DOCKET

MAR 2 1 1972

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Docket No. 50-271

Vermont Yankee Nuclear Power Corp.
ATTN: Mr. Albert A. Cree
President
77 Grove Street
Rutland, Vermont 05701

Gentlemen:

Pursuant to the Initial Decision of the Atomic Safety and Licensing Board, dated March 14, 1972, the Atomic Energy Commission has issued Facility Operating License No. DPR-28 (copy enclosed) to the Vermont Yankee Nuclear Power Corporation. The license permits fuel loading and low-power testing at power levels not to exceed 15.9 megawatts thermal, in accordance with the Technical Specifications appended thereto. A related notice which has been forwarded to the Office of the Federal Register for filing and publication is enclosed for your information. A copy of the Initial Decision has already been furnished you.

Two signed copies of Amendment No. 4 to Indemnity Agreement No. B-49, which covers the activities authorized under License No. DPR-28 are enclosed for your review and acceptance. Please sign and return one copy of the amendment to this office.

Sincerely,

Original Signed by
Peter A. Morris

Peter A. Morris, Director
Division of Reactor Licensing

Enclosures:
1. Facility Operating License DPR-28 w/Technical Specifications (including revised pps)
2. Federal Register Notice
3. Amendment No. 4 to Indemnity Agreement B-49

cc: (See next page)

CRESS: #Office ▶	BWR-1:DRL	BWR-1:DRL	OGC	AD:BWR:DRL	DRL	
MC #218-010 and 218-019 SURNAME ▶	SMKari/pf	WRButler	RSBoyd	RSBoyd	PAMorris	LB
3/17/72 DATE ▶	3/17/72	3/20/72	3/20/72	3/21/72	3/21/72	

Form AEC-318 (Rev. 9-53) AECM 0240 ☆ U. S. GOVERNMENT PRINTING OFFICE: 1971 —446 —154

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UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

VERMONT YANKEE NUCLEAR POWER CORPORATION

(VERMONT YANKEE NUCLEAR POWER STATION)

DOCKET NO. 50-271

FACILITY OPERATING LICENSE

License No. DPR-28

Facility Operating License No. DPR-28 is hereby issued to Vermont Yankee Nuclear Power Corporation as follows:

1. This license applies to the Vermont Yankee Nuclear Power Station, a single cycle, boiling water, light water moderated and cooled reactor, and associated steam generators and electric generating equipment (the facility). The facility is located on the applicant's site, in the Town of Vernon, Windham County, Vermont, and is described in the application as amended.

2. Subject to the conditions and requirements incorporated herein, the Commission hereby licenses the applicant:

   A. Pursuant to Section 104b of the Atomic Energy Act of 1954, as amended (the Act), and 10 CFR Part 50, "Licensing of Production and Utilization Facilities", to possess, use, and operate the facility as a utilization facility at the designated location on the Vermont Yankee site;

   B. Pursuant to the Act and 10 CFR Part 70, "Special Nuclear Material", to receive, possess, and use at any one time up to 1800 kilograms of U-235 contained in reactor fuel assemblies, and up to ten individual fuel rods; 16 grams of plutonium encapsulated as Pu-Be-Neutron source assemblies; and 140 grams of U-235 contained in aluminum-clad elements, all in connection with operation of the facility.

   C. Pursuant to the Act and 10 CFR Part 30, "Rules of General Applicability to Licensing of Byproduct Material", to receive, possess, and use in connection with operation of the facility any byproduct material with Atomic numbers between 3 and 83, inclusive in any form with no nuclide to exceed 2 millicuries; 50 curies of cesium 137, 25 millicuries of cobalt 60 both as sealed sources; 100 microcuries of strontium 90 as sealed instrument check sources, each source not to exceed 5 microcuries; 1 curie of americium 241 as a sealed source; and 1 curie of krypton 85 as gas.

D. Pursuant to the Act and 10 CFR Parts 30 and 70, to possess, but not to separate, such byproduct and special nuclear material as may be produced by operation of the facility.

3. This license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations: 10 CFR Part 20, Section 30.34 of 10 CFR Part 30, Section 40.41 of 10 CFR Part 40, Sections 50.54 and 50.59 of 10 CFR Part 50, and Section 70.32 of 10 CFR Part 70; and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified below:

A. Maximum Power Level

Vermont Yankee is authorized to load fuel and perform low-power testing at power levels not to exceed 15.9 megawatts thermal (1% of the rated power level of the facility).

B. Technical Specifications

The Technical Specifications contained in Appendix A attached hereto are hereby incorporated in this license. Vermont Yankee shall load fuel and perform low-power testing at power levels not to exceed 15.9 megawatts thermal in accordance with the Technical Specifications, and may make changes therein only when authorized by the Commission, in accordance with the provisions of Section 50.59 of 10 CFR Part 50.

C. Reports

Vermont Yankee shall make certain reports in accordance with the requirements of the Technical Specifications.

D. Records

Vermont Yankee shall keep facility operating records in accordance with the requirements of the Technical Specifications.

4. Vermont Yankee shall observe such standards and requirements for the protection of the environment as are validly imposed pursuant to authority established under Federal and State law and as are determined by the Commission to be applicable to the facility covered by this operating license. This condition does not apply to radiological effects since such effects are dealt with in other provisions of the operating license.

5. This license is issued without prejudice to subsequent licensing action which may be taken by the Commission with regard to the environmental aspects of the facility. Issuance of this license shall not preclude subsequent adoption of alternatives in facility design or operations of the type that could result from the environmental review called for by 10 CFR Part 50, Appendix D.

6. This license is effective as of the date of issuance, and shall expire six (6) months from said date, unless extended for good cause shown, or upon the earlier issuance of a subsequent licensing action.

FOR THE ATOMIC INERGY COMMISSION

Peter A. Morris, Director
Division of Reactor Licensing

Enclosure:
Appendix A
Technical Specifications

Date of Issuance:

MAR 2 1 1972

UNITED STATES ATOMIC ENERGY COMMISSION

DOCKET NO. 50-271

VERMONT YANKEE NUCLEAR POWER CORPORATION

(VERMONT YANKEE NUCLEAR POWER STATION)

NOTICE OF ISSUANCE OF FACILITY OPERATING LICENSE

Notice is hereby given that the Atomic Energy Commission (the Commission) has issued Facility Operating License No. DPR-28 to Vermont Yankee Nuclear Power Corporation (Vermont Yankee) which permits fuel loading and low-power testing, at power levels not to exceed 15.9 megawatts (thermal), of the Vermont Yankee Nuclear Power Station, a boiling water nuclear reactor located at the licensee's site in Windham County, Vermont. The facility is designed for operation at approximately 1593 megawatts thermal, but in accordance with the provisions of Facility Operating License No. DPR-28 and the Technical Specifications appended thereto, activities under the license are restricted to fuel loading and low-power testing at power levels not to exceed 15.9 megawatts thermal (1% of the facility's rated power level of 1593 MWt).

A notice of hearing on Vermont Yankee's application for a facility license was issued by the Commission on February 24, 1971 (36 F.R. 3837). Pursuant to a Commission Order, a public hearing commenced on August 10, 1971, in Brattleboro, Vermont. This hearing is still in progress. On October 22, 1971, Vermont Yankee made a motion, pursuant to Sections 2.730, 50.57(c) and Appendix D to Part 50, Section D.2 of the Commission's rules and regulations, for an order authorizing the Director of Regulation to issue a license

authorizing the loading of fuel in the reactor core and limited operation of the facility at a power level of not more than one percent of the proposed full-power rating of 1593 megawatts thermal for the purposes of low-power start-up testing. A Supplementary Notice of Hearing, pertaining to environmental matters not previously encompassed by the Notice of Hearing, was issued by the Commission on March 1, 1972 (37 F.R. 4733).

In response to the licensee's request for a license authorizing initial fuel loading and low-power start-up testing, and in accordance with the provisions of paragraph D.2 of Appendix D to 10 CFR Part 50, further evidence was presented to the Board by the applicant and the Commission's staff concerning environmental impact of such operation. On March 14, 1972, the Atomic Safety and Licensing Board (the Board) issued an Initial Decision authorizing the Director of Regulation to issue a license authorizing fuel loading and low-power testing of the Vermont Yankee plant at power levels not to exceed 15.9 megawatts thermal in accordance with the Technical Specifications (Appendix "A") appended thereto.

The Commission's regulatory staff has inspected the facility and has determined that, for operation as authorized by the license, the facility has been constructed in accordance with the application, as amended, the provisions of Provisional Construction Permit No. CPPR-36, the Atomic Energy Act of 1954, as amended (the Act), and the Commission's regulations. The licensee has submitted proof of financial protection in satisfaction of the requirements of 10 CFR Part 140.

The Board has concluded that the facility will operate in conformity with the application, as amended, the provisions of the Act, and the rules and regulations of the Commission and will not be inimical to the common defense

and security or to the health and safety of the public and that Vermont Yankee is technically and financially qualified to engage in the activities authorized by the operating license. The Board has further concluded that the activities authorized by the license will not have a significant, adverse impact on the quality of the environment and that the requirements of 10 CFR 50.57 (c) have been satisfied.

The license is effective as of the date of issuance and shall expire six (6) months from said date unless extended for good cause shown or upon the earlier issuance of a subsequent licensing action.

Copies of (1) the Board's Initial Decision, dated March 14, 1972, (2) Facility Operating License No. DPR-28, complete with Technical Specifications (Appendix "A"), (3) the Safety Evaluation for the Vermont Yankee Nuclear Power Station, dated June 1, 1971, and Supplements 1 and 2, thereto, dated July 7, 1971, and July 19, 1971, respectively, (4) the report of the Advisory Committee on Reactor Safeguards, dated March 9, 1971, and (5) "Discussion and Conclusions by the Division of Reactor Licensing, Pursuant to Appendix D of 10 CFR Part 50 Supporting the Issuance of an Operating License to Vermont Yankee Nuclear Power Corporation Authorizing the Loading of Fuel and Operation Not in Excess of 15.9 MWt, Vermont Yankee Nuclear Power Station, Docket No. 50-271," dated November 27, 1971, are available for public inspection in the Commission's Public Document Room, 1717 H Street, N. W., Washington, D. C. and at the Brooks Memorial Library, 224 Main Street, Brattleboro, Vermont. Copies of items

(2), (3) and (5) may be obtained upon request addressed to the Atomic Energy Commission, Washington, D. C. 20545, Attention: Director, Division of Reactor Licensing.

Dated at Bethesda, Maryland, this 21st day of March, 1972.

FOR THE ATOMIC ENERGY COMMISSION

Roger S. Boyd, Assistant Director
for Boiling Water Reactors
Division of Reactor Licensing

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3.3 LIMITING CONDITIONS FOR OPERATION	4.3 SURVEILLANCE REQUIREMENTS

greater than those specified in 3.3.C. In no case shall the number of inoperable rods which are not fully inserted be greater than six during power operation.

B. Control Rods

1. Each control rod shall be either coupled to its drive or placed in the inserted position and its directional valves disarmed electrically. When removing up to one control rod drive per quadrant for inspection and the reactor is in the refueling mode, this requirement does not apply.

B. Control Rods

1. The coupling integrity shall be verified:

   (a) When a rod is withdrawn the first time subsequent to each refueling outage or after maintenance, observe discernable response of the nuclear instrumentation; however, for initial rods when response is not discernable, subsequent exercising of these rods after the reactor is critical shall be performed to verify instrumentation response; and

   (b) When a rod is fully withdrawn, observe that the rod does not go to the over-travel position. Prior to startup following a refueling outage, each rod shall be fully withdrawn continuously to observe that the rate of withdrawal is proper and that the rod does not go to the over-travel position. Following uncoupling, each control rod drive and blade shall be tested to verify positive coupling and the results of each test shall be recorded. This test shall consist of checking the operability of the over-travel indicator circuit prior to coupling by withdrawing the drive and observing the over-travel light. The drive and blade shall then be immediately coupled and fully withdrawn. The position and over-travel lights shall be observed.

3.3 LIMITING CONDITIONS FOR OPERATION	4.3 SURVEILLANCE REQUIREMENTS
2. The control rod drive housing support system shall be in place when the reactor coolant system is pressurized above atmospheric pressure with fuel in the reactor vessel unless all operable control rods are fully inserted.	2. The control rod drive housing support system shall be inspected after reassembly and the results of the inspection recorded.
3. While the reactor is below 10% power, the Rod Worth Minimizer(RWM) shall be operating while moving control rods except that: (a) if after withdrawal of a significant number of rods during a start-up, the RWM fails, the start-up may continue provided a second licensed operator monitors further withdrawal; or (b) if all rods except those that can not be moved with control rod drive pressure are fully inserted, no more than two rods may be moved.	3. Prior to control rod withdrawal for startup the rod worth minimizer(RWM) shall be verified as operable by performing the following: (1) The Reactor Engineer shall verify that the control rod withdrawal sequence for the Rod Worth Minimizer computer is correct. (2) The Rod Worth Minimizer diagnostic test shall be performed. (3) Out-of-Sequence control rods in each distinct RWM group shall be selected and the annunciation of the selection errors verified. (4) An out-of-sequence control rod shall be withdrawn no more than three notches and the rod block function verified.

8/21/72

3.3 LIMITING CONDITIONS FOR OPERATION	4.3 SURVEILLANCE REQUIREMENTS

4. Control rod patterns and the sequence of withdrawal or insertion shall be established such that:

   a) when the reactor is critical and below 10% power the maximum worth of any in-sequence control rod which is not electrically disarmed shall be less than 1.25% delta k.

   b) when the reactor is above 10% power the maximum worth of any control rod even presuming a single error by an operator shall be less than 2.0% delta k.

3.3 LIMITING CONDITIONS FOR OPERATION	4.3 SURVEILLANCE REQUIREMENTS
5. Control rods shall not be withdrawn for startup or refueling unless at least two source range channels have an observed count rate greater than or equal to three counts per second.	5. Prior to control rod withdrawal for startup or during refueling, verification shall be made that at least two source range channels have an observed count rate of at least three counts per second.
6. During operation with limiting control rod patterns, as determined by the nuclear engineer, either:	6. When a limiting control rod pattern exists, an instrument functional test of the RBM shall be performed prior to withdrawal of the designated rod(s) and daily thereafter.
(a) Both RBM channels shall be operable; or	
(b) Control rod withdrawal shall be blocked; or	
(c) The operating power level shall be limited so that the MCHFR will remain above 1.0 assuming a single error that results in complete withdrawal of any single operable control rod.	

5. The Source Range Monitor (SRM) system has no scram function. It does provide the operator with a visual indication of neutron level. The consequences of reactivity accidents are a function of the initial neutron flux. The requirement of at least three counts per second assures that any transient, should it occur, begins at or above the initial value of 10^{-8} of rated power used in the analyses of transients from cold conditions. One operable SRM channel is adequate to monitor the approach to criticality therefore two operable SRM's are specified for added conservatism.

6. The Rod Block Monitor (RBM) is designed to automatically prevent fuel damage in the event of erroneous rod withdrawal from locations of high power density during high power level operation. During reactor operation with certain limiting control rod patterns, the withdrawal of a designated single control rod could result in one or more fuel rods with MCHFR's less than 1.0. During use of such patterns, it is judged that testing of the RBM system prior to withdrawal of such rods will provide added assurance that improper withdrawal does not occur. It is the responsibility of the Nuclear Engineer to identify these limiting patterns and the designated rods either when the patterns are initially established or as they develop due to the occurrence of inoperable control rods.

C. Scram Insertion Times

The control rod system is designed to bring the reactor subcritical at a rate fast enough to prevent fuel damage. The limiting power transient is that resulting from a turbine stop valve closure with a failure of the turbine bypass system. Analysis of this transient shows that the negative reactivity rates resulting from the scram with the average response of all the drives as given in the above Specification, provide the required protection, and MCHFR remains greater than 1.0.

The scram times for all control rods shall be determined during each operating cycle. The weekly control rod exercise test serves as a periodic check against deterioration of the control rod system and also verifies the ability of the control rod drive to scram. The frequency of exercising the control rods under the conditions of two or more control rods valved out of service provides even further assurance of the reliability of the remaining control rods.

3.3 LIMITING CONDITIONS FOR OPERATION

C. Scram Insertion Times

1. The average scram time, based on the de-energization of the scram pilot valve solenoids of all operable control rods in the reactor power operation condition shall be no greater than:

% Inserted From Fully Withdrawn	Avg. Scram Insertion Times (sec)
5	0.375
20	0.90
50	2.00
90	4.00

The average of the scram insertion times for the three fastest control rods of all groups of four control rods in a two by two array shall be no greater than:

% Inserted From Fully Withdrawn	Avg. Scram Insertion Times (sec)
5	0.398
20	0.954
50	2.120
90	4.25

2. The maximum scram insertion time for 90% insertion of any operable control rod shall not exceed 7.00 seconds.

4.3 SURVEILLANCE REQUIREMENTS

C. Scram Insertion Times

1. After each refueling outage with reactor pressure above 800 psig and prior to power operation all control rods shall be subject to scram-time tests from the fully withdrawn position. The scram times shall be measured without reliance on the control rod drive pumps.

2. At 16 week intervals, 50% of the control rod drives shall be tested as in 4.3.C.1 so that every 32 weeks all of the control rods shall have been tested. Whenever 50% of the control rod drives have been scram tested, an evaluation shall be made to provide reasonable assurance that proper control rod drive performance is being maintained.

3. 25 of the operable control rods, selected to be uniformly distributed throughout the core, shall be scram-time tested at full reactor pressure at the time intervals listed below following any outage exceeding 72 hours in duration: 1 week, 2 weeks, 4 weeks, 8 weeks, 16 weeks and continuing at 16 week intervals:

   (a) If the mean 90% insertion time of the tested control rod drives increases by more than 0.25 seconds or if the mean insertion time exceeds 3.25 seconds, then an additional sample of 25 control rods, selected to be uniformly distributed

3.3 LIMITING CONDITIONS FOR OPERATION	4.3 SURVEILLANCE REQUIREMENTS

throughout the core, shall be scram tested. If the mean 90% insertion time of the 50 selected control rod drives exceeds 3.75 seconds, then all operable drives will be tested. Subsequent testing shall revert to the original 25 control rods at the 1 week, 2 week, etc., sequence interval; and

(b) If any control rod exceeds the mean 90% insertion time of the 25 control rod sample by more than 0.75 seconds, then the 8 control rods immediately surrounding the control rod shall be scram tested. Thereafter, those additional control rods which exceed the mean 90% insertion time by 0.75 seconds shall be scram-time tested concurrently with the original 25 control rod samples.

4. Specification 4.3.C shall be evaluated after one operating cycle and the conclusions of this evaluation shall be reviewed with the AEC to determine the need and extent of this specification during subsequent operating cycles.

D. Control Rod Accumulators

At all reactor operating pressures, a rod accumulator may be inoperable provided that no other control rod in the nine-rod square array around this rod has a:

D. Control Rod Accumulators

Once a shift check the status of the pressure and level alarms for each accumulator.

3.3 (Cont'd)

B. Control Rod Withdrawal

1. Control rod dropout accidents as discussed in the FSAR can lead to significant core damage. If coupling integrity is maintained, the possibility of a rod dropout accident is eliminated. The overtravel position feature provides a positive check as only uncoupled drives may reach this position. Neutron instrumentation response to rod movement provides a verification that the rod is following its drive.

2. The control rod housing support restricts the outward movement of a control rod to less than 3 inches in the extremely remote event of a housing failure. The amount of reactivity which could be added by this small amount of rod withdrawal, which is less than a normal single withdrawal increment, will not contribute to any damage of the primary coolant system. The design basis is given in Subsection 3.5.2 of the FSAR, and the design evaluation is given in Subsection 3.5.4. This support is not required if the reactor coolant system is at atmospheric pressure since there would then be no driving force to rapidly eject a drive housing.

3. In the course of performing normal startup and shutdown procedures, a pre-specified sequence for the withdrawal or insertion of control rods is followed. Control rod dropout accidents which might lead to significant core damage, can not occur if this sequence of rod withdrawals or insertions is followed. The Rod Worth Minimizer restricts withdrawals and insertions to those listed in the pre-specified sequence and provides an additional check that the reactor operator is following prescribed sequence. Although beginning a reactor startup without having the RWM operable would entail unnecessary risk, continuing to withdraw rods if the RWM fails subsequently is acceptable if a second licensed operator verifies the withdrawal sequence . Continuing the startup increases core power, reduces the rod worth and reduces the consequences of dropping any rod. Withdrawal of rods for testing is permitted with the RWM inoperable, if the reactor is subcritical and all other rods are fully inserted. Above 10% power the RWM is not need since even with a single error an operator cannot withdraw a rod with sufficient worth, which if dropped, would result in anything but minor consequences.

4. The specified withdrawal sequences are characterized by homogenous, scattered patterns of control rods which minimize control rod worth. In the range from cold critical to somewhat less than 10% power, the calculated worth of any rod in the prescribed sequence is less than 1.25% delta k. Dropping of this maximum worth in-sequence rod at the design rate of the 5 feet/sec at power levels below 10% will result in peak fuel enthalpy of less than 170 cal/gm, the criterion for fuel clad perforation Above 10% power the consequence of a rod drop are less severe and the worths of rods in normal patterns are much less, therefore limiting rods worths to 2.0% delta k at power levels above 10% is conservative.

APPENDIX B

TO

OPERATING LICENSE DPR-28

NON-RADIOLOGICAL TECHNICAL SPECIFICATIONS

AND BASES

FOR

VERMONT YANKEE NUCLEAR POWER STATION

VERNON, VERMONT

VERMONT YANKEE NUCLEAR POWER CORPORATION

DOCKET NO. 50-271

7-31-72

1.0 LIMITING CONDITIONS FOR OPERATION

1.1 CONDENSER COOLING WATER

Applicability:

Applies to discharges of non-radioactive effluents from the station.

Objective:

To assure that non-radioactive effluents are released to the environment in an orderly manner and are maintained below established limits.

Specification:

A. Discharge Temperature

1. Thermal discharges into the Vernon Pond will be controlled to meet the following temperature rise conditions:

Maximum River Temperature Measured At The Upstream Monitor	Allowable Increase In Temperature Measured At The Downstream Monitor
Above 66°F	1°F
63°F to 65°F	2°F
59°F to 62°F	3°F
55°F to 58°F	4°F
Below 55°F	5°F

2.0 SURVEILLANCE REQUIREMENTS

2.1 CONDENSER COOLING WATER

Applicability:

Applies to monitoring and sampling of non-radioactive effluents discharged from the station and the determination of their environmental impact.

Objective:

To ascertain that the non-radioactive releases are below the established limits and to determine their effects on the environment.

Specification:

A. Discharge Temperature

1. River water temperatures shall be continuously measured at locations 3-1/2 miles upstream of the plant and 0.65 miles downstream of the Vernon Dam. The downstream monitoring location is subject to confirmation that it provides a representative, well-mixed water temperature of Vernon Pond as determined by the Temperature Monitoring Survey, pg. 11 and 12, Table 2.2-1.

1.0 LIMITING CONDITIONS FOR OPERATION	2.0 SURVEILLANCE REQUIREMENTS
2. No discharge of heated wastes, except for cooling tower blowdown, shall be made from the plant when the temperature of the river upstream of the condenser water inlet is 70°F or higher.	2. Mixing zone configuration and extent shall be monitored as described in Table 2.2-1, "Temperature Monitoring Survey" (as modified for the temporary operating license). The results of the temperature monitoring program shall be used to establish the 50 acre zones under varying river flows for open-cycle operation.
3. The discharges of heated water shall be controlled so that the rate of change due to operation or normal startup or shutdown conditions shall not exceed 0.5°F per hour from May 1 through October 31 nor 1.0°F per hour from November 1 through April 30, as measured at the upstream and downstream monitors.	
4. Thermal discharges into the Vernon Pond will be controlled so that the resultant temperature at the periphery of a 50 acre zone shall not exceed 45°F when the ambient river water temperature is less than 40°F or increase more than 5°F when the ambient river water temperature is above 40°F.	

1.0 LIMITING CONDITIONS FOR OPERATION	2.0 SURVEILLANCE REQUIREMENTS
B. Chemical Concentrations	B. Chemical Concentrations
1. The free residual chlorine in the plant effluent at the aerating structure shall be maintained at or below 0.1 mg/liter during chlorination by the automatic control system.	1. Free residual chlorine concentration shall be continuously monitored and recorded at the discharge from the condenser. At least once per month the automatic control system will be calibrated. During chlorination weekly free chlorine analyses shall be made at the end of the aerating structure by use of analytical methods that are sensitive to chlorine discharge concentration limits to determine the effectiveness of the aerating structure in removing free chlorine.
2. The desired criteria and goal toward which the applicant should strive is a total residual chlorine concentration of 0.1 mg/l or less in the plant effluent to Vernon Pond. However, plant design and the uncertainties of the interaction of chlorine residuals in the environment are such that flexibility must be incorporated into the criteria. Because of these uncertainties, the applicant will be permitted a period of 120 days in which total residual chlorine level in the discharge shall not exceed 0.5 mg/l, in accord with the detailed monitoring and analysis described in B2 under Surveillance Requirements. After evaluation of the report described in B2 the limiting condition of operation for total residual chlorine will be reconsidered.	2. During the first 90 days following the issuance of a full power operating license a series of samples will be taken at least on a weekly basis at the end of the aerating structure and in the immediate receiving water to characterize the chlorine discharge to Vernon Pond. Sampling shall be done in such a manner as to define the concentration-time relationships of free and combined chlorine at the end of the aeration structure and in the immediate receiving water area (100 ft from the discharge) during chlorination. Within 120 days of the issuance of a full power operating license, the applicant will submit a report describing the chlorine monitoring program and indicate the lowest practical total residual chlorine discharge level

1.0 LIMITING CONDITIONS FOR OPERATION	2.0 SURVEILLANCE REQUIREMENTS
If the total residual chlorine level at the aerating structure exceeds 0.5 mg/l or 0.1 mg/l in the receiving water 100 ft from the discharge structure, as determined by an analysis of 3 samples, chlorination shall cease until the system is corrected. Any corrective actions required to maintain the 0.5 mg/l limit shall be described in the plant Monthly Operations Report. During chlorination the discharge area shall be visually inspected (6 times per week) for evidence of detrimental effects on aquatic life, such as dead fish or fish in distress. Such evidence, if any, shall be noted and a record of such evidence shall be maintained.	to Vernon Pond (i.e. concentration over a given time period) that is compatible with plant operation.
3. The hydrogen ion concentration of plant discharges shall be controlled within pH limits of 6.5 - 8.0, except when due to natural causes.	3. The pH of the condenser cooling water shall be continuously monitored and recorded.
	4. During operation with inoperable analyzers or recorders, daily grab samples shall be collected and analyzed to confirm chemical concentration limits.
5. Approximately 10,600 gallons per month of sodium hypochlorite (15% solution) will be released to condenser cooling water during chlorination (during open-cycle) for slime and algae control. During closed-cycle cooling water operation about 900 gallons per month of sulfuric acid will be used for pH control. In the regeneration of cation and anion make-up demineralizers, about 470 gallons per month of sodium hydroxide will be used. Mixed bed demineralizers will require approximately 340 gallons per month of sulfuric acid for regeneration.	5. The usage of sodium hypochlorite and sulfuric acid for the treatment of cooling water and the usage of sulfuric acid and sodium hydroxide for demineralizer regeneration shall be recorded in the Plant Monthly Operation Report.

1.0 LIMITING CONDITIONS FOR OPERATION	2.0 SURVEILLANCE REQUIREMENTS
C. River Flow A minimum flow of 1,200 cubic feet per second of water will be provided through the dam at Vernon, Vermont at all times during plant operation. If, due to causes beyond Vermont Yankee's control, the flow must be reduced below 1,200 cfs, the condenser cooling system will be operated in a closed cycle mode and a report will be made to the AEC in accordance with Section 6.7 (a) of Appendix A.	C. River Flow Measurement of continuous river flow through the dam at Vernon, Vermont shall be recorded via the U.S.G.S. tailrace gage at the Vernon hydroelectric station.
D. Fish Kill Fish collected on the trash racks or traveling water screens at the station shall be identified by species, size and quantity. While the impact of fish mortalities which may occur at Vermont Yankee with respect to the local fishery resource is unknown, these data will be collected and assessed by AEC and state representatives as part of the surveillance program described in Section 2.22 of this Appendix (Non-Radiological Monitoring).	D. Fish Kill Data on fish collected shall be included in the monthly plant operating report.
	E. Administrative Controls 1. The action to be taken in the event of an abnormal occurrence in plant operation will be in accordance with Section 6.3 of Appendix A.

1.0 LIMITING CONDITIONS FOR OPERATION	2.0 SURVEILLANCE REQUIREMENTS

2. Records and logs relative to the following items shall be retained for 5 years:

   a) River water temperature measurement at the upstream and downstream monitors.

   b) Free and total chlorine residual measurements.

   c) pH measurements.

3. The following items shall be reported in the Monthly Operating Report:

   a) Free and total chlorine residual measurements.

   b) Usage of sodium hypochlorite, sulfuric acid and sodium hydroxide.

   c) Fish killed.

BASES - CONDENSER COOLING WATER

A. The condenser cooling water system is designed to operate with minimal thermal effects on the Connecticut River and is capable of meeting the river temperature requirements of the permit issued by the State of Vermont Water Resources Board, dated June 10, 1968, as amended November 26, 1971, and as set forth above in Specification 1.1, A - Limiting Conditions For Operation - Discharge Temperature. The Water Resources Board, in arriving at the conditions of the permit, had the advantage of considering the opinions of expert witnesses from the Fish & Game Department of the State of Vermont, New Hampshire and Massachusetts, as well as from the Technical Committee for Fishery Management of the Connecticut River Basin. The conditions of the permit, as amended, conform to the "Regulations Governing Water Classification and Control of Quality" (Section 11, Vermont Water Quality Regulations). This regulation has been approved by the Environmental Protection Agency and was adopted by the State of Vermont Water Resources Board on May 29, 1971.

The absolute temperature of the condenser cooling water discharge will be dependent upon the allowable temperature rise in the river and upon river flow. Cooling water leaves the condenser at about 20°F above ambient river water temperature during full power operation. This water is discharged directly to the river, if the river flow is sufficient to reduce the temperature to the allowable increase over ambient within the mixing zone. With low river flows, a portion of the condenser cooling water is diverted through the cooling towers prior to discharge to the river. Thus, when ambient river water temperature reaches 70°F wet bulb temperature, blowdown discharge temperature to the river is estimated to be approximately 90°F which, after mixing with the specified minimum river flow, is calculated to result in a rise in river temperature of 0.146°F. The rate of change of heat discharged to the river is a function of plant power level and condenser cooling system operation. Based on the fact that the station will normally be operated at a steady load, the heat rejected to the condenser cooling system should be constant. Control of this system is maintained such that sudden changes of flow from the discharge structure to the river, or sudden changes in the mode of cooling tower operation, are avoided -- thus minimizing rate of temperature changes.

BASES - CONDENSER COOLING WATER (continued)

Aquatic ecology investigations of the Connecticut River in the vicinity of Vernon, Vermont were undertaken by the Applicant during a four year period prior to plant operation. These investigations included qualitative and quantitative studies of the fish community, phytoplankton, zooplankton, benthic fauna, vascular plants and the physical and chemical characteristics of the river. Continuation of these studies as set forth in Specification 1.2, in conjunction with operation of the station in conformance with conditions of paragraph A of Specification 1.1, is designed to evaluate the impact of the plant on the ecosystem of the Connecticut River.

A temperature limitation in the Vernon Pond of 45°F when the ambient river water temperature is less than 40°F or an increase of no more than 5°F when the ambient river water temperature is above 40°F has been established by the Atomic Energy Commission. A 50 acre area has been exempted from these limitations for the first year during which a comprehensive study of the temperature variations in the Vernon Pond will be made. If the results of the temperature monitoring survey and the results of the operational monitoring program provide information which shows that there is no significant or irreversible effects on the Vernon Pond, an appropriate exempted area will be considered. Otherwise 10 acres will be established as the extent of the exempt area. Because the thermal plume from the plant discharge is dependent on the varying river flows, no permanent exempt area is specified. Rather the location of the exempt area will be established by a temperature monitoring program described in Table 2.2-1 as modified for the temporary operating license.

B. Chlorine, in the form of sodium hypochlorite, is introduced to the condenser cooling system to control biological fouling of the traveling water screens, piping, condenser tubes and cooling towers. The free chlorine residual in the condenser discharge is maintained at a preset limit by a chlorine residual analyzer-controller. The level of chlorine used in batch injection is determined by its effective concentration within the condenser tubes by the need to avoid deleterious effects in the discharge effluent and by the relative high cost of chlorine. The batch treatment is administered twice per day for 40 minute periods.

BASES - CONDENSER COOLING WATER (continued)

Vernon Pond contains ammonia and nitrogenous materials which will react to form chloramines (combined chlorine) with the free chlorine injection. Thus during chlorination both free and combined chlorine will be discharged to Vernon Pond.

As mentioned previously, the interim use of a 0.5 mg/liter total residual chlorine discharge limit in conjunction with a detailed monitoring program is based on the uncertainties of chlorine behavior in the environment, and the fact that plant design is such that the desired effluent limit of 0.1 mg/liter total residual chlorine may not be compatible with plant operation. Although the selection of 0.5 mg/liter total residual chlorine as a discharge limit is primarily a judgment decision based on limited information on chlorine interaction with the aquatic environment, the Staff believes that the maintenance of a 0.1 mg/liter or less free chlorine residual at the discharge will result in a total residual chlorine discharge less than 0.5 mg/liter. The Staff is also of the opinion that a 0.5 mg/liter total residual chlorine effluent diluted with receiving water is not likely to have an adverse impact on those organisms that are capable of avoiding the immediate discharge area (e.g. fish).

During closed cycle operation nearly all chlorine is expected to be dissipated as the cooling water passes through the cooling towers. In addition the discharge flow to the river is approximately 1% of the flow during open cycle operation. For cooling tower operation, the unlikely occurrence of 0.5 mg/liter of total residual chlorine discharged at minimum flow (1200 cfs) into Vernon Pond would result in a concentration of 0.005 mg/liter in the immediate receiving water. Much lower concentrations would be predicted for average and maximum river flows.

The discharge during open cycle operation is diluted with river water and subsequent unchlorinated condenser cooling water. The unchlorinated condenser cooling water further reduces the chlorine residual in the river. Each chlorine injection is followed by a period of over 11 hours during which no chlorine is discharged to the river. Estimated total chlorine residuals in the immediate discharge area during open cycle operation and

BASES - CONDENSER COOLING WATER (continued)

considering only river dilution would be 0.01 and 0.009 mg/liter for average and maximum river flows. For minimum flow, a discharge of 0.5 mg/liter of total residual chlorine would result in 0.4 mg/liter of the same in the immediate receiving water. Although this concentration has been shown to be a lethal to a number of different aquatic species in laboratory studies, and in field studies where organisms (e.g. fish) have been held in discharge areas, the applicability of these studies and their toxicity results to an operating power plant and to organisms that can avoid unfavorable stresses is questionable. Because few sessile organisms inhabit the immediate discharge area and mobile species such as fish would be expected to avoid 0.4 mg/liter of total residual chlorine no adverse impact on the Vernon Pond ecosystem is expected.

Vermont Yankee will establish the minimum chlorine injection program consistent with the requirements for control of biological fouling of the condenser cooling system and protection of aquatic life.

During closed cycle operation, sulfuric acid is used to maintain neutral pH and to prevent delignification of the wood in the cooling tower. The sulfuric acid addition is controlled by a pH control system which automatically adjusts the feed of sulfuric acid to correct and maintain the pre-established pH limit. The pH sample point is located in the condenser discharge.

Effluents from the regeneration of the makeup demineralizer are also introduced into the circulating water discharge. Sulfuric acid is used to regenerate cation exchange resins and sodium hydroxide is used to regenerate the anion exchange resins. These chemicals in the form of sodium sulfate are brought to a neutrual pH prior to discharge into the circulating water system.

C. A minimum flow of 1200 cubic feet per second will be maintained through the dam at Vernon, Vermont at all times during plant operation. This flow is maintained to provide the Connecticut River and its tributaries with the advantages and benefits of more adequate and sustained flow of water.

1.0 LIMITING CONDITIONS FOR OPERATION	2.0 SURVEILLANCE REQUIREMENTS

1.2 NON-RADIOLOGICAL ENVIRONMENTAL MONITORING

1. An environmental monitoring program will be conducted to monitor the effects of plant operation on the environment.

2.2 NON-RADIOLOGICAL ENVIRONMENTAL MONITORING

1. An environmental monitoring program given in Table 2.2 shall be conducted. An annual report of the previous year's studies will be submitted by April of each year. This report will record the results of the previous year's studies and discuss any significant trends of change observed in the parameters examined.

2. An advisory group comprised of representatives from the States of Vermont and New Hampshire, Commonwealth of Massachusetts and the Atomic Energy Commission shall meet at least annually to review the results of the monitoring program and recommend alterations to the program status.

TABLE 2.2-1

OPERATIONAL MONITORING PROGRAM

As in the case of the pre-operational monitoring program, the operational monitoring program includes the following studies:

1. Hydrology

2. Water Quality

   a. D. O. and Temperature
   b. Automatic Water Quality Monitoring
   c. Laboratory Analyses

3. Biological

   a. Phytoplankton
   b. Zooplankton
   c. Benthic Fauna
   d. Fish
   e. Vascular Plants

4. Entrainment

5. Sound Studies

1. Hydrology - Hydrology records will be obtained from the U.S. Department of Interior Geological Survey Gage at the Vernon Dam, for all years of the study, one-four. These data will be plotted to show the following:

1. Maximum instantaneous discharge
2. Cumulative discharge distribution
3. Mean monthly discharge
4. Mean daily discharge
5. Representative bi-hourly discharge

Plant operational data will be incorporated into this area of study so that a complete record of heat addition and flow rates will be available for understanding the biological and chemical parameters. Discussions of unusual flow patterns, as well as the 1200 cfs minimum flow, will be contained in reports and compared to the river flow prior to plant operation, primarily during the years 1967-1971.

Mixing zone configuration and extent under various rates of river flow and plant discharge modes will be determined from dye diffusion and temperature monitoring studies during the first year of full power plant operation. The studies to be performed are outlined in more detail below.

a) Temperature Monitoring Survey

A comprehensive temperature monitoring survey will be conducted when the plant goes on open cycle operation which will provide horizontal and vertical coverage of the thermal plume under varying river flows and plant discharge modes.

1. Station Locations - Transects will be established at approximately 500 foot intervals commencing 500 feet upstream of the intake structure and extending downstream to Vermont Yankee Station No. 3, a distance of 1.5 miles. Permanent range markers will be established on both shores to provide alignment control. Buoys will be placed at quarter points along each transect to facilitate vertical measurement. A minimum of 2 mobile temperature monitors shall be installed in Vernon Pond in appropriate locations selected by the applicant to monitor the thermal plume. These monitors shall be installed to monitor the blowdown during the temporary license period.

TABLE 2.2-1 (Continued)

2. Procedure - Monitoring of the plume will be performed at eleven stations upstream of Vernon Dam and also at Vermont Yankee Station No. 3 and the most upstream station below Vernon Dam which is safe to navigate. Bottom contours will be obtained at each station. Immediately prior to each temperature sampling time ambient temperatures will be measured and recorded at three depths (1', 5' and 10') simultaneously with the boat underway across the river at a constant speed.

In addition to the horizontal temperature tracking, vertical measurements throughout the entire water column will be obtained at quarter points in the river.

3. Monitoring Schedule - Based upon the available U.S.G.S. Flow Records of the area it is felt that the following schedule will adequately cover all flow conditions of the river and plant discharge modes.

Dates	Interval	No. Sampling Days/ Interval	Sampling Times/ Day
October - December	6 Days	2	2
January - March 15	9 Days	1	2
March 16 - June 1	6 Days	1	2

The above dates represent the approximate periods that ambient temperatures in the river are below 66°F. Additions or deletions from the above schedule will be made should extreme conditions be present on other than a scheduled sampling time or as a careful review of the data might dictate. The actual sampling times during any given day will be conducted once during the high flow period and once during the low flow period of the day. Time will be allowed for these flows to stabilize before commencing the survey. Close coordination with the operation of the plant will be maintained to determine changes in discharge modes.

4. Equipment Calibration - All instrumentation used will be calibrated prior to, during and at the completion of the survey. All temperature measurements will be determined by the use of thermometers and thermistors whose calibration has been performed by or is directly traceable to the National Bureau of Standards.

5. Data Reduction - Data obtained from each complete set of temperature measurements will be reduced and ΔT above ambient river temperature will be plotted as isotherms. Plotted data will include date, time, river flow, ambient temperatures, and surface areas within different isotherms. River flows will be computed from river stage observations at the Vernon Hydroelectric plant without regard to backwater corrections. Actual flows will be submitted pending receipt from U.S.G.S.

b) Dye Diffusion Study

A dye diffusion survey will be conducted in Vernon Pond, concurrently with one or more of the temperature surveys. As the natural temperatures in Vernon Pond vary at times up to 1.5°F this dye study would help determine increases in ambient not due to plant heat load as background fluorescence is relatively constant. In addition, this study will provide a check on the diffusion characteristics of the Vernon Pond.

2. Water Quality

a. Dissolved Oxygen and Temperature - Special dissolved oxygen and temperature studies of the Connecticut River will be undertaken during the first two years of plant operation. Variations of temperature and dissolved oxygen at selected stations with respect to location and depth in the river will be determined at different times of the year. The stations to be used in these studies will be those used in the pre-operational special dissolved oxygen and temperature studies (Stations 1, 2, 3, 4, 5 and 7 on Figure 2.2) unless the hydrology studies indicate a need to change the location of these stations.

If weather and river flow conditions permit, a set of data will be collected once each month in the first year, once every other month in the second and four times a year during the third and fourth years. Data will be presented as in the pre-operational study and any significant changes in D. O. or temperature patterns will be noted.

TABLE 2.2-1 (Continued)

b. Water Quality Monitoring - Operation of two Honeywell monitors at Stations 3 and 7 will continue. River temperatures at these locations will be reduced to hourly average temperatures from which daily and monthly average temperatures will be calculated and tabulated. D. O. will be tabulated as daily averages and as maxima and minima with their respective times of occurrence. pH will be tabulated as daily maxima, daily minima, and daily range. Turbidity and Conductivity will be tabulated as daily averages.

c. Laboratory Analysis of Water Quality Parameters - Laboratory analyses for selected water quality parameters will be conducted on a routine basis throughout the survey period. It is proposed to establish a 3 phase program for the sampling and analysis. Samples of water collected at the groundwater stations listed in Table 4.8.1c of Appendix A of the Technical Specifications shall be analyzed during the Spring and Fall for sulfates, sodium and chloride concentrations.

Phase I (First Year) - Grab samples for water quality parameters will be collected from each of six Vermont Yankee sample stations (Stations 1, 2, 3, 4, 5 and 7 on Figure 2.2) once every month during the first year. These samples will be analyzed for the following water quality parameters: pH, dissolved oxygen (D.O.) biochemical oxygen demand (BOD), total hardness, calcium hardness, chloride, sulfate, sulfite, total phosphorus, nitrate solids, cadmium, total chromium, copper, total iron, nickel, sodium, zinc, mercury, silver and lead.

If the BOD is found to be significantly different from that encountered in the pre-operational studies, a new determination of the deoxygenation constant, K_1, will be made and other studies of the organic wastes in the stream will be undertaken.

Phase II (Second Year) - The sampling and analysis program of the second year will be identical to the 1969-1970 year long intensive sampling program at Stations 3 and 7. Samples at these two stations will be collected every 15 days ensuring a progression of sampling dates through each day of the week. Every other set of samples will be collected as a composite sample from noon one day to noon the following day. The alternative set of samples will be collected as a grab sample at one time. Water quality tests to be performed on these samples will be identical to those in the Phase I program.

Phase III (Third and Fourth Years) - Samples taken for water quality analysis in the third and fourth years will be grab samples collected four times a year at Stations 3 and 7.

The parameters for which analyses will be performed will be the same as those in Phases I and II, unless this previous work indicates a need to modify the list of tests.

Variation in magnitude of these parameters in all years of study will be related in the volume of flow in the river. Other trends and changes will be noted in reports and be available for use in evaluation of the biological parameters.

3. Biological

a. Phytoplankton and Zooplankton Studies - If phytoplankton and zooplankton changes occur as a result of thermal enrichment in the river, it is probable that such changes will be evident during the first years of operation of Vermont Yankee. Therefore, the major emphasis in the first two years of operational biological studies will be on plankton. Samples will be collected from each of the six stations that were used in the pre-operational study. These stations are:

a) Vermont Yankee Station 7 (midstream), 4.25 miles north of Vernon Dam. Average depth 35 feet.

b) Vermont Yankee Station 5 (midstream), 1.25 miles north of Vernon Dam. Average depth 20 feet.

c) Vermont Yankee Station 4 (New Hampshire quarter), 0.75 miles north of Vernon Dam. Average depth 9 feet.

d) Vermont Yankee Station 4 (Vermont quarter), 0.75 miles north of Vernon Dam. Average depth 10 feet.

e) Vermont quarter, 0.1 miles north of Vernon Dam. Average depth 49 feet.

f) Vermont Yankee Station 3 (monitor), 0.65 miles south of Vernon Dam.

Each station will be sampled monthly during the first through fourth years. An additional sample will be taken at each station during the months of May through October in the first and second year. Phytoplankton and zooplankton counts will be made in all samples collected and planktons will be identified to the appropriate level.

b. Benthic Fauna - Samples of benthic fauna from each of the six Vermont Yankee Stations will be collected once during the months of May and August in the first and in the fourth year. One sample from each station will be collected monthly in May through December in the second and third year. In the third year the program will be intensified by the collection of an additional sample set each month in June, July, August and September. The number of genera at each station will be determined and the relative abundance of each genus will be recorded.

c. Fish - In the first year the collection of approximately 500 fish above and below Vernon Dam will be made. All fish will be weighed and measured and representative scale samples will be taken for age-growth determination. Preliminary age-growth studies will be completed during the first year as well as the completion of age-growth studies from the pre-operational sampling programs. In the second year a collection of approximately 2,000 fish above and 2,000 fish below Vernon Dam will be made. During the third year, these data, as well as previous data, will be used to determine and prepare a detailed report regarding the growth rates in the fish population both above and below Vernon Dam. In the fourth year, a collection of approximately 1,000 fish upstream and downstream of Vernon Dam for final age-growth determination, species diversity and weights will be completed. Species make-up and population changes, if they occur, will be compared with pre-operational data.

d. Vascular Plants - In the first, second and fourth years, vascular plant studies will be limited primarily to the observation of two marshes which were examined in considerable detail in the pre-operational studies. Any unusual changes will be noted and recorded. During the third year transect studies will be completed in these marshes duplicating the methods used in the pre-operational survey of these areas.

TABLE 2.2-1 (Continued)

4. Entrainment

The following studies will be conducted to better understand the immediate effects of the entrainment:

1. Phytoplankton and zooplankton samples will be taken in the cooling water intake and discharge structures when the plant is operating in an open cycle mode. Samples will be taken bi-weekly at approximately two week intervals. Each sample will be analyzed to determine the number of organisms present per unit volume of water and the dominant organisms present will be identified. The number of organisms surviving in the discharge sample will be determined by generally accepted methods and recorded.

2. Fish larvae in the samples mentioned in (1) above will be counted and identified.

3. When the plant is operating in a closed cycle mode phytoplankton and zooplankton samples will be taken in the service water intake structure. Samples will be taken bi-weekly at approximately two week intervals and analyzed as noted in (1) and (2) above.

5. Sound Studies - An environmental sound survey will be conducted during the first year of plant operation. The survey will be conducted during at least two seasons of the year. It will consist of sound pressure level measurements taken at 12 sampling points described below. These sampling points are the same as those for which background sound level measurements are available. The sample points are as follows:

1. North property line of Vermont Yankee
2. Closest residence to Vermont yankee - Zalusny home
3. Gasoline station at the entrance road
4. Vernon school
5. Hinsdale school
6. Home on the east shore of the river opposite the plant
7. Intersection of New Hampshire Route No. 119 and dirt road to shoreline opposite Vermont Yankee
8. Water Quality Monitor No. 3
9. Entrance gate to Hinsdale Race Track
10. Home in New Hampshire (Paul Aust house)
11. Route No. 142, west of Vernon school
12. Route No. 142, in parking lot of Vernon Post Office

TABLE 2.2-1 (Continued)

Sound level measurements will be taken on the "A", "B", "C" and "All Pass (Linear)" scales with analyses in 10 preferred frequency bands ranging from 31.5 Hz to 32,000 Hz.

A report will be issued reporting the results of the environmental sound survey.

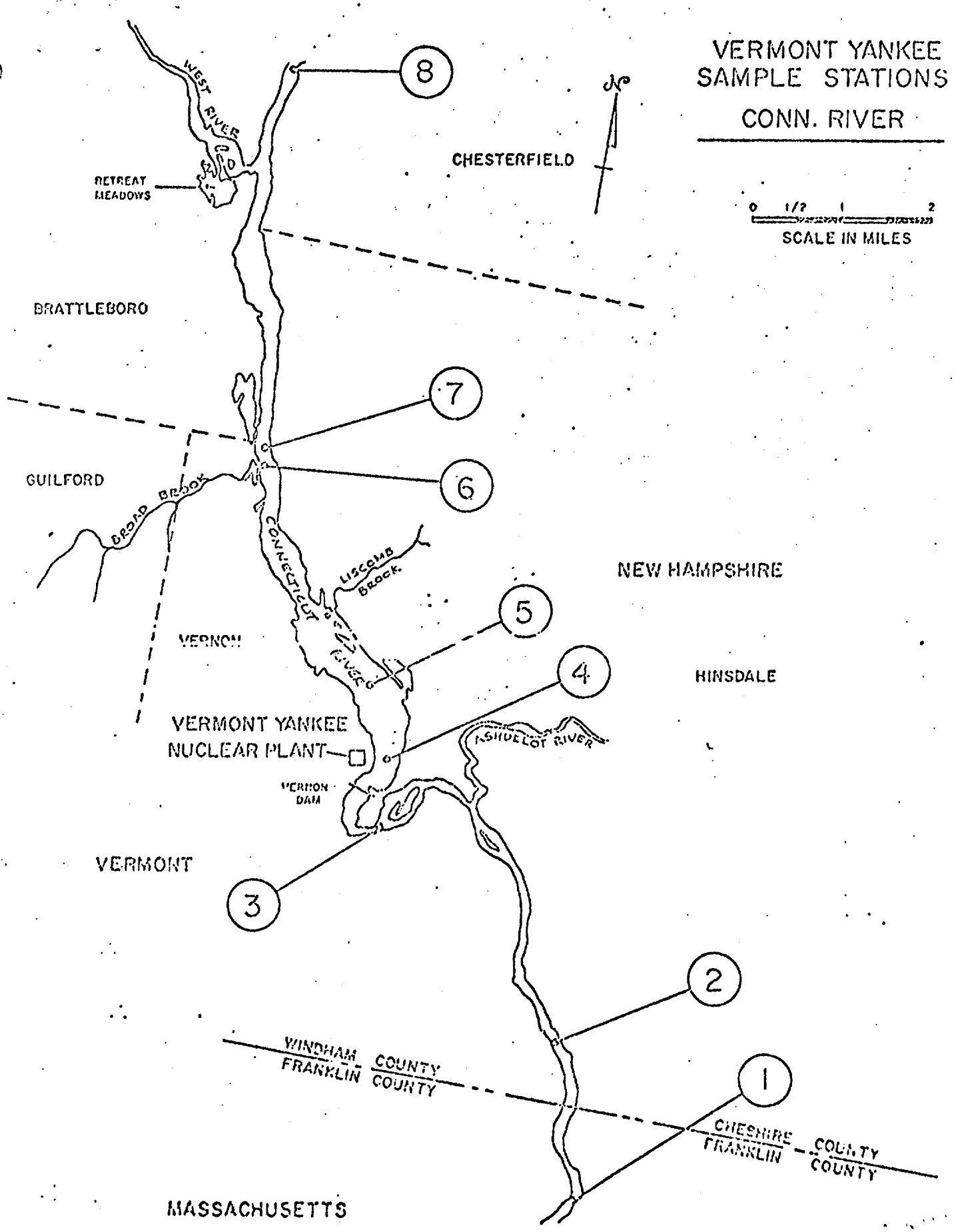
VERMONT YANKEE
SAMPLE STATIONS
CONN. RIVER
0 1/2 1 2
SCALE IN MILES
8
7
6
5
4
3
2
1
WEST RIVER
RETREAT MEADOWS
CHESTERFIELD
BRATTLEBORO
GUILFORD
BROAD BROOK
CONNECTICUT RIVER
LISCOMB BROOK
NEW HAMPSHIRE
VERNON
HINSDALE
VERMONT YANKEE
NUCLEAR PLANT
VERNON DAM
ASHUELOT RIVER
VERMONT
WINDHAM COUNTY
FRANKLIN COUNTY
CHESHIRE COUNTY
FRANKLIN COUNTY
MASSACHUSETTS

TABLE 2.2-2

VERMONT YANKEE OPERATIONAL STUDIES
YEARLY SAMPLING TIMES/NUMBER STATIONS

	First Year		Second Year		Third Year		Fourth Year	
	Number Sampling Times	No. Stations	Number Sampling Times	No. Stations	Number Sampling Times	No. Stations	Number Sampling Times	No. Stations
Hydrology	12	1	12	1	12	1	12	1
Water Quality								
D.O. & Temperature	9*	6	5*	6	4	5	4	6
Water Quality Monitor	Continuous	2	Continuous	2	Continuous	2	Continuous	2
Laboratory	12*	6	24	2	4	2	4	2
Biological								
Phytoplankton	18	6	18	8	12	6	12	6
Zooplankton	18	6	18	6	12	6	12	6
Benthic Fauna	2*	6	9*	6	13*	6	2*	6
Fish	**	6	**	6	**	6	**	6
Vascular Plants	1	2	1	2	12	2	1	2

*Estimated - Actual Number of Sampling Times will depend on weather conditions.

**Actual Number of Sampling Times will depend on success of sampling.

BASES - OPERATIONAL MONITORING PROGRAM

Environmental changes as a result of the Vermont Yankee Nuclear Power Plant operation may occur at various rates for different physical, chemical and biological parameters. Biological changes as a result of thermal enrichments do not occur at all biological levels at the same time. In general, lower forms of life such as zooplankton and phytoplankton respond more quickly to warmer temperatures than do such higher forms as fish and vascular plants. In view of this fact, a graded program of monitoring of different ecological parameters is planned. Emphasis of plankton, bottom fauna and water chemistry will be made during the first three (3) years of the study. Fish and vascular plants will have major study emphasis in the second through fourth years. All parameters will be studied each year to some degree and the various programs will be kept flexible enough to accommodate any indicated need for a change in emphasis or an immediate expansion of the monitoring program.

Instrumentation calibration will be performed bi-weekly. The temperature monitor is calibrated to 0.1°F, the conductivity sensor is calibrated to $\pm$ 0.75% full scale at 25°C and the dissolved oxygen sensor is calibrated to 0.1 ppm.

The following lists the sensitivity of the techniques used in water quality analysis:

pH	0.001
Alkalinity	0.1 mg/liter
Total Hardness	1.0 mg/liter
Calcium Hardness	1.0 mg/liter
Chloride	0.1 mg/liter
Sulfate	0.1 mg/liter
Total Phosphate	0.01 mg/liter
Ortho Phosphate	0.01 mg/liter
Nitrate Nitrogen	0.01 mg/liter
Ammonia Nitrogen	0.01 mg/liter
Color	0.5 Standard Units
Turbidity	0.01 Formazin turbidity units
Total Solids	1.0 mg/liter
Fixed Total Solids	1.0 mg/liter
Settleable Solids	0.1 mg/liter
Mercury	0.0005 mg/liter
Cadmium	0.001 mg/liter
Chromium	0.005 mg/liter
Copper	0.02 mg/liter
Iron	0.01 mg/liter
Lead	0.005 mg/liter
Nickel	0.1 mg/liter
Chlorine Residual (Free)	0.02 mg/liter
Total Chlorine Residual (Chemical)	0.05 mg/liter