate of approximately 360,000 gpm using a once-through cooling configuration. When the plant is operated in a closed-cycle configuration using both cooling towers, the amount of water pumped from Vernon Pool is reduced to about 10,000 gpm (22 cfs).

Except for consumptive water use, cooling water is discharged to Vernon Pool. A maximum consumptive water use of 5,000 gpm (11 cfs) occurs from cooling tower evaporation when the plant is operated in a closed-cycle configuration [Reference 4-1, Section III.D]. Therefore, consumptive water loss due to the operation of VYNPS is approximately 0.1% of the average daily flow at Vernon Dam. If the plant operates under the conditions of the proposed power uprate project during the extended operational period, consumptive water loss may increase. The worst case scenario would occur if weather conditions for continuous use of closed-cycle cooling and the highest evaporation rate coincided with a low river flow of 1,250 cfs. In this situation, the loss would be less than 1.5% of stream flow. However, consumptive water loss is still below the Vermont Water Quality Standards (Section 3-01.B.1) streamflow protection guideline of no more than 5% diminished flow at the 7Q10 stream flow rate. Thus, this loss of instream flow has an insignificant impact on the overall flow of the Connecticut River through the Vernon Pool.

4.1.5.3 Riparian Uses

The demand for water from Vernon Pool and the Connecticut River by municipal, agricultural, and industrial users is low and there is no reported water availability problem on the river. The major industrial use of the river water is for hydropower purposes.

Although relatively small, the consumptive loss of water at VYNPS removes water from potential hydropower uses downstream. Entergy pays TransCanada annually for the loss of water that would otherwise be used for hydropower generation at the Vernon Dam Hydroelectric Station. Compensation for loss is calculated according to hours of cooling tower operation, impact on power generation at the dam, and daily power cost [Reference 4-20].

4.1.5.4 Instream Ecological Uses

The various ecological communities of Vernon Pool are described in Section 2.2. Because VYNPS is located on a river impoundment and there are no reported water availability problems, the relatively small consumptive water loss from VYNPS does not have a significant adverse impact on hydrology of the Connecticut River or on its instream ecological communities. The results of annual ecological monitoring conducted for over 30 years support this conclusion [Reference 4-6; Reference 4-10].

4.1.6 Conclusion

The continued operation of VYNPS will not result in water use conflicts on Vernon Pool or the Connecticut River. Consumptive water loss due to the operation of VYNPS as discussed in Section 4.1.5.2 above is well below the Vermont Water Quality Standards (Section 3-01, B.1) streamflow protection guideline of no more than 5% diminished flow at the 7Q10 stream flow rate. Since the plant became operational in 1972, water withdrawal has caused no water availability concerns for the pool, conflicts with other off-stream users, or adverse impacts on riparian or instream ecological communities. This conclusion is supported by the results of studies conducted at the plant and on the river for over 30 years. Therefore, Entergy concludes that any water use conflict during the period of license renewal would remain SMALL and it does not warrant further mitigation.

4.2 Entrainment of Fish and Shellfish in Early Life Stages

4.2.1 Description of Issue

Entrainment of fish and shellfish in early life stages (for all plants with once-through and cooling pond heat dissipation systems)

4.2.2 Findings from Table B-1, Appendix B to Subpart A

SMALL, MODERATE or LARGE. The impacts of entrainment are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, such that entrainment studies conducted in support of the original license may no longer be valid. See 10 CFR 51.53(c)(3)(ii)(B).

4.2.3 Requirement [10 CFR 51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations and, if necessary, a 316(a) variance in accordance with 40 CFR 125, or equivalent state permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock and impingement and entrainment.

4.2.4 Background

The effects of entrainment on aquatic resources were considered by NRC at the time of original licensing and are periodically reconsidered by EPA or state water quality permitting agencies in the development of National Pollutant Discharge Elimination System (NPDES) permits and 316(b) demonstrations. The impacts of fish and shellfish entrainment are small at many plants, but they may be moderate or even large at a few plants with once-through cooling systems. Further, ongoing restoration efforts may increase the numbers of fish susceptible to intake effects during the license renewal period, so that entrainment studies conducted in support of the original license may no longer be valid. [Reference 4-11, Section 4.2.2.1.2]

4.2.5 Analysis of Environmental Impact

VYNPS uses a variable condenser cooling system which can be operated in a variety of configurations to maintain compliance with temperature discharge limits. The cooling system can be operated in a once-through configuration, a closed-cycle recirculating system utilizing cooling towers, or a combination of both, known as hybrid cycle mode. The plant withdraws cooling water from Vernon Pool at a maximum rate of approximately 360,000 gpm using a once-through cooling configuration. When the plant is operated in a closed-cycle configuration using both cooling towers, the amount of water pumped from Vernon Pool is reduced to about 10,000 gpm (22 cfs). The operational mode of the plant cooling water system is related to calendar dates and ambient river temperatures as specified in VYNPS NPDES Permit VT0000264 (VDEC Permit No. 3-1199), included as Attachment D. VYNPS operates the condenser cooling water system in a once-through, recirculating, or hybrid configuration according to temperature limits established for the plant. Therefore, the plant operates in a closed cycle mode during warmer months of the year when the peak larval fish densities occur in the river. Following the extended power uprate, operation in the closed cycle mode may also be required at times during the cooler months. During open cycle operation, the extended power uprate will not result in any change to the flow rate of water withdrawn from the Connecticut River through the intake. Therefore, no increase in entrainment would be expected following the extended power uprate.

4.2.5.1 Environmental Monitoring

Part IV of the NPDES Permit requires VYNPS to conduct environmental monitoring studies to assure the plant does not violate applicable water quality standards and is not adverse to fish and other wildlife that inhabit the Connecticut River. In addition to monitoring compliance with established temperature limits, the studies require annual monitoring of river flow rate, water quality, macroinvertebrate populations, larval fish, resident fish populations, anadromous fish (American shad and Atlantic salmon), and fish impingement. A copy of the most recent annual report is included as Attachment F [Reference 4-10]. Results of these reports are reviewed by an Environmental Advisory Committee composed of the Vermont Department of Environmental Conservation, Vermont Department of Fish and Wildlife, New Hampshire Department of Environmental Services, New Hampshire Department of Fish and Game, Massachusetts

Department of Environmental Protection, Massachusetts Division of Fish and Wildlife, and USFWS Coordinator of the Connecticut River Anadromous Fish Program [Reference 4-16].

4.2.5.2 Entrainment (Larval Fish Sampling)

Entrainment occurs when planktonic larval fish drifting in the river are carried with cooling water through the intake screens, pumps and steam condensers. High mortality to larval fish results from mechanical and hydraulic forces experienced within the cooling system. Although studies have shown some larval fish survive entrainment, it is usually assumed for monitoring purposes that 100% mortality occurs.

Weekly larval fish sampling is conducted annually from May through mid-July in the vicinity of the VYNPS intake structure. Samples are collected at the surface, mid-depth and near the bottom of Vernon Pool in the vicinity of VYNPS using a 50-cm diameter plankton net towed behind a boat. A flow meter is used to estimate the volume of each sample. Samples are washed and preserved in 5% formalin for laboratory sorting and identification. Identification is performed at the lowest taxonomic level practical.

Between 1988 and 1997 [Reference 4-6], a total of approximately 6000 larval fish representing 14 taxa were collected and identified. Minnows and white perch (comprising 84% of the total) were the most abundant taxa collected. Sunfishes (*Lepomis spp*.), yellow perch, common carp, walleye, and largemouth bass together made up the remaining 16%. A total of 4 largemouth bass and 1 American shad were collected during the period. Overall, the relative density of larval fish in the Connecticut River and cooling water pumped from the river was low. The results of the 1988-1997 review confirmed earlier conclusions that the impact of entrainment at VYNPS on fish populations in the Connecticut River was minimal and resulted in no adverse impact [Reference 4-2, page 32-1].

Annual entrainment monitoring and reporting has continued at VYNPS as a condition of the plant discharge permit. In 2003, 33 ichthyplankton samples were collected in Vernon Pool [Reference 4-9, Section 5.2.4]. A total of 1,222 larval fish were identified in these samples. The most common larval fish present were spottail shiner (72%), with white perch, centrachids, yellow perch, common carp, white sucker and walleye making up the remaining 28%. [Reference 4-9, Section 5.2.4] During the 2004 monitoring period, a total of 1,057 larval fish were collected in samples from Vernon Pool, with sample composition being similar to previous years. Sunfishes made up 69% of the larval fish collected, with spottail shiner, white perch, white sucker, common carp, yellow perch, tessellated darter, and walleye eggs and larva making up the remaining 31%. [Reference 4-10, Section 5.2.4] These results continue to demonstrate the low larval fish densities in the area and that the impact of entrainment on the indigenous community of fish in Vernon Pool has been minimal.

Years of annual monitoring at VYNPS has demonstrated that larval fish densities are low in the vicinity of the plant cooling water intake structure. Annual monitoring in Vernon Pool has also demonstrated that the total number and species composition of resident fish populations in the

river has not changed significantly over the years and is typical of populations present in the Connecticut River basin.

4.2.6 Conclusion

Although the plant operates in a closed cycle mode during warmer months of the year when the peak larval densities are occurring (and may also operate in a closed cycle mode at times during the cooler months after the extended power uprate), VYNPS has conducted extensive studies on the potential impact of cooling water withdrawals from Vernon Pool on indigenous communities of fish in Vernon Pool. Over 30 years of monitoring data collected on the Connecticut River support the conclusion that the plant has not had an adverse impact on indigenous fish populations, including federally listed threatened and endangered species. The results of the most recent annual monitoring studies continue to support this conclusion [Reference 4-10]. Therefore, Entergy concludes that any impact on these populations from larval fish entrainment during the license renewal period would be SMALL and does not warrant further mitigation.

4.3 Impingement of Fish and Shellfish

4.3.1 Description of Issue

Impingement of fish and shellfish (for all plants with once-through and cooling pond heat dissipation systems)

4.3.2 Findings from Table B-1, Appendix B to Subpart A

SMALL, MODERATE or LARGE. The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. See 10 CFR 51.53(c)(3)(ii)(B).

4.3.3 Requirement [10 CFR 51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations and, if necessary, a 316(a) variance in accordance with 40 CFR 125, or equivalent state permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock and impingement and entrainment.

4.3.4 Background

Aquatic organisms that are drawn into the intake with the cooling water and are too large to pass through the debris screens may be impinged against the screens. Mortality of fish that are impinged is high at many plants because impinged organisms are eventually suffocated by being held against the screen mesh or are abraded, which can result in fatal infection. Impingement can affect large numbers of fish and invertebrates (crabs, shrimp, jellyfish, etc.). As with entrainment, operational monitoring and mitigative measures have allayed concerns about

population-level effects at most plants, but impingement mortality continues to be an issue at others. Consultation with resource agencies revealed that impingement is a frequent concern at once-through power plants, particularly where restoration of anadromous fish may be affected. Impingement is an intake-related effect that is considered by EPA or state water quality permitting agencies in the development of NPDES permits and 316(b) determinations. The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through cooling systems. [Reference 4-11, Section 4.2.2.1.3]

4.3.5 Analysis of Environmental Impact

VYNPS utilizes a variable condenser cooling system which can be operated in a variety of configurations to maintain compliance with temperature discharge limits. The cooling system can be operated in a once-through configuration, a closed-cycle recirculating system utilizing cooling towers, or a combination of both, known as hybrid cycle mode. The plant withdraws cooling water from Vernon Pool at a maximum rate of approximately 360,000 gpm using a once-through cooling configuration. When the plant is operated in a closed-cycle configuration using both cooling towers, the amount of water pumped from Vernon Pool is reduced to about 10,000 gpm (22 cfs).

The operational mode of the plant cooling water system is related to calendar dates and ambient river temperatures as specified in the VYNPS NPDES Permit VT0000264 (VDEC Permit No. 3-1199), which is included as Attachment D. VYNPS is required to operate the condenser cooling water system in a once-through, recirculating, or hybrid configuration according to temperature limits established for the plant. Therefore, the plant operates in a closed cycle mode during warmer months of the year.

Following the extend power uprate, operation in the closed cycle mode may also be required at times during the cooler months. During open cycle operation, the extended power uprate will not result in any change to the flow rate of water withdrawn from the Connecticut River through the intake. Therefore, no increase in impingement would be expected following the extended power uprate

4.3.5.1 Environmental Monitoring

Part IV of the NPDES Permit requires VYNPS to conduct environmental monitoring studies to demonstrate the plant does not violate applicable water quality standards and is not adverse to fish and other wildlife that inhabit the Connecticut River. In addition to monitoring compliance with established temperature limits, the studies require annual monitoring of river flow rate, water quality, macroinvertebrate populations, larval fish, resident fish populations, anadromous fish (American shad and Atlantic salmon), and fish impingement. A copy of the most recent annual report is included as Attachment F [Reference 4-10]. Results of these reports are reviewed by an Environmental Advisory Committee composed of the Vermont Department of Environmental Conservation, Vermont Department of Fish and Wildlife, New Hampshire Department of Environmental Services, New Hampshire Department of Fish and Game, Massachusetts Department of Environmental Protection, Massachusetts Division of Fish and

Wildlife, and USFWS Coordinator of the Connecticut River Anadromous Fish Program [Reference 4-16].

As a condition of the NPDES Permit, limits were established by the EAC for the number of American shad and Atlantic salmon, considered by the EAC as two important species of fish which could be impinged. These impingement limits are based on calculations outlined in Part IV of the NPDES Permit (see Attachment D) and may vary to some degree on an annual basis. Annual impingement losses below these calculated values were not considered by the EAC to adversely affect populations of these two important species in the Connecticut River.

4.3.5.2 Fish Populations

The fish community was routinely sampled upstream and downstream of Vernon Dam during 1986 - 1997 as part of the NPDES monitoring requirements utilizing trap nets and electrofishing gear. The sampling effort occurred during May, June, September and October. During a nine-year sampling period (1986, 1988 and 1990 - 1997), a total of 30,202 fish representing 30 species was collected. The most common fishes collected were yellow perch (26%), rock bass (11%), pumpkin seed (10%), spottail shiner (9%) and white sucker (9%). Upstream collections (reservoir habitat) accounted for 66% of the fish caught with yellow perch (36%), pumpkinseed (14%) and white sucker (9%) being the most abundant. The most abundant fishes captured downstream of Vernon Dam (riverine and flowing pool habitat) were rock bass (21%), smallmouth bass (14%) and spottail shiner (11%). [Reference 4-6]

The annual abundance for each of the species, which comprised approximately 95% of the total catch, varied throughout the period and was likely due to natural yearly and seasonal fluctuations and recruitment success. These findings were similar to those previously reported [Aquatec 1990] and indicate there have been no adverse trends in population as a result of VYNPS operations. [Reference 4-6]

Annual fish population studies have continued as a condition of the plant discharge permit. In 2003, a total of 858 fish representing 24 species was collected utilizing electrofishing gear. Upstream collections accounted for 74% of the fish caught with yellow perch (36%), bluegill (32%) and pumpkinseed (12%) being the most abundant. The most abundant fishes captured downstream of Vernon Dam were smallmouth bass (38%), bluegill (19%), spottail shiner (14%) and rock bass (8%). [Reference 4-9] In 2004, a total a total of 627 fish representing 22 species was collected utilizing electrofishing gear. Upstream collections accounted for 74% of the fish caught with yellow perch (42%), bluegill (27%), pumpkinseed (10%) and largemouth bass (7%) being the most abundant. The most abundant fishes captured downstream of Vernon Dam were smallmouth bass (29%), rock bass (18%), spottail shiner (16%) and American shad (12%) [Reference 4-10]

Based on current population studies as compared to previous years, results continue to demonstrate no discernible downward trend in fish communities or species. Therefore, there has been no evidence of an adverse trend as a result of VYNPS operations.

4.3.5.3 Impingement

Fish impingement occurs when juvenile and adult fish too large to be entrained collect on the 3/8-inch mesh screens located at the intake structure. Mortality of fish that are impinged is high at many plants because impinged organisms are eventually suffocated by being held against the screen mesh or are abraded, which can result in fatal infections. The purpose of the impingement monitoring program at VYNPS was to provide sufficient information for the accurate determination of impingement impacts by the plant on fish populations in Vernon Pool.

Routine impingement sampling is conducted at the circulating water intake screens during the periods of April 1 through June 15 and August 1 through October 31. Samples are collected weekly using 6-day backwash and 24-hour backwash samples. Collected fish are identified to the lowest practical taxon, weighed to the nearest gram, and the total length is measured to the nearest millimeter.

In 1988 and 1990 - 1997, a total of nearly 15,000 fish were collected during sampling efforts conducted in the spring and fall. The most abundant fish collected at VYNPS was *Lepomis* spp. (46%), followed by yellow perch (15%), rock bass (11%), and spottail shiner (8%). A total of 387 American shad and 202 Atlantic salmon smolts were impinged during the 9-year period of study, comprising 3% and 1%, respectively, of the total fish impinged. During this period of review, the NPDES Permit calculated limits for anadromous fish were never exceeded. [Reference 4-6, Section 6.0] These monitoring results support earlier findings that impingement losses at VYNPS are low and that the operation of the plant does not result in significant adverse impacts to resident fish communities.

Annual impingement monitoring and reporting has continued at VYNPS as a condition of the plant discharge permit. During 2003, a total of 1,142 fish were impinged during the April through October monitoring period [Reference 4-9]. Bluegill (33%), yellow perch (15%), pumpkinseed (14%), black crappie (11%) and rock bass (9%) were the most abundant in samples collected during the year. A total of 13 American shad and 28 Atlantic salmon smolts were impinged during 2003, comprising 1% and 2%, respectively, of the total fish impinged. [Reference 4-9] During the 2004 monitoring period, a total of 236 fish were impinged. American shad (31%), bluegill (28%), rock bass (10%), yellow perch (8%) and black crappie (4%) were the most abundant in samples collected during the year. No Atlantic salmon smolts were impinged during 2004. [Reference 4-10] The composition of impinged fish during 2003 and 2004 was similar to previous years.

Annual monitoring at VYNPS has demonstrated that impingement losses are consistently below the specified limits for the two anadromous species of concern (American shad and Atlantic salmon). Annual monitoring in Vernon Pool also demonstrates that the total number and species composition of resident fish populations in the river has not changed significantly over the years and is typical of populations present in the Connecticut River basin [References 4-9, 4-10].

4.3.6 Conclusion

VYNPS has conducted extensive studies on the potential impact of cooling water withdrawals from Vernon Pool on indigenous communities of fish in Vernon Pool. Over 30 years of monitoring data collected on the Connecticut River support the conclusion that the plant has not had an adverse impact on fish populations, including federally listed and threatened and endangered species. The results of the most recent annual monitoring studies continue to support this conclusion. Therefore, Entergy concludes that any impact on these populations from larval fish entrainment during the license renewal period would be SMALL and does not warrant further mitigation.

4.4 Heat Shock

4.4.1 Description of Issue

Heat shock (for all plants with once-through and cooling pond heat dissipation systems)

4.4.2 Findings from Table B-1, Appendix B to Subpart A

SMALL, MODERATE or LARGE. Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants. See 10 CFR 51.53(c)(3)(ii)(B).

4.4.3 Requirement [10 CFR 51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(a) determinations and variance in accordance with 40 CFR 125, or equivalent state permits and supporting documentation. If the applicant can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock.

4.4.4 Background

Based on the research literature, monitoring reports, and agency consultations, the potential for thermal discharges to cause thermal discharge effect mortalities is considered small for most plants. However, impacts may be moderate or even large at a few plants with once-through cooling systems. For example, thermal discharges at one plant are considered by the agencies to have damaged the benthic invertebrate and seagrass communities in the effluent mixing zone around the discharge canal; as a result, helper cooling towers have been installed to reduce the discharge temperatures. Conversely, at other plants it may become advantageous to increase the temperature of the discharge in order to reduce the volume of water pumped through the plants and thereby reduce entrainment and impingement effects. Because of continuing concerns about thermal discharge effects and the possible need to modify thermal discharges in the future in response to changing environmental conditions, this is a Category 2 issue for plants with once-through cooling systems. [Reference 4-11, Section 4.2.2.1.4]

4.4.5 Analysis of Environmental Impact

VYNPS utilizes a variable condenser cooling system which can be operated in a variety of configurations to maintain compliance with temperature discharge limits. The cooling system can be operated in a once-through configuration, a closed-cycle recirculating system utilizing cooling towers, or a combination of both, known as hybrid cycle mode. The plant withdraws cooling water from Vernon Pool at a maximum rate of approximately 360,000 gpm using a once-through cooling configuration. When the plant is operated in a closed-cycle configuration using both cooling towers, the amount of water pumped from Vernon Pool is reduced to about 10,000 gpm (22 cfs).

4.4.5.1 Temperature Limits

The operational mode of the plant cooling water system is related to calendar dates and ambient river temperatures as specified in VYNPS NPDES Permit VT0000264 (VDEC Permit No. 3-1199), included as Attachment D.

VYNPS operates the condenser cooling water system in a once-through, recirculating, or hybrid configuration according to limits established for two periods of the year.

- During the summer (May 16 through October 14), the increase in temperature above ambient at Station 3 shall not exceed the following limits. Although not necessary for operation after the extended power uprate, Entergy has applied for an amendment to the NPDES permit to allow a 1°F increase in the thermal discharge limits applicable to the summer period for river temperatures above 55°F and below 78°F.

River Temperature at Station 7 (upstream)	Increase Above Ambient at Station 3 (downstream)
>63°F	2°F
>59°F, < 63°F	3°F
>55°F, <59°F	4°F
< 55°F	5°F

- During the winter (October 15 through May 15), the discharge of cooling water to the river is permitted under the following standards:

  (1) when using once-through cooling, the temperature at Station 3 (downstream of Vernon Dam) shall not exceed 65°F;

  (2) the rate of temperature change shall not exceed 5°F/hr; and

  (3) the increase in temperature above ambient shall not exceed 13.4°F.

As discussed in Section 2.2, river flow at Vernon Dam is regulated to maintain a minimum sustained flow of 1,250 cfs, if sufficient flow is available. The theoretical maximum temperature increase from plant discharges is 12.9°F above ambient, when the river flow is 1,250 cfs. At this flow rate, the above temperature standards allow operation of the plant in a once-through cooling configuration from October 15 through May 15 when the river temperature is less than 52.1°F. When the ambient water temperature is greater than 52.1°F, the temperature of the discharge can be reduced by using cooling towers. [Reference 4-10, Section 2.1]

Since operational and temperature limits have been established in the VYNPS NPDES Permit to protect water quality in the Connecticut River, potential thermal impacts of cooling water discharges on aquatic biota are minimal.

4.4.5.2 Environmental Monitoring

Part IV of the discharge permit requires VYNPS to conduct environmental monitoring studies to assure the plant does not violate applicable water quality standards and is not adverse to fish and other wildlife that inhabit the Connecticut River. In addition to monitoring compliance with established temperature limits, the studies require annual monitoring of river flow rate, water quality, macroinvertebrates, larval fish, resident fish populations, anadromous fish (American shad and Atlantic salmon), and fish impingement. A copy of the most recent annual report is included in Attachment F [Reference 4-10]. Annual reports are reviewed by an Environmental Advisory Committee composed of agencies representing the states of Vermont, New Hampshire, Massachusetts, and the USFWS.

4.4.5.3 316(a) Demonstrations

VYNPS was originally permitted in 1973 to operate solely in closed-cycle cooling mode until determinations could be made concerning possible environmental impacts from the thermal discharge of a once-through cooling system. VYNPS operated in the closed-cycle mode until February 1974 when the first of several once-through cooling testing modes was begun.

There have been numerous technical reports prepared for VYNPS in support of previous [Reference 4-8, Section 3.2]. The 316(a) demonstrations described the results of monitoring studies performed in the vicinity of the plant and examined the potential for adverse environmental impact due to the proposed changes in the thermal discharge limits. The demonstrations concluded that thermal discharge limits at VYNPS assure the protection and propagation of a balanced indigenous community of aquatic life in the Connecticut River Reference 4-8, Section 5.2]. The result of these demonstrations is reflected in the NPDES Permit thermal discharge limits discussed in Section 4.4.5.1 above.

4.4.6 Conclusion

Although operational and temperature limits have been established in the station's NPDES permit to protect water quality in the Connecticut River, VYNPS has extensively studied the potential thermal impact of cooling water discharges on aquatic biota. Over 30 years of data

collected on the Connecticut River support the conclusion that the plant does not have an adverse impact on fish or shellfish populations. Therefore, Entergy concludes that any impact on these populations from heat shock during the license renewal period would be SMALL and does not warrant further mitigation.

4.5 Groundwater Use Conflicts (Plants Using >100 gpm of Groundwater)

4.5.1 Description of Issue

Groundwater use conflicts (potable and service water, and dewatering: plants that use >100 gpm)

4.5.2 Findings from Table B-1, Subpart A, Appendix A

SMALL, MODERATE, or LARGE. Plants that use more than 100 gpm may cause groundwater use conflicts with nearby groundwater users. See 10 CFR 51.53(c)(3)(ii)(C).

4.5.3 Requirement [10 CFR 51.53(c)(3)(ii)(C)]

If the applicant's plant uses Ranney wells or pumps more than 100 gallons (total onsite) of groundwater per minute, an assessment of the impact of the proposed action on groundwater use must be provided.

4.5.4 Background

Those nuclear plants that use groundwater may affect the utility of groundwater to neighbors. This impact could occur as a direct effect of pumping groundwater, thereby either lowering the water table and reducing the availability or inducing infiltration of water of lesser quality into the ground. Neighboring groundwater users could also be affected indirectly if construction or operation of the power plant were to disrupt the normal recharge of the groundwater aquifer. The impact to neighboring groundwater users is likely to be most significant at a site where water resources are limited. Groundwater usage impact may be important at those sites where a power plant's usage rate exceeds 0.0063 m^3/s (100 gpm). Lower usage rates are not expected to impact sole source or other aquifers significantly. [Reference 4-11, Section 4.8.1].

4.5.5 Analysis of Environmental Impact

As discussed in Section 2.3 of this ER, the actual pump rate from all onsite potable wells was 8.54 gpm based on measured water usage during 2002 and 2003. In addition, an estimate of the groundwater demand that would be needed for 1,700 employees on the VYNPS site during a refueling outage was also calculated. Based on this calculation, the maximum groundwater demand would be 35.4 gpm as shown in Table 2-2 of this ER. These values are well below the pump rate of 100 gallons (total onsite) of groundwater per minute. Therefore, Entergy concludes that environmental impact of water use conflicts from license renewal would be SMALL and does not warrant mitigation.

4.5.6 Conclusion

VYNPS does not pump more than 100 gallons (total onsite) of groundwater per minute for onsite use. Therefore, Entergy concludes that environmental impact of water use conflicts from license renewal would be SMALL and does not warrant mitigation.

4.6 Groundwater Use Conflicts (Plants Using Cooling Towers Withdrawing Make-Up Water from a Small River)

4.6.1 Description of Issue

Groundwater use conflicts (plants using cooling towers withdrawing make-up water from a small river)

4.6.2 Findings from Table B-1, Appendix B to Subpart A

SMALL, MODERATE, or LARGE. Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other groundwater or upstream surface water users come on line before the time of license renewal. See §51.53(c)(3)(ii)(A).

4.6.3 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than 3.15×10^{12} ft^3/year (9×10^{10} m^3/year), an assessment of the impact of the proposed action on the flow of the river and related impacts on instream and riparian ecological communities must be provided. The applicant shall also provide an assessment of the impacts of the withdrawal of water form the river on alluvial aquifers during low flow.

4.6.4 Background

Consultation with regulatory and resource agencies indicate the water use conflicts are already a concern at two closed-cycle nuclear power plants (Limerick and Palo Verde) and may be a problem in the future at Byron Station and the Duane Arnold Energy Center. Because water use conflicts may be small or moderate during the license renewal period, this a Category 2 issue for nuclear plants with closed-cycle cooling systems. [Reference 4-11, Section 4.3.2.1]

4.6.5 Analysis of Environmental Impact

4.6.5.1 Hydrology

VYNPS is located on Vernon Pool, an approximately 25-mile long 2,500 acre impoundment, which was created by the construction of Vernon Dam and hydroelectric station on the Connecticut River at River Mile 142. The dam was constructed in 1909 by the New England Power Company and is currently owned and operated by TransCanada. The facility has a rated

capacity of 44.4 MW and is required to maintain a minimum sustained flow of 1,250 cfs of inflow. The surface elevation of the pool fluctuates as much as 8 feet due to operations at upstream and downstream dams and runoff inflow. The maximum depth of the pool near Vernon Dam is approximately 40 feet. Based on flows from 1944 to 1988, the average daily flow is approximately 10,500 cfs. The average annual flow rate for the river at Vernon Dam is approximately 3.3×10^{11} ft^3/year.

4.6.5.2 Cooling Water Use

VYNPS uses a variable condenser cooling system which can be operated in a variety of configurations to maintain compliance with temperature discharge limits. The cooling system can be operated in a once-through configuration, a closed-cycle recirculating system utilizing cooling towers, or a combination of both, known as hybrid cycle mode. The plant withdraws cooling water from Vernon Pool at a maximum rate of approximately 360,000 gpm using a once-through cooling configuration. When the plant is operated in a closed-cycle configuration using both cooling towers, the amount of water pumped from Vernon Pool is reduced to about 10,000 gpm (22 cfs).

Except for consumptive water use, cooling water is discharged to Vernon Pool. A maximum consumptive water use of 5,000 gpm (11 cfs) occurs from cooling tower evaporation when the plant is operated in a closed-cycle configuration [Reference 4-1, Section III.D]. Therefore, consumptive water loss due to the operation of VYNPS is approximately 0.1% of the average daily flow at Vernon Dam, which is well below the Vermont Water Quality Standards (Section 3-01.B.1) streamflow protection guideline of no more than 5% diminished flow at the 7Q10 stream flow rate. Thus, this loss of instream flow has an insignificant impact on the overall flow of the Connecticut River through Vernon Pool.

If the plant operates under the conditions of the proposed power uprate project during the extended operational period, consumptive water loss may increase slightly. The worst case scenario would occur if weather conditions for continuous use of closed-cycle cooling and the highest evaporation rate coincided with a low river flow of 1,250 cfs. In this situation, the loss would be less than 1.5% of stream flow. Vermont Water Quality Standards (Section 3-01.B.1) require that all uses of waters be supported by the streamflow and use a streamflow protection guideline of no more than 5% diminished flow at the 7Q10 stream flow rate. 7Q10 seven day low flow, ten year return period means a drought flow equal to the lowest mean flow for seven consecutive days, adjusted to nullify any effects of artificial flow regulation that has a 10% chance of occurring in any given year. Thus, the additional evaporative loss would not be significant based on the State of Vermont guidelines.

Although relatively small, the consumptive loss of water at VYNPS removes water from potential hydropower uses downstream. Entergy pays TransCanada annually for the loss of water that would otherwise be used for hydropower generation at Vernon Dam hydroelectric station. Compensation for loss is calculated according to hours of cooling tower operation, impact on power generation at the dam, and daily power cost [Reference 4-20].

4.6.5.3 Groundwater

The local groundwater level fluctuates depending on precipitation and water level changes in the Connecticut River. Drainage from precipitation or water level changes in the river occurs over a rock surface beneath a thin layer of overburden. No artesian aquifers occur in the area near VYNPS and groundwater is contained in surficial glacial deposits or in the uppermost fractured bedrock. High yield groundwater wells in the vicinity are typically located where glacial deposits are usually thick and permeable. Local wells installed in bedrock have low yields.

The local groundwater gradient slopes toward the river, into which the groundwater discharges. When the river stage rises rapidly, the gradient may reverse, in which case the river recharges the local groundwater resource [Reference 4-1, Section II.E.4]. Groundwater levels at the VYNPS site vary from a depth of 5 to 30 feet [Reference 4-4, Section 2.4.2.3.2]. No direct or indirect impact on local groundwater resources has been attributed to the operation of VYNPS. Also, no additional groundwater use is anticipated during the period of license renewal.

4.6.6 Conclusion

The continued operation of VYNPS will not result in a water use conflict in Vernon Pool and the Connecticut River. Cooling water consumptive water loss as discussed in Section 4.6.5.2 above is a very small percentage of the overall flow of the river through Vernon Dam and is well below the Vermont Water Quality Standards (Section 3-01, B.1) streamflow protection guideline of no more than 5% diminished flow at the 7Q10 stream flow rate. Since the plant became operational in 1972, water withdrawal has caused no water availability concerns for the river or conflicts with other off-stream users. In addition, during periods of diminished river flow, withdrawal of water from the river would not affect recharge of the alluvial aquifer, because the river is generally not a source of recharge during these periods. Therefore, Entergy concludes that impacts to river or aquifer elevation, or aquifer recharge rates would be SMALL and does not warrant further mitigation.

4.7 Groundwater Use Conflicts (Plants Using Ranney Wells)

4.7.1 Description of Issue

Groundwater use conflicts (plants using Ranney wells)

4.7.2 Findings from Table B-1, Subpart A, Appendix A

SMALL, MODERATE, or LARGE. Ranney wells can result in potential groundwater depression beyond the site boundary. Impacts of large groundwater withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal. See 10 CFR 51.53(c)(3)(ii)(C).

4.7.3 Requirement [10 CFR 51.53(c)(3)(ii)(C)]

If the applicant's plant uses Ranney wells or pumps more than 100 gallons (total onsite) of groundwater per minute, an assessment of the impact of the proposed action on groundwater use must be provided.

4.7.4 Analysis of Environmental Impact

VYNPS does not utilize Ranney wells. Drinking water is supplied by onsite wells and cooling water is taken from the Connecticut River. Therefore, this issue is not applicable to VYNPS and analysis is not required.

4.8 Degradation of Groundwater Quality

4.8.1 Description of Issue

Groundwater quality degradation (cooling ponds at inland sites)

4.8.2 Findings from Table B-1, Subpart A, Appendix A

SMALL, MODERATE, or LARGE. Sites with closed-cycle cooling ponds may degrade groundwater quality. For plants located inland, the quality of the groundwater in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses. See 10 CFR 51.53(c)(3)(ii)(D).

4.8.3 Requirement [10 CFR 51.53(c)(3)(ii)(D)]

If the applicant's plant is located at an inland site and utilizes cooling ponds, an assessment of the impact of the proposed action on groundwater quality must be provided.

4.8.4 Analysis of Environmental Impact

VYNPS does not utilize cooling ponds. VYNPS utilizes a once-through cooling system and helper cooling towers. Therefore, this issue is not applicable to VYNPS and analysis is not required.

4.9 Impacts of Refurbishment on Terrestrial Resources

4.9.1 Description of Issue

Refurbishment impacts - Terrestrial Resources

4.9.2 Findings from Table B-1, Subpart A, Appendix A

SMALL MODERATE, or LARGE. Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and

animal communities may be affected until the specific proposal is presented with the license renewal application. See 10 CFR 51.53(c)(3)(ii)(E).

4.9.3 Requirement [10 CFR 51.53(c)(3)(ii)(E)]

All license renewal applicants shall assess the impact of refurbishment and other license renewal related construction activities on important plant and animal habitats.

4.9.4 Analysis of Environmental Impact

As noted in Section 3.3, no refurbishment activities are required for VYNPS license renewal. Therefore this issue is not applicable to VYNPS and no analysis is required.

4.10 Threatened or Endangered Species

4.10.1 Description of Issue

Impacts from refurbishment and continued operations on threatened or endangered species

4.10.2 Findings from Table B-1, Appendix B to Subpart A

SMALL, MODERATE or LARGE. Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected. See 10 CFR 51.53(c)(3)(ii)(E).

4.10.3 Requirement [10 CFR 51.53(c)(3)(ii)(E)]

All license renewal applicants shall assess the impact of refurbishment and other license renewal related construction activities on important plant and animal habitats. Additionally, the applicant shall assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act.

4.10.4 Background

The NRC did not reach a conclusion about the significance of potential impacts to threatened and endangered species in the GEIS because (1) the significance of impacts on such species cannot be assessed without site- and project-specific information that will not be available until the time of license renewal and (2) additional species that are threatened with extinction and that may be adversely affected by plant operations may be identified between the present and the time of license renewal [Reference 4-11, Section 3.9].

4.10.5 Analysis of Environmental Impacts

Section 2.5 of this ER discusses threatened or endangered species that occur within the vicinity of the VYNPS site. Section 2.4 addresses issues related to critical and important habitats, including deer wintering areas, wetlands and unique natural areas.

As discussed in Section 3.3, Entergy has no plans to conduct refurbishment or construction activities at VYNPS during the license renewal term. Therefore, there would be no refurbishment-related impacts to special-status species and no further analysis of refurbishment-related impacts is applicable.

During the environmental assessment of the proposed power uprate project at VYNPS, the Vermont Nongame and Natural Heritage Program (VNNHP) was contacted for information regarding threatened and endangered species and unique natural areas in the vicinity of the plant [Reference 4-16]. The VNNHP concluded that no adverse impacts to protected plants would occur.

Several rare plants have been recorded on the VYNPS site [Reference 4-16]. These include giant Solomon's seal, tapering rush, and trailing stitchwort. Because access to the site is limited, natural communities of these plants have been left relatively undisturbed since construction of the site was completed. The existing community of giant Solomon's seal at the site is routinely monitored by VNNHP. The only Vermont-protected species known by VNNHP likely to occur at the site is the great St. John's wort. It occurs immediately above Vernon Dam and very near the VYNPS site boundary. Since no development is planned for this area of the plant site, continued operation of the plant during the license renewal period will have no impact on this state-listed species. Near Vernon Dam, but not occurring on the VYNPS site, are several other state-listed plants including horned pond weed, small water wort, pygmy weed and Frank's love grass.

Additionally, a bald eagle nest has been reported to occur north of Stebbins Island (New Hampshire) which is located approximately 1 river mile downstream from VYNPS [Reference 4-16]. However, there are no anticipated potential impacts on this nest site from VYNPS continued operations since there are no plans to alter operations, expand existing facilities, or require additional land in support of license renewal.

Entergy is not aware of any potential concerns regarding threatened or endangered species which could occur due to the operation of VYNPS. There are no plans to alter operations and any maintenance activities necessary to support license renewal would be limited to previously disturbed areas on-site. In addition, no expansion of existing facilities is planned and no additional land disturbance is anticipated in support of license renewal. Therefore, no adverse impacts to threatened or endangered terrestrial species from current or future operations are anticipated.

In addition, based on consultation with state and federal fish and wildlife agencies (see Attachment A and Attachment B), no critical habitats have been designated within the VYNPS

vicinity and no impacts are anticipated to threatened and endangered species during the license renewal period.

4.10.6 Conclusion

There are no major refurbishment activities required for license renewal at VYNPS. Therefore, there will be no impact to threatened and endangered species from refurbishment activities.

The continued operation of VYNPS is not anticipated to impact the three rare species known to exist on the site. Protection of the giant Solomon's seal community is assured through field monitoring performed by VNNHP. As already discussed, any maintenance activities necessary to support license renewal would be limited to previously disturbed areas on-site and no additional land disturbance is anticipated in support of license renewal. Therefore, Entergy concludes that impacts to threatened or endangered species from license renewal would be SMALL and does not warrant further mitigation.

Renewal of the operating license for VYNPS is not expected to result in the taking of any threatened or endangered species. Renewal of the license is not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modifications of any critical habitat.

4.11 Air Quality During Refurbishment (Nonattainment and Maintenance Areas)

4.11.1 Description of Issue

Air quality during refurbishment (nonattainment and maintenance areas)

4.11.2 Findings from Table B-1, Subpart A, Appendix A

SMALL, MODERATE, or LARGE. Air quality impacts from plant refurbishment associated with license renewal are expected to be small. However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas. The significance of the potential impact cannot be determined without considering the compliance status of each site and the number of workers expected to be employed during the outage. See 10 CFR 51.53(c)(3)(ii)(F).

4.11.3 Requirement [10 CFR 51.53(c)(3)(ii)(F)]

If the applicant's plant is located in or near a nonattainment or maintenance area, an assessment of vehicle exhaust emissions anticipated at the time of peak refurbishment workforce must be provided in accordance with the Clean Air Act as amended.

4.11.4 Analysis of Environmental Impact

As discussed in Section 3.3, Entergy has no plans for refurbishment related to license renewal at VYNPS. In addition, as discussed in Section 2.11, Vermont is in attainment with the National

Ambient Air Quality Standards. The nearest non-attainment areas due to the one-hour ozone standard are Hillsborough County, New Hampshire, approximately 30 miles northeast of VYNPS, and the entire state of Massachusetts, approximately 5 miles south of VYNPS. Therefore, this issue is not applicable to VYNPS and analysis is not required.

4.12 Impact on Public Health of Microbiological Organisms

4.12.1 Description of Issue

Microbiological organisms (public health) (plants using lakes or canals, or cooling towers, or cooling ponds that discharge to a small river)

4.12.2 Finding from Table B-1, Appendix B to Subpart A

SMALL, MODERATE or LARGE. These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically. See 10 CFR 51.53(c)(3)(ii)(G).

4.12.3 Requirement [10 CFR 51.53(c)(3)(ii)(G)]

If the applicant's plant uses a cooling pond, lake, or canal or discharges into a river having an annual average flow rate of less than 3.15×10^{12} ft^3/year (9×10^{10} m^3/year), an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water must be provided.

4.12.4 Background

Public health questions require additional consideration for the 25 plants using cooling ponds, lakes, canals, or small rivers because the operation of these plants may significantly enhance the presence of thermophilic organisms. The data for these sites are not now at hand and it is impossible to predict the level of thermophilic organism enhancement at a given site with current knowledge. Thus, the impacts are not known and are site-specific. Therefore, the magnitude of the potential public health impacts associated with thermal enhancement of *N. fowleri* cannot be determined generically [Reference 4-11, Section 4.3.6].

4.12.5 Analysis of Environmental Impact

According to the U.S. Center for Disease Control, *Naegleria* is commonly found in the environment and only one species, *N. fowleri,* is known to infect humans [Reference 4-17]. Infections are very rare with only 24 reported cases occurring between 1989 and 2000. These infections, which generally occur in the summer when water temperatures are high and water levels are low, take place when the amoeba enters the nose of people who are swimming or diving in warm freshwater. There are no reported cases of *N. fowleri* infection or amoebic meningoencephalitis in the vicinity of VYNPS.

Naegleria begins to proliferate at temperatures of around 30° C (86° F) and thrives at temperatures of 35 to 45°C (95 to 113°F). Water temperatures as measured near VYNPS vary from 32°F to 84°F, and therefore are below the range at which *N. fowleri* would be a concern.

In 1997, 1999, and 2001, VYNPS collected water samples from the Connecticut River and the east and west cooling towers and analyzed them for the presence of total bacteria and *Legionella* spp. During 2004, VYNPS collected water samples from the Connecticut River and the east and west cooling towers and analyzed them for the presence of *Legionella* spp. Samples were collected between July and September and were analyzed using the fluorescein isothiocyanate (FITC) method for total bacteria and the PL-DFA (direct immunofluoresence assay) method for presumptive *Legionella* counts. There are many species of *Legionella* and this method does not specifically identify *Legionella pneumophila*, the causal agent of Legionnaire's disease. The PL-DFA method is used primarily as an effective method for screening water samples for significantly high concentrations of *Legionella* bacteria. The test also cannot determine if the species of *Legionella* present are virulent and thus capable of causing a respiratory infection in humans.

Total bacteria counts were similar in all samples collected. *Legionella* counts were below the method detection level (1000 cells/ml) during 1997 and 1999. In samples collected during 2001, slightly elevated *Legionella* concentrations were detected in both raw river water samples and samples collected from the east cooling tower. *Legionella* concentrations in the west cooling tower were at or below the method detection level. All *Legionella* concentrations were considered to be relatively low due to the PL-DFA test's inability to distinguish between living and dead bacteria. During 2004, all *Legionella* results were negative.

Studies on thermophilic pathogens at power plants have concluded that risk of infection from aerosols containing *Legionella* sp. is not a public health risk but rather a potential onsite industrial hygiene concern that is managed through appropriate industrial hygiene practices [Reference 4-13, Section 4.1.4].

According to the Vermont Department of Health (VDH), contact recreation on the Connecticut River is uncommon [Reference 4-5]. In addition, no public swimming areas occur on the river between Brattleboro and Vernon. Although a few cases of giardiasis have been contracted in recent years from other water bodies in Windham County, no cases of any water-borne illness related to contact with the Connecticut River have been reported. Therefore, due to the low incidence of swimming and diving activities in the river near VYNPS, the potential for exposure to the microorganism is low.

4.12.6 Conclusion

There has been no known impact of VYNPS operation on public health related to thermophilic microorganisms to date. VYNPS's analyses and evaluations, including consultation with the VDH, indicate that the impacts of deleterious microbiological organism from plant operations during the license renewal term are expected to be SMALL and mitigation is not warranted.

4.13 Electromagnetic Fields—Acute Effects

4.13.1 Description of Issue

Electromagnetic fields, acute effects (electric shock)

4.13.2 Findings from Table B-1, Subpart A, Appendix A

SMALL, MODERATE or LARGE. Electric shock resulting from direct access to energized conductors or from induced charges in metallic structures has not been a problem at most operating plants and generally is not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electrical shock potential at the site. See 10 CFR 51.53(c)(3)(ii)(H).

4.13.3 Requirements [10 CFR 51.53(c)3)(ii)(H)]

If the applicant's transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the National Electric Safety Code for preventing electric shock from induced currents, an assessment of the impact of the proposed action on the potential shock hazard from the transmission lines must be provided.

4.13.4 Background

The transmission line of concern is that between the plant switchyard and the intertie to the transmission system. With respect to shock safety issues and license renewal, three points must be made. First, in the licensing process for the earlier licensed nuclear plants, the issue of electrical shock safety was not addressed. Second, some plants that received operating licenses with a stated transmission line voltage may have chosen to upgrade the line voltage for reasons of efficiency, possibly without reanalysis of induction effects. Third, since the initial NEPA review for those utilities that evaluated potential shock situations under the provision of the NESC, land use may have changed, resulting in the need for reevaluation of this issue.

The electrical shock issue, which is generic to all types of electrical generating stations, including nuclear power plants, is of small significance for transmission lines that are operated in adherence with NESC. Without review of each nuclear plant's transmission line conformance with NESC criteria, it is not possible to determine the significance of the electrical shock potential [Reference 4-11, Sections 4.5.4 and 4.5.4.1].

4.13.5 Analysis of Environmental Impact

As discussed in Section 3.2.7 of this ER, the only transmission lines constructed to connect VYNPS to the New England transmission grid are from the plant to the 345 kV and 115 kV switchyards. The transmission lines exiting the switchyards are part of the New England transmission grid that was constructed to supply purchased power to the State of Vermont even if the station had not been located at the Vernon site.

The 345 kV transmission lines (spans 1 and 2) between the plant and switchyards were evaluated during the power uprate with respect to additional line sag due to increased station output and line clearance to the ground. Based on this review, it was determined that the required minimum ground clearance of 29.3 feet shown in Table 232-1 of the National Electrical Safety Code (NESC) continued to be met as it relates to line heights even with the anticipated additional sag [Reference 4-3, Section 3.1].

Ground clearance for the 115 kV transmission lines (spans 3, 4, 5 and 6) is 38 feet and greater, which is well within the acceptable ground clearance limits specified in the NESC [Reference 4-19].

4.13.6 Conclusion

Transmission lines from the plant to the switchyards are in conformance with the NESC recommendations for preventing electric shock. Therefore, the impact of the potential for electric shock is SMALL and does not warrant further mitigation.

4.14 Housing Impacts

4.14.1 Description of Issue

Housing Impacts

4.14.2 Findings from Table B-1, Appendix B to Subpart A

SMALL, MODERATE or LARGE. Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the workforce associated with refurbishment may be associated with plants located in sparsely populated areas or in areas with growth control measures that limit housing development. See 10 CFR 51.53(c)(3)(ii)(I).

4.14.3 Requirement [10 CFR 51.53(c)(3)(ii)(I)]

An assessment of the impact of the proposed action on housing availability… within the vicinity of the plant must be provided.

4.14.4 Background

The impacts on housing are considered to be of small significance when a small and not easily discernible change in housing availability occurs, generally as a result of a very small demand increase or a very large housing market. Increases in rental rates or housing values in these areas would be expected to equal or slightly exceed the statewide inflation rate. No extraordinary construction or conversion of housing would occur where small impacts are foreseen.

The impacts on housing are considered to be of moderate significance when there is a discernible but short-lived reduction in available housing units because of project-induced in-migration. The impacts on housing are considered to be of large significance when project-related demand for housing units would result in very limited housing availability and would increase rental rates and housing values well above normal inflationary increases in the state.

Moderate and large impacts are possible at sites located in rural and remote areas, at sites located in areas that have experienced extremely slow population growth (and thus slow or no growth in housing), or where growth control measures that limit housing development are in existence or have been recently lifted. [Reference 4-11, Section 3.7.2]

4.14.5 Analysis of Environmental Impact

Supplement 1 to Regulatory Guide 4.2, provides the following guidance.

Section 4.14.1 states, "If there will be no refurbishment or if refurbishment involves no additional workers, then there will be no impact on housing and no further analysis is required."

Section 4.14.2 states, "If additional workers are not anticipated, there will be no impact on housing and no further analysis is required."

The VYNPS site has approximately 678 full time workers (Entergy employees and baseline contractors) during normal plant operations. The majority of these employees live within the three-county area adjacent to the plant. As discussed in Section 2.9 of this ER, little discernible change in housing availability has occurred in the three-county area near VYNPS since 1990. In addition, vacancy rates have remained relatively stable and the number of available units has kept pace with the low to moderate growth in the area population.

As noted in Section 3.3, there are no major refurbishment activities required for VYNPS license renewal. Additionally, Entergy does not anticipate a need for additional full time workers during the license renewal period. Therefore, no further analysis is required for this issue.

4.14.6 Conclusion

Although the State of Vermont has growth control measures in place under Vermont's Land Use and Development Law Title 10, Chapter 151 (Act 250), Entergy concludes that the impact on housing from the continued operation of VYNPS will be SMALL and that no mitigation is required. This conclusion is based on the following.

- As noted in Section 3.3, there are no major refurbishment activities required for license renewal at VYNPS. Therefore, there will not be an increase in outage workers over the number of workers required for typical plant outages. Likewise, there will not be an increase in the length of the typical plant outage.

- Entergy does not anticipate an increase in employment during the license renewal period.

- The number of VYNPS employees will continue to be a small percentage of the population in the adjacent counties during the period of the extended license.

4.15 Public Utilities: Public Water Supply Availability

4.15.1 Description of Issue

Public Services (public utilities)

4.15.2 Findings from Table B-1, Appendix B to Subpart A

SMALL or MODERATE. An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability. See 10 CFR 51.53(c)(3)(ii)(I).

4.15.3 Requirement [10 CFR 51.53(c)(3)(ii)(I)]

… [T]he applicant shall provide an assessment of the impact of population increases attributable to the proposed project on the public water supply.

4.15.4 Background

Impacts on public utility services are considered small if little or no change occurs in the utility's ability to respond to the level of demand and thus there is no need to add capital facilities. Impacts are considered moderate if overtaxing of facilities during peak demand periods occurs. Impacts are considered large if existing service levels (such as the quality of water and sewage treatment) are substantially degraded and additional capacity is needed to meet ongoing demands for services.

In general, small to moderate impacts to public utilities were observed as a result of the original construction of the case study plants. While most locales experienced an increase in the level of demand for services, they were able to accommodate this demand without significant disruption. Water service seems to have been the most affected public utility.

Public utility impacts at the case study sites during refurbishment are projected to range from small to moderate. The potentially small to moderate impact at Diablo Canyon is related to water availability (not processing capacity) and would occur only if a water shortage occurs at refurbishment time.

Because the case studies indicate that some public utilities may be overtaxed during peak periods, the impacts to public utilities would be moderate in some cases, although most sites would experience only small impacts [Reference 4-11, Section 3.7.4.5].

4.15.5 Analysis of Environmental Impact

As noted in Section 3.3, there are no major refurbishment activities required for VYNPS license renewal. Therefore, there will be no impact to public utilities from refurbishment activities. In addition, Entergy does not anticipate a need for additional workers during the period of extended operation. Therefore, there will be no impact to public utilities from additional plant workers living in the three-county area near the plant.

The plant is not connected to any local public water system. All onsite water needed for potable and industrial makeup uses is provided by the plant's own water systems [Reference 4-16]. These onsite wells (see Table 2-2), which are permitted by the VDEC, supply all potable water for the site, with industrial make-up water supplied from a combination of groundwater wells and river water. The VYNPS site is also not connected to a municipal wastewater treatment system. All wastewater is treated on-site in systems permitted by the State of Vermont [Reference 4-16].

4.15.6 Conclusion

License renewal operations will not cause any appreciable increased demand on the public water supply system. As noted in Section 3.3, there are no major refurbishment activities required for license renewal at VYNPS. Entergy also does not anticipate that additional workers will be employed during the period of extended operations. In addition, no public water systems (see Table 2-9) are utilized by the plant.

As discussed in Section 2.10.1, both public and private water systems in the region appear to be adequate to provide the capacity and meet the demand of residential and industrial customers in the area. Therefore, impacts to public water supplies will continue to be SMALL and no evaluation of mitigation measures is warranted.

4.16 Education Impacts from Refurbishment

4.16.1 Description of Issue

Public Services (effects of refurbishment activities upon local educational system)

4.16.2 Findings from Table B-1, Appendix B to Subpart A

SMALL or MODERATE. Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors. See 10 CFR 51.53(c)(3)(ii)(I).

4.16.3 Requirement [10 CFR 51.53(c)(3)(ii)(I)]

An assessment of the impact of the proposed action on…public schools (impacts from refurbishment activities only) within the vicinity of the plant must be provided.

4.16.4 Analysis of Environmental Impact

As noted in Section 3.3, there are no major refurbishment activities required for VYNPS license renewal. Therefore this issue is not applicable to VYNPS and no analysis is required.

4.17 Offsite Land Use—Refurbishment

4.17.1 Description of Issue

Offsite Land Use (effects of refurbishment activities)

4.17.2 Findings from Table B-1, Appendix B to Subpart A

SMALL or MODERATE. Impacts may be of moderate significance at plants in low population areas. See 10 CFR 51.53(c)(3)(ii)(I).

4.17.3 Requirement [10 CFR 51.53(c)(3)(ii)(I)]

An assessment of the impact of the proposed action on… land-use…within the vicinity of the plant must be provided.

4.17.4 Analysis of Environmental Impact

As noted in Section 3.3, there are no major refurbishment activities required for VYNPS license renewal. Therefore, there will be no impacts from refurbishment activities and no analysis is required.

4.18 Offsite Land Use—License Renewal Term

4.18.1 Description of Issue

Offsite Land Use (effects of license renewal)

4.18.2 Findings from Table B-1, Appendix B to Subpart A

SMALL, MODERATE or LARGE. Significant changes in land-use may be associated with population and tax revenue changes resulting from license renewal. See 10 CFR 51.53(c)(3)(ii)(I).

4.18.3 Requirement [10 CFR 51.53(c)(3)(ii)(I)]

An assessment of the impact of the proposed action on …land-use…within the vicinity of the plant must be provided.

4.18.4 Background

During the license renewal term, new land use impacts could result from plant-related population growth or from the use of tax payments from the plant by local government to provide public services that encourage development.

However, as noted in Regulatory Guide 4.2, Section 4.17.2, Table B-1 of 10 CFR 51 partially misstates the conclusion reached in Section 4.7.4.2 of NUREG-1437. NUREG-1437, Section 4.7.4.2 concludes that "population-driven land use changes during the license renewal term at all nuclear plants will be small." Regulatory Guide 4.2 further states that "Until Table B-1 is changed, applicants only need cite NUREG-1437 to address population-induced land-use change during the license renewal term." Therefore, the discussion will be limited to the land use changes that may result from tax payments made by the plant to local governments.

The assessment of new tax-driven land use impacts in the GEIS considered the following:

(1) the size of the plant's tax payments relative to the community's total revenues,

(2) the nature of the community's existing land use pattern, and

(3) the extent to which the community already has public services in place to support and guide development.

In general, if the plant's tax payments are projected to be small relative to the community's total revenue, new tax-driven land use changes during the plant's license renewal term would be small, especially where the community has pre-established patterns of development and has provided adequate public services to support and guide development. If the plant's tax payments are projected to be medium to large relative to the community's total revenue, new tax-driven land use changes would be moderate.

This is most likely to be true where the community has no pre-established patterns of development (i.e., land use plans or controls) or has not provided adequate public services to support and guide development in the past, especially infrastructure that would allow industrial development. If the plant's tax payments are projected to be a dominant source of the community's total revenue, new tax-driven land use changes would be large. This would be especially true where the community has no pre-established pattern of development or has not provided adequate public services to support and guide development in the past.

Based on predictions for the case study plants, it is projected that all new population-driven land use changes during the license renewal term at all nuclear plants will be small because population growth caused by license renewal will represent a much smaller percentage of the local area's total population than has operations-related growth. Also, any conflicts between offsite land use and nuclear plant operations are expected to be small. In contrast, it is projected that new tax-driven land use changes may be moderate at a number of sites and large at some others. Because land use changes may be perceived by some community members as adverse

and by others as beneficial, the staff is unable to assess generically the potential significance of site-specific off-site land use impacts [Reference 4-11, Section 4.7.4.2].

4.18.5 Analysis of Environmental Impact

The environmental impacts from this issue are from population-driven land use changes and from tax-driven land use changes.

4.18.5.1 Population-Driven Land Use Changes

Entergy agrees with the GEIS conclusion that new population-driven land use changes at VYNPS during the license renewal term will be SMALL [Reference 4-11, Section 4.7.4.2]. Entergy does not anticipate that additional workers will be employed at VYNPS during the period of extended operations. Therefore, there will be no adverse impact to the offsite land use from plant-related population growth.

4.18.5.2 Tax-Driven Land Use Changes

Brattleboro and Vernon Townships are the only local jurisdictions in Windham County that tax VYNPS directly and are the principal jurisdictions that receive tax revenue as a result of the plant's existence. The majority of local taxes are paid to Vernon for the VYNPS plant facility, with remaining taxes paid to Brattleboro for the VYNPS corporate office building located in Brattleboro. Because there are no major refurbishment activities and no new construction as a result of license renewal, no new sources of plant-related tax payments are expected that could significantly influence land use in Windham County. During the license renewal term, however, new land-use impacts could result from the use by local governments of the tax revenue paid by Entergy for the assessed value of the VYNPS plant site. As shown in Section 2.7 of this report, Entergy paid Vernon and Brattleboro Townships a total of approximately $1.4 million in property taxes during 2005. In addition, the facility paid $4.5 million in state electric generation tax and electric generation education taxes.

Windham County has experienced relatively low population growth and limited land-use changes since 1990. Between 1990 and 2003, the population growth occurred at an average annual rate of 0.3% (see Section 2.6). Although recent population growth is not directly related to the presence of VYNPS, continued growth could be affected by the economic benefit of the plant on local schools, roads, and community services. Continuation of local tax receipts from VYNPS contributes to keeping tax rates below what they otherwise would be to fund local government and also provides for a higher level of public infrastructure and services than otherwise would be possible. This enhances the county's attractiveness as a place to live and could contribute to overall growth of the area and the conversion of open space and woodlands to residential and commercial uses.

Although the property tax paid by VYNPS represents a significant portion of local property tax revenue, the impacts from tax-driven off-site land use changes is expected to be small because the area around VYNPS has pre-established land-use patterns of development that are

anticipated to continue during the license renewal term, and public services and regulatory controls are in place to support and guide development.

4.18.6 Conclusion

Entergy agrees with the GEIS conclusion that new population-driven land use changes at VYNPS during the license renewal term will be SMALL. Entergy does not anticipate that additional workers will be employed at VYNPS during the period of extended operation. Therefore, there will be no adverse impact to the offsite land use from additional plant workers.

In addition, the impact to tax-driven land use changes from the continued payment of property taxes at VYNPS is expected to be SMALL and no mitigation is required.

4.19 Transportation

4.19.1 Description of Issue

Public services, Transportation

4.19.2 Finding from Table B-1, Appendix B to Subpart A

SMALL, MODERATE, or LARGE. Transportation impacts (level of service) of highway traffic generated during plant refurbishment and during the term of the renewed license are generally expected to be of small significance. However, the increase in traffic associated with additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites. See 10 CFR 51.53(c)(3)(ii)(J).

4.19.3 Requirement [10 CFR 51.53(c)(3)(ii)(J)]

All applicants shall assess the impact of the proposed project on local transportation during periods of license renewal refurbishment activities and during the term of the renewed license.

4.19.4 Background

Impacts to transportation during the license renewal term would be similar to those experienced during current operations and would be driven mainly by the workers involved in current plant operations.

Based on past and projected impacts at the case study sites, transportation impacts would continue to be of small significance at all sites during operations and would be of small or moderate significance during scheduled refueling and maintenance outages. Because impacts are determined primarily by road conditions existing at the time of the project and cannot be easily forecast, a site specific review will be necessary to determine whether impacts are likely to be small or moderate and whether mitigation measures may be warranted [Reference 4-11, Section 4.7.3.2].

4.19.5 Analysis of Environmental Impact

As discussed in Section 3.3, there are no refurbishment activities required for VYNPS license renewal. Therefore, there will be no impact on local transportation from any refurbishment. In addition, as discussed in Section 3.5, there is no expected increase in the total number of employees that will be on-site during the period of extended operation. Therefore, there should be no increase in traffic associated with additional workers during the period of extended operation.

Local traffic patterns near VYNPS were evaluated in January 2003 by SVE Associates of Brattleboro, Vermont [Reference 4-16, Exhibit EN-SAS-18]. The purpose of the study was to evaluate traffic impacts related to the proposed VYNPS power uprate. The 20% power uprate project was not expected to increase the number of permanent employees or result in any major changes to the plant.

Traffic volumes for the study along existing roads were based upon Vermont Agency of Transportation (VAT) automatic traffic recorder station history 1971-2001 and the VAT's route log annual average daily traffic values in 2000 [Reference 4-18]. Projected traffic generation was based on the existing traffic counts at VYNPS for an estimated 1,700 permanent and contractor employees working at the site during a refueling outage. The estimated number of employees included a contingency of 200 above the number of employees actually projected for the outage.

Existing traffic volumes at VYNPS were based upon vehicle counts at the main gate in December 2002 and were found to average 873 vehicles per day (VPD) Monday through Thursday. Based on 2002 VAT data, typical non-outage traffic volumes along Vermont Route 142 are 5,300 VPD north of the facility and 2,600 VPD south of the facility.

For the April 2004 refueling outage, it was estimated that a total of 2,816 VPD over normal traffic volumes would occur. The distribution of peak traffic occurring during shift changes would occur as described in Table 4-3.

Table 4-3
Estimated Traffic Volume (Vehicles per Hour), April 2004 VYNPS Refueling Outage

Traffic Flow	Morning Shift Change (0530 - 0700 hrs)	Evening Shift Change (1730 - 1900 hrs)
Leaving VYNPS Heading North on Route 142	211	317
Leaving VYNPS Heading South on Route 142	70	106
Entering VYNPS from the North on Route 142	317	211
Entering VYNPS from the South on Route 142	106	70

Traffic performance is generally defined in the qualitative term of level of service (LOS), which describes operational traffic conditions as perceived by motorists. These conditions are described as factors such as speed, travel time, traffic interruptions, safety and convenience. LOS values range from "A" (little to no delay) to "F" (extreme delay). The VAT design standard for collector streets, such as Vermont Route 142, is "C" or "D".

Based on traffic volume studies near VYNPS in 2003, it was concluded that LOS values for Vermont Route 142 near the site would

- be similar before and after the proposed power uprate for normal (non-outage) periods;
- during a refueling outage with 1,700 personnel working at the site, be the same south of the site and change from "C" to "D" north of the site; and
- be acceptable during a major refueling outage and during periods of normal (non-outage) operations.

4.19.6 Conclusion

As noted in Section 3.3, there are no major refurbishment activities required for VYNPS license renewal. Additionally, as noted in Section 3.5, there are no expected increases in the total number of employees that will be on-site during the period of extended operation. Therefore, impacts on local traffic will be SMALL and no mitigation measures are warranted.

4.20 Historic and Archaeological Properties

4.20.1 Description of Issue

Historic and Archaeological Resources

4.20.2 Finding from Table B-1, Appendix B to Subpart A

SMALL, MODERATE or LARGE. Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer (SHPO) to determine whether there are properties present that require protection. See 10 CFR 51.53(c)(3)(ii)(K).

4.20.3 Requirement [10 CFR 51.53(c)(3)(ii)(K)]

All applicants shall assess whether any historic or archaeological properties will be affected by the proposed project.

4.20.4 Background

It is unlikely that moderate or large impacts to historic resources occur at any site unless new facilities or service roads are constructed or new transmission lines are established.

However, the identification of historic resources and determination of possible impact to them must be done on a site-specific basis through consultation with the SHPO. The site-specific nature of historic resources and the mandatory National Historic Preservation Act consultation process mean that the significance of impacts to historic resources and the appropriate mitigation measures to address those impacts cannot be determined generically [Reference 4-11, Section 3.7.7].

4.20.5 Analysis of Environmental Impact

As discussed in Section 3.3, there are no major refurbishment activities required for VYNPS license renewal. Therefore, no further analysis is required as it relates to refurbishment activities.

As discussed in Section 2.12.1, extensive subsurface archeological excavation was performed at the site before VYNPS was constructed. No significant archeological resources were identified.

VYNPS consulted with the Vermont SHPO during the proposed power uprate review project in 2003. The SHPO reviewed the proposed project for its potential effects on archaeologically and historically sensitive areas and determined that no prehistoric or historic resources would be affected by the project [Reference 4-16, Exhibit EN-SAS-9].

Entergy also consulted with the Vermont SHPO during the preparation of this ER (see Attachment C). SHPO reviewed the license renewal project for potential effects on historic and archaeological resources and had no concerns as long as no soil disturbance occurs during the license renewal period (see Attachment C). Entergy has no plans to alter operations, expand existing facilities or disturb additional land in support of license renewal. Therefore, SHPO's determination of no impacts to historic and archaeological resources made during the proposed power uprate project continues to remain valid for license renewal.

4.20.6 Conclusion

As noted in Section 3.3, there are no major refurbishment activities required for license renewal at VYNPS. There are also no plans to alter operations, expand existing facilities or disturb additional land in support of license renewal. In addition, based on consultation with the Vermont SHPO (see Attachment C), no historic or archaeological resources would be affected by operation of the plant during the license renewal period. Therefore, the potential impact of continued operation of VYNPS during the period of the renewed license on historic or archeological resources will be SMALL and evaluation of mitigation measures is not warranted.

4.21 Severe Accident Mitigation Alternatives

4.21.1 Description of Issue

Severe accidents

4.21.2 Finding from Table B-1, Appendix B to Subpart A

SMALL. The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives. See 10 CFR 51.53(c)(3)(ii)(L).

4.21.3 Requirement [10 CFR 51.53(c)(3)(ii)(L)]

If the staff has not previously considered severe accident mitigation alternatives for the applicant's plant in an environmental impact statement or related supplement or in an environmental assessment, a consideration of alternatives to mitigate severe accidents must be provided.

4.21.4 Background

The staff concluded that the generic analysis summarized in the GEIS applies to all plants and that the probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts of severe accidents are of small significance for all plants. However, not all plants have performed a site-specific analysis of measures that could mitigate severe accidents. Consequently, severe accidents are a Category 2 issue for plants that have not performed a site-specific consideration of severe accident mitigation and submitted that analysis for Commission review [Reference 4-11, Section 5.5.2.5].

4.21.5 Analysis of Environmental Impact

The method used to perform the Severe Accident Mitigation Alternative (SAMA) analysis was based on the handbook used by the NRC to analyze benefits and costs of its regulatory activities [Reference 4-12].

Environmental impact statements and environmental reports are prepared using a sliding scale in which impacts of greater concern and mitigation measures of greater potential value receive more detailed analysis than impacts of less concern and mitigation measures of less potential value. Accordingly, Entergy Operations used less detailed feasibility investigation and cost estimation techniques for SAMA candidates having disproportionately high costs and low benefits and more detailed evaluations for the most viable candidates.

The following is a brief outline of the approach taken in the SAMA analysis.

(1) Establish the Baseline Impacts of a Severe Accident

Severe accident impacts were evaluated in four areas:

- Off-site exposure costs – monetary value of consequences (dose) to off-site population

  The Probabilistic Safety Assessment (PSA) model was used to determine total accident frequency (core damage frequency (CDF) and containment release frequency). The Melcor Accident Consequences Code System 2 (MACCS2) was used to convert release input to public dose. Dose was converted to present worth dollars (based on a valuation of $2,000 per person-rem and a present worth discount factor of 7%).

- Off-site economic costs – monetary value of damage to off-site property

  The PSA model was used to determine total accident frequency (core damage frequency and containment release frequency). MACCS2 was used to convert release input to off-site property damage. Off-site property damage was converted to present worth dollars based on a discount factor of 7%.

- On-site exposure costs – monetary value of dose to workers

  Best estimate occupational dose values were used for immediate and long-term dose. Dose was converted to present worth dollars (based on a valuation of $2,000 per person-rem and a present worth discount factor of 7%).

- On-site economic costs – monetary value of damage to on-site property

  Best estimate cleanup and decontamination costs were used. On-site property damage estimates were converted to present worth dollars based on a discount factor of 7%. It was assumed that, subsequent to a severe accident, the plant would be decommissioned rather than restored. Therefore replacement and refurbishment costs were not included in on-site costs. Replacement power costs were considered.

(2) Identify SAMA Candidates

Potential SAMA candidates were identified from the following sources (see Attachment E for reference details):

- Severe Accident Mitigation Design Alternative (SAMDA) analyses submitted in support of original licensing activities for other operating nuclear power plants and advanced light water reactor plants;

- SAMA analyses for other BWR plants, including the evolutionary General Electric Advanced Boiling Water Reactor (ABWR) design;

- NRC and industry documentation discussing potential plant improvements;

- VYNPS Individual Plant Examination (IPE) of internal and external events reports (in both reports, several enhancements related to severe accident insights were recommended and implemented); and

- VYNPS PSA model risk significant contributors.

(3) Phase I - Preliminary Screening

Potential SAMA candidates were screened out if they modified features not applicable to VYNPS, if they had already been implemented at VYNPS, or if they were similar in nature and could be combined with another SAMA candidate to develop a more comprehensive or plant-specific SAMA candidate.

(4) Phase II - Final Screening and Cost Benefit Evaluation

The remaining SAMA candidates were evaluated individually to determine the benefits and costs of implementation, as follows.

- The total benefit of implementing a SAMA candidate was estimated in terms of averted consequences (benefits estimate).

  - The baseline PSA model was modified to reflect the maximum benefit of the improvement. Generally, the maximum benefit of a SAMA candidate was determined with a bounding modeling assumption. For example, if the objective of the SAMA candidate was to reduce the likelihood of a certain failure mode, then eliminating the failure mode from the PSA would bound the benefit, even though the SAMA candidate would not be expected to be 100% effective in eliminating the failure. The modified model was then used to produce a revised accident frequency.

  - Using the revised accident frequency, the method previously described for the four baseline severe accident impact areas was used to estimate the cost associated with each impact area following implementation of the SAMA candidate.

  - The benefit in terms of averted consequences for each SAMA candidate was then estimated by calculating the arithmetic difference between the total estimated cost associated with all four impact areas for the baseline plant

design and the revised plant design following implementation of the SAMA candidate.

- The cost of implementing a SAMA was estimated by one of the following methods (cost estimate).

  - An estimate for a similar modification considered in a previously performed SAMA or SAMDA analysis was used. These estimates were used for comparison against an estimated benefit at VYNPS since they were developed in the past and no credit was taken for inflation when applying them to VYNPS. In addition, several of them were developed from SAMDA analysis (i.e., during the design phase of the plant), and therefore did not consider the additional costs associated with performing design modifications to an existing plant (i.e., reduced efficiency, minimizing dose, disposal of contaminated material, etc.).

  - Engineering judgment on the cost associated with procedural changes, engineering analysis, testing, training and hardware modification was applied to formulate a conclusion regarding the economic viability of the SAMA candidate.

  The detail of the cost estimate was commensurate with the benefit. If the benefit was low, it was not necessary to perform a detailed cost estimate to determine if the SAMA was cost beneficial.

(5) Sensitivity Analyses

Two sensitivity analyses were conducted to gauge the impact of key assumptions upon the analysis. One sensitivity analysis was to investigate the sensitivity of assuming a 28-year period for remaining plant life. The other sensitivity analysis was to investigate the sensitivity of each analysis case to the discount rate of 3%.

The SAMA analysis for VYNPS is presented in the following sections. Attachment E.1 and Attachment E.2 provide a more detailed discussion of the process presented above.

4.21.5.1 Establish the Baseline Impacts of a Severe Accident

A baseline was established to enable estimation of the risk reductions attributable to implementation of potential SAMA candidates. This severe accident risk was estimated using the VYNPS PSA model and the MACCS2 consequence analysis software code. The PSA model used for the SAMA analysis (Revision VY04R1) is an internal events risk model.

4.21.5.1.1 The PSA Internal Events Model - Level 1 and Level 2 Analysis

The PSA model (Level 1 and Level 2) used for the SAMA analysis was the most recent internal events risk model for VYNPS (Revision VY04R1). This current model is an updated version of the model used in the 1993 IPE and reflects the VYNPS configuration and extended power uprate design changes as of September 2004. It also uses component failure and unavailability data as of March 2002 and resolves comments provided during the industry peer review of the model, conducted in November 2000. The VYNPS model adopts the large event tree / small fault tree approach and uses the support state methodology, embodied in the RISKMAN code, for quantifying core damage frequency.

An uncertainty analysis associated with internal events core damage frequency (CDF) was performed. The ratio of the core damage frequency at the 95th percent confidence level to the mean CDF is a factor of 2. This analysis is presented in Section E.1.1 of Attachment E.

The VYNPS Level 2 analysis uses a Containment Event Tree (CET) to analyze all core damage sequences identified in the Level 1 analysis. The CET evaluates systems, operator actions, and severe accident phenomena in order to characterize the magnitude and timing of radionuclide release. The result of the Level 2 analysis is a list of sequences involving radionuclide release, along with the frequency and magnitude/timing of release for each sequence.

4.21.5.1.2 The PSA External Events Model - Individual Plant Examination of External Events (IPEEE) Model

The VYNPS IPEEE, Revision 1 model was reviewed and used for SAMA analysis. The seismic, high wind and external flooding analyses results in the finding that the plant is adequately designed to protect against the effects of these natural events. The seismic portion of the IPEEE program was completed in conjunction with the SQUG program. VYNPS performed a seismic margin assessment (SMA) following the guidance of NUREG-1407, *Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities*, June 1991, and EPRI NP-6041-SL, Revision 1, *A Methodology for Assessment of Nuclear Power Plant Seismic Margin*, August 1991.

The VYNPS fire analysis was performed using the EPRI Fire Induced Vulnerability Evaluation (FIVE) methodology for qualitative and quantitative screening of fire areas and for fire analysis of areas that did not screen. The FIVE methodology is primarily a screening approach used to identify plant vulnerabilities due to fire initiating events. The end result of VYNPS's IPEEE fire analysis identified the CDF for significant fire areas. A number of plant improvements were identified and, as described in NUREG-1742, *Perspectives Gained from the IPEEE Program*, Final Report, April 2002, these improvements were implemented.

4.21.5.1.3 MACCS2 Model - Level 3 Analysis

A "Level 3" model was developed using the MACCS2 consequence analysis software code to estimate the hypothetical impacts of severe accidents on the surrounding environment and

members of the public. The principal phenomena analyzed were atmospheric transport of radionuclides, mitigation actions (i.e., evacuation, condemnation of contaminated crops and milk) based on dose projection; dose accumulation by a number of pathways, including food and water ingestion; and economic costs. Input for the Level 3 analysis included the core radionuclide inventory, source terms from the VYNPS PSA model, site meteorological data, projected population distribution (within 50-mile radius) for the year 2032, emergency response evacuation modeling, and economic data. The MACCS2 input data are described in Section E.1.5 of Attachment E.

4.21.5.1.4 Evaluation of Baseline Severe Accident Impacts Using the Regulatory Analysis Technical Evaluation Handbook Method

This section describes the method used for calculating the cost associated with each of the four impact areas for the baseline case (i.e., without SAMA implementation). This analysis was used to establish the maximum benefit that a SAMA could achieve if it eliminated all risk due to VYNPS at-power internal events. [Reference 4-12]

Off-Site Exposure Costs

The Level 3 baseline analysis resulted in an annual off-site exposure risk of 9.16 Person- rem. This value was converted to its monetary equivalent (dollars) via application of the $2,000 per person rem conversion factor from the *Regulatory Analysis Technical Evaluation Handbook* [Reference 4-12]. This monetary equivalent was then discounted to present value using the formula from the same source:

$$APE = (F_S D_{P_S} - F_A D_{P_A}) R \frac{1 - e^{-rt_f}}{r}$$

where

APE =monetary value of accident risk avoided from population doses, after discounting;

R = monetary equivalent of unit dose, ($/person-rem);

F = accident frequency (events/year);

D_P = population dose factor (person-rem/event);

S = status quo (current conditions);

A = after implementation of proposed action;

r = discount rate (%); and

t_f = license renewal period (years).

Using a 20-year license renewal period, a 7% discount rate, assuming FA is zero, and the baseline core damage frequency of 5.03E-06/year resulted in the monetary equivalent value of $197,176. This value is presented in Table 4-4.

Off-Site Economic Costs

The Level 3 baseline analysis resulted in an annual off-site economic risk monetary equivalent of $21,000. This value was discounted in the same manner as the public health risks in accordance with the following equation:

$$AOC = (F_S P_{D_S} - F_A P_{D_A}) \frac{1 - e^{-rt_f}}{r}$$

where

AOC =monetary value of risk avoided from off-site property damage, after discounting;

P_D = off-site property loss factor ($/event);

F = accident frequency (events/year);

S = status quo (current conditions);

A = after implementation of proposed action;

r = discount rate (%); and

t_f = license renewal period (years).

Using previously defined values; the resulting monetary equivalent is $226,021. This value is presented in Table 4-4.

On-site Exposure Costs

The values for occupational exposure associated with severe accidents were not derived from the PSA model, but from information in the *Regulatory Analysis Technical Evaluation Handbook* [Reference 4-12]. The values for occupational exposure consist of "immediate dose" and "long-term dose." The best estimate value provided for immediate occupational dose is 3,300 person rem, and long-term occupational dose is 20,000 person-rem (over a 10-year clean-up period). The following equations were used to estimate monetary equivalents.

Immediate Dose

$$W_{IO} = (F_S D_{IO_S} - F_A D_{IO_A}) R \frac{1 - e^{-rt_f}}{r} \qquad (1)$$

where

W_{IO} = monetary value of accident risk avoided from immediate doses, after discounting;

IO = immediate occupational dose;

R = monetary equivalent of unit dose, ($/person-rem);

F = accident frequency (events/year);

D_{IO} = immediate occupational dose (person-rem/event;

S = status quo (current conditions);

A = after implementation of proposed action;

r = discount rate (%); and

t_f = license renewal period (years).

The values used in the analysis were

R = $2,000/person rem;

r = 0.07;

D_{IO} = 3,300 person rem /accident; and

t_f = 20 years.

For the basis discount rate, assuming F_A is zero, the bounding monetary value of the immediate dose associated with VYNPS's accident risk is

$$W_{IO} = (F_S D_{IO_S}) R \frac{1 - e^{-rt_f}}{r}$$

$$W_{IO} = 3300 \times F_S \times \$2000 \times \frac{1 - e^{-0.07 \times 20}}{0.07}$$

$$W_{IO} = (\$7.10 \times 10^7) F_s$$

For the baseline core damage frequency, 5.03 x 10^{-6}/year,

$W_{IO} = \$357$

Long-Term Dose

$$W_{LTO} = (F_S D_{LTO_S} - F_A D_{LTO_A}) R \times \frac{1 - e^{-rt_f}}{r} \times \frac{1 - e^{-rm}}{rm} \qquad (2)$$

where

W_{LTO} =monetary value of accident risk avoided long-term doses, after discounting ($);

LTO = long-term occupational dose;

m = years over which long-term doses accrue;

R = monetary equivalent of unit dose, ($/person-rem);

F = accident frequency (events/year);

D_{LTO} = long-term occupational dose (person-rem/event);

S = status quo (current conditions);

A = after implementation of proposed action;

r = discount rate (%); and

t_f = license renewal period (years).

The values used in the analysis were

R = $2,000/person rem;

r = .07;

D_{LTO} = 20,000 person-rem /accident;

m = 10 years; and

t_f = 20 years.

For the basis discount rate, assuming F_A is zero, the bounding monetary value of the long term dose associated with VYNPS's accident risk is

$$W_{LTO} = (F_S D_{LTO_S}) R \times \frac{1 - e^{-rt_S}}{r} \times \frac{1 - e^{-rm}}{rm}$$

$$W_{LTO} = (F_S \times 20000)\$2000 \times \frac{1 - e^{-0.07 \times 20}}{0.07} \times \frac{1 - e^{-0.07 \times 10}}{0.07 \times 10}$$

$$W_{LTO} = (\$3.10 \times 10^{8}) F_S$$

For the core damage frequency for the baseline, 5.03 x 10^{-6}/year,

W_{LTO} = $1,557.

Total Occupational Exposures

Combining equations (1) and (2) above, using delta (∆) to signify the difference in accident frequency resulting from the proposed actions, and using the above numerical values, the long-term accident related on-site (occupational) exposure avoided is

$$AOE = \Delta W_{IO} + \Delta W_{LTO} \ (\$)$$

where

AOE = on-site exposure avoided.

The bounding value for occupational exposure (AOE_B) is

$$AOE_B = W_{IO} + W_{LTO} = \$357 + \$1,557 = \$1,915$$

The resulting monetary equivalent of $1,915 is presented in Table 4-4.

On-Site Economic Costs

Clean-up/Decontamination

The total cost of clean-up/decontamination of a power reactor facility subsequent to a severe accident is estimated in the *Regulatory Analysis Technical Evaluation Handbook* [Reference 4-12] to be $1.5 x 10^{9}. This same value was adopted for

these analyses. Considering a 10-year cleanup period, the present value of this cost is

$$PV_{CD} = \left(\frac{C_{CD}}{m}\right)\left(\frac{1 - e^{-rm}}{r}\right)$$

where

PV_{CD} =present value of the cost of cleanup/decontamination;

CD = clean-up/decontamination;

C_{CD} = total cost of the cleanup/decontamination effort ($);

m = cleanup period (years);

r = discount rate (%).

Based upon the values previously assumed,

$$PV_{CD} = \left(\frac{\$1.5E+9}{10}\right)\left(\frac{1 - e^{-0.07 \times 10}}{0.07}\right)$$

$$PV_{CD} = \$1.08E+9.$$

This cost is integrated over the term of the proposed license extension as follows:

$$U_{CD} = PV_{CD}\frac{1 - e^{-rt_f}}{r}$$

where,

U_{CD} = total cost of clean up/decontamination over the life of the plant.

Based upon the values previously assumed,

$$U_{CD} = \$1.16E+10\,.$$

Replacement Power Costs

Replacement power costs were estimated in accordance with the *Regulatory Analysis Technical Evaluation Handbook* [Reference 4-12]. Since replacement power will be needed for the time period following a severe accident, for the remainder of the expected generating plant life, long-term power replacement

calculations have been used. The present value of replacement power was estimated as follows:

$$PV_{RP} = \left(\frac{\$1.2x10^{8}}{r}\right)(1 - e^{-rt_f})^{2}$$

where

PV_{RP} =present value of the cost of replacement power for a single event;

t_f = license renewal period (years); and

r = discount rate (%).

The $\$1.2x10^{8}$ value has no intrinsic meaning but is a substitute for a string of non-constant replacement power costs that occur over the lifetime of a "generic" reactor after an event. This equation was developed in the *Regulatory Analysis Technical Evaluation Handbook* [Reference 4-12] for discount rates between 5% and 10% only.

Based upon the values previously assumed,

$$PV_{RP} = \left(\frac{\$1.2x10^{8}}{r}\right)(1 - e^{-rt_f})^{2} = \left(\frac{\$1.2x10^{8}}{0.07}\right)(1 - e^{-(0.07)(20)})^{2} = \$9.73x10^{8}$$

To account for the entire lifetime of the facility, U_{RP} was then calculated from PV_{RP}, as follows:

$$U_{RP} = \left(\frac{PV_{RP}}{r}\right)(1 - e^{-rt_f})^{2}$$

where

U_{RP} = present value of the cost of replacement power over the remaining life;

t_f = license renewal period (years); and

r = discount rate (%).

Based upon the values previously assumed,

$$U_{RP} = \left(\frac{PV_{RP}}{r}\right)(1 - e^{-rt_f})^2 = \left(\frac{\$9.73x10^8}{0.07}\right)(1 - e^{-(0.07)(20)})^2 = \$7.89x10^9 .$$

Total On-Site Property Damage Costs

Combining the cleanup/decontamination and replacement power costs, using delta (ΔF) to signify the difference in accident frequency resulting from the proposed actions, and using the above numerical values, the best-estimate value of averted occupational exposure can be expressed as

$$AOSC = \Delta F(U_{CD} + U_{RP}) = \Delta F(\$1.16x10^{10} + \$7.89x10^9) = \Delta F(\$1.95x10^{10})$$

where

ΔF = difference in annual accident frequency resulting from the proposed action.

For the baseline CDF, $5.03x10^{-6}$/year,

AOSC = $98,156.

The resulting monetary equivalent of $98,156 is presented in Table 4-4.

Table 4-4
Estimated Present Dollar Value Equivalent of Internal Events CDF at VYNPS

Parameter	Present Dollar Value ($)
Off-site exposure costs	$197,176
Off-site economic costs	$226,021
On-site exposure costs	$1,915
On-site economic costs	$98,156
Total	**$523,269**

4.21.5.2 Identify SAMA Candidates

Based on a review of industry documents, an initial list of SAMA candidates was identified. Since VYNPS is a typical General Electric (GE) nuclear power reactor, considerable attention was paid to the SAMA candidates from SAMA analyses for other GE plants. Attachment E lists the specific documents from which SAMA candidates were initially gathered.

In addition to SAMA candidates identified from the review of industry documents, additional SAMA candidates were obtained from plant-specific sources, such as the VYNPS IPE and IPEEE. In both the IPE and IPEEE, several enhancements related to severe accident insights were recommended and implemented. These enhancements were included in the comprehensive list of SAMA candidates and were verified to have been implemented during preliminary screening.

The current VYNPS PSA model was used to identify plant-specific modifications for inclusion in the comprehensive list of SAMA candidates. The risk significant terms from the PSA model were reviewed for similar failure modes and effects that could be addressed through a potential enhancement to the plant. The correlation between candidate SAMAs and the risk significant terms are listed in Table E.1-3 of Attachment E. The comprehensive list contained a total of 302 SAMA candidates. The first step in the analysis of these candidates was to eliminate the non-viable SAMA candidates through preliminary screening.

4.21.5.3 Preliminary Screening (Phase I)

The purpose of the preliminary SAMA screening was to eliminate from further consideration enhancements that were not viable for implementation at VYNPS. Potential SAMA candidates were screened out if they modified features not applicable to VYNPS or if they had already been implemented at VYNPS. In addition, where it was determined those SAMA candidates were potentially viable but were similar in nature, they were combined to develop a more comprehensive or plant-specific SAMA candidate.

During this process, 236 of the 302 initial SAMA candidates were eliminated, leaving 66 SAMA candidates for further analysis. The list of original 302 SAMA candidates and applicable screening criterion is available in on-site documentation.

4.21.5.4 Final Screening and Cost Benefit Evaluation (Phase II)

A cost/benefit analysis was performed on the remaining SAMA candidates. The method for determining if a SAMA candidate was cost beneficial consisted of determining whether the benefit provided by implementation of the SAMA candidate exceeded the expected cost of implementation. The benefit was defined as the sum of the reduction in dollar equivalents for each severe accident impact area (off-site exposure, off-site economic costs, occupational exposure, and on-site economic costs). If the expected implementation cost exceeded the estimated benefit, the SAMA was not considered cost-beneficial.

The result of implementation of each SAMA candidate would be a change in the severe accident risk (i.e., a change in frequency or consequence of severe accidents). The method of calculating the magnitude of these changes is straightforward. First, the severe accident risk after implementation of each SAMA candidate was estimated using the same method as for the baseline. The results of the Level 2 model were combined with the Level 3 model to calculate these post-SAMA risks. The results of the benefit analyses for the SAMA candidates are presented in Table E.2-1 of Attachment E.

Each SAMA evaluation was performed in a bounding fashion. Bounding evaluations were performed to address the generic nature of the initial SAMA concepts. Such bounding calculations overestimate the benefit and thus are conservative calculations. For example, one SAMA dealt with installing digital large break LOCA protection; the bounding calculation estimated the benefit of this improvement by total elimination of risk due to large break LOCA (see the Phase II analysis of SAMA 62 in Table E.2-1). Such a calculation obviously overestimated the benefit, but if the inflated benefit indicated that the SAMA is not cost beneficial, then the purpose of the analysis was satisfied.

As described above for the baseline, values for avoided public and occupational health risk were converted to a monetary equivalent (dollars) via application of the *Regulatory Analysis Technical Evaluation Handbook [*Reference 4-12] conversion factor of $2,000 per person-rem and discounted to present value. Values for avoided off-site economic costs were also discounted to present value. The formula for calculating net value for each SAMA was

Net value =($APE + $AOC + $AOE + $AOSC) - COE

where

$APE = value of averted public exposure ($);

$AOC = value of averted off-site costs ($);

$AOE = value of averted occupational exposure ($);

$AOSC = value of averted on-site costs ($); and

COE = cost of enhancement ($).

If the net value of a SAMA was negative, the cost of the enhancement was greater than the benefit and the SAMA was not cost-beneficial.

The SAMA analysis considered that external events (including fires and seismic events) could lead to potentially significant risk contributions. To account for the risk contribution from external events and uncertainties, the cost of SAMA implementation was compared with a benefit value calculated by applying a multiplier of ten to the internal events estimated benefit. This value is defined as an upper bound estimated benefit. This treatment accounts for the impact of external events and uncertainty associated with the internal events.

The baseline risk contribution from external events was dominated by fire. A conservative EPRI FIVE methodology was used for the VYNPS IPEEE fire analysis. The fire analysis was done as a screening analysis only and not as a determination of the fire CDF at VYNPS. Since the fire zone conditional core damage probability is calculated by failing all equipment in the fire zone, a SAMA that reduces internal events CDF may not reduce the fire CDF for a zone. Thus the resulting benefit value is inflated and therefore overly conservative.

Summing the fire zone CDF values for VYNPS (Table E.1-11) results in approximately 5.58E-05 per reactor-year, which is about a factor of eleven higher than the internal events CDF of 5.03E-06 per reactor-year. As described above, this fire CDF is only a screening value. A more realistic fire CDF may be about a factor of three less than this value. [Reference 4-14] With a factor of three reduction, the fire CDF is about 1.86 E-05 per year, which is slightly more than three times higher than the internal events CDF. This would justify use of a multiplier of four to the averted cost estimates (for internal events) to represent the additional SAMA benefits in external events.

CDF uncertainty calculations resulted in a factor of two (Table E.1-3). Therefore, a multiplier of eight would be reasonable to account for both external events and uncertainties.

Use of an upper bound estimated benefit is considered appropriate because of the inherent conservatism in the external events modeling approach and conservative assumptions in benefit modeling of individual SAMA candidates. In addition, not all potential enhancements would be impacted by an external event. In some cases an external event would only impose partial failure of systems or trains. Therefore, using ten times the internal events estimated benefit to account for external events and uncertainty is conservative.

The expected cost of implementation of each SAMA (COE) was established from existing estimates of similar modifications combined with engineering judgment. Most of the cost estimates were developed from similar modifications considered in previous performed SAMA and SAMDA analyses. In particular, these cost estimates were derived from the following major sources.

- GE ABWR SAMDA Analysis
- Peach Bottom SAMA Analysis
- Quad Cities SAMA Analysis
- Dresden SAMA Analysis
- ANO-2 SAMA Analysis

A number of additional conservatisms associated with implementation were included in the cost-benefit analysis. The cost estimates for implementing the SAMAs did not include the cost of replacement power during extended outages required to implement the modifications, nor did they include contingency costs associated with unforeseen implementation obstacles. Estimates based on modifications that were implemented or estimated in the past were presented in terms of dollar values at the time of implementation and were not adjusted to present-day dollars. In addition, several of the implementation cost estimates were originally developed for SAMDA analyses (i.e., during the design phase of the plant) and therefore do not capture the additional costs associated with performing design modifications to existing plants (i.e., reduced efficiency, minimizing dose, disposal of contaminated material, etc.).

Detailed cost estimates were often not required to make informed decisions regarding the economic viability of a potential plant enhancement when compared to attainable benefit. Implementation costs for several of the SAMA candidates were clearly in excess of the attainable benefit estimated from a particular analysis case. For less clear cases, engineering judgment was applied to determine if a more detailed cost estimate was necessary to formulate a conclusion regarding the economic viability of a particular SAMA. Nonetheless, the cost of SAMA candidates was conceptually estimated to the point where conclusions regarding the economic viability of the proposed modification could be adequately gauged. The cost-benefit comparison and disposition of each of the 66 Phase II SAMA candidates is presented in Table E.2-1 of Attachment E.

4.21.5.5 Sensitivity Analyses

Two sensitivity analyses were conducted to gauge the impact of key assumptions upon the analysis. The main factors affecting present worth are the extended plant life and the discount rate. A description of each follows.

Sensitivity Case 1: Years Remaining until End of Plant Life

The purpose of this sensitivity case was to investigate the sensitivity of assuming a 28-year period for remaining plant life (i.e., eight years on the original plant license plus the 20-year license renewal period). The 20-year licensing renewal period was used in the base case. The resultant monetary equivalent for internal event was calculated by using 28 years remaining until end of facility life to investigate the impact on each analysis case.

Sensitivity Case 2: Conservative Discount Rate

The purpose of this sensitivity case was to investigate the sensitivity of each analysis case to the discount rate. The discount rate of 7.0% used in the base case analyses is conservative relative to corporate practices; nonetheless, a lower discount rate of 3.0% was assumed in this case to investigate the impact on each analysis case.

The benefits estimated for each of these sensitivities are presented in Table E.2-2 of Attachment E.

4.21.6 Conclusion

This analysis addressed 302 SAMA candidates for mitigating severe accident impacts. Phase I screening eliminated 236 SAMA candidates from further consideration, based on either inapplicability to VYNPS's design or features that had already been incorporated into VYNPS's current design, procedures and/or programs. During the Phase II cost-benefit evaluation of the remaining 66 SAMA candidates, an additional 63 SAMA candidates were eliminated because their cost was expected to exceed their benefit and were therefore determined not to be cost-beneficial.

Three Phase II SAMA candidates (i.e., 47, 65 and 66), presented in Table 4-5, were found to be potentially cost-beneficial for mitigating the consequences of a severe accident for VYNPS.

- A plant modification was recommended to install a water spray shield to protect the ECCS train A power cabinet from an internal flooding event (SAMA candidate 47).

- A plant procedural enhancement was recommended to defeat the low-pressure permissive signal of the core spray and LPCI injection valves for reactor pressure vessel (RPV) injection during transients and LOCAs (SAMA candidate 65).

- A plant modification was recommended to install a key lock bypass switch on core spray and LPCI injection valves to bypass the low pressure permissive signal for RPV injection during transients and LOCAs (SAMA candidate 66).

These SAMA candidates do not relate to adequately managing the effects of aging during the period of extended operation. In addition, since the SAMA analysis is conservative and is not a complete engineering project cost-benefit analysis, it does not estimate all of the benefits or all of the costs of a SAMA. For instance, it does not consider increases or decreases in maintenance or operation costs following SAMA implementation. Also, it does not consider the possible adverse consequences of procedure changes, such as additional personnel dose. Therefore, the above potentially cost-beneficial SAMAs have been submitted for engineering project cost-benefit analysis.

Although the procedural change and associated training recommended under SAMA candidate 65 would achieve the same benefit for transients and LOCAs as the modification recommended under SAMA 66, implementation of SAMA candidate 66 would greatly increase the probability of success and thus also reduce plant risk due to fire.

The sensitivity studies indicated that the results of the analysis would not change for the conditions analyzed.

Table 4-5
Final SAMAs

Phase II SAMA ID	SAMA Title	Result of Potential Enhancement	CDF Reduction	Off-site Dose Reduction	Estimated Benefit	Upper Bound Estimated Benefit	Estimated Cost
047	Shield injection system electrical equipment from potential water spray	This SAMA would reduce risk associated with internal flooding events. Train A of the ECCS power cabinet, which provides power to one train of low-pressure sensors, would be impacted by flooding initiators. These low-pressure sensors provide a permissive signal, which allows the core spray and LPCI injection valves to open for RPV injection.	4.77%	4.91%	$26,000	$260,000	$250,000
	Basis for Conclusion: Eliminated the CDF contribution due to internal flooding initiators that could impact injection system electrical equipment to conservatively assess the benefit of this SAMA. The cost of implementing this SAMA was estimated to be $250,000 by engineering judgment.						

Table 4-5
Final SAMAs

Phase II SAMA ID	SAMA Title	Result of Potential Enhancement	CDF Reduction	Off-site Dose Reduction	Estimated Benefit	Upper Bound Estimated Benefit	Estimated Cost
065	Improve operator action: Defeat the low reactor pressure interlocks to open LPCI or core spray injection valves during the transients with stuck open Safety Relief Valves (SRVs) or LOCAs in which random failures prevent all low pressure injection valves from opening	This SAMA would reduce the core damage frequency contribution from the transients with stuck open SRVs and from LOCAs. Core spray and LPCI injection valves require a low pressure permissive signal from the same two sensors to open the valves for RPV injection.	25.84%	27.51%	$142,000	$1,420,000	$50,000
	Basis for Conclusion: The probability of the ECCS low pressure permissives failing was eliminated to conservatively assess the benefit of this SAMA on CDF. The cost of implementing this SAMA was estimated to be $50,000 by engineering judgment.						

Table 4-5
Final SAMAs

Phase II SAMA ID	SAMA Title	Result of Potential Enhancement	CDF Reduction	Off-site Dose Reduction	Estimated Benefit	Upper Bound Estimated Benefit	Estimated Cost
066	Install a bypass switch to bypass the low reactor pressure interlocks of LPCI or core spray injection valves	This SAMA would reduce the core damage frequency contribution from the transients with stuck open SRVs and from LOCAs. Core spray and LPCI injection valves require a low pressure permissive signal from the same two sensors to open the valves for RPV injection.	25.84%	27.51%	$142,000	$1,420,000	$1,000,000
	Basis for Conclusion: The probability of the ECCS low pressure permissives failing was eliminated to conservatively assess the benefit of this SAMA on CDF. The cost of implementing this SAMA at Dresden was estimated to be $1 million.						

4.22 Environmental Justice

4.22.1 Description of Issue

Environmental Justice

4.22.2 Finding from Table B-1, Appendix B to Subpart A

"The need for and the content of an analysis of environmental justice will be addressed in plant-specific reviews."

4.22.3 Requirement

Other than the above referenced finding, there is no requirement concerning environmental justice in 10 CFR 51.

4.22.4 Background

The following background information is from Regulatory Guide 4.2.

Environmental justice was not reviewed in NUREG-1437. Executive Order 12898, "Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations," issued on February 11, 1994, is designed to focus the attention of Federal agencies on the human health and environmental conditions in minority and low-income communities. The NRC Office of Nuclear Reactor Regulation is guided in its consideration of environmental justice by Attachment 4, "NRR Procedures for Environmental Justice Reviews," to NRR Office Instruction No. LIC-203, Revision 1, "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues," May 24, 2004. NRR Office Instruction No. LIC-203 is revised periodically. The environmental justice review involves identifying off-site environmental impacts, their geographic locations, minority and low-income populations that may be affected, the significance of such effects, and whether they are disproportionately high and adverse compared to the population at large within the geographic area, and if so, what mitigative measures are available and which will be implemented. The NRC staff will perform the environmental justice review to determine whether there will be disproportionately high human heath and environmental effects on minority and low-income populations and report the review in its SEIS. The staff's review will be based on information provided in the ER and developed during the staff's site-specific scoping process.

The NRC's Office of Nuclear Reactor Regulation Office Instruction No. LIC-203, Revision 1 [Reference 4-15] contains a procedure for incorporating environmental justice into the licensing process. Entergy used this process in conducting the review and analysis of this issue.

4.22.5 Analysis

The consideration of environmental justice is required to assure that federal programs and activities will not have "disproportionately high and adverse human health or environmental effects…on minority populations and low income populations…" Entergy's analyses of the

Category 2 issues defined in 10CFR51.53(c)(3)(ii) determined that the environmental impacts of renewing the VYNPS license are small. Thus, no high and adverse impact on minority or low-income populations would occur from the proposed action. As a note, if replacement of the electricity generated by VYNPS with fossil-fuel sources was considered as an alternative to the proposed action, the environmental justice ramifications of that alternative's air emissions and other environmental impacts would need to be considered. Based on the review of these issues, no review for environmental justice is necessary. However, Entergy presents environmental justice demographic information in Section 2.6.2 of this ER to assist the NRC in its review.

4.22.6 Conclusion

As part of its environmental assessment of this proposed action, Entergy has determined that the environmental impacts of renewing the VYNPS license are small. This conclusion is supported by the review performed of the Category 2 issues defined in 10 CFR 51.53(c)(3)(ii) presented in this ER.

Because all impacts are small, and because there are few low income or minority populations in the environmental impact area and or in close proximity to the plant, there can be no disproportionately high and adverse impacts or effects on members of the public, including minority and low-income populations, resulting from the renewal of the VYNPS license.

4.23 References

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5.0 ASSESSMENT OF NEW AND SIGNIFICANT INFORMATION

"The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware."
[10 CFR 51.53(c)(3)(iv)]

The NRC has resolved most license renewal environmental issues generically and only requires an applicant to analyze those issues the NRC has not resolved generically. While NRC regulations do not require an applicant's environmental report to contain analyses of the impacts of those environmental issues that have been generically resolved [10 CFR 51.53(c)(3)(i)], the regulations do require that an applicant identify any new and significant information of which the applicant is aware [10 CFR 51.53(c)(3)(iv)].

Entergy implemented a process to identify the following:

- information that identifies a significant environmental issue not covered in NRC's GEIS and codified in the regulation, or

- information not covered in the GEIS analyses that lead to an impact finding different from that codified in the regulation.

The term "significant" is not specifically defined by the NRC. For its review, Entergy used guidance available in Council on Environmental Quality regulations. The NEPA authorizes CEQ to establish implementing regulations for federal agency use. NRC requires license renewal applicants to provide NRC with input, in the form of an environmental report, that NRC will use to meet NEPA requirements as they apply to license renewal [10 CFR 51.10].

CEQ guidance provides that federal agencies should prepare environmental impact statements for actions that would significantly affect the environment [40CFR1502.3], focus on significant environmental issues [40CFR1502.1], and eliminate from detailed study issues that are not significant [40CFR1501.7(a)(3)]. The CEQ guidance includes a lengthy definition of "significantly" that requires consideration of the context of the action and the intensity or severity of the impact(s) [40CFR1508.27]. Entergy expects that MODERATE or LARGE impacts, as defined by NRC, would be significant. Section 4.0 presents the NRC definitions of MODERATE and LARGE impacts.

Entergy reviewed SEISs associated with other license renewal applications to determine if there were new issues identified for those plants that may be applicable to VYNPS. In addition, some regulatory agencies were consulted regarding new and significant information. Furthermore, Entergy has an ongoing assessment process for identifying and evaluating new and significant information that may affect programs at the Entergy nuclear sites, including those related to license renewal matters.

This process is directed in a joint effort by the nuclear corporate support group and environmental focus group members composed of technical personnel from the Entergy Nuclear South and Entergy Nuclear Northeast sites. A summary of this process follows.

- Issues relative to environmental matters are identified as follows:
    - participation in industry utility groups (i.e., EEI, EPRI, NEI and USWAG);
    - participation in non-utility groups (i.e., Institute of Hazardous Materials Management and National Registry of Environmental Professionals);
    - periodic reviews of proposed regulatory changes; and
    - Entergy Nuclear environmental focus group meetings.
- If the issue is applicable to the nuclear sites, it is then further evaluated by the nuclear corporate support group and environmental focus group that consist of technical personnel involved in environmental compliance, environmental monitoring, environmental planning, natural resource management, and health and safety issues. Necessary changes are made to the program and implemented in accordance with site and corporate procedures.

Additional actions incorporated into this assessment process specifically for VYNPS license renewal include the following:

- review of documents related to environmental issues at VYNPS;
- review of internal procedures for reporting to the NRC events that could have environmental impacts; and
- credit for the oversight provided by inspections of plant facilities by state and federal regulatory agencies.

As a result of this assessment, Entergy is aware of no new and significant information regarding the environmental impacts of VYNPS license renewal.

6.0 SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

6.1 License Renewal Impacts

Entergy has reviewed the environmental impacts of renewing the VYNPS operating license and has concluded that all impacts would be SMALL and would not require mitigation. This environmental report documents the basis for Entergy's conclusion. Section 4 incorporates by reference NRC findings for the 52 Category 1 issues that apply to VYNPS (and for the 2 "NA" issues for which NRC came to no generic conclusion), all of which have impacts that are SMALL. The remainder of Section 4 analyzes Category 2 issues, all of which are either not applicable or have impacts that would be SMALL. Table 6-1 identifies the impacts that VYNPS license renewal would have on resources associated with Category 2 issues.

6.2 Mitigation

6.2.1 Requirement [10 CFR 51.45(c)]

The report must contain a consideration of alternatives for reducing adverse impacts, as required by §51.45(c), for all Category 2 license renewal issues in Appendix B to subpart A of this part. No such consideration is required of Category 1 issues in Appendix B to subpart A of this part. [10 CFR 51.53 (c)(3)(iii)]

6.2.2 Entergy Response

As discussed in Supplement 1 to Regulatory Guide 4.2, "Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses," when adverse environmental effects are identified, 10 CFR 51.45(c) requires consideration of alternatives available to reduce or avoid these adverse effects. Furthermore, Regulatory Guide 4.2 states, "Mitigation alternatives are to be considered no matter how small the adverse impact; however, the extent of the consideration should be proportional to the significance of the impact." [Reference 6-2]

As described in Section 6.1 and shown in Table 6-1, analysis of the Category 2 issues found the impacts to be small for the applicable issues. For these issues, the current permits, practices, and programs that mitigate the environmental impacts of plant operations are adequate. This ER finds that no additional mitigation measures are sufficiently beneficial as to be warranted.

Table 6-1
Environmental Impacts Related to License Renewal at VYNPS

Issue	Environmental Impact
Surface Water Quality, Hydrology and Use (for All Plants)	
Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow) 10 CFR 51.53(c)(3) (ii)(A)	**SMALL.** VYNPS's current cooling water makeup is a very small percentage (0.1%) of the average daily flow through Vernon Dam. Water withdrawal has caused no water availability concerns for the river, conflicts with other off-stream users, or adverse impacts on riparian or in-stream ecological communities. Consideration of mitigation is not required.
Aquatic Ecology (for All Plants with Once-Through and Cooling Pond Heat Dissipation Systems)	
Entrainment of fish and shellfish 10 CFR 51.53(c)(3)(ii)(B)	**SMALL.** Annual studies on potential impact of cooling water withdrawals from Vernon Pool on indigenous communities of fish in Vernon Pool have shown no adverse impact. Consideration of mitigation is not required.
Impingement of fish and shellfish 10 CFR 51.53(c)(3)(ii)(B)	**SMALL**. Annual studies on potential impact of cooling water withdrawals from Vernon Pool on indigenous communities of fish in Vernon Pool have shown no adverse impact. Consideration of mitigation is not required.
Heat shock 10 CFR 51.53(c)(3)(ii)(B)	**SMALL**. Studies on potential impact of cooling water discharges on aquatic biota have shown no adverse impact. Consideration of mitigation is not required.
Groundwater Use and Quality	
Groundwater use conflicts (plants using >100 gpm of ground-water) 10 CFR 51.53(c)(3)(ii)(C)	**SMALL.** VYNPS groundwater pump rate from all onsite potable wells is 8.54 gpm based on measured water usage during 2002 and 2003. Estimate of groundwater demand needed for 1,700 employees during a refueling outage was 35.4 gpm. Consideration of mitigation is not required.
Groundwater use conflicts (plants using cooling towers withdrawing make-up water from a small river) 10 CFR 51.53(c)(3)(ii)(A)	**SMALL.** VYNPS's current cooling water makeup is a very small percentage (0.1%) of the average daily flow through Vernon Dam and does not affect river or aquifer elevation, or aquifer recharge rates. Water withdrawal has caused no water availability concerns for the river or conflicts with other off-stream users. Consideration of mitigation is not required.
Groundwater use conflicts (Ranney Wells) 10 CFR 51.53(c)(3)(ii)(C)	**NONE**. VYNPS does not use Ranney wells. Consideration of mitigation is not required.
Degradation of groundwater quality 10 CFR 51.53(c)(3)(ii)(D)	**NONE.** VYNPS does not use cooling ponds. Consideration of mitigation is not required.

Table 6-1
Environmental Impacts Related to License Renewal at VYNPS
(Continued)

Issue	Environmental Impact
Terrestrial Resources	
Refurbishment impacts on terrestrial resources 10 CFR 51.53(c)(3)(ii)(E)	**NONE.** No major refurbishment activities identified. Consideration of mitigation is not required.
Threatened or Endangered Species (for All Plants)	
Threatened or endangered species 10 CFR 51.53(c)(3)(ii)(E)	**SMALL.** No major refurbishment activities identified. No threatened or endangered species impacted by continued operations of VYNPS. Consideration of mitigation is not required.
Air Quality	
Air quality during refurbishment 10 CFR 51.53(c)(3)(ii)(F)	**NONE.** No major refurbishment activities identified. Consideration of mitigation is not required.
Human Health	
Microbiological (Thermophilic) Organisms 10 CFR 51.53(c)(3)(ii)(G)	**SMALL.** Contact recreation on the Connecticut River is uncommon and there are no public swimming areas occurring on the river between Brattleboro and Vernon. Potential for exposure is extremely low. Consideration of mitigation is not required.
Electromagnetic fields – Acute effects 10 CFR 51.53(c)(3)(ii)(H)	**SMALL.** Transmission lines from plant to switchyards are in conformance with NESC criteria. Transmission lines exiting the switchyards were constructed for the New England power grid and are not owned by Entergy. Consideration of mitigation is not warranted.
Socioeconomics	
Housing impacts 10 CFR 51.53(c)(3)(ii)(I)	**SMALL.** No major refurbishment activities identified. Entergy does not anticipate an increase in employment during period of extended operation. Therefore, there no additional impacts to housing are expected due to continued operations of VYNPS. Consideration of mitigation is not required.
Public utilities: public water supply availability 10 CFR 51.53(c)(3)(ii)(I)	**SMALL.** No major refurbishment activities identified and no additional workers anticipated during the period of extended operation. Public water systems near VYNPS have adequate system capacity to meet demand of residential and industrial customers in the area. Consideration of mitigation is not required.

Table 6-1
Environmental Impacts Related to License Renewal at VYNPS
(Continued)

Issue	Environmental Impact
Education impacts from refurbishment 10 CFR 51.53(c)(3)(ii)(I)	**NONE.** No major refurbishment activities identified. Consideration of mitigation is not required.
Offsite land use (effects of refurbishment activities) 10 CFR 51.53(c)(3)(ii)(I)	**NONE.** No major refurbishment activities identified. Consideration of mitigation is not required.
Offsite land use (effects of license renewal) 10 CFR 51.53(c)(3)(ii)(I)	**SMALL.** Area around VYNPS has pre-established land patterns of development and has public services and regulatory controls in place to support and guide development. No additional workers anticipated during the period of extended operation. Consideration of mitigation is not required.
Local transportation impacts 10 CFR 51.53(c)(3)(ii)(J)	**SMALL**. No major refurbishment activities identified and no increases in total number of employees during the period of extended operation. Consideration of mitigation is not required.
Historic and archaeological properties 10 CFR 51.53(c)(3)(ii)(K)	**SMALL**. No major refurbishment activities identified and no archaeologically and historically sensitive areas present on-site. Consideration of mitigation is not required.
Postulated Accidents	
Severe accident mitigation alternatives 10 CFR 51.53(c)(3)(ii)(L)	**SMALL.** No impact from continued operation. Potentially cost-effective SAMAs are not related to adequately managing the effects of aging during period of extended operation. Consideration of mitigation is not required.

6.3 Unavoidable Adverse Impacts

6.3.1 Requirement [10 CFR 51.45(b)(2)]

The applicant's report shall discuss any adverse environmental effects which cannot be avoided upon implementation of the proposed project.

6.3.2 Entergy Response

Section 4 contains the results of Entergy's review and the analyses of the Category 2 issues as required by 10 CFR 51.53(c)(3)(ii). These reviews take into account the information that has been provided in the GEIS, Appendix B to Subpart A of 10 CFR 51, and information specific to VYNPS.

This review and analysis did not identify any significant adverse environmental impacts associated with the continued operation of VYNPS. The evaluation of structures and components required by 10 CFR 54.21 has been completed. No plant refurbishment activities, outside the bounds of normal plant component replacement and inspections, have been identified to support continued operation of VYNPS beyond the end of the existing operating license. As a result of these reviews and analyses, Entergy is not aware of significant adverse environmental effects that cannot be avoided upon implementation of the proposed project.

6.4 Irreversible or Irretrievable Resource Commitments

6.4.1 Requirement [§51.45(b)(5)]

The applicant's report shall discuss any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

6.4.2 Entergy Response

The continued operation of VYNPS for the period of extended operation will result in irreversible and irretrievable resource commitments, including the following:

- nuclear fuel, which is consumed in the reactor and converted to radioactive waste;
- the land required to dispose of spent nuclear fuel, low-level radioactive wastes generated as a result of plant operations, and sanitary wastes generated from normal industrial operations;
- elemental materials that will become radioactive; and
- materials used for the normal industrial operations of VYNPS that cannot be recovered or recycled or that are consumed or reduced to unrecoverable forms.

Other than the above, there are no major refurbishment activities or changes in operation of VYNPS during the period of extended operation that would irreversibly or irretrievably commit environmental components of land, water and air.

6.5 Short-term Use Versus Long-term Productivity

6.5.1 Requirement [10 CFR 51.45(b)(4)]

The applicant's report shall discuss the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity.

6.5.2 Entergy Response

The *Final Environmental Statement (FES) Related to Operation of Vermont Yankee Nuclear Power Station* evaluated the relationship between the short-term uses of the environment and the maintenance and enhancement of the long-term productivity associated with the construction and operation of VYNPS [Reference 6-1, Section VIII]. The period of extended operation will not change the short-term uses of the environment from the uses previously evaluated in the FES. The period of extended operation will postpone the availability of the site resources (land, air, water). However, extending operations will not adversely affect the long-term uses of the site.

There are no major refurbishment activities or changes in operation of VYNPS planned for the period of extended operation that would alter the evaluation of the FES for the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity of these resources.

6.6 References

6-1 AEC (U. S. Atomic Energy Commission). 1972. Final Environmental Statement Related to Operation of Vermont Yankee Nuclear Power Station, Vermont Yankee Nuclear Power Corporation, Docket No. 50-271, Unites States Atomic Energy Commission, Directorate of Licensing, July 1972.

6-2 NRC (U. S. Nuclear Regulatory Commission). 2000. Supplement 1 to Regulatory Guide 4.2, Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses, September 2000.

7.0 ALTERNATIVES CONSIDERED

7.1 Introduction

NRC regulations require that an applicant's environmental report discuss alternatives to a proposed action [10 CFR 51.45(b)(3)]. The intent of this review is to enable the Commission to consider the relative environmental consequences of the proposed action as compared to the environmental consequences of other activities that also meet the purpose of the proposed action. In addition, this review addresses the environmental consequences of taking no action [Reference 7-1, Section 8.2]. For license renewal, there are only two alternatives that meet the purpose of the requirement: not renew the operating license or renew the operating license. The alternatives are discussed below.

7.2 Proposed Action

VYNPS will have a rating of approximately 650 gross MWe after the power uprate. The average capacity factor of VYNPS for the last three years was 90.4%. The proposed action is to renew the operating license for VYNPS, which would provide the opportunity for Entergy to continue to operate VYNPS through the period of extended operation.

The review of the environmental impacts required by 10 CFR 51.53(c)(3)(ii) is provided in Section 4 of this ER. Based on this review, Entergy concludes that the environmental impacts of extended VYNPS operation would be small.

7.3 No-Action Alternative

The "no-action alternative" to the proposed action is not to renew the operating license for VYNPS. In this alternative, it is expected that VYNPS will continue to operate up to the end of the existing operating license, at which time plant operation would cease and decommissioning would begin. Because VYNPS constitutes a significant block of long-term base load capacity, it is reasonable to assume that a decision not to renew the VYNPS licenses would necessitate the replacement of its approximately 650 gross MWe with other sources of generation. The environmental impacts of the no-action alternative would be

- the environmental impacts from decommissioning the VYNPS unit, and
- the environmental impacts from a replacement power source.

Environmental impacts associated with decommissioning are discussed in Section 7.4. The environmental impacts associated with a replacement power source would be the impacts from the construction and operation of a source of replacement power at a new location (greenfield) or at the VYNPS site (brownfield). The environmental impacts of these various types of replacement power are discussed in Section 8.

7.4 Decommissioning Impacts

A nuclear power plant licensee is required to submit decommissioning plans within two years following permanent cessation of operation of a unit or at least five years before expiration of the operating license, whichever occurs first, pursuant to the requirements of 10 CFR 50.54(b).

The GEIS defines decommissioning as the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license [Reference 7-1, Section 7.1]. NRC-evaluated decommissioning options include immediate decontamination and dismantlement (DECON), and safe storage of the stabilized and defueled facility (SAFSTOR) for a period of time, followed by decontamination and dismantlement.

Regardless of the option chosen, decommissioning must be completed within a 60-year period. Under the no-action alternative, Entergy would continue operating VYNPS until the current license expires, then initiate decommissioning activities in accordance with NRC requirements. The GEIS describes decommissioning activities based on an evaluation of an example reactor (the "reference" boiling-water reactor is the 1,155 MWe Washington Public Power Supply System's Columbia Nuclear Power Plant). This is a substantially larger plant than VYNPS and therefore bounds decommissioning activities that Entergy would conduct at VYNPS.

As the GEIS notes, NRC has evaluated environmental impacts from decommissioning. NRC-evaluated impacts include occupational and public radiation dose; impacts of waste management; impacts to air and water quality; and ecological, economic, and socioeconomic impacts. NRC indicated in Section 4.3.8 of the *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities* [Reference 7-2] that the environmental effects of greatest concern (i.e., radiation dose and releases to the environment) are substantially less than the same effects resulting from reactor operations. Entergy adopts by reference the NRC conclusions regarding environmental impacts of decommissioning.

Entergy notes that decommissioning activities and their impacts are not discriminators between the proposed action and the no-action alternative. Entergy will have to decommission VYNPS; license renewal would only postpone decommissioning for 20 years. NRC has established in the GEIS that the timing of decommissioning operations does not substantially influence their environmental impacts. Entergy adopts by reference the NRC findings (10 CFR 51 Appendix B, Table B-1, Decommissioning) to the effect that delaying decommissioning until after the renewal term would have small environmental impacts.

Entergy concludes that the decommissioning impacts under the no-action alternative would not be substantially different from those occurring following license renewal, as identified in the GEIS [Reference 7-1, Section 8.4] and in the decommissioning generic environmental impact statement [Reference 7-2, Section 6.0]. These impacts would be temporary and would occur at the same time as the impacts from meeting system generating needs.

7.5 Alternative Energy Sources

Nuclear power plants are commonly used for base-load generation. The GEIS states that coal-fired and gas-fired generation capacity are the feasible alternatives to nuclear power generating capacity, based on current (and expected) technological and cost factors. The following generation alternatives were considered in detail in this ER.

- Coal-fired generation at an alternate site (Section 8.1.1). Entergy did not consider coal-fired generation at the VYNPS site since it was concluded that there was not enough land to build a coal-fired unit and a coal yard. Based on Table 8.1 of the GEIS, it would take approximately 1.7 acres of land per MWe to construct a coal-fired plant. VYNPS is situated on 125 acres. Therefore, for the hypothetical 620 gross MWe coal-fired unit discussed in Section 8.1.1, it would take approximately 1,054 acres of land.

- Natural gas-fired generation at the VYNPS site and at an alternate site (Section 8.1.2)

- Nuclear generation at an alternate site (Section 8.1.3). Entergy did not consider nuclear generation at the VYNPS site since it was concluded that there was not enough land to build a nuclear unit. Based on Table 8.1 of the GEIS, it would take approximately 0.5 to 1.0 acres of land per MWe to construct a nuclear plant. VYNPS is situated on 125 acres. Therefore, for the hypothetical 650 MWe nuclear plant discussed in Section 8.1.3, it would take approximately 325 to 350 acres of land.

Entergy's experience indicates that, although customized unit sizes can be built, using standardized sizes is more economical. For example, a standard sized gas-fired combined cycle plant has a net capacity of 585 MWe. The plant consists of two 189-MWe gas turbines and 207 MWe of heat recovery capacity. For comparability, Entergy set the net power of the hypothetical coal-fired unit equal to the hypothetical gas-fired plant (585 MWe). Although both provide less capacity than VYNPS (650 MWe), this ensures against overestimating environmental impacts from the alternatives. The shortfall in capacity could be replaced by other methods.

These alternatives are presented (Sections 8.1.1, 8.1.2 and 8.1.3, respectively) as if such plants were constructed at the VYNPS site (natural gas-fired only), using the existing water intake and discharge structures, switchyard, and transmission lines, or at an alternate location that could be either a current industrial site or an undisturbed, pristine site requiring a new generating building and facilities, new switchyard, and at least some new transmission lines. In this ER, a "greenfield" site is assumed to be an undisturbed, pristine site.

Depending on the location of an alternative site, it might also be necessary to connect to the nearest gas pipeline (in the case of natural gas) or rail line (in the case of coal). The requirement for these additional facilities may increase the environmental impacts relative to those that would be experienced at the VYNPS site.

The potential for using imported power is discussed in Section 8.1.4. Imported power is considered feasible, but would result in the transfer of environmental impacts from the current region in Vermont to some other location in Vermont, another state, or Canadian province. In addition, there is no assurance that the capacity or energy would be available.

As stated in NUREG-1437, Vol.1, Section 8.1, the "NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable" [Reference 7-1]. Accordingly, the following alternatives were not considered as reasonable replacement power.

- wind
- solar
- hydropower
- geothermal
- wood energy
- municipal solid waste
- other biomass-derived fuels
- oil
- fuel cells
- delayed retirement
- utility-sponsored conservation
- combination of alternatives

These technologies were eliminated as possible replacement power alternatives for one or more of the following reasons.

- High land-use impacts - Some of the technologies listed above (wind, solar, hydroelectric) would require a large area of land and would thus require a greenfield siting plan. This would result in a greater environmental impact than continued operation of VYNPS.

- Low capacity factors - Some of the technologies identified above (wind, solar and hydroelectric) are not capable of producing the nearly 650 gross MWe of power at high capacity factors. These generation technologies are used as peaking power sources, as opposed to base-load power sources, and for this reason are not reasonable alternatives.

- Geographic availability of the resource - Some of the technologies are not feasible because there is no feasible location in the area served by VYNPS.

- Emerging technology - Some of the technologies has not been proven as reliable and cost effective replacements of a large generation facility. Therefore, these technologies are typically used with smaller (lower MWe) generation facilities.

- Availability - There is no assurance of the availability of imported power.

7.6 References

7-1 NRC (U. S. Nuclear Regulatory Commission). 1996. NUREG-1437, Generic Environmental Statement for License Renewal of Nuclear Power Plants, Final Report, May 1996.

7-2 NRC (U. S. Nuclear Regulatory Commission). 2002. NUREG-0586 Supplement 1, Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors, Washington, DC, August 2002.

8.0 COMPARISON OF IMPACTS

The following key assumptions have been made in the review of alternative energy sources. These key assumptions are intended to simplify the evaluation, yet still allow the no-action alternative review to meet the intent of NEPA requirements and NRC environmental regulations.

- The goal of the proposed action (license renewal) is the production of approximately 650 gross MWe base-load generation. Alternatives that do not meet the goal are not considered in detail.
- The shortfall in capacity of the hypothetical coal-fired and gas-fired units could be replaced by other methods.
- The environmental impacts from the 1,000 MWe nuclear reactor would need to be adjusted to reflect replacement of VYNPS, which has a capacity of 650 gross MWe.
- The time frame for the needed generation is 2012 through 2032.
- Purchased power is not considered a reasonable alternative because it merely shifts the need for new base load capacity to a different region and there is no assurance that the capacity or energy would be available. See Section 8.1.4.
- The average capacity factor of VYNPS for the last three years was 90.4%. The capacity factor is targeted to remain at or near this value throughout the plant's operating life.

8.1 Comparison of Environmental Impacts for Reasonable Alternatives

As stated in the GEIS, the "NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable" [Reference 8-11, Section 8.1]. Below is a discussion of the supply side alternative energy technologies that Entergy could utilize if the license for VYNPS is not renewed. These alternatives are within the range of alternatives capable of meeting the goal of approximately 650 gross MWe base-load generation (replacement power for VYNPS).

Conventional coal-fired, oil and natural gas-fired combined cycle and advanced light water reactor are currently available conventional base-load technologies considered to replace VYNPS generation upon its termination of operation. These sources are considered viable alternatives based upon current Entergy planning strategies.

The environmental impacts discussed in this chapter are for the construction and operation of these generation facilities. Impacts are evaluated for a greenfield case (building on a new, pristine condition site) and a brownfield case (constructing new generation on the existing VYNPS site, with exception of coal-fired and advanced light water reactor units).

The continued operation of VYNPS for the period of extended operation would result in less environmental impact than that of the replacement power that could be obtained from other reasonable generating sources, as described below.

8.1.1 Coal-Fired Generation

NRC has evaluated coal-fired generation alternatives in each of the plant-specific Supplements to the GEIS. For the Oconee boiling-water reactors, NRC analyzed 2,500 MWe of coal-fired generation capacity [Reference 8-12, Section 8.2.1]. Entergy has reviewed the NRC analysis, believes it to be sound, and notes that it analyzed substantially more generating capacity than the VYNPS 650 gross MWe discussed in this analysis. In defining the VYNPS coal-fired alternative, Entergy has used site-specific input and has scaled from the NRC analysis, where appropriate.

Tables 8-1 through 8-3 present the basic coal-fired alternative emission control characteristics, emission estimates and waste generation volumes. Entergy based its emission control technology and percent control assumptions on alternatives that the EPA has identified as being available for minimizing emissions [Reference 8-6]. For the purposes of analysis, Entergy assumed that coal and lime (calcium hydroxide) would be delivered by barge to a newly-constructed receiving dock on site.

The coal-fired alternative that Entergy has defined would be located at an alternative site.

Table 8-1
Coal-Fired Alternative Emission Control Characteristics

Characteristic	Basis
Unit size = 585 MW ISO rating net[1]	Calculated to be <VYNPS gross capacity (650 MW)
Unit size = 620 MW ISO rating gross[1]	Calculated based on 6% onsite power use
Number of units = 1	
Boiler type = tangentially fired, dry-bottom	Minimizes nitrogen oxide emissions [Reference 8-6, Table 1.1-3]
Fuel type = bituminous, pulverized coal	Typical for coal used in Massachusetts
Fuel heating value = 12,464 Btu/lb	2000 value for coal used in Massachusetts [Reference 8-5, Table 25]
Fuel ash content by weight = 8.2%	2000 value for coal used in Massachusetts [Reference 8-5, Table 25]
Fuel sulfur content by weight = 0.69%	2000 value for coal used in Massachusetts [Reference 8-5, Table 25]
Uncontrolled NO_x emission = 10 lb/ton Uncontrolled CO emission = 0.5 lb/ton	Typical for pulverized coal, tangentially fired, dry-bottom, NSPS [Reference 8-6, Table 1.1-3]
Heat rate = 10,200 Btu/kWh	Typical for coal-fired, single-cycle steam turbines [Reference 8-5, page 110]
Capacity factor = 0.85	Typical for newer large coal-fired units
NO_x control = low NO_x burners, overfire air and selective catalytic reduction (95% reduction)	Best available and widely demonstrated for minimizing NO_x emissions [Reference 8-6, Table 1.1-2]
Particulate control = fabric filters (baghouse - 99.9% removal efficiency)	Best available for minimizing particulate emissions [Reference 8-6, pp. 1.1-6 and -7]
SO_x control = Wet scrubber – lime (95% removal efficiency)	Best available for minimizing SO_x emissions [Reference 8-6, Table 1.1-1]

Btu = British thermal unit
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59°F, 60% relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kWh = kilowatt-hour
NSPS = New Source Performance Standard
lb = pound
MW = megawatt
NO_x = nitrogen oxides
SO_x = oxides of sulfur
< = less than

1. The difference between "net" and "gross" is electricity consumed by auxiliary equipment and environmental control devices [Reference 8-5, page 109].

Table 8-2
Air Emissions from Coal-Fired Alternative

Parameter	Calculation	Result
Annual coal consumption	$\frac{620\,MW}{unit} \times \frac{10,200\,Btu}{kw \times hr} \times \frac{1,000\,kW}{MW} \times \frac{lb}{12,464\,Btu} \times \frac{24\,hr}{day} \times \frac{365\,day}{yr} \times \frac{ton}{2,000\,lb} \times 0.85$	1,888,980 tons of coal per year
SO_x[a,b]	$\frac{1,888,980\,tons}{yr} \times \frac{38 \times 0.69\,lb}{ton} \times \frac{ton}{2,000\,lb} \times \frac{100-95}{100}$	1,238 tons SO_x per year
NO_x[b,c]	$\frac{1,888,980\,tons}{yr} \times \frac{10\,lb}{ton} \times \frac{ton}{2,000\,lb} \times \frac{100-95}{100}$	472 tons NO_x per year
CO[b]	$\frac{1,888,980\,tons}{yr} \times \frac{0.5\,lb}{ton} \times \frac{ton}{2,000\,lb}$	472 tons CO per year
TSP	$\frac{1,888,980\,tons}{yr} \times \frac{10 \times 8.2\,lb}{ton} \times \frac{ton}{2,000\,lb} \times \frac{100-99.9}{100}$	77 tons TSP per year
PM_{10}[d]	$\frac{1,888,980\,tons}{yr} \times \frac{2.3 \times 8.2\,lb}{ton} \times \frac{ton}{2,000\,lb} \times \frac{100-99.9}{100}$	18 tons PM_{10} per year

a. Reference 8-6, Table 1.1-1.

b. Reference 8-6, Table 1.1-3.

c. Reference 8-6, Table 1.1-2.

d. Reference 8-6, Table 1.1-4.

CO = carbon monoxide

NO_x = nitrogen oxides

PM_{10} = particulates having diameter less than 10 microns

SO_x = oxides of sulfur

TSP = total suspended particulates

Table 8-3
Solid Waste from Coal-Fired Alternative

Parameter	Calculation	Result
Annual SO_x generated[a]	$\frac{1{,}888{,}980 \text{ tons coal}}{\text{yr}} \times \frac{0.69 \text{ tons}}{100 \text{ tons coal}} \times \frac{64.1 \text{ tons } SO_2}{32.1 \text{ tons S}}$	26,027 tons of SO_x per year
Annual SO_x removed	$\frac{26{,}027 \text{ tons } SO_2}{\text{yr}} \times \frac{95}{100}$	24,726 tons of SO_x per year
Annual ash generated	$\frac{1{,}888{,}980 \text{ tons coal}}{\text{yr}} \times \frac{8.2 \text{ tons ash}}{100 \text{ tons coal}} \times \frac{99.9}{100}$	154,741 tons of ash per year
Annual lime consumption[b]	$\frac{26{,}027 \text{ tons } SO_2}{\text{yr}} \times \frac{56.1 \text{ tons CaO}}{64.1 \text{ tons } SO_2}$	22,779 tons of CaO per year
Calcium sulfate[c]	$\frac{24{,}726 \text{ tons } SO_2}{\text{yr}} \times \frac{172 \text{ tons Ca } SO_4 \bullet 2H_2O}{64.1 \text{ tons } SO_2}$	66,347 tons of $CaSO_4 \cdot 2H_2O$ per year
Annual scrubber waste[d]	$\frac{22{,}779 \text{ tons CaO}}{\text{yr}} \times \frac{100-95}{100} + 66{,}347 \text{ tons Ca } SO_4 \bullet 2H_2O$	67,486 tons of scrubber waste per year
Total volume of scrubber waste[e]	$\frac{67{,}486 \text{ tons}}{\text{yr}} \times 40 \text{ yr} \times \frac{2{,}000 \text{ lb}}{\text{ton}} \times \frac{\text{ft}^3}{144.8 \text{ lb}}$	37,285,083 ft^3 of scrubber waste
Total volume of ash[f]	$\frac{154{,}741 \text{ tons}}{\text{yr}} \times 40 \text{ yr} \times \frac{2{,}000 \text{ bl}}{\text{ton}} \times \frac{\text{ft}^3}{100 \text{ lb}}$	123,792,800 ft^3 of ash
Total volume of solid waste	$37{,}285{,}083 ft^3 + 123{,}792{,}800 \text{ ft}^3$	161,077,883 ft^3 of solid waste
Waste pile area (acres)	$\frac{161{,}077{,}883 \text{ ft}^3}{30 \text{ ft}} \times \frac{\text{acre}}{43{,}560 \text{ ft}^2}$	123.3 acres of solid waste
Waste pile area (ft x ft square)	$\sqrt{161{,}077{,}883 \text{ ft}^3/30 \text{ ft}}$	2,317 feet by feet square of solid waste

Based on annual coal consumption of 1,888,980 tons per year (Table 8-2).

a. Calculations assume 100% combustion of coal.

b. Lime consumption is based on total SO_2 generated.

c. Calcium sulfate generation is based on total SO_2 removed.

d. Total scrubber waste includes scrubbing media carryover.

e. Density of $CaSO_4 \cdot 2H_2O$ is 144.8 lb/ft3.

f. Density of coal bottom ash is 100 lb/ft3 [Reference 8-8].

S = sulfur
SO_2 = sulfur dioxide
SO_x = oxides of sulfur
CaO = calcium oxide (lime)
$CaSO_4 \cdot 2H_2O$ = calcium sulfate dihydrate

8.1.1.1 Closed-Cycle Cooling System

The overall impacts at an alternate greenfield site of the coal-fired generating system using a closed-cycle cooling system with cooling towers are discussed in the following sections. The magnitude of impacts for the alternate site will depend on the location of the particular site selected. VYNPS currently uses once-through and closed-cycle cooling systems or a combination of both, known as hybrid cycle mode. For the purposes of comparison with an alternative site, it is assumed that the replacement coal-fired plant sited at an alternate site also would use a closed-cycle cooling system.

The environmental impacts of building a coal-fired generation facility with a closed-cycle cooling system at an alternate site are summarized in Table 8-4.

8.1.1.1.1 Land Use

Based on Table 8.1 of the GEIS it is estimated that it would take approximately 1.7 acres of land per MWe to construct a coal-fired plant. Therefore, for the hypothetical 620 gross MWe plant utilized in this analysis, it would take approximately 1,054 acres of land. This would amount to a considerable loss of natural habitat or agricultural land for the plant site alone, excluding that required for mining and other fuel-cycle impacts.

Additional land might also be needed for transmission lines and rail lines, depending on the location of the site relative to the nearest inter-tie connection and rail spur. Depending on the transmission line routing and nearest rail line, these alternatives could result in MODERATE to LARGE land use impacts.

Land-use changes would occur offsite in an undetermined coal-mining area to supply coal for the plant. In the GEIS, the staff estimated that approximately 22 acres of land per MWe would be affected for mining the coal and disposing of the waste to support a coal-fired plant during its operational life [Reference 8-11]. Therefore, for the hypothetical 620 gross MWe plant utilized in this analysis, it would take approximately 13,640 acres of land. Partially offsetting this offsite land use would be the elimination of the need for uranium mining and processing to supply fuel for VYNPS. In the GEIS, the staff estimated that approximately 1 acre per MWe would be affected for mining and processing the uranium during the operating life of a nuclear power plant [Reference 8-11]. Therefore, for the hypothetical 620 gross MWe plant utilized in this analysis, it would take approximately 620 acres of land.

The impact of a coal-fired generating unit with a closed-cycle cooling system on land use located at an alternate site is considered as MODERATE to LARGE.

8.1.1.1.2 Ecology

Constructing a coal-fired plant at an alternate site would alter ecological resources because of the need to convert roughly 1,054 acres of land at the site to industrial use for plant, coal storage, and ash and scrubber sludge disposal. However, some of this land might have been previously disturbed.

Coal-fired generation at an alternative site would introduce construction impacts and new incremental operational impacts. Even assuming siting at a previously disturbed area, the impacts would alter the ecology. Impacts could include wildlife habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity.

Use of cooling makeup water from a nearby surface water body could have adverse impacts on aquatic resources. If needed, construction and maintenance of an electric power transmission line and a rail spur would have ecological impacts. There would be some impact on terrestrial ecology from water drift from the cooling towers. Overall, the ecological impacts of constructing a coal-fired plant with a closed-cycle cooling system at an alternate site are considered to be MODERATE to LARGE.

8.1.1.1.3 Water Use and Quality

Surface Water

Cooling water at an alternate site would likely be withdrawn from a surface water body and would be regulated by a permit. Depending on the water source, the impacts of water use for cooling system makeup water and the effects on water quality caused by cooling tower blowdown could have noticeable impacts. Therefore, the impacts of a new coal-fired plant utilizing a closed-cycle cooling system at an alternate site are considered SMALL to MODERATE.

Groundwater

Impacts of groundwater withdrawal would be SMALL if only used for potable water. If groundwater is used to supply makeup water, then the impacts could be MODERATE to LARGE. Therefore, groundwater impacts from a coal-fired plant on the aquifer would be site-specific and dependent on aquifer recharge and other withdrawals. The overall impacts would be SMALL to LARGE.

8.1.1.1.4 Air Quality

Air quality impacts of coal-fired generation are considerably different from those of nuclear power. A coal-fired plant emits oxides of sulfur (SO_x), nitrogen oxides (NO_x), particulate matter, and carbon monoxide, all of which are regulated pollutants. As already stated, Entergy has assumed a plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. Entergy estimates the coal-fired alternative emissions to be as follows (from Table 8-2):

Oxides of sulfur = 1,238 tons per year

Oxides of nitrogen = 472 tons per year

Carbon monoxide = 472 tons per year

Particulates:

Total suspended particulates = 77 tons per year

PM_{10} (particulates having a diameter of less than 10 microns) = 18 tons per year

The acid rain requirements of the Clean Air Act amendments capped the nation's SO_x emissions from power plants. Under the Clean Air Act amendments, each company with fossil-fuel-fired units was allocated SO_x allowances. To be in compliance with the Act, the companies must hold enough allowances to cover their annual SO_x emissions. Entergy would have to purchase allowances to cover its SO_x emissions.

NRC did not quantify coal-fired emissions in the GEIS but implied that air impacts would be substantial. NRC noted that adverse human health effects from coal combustion have led to important federal legislation in recent years and that public health risks, such as cancer and emphysema, have been associated with coal combustion. NRC also mentioned global warming and acid rain as potential impacts. Entergy concludes that federal legislation and large-scale concerns, such as global warming an d acid rain, are indications of concerns about destabilizing important attributes of air resources. However, SO_x emission allowances, NO_x emission offsets, low NO_x burners with overfire air and selective catalytic reduction, fabric filters or electrostatic precipitators, and scrubbers are provided as mitigation measures. As such, Entergy concludes that the coal-fired alternative would have MODERATE impacts on air quality; the impacts would be clearly noticeable, but would not destabilize air quality in the area.

8.1.1.1.5 Waste

Entergy concurs with the GEIS assessment that the coal-fired alternative would generate substantial solid waste. The coal-fired plant would annually consume approximately 1,888,980 tons of coal having an ash content of 8.2%. After combustion, 99.9% of this ash (approximately 154,741 tons per year) would be collected and disposed of at either an onsite or offsite landfill. In addition, approximately 67,486 tons of scrubber waste would be disposed of each year (based on annual calcium hydroxide usage of approximately 22,779 tons). Entergy estimates that ash and scrubber waste disposal over a 40-year plant life would require approximately 123.3 acres. The amount of land needed for final disposal of ash may be less dependant upon the availability of local recycling options for the ash. Table 8-3 shows how Entergy calculated ash and scrubber waste volumes. While only half this waste volume and land use would be attributable to the 20-year license renewal period alternative, the total numbers are pertinent as a cumulative impact.

Entergy believes that, with proper siting coupled with current waste management and monitoring practices, waste disposal would not destabilize any resources. Some wooded terrestrial habitat would be dedicated to the waste site. However, after closure of the waste site and revegetation, the land would be available for other uses. For these reasons, Entergy believes that waste disposal for the coal-fired alternative would have MODERATE impacts; the impacts of increased waste disposal would be clearly noticeable, but would not destabilize any important resource and further mitigation would be unwarranted.

8.1.1.1.6 Human Health

Coal-fired power generation introduces worker risk from coal and limestone mining, worker and public risk from coal and lime/limestone transportation, worker and public risk from disposal of coal combustion wastes, and public risk from inhalation of stack emissions. Emission impacts can be widespread and health risk is difficult to quantify. The coal alternative also introduces the risk of coal pile fires and attendant inhalation risk.

The NRC stated in the GEIS that there could be human health impacts (cancer and emphysema) from inhalation of toxins and particulates from a coal-fired plant, but the GEIS does not identify the significance of these impacts [Reference 8-11]. In addition, the discharges of uranium and thorium from coal-fired plants can potentially produce radiological doses in excess of those arising from nuclear power plant operations [Reference 8-9].

Regulatory agencies, including the EPA and State agencies, set air emission standards and requirements based on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. EPA has recently concluded that certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures from sources such as coal-fired power plants. However, in the absence of more quantitative data, human health impacts from radiological doses and inhaling toxins and particulates generated by a coal-fired plant at an alternate site are considered to be SMALL.

8.1.1.1.7 Socioeconomics

Based on Table 8.1 of the GEIS, construction of the coal-fired alternative would take approximately 1 year per 200 MWe rating. The peak workforce is estimated to range from 1.2 to 2.5 additional workers per MWe during the construction period, based on estimates given in Table 8.1 of the GEIS. Therefore, for the hypothetical 620 gross MWe plant utilized in this analysis, it would take approximately three years to construct the plant with the workforce ranging from approximately 744 to 1,550 workers.

Communities around the new site would have to absorb the impacts of a large, temporary work force (up to approximately 1,550 workers at the peak of construction) and a permanent work force of approximately 0.2 workers per MWe based on Table 8.1 of the GEIS or approximately 124 workers for the hypothetical 620 gross MWe plant utilized in this analysis. In the GEIS, the staff stated that socioeconomic impacts at a rural site would be larger than at an urban site, because more of the peak construction work force would need to move to the area to work. Alternate sites would need to be analyzed on a case-by-case basis. Therefore, socioeconomic impacts at an isolated rural site could be LARGE.

Transportation related impacts associated with commuting construction workers at an alternate site would be site dependent, but could be MODERATE to LARGE.

Transportation impacts related to commuting of plant operating personnel would also be site dependent, but can be characterized as SMALL to MODERATE.

At most alternate sites, coal and lime would be delivered by rail, although barge delivery is feasible for a location on navigable waters. Transportation impacts would depend upon the site location. Socioeconomic impacts associated with rail transportation would be MODERATE to LARGE. Barge delivery of coal and lime/limestone would have SMALL socioeconomic impacts.

8.1.1.1.8 Aesthetics

Alternative site locations could reduce the aesthetic impact of coal-fired generation if siting were in an area that was already industrialized. In such a case, however, the introduction of tall stacks and cooling towers would probably still have a MODERATE incremental impact. Locating at other, largely undeveloped sites could show a LARGE impact.

8.1.1.1.9 Historic and Archaeological Resources

Before construction at an alternate site, studies would be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would be needed for areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other rights-of-way). Historic and archeological resource impacts can generally be effectively managed and as such are considered SMALL.

Table 8-4
Summary of Environmental Impacts from Coal-Fired Generation
Using Closed-Cycle Cooling at an Alternate Greenfield Site

Impact Category	Impact	Comments
Land Use	MODERATE to LARGE	Approximately 1,054 acres, including transmission lines and rail line for coal delivery.
Ecology	MODERATE to LARGE	Impact will depend on ecology of site.
Water Use and Quality:		
- Surface Water	SMALL to MODERATE	Impact will depend on volume and other characteristics of receiving water.
- Groundwater	SMALL to LARGE	Impact will depend on site characteristics and availability of groundwater.

Table 8-4
Summary of Environmental Impacts from Coal-Fired Generation Using Closed-Cycle Cooling at an Alternate Greenfield Site (Continued)

Impact Category	Impact	Comments
Air Quality	MODERATE	SO_x – 1,238 MT/yr – allowances required NO_x – 472 MT/yr – allowances required Particulate – 77 MT/yr (filterable) – 18 MT/yr (unfilterable) Carbon monoxide – 472 MT/yr Trace amounts of mercury, arsenic, chromium, beryllium and selenium
Waste	MODERATE	Total waste volume would be estimated around 222,227 MT/yr of ash and scrubber sludge.
Human Health	SMALL	Impacts considered minor.
Socioeconomics	SMALL to LARGE	Communities would have to absorb impacts of a large, temporary workforce (up to approximately 1,550 workers at the peak of construction) and a permanent work force of approximately 124 workers. Impacts at a rural site would be larger. Transportation-related impacts associated with commuting construction workers would be site dependent.
Aesthetics	MODERATE to LARGE	Could reduce aesthetic impact if siting is in an industrial area. Impact would be large if siting is largely in an undeveloped area.
Historic and Archaeological Resources	SMALL	Would necessitate cultural resource studies.

8.1.1.2 Once-Through Cooling System

The environmental impacts of constructing a coal-fired generation system at an alternate greenfield site using once-through cooling are similar to the impacts for a coal-fired plant using a closed-cycle cooling system. However, there are some environmental differences between the closed-cycle and once-through cooling systems. Table 8-5 summarizes the incremental differences.

Table 8-5
Summary of Environmental Impacts from Coal-Fired Generation Using Once-Through Cooling at an Alternate Greenfield Site

Impact Category	Impact	Comments
Land Use	MODERATE to LARGE	Compared with a closed-cycle cooling system, less land would be required because cooling towers and associated infrastructure not needed.
Ecology	MODERATE to LARGE	Slightly reduced environmental impacts because there are no cooling towers; however, increased water withdrawal may impact aquatic resources.
Water Use and Quality: - Surface Water	SMALL to MODERATE	Impact would depend on surface water body characteristics, volume of water withdrawn, and characteristics of the discharge.
- Groundwater	SMALL to LARGE	Impact would depend on site characteristics and availability of groundwater. It is unlikely that groundwater would be used for once-through cooling, but could be used for sanitary water.
Air Quality	MODERATE	No change.
Waste	MODERATE	No change.
Human Health	SMALL	No change.
Socioeconomics	SMALL to LARGE	No change.
Aesthetics	MODERATE to LARGE	Reduced aesthetic impact because cooling towers would not be used.
Historic and Archaeological Resources	SMALL	Less land impacted.

8.1.2 Natural Gas-Fired Generation

Entergy has chosen to evaluate gas-fired generation, using combined-cycle turbines, because it has determined that the technology is mature, economical, and feasible. Table 8-6 presents the basic gas-fired alternative characteristics and Table 8-7 presents emission estimates.

NRC evaluated environmental impacts from gas-fired generation alternatives in the GEIS, focusing on combined-cycle plants. NRC has evaluated the environmental impacts of constructing and operating four 440-MW combined-cycle gas-fired units as an alternative to a nuclear power plant license renewal [Reference 8-11]. This analysis would bound the gas-fired alternative analysis for VYNPS because Entergy has defined a reasonable gas alternative for VYNPS as 608 MWe combined cycle plant. Entergy has adopted the rest of the NRC analysis with necessary Entergy-specific modifications noted. Although air emissions from the gas-fired unit would be substantially smaller than from the coal-fired unit, human health effects associated with such emissions would be of concern.

Table 8-6
Gas-Fired Alternative Emission Control Characteristics

Characteristic	Basis
Unit size = 585 MW ISO rating net[a] Two 189-MW combustion turbines and a 207-MW heat recovery boiler	Manufacturer's standard size gas-fired combined cycle plant that is <VYNPS gross capacity (650 MW)
Unit size = 608 MW ISO rating gross[a]	Calculated based on 4% onsite power
Number of units = 1	
Fuel type = natural gas	Assumed
Fuel heating value = 1,042 Btu/ft^3	2000 value for gas used in Massachusetts [Reference 8-5, Table 25]
Fuel sulfur content = 0.0034 lb/MMBtu	Used when sulfur content is not available [Reference 8-7, Table 3.1-2a]
NO_x control = selective catalytic reduction (SCR) with steam/water injection	Best available for minimizing NO_x emissions [Reference 8-7, Table 3.1 Database]
Fuel NO_x content = 0.0109 lb/MMBtu	Typical for large SCR-controlled gas-fired units with water injection [Reference 8-7, Table 3.1 Database]
Fuel CO content = 0.0023 lb/MMBtu	Typical for large SCR-controlled gas-fired units [Reference 8-7, Table 3.1]
Heat rate = 6,204 Btu/kWh	Manufacturer's listed heat rate for this unit.
Capacity factor = 0.85	Typical for large gas-fired base load units (Entergy experience)

a. The difference between "net" and "gross" is electricity consumed by auxiliary equipment and environmental control devices [Reference 8-5, page 109].

Btu = British thermal unit
ft^3 = cubic foot
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59°F, 60% relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kWh = kilowatt-hour
MM = million
MW = megawatt
NO_x = nitrogen oxides
< = less than
SCR = selective catalytic reduction

Table 8-7
Air Emissions from Gas-Fired Alternative

Parameter	Calculation	Result
Annual gas consumption	$\frac{608\ \text{MW}}{\text{unit}} \times \frac{6{,}204\ \text{Btu}}{\text{kW} \times \text{hr}} \times \frac{1{,}000\ \text{kW}}{\text{MW}} \times 0.85 \times \frac{\text{ft}^3}{1{,}042\ \text{Btu}} \times \frac{24\ \text{hr}}{\text{day}} \times \frac{365\ \text{day}}{\text{yr}}$	26,954,462,833 ft^3 per year
Annual Btu input	$\frac{26{,}954{,}462{,}833\ \text{ft}^3}{\text{yr}} \times \frac{1.042\ \text{Btu}}{\text{ft}^3} \times \frac{\text{MMBtu}}{10^6\text{Btu}}$	28,086,550 MMBtu per year
SO_x[a]	$\frac{0.0034\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{28{,}086{,}550\ \text{MMBtu}}{\text{yr}}$	47.7 tons SO_x per year
NO_x[b]	$\frac{0.0109\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{28{,}086{,}550\ \text{MMBtu}}{\text{yr}}$	153.1 tons NO_x per year
CO[b]	$\frac{0.0023\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{28{,}086{,}550\ \text{MMBtu}}{\text{yr}}$	32.2 tons CO per year
TSP[a]	$\frac{0.0019\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{28{,}086{,}550\ \text{MMBtu}}{\text{yr}}$	26.7 tons filterable TSP per year
PM_{10}[a]	$\frac{26.7\ \text{tons TSP}}{\text{yr}}$	26.7 tons filterable PM_{10} per year

a. Reference 8-7, Table 3.1-2a.

b. Reference 8-7, Table 3.1-1.

CO = carbon monoxide

NO_x = oxides of nitrogen

PM_{10} = particulates having diameter less than 10 microns

SO_x = oxides of sulfur

TSP = total suspended particulates

8.1.2.1 Closed Cycle Cooling System

The overall impacts of the natural-gas-generating system with a closed-cycle cooling system located at the VYNPS site or an alternate site are summarized in Table 8-8 and discussed in the following sections. The magnitude of impacts at an alternate site will depend on the location of the particular site selected.

8.1.2.1.1 Land Use

Gas-fired generation at the VYNPS site would require converting the existing industrial site to a gas plant. Almost all the converted land would be used for the power block. Additional land would be disturbed during pipeline construction. Some additional land would also be required for backup oil storage tanks. The nearest gas pipeline tie-in, located near Renfrew, Massachusetts (Tennessee Gas Pipeline), is approximately 40 miles from the VYNPS site. Therefore, gas-fired generation land use impacts at the existing VYNPS site are SMALL to MODERATE; the impacts would noticeably alter the habitat but would not destabilize important attributes of the resource.

In addition to the land required for the gas-fired plant, construction at a greenfield site could impact approximately 20 to 50 acres for offices, roads, parking areas, and a switchyard. The power block could require approximately 60 acres. Some additional land would also be required for backup oil storage. It is assumed that additional acreage may be necessary for transmission lines (assuming the plant is sited 10 miles from the nearest inter-tie connection), although this would depend on the actual plant location. Plants of this type are usually built very close to existing natural gas pipelines. Including the land required for pipeline construction, a greenfield site could require approximately 500 acres. Depending on the transmission-line routing, the greenfield site alternative could result in SMALL to MODERATE land-use impacts.

8.1.2.1.2 Ecology

Siting gas-fired generation at the existing VYNPS site would have MODERATE ecological impacts because the facility would be constructed partly on previously disturbed areas and would disturb relatively little acreage at the site. However, significant habitat would be disturbed by approximately 40 miles of pipeline construction. Ecological impacts could be reduced by using the existing intake and discharge system. Past operational monitoring of the effects of the cooling systems at VYNPS has not shown significant negative impacts to the Connecticut River ecology, and this would be expected to remain unchanged.

The GEIS noted that land-dependent ecological impacts from construction would be SMALL unless site-specific factors indicate a particular sensitivity and that operational impact would be smaller than for other fossil fuel technologies of equal capacity. The connection to a gas pipeline located approximately 40 miles from the VYNPS site is a site-specific factor that would make the gas-fired alternative's ecological impacts larger than those of license renewal. Therefore, in this case, the appropriate characterization of gas-fired generation ecological impacts is MODERATE.

Construction at a greenfield site could alter the ecology of the site and could impact threatened and endangered species. These ecological impacts could be SMALL to MODERATE.

8.1.2.1.3 Water Use and Quality

Surface Water

The plant would use the existing VYNPS intake and discharge structures as part of a closed-cycle cooling system; therefore, water quality impacts would continue to be SMALL.

Water quality impacts from sedimentation during construction is another land related impact that the GEIS categorized as SMALL. The GEIS also noted that operational water quality impacts would be similar to, or less than, those from other centralized generating technologies. The NRC has concluded that water quality impacts from coal-fired generation would be SMALL, and gas-fired alternative water usage would be less than that for coal-fired generation. Surface water impacts would remain SMALL; the impacts would not be detectable or be so minor that they would not noticeably alter important attributes of the resource.

For alternative greenfield sites, the impact on surface water would depend on the volume and other characteristics of the receiving body of water. The impacts would be SMALL to MODERATE.

Groundwater

As discussed in Section 2.3 of this ER, VYNPS utilizes groundwater for potable water purposes and to some extent for plant makeup purposes. However based on actual measured water usage, pump rate from all wells are typically less than 10 gpm during non-outage situations and typically less than 36 gpm during outage situations. Since there will be a reduction in workforce over the period of phasing into the operational period of the gas-fired plant, there will be a reduction in overall groundwater withdrawal. Therefore, groundwater impacts would be SMALL; the impacts would be so minor that they would not noticeably alter important resources.

For alternative greenfield sites, the impact to the groundwater would depend on the site characteristics, including the amount of groundwater available. The impacts would range between SMALL and LARGE.

8.1.2.1.4 Air Quality

Natural gas is a relatively clean-burning fossil fuel; the gas-fired alternative would release similar types of emissions, but in lesser quantities, than the coal-fired alternative. Control technology for gas-fired turbines focuses on NO_x emissions. Entergy estimates the gas-fired alternative emissions to be as follows (from Table 8-7):

Sulfur oxides = 47.7 tons per year

Oxides of nitrogen = 153.1 tons per year

Carbon monoxide = 32.2 tons per year

Filterable Particulates = 26.7 tons per year (all particulates are PM_{10})

Regional air quality and Clean Air Act requirements also are applicable to the gas-fired generation alternative. NO_x effects on ozone levels, SO_x allowances, and NO_x emission offsets could all be issues of concern for gas-fired combustion. While gas-fired turbine emissions are less than coal-fired boiler emissions, and regulatory requirements are less stringent, the emissions are still substantial. Entergy concludes that emissions from the gas-fired alternative located at VYNPS would noticeably alter local air quality, but would not destabilize regional resources. Air quality impacts would therefore be MODERATE, but substantially smaller than those of coal-fired generation.

Siting the gas-fired plant elsewhere would not significantly change air quality impacts because the site could be in a greenfield area that is not a serious nonattainment area for ozone. In addition, the location could result in installing more or less stringent pollution control equipment to meet the regulations. Therefore, the impacts would be MODERATE.

8.1.2.1.5 Waste

There are only small amounts of solid waste products (i.e., ash) from burning natural gas fuel. The GEIS concluded that waste generation from gas-fired technology would be minimal. Gas firing results in very few combustion by-products because of the clean nature of the fuel. Waste generation would be limited to typical office wastes. This impact would be SMALL; waste generation impacts would be so minor that they would not noticeably alter important resource attributes.

Siting the facility at an alternate greenfield site would not alter the waste generation; therefore, the impacts would continue to be SMALL.

8.1.2.1.6 Human Health

The GEIS analysis mentions potential gas-fired alternative health risks (cancer and emphysema). The risk may be attributable to NO_x emissions that contribute to ozone formation, which in turn contributes to health risks. As discussed in Section 8.1.1.1.4 for the coal-fired alternative, legislative and regulatory control of the nation's emissions and air quality are protective of human health, and the human health impacts from gas-fired generation would be SMALL; that is, human health effects would not be detectable or would be so minor that they would neither destabilize nor noticeably alter important attributes of the resource.

Siting of the facility at an alternate greenfield site would not alter the possible human health effects. Therefore, the impacts would be SMALL.

8.1.2.1.7 Socioeconomics

It is assumed that gas-fired construction would take place while VYNPS continues operation, with completion of the replacement plant at the time that the nuclear plant would halt operations. Construction of the gas-fired alternative would take much less time than constructing other plants. During the time of construction, the surrounding communities would experience demands on housing and public services that could have MODERATE impacts. After construction, the communities would be impacted by the loss of jobs, construction workers would leave, VYNPS nuclear plant workforce would decline through a decommissioning period to a minimal maintenance size, and the gas-fired plant would introduce a replacement tax base of approximately 100 new jobs.

The GEIS concluded that socioeconomic impacts from constructing a gas-fired plant would not be very noticeable and that the small operational workforce would have the lowest socioeconomic impacts (local purchases and taxes) of nonrenewable technologies. Compared to the coal-fired alternative, the smaller size of the construction workforce, the shorter construction time-frame, and the smaller size of the operations workforce would reduce some of the socioeconomic impacts. For these reasons, the socioeconomic impacts of gas-fired-generation socioeconomic impacts would be SMALL to MODERATE; that is, depending on other growth in the area, socioeconomic effects could be noticed, but they would not destabilize important attributes of the resource.

Construction at another site would relocate some socioeconomic impacts, but would not eliminate them. The community around the VYNPS site would still experience the impact of the loss of VYNPS operational jobs and the tax base. The communities around the new site would have to absorb the impacts of a temporary workforce and a small permanent workforce. Therefore, the impacts would be MODERATE to LARGE, based on net job and tax-base losses in the VYNPS. This impact is about the same in the VYNPS area as in the no-action alternative.

8.1.2.1.8 Aesthetics

The combustion turbines and heat-recovery boilers would be relatively low structures and would be screened from most offsite vantage points by intervening woodlands. The steam turbine building would be taller and, together with the exhaust stacks, could be visible offsite.

The GEIS analysis noted that land-related impacts, such as aesthetic impacts, would be small unless site-specific factors indicate a particular sensitivity. As in the case of the coal-fired alternative, aesthetic impacts from the gas-fired alternative would be noticeable. However, because the gas-fired structures are shorter than the coal-fired structures and more amenable to screening by vegetation, it was determined that the aesthetic resources would not be destabilized by the gas-fired alternative. For these reasons, aesthetic impacts from a gas-fired plant would be SMALL to MODERATE; the impacts would be clearly noticeable, but would not destabilize this important resource.

Alternative locations could reduce the aesthetic impact of gas-fired generation if siting was in an area that was already industrialized. In such a case, however, the introduction of the steam

generator building, stacks, and cooling tower plumes would probably still have a SMALL to MODERATE incremental impact.

8.1.2.1.9 Historic and Archaeological Resources

The GEIS analysis noted, as for the coal-fired alternative, that cultural resource impacts of the gas-fired alternative would be SMALL unless important site-specific resources were affected. Gas-fired alternative construction at the VYNPS site would affect a smaller area within the footprint of the coal-fired alternative. Therefore, cultural resource impacts would be SMALL; that is, cultural resource impacts would not be detectable or would be so minor that they would neither destabilize nor noticeably alter important attributes of the resource.

Construction at another site could necessitate instituting cultural resource preservation measures, but impacts can generally be managed and maintained as SMALL. Cultural resource surveys would be required for the pipeline construction and other areas of ground disturbance associated with this alternative.

Table 8-8
Summary of Environmental Impacts from Gas-Fired Generation Using Closed-Cycle Cooling at VYNPS and Alternate Greenfield Site

Impact Category	VYNPS Site		Alternative Greenfield Site	
	Impact	Comments	Impact	Comments
Land Use	SMALL to MODERATE	Approximately 60 acres required for power block, 150 acres disturbed for pipeline construction, additional land for backup oil storage tanks.	SMALL to MODERATE	Up to 500 acres required for site, pipelines, transmission line connection; additional land for backup oil storage tanks.
Ecology	MODERATE	Constructed on land within VYNPS site. Possible significant habitat loss due to pipeline construction.	SMALL to MODERATE	Impact depends on location and ecology of site; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water Use and Quality				
- Surface Water	SMALL	Uses existing intake and discharge structures and cooling system.	SMALL to MODERATE	Impact depends on volume and characteristics of receiving water body.
-Groundwater	SMALL	Reduced groundwater withdrawals due to reduced workforce.	SMALL to LARGE	Groundwater impacts would depend on uses and available supply.
Air Quality	MODERATE	Primarily nitrogen oxides. Impacts could be noticeable, but not destabilizing.	MODERATE	Same impacts as VYNPS site.
Waste	SMALL	Small amount of ash produced.	SMALL	Same impacts as VYNPS site.
Human Health	SMALL	Impacts considered minor.	SMALL	Same impacts as VYNPS site.

Table 8-8
Summary of Environmental Impacts from Gas-Fired Generation Using Closed-Cycle Cooling at VYNPS and Alternate Greenfield Site (Continued)

Impact Category	VYNPS Site		Alternative Greenfield Site	
	Impact	Comments	Impact	Comments
Socioeconomics	SMALL to MODERATE	Additional workers during construction period, followed by reduction from current VYNPS workforce.	MODERATE to LARGE	Construction impacts would be relocated. Community near VYNPS would still experience workforce reduction.
Aesthetics	SMALL to MODERATE	Visual impact of stacks and equipment would be noticeable, but not as significant as coal option.	SMALL to MODERATE	Alternate location could reduce aesthetic impact if siting is in an industrial area.
Historic and Archaeological Resources	SMALL	Only previously disturbed and adjacent areas would be affected.	SMALL	Alternate location would necessitate cultural resource studies.

8.1.2.2 Once-Through Cooling System

The environmental impacts of constructing a natural-gas-fired generation system at the VYNPS site and an alternate site using a once-through cooling system are similar to the impacts for a natural-gas-fired plant using closed-cycle cooling with cooling towers. However, there are some environmental differences between the closed-cycle and once-through cooling systems. Table 8-9 summarizes the incremental differences.

Table 8-9
Summary of Environmental Impacts from Gas-Fired Generation Using Once-Through Cooling at VYNPS and Alternate Greenfield Site

Impact Category	VYNPS Site		Alternative Greenfield Site	
	Impact	Comments	Impact	Comments
Land Use	SMALL to MODERATE	15 to 20 acres less land required because cooling towers and associated infrastructure are not needed.	SMALL to MODERATE	15 to 20 acres less land required because cooling towers and associated infrastructure are not needed.
Ecology	SMALL	Less terrestrial habitat lost and cooling tower effects eliminated. Increased water withdrawal, but aquatic impact would be similar to current VYNPS operations.	SMALL to MODERATE	Impact would depend on ecology at the site. No impact to terrestrial ecology from cooling tower drift. Increased water withdrawal and possible greater impact to aquatic ecology.
Water Use and Quality - Surface Water - Groundwater	 SMALL to MODERATE SMALL	 No discharge of cooling tower blowdown containing dissolved solids. Increased water withdrawal and more thermal load on receiving body of water. No change.	 SMALL to MODERATE SMALL to LARGE	 No discharge of cooling tower blowdown containing dissolved solids. Increased water withdrawal and more thermal load on receiving body of water. Groundwater impacts would depend on uses and available supply. It is unlikely that groundwater would be used for once-through cooling, but could be used for sanitary water.
Air Quality	MODERATE	No change.	MODERATE	No change.
Waste	SMALL	No change.	SMALL	No change.

Table 8-9
Summary of Environmental Impacts from Gas-Fired Generation Using Once-Through Cooling at VYNPS and Alternate Greenfield Site (Continued)

Impact Category	VYNPS Site		Alternative Greenfield Site	
	Impact	Comments	Impact	Comments
Human Health	SMALL	No change.	SMALL	No change.
Socioeconomics	SMALL to MODERATE	No change.	MODERATE to LARGE	No change.
Aesthetics	SMALL to MODERATE	Reduced aesthetic impact because cooling towers would not be used.	SMALL to MODERATE	Reduced aesthetic impact because cooling towers would not be used.
Historic and Archaeological Resources	SMALL	Less land affected.	SMALL	Less land affected.

8.1.3 Nuclear Power Generation

Since 1997, the NRC has certified three new standard designs for nuclear power plants under 10 CFR 52, Subpart B. These designs are the U.S. Advanced Boiling Water Reactor (10 CFR 52, Appendix A), the System 80+ Design (10 CFR 52, Appendix B), and the AP600 Design (10 CFR 52, Appendix C). All of these plants are light-water reactors. Although no applications for a construction permit or a combined license based on these certified designs have been submitted to NRC, the submission of the design certification applications indicates continuing interest in the possibility of licensing new nuclear power plants. In addition, recent volatility of natural gas and electricity has made new nuclear power plant construction more attractive from a cost standpoint. Consequently, construction of a new nuclear power plant at an alternate site using closed-cycle cooling is considered in this section. It was assumed that the new nuclear plant would have a 40-year lifetime [Reference 8-14, Section 8.2.3].

The NRC summarized environmental data associated with the uranium fuel cycle in Table S-3 of 10 CFR 51.51. The impacts shown in Table S-3 are representative of the impacts that would be associated with a replacement nuclear power plant built to one of the certified designs, sited at an alternate site. The impacts shown in Table S-3 are for a 1,000 MWe reactor and would need to be adjusted to reflect replacement of VYNPS, which has a capacity of 650 gross MWe. The environmental impacts associated with transporting fuel and waste to and from a light-water cooled nuclear power reactor are summarized in Table S-4 of 10 CFR 51.52. The summary of NRC's findings on NEPA issues for license renewal of nuclear power plants in Table B-1 of 10 CFR 51 Subpart A, Appendix B, is also relevant, although not directly applicable, for

consideration of environmental impacts associated with the operation of a replacement nuclear power plant [Reference 8-14, Section 8.2.3].

8.1.3.1 Closed-Cycle Cooling System

The environmental impacts of constructing a nuclear power plant at an alternate site using closed-cycle cooling are summarized in Table 8-10.

8.1.3.1.1 Land Use

Land use requirements at an alternate site would require land for the nuclear power plant plus the possible need for land for a new transmission line. In addition, it may be necessary to construct a rail spur to an alternate site to bring in equipment during construction. Depending on transmission line routing, siting a new nuclear plant at an alternate site would result in MODERATE to LARGE land use impacts, and probably would be LARGE for a greenfield site [Reference 8-14, Section 8.2.3.1].

8.1.3.1.2 Ecology

At an alternate site, there would be construction impacts and new incremental operational impacts. Even assuming siting at a previously disturbed area, the impacts would alter the ecology. Impacts could include wildlife habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity. Use of cooling water from a nearby surface water body could have adverse aquatic resource impacts. Construction and maintenance of the transmission line would have ecological impacts. Overall, the ecological impacts at an alternate site would be MODERATE to LARGE [Reference 8-14, Section 8.2.3.1].

8.1.3.1.3 Water Use and Quality

Surface Water

For a replacement reactor located at an alternate site, new intake structures would need to be constructed to provide water needs for the facility. Impacts would depend on the volume of water withdrawn for makeup, relative to the amount available from the intake source and the characteristics of the surface water. Plant discharges would be regulated by the State of Vermont or other state jurisdiction. Some erosion and sedimentation may occur during construction. The impacts would be SMALL to MODERATE.

Groundwater

A nuclear power plant sited at an alternate site may use groundwater. The impacts of such a withdrawal rate on an aquifer would be site specific and dependent on aquifer recharge and other withdrawal rates from the aquifer. Therefore, the overall impacts would be SMALL to LARGE.

8.1.3.1.4 Air Quality

Construction of a new nuclear plant at an alternate site would result in fugitive emissions during the construction process. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process. An operating nuclear plant would have minor air emissions associated with diesel generators. These emissions would be regulated. [Reference 8-14, Section 8.2.3.1] Emissions for a plant sited in Vermont would be regulated by the VDEC. Overall, emissions and associated impacts are considered SMALL [Reference 8-14, Section 8.2.3.1].

8.1.3.1.5 Waste

The waste impacts associated with operation of a nuclear power plant are listed in Table B-1 of 10 CFR 51 Subpart A, Appendix B. In addition to the impacts shown in Table B-1, construction-related debris would be generated during construction activities and removed to an appropriate disposal site. Overall, waste impacts are considered SMALL [Reference 8-14, Section 8.2.3.1].

8.1.3.1.6 Human Health

Human health impacts for an operating nuclear power plant are identified in 10 CFR 51 Subpart A, Appendix B, Table B-1. Overall, human health impacts are considered SMALL [Reference 8-14, Section 8.2.3.1].

8.1.3.1.7 Socioeconomics

For a 1,000 MWe reactor, it was assumed that the construction period would be 5 years and the peak workforce would be 2,500. Since VYNPS's current reactor is rated at 650 gross MWe, construction period and peak workforce may be less, but impacts are expected to be consistent with that of the 1,000 MWe reactor.

Construction of a replacement nuclear power plant at an alternate site would relocate some socioeconomic impacts, but would not eliminate them. The communities around the VYNPS site would still experience the impact of VYNPS operational job loss (although potentially tempered by projected economic growth), and the communities around the new site would have to absorb the impacts of a large, temporary work force (up to 2,500 workers at the peak of construction) and a permanent work force of approximately 678 workers. In the GEIS, the NRC noted that socioeconomic impacts at a rural site would be larger than at an urban site because more of the peak construction work force would need to move to the area to work. Alternate sites would need to be analyzed on a case-by-case basis. Socioeconomic impacts at rural sites could be LARGE [Reference 8-14, Section 8.2.3.1].

Transportation-related impacts associated with commuting workers at an alternate site are site dependent, but could be MODERATE to LARGE. Transportation impacts related to commuting of plant operating personnel would also be site dependent but can be characterized as SMALL [Reference 8-14, Section 8.2.3.1].

8.1.3.1.8 Aesthetics

At an alternate site, depending on placement, there would be an aesthetic impact from the buildings. There would also be a significant aesthetic impact associated with construction of a new transmission line to connect to other lines to enable delivery of electricity. Noise and light from the plant would be detectable offsite. The impact of noise and light would be mitigated if the plant is located in an industrial area adjacent to other power plants, in which case the impact could be SMALL. The impact could be MODERATE if a transmission line needs to be built to the alternate site. The impact could be LARGE if a greenfield site is selected [Reference 8-14, Section 8.2.3.1].

8.1.3.1.9 Historic and Archeological Resources

Before construction at an alternate site, studies would be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on cultural resources. The studies would be needed for areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other rights-of-way). Historic and archeological resource impacts can generally be effectively managed and as such are considered SMALL.

Table 8-10
Summary of Environmental Impacts from Nuclear Power Generation
Using Closed-Cycle Cooling at Alternate Greenfield Site

Impact Category	Alternative Greenfield Site	
	Impact	**Comments**
Land Use	MODERATE to LARGE	Requires 325 to 650 acres for the plant and 650 acres for uranium mining.
Ecology	MODERATE to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and transmission line routes; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water Use and Quality - Surface Water	SMALL to MODERATE	Impact will depend on the volume of water withdrawn and discharged and the characteristics of the surface water body.
- Groundwater	SMALL to LARGE	Groundwater impacts would depend on uses and available supply.
Air Quality	SMALL	Fugitive emissions and emissions from vehicles and equipment during construction. Small amount of emissions from diesel generators and possibly other sources during operation. Emissions are similar as current releases at VYNPS site.

Table 8-10
Summary of Environmental Impacts from Nuclear Power Generation
Using Closed-Cycle Cooling at Alternate Greenfield Site
(Continued)

Impact Category	Alternative Greenfield Site	
	Impact	Comments
Waste	SMALL	Waste impacts for an operating nuclear power plant are set out in 10 CFR 51, Appendix B, Table B-1. Debris would be generated and removed during construction.
Human Health	SMALL	Human health impacts for an operating nuclear power plant are set out in 10 CFR 51, Appendix B, Table B-1.
Socioeconomics	SMALL to LARGE	Construction impacts depend on location. Impacts at a rural location could be LARGE. Surrounding community would experience loss of tax base and employment with MODERATE impacts. Transportation impacts associated with construction workers could be MODERATE to LARGE. Transportation impacts of commuting workers during operations would be SMALL.
Aesthetics	SMALL to LARGE	Impacts would depend on the characteristics of the alternate site. Impacts would be SMALL if the plant is located adjacent to an industrial area. New transmission lines would add to the impacts and could be MODERATE. If a greenfield site is selected, the impacts could be LARGE.
Historic and Archaeological Resources	SMALL	Potential impacts can be effectively managed.

8.1.3.2 Once-Through Cooling System

The environmental impacts of constructing a nuclear power plant that uses once-through cooling at an alternate site are similar to the impacts for a nuclear power plant using closed-cycle cooling with cooling towers. However, there are some differences in the environmental impacts between the closed-cycle and once-through cooling systems. In those impact categories related to land-area requirements, such as land use, terrestrial ecology, and cultural resources, the impacts are likely to be smaller if the site uses a once-through cooling system rather than a closed-cycle cooling system. However, the impacts of a plant with a once-through cooling system are likely to be greater than a plant with a closed-cycle cooling system in the areas of water use and aquatic ecology because of the need for greater quantities of cooling water. Table 8-11 summarizes the incremental differences.

Table 8-11
Summary of Environmental Impacts from Nuclear Power Generation Using Once-Through Cooling at Alternate Greenfield Site

Impact Category	Alternative Greenfield Site	
	Impact	Comments
Land Use	MODERATE to LARGE	Requires 325 to 650 acres for the plant and 650 acres for uranium mining.
Ecology	MODERATE to LARGE	Impact would depend on ecology of the site. No impact to terrestrial ecology from cooling tower drift. Increased water withdrawal with possible greater impact to aquatic ecology.
Water Use and Quality - Surface Water	SMALL to MODERATE	No discharge of cooling tower blowdown. Increased water withdrawal and more thermal load on receiving body of water.
- Groundwater	SMALL to LARGE	No change.
Air Quality	SMALL	No change.
Waste	SMALL	No change.
Human Health	SMALL	No change.
Socioeconomics	MODERATE to LARGE	No change.
Aesthetics	SMALL to LARGE	Reduced aesthetic impact because cooling towers would not be used, but impacts could still be large if lengthy transmission line is required.
Historic and Archaeological Resources	SMALL	Less land impacted.

8.1.4 Purchased Electrical Power

If available, purchased power from other sources could potentially obviate the need to renew the VYNPS license. "Purchased power" is power purchased and transmitted from electric generation plants that the applicant does not own and that are located elsewhere within the region, nation, Canada or Mexico.

In theory, purchased power is a feasible alternative to VYNPS license renewal. There is no assurance, however, that sufficient capacity or energy would be available in the 2012 through 2032 time-frame to replace the 650 gross MWe base-load generation. For example, EIA projects that total gross U.S. imports of electricity from Canada and Mexico will gradually increase from 38.4 billion kWh in year 2001 to 47.2 billion kWh in year 2010 and then gradually decrease to 28.9 billion kWh in year 2020 [Reference 8-2, page 149]. On balance, it appears unlikely that electricity imported from Canada or Mexico would be able to replace the VYNPS generating capacity.

More importantly, regardless of the technology used to generate purchased power, the generating technology would be one of those described in this ER and in the GEIS (probably coal, natural gas, nuclear or hydroelectric). The GEIS description of other technology impacts is representative of imported power impacts related to VYNPS license renewal alternatives [Reference 8-13, Section 8.2.3].

8.2 Alternatives Not Within the Range of Reasonable Alternatives

Other commonly known generation technologies considered are listed in the following paragraphs. However, these sources have been eliminated as reasonable alternatives to the proposed action because the generation of 650 gross MWe of electricity as a base-load supply using these technologies is not technologically feasible.

8.2.1 Wind

In the entire six-state New England region, only two wind projects are in operation: the 6 MW Searsburg project in Vermont and a 320 kW project in Massachusetts owned by Princeton Municipal Light. There is also an additional project under active development in southern Vermont (Equinox) [Reference 8-4, page 1]. Wind turbines typically operate at a 25 to 35% capacity factor compared to 80 to 95% for a base load plant. This low capacity factor results from the high degree of intermittence of wind energy in many locations. Current energy storage technologies are too expensive to permit wind power plants to serve as large base load plants.

In Vermont, the windiest sites are located on the north-south ridgelines. These locations are often in remote areas, far from the load centers where the electricity will be consumed. The most desirable ridgelines are above 2,500 feet in elevation. Any intrusion on the fragile habitat at that elevation would have to be approached with extreme caution. Furthermore, there are environmental concerns revolving around migratory birds and bats that would have to be addressed by wind developers. In a tourist state like Vermont, the aesthetic impact of ridgeline development has been raised as a concern by many involved in the wind energy debate. The

cost of this impact and its perceived intrusion on remote areas will have to be balanced with the environmental benefits of clean energy. [Reference 8-15]

Wind energy also has a large land requirement, approximately 150 acres of land to generate 1 MWe of electricity. Therefore, to replace the 650 gross MWe of electricity generated by VYNPS, approximately 97,500 acres would be required. Also, new easements, road building, and some clearing for towers and blades would be required. This eliminates the possibility of co-locating a wind-energy facility with a retired nuclear power plant. A siting plan would be required. Construction of several hundred wind turbines would also require extensive construction of transmission lines to bring the power and the energy to market. This would have a LARGE impact upon much of the natural environment in the affected areas.

Wind power could be included in a combination of alternatives to replace VYNPS. The environmental impacts of a large-scale wind farm are described in the GEIS [Reference 8-11]. The construction of roads, transmission lines, and turbine tower supports would result in short-term impacts, such as increases in erosion and sedimentation, and decreases in air quality from fugitive dust and equipment emissions. Construction in undeveloped areas would have the potential to disturb and impact cultural resources or habitat for sensitive species. During operation, some land near wind turbines could be available for compatible uses such as agriculture. The continuing aesthetic impact would be considerable, and there is a potential for bird collisions with turbine blades. Wind farms generate very little waste and pose no human health risk other than from occupational injuries. Although most impacts associated with a wind farm are SMALL or can be mitigated, some impacts such as the continuing aesthetic impact and impacts to sensitive habitats could be LARGE, depending on the location.

8.2.2 Solar

The average capacity factor for this technology is estimated to be between 25 and 40% annually. This technology has high capital costs and lacks base-load capability unless combined with natural gas backup. It requires very large energy-storage capabilities. Based upon solar energy resources, the most promising region of the country for this technology is the West. [Reference 8-13, Section 8.2.4.2]

There are also substantial impacts to natural resources (wildlife habitat, land-use, and aesthetic impacts) from construction of solar-generating facilities. As stated in the GEIS, land requirements are high. Based on the land requirements of 14 acres for every 1 MWe generated, approximately 9,100 acres would be required to replace the 650 gross MWe's produced by VYNPS. There is not enough land for a solar system at the existing VYNPS site and environmental impacts at an alternate site would be LARGE.

The construction impacts would be similar to those associated with a large wind farm as discussed in Section 8.2.1. The operating facility would also have considerable aesthetic impact. Solar installations pose no human health risk other than from occupational injuries. The manufacturing process for constructing a large amount of photovoltaic cells would result in waste generation, but this waste generation has not been quantified. Some impacts, such as impacts

to sensitive areas, loss of productive land, and the continuing aesthetic impact, could be LARGE, depending on the location.

8.2.3 Hydropower

Hydroelectric power has an average annual capacity factor of 46%. Section 8.3.4 of the GEIS, indicates that the percentage of the U. S. electrical generation consisting of hydroelectricity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern over flooding, destruction of natural habitat, and destruction of natural river courses. Section 8.3.4 of the GEIS, estimates land use of 1-million acres per 1000 MWe (or l,000 acres per MWe) for hydroelectric power, resulting in a LARGE environmental impact. [Reference 8-13, Section 8.2.4.3] Due to the lack of locations for siting a hydroelectric facility large enough to replace VYNPS, local hydropower is not a feasible alternative to VYNPS license renewal.

There is little likelihood that any new conventional hydro development will occur in Vermont in the future. It is more likely that a decrease in production will occur as removal of additional dams is considered (i.e., Peterson Dam) or operating conditions imposed as a result of relicensing of existing hydro projects will reduce the available generation from Vermont's existing portfolio of hydro plants. [Reference 8-15]

8.2.4 Geothermal

Geothermal has an average capacity factor of 90% and can be used for base-load power where available. However as illustrated by Figure 8.4 in the GEIS, geothermal plants might be located in the western continental U.S., Alaska, and Hawaii where geothermal reservoirs are prevalent. This technology is not widely used as base-load generation due to the limited geographic availability of the resource and the immature status of the technology. [Reference 8-13, Section 8.2.4.4] This technology is not applicable to the region where the replacement of 650 gross MWe is needed. Vermont has vast low-temperature resources suitable for geothermal heat pumps but does not have sufficient resources to utilize the other geothermal technologies [Reference 8-16].

8.2.5 Wood Energy

A wood-burning facility can provide base-load power and operate with an average annual capacity factor of around 70 to 80% and with 20 to 25% efficiency. The cost of the fuel required for this type of facility is highly variable and very site-specific. The 53 MW McNeil Station, the largest wood-fired generator in the world when it came on line, was developed with great promise as an in-state generating source, a market for low-grade wood to aid Vermont forest management, insulation from volatile oil prices, and a significant employer generating other associated economic benefits [Reference 8-15]. However, since the plant opened in June 1984, McNeil's fuel price of about 3.5 cents/kWh was not competitive with the post-1986 regime of low oil prices [Reference 8-15]. Among the factors influencing costs are the environmental considerations and restrictions that are influenced by public perceptions, easy access to fuel sources, and environmental factors. In addition, the technology is expensive and inefficient. Current conditions still do not allow McNeil to operate as a base load facility as originally

envisioned, but instead gives its owners a price ceiling on the market prices they face [Reference 8-15]. Like many other large plants that came on line at the time of high oil prices, interest rates, and other capital costs, McNeil was an investment that looked better then than it does today]. Therefore, economics alone eliminate biomass technology as a reasonable alternative.

Estimates in the GEIS suggest that the overall level of construction impact per MW of installed capacity should be approximately the same as that for a coal-fired plant, although facilities using wood waste for fuel would be built at smaller scales [Reference 8-11]. Like coal-fired plants, wood-waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment. Because of uncertainties associated with obtaining sufficient wood and wood waste to fuel a base load generating facility, ecological impacts of large-scale timber cutting (e.g., soil erosion and loss of wildlife habitat), and relatively low energy conversion efficiency, Entergy has determined that wood waste is not a feasible alternative to renewing the VYNPS OL.

8.2.6 Municipal Solid Waste

The initial capital costs for this technology are much greater than the comparable steam-turbine technology found at wood-waste facilities. This is due to the need for specialized municipal solid waste-handling and waste-separation equipment and stricter environmental emissions controls. The decision to burn municipal waste to generate energy is usually driven by the need for an alternative to landfills rather than by energy considerations. High costs prevent this technology from being economically competitive. Thus, municipal solid waste generation is not a reasonable alternative. [Reference 8-13, Section 8.2.4.6]

Currently, there are approximately 89 waste-to-energy plants operating in the United States. These plants generate approximately 2,500 MWe, or an average of approximately 28 MWe per plant [Reference 8-10]. Approximately 23 typical waste-to-energy plants would be required to replace the 650 gross MWe base load capacity of VYNPS. Therefore, the generation of electricity from municipal solid waste would not be a feasible alternative to renewal of the VYNPS OL.

8.2.7 Other Biomass-Derived Fuels

In addition to wood and municipal solid waste fuels, there are several other concepts for fueling electric generators, including burning energy crops, converting crops to a liquid fuel such as ethanol (ethanol is primarily used as a gasoline additive for automotive fuel), and gasifying energy crops (including wood waste). The GEIS points out that none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a base-load plant such as VYNPS. For these reasons, such fuels do not offer a feasible alternative to VYNPS license renewal. In addition, these systems have LARGE impacts on land use. [Reference 8-13, Section 8.2.4.7]

8.2.8 Oil

Oil is not considered a stand-alone fuel because it is not cost-competitive when natural gas is available. The cost of an oil-fired operation is about eight times as expensive as a nuclear or coal-fired operation. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation. For these reasons, oil-fired generation is not a feasible alternative to VYNPS license renewal, nor is it likely to be included in a mix with other resources except as a back-up fuel. [Reference 8-13, Section 8.2.4.8]

8.2.9 Fuel Cells

Phosphoric acid fuel cells are the most mature fuel-cell technology, but they are only in the initial stages of commercialization. Two-hundred turnkey plants have been installed in the U.S., Europe, and Japan. Recent estimates suggest that a company would have to produce 100 MWe of fuel-cell stacks annually to achieve a price of $1,000 to $1,500 per kilowatt. However, the current production capacity of all fuel-cell manufacturers only totals about 60 MW per year. The use of fuel cells for base-load capacity requires very large energy-storage devices that are not feasible for storage of sufficient electricity to meet the base-load generating requirements. This is a very expensive source of generation, which prevents it from being competitive. This technology also has a high land use impact, which, like wind technology, results in a LARGE impact to the natural environment. It is estimated that 35,000 acres of land would be required to generate 1000 MWe of electricity. Therefore, fuel cells are not considered a feasible alternative to license renewal. [Reference 8-13, Section 8.2.4.10]

As market acceptance and manufacturing capacity increase, natural-gas-fueled fuel cell plants in the 50- to 100-MW range are projected to become available. At the present time, however, fuel cells are not economically or technologically competitive with other alternatives for base load electricity generation, and progress in market growth and cost reduction has been slower than alternatives anticipated [Reference 8-1]. Fuel cells are, consequently, not a feasible alternative to renewal of the VYNPS OL.

8.2.10 Delayed Retirement

Even without retiring any Entergy owned or non-Entergy owned generating units, it is expected that additional capacity will be required in the near future. Thus, even if substantial capacity were scheduled for retirement and could be delayed, some of the delayed retirement would be needed just to meet load growth.

Replace Section 8.2.10 with the following:

Even without retiring any Entergy owned or non-Entergy owned generating units, it is expected that additional capacity will be required in the near future. Thus, even if substantial capacity were scheduled for retirement and could be delayed, some of the delayed retirement would be needed just to meet load growth. JDJ 1-17-06

VYNPS would be required, in part, to offset any actual retirements that occur. Delayed retirement of other Entergy or non-Entergy generation units is unlikely to displace the need for 650 gross MWe of capacity over the twenty years of extended operation and therefore, would not be a feasible alternative to VYNPS license renewal.

8.2.11 Utility-Sponsored Conservation

The concept of conservation as a resource does not meet the primary NRC criterion "that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable." It is neither single, nor discrete, nor is it a source of generation. [Reference 8-13, Section 8.2.4.12]

Demand side management (DSM) resource strategies aimed at increasing energy efficiency on the customer side of the electric meter generally fall under the following categories.

- Energy efficiency: selecting equipment that will perform the same work with less energy input.

- Load response: customers agree to respond to utility requests to reduce use during times of utility peak demand.

- Load management: encouraging customers to reduce their loads during peak times of day and peak season through the use of time-of-use rates, seasonal rates, and interruptible contracts; or direct load control where a utility interrupts power supply to customer equipment.

Since 1990, DSM programs in Vermont have contributed more than 400,000 MWh in cumulative electricity savings and reduced Vermont's cumulative winter peak by more than 90 MW. [Reference 8-15]

Today Vermont's electric energy efficiency programs are administered by a statewide entity funded through an energy efficiency charge on all customers' bills. Efficiency Vermont, which currently serves as the state's energy efficiency utility, delivers a set of statewide energy efficiency programs to most customers in the state. Electric distribution utilities remain responsible for other demand side management, including distributed utility planning DSM, load response programs, and load management strategies. [Reference 8-15]

The term "energy conservation" is sometimes used instead of "energy efficiency" when people talk about saving energy. Energy conservation means using less energy through changes in behavior such as turning off lights, turning down thermostats, hanging clothes on the line instead of using a clothes dryer, etc. Energy conservation is not generally relied upon by utilities as a demand side management strategy, but it can be a valuable way for users of electricity to reduce their own electric energy costs and make a contribution to reducing environmental impacts. It also plays an important role in maintaining reliability when periods of unusually high peak usage threaten to overwhelm the system. [Reference 8-15]

The environmental impacts of an energy conservation program would be SMALL, but the potential to displace the entire generation at VYNPS solely with conservation is not realistic. Therefore, the conservation option by itself is not considered a reasonable replacement for the VYNPS OL renewal alternative.

8.2.12 Combination of Alternatives

NRC indicated in the GEIS that, while many methods are available for generating electricity and a huge number of combinations or mixes can be assimilated to meet system needs, such expansive consideration would be too unwieldy given the purposes of the alternatives analysis. Therefore, NRC determined that a reasonable set of alternatives should be limited to analysis of single discrete electrical generation sources and only those electric generation technologies that are technically reasonable and commercially viable [Reference 8-11, Section 8.1]. Consistent with the NRC determination, Entergy has not evaluated mixes of generating sources.

8.3 Proposed Action vs. No-Action

The proposed action is the renewal of the operating license VYNPS. The specific review of the fifteen environmental impacts, required by 10 CFR 51.53(c)(3)(ii), concluded that there would be no adverse impact to the environment from the continued operation of VYNPS through the period of extended operation.

The no-action alternative to the proposed action is the decision not to pursue renewal of the operating license for VYNPS. The environmental impacts of the no-action alternative would be the impacts associated with the construction and operation of the type of replacement power utilized. In effect, the net environmental impacts would be transferred from the continued operation of VYNPS to the environmental impacts associated with the construction and operation of a new generating facility. This new generating facility would almost certainly be constructed at a greenfield location due to the air impacts associated with constructing one of the viable technologies on the VYNPS site. Therefore, the no-action alternative would have no net environmental benefits.

The environmental impacts associated with the proposed action (the continued operation of VYNPS) were compared to the environmental impacts from the no-action alternative (the construction and operation of other reasonable sources of electric generation). Entergy believes this comparison shows that the continued operation of VYNPS would produce fewer significant environmental impacts than the no-action alternative. There are significant differences in the impacts to air quality and land use between the proposed action and the reasonable alternative generation sources.

In addition, there would be adverse socioeconomic impacts (including local unemployment, loss of local property tax revenue, and higher energy costs) to the area around VYNPS from the decision not to pursue license renewal.

The *Joint DOE-Electric Power Research Institute Strategic Research and Development Plan to Optimize U.S. Nuclear Power Plants* stated, "…nuclear energy was one of the prominent energy

technologies that could contribute to alleviate global climate change and also help in other energy challenges including reducing dependence on imported oil, diversifying the U.S. domestic electricity supply system, expanding U.S. exports of energy technologies, and reducing air and water pollution." The Department of Energy agreed with this perspective and stated, "…it is important to maintain the operation of the current fleet of nuclear power plants throughout their safe and economic lifetimes" [Reference 8-3]. The renewal of the VYNPS operating license is consistent with these goals.

8.4 Summary

The proposed action is the renewal of the VYNPS operating license. The proposed action would provide the continued availability of approximately 650 gross megawatts of base-load power generation through 2032.

CO_2 emissions are a major contributor to anthropogenic greenhouse gas emissions and climate change. These emissions results from the efficiency of the technologies utilized to produce and deliver the energy and carbon content of the fuel being utilized. Based on the U.S. DOE - Voluntary Reporting of Greenhouse Gas Emission, Fuel and Energy Emission Coefficients, below is a comparison of the CO_2 content of various fuels.

Fuel	Pounds CO_2 per Million Btu
Subbituminous coal	212.7
Bituminous coal	205.3
#6 fuel oil	173.9
Natural gas	117.1
Nuclear	0
Renewable sources	0

Below are estimates of CO2 emissions that would result if other fuel technologies were utilized to supply the 650 gross MWe of electricity that is currently being generated by VYNPS. The technologies, fuels and production efficiencies shown are based upon "greenfield plants" that have recently been permitted as having "Best Available Control Technology (BACT)" under the New Source Review (NSR) Permit program. In addition, estimates are also based on a 92% capacity factor which is what the Entergy's northeast nuclear fleet achieved overall during 2004.

Technology	Fuel	Heat Rate (Btu/KWh)	Electricity (MWH/yr)	CO_2 Emissions (metric tons/yr)
Pulverized coal	Bituminous coal	9,928	5,238,480	4,843,163

Pulverized coal	Subbituminous coal	9,700	5,238,480	4,902,500
Combined cycle gas turbine	Natural gas	6,814	5,238,480	1,895,996

The environmental impacts of the continued operation of VYNPS, providing approximately 650 gross megawatts of base-load power generation through 2032, are superior to impacts associated with the best case among reasonable alternatives. The continued operation of VYNPS would create significantly less environmental impact than the construction and operation of new base-load generation capacity.

Finally, the continued operation of VYNPS will have a significant positive economic impact on the communities surrounding the station.

8.5 References

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8-2 DOE/EIA (U. S. Department of Energy, Energy Information Administration). 2004. Annual Energy Outlook 2004 with Projections to 2025. DOE/EIS-0383, Washington, D.C.

8-3 DOE-EPRI (U. S. Department of Energy–Electric Power Research Institute). 1998. Joint DOE-EPRI Strategic Research and Development Plan to Optimize U.S. Nuclear Power Plants, Volume 1, March 20, 1998.

8-4 EEV (Energy & Environmental Ventures LLV). Wind Energy in the Northeastern U.S., Leverage Points for Growth. Available at http://www.ctcleanenergy.com/investment / Wind_Energy_Northeastern_US.pdf. Accessed on October 25, 2004.

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8-11 NRC (U. S. Nuclear Regulatory Commission). 1996. NUREG-1437, Generic Environmental Statement for License Renewal of Nuclear Power Plants, Final Report, May 1996.

8-12 NRC (U. S. Nuclear Regulatory Commission). 1999. Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Oconee Nuclear Station. NUREG-1437, Supplement 2. Office of Nuclear Reactor Regulations, Washington, DC.

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8-14 NRC (U. S. Nuclear Regulatory Commission). 2003. Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Peach Bottom Atomic Power Station, Units 2 and 3. NUREG-1437, Supplement 10. Office of Nuclear Reactor Regulation, Washington, D.C., January 2003.

8-15 VEP (Vermont Electric Plan). 2005. Vermont Electric Plan 2005, January 19, 2005, Department of Public Service, Montpelier, VT.

8-16 VGR (Vermont Geothermal Resources). 2004. Vermont Geothermal Resources, July 21, 2004. Available at http://www.eere.energy.gov/state_energy/tech_geothermal.cfm?state=VT.

9.0 STATUS OF COMPLIANCE

9.1 Requirement [10 CFR 51.45(d)]

The environmental report shall list all Federal permits, licenses, approvals and other entitlements which must be obtained in connection with the proposed action and shall describe the status of compliance with these requirements. The environmental report shall also include a discussion of the status of compliance with applicable environmental quality standards and requirements including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements which have been imposed by Federal, State, regional, and local agencies having responsibility for environmental protection.

9.2 Environmental Permits

Table 9-1 provides a list of the environmental permits held by VYNPS and the compliance status of these permits. These permits will be in place as appropriate throughout the period of extended operation given their respective renewal schedules. Other than routine renewals required at frequencies specified by the permits in Table 9-1, no state, federal, or local environmental permits have been identified as being required for re-issuance to support the extension of the VYNPS operating license.

Since VYNPS is not located in a municipality, no zoning restrictions apply. However, the site headquarters and training center for VYNPS which is located in Brattleboro is subject to zoning restrictions. The town of Brattleboro Zoning Ordinance (March 16, 2002) requires a "zoning permit" before any "land development" may be commenced or before any "land or structure may be used differently or in any way extended." Additional restrictions that VYNPS could be subjected to, depending on the activity, are as follows.

9.2.1 Water Quality (401) Certification

With respect to applicants for a federal license to conduct an activity that might result in a discharge into navigable waters, Section 401 of the Clean Water Act (CWA) establishes certain requirements for certifications from the state that the discharge will comply with certain CWA requirements (33 USC 1341). As reported in the FES (1972), the Vermont Water Resources Board provided a water quality certification on October 29, 1970, as amended on November 26, 1971, reflecting its receipt of reasonable assurance that operation of Vermont Yankee will not violate applicable water quality standards. In addition, the current and effective NPDES permit issued by the Vermont Agency of Natural Resources reflects continued compliance with applicable CWA standards. Excerpts of this permit are included in Attachment D.

9.3 Environmental Permits - Discussion of Compliance

Station personnel are primarily responsible for monitoring and ensuring that VYNPS complies with its environmental permits and applicable regulations. Sampling results are submitted to the appropriate agency. VYNPS has an excellent record of compliance with its environmental permits, including monitoring, reporting and operating within specified limits.

Sanitary wastewater and laboratory wastewater from the facility are discharged to six onsite septic systems. These onsite systems are regulated under Indirect Discharge Permit ID-9-0036-2.

Entergy has measures in place to ensure that environmentally sensitive areas are adequately protected during site operations and project planning. These measures include an environmental review and evaluation checklist and also established controls and methods for evaluating potential environmental affects from plant operations and project planning. Therefore, planned projects or changes in plant operations would be required to undergo an environmental review and evaluation prior to implementation, with appropriate permits obtained or modified as necessary.

9.4 Agency Consultations

Although not required of an applicant by federal law or NRC regulation, Entergy has chosen to invite comment from the following federal and state agencies regarding potential effects that VYNPS license renewal might have on threatened and endangered species and archaeological and historical sites.

Agency	Authority	Activity Covered
U.S. Fish and Wildlife Service	Endangered Species Act Section 7	Requires Federal agency issuing a license to consult with USFWS.
Vermont Department of Fish and Wildlife	Endangered Species Act Section 7	Requires Federal agency issuing a license to consult with FWS at the state level.
Vermont Nongame and Natural Heritage Program	Endangered Species Act Section 7	Requires Federal agency issuing a license to consult with the VNNHP.
Vermont Division of Historic Preservation	National Historic Preservation Act Section 106	Requires Federal agency issuing a license to consider cultural impacts and consult with SHPO.

Table 9-1
VYNPS Environmental Permits and Compliance Status

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
VDEC	Clean Air Act Section 112	Air Contaminant Source Registration Certificate	WM2335	Issued: July 1, 2005 Expires: June 30, 2006	Operation of air emission sources (diesel generators, boilers and oil burners).
VDEC	Federal Water Pollution Control Act Section 402	NPDES Permit	VT0000264 (VDEC #3-1199)	Issued: July 11, 2001 Expires: March 31, 2006[1]	Plant wastewater discharges to Connecticut River.
VDEC	Resource Conservation and Recovery Act – Subtitle C	Hazardous Waste Generator	VTR000504167	Not Applicable	Hazardous waste generation
VDEC	Title 10, V.S.A., Chapters §1259 and §1263	Indirect Discharge Permit	ID-9-0036-2	Issued: June 10, 2002 Expires: September 30, 2005[2]	Indirectly discharge treated domestic sewage and other wastes to the groundwater and indirectly into the Connecticut River.
VDEC	Title 10 V.S.A., §1671 & §1675(b)	Public Water System Permit to Operate (COB Water System)	20559	Issued: May 21, 2002 Expires: May 21, 2008	Withdrawal of groundwater for drinking and plant purposes.
VDEC	Title 10 V.S.A., §1671 & §1675(b)	Public Water System Permit to Operate (Main Plant Water System)	8332	Issued: May 21, 2002 Expires: May 21, 2008	Withdrawal of groundwater for drinking and plant purposes.
VDEC	Title 10 V.S.A., §1671 & §1675(b)	Public Water System Permit to Operate (NEOB Water System)	20738	Issued: May 21, 2002 Expires: May 21, 2008	Withdrawal of groundwater for drinking and plant purposes.

Table 9-1
VYNPS Environmental Permits and Compliance Status
(Continued)

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
ACE	Clean Water Act Section 404	Dredging Permit	200302129	Issued: October 15, 2002 Expires: October 15, 2007	Fill in of the Connecticut River in conjunction with the maintenance of security wires at the intake structure.
VDEC	RCRA – Subtitle I	Underground Storage Permit	806	Issued: October 1, 2004 Expires: October 1, 2009	Underground diesel and gasoline storage.
VDEC	Clean Water Act Section 405(d) and 40CFR503	Solid Waste Management Facility Certification	F9906-A1	Issued: December 3, 2004 Expires: September 30, 2009	Land application of septage
DOT	49 CFR 107, Subpart G	Hazardous Materials Certificate of Registration	063003 006 013LN	Issued: March 21, 1972 Expires: MArch 21, 2012	Radioactive and hazardous materials shipments.
NRC	Atomic Energy Act, 10 CFR 50	License to operate	DPR-28	Issued: March 21, 2012 Expires: March 21, 2032	Operation of VYNPS.
CVDEM	Title 44, Code of Virginia, Chapter 3.3, Section 44-146.30	Application for Registration to Transport Hazardous Radioactive Materials	VY-S-073104	Issued: August 10, 2004 Expires: July 31, 2006	Transportation of radioactive waste into the Commonwealth of Virginia
SCDHEC	Act No.429 of 1980, South Carolina Radioactive Waste Transportation and Disposal Act	South Carolina Radioactive Waste Transport Permit	0002-44-04-X	Issued: January 1, 2006 Expires: December 31, 2006	Transportation of radioactive waste into the State of South Carolina
TDEC	Tennessee Department of Environment and Conservation Regulations	Tennessee Radioactive Waste-License-for-Delivery	T-VT001-L06	Issued: January 1, 2006 Expires: December 31, 2006	Shipment of radioactive material into Tennessee to a disposal/processing facility

1. Renewal application submitted September 29, 2005.
2. Renewal application submitted July 6, 2005.

ACE - ACE U.S. Army Corps of Engineers

CVDEM - Commonwealth of Virginia (Department of Emergency Management)

DOT - U.S. Department of Transportation

NRC - U.S. Nuclear Regulatory Commission

SCDHEC - South Carolina Department of Health and Environmental Control

TDEC - Tennessee Department of Environment and Conservation (Division of Radiological Health)

VDEC - Vermont Department of Environmental Conservation

Attachment A

Vermont Department of Fish and Wildlife Correspondence

- Letter from Gary Tucker, FTN Associates, LTD., to Wayne Larroche, Vermont Department of Fish and Wildlife, dated September 15, 2004.
- Letter from Wayne Larroche, Vermont Department of Fish and Wildlife, to Gary Tucker, FTN Associates, LTD., dated December 7, 2005.

ftn Associates Ltd.
water resources / environmental consultants
3 Innwood Circle, Suite 220 • Little Rock, AR 72211-2492 • (501) 225-7779 • Fax (501) 225-6738

September 15, 2005

Mr. Thomas Torti, Secretary
Vermont Agency of Natural Resources
103 South Main Street, Center Building
Waterbury, VT 05671-0301

RE: Entergy Nuclear Vermont Yankee, LLC
License Renewal Application
FTN No. 6045-190

Dear Mr. Torti:

Entergy Nuclear Vermont Yankee, LLC (Entergy) is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating license for the Vermont Yankee Nuclear Power Station (VYNPS). Although VYNPS' current operating license does not expire until March 2012, the NRC's rigorous license renewal process and other regulatory reviews make it prudent for Entergy to submit its application for license renewal to the NRC in early 2006 in order to preserve Entergy's option to operate VYNPS beyond March 2012.

As part of the NRC's license renewal process, the NRC requires license applicants to "assess the impact of the proposed action." This assessment, which is contained in the licensee's Environmental Report submitted as part of the application, addresses specific environmental issues related to the continued operation of the Station during the license renewal period (typically an additional 20 years). Following Entergy's submission of its application, the NRC will request an informal consultation with your office with respect to the matters referenced in this letter. By contacting you early in the application process, we hope to not only identify any issues that need to be addressed in the licensee assessment, but also to identify any information your office may need to facilitate the NRC consultation and respond to any questions that you may have regarding this aspect of the license renewal process.

Based on Entergy's preliminary assessment, the continued operation of VYNPS during the license renewal period would not be expected to adversely affect the environment within the vicinity of the Station. Entergy currently has no plans to alter operations over the license renewal period and any maintenance activities necessary to support license renewal would be limited to previously disturbed areas on-site. Finally, no expansion of existing facilities is planned and no additional land disturbance is anticipated in support of license renewal.

To ensure that impacts are adequately addressed, we are requesting (under separate cover) information regarding any concerns from the Vermont Department of Environmental Conservation and the Vermont Department of Fish and Wildlife. If needed, please forward this request for information to other departments in the Agency of Natural Resources which may have pertinent comments. Entergy will include a copy of this letter and responses from your Agency in the Environmental Report that will be submitted to the NRC as part of the VYNPS license renewal application.

If you have questions or need additional information, please feel free to call me or Bob West at (501) 225-7779.

Kindest regards,
FTN ASSOCIATES, LTD.

Bob West FOR

Gary E. Tucker, PhD, PWS
Environmental Scientist

GET/sec

Attachments

cc: Rick Buckley; Entergy
Lynn DeWald; Entergy

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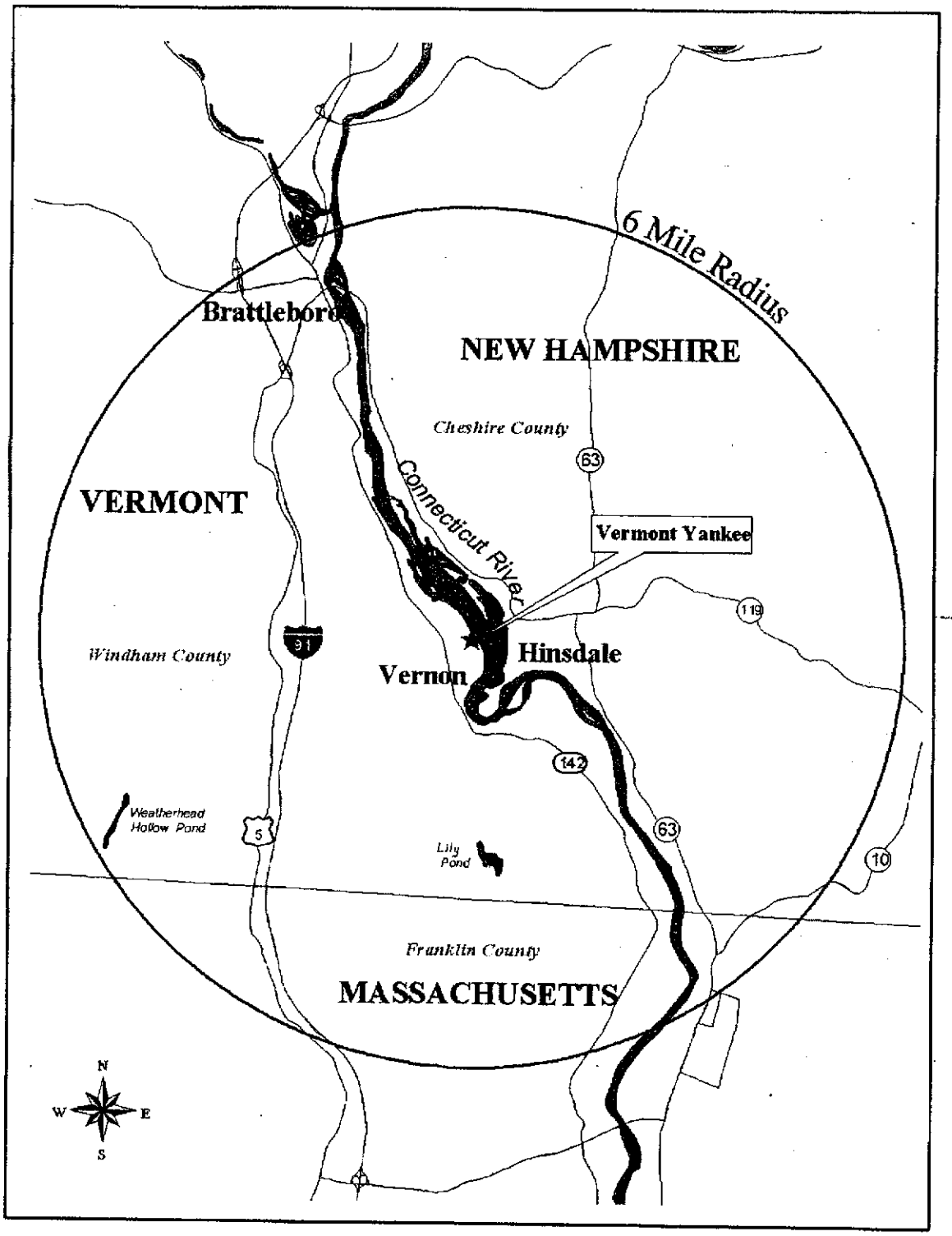

General Vicinity of VYNPS

State of Vermont

AGENCY OF NATURAL RESOURCES

Department of Fish and Wildlife
Department of Forests, Parks and Recreation
Department of Environmental Conservation

DEPARTMENT OF FISH AND WILDLIFE
103 South Main Street, 10 South
Waterbury, Vermont 05671-0501

Tel.: (802) 241-3700
TDD: 1-800-253-0191

Wayne Laroche, Commissioner
Telephone: 802-241-3730
Facsimile: 802-241-3295

December 7, 2005

Gary E. Tucker, PhD, PWS
FTN Associates, Ltd.
3 Innwood Circle, Ste 220
Little Rock, AR 72211-2492

Dear Dr. Tucker:

This letter is in response to your letter dated September 15, 2005, requesting information from this Department that would be instrumental to Entergy Nuclear Vermont Yankee, LLC (Entergy) in identifying environmental issues and informational needs to be addressed in its permit application for renewal of the current operating license beyond March 2012. Specifically, the areas of interest you identified include potential impacts to: (1) threatened or endangered flora or natural communities; (2) threatened or endangered fauna or critical wildlife habitats; and (3) game and non-game fish. Each of these areas is addressed below.

Threatened or Endangered Flora, Fauna, Natural Communities and Wildlife Habitat

We have attached a three-page document from our Biotics Database that lists the rare, threatened and endangered species and natural communities for the six mile study area. We also have a 139 page document with the "element occurrence" location data for each species and community listed above, and GIS shape files with locations of the occurrences that our Department can also provide to Entergy if they are interested. We request that the site location information for all threatened and endangered species be kept confidential by Entergy and its agents to help protect these vulnerable species.

The attached dataset does not include element occurrence records from Massachusetts or New Hampshire, with the exception of some occurrences that are located in the Connecticut River along the Vermont/New Hampshire border. The applicant would need to contact the appropriate programs in Massachusetts and New Hampshire for these records.

DEC 12 2005

Of the species listed only the dwarf wedge mussel and bald eagle are federally listed. All the other species listed are either state rare or state-listed as threatened or endangered. The dwarf wedge mussel has been documented from Brattleboro and further north in Vermont, but not Vernon. It has been included because it may occur in Vernon. We recommend that Entergy conduct an inventory to determine if dwarf wedge mussel is present because it is a species that could be affected by water quality and plant operation.

Great St. Johnswort may occur on the riverbank in the vicinity of the Vermont Yankee Nuclear Power Station (VYNPS). This is a state threatened species and it is known to occur upstream.

Other potential issues/impacts for Vermont wildlife species and habitats in the vicinity of VYNPS have not been identified to date. Our Department requests that Entergy provide a literature review on the subject of "nuclear energy and wildlife impacts" as part of the application material.

If you have any additional questions regarding rare, threatened and endangered species, wildlife habitats or natural communities please do not hesitate to contact Wildlife Information Manager, Everett Marshall at 802-241-3715.

Fish and Fishery Resources

VYNPS operations and more particularly its use of the Connecticut River for plant cooling water and impacts of the heated discharge on aquatic biota are important issues. Many of these concerns have been and continue to be addressed through the NPDES permit process. The issues pertain to entrainment of resident and migratory fishes via the water intake structure and the effects of discharging heated non-contact cooling water back to the river on aquatic biota and their habitats. A number of the issues identified below have been investigated by Entergy and the previous owners of VYNPS with results appearing in Vermont Yankee/Connecticut River System Analytical Reports, 1984-1995.

Within the project area, at least 33 species of fish have been observed (see attachment, Table 5-6). Of this number, four are migratory species and occupy the project area during certain seasons of the year. The restoration of migratory fishes to the Connecticut River has been the focus of state and federal fishery agencies, power companies, and non-governmental organizations representing the four basin states since the late 1960s. Because the VYNPS is located in a critical reach of the Connecticut River which serves as a migratory corridor for anadromous (Atlantic salmon, American shad, blueback herring, sea lamprey) and catadromous (American eel) fishes linking spawning and rearing habitats located in freshwater and marine environments. Specifically, the issues are:

1. Changes in the river thermal regime which may influence anadromous fish spawning migrations up the Connecticut River and into the project area, including river sections below and above Vernon dam.

2. Heated water discharge effects on anadromous fish passage through the fish ladder located at Vernon dam. The fishway is located on the same river bank and a short distance downstream from the VYNPS discharge point.

3. Effects on the outmigration of spent adult and juvenile anadromous fishes through the Vernon impoundment, including passage delays and residualism which may expose outmigrant salmon to increased mortality from predators and/or cause physiological changes in salmon smolts that might reduce fish survival to life in seawater.

4. The influence of increased water temperatures on shad egg production, maturation, and spawning.

5. The entrainment of anadromous fishes at the VYNPS water intake structure.

Apart from the migratory fishes, the majority of the remaining fishes make up the resident year-round fish community. The presence of the Vernon dam within the VYNPS project area influences the river by creating two different habitats and associated fish communities (lentic and lotic) above and below the dam, respectively. Potentially resident fish populations dependent on these habitats may be affected by temperature changes influenced by the release of heated cooling water to the river, including:

1. Elevating temperatures above certain thresholds necessary of optimal growth, reproduction, and survival of individual fish species.

2. Altering the composition and function of the fish community as a whole and its relation to other aquatic biota.

3. Effects on fish species (size and abundance) important to sport fisheries of the Connecticut River.

4. Loss of resident fishes due to entrainment.

Lastly, assuring that fish populations are healthy and sport fish harvested for consumption are safe from radiation contamination has been identified as an issue of state concern.

The fishery issues identified above capture those which have been the focus of attention during NPDES permitting reviews. Additional issues may become apparent as this licensing process moves forward.

If you have any additional fish questions or information needs, please do not hesitate to contact Fisheries Biologist Ken Cox at 802-885-8828.

Sincerely,

Wayne A. Laroche
Commissioner

cpm

Enclosure

cc: Ron Regan, Director of Wildlife
Eric Palmer, Director of Fisheries

Vermont Department of Fish and Wildlife
Nongame and Natural Heritage Program
Biotics Database
Rare Species and State-significant Natural Community Element Occurrences

The search for this report included element occurrences in Vermont within 6 miles of Vermont Yankee.

		G RANK	S RANK	FED STATUS	VT STATUS	LAST OBS
ADVENT CHRISTIAN CHURCH SITE						
Chimaphila maculata	Spotted Wintergreen	G5	S2			1984
BIG POND SOUTH						
Cassia nictitans	Wild Sensitive Plant	G5	S2			1982
BRATTLEBORO HIGH SCHOOL SITE						
Hypericum gentianoides	Orange-grass St. John's-wort	G5	S2S3			1982
BRATTLEBORO LUMBERYARD						
Cassia nictitans	Wild Sensitive Plant	G5	S2			1982
BRATTLEBORO RR YARD SITE						
Eragrostis capillaris	Lace Love-grass	G5	S2S3			1981
BROAD BROOK MOUTH-VERNON						
Cassia nictitans	Wild Sensitive Plant	G5	S2			1989
Hypericum ascyron	Great St. John's-wort	G4	S2		T	1969
Hypericum gentianoides	Orange-grass St. John's-wort	G5	S2S3			1982
Isoetes engelmannii	Engelmann's Quillwort	G4	S1		T	1968
BULLDOZER ESTATES SITE						
Hypericum gentianoides	Orange-grass St. John's-wort	G5	S2S3			1985
Panicum sphaerocarpon	Spherical Panic-grass	G5	S1			1985
CONNECTICUT RIVER-HINSDALE/VERNON						
Haliaeetus leucocephalus	Bald Eagle	G4	SHB,S2N	LT,PDL	E	2004
CONNECTICUT RIVER-VERNON						
Hybognathus regius	Eastern Silvery Minnow	G5	S2			1987
CONNECTICUT RIVER-WILDER DAM TO VERNON DAM						
Alasmidonta heterodon	Dwarf Wedgemussel	G1G2	S1	LE	E	2004
FIRST VERNON MEETINGHOUSE SITE						
Helianthus strumosus	Harsh Sunflower	G5	S2S3		T	1985
FORT DUMMER STATE PARK						
Asclepias exaltata	Poke Milkweed	G5	S3			1989
Aureolaria virginica	Downy False-foxglove	G5	S2?			1989
Chimaphila maculata	Spotted Wintergreen	G5	S2			2001
Cinna arundinacea	Stout Wood Reed-grass	G5	S3			1989
Cornus florida	Flowering Dogwood	G5	S1		T	1998
Lilium philadelphicum	Wood Lily	G5	S3			1989
Lindera benzoin	Spicebush	G5	S3S4			1989
Muhlenbergia tenuiflora	Slender Muhly	G5	S3			1989
FOX HILL						
Cassia nictitans	Wild Sensitive Plant	G5	S2			1984
Chimaphila maculata	Spotted Wintergreen	G5	S2			2002
Corylus americana	American Hazelnut	G5	S2			1984
Isotria verticillata	Large Whorled Pogonia	G5	S2		T	2004
Quercus coccinea	Scarlet Oak	G5	S1			2002
I-91 #1 BORROW PIT POND						
Ambystoma jeffersonianum	Jefferson Salamander	G4	S2		SC	1988
LILY POND SOUTH						
Chimaphila maculata	Spotted Wintergreen	G5	S2			1989
Lycopus virginicus	Virginia Bugleweed	G5	S2			1999
Nyssa sylvatica	Black Gum or Tupelo	G5	S2			1999

		G RANK	S RANK	FED STATUS	VT STATUS	LAST OBS
LILY POND-VERNON						
Eleocharis olivacea	Olive Spikerush	G5	S1			1989
Fimbristylis autumnalis	Autumn Fimbristylis	G5	S1		E	1985
Hypericum gentianoides	Orange-grass St. John's-wort	G5	S2S3			2001
Lycopus virginicus	Virginia Bugleweed	G5	S2			1999
Myriophyllum verticillatum	Whorled Water-milfoil	G5	S1			1991
Nyssa sylvatica	Black Gum or Tupelo	G5	S2			1999
Potamogeton bicupulatus	Snail-seed Pondweed	G4	S2			1991
Potamogeton confervoides	Tuckerman's Pondweed	G4	S2			1991
Rhexia virginica	Virginia Meadow-beauty	G5	S1		T	1986
Utricularia inflata var. minor	Inflated Bladderwort	G4	SH			2005
Viola lanceolata	Lance-leaved Violet	G5	S1		T	1983
MILLER SHRUB SWAMPS						
Ambystoma jeffersonianum	Jefferson Salamander	G4	S2		SC	2003
Nyssa sylvatica	Black Gum or Tupelo	G5	S2			1988
MILLER'S MEADOW						
Ambystoma jeffersonianum	Jefferson Salamander	G4	S2		SC	2003
NORTH VERNON						
Equisetum pratense	Meadow Horsetail	G5	S3			1981
NORTH VERNON FLOODPLAIN						
Cinna arundinacea	Stout Wood Reed-grass	G5	S3			1984
Stellaria alsine	Trailing Stitchwort	G5	S1			1984
OLD GUILFORD WELCOME CENTER						
Coluber constrictor	Eastern Racer	G5	S1		T	2003
POND ROAD FIELDS						
Panicum oligosanthes	Few-flowered Panic-grass	G5	S2			1985
RAILROAD SWAMP						
Clemmys guttata	Spotted Turtle	G5	S1		E	2002
ROARING BROOK WMA						
Chimaphila maculata	Spotted Wintergreen	G5	S2			2002
Isotria verticillata	Large Whorled Pogonia	G5	S2		T	2004
ROARING BROOK-FOX HILL						
Quercus coccinea	Scarlet Oak	G5	S1			2002
S VERNON						
Equisetum pratense	Meadow Horsetail	G5	S3			1912
SANDLOT STOP						
Panicum oligosanthes	Few-flowered Panic-grass	G5	S2			1985
Paspalum ciliatifolium	Slender Paspalum	G3G5	S2			1985
SEVERANCE POND						
Hemidactylium scutatum	Four-toed Salamander	G5	S2		SC	1958
SOUTH OF TYLER HILL						
Nyssa sylvatica	Black Gum or Tupelo	G5	S2			2000
SOUTH VERNON RAILROAD						
Crotalaria sagittalis	Rattlebox	G5	S1		T	2002
Hypericum gentianoides	Orange-grass St. John's-wort	G5	S2S3			2002
STEBBINS ISLAND BANK						
Cenchrus longispinus	Sandbur	G5	S4			1985
STEBBINS ROAD						
Bufo fowleri	Fowler's Toad	G5	S1		SC	2003
TYLER HILL GRAVEL PIT						
Dichanthelium xanthophysum	Yellow Panic-grass	G5	S3			1987
VERMONT YANKEE FLATS						
Juncus acuminatus	Tapering Rush	G5	S1			1968
VERNON						
Panicum virgatum	Switch Grass	G5	S3			1982

		G RANK	S RANK	FED STATUS	VT STATUS	LAST OBS
VERNON BLACK GUM SWAMP						
Ilex laevigata	Smooth Holly	G5	SNA			1999
Nyssa sylvatica	Black Gum or Tupelo	G5	S2			2001
Sisyrinchium angustifolium	Narrow Blue-eyed Grass	G5	S2			1990
Thelypteris simulata	Massachusetts Fern	G4G5	S1			2000
Woodwardia virginica	Virginia Chain-fern	G5	S1		T	1990
VERNON DAM SITE						
Elatine minima	Small Water-wort	G5	S1			1982
Eleocharis intermedia	Matted Spikerush	G5	S2S3			1984
Equisetum pratense	Meadow Horsetail	G5	S3			1990
Eragrostis frankii	Frank's Love-grass	G5	S2S3			1982
Hypericum ascyron	Great St. John's-wort	G4	S2		T	1987
Mimulus moschatus	Musk Flower	G5	S2S3			1987
Polygonatum biflorum var. commutatum	Giant Solomon's Seal	G5T5	S1			2001
Rhododendron nudiflorum	Pinxter-flower	G5	SH			1965
Scirpus purshianus	Pursh's Bulrush	G4G5	S2S3			1991
Tillaea aquatica	Pygmyweed	G5	S2			1982
Zannichellia palustris	Horned Pondweed	G5	S1			1982
VERNON FIRE DEPARTMENT SITE						
Aureolaria pedicularia	Feverweed	G5	S1			1982
Bartonia virginica	Yellow Bartonia	G5	S2			1984
Carex brevior	Sedge	G5?	S2S3			1996
Cassia nictitans	Wild Sensitive Plant	G5	S2			1996
Hypericum gentianoides	Orange-grass St. John's-wort	G5	S2S3			1996
Lespedeza hirta	Hairy Bush-clover	G5	S1		T	1982
Panicum oligosanthes	Few-flowered Panic-grass	G5	S2			1996
Paspalum ciliatifolium	Slender Paspalum	G3G5	S2			1996
Polygala polygama	Racemed Milkwort	G5	S2			1985
Polygala verticillata	Whorled Milkwort	G5	S2			1996
Solidago odora	Sweet Goldenrod	G5	S1		T	1983
VERNON HALL						
Lechea mucronata	Hairy Pinweed	G5	S1		E	1902
Panicum oligosanthes	Few-flowered Panic-grass	G5	S2			1984
VERNON HATCHERY POND						
Chimaphila maculata	Spotted Wintergreen	G5	S2			2004
Nyssa sylvatica	Black Gum or Tupelo	G5	S2			2004
VERNON POWERLINE SITE						
Cassia nictitans	Wild Sensitive Plant	G5	S2			1996
Crotalaria sagittalis	Rattlebox	G5	S1		T	1996
Helianthemum bicknellii	Plains Frostweed	G5	S2S3		T	1996
Helianthemum canadense	Canada Frostweed	G5	S2S3			1984
Nyssa sylvatica	Black Gum or Tupelo	G5	S2			1984
Panicum oligosanthes	Few-flowered Panic-grass	G5	S2			1996
VERNON RECREATION PARK EAST						
Nyssa sylvatica	Black Gum or Tupelo	G5	S2			1999
Quercus coccinea	Scarlet Oak	G5	S1			1999
WEATHERHEAD HOLLOW MARSH						
Scirpus purshianus	Pursh's Bulrush	G4G5	S2S3			1995

Attachment B

U.S. Fish and Wildlife Service Correspondence

- Letter from Gary Tucker, FTN Associates, LTD., to Marvin Moriarty, U.S. Fish and Wildlife Service, dated September 15, 2004.
- Letter from Michael J. Amaral, U.S. Fish and Wildlife Service, to Gary Tucker, FTN Associates, LTD., dated December 16, 2005.

ftn Associates Ltd.
water resources / environmental consultants
3 Innwood Circle, Suite 220 • Little Rock, AR 72211-2492 • (501) 225-7779 • Fax (501) 225-8738

September 15, 2005

Mr. Marvin Moriarty, Director
US Fish and Wildlife Service
Northeast Region
300 Westgate Center Drive
Hadley, MA 01035

RE: Entergy Nuclear Vermont Yankee, LLC
License Renewal Application
FTN No. 6045-190

Dear Mr. Moriarty:

Entergy Nuclear Vermont Yankee, LLC (Entergy) is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating license for the Vermont Yankee Nuclear Power Station (VYNPS). Although VYNPS' current operating license does not expire until March 2012, the NRC's rigorous license renewal process and other regulatory reviews make it prudent for Entergy to submit its application for license renewal to the NRC in early 2006 in order to preserve Entergy's option to operate VYNPS beyond March 2012.

As part of the NRC's license renewal process, the NRC requires license applicants to "assess the impact of the proposed action." This assessment, which is contained in the licensee's Environmental Report submitted as part of the application, addresses specific environmental issues related to the continued operation of the Station during the license renewal period (typically an additional 20 years). Following Entergy's submission of its application, the NRC will request an informal consultation with your office with respect to the matters referenced in this letter. By contacting you early in the application process, we hope to not only identify any issues that need to be addressed in the licensee assessment, but also to identify any information your office may need to facilitate the NRC consultation and respond to any questions that you may have regarding this aspect of the license renewal process.

Based on Entergy's preliminary assessment, the continued operation of VYNPS during the license renewal period would not be expected to adversely affect the environment within the vicinity of the Station. Entergy currently has no plans to alter operations over the license renewal period and any maintenance activities necessary to support license renewal would be limited to previously disturbed areas on-site. Finally, no expansion of existing facilities is planned and no additional land disturbance is anticipated in support of license renewal.

To ensure that impacts are adequately addressed, we are requesting from your office pertinent information regarding concerns, if any, that you may have regarding potential impacts to threatened or endangered species, or other species of interest, in the vicinity of the Station (see attached map) during the license renewal period. After your review, we would appreciate your office sending a letter detailing any concerns you may have or confirmation that no concerns exist. Entergy will include a copy of this letter, and your response to this letter, in the Environmental Report that will be submitted to the NRC as part of the VYNPS license renewal application.

If you have questions or need additional information, please feel free to call me or Bob West at (501) 225-7779.

Kindest regards,
FTN ASSOCIATES, LTD.

Gary E. Tucker, PhD, PWS
Environmental Scientist

GET/sec

Attachments

cc: Rick Buckley; Entergy
Lynn DeWald; Entergy
Janice N. Rowan, Coordinator; USFWS

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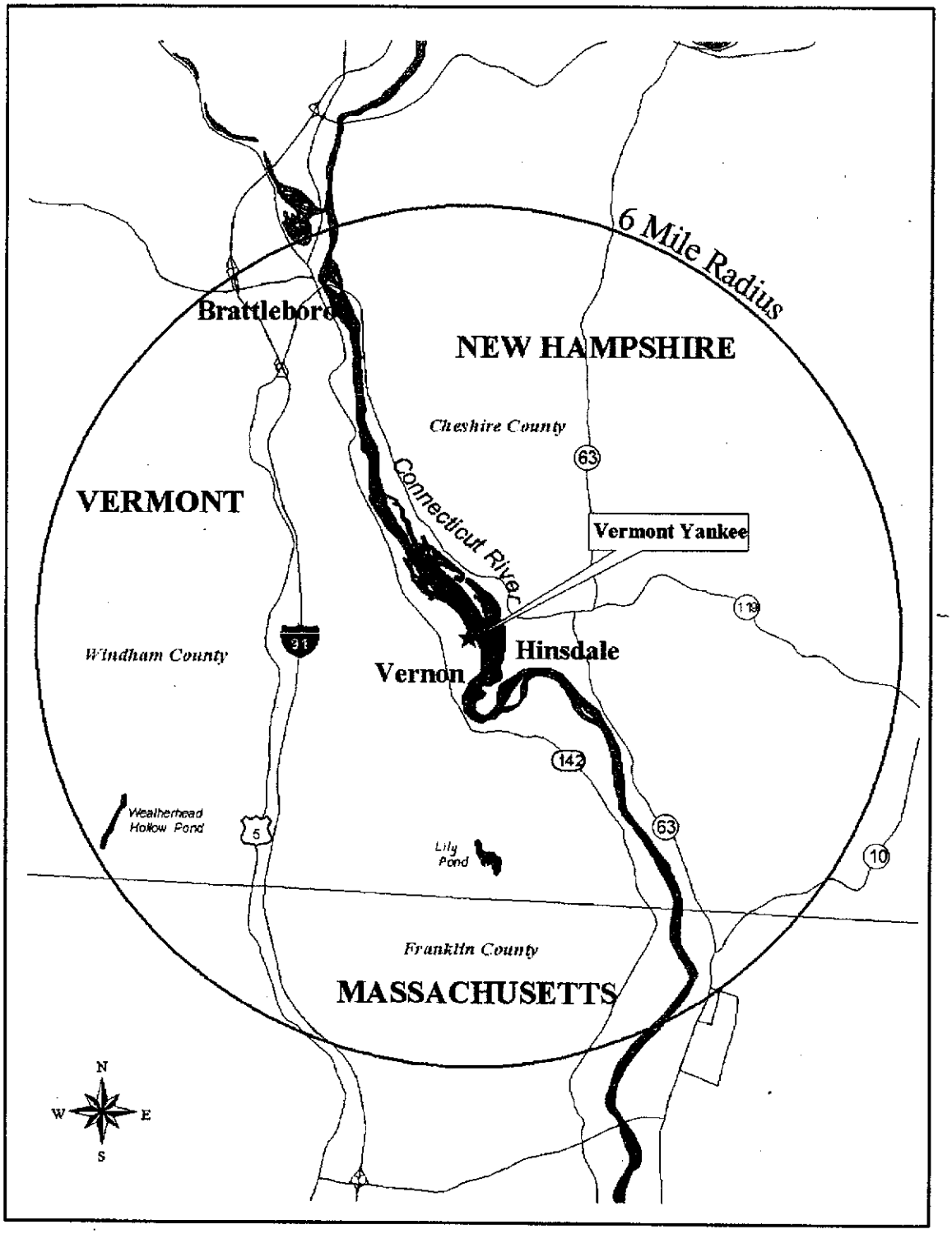

General Vicinity of VYNPS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087

December 16, 2005

Gary E. Tucker, PhD, PWS
FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Dear Dr. Tucker:

This responds to your recent correspondence requesting information on the presence of federally-listed and/or proposed endangered or threatened species in relation to the Vermont Yankee Nuclear Power Station.

Bald eagles (*Haliaeetus leucocephalus*) are known to nest less than 1 mile downstream of the plant. No other federally-listed or proposed, threatened or endangered species or critical habitat under the jurisdiction of the U.S. Fish and Wildlife Service are known to occur in the project area. Preparation of a Biological Assessment or further consultation with us under Section 7 of the Endangered Species Act is not required.

Based upon our knowledge, no impacts to the eagles are known to occur at this site that could be attributed to the power station. This concludes our review of listed species and critical habitat in the project location and environs referenced above. No further Endangered Species Act coordination of this type is necessary for a period of one year from the date of this letter, unless additional information on listed or proposed species becomes available.

Thank you for your coordination. Please contact Anthony Tur at 603-223-2541 if we can be of further assistance.

Sincerely yours,

Michael J. Amaral

Michael J. Amaral
Endangered Species Specialist
New England Field Office

RECEIVED
DEC 19 2005
BY:

Attachment C

Vermont Division for Historic Preservation (SHPO) Correspondence

- Letter from Gary Tucker, FTN Associates, LTD., to Jane Lendway, Vermont Division for Historic Preservation, dated September 15, 2004.
- Letter from Jane Lendway, Vermont Division for Historic Preservation, to Gary Tucker, FTN Associates, LTD., dated October 17, 2005.

ftn Associates Ltd.
water resources / environmental consultants

September 15, 2005

Ms. Jane Lendway
State Historic Preservation Officer
Division of Historic Preservation
National Life Building
Drawer 20
Montpelier, VT 05620-0501

RE: Entergy Nuclear Vermont Yankee, LLC
License Renewal Application
FTN No. 6045-190

Dear Ms. Lendway

Entergy Nuclear Vermont Yankee, LLC (Entergy) is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating license for the Vermont Yankee Nuclear Power Station (VYNPS). Although VYNPS' current operating license does not expire until March 2012, the NRC's rigorous license renewal process and other regulatory reviews make it prudent for Entergy to submit its application for license renewal to the NRC in early 2006 in order to preserve Entergy's option to operate VYNPS beyond March 2012.

As part of the NRC's license renewal process, the NRC requires license applicants to "assess the impact of the proposed action." This assessment, which is contained in the licensee's Environmental Report submitted as part of the application, addresses specific environmental issues related to the continued operation of the Station during the license renewal period (typically an additional 20 years). Following Entergy's submission of its application, the NRC will request an informal consultation with your office with respect to the matters referenced in this letter. By contacting you early in the application process, we hope to not only identify any issues that need to be addressed in the licensee assessment, but also to identify any information your office may need to facilitate the NRC consultation and respond to any questions that you may have regarding this aspect of the license renewal process.

Based on Entergy's preliminary assessment, the continued operation of VYNPS during the license renewal period would not be expected to adversely affect the environment within the vicinity of the Station. Entergy currently has no plans to alter operations over the license renewal period and any maintenance activities necessary to support license renewal would be limited to previously disturbed

areas on-site. Finally, no expansion of existing facilities is planned and no additional land disturbance is anticipated in support of license renewal.

To ensure that impacts are adequately addressed, we are requesting from your office pertinent information regarding concerns, if any, that you may have regarding potential impacts to archeological or historic resources in the vicinity of the Station (see attached map) during the license renewal period. After your review, we would appreciate your office sending a letter detailing any concerns you may have or confirmation that no concerns exist. Entergy will include a copy of this letter, and your response to this letter, in the Environmental Report that will be submitted to the NRC as part of the VYNPS license renewal application.

If you have questions or need additional information, please feel free to call me or Bob West at (501) 225-7779.

Kindest regards,
FTN ASSOCIATES, LTD.

Gary E. Tucker, PhD, PWS
Environmental Scientist

GET/sld

Attachments

cc: Mr. Rick Buckley; Entergy
Ms. Lynn DeWald; Entergy
Mr. John S. Hall; VT Department of Housing and Community Affairs

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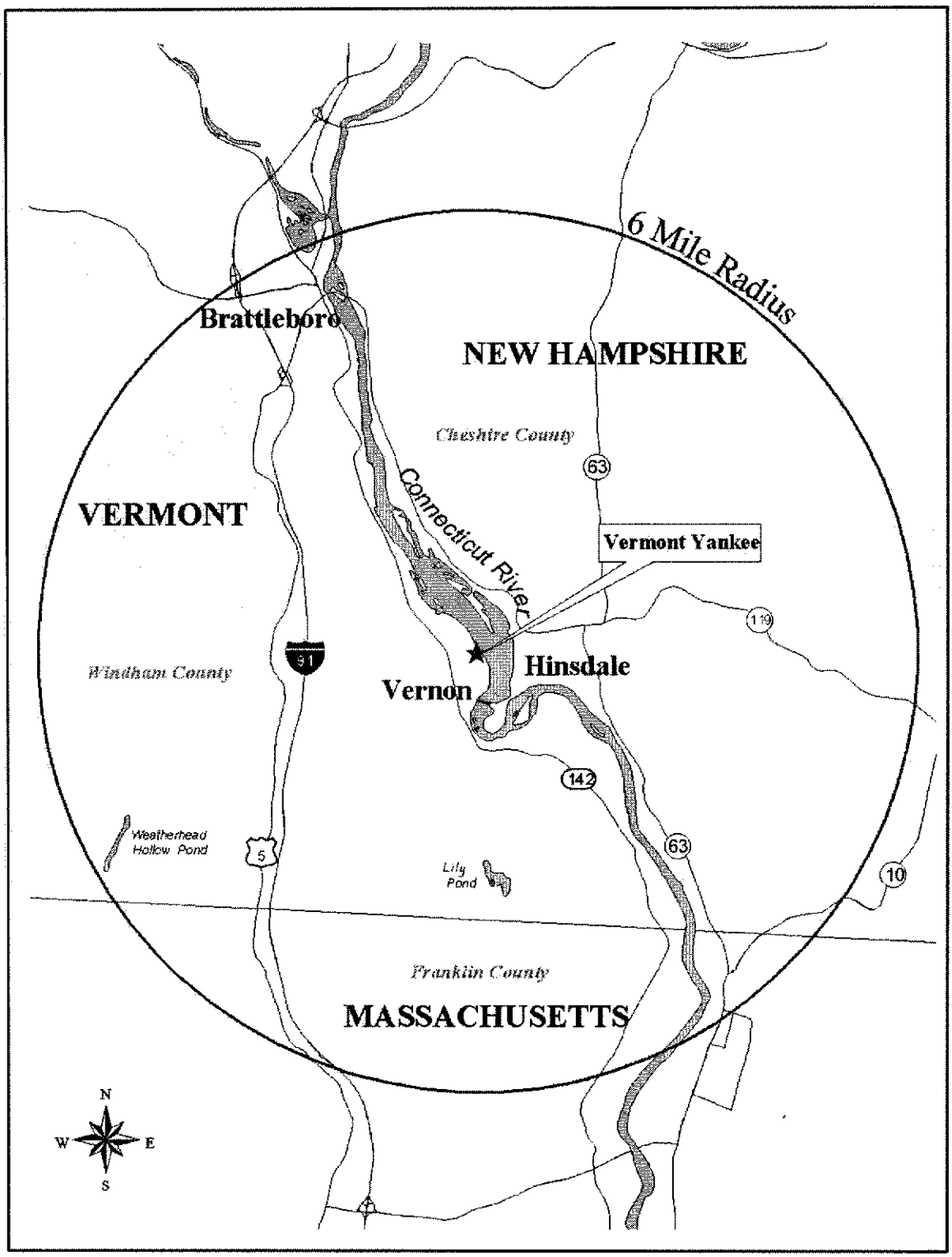

General Vicinity of VYNPS

VERMONT

State of Vermont
Department of Housing and Community Affairs
National Life Building, Drawer 20
Montpelier, VT 05620-0501
www.dhca.state.vt.us

[phone] 802-828-3211
[Department fax] 802-828-2928
[Historic Preservation fax] 802-828-3206

Agency of Commerce & Community Development

October 17, 2005

Gary E. Tucker, PhD, PWS
Environmental Scientist
FTN Associates
3 Innwood Circle
Little Rock, AR 72211

Re: Proposed License Renewal Application, Entergy Nuclear Vermont Yankee, LLC, Vernon, Vermont.
NRC.

Dear Mr. Tucker:

Thank you for your correspondence dated September 15, 2005 and received September 22, 2005 concerning the above project having United States Nuclear Regulatory Commission (NRC) involvement (DHP #WD03-001).

The Division for Historic Preservation is reviewing this proposed undertaking pursuant to 36 CFR 800.4, regulations established by the Advisory Council on Historic Preservation to implement Section 106 of the National Historic Preservation Act. Project review consists of identifying the project's potential impacts to historic buildings and structures, historic districts, historic landscapes and settings, and to known or potential archeological resources.

According to your letter, ftn Associates is seeking the Division's preliminary comments regarding Entergy Nuclear Vermont Yankee, LLC's proposed license renewal application to the NRC. We understand that Entergy "currently has no plans to alter operations over the license renewal period and any maintenance activities necessary to support license renewal would be limited to previously disturbed areas on-site. Finally, no expansion of existing facilities is planned and no additional land disturbance is anticipated in support of license renewal." Based on the information presented, it appears that no historic or archeological resources will be affected by the license renewal. However, if project plans change in the future the Division will be fully apprised and given an opportunity to comment on the proposed changes to the NRC application per Section 106 of the National Historic Preservation Act.

If you have any questions or need clarification regarding any of the above, please do not hesitate to contact Judith Williams Ehrlich, Environmental Review Coordinator, at (802) 828-3049.

Sincerely,
VERMONT DIVISION FOR HISTORIC PRESERVATION

Jane Lendway
State Historic Preservation Officer

Cc: Julie Kelliher, Agency of Commerce and Community Development

Attachment D

VYNPS NPDES Permit Number VT0000264

(VDEC Permit No. 3-1199)

State of Vermont

AGENCY OF NATURAL RESOURCES
Department of Environmental Conservation

Wastewater Management Division
103 South Main Street - Sewing Bldg.
Waterbury, Vermont 05671-0405

Telephone: (802) 241-3822
Fax: (802) 241-2596
www.anr.state.vt.us/dec/ww/wwmd.cfm

Department of Fish and Wildlife
Department of Forests, Parks and Recreation
Department of Environmental Conservation
State Geologist
RELAY SERVICE FOR THE HEARING IMPAIRED
1-800-253-0191 TDD>Voice
1-800-253-0195 Voice>TDD

June 9, 2003

cc. E. Zoli - Goodwin Procter LLP

Lynn DeWald
Entergy Nuclear Vermont Yankee
320 Governor Hunt Road
Vernon, VT 05354

Re: Final Amended Discharge Permit #3-1199

Dear Ms DeWald :

Enclosed is your copy of the above referenced permit, which has been signed by the Director of the Wastewater Management Division for the Commissioner of the Department of Environmental Conservation. Please read the permit carefully and familiarize yourself with all its terms and conditions. Your attention is particularly directed to those conditions which may require written responses by certain dates.

One comment relative to this permit was received during the public notice period. The commenter asked that the toxicity of the replacement chemical be considered. As discussed in the fact sheet accompanying the draft permit, prior to noticing the proposed permit the chemical was evaluated by the Department for toxicity to aquatic biota in the Connecticut River and was approved for usage at the level indicated in the permit.

If you have any questions concerning your permit, please contact Carol Carpenter at 241-3828.

Sincerely,

Brian D. Kooiker
Chief, Discharge Permits Section

Enclosure
cc: EAC members

Permit No. 3-1199
File No. 13-17
NPDES No. VT0000264
Project ID No. NS75-0006

AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
WASTEWATER MANAGEMENT DIVISION
103 SOUTH MAIN STREET
WATERBURY, VERMONT 05671-0405

AMENDED DISCHARGE PERMIT

In compliance with the provisions of the Vermont Water Pollution Control Act, as amended, (10 V.S.A. Chap. 47 1251 et. seq;) and the Federal Clean Water Act, as amended (33 U.S.C. §1251 et seq),

Entergy Nuclear Vermont Yankee, LLC
185 Old Ferry Road
Brattleboro, VT 05302

(hereinafter referred to as the "permittee") is authorized, by the Secretary, Agency of Natural Resources, to discharge from a facility located at:

320 Governor Hunt Road
Vernon, Vermont

to the Connecticut River, Class B at the point of discharge

in accordance with effluent limitations, monitoring requirements, and other conditions set forth in Parts I, II, III hereof.

This permit shall become effective on the date of signing

This permit and the authorization to discharge shall expire on March 31, 2006.

Signed this 9th day of June, 2003.

Jeffrey Wennberg, Commissioner
Department of Environmental Conservation

By Brian D. Kooiker
Brian D Kooiker, Chief
Direct Discharge Section

Part I

A. EFFLUENT LIMITATIONS, MONITORING REQUIREMENTS, AND SPECIAL CONDITIONS

1. Through March 31, 2006, the permittee is authorized to discharge from outlet serial number S/N 001: Circulating water discharge - main condenser cooling water and service water. Such discharges shall be limited by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	lbs/day		Other units			
	Monthly Avg.	Daily Max.	Monthly Avg.	Daily Max.	Measurement Frequency	Sample Type
Flow: Open/Hybrid-Cycle				543 MGD	Daily	Calculated Flow
Closed Cycle				12.1 MGD	Daily	Calculated Flow
Temperature	see Part I.6.a-e, pp.4-5					
Free Residual Chlorine	(b)		0.2 mg/l		(c)	Grab
Total Residual Oxidant	(a)(b)		Monitor Only		(c)	Grab
pH		6.5 to 8.5 Standard Units			1 x daily	Grab (d)

The effluent shall not have concentrations or combinations of contaminants including oil, grease, scum, foam, or floating solids which would cause a violation of the water quality standards of the receiving water.

Samples taken in compliance with the monitoring requirements specified above shall be collected at locations which are representative of the effluents discharged.

(a) Where "Total Oxidant" is chlorine, chlorine plus bromine, or bromine.

(b) Oxidant or chlorine injection is limited to discharge during closed cycle only and detectable residuals are not to exceed 2 hours/day with the exception that the service water system may be treated during open/hybrid cycle provided that treatment does not exceed 2 hours/day with no detectable oxidant being measured at the discharge structure.

(c) Monitoring is required during the period that oxidant, or chlorine, treatment is occurring. The duration of the treatment shall be reported for each treatment day in the monthly discharge monitoring report.

(d) A daily grab represents the minimum monitoring frequency. Continuous pH monitoring is acceptable and if utilized will require reporting daily minimum and maximum values on the monthly monitoring report.

2. Through March 31, 2006, the permittee is authorized to discharge from outfall serial number S/N 002: Radioactive liquid. Such discharges shall be limited by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS		MONITORING REQUIREMENTS	
	Monthly Avg.	Daily Max.	Measurement Frequency	Sample Type
Flow		0.01 MGD	(a)	Estimate
Radioactivity	see Part 1.10.a-f., pp.6-7		(a)	see Part 1.10.a-f.
pH	6.5 to 8.5 Standard Units		(a)	Grab

The effluent shall not have concentrations or combinations of contaminants including oil, grease, scum, foam, or floating solids which would cause a violation of the water quality standards of the receiving water.

Samples taken in compliance with the monitoring requirements specified above shall be collected at locations that are representative of the radioactive effluent discharge.

(a) Shall be monitored daily when the discharge occurs. When it is determined that a discharge of radioactive liquid wastewater is necessary, the permittee shall notify the Wastewater Management Division prior to the discharge or, if necessary, within 24 hours following the discharge.

3. Through March 31, 2006, the permittee is authorized to discharge from outfall serial number S/N 003: Plant Heating Boiler Blowdown. Such discharges shall be limited by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS		MONITORING REQUIREMENTS	
	Monthly Avg.	Daily Max.	Measurement Frequency	Sample Type
Flow		0.001 MGD (a)	Each discharge	Estimate
BetzDearborn Cortrol OS7700	(b)		No Monitoring Required	

The effluent shall not have concentrations or combinations of contaminants including oil, grease, scum, foam, or floating solids which would cause a violation of the water quality standards of the receiving water.

Samples taken in compliance with the monitoring requirements specified above shall be collected before combining with other waste streams.

(a) Each of the two boilers may be drained of 0.002 MGD at the end of the heating season.
(b) See Part I.15.

4. Through March 31, 2006, the permittee is authorized to discharge from outfall serial number S/N 004: Water treatment carbon filter backwash. Such discharges shall be limited by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS		MONITORING REQUIREMENTS	
	Monthly Avg.	Daily Max.	Measurement Frequency	Sample Type
Flow		0.010 MGD	(a)	Estimate
Total Suspended Solids		8.3 lbs.	No Monitoring Required	

The effluent shall not have concentrations or combinations of contaminants including oil, grease, scum, foam, or floating solids which would cause a violation of the water quality standards of the receiving water.

(a) Shall be monitored daily when the discharge occurs.

5. Through March 31, 2006, the permittee is authorized to discharge from outfall serial number S/N 005: Cooling water discharge from the four RHR-Service Water pumps.

The permittee may discharge up to 14,000 gpd. No effluent limits or monitoring is required for this waste stream.

6. The permittee is required to operate its circulating water cooling facilities whether closed, open, or in a hybrid mode as follows:

a. During the period **October 15 through May 15**:

(1). The temperature at Station 3 shall not exceed 65°F.

(2). The rate of change of temperature at Station 3 shall not exceed 5°F per hour. The rate of change of temperature shall mean the difference between consecutive hourly average temperatures.

(3). The increase in temperature above ambient at Station 3 shall not exceed 13.4°F. The increase in temperature above ambient shall mean plant induced temperature increase as shown by equation 1.1 (defined on page 1-8 of Vermont Yankee's 316 Demonstration: Engineering, Hydrological and Biological Information and Environmental Impact Assessment (March 1978).

b. During the period **May 16 through October 14**, the increase in temperature above ambient at Station 3 shall not exceed the limits set forth in the following table:

Station 7 Temperature	Increase in Temperature Above Ambient at Station 3
Above 63°F	2°F
>59°F, ≤63°F	3°F
≥55°F, ≤59°F	4°F
Below 55°F	5°F

The increase in temperature above ambient shall mean plant induced temperature

increase as shown by equation 1.1 (defined on page 1-8 of Vermont Yankee's 316 Demonstration: Engineering, Hydrological and Biological Information and Environmental Impact Assessment (March 1978).

c. Experimental open/hybrid cycle test programs with alternative thermal limits (to 6a. and 6b. above) may be administered as approved by the Vermont Yankee Environmental Advisory Committee (defined in Part I.12) and which receive written authorization from the Secretary of the Agency of Natural Resources.

d. During power operation, if an unexpected failure results in a complete loss of the cooling tower system, the above restrictions may be modified for a period not to exceed 24 hours to allow an orderly shutdown by utilizing the main condenser as a heat sink and operating in an open-cycle mode. The cooling tower system includes all auxiliary components required for cooling tower operation.

e. Notwithstanding the above, the Secretary may reopen and modify the permit to incorporate more stringent effluent limitations for control of the thermal component of Entergy Nuclear Vermont Yankee's discharge, including the requirements of closed-cycle operation, if the Secretary determines that open-cycle operation is having an adverse effect in resident or anadromous fish species in the river. Entergy Nuclear Vermont Yankee will be given notice and opportunity for a hearing prior to the imposition of such more stringent effluent limitations.

7. Through March 31, 2006, the permittee is authorized to discharge from outfall serial numbers S/N 006, 007, 008, 010, 011: Stormwater runoff; and demineralized trailer rinse down water (S/N 006 only).

006 - North Storm System Discharge Point: to the north of the intake structure.
007 - South Storm System Discharge Point: to the forebay of the discharge structure; includes discharges from S/N 003, S/N 004 and S/N 005.
008 - Southeast Storm System Discharge Point: to the southeast of the east cooling tower.
010 - 345 kV Switchyard Storm System Discharge Point: about 300 yards north of the intake structure.
011 - 115kV Switchyard Storm System Discharge Point: about 350 yards north of the intake structure.

Effluent limits and monitoring are not required for the stormwater discharges; however, future storm drain and manhole construction shall conform to the Agency's policy for stormwater treatment.

The permittee is authorized to discharge demineralized trailer rinse down water to the stormdrain system (S/N 006). The permittee may discharge up to 10,000 gpd. No effluent limits or monitoring is required for this waste stream.

8. Through March 31, 2006, the permittee is authorized to discharge from outfall serial number S/N 009: Strainer and traveling screen backwash.

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS Monthly Avg.	Daily Max.	MONITORING REQUIREMENTS Measurement Frequency	Sample Type
Flow		0.050 MGD	(a)	Estimate
Bulab 8006	(b)		No Monitoring Required	

The effluent shall not have concentrations or combinations of contaminants including oil, grease, scum, foam, or floating solids which would cause a violation of the water quality standards of the receiving water.

Samples taken in compliance with the monitoring requirements specified above shall be collected before combining with other waste streams.

(a) Shall be monitored daily when the discharge occurs.
(b) See Part I.15.

9. The permittee will conduct an environmental monitoring program to measure and record physical, chemical, and biological data to assure compliance with the requirements of this permit in accord with Part IV of this permit: Environmental Monitoring Studies, Connecticut River. The permittee shall submit an annual report by **May 31** of each year to the Secretary of the Agency of Natural Resources and the Environmental Advisory Committee.

10. All radioactive liquid waste collected in the plant will be processed through a treatment system, including filtering and/or demineralization, and the liquid will be processed and disposed of in accordance with the Nuclear Regulatory Commission Regulations. Low level radioactive wastes may be released to the Connecticut River after treatment pursuant to Final Safety Analysis Report, Volume 111, Section 9.2; Station Radioactive Liquid Waste System, Vermont Yankee Nuclear Power Station, as amended, subject to the following restrictions:

a. The maximum instantaneous concentration of radionuclides in liquid effluents released to the unrestricted environment shall not exceed the limits specified in 10 CFR Part 20.1001 - 20.2401, Appendix B, Table 2, including applicable notes thereto.

b. The maximum annual quantity of radionuclides, except tritium, in liquid effluents released to the unrestricted environment shall not exceed five (5) curies.

c. The maximum annual quantity of tritium in liquid effluents released to the unrestricted environment shall not exceed five (5) curies.

d. The dose or dose commitment to a member of the public from radionuclides in liquid effluents released to the unrestricted environment shall be limited to the following:

i. During any calendar quarter: less than or equal to 1.5 millirems to the total body, and less than or equal to 5 millirems to any organ.

ii. During any calendar year: less than or equal to 3 millirems to the total body, and less than or equal to 10 millirems to any organ.

e. The permittee shall report to the Agency of Natural Resources any abnormal releases of radioactivity in liquid effluents in a manner and timeframe consistent with Nuclear Regulatory Commission requirements.

f. The permittee shall monitor and report concentrations, quantities, and calculated doses of gamma radionuclides and tritium in liquid effluents released to the Connecticut River and report such data to the Agency of Natural Resources. Other radionuclides shall be reported to the Agency of Natural Resources in a manner consistent with the reports submitted to the Nuclear Regulatory Commission.

11. An Environmental Advisory Committee (EAC) is comprised of one individual each representing (1) Vermont Department of Environmental Conservation; (2) Vermont Department of Fish and Wildlife; (3) New Hampshire Fish and Game Department; (4) New Hampshire Department of Environmental Services; (5) Massachusetts Office of Watershed Management; (6) Massachusetts Division of Fisheries and Wildlife; and, (7) Coordinator of the Connecticut River Anadromous Fish Program, U.S. Fish and Wildlife Service. The EAC shall be advisory in function and Entergy Nuclear Vermont Yankee, LLC shall meet with the EAC as often as necessary, but at least annually, to review and evaluate the aquatic environmental monitoring and studies program. The Entergy Nuclear Vermont Yankee, LLC Chemistry Manager or designee will serve as the administrative coordinator and Secretary for the EAC.

12. The temperature probe in the Vernon fishway shall be compatible with the temperature monitoring system utilized at Stations 3 and 7 in the Connecticut River.

13. Racks and screens preventing fish and other wildlife from entering the condenser water intake must be operated and maintained in a manner as previously approved by the Vermont Water Resources Board. Solids collected on the traveling screen shall not be returned to the Connecticut River.

14. The permittee is authorized to pump river silt, as necessary, that deposits in the intake structure and cooling tower basins, in the form of a silt-water slurry to be deposited on land on the plant site in the sedimentation area. Slurry volumes to be pumped shall not exceed 0.500 MGD or 350 gpm. River sediment/silt will be pumped from the West Cooling Tower into the existing spray pond where it will be passively filtered to reduce turbidity before the water portion is routed to the discharge structure. The remaining sediment will be removed form the spray pond and disposed of properly in accordance with state and federal statutes and regulations.

15. The permittee is authorized to use either the following chemicals, or chemicals which are similar in composition, concentration, and toxicity, to the maximum concentrations indicated below. An increase in dosage rate or a substantial change in the chemicals identified must be reviewed and approved by the Department to assure that no adverse impact will occur. A substantial change in chemicals shall be defined as chemicals that are not similar in composition, concentration, and toxicity to those identified. A change of chemical vendors will require, as a minimum, a submittal of the appropriate MSDS, prior to use of the chemical, to the Wastewater Management Division of the Department.

Bulab 8006: penetrant/biodispersant for use in minimizing and removing fouling within the Service Water System; maximum concentration 20 ppm.

Bulab 7034 or Depositrol BL5303: general corrosion inhibitors for use in service water or circulating water; maximum concentration 30 ppm.

Bulab 9027 or Inhibitor AZ8103: copper corrosion inhibitors for use in the circulating water for condenser corrosion control. Maximum concentration for Bulab 9027 is 10 ppm. Maximum concentration for Inhibitor AZ8103 is 50 ppm (used monthly for a 10 minute period).

Dianodic DN2301: a dispersant for use in the circulating and service water systems; maximum concentration 20 ppm.

Ondeo Nalco H-550 or Spectrus NX-1104: a biocide for use in service waters as an alternative or in addition to bromine/chlorine. The use of these chemicals must be controlled such that the discharge concentration to the Connecticut River of either chemical is maintained at less than 2.0 ppm.

Cortrol OS7700: an oxygen scavenger and pH control agent containing hydroquinone as the oxygen scavenger. Use concentration varies from approximately 100 ppm to 2,000 ppm. Boiler discharges are limited to 15 ppm as hydroquinone.

Ferroquest FQ7101: a chemical for use in the service water system to correct biological/corrosion fouling with the service water pumps. The maximum concentration is 96 ppm for one minute approximately eight times per year.

Ferroquest FQ7102: a pH control agent. Less than two gallons are used to maintain a neutral pH when using FQ 7101. The maximum concentration is 7 ppm for one minute approximately eight times per year.

Oxidizing biocides (chlorine or chlorine with bromine) for treatment of the Service Water System (SWS)

a. Open/hybrid cycle, treatment of the SWS shall not exceed 2 hours per day with no detectable free residual oxidant being measured at the discharge structure (S/N 001).

b. Closed cycle, free residual oxidant as measured at the discharge structure (S/N 001) is limited to 0.2 mg/l and detectable residual oxidant shall not exceed 2 hours per day.

16. There shall be no discharge of polychlorinated biphenyl compounds, such as those commonly used for transformer fluids.

17. There shall be no discharges of metal cleaning waste including wastewater from chemical cleaning of boiler tubes, air preheater washwater, and boiler fireside washwater.

B. REAPPLICATION

If the permittee desires to continue to discharge after the expiration date of this permit, the permittee shall apply on the application forms then in use at least 180 days before the permit

expires.

Reapply for a Discharge Permit by **September 30, 2005**.

C. OPERATING FEES

This discharge is subject to operating fees. The permittee shall submit the operating fees in accordance with the procedures provided by the Secretary.

D. MONITORING AND REPORTING

1. Sampling and Analysis

The sampling, preservation, handling, and analytical methods used shall conform to regulations published pursuant to Section 304(g) of the Clean Water Act, under which such procedures may be required. Guidelines establishing these test procedures have been published in the Code of Federal Regulations, Title 40, Part 136 (Federal Register, Vol. 56, No. 195, July 1, 1999 or as amended).

Samples shall be representative of the volume and quality of effluent discharged over the sampling and reporting period. All samples are to be taken during normal operating hours. The permittee shall identify the effluent sampling location used for each discharge.

2. Reporting

The permittee is required to submit monitoring results as specified on a Discharge Monitoring Report (Form WR-43). Reports are due on the 15th day of each month, beginning with the month following the effective date of this permit.

If, in any reporting period, there has been no discharge, the permittee must submit that information by the report due date.

Signed copies of these, and all other reports required herein, shall be submitted to the Secretary at the following address:

Agency of Natural Resources
Department of Environmental Conservation
Wastewater Management Division
103 South Main Street
Waterbury, Vermont 05671-0405

All reports shall be signed:

a. In the case of corporations, by a principal executive officer of at least the level of vice president, or his/her duly authorized representative, if such representative is responsible for the overall operation of the facility from which the discharge described in the permit form originates;

b. In the case of a partnership, by the general partner;

c. In the case of a sole proprietorship, by the proprietor;

d. In the case of a municipal, state, or other public facility, by either a principal executive officer, ranking elected official, or other duly authorized employee.

3. Recording of Results

The permittee shall maintain records of all information resulting from any monitoring activities required including:

a. The exact place, date, and time of sampling;
b. The dates and times the analyses were performed;
c. The person(s) who performed the analyses;
d. The analytical techniques and methods used including sample collection, handling, and preservation techniques;
e. The results of all required analyses;
f. The records of monitoring activities and results, including all instrumentation and calibration and maintenance records;
g. The original calculation and data bench sheets of the operator who performed analysis of the influent or effluent pursuant to requirements of Section I.A of this permit.

The results of monitoring requirements shall be reported (in the units specified) on the Vermont reporting form WR-43 or other forms approved by the Secretary.

4. Additional Monitoring

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report. Such increased frequency shall also be indicated.

PART II

A. MANAGEMENT REQUIREMENTS

1. Facility Modification / Change in Discharge

All discharges authorized herein shall be consistent with the terms and conditions of this permit. Such a violation may result in the imposition of civil and/or criminal penalties as provided for in Section 1274 and 1275 of the Vermont Water Pollution Control Act. Any anticipated facility expansions, production increases, or process modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new permit application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Following such notice, the permit may be modified to specify and limit any pollutants not previously limited.

2. Noncompliance Notification

In the event the permittee is unable to comply with any of the conditions of this permit due among other reasons, to:

a. breakdown or maintenance of waste treatment equipment (biological and physical-chemical systems including, but not limited to, all pipes, transfer pumps, compressors, collection ponds or tanks for the segregation of treated or untreated wastes, ion exchange columns, or carbon absorption units),

b. accidents caused by human error or negligence, or

c. other causes such as acts of nature,

the permittee shall notify the Secretary within 24 hours of becoming aware of such condition or by the next business day and shall provide the Secretary with the following information, in writing, within five (5) days:

i. cause of non-compliance

ii. a description of the non-complying discharge including its impact upon the receiving water;

iii. anticipated time the condition of non-compliance is expected to continue or, if such condition has been corrected, the duration of the period of non-compliance;

iv. steps taken by the permittee to reduce and eliminate the non-complying discharge; and

v. steps to be taken by the permittee to prevent recurrence of the condition of non-compliance.

3. Operation and Maintenance

All waste collection, control, treatment. And disposal facilities shall be operated in a manner consistent with the following:

a. The permittee shall, at all times, maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit; and

b. The permittee shall provide an adequate operating staff which is duly qualified to carry out the operation, maintenance, and testing functions required to insure compliance with the conditions of this permit.

4. Quality Control

The permittee shall calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at regular intervals to ensure accuracy of measurements or shall ensure that both activities will be conducted.

The permittee shall keep records of these activities and shall provide such records upon request of the Secretary.

The permittee shall analyze any additional samples as may be required by the Agency of Natural Resources to ensure analytical quality control.

5. Bypass

The diversion or bypass of facilities necessary to maintain compliance with the terms and conditions of this permit is prohibited, except where authorized under terms and conditions of an emergency pollution permit issued pursuant to 10 V.S.A. Section 1268.

6. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any adverse impact to waters of the State resulting from non-compliance with any condition specified in this permit, including accelerated or additional monitoring as necessary to determine the nature and impact of the non-complying discharge.

7. Records Retention

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed, calibration and maintenance of instrumentation, and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, and shall be submitted to Department representatives upon request. This period shall be extended during the course of unresolved litigation regarding the discharge of pollutants or when requested by the Secretary.

8. Solids Management

Collected screenings, sludges, and other solids removed from liquid wastes shall be stored, treated and disposed of in accord with the terms and conditions of any certification, interim or final, transitional operation authorization or order issued pursuant to 10 V.S.A., Chapter 159 that is in effect on the effective date of this permit or is issued during the term of this permit.

9. Emergency Pollution Permits

Maintenance activities, or emergencies resulting from equipment failure or malfunction, including power outages, which result in an effluent which exceeds the effluent limitations specified herein, shall be considered a violation of the conditions of this permit, unless the permittee immediately applies for, and obtains, an emergency pollution permit under the provisions of 10 V.S.A., Chapter 47, Section 1268. The permittee shall notify the Department of the emergency situation within 24 hours.

10 V.S.A., Chapter 47, Section 1268 reads as follows:

"When a discharge permit holder finds that pollution abatement facilities require repairs, replacement, or other corrective action in order for them to continue to meet standards specified in the permit, he may apply in the manner specified by the Secretary for an

emergency pollution permit for a term sufficient to effect repairs, replacements or other corrective action. The permit may be issued without prior public notice if the nature of the emergency will not provide sufficient time to give notice; provided that the Secretary shall give public notice as soon as possible but in any event no later than five days after the effective date of the emergency pollution permit. No emergency pollution permit shall be issued unless the applicant certifies and the Secretary finds that:

(1) there is no present, reasonable alternative means of disposing of the waste other than by discharging it into the waters of the State during the limited period of time of the emergency;

(2) the denial of an emergency pollution permit would work an extreme hardship upon the applicant;

(3) the granting of an emergency pollution permit will result in some public benefit;

(4) the discharge will not be unreasonably harmful to the quality of the receiving waters;

(5) the cause or reason for the emergency is not due to willful or intended acts or omissions of the applicant."

Application shall be made to the Secretary of the Agency of Natural Resources, Department of Environmental Conservation, Wastewater Management Division, 103 South Main Street, Waterbury, Vermont 05671-0405.

10. Power Failure

In order to maintain compliance with the effluent limitations and prohibitions of this permit, the permittee shall either:

a. Provide an alternative power source sufficient to operate the wastewater control facilities; or, if such alternative power source is not in existence,

b. Halt, reduce, or otherwise control production and/or all discharges upon the reduction, loss, or failure of the primary source of power to the wastewater control facilities.

B. RESPONSIBILITIES

1. Right of Entry

The permittee shall permit the Secretary or authorized representative, upon presentation of proper credentials:

a. to enter upon the permittee's premises where an effluent source or any records required to be kept under the terms and conditions of this permit are located; and

b. to have access to and copy any records required to be kept under the terms and conditions of this permit;

c. to inspect any monitoring equipment or method required in this permit; or

d. to sample any discharge of pollutants.

2. Transfer of Ownership or Control

This permit is not transferable without prior written approval of the Secretary. All application and operating fees must be paid in full prior to transfer of this permit. In the event of any change in control or ownership of facilities from which the authorized discharges emanate, the permittee shall provide a copy of this permit to the succeeding owner or controller and shall send written notification of the change in ownership or control to the Secretary. The permittee shall also inform the prospective owner or operator of their responsibility to make an application for transfer of this permit. This application must include as a minimum; a written statement from the prospective owner or operator certifying:

a. The conditions of the operation that contribute to, or affect, the discharge will not be materially different under the new ownership.

b. The prospective owner or operator has read and is familiar with the terms of the permit and agrees to comply with all terms and conditions of the permit.

c. The prospective owner or operator has adequate funding to operate and maintain the treatment system and remain in compliance with the terms and conditions of the permit.

d. The date of the sale or transfer of the business.

The Department may require additional information dependent upon the current status of the facility operation, maintenance, and permit compliance.

3. Confidentiality

Pursuant to 10 V.S.A. 1259(b):

"Any records, reports or information obtained obtained under this permit program shall be available to the public for inspection and copying. However, upon a showing satisfactory to the secretary that any records, reports or information or part thereof, other than effluent data, would, if made public, divulge methods or processes entitled to protection as trade secrets, the secretary shall treat and protest those records, reports or information as confidential. Any records, reports or information accorded confidential treatment will be disclosed to authorized representatives of the state and the United States when relevant to any proceedings under this chapter."

4. Permit Modification

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

5. Toxic Effluent Standards

If a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307 (a) of the Federal Clean Water Act for a toxic pollutant which is present in the discharge, and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, the secretary shall revise or modify the permit in accordance with the toxic effluent standard or prohibition and so notify the permittee.

6. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under 10 V.S.A. Section 1281.

7. Civil and Criminal Liability

Except as provided in permit conditions on Bypass (Part II, A. 5.), Power Failure (Part II, A. 10.), and Emergency Pollution Permits (Part II, A. 9.), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance. Civil penalties as authorized under 10 V.S.A. §1274 and 10 V.S.A. §8010, shall not exceed $10,000 a day for each day of violation. Criminal penalties, as authorized under 10 V.S.A. §1275, shall not exceed $25,000 for each day of violation, imprisonment for up to six months, or both.

8. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Clean Water Act.

9. Property Rights

Issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State, or local laws or regulations.

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall

not be affected thereby.

11. Authority

This permit is issued under authority of 10 V.S.A. Section 1259 which states that: "No person shall discharge any waste, substance, or material into waters of the State, nor shall any person discharge any waste, substance, or material into an injection well or discharge into a publicly owned treatment works any waste which interferes with, passes through without treatment, or is otherwise incompatible with those works or would have a substantial adverse effect on those works or on water quality, without first obtaining a permit for that discharge from the Secretary", and under the authority of Section 402 of the Clean Water Act, as amended.

PART III

A. OTHER REQUIREMENTS

This permit shall be modified, suspended or revoked to comply with any applicable effluent standard or limitation issued or approved under Sections 301(b)(2)(C) and (D), 304(b)(2), and 307(a)(2) of the Clean Water Act, if the effluent standard or limitation so issued or approved:

1. Contains different conditions or is otherwise more stringent than any effluent limitation in the permit; or

2. Controls any pollutant not limited in the permit.

The permit as modified or reissued under this paragraph shall also contain any other requirements of the Vermont Water Pollution Control Act then applicable.

B. DEFINITIONS

For purposes of this permit, the following definitions shall apply:

The Act - The Vermont Water Pollution Control Act, 10 V.S.A. Chapter 47.

Average - The arithmetic mean of values taken at the frequency required for each parameter over the specific period.

The Clean Water Act - The federal Clean Water Act, as amended.

Composite Sample - A sample consisting of a minimum of one grab sample per hour collected over a normal operating day and combined proportional to flow, or a sample continuously collected proportional to flow over a normal operating day.

Daily Discharge - The discharge of a pollutant measured during a calendar day or any 24 hour period that reasonably represents the calendar day for purposes of sampling.

For pollutants with limitations expressed in pounds, the daily discharge is calculated as the total pounds of pollutants discharged over the day.

For pollutants with limitations expressed in mg/l, the daily discharge is calculated as the average measurement of the pollutant over the day.

Grab Sample - An individual sample collected in a period of less than 15 minutes.

Maximum Day (maximum daily discharge limitation) - The highest allowable "daily discharge" (mg/l, lbs., or gallons).

Mean - The mean value is the arithmetic mean.

Monthly Average (average monthly discharge limitation) - The highest allowable average of daily discharges (mg/l, lbs., or gallons) over a calendar month, calculated as the sum of all daily discharges (mg/l, lbs.,or gallons) measured during a calendar month, divided by the number of daily discharges measured during that month.

NPDES - The National Pollutant Discharge Elimination System.

Secretary - The Secretary of the Agency of Natural Resources

Closed-Cycle Operation and Blowdown - The circulating water system mode in which water is circulated through the cooling towers to dissipate condenser heat. The only water discharged to the River during closed-cycle operation is the blowdown from the cooling towers except for minor leakage through the intake gates which is less than 1% of the circulating water flow. Blowdown refers to the water continuously removed from the cool side of the cooling tower collection basins to rid cooling towers of dissolved solids.

Instantaneous Maximum - A value not to be exceeded in any grab sample.

PART IV

ENVIRONMENTAL MONITORING STUDIES, CONNECTICUT RIVER

The environmental monitoring and studies specified in Part IV are intended to assure that the discharges authorized by this permit do not violate applicable Vermont Water Quality Standards and are not adverse to fish and other wildlife that inhabit the Connecticut River in and around the vicinity of Vernon.

In the event the US Fish and Wildlife Service determines that the field sampling activities as required in the **Larval Fish, Fish, Anadromous Fish,** and **Fish Impingement** sections of this permit may violate the applicable provisions of Endangered Species Act of 1973 as amended (16 USC 1531-43) the Agency, after consultation with other appropriate governing agencies, may direct the permittee to make changes and/or substitutions in the sampling protocol as required in this permit.

CONNECTICUT RIVER MONITORING

River Flow Rate

Frequency/Date: Once per hour - All months
Location: Vernon Dam
River flow data shall be tabulated based on data supplied by the Wilder Station.

Temperature

Frequency/Date: Once per hour - All months
Location: Stations 3 and 7
Water temperature shall be measured to within 0.1 °F.

Frequency/Date: Once per hour - During fishway operation
Location: Vernon Fishway
Water temperature shall be measured to within 0.1 °F. These data shall be collected only when the fishway is officially operating. Data shall be reported as hourly, daily, monthly means.

Water Quality Parameters

Frequency/Date: Once per month - All months
Location: Stations 3 and 7, and the Plant discharge
Water quality parameters shall be grab samples collected via monitor pumps or directly from the River for the following:

	Location		
Parameter	**Station 7**	**Discharge**	**Station 3**
Copper	*	*	*
Iron	*	*	*
Zinc	*	*	*

* Monitoring required only if Entergy Nuclear Vermont Yankee is operating during the specified sample period.

Macroinvertebrates

Macroinvertebrates shall be collected according to the following schedule:

Frequency/Date: June, August, and October (once each month)
Locations: Stations 2 and 3

Cage samplers shall be deployed in June, August, and October. Multiple samplers (minimum of three) should be set at each deployment. Physical characteristics at deployment sites should be standardized between stations to the greatest extent possible. Final sampling plan to be approved by the DEC.

Larval Fish

Larval fish shall be collected when the plant cooling water intake is operating in open/hybrid cycle according to the following schedule and methods:

Frequency/Date: Weekly - May through July 15
Location: Connecticut River adjacent to the plant intake

Collect three plankton net samples on the same day in each week. The net shall be deployed as close as possible to the intake allowing each sample to be representative of the water column, bottom to surface. The volume sampled shall be measured with a flow meter mounted near the net mouth and used to calculate the density of larval fish in each tow. Larval fish shall be identified to the lowest distinguishable taxonomic level and enumerated.

With the written concurrence of the Agency, the sampling method may be modified or replaced.

Fish

Fish shall be collected according to the following schedule and methods:

Frequency/Date: Monthly - May, June, September, and October
Locations: Connecticut River at Rum Point; Station 5; Station 4; N.H. Setback; 0.1 mile south of the Vernon Dam; Station 3; Stebbin Island; and, Station 2

Fish shall be collected at each location with boat mounted electrofishing gear. All fish caught shall be identified, enumerated to the lowest distinguishable taxonomic level, and measured for length and weight. A representative sample of American Shad and Atlantic Salmon shall be scaled for annuli determination of age. Catch-per-unit-of-effort (CPUE) shall be calculated for each species sampled.

Anadromous Fish

Juvenile and adult American shad shall be monitored according to the following schedule:

Frequency/Date: Twice monthly - July through October
Locations: Connecticut River 0.1 mile south of Vernon Dam; Station 3; and Stebbin Island

Juvenile shad shall be collected at each location with boat mounted electrofishing gear. All captured juvenile American shad shall be identified, enumerated, and measured for length and weight. Catch-per-unit-of-effort shall be calculated.

Frequency/Date: Twice monthly - July through October
Location: Connecticut River between Vernon Dam and the confluence of the West River

Collect 20 beach seine hauls and 12 surface trawl tows (utilizing midwater trawl tow gear) per sampling event. All fish caught shall be identified, enumerated to the lowest distinguishable taxonomic level, and measured for length and weight. Catch-per-unit-of-effort shall be calculated for American shad.

Frequency/Date: Weekly - May 15 through June
Location: Vernon Fish Ladder

Adult American shad shall be sampled in the fish trap and enumerated, measured for length and weight and evaluated for sex and sexual condition. Scale samples shall be taken from each fish and used for annuli determination of age.

All sampling activities at the Vernon Fish Ladder are under the direction of the Vermont Department of Fish & Wildlife.

Fish Impingement

Impingement samples shall be collected when the plant cooling water intake is operating in open/hybrid cycle according to the following schedule and methods:

Frequency/Date: Weekly - April 1 through June 15; August 1 through October 31
Locations: Circulating water traveling screens

Prior to the start of each weekly sample, the three circulating water screens shall be backwashed and the debris removed. Debris shall be examined for American shad and Atlantic salmon. On the following day, the three circulating water screens shall be backwashed and the debris shall be sorted to remove all impinged fish. Fish shall be identified to the lowest distinguishable taxonomic level, enumerated, measured for total length and weighed.

(When air temperatures are at freezing the permittee may be unable to rotate the traveling screens until the air temperature rises above freezing. In such cases, the scheduled sample may be collected once air temperatures have risen above freezing.)

Standard Operating Procedures

Field sampling required as specified in the **Macroinvertebrates, Larval Fish, Fish, Anadromous Fish,** and **Fish Impingement** sections shall be performed according to approved Standard Operating Procedures. A Standard Operating Procedures Manual describing the field sampling activities shall be provided to the Agency for review and approval prior to the start of field sampling.

Atlantic salmon: The plant shall revert to closed cycle if the annual Atlantic salmon impingement limit as determined by the U.S. Fish and Wildlife Service, is exceeded and shall remain on closed cycle until June 15 of the current calendar year. If any anadromous Atlantic salmon are impinged, the Vermont Department of Fish and Wildlife shall be notified.

1. If Atlantic salmon are impinged, the frequency of impingement sampling shall increase to daily sampling when either of the following criteria are met:

   a. when any daily impingement of Atlantic salmon exceeds 10% of the annual impingement limit or,

   b. when 50% or more of the annual limit have been exceeded during the current year.

   Daily impingement sampling shall continue until three consecutive daily samples have been collected and no Atlantic salmon obtained. Sampling frequency shall then revert to weekly sampling.

2. If the criteria listed above are not met, impingement sampling will remain on a weekly schedule.

The maximum number of Atlantic salmon which can be impinged by Entergy Nuclear Vermont Yankee, LLC during a calendar year is determined by:

Impinged Atlantic salmon limit = 0.001 x (smolt equivalents)

Smolt equivalents (SE) are defined as:

$$SE = SE_F + SE_P + SE_S + SE_N$$

where:

SE_F is defined as the total number of smolt equivalents available from fry plants upstream of Vernon Dam. This number is calculated by:

$SE_F = 0.0675$ x (two year previous fry)

Two year previous fry is defined as the total number of fry stocked upstream of the Vernon Dam two years previous.

SE_P is defined as the total number of smolt equivalents available from parr plants upstream of the Vernon Dam. This number is calculated by:

$SE_P = [(0.25 \times (\text{yearling parr})) + (0.11 \times (\text{two-year previous under yearling})]$

Yearling parr is defined as the total number of 1+ parr stocked upstream of the Vernon Dam during the previous calendar year.

Two-year previous under yearling parr is defined as the total number of 0+ parr stocked two years previous.

SE_S is defined as the total number of smolt equivalents available from smolt stocked upstream of Vernon Dam. This number is calculated by:

$SE_S = 1 \times (\text{smolts stocked})$

Smolts stocked is defined as the total number of smolts stocked upstream during the current monitoring year.

SE_N is defined as the total number of smolt equivalents available from natural reproduction upstream of Vernon Dam. This number is calculated by:

$SE_N = 0.58 \times 7000 \times 0.01 \times (\text{adult salmon})$

0.58 represents 58% of the run as female.
7000 represents the average number of eggs per female.
0.01 represents a 1% survival of eggs to the smolt stage.
Adult salmon is defined as the number of adult salmon passed through the Vernon Fishway three years previous.

American shad: The plant shall revert to closed cycle if the annual American shad impingement limit, as determined by the U.S. Fish and Wildlife Service, is exceeded and shall remain on closed cycle until November 15 of the current calendar year. If any anadromous American shad are impinged, the Vermont Department of Fish and Wildlife shall be notified.

1. If 50% or more of the annual limit have been exceeded during the current year, impingement sampling frequency shall increase to daily sampling upon the impingement of any American shad and continue until three consecutive daily samples not containing these fishes are obtained. Sampling would then revert back to weekly sampling.

2. If the above criterion is not met, impingement sampling shall remain on a weekly schedule.

The maximum number of American shad which can be impinged by Entergy Nuclear Vermont Yankee, LLC during a calendar year is determined by:

Impinged American shad limit = 1 x number of American shad

The number of American shad is defined as the number of American shad passed at the Vernon fish ladder or otherwise introduced above Vernon Dam during the calendar year.

No Adverse Impact on Biota Evaluation:

The above task-oriented monitoring program defines a minimal data collection study on the water quality and biota adjacent to the plant. In order to demonstrate that the operation of the plant does not result in an adverse effect on fish and other wildlife, including their value as fish and game and their habitat and ecology, additional objective specific studies and data evaluation may be required. These additional study topics would be as a result of changes observed during the task-oriented program and/or Environmental Advisory Committee (EAC) concerns raised for fish or other biota.

The EAC (in conjunction with the Vermont Department of Fish and Wildlife) may modify the fish sampling protocol if it has been determined that the impact on biota adjacent to the plant may be adversely affected. The modifications shall be made in writing and submitted to the DEC and Entergy Nuclear Vermont Yankee, LLC.

Objective specific investigations would be defined and reviewed by the EAC annually. A draft proposal for the following years studies, if any, would be submitted by Entergy Nuclear Vermont Yankee, LLC to the EAC for review by October 1 of the current year. A progress report on studies conducted during the current year would be submitted by Entergy Nuclear Vermont Yankee, LLC to the EAC by February 1. Proposed changes to the draft proposal would by submitted by March 1.

Macroinvertebrate Investigation - During 2002-03 Entergy Nuclear Vermont Yankee, LLC shall complete a study on the macroinvertebrate populations in the Vernon Pool. Specifics of the study shall be coordinated between the Department of Environmental Conservation and Entergy Nuclear Vermont Yankee, LLC prior to commencement of the study.

The Department may amend this permit to include other specific EAC investigations.

AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
WASTEWATER MANAGEMENT DIVISION
103 SOUTH MAIN STREET
WATERBURY, VERMONT 05671-0405

FACT SHEET

(May 2001, amended July 2001, **amended May 2003***)

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
PERMIT TO DISCHARGE TO WATERS OF THE UNITED STATES

FILE NO: 13-17
PERMIT NO: 3-1199
NPDES NO: VT0000264
PROJECT ID NO: NS75-0006

NAME AND ADDRESS OF APPLICANT:

Entergy Nuclear Vermont Yankee
322 Governor Hunt Road
Vernon, Vermont 05354

cc: Elise Zoli
Goodwin Proctor/LLP

NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:

Entergy Nuclear Vermont Yankee
322 Governor Hunt Road
Vernon, Vermont 05354

RECEIVING WATER: Connecticut River

CLASSIFICATION: Class B

I. Proposed Action, Type of Facility, and Discharge Location

The above named applicant has applied to the Vermont Department of Environmental Conservation for a permit to discharge into the designated receiving water. The facility is engaged in the operation of a nuclear electrical generating station. The discharge is combined effluent from condenser cooling water and service water, boiler blowdown, water treatment process and carbon filter backwash, radioactive waste treatment system, demineralized trailer rinsedown water and stormwater runoff.

* **This is a permit amendment. Proposed changes to the permit are addressed on page 7 of this fact sheet.**

II. Description of Discharge

A quantitative description of the discharge in terms of significant effluent parameters is based upon the permit application and supporting documents including the final 316 Demonstration Report and a summary of the self-monitoring data.

III. Limitations and Conditions

The effluent limitations, monitoring requirements, and special conditions may be found on the following pages of the draft permit:

Effluent Limitations and Monitoring Requirements	Pages 2 through 9
Special Conditions	Pages 2 through 9

IV. Facility Description and Background

Entergy Nuclear Vermont Yankee owns and operates a nuclear power station in Vernon, Vermont. The facility is located on the west shore of Vernon Pool, an impoundment of the Connecticut River created by Vernon Dam. The dam and Vernon Station, a hydroelectric facility, are located approximately 0.5 miles downstream from Vermont Yankee. The Vermont Yankee Nuclear Power Station (VYNPS), which began operation in 1972, is classified as a Boiling Water Reactor (BWR) with a rated core thermal power level of 1593 MW, providing a gross electrical output of 537 MW. The remainder of the energy, 1056 MW, is removed as heat by the circulating water system as it passes by the condenser and discharges to the Connecticut River (S/N 001), or to the atmosphere via mechanical draft cooling towers. There are several other processes associated with the electro-generation and facility operations, which may result in a discharge. Typically these discharges are not continuous and occur infrequently. These include radioactive liquid (S/N 002), plant-heating boiler blowdown (S/N 003), water treatment and carbon filter backwash (S/N 004), cooling water discharge from the four RHR-SW pumps (S/N 005), site stormwater runoff (S/N 006, 007, and 008), demineralized trailer rinse down water (S/N 006), and strainer and traveling screen backwash (S/N 009). A schematic of the design maximum capacity wastewater flows is attached.

Currently, VYNPS has a State of Vermont NPDES Discharge Permit (Permit No. 3-1199, NPDES No. VT0000264). Vermont Yankee has applied for a renewal of this permit. The Department intends to issue a draft discharge permit with effluent limitations, monitoring requirements, and other special conditions based on Titles III and IV of the Clean Water Act in accordance with 40 CFR Parts 122-125 and 423, The Vermont Water Pollution Control Act 10 VSA Chapter 47, Vermont Water Pollution Control Permit Regulations, the Vermont Water Quality Standards, and the Final 316 Demonstration Report: Biological, Hydrological, & Engineering Information and Environmental Impact Assessment (For the period 16 May to 14 October), June 1990.

V. Permit Basis and Explanation of Effluent Limitation Derivation

The following is a description of each of the authorized discharges including background and highlighting modifications from the previously issued permit that are proposed in the draft permit.

S/N 001 - Condenser Cooling Water and Service Water

Condenser cooling water is the secondary coolant in the nuclear reactor system. In the BWR, primary coolant water (pumped from the Connecticut River) is converted to high purity steam which passes through the high-pressure and low-pressure turbine generator for electrical generation. Exhaust steam enters a water cooled condenser, where it is cooled back to water and recirculated in the process. The condenser cooling water removes unused heat energy from the primary system and as a non-contact cooling system, is not a source of plant related radioactivity released as a liquid effluent.

Vermont Yankee has various modes of condenser cooling operation which determines the volumes of water and amounts of heat discharged to the river. In order to comply with the thermal criteria for discharge (dependent on river conditions and plant operations), condenser cooling water may be discharged directly to the Connecticut River ('open-cycle, or once through cooling'), or may be directed to the mechanical draft cooling towers. These discharges may wholly, or in part, be returned to the river and/or the plant's circulating water system ('hybrid or closed cycle').

Excess service waters (up to 10,000 gpd) discharge through the circulating water system prior to combining with the condenser cooling water. Vermont Yankee upgraded its service water system in 1994 to include the ability to chemically treat (chlorine or chlorine with bromine) for biofouling. These oxidizing biocides were included under Condition I.A.15.

The dilution of the service waters (for cooling of plant equipment) prior to discharge is approximately 36:1. The discharge limitations for free residual chlorine and total residual oxidant will remain unchanged from the previous permit.

The proposed permit includes the addition of two new chemicals for use in the RHR service water system to correct biological/corrosion fouling of the four service water pumps. Each pump will be serviced approximately twice a year and each discharge containing Ferroquest FQ7101(treatment chemical) and FQ7102 (for maintaining a neutral pH) will last only one minute. The maximum concentration for FQ7101 is 96 ppm for one minute and for FQ7102 the maximum concentration is 7 ppm for one minute. The effluent from the cleaning (approximately 300 gallons of 10% Ferroquest 7101) will discharge to the service water system (5,000 gpm flow) then enter the circulating water system (240,000 gpm flow) to the discharge structure via S/N 001.

During the winter months all of the service water is routed to a deep basin under the West Cooling Tower which contains 1.6 million gallons of water prior to entering the discharge structure (S/N 001). This is used to prevent icing and is in place when the river temperature drops below 45 degrees F. During this time additional dilution is available.

Other Limits for Discharge S/N 001

Maximum discharge occurs during 'open/hybrid-cycle' and will remain as previously permitted at 543 MGD. Closed cycle operation maximum flow rate will remain at 12.1 MGD. These are calculated values, determined through the use of pump curves.

The permit continues to require continuous ambient temperature monitoring in the Connecticut River. This monitoring will ensure that temperature limits in the Vermont Water Quality Standards are met under all operating conditions.

Under the provisions of both the Clean Water Act, Section 316 and the Vermont Water Quality Standards, Section 3-01, alternative thermal limitations may be granted where a demonstration is made that such alternative limits will not result in an adverse effect on biota or beneficial values or uses associated with the classification of the receiving waters. The results of the 316 demonstration (Final 316 Demonstration Report: Biological, Hydrological, & Engineering Information and Environmental Impact Assessment (For the period 16 May to 14 October), June 1990, and the Summary Report of the 1986 - 1997 Ecological Studies of the Connecticut River, Vernon, Vermont indicated that the plant operations had not altered the distribution, abundance, or diversity of aquatic biota of the Connecticut River near Vernon.

Based upon this demonstration and the annual ecological monitoring studies, the existing thermal limits remain unchanged from the previous permit.

S/N 002 - Radioactive Liquid

The discharge of low level radioactive liquids may occur from the radwaste building after treatment. This discharge is intermittent and occurs on a very infrequent basis. According to self-monitoring data, the last discharge occurred in December, 1981. The restrictions on radioactive discharges, Condition I.10. a-f, have not been modified. The previously permitted discharge limit of 0.01 MGD is unchanged.

S/N 003 - Plant Heating Boiler Blowdown

The plant-heating boilers discharge relatively small volumes of blowdown on an intermittent basis most months. The maximum daily flow rate is 0.0010 MGD except that each of the two boilers may be drained of 0.0020 MGD at the end of the heating season. (Each boiler has a capacity of 2000 gallons.) This is unchanged from the previous permit. This waste stream discharges through S/N 007 to the outlet structure forebay.

The name, but not the chemical itself, of the corrosion control chemical has been changed from Betz Layup-1 to BetzDearborn Cortrol OS7700.

S/N 004 - Carbon Filter Backwash

This system is part of the river water purification system and generates river solids. This discharge is defined by 40 CFR 423.12 as a 'low volume waste stream' which has established total suspended solids (TSS) limits calculated using the flow rate and a concentration of 100 mg/l. The flow rate and total suspended solids limit remains unchanged from the previous permit. This waste stream discharges through S/N 007 to the outlet structure forebay.
Data from the past five years indicate that the discharge of total suspended solids is less than 3%

of the existing pounds limit of 8.3. As a result this permit proposes to delete the requirement for TSS monitoring.

S/N 005 - Minor Cooling Water from Residual Heat Removal-Service Water Pumps

S/N 005 is a minor cooling water (service water motor coolers) discharge from the four RHR-SW pumps, typically operated only during plant shutdown at a maximum flow of 0.014 MGD. There are no additives and the discharges are only slightly thermally enhanced. No effluent limits or monitoring is required for this waste stream which discharges through S/N 007 to the outlet structure forebay. This is unchanged from the previous permit.

S/N 006, 007, 008, 010, 011 - Stormwater Discharges and Demineralized Trailer Rinse Down Water (S/N 006 only)

Authorization to discharge stormwater runoff from discharge points S/N 006, 007, and 008 will be retained in this permit. Vermont Yankee has applied for a permit amendment to add two existing stormwater discharge points (a part of the original plant design) which were previously not identified in the permit. These are S/N 010, stormwater from the 345 kV switchyard discharging about 300 yards north of the intake and S/N 011, stormwater from the 115kV switchyard discharging about 350 yards north of the intake.

In addition to the stormwater discharges, the permit proposes to add 'demineralized trailer rinse downs' to discharge point S/N 006. Approximately four times a year a trailer truck with six ion exchange resin tanks enters the facility in order to make demineralized make-up water for the reactor. The proposed flow would be up to 0.01 MGD. Due to the high quality of this discharge no monitoring is proposed.

S/N 009 - Strainer and Traveling Screen Backwash Water

S/N 009 is a minor discharge of river water from the backwash of the Circulating and Service Water Traveling Screens and the Service Water Strainers. It is located a few feet north of the service water intake bay at the intake structure. Operation of the traveling screens and strainers is intermittent based upon differential pressure resulting in 0.014 to 0.050 MGD being discharged through S/N 009. The previous permit limited the flow to 0.035 mgd; the proposed permit limits the flow to 0.050 mgd. Data from spring 2000 indicated that high river flows containing debris may cause the circulating water traveling screens to backwash more often than three times per day, which was the basis for the original 0.035 mgd limit. The maximum period of time the traveling screens and the strainers would backwash in a 24-hour period is approximately three hours. Prior to being discharged, the backwash water flows into a trash pit where debris is removed from the effluent stream. Due to its location, much of the backwash water would in fact enter the service water intake structure.

A service water treatment chemical, Bulab 8006, (a penetrant/biodispersant) is added at a concentration of up to 20 ppm. Because of the intermittent nature of the discharge, the fact that much of this discharge enters the service water intake structure, and the dilution ratio of the receiving water, there should be no adverse impact to the Connecticut River. Monitoring of this discharge is not required. This is unchanged from the previous permit.

Part IV - Environmental Monitoring Studies, Connecticut River

Several changes have been proposed for Part IV of the permit as a result of discussions between members of the Environmental Advisory Committee with input from Vermont Yankee and their consultant Normandeau Associates.

Macroinvertebrates

The section on dredge samples is proposed to be deleted from the permit. The Section on cage samples has been modified slightly. To compensate for the loss of dredge samples Vermont Yankee will begin an objective specific study (2002-03) involving macroinvertebrate populations in Vernon Pool. Specifics of the study will be worked out between the Department of Environmental Conservation and Vermont Yankee.

Larval Fish and Fish

The ichthyoplankton field sampling procedures will remain as in the previous permit with some minor changes. The procedure may be modified with the written approval of the Agency. (Larval Fish)

The section on trap nets is proposed to be deleted in order to protect the nesting pair of bald eagles on the island below Vernon Dam. Electrofishing will remain a requirement. (Fish)

Anadromous Fish

This section has been enhanced to include both juvenile and adult shad. The previous permit only included juvenile shad. Other stations including the Vernon Fish Ladder are proposed to be included in the permit.

Atlantic Salmon

A change in the formula for estimating the annual Atlantic salmon impingement limit is proposed to be corrected. In the existing permit's "smolt equivalent" formula, the variable SE_n is based on the following:
"Adult salmon is defined as the number of adult salmon passed through the Vernon Fishway two years previous."
Three, instead of two, years is proposed in the draft permit.

Standard Operating Procedures Manual

Proposed language requires the development of a manual to be submitted to the Agency for review and approval prior to the start of field sampling.

*** Proposed Permit Changes (May 2003)**

Part I.A.15. - The chemical Nalco H-550 is proposed to replace Bulab 6002. A review of the information submitted including MSDS indicated that the chemical at a concentration of less than 2.0 ppm (which assumes no demand) will not have an adverse impact on the biota in the receiving water.

Part I.A. - The previous language in Part I.A. addressing floating and foaming solids has been changed to "The effluent shall not have concentrations or combinations of contaminants including oil, grease, scum, foam, or floating solids which would cause a violation of the water quality standards of the receiving water." This language is identical to language used in the Department's municipal discharge permits.

Part IV. Fish Impingement - The Department understands that collecting fish samples off the traveling screens may be problematic during freezing weather. The section has therefore been modified to include the following language: "When air temperatures are at freezing the permittee may be unable to rotate the traveling screens until the air temperature rises above freezing. In such cases, the scheduled sample may be collected once air temperatures have risen above freezing." This still ensures that the sample will be collected as required.

Part IV. Fish - The Station 4 monitoring location has been added to this section of the permit. It was inadvertently left out of the existing permit.

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