SEABROOK STATION

APPLICANTS

ENVIRONMENTAL REPORT

OPERATING LICENSE STAGE

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SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

SEABROOK, NEW HAMPSHIRE

Volume 1

SEABROOK STATION

APPLICANTS

ENVIRONMENTAL REPORT

OPERATING LICENSE STAGE

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

SEABROOK, NEW HAMPSHIRE

Revision 2
June 1982

INTRODUCTION

This Environmental Report-Operating License Stage (ER-OLS) constitutes one portion of an application to the United States Nuclear Regulatory Commission (NRC) for a Class 103 operating license for Seabrook Station - Units 1 and 2. Its purpose is to supply to the NRC certain information the NRC requires in order to discharge its obligation under the National Environmental Policy Act of 1969 (Public Law 91-190).

In accordance with 10CFR51.21, this ER-OLS discusses the same matters described in Applicant's Environmental Report - Construction Permit Stage (ER-CPS), but only to the extent that they differ or reflect new information than was presented in either Applicant's ER-CPS or in the Final Environmental Impact Statement (FEIS) prepared by the NRC in connection with the issuance of the construction permit for Seabrook Station - Units 1 and 2. Information contained in the Seabrook Station - Units 1 and 2 ER-CPS or FEIS that remains unchanged is incorporated by reference in Applicant's ER-OLS.

This ER-OLS is organized in the manner set forth in the NRC's Regulatory Guide 4.2, Revision 2 dated July 1976. The Table of Contents which follows this Introduction presents an overview of the report.

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1.0 INTRODUCTION

CHAPTER 1

PURPOSE OF THE PROPOSED FACILITY AND ASSOCIATED TRANSMISSION

1.0 INTRODUCTION

The purpose of this section is to document the need for the Seabrook Nuclear Generating Station - Units 1 & 2. The following subsections include a discussion of conservation programs, load forecasting, system capability, reserves, bulk power planning, and criteria for Public Service Company of New Hampshire (PSNH), and the New England Power Pool (NEPOOL). Other objectives of the plant and the consequences of delay are also discussed.

Since filing the Seabrook 1 & 2 Environmental Report - Construction Permit Stage (ER-CPS), the following factors affecting the system have changed:

a. The load forecasts have been updated.

b. Substantial changes have been made in the construction schedule of proposed units in New England.

c. The percent ownership of the Seabrook units has changed. The anticipated ownership is tabulated in Table 1.0-1.

The differences between the data presented here and that currently on file, are due to the use of current data in this document.

The planning of bulk power facilities in New England is undertaken through NEPOOL. As stated in the agreement by which New England's major electric utility systems created NEPOOL in 1971:

"The objectives of NEPOOL are, through joint planning, central dispatching, cooperation in environmental matters, and coordinated construction, operation and maintenance of electric generation, and transmission facilities owned or controlled by the Participants, and through the provision of a means for more effective coordination with other power pools and utilities situated in the United States and Canada:

(a) to assure that the bulk power supply of New England and any adjoining areas served by Participants conforms to proper standards of reliability, and

(b) to attain maximum practicable economy, consistent with such proper standards of reliability, in such bulk power supply and to provide for equitable sharing of the resulting benefits and costs."

The obligations of the NEPOOL Participants include, among other things, the central dispatch of all generating units owned by NEPOOL Participants, maintenance of generating reserves adequate to insure the reliability of the pool, joint use of the transmission facilities for specified pool purposes, and joint planning of future generation and transmission.

To implement its objectives, NEPOOL has formed various committees and working groups to examine specific aspects of regional cooperation. One of these committees, the NEPOOL Planning Committee, has a Generation Task Force charged with investigating the expansion of generation for the New England region. The Generation Task Force has established guidelines for capacity planning within which the NEPOOL Participants coordinate their plans, and the Planning Committee has formulated planning standards to assure reliable system development.

Every electric system in New England is dependent, in some degree, upon its transmission interconnections with neighboring systems within New England and beyond for the reliability of its system. This interdependence between utility systems and between larger areas is an essential ingredient of modern bulk power supply.

NEPOOL provides an organizational framework through which the New England Utility Systems can consummate purchases or sales with each other and neighboring regional systems such as the New Brunswick Electric Power Commission and the New York Power Pool.

Under NEPOOL each Participant has an obligation to meet its own "Capability Responsibility". This means that each individual system must install or otherwise participate in capacity equal to its share of the total generating capacity required to serve the New England load.

New England is one of the four areas that make up the Northeast Power Coordinating Council (NPCC). NPCC acts as a coordinator for planning and operating purposes between its four areas. NEPOOL is a power pool and a major subregion of NPCC. In calculating bulk power requirements, ties to neighboring pools are given due consideration; therefore, this report will deal with the applicant's system and NEPOOL only.

TABLE 1.0-1

ANTICIPATED SEABROOK OWNERSHIP
AT THE END OF THE TRANSFER PERIOD*

Owning Entity	Ownership Percentage
Public Service Company of New Hampshire	35.23497%
United Illuminating Company	17.50000
Massachusetts Municipal Wholesale Electric Company	11.59340
New England Power Company	9.95766
Central Maine Power Company	6.04178
Connecticut Light & Power Company	4.05985
Commonwealth Electric Company	3.52317
Montaup Electric Company	2.89989
Bangor Hydro-Electric Company	2.17391
New Hampshire Electric Cooperative	2.17391
Central Vermont Public Service Corporation	1.59096
Maine Public Service Company	1.46056
Fitchburg Gas & Electric Light Company	0.86519
Taunton Municipal Lighting Plant Commission	0.43479
Vermont Electric Cooperative, Inc.	0.41259
Hudson Light & Power Department	0.07737
TOTAL	100.00000%

11/26/79

* All transfers expected to be complete by approximately June 1982

1.1 SYSTEM DEMAND AND RELIABILITY

1.1 SYSTEM DEMAND AND RELIABILITY

1.1.1 Conservation Programs

PSNH has sponsored the Edison Electric Institute National Energy Watch (NEW) program in its service area. This program is aimed directly at the residential customer and its objectives are: To help reduce the drain on fossil fuels that are in short supply, to reduce the requirement for new generating facilities, and to help the homeowner to reduce his energy bills to a minimum. The program stresses methods of conserving energy such as the thermal integrity of the residence (insulation), the installation of more efficient energy consuming equipment, and the adoption of better energy use habits by the consumer.

The NEW program has been advertised via press conferences and promotional ads in newspapers, radio spots, truck signs, counter cards, and bill stuffers. Presentations have been made at service clubs and other organizational meetings.

PSNH has trained people who make energy audits of a customer's premises on request. To date over 5,700 audits have been completed.

The program is ongoing in that conservation literature is continuously being supplied to the public and PSNH personnel are continuing to make energy audits.

It appears that PSNH will be participating in the Residential Conservation Service Program sometime in 1981, after the N. H. State Plan is approved by the Department of Energy.

The RCS program will be folded in under the umbrella of the NEW Program. It will be presented to residential customers as the NEW-RCS Program (National Energy Watch - Residential Conservation Service). This program brings together in one package many suggestions to help customers adopt energy-conserving practices, install conservation measures, and produce energy from renewable resources. The result will increase energy efficiency in the home.

In addition to identifying energy measures applicable for the home, we will provide lists of qualified contractors who can install suggested measures, suppliers who sell conservation materials for the do-it-yourselfer, and lenders who will loan money for energy-related home improvement projects.

Because 20% of all U.S. energy is consumed in homes, the NEW-RCS Program is expected to have an important impact on energy conservation, assist in reducing oil imports, aid the national balance of payments and slow the pace of inflation.

PSNH implemented a program in the spring of 1979 to help commercial and industrial customers conserve energy. This program is called the Energy Management Action Program. The assistance to the customer covers energy use and misuse in buildings, planning for energy management, analyzing utility bills, energy audits identifying low/no cost opportunities to conserve energy, lighting system modifications, and power factor corrections.

In addition to the extensive customer assistance conservation programs offered by the Company, the Company also has several load management and conservation incentives in its present rates. The existing tariff includes optional time-of-day rates and optional off-peak water heating rates for residential customers, optional off-peak provisions in large power customer's rates, and off-peak water heating rates for general service customers.

The Company has also suggested to the New Hampshire Public Utilities Commission several additional programs it believes could be offered to customers to further encourage the wise use of energy. These programs include interruptible rates for large power customers, optional time-of-day rates, a revised off-peak water heating program, and an off-peak storage space heating program.

1.1.2 Effects of Increased Rates

The effect of increasing rates on consumption of electrical energy is commonly termed the elasticity of demand with respect to price.

Increases in the price of all energy forms (electricity, oil, and gas) have had an effect on the consumption of electrical energy. Specific quantification of the response to price is difficult, although some general effects are known.

First, the response to price of the utilization of an appliance or process is dependent upon the extent of its alternatives. For example, response to electric price increases on appliance utilization may be greater for electric space heating and water heating, due to the availability of supplemental and alternate systems, than for appliances where no clear or close substitute exists. Thus the demands for electricity to run lights or a refrigerator would be less elastic than the demand for space heating and water heating.

Second, the response to price is dependent on the extent that the item is considered a necessity and electricity is considered a necessity by many.

Third, cross elasticity must be taken into account. For instance, the Company believes that recent increases in the price of home heating oil have been responsible in part for the number of electric space heating units installed in new residences, rising from 37% in 1977 to 70% in 1979.

The Company has tried to quantify the effects of increasing electrical rates on the consumption of electrical energy and this effect is one of the factors that has led the Company to reduce its load forecast to approximately 4.2%. The timely completion of Seabrook Station will help to insure the reasonability of electric prices with respect to other energy prices in the Company's service area and provide an overall energy insurance should the availability of both oil and natural gas become restricted among commercial, industrial, and even residential users.

1.1.3 Applicant's System

PSNH supplies approximately 90% of the electric power used in New Hampshire. This includes retail sales and wholesale for resale sales. The highest net prime peak experienced by the Company was 1203 MW on January 12, 1981. To deliver this power to its customers, the Company uses a transmission system made up of 345 kV, 115 kV, and 69 kV lines which are interconnected with lines of other companies in the New England Power Pool.

To meet the 1203 MW of load, the Company had 1474 MW of generation. This generation is detailed in Table 1.1-1. To meet future loads, the Company is planning the generation additions shown in Table 1.1-2. These additions, included with existing generation, will give the Company the ownership of 2045 MW when Seabrook 2 is complete.

The highest peak load experienced in New England was 15,620 MW experienced on January 12, 1981. New England had a total of 21,669 MW of generation to meet that load.* The New England Load and Capacity Report is appended (Appendix B). This shows a breakdown of the generation in New England by type and also details the expected additions, reratings and retirements.

1.1.4 Load Characteristics

An integral part of managing an electric utility is forecasting future electric demand within the utility's service area. Yet forecasting has increasingly become a more formidable challenge as social, economic, demographic and political forces create an ever-changing pattern of complexity. To provide a reasonable forecast in this environment requires continuing research to develop and improve the information and techniques which provide the basis for the forecast.

1.1.4.1 Load Analysis

The actual peak demands for PSNH during the past 10 years and the most recent forecast of peak demand are shown in Table 1.1-3. Table 1.1-4 shows actual and forecast annual energy requirements for PSNH.

PSNH's sustained long-term load growth reflects the rapid growth which New Hampshire continues to experience in population, business, and other areas.

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*New England Load and Capacity Report, 1981-1996, NEPOOL, April 1, 1981.

To meet the anticipated energy requirements of New Hampshire, PSNH must provide a reliable and economic source of power. Seabrook Units 1 and 2 will be PSNH's major plan to meet this need. Figures 1.1-1 and 1.1-2 show the extent to which Seabrook will serve PSNH's energy requirements in 1986 and 1987.

The actual peak demand for NEPOOL for the past 10 years and the most recent forecast of peak demands are shown in Table 1.1-5. Table 1.1-6 shows actual and forecast energy requirements for NEPOOL.

1.1.4.2 Demand Projections

Compared to earlier forecast methodologies, PSNH's current methodology incorporates several improvements. Prior to 1973, the peak load forecast was initially prepared independent of the energy sales forecast by applying regression analysis techniques to historical peak load data and by adjusting these loads where specific knowledge of load patterns and load conditions were known. The resulting peak load values were then cross checked with the energy sales forecast for reasonableness by adding to energy sales an estimate of system losses and Company use to obtain net prime output. The system annual load factor was then calculated using the derived net prime output and forecasted peak loads. These resulting load factors were then compared to the historical record of such values and judged for reasonableness in terms of implied future trends.

However, the occurrence of the energy crisis just prior to the 1973-74 winter peak and the abrupt change that conservation and economic factors had on peak loads suggested that peak load forecasts based primarily on regression analysis were less appropriate for the future since insufficient peak load data had been accumulated under the new circumstances. It was, therefore, decided that a method basing the peak load forecast upon the energy sales would be more appropriate because the energy sales forecast used a more advanced methodology for recognizing the change that had occurred, and also incorporated detailed considerations such as various end-use analyses, demographic factors, and economic considerations. The preference for this methodology was based upon the principle that breaking down any of a forecast's major components into smaller independent components about which hopefully more is known, minimizes reliance on judgment and provides a more scientifically developed forecast.

Another advancement in the companies forecast is the development of a computer model which produces 8,760 hourly loads for each year of the forecast, allowing the impact of load management programs to be quantified for peak and off peak hours.

The projected values for annual peak demand which are based on the sales forecast are shown in Table 1.1-3 and were developed in the following manner. The total prime sales forecast, is produced by summarizing its six individual classes: residential, commercial, industrial, public street lighting, other public authorities and other utilities. Historical trends of sales to these various classes are developed in chart form as a guide to future sales estimates. The estimates for each of the classes is prepared using a particular procedure developed for each class. Following is a list of some of the input data used in one or more of the class forecasting procedures:

a. Historical data, and future estimates related to state population, number of households and customers.

b. Past and projected statistics on residential customer electrical appliance saturations and kilowatt-hour use per appliance, including hourly load characteristics of off peak devices.

c. Historical and estimated future data on the number of electrical space heating customers and the kilowatt-hour use per installation.

d. Data on expected future kilowatt-hour use per customer reflecting past historical trends and based on general information affecting future use patterns such as the Department of Energy Appliance Efficiency Standards, household size and supplemental systems.

e. Reports on present and expected future changes within the Company's service area collected from operating divisions. These reports from division managers include general information on growth, economic conditions, and subjective evaluations of other factors which might influence sales in their areas, together with reports of existing customers' electric load changes and plans for new customer electric load additions.

f. Industrial class sales are examined by two digit standard industrial classification codes (SIC). The industrial class is divided into manufacturing and nonmanufacturing components. The manufacturing component includes manufacturing and processing plants and offices for manufacturing concerns, while the nonmanufacturing component, also known as the commercial and services component, consists of a wide variety of customers including hospitals, retail, and wholesale sales establishments.

Other data of significance which is collected and weighed for their potential on the sales forecast include those statistics and reports which relate to national and state demography, future business or economic conditions, state employment forecasts, information on potential new uses for electricity, and many other factors believed to influence the level of kilowatt-hour sales by the Company.

Based on a wide range of information, the annual sales forecast is developed for each class and combined to produce the total annual sales forecast, before load shape modifications or specific load management programs are introduced. Total monthly energy sales are derived from total annual sales using a disaggregated class-by-class methodology. Monthly factors for each class are developed using seasonal adjustment programs which statistically differentiates among the general trend components, seasonal components, and irregular components influencing loads. Applying these monthly factors to class annual sales forecasts produces monthly prime sales by class which are then summed to provide a combined monthly sales prime total for all classes for each month of the year. Actual monthly sales data are shown in Table 1.1-7 and the forecast of monthly sales is shown in Table 1.1-8.

Monthly net prime output is calculated from monthly energy sales by determining appropriate monthly factors to apply to energy sales to account for Company use, energy losses, and the lag in energy sales compared to production.

Load factors for each month are developed, with consideration given to time-of-day rates, load management, conservation, and supplemental systems. These load factors are then applied to monthly net prime output to obtain monthly peak demands for each month of the forecast period. The monthly net prime output and monthly peak loads developed above are submitted to the hourly load model, which uses daily load shapes for peak days, average weekdays and average weekend days by month to calculate hourly load data for all 8,760 hours of each year of the forecast. Specific load modification programs are introduced to these initial hourly loads and the impact of each modification is quantitatively developed for each hour of the year. These specific load modification programs include base load capacity purchases by other utilities served by the company, as well as residential off-peak storage appliances. Actual monthly peak demands are shown in Table 1.1-9 and the forecast of monthly peak demands are shown in Table 1.1-10.

PSNH's forecast projects an annual growth rate of approximately 4.0% in total electrical energy used by customers, and an annual growth rate of 4.2% in the peak demand.

These rates are below the actual historical growth which occurred before the 1973/74 oil embargo period and are more representative of conditions emerging from the past five post-embargo years. Tables 1.1-11 and 1.1-12 show previous forecasts and compare them to actual data that is available. The tables demonstrate the substantial changes that have occurred. The growth rate of the most recent edition of the forecast is lower than the prior edition by approximately 1% for energy and peak loads. The downward revision reflects post-embargo conditions which are closely coupled with energy and the economy.

The forecast continues to show confidence in New Hampshire's future, more so than the confidence shown in many other forecasts for the nation as a whole. PSNH believes this confidence is justified because of the economic and other life style advantages which New Hampshire has offered in the past and should continue to offer in the future as compared to other areas of the nation and the region. The forecast is therefore based on the belief that the long-term economy of New Hampshire will remain sound as a result of continued prudent and coordinated planning within the state by all levels of industry and government.

The Company has also been jointly involved in the development of an econometric end-use model with other members in NEPOOL, and this has provided valuable insight into certain areas of the PSNH forecast.

The NEPOOL project was undertaken in response to events since 1973, which introduced uncertainty into forecasts of electric energy demand and the need to explicitly examine the determinants of this demand.

Throughout the project, model development was guided by the Load Forecasting Task Force of the NEPOOL Planning Committee who retained Battelle Columbus Laboratories as a consultant for the project. The model provides long range forecasts of total annual electric energy demand and peak loads. The model develops its forecasts by examining the components of load. It considers the contribution of every major appliance, all manufacturing industries, and several commercial categories to peak loads and to annual demand. It has a high degree of detail.

The large-scale computer simulation model incorporates its own regional model of the New England economy. Given national employment forecasts, the model produces forecasts of employment and population for each state. These forecasts provide the basis for the energy forecasts. It also forecasts peak loads, load profiles, and load duration curves which are consistent with annual energy demand. It emphasizes about 50 end-use categories of electric energy demand.

The simulation model is divided into two major sectors; a power sector and an economic/demographic sector. These are further subdivided into numerous subsectors. The function of the economic/demographic sector is to forecast the number of users in each category. The power sector forecasts the average use for a desired period of time.

The simulation model provides estimates of the number of electrical appliances and hourly demands for each appliance type. Within the power sector, residential energy and demand forecasts are produced by summing hourly demands by appliance type.

The model uses employment within commercial establishments as a key factor in determining commercial electric energy and demand forecasts. Eight commercial end-use categories (such as retail trade) are considered within the model.

Industrial electric energy and demand forecasts are calculated for each of 20 manufacturing industries. Relationships between employment, productivity, and electric energy use are employed in deriving these forecasts.

Estimates of hourly, daily, monthly, or annual electric energy demand are obtained by summing all the individual sectors.

Tables 1.1-13 and 1.1-14 show previous NEPOOL forecasts and compare them to actual data that is available.

1.1.5 System Capacity

PSNH is a participant in NEPOOL. NEPOOL is an integrated electric system with central generation dispatch, coordinated maintenance scheduling, and coordinated planning. Reliability is, therefore, a pool function. The NEPOOL reliability standards state that firm load will not be interrupted more than once in ten years due to a generation deficiency.

Table 1.1-15 shows actual and projected loads for New England from 1980 to 1991. Required reserves and capability are also shown. In this tabulation, Pilgrim 2 (1150 MW nuclear unit) is scheduled to come on-line in the 1987-88 power year (for planning purposes, NEPOOL uses a power year starting November 1 and ending October 31). This unit does not yet have a construction permit. Sears Island (568 MW coal unit) is scheduled for the 1989-90 power year. This unit was rejected by the Maine PUC and the case is now being reheard.

Table 1.1-16 contains PSNH loads and projected loads for the period from 1975 to 1990. Required reserves and capability are also shown. PSNH is short of capacity in the early 1980's. This will be made up by short-term purchases of parts of units owned by other NEPOOL participants.

Table 1.1-17 lists PSNH units and contains an estimate of projected capacity factors for these units.

1.1.6 Reserve Margins

NEPOOL is responsible for calculating required reserves. It is the responsibility of each NEPOOL participant to supply its share of those reserves.

1.1.6.1 Maintenance Scheduling

NEPOOL schedules maintenance outages on all generators owned by pool participants. This is done in a manner so that the risk of loss of load is levelized throughout the year.

1.1.6.2 Minimum Reserve Requirement

Minimum reserve requirements are also determined by NEPOOL. Probabilistic methods are used to determine these reserve requirements. The computer program tries to levelize risk in each of 13 equal periods in a year. The period risks are then summed to determine the yearly risk. Due consideration is given to operating procedures and interconnections as well as maintenance schedules and forced outages.

1.1.6.3 Effect of Seabrook on Capacity Requirement

As shown in Table 1.1-16, Seabrook will allow PSNH to meet its capability responsibility to NEPOOL during the mid and late 1980's. Without Seabrook, PSNH would be short of capacity. This shortage is shown in Table 1.1-18.

The addition of the Seabrook units to the NEPOOL system will result in the reserves shown in Table 1.1-15. If the present pool forecast is met, these reserves are higher than necessary to meet criteria, but the Seabrook generation will displace oil as discussed in Section 1.2 of this report.

There are no new transmission ties being built to entities outside of New England although a tie to Quebec is under study. In planning studies, the ties to New York represent 800-1000 MW of firm generation and the tie to New Brunswick represents 450 MW of firm generation. These values are used when calculating minimum reserve requirements.

1.1.6.4 Reserve Margin Responsibility of Pool Participants

As noted previously, NEPOOL is responsible for calculating required reserve margins for the pool and the participants are responsible for maintaining their share of the reserve margins. The participant's share of the reserves is based on the relationship his load has to the total pool load. Participants not providing their share of the reserve pay a penalty to the pool.

1.1.7 External Support Studies

1.1.7.1 Reserve Criteria

The Reliability Standards for NEPOOL state:

"Generating capacity should be installed in such a manner that, after due allowance for the factors enumerated below, the expected frequency of insufficient generation (including contract purchases) to cover the New England load, as determined on an annual (power year) basis, should not exceed one occurrence in ten years:

a) The possibility that load forecasts may be exceeded as a result of weather variations.

b) Immature and mature equivalent forced outage rates appropriate for generating units of various sizes and types, recognizing partial and full outages.

c) Seasonal adjustment of generation capability.

d) Proper maintenance requirements.

e) The reliability benefits of interconnections with systems that are not NEPOOL participants.

f) Such other factors as may from time-to-time be appropriate.

The use of the procedures outlined in NEPEX Operating Procedure #4 shall not be construed as a failure to cover load for the purposes of this criterion."

For planning purposes, the assumed equivalent forced outage rate of a generating unit connected to the transmission network by a radial transmission line will be increased to reflect the estimated transmission line forced outage rate if significant.

The potential power transfers from outside New England that are considered in determining the New England capacity requirements must not exceed the firm emergency interpool transmission transfer capabilities.

1.1.7.2 Required Reserves

Preliminary studies indicate the NEPOOL reserve requirements will be between 22 and 27% in the time period from 1985 to 1989. These figures are shown in Table 1.1-19.

The NEPOOL system will have adequate reserves in 1986/1987, which is projected to be the first full year of commercial operation for the entire Seabrook Station. (See Table 1.1-15.)

TABLE 1.1-1

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
PRESENT CAPACITY

Unit	Capacity (MW)	Fuel	Function
Owned			
Merrimack 1	119	Coal	Base
Merrimack 2	337	Coal	Base
Newington	420	Oil	Intermediate
Ownership in Four Yankee Plants	98	Nuclear	Base
Various Intermediate Oil Plants	240	Oil	Intermediate
Various Peaking Plants	114	Oil	Peaking
Hydro	51	-	Peaking and Base
TOTAL	1379		
Purchases			
Various	195	Oil	Intermediate-Peaking
TOTAL	195		
Sales			
Merrimack 2 (Life of Unit)	100	Coal	Base
Various			
TOTAL	100		
TOTAL CAPACITY	1474		

TABLE 1.1-2

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
PLANNED FUTURE CAPACITY

Unit	Capacity	Fuel	Function	Date In Service
Owned				
Seabrook 1*	405	Nuclear	Base	2/1984
Seabrook 2*	405	Nuclear	Base	5/1986
Pilgrim 2*	40	Nuclear	Base	11/1987
Garvin's Hydro	6	Hydro	Peaking	11/1981
Eastman Falls Hydro	4	Hydro	Peaking	11/1983
Errol Hydro	2	Hydro	Peaking	11/1984
Murphy Hydro	2	Hydro	Peaking	11/1985
Rerating				
Schiller 4,5,6	-12	Coal	Base	1983
Retirements				
Eastman Falls	1	Hydro	Peaking	11/1983
Manchester Steam	21	Oil	Peaking	11/1981
Danial Street	19	Oil	Peaking	11/1983
Sales				
Merrimack 2 (Life of Unit)	100	Coal		

Purchases**

Unit	Capacity	Fuel	Function	Begins	Ends
Various	286	Oil	Intermediate	11/81	10/82
Various	171	Oil	Intermediate	11/82	10/83
Various	285	Oil	Intermediate	11/83	2/84
Various	68	Oil	Intermediate	3/84	10/84
Various	8	Oil	Intermediate	11/84	10/85
Various	96	Oil	Intermediate	11/85	5/86
Various	8	Oil	Intermediate	6/86	10/86

* Company Ownership

** At Time of System Peak

TABLE 1.1-3

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
ACTUAL AND FORECAST PEAK DEMANDS

ACTUAL DEMANDS		FORECAST DEMANDS	
Power Year*	Load (MW)	Power Year*	Load (MW)
1969-70	679.3	1981-82	1214
1970-71	745.2	1982-83	1274
1971-72	812.5	1983-84	1335
1972-73	930.1	1984-85	1381
1973-74	950.1	1985-86	1450
1974-75	915.1	1986-87	1491
1975-76	1026.2	1987-88	1562
1976-77	1112.6	1988-89	1633
1977-78	1124.9	1989-90	1709
1978-79	1173.0	1990-91	1787
1979-80	1159.0		
1980-81	1203.0		

* A power year is defined as the period beginning November 1 of the first year through October 31 of the second year.

TABLE 1.1-4

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
ACTUAL AND FORECAST NET PRIME ENERGY OUTPUT

ACTUAL OUTPUT		FORECAST OUTPUT	
Year	Load (MWH)	Year	Load (MWH)
1970	3,689,544	1981	6,234,675
1971	4,039,970	1982	6,374,859
1972	4,520,790	1983	6,678,208
1973	4,857,130	1984	6,896,627
1974	4,898,064	1985	7,172,558
1975	4,918,715	1986	7,452,094
1976	5,315,790	1987	7,747,698
1977	5,448,669	1988	8,099,335
1978	5,821,622	1989	8,470,847
1979	6,018,479	1990	8,875,488
1980	6,127,142	1991	9,278,549

TABLE 1.1-5

NEW ENGLAND POWER POOL
ACTUAL AND FORECAST PEAK DEMANDS

ACTUAL DEMANDS		FORECAST DEMANDS	
Power Year*	Load (MW)	Power Year*	Load (MW)
1969-70	10,600	1981-82	15,924
1970-71	11,643	1982-83	16,354
1971-72	12,135	1983-84	16,809
1972-73	13,548	1984-85	17,262
1973-74	12,852	1985-86	17,681
1974-75	12,891	1986-87	18,131
1975-76	13,908	1987-88	18,643
1976-77	14,739	1988-89	19,199
1977-78	14,846	1989-90	19,779
1978-79	15,111	1990-91	20,356
1979-80	15,311	1991-92	20,978
1980-81	15,620		

* A power year is defined as the period beginning November 1 of the first year through October 31 of the second year.

TABLE 1.1-6

NEW ENGLAND POWER POOL
ACTUAL AND FORECAST OF NET PRIME ENERGY OUTPUT

ACTUAL OUTPUT		FORECAST OUTPUT	
Year	Load (GWH)	Year	Load (GWH)
1970	61,278	1981	87,359
1971	65,208	1982	89,836
1972	70,587	1983	92,441
1973	76,202	1984	94,961
1974	73,216	1985	97,307
1975	73,700	1986	99,800
1976	78,310	1987	102,550
1977	79,781	1988	105,506
1978	82,500p	1989	108,654
1979	84,000p	1990	111,893
1980	85,050p	1991	115,282

p = preliminary

TABLE 1.1-7

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
ACTUAL PRIME ENERGY SALES BY MONTH IN MWH
FOR THE CALENDAR YEARS 1970 THROUGH 1980

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1970	322784	296821	298076	284263	263351	259787	260046	276639	270842	273440	283919	321318
1971	353731	332500	332709	307881	286248	288501	277279	304192	302143	291515	320661	366654
1972	393013	385792	389136	340448	324445	314594	302906	327604	320319	340855	369039	399783
1973	450861	419968	386615	376041	347863	346376	347537	380993	354796	364056	383190	387145
1974	439254	421327	390543	390949	353042	339037	343932	358571	350395	368730	374160	421616
1975	445689	428469	396635	379966	338659	337567	342974	366433	351663	353182	353213	436393
1976	505513	457643	439228	396537	350505	372461	364811	381296	374542	369859	420979	480812
1977	523694	472804	442827	407021	373107	375243	370909	404206	399858	387594	408890	474470
1978	541285	502308	488423	445378	405478	406827	395731	429575	415498	420317	441586	491622
1979	563341	550463	500046	471552	422903	418906	422367	464946	421090	440267	451216	475777
1980	544452	546387	514584	452379	413903	417530	425144	454674	440628	444784	456079	530957

TABLE 1.1-8

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
FORECAST OF PRIME ENERGY SALES BY MONTH IN MWH
FOR THE CALENDAR YEARS 1981 THROUGH 1991

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	587,548	561,978	525,988	478,404	433,054	432,372	423,540	457,975	442,685	442,914	462,267	521,176
1982	601,274	575,092	537,619	489,039	442,789	441,925	431,883	468,215	452,362	452,693	472,895	533,375
1983	631,859	604,757	564,714	512,783	463,409	462,032	451,393	489,481	472,852	473,698	495,497	560,005
1984	662,910	634,803	592,282	537,178	484,948	468,907	457,251	497,233	480,176	480,901	504,669	572,428
1985	681,453	653,705	607,020	548,877	492,999	492,357	480,135	522,112	504,066	505,291	530,733	602,682
1986	716,919	688,111	638,386	570,598	511,019	509,416	496,324	540,362	521,622	519,741	545,639	617,313
1987	733,421	705,143	651,098	589,907	535,411	532,259	519,710	565,973	546,170	547,948	570,605	645,454
1988	770,679	740,051	684,223	617,845	560,237	558,100	543,558	583,956	566,660	567,528	597,218	678,360
1989	807,502	776,756	717,124	644,821	584,847	581,992	562,832	610,189	592,134	594,502	626,003	711,241
1990	847,444	815,254	752,628	676,500	611,812	610,229	588,958	639,609	619,539	620,789	653,949	746,656
1991	887,984	854,526	788,677	708,265	638,583	634,492	612,945	669,135	645,078	648,083	684,860	782,242

TABLE 1.1-9

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
ACTUAL PEAK DEMAND BY MONTH IN MW
FOR THE CALENDAR YEARS 1970 THROUGH 1980

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1970	679.3	623.3	582.1	587.9	575.7	550.4	575.1	581.0	561.0	612.0	640.3	739.3
1971	745.2	723.3	645.7	616.7	602.6	620.4	625.9	647.5	602.9	609.6	724.6	805.7
1972	812.5	782.8	742.2	676.8	643.9	628.4	676.8	692.1	639.8	731.7	797.1	875.1
1973	930.1	887.7	746.7	756.2	703.7	743.1	721.1	785.3	762.3	808.0	828.4	861.7
1974	950.1	884.1	855.7	812.6	722.4	739.7	756.2	727.1	711.6	785.4	890.1	875.9
1975	915.1	895.6	840.7	805.2	679.3	763.4	767.9	782.2	680.1	782.4	845.3	999.2
1976	1026.2	1007.2	879.8	835.6	712.9	807.8	767.4	817.9	718.7	831.0	927.3	1112.6
1977	1047.8	981.2	879.5	841.3	789.5	778.9	902.9	911.7	839.5	818.6	949.8	1124.9
1978	1107.0	1077.0	985.0	878.0	821.0	852.0	899.0	937.0	840.0	872.0	1077.0	1109.0
1979	1120.0	1173.0	1014.0	956.0	843.0	905.0	930.0	954.0	869.0	901.0	972.0	1152.0
1980	1099.0	1080.0	1041.0	876.0	814.0	922.0	989.0	970.0	960.0	956.0	1018.0	1145.0

TABLE 1.1-10

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
FORECAST OF PEAK DEMAND BY MONTH IN MW
FOR THE CALENDAR YEARS 1981 THROUGH 1991

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1185.	1181.	1058.	965.	877.	926.	951.	988.	885.	947.	1063.	1214.
1982	1212.	1208.	1081.	986.	897.	946.	970.	1010.	904.	968.	1087.	1242.
1983	1274.	1270.	1136.	1034.	939.	988.	1012.	1055.	944.	1011.	1137.	1302.
1984	1335.	1332.	1190.	1082.	981.	1013.	1039.	1084.	967.	1038.	1170.	1344.
1985	1381.	1378.	1228.	1114.	1007.	1061.	1088.	1135.	1012.	1087.	1226.	1409.
1986	1450.	1449.	1290.	1160.	1046.	1101.	1129.	1179.	1051.	1126.	1269.	1454.
1987	1491.	1490.	1323.	1201.	1092.	1149.	1179.	1232.	1098.	1182.	1325.	1521.
1988	1562.	1562.	1386.	1257.	1143.	1202.	1232.	1277.	1141.	1227.	1384.	1593.
1989	1633.	1633.	1449.	1311.	1193.	1254.	1279.	1333.	1190.	1282.	1446.	1665.
1990	1709.	1709.	1517.	1372.	1246.	1312.	1337.	1394.	1243.	1338.	1510.	1743.
1991	1786.	1787.	1586.	1434.	1298.	1364.	1391.	1456.	1294.	1396.	1577.	1820.

TABLE 1.1-11

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SUMMARY OF ACTUAL AND FORECAST PEAK DEMAND
(MW)

YEAR PREPARED	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	ACTUAL PEAK
YEAR SUBMITTED	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	DEMAND
POWER YEAR											
1971-72	805										812.5
1972-73	887	887									930.1
1973-74	977	977	977								950.1
1974-75	1075	1075	1075	987							915.1
1975-76	1184	1184	1184	1117	1098						1026.2
1976-77	1304	1304	1304	1224	1186	1109					1112.6
1977-78	1436	1436	1436	1347	1285	1195	1195				1124.9
1978-79	1582	1582	1582	1492	1389	1287	1287	1225			1173.0
1979-80	1742	1742	1742	1674	1491	1386	1386	1300	1248		1159.0
1980-81	1918	1918	1918	1895	1599	1493	1493	1394	1329	1296	1203.0
1981-82		2112	2112	2163	1711	1598	1598	1498	1416	1363	
1982-83			2325	2462	1829	1709	1709	1611	1510	1432	
1983-84				2794	1955	1829	1829	1733	1611	1507	
1984-85					2090	1957	1957	1865	1720	1589	
1985-86						2094	2094	2011	1838	1667	
1986-87							2241	2175	1965	1750	
1987-88								2341	2101	1838	
1988-89									2246	1930	
1989-90										2025	

TABLE 1.1-12

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
COMPARISON OF PEAK DEMAND FORECASTS AND ACTUAL
(FORECAST LOAD EXPRESSED AS PERCENT OF ACTUAL LOAD)

YEAR PREPARED	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
YEAR SUBMITTED	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
1971-72	99.1									
1972-73	95.4	95.4								
1973-74	102.8	102.8	102.8							
1974-75	117.5	117.5	117.5	107.8						
1975-76	115.4	115.4	115.4	108.8	107.0					
1976-77	117.2	117.2	117.2	110.0	106.6	99.7				
1977-78	127.6	127.6	127.6	119.7	114.2	106.2	106.2			
1978-79	134.9	134.9	134.9	127.2	118.4	109.7	109.7	104.4		
1979-80	150.3	150.3	150.3	144.4	128.6	119.6	119.6	112.2	107.7	
1980-81	158.6	158.6	158.6	156.7	132.3	123.5	123.5	115.3	109.9	107.3

Table 1.1-11 contains the loads from which these percentages are calculated.

TABLE 1.1-13

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SUMMARY OF NEPOOL ACTUAL AND FORECAST PEAK DEMAND

YEAR PREPARED YEAR SUBMITTED	1970 1971	1971 1972	1972 1973	1973 1974	1974 1975	1975 1976	1976 1977	1977 1978	1978 1978*	1979 1980*	1980 1981*	ACTUAL PEAK DEMAND
POWER YEAR												
1971-72	12,820											12,135
1972-73	13,846	13,562										13,548
1973-74	14,941	14,630	14,406									12,582
1974-75	16,129	15,824	15,554	14,108								12,891
1975-76	17,488	17,074	16,731	15,450	14,146							13,908
1976-77	18,897	18,424	17,965	16,975	15,027	14,518						14,739
1977-78	20,433	19,864	19,312	18,605	16,066	15,317	15,217					14,846
1978-79	22,092	21,435	20,732	19,936	17,146	16,159	16,051	15,780				15,111
1979-80	23,880	23,147	22,286	21,398	18,212	17,107	16,918	16,520	16,595			15,311
1980-81	25,821	24,950	23,937	22,953	19,386	18,129	17,846	17,280	17,266	16,111		15,620
1981-82	27,879	26,896	25,718	24,684	20,639	19,191	18,820	18,050	18,036	16,250	15,920	
1982-83		29,092	27,596	26,577	21,956	20,249	19,814	18,850	18,822	16,590	16,350	
1983-84			29,728	28,571	23,353	21,369	20,851	19,670	19,755	16,960	16,810	
1984-85				30,696	24,782	22,578	21,964	20,560	20,668	17,390	17,260	
1985-86					26,298	23,831	23,134	21,480	21,502	17,870	17,680	
1986-87						25,105	24,379	22,440	22,267	18,420	18,130	
1987-88							25,694	23,440	22,989	18,960	18,640	
1988-89								24,470	23,595	19,500	19,200	
1989-90									24,120	20,040	19,780	
1990-91										20,650	20,360	
1991-92											20,980	

* NOTE: NEPOOL Model Forecasts, all other sum of NEPOOL Company statistics.

TABLE 1.1-14

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
COMPARISON OF NEPOOL PEAK DEMAND FORECASTS AND ACTUAL
(FORECAST LOAD EXPRESSED AS PERCENT OF ACTUAL LOAD)

YEAR PREPARED	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
YEAR SUBMITTED	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
1971-72	105.6									
1972-73	102.2	100.1								
1973-74	116.3	113.8	112.1							
1974-75	125.1	122.8	120.7	109.4						
1975-76	125.7	122.8	120.3	111.1	101.7					
1976-77	128.2	125.0	121.9	115.2	102.0	98.5				
1977-78	137.6	133.8	130.1	125.3	108.2	103.2	102.5			
1978-79	146.2	141.9	137.2	131.9	113.5	106.9	106.2	104.4		
1979-80	156.0	151.2	145.6	139.8	118.9	111.7	110.5	107.9	108.4	
1980-81	165.3	159.7	153.2	146.9	129.1	116.1	114.3	110.6	110.5	103.1

Table 1.1-13 contains the loads from which these percentages are calculated.

TABLE 1.1-15

NEPOOL LOAD, CAPABILITY & REQUIRED RESERVES

Year*	Load MW	Capability MW	Percent Reserve MW	Percent Required Reserve MW
1981-1982	15,920	21,910	37.6	18-22
1982-1983	16,350	22,192	35.7	18-22
1983-1984	16,810	22,209**	32.1**	18-22
1984-1985	17,260	23,340	35.2	18-22
1985-1986	17,680	23,216**	31.3**	22-27
1986-1987	18,130	25,518	40.8	22-27
1987-1988	18,640	26,537	42.4	22-27
1988-1989	19,200	26,537	38.2	22-27
1989-1990	19,780	27,104	37.0	22-27

* NOTE: NEPOOL is winter peaking and to facilitate calculations, the Pool uses a "Power Year" which starts November 1 and ends October 31. The "Power Year" 1979-1980 starts November 1, 1979 and ends October 31, 1980.

** These numbers do not match those of the New England Load and Capacity Report because the on-line date for Seabrook was supplied after the report was issued.

TABLE 1.1-16

PSNH LOAD, CAPABILITY,*** & RESERVES

Year*	Load	Capability	Actual Reserve
1975-1976	1026.2	1304	27.1
1976-1977	1112.6	1544	38.8
1977-1978	1124.9	1443	28.3
1978-1979	1173.0	1448	23.4
1979-1980	1159	1507	30.0
1980-1981	1208	1474	22.5
1981-1982	1214	1550	27.7
1982-1983	1274	1435	12.6
1983-1984	1335	1520	13.9
1984-1985	1381	1650	19.5
1985-1986	1450	1740	20.0
1986-1987	1491	2045**	37.1
1987-1988	1562	2085**	33.5
1988-1989	1633	2085**	27.7
1989-1990	1709	2085**	22.0
1990-1991	1787	2085**	16.7

NOTE: * Power Year - Start November 1 and ends October 31.

** Possible buyback up to 96 MW not included.

*** Includes purchases at time of system peak.

TABLE 1.1-17

PSNH OWNED GENERATION
YEARLY PROJECTED CAPACITY FACTOR FOR NEW ENGLAND ECONOMIC DISPATCH

Unit	80	81	82	83	84	85	86	87	88	89
Merrimack 1	80	80	80	80	80	80	80	80	80	80
Merrimack 2	70	70	70	70	70	70	70	70	70	70
Newington	50	55	55	50	50	45	45	40	35	40
4 Yankee Plants	75	75	75	75	75	75	75	75	75	75
Various Interme-diate Oil Plants	10-40	10-40	10-40	10-40	10-40	10-40	10-40	10-40	10-40	10-40
Various Peaking Plants	0-10	0-10	0-10	0-10	0-10	0-10	0-10	0-10	0-10	0-10
Hydro	70	70	70	70	70	70	70	70	70	70
Seabrook 1 (2/84)					49	60	65	67	69	72
Seabrook 2 (5/86)							34	60	65	67
Pilgrim 2 (11/87)								10	60	60
Garvins Hydro (11/81)		10	75	75	75	75	75	75	75	75
Eastman Falls Hydro (11/83)				10	70	70	70	70	70	70

TABLE 1.1-18

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
CAPABILITY VERSUS REQUIREMENTS WITHOUT SEABROOK

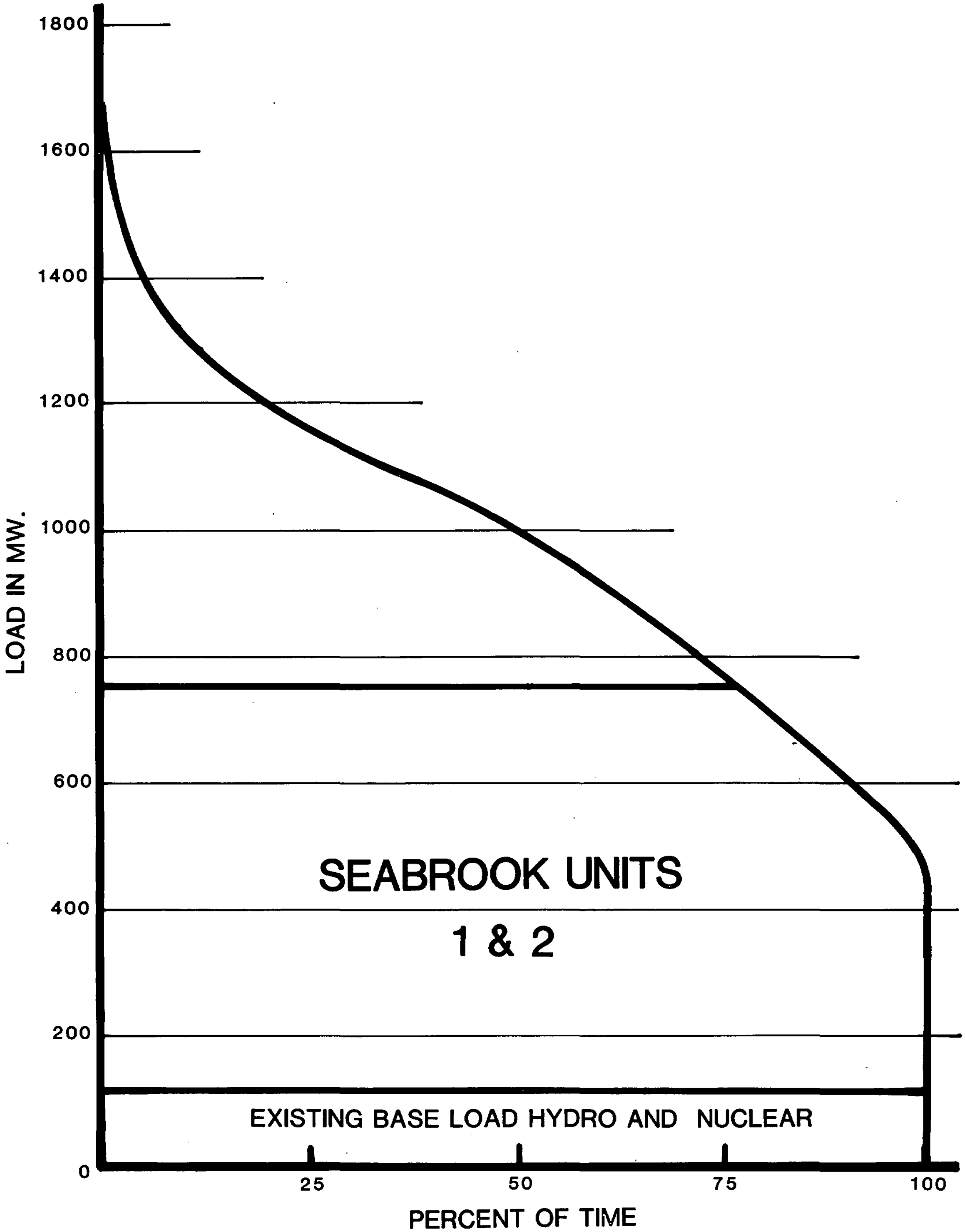
Year	Requirements (Load Plus Reserve)	Capability Without Seabrook
1984-1985	1579	1245
1985-1986	1740 - 1812*	1247
1986-1987	1789 - 1863*	1235
1987-1988	1874 - 1925*	1275
1988-1989	1960 - 2041*	1275
1989-1990	2050 - 2136*	1275
1990-1991	2144 - 2233*	1275

* Assumed 20-25% reserve requirement. Until Capability Responsibility is set by NEPOOL exact requirements cannot be calculated.

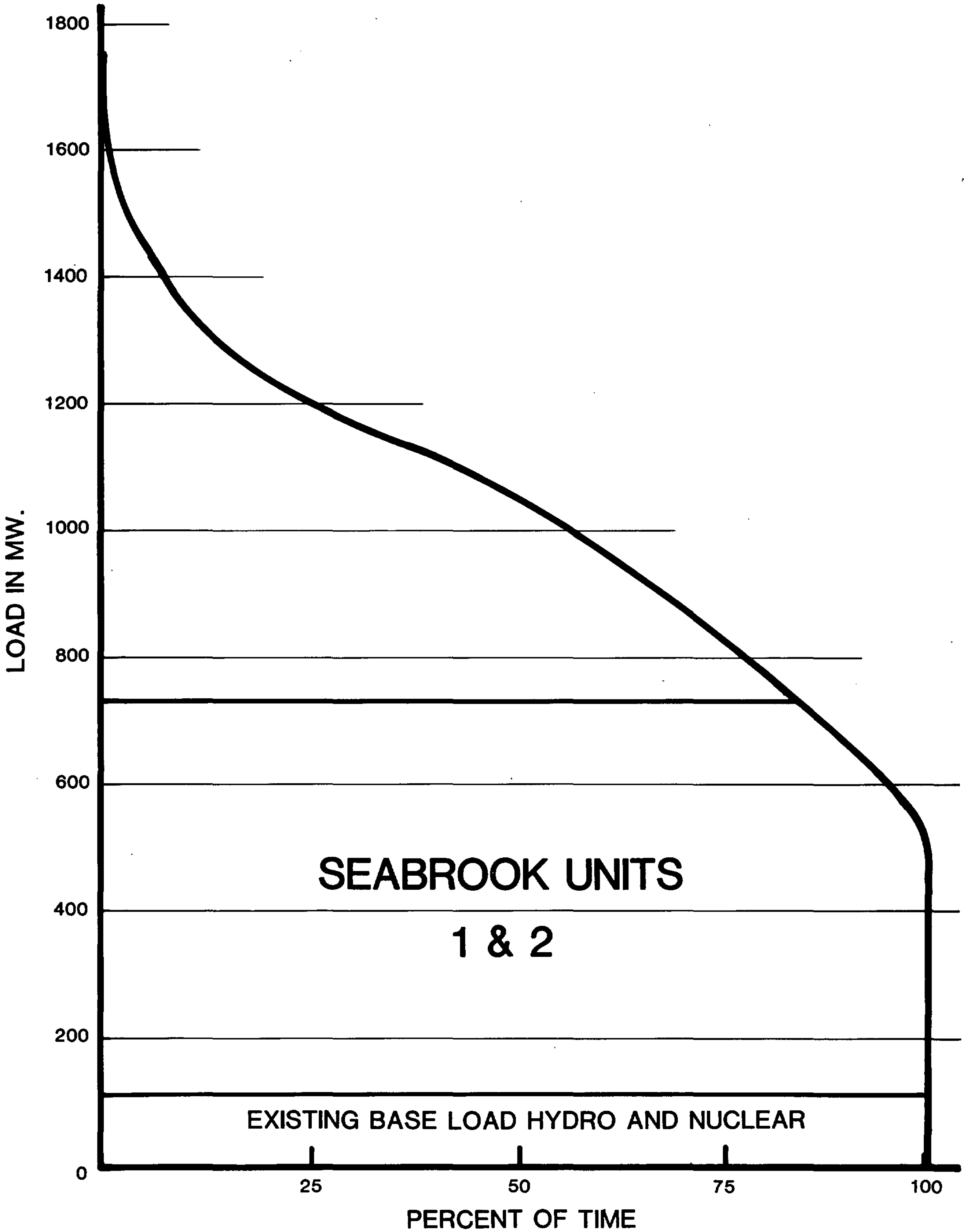
TABLE 1.1-19

NEPOOL REQUIRED RESERVES (PERCENT)

Year	Required Reserves (Percent)
1985-1986	22-27
1986-1987	22-27
1987-1988	22-27
1988-1989	22-27



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	PROJECTED ANNUAL LOAD DURATION CURVE FOR 1986 WITH SEABROOK UNITS 1 & 2 IN OPERATION
	FIGURE 1.1-1



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	PROJECTED ANNUAL LOAD DURATION CURVE FOR 1987 WITH SEABROOK UNITS 1 & 2 IN OPERATION FIGURE 1.1-2

1.2 OTHER OBJECTIVES

1.2 OTHER OBJECTIVES

There is no intent to use the Seabrook Station to produce process steam or for desalination of water or for any other commercial venture except the production of electric power.

The production of electricity from this plant will displace approximately 23,000,000 BBLS of oil per year presently used for this purpose and this is a very real objective. Without Seabrook and the other nuclear plants proposed for New England, it will be impossible to meet the presidential guideline of a 50% reduction in the use of oil by 1990.

Another objective is to bring stability to the cost of electric energy in New Hampshire and New England. No price stability can be obtained when imported oil must be relied on for the production of electricity.

1.3 CONSEQUENCES OF DELAY

1.3 CONSEQUENCES OF DELAY

1.3.1 One Year Delay

If the Seabrook units are delayed one year, an additional 23,000,000 BBLS of oil will be burned by New England utilities at an additional cost of $1225 million. PSNH costs to provide power to its customers for the year will increase by $300 million. The cost of Seabrook Station will be increased by $400-450 million which will cost New England electric power users about $80-90 million annually.

1.3.2 Two Year Delay

If the Seabrook units are delayed two years, the additional oil burned by New England utilities will be 46,000,000 BBLS at an additional cost of $2560 million. PSNH costs to provide electricity to its customers will increase by $600 million. The cost of Seabrook Station will increase by 900-1000 million dollars.

1.3.3 Three Year Delay

If the Seabrook units are delayed three years, the additional oil burned in New England will be 69,000,000 BBLS at an additional cost of $4010 million. PSNH costs to provide electricity to its customers will increase by $950 million and the cost of Seabrook Station will increase by $1400-1500 million.

CHAPTER 2
THE SITE AND ENVIRONMENTAL INTERFACES

CHAPTER 2

THE SITE AND ENVIRONMENTAL INTERFACE

CONTENTS

CONTENTS (Continued)

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CHAPTER 2

THE SITE AND ENVIRONMENTAL INTERFACE

TABLES

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TABLES (Continued)

TABLES (Continued)

TABLES (Continued)

TABLES (Continued)

TABLES (Continued)

CHAPTER 2

THE SITE AND ENVIRONMENTAL INTERFACE

FIGURES

FIGURES (Continued)

FIGURES (Continued)

FIGURES (Continued)

2.1 GEOGRAPHY AND DEMOGRAPHY

CHAPTER 2

THE SITE AND ENVIRONMENTAL INTERFACE

This chapter presents basic background material on the physical, biological and human characteristics of the site and its environment. It is based on work done by or for Applicant, as well as the work of others available through technical literature and other reference materials.

2.1 GEOGRAPHY AND DEMOGRAPHY

2.1.1 Site Location and Description

2.1.1.1 Specification of Location

The information presented in the corresponding Section 2.1 of the Seabrook Station ER-CPS remains basically unchanged. The geographical coordinates of each reactor unit are now included as follows:

	Latitude and Longitude	Universal Transverse Mercator Coordinates
Unit No. 1	N 42° 53' 55" W 70° 50' 59"	4751005 mN (Zone 19) 348994 mE
Unit No. 2	N 42° 53' 53" W 70° 51' 04"	4750928 mN (Zone 19) 348862 mE

Figures 2.1-1 and 2.1-2 show the location of the site with respect to the surrounding 50-mile and 10-mile areas, respectively.

2.1.1.2 Site Area

The information for this subsection was presented in the Seabrook Station ER-CPS Subsection 2.1. Updated maps showing additional information concerning site boundaries, location of principal station structures including the visitors education center, and surrounding topographical features are included on Figures 2.1-3 and 2.1-4.

The total land area owned by the utility in connection with the Seabrook Station site is approximately 896 acres. The land area within the site boundary, or exclusion area boundary, is approximately 719 acres.

2.1.1.3 Boundaries for Establishing Effluent Release Limits

The boundary for establishing gaseous effluent release limits is the site boundary. The area within the boundary consists of:

a. Land and marsh surface area above the mean high water line, and,

b. Two tidal streams, Brown's River and Hunt's Island Creek, which are public waterways of the State of New Hampshire.

The area referred to above consists of real property which is owned in fee including mineral rights, by Public Service Company of New Hamsphire. Therefore, Public Service Company of New Hampshire has full legal right to control access to that area for all purposes. The area refered to above consists of two tidal streams, both of which are virtually dry at low tide. Although the public has the right to use these waters for boating and fishing, the actual occupancy rate is low and of short duration because of the small size and tidal nature of these streams which make them impassable at low tide. Numerous observations made of boating activity on these streams during the summer boating season has shown no significant use with only an occasional boat passing through the 3,000 foot exclusion area.

Access to the area within the site boundary will be controlled by signs at normal access points, e.g., Rocks Road, the main access road, and Brown's River and Hunt's Island Creek, and by visual observation where practical. The presence of individuals within the site boundary who are using the public waterways would be of short duration because of the tidal nature of these waterways.

The location of the site with respect to adjacent bodies of water and the distance from the plant's gaseous effleunt vents located on top of each of the reactor containment buildings to the nearest point on the boundary is also shown on Figure 2.1-4.

All liquid radwaste effluents are discharged from the station via a submerged multiport diffuser beginning approximately 1.1 miles off Hampton Harbor inlet. The concentration of all radioactive liquid effluents at the point of discharge from the diffuser will be below the limits specified in 10CFR Part 20, Appendix B, Table II. The dose objectives of Appendix I to 10CFR Part 50 will be met at the edge of the initial mixing area where the effluents have undergone immediate mixing (prompt dilution) only.

2.1.2 Population Distribution

Information for this subsection is presented in Subsection 2.2 of the Seabrook Station ER-CPS. This information has been updated and revised with the most current population estimates and projections available from both state and local sources in the following subsections.

2.1.2.1 Population Within 10 Miles

Table 2.1-1 lists municipalities in each state which are located wholly or partly within 10 miles of the site. Table 2.1-1 shows the 1970 resident population, the 1980 estimated resident population, and the projected population for the first year (1983) of reactor operation. Figures 2.1-5 and 2.1-6 show the projected resident population distribution within 10 miles of the site for the years 1983 and 2025, respectively. These times are the estimated year of Unit 1 startup and the approximate end of the life of the facility. Table 2.1-2 breaks down the resident population by segment for the two dates stated above and for the census decades between 1980 and 2020.

The distribution of the permanent resident population for 1983 within five miles of the site was determined using a combination of residential electric meter location information for 1978 and 1979, a mosaic of aerial photographs taken in July 1978, and the results of a field survey performed in December 1978. The distribution of population in the area between five and ten miles from the site was made by area allocation in conjunction with review of local USGS maps. The fraction of a town's populated areas within each sector defined by the grid of concentric circles and radial lines was determined. The same fraction of each town's population was assigned to that segment.

The future population estimates for the area are based on the current state and federal projections (References 1, 2, 3, and 4).

2.1.2.2 Population Between 10 and 50 Miles

The 50-mile radius around the site includes portions of New Hampshire, Massachusetts, and Maine.

Figures 2.1-7 and 2.1-8 show the projected resident population distribution within 50 miles of the site for the years 1983 and 2025, respectively. Table 2.1-3 breaks down the resident population by segment for the two dates stated above and for the census decades between 1980 and 2020. This table also presents cumulative populations for annular rings and for radial distances. The distribution of population in the area between 10 and 50 miles was made by area allocation.

The references for projecting populations in cities and towns in Massachusetts and New Hampshire have been indicated in the previous section. For cities and towns in Maine, 1980 population estimates were obtained from Reference 5. The projections are based on population trends between 1970 and 1975 observed in the municipality itself, the surrounding cluster of municipalities and the county in which the municipality is located. The 1990 and 2000 projections in Maine are based on the Bureau of Economic Analysis for the state of Maine (Reference 4) and applied to the cities and towns in the study area. The rate of change between 1990 and 2000 was used to project for later times.

2.1.2.3 Transient Population

a. Seasonal Resident Population

Figure 2.1-9 provides a current estimate and distribution of seasonal dwelling units based on annual electric use and 1970 U.S. Census of housing data on vacant-seasonal and migratory units within 10 miles of the site. Table 2.1-4 breaks down the seasonal and year-round dwelling units based on residential electric meter use patterns by town for those towns which are totally or partially within 5 miles of the site. The total seasonal residential units within 5 miles of Seabrook Station are estimated at 4,013. Approximately 71% (2,843) of these units are located in the Seabrook-Hampton Beach area, 19% (755) are located in the Salisbury Beach area, and 10% in non-beach areas. Between 5 and 10 miles of the site, the estimated seasonal housing count is 1,646 units. A 1978 survey of beach area housing indicated weighted average weekday and weekend occupancies per seasonal residents of 5.4 and 7.6 persons, respectively. Figures 2.1-10 and 2.1-11 provide estimates of the current seasonal resident populations for typical summer weekday and weekend conditions within a 10-mile radius. It is estimated that approximately 30,555 persons are associated with the seasonal homes on a weekday and about 43,012 on a weekend day.

b. Overnight Accommodations

Survey work was undertaken to determine the location and estimated capacity of major overnight accommodations within 10 miles of Seabrook Station. Accommodations included hotels, motels, and a number of guest houses. Several hundred facilities were identified with an estimated capacity of 11,024 within the 10-mile radius.

The majority of facilities surveyed were concentrated in the "beach area" and within the 5-mile radius. A total of 210 facilities were identified in the 0 to 5-mile study area with an estimated capacity of 10,019 people as compared to only 20 such facilities identified in the larger 5 to 10-mile study area with an estimated capacity of 1,005. Thus, 91% of the total overnight accommocation capacity is within the 5-mile radius of the site with the remaining 9% being located within the 5 to 10-mile study area. Approximately 82% of the total capacity within the 5-mile radius is found in the beach area, primarily in Hampton Beach. Table 2.1-5 of the Seabrook Station FSAR contains a summary listing of accommodations identified in the site area. Estimated peak overnight populations have been summarized on Figure 2.1-12 by distance and direction from Seabrook Station.

c. Campgrounds

An inventory of both public and private campgrounds was made for the area within 10 miles of Seabrook Station (Table 2.1-5). Figure 2.1-13 summarizes the distribution of the estimated capacity of the camping population for the 10-mile study area. A total of 17 facilities with an estimated capacity of about 7,648 were identified as part of this inventory. Six of these facilities, with a total estimated capacity of approximately 3,160 campers, are located within a 5-mile radius.

d. Beach Area Daily Transient Population

1. Parking Lot Capacity Estimates

A substantial daily transient population during the summer period is associated with the beaches and other recreational facilities in the vicinity of Seabrook Station. The coastal beaches within 10 miles of Seabrook Station extended to Plum Island Beach in Newbury, Massachusetts to the south, to Wallis Sands Beach in Rye, New Hampshire to the northeast. The beaches are generally readily accessible to the public in this area. Estimates from aerial surveys of available parking spaces in the beach area provided the basis for estimating this daily transient population category since as the majority of daily transients arrive by automobile. During the summers of 1978 and 1979, beach area parking lots were identified by field inspection. Capacity estimates were developed from interviews with parking lot operators and by review of aerial photography of the beach area parking lots.

An average automobile occupancy factor was estimated at 3.2 persons per vehicle. This figure is based on a survey conducted in July 1978 at Hampton and Salisbury Beaches. Table 2.1-6 provides a summary of beach area parking facilities, capacity estimates, and the maximum number of vehicles observed as part of a 1979 summer survey program. Within the 10-mile radius, it is estimated that 13,336 parking lot spaces (including metered street parking spaces but excluding leased spaces) exist in the beach area. The maximum number of vehicles in the parking lots commonly used by daily transients during the summer of 1979 was observed to be 9,962. Figure 2.1-14 shows the distribution of vehicles for this peak use period.

Figure 2.1-15 is a capacity type estimate of the peak population associated with surveyed beach parking lot spaces.

Some parking spaces in the beach area are leased during the summer months by seasonal residents and by motels for their lodgers, and therefore, have not been included in the above capacity estimate. Leased spaces identified were located in five municipal parking lots, one in Salisbury and four in Hampton. A total of 559 leased parking spaces were identified in the beach area within 10 miles of the site.

2. On-Street Parking

Survey work was undertaken to estimate the daily transient population utilizing on-street parking in the beach area during the summer. An estimate of the total capacity of on-street parking spaces available to daily transients was made by comparing aerial photography taken of the beach area at 8:00 a.m. and 1:00 p.m. on a fair weather weekend beach day.

On-street parking was defined as the number of available parking spaces which are in the right-of-way of a road, or within approximately 10 feet of the edge of the traffic lane. It was also assumed that vehicles observed parked on-street in the 1:00 p.m. aerial photographs and not found in the same location or in nearby driveways in the 8:00 a.m. aerial photographs belonged to daily transients (e.g., persons making day trips to the beaches). Conversely, it was assumed that vehicles observed in both the 8:00 a.m. and 1:00 p.m. photos belonged to the "seasonal or permanent residents" or were associated with the "overnight" beach area populations and thus, were not part of the daily transient population.

The extent of illegal parking in the beach area was also considered. Parking ordinances were obtained from town police departments and reviewed. "No Parking" zones were outlined on local street maps from field observations of existing signs. By comparing on-street parking in the 1:00 p.m. aerial photographs against the parking maps, a tabulation of illegally parked vehicles in the beach areas was made for a high-use weekend beach day. The amount of illegal parking was determined to be approximately 10% of the total number of vehicles observed parked on-street in the 1:00 p.m. aerial photography.

Estimating the total capacity of on-street parking involved an examination of the aerial photography. Spaces occupied by vehicles as well as empty spaces observed on the streets were recorded. The estimate of "on-street parking" required judgment regarding the distance daily transients would park from the beach. Thus, in all areas except Hampton Beach, a maximum distance of approximately 600 feet from the beach was assumed as the boundary of "on-street parking" used by daily transients. All streets in Hampton Beach were assessed for their on-street parking capacity, since it was observed that more parking at greater distances was common in this area.

From a detailed study of orthogonal aerial photographs for the beach area, a total of 4,574 vehicles were observed parked on-street at 1:00 p.m., July 8, 1979, within the beach area and within the 5-mile radius. This is 87% of the total on-street parking capacity (5,262). Of this total, 2,514 or 48% were defined as daily transients since these vehicles were not observed in the 8 a.m. photo series. Approximately 10% of the total number of vehicles parked on-street were parked illegally. Most areas where on-street parking occurred were at or near capacity for the observed date. Half of the empty on-street parking spaces were located (in sectors NE 3-4 and NE 4-5) north of the more popular Hampton Beach. The total on-street parking capacity for daily transients was estimated to be about 3,202 vehicles. The daily transient population associated with this parking is estimated at about 10,246 persons (assuming 3.2 persons per vehicle).

Figure 2.1-16 shows the distribution of on-street parking estimated to be available to daily transients within the 10-mile radius. A beach area on-street parking capacity population estimate is included in Figure 2.1-17 for this same area.

3. Origin/Destination Survey

An analysis was performed to determine if significant "double-counting" of the "permanent population" within capacity estimates for "daily transients" in the beach area was occurring by the counting methods employed. Survey work was directed at estimating the percentage of permanent residents residing within the 0 to 5-mile and 5 to 10-mile radii of the site and typically traveling to the Hampton/Seabrook/Salisbury Beaches during the summer season for the day. Individuals arriving by car at major parking lots in the beach area were questioned on origins of their trips for both weekdays and weekends. A summary of the survey results is included on Table 2.1-7.

The results of the survey show that for all locations, averaged over all days of the week, about 5% of the people surveyed came from within 5 miles of the Seabrook Station to the beach area, and 10% came from within 10 miles of the station. On weekends, this figure is somewhat lower, 3% of all beach area users came from within the 5-mile radius and 7% from within the 10-mile radius. On weekdays, the results are 6% from within 5 miles and 14% from within 10 miles of the site.

e. Other Activities

1. Seabrook Greyhound Park

A major commercial dog race track, Seabrook Greyhound Park, is located 2-1/4 miles west of the site. The facility operates year-round according to the following schedule (as of October 1979).

Evening Activity - Races are scheduled nightly, except Sundays, from 7:45 to 11:00 p.m.

Daytime Activity - Races are scheduled on Tuesdays and Thursdays between 1:15 and 4:00 p.m. and on Saturday between 12:00 noon and 4:00 p.m.

Track attendance data from January 1977 to September 1979 was reviewed. Highest recorded attendance during this 33-month period was on September 1, 1979, with an evening attendance of 7,027 persons. Observation of the facility on this day indicated that the track's parking lot with approximately 3,100 spaces was nearly full. The peak capacity of the track is estimated at 7,500 persons.

2. Route 1

Route 1 is a major north-south artery located in the 0 to 10-mile area and running by the site. A variety of commercial uses exist along Route 1 and include, for example, shopping centers, gas stations, restaurants and fast food chains, motels, automobile dealers and repair shops, taverns, gift shops, and building supply stores. Shopping centers found along this route have the greatest concentrations of vehicles. Six shopping centers were identified along Route 1 within the 10-mile radius. These major shopping facilities include:

Shopping Center	Distance/ Direction	Lot Vehicle Capacity Estimate	Max. Observed
Seabrook Plaza	W/0-1 mi	710	265
Seabrook Southgate	SW/1-2 mi	730	460
Convenience Shopping Center	S/3-4 mi	50	22
Hampton Court (lacks major tenant)	N/4-5 mi	750	67
North Hampton Village Shopping Center	N/5-6 mi	140	66
Southgate Plaza	NNE/9-10 mi	550	286

Vehicles parked at these facilities were recorded for 10 days during the summer of 1979. Observations were made between 1:00 and 5:00 p.m. on both weekday and weekend periods. Maximum number of vehicles observed, as noted above, were less than the lot capacity estimates.

3. Recreational Boating

Recreational boating is prevalent in the summer months in the Hampton Harbor vicinity. Boating activity on the Hampton and Blackwater Rivers within a 2-mile radius of Seabrook Station is concentrated within their lower stretches, in the Hampton Harbor area. Many of the moving boats observed during the 1979 summer season in Hampton Harbor were either departing for or returning from the Atlantic Ocean.

Boating activity in the Atlantic Ocean was largely concentrated within two or three miles of Hampton Harbor inlet. It is highly probable that many of the sailboats, which accounted for roughly half of all boats observed in the Atlantic, originated at points either north (Portsmouth) or south (Ipswich, Gloucester) of Hampton Harbor. No sailboats were observed in Hampton Harbor.

The largest number of boats observed during 1979 within the 5-mile radius in the Atlantic Ocean was estimated to be 300. The average weekend observation during the summer in the Atlantic Ocean, within 5 miles of Seabrook Station, was 95 boats. Weekday boating activity was substantially less than weekend activity.

Boating activity in the 5 to 10-mile area is concentrated on the Merrimack River, approximately 6 to 7 miles south from Seabrook Station and in Rye Harbor about 9 miles northeast of Seabrook Station.

4. Major Manufacturing

An inventory of major employers associated with major manufacturing facilities was taken for the 10-mile study area. Figure 2.1-18 shows the distribution of the major employer population within a 10-mile radius. Employment related to small manufacturing (less than 10 persons), commercial retail and service type business is not included.

Within the 0 to 5-mile radius, there are an estimated 3,343 employees associated with firms of 10 persons or more. The number of employees in the 5 to 10-mile radius is estimated to be 4,534. In the 0 to 10-mile radius, therefore, there are an estimated 7,877 employees. Over 50% of these employees are located in a 3-mile ring (between the 4 and 7-mile radii) in the following sectors: WSW, SW, SSW, and S. This area includes the towns of Newburyport, Amesbury, and Salisbury, Massachusetts. A total of 20% of the estimated number of employees work in Seabrook, New Hampshire, in a 2-mile ring (between the 1 and 3-mile radii) in the W, WSW, and SW sectors.

5. Educational Facilities

Table 2.1-8 indicates the location and estimated population of school facilities located within 10 miles of the site. A total school population of 6,020 at 18 facilities have been identified within 0 to 5 miles of the site, and an additional population of 15,469 at 53 facilities within the 5 to 10-mile radius.

6. Medical Related Facilities

Information on the location and capacities of major medical related facilities within 10 miles is provided in Table 2.1-9. The majority of the medical related population within the 10-mile radius is found within the 5 and 10-mile radii. Approximately 10% (or 329 persons) of the total estimated medical related population is located within the 5-mile study area and 90% (or 3,146 persons) within 5 to 10 miles. Hospital staff were included in the estimates of this medical related population estimate.

7. Population Summary

Table 2.1-10 presents a summary of the total peak summer transient population within 10 miles of the site. As indicated, the peak summer weekend day transient population, including seasonal residents, overnight visitors and daily transients, is estimated at about 84,366 for the 5-mile radius and approximately 32,622 for the 5 to 10-mile radius. Figure 2.1-19 shows the distribution of this estimated summer peak weekend transient population. Figure 2.1-20 is a similar figure showing an estimate and distribution of the summer weekday transient population. This estimate assumes that both lot and street type beach area parking would be at 43%* capacity as estimated for the weekend condition and that the estimate of the manufacturing workforce is included. The summer weekday transient population is estimated at 55,687 for the 0 to 5-mile area, and 80,684 within 10 miles.

There is no significant difference between the 1970 U.S. age distribution for the region bordering the site within 50 miles. Table 2.1-11 compares the U.S. and state estimates of age distribution.

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*Based on the maximum number of vehicles observed in lots within the 5-mile radius on a weekday during the summer of 1979 (7/20/79). The estimate reflects highest weekday count of 46 weekdays between June and September for which data was included.

2.1.2.4 References

1. New Hampshire Office of Comprehensive Planning, "Interim Revisions--New Hampshire Population Projections for Towns and Cities to the Year 2000," August 1977.

2. Massachusetts Department of Public Health--Office of State Health Planning, "Population Projections Massachusetts, City and Town Age-Sex Data, 1980 and 1985," August 1978.

3. Massachusetts Department of Public Health--Office of State Health Planning, "Population Projections Methodology and Handbook for Users," August 30, 1978.

4. Bureau of Economic Analysis, Regional Economic Analysis Division, U.S. Department of Commerce, "Population, Personal Income and Earnings By State; Projections to 2000," October 1977.

5. SPO Statistical Reports, Population Projection Series PPS-2, Maine Municipal Population Projections 1977, 1980, 1982; August 1977.

2.1.3 Uses of Adjacent Lands and Waters

2.1.3.1 Land Use and Resources

The information presented on use of lands adjacent to Seabrook Station is consistent with that presented in Sections 2.1 and 2.2 of the ER-CPS. Additional data is presented below.

The Seabrook Station is bordered on the north, east and south by marshland extending to estuarine streams and Hampton Harbor. The land to the west is characterized as second growth and scrubland. A report entitled Existing Land Use Report prepared as part of a 1977 planning study for the town of Seabrook summarized the total acreage in Seabrook associated with general land use categories. Estimates for acreage devoted to these catagories is for September 1977. This information is summarized below with estimates of land uses in 1967 for comparative purposes to show recent growth.

Land Use	Acreage 1967	Acreage 1977*	Acreage Change
Residential	501	786	285 (57%)
Business	34	148	114 (335%)
Industry	94	111	17 (18%)
Utilities, Street	178	770	592 (333%)
Public, Semi-Private	35	168	133 (380%)
Vacant	4918	3777	-1141 (-23%)
Total	5760	5760	0

* Percentages are figured solely on land area, with all water bodies eliminated. Public Service Company of New Hampshire acreage has been included under the Utilities, Streets heading. All marsh acreage has been included under the Vacant heading.

A review of this table indicates the acreage totals in all categories increased over the ten-year period with a corresponding decrease in vacant, undeveloped land. If the marsh were excluded, approximately 30% of the total undeveloped land would have been developed over the 1967-1977 period. Vacant land remains the largest single land use category, presently comprising 66% of Seabrook's total land area. Approximately 14% of the town's total land area is characterized as residential and about 18% associated with the categories of business, industry, utilities and streets.

Table 2.1-12 describes the land use for a 5-mile area around the Station with the relative percentages of each being indicated. This information was derived through the interpretation of 1978 aerial photos of the Station and the sea coast region. Figure 2.1-2 describes the proximity of the site to topographical features in the area. Figure 2.1-3 indicates the location of the site perimeter, exclusion area boundary, utility property, as well as abutting and adjacent properties. Figure 2.1-21 entitled "Low Population Zone" indicates the locations of local water bodies, wooded areas, commercial, industrial and residential areas with respect to the station. Major transportation routes in the immediate area are indicated in Figure 2.1-21 as well. Information on site acreage and station layout is shown on Figure 2.1-3.

Agricultural data, which is an addition to that presented in the Seabrook ER-CPS, is presented in Tables 2.1-14 through 2.1-16 for a 50-mile radius area around the Station. Data obtained from the U.S. Department of Commerce's Bureau of Census for 1974 has been presented on a county basis for all counties which fall within this 50-mile area. Table 2.1-13 describes the percent of each county that falls within this area, but data presented in Tables 2.1-15 and 2.1-16 covers the entire county.

Table 2.1-14 presents data on the nearest agricultural activities to the Station for each of the sixteen compass points. It should be noted that the nearest residents in all directions are considered to have a vegetable garden. Agricultural land use characteristics on a county basis are described in Table 2.1-15. The data is presented such that the number of acres in farms is divided between those farms that are in a productive state and those that are not. Table 2.1-16 presents the major crops grown during 1974, the acreage devoted to each, the yield per acre, and total harvest on a county basis.

Livestock and livestock products are summarized in Table 2.1-17. The data also obtained from the Bureau of the Census for 1974, describes the number of head raised and the average market value received per head. Table 2.1-18 summarizes the milk production within the region on a county basis. Data here were obtained from the Commonwealth of Massachusetts, Department of Agriculture's Dairy Division and was tabulated for the towns within fifty miles of the Seabrook Station. Feeding regimes of livestock within the region is comprised of both hay and commerical feeds. Hay production in the region as well as corn are presented in Table 2.1-16. Commerical feeds such as mixed dairy feeds of varing nutritional content are purchased as either supplemental or primary feed. The grazing season for livestock varies depending on the weather conditions, but usually runs from May through October.

Recreational hunting is a popular activity throughout the 50-mile region surrounding the Station. Although a number of species are taken, bag limits and hunting seasons are regulated by federal and state fish and wildlife departments on all huntable species. The major species taken in this region are the upland game birds (woodcock, pheasant, ruffed grouse), waterfowl (black duck, mallard, teal, Canada goose), small mammals (cottontail rabbit, snowshoe hare) and the larger game species (black bear, white-tailed deer).

a. Zoning 0 to 5 miles

All of the towns within the five-mile radius of the Seabrook site have zoning ordinances with the exception of Amesbury and Salisbury which have bylaws that regulate land use.

Information was obtained for these eight towns with particular emphasis being placed on those portions within the 0-5 mile radius.

Town	Approx. % of Town Within 5 Miles	Description
New Hampshire		
1. Hampton	98%	The town of Hampton is located north of the site between the 1 and 5 mile radii. Major roads in the town that run within the 5-mile study area include the New Hampshire Turnpike (I-95) and the Exeter-Hampton Expressway and Route 1 and 1A. The town includes almost 5 miles of coastal land that is located within the study area.
2. Hampton Falls	93%	Hampton Falls is primarily located NW of the proposed site. The boundary of the town comes within 1,000 feet of the site at its closest point and stretches out beyond the 5-mile study area. Major roads in the town include the New Hampshire Turnpike, and Routes 88, 84, and 1.
3. Kensington	26%	The town of Kensington is located WNW of the proposed site and at its closest point is 3.5 miles from the site. The major roads in the town that are within the 5-mile study area include Routes 107 and 84. The town borders Hampton Falls and Seabrook on

			the east and South Hampton on the south.
4.	North Hampton	21%	The portion of the town of North Hampton within the study area includes part of the sectors 4 to 5 miles from the proposed site NNW, W, NNE, and NE. The major roads in that portion of the town described above include I-90 and Routes 1 and 151. The North Hampton coastline does not fall within the study area.
5.	Seabrook	100%	The site is located within the town of Seabrook approximately 1,000 feet south of the Hampton Falls border and 1.75 miles west of the Atlantic Ocean. The majority of the town's area is located SE, S, and W of the site. The major roads in the town include I-95 and Routes 1 and 1A. All of Seabrook's approximately 1.5 miles of coastal land is located within the study area.
6.	South Hampton	22%	South Hampton is located due west of the site and the town of Seabrook. At its closest point, the town falls within 3.5 miles of the site. The major roads in the town that fall within the five mile study area are Market Rd. (Rt. 150) and New Zealand Rd. Due north is the town of Kensington and south, the town of Amesbury.
Massachusetts			
7.	Amesbury	25%	The town of Amesbury is located 3 1/2 miles SW of the site. Major roads in the town include I-95, I-495, and Rts. 110, 150, and 107A.
8.	Salisbury	82%	Salisbury is located due south of the site. At its closest point, the town is a little over 2 miles

from the site. Major roads in the town include I-95 and Rts. 1, 1A, 110 and 286. Over 2 1/2 miles of the town's 3 1/2 miles of coastline fall within 5 miles of the proposed site.

The following is a summary of zoning and land use regulations for these.

Hampton, New Hampshire

The following is a summary of the current zoning in the town of Hampton. This information, taken from the Draft Zoning Summary prepared by the Southeastern New Hampshire Regional Planning Commission, July 1974, remains little changed to this date.

Hampton has a zoning ordinance (adopted in 1949 and amended almost annually since) and subdivision control regulations. The zoning ordinance provides for eight districts: Residence AA, Residence A, Residence B, Residence C Seasonal, Business, Seasonal Business, Industrial, and General.

Residence AA: Permitted uses are single-family residence, farm buildings, churches, schools and municipal buildings. Minimum lot requirements are one acre and 200 feet of frontage.

Residence A: Permitted uses are the same as for the Residence AA district. Minimum lot requirements are 15,000 sq. ft. and 125 feet of frontage.

Residence B: Permitted uses include those permitted in Residence A and AA Districts plus lodging houses, apartment houses and tourist accommodations. Minimum lot requirements are 7,500 sq. ft. and 75 feet of frontage.

Residence C Seasonal: Permitted uses are single or double family residence. Minimum lot requirements are 6,000 sq. ft. and 60 feet of frontage.

Business: Permitted uses include any use permitted in Residence B District, except single-family dwellings, plus shops, restaurants, offices, theaters, and building supply yards. Minimum requirements are 20 feet of frontage on street or public parking area.

Seasonal Business: Permitted uses include any use permitted in Business District plus general outdoor recreation. Minimum lot requirements are the same as for the Business District.

Industrial: Permitted uses include any use permitted in Business District, except multi-family dwellings, plus light manufacturing, machine shops, and heavy manufacturing provided the planning board approves. Minimum lot requirements are 20 feet of frontage on a street or public parking lot and building must be 30 feet back from right-of-way.

General: Permitted uses include any use permitted in the Business Districts plus light manufacturing, mobile homes and mobile home parks. Mobile home parks are subject to the following minimum requirements: minimum park area 120,000 sq. ft., minimum site area 10,000 sq. ft. and 40 feet of frontage; parks must have at least 20 sites to be certified for occupancy. Transient parks have slightly different requirements.

Almost the entire town is included within this 5-mile radius. Most of the areas east of Route 1 and west of I-95 are zoned for residential while the central portion of the town (between I-95 and Route 1) are zoned for general commercial and industrial purposes. There is also a relatively large area zoned for seasonal businesses in the vicinity of Hampton Beach.

Hampton Falls, New Hampshire

The town of Hampton Falls has a comprehensive master plan of zoning ordinances and building regulations which likewise is amended on an annual basis. It is divided into the following districts:

A Agricultural - Residential District

B Business District

With respect to development in the Agricultural - Residential District the minimum lot area shall be 87,120 sq. ft. and have a minimum frontage of 250 feet on the principal route of access to the lot.

The Business District on the Zoning Map is 300 feet in from both sides of Route 1. Permitted land uses in the residential agricultural district includes both single family dwellings, public buildings, recreational areas and camps, agricultural pursuits, and mobile homes. Typical businesses are permitted in the "B District".

Kensington, New Hampshire

The town of Kensington has zoning and subdivision regulations which are reviewed and amended annually. The zoning ordinance does not provide for special use districts in the town. Commerical, industrial, and residential uses are allowed. Mobile homes or trailers are included as an allowed residential use, although mobile home parks are not allowed. Such development is permitted throughout the town if special conditions are met including the following:

- o residential minimum lot requirements of 1 acre and 150 feet of frontage;

- o multiple unit residential developments are allowed provided that a minimum of 2 acres is provided for the first unit and, one acre for each additional unit;

- o commercial and industrial minimum lot requirements are 2 acres and 250 feet of road frontage.

North Hampton, New Hampshire

North Hampton has a zoning ordinance and subdivision regulations which are amended annually. The zoning ordinance provides for four districts: R-1 High Density Residential, R-2 Medium Density Residential, R-3 Low Density Residential, and 1-B Industrial Business District.

High Density Residential: Permitted uses include agriculture, single family dwellings, and public facilities, such as schools and churches. Special exceptions include municipal buildings and hospitals. Minimum lot requirements are two acres and 175 feet of frontage.

Medium Density Residential: Permitted uses and special exception are the same as in the High Density Residential. Minimum lot requirements are two acres and 175 feet of frontage.

Low Density Residential: Permitted uses are the same as for High Density Residential, except churches. Minimum lot requirements are two acres and 175 feet of frontage.

Industrial-Business District: Permitted uses include agriculture, motels, restaurants, public utility buildings, etc. Special exceptions include planned unit industrial and business projects and multiple-family dwellings. Single-family dwellings are prohibited. Minimum lot requirements are two acres and 250 feet of frontage.

Mobile homes are allowed only in existing parks. No new parks are allowed.

Seabrook, New Hampshire

Seabrook has a zoning ordinance that provides for five districts which were adopted in 1974 and amended in 1977, 1978, and 1979.

Zone 1 (Residential): Permitted uses include single and two family dwellings, resident-professional offices, public building, guest houses in which the owner is prime occupant, churches, and schools. Two such districts exist in the town, one west of Route I-95 and another in the vicinity of Salisbury Beach.

Zone 2 (Residential-Retail): Permitted uses include any in Zone 1 plus agriculture and related buildings, home occupations, retail businesses, service stations, nursing homes, cemeteries, commercial recreation, theatres and halls, travel-trailer parks, hotels and motels, restaurants and lounges, and restricted manufacturing businesses. This district includes most of the central portion of the town (the area east of I-95 to the salt marsh).

Zone 3 (Commercial): Permitted uses include any permitted in Zones 1 and 2 plus warehouses, storage and wholesaling establishments, and restricted manufacturing businesses. This district is located generally in the northern portion of the town and is generally bounded by the Brown River, Lafayette Road, Railroad Road, and the salt marsh.

Zone 4 (Recreational): Restricted to recreational use, no structures for any purpose are permitted. Seabrook Beach is Zone 4.

Zone 5 (Unrestricted): Any use is permitted. However, Zone 5 consists primarily of salt marsh land, and as such is controlled by state law. Currently, state policy is to prohibit development on marshland, or if allowed, a state permit is required to do so.

Minimum lot requirements are 30,000 sq. ft. area and 125 feet of frontage in all zones except Zone 4.

All of the town of Seabrook is included within the 5-mile radius.

South Hampton, New Hampshire

The town of South Hampton has a zoning ordinance adopted in 1974 which divides the town into five districts:

1. Rural - Residential

2. Wetland Conservation

3. Commercial

4. Industrial

5. Historic

Rural-Residential: Areas include all of town except the areas in commercial industrial and wetlands districts. Permitted uses include single family dwellings, farming and related agricultural uses, churches, schools, public buildings, and customary home occupations. Minimum lot requirements are 200 feet of frontage on an existing town approved road and 2 acres.

Wetlands-Conservation: This district includes those "areas delineated as poorly drained or very poorly drained soils identified in the Soil Survey Rockingham County New Hampshire issues August 1959 and revised for this ordinance by the USDA Soil Conservation District..." Permitted uses are any use that does not result in the erection of any structure or alter the surface configuration by the addition of fill and that is otherwise permitted by the ordinance.

Commercial and Industrial: Includes areas 1000 feet on either side of route 150. Permitted uses include any use permitted in Rural-Residential District plus commercial businesses (wholesale and retail), mobile home parks and sales, stables and kennels, greenhouses, and golf courses. Minimum lot requirements are the same as the Rural-Residential District. Any request for industrial use of a parcel of land must be submitted to the Planning Board, which shall hold at least two public hearings on the re-zoning of that land for industrial use.

Historic: Consists of that area known as the "Hill Top." Any changes to the exterior of existing buildings and any new construction must be approved by the Historic District Commission.

The portion of the area within the 5-mile radius are all rural residential with the exception of the commercial along Route 150.

<u>Amesbury, Massachusetts</u>

The town of Amesbury, Massachusetts has zoning bylaws which were adopted in 1971, revised through 1978, and attested to in 1979. The area within five miles of the proposed site are several separate districts. The majority of the area in the northeastern portion of the town is zoned residential with minimum lot requirements of 20,000 and 30,000 sq. ft. There are also four smaller areas zoned for industrial and commercial purposes and two areas zoned as residential with minimum (8,000 feet) lot area requirements.

<u>Salisbury, Massachusetts</u>

The town of Salisbury, Massachusetts has zoning bylaws and is divided into six zoning districts:

1. Low Density Residential

2. Medium Density Residential

3. High Density Residential

4. Beach - Commercial

5. Commercial

6. Light Industry

Approximately 82% of the town occurs within five miles of the site. A major portion of this area is zoned low and medium density residential with minimum lot requirements of two and one acres respectively. The area along Salisbury Beach is zoned as high residential with the exception of the area around the junction of Route 1A at the beach, which is zoned Beach-Commercial. Lot requirements are one quarter acre for the high residential, with no lot size requirements for the area zoned as Beach-Commerical. Commercially zoned areas have a one-half acre lot requirement, these areas being located primarily along Route 110, and from the junction of Route 110 and Route 1A to the beach area, and a smaller area toward the north. Light industry is centered around the junction of Routes 495 and I-95, this having minimum lot requirements of one acre.

2.1.3.2 Surface Water Resources

Material on surface water resources contained in this section is consistent with that presented in Sections 2.4.1 and 6.1.1 of the Seabrook ER-OLS and is an addition to Sections 2.2 and 2.5.1.3 of the ER-CPS. Additional data to these is presented below.

As well as portions of the Merrimack and New Hampshire coastal drainage basins, which are described in Section 2.5.1.3 of the ER-CPS for the region adjacent to the Seabrook Station, a number of major river basins occur within fifty miles of the site. These are described through U.S.G.S. stream gauge data presented in Table 2.1-19.

Surface water usage within fifty miles of the site is extremely varied. In addition to recreational uses (fishing, boating, swimming, etc.), the largest single use of fresh surface water in the region would be for domestic and industrial water supply. A portion of the area receives its water supplies through groundwater sources as well. This is described in ER-CPS Section 2.5.2.2.1.

2.1.3.3 Groundwater Resources

Material presented on groundwater resources, orginally presented in ER-CPS Section 2.2, remains unchanged. Additional information on groundwater resources and usage is described in detail in Sections 2.4.2 and 6.1.2 of the Seabrook ER-OLS.

2.1.3.4 Recreational and Commercial Fish and Shellfish

The material presented on marine fish, shellfish and freshwater fish harvesting is an addition to that presented in Section 2.2 of the Seabrook ER-CPS. Material pertaining to the fishery resources adjacent to the station is presented in Section 2.7.2 of the ER-CPS.

a. Recreational Fisheries Resources and Harvest

Recreational fish harvesting within a 50-mile radius of the site is important both to the marine and freshwater environments, with the species being taken being a function of season, location and method.

In the marine environment the area from Casco Bay, Maine to Scituate Harbor, Massachusetts provides a high diversity in species. Striped bass (Morone saxatilis), appears to be one of the major species, frequenting most, if not all, the rivers, streams and estuaries. From the Isles of Shoals to Scituate Harbor anglers catch over one million pounds annually, half coming from the Merrimack and Parker River estuaries alone. Most of these weigh three to five pounds with a few 50-pound individuals being taken as well.

Smelt (Osmerus mordax), are sought from the Presumpscot River, north of Portland, south, especially in the fall and early winter in nearly all bays and harbors into which freshwater flows. In the spring during their spawning runs, smelt are also taken along most all streams and rivers by dipnets. Tomcod (Microgadus tomcod), Cunner (Tautogolabrus adspersus), and white perch (Morone americana), often occur in the same areas as the smelt yet are caught only incidentally.

While efforts are now being undertaken to restore the shad (Alosa sapidissima), and Atlantic salmon (Salmo salar), populations through restocking, returns from these are not expected to provide a viable recreational stock for some years to come.

Other species include the flounders, both winter (Pseudopleuronectes americanus) and yellow tail (Limanda ferruginea), which are caught mostly within a mile or so offshore. Smooth flounder (Liopsetta putnami), is confined to the close vicinity of the coast, occuring chiefly in estuaries, river mouths, sheltered bays and harbors on the soft mud bottoms. Bluefin tuna (Thunnus thynnus) fishing also occurs to some degree throughout the area, primarily a few miles or more offshore. Within the last few years the average weight has been from 300 to 600 pounds with few weighing less than 200 pounds. Bluefish (Pomatomus saltatrix), as large as five to six pounds are caught in the area south of the Isles of Shoals while smaller individuals called snappers are found south of Boston in the fall.

Atlantic mackerel (Scomber scombrus) are abundant throughout this area during warm months. Large ones, called sea mackerel, usually arrive first around early June. Most of these mackerel weigh one to two pounds but some may be three or even four pounds. During summer, the younger and substantially smaller mackerel usually occur closer to shore than do the adults.

Cod (Gadus morhua), the principal groundfish, account for the greatest total weight of any fish landed by anglers. During spring and fall, cod can be caught along the shore in depths as shallow as 5 feet, but most are caught throughout the year from boats in depths of 100 to 300 feet. Pollock (Pollachius virens) to 40 pounds are taken incidentally while cod fishing. Considered a prize catch, haddock (Melanogrammus aeglefinus) are highly sought by anglers. Yet each year haddock have become more scarce. Cusk (Brosme brosme) and wolfish (Anarhichas tupus) are caught in the same areas as cod. Boats that drift off irregular or rough bottom into the deep mud basins usually catch white hake (Urophycis tenuis), squirrel hake (Urophycis chuss), and silver hake (Merluccius bilinearis).

Throughout the region a substantial portion of these species are taken on charter or party boats. This is comprised of all vessels which are licensed to take passengers for hire to fish for particular species for a portion of the day. Table 2.1-20 identifies the number of boats operating along the New England coast by season and the number of 6 passengers they normally accommodate. Table 2.1-21 breaks down the boats by state and mean number of days that they operate annually by passenger capacity. Additional information is presented in previous Section 2.1.2.3 Subsection E-3.

As well as the party boats, species are taken by individual anglers through various methods. A breakdown of these methods along the northern Massachusetts coast is depicted in Table 2.1-22.

The region around Seabrook Station has significant freshwater resources. The predominate species sought after within 50 miles of the site include for cold water species, the brook trout (Salvelinus fontinalis), rainbow trout (Salmo gairdneri), brown trout (Salmo trutta), lake trout (Salvelinus namaycush), coho salmon (Oncorhynchus kisutch) and landlock salmon (Salmo salar). In addition to these smelt (Osmerus mordax), smallmouth bass (Micropterus dolomieui), largemouth bass (Micropterus salmoides), yellow perch (Perca flavescens), white perch (Morone americana), chain pickerel (Esox niger) and the brown bullhead (Ictalurus nebulosus) are important recreational species. Although the majority of these are native to the area, some of the salmonids are produced and stocked in waterways to enhance native populations. Table 2.1-2,3 gives an indication of the number of fish stocked within 50 miles of Seabrook by species and state. Table 2.1-24 describes the location of the fish hatcheries of each state and the species that they produce.

b. Commercial Fisheries Resources and Harvest

Commercial fisheries along the New England coast involve an estimated forty finfish species and a dozen shellfish species. The magnitude of harvest is represented by Tables 2.1-25 through 2.1-30, which represents the 1977 harvest for coastal counties within fifty miles of Seabrook. The tables indicate the total pounds taken and its dollar value for each species. Data was obtained through the cooperation of the National Marine Fisheries Services, Statistical Branch in Gloucester, Massachusetts.

Total commercial fisheries landings for 1978 and 1979 and their associated values are presented in Table 2.1-31 and by port for 1976 through 1979 in Table 2.1-32.

2.1.3.5 References

1. U.S. Department of Commerce, Bureau of Census "1974 Census of Agriculture," Volume 1, Parts 19, 21, 29 for Maine, New Hampshire and Massachusetts.

2. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service "Anglers' Guide to the United States Atlantic Coast," Section I Passamaquoddy Bay, Maine to Cape Cod. July 1974.

3. U.S. Geological Survey, Water-Data Report NH-VT-78-1 Water Year 1978.

4. U.S. Geological Survey, Water-Data Report ME-78-1 Water Year 1978.

5. U.S. Geological Survey, Water-Data Report MA-RI-78-1 Water Year 1978.

6. Nicholson, L.E.; McConnell, K.E.; "A Description of the New England Headboat Fleet" Report to New England Regional Fisheries Management Council; URI, December 1977.

7. McConnell, K.E.; Nicholson, L.E.; "An Economic Study of the Party Boat Industry" Report to New England Regional Fisheries Management Council; URI, November 1978.

8. Massachusetts Division of Marine Fisheries, "Summarization of Massachusetts Marine Sport Fishery Statistics" 1975.

9. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service "Fisheries of the United States, 1975" Current Fisheries Statistics No. 6000.

10. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service "Fisheries of the United States, 1979" Current Fisheries Statistics No. 8000.

TABLE 2.1-1

POPULATIONS OF MUNICIPALITIES WHOLLY OR PARTIALLY WITHIN 10 MILES OF THE SITE

New Hampshire	1970(1)	1980(2)	1983(4)
Brentwood	1,468	2,170	2,668
East Kingston	838	1,190	1,376
Exeter	8,892	10,720	11,230
Greenland	1,784	2,210	2,564
Hampton	8,011	10,820	12,278
Hampton Falls	1,254	1,500	1,602
Kensington	1,044	1,350	1,518
Kingston	2,882	4,640	5,018
Newfields	843	1,000	1,060
Newton	1,920	4,060	4,678
North Hampton	3,259	4,910	5,888
Portsmouth	25,717	28,430	28,580
Rye	4,083	5,230	6,034
Seabrook	3,053	6,000	6,672
South Hampton	558	800	920
Stratham	1,512	2,500	3,040
Massachusetts			
Amesbury	11,388	16,560(3)	17,000
Haverhill	46,120	46,340	47,300
Merrimac	4,245	4,710	4,800
Newbury	3,804	4,920	5,010
Newburyport	15,807	16,740	17,000
Salisbury	4,179	5,150	5,250
West Newbury	2,254	2,690	2,750

(1) U.S. Census of Population, 1970

(2) Interim Revisions, New Hampshire Population Projections for Towns and Cities to the Year 2000. August 1977. New Hampshire Office of Comprehensive Planning. Projected 1980 populations for East Kingston, Exeter, Seabrook, and Stratham are less than 1978 population estimates for the same communities, Rockingham and Stratford County Population Data: 1978 Estimates - Rockingham-Stratford Census Project. This is also noted for these same communities and Portsmouth in the 1978 Population Estimates of New Hampshire Cities and Towns prepared by the New Hampshire Office of Comprehensive Planning, August 1979.

(3) Population Projections 1980-1985, Massachusetts Department of Public Health, Office of State Health Planning, August 1978.

(4) Estimates based on same sources indicated on footnotes (2) and (3) and interpolated for 1983.

TABLE 2.1-2
(Sheet 1 of 4)

PROJECTED POPULATION BY SECTOR 0 TO 10 MILES

Sector	Year	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles	5-10 Miles	Cumulative Totals By Sector
N	1980	20	80	470	700	700	4,440	6,110
	1983	20	80	530	800	470	5,190	7,090
	1990	20	100	700	1,050	630	6,920	9,420
	2000	20	100	760	1,150	760	9,420	12,210
	2010	20	100	840	1,270	970	13,010	16,210
	2020	20	100	920	1,400	1,220	18,210	21,870
	2025	20	100	970	1,470	1,380	22,010	25,950
NNE	1980	0	0	1,700	1,980	370	8,180	12,230
	1983	0	0	1,930	2,250	430	8,820	13,430
	1990	0	0	2,540	2,960	580	10,300	16,380
	2000	0	0	2,780	3,250	720	12,260	19,010
	2010	0	0	3,060	3,570	910	14,830	22,370
	2020	0	0	3,370	3,930	1,150	18,200	26,650
	2025	0	0	3,540	4,120	1,310	20,410	29,380
NE	1980	0	70	790	1,350	820	980	4,010
	1983	0	70	900	1,540	940	1,140	4,590
	1990	0	100	1,180	2,020	1,240	1,520	6,060
	2000	0	110	1,290	2,220	1,400	2,000	7,020
	2010	0	120	1,420	2,440	1,590	2,640	8,210
	2020	0	130	1,570	2,680	1,800	3,480	9,660
	2025	0	140	1,640	2,820	1,940	4,040	10,580
ENE	1980	0	440	820	110	0	0	1,370
	1983	0	500	930	120	0	0	1,550
	1990	0	670	1,230	160	0	0	2,060
	2000	0	730	1,350	180	0	0	2,260
	2010	0	800	1,480	200	0	0	2,480
	2020	0	880	1,630	220	0	0	2,730
	2025	0	920	1,710	230	0	0	2,860
E	1980	0	480	0	0	0	0	480
	1983	0	540	0	0	0	0	540
	1990	0	710	0	0	0	0	710
	2000	0	780	0	0	0	0	780
	2010	0	860	0	0	0	0	869
	2020	0	940	0	0	0	0	940
	2025	0	990	0	0	0	0	990

TABLE 2.1-2
(Sheet 2 of 4)

Sector	Year	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles	5-10 Miles	Cumulative Totals By Sector
ESE	1980	0	930	0	0	0	0	930
	1983	0	1,040	0	0	0	0	1,040
	1990	0	1,290	0	0	0	0	1,290
	2000	0	1,530	0	0	0	0	1,530
	2010	0	1,830	0	0	0	0	1,830
	2020	0	2,190	0	0	0	0	2,190
	2025	0	2,410	0	0	0	0	2,410
SE	1980	0	50	530	0	0	0	580
	1983	0	60	570	0	0	0	630
	1990	0	70	640	0	0	0	710
	2000	0	90	730	0	0	0	820
	2010	0	110	840	0	0	0	950
	2020	0	130	970	0	0	0	1,100
	2025	0	150	1,040	0	0	0	1,190
SSE	1980	10	90	260	330	520	4,340	5,550
	1983	10	100	280	330	520	4,420	5,660
	1990	20	120	320	340	550	4,600	5,950
	2000	20	150	360	360	570	4,790	6,250
	2010	20	180	420	370	590	4,980	6,560
	2020	30	220	490	390	600	5,180	6,910
	2025	30	250	530	400	630	5,280	7,120
S	1980	120	250	540	570	990	7,620	10,090
	1983	140	270	600	580	1,010	7,760	10,360
	1990	170	330	710	600	1,050	8,080	10,940
	2000	210	410	750	620	1,100	8,400	11,490
	2010	250	500	1,030	650	1,140	8,730	12,300
	2020	310	600	1,240	680	1,190	9,080	13,100
	2025	340	670	1,380	690	1,210	9,270	13,560
SSW	1980	250	280	420	510	400	9,000	10,860
	1983	280	310	440	510	400	9,160	11,100
	1990	340	380	470	540	420	9,540	11,690
	2000	410	460	510	540	440	9,920	12,280
	2010	500	560	560	580	450	10,320	12,970
	2020	610	680	610	600	470	10,730	13,700
	2025	680	750	650	610	480	10,950	14,120

TABLE 2.1-2
(Sheet 3 of 4)

Sector	Year	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles	5-10 Miles	Cumulative Totals By Sector
SW	1980	60	670	390	230	3,290	11,720	16,360
	1983	60	750	390	230	3,350	11,930	16,710
	1990	80	910	410	240	3,480	12,420	17,540
	2000	100	1,110	430	250	3,620	12,920	18,430
	2010	120	1,350	440	260	3,770	13,430	19,370
	2020	140	1,650	460	270	3,920	13,970	20,410
	2025	160	1,830	470	280	4,000	14,530	21,270
WSW	1980	0	670	650	300	3,370	7,570	12,560
	1983	0	750	710	310	3,420	7,800	12,990
	1990	0	910	850	340	3,560	8,340	14,000
	2000	0	1,110	1,020	370	3,710	9,030	15,240
	2010	0	1,350	1,220	400	3,860	9,930	16,760
	2020	0	1,650	1,470	440	4,010	11,170	18,740
	2025	0	1,830	1,620	460	4,090	12,060	20,060
W	1980	110	680	270	320	650	2,230	4,260
	1983	120	750	290	360	740	2,560	4,820
	1990	140	920	350	450	950	3,320	6,130
	2000	170	1,120	410	530	1,330	4,510	8,070
	2010	210	1,360	480	640	1,920	6,250	10,860
	2020	260	1,660	570	760	2,890	8,820	14,910
	2025	290	1,850	620	840	3,580	10,750	17,930
WNW	1980	170	70	250	70	650	2,660	3,880
	1983	180	80	270	80	740	2,960	4,310
	1990	190	90	320	90	930	3,660	5,280
	2000	210	90	320	90	1,080	4,730	6,520
	2010	240	100	330	100	1,250	6,200	8,220
	2020	270	100	340	100	1,450	8,250	10,510
	2025	280	100	340	100	1,560	9,700	12,080
NW	1980	20	220	150	120	120	6,440	7,070
	1983	30	240	160	120	120	6,760	7,430
	1990	30	280	190	140	140	7,540	8,320
	2000	30	280	190	150	150	8,550	9,350
	2010	30	290	200	150	150	9,750	10,570
	2020	30	290	200	150	150	11,170	11,990
	2025	30	300	210	160	150	12,030	12,880
NNW	1980	30	270	140	170	290	3,480	4,380
	1983	30	280	160	200	330	4,050	5,050
	1990	30	330	190	260	440	5,360	6,610
	2000	30	340	190	280	480	7,600	8,920
	2010	40	340	220	310	530	11,130	12,570
	2020	40	350	230	340	580	16,680	18,220
	2025	40	360	240	360	610	21,110	22,720

TABLE 2.1-2
(Sheet 4 of 4)

Sector	Year	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles	5-10 Miles
Cumula-	1980	790	5,250	7,390	6,760	11,870	68,660
tive	1983	870	5,820	8,160	7,430	12,470	72,550
Ring	1990	1,020	7,210	10,100	9,190	13,970	81,600
Totals	2000	1,200	8,410	11,090	9,990	15,360	94,130
	2010	1,430	9,850	12,540	10,940	17,130	111,200
	2020	1,710	11,570	14,070	11,960	19,380	134,940
	2025	1,870	12,650	14,960	12,540	20,940	152,140

	Year	0-1 Mile	0-2 Miles	0-3 Miles	0-4 Miles	0-5 Miles	0-10 Miles
Cumula-	1980	790	6,040	13,430	20,190	32,060	100,720
tive	1983	870	6,690	14,850	22,280	34,750	107,300
Totals	1990	1,020	8,230	18,330	27,520	41,490	123,090
	2000	1,200	9,610	20,700	30,690	46,050	140,180
	2010	1,430	11,280	23,820	34,760	51,890	163,090
	2020	1,710	13,280	27,350	39,310	58,690	193,630
	2025	1,870	14,520	29,480	42,020	62,960	215,100

TABLE 2.1-3
(Sheet 1 of 4)

PROJECTED POPULATION BY SECTOR - 0 TO 50 MILES

Sector	Year	0-10 Miles	10-20 Miles	20-30 Miles	30-40 Miles	40-50 Miles	Cumulative Totals By Sector
N	1980	6,100	22,800	30,400	20,000	6,200	85,500
	1983	7,100	23,500	30,800	20,500	6,300	88,200
	1990	9,400	25,200	31,800	21,500	6,600	94,500
	2000	12,200	27,400	32,700	22,300	6,900	101,500
	2010	16,200	28,400	33,800	23,200	7,200	108,800
	2020	21,900	30,400	35,000	24,100	7,500	118,900
	2025	26,000	35,000	35,600	24,600	7,700	128,900
NNE	1980	12,200	30,600	10,300	16,500	38,900	108,500
	1983	13,400	31,300	10,500	16,800	39,700	111,700
	1990	16,400	32,800	11,000	17,600	41,700	119,500
	2000	19,000	34,800	11,500	18,300	43,300	126,900
	2010	22,400	37,000	11,900	19,100	45,000	135,400
	2020	26,700	39,700	12,400	19,800	46,900	145,500
	2025	29,400	41,300	12,700	20,200	47,800	151,400
NE	1980	4,000	2,100	0	0	0	6,100
	1983	4,600	2,200	0	0	0	6,800
	1990	6,100	2,500	0	0	0	8,600
	2000	7,000	2,800	0	0	0	9,800
	2010	8,200	3,200	0	0	0	11,400
	2020	9,700	3,700	0	0	0	13,400
	2025	10,600	4,100	0	0	0	14,700
ENE	1980	1,400	0	0	0	0	1,400
	1983	1,600	0	0	0	0	1,600
	1990	2,100	0	0	0	0	2,100
	2000	2,300	0	0	0	0	2,300
	2010	2,500	0	0	0	0	2,500
	2020	2,700	0	0	0	0	2,700
	2025	2,900	0	0	0	0	2,900
E	1980	500	0	0	0	0	500
	1983	500	0	0	0	0	500
	1990	700	0	0	0	0	700
	2000	800	0	0	0	0	800
	2010	900	0	0	0	0	900
	2020	900	0	0	0	0	900
	2025	1,000	0	0	0	0	1,000

TABLE 2.1-3
(Sheet 2 of 4)

Sector	Year	0-10 Miles	10-20 Miles	20-30 Miles	30-40 Miles	40-50 Miles	Cumulative Totals By Sector
ESE	1980	900	0	0	0	0	900
	1983	1,000	0	0	0	0	1,000
	1990	1,300	0	0	0	0	1,300
	2000	1,500	0	0	0	0	1,500
	2010	1,800	0	0	0	0	1,800
	2020	2,200	0	0	0	0	2,200
	2025	2,400	0	0	0	0	2,400
SE	1980	600	8,100	800	0	0	9,500
	1983	600	8,200	900	0	0	9,700
	1990	700	8,500	900	0	0	10,100
	2000	800	8,900	900	0	0	10,600
	2010	1,000	9,200	1,000	0	0	11,200
	2020	1,100	9,600	1,000	0	0	11,700
	2025	1,200	10,000	1,000	0	0	12,200
SSE	1980	5,600	13,400	22,000	0	0	41,000
	1983	5,700	13,700	22,400	0	0	41,800
	1990	6,000	14,200	23,300	0	0	43,500
	2000	6,300	14,800	24,300	0	0	45,400
	2010	6,600	15,400	25,200	0	0	47,200
	2020	6,900	16,000	26,300	0	0	49,200
	2025	7,100	16,300	26,800	0	0	50,200
S	1980	10,100	18,600	171,400	97,500	206,700	504,300
	1983	10,400	18,900	174,500	99,300	210,500	513,600
	1990	10,900	19,700	181,700	103,400	219,100	534,800
	2000	11,500	20,500	189,000	107,500	227,900	556,400
	2010	12,300	21,300	196,500	111,800	237,000	578,900
	2020	13,100	22,200	204,400	116,300	246,500	602,500
	2025	13,600	22,600	210,000	118,600	251,400	616,200
SSW	1980	10,900	20,200	161,100	869,000	801,500	1,862,700
	1983	11,100	20,600	164,000	884,600	815,900	1,896,200
	1990	11,700	21,400	170,800	921,100	849,600	1,974,600
	2000	12,300	22,300	177,600	957,100	883,600	2,052,900
	2010	13,000	23,200	184,700	996,300	918,900	2,136,100
	2020	13,700	24,100	192,100	1,036,100	955,700	2,221,700
	2025	14,100	24,600	196,000	1,056,800	974,800	2,266,300

TABLE 2.1-3
(Sheet 3 of 4)

Sector	Year	0-10 Miles	10-20 Miles	20-30 Miles	30-40 Miles	40-50 Miles	Cumulative Totals By Sector
SW	1980	16,400	66,300	185,600	176,000	127,300	571,600
	1983	16,700	67,500	189,000	179,100	129,600	581,900
	1990	17,500	70,300	196,700	186,500	135,000	606,000
	2000	18,400	73,100	204,600	194,000	140,400	630,500
	2010	19,400	76,100	212,800	201,800	146,000	656,100
	2020	20,400	79,100	221,300	209,800	151,800	682,400
	2025	21,300	80,700	225,700	214,000	154,900	696,600
WSW	1980	12,600	26,100	95,000	113,700	34,700	282,100
	1983	13,000	26,500	100,200	120,300	35,800	295,800
	1990	14,000	27,600	112,500	135,700	38,500	328,300
	2000	15,200	28,700	125,800	151,200	41,200	362,100
	2010	16,800	29,900	141,100	168,100	44,300	400,200
	2020	18,700	31,100	158,500	187,200	47,900	443,400
	2025	20,100	31,700	168,400	198,000	50,200	468,400
W	1980	4,300	15,600	47,600	84,900	21,500	173,900
	1983	4,800	17,300	50,400	90,700	23,200	186,400
	1990	6,100	21,100	57,000	104,100	27,000	215,300
	2000	8,100	24,300	63,600	118,800	30,800	245,600
	2010	10,900	28,100	71,300	136,500	35,200	282,000
	2020	14,900	32,500	80,200	158,000	40,300	325,900
	2025	17,900	35,000	85,400	171,000	43,300	352,600
WNW	1980	3,900	7,900	12,900	61,400	33,300	119,400
	1983	4,300	9,000	13,400	63,300	34,500	124,500
	1990	5,300	11,700	14,800	67,700	37,300	136,800
	2000	6,500	16,300	16,200	72,700	40,600	152,300
	2010	8,200	23,800	17,800	78,200	44,300	172,300
	2020	10,500	36,200	19,600	84,400	48,300	199,000
	2025	12,100	46,900	20,700	87,900	50,600	218,200
NW	1980	7,100	8,000	3,600	10,300	16,100	45,100
	1983	7,400	8,800	3,700	10,600	16,700	47,200
	1990	8,300	10,600	4,000	11,300	18,100	52,300
	2000	9,400	13,200	4,200	12,100	19,800	58,700
	2010	10,600	16,700	4,500	12,900	21,700	66,400
	2020	12,000	21,300	4,700	14,000	23,800	75,800
	2025	12,900	27,500	4,900	14,500	26,200	86,000
NNW	1980	4,400	13,900	18,500	14,200	5,400	56,400
	1983	5,100	14,400	18,900	14,400	5,600	58,400
	1990	6,600	15,400	19,800	15,000	6,000	62,800
	2000	8,900	16,900	20,700	15,900	6,400	68,800
	2010	12,600	19,000	21,600	16,800	7,000	77,000
	2020	18,200	22,100	22,700	17,900	7,500	88,400
	2025	22,700	24,400	23,200	18,500	7,900	96,700

TABLE 2.1-3
(Sheet 4 of 4)

	Year	0-10 Miles	10-20 Miles	20-30 Miles	30-40 Miles	40-50 Miles
Incremental Ring Totals	1980	100,700	253,600	759,200	1,463,500	1,291,600
	1983	107,300	261,900	778,700	1,499,600	1,317,800
	1990	123,100	281,000	824,300	1,583,900	1,378,900
	2000	140,200	304,000	871,100	1,669,900	1,440,900
	2010	163,100	331,300	922,200	1,764,700	1,506,600
	2020	193,600	368,000	978,200	1,867,600	1,576,200
	2025	215,100	400,100	1,010,400	1,924,100	1,614,800

	Year	0-10 Miles	0-20 Miles	0-30 Miles	0-40 Miles	0-50 Miles
Cumulative Totals	1980	100,700	354,300	1,113,500	2,577,000	3,868,600
	1983	107,300	369,200	1,147,900	2,647,500	3,965,300
	1990	123,100	404,100	1,228,400	2,812,300	4,191,200
	2000	140,200	444,200	1,315,300	2,985,200	4,426,100
	2010	163,100	494,400	1,416,600	3,181,300	4,687,900
	2020	193,600	561,600	1,539,800	3,407,400	4,983,600
	2025	215,100	615,200	1,625,600	3,549,700	5,164,500

TABLE 2.1-4

TOTAL ESTIMATED SEASONAL & YEAR-ROUND DWELLING UNITS
FOR TOWNS WITHIN 5 MILES OF SEABROOK STATION*
(BASED ON 1978-79 ELECTRIC METER USE DATA)

New Hampshire	Estimated Number Seasonal Living Units	Estimated Number Year-Round Living Units	Total Seasonal & Year-Round Living Units
(1) Hampton	2,526	4,084	6,610
Hampton Beach	(2,425)	(1,721)	(4,146)
Hampton	(101)	(2,363)	(2,464)
(2) Hampton Falls	64	439	503
(3) Kensington	28	429	457
(4) South Hampton	13	217	230
(5) Seabrook	429	2,444	2,936
Total New Hampshire	3,060	7,613	10,736
Massachusetts			
(6) Amesbury	373	4,368	4,741
(7) Salisbury	857	2,048	2,905
Total Massachusetts	1,230	6,416	7,646
Total New Hampshire & Massachusetts	4,290	14,029	18,382

* Note. Estimates of seasonal units based on electric meter use for an annual period. Individual meters with residential rate codes were reviewed for the "Seasonal Months" of July and August, and compared to the "Off-Season Months" of November to March. Seasonal meters were defined as those for which the "seasonal" electric use (i.e., KWhr/Mo) was at least three (3) times greater than the "Off-Season" use of electricity. Meters not classified as "seasonal" were classified as year-round and assumed to be associated with the permanent resident population.

TABLE 2.1-5
(Sheet 1 of 2)

CAMPING FACILITIES WITHIN 10 MILES OF SEABROOK STATION

Name	Location* (Sector)	Approximate No. of Sites	Estimated Capacity	Season
Tidewater	Hampton (N 2-3)	100 trailer + 25 tent sites = 125 total	500	May - October
Wakeda	Hampton Falls (NW 4-5)	300	1,200	May 1 - October 15
Adams	Seabrook (S 1-2)	75	300	May 15 - October 1
Shel Al Mobile Estates & Camping	N. Hampton (N 5-6)	190	800	May 15 - October 1
Hampton Beach Trailer	Hampton (NE 3-4)	190	760	May 1 - October 1
Rusnick Campground (day camp)	Salisbury (SSW 2-3)	NA	NA	NA
Pike's Camping Area	Salisbury (S 4-5)	40 trailer + 40 tent sites = 80 total	400	NA
Salisbury Beach State Reservation (camping area only)	Salisbury (SSE 5-6)	350 trailer + 135 tent sites = 485 total	1,940	NA
Weemac Campground	Amesbury (WSW 7-8)	100 sites 7 cabins	556	Mid-May - Mid-October
Camp Bauercrest	Amesbury (WSW 7-8)			Summer Camp

* No camping facilities identified within 0 to 5 miles in either Kensington, South Hampton or Amesbury.

TABLE 2.1-5
(Sheet 2 of 2)

Name	Location (Sector)	Approximate No. of Sites	Estimated Capacity	Season
Tuxbury Pond Camping Area	S. Hampton (WSW 7-8)	130 sites	520	Mid-May - October 1
Camp Holiday	Amesbury (WSW 7-8)		NA	
Camp Treefoil (Camp Kent)	Amesbury (WSW 5-6)		NA	Summer Camp
Pinebrook Campground	Kingston (WSW 10)		NA	
The Green Gate Camping Area	Exeter (NW 7-8)	80 sites	400	May 26 - October 1
Exeter Elms Campground	S. Exeter (NW 7-8)	68 sites	272	May 30 - October 1
Camp Gundalow	(N 9-10)		NA	

TABLE 2.1-6

BEACH PARKING LOT CAPACITIES AND OBSERVED PEAKS
(0 to 10- mile radius)

Sector	Marked Spaces (including leased)		Estimated Unmarked Spaces	Estimated[1] Total Parking Lot Capacity	Observed Single[1] Peak Day Count for 1979
SSE 8-9	0		71	71	13
SSE 7-8	180		419	599	396
SSE 6-7	125		300	425	389
SSE 5-6	1,861		60	1,921	1,130
SSE 4-5	876	(30)	738	1,614	1,187
SSE 3-4	297		714	1,011	461
SE 2-3	61		141	202	188
ESE 1-2	0		317	317	289
E 1-2	0		2,551	2,551	1,914
ENE 1-2	1,882	(318)	620	2,502	2,283
ENE 2-3	435	(211)	479	914	875
ENE 3-4	0		35	35	13
NE 3-4	562		52	614	547
NE 4-5	135		177	312	190
NE 5-6	115		36	151	151
NE 7-8	80		167	247	247
NE 8-9	0		409	409	248
Total (all sectors)	6,609	(599)[2]	7,286	13,895[3]	10,521

(1) Including 559 leased parking spaces to local business.
(2) Estimate of leased spaces contained in brackets.
(3) Includes marked and unmarked parking lot spaces.

TABLE 2.1-7

BEACH TRAVEL
ORIGIN-DESTINATION SURVEY RESULTS
(WEEKDAY - WEEKEND TOTALS)

Trip Origin (Radial Distance from Seabrook Station)	Summary of Weekday Survey Results		Summary of Weekend Survey Results		Total All Survey Days	
	Number of Surveys	%	Number of Surveys	%	Number of Surveys	%
0-5	100	6.3	54	3.3	154	4.8
5-10	119	7.5	57	3.5	176	5.5
10-20	128	8.1	65	4.0	193	6.0
20-30	264	16.7	234	14.4	498	15.5
30-40	333	21.0	427	26.3	760	23.7
40-50	88	5.6	134	8.3	222	6.9
50+	552	34.8	651	40.1	1,203	37.5
Total	1,584	100.0	1,622	100.0	3,206	100.0

TABLE 2.1-8
(Sheet 1 of 14)

NEW HAMPSHIRE

SCHOOLS WITHIN 10 MILES OF THE SEABROOK SITE

Town	School	Grades	Distance (miles) & Direction (sector)	(B) No. of Students	(C) No. of Teachers	(D) No. of Staff	(A) Total Fall 1978 Population (B+C+D=A)
Hampton	Aslans' Pride Nursery School 200 High Street	N	NNE 3 (NNE 2-3)	20 - 3 da/wk 18 - 2 da/wk 38 students	3		41
Hampton	Center Elementary School Winnacunnet Road	K-4	NNE 2-1/2 (NNE 2-3)	351	25	12	338
Hampton	Marston Elementary Off of High Street	1-4	NNE 3 (NNE 2-3)	290	22	10	322
Hampton	Hampton Academy Jr. High School 29 Academy Avenue	5-8 s.p.	NNE 3 (NNE 2-3)	537	37	16	590
Hampton	Winnacunnet Cooperative High School Landing Road	9-12	NNE 2-1/2 (NNE 2-3)	1,318	88	36	1,442
Hampton	Sacred Heart Elementary	1-8	NNE 3 (NNE 2-3)	212	8	27	247

TABLE 2.1-8
(Sheet 2 of 14)

Town	School	Grades	Distance (miles) & Direction (sector)	(B) No. of Students	(C) No. of Teachers	(D) No. of Staff	(A) Total Fall 1978 Population (B+C+D=A)
Hampton Falls	Hampton Falls Kindergarten & Nursery School Rte. 84	N&K	NW 1-1/2 (NW 1-2)	38	3 full time 1 part time		42
Hampton Falls	Lincoln-Ackerman Elementary Exeter Road	1-8	NW 1-1/2 (NW 1-2)	178	15	12	205
Kensington	Kensington Elementary	1-6	WNW 5 (WNW 4-5)	156	6 full time 9 part time	17	188
North Hampton	Busy Beaver Kindergarten 17 Pine Street	K	NNE 5 (NNE 4-5)	23 (divided into 2 shifts)	2		25
North Hampton	229 Atlantic Avenue Montessori School of Creative Learning	Up to 14 years old	N 5-1/4 (N 5-6)	25 morning 15 afternoon	2	3-5	47

SB 1 & 2
ER-OLS

TABLE 2.1-8
(Sheet 3 of 14)

Town	School	Grades	Distance (miles) & Direction (sector)	(B) No. of Students	(C) No. of Teachers	(D) No. of Staff	(A) Total Fall 1978 Population (B+C+D=A)
North Hampton	N. Hampton Elementary Atlantic Avenue	K-8	NNE 5-1/4 (NNE 5-6)	459	35	17	511
Seabrook	Seabrook Elementary and Jr. High Walton Road	K-8	S 1-1/4 (S 1-2)	671	44	24	739
South Hampton	Barnard Elementary Jewell Street	K-8	WSW 6 (WSW 5-6)	89	9	3	101

TABLE 2.1-8
(Sheet 4 of 14)

MASSACHUSETTS SCHOOLS WITHIN 10 MILES OF THE SEABROOK SITE

Town	School	Grades	Distance (miles) & Direction (sector)	(B) No. of Students	(C) No. of Teachers	(D) No. of Staff	(A) Total Fall 1978 Population (B+C+D=A)
Amesbury	Amesbury Elementary S. Hampton Road	1-4	WSW 5 (WSW 4-5)	527	21	43	591
Amesbury	Amesbury Middle School Main Street	6-8	SW 5-1/2 (SW 5-6)	701	43	26	770
Amesbury	Amesbury High School Highland Street	9-12	SW 5-1/2 (SW 5-6)	840	65	22	927
Amesbury	Horace Mann School Congress Street	K	SW 4-1/2 (SW 4-5)	207 (divided into 2 shifts)	12	4	223
Amesbury	Amesbury Country Day School 186 Market	Pre K & K	WSW 4-1/2 (WSW 4-5)	125 (divided into 3 shifts)	4	2	131

TABLE 2.1-8
(Sheet 5 of 14)

Town	School	Grades	Distance (miles) & Direction (sector)	(B) No. of Students	(C) No. of Teachers	(D) No. of Staff	(A) Total Fall 1978 Population (B+C+D=A)
Amesbury	Seventh Day Adventists School Monroe Street	1-8	SW 5 (SW 4-5)	14	1	3	18
Amesbury	Charles C. Cashman Friend Street	1-5	WSW 5-3/4 (WSW 5-6)	641	32	24	697
Salisbury	Kiddie Corner Nursery 16 John Street	N	SW 2-1/2 (SW 2-3)	32	2		34

TABLE 2.1-8
(Sheet 6 of 14)

Town	School	Grades	Distance (miles) & Direction (sector)	(B) No. of Students	(C) No. of Teachers	(D) No. of Staff	(A) Total Fall 1978 Population (B+C+D=A)
Amesbury	Harbor Schools, Inc. (2 units) Pleasant Valley Road	Special	SW 7-1/4 (SW 7-8)	20	5		25
Amesbury	Miss Rose's Child Care Center Rte. 110 & Main Street	N-K & Daycare	SW 5-1/2 (SW 5-6)	68	6		74
Merrimac	Helen R. Donaghue School Union Street	3-6	WSW 9-1/4 (WSW 9-10)	323	23	3	347
Merrimac	Red Oak School Church Street	K-3	WSW 9-1/4 (WSW 9-10)	211	29		240
Haverhill	Rocks Village School	K-3	SW 10 (SW 9-10)	27	2	1	30
Haverhill	Merrimac Child Care Center High Street	K	SW 8-3/4 (SW 8-9)	24	3		27

TABLE 2.1-8
(Sheet 7 of 14)

Town	School	Grades	Distance (miles) & Direction (sector)	(B) No. of Students	(C) No. of Teachers	(D) No. of Staff	(A) Total Fall 1978 Population (B+C+D=A)
Salisbury	Salisbury Memorial School (also called Jacob F. Spalding) Maple Street	K-6	S 4 (S 3-4)	654	28	19	701
Salisbury	Salisbury Plains School Main Street	K	SW 3 (SW 2-3)	90	3	0	93

TABLE 2.1-8
(Sheet 8 of 14)

Town	School	Grades	Distance (miles) & Direction (sector)	(B) No. of Students	(C) No. of Teachers	(D) No. of Staff	(A) Total Fall 1978 Population (B+C+D=A)
Haverhill	Rocks Village School	K-3	SW 10 (SW 9-10)	27	2	1	30
Newbury	Newbury Elementary 63 Hanover Street	K-6	S 7-1/2 (S 7-8)	382	15	8	405
Newbury	Woodbridge School Graham Avenue	1-2	S 7 (S 7-8)	91	4	3	98
Newbury	Harbor School 24 Rolfe's Lane	Special	S 6-3/4 (S 6-7)	22	6		28
Newbury	Harbor School 28 Rolfe's Lane	Special	S 6-3/4 (S 6-7)	24	7		31
Newburyport	Belleville School 333 High Street	K-4	SSW 6-1/2 (SSW 6-7)	577	28	2	607
Newburyport	George W. Brown School Milk Street	K-4	S 6-1/2 (S 6-7)	322	17	2	341

TABLE 2.1-8
(Sheet 9 of 14)

Town	School	Grades	Distance (miles) & Direction (sector)	(B) No. of Students	(C) No. of Teachers	(D) No. of Staff	(A) Total Fall 1978 Population (B+C+D=A)
Newburyport	Davenport School Congress Street	K-4	SSW 6 (SSW 6-7)	105	5	2	112
Newburyport	Kelley School 149 High Street	K-4	SSW 6-1/4 (SSW 6-7)	116	7	2	125
Newburyport	Ruppert A. Nook Middle School Low Street	5-8	SSW 6-1/2 (SSW 6-7)	966	68	17	1,051
Newburyport	Newburyport High School 241 High Street	9-12	S 6 (S 6-7)	871	56	15	942
Newburyport	Immaculate Conception Green & Washington Streets	1-8	SSW 6-1/2 (SSW 6-7)	182	NA - Approx.--	20	202
Newburyport	Living & Learning School 151 Low Street	N-K	SSW 6-1/2 (SSW 6-7)	90	13	NA	103

TABLE 2.1-8
(Sheet 10 of 14)

Town	School	Grades	Distance (miles) & Direction (sector)	(B) No. of Students	(C) No. of Teachers	(D) No. of Staff	(A) Total Fall 1978 Population (B+C+D=A)
Newburyport	Mrs. Haley's Preschool 29 Marlboro Street	N-K	S 6-1/2 (S 6-7)	NA	NA		NA
Newburyport	My School YMCA - State Street	N-K	S 6 (S 6-7)	24	4	0	28
Newburyport	Spring Street School 6 Parsons Street	N-3	S 6-1/2 (S 6-7)	39	6	0	45
Newburyport	The First School 893 Main Street W. Newbury	K-3	SW 7-1/2 (SW 7-8)	11	2		13
Newburyport	The Children's House 23 Chapel Street	N-K	SSW 5-3/4 (SSW 5-6)	24	3		27
Newburyport	Mrs. Murray's Nursery School 13 Federal Street	N-K	S 6-1/4 (S 6-7)	60	4		34

TABLE 2.1-8
(Sheet 11 of 14)

Town	School	Grades	Distance (miles) & Direction (sector)	(B) No. of Students	(C) No. of Teachers	(D) No. of Staff	(A) Total Fall 1978 Population (B+C+D=A)
Greenland	Central School Post Road	1-8	N 9-1/4 (N 9-10)	312	20	6	338
W. Newbury	Central Grammar School 381 Main Street	1, 2	SW 10 (SW 9-10)	141	7	5	153
W. Newbury	Dr. Page School 694 Main Street	3-6	SW 8-1/4 (SW 8-9)	228	12	7	247
Rye	Elementary School 461 Sagamore Road	1-5	NNE 10 (NNE 9-10)	200	20		220
Rye	Rye Junior High School 501 Washington Road	6-8	NNE 9-1/4 (NNE 9-10)	300	20		320
Stratham	Memorial School Bunker Hill Avenue	1-6	NNW 8-1/2 (NNW 8-9)	251	17	7	275
Stratham	Acorn School Winnicut Road	K-3	N 8-1/2 (N 8-9)	51	4		55

TABLE 2.1-8
(Sheet 12 of 14)

Town	School	Grades	Distance (miles) & Direction (sector)	(B) No. of Students	(C) No. of Teachers	(D) No. of Staff	(A) Total Fall 1978 Population (B+C+D=A)
E. Kingston	Elementary School Andrews Lane	3-6	WNW 8-1/2 (WNW 8-9)	92	9		101
E. Kingston	Brown's Academy	1, 2	WNW 8-1/2 (WNW 8-9)	35	2		37
Newton	Teddy Bear Nursery School 40 Highland Road	N	W 10 (W 9-10)	54	4		58
Exeter	Montessori School of Exeter 8 Center Street	N-K	NW 7-2/3 (NW 7-8)	40	4		44
Exeter	Rockingham School for Special Children 40 Lincoln Street	Special	NW 7-1/4 (NW 7-8)	41	NA	NA	NA
Exeter	Richie-McFarland Children's	2-6 yrs.	NW 7-1/4 (NW 7-8)	20	4	3	27

TABLE 2.1-8
(Sheet 13 of 14)

Town	School	Grades	Distance (miles) & Direction (sector)	(B) No. of Students	(C) No. of Teachers	(D) No. of Staff	(A) Total Fall 1978 Population (B+C+D=A)
Exeter	Philips-Exeter Academy	9-12	NW 7-1/4 (NW 7-8)	970	125	NA Approx. 100	1,195
Exeter	Exeter Day Care Center 261 Water Street	N	NW 8 (NW 7-8)	45	9		54
Exeter	Exeter Day School 6 Marlboro Street	3-5 yrs.	NW 7-1/4 (NW 7-8)	125	8		132
Exeter	Exeter Elementary School Lincoln Street	1 & 2	NW 7-1/2	672	75		742
		3-6	(NW 7-8)	271	50	0	321
Exeter	High School Linden Street	9-12	NW 7-1/2 (NW 7-8)	1,305	90		1,395
	Vocational High School (Planned Opening 9/80)	11 & 12	NW 7-1/2 (NW 7-8)	690 max. 2 sessions	20-40	12	742
Exeter	Jr. High School	6-8	NW 7-1/2 (NW 7-8)	630	50		680

TABLE 2.1-8
(Sheet 14 of 14)

Town	School	Grades	Distance (miles) & Direction (sector)	(B) No. of Students	(C) No. of Teachers	(D) No. of Staff	(A) Total Fall 1978 Population (B+C+D=A)
Exeter	Main Street School Main Street	1, 2 Special	NW 7-1/2 (NW 7-8)	291	20		311
Exeter	School Street School School Street		NW 7-3/4 (NW 7-8)	------Current Use - Office Space-------			
Exeter	ABC Preschool 16 Ridgecrest Drive	3-6 yrs.	NW 7-3/4 (NW 7-8)	32	2		34
Exeter	Child Garden Country Day 9 Chestnut Street	K-3	NW 7-3/4 (NW 7-8)	NA	NA		NA

TABLE 2.1-9
(Sheet 1 of 4)

MEDICAL RELATED FACILITIES WITHIN 10 MILES OF THE SEABROOK STATION

Name and Type	Location (Sector)	Bed Capacity (Estimated Population)	Planned Expansion
		NEW HAMPSHIRE	
		Hampton	
Odyssey House (Medical and Theraputic Treatment)	30 Winnacunnett (NNE 2-3)	40 adolescents, 15 staff (55 persons)	None
Seacoast Health Center Inc. (nursing home)	22 Tuck Road (NNE 3-4)	76 beds, staff estimate N/A - (77 persons)	None
		MASSACHUSETTS	
		Salisbury	
Greenleaf House Nursing Home	335 Elm Street (SSW 4-5)	60 beds, 60 staff (120 persons)	None
		Amesbury	
Amesbury Hospital Highland Avenue	(SW 5-6)	63 bed max., 47 avg., 230 staff (Total 293)	None
Amesbury Nursing and Retirement Home	22 Maple Street (WSW 5-6)	124 beds, 110 staff (234 persons)	None

TABLE 2.1-9
(Sheet 2 of 4)

Name and Type	Location (Sector)	Bed Capacity (Estimated Population)	Planned Expansion
		Amesbury (continued)	
Hillside Nursing Home	29 Hillside (SW 5-6)	26 beds, 8 staff (34 persons)	None
Maplewood Manor Nursing Home	Morril Place (SW 5-6)	120 beds, 100 staff (220 persons)	None
Eastwood Rest Home	39 High Street (SW 5-6)	33 beds, 12 staff (45 persons)	None
North Eastwood Rest Home	276 Main (SW 5-6)	20 beds, 10 staff (26 persons)	Possible expansion of 17 beds, 10 staff
Parkside Rest Home	56 Sparhawk (SW 5-6)	30 beds, 8 staff (38 persons)	None
		Newburyport	
Anna Jacques Hospital	Highland Avenue (SSW 6-7)	104 beds, 520 staff (624 persons)	33 bed med/ surg. addition sched. to begin 3/1/80

Table 2.1-9
(Sheet 3 of 4)

Name and Type	Location (Sector)	Bed Capacity (Estimated Population)	Planned Expansion
	Newburyport (continued)		
Brigham Manor Nursing Home	77 High Street (S 6-7)	64 beds, 60 staff (124 persons)	None
Country Manor Convalescent Home, Inc.	Low Street (SSW 6-7)	123 beds, 100 staff (223 persons)	None
Newburyport Manor Chronic Hospital	Low & Hale Street (SSW 6-7)	102 beds, 100 staff (202 persons)	None
Worcester Park Nursing Home	351 High Street (SSW 5-6)	68 beds, 56 staff (124 persons)	None
Home for Aged Men (Newburyport Society)	361 High Street (SSW 5-6)	9 residents, 8 full and part-time staff (17 persons)	None
Link House Treatment Center	37 Washington (SSW 6-7)	12 beds, 5 staff (17 persons)	None
Home for Aged Women (Newburyport Society)	75 High Street (S 6-7)	10 residents, 9 full and part-time staff (19 persons)	None

Table 2.1-9
(Sheet 4 of 4)

Name and Type	Location (Sector)	Bed Capacity (Estimated Population)	Planned Expansion
		Exeter	
Exeter Hospital	(NW 7-8)	110 beds, 400 staff (510 persons)	None
Court Street Unit	(NW 7-8)	100 beds, 100 staff (200 persons)	None
Eventide Home, Inc.	81 High Street (NW 7-8)	21 beds, 12 nurses, 13 staff (46 persons)	None
Goodwin's of Exeter	Hampton Road (NW 7-8)	75 beds, 75 staff (150 persons)	None

TABLE 2.1-10

ESTIMATED PEAK POPULATION WITHIN TEN MILES

Transient Population	0-5 Miles	5-10 Miles	0-10 Miles
(1) Seasonal Resident			
(a) Weekend Day	30,500	12,512	43,012
(b) Weekday	(21,669)	(8,886)	(30,555)
(2) Overnight Visitors			
(a) Hotels, Motels and Guesthouses	10,019	1,005	11,024
(b) Camping	3,160	4,488	7,648
(3) Daily transient			
(a) Fee and Free Lots and Metered On-Street Parking	30,441	12,233	42,674
(b) "On-Street" Parking	10,246	2,384	12,630
Total Seasonal Resident, Overnight Visitors and Daily Transients	84,366	32,622	116,988
Total Permanent Population 1980	32,060	68,660	100,720
Total Peak Transient and Permanent Population	116,426	101,282	217,708

TABLE 2.1-11

POPULATION AGE GROUP DISTRIBUTION

	Percent of Total Population (1970)				
Age Group (years)	U.S.	Massachusetts	Maine	New Hampshire	Rockingham County* New Hampshire
0-11	26.1%	21.8%	22.7%	23.2%	25.7%
12-18	13.8%	13.1%	13.8%	13.2%	11.3%
over 18	60.1%	65.1%	63.5%	63.6%	63.0%

* Seabrook site located in Rockingham County, New Hampshire

TABLE 2.1-12

LAND USE ADJACENT TO SEABROOK STATION *

Land Use	Acreage	Percent
Agricultural	3,127	9.28
Commercial	297	0.88
Industrial	672	1.99
Marsh	6,420	19.05
Open Land	954	2.83
Recreational	302	0.91
Residential (low)	3,084	9.15
Residential (high)	2,437	7.23
Woodland	16,404	48.68
TOTAL	33,697	100

*For a 5-mile radius from the site

TABLE 2.1-13

COUNTIES WITHIN 50 MILES OF THE SEABROOK STATION

State Counties	Estimated Percentage Within 50 Miles
Maine	
York	75
Massachusetts	
Essex	100
Middlesex	85
Norfolk	30
Plymouth	15
Suffolk	100
Worcester	10
New Hampshire	
Belknap	40
Carroll	10
Hillsborough	65
Merrimack	45
Rockingham	100
Stratfford	100

TABLE 2.1-14

LOCATION OF NEAREST AGRICULTURAL PARAMETERS[1]
WITHIN FIVE MILES

Compass Sectors	Residence (miles)	Vegetable Garden (miles)	Milk Goat (miles)	Milk Cow (miles)	Beef[2] Cow (miles)
N	0.7	0.7	–	3.0	3
NNE	2.0	2.0	–	–	–
NE	1.5	2.0	–	–	–
ENE	1.6	1.7	–	–	–
E	1.6	–*	–	–	–
ESE	1.5	–	–	–	–
SE	1.5	–	–	–	–
SSE	0.7	2.2	–	–	–
S	0.6	0.7	–	4.3	–
SSW	0.7	0.8	–	3.0	2.8
SW	0.6	0.8	–	3.2	1.3
WSW	1.1	1.2	–	3.3	1.4
W	0.6	0.6	3.8	–	3.2
WNW	0.7	1.4	–	4.4	3.8
NW	0.8	0.8	4.4	–	2.0
NNW	0.7	1.2	0.8	2.5	1.7

2

*Slash denotes that the category did not occur in the sector.

(1) Location of nearest agriculture parameters within five miles identified during site survey the fall of 1981, unless otherwise noted.

(2) Nearest Beef cow locations identified during survey conducted Fall of 1981 and Spring of 1982, through a combination of aerial inspections, roadside inspections and interviews with agricultural authorities and owners of beef and dairy herds.

TABLE 2.1-15
(Sheet 1 of 5)

1978 AGRICULTURAL STATISTICS FOR SURROUNDING MAINE COUNTIES

LAND USE	York County
Approximate land area of county in acres	640,768
Number of farms	506
Average size of farms in acres	162
Land in farms (acres)	81,954
Proportion of land area in farms (%)	12.8
Total cropland in farms (acres)	31,042
Harvested (acres)	23,064
Pasture or grazing (acres)	5,708
Other (acres)	2,270
Woodland or woodland pasture in farms (acres)	42,998
Other pastureland and rangeland (acres)	1,801
House lots, ponds, roads, wasteland	6,113
Percent (%) of total land area in farms	12.8
Percent (%) of farmland utilized as cropland	37.8
Percent (%) of cropland that is harvested	74.3
Percent (%) of cropland that is used as pasture or grazing land	18.4
Percent (%) of cropland used for miscellaneous purposes	7.3
Percent (%) of farmland utilized as woodland or woodland pasture	52.5
Percent (%) of all other land in farms	9.7

Source: U.S. Bureau of the Census

TABLE 2.1-15
(Sheet 2 of 5)

1978 AGRICULTURAL STATISTICS FOR SURROUNDING NEW HAMPSHIRE COUNTIES

Land Use	Belknap County	Carroll County	Hillsborough County
Approximate land area of county in acres	256,064	600,256	567,680
Number of farms	134	110	390
Average size of farms in acres	173	226	146
Land in farms (acres)	23,163	24,807	56,764
Proportion of land area in farms (%)	9.0	4.1	10.0
Total cropland in farms (acres)	6,425	6,128	21,349
Harvested (acres)	4,608	4,689	16,140
Pasture or grazing (acres)	1,078	920	3,886
Other (acres)	739	519	1,323
Woodland or woodland pasture in farms (acres)	15,182	17,000	29,682
Other pastureland and rangeland (acres)	723	325	1,442
House lots, ponds, roads, wasteland (acres)	833	1,354	4,291
Percent (%) of total land area in farms	9.0	4.1	10.0
Percent (%) of farmland utilized as cropland	27.7	24.7	37.6
Percent (%) of cropland that is harvested	71.7	76.5	75.6
Percent (%) of cropland that is used as pasture or grazing land	16.8	15.0	18.2
Percent (%) of cropland used for miscellaneous purposes	11.5	8.5	6.2
Percent (%) of farmland utilized as woodland or woodland pasture	65.6	68.5	52.3
Percent (%) of all other land in farms	6.7	6.8	10.1

Source: U.S. Bureau of the Census

TABLE 2.1-15
(Sheet 3 of 5)

1978 AGRICULTURAL STATISTICS FOR SURROUNDING NEW HAMPSHIRE COUNTIES

Land Use	Merrimack County	Rockingham County	Strafford County
Approximate land area of county in acres	595,328	441,984	240,320
Number of farms	370	365	192
Average size of farms in acres	175	125	153
Land in farms (acres)	64,924	45,479	29,393
Proportion of land area in farms (%)	10.9	10.3	12.2
Total cropland in farms (acres)	22,273	18,434	12,811
Harvested (acres)	16,320	13,037	9,708
Pasture or grazing (acres)	4,842	3,654	2,091
Other (acres)	1,111	1,743	1,012
Woodland or woodland pasture in farms (acres)	36,761	21,386	14,407
Other pastureland and rangeland (acres)	2,356	1,755	460
House lots, ponds, roads, wasteland (acres)	3,534	3,904	1,715
Percent (%) of total land area in farms	10.9	10.3	12.2
Percent (%) of farmland utilized as cropland	34.3	40.6	43.6
Percent (%) of cropland that is harvested	73.3	70.7	75.8
Percent (%) of cropland that is used as pasture or grazing land	21.7	20.0	16.3
Percent (%) of cropland used for miscellaneous purposes	5.0	9.3	7.9
Percent (%) of farmland utilized as woodland or woodland pasture	56.6	47.0	49.0
Percent (%) of all other land in farms	9.1	12.4	7.4

Source: U.S. Bureau of the Census

TABLE 2.1-15
(Sheet 4 of 5)

1978 AGRICULTURAL STATISTICS FOR SURROUNDING MASSACHUSETTS COUNTIES

Land Use	Essex County	Middlesex County	Norfolk County
Approximate land area of county in acres	316,096	528,128	252,160
Number of farms	348	577	207
Average size of farms in acres	87	73	67
Land in farms (acres)	30,229	41,866	13,835
Proportion of land area in farms (%)	9.6	7.9	5.5
Total cropland in farms (acres)	16,712	23,329	5,400
Harvested (acres)	12,342	17,343	3,670
Pasture or grazing (acres)	2,894	4,357	1,453
Other (acres)	1,476	1,629	277
Woodland or woodland pasture in farms (acres)	9,183	12,846	6,739
Other pastureland and rangeland (acres)	1,189	1,091	402
House lots, ponds, roads, wasteland (acres)	3,145	4,600	1,294
Percent (%) of total land area in farms	9.6	7.9	5.5
Percent (%) of farmland utilized as cropland	55.3	55.7	39.0
Percent (%) of cropland that is harvested	73.9	74.3	68.0
Percent (%) of cropland that is used as pasture or grazing land	17.3	18.7	26.9
Percent (%) of cropland used for miscellaneous purposes	8.8	7.0	5.1
Percent (%) of farmland utilized as woodland or woodland pasture	30.4	30.7	48.7
Percent (%) of all other land in farms	14.3	13.6	12.3

Source: U.S. Bureau of the Census

TABLE 2.1-15
(Sheet 5 of 5)

1978 AGRICULTURAL STATISTICS FOR SURROUNDING MASSACHUSETTS COUNTIES

Land Use	Plymouth County	Suffolk County	Worcester County
Approximate land area of county in acres	418,688	68,088	965,760
Number of farms	590	6	864
Average size of farms in acres	141	3	150
Land in farms (acres)	82,939	15	129,740
Proportion of land area in farms (%)	19.8	N/A	13.7
Total cropland in farms (acres)	22,284	15	59,485
Harvested (acres)	18,236	11	41,733
Pasture or grazing (acres)	2,005	N/A	14,590
Other (acres)	2,043	N/A	3,162
Woodland or woodland pasture in farms (acres)	38,711	N/A	54,302
Other pastureland and rangeland (acres)	3,179	N/A	6,447
House lots, ponds, roads, wasteland (acres)	18,765	N/A	9,506
Percent (%) of total land area in farms	19.8	N/A	13.7
Percent (%) of farmland utilized as cropland	26.8	N/A	45.8
Percent (%) of cropland that is harvested	81.8	N/A	70.2
Percent (%) of cropland that is used as pasture or grazing land	9.0	N/A	24.5
Percent (%) cropland used for miscellaneous purposes	9.2	N/A	5.3
Percent (%) of farmland utilized as woodland or woodland pasture	46.7	N/A	41.9
Percent (%) of all other land in farms	26.5	N/A	12.3

Source: U.S. Bureau of the census
Note: N/A = Information Not Available

TABLE 2.1-16
(Sheet 1 of 5)

1978 CROP CHARACTERISTICS FOR SURROUNDING MAINE COUNTIES

	York County
Corn for Silage (green)	
Acreage	2,192
Yield/Year (tons)	25,554
Yield/Acre (tons)	11.7
Alfalfa Hay (dry)	
Acreage	1,870
Yield/Year (tons)	3,961
Yield/Acre (tons)	2.1
All Hay (dry)	
Acreage	18,181
Yield/Year (tons)	27,678
Yield/Acre (tons)	1.5
Apples	
Acreage	1,580
Yield/Year (lbs)	17,570,604
Yield/Acre (lbs)	11,121
Vegetables, Melons, Sweet Corn	
Farms	52
Acreage	514
Irish Potatoes	
Farms	18
Acreage	NA
Hundred Weight	NA
Orchards (including apples)	
Farms	49
Acreage	1,593

Source: 1978 Census of Agriculture; Vol. 1, Part 19, Maine (AC78-A-19), U.S. Department of Commerce, Bureau of the Census.

NA: Information Not Available.

TABLE 2.1-16
(Sheet 2 of 5)

1978 CROP CHARACTERISTICS FOR SURROUNDING NEW HAMPSHIRE COUNTIES

	Belknap County	Carroll County	Hillsborough County
Corn for Silage (green)			
Acreage	383	1,163	1,881
Yield/Year (tons)	5,547	20,218	27,394
Yield/Acre (tons)	14.5	17.4	14.6
Alfalfa Hay (dry)			
Acreage	613	830	2,734
Yield/Year (tons)	1,295	2,086	5,751
Yield/Acre (tons)	2.1	2.5	2.1
All Hay (dry)			
Acreage	4,115	3,341	10,275
Yield/Year (tons)	6,176	5,482	17,339
Yield/Acre (tons)	1.5	1.6	1.7
Other Tame Dry Hay			
Acreage	2,113	1,725	5,064
Yield/Year (tons)	3,152	2,795	8,379
Yield/Acre (tons)	1.5	1.6	1.7
Apples			
Acreage	98	71	2,079
Yield/Year (lbs)	629,695	NA	33,504,045
Yield/Acre (lbs)	642.6	NA	16,116
Vegetables, Melons, Sweet Corn			
Farms	16	22	49
Acreage	83	96	2,257
Irish Potatoes			
Farms	9	5	9
Acreage	6	3	114
Hundred Weight	1,304	170	33,490
Orchards (including apples)			
Farms	23	17	58
Acreage	164	77	2,175

Source: 1978 Census of Agriculture; Vol. 1, Part 29, New Hampshire (AC78-A-29), U.S. Department of Commerce, Bureau of the Census.

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TABLE 2.1-16
(Sheet 3 of 5)

1978 CROP CHARACTERISTICS FOR SURROUNDING NEW HAMPSHIRE COUNTIES

	Merrimack County	Rockingham County	Stafford County
Corn for Silage (green)			
Acreage	3,667	1,502	1,599
Yield/Year (tons)	62,921	25,240	19,067
Yield/Acre (tons)	17.2	16.8	11.9
Alfalfa Hay (dry)			
Acreage	3,438	2,472	1,388
Yield/Year (tons)	8,451	5,721	2,666
Yield/Acre (tons)	2.5	2.3	1.9
All Hay (dry)			
Acreage	12,051	9,503	7,568
Yield/Year (tons)	24,047	16,647	11,363
Yield/Acre (tons)	2.0	1.8	1.5
Other Tame Dry Hay			
Acreage	5,918	4,665	4,600
Yield/Year (tons)	10,517	7,704	6,737
Yield/Acre (tons)	1.8	1.7	1.5
Apples			
Acreage	382	958	167
Yield/Year (lbs)	3,317,140	16,490,645	1,421,486
Yield/Acre (lbs)	8,684	17,214	8,512
Vegetables, Melons, Sweet Corn			
Farms	44	59	25
Acreage	111	889	190
Irish Potatoes			
Farms	19	10	6
Acreage	18	78	NA
Hundred Weight	3,692	7,630	NA
Orchards (including apples)			
Farms	40	31	25
Acreage	413	1,015	190

Source: 1978 Census of Agriculture; Vol. 1, Part 29, New Hampshire (AC78-A-29), U.S. Department of Commerce, Bureau of the Census.

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TABLE 2.1-16
(Sheet 4 of 5)

1978 CROP CHARACTERISTICS FOR SURROUNDING MASSACHUSETTS COUNTIES

	Essex County	Middlesex County	Norfolk County
Corn for Silage (green)			
Acreage	1,419	1,849	401
Yield/Year (tons)	22,420	32,278	6,848
Yield/Acre (tons)	15.8	17.5	17.1
All Hay (dry)			
Acreage	8,297	10,944	2,732
Yield/Year (tons)	16,701	20,320	4,605
Yield/Acre (tons)	2.0	1.9	1.7
Other Tame Dry Hay			
Acreage	4,909	5,046	1,395
Yield/Year (tons)	10,592	9,026	2,322
Yield/Acre (tons)	2.2	1.8	1.7
Apples			
Acreage	356	1,212	71
Yield/Year (lbs)	3,727,414	14,224,300	461,498
Yield/Acre (lbs)	10,470.3	11,736.2	6,499.9
Vegetables, Melons, Sweet Corn			
Farms	89	125	34
Acreage	1,826	2,569	408
Irish Potatoes			
Farms	13	12	NA
Acreage	23	62	NA
Hundred Weight	2,603	6,909	NA
Orchards (including apples)			
Farms	27	65	16
Acreage	381	1,373	76

Source: 1978 Census of Agriculture; Vol. 1, Part 21, Massachusetts (AC78-A-21), U.S. Department of Commerce, Bureau of the Census.

NA = Information Not Available.

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TABLE 2.1-16
(Sheet 5 of 5)

1978 CROP CHARACTERISTICS FOR SURROUNDING MASSACHUSETTS COUNTIES

	Plymouth County	Suffolk County	Worcester County
Corn for Silage (green)			
Acreage	3,279	NA	8,458
Yield/Year (tons)	34,431	NA	141,740
Yield/Acre (tons)	10.5	NA	16.8
All Hay (dry)			
Acreage	4,656	NA	29,421
Yield/Year (tons)	8,667	NA	62,019
Yield/Acre (tons)	1.9	NA	2.1
Other Tame Dry Hay			
Acreage	2,584	NA	17,618
Yield/Year (tons)	4,184	NA	35,818
Yield/Acre (tons)	1.6	NA	2.0
Apples			
Acreage	106	NA	3,010
Yield/Year (lbs)	278,888	NA	43,148,562
Yield/Acre (lbs)	2,631	NA	14,335
Vegetables, Melons, Sweet Corn			
Farms	67	NA	107
Acreage	854	NA	1,514
Irish Potatoes			
Farms	4	NA	14
Acreage	6	NA	30
Hundred Weight	1,338	NA	6,114
Orchards (including apples)			
Farms	31	NA	100
Acreage	142	NA	3,222

Source: 1978 Census of Agriculture; Vol. 1, Part 21, Massachusetts (AC78-A-21), U.S. Department of Commerce, Bureau of the Census.

NA = Information Not Available.

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2

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TABLE 2.1-17
(Sheet 1 of 3)

1978 LIVESTOCK AND LIVESTOCK PRODUCTS FOR MAINE BY COUNTY WITHIN 50 MILES

	York
Cattle & Calves	
Number of Head	8,844
Number Sold	4,655
Dairy Products Sold	
Farms	98
Dollars ($1000)	4,235
Number of Milk Cows	3,598
Sheep & Lambs	
Number of Head	789
Number Sold	541
Hogs & Pigs	
Number of Head	830
Number Sold	837
Poultry	
Number of Hens and Pullets of Laying Age	586,186
Broilers Sold	2,346,836
Turkeys Sold	233

Source: 1978 Census of Agriculture, Vol. 1, Part 19, Maine (AC78-A-19), U.S. Department of Commerce, Bureau of the Census.

NA = Information Not Available.

TABLE 2.1-17
(Sheet 2 of 3)

1978 LIVESTOCK AND LIVESTOCK PRODUCTS FOR NEW HAMPSHIRE BY COUNTY WITHIN 50 MILES

	Belknap	Carroll	Hillsborough	Merrimack	Rockingham	Strafford
Cattle & Calves						
Number of Head	1,985	2,009	6,802	10,922	5,101	3,707
Number Sold	1,273	796	4,408	5,854	2,559	1,416
Dairy Products Sold						
Farms	24	14	72	101	53	34
Dollars ($1,000)	763	1,075	3,688	5,591	2,593	2,066
Number of Milk Cows	651	876	2,999	4,456	2,112	1,631
Sheep & Lambs						
Number of Head	128	326	758	1,238	702	481
Number Sold	67	151	465	748	789	400
Hogs & Pigs						
Number of Head	199	264	3,644	778	1,708	330
Number Sold	314	1,144	3,949	1,682	2,138	605
Poultry						
Number of Hens and Pullets of Laying Age	NA	18,924	327,553	65,494	143,907	NA
Broilers Sold	206*	NA	5,262*	246	37,759*	954*
Turkeys Sold	74*	13*	302	1,325*	4,472*	256*

Source: 1978 Census of Agriculture, Vol. 1, Part 29, New Hampshire (AC78-A-29)
U.S. Department of Commerce, Bureau of the Census.

NA = Information Not Available.

* Numbers represent inventory of poultry when numbers sold not available.

TABLE 2.1-17
(Sheet 3 of 3)

1978 LIVESTOCK AND LIVESTOCK PRODUCTS FOR MASSACHUSETTS BY COUNTY WITHIN 50 MILES

	Essex	Middlesex	Norfolk	Plymouth	Worcester	Suffolk
Cattle & Calves						
Number of Head	4,151	5,719	1,572	4,783	22,776	NA
Number Sold	2,729	2,971	773	3,012	13,454	NA
Dairy Products Sold						
Farms	34	51	21	37	230	NA
Dollars ($1000)	2,616	2,934	912	3,892	14,495	NA
Number of Milk Cows	2,054	2,216	754	2,893	11,888	NA
Sheep & Lambs						
Number of Head	233	664	503	476	1,270	NA
Number Sold	130	362	382	317	773	NA
Hogs & Pigs						
Number of Head	2,991	13,766	1,331	5,649	15,012	NA
Number Sold	3,175	13,850	1,829	6,408	15,628	NA
Poultry						
Number of Hens and Pullets of Laying Age	48,072	193,502	21,818	24,856	438,924	NA
Broilers Sold	30,600*	14,416*	157*	287*	1,387*	NA
Turkeys Sold	2,809*	14,806	NA	680*	2,294*	NA

Source: 1978 Census of Agriculture, Vol. 1, Part 21, Massachusetts (AC78-A-21)
U.S. Department of Commerce, Bureau of the Census.

NA = Information Not Available.

* Numbers represent inventory of poultry when numbers sold not available.

2

2

2

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TABLE 2.1-18

1981 AVERAGE DAILY MILK PRODUCTION FOR COUNTIES WITHIN 50 MILES

	County	Number of Head	Pounds Milk Sold/Day
Maine			
	York	2,868	88,191
New Hampshire			
	Belknap	675	12,332
	Carroll	930	16,997
	Hillsboro	3,450	98,605
	Merrimack	4,427	124,055
	Rockingham	2,195	57,375
	Strafford	1,490	40,201
Massachusetts			
	Essex	2,210	60,625
	Middlesex	1,917	59,280
	Norfolk	664	19,280
	Plymouth	3,478	117,450
	Worcester	12,219	384,090

Source: Massachusetts Department of Food and Agriculture; Dairy Division; Boston, MA.

2

TABLE 2.1-19
(Sheet 1 of 3)

1978 STREAM GAUGE DATA

USGS Stream Gauge Number	Location	Drainage Area (sq. mi.)	Period of Record	Average Flow C.F.S.	Minimum Flow C.F.S.	Minimum Flow Date	Maximum Flow C.F.S.	Maximum Flow Date
01066500	Saco River Basin Little Ossipee River @ So. Limington, ME	161	9/40-current	294	1.7	10.7/65	5,760	3/15/77
01069500	Mousam River Basin Mousam River @ W. Kennebunk, ME	105	10/39-current	181	0.4	11/10/64	3,540	3/14/77
01072100	Piscataqua River Basin Salmon Falls River @ Milton, NH	108	10/68-current	209	19	8/30/70	3,500	3/15/77
01073000	Piscataqua River Basin Oyster River @ Durham, NH	12.1	10/34-current	19.4	0.23	8/18/71	862	9/11/54
01073500	Piscataqua River Basin Lampray River @ Newmarket, NH	183	7/34-current	280	1.0	10/21/35	5,490	3/20/36
01073600	Piscataqua River Basin Dudley Brook @ Exeter, NH	4.97	5/62-current	7.15	0.0	---	358	4/2/73
01087000	Merrimack River Basin Blackwater River @ Webster, NH	129	2/27-current	213	3.0	9/17/41	11,000	3/19/36
01089000	Merrimack River Basin Soucook River @ Concord, NH	76.8	10/51-current	111	1.5	8/7/65	3,700	3/14/77
01090800	Merrimack River Basin Piscataquog River @ E. Weare, NH	63.1	3/63-current	93.9	0.0	8/27/64	1,530	5/1/69
01091000	Merrimack River Basin So. Branch Piscataquog @ Goffstown, NH	104	7/40-9/78	165	2.4	8/20/66	4,100	6/25/44

TABLE 2.1-19
(Sheet 2 of 3)

USGS Stream Gauge Number	Location	Drainage Area (sq. mi.)	Period of Record	Average Flow C.F.S.	Minimum Flow C.F.S.	Minimum Flow Date	Maximum Flow C.F.S.	Maximum Flow Date
01092000	Merrimack River Basin Merrimack River @ Manchester, NH	3,092	10/36-current	5,274	98	10/11/64	102,500	9/23/38
01094400	Merrimack River Basin No. Nashua River @ Fitchburg, MA	63.6	10/72-current	128	9.4	7/31/77	2,080	12/21/73
01094500	Merrimack River Basin No. Nashua River @ Leominster MA	110	9/35-current	193	11.0	8/29/48	16,300	3/18/36
01095500	Merrimack River Basin So. Branch Nashua River @ Clinton, MA	107.69	7/1896-current	188	--	--	--	--
01096000	Merrimack River Basin Squannacook River @ West Groton, MA	62.8	10/49-current	110	2.0	9/7/65	4,010	10/16/55
01096500	Merrimack River Basin Nashua River @ E. Pepperell, MA	433	10/35-current	561	1.1	8/13/39	20,900	3/20/36
01097000	Merrimack River Basin Assabet River @ Maynard, MA	116	7/41-current	183	0.20	2/7/65	4,250	8/20/55
01097500	Merrimack River Basin Sudbury River @ Framingham, MA	75.2	1/1875-current	115	--	--	--	--
01099500	Merrimack River Basin Concord River @ Lowell, MA	405	10/36-current	620	4.0	9/29/57	4,800	3/22/68
01100000	Merrimack River Basin Merrimack River @ Lowell, MA	4,635	6/23-current	7,200	199	9/23/23	173,000	3/20/36

TABLE 2.1-19
(Sheet 3 of 3)

USGS Stream Gauge Number	Location	Drainage Area (sq. mi.)	Period of Record	Average Flow C.F.S.	Minimum Flow C.F.S.	Minimum Flow Date	Maximum Flow C.F.S.	Maximum Flow Date
01100600	Merrimack River Basin Shawsheen River @ Wilmington, MA	35.3	11/63-current	58.1	1.2	8/30/66	1,050	3/19/68
01101000	Parker River Basin Parker River @ Byfield, MA	21.6	10/45-current	36.3	0.09	9/25/57	489	3/19/68
01101500	Ipswich River Basin Ipswich River @ So. Middleton, MA	43.4	6/38-current	62.0	0.1	9/24/57	833	3/19/68
01102000	Ipswich River Basin Ipswich River @ Ipswich, MA	124	6/30-current	188	0.34	9/20/78	2,680	3/20/68
01102500	Mystic River Basin Aberjona River @ Winchester, MA	24.2	4/39-current	27.6	0.00	10/10/50	835	8/19/55
01104200	Charles River Basin Charles River @ Wellesley, MA	211	8/59-current	272	1.0	9/8/65	2,410	3/21/68
01104500	Charles River Basin Charles River @ Waltham, MA	227	8/31-current	295	0.1	10/1/43	4,150	2/3/76
01105557	Blacks Creek Basin Furnace Brook @ Quincy, MA	3.83	10/72-current	5.90	0.11	6/21/73	291	5/13/75
01105585	Weymouth Fore River Basin Town Brook @ Quincy, MA	4.25	9/72-current	8.86	0.68	8/2/75	481	5/13/75
01105600	Weymouth Back River Basin Old Swamp River @ So. Weymouth, MA	4.29	5/66-current	9.52	0.11	9/10/71	566	3/18/68

Source: U.S. Geological Survey

TABLE 2.1-20

COASTAL PARTY BOAT NUMBERS AND CAPACITIES [1]

Operating Within 20 Miles of Shore

State	Season	Number Vessels	Passenger Mean	Passenger Range	Total
Maine[2]		38	37.2	16-83	1414
New Hampshire	(April 2-October 31)	15	48.4	30-72	726
New Hampshire	(November 1-April 1)	15	31.3	18-72	469
Massachusetts	(April 2-October 31)	91	50.9	13-140	4631
Massachusetts	(November 1-April 1)	91	32.3	4-97	2939

Operating Up to 50-100 Miles From Shore

State	Vessels	Passenger Mean	Passenger Range	Total
Maine	0	-	-	-
New Hampshire	1	72	-	72
Massachusetts	8	51.4	13-97	411

1. Does not include crew
2. Based on incomplete records

Source: N.E. Regional Fisheries Management Council; 1977

TABLE 2.1-21

MEAN NUMBER DAYS FISHED

State	Passenger Capacities		
	7-40	41-70	71+
Maine & New Hampshire	78	100	120
Massachusetts	104	110	133

Source: N.E. Regional Fisheries Management Council; 1978

TABLE 2.1-22

MASSACHUSETTS ANGLER DISTRIBUTION BY FISHING ACTIVITY

Fishing Practice	Percent of Total Area 1	Area 2	Area 3
Surf Fishing Accesses, Jetties	20.7	3.0	1.7
Bridges, Inlets, Canals, Piers	51.4	68.9	60.2
Transient boaters	21.4	20.8	28.1
Resident Boaters	6.5	7.3	10.0

Area 1: Newburyport to Gloucester
Area 2: Gloucester to Cohasset
Area 3: Cohasset to Plymouth

Source: Massachusetts Division of Marine Fisheries; 1977

TABLE 2.1-23

FISH STOCKING 1979 IN THE VICINITY OF SEABROOK *

State	Species	Number	Pounds
Maine	Landlock Salmon	1,000	169
	Rainbow Trout	300	33
	Brown Trout	58,850	5,022
	Lake Trout	6,000	500
	Brook Trout	18,600	3,666
Total		84,750	9,390
Massachusetts	Rainbow Trout	96,800	10,648+
	Brown Trout	18,300	1,562+
	Brook Trout	71,300	14,053+
Total		186,400	26,263+
New Hampshire	Landlock Salmon	59,300	10,022+
	Rainbow Trout	67,425	7,417+
	Brown Trout	11,250	960+
	Lake Trout	10,000	833+
	Brook Trout	68,101	13,423+
Total		216,076	32,655+

* Within 50 miles
+ Estimated poundage

TABLE 2.1-24

1979 STATE FISH HATCHERIES AND SPECIES PRODUCED

Location	Species Produced
Maine	
Augusta	Lake Trout
Casco	Landlock & Atlantic Salmon
Deblois	Brook & Brown Trout
Embden	Landlock Salmon; Lake, Brook & Rainbow Trout, (Rearing Station)
Enfield	Salmon, Lake & Brook Trout, Artic Char
Gray	Brook & Lake Trout
Grand Lakes Stream	Landlock Salmon
New Gloucester	Brown Trout
Palermo	Brook & Brown trout (Rearing Station)
Phillips	Brook Trout (Brood Stock)
Massachusetts	
Belchertown	Brook, Brown & Rainbow trout
Montigue	Trout Species
Palmer	Coho, Landlock, Atlantic & Cocanese Salmon
Sandwich	Coho Salmon & Trout Species
Sunderland	Trout Species
North Andover	S.M. Bass, L.M. Bass, Chain Pickerel
New Hampshire	
New Durham	Landlock Salmon; Rainbow, Brook, Brown & Lake Trout
New Hampton	Brook Trout

TABLE 2.1-25

1977 COMMERICAL FISHERIES*
YORK COUNTY, MAINE

Species	Harvest (lbs)	Value($)
Alewives	35,000	2,000
Anglerfish	118,902	44,096
Cod	2,636,422	668,974
Cusk	213,623	39,562
Flounder	1,194,271	380,646
Haddock	670,310	297,143
White Hake	1,185,258	163,554
Halibut	5,544	6,974
Atlantic Mackerel	13,808	4,034
Ocean Perch	34,902	7,136
Pollock	3,461,370	548,757
Shad	12,117	1,085
Sharks	3,193	363
Skate	11,883	1,276
Sturgeon	2,692	394
Bluefin Tuna	8,450	5,272
Whiting	70,309	5,473
Wolffish	13,804	1,393
Unclassified (food)	31,624	4,208
Lobster	1,036,559	1,775,456
Shrimp	37,968	20,724
Soft Clams	15,345	19,667
Squid	1,825	290
Seaweed (Irish Moss)	524,560	27,800
TOTAL	11,339,739	4,026,277

Source: NMFS, Atlantic Ocean Data

TABLE 2.1-26

1977 COMMERCIAL FISHERIES
ROCKINGHAM COUNTY, NEW HAMPSHIRE

Species	Harvest (lbs)	Value ($)
Alewives	210,000	7,518
Anglerfish	43,781	14,736
Bluefish	200	40
Cod	951,025	234,427
Cusk	131,297	24,314
Eel	5,600	4,963
Flounder	463,122	143,871
Haddock	223,637	89,766
White Hake	395,136	54,530
Halibut	3,010	4,615
Sea Herring	54,383	2,638
Launce	6,400	2,624
Mackerel	4,562	728
Ocean Perch	9,599	2,003
Pollock	1,207,850	191,444
Shad	4,239	382
Sharks	3,980	584
Skate	5,838	606
Striped Bass	2,000	700
Common Sturgeon	1,076	179
Bluefin Tuna	3,547	2,833
Whiting	35,184	2,736
Wolffish	2,540	276
Unclassified (food)	9,708	1,372
Shrimp	2,850	2,500
Rock Crab	22,600	2,373
Lobster	474,100	812,038
Sandworms	23,800	32,280
TOTAL	4,301,064	1,637,076

Source NMFS, Atlantic Ocean, Great Bay and Hampton River Data

TABLE 2.1-27

1977 COMMERCIAL FISHERIES
ESSEX COUNTY, MASSACHUSETTS

Species	Harvest(lbs)	Value($)
Alewives	81,800	17784
Anglerfish	638,800	241,793
Bluefish	32,900	6,204
Butterfish	300	181
Cod	23,206,900	5,024,705
Cusk	1,235,300	213,244
Common Eel	35,700	19,322
Conger Eel	1,500	130
Flounder	11,309,400	4,180,404
Haddock	9,918,200	3,188,925
Red Hake	1,212,900	129,386
White Hake	2,930,200	445,236
Halibut	47,100	52,514
Sea Herrings	31,926,000	1,172,964
Launce	36,000	12,600
Mackerel	455,300	77,235
Menhaden	17,407,600	400,825
Ocean Perch	11,944,700	1,749,103
Ocean Pout	800	100
Pollock	9,383,900	1,337,171
Sea Bass	200	57
Shad	200	23
Sharks	11,200	1,203
Skate	82,100	9,379
Smelt	100	11
Striped Bass	84,600	67,566
Sturgeon	1,800	369
Swordfish	603,400	775,532
Tautog	2,300	299
Tilefish	13,900	3,139
Bluefin Tuna	752,600	376,081
Whiting	24,376,700	2,085,243
Wolffish	461,400	40,318
Unclassified (food)	965,800	229,434
Lobster	2,468,192	4,563,375
Mussels	2,000	1,200
Rock Crab	14,000	3,500
Sandworms	20,000	40,000
Sea Scallops	106,300	148,798
Shrimp	521,100	282,938
Soft Clams	286,819	529,512
Squid	1,917,600	170,900
TOTAL	154,497,111	27,582,703

Source: NMFS, Atlantic Ocean Data

TABLE 2.1-28

1977 FISHERIES STATISTICS SUFFOLK COUNTY, MASSACHUSETTS

Species	Harvest (lbs)	Value ($)
Bluefish	6,000	900
Cod	8,775,700	2,098,964
Cusk	232,100	46,286
Common Eel	15,000	8,200
Flounder	1,273,700	557,447
Haddock	5,930,900	2,123,302
Red Hake	500	375
White Hake	509,000	97,718
Halibut	1,300	1,667
Ocean Perch	2,183,700	450,846
Pollock	3,323,700	601,328
Striped Bass	15,000	11,250
Bluefin Tuna	41,400	20,747
Whiting	7,700	737
Wolffish	177,000	18,120
Unclassfied (food)	2,900	871
Lobster	880,467	1,562,613
Soft Clams	25,831	39,740
TOTAL	23,401,898	7,641,111

Source: NMFS, Atlantic Ocean Data

TABLE 2.1-29

1977 COMMERCIAL FISHERIES
NORFOLK COUNTY, MASSACHUSETTS

Species	Harvest (lb)	Value ($)
Bluefish	4,000	600
Cod	52,000	12,960
Common Eel	12,000	6,000
Flounder	28,000	8,240
Pollock	3,000	1,500
Striped Bass	10,000	7,500
Bluefin Tuna	4,600	2,694
TOTAL	113,600	39,494

Source: NMFS, Atlantic Ocean Data

TABLE 2.1-30

1977 COMMERCIAL FISHERIES
PLYMOUTH COUNTY, MASSACHUSETTS

Species	Harvest (lbs)	Value ($)
Alewives	26,000	910
Anglerfish	50,600	15,127
Bluefish	26,600	4,484
Butterfish	1,300	469
Cod	1,349,600	349,308
Cusk	4,800	570
Common Eel	21,100	11,770
Conger Eel	1,000	72
Flounder	1,327,000	491,518
Haddock	25,300	8,677
Red Hake	53,100	3,296
White Hake	49,500	5,687
Halibut	400	529
Mackerel	11,600	2,989
Ocean Pout	75,000	5,098
Pollock	232,300	25,524
Scup	81,600	11,196
Sea Bass	2,600	2,646
Sea Trout	1,100	126
Sharks	1,000	54
Skate	26,100	2,477
Striped Bass	113,100	99,485
Sturgeon	700	94
Swordfish	144,700	211,947
Tautog	17,300	1,258
Tilefish	100	27
Bluefin Tuna	111,000	72,732
Whiting	181,800	13,153
Wolffish	15,500	1,302
Unclassified (food)	92,500	27,090
Conch	26,250	10,500
Hard Clam	46,079	125,670
Lobster	1,055,181	1,980,900
Mussels	135,000	76,500
Razor Clams	928	348
Rock Crab	11,000	2,750
Sandworms	10,500	20,000
Bay Scallops	15,500	48,050
Sea Scallops	257,700	370,717
Seaweed (Irish Moss)	1,079,400	43,174
Soft Clams	56,667	87,180
Squid	94,300	21,818
TOTAL	6,832,805	4,157,222

Source: NMFS, Atlantic Ocean Data

TABLE 2.1-31

COMMERCIAL LANDINGS BY STATE

State	1978 Thousands Pounds	1978 Thousands Dollars	1979 Thousands Pounds	1979 Thousands Dollars
Maine	190,203	68,833	232,105	80,260
New Hampshire	4,862	1,750	7,495	3,327
Massachusetts	376,878	152,251	374,706	175,544

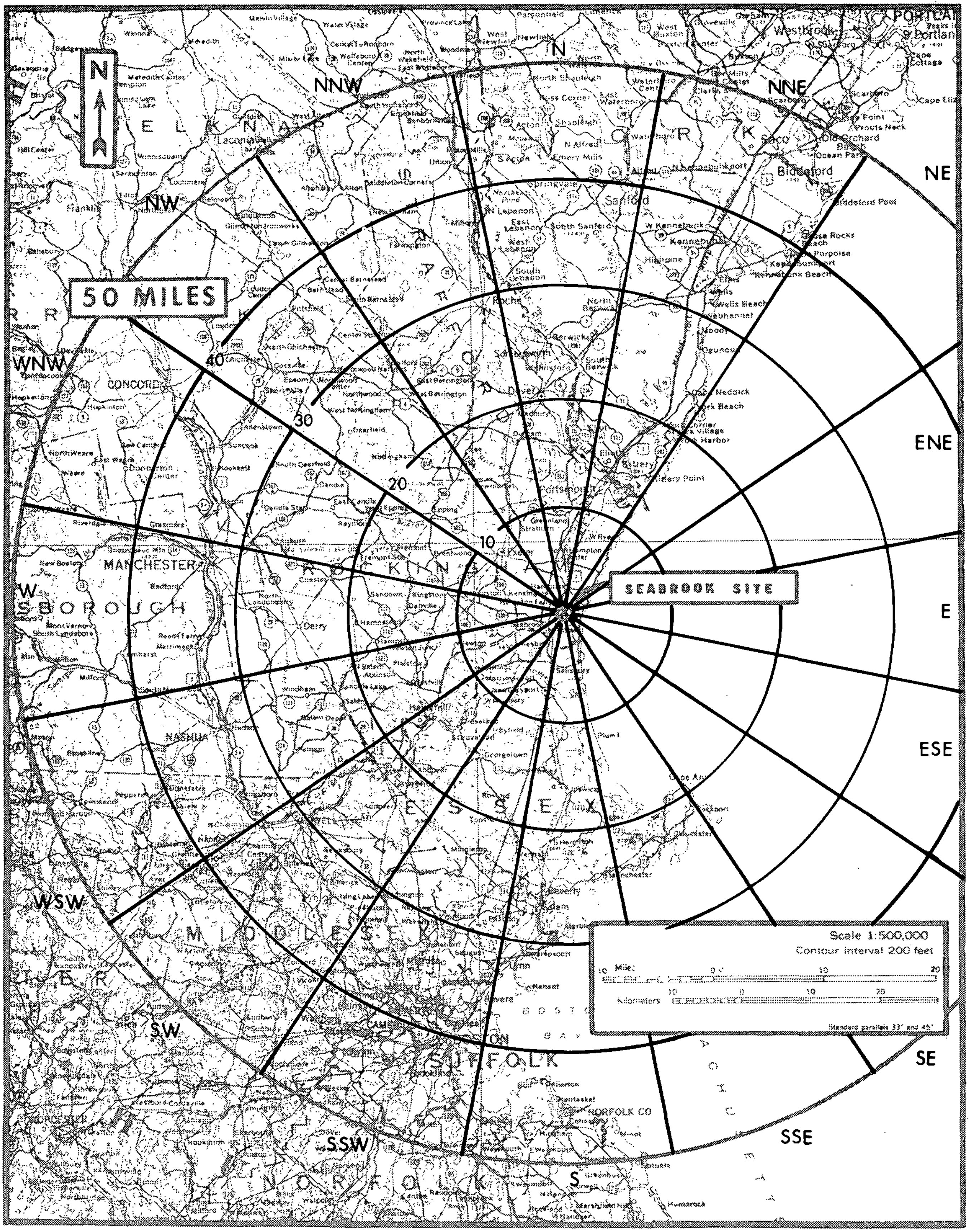
Source: NMFS Data

TABLE 2.1-32

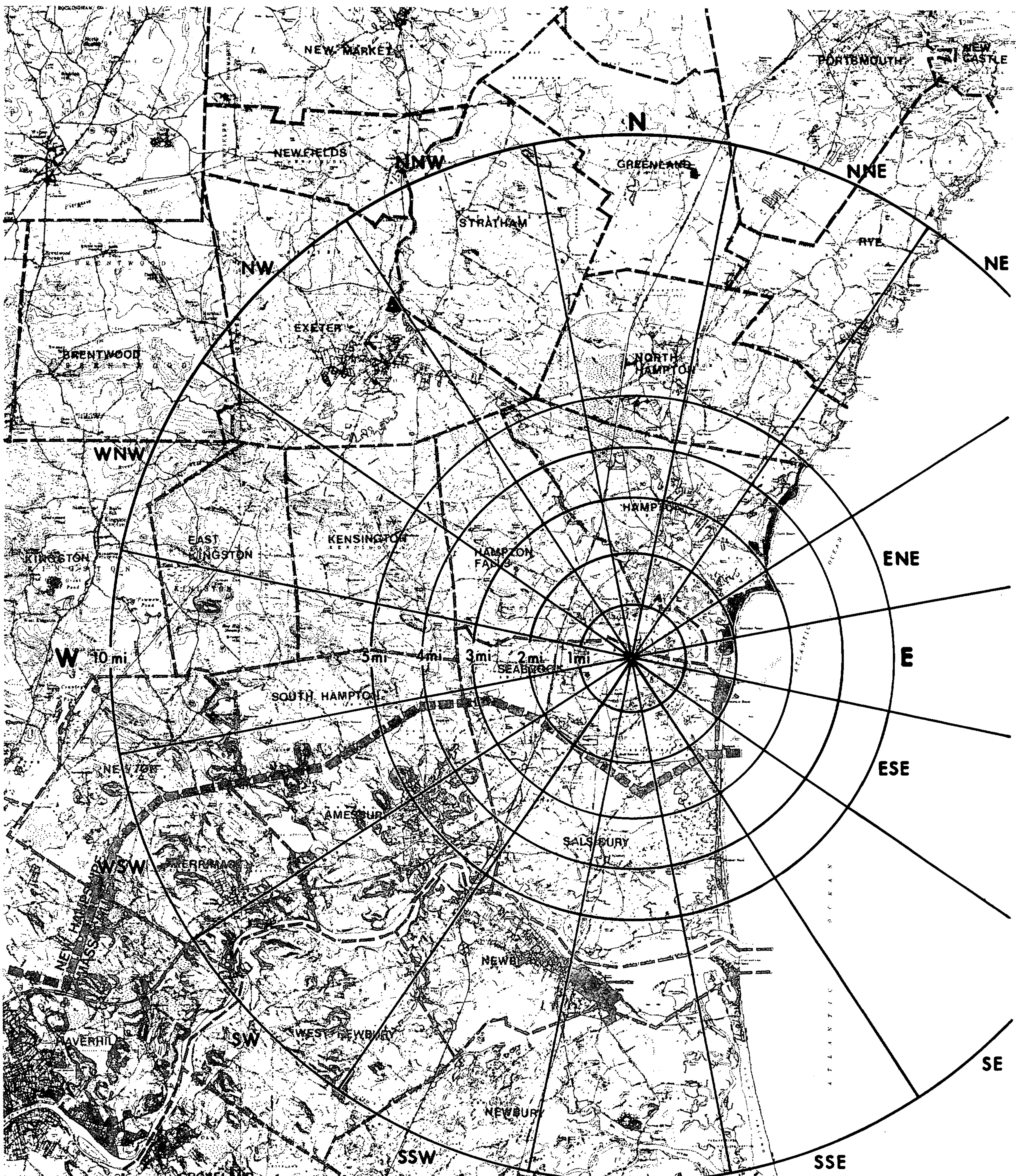
COMMERCIAL LANDINGS BY PORT

Port	1975	1976	1977	1978	1979
Portland, Maine					
Million Pounds	30.2	27.3	30.4	45.9	59.6
Million Dollars	N/A	3.4	4.7	7.5	10.1
Gloucester, Mass.					
Million Pounds	126.4	144.2	150.9	185.1	160.2
Million Dollars	14.5	16.5	21.5	28.9	29.7
Boston, Mass.					
Million Pounds	24.5	23.3	22.2	27.3	30.3
Million Dollars	6.3	6.8	6.0	8.1	10.7

N/A - Not Available
Source: NMFS Data



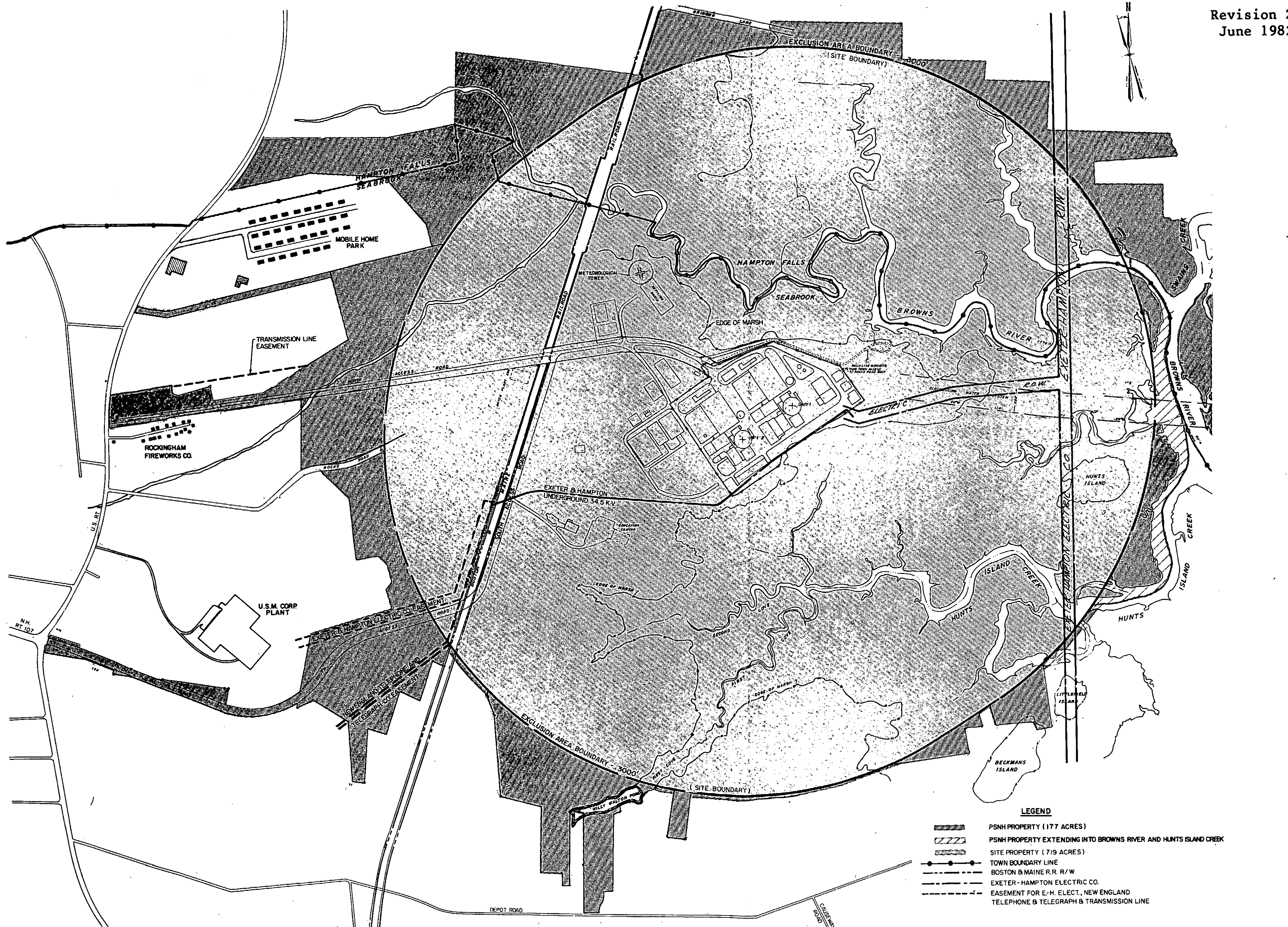
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	LOCATION OF SITE WITHIN SOUTHEASTERN NEW HAMPSHIRE
	FIGURE 2.1-1



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

SITE AREA: 0-10 MILES

FIGURE 2.1-2

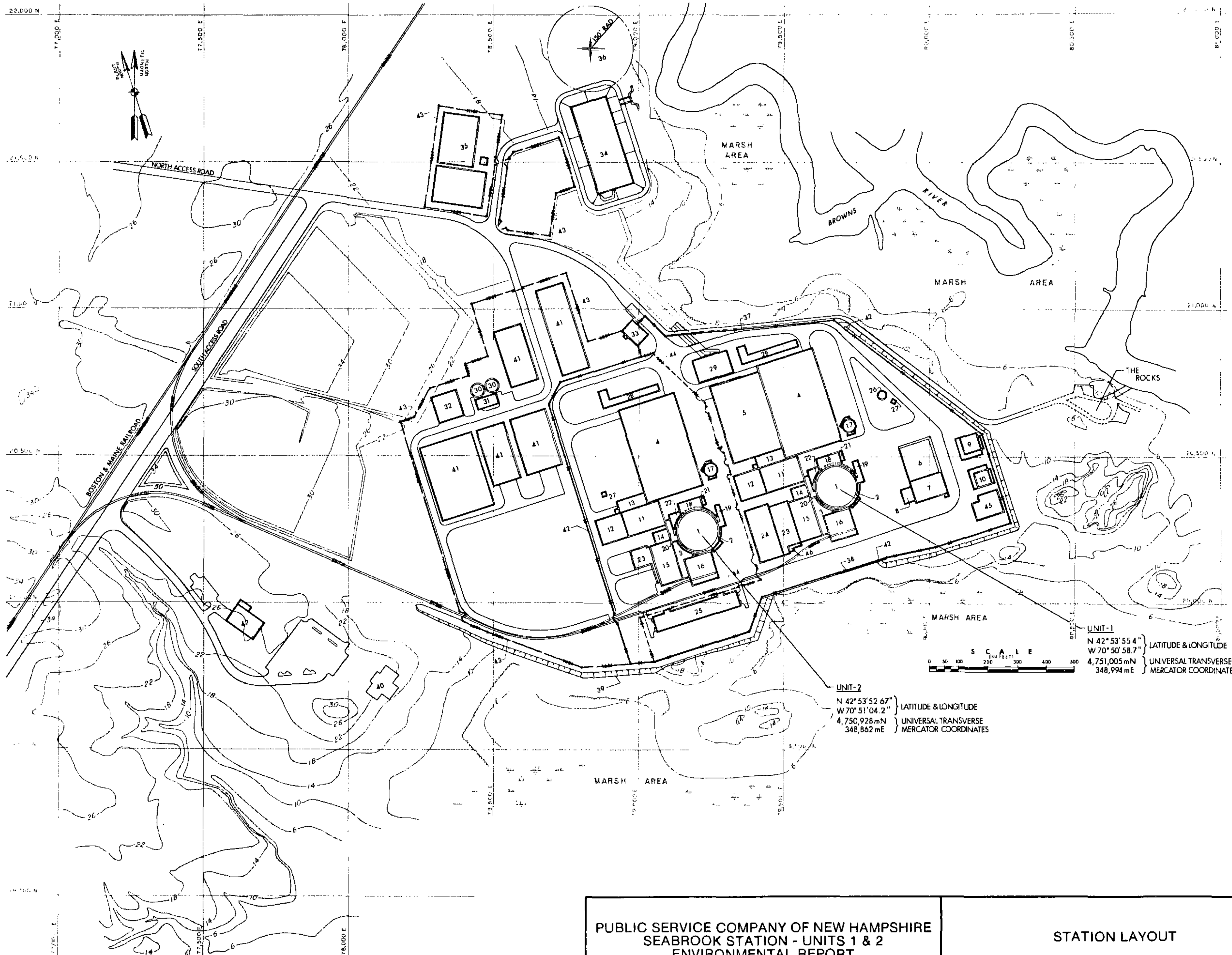


SCALE
(IN FEET)
500 0 500 1000

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	SITE BOUNDARIES
	FIGURE 2.1-3

PRINCIPLE STATION STRUCTURES

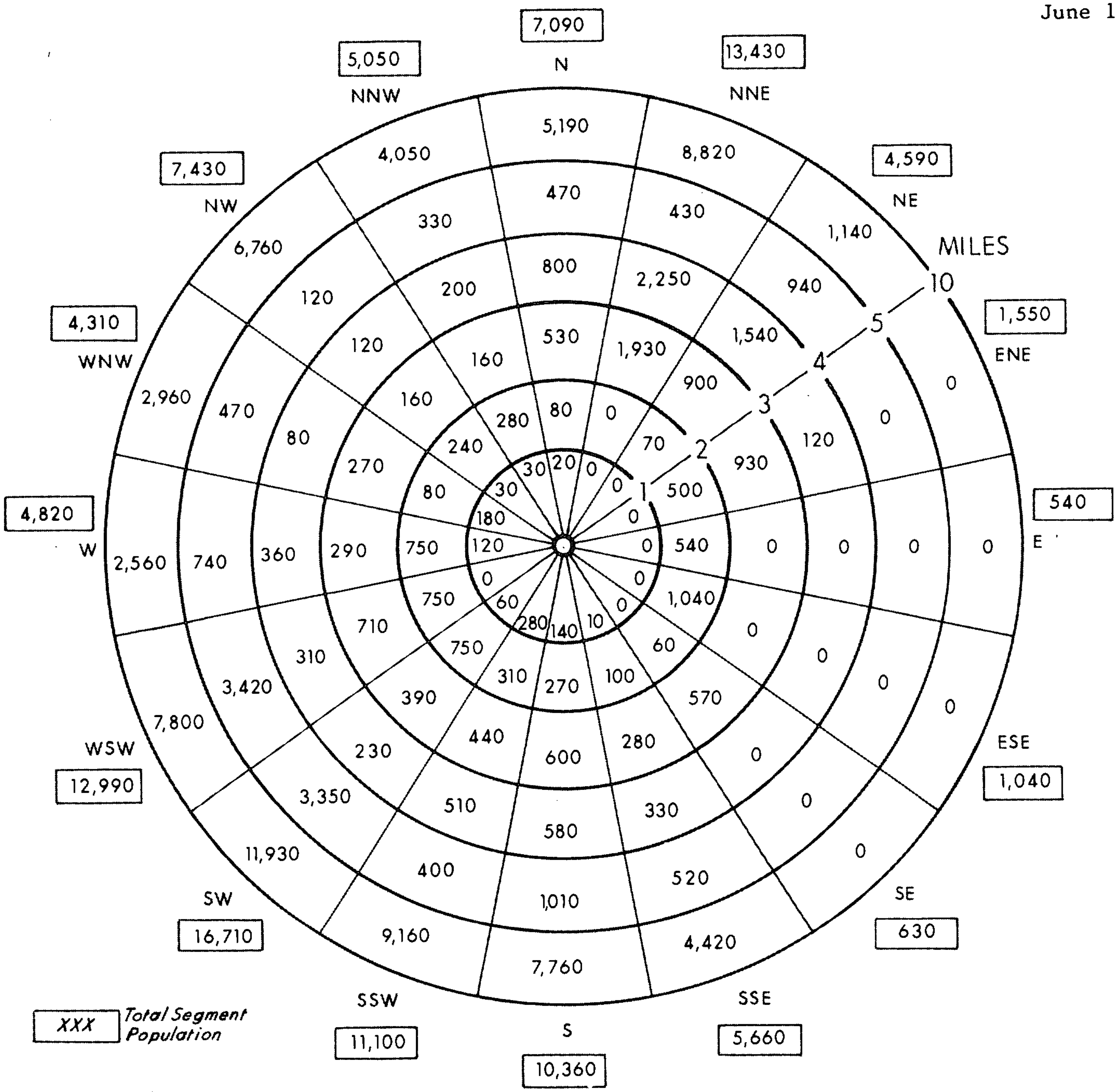
1 CONTAINMENT STRUCTURE
2 CONTAINMENT ENCLOSURE AREA
3 CONTAINMENT ENCLOSURE VENTILATION AREA
4 TURBINE BUILDING AND HEATER BAY
5 ADMINISTRATION AND SERVICE BUILDING
6 CIRCULATING WATER PUMPHOUSE
7 SERVICE WATER PUMPHOUSE
8 ELECTRICAL CONTROL ROOM
9 INTAKE TRANSITION STRUCTURE
10 DISCHARGE TRANSITION STRUCTURE
11 CONTROL BUILDING
12 DIESEL GENERATOR BUILDING
13 NON-ESSENTIAL SWITCHGEAR ROOM
14 RHR SPRAY EQUIPMENT VAULT
15 PRIMARY AUXILIARY BUILDING
16 FUEL STORAGE BUILDING
17 CONDENSATE STORAGE TANK
18 EMERGENCY FEEDWATER PUMPHOUSE
19 STEAM & FEEDWATER PIPE CHASE (EAST)
20 STEAM & FEEDWATER PIPE CHASE (WEST)
21 PRE-ACTION VALVE BUILDING
22 PERSONNEL HATCH AREA
23 TANK FARM AREA
24 WASTE PROCESSING BUILDING
25 SERVICE WATER COOLING TOWER
26 DEMINERALIZED WATER STORAGE TANK
27 CONTROL BUILDING MAKE-UP AIR INTAKE STRUCTURE
28 TRANSFORMER AREA
29 SWITCHING STATION (SUBSTATION)
30 FIRE PROTECTION TANKS
31 FIRE PUMP HOUSE
32 FUEL OIL STORAGE TANK
33 GUARD HOUSE
34 SETTLING BASIN
35 SEWAGE TREATMENT & LAGOON AREA
36 METEORLOGICAL TOWER
37 RETAINING WALL
38 SEAWALL
39 RIPRAP
40 EDUCATION CENTER
41 MISC NON-OPERATIONAL STRUCTURES
42 PERMAMENT SECURITY FENCE FOR OPERATING UNITS 1 AND 2
43 SUPPLEMENTARY FENCE FOR PROTECTION OF ANCILLARY PLANT STRUCTURES
44 TEMPORARY SECURITY FENCE ISOLATING OPERATING UNIT 1 DURING CONSTRUCTION OF UNIT 2
45 CHLORINATION BUILDING
46 STEAM GENERATOR BLOWDOWN BUILDING
47 TRAINING CENTER



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

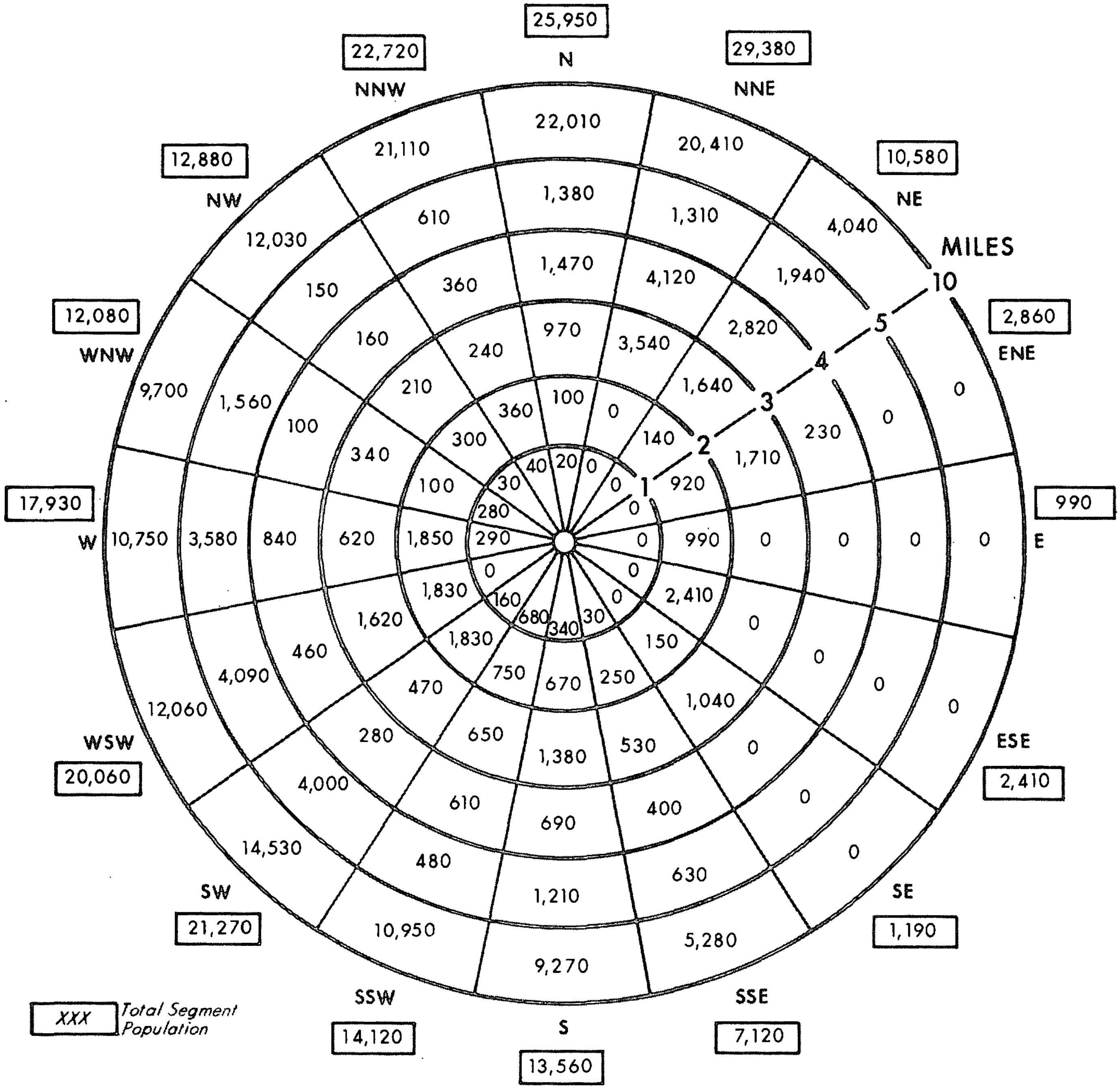
STATION LAYOUT

FIGURE 2.1-4



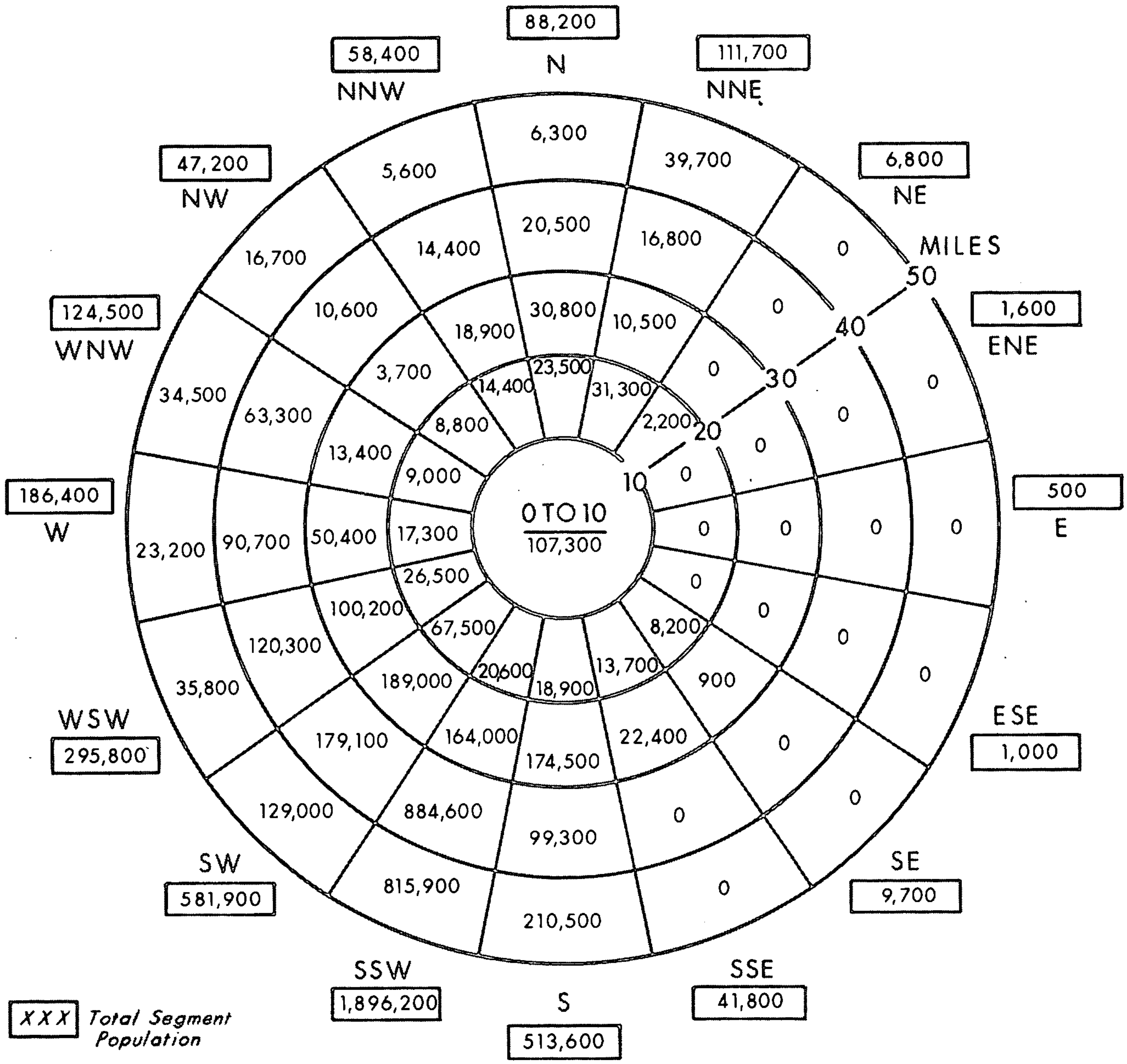
POPULATION TOTALS			
RING MILES	**RING POPULATION**	**TOTAL MILES**	**CUMULATIVE POPULATION**
0-1	870	0-1	870
1-2	5,820	0-2	6,690
2-3	8,160	0-3	14,850
3-4	7,430	0-4	22,280
4-5	12,470	0-5	34,750
5-10	72,550	0-10	107,300

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	1983 RESIDENT POPULATION (0-10 MILES) FIGURE 2.1-5



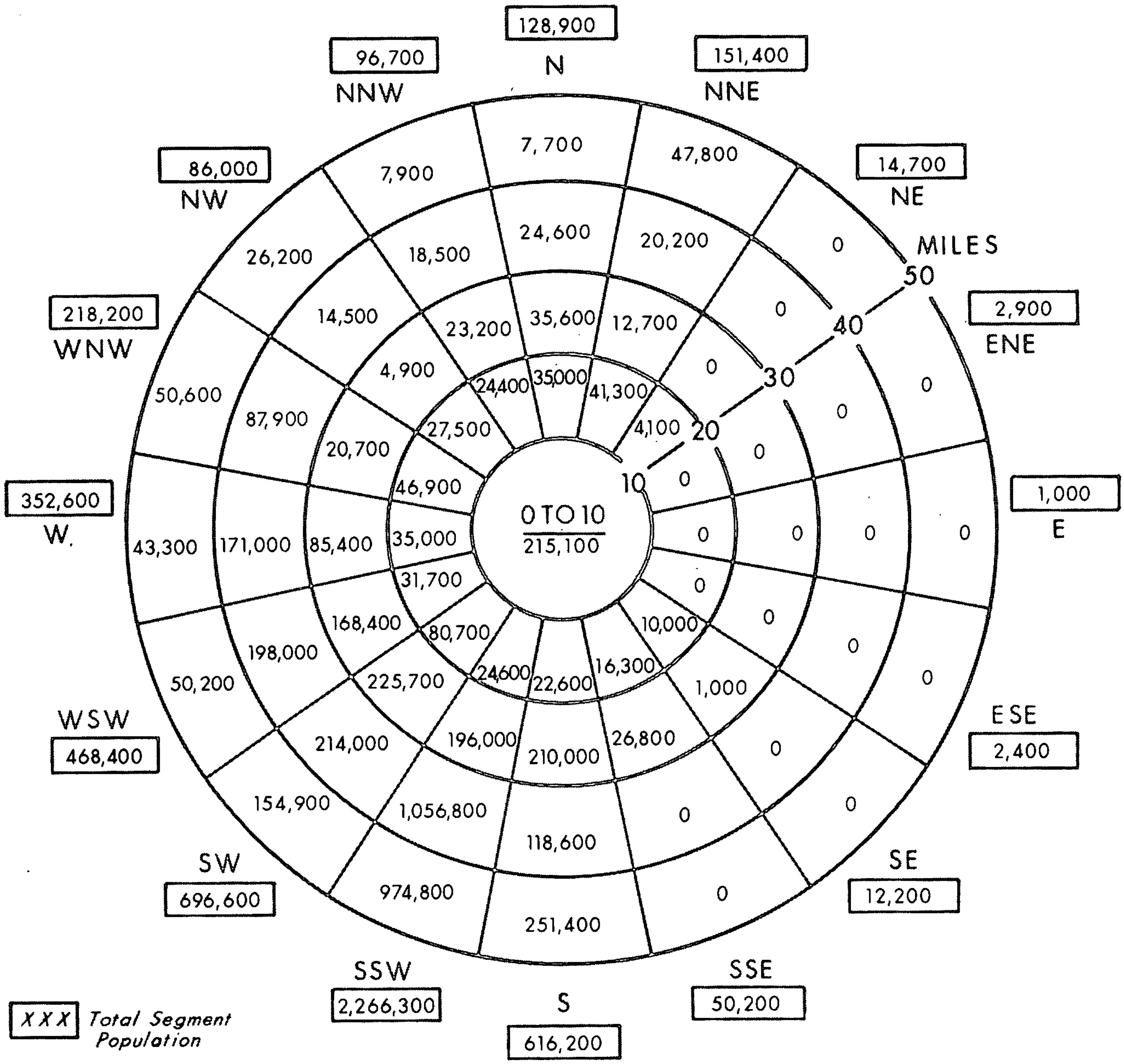
POPULATION TOTALS			
RING MILES	RING POPULATION	TOTAL MILES	CUMULATIVE POPULATION
0-1	1,870	0-1	1,870
1-2	12,650	0-2	14,520
2-3	14,960	0-3	29,480
3-4	12,540	0-4	42,020
4-5	20,940	0-5	62,960
5-10	152,140	0-10	215,100

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	2025 RESIDENT POPULATION (0-10 MILES) FIGURE 2.1-6



POPULATION TOTALS			
RING, MILES	RING POPULATION	TOTAL MILES	CUMULATIVE POPULATION
0-10	107,300	0-10	107,300
10-20	261,900	0-20	369,200
20-30	778,700	0-30	1,147,900
30-40	1,499,600	0-40	2,647,500
40-50	1,317,800	0-50	3,965,300

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	1983 RESIDENT POPULATION (0-50 MILES)
	FIGURE 2.1-7

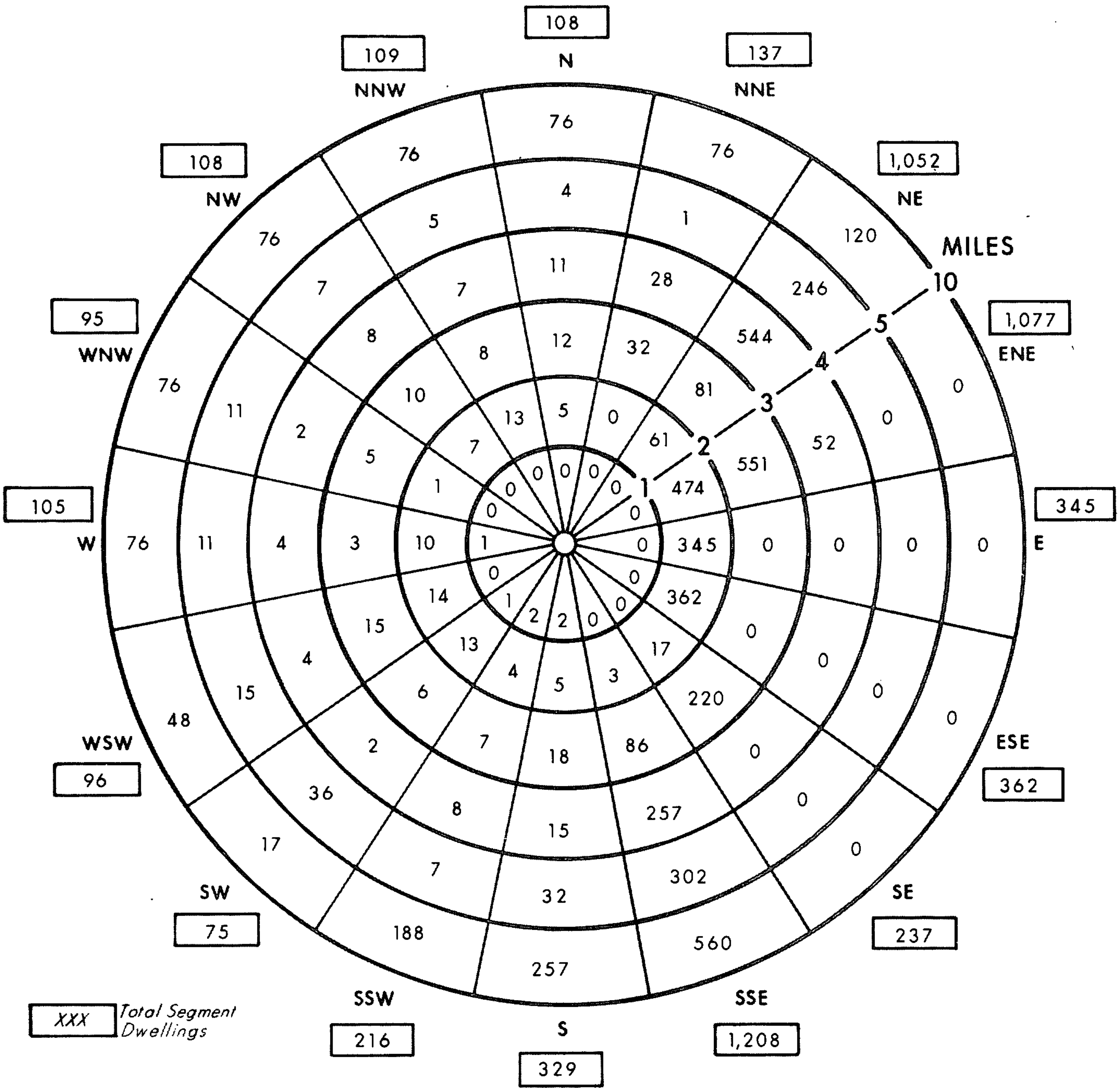


POPULATION TOTALS			
RING, MILES	RING POPULATION	TOTAL MILES	CUMULATIVE POPULATION
0-10	215,100	0-10	215,100
10-20	400,100	0-20	615,200
20-30	1,010,400	0-30	1,625,600
30-40	1,924,100	0-40	3,549,700
40-50	1,614,800	0-50	5,164,500

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

2025 RESIDENT POPULATION
(0-50 MILES)

FIGURE 2.1-8

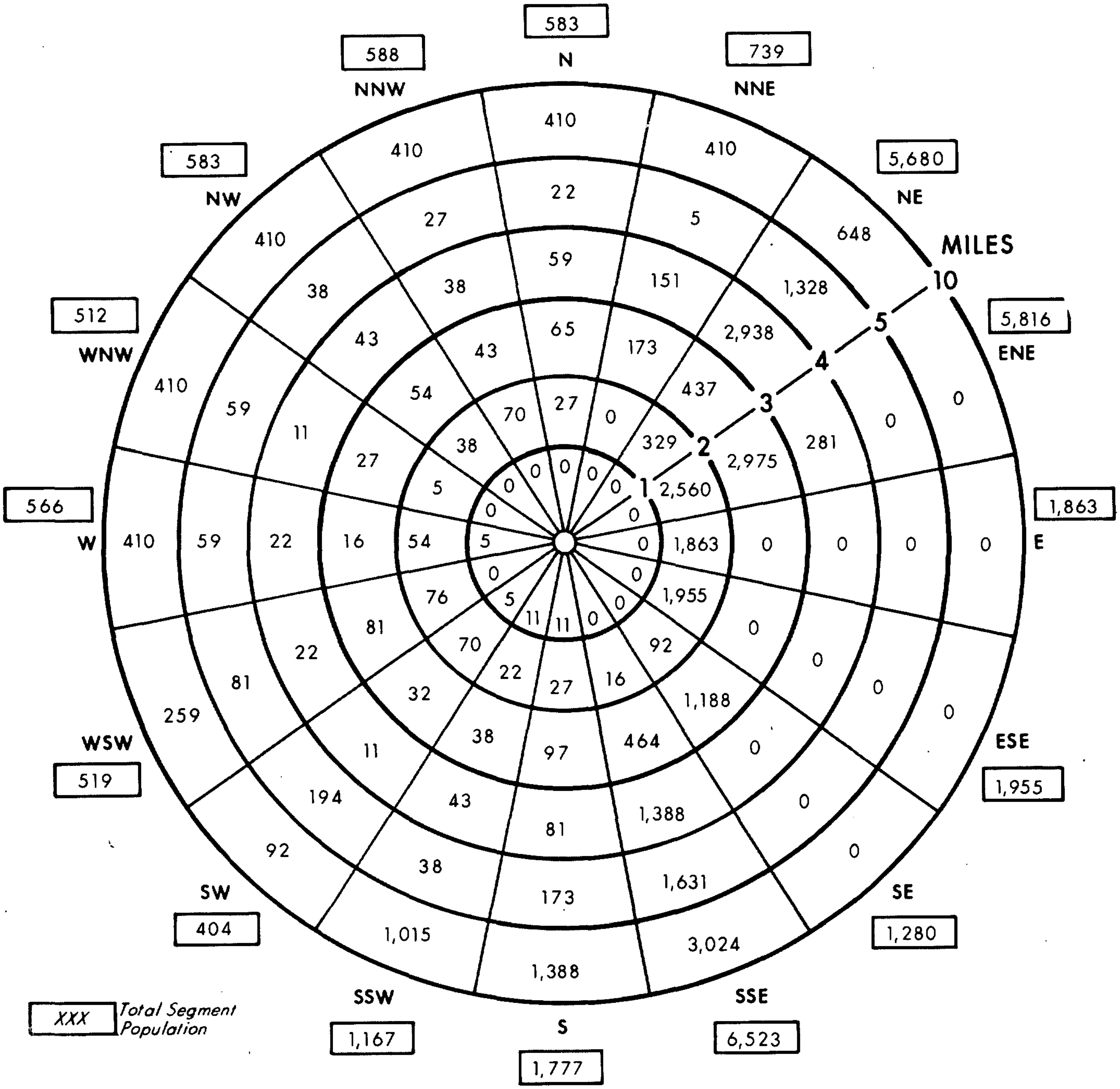


DWELLING TOTALS			
RING MILES	RING DWELLINGS	TOTAL MILES	CUMULATIVE DWELLINGS
0-1	6	0-1	6
1-2	1,334	0-2	1,340
2-3	1,054	0-3	2,394
3-4	942	0-4	3,336
4-5	677	0-5	4,013
5-10	1,646	0-10	5,659

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

SEASONAL DWELLING UNITS
(0-10 MILES)

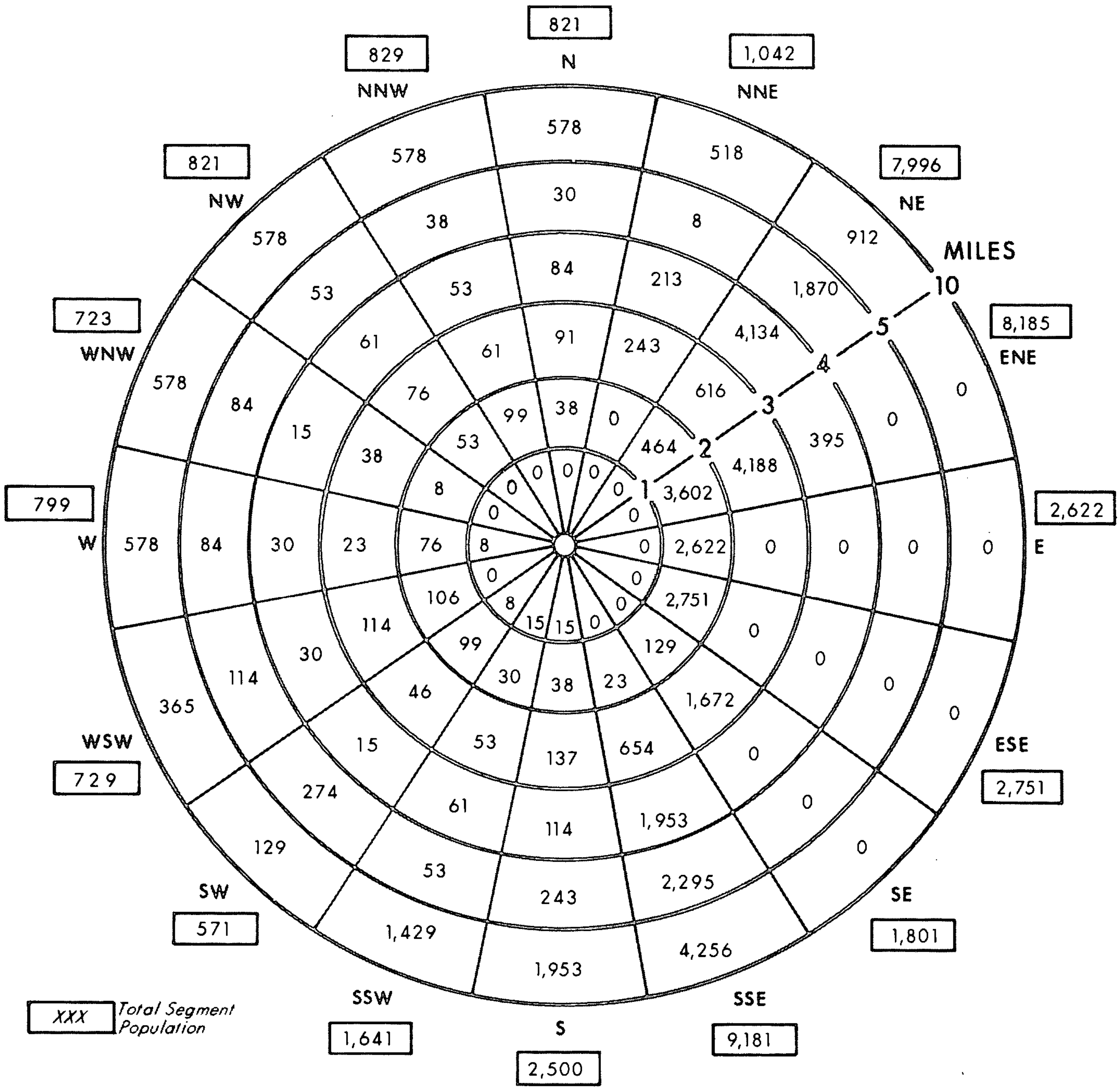
FIGURE 2.1-9



POPULATION TOTALS			
RING MILES	RING POPULATION	TOTAL MILES	CUMULATIVE POPULATION
0-1	32	0-1	32
1-2	7,204	0-2	7,236
2-3	5,690	0-3	12,296
3-4	5,088	0-4	18,014
4-5	3,655	0-5	21,669
5-10	8,886	0-10	30,555

* POPULATION = NUMBER OF DWELLING UNITS × 5.4 PERSONS/UNIT

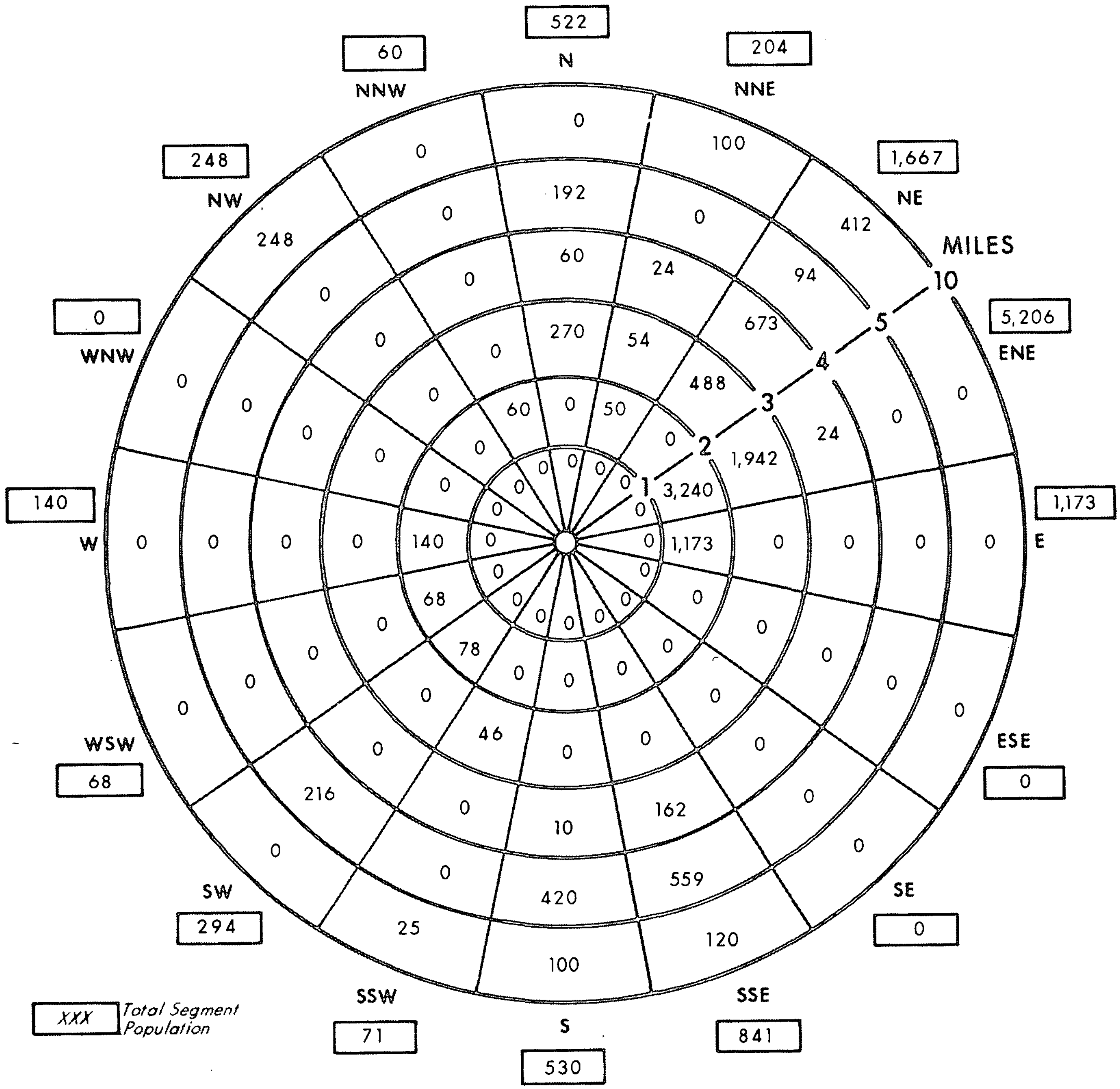
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	WEEKDAY SEASONAL DWELLING UNIT POPULATION* (0-10 MILES) FIGURE 2.1-10



POPULATION TOTALS			
RING MILES	RING POPULATION	TOTAL MILES	CUMULATIVE POPULATION
0-1	46	0-1	46
1-2	10,138	0-2	10,184
2-3	8,012	0-3	18,196
3-4	7,158	0-4	25,354
4-5	5,146	0-5	30,500
5-10	12,512	0-10	43,012

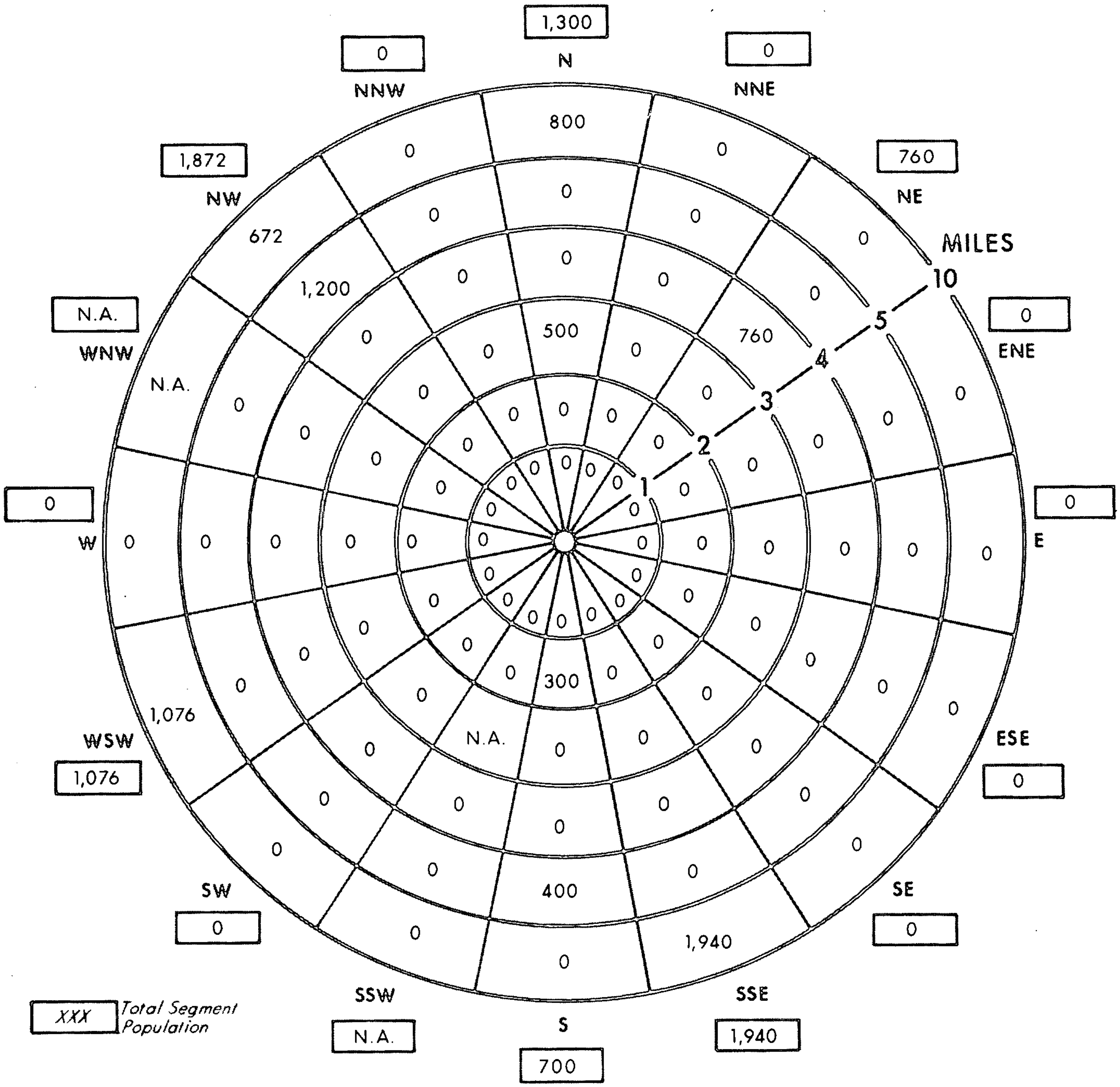
* POPULATION = NUMBER OF DWELLING UNITS × 7.6 PERSONS/UNIT

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	WEEKEND SEASONAL DWELLING UNIT POPULATION* (0-10 MILES) FIGURE 2.1-11



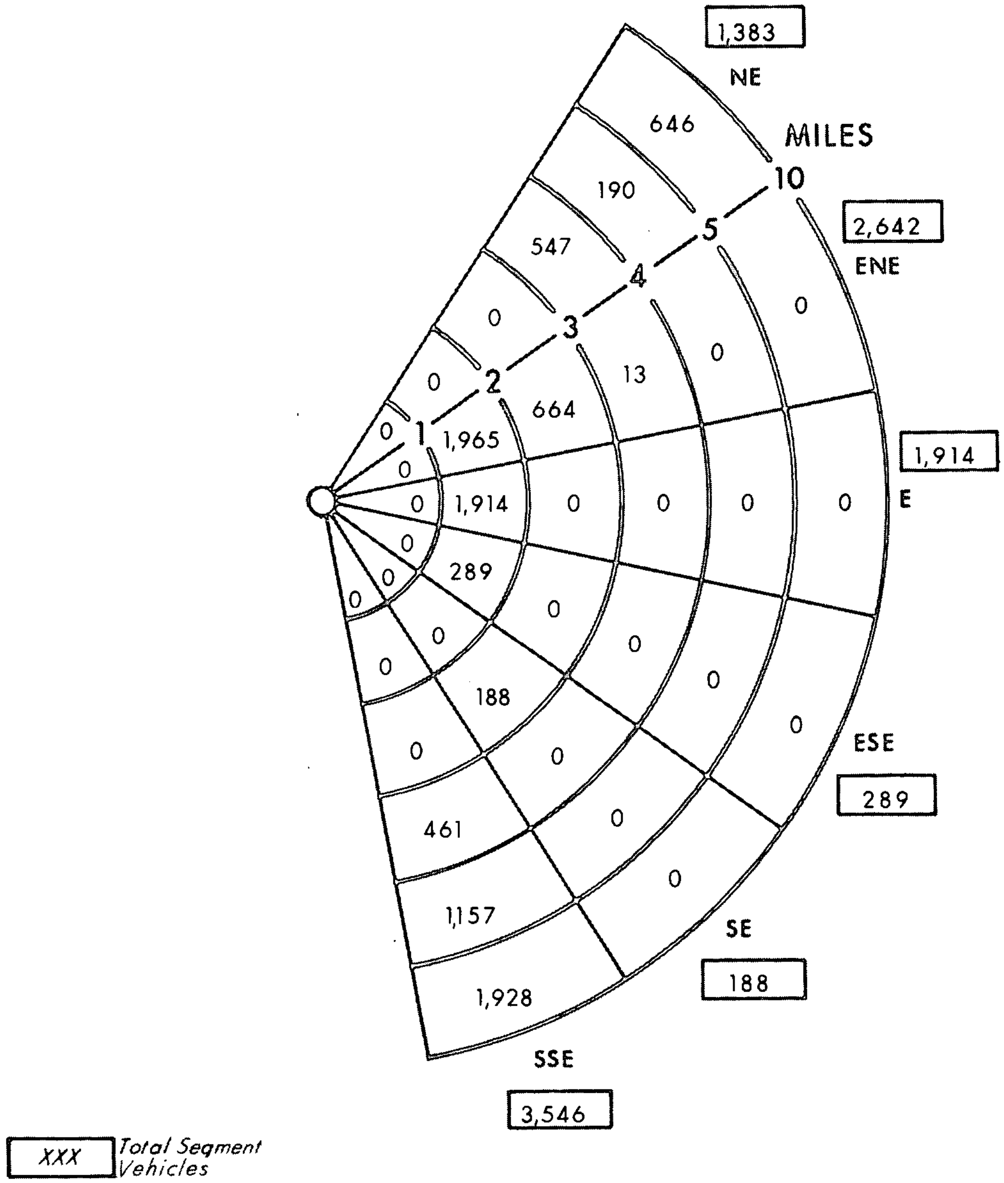
POPULATION TOTALS			
RING MILES	RING POPULATION	TOTAL MILES	CUMULATIVE POPULATION
0-1	0	0-1	0
1-2	4,809	0-2	4,809
2-3	2,800	0-3	7,609
3-4	929	0-4	8,538
4-5	1,481	0-5	10,019
5-10	1,005	0-10	11,024

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	SEASONAL OVERNIGHT PEAK POPULATION (HOTEL, MOTEL AND GUESTHOUSES) (0-10 MILES)
	FIGURE 2.1-12



POPULATION TOTALS			
RING MILES	**RING POPULATION**	**TOTAL MILES**	**CUMULATIVE POPULATION**
0-1	0	0-1	0
1-2	300	0-2	300
2-3	500	0-3	800
3-4	760	0-4	1,560
4-5	1,600	0-5	3,160
5-10	4,488	0-10	7,648

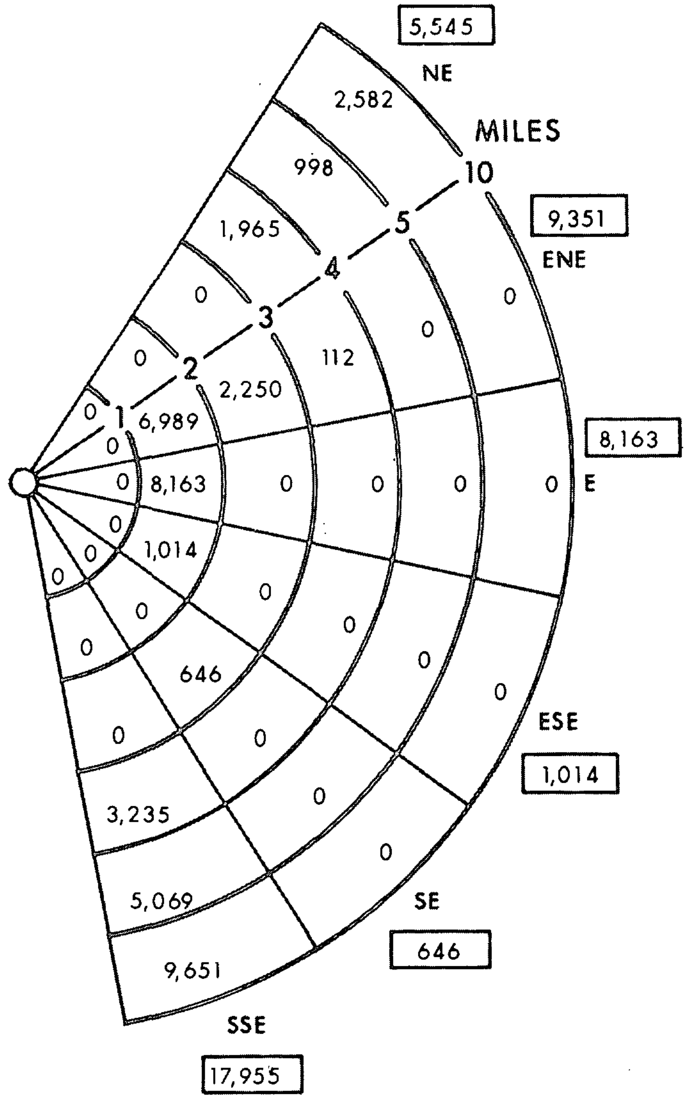
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	PEAK CAMPGROUND POPULATION (0-10 MILES)
	FIGURE 2.1-13



VEHICLE TOTALS			
RING MILES	RING VEHICLES	TOTAL MILES	CUMULATIVE VEHICLES
0-1	0	0-1	0
1-2	4,168	0-2	4,168
2-3	852	0-3	5,020
3-4	1,021	0-4	6,041
4-5	1,347	0-5	7,388
5-10	2,574	0-10	9,962

* DATA REPRESENTS VEHICLE COUNTS FOR JULY 22,1979 (LESS LEASED PARKING SPACES).

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	**MAXIMUM NUMBER OF VEHICLES OBSERVED IN BEACH AREA PARKING LOTS* (0-10 MILES)**
	FIGURE 2.1-14

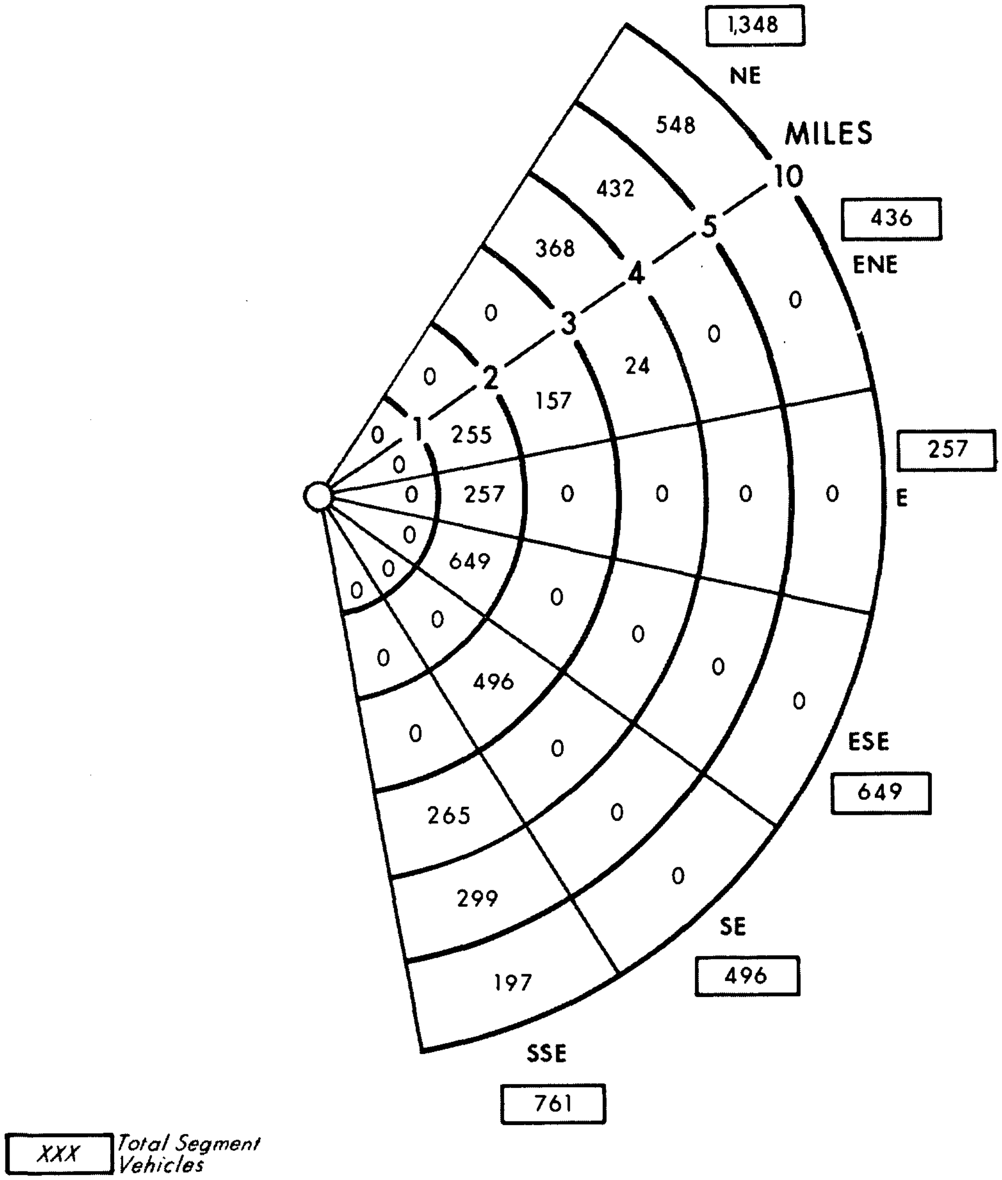


XXX	Total Segment Population

POPULATION TOTALS			
RING MILES	RING POPULATION	TOTAL MILES	CUMULATIVE POPULATION
0-1	0	0-1	0
1-2	16,166	0-2	16,166
2-3	2,896	0-3	19,062
3-4	5,312	0-4	24,374
4-5	6,067	0-5	30,441
5-10	12,233	0-10	42,674

* POPULATION=CAPACITY OF LOTS(LESS LEASED SPACE) × 3.2 PERSONS/VEHICLE

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	BEACH AREA PARKING LOTS ESTIMATED PEAK TRANSIENT POPULATION* (0-10 MILES)
	FIGURE 2.1-15



VEHICLE TOTALS			
RING MILES	RING VEHICLES	TOTAL MILES	CUMULATIVE VEHICLES
0-1	0	0 - 1	0
1-2	1,161	0 - 2	1,161
2-3	653	0 - 3	1,814
3-4	657	0 - 4	2,471
4-5	731	0 - 5	3,202
5-10	745	0 - 10	3,947

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
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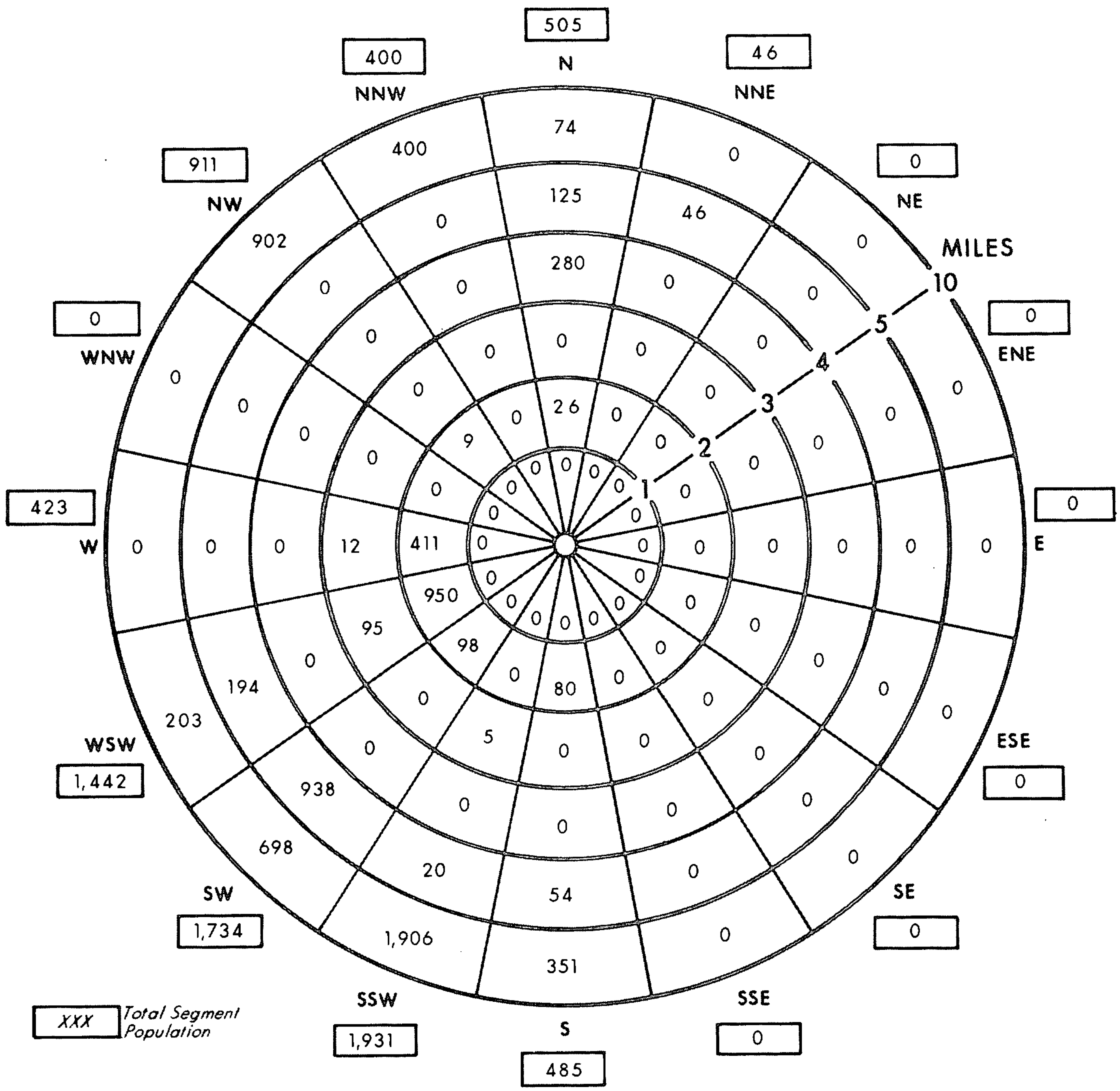
OPERATING LICENSE STAGE

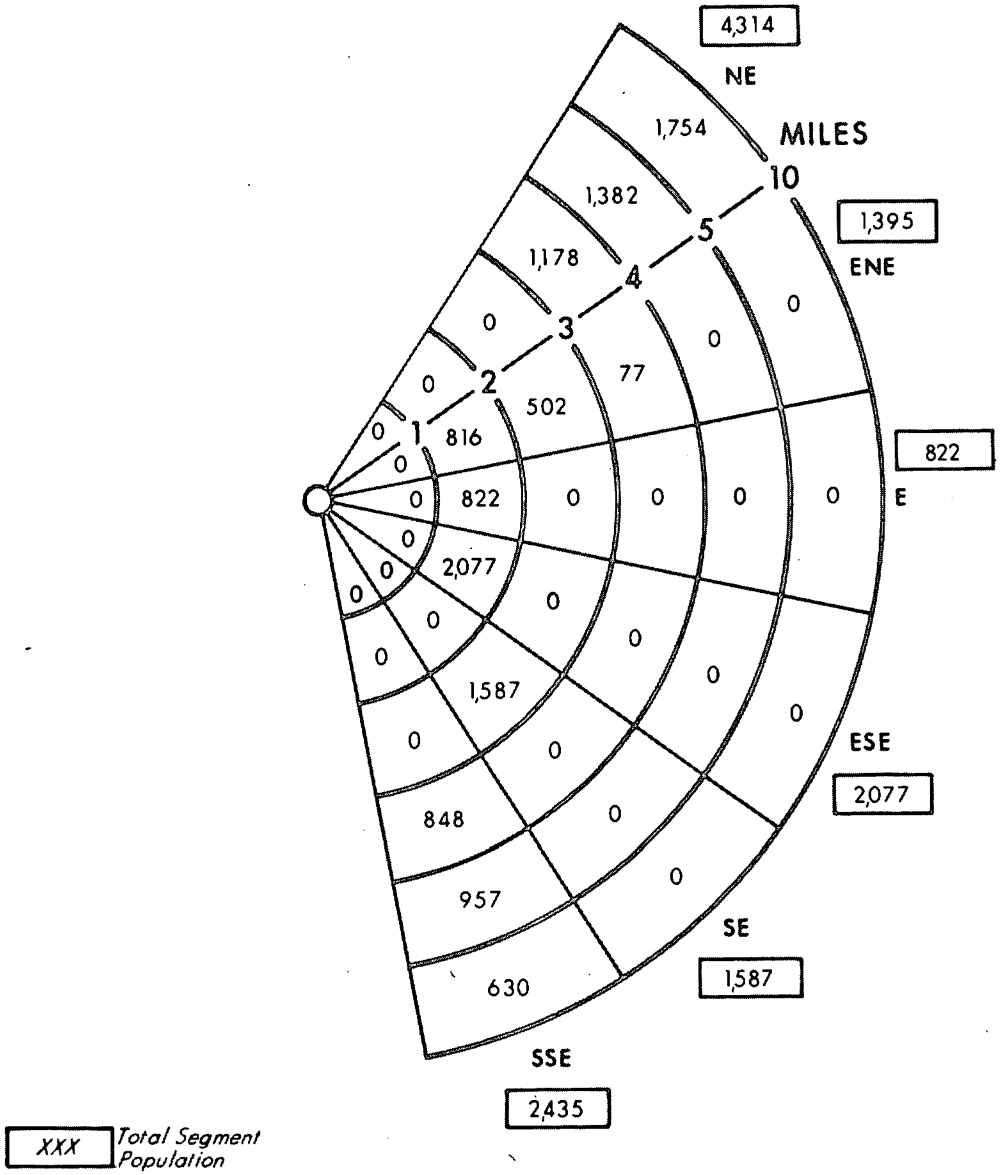
BEACH AREA ON-STREET
VEHICLE PARKING CAPACITY
DAILY TRANSIENTS ONLY
(0-10 MILES)

FIGURE 2.1-16



POPULATION TOTALS			
RING MILES	RING POPULATION	TOTAL MILES	CUMULATIVE POPULATION
0-1	0	0-1	0
1-2	1,574	0-2	1,574
2-3	112	0-3	1,686
3-4	280	0-4	1,966
4-5	1,377	0-5	3,343
5-10	4,534	0-10	7,877

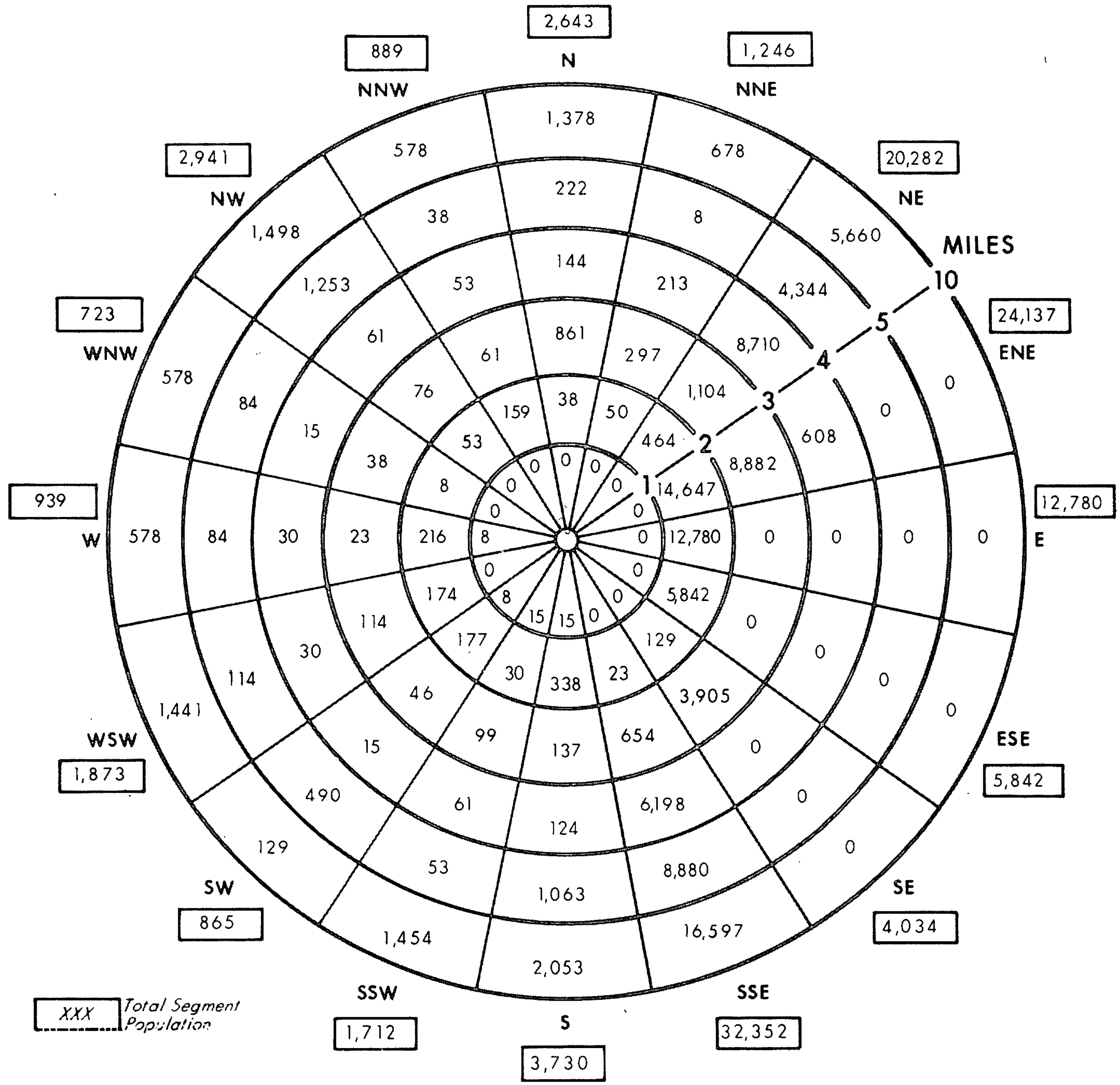
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	POPULATION OF MAJOR EMPLOYERS (0-10 MILES)
	FIGURE 2.1-18



POPULATION TOTALS			
RING MILES	RING POPULATION	TOTAL MILES	CUMULATIVE POPULATION
0-1	0	0 - 1	0
1-2	3,715	0 - 2	3,715
2-3	2,089	0 - 3	5,804
3-4	2,103	0 - 4	7,907
4-5	2,339	0 - 5	10,246
5-10	2,384	0 - 10	12,630

* POPULATION = ON-STREET VEHICLE PARKING CAPACITY × 3.2 PERSONS/VEHICLE

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	BEACH AREA ON-STREET PARKING POPULATION ESTIMATE* DAILY TRANSIENTS ONLY (0-10 MILES) FIGURE 2.1-17



POPULATION TOTALS			
RING MILES	RING POPULATION	TOTAL MILES	CUMULATIVE POPULATION
0-1	46	0-1	46
1-2	35,128	0-2	35,174
2-3	16,297	0-3	51,471
3-4	16,262	0-4	67,733
4-5	16,633	0-5	84,366
5-10	32,622	0-10	116,988

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
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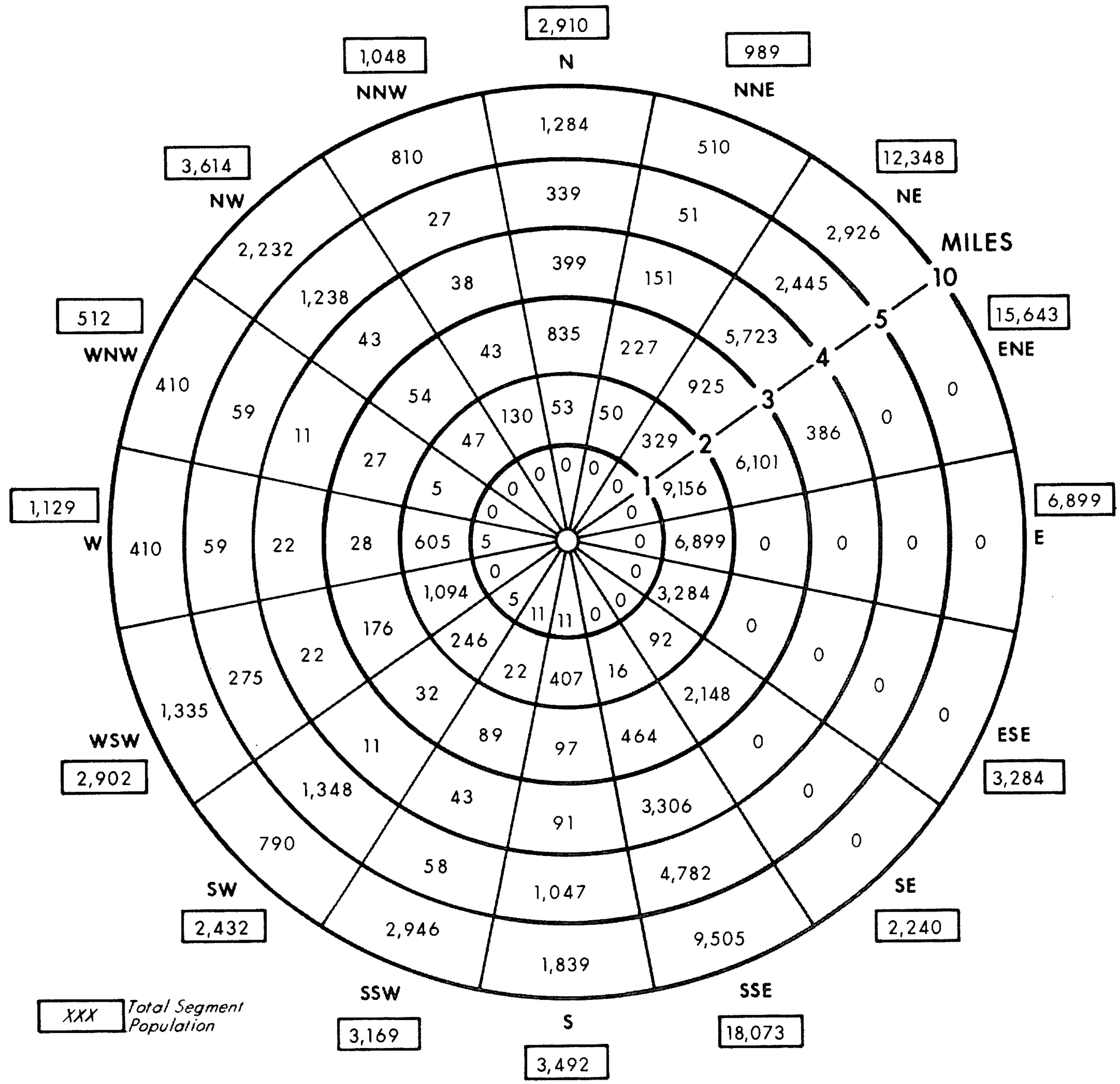
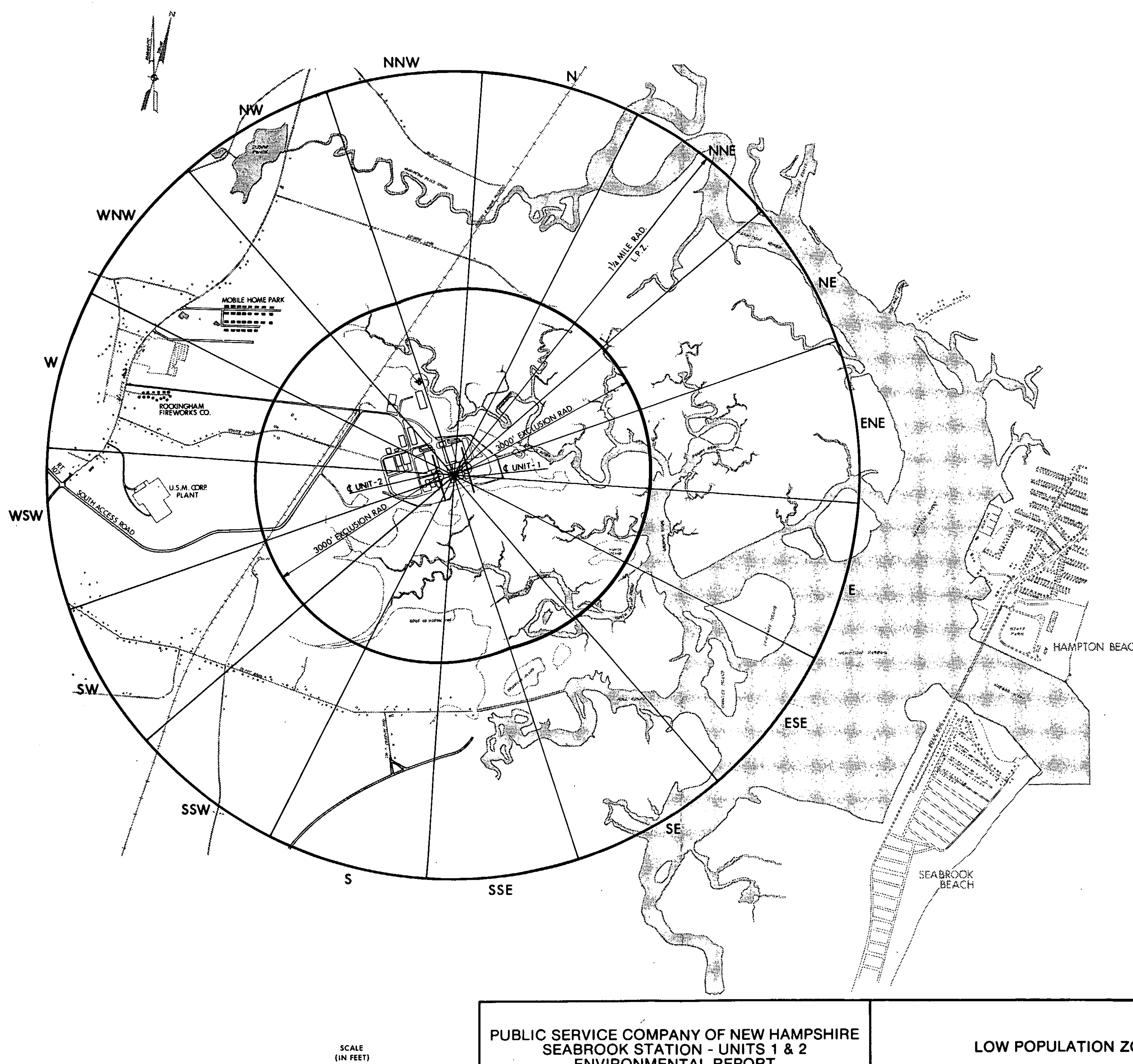
1980 PEAK SUMMER WEEKEND
TRANSIENT POPULATION
(0-10 MILES)

FIGURE 2.1-19



POPULATION TOTALS			
RING MILES	**RING POPULATION**	**TOTAL MILES**	**CUMULATIVE POPULATION**
0-1	32	0-1	32
1-2	22,435	0-2	22,467
2-3	11,246	0-3	33,713
3-4	10,246	0-4	43,959
4-5	11,728	0-5	55,687
5-10	24,997	0-10	80,684

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	1980 PEAK SUMMER WEEKDAY TRANSIENT POPULATION (0-10 MILES) FIGURE 2.1-20



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

LOW POPULATION ZONE

FIGURE 2.1-21

2.2 ECOLOGY

2.2 ECOLOGY

2.2.1 Terrestrial Ecology

The information in this section remains unchanged from that presented in the comparable section of the Seabrook Station ER-CPS (Section 2.7.1) except as noted below. Additional information is also presented.

Construction of the station has resulted in the elimination of portions of the terrestrial biotic communities previously described in the ER-CPS. Generally, the area affected is that identified as the construction site proper in CP-ER Section 4.1.1. Greater familiarity with the surrounding undisturbed plant and animal populations gained over the past six years verifies the information presented earlier. The types of life previously found on the site before construction still exist in areas adjacent to the station. While the imposition of a large cleared area now occupied by the project must exert some influence on nearby undisturbed ecological features, it has not yet modified its qualitative character to an observable degree.

Biotic features noted earlier can still be found in the contiguous area. In particular, certain plants and plant associations that were judged worthy of protection have been given special attention and have therefore survived construction trauma. Specifically, the ~~wild coffee~~ (Triosteum aurantiacum) and its associates bush clover (Lespedeza sp.), Venus' looking glass (Specularia sp.), and wild licorice (Galium circaezans) that were located on the site were protected by fencing. Another area, the hemlock ravine, a botanical association that occupies about eight acres along the south edge of the access road into the Education Center has been preserved. ~~Other ordinary plant associations, generally stands of hardwood trees, have been left wherever possible.~~ The surrounding Spartina marsh received careful protection from harm by construction activity and appears to be in a condition comparable to that of the preconstruction period.

2.2.2 Aquatic Ecology

2.2.2.1 Introduction

Plankton, benthos and finfish have been monitored in the Hampton-Seabrook estuary and the nearshore marine areas since 1969. Initial studies (NAI, 1971, 1972 a-i) focus on the biota of the estuary where the intake location was originally proposed. Up to 1975, several special studies were conducted to address questions on the offshore siting of the intake and discharge structures. Beginning in July 1975, a pre-operational program was adopted to establish consistent spatial and temporal monitoring in the study area.

Herein is a review of the major biotic components of the local marine community with a concentration on data collected since 1975; more detailed information can be gained by referring to the technical documents cited in each section. Discussed are species present in each habitat, their spatial and temporal distribution and their relative abundance.

2.2.2.2 Plankton

a. General

An overview of the major components of the plankton community recorded in the Seabrook study area is presented in Table 2.2-1.

b. Phytoplankton

Phytoplankton typically reach peak abundance in late spring and again, in fall. These "blooms" are directly related to availability of light and plant nutrients which are, in turn, generally associated with seasonal patterns of thermal stratification and destratification (mixing) of the water column and coastal runoff.

In the vicinity of the intake site (Station 2), net phytoplankton blooms typically occur in the spring from March through April and in the fall from September through November; in 1978, an additional peak was exhibited in the surface waters in June (Figure 2.2-1). Blooms are typically dominated by the chain forming diatom, *Chaetoceros Thalassiosira*, whose distribution varied seasonally (NAI, 1977a; 1980a). *Thalassiosira* have been numerically important during the early spring, *Ceratium* are mid-summer to fall dominants and *Rhizosolenia alata* and *Skeletonema costatum* are fall dominants (Table 2.2-2).

The total phytoplankton community (including nanoplankton), monitored through biomass (chlorophyll *a*) and productivity (^{14}C) estimates, also reflect the spring and fall blooms in the populations (Figure 2.2-2). Certain nutrient levels in the seawater show a tendency toward maximum levels in winter, prior to the spring phytoplankton bloom (Figure 2.2-3). Since 1977, whole water collections were made which sample both the nanoplankton and net phytoplankton fractions together. The smaller portion of the phytoplankton community, however, comprises the largest variety of taxa, represent a considerable portion of the biomass (especially in summer) and contribute substantially to measures of primary production (e.g., ^{14}C uptake). Whole water phytoplankton densities (which include both nanoplankton and net phytoplankton) are greatest in early spring from March through April, in summer from late May through early June and in fall from October through November (Figure 2.2-1); these blooms have been dominated by *Skeletonema costatum* and *Olisthodiscus luteus*. The chlorophyll A and Carbon 14 uptake values reflect these blooms. Ranking the most abundant whole water phytoplankton in 1978 (Table 2.2-2) reveals that the smaller centric diatoms are much more abundant than net collections indicate.

c. Zooplankton

Microzooplankton in the vicinity of the intake site (Station 2) demonstrate a definite seasonal pattern with highest densities in summer and lowest densities in winter (Figure 2.2-4). Holoplankters, invertebrate animals which spend their entire life cycle drifting in the water column (e.g., copepod nauplii, Oithona spp. and Pseudocalanus spp.) comprise approximately 80% of the microzooplankton (Table 2.2-3). Meroplankton, the early life stages of benthic invertebrates (e.g., bivalve veliger larvae, gastropod veliger larvae and polychaete larvae) and finfish (Section 2.2.2.4) are seasonally abundant. Bivalve veliger larvae rank third or fourth and comprise approximately 15% of the microzooplankton over the year.

Mesozooplankton follow the same seasonal pattern as microzooplankton, with highest densities in summer and lowest in winter (Figure 2.2-4). Calanoid copepods (e.g., Pseudocalanus spp., Temora longicornis and Centropages spp.) comprise approximately 80% of the mesozooplankton (Table 2.2-4).

Although the seasonal distribution of the macrozooplankton (collected after July 1977) was similar to the mesozooplankton (collected prior to July 1977), overall densities were lower (Figure 2.2-4). The change in mesh size was reflected in lower zooplankton densities during the winter months due to a shift toward the collection of the larger and generally less abundant holoplankton and meroplankton (Table 2.2-4). Larger calanoid copepods (e.g., Calanus finmarchicus, Centropages spp. and Pseudocalanus spp.) comprise approximately 60% of the macrozooplankton.

2.2.2.3 Benthos

a. General

The types of benthic organisms found in the Hampton-Seabrook study area are determined by the type of substrate in each locale as well as its depth or degree of exposure (Table 2.2-5). Invertebrates ranging from interstitial microfauna (e.g., harpacticoid copepods) to motile epibenthos (e.g., lobsters) and macroalgae from crustose corallines to kelps have been studied (Table 2.2-5). An overview of each aspect of the community is given below.

b. Marine Macrofauna

1. Intertidal

Distribution and composition of the Hampton-Seabrook intertidal faunal communities is determined primarily by substrate type and degree of exposure to wave action (Lubchenco and Menge, 1978; Menge, 1976; NAI, 1979b). Along with these major community structuring parameters, faunal adaptation to physical parameters associated with tidal height, i.e., length of immersion, fluctuations of water temperature and salinity, secondarily determines the distribution and composition of this faunal community (Stephenson and Stephenson, 1972). Three distinct substrate types are found in the study area: 1) algae covered ledge at Outer Sunk Rocks (Station 1); 2) algae covered boulders (small to large) on cobble matrix at Great Boar's Head (Station 4); and 3) medium-fine sand moderately well sorted at Hampton Beach (Station 2).

Ledges and boulders within the study area have major community characteristics similar to those found on hard substrates studied by Lubchenco and Menge (1978); dominant taxa are listed in Table 2.2-6. Going from mean high water to mean low water Semitalanus balanoides gives way to Mytilid dominance (NAI, 1977b, 1979b). Fucoid algae (Fucus spp. and Ascophyllum nodosum) give way to Chondrus crispus and Gigartina stellata from mean high water to mean low water (see Section d.2). Total species varies inversely with tidal height (Table 2.2-7).

Both hard substrate stations are subjected to intermediate wave exposure (as defined by Lubchenco and Menge, 1978) since both Chondrus crispus and Mytilids exist in the low intertidal. The stations differ physically, in that solid ledge with a steep slope is found at Outer Sunk Rocks while at Great Boar's Head small to large boulders are distributed over a gradual slope (Figure 2.2-5). Such substrate and slope distinctions produce differences in the distribution of faunal dominants and in the composition of algal dominants. The differences are seen primarily in the area around mean sea level. At Boar's Head Semibalanus balanoides, Fucus distichus spp. edentatus and F. vesiculosus dominate the mean sea level zone (Table 2.2-6, Subsection d.2), while at Outer Sunk Rocks Mytilids, F. vesiculosus and Ascophyllum nodosum dominate this zone (Table 2.2-6, Subsection d.2). In the mean high water zone, the faunal and algal dominants are the same at both stations, B. balanoides and A. nodosum; in the mean low water zone Mytilids, C. crispus and G. stellata dominate.

Communities at the two hard substrate stations though somewhat different in composition, exhibit similar community stability. Structural dominances have not changed since the study began in September 1975 (NAI, 1977b, 1979b). Comparisons of results between years indicate that while individual species' settlement and survivorship does change between years, dominance does not.

Whereas the hard substrate stations are relatively stable over time, the sand substrate station (Hampton Beach) is characterized by considerable biological instability. This station is sparsely occupied by a constantly changing assortment of invertebrates

(Tables 2.2-6 and 2.2-8). A stable sand beach community with moderate seasonal variability and fluctuations in population densities as observed at nearby Wallis Sands Beach in Rye, New Hampshire (Croker, 1977 and Croker et al., 1975), was not found at the Hampton Beach site. Over the two years of study at Station 2 no consistent pattern of dominance or species composition was observed (NAI, 1977b, 1979b). The Hampton Beach site is subject to storm erosion in winter and a high volume recreational use in summer, including sand redistribution by bulldozer from mid and high areas to the lower sections of the beach and mechanical s.ifting of the intertidal zone for litter (NAI, 1979b). These activites probably result in a major disruption of community development since they occur during periods of high water temperatures and normally maximum beach profile stability.

2. Subtidal

Subtidal substrate in the area of the Seabrook Station discharge structures is primarily ledge or large boulders (Table 2.1-9). An area of cobble (rock less than 6" in diameter) exists in the northeast quadrat of the study area primarily around the 60' or greater depth contour. The area around the intake is composed of fine to very fine sand, moderately well sorted (Table 2.2-9). Substrate heterogeneity has a major influence on the natural variability found within the shallow subtidal benthic communities, not only within the area of Seabrook Station discharge and intake structures but along the entire New Hampshire coast.

Substrate and depth are helpful in explaining distributional trends (NAI, 1977b, 1979b). Along with these physical characteristics, the abundance of the foliose red algae, Phyllophora and Ptilota, amount of siltation on hard substrates, sediment sorting, sediment chemical oxygen demand and species redundancy on sand substrates are helpful in explaining the structure of the macrofaunal community (Figure 2.2-6). Of the 593 taxa and 253,956 individuals collected during two years of study (NAI, 1979b), the number of taxa showed the following substrate distribution: # taxa, sand < # taxa, hard/cobble < # taxa, hard/ledge (Figure 2.2-7).

The hard substrate areas are a mosaic of rocks, ledge, gravel and sand, each with an associated faunal assemblage. The majority of hard substrate fauna, including the numerically dominant, form a ubiquitous group of epifaunal species commonly associated across all the depth zones studied (Table 2.2-10). The past years of study suggests these taxa occur with high fidelity within the Seabrook hard substrate stations (NAI, 1979b). In addition to this ubiquitous group of dominant fauna, there are smaller hard substrate species groups composed of the less common, less abundant taxa distributed within narrower depth ranges. In total, these groups represent less than 15% of all organisms collected (NAI, 1979b).

On sand substrate there is a ubiquitous group of fauna, as well, that composes greater than 85% of the organisms collected (Table 2.2-10) and occur with high fidelity. At those stations with very fine, poorly sorted sediments or which overlay areas of gravel the continuity of the ubiquitous fauna group breaks down (NAI, 1979b); these groups are composed of the less common, less abundant taxa.

Recruitment to species populations and predation by finfish and epibenthic crustaceans induce variability in abundance of specific taxa. At hard substrate stations, peaks in total number of individuals generally occur during the spring and fall (Figure 2.2-8). At sand stations, no consistent temporal trends are observed in total number of taxa and in total number of individuals (Figures 2.2-7 and 2.2-8). Spawning and recruitment generally occur during all seasons of the year. Some recruitment activity occurs during the spring, while early summer generally constitutes a period of low recruitment. The major predators (lobster, crabs, cunner, pollock, cod, winter flounder) are generally abundant during spring and early summer months (NAI, 1979b). The most active recruitment period occurs during the late summer, fall period with most of the dominant fauna exhibiting peak densities during October (NAI, 1979b). A comparison of the two fall periods studied indicates that recruitment during fall 1976 was generally equal to or greater than during fall 1975 (NAI, 1979b). During the winter, fewer species spawn and recruit while most major predators leave the area or become inactive. It does not appear that rates of recruitment are correlated with water temperature at least within the range of variation experienced during past study years. Most other biological functions within the Seabrook benthic community do, however, appear to be correlated with water temperature. General activity (feeding, movement, etc.) decreases as water temperature decreases during November and increases as water temperature increases during March-April. Greatest activity occurs during the months of highest water temperatures (July, August, September).

3. Meiofauna

Meiofauna are defined as those metazoans passing through a 1.0 mm sieve and retained on a 0.063 mm sieve (Wieser, 1960; McIntyre, 1969; McIntyre and Murison, 1973). Meiobenthos consist of permanent members, viz., species of small adult size which spend their entire life in the habitat; and temporary meiobenthos, viz., juvenile stages of the macrofauna (McIntyre, 1969). Most invertebrate classes are represented in the meiofauna, some of which are unique, aberrant forms restricted exclusively to meiofaunal existence (Swedmark, 1964). Due to short generation times and extremely small size, meiofauna may be more responsive indicators of environmental stress than their macrofaunal counterparts (Fenchel, 1967; McIntyre, 1969).

Between 1975 and 1977, meiofauna have been studied in three marine habitats in the Hampton-Seabrook coastal area: 1) oceanic subtidal soft substrate, 2) estuarine intertidal and subtidal soft substrates, and 3) oceanic algal holdfasts. Methods used for these studies as well as specific details of station locations and descriptions are presented in NAI, 1977b and 1979b.

Few temporally consistent biological patterns were apparent from the results of quarterly meiofaunal sampling. Meiobenthos exhibit either short life cycles or short residence times in the meiofauna. Also, these events are species specific and probably not synchronous among the community. In addition, substrate disturbance is common, breaking temporal continuity of the community at stations sampled over time. Difficulty of identifying meiofaunal taxa to species is yet another compounding factor hindering temporal descriptions.

Diverse taxonomic assemblages characterize the meiofauna at all habitats sampled from 1975 through mid-1977 (Table 2.2-11). Nematodes and harpacticoid copepods dominate the community compositions at all sites surveyed (Table 2.2-12). While nematodes were not identified to species, 47 distinct harpacticoid species have been identified from the habitats samples (Table 2.2-13). Most of these species were habitat specific as only 10 species were collected from all habitats.

Studies of harpacticoid copepods in the meiofauna communities, involving both taxonomic and reproductive investigations, show that temporal biological events can be both species specific as well as habitat specific. Ubiquitously distributed harpacticoid species such as, Halectinosoma sp. 1 and Dactylopodia vulgaris reach population peaks at different times in different habitats. At estuarine stations, spring peaks are common, whereas at the oceanic habitats summer-fall peaks are observed (Table 2.2-14). Dominance structure, at least among harpacticoids, is continuous over time. Records from the oceanic soft substrate stations show that Thompsonula hyaenae, Helectinosoma sp. 1 and Dactylopodia vulgaris persist as dominants at least from mid-1975 through mid-1977 (Table 2.2-14).

4. Settling Panel Community

A total of 98 faunal taxa, 23 macroalgal taxa and 14 diatom species have been collected between 1975 and 1978 on settling panels (Table 2.2-15). Some differences are observed between offshore stations (1, 4) and nearshore stations (19, 31) which suggest some relationship between the distance from major shallow water habitat areas and the intensity of settlement by pelagic larvae (NAI, 1980b). Otherwise the taxa common to all stations are generally species characteristic of shallow marine habitats along the northern New England coast (Table 2.2-15), each exhibiting a pelagic phase in its life cycle. Thus, the four coastal stations are probably exposed to the same assemblage of surface oriented pelagic larvae due to the mixing and distributional effects of wind, tide and current in the local area. The ubiquity of dominant settlement taxa has been documented by numerous other studies in northern New England (NAI, 1980b).

Settlement of diatoms, macroalgae and macrofauna have exhibited distinct seasonal patterns which have been repeated in each year studied. Each major species exhibits a characteristic period and duration of settlement activity (Figure 2.2-9). These activity periods correspond most strongly to seasonal changes in water temperature (NAI, 1977b and 1979b). Summer and early fall are the most active periods for settlement of macroalgae and animals. Diatoms are more common on panels in early spring and late fall, perhaps reflecting a reduced competition for space and not reproductive peaks. Of all species collected on fouling panels (Table 2.2-15) Mytilus edulis has the most prolific and prolonged settlement period (Figure 2.2-10). The hydroid Tubularia spp. exhibits the most intensive growth on settlement panels; however its initial settlement has been temporally unpredictable over the course of this study.

Two types of colonizers occur: primary, which are those taxa which can colonize bare or previously settled surfaces during their active periods, e.g., Balanus, Mytilus, most diatoms and algae, and Tubularia spp., and secondary, those taxa which only successfully colonize surfaces with existing flora and fauna, e.g., Hiatella spp. and most polychaetes. Secondary colonizers successfully settle only where a suitable habitat exists during their brief period of colonizing activity.

Both season and duration of panel exposure affect the diversity and biomass of the settling biota (Table 2.2-16). A one month panel exposed in August was usually more diverse and heavily colonized than a four month panel exposed from January through April (NAI, 1980b). Between year differences in colonization, however, is minimal. The composition of settlement biota has been dominated by the same group of species (Table 2.2-17) in all three years of study (NAI, 1977b and 1979b).

c. Estuarine Macrofauna

1. General

The Hampton-Seabrook estuary is composed of two regions, Hampton and Seabrook harbor areas (Stations 8 and 6, respectively) that include the Public Service barge docking facility, and the river systems (which include Stations 3 [Brown's River] and 7 [Tide Mill Creek]) which drain into the harbor areas. The harbor area consists of large, sandy tidal flats with temperature and salinity characteristics similar to the nearshore marine waters. The rivers are relatively narrow cuts in the salt marsh with steep banks and sand-silt substrates; considerable fluctuations in temperature and salinity occur in these rivers due to the influence of fresh water and the high surface to volume ratio of the water body.

2. Intertidal

The intertidal habitat in the Hampton-Seabrook estuary consists primarily of fine to medium sand. A total of 89 taxa were collected intertidally through 1977 at the four sites studied (Table 2.2-18). These taxa were dominated by Streblospio benedicti, Mya arenaria, Nereis diversicolor-virens, Capitella capitata, Mytilidae, Macoma balthica and Tellina agilis (Table 2.2-19). The numbers of species present at all stations were variable, ranging from 2 to 35 species; no consistent spatial pattern was observed (Figure 2.2-11). Total abundances of all species also varied; Station 8 had high overall abundances, Stations 3 and 7 had moderate abundances and Station 6 had low abundances (Figure 2.2-11).

Numbers of species collected at intertidal stations showed no consistent seasonal trends; however, a slight increase was noted in 1976-1977 compared to 1975-1976 (Figure 2.2-11). Overall abundances were variable but peaks were noted in August 1976 and May 1977. These peaks were due to large numbers of Mya arenaria, Streblospio benedicti and Capitella capitata (Figure 2.2-12).

3. Subtidal

The subtidal habitat in the estuary is largely composed of very fine to medium sand. A total of 126 species was collected subtidally through 1977 (Table 2.2-18), dominated by Mya arenaria, Streblospio benedicti, Mytilidae, Capitella capitata, Gemma gemma, Nereis diversicolor-virens, and Tellina agilis and Paraonis fulgens (Table 2.2-19). The numbers of species are similar at all stations ranging from 7 to 44 species (Figure 2.2-13); no spatial differences are observed. Total abundances are variable and consistently lowest at Station 7 (Figure 2.2-13). No other consistent spatial abundance patterns are noted.

Numbers of species show no consistent seasonal trends, however, numbers were higher in 1976-1977 than 1975-1976 (Figure 2.2-13). Abundances were variable over time, with peaks noted in February 1976 (Station 3 only), August 1977 (Stations 3, 7 and 8) and November 1977 (Station 6 only) (Figure 2.2-13). These peaks were primarily due to large abundances of Streblospio benedicti, Mya arenaria, Capitella capitata, Mytilidae and Tellina agilis (Figure 2.2-14).

d. Marine Macroalgae

1. General

The benthic macroalgal community on rock substrates in the Hampton-Seabrook study area consists of dominant perennial species with the intermittent occurrence of annuals. The major associations are distributed in overlapping vertical bands, their distribution depending primarily on their particular light requirements and secondarily on their submersion and temperature requirements (NAI, 1977a, 1977b, 1979b). Standing crop and numbers of taxa show a vertical orientation with maximum values in the lower intertidal and consistent reduction with depth. Because perennials dominate, the major algal associations remain fairly constant over time. Any fluctuations in standing crop or numbers of taxa are due to the occurrence of annual species and to general periods of maximum growth and recruitment.

2. Intertidal Flora

Algal cover is the dominant feature of the rocky intertidal. At least 65 taxa (Table 2.2-20) have been found intertidally, with standing crops reaching 5000 gms (dry weight)/m^2 (NAI, 1977b, 1979b). Temporal variation in biomass, number of taxa and dominant species is small (NAI, 1977b, 1979b); Fucus spp., Ascophyllum nodosum and Chondrus crispus are year-round dominants. Spatial variation in biomass and number of taxa is small and is primarily a function of zonation and exposure (Table 2.2-21). Mean high water areas are low in biomass and important taxa; although numerous minute Chlorophycean taxa occur sporadically, generally the major habitat formers of other zones (Ascophyllum and Fucus) are present only in small quantities.

Great Boar's Head (Station 4) is covered by dense mats of Fucus spp. and A. nodosum from just below mean high water to just above the low water mark. Here, C. crispus is important only in the sublittoral fringe area. At Outer Sunk Rocks, Fucus spp. dominate the mean sea level zone, while C. crispus (and to a lesser extent, Gigartina stellata) are clearly dominant in the lower intertidal (NAI; 1977b, 1979b).

3. Subtidal Flora

At least 58 taxa occur subtidally in this area (Table 2.2-22) with 14 to 26 taxa occurring at each station. Seasonal biomass averages show that temporal variation in the subtidal flora is unimportant when compared to spatial (depth) changes (Table 2.2-23). Mean biomass is highest from the surface to -20 feet and decreases rapidly below -30 feet; species richness drops off sharply below -60 feet (NAI, 1977b, 1979b). The dominant understory flora show distinct depth zones (Table 2.2-23) and is dominated by Chondrus crispus, Phyllophora spp., or Ptilota serrata. The kelps, Agarum cribrosum, Laminaria saccharina, L. digitata and Alaria esculenta, form a canopy and also show distinct depth preferences (Figure 2.2-15).

2.2.2.4 Finfish

Approximately 73 finfish species have been collected in New Hampshire coastal waters since 1972 (Table 2.2-24; NAI, 1974b, 1975, 1977a, 1979a, 1980c). This inshore finfish assemblage can be categorized as groundfish (on bottom), browsers (near bottom) and pelagic (in water column) species, although some species can be included in more than one category (Table 2.2-25). Finfish have been studied both in the areas of the intake and discharge as well as in the Hampton-Seabrook estuary.

The principal groundfish encountered in this area of the New Hampshire coast have been the yellowtail flounder (Limanda ferruginea), red and white hake (Urophycis chuss, U. tenuis), silver hake (Merluccius bilinearis), and winter flounder (Pseudopleuronectes americanus) (Table 2.2-26). While rainbow smelt (Osmerus mordax) and Atlantic cod (Gadus morhua) are not strictly bottom fish, they tend to be found near the bottom and thus are common in the bottom trawls at certain times of the year. Yellowtail flounder, hake and Atlantic cod have been most abundant at the deeper, more offshore otter trawl transects. Rainbow smelt and winter flounder, in comparison, have been reported to have a more inshore distribution; and only the latter species has been collected in greater numbers at the inshore transect. The silver hake is a predator whose distribution is dependent primarily on the availability of prey, and therefore is neither a deepwater nor an inshore species. Hake (Urophycis spp.) are encountered inshore from March through December, reaching maximum abundance during the summer and early autumn. These species move offshore during the winter. The silver hake is a summer migrant, with both adults and juveniles utilizing the coastal waters for feeding from May through November. Adult silver hake also spawn nearshore during the summer. The yellowtail flounder, winter flounder, and Atlantic cod are all permanent residents of the nearshore region, although there are minor seasonal fluctuations in abundance for each species.

Observations by SCUBA divers along rocky substrates which are inaccessible by otter trawls indicate that cunner (Tautogolabrus adspersus), pollock

(Pollachius virens), and radiated shanny (Ulvaria subbifurcata) are also common members of the near-bottom community. Density estimates by divers indicate that cunner is perhaps the most abundant finfish species in the nearshore region. Cunner are permanent residents of the area, but are active only from April through December, becoming torpid throughout the winter.

The principal pelagic finfish encountered along the New Hampshire coast are the Atlantic herring (Clupea harengus), Atlantic mackerel (Scomber scombrus), blueback herring (Alosa aestivalis) and alewife (Alosa pseudoharengus) (Table 2.2-27). The spatial distribution of these species is variable and results in erratic catches among stations. This spatial variability is the result of the schooling and wandering behavior of most pelagic species. Atlantic herring appear in inshore waters during the colder months, usually from early autumn through spring. The mackerel, alewife and blueback herring are summer inhabitants of the inshore regions. Mackerel are found in the nearshore regions from June through November, and alewives and bluebacks are present in the estuaries and nearshore zone from March through November.

The most abundant finfish species utilizing the Hampton-Seabrook estuary are the American sand lance (Ammodytes americanus), winter flounder (Pseudopleuronectes americanus), rainbow smelt (Osmerus mordax), Atlantic silversides (Menidia menidia), and killifish (Fundulus spp.) (Table 2.2-28). The Atlantic silversides and killifish are permanent estuarine residents, but are most abundant during the summer and autumn. The spatial distribution of these two species appears to be dependent on salinity, with silversides preferring higher salinities, and killifish the more brackish regions.

American sand lance abundance in the estuary varies both temporally and spatially. Sand lance move offshore to spawn during the late autumn and winter, with larvae appearing in inshore regions the following spring. The winter flounder is an inshore resident with maximum abundance during the spring and fall. High water temperatures cause a temporary offshore movement during the summer. Winter flounder abundance has been relatively stable since 1976. Rainbow smelt abundance along the coast and within the Hampton-Seabrook estuary has been variable since 1975. The adults have been reported to remain in nearshore coastal waters during the summer, and move into the estuary during the late fall and winter; none have been collected in the nearshore Hampton-Seabrook area during the summer.

Seventeen taxa of finfish eggs and 36 species of larvae have been collected within the Hampton-Seabrook study area (Table 2.2-24). Fish eggs are most abundant during the spring and summer when American plaice (Hippoglossoides platessoides), hake (Urophycis spp.) and Labrid/Limanda eggs are dominant (Figure 2.2-16). Egg densities are lowest in mid-winter when primarily pollock (Pollachius virens) and Gadus/Melanogrammus eggs are found. As would be expected, fish larvae are also most abundant during the summer, but there are secondary peaks during the late fall and early winter, primarily because of Clupea harengus larvae moving into the water column

(Figure 2.2-17). Ichthyoplankton succession in nearshore New Hampshire waters as illustrated in Figures 2.2-16 and 17, generally runs as follows:

SEASON	DOMINANT EGG TYPES	DOMINANT LARVAL SPECIES
Winter	Cod, pollock	Sand lance, pollock
Spring	Labrid/*Limanda*, plaice	*Liparis*, sand lance, winter flounder
Summer	Labrid/*Limanda*, hake	Cunner, yellowtail flounder
Autumn	Cod, hake	Four beard rockling, silver hake, Atlantic herring

2.2.2.5 Indicator Species

As part of the environmental monitoring, a program has been established to select certain species from each biological community to act as "indicator" species. The rationale and approach to this concept was presented in the Summary Document (NAI, 1977a). A review of candidates is currently underway to establish appropriate indicator species.

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TABLE 2.2-1

STRUCTURE OF THE PLANKTON COMMUNITY IN HAMPTON-SEABROOK COASTAL WATERS.

CLASSIFICATION BASED ON COLLECTION METHOD	SIZE OF ORGANISMS COLLECTED (μ)	PLANKTON TYPE COLLECTED	DOMINANT LOCAL FORMS AND INDICATOR SPECIES (*)	TIME OF MAXIMUM OCURRENCE
Whole water (cast bottle)	10^1 10^2 10^3 10^4 10^5	Nanoplankton[1] Net phytoplankton[2]	Diatom *Skeletonema costatum** *Rhizosolenia delicatula*	 Spring, Fall Spring, Fall
Net phytoplankton (0.076 mm net, pumped)		Net phytoplankton	Diatom *Chaetoceros* spp. Dinoflagellate *Ceratium* spp.	 Spring, Fall Spring, Fall
Microzooplankton (0.076 mm net, pumped)		Holoplankton[3] Meroplankton[4]	Copepoda (H) Copepoda nauplii *Pseudocalanus* spp. copepodites *Oithona* spp. copepodites *Eurytemora herdmani** Bivalvia (M) Bivalve veliger larvae	 Apr-Jun, Sep-Nov Apr-Jun, Sep-Nov Apr-Jun, Sep-Nov May-Aug
Mesozooplankton (0.333 mm net, towed)		Holoplankton Meroplankton Tychoplankton[5]	Copepoda (H) *Pseudocalanus* spp. adults *Temora longicornis* adults Cladocera (H) *Evadne* spp.	 Apr-Jun Apr-Jun Jun-Jul
Macrozooplankton (0.505 mm net, towed)		Holoplankton Meroplankton Tychoplankton	Copepoda (H) *Calanus finmarchicus* *Centropages* spp. adults Decopoda (M) *Cancer borealis* zoea	 Apr-May, Jul-Aug Aug-Dec Jun-Sep

Phytoplankton may be classified based on size:

[1]Nanoplankton include cells and chains ≤ 0.076 mm

[2]Net phytoplankton include cells and chains retained in a 0.076 mm mesh net

Zooplankton may be classified based on the relative portion of a species' life cycle that is spent in the water column:

[3]Holoplankton (H) include those species whose entire life cycle is planktonic.

[4]Meroplankton (M) include the floating developmental stages (eggs and larvae) of the benthos and nekton.

[5]Tychoplankton (T) are invertebrates which have temporarily migrated or have been swept from their normal benthic habitat into the water column.

TABLE 2.2-2

PERCENT COMPOSITION OF DOMINANT WHOLE WATER AND NET PHYTOPLANKTON AT STATION 2 (INTAKE SITE) SURFACE AND -15m AVERAGED.

TAXA	WHOLE WATER	NET		
	JAN-DEC 1978[a]	JAN-DEC 1978[a]	JUL 1976-JUN 1977	JUL 1975-JUN 1976
Skeletonema costatum	48.90	1.37	17.69	
Rhizosolenia delicatula	15.72			
Nitzschia delicatissima	8.76		1.44	
Thalassionema nitzschiodes	6.68			
Pennales	4.70			
Chaetoceros debilis	3.36	63.86	3.19	45.18
Nitzschia longissima	1.00			
Chaetoceros laciniosus		7.91		2.06
Thalassiosira nordenskioldii		8.05		3.36
Nitzschia seriata			2.26	
Chaetoceros diadema		4.69		
Chaetoceros decipiens		4.69	3.15	
Chaetoceros sp.		2.46	27.24	1.05
Chaetoceros lorenzianus		1.62		
Chaetoceros affinis			9.74	2.51
Coscinodiscus sp.			3.98	
Thalassiosira rotula			1.20	
Chaetoceros compressus				3.06
Ceratium tripos			12.94	
Rhizosolenia alata			2.38	
Ceratium longipes			2.11	
Chaetoceros didymus			2.16	
Chaetoceros brevis			1.01	1.64
Chaetoceros furcellatus				3.43

[a] Sampling schedule changed from a split year (July - June) schedule to a calendar year (January - December); July - December 1977 is not included here.

TABLE 2.2-3

PERCENT COMPOSITION OF MICROZOOPLANKTON AT STATION 2 (INTAKE SITE) SURFACE AND -15m AVERAGED: JULY 1975 THROUGH DECEMBER 1978[a].

TAXA	TYPE[b]	JAN-DEC 1978[c]	JUL 1976-JUN 1977	JUL 1975-JUN 1976
Copepod nauplii, unidentified	H	40.84	32.63	27.99
Oithona spp. copepodite	H	9.86	16.13	19.80
Bivalve veliger larvae, unidentified	M	12.94	11.88[d]	16.49
Pseudocalanus spp. copepodite	H	7.05	10.21	9.70
Oithona spp. nauplii	H	11.88	14.55	8.45
Gastropod veliger larvae	M	1.96	2.34	3.21
Microsetella norvegica	H	1.04	1.44	2.56
Oithona spp. female	H	1.08	2.73	2.20
Cirripedia nauplii	M	0.21	1.15	1.69
Centropages spp. copepodite	H	0.64	1.92	1.60
Temora longicornis copepodite	H	0.78	0.54	1.35
Polychaete larvae	M	2.29	0.29	1.28
Rotifera	H	0.05		0.69
Opisthobranchia veliger	M	1.79	0.42	0.52
Harpacticoida	T	0.35		0.44
Cirripedia cypris	M	0.16	0.31	0.37
Foraminiferida	T	2.57		0.30
Oithona spp. male	H	0.33	0.72	0.26
Tintinnidae	H	1.34		0.25
Acartia spp. copepodite	H	1.41	0.52	0.22
Echinoderm larvae	M	0.39	0.19	0.20
Bryozoan cyphonautes larvae	M	0.13	0.58	
Eurytemora spp. copepodite	H	2.41	0.50	
Paracalanus parvus copepodite	H		0.42	

[a]Excluding July-December 1977.

[b]H = Holoplankton. M = Meroplankton. T = Tychoplankton.

[c]All organisms were enumerated in the 1978 samples, however, only the selected taxa are included in this percent composition. Only selected taxa were enumerated in the 1975, 1976 and 1977 samples.

[d]Does not include *Modiolus modiolus* veligers collected on 7 October 1976; this single occurrence at a magnitude of $10^5/m^3$ obscured normal trends.

TABLE 2.2-4

PERCENT COMPOSITION OF MESOZOOPLANKTON AND MACROZOOPLANKTON AT STATION 2 (INTAKE SITE) FROM OBLIQUE TOWS, JULY 1975 THROUGH DECEMBER 1978[a].

TAXA	TYPE[b]	MACROZOOPLANKTON[d]	MESOZOOPLANKTON[e]	
		JAN-DEC 1978	JUL 1976-JUN 1977	JUL 1975-JUN 1976
Pseudocalanus spp. females	H	2.78	38.50	19.53
Evadne spp.	H		3.01	12.54
Temora longicornis males	H		2.90	10.28
Calanus finmarchicus copepodites	H	37.37	5.30	7.16
Temora longicornis females	H		1.93	7.14
Centropages typicus females	H	12.75	5.75	6.90
Acartia tonsa adults	H			5.50
Larvacea	H			4.93
Pseudocalanus spp. males	H		10.08	4.17
Centropages typicus males	H	8.23	4.93	3.44
Podon sp.	H		3.95	3.36
Metridia lucens copepodites	H	1.48	5.76	3.01
Acartia longiremus adults	H			2.22
Tortanus discaudatus males	H	1.29	0.84	2.13
Eurytemora herdmani females	H		2.76	1.71
Sagitta elegans	H	2.76		1.61
Centropages hamatus females	H			1.06
Centropages hamatus males	H			0.96
Tortanus discaudatus females	H	1.37	0.86	0.91
Acartia hudsonica adults	H		4.09	
Eurytemora herdmani males	H		2.22	
Cancer borealis stage I[c]	M	5.59		
Cirripedia nauplii[c]	M	4.96		
Eualus pusiolus[c]	M	1.78		
Cirripedia cypris[c]	M	1.63		
Meganyctiphanes norvegica furcilia[c]	H	1.47		
Calanus finmarchicus females	H	1.39		
Euphausiacea calyptopis[c]	H	0.95		

[a]Excluding July through December 1977.

[b]H = Holoplankton. M = Meroplankton

[c]Not enumerated in mesozooplankton samples.

[d]Zooplankton collected in .505 mm mesh nets.

[e]Zooplankton collected in .333 mm mesh nets.

TABLE 2.2-5

GENERAL DESCRIPTION OF BENTHIC COMMUNITIES IN THE HAMPTON-SEABROOK STUDY AREA.

HABITAT/ DEPTH	SUBSTRATE	ORGANISM CATEGORY SAMPLED	REPRESENTATIVE DOMINANT TAXA	ORGANISM TYPE
Marine Intertidal	Ledge/Boulder	Macroinvertebrates	*Littorina littorea* *Balanus balanoides*[a] *Mytilus edulis*	Gastropod Barnacle Mussel
	Ledge/Boulder	Macroalgae	*Fucus vesiculosus* *Ascophyllum nodosum* *Chondrus crispus*	Fucoid brown Fucoid brown Foliose red
	Sand	Macroinvertebrates	*Mytilus edulis* *Turtonia minuta* *Gammarus lawrencianus*	Bivalve Bivalve Amphipod
Marine Subtidal	Ledge/Boulder	Epibenthic crustacean	*Homarus americanus* *Cancer* spp.	Crustacean Crustacean
	Ledge/Boulder	Canopy macroalgae	*Laminaria* spp. *Agarum cribrosum*	Kelp Kelp
	Ledge/Boulder	Understory macroalgae	*Chondrus crispus* *Phyllophora* spp. *Ptilota serrata*	Foliose red Foliose red Foliose red
	Ledge/Boulder	Macroinvertebrates	Several taxa from every category, see Table 2.2-8	
	Ledge/Boulder	Meiofauna	Nematodes Harpacticoid copepods	
	Sand	Macroinvertebrates	*Tellina agilis* *Protohaustorius deichmanne* Several others, see Table 2.2-8	Bivalve Amphipod
	Sand	Meiofauna	Nematodes Harpacticoid copepods	
	Artificial substrate (plexiglass/wood)	"Fouling" Macroinvertebrates	*Mytilus edulis* *Jassa falcata* *Tubularia larynx*	Bivalve Amphipod Hydroid
Estuarine Intertidal	Sand/silt	Macroinvertebrates	*Nereis virens* *Streblospio benedicti* *Mya arenaria*	Polychaete Polychaete Bivalve
	Sand/silt	Meiofauna	Nematodes Harpacticoid copepods	
Estuarine Subtidal	Sand/silt	Macroinvertebrates	*Mya arenaria* Mytilidae *Streblospio benedicti*	Bivalve Bivalve Polychaete
	Sand/silt	Meiofauna	Nematodes Harpacticoid copepods	

[a]Semibalanus (=Balanus) balanoides

TABLE 2.2-6

BIOLOGICAL INDEX VALUES OF DOMINANT TAXA COLLECTED AT HARD AND SAND SUBSTRATE INTERTIDAL MARINE STATIONS DURING 1975-1976 AND 1976-1977.

	BIOLOGICAL INDEX VALUES																	
	HARD SUBSTRATE										SOFT SUBSTRATE							
	1975-1976					1976-1977					1975-1976			1976-1977				
	STATION 1		STATION 4			STATION 1		STATION 4			STATION 2			STATION 2				
SPECIES	MLW	MSL	MLW	MSL	MHW	MLW	MSL	MLW	MSL	MHW	MLW	MSL	MHW	MLW	MSL	MHW		
Mytilidae	100	100	100	86	14	100	100	100	90	60	25	55	---	42	67	83		
Oligochaeta	93	93	80	31	---	---	---	35	---	---	---	---	---	---	---	---		
Jaera marina	91	43	68	49	---	93	26	53	31	34	---	---	---	---	---	---		
Nucella lapillus	84	68	57	20	---	93	65	40	---	---	---	---	---	---	---	---		
Hiatella spp.	84	30	38	---	---	89	35	24	---	---	---	---	---	8	42	50		
Lacuna vincta	77	11	78	18	---	83	9	67	28	---	---	---	---	---	---	---		
Hyale nilssoni	75	77	91	67	14	79	77	79	53	39	---	---	---	---	---	---		
Skeneopsis planorbis	74	41	59	---	---	84	23	33	---	---	---	---	---	---	---	---		
Fabricia sabella	56	5	59	20	---	58	60	69	---	---	---	---	---	---	25	---		
Anomia spp.	48	---	20	---	---	80	41	43	---	17	---	---	---	8	42	50		
Balanus balanoides [a]	37	95	47	100	21	45	88	94	84	83	---	---	---	---	---	---		
Littorina obtusata	34	57	86	75	57	56	46	78	75	26	---	---	---	---	---	---		
Jassa falcata	34	41	56	10	---	56	1	40	22	9	---	---	---	---	---	---		
Acmaea testudinalis	27	27	42	---	---	45	12	39	---	4	---	---	---	---	---	---		
Littorina littorea	21	---	75	65	79	22	---	73	56	48	---	---	---	---	---	---		
Littorina saxatilis	---	23	8	12	---	1	14	1	15	26	---	---	---	---	---	---		
Carcinus maenas	---	---	33	29	50	14	14	20	---	17	---	---	---	---	---	---		
Turtonia minutus	---	---	---	---	---	97	60	36	---	---	---	---	---	---	58	30		
Amphiporeia virginiana	---	---	---	---	---	---	---	---	---	---	50	---	---	42	---	---		
Scolelepsis squamatus	---	---	---	---	---	---	---	---	---	---	6	55	---	8	---	---		
Tellina agilis	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	58		

[a]Semibalanus (=Balanus) balanoides

TABLE 2.2-7

SPECIES RICHNESS AND TOTAL ABUNDANCE ($\#/m^2$) OF FAUNA ASSOCIATED WITH TIDE LEVEL[a] ON ROCKY INTERTIDAL SUBSTRATES.

STATION 1, 1976

TIDE LEVEL	SPRING # TAXA	SPRING #/m²	SUMMER # TAXA	SUMMER #/m²	FALL # TAXA	FALL #/m²	WINTER # TAXA	WINTER #/m²
MHW	NOT SAMPLED[b]							
MSL	0	0	26	65,112	28	364,960	22	229,024
MLW	37	55,656	49	341,716	62	475,552	63	228,184

STATION 4, 1976

TIDE LEVEL	SPRING # TAXA	SPRING #/m²	SUMMER # TAXA	SUMMER #/m²	FALL # TAXA	FALL #/m²	WINTER # TAXA	WINTER #/m²
MHW	4	100	5	280	10	260	4	176
MSL	15	14,912	16	66,160	13	5,960	8	6,496
MLW	20	6,816	37	55,044	36	22,324	17	5,256

[a]Based on results from destructive samples collected in 1976.

[b]Rocks submerged at high water.

TABLE 2.2-8

NUMBERS OF FAUNAL TAXA, NUMBERS OF INDIVIDUALS AND SPECIES DIVERSITY IN SAMPLES TAKEN DURING THE 1976-1977 SAND-SUBSTRATE INTERTIDAL STUDY.

Station	SPRING 1976				SUMMER 1976				FALL 1976				WINTER 1976			
	Taxa $\bar{X}$[1]	Taxa Σ[2]	#[3]	H'[4]	Taxa $\bar{X}$	Taxa Σ	#	H'	Taxa $\bar{X}$	Taxa Σ	#	H'	Taxa $\bar{X}$	Taxa Σ	#	H'
2 MHW	1	1	8	0.00	1	2	4	<0.01	1	1	3	0.00	1	1	19	0.00
2 MSL	1	5	40	1.36	1	5	48	.82	1	3	307	.77	2	7	1578	.75
2 MLW	1	2	4	<0.01	1	3	12	1.58	1	3	10	1.58	1	5	22	2.13

Station	SPRING 1977				SUMMER 1977			
	Taxa $\bar{X}$	Taxa Σ	#	H'	Taxa $\bar{X}$	Taxa Σ	#	H'
2 MHW	4	12	397	1.16	1	1	3	0.00
2 MSL	1	2	10	.92	0	0	0	-
2 MLW	1	2	22	.98	1	2	252	.12

1 Mean number of taxa per replicate

2 Total number of different taxa identified in all replicates

3 Mean raw counts per five 45 cm^2 replicates

4 H' = Shannon/Weaver diversity index

SB 1 & 2
ER-OLS

TABLE 2.2-9

BENTHIC STATION LOCATION AND DESCRIPTION, 1977

STATION	DEPTH (FT)	LOCATION LONGITUDE	LATITUDE	SUBSTRATE[a]
2	80	70°46'47"	42°52'51"	68% cobble with sand-silt matrix primarily in NE, NW, SW quadrants; 3% algae covered ledge and 29% exposed ledge in SE quadrant
11	60	70°47'07"	42°54'24"	A layer of very fine sand, moderately well sorted (M_z = 3.28, σ_I = 0.55), coarse skewed, leptokurtic over pea gravel
12	50	70°47'20"	42°53'59"	Mixed algae covered large boulders (60%) with mussel beds (25%), cobble (5%) and exposed ledge (10%)
13	60	70°46'58"	42°53'54"	Mixed algae covered large boulders (55%) with mussel beds (25%), cobble (12%) and exposed ledge (8%)
14	90	70°46'56"	42°53'29"	Fine sand, poorly sorted (M_z = 2.14, σ_I = 1.25), symmetrically skewed, leptokurtic
19	40	70°47'10"	42°53'37"	70% scattered mussel beds and 30% algae covered ledge
23	35	70°47'24"	42°53'28"	50% scattered mussel beds, 48% algae covered ledge and 2% cobble
24	30	70°48'12"	42°53'24"	Fine sand, well sorted (M_z = 2.62, σ_I = 0.45), symmetrically skewed, mesokurtic
26	20	70°47'58"	42°53'51"	Mixed algae covered large boulders (55%) with *Corallina* covered boulders (30%), cobble (8%), mussels (5%) and exposed ledge (2%)
27	17	70°47'35"	42°53'57"	90% large boulders covered by foliose algae, 5% mussel beds, 3% exposed ledge and 2% cobble
29	40	70°45'33"	42°54'33"	Fine to very fine sand, moderately to moderately well sorted (M_z = 2.97, σ_I = 0.73), strongly coarse skewed, mesokurtic to leptokurtic
31	30	70°45'24"	42°58'04"	63% scattered mussel beds, 30% algae covered ledge, 5% *Corallina* covered ledge and 2% cobble
33	25	70°45'15"	42°58'58"	Very fine sand, well sorted (M_z = 3.09, σ_I = 0.39) symmetrically skewed, mesokurtic

[a] Substrate descriptions represent only areas where random samples were located

TABLE 2.2-10
(Sheet 1 of 2)

DOMINANT SPECIES (BASED ON BIOLOGICAL INDEX VALUES, NAI, 1979b)
COLLECTED AT SUBTIDAL MARINE STATIONS FROM 1975-1977.

TAXA	1975-1976 H*	1975-1976 C	1975-1976 S	1976-1977 H	1976-1977 C	1976-1977 S	SAMPLING PERIODS WITH HIGHEST DENSITIES
Circeis spirillum	100	86		99	61		Apr 1976
Mytilidae spat	97		74	97	85		Oct 1975 & 1976
Pontogeneia inermis	95	75	67	95			Jul 1975 & 1976
Asterias spp.	95	66		97			Oct 1975 & 1976; Jul 1976
Lacuna vincta	93			93			Jul 1975 & 1976
Ischyrocerus anguipes	93			81			Apr 1976 & 1977
Hiatella spp.	92	63		94	73		Oct 1975 & 1976
Caprella septentrionalis	91			87			Jul 1975 & 1976; Oct 1976
Spirorbis spirorbis	89	74		72			No peaks
Tonicella rubra	88			89			Oct 1975 & 1976; Jul 1975
Strongylocentrotus droebachiensis	88	62		95	61		Oct 1975 & 1976
Ophiopholis aculeata	88			91			Jul 1975; Oct 1976; Apr 1977
Molgula spp.	88			92			Oct 1975 & 1976
Achelia spinosa	86			91			Oct 1975; Jan 1977
Eualus pusiolus	84			81			Oct 1975; Jan 1977
Pleusymtes glaber	83			87			Jan 1976 & 1977; Apr 1976
Dendrodoa sp.	83			82			Oct 1975 & 1976
Balanus balanus	82			72			Oct 1975; Jul 1976
Anomia spp.	80			93	91		Oct 1975; Apr 1977
Lepidonotus squamatus	78			81			Oct 1975 & 1976
Amphipholis squamatus	75	77					Jul 1975 & 1976
Cerastoderma pinnulatum	73	94		73	96		Jan 1976; Apr 1976; Oct 1976
Idotea phosphorea	73			72			Oct 1975 & 1976
Ophiura robusta	72	82					Oct 1975 & 1976
Boltenia echinata	72						Oct 1975; Jan 1977
Nereis pelagica	71						Oct 1975 & 1976; Jul 1975
Henricia sanguinolenta	71			77			Oct 1975 & 1976
Harmothoe imbricata	70			75			Oct 1975 & 1976
Corophium acherusicum/insidiosum	70			73			Jul 1975; Oct 1976
Jassa falcata				73			Jul 1975; Oct 1976
Diaphana minuta				72			Oct 1975 & 1976
Alvania areolata				70			Oct 1976

TABLE 2.2-10
(Sheet 2 of 2)

TAXA	1975-1976 H*	1975-1976 C	1975-1976 S	1976-1977 H	1976-1977 C	1976-1977 S	SAMPLING PERIODS WITH HIGHEST DENSITIES
Unciola spp.		98	56		99	84	Oct 1975; Jul 1976
Corophium crassicorne		86			91		Oct 1975 & 1976; Jan 1977
Euclymene collaris		67					Oct 1975 & 1976
Musculus niger		63					Oct 1975; Jul 1976
Pectinaria granulata					60		Oct 1975 & 1976
Balanus crenatus					65		No peaks
Tellina agilis			96			84	Oct 1975 & 1976; Jan 1976
Protohaustorius deichmanne			89			63	Jul 1975 & 1976
Spisula solidissima			83				Jul 1975 & 1976
Pseudoleptocuma minor			83			77	Jul 1975; Oct 1976; Jan 1977
Echinarachnius parma			82			95	Oct 1975 & 1976
Acanthohaustorius millsi			79			65	Jan 1976 & 1977; Jul 1975
Sthenelais limicola			78			76	Jul 1975 & 1976
Psammonyx nobilis			77			65	Jan 1976; Apr 1977
Trichophoxus epistomus			75			54	No peaks
Orbinia swani			67			58	Apr 1976 & 1977; Oct 1975
Arctica islandica			63			52	Jan 1976 & 1977
Diastylis polita			58			60	Apr 1976; Oct 1976
Clymenella torquata			56			71	Oct 1975 & 1976
Scoloplos armiger			54				Apr 1976 & 1977; Oct 1975
Edotea triloba						86	Oct 1975 & 1976
Chiridotea tuftsi						72	Oct 1975 & 1976
Nephtys caeca						66	Jul 1975 & 1976
Cirratulidae						58	No peaks
Cirolana polita						57	Jan 1976; Oct 1976
Lampros quadriplicata						55	Jan 1976; Oct 1976
Nephtys bucera						53	Oct 1975; Jan 1977

* H = Hard substrate, numerically dominant species > 70% BIV
C = Cobble substrate, numerically dominant species > 60% BIV
S = Sand substrate, numerically dominant species > 50% BIV

TABLE 2.2-11

DISTRIBUTION AND RELATIVE ABUNDANCES OF MEIOFAUNAL TAXA IN THE HAMPTON-SEABROOK STUDY AREA, 1975-1977.

	COASTAL SOFT SUBSTRATE	ESTUARINE INTERTIDAL	ESTUARINE SUBTIDAL	COASTAL HOLDFAST
Annelida (unidentified larvae)	P[1]	P	P	C
Polychaetes	C	P	P	C
Archiannelida	---	---	---	R
Chaetogordus canaliculatus	R	R	R	---
Oligochaeta	P	C	C	P
Hirudinea	---	R	---	---
Aschelminthes				
Gastrotricha (unidentified)	P	P	R	R
Macrodasyoidae	C	R	R	R
Thaumastodermatidae	P	---	---	---
Chaetonotoida	R	R	---	---
Kinorhyncha				
Campyloderes macquariae	---	---	---	P
Nematoda	A	A	A	A
Desmoscolex sp.	R	R	R	C
Draconematidae	R	---	R	C
Epsilonematidae	---	R	---	---
Platyhelminthes (*Turbellaria*)	C	P	C	C
Rhynchocoela	---	---	---	P
Tardigrada (unidentified)	R	P	R	---
Batillipes sp.	R	R	---	---
Halechiniscus sp.	---	R	---	---
Mollusca				
Bivalvia	C	R	P	A
Gastropoda	P	R	R	P
Opistobranchia	---	---	---	P
Polyplacophora	R	---	---	R
Echinodermata				
Ophiuroidae	---	---	---	P
Holothuroidea	R	---	R	---
Echinoidea	R	---	---	P
Asteroidea	---	---	---	R
Cnidaria				
Anthozoa	R	R	---	---
Hydrozoa	---	---	---	R
Arthropoda				
Insecta	R	P	R	R
Halacaridae	P	P	C	C
Ostracoda	C	P	P	A
Amphipoda	C	R	P	C
Cumacea	P	---	R	---
Tanaidacea	P	R	R	---
Isopoda	R	R	---	R
Calanoida	C	R	C	R
Cyclopoda	P	R	R	R
Harpacticoida	A	A	A	A
Mystacocarida	---	R	---	---
Larvae				
Megalops	R	P	C	R
Nauplii	C	C	A	C
Crab zoea	---	---	---	R
Chordata				
Ascidacea larvae	---	---	---	P
Others (unidentified)	R	P	P	P
TOTAL NUMBER OF TAXA	33	31	26	33

[1]A = Abundant
C = Common
P = Present
R = Rare

TABLE 2.2-12

SUMMARY OF MEIOFAUNAL ABUNDANCES AND DOMINANT TAXONOMIC GROUP COMPOSITION IN THE HAMPTON-SEABROOK STUDY AREA.

STATION		MEAN ABUNDANCES 1975-76	1976-77	DOMINANT GROUP AT REPRESENTATIVE STATION	PERCENT COMPOSITION WINTER 1976	WINTER 1977	SPRING 1976	SPRING 1977	SUMMER 1975	SUMMER 1976	FALL 1975	FALL 1976
Coastal	10	574.5	NS	Station 29								
Soft	11	456.5	247.9	(Intake)								
Substrate	14	NS[1]	148.6	Nematodes	98.5	86.2	90.8	86.5	89.5	80.7	87.4	79.0
[#/10cm^2]	24	317.5	NS	Harpacticoids	1.0	10.1	2.3	6.4	4.3	5.2	3.3	17.0
	29	701.0	285.5	Other	0.5	3.3	6.9	7.1	6.2	14.2	9.3	4.0
	33	553.3	188.2									
Estuarine	3	361.2	342.0	Station 3I								
Soft	6	638.4	258.0	(Browns River)								
Substrate	7	545.7	726.4	Nematodes	43.4	91.1	22.2	22.1	93.0	88.2	92.9	47.9
Intertidal (I)	8	NS	708.3	Harpacticoids	51.1	7.9	56.9	69.9	4.5	2.9	4.3	33.2
[#/10cm^2]				Other	5.5	1.0	20.9	8.0	2.5	8.9	2.8	18.9
Subtidal (S)	3	194.7	988.3	Station 3S								
[#/10cm^2)	6	630.6	351.2	(Browns River)								
	7	130.4	197.2	Nematodes	71.8	23.7	30.5	41.9		90.2	89.7	93.9
	8	NS	559.7	Harpacticoids	19.3	70.9	14.8	50.8	NS	2.4	7.4	2.9
				Other	8.9	5.4	54.7	7.3		7.4	2.9	3.2
Coastal	26 (C[2])	966.8	1141.5	Station 26 (c)								
Hard	26 (L[3])	NS	666.9	(Outer Sunk Rocks)								
Substrates				Nematodes	30.2	49.7	35.1	39.7	3.3	21.2	20.0	48.9
Holdfasts				Harpacticoids	17.1	30.2	14.6	20.4	35.2	21.1	20.1	21.4
[#/10gm]				Bivalves	13.2	3.5	6.7	0.6	28.9	41.2	24.7	10.5
				Others	39.5	16.6	43.7	39.3	32.6	16.5	35.2	19.2

[1]NS = Not Sampled

C[2] = *Corallina officinalis*

L[3] = *Laminaria digitata* holdfasts

TABLE 2.2-13
(Sheet 1 of 2)

DISTRIBUTION AND RELATIVE ABUNDANCES OF
MEIOFAUNAL HARPACTICOID COPEPOD SPECIES AMONG HABITATS.*

	OCEANIC	ESTUARINE SUBTIDAL	ESTUARINE INTERTIDAL	OCEANIC HOLDFASTS
Alteutha oblonga	P*	R	---	R
Ameira longipes	---	---	R	C
Ameira parvula	R	R	---	R
Ameira sp.	R	---	---	---
Amphiascus minutus	R	P	C	A[1]
Asellopsis littoralis	R	---	---	---
Cletocamptus bicolor	---	---	R	---
Cletocamptus deitersi	---	---	R	---
Cletodidae	---	R	R	---
Cletodes sp.	R	---	---	---
Cylindropsyllus laevis	P	R	C	---
Dactylopodia vulgaris	C	A[2]	P	A
Dactylopodia sp.	R	---	---	P
Danielssenia typica	---	P	---	P
Echinolaophonta horrida	---	---	---	P
Ectinosomatidae	P	R	R	P
Ectinosoma melaniceps	P	R	R	C
Enhydrosoma buckholtzi	---	---	R	---
Enhydrosoma longifurcatum	---	C	R	---
Enhydrosoma propinquum	---	R	R	---
Enhydrosoma sp.	P	R	---	---
Halectinosoma neglectum	P	R	R	P
Halectinosoma sp. 1	A	C	A	P
Halectinosoma spp.	P	---	R	R
Harpacticus sp.	R	R	---	---
Heterolaophonte minuta	---	R	P	---
Heterolaophonte sp.	---	---	---	R
Heteropsyllus sp. 1	---	---	R	---
Heteropsyllus nunni	---	R	R	---
Laophontidae	R	R	R	P
Laophonte inopinata	---	---	---	C
Leimia vaga	---	P	---	---
Mesochra pygmaea	R	P	P	P
Microarithridon littorale	R	C	P	---
Microsetella norvegica	P	P	R	P
Microsetella sp.	---	---	---	R
Normanella minuta	---	R	---	---
Normanella sp.	R	R	---	P
Orthopsyllus linearis	---	---	---	P
Paralaophonte hyperborea	---	---	---	R
Paralaophonte macera	---	---	R	A

TABLE 2.2-13
(Sheet 2 of 2)

	OCEANIC	ESTUARINE SUBTIDAL	ESTUARINE INTERTIDAL	OCEANIC HOLDFASTS
Paramphiascella mediterranea	---	---	R	R
Parastenhelia spinosa	---	---	---	A[1]
Parathalestris intermedia	R	---	R	P
Paronychocamptus wilsoni	---	C	C	---
Pseudobradya sp. 1	C	P	---	R
Pseudobradya sp. 2	R	---	---	---
Pseudolaophonte sp. 1	---	R	---	---
Pseudonychocamptus koreni	---	---	R	---
Rhizothrix minuta	P	---	---	---
Scottolana canadensis	---	P	R	---
Scutellidium hippolytes	---	---	---	C
Stenhelia divergens	P	P	P	R
Stylicletodes sp.	---	R	---	---
Tachidius discipes	P	A[1]	A[1]	R
Tegastidae	---	---	R	P
Thompsonula hyaenae	A[1]	A[3]	P	P
Tisbe sp.	P	P	---	C
Juveniles	A	A	A	A
Unidentifiable	R	R	R	R
TOTAL TAXA: 58	31	35	34	35
DISTINCT TAXA: 47	22	27	27	25

[1]The most abundant species
[2]Abundant only at Station 6S, 8S
[3]Very abundant only at Station 8S

*--- = Not observed
R = Rare, limited in all respects
P = Present, occasional individuals, limited seasonally and spatially
C = Common, many individuals usually restricted seasonally or spatial
A = Abundant, many individuals, most seasons, all stations

TABLE 2.2-14

TOTAL ABUNDANCES (ALL STATIONS SUMMED) OF DOMINANT HARPACTICOID SPECIES.

SPECIES/HABITAT TYPE	1975 S	F[3]	W	1976 SP	S	F	1977 W	SP
Thompsonula hyaenae								
[1]Oceanic Soft Substrate	23.5	57.4	16.2	3.5	5.9	92.0	30.4	17.7
[1]Estuarine Intertidal	---	NOT SAMPLED		---	0.4	0.4	0.0	5.9
[1]Estuarine Subtidal	---	NOT SAMPLED		---	0.0	41.4	3.3	183.7
[2]Oceanic Holdfasts	0.0	1.9	0.3	0.0	7.8	0.0	0.0	0.0
Helectinosoma sp. 1								
[1]Oceanic Soft Substrate	9.9	12.5	8.4	18.6	16.8	43.6	11.7	12.8
[1]Estuarine Intertidal	---	NOT SAMPLED		---	15.7	33.8	12.8	61.7
[1]Estuarine Subtidal	---	NOT SAMPLED		---	7.3	6.3	79.3	88.8
[2]Oceanic Holdfasts	7.1	9.4	0.6	1.8	2.2	0.0	0.0	3.1
Dactylopodia vulgaris								
[1]Oceanic Soft Substrate	5.2	1.1	1.1	1.4	8.6	7.7	3.4	3.6
[1]Estuarine Intertidal	---	NOT SAMPLED		---	1.1	0.0	0.4	5.2
[1]Estuarine Subtidal	---	NOT SAMPLED		---	0.4	3.3	15.7	134.9
[2]Oceanic Holdfasts	267.1	5.6	1.1	8.0	114.6	26.6	14.3	2.7
Tachidius discipes								
[1]Oceanic Soft Substrate	0.0	1.8	0.0	0.7	3.3	0.0	0.0	0.0
[1]Estuarine Intertidal	---	NOT SAMPLED		---	55.7	131.3	27.8	541.6
[1]Estuarine Subtidal	---	NOT SAMPLED		---	6.2	11.4	402.6	701.0
[2]Oceanic Holdfasts	---------------- VERY RARE ----------------							
Amphiascus minutus								
[1]Oceanic Soft Substrate	0.0	0.0	0.0	0.0	0.8	0.0	0.4	0.0
[1]Estuarine Intertidal	---	NOT SAMPLED		---	8.5	5.8	13.2	12.2
[1]Estuarine Subtidal	---	NOT SAMPLED		---	0.0	1.4	0.4	0.4
[2]Oceanic Holdfasts	0.0	86.0	21.0	25.0	84.7	77.6	164.8	28.6

[1] #/10 cm^2

[2] #/10 gm of algae

[3] S = summer
F = fall
W = winter
SP = spring

TABLE 2.2-15
(Sheet 1 of 3)

RELATIVE ABUNDANCES OF TAXA COLLECTED ON SHORT TERM, TRIANNUAL AND LONG TERM SETTLEMENT PANELS.*

TAXA	RELATIVE ABUNDANCE ST	TA	LT
MOLLUSCA			
Bivalvia			
Mytilidae	A	A	A
Hiatella spp.	C	A	A
Anomia spp.	P	C	C
Cerastoderma pinnulatum	P	P	P
Placopecten magellanicus	-	P	-
Turtonia minuta	R	R	-
Tellina agilis	-	R	-
Mya arenaria	R	R	-
Arctica islandica	R	-	-
Unk bivalve	R	-	-
Gastropodia			
Lacuna vincta	C	C	P
Littorina obtusata	R	R	-
Littorina saxatilis	-	R	-
Skeneopsis planorbis	-	R	-
Nucella lapillus	R	-	-
Diaphana minuta	-	-	R
Margarites helicinus	-	-	R
Nudibranchia			
Coryphella sp.	P	-	-
Coryphella rufibranchialis	P	C	P
Dendronotus sp.	-	P	P
Dendronotus frondosus	-	P	P
Eubranchus spp.	-	R	-
Eubranchus exigua	-	C	-
Eubranchus pallidus	-	R	-
Onchidorus sp.	R	R	-
Onchidorus aspera	-	R	-
Doto coronato	R	R	R
Catriona aurantia	-	C	C
Facelina bostoniensis	-	P	-
Nudibranchia unk	P	-	-

TAXA	RELATIVE ABUNDANCE ST	TA	LT
ANNELIDA			
Polychaeta			
Phyllodoce spp. (Juv.)	R	P	R
Phyllodoce mucosa	-	-	P
Phyllodoce maculata	-	-	P
Neridae (Juv.)	P	P	P
Nereis pelagica	R	P	P
Harmothoe spp.	R	P	P
Harmothoe imbricata	P	C	C
Lepidonotus squamatus	P	P	P
Polynoidae	-	R	R
Circeis spirillum	R	R	R
Eulalia viridis	-	R	-
Eupolymnia spp.	-	-	R
PLATYHELMENTHES			
Turbellaria sp.	P	P	-
ARTHROPODA			
Pycnogonida			
Phoxichilidium femoratum	-	P	R
Crustacea			
Copepoda			
Harpacticoida	C	C	C
Calanoida	C	C	C
Cirrepedia			
Balanus spp. (Juv.)	P	C	C
Balanus crenatus	P	P	P
Semibalanus balanoides	P	P	P
Balanus balanus	R	-	P

TABLE 2.2-15
(Sheet 2 of 3)

TAXA	ST	TA	LT
Isopoda			
Jaera marina	R	R	-
Idotea phosphorea	-	R	-
Amphipoda			
Jassa falcata	A	A	A
Pontogenia inermis	P	P	P
Hyale nilssoni	-	R	-
Stenothoidae	R	R	-
Stenothoe spp.	-	R	-
Calliopius laeviusculus	R	-	-
Corophium spp.	-	R	-
Corophium insidiosum	-	R	-
Caprella spp.	-	-	R
Caprella septentrionalis	R	-	-
Cumacea			
Pseudoleptocuma minor	-	-	R
CNIDARIA			
Hydrozoan			
Tubularia spp.	A	A	A
Tubularia larynx	A	A	A
Campanularidae	P	-	R
Campanularia spp.	P	R	R
Obelia spp.	P	R	-
Obelia geniculata	P	R	R
Obelia dichotoma	P	R	-
Clytia hemisphaerica	R	-	-
Clytia gracillus	-	R	-
Bougainvillia spp.	R	-	-
Dicoryne spp.	R	-	-
Eudendrium spp.	R	R	-
Sertularia cupressina	-	R	-
Dynamena pumila	R	-	-
Anthozoa			
Metridium senile	R	P	R
BRYOZOA			
Ectoprocta			
Electra pilosa	P	C	P
Hippothoa hyalina	P	P	P
Scruparia ambigua	P	P	-
Disparella hispida	-	R	-
Crisia eburnea	R	R	R
Amathia vidovici	-	R	-
Diaporecia harmerii	-	-	R
Smittinidae	-	-	R
Parasmittina nitida	R	-	-
PORIFERA			
Calcarea			
Leucosolenia botryoides	-	R	R
Clathrina coriacea	-	-	R
ECHINODERMATA			
Holothuroidea			
Psolus spp.	R	R	R
Echinoidea			
Strongylocentrotus droebachiensis	R	P	P
Asteroidea			
Asterias spp.	R	P	P
Ophiuroidea			
Ophiuroidea (Juv.)	-	R	-
Ophiopholus aculeata	-	R	-
PROTOZOA			
Ciliophora			
Vorticella sp.	C	-	-
TOTAL fauna	60	71	50

TABLE 2.2-15
(Sheet 3 of 3)

TAXA	ST	TA[1]	LT
DIATOMS			
Bacillariophyceae			
Centrales			
Biddulphia spp.	C	–	–
Isthmia spp.	R	–	–
Cocconies spp.	P	–	–
Coscinodiscus spp.	C	–	–
Melosira spp.	C	–	–
Pennales			
Navicula/Nitzchia spp.	A	–	–
Navicula colonial	A	–	–
Pleurosigma spp.	R	–	–
Gyrosigma/Pleurosigma spp.	R	–	–
Licmophora spp.	A	–	–
Grammatophora spp.	C	–	–
Fragilaria spp.	C	–	–
Achnanthes spp.	R	–	–
Rhabdonema spp.	P	–	–
Total diatoms	14	NR[1]	NR

TAXA	ST	TA	LT
MACROALGAE			
Chlorophyceae			
Enteromorpha spp.	C	C	P
Ulothrix spp.	R	–	–
Ulothrix flacca	R	–	–
Urospora spp.	P	R	–
Urospora penicilliformis	R	–	–
Ulva lactuca	P	R	–
Blidingia marginata	–	P	–
Phaeophyceae			
Ectocarpus spp.	C	A	C
Ectocarpus confervoides	–	–	P
Ectocarpus selculosus	R	–	–
Giffordia spp.	R	P	P
Giffordia granulosus	R	–	–
Giffordia sandriana	P	–	–
Petalonia fascia	R	C	–
Myrionema sp.	P	–	–
Laminaria saccharina	R	–	C
Laminaria sp.	–	–	C
Agarium cribrosum	–	–	R
Rhodophyceae			
Ceramium sp.	R	–	–
Ceramium rubrum	P	R	–
Polysiphonia spp.	R	–	–
Polysiphonia urceolata	R	P	–
Scagelia pylaisii	R	R	–
TOTAL macroalgae	19	10	7

[1] Triannual and long-term panels were not examined for diatoms.

* = Not Observed
R = Rare
P = Present
C = Common
A = Abundant

TABLE 2.2-16

EFFECTS OF SEASON AND EXPOSURE DURATION ON DIVERSITY AND INTENSITY OF SETTLEMENT ON COASTAL FOULING PANELS, 1977-1978 RESULTS.

STATION AND PARAMETER MEASURED		PANEL TYPE: SHORT TERM 1 MONTH					PANEL TYPE: TRIANNUAL 4-MONTH			PANEL TYPE: LONG TERM 12 MONTHS
		MINIMUM #	MINIMUM MONTH	MAXIMUM #	MAXIMUM MONTH	MEAN 1977 1978	SPRING 1977 1978	SUMMER 1977 1978	FALL 1977 1978	1978 ONLY
Station 1 1978[4]	# taxa[1]	5	Feb	14	Aug	8	--- 7	--- 16	15 19	21
	# individuals[2]	0	Mar Apr	83	Jul	22	--- 13	--- 6,823	504 2,736	9,768
	Biomass[3]	---	---	---	---	---	---	---	---	590.5gm
Station 4 1978[4]	# taxa	6	Mar	17	Aug	11	--- 5	--- 19	10 18	23
	# individuals	0	Mar Apr	90	Aug	19	--- 6	--- 5,458	208 871	6,082
	Biomass	---	---	---	---	---	---	---	---	804.8gm
Station 19 1977-1978	# taxa	5	Nov 1977	30	Aug 1977	11 11	5 11	35 18	28 21	21
	# individuals	0	Mar 1978	4,584	Aug 1978	404 414	49 18	15,731 15,024	14,070 4,446	8,637
	Biomass	---	---	---	---	---	---	---	---	758.8gm
Station 31 1977-1978	# taxa	4	Nov '77 Feb '78	16	Oct 1978	10 11	7 12	20 20	20 20	25
	# individuals	0	Feb '78 Mar '78	844	Aug 1977	187 86	16 76	21,084 40,141	43,573 8,328	11,794
	Biomass	---	---	---	---	---	---	---	---	735.7gm

[1]Diatoms, algae, fauna
[2]Fauna only
[3]Mean of two replicates (gm/dry wt)
[4]Station established in late 1977

SB 1 & 2
ER-OLS

TABLE 2.2-17

DOMINANT TAXA GENERALLY OCCURRING ON SETTLING PANELS REGARDLESS OF STATION.

FAUNA

Solitary taxa

Mytilidae
Hiatella spp.
Jassa falcata
Anomia spp.
Lacuna vincta
Balanus spp.
Nereis pelagica

Colonial taxa

Tubularia larynx
Electra pilosa
Vorticella sp.

MACROALGAE

Laminaria saccharina
Ectocarpus spp.

DIATOMS

Navicula spp.
Nitzschia spp.
Fragilaria spp.
Biddulphia spp.

TABLE 2.2-18
(Sheet 1 of 3)

ESTUARINE SPECIES LISTING

SPECIES NAME	SAMPLE PERIOD 1976 AUG	1976 NOV	1977 FEB	1977 MAY	FEEDING TYPE[b]
Phylum Rhynchocoela					
Rhynchocoela sp. B			I,S[a]	S	C (inf)
Rhynchocoela sp. D		I			
Rhynchocoela sp. E	S				
Rhynchocoela sp. F		S			
Rhynchocoela sp. H	S	S			
Phylum Annelida					
Order Phyllodocida					
Aglaophamus circinata				I	DF
Eteone flava		I	I,S	I,S	C
Eteone heteropoda	I,S	I	S	I,S	C (inf)
Eteone lactea	I,S	S			C (")
Eteone longa	I,S	I,S	I,S	I,S	C (")
Eteone sp.	I,S	I,S	I	I	C
Exogone hebes	S	I,S	S	S	C (")
Harmothoe imbricata	S				C
Microphthalmus aberrans	S				C (")
Nephtyidae	S				C (")
Nephtys caeca	I,S	I,S	I,S	I,S	C
Nephtys ciliata	I,S	I	S	I,S	C
Nephtys incisa	S				DF
Nephtys juvenile				S	C (")
Nereidae juveniles	I				D (")
Nereis diversicolor	I,S	I,S	I,S	I,S	O (")
Nereis diversicolor-virens	I,S	I,S	I,S	I,S	O
Nereis grayi		I			O (")
Nereis sp.	S	I	I	I,S	O
Nereis virens	S		I,S	I	O (")
Pholoe minuta	S	S	I,S	I	C
Phyllodoce maculata	I,S	I,S			C
Phyllodoce mucosa	I				C
Sthenelais limicola			S		C
Order Capitellida					
Capitella capitata	I,S	I,S	I,S	I,S	DF
Capitellidae	S	I			DF (")
Clymenella torquata	I,S	I,S	I,S	I	DF
Euclymene collaris	S				DF
Heteromastus filiformis	I,S		I,S	I	DF (")
Maldanidae juvenile	S				DF (")
Order Spionida					
Aricidea catherinae	S	S	I,S	I, S	DF
Aricidea sp.	S			S	DF (")
Paraonidae	S	I,S			DF (")
Paraonis fulgens	I,S	I,S	I,S	S	DF
Paraonis sp.	S		S	S	DF
Polydora ligni	S	S	I,S	I,S	DF (inf)
Polydora socialis			S	S	DF (")
Polydora sp.	I,S	I,S	S	I,S	DF
Prionospio steenstrupi				S	DF (")
Pygospio elegans	I,S	I,S	I,S	I,S	DF (")
Scolecolepides viridis	I,S	S	I,S	I,S	DF
Scolelepis squamatus	I,S	I,S	I,S	I,S	DF

TABLE 2.2-18
(Sheet 2 of 3)

SPECIES NAME	SAMPLE PERIOD 1976 AUG	1976 NOV	1977 FEB	1977 MAY	FEEDING TYPE[b]
Spio filicornis	I,S	I,S	I,S	I,S	DF
Spio setosa	I,S	S			DF
Spio sp. A				I,S	DF (")
Spio sp. B				I,S	DF (")
Spio sp. E				S	DF (")
Spio sp.	S	S		I	DF (")
Spionidae	I,S	I,S	I,S	I,S	DF (")
Spiophanes bombyx	I,S	S	I,S	I,S	DF
Streblospio benedicti	I,S	I,S	I,S	I,S	DF
Order Ariciida					
Scoloplos acutus		S		S	DF
Scoloplos armiger		S			DF
Scoloplos robustus	I		I,S	I	DF (")
Scoloplos sp.	I,S	I,S	I,S	I,S	DF
Order Cirratulida					
Chaetozone sp. A	I,S	S	S	I,S	DF (")
Cirratulidae	I,S	S	I,S	I,S	DF (")
Order Terebellida					
Ampharete arctica			S	S	DF
Ampharete sp.				S	DF (")
Ampharetidae	S				DF
Asabellides oculata	S				DF
Pectinaria gouldii	I				DF
Pectinaria granulata	S				DF
Order Sabellida					
Circeis spirillum			S	I	SF
Fabricia sabella	I	I	I	I,S	SF (")
Potamilla reniformis		I			SF
Phylum Mollusca					
Class Gastropoda					
Crepidula fornicata	S	S	S		H
Gastropod unk 12				S	
Hydrobia totteni	I	I,S	I	I,S	DF
Lacuna vincta	I,S	I			H
Littorina littorea	S	I,S	I,S	I,S	H
Littorina obtusata	S			I	H
Lunatia triseriata	I	I		I	C
Skeneopsis planorbis			I,S		H
Subclass Opisthobranchia					
Onchidoris aspera			S		C
Class Pelecypoda					
Anomia sp.		S	S	I,S	SF
Arctica islandica			S	I,S	SF
Cerastoderma pinnulatum	S				SF
Ensis directus	I,S	I,S	I,S		SF
Gemma gemma	I,S	S	I,S	I,S	DF (")
Hiatella sp.	I,S			I	SF
Macoma balthica	I,S	I,S	I,S	I,S	DF
Macoma calcarea			I,S		DF
Mya arenaria	I,S	I,S	I,S	I,S	SF
Mytilidae spat	I,S	I,S	I,S	I,S	SF
Petricola pholadiformis		S			SF (inf)
Spisula solidissima		I,S			SF
Tellina agilis	I,S	I,S	I,S	I,S	DF
Tellinidae	S				DF (")

TABLE 2.2-18
(Sheet 3 of 3)

SPECIES NAME	SAMPLE PERIOD 1976 AUG	1976 NOV	1977 FEB	1977 MAY	FEEDING TYPE[b]
Phylum Arthropoda					
Class Pantopoda					
Achelia spinosa				I	C
Order Cirripedia					
Balanus balanoides		I		S	SF (inf)
Balanus crenatus	S	S		S	SF (")
Balanus improvisus	I,S	S	S	S	SF (")
Order Cumacea					
Cumacean A	S				DF (")
Diastylis quadrispinosa		S			DF
Oxyurostylis smithi	I,S	I,S	S	I	DF (")
Order Tanaidacea					
Heterotanais limicola			S		O
Order Isopoda					
Chiridotea tuftsii			S		O
Edotea triloba	I		S	S	O
Idotea phosphorea	I	I	I,S	S	O
Jaera marina	S	S	S	I,S	O (")
Order Amphipoda					
Acanthohaustorius millsi		S	I	I,S	DF
Ampelisca abdita-vadorum	I,S	I,S	I,S	S	DF
Amphithoe rubricata	S		I		DF
Calliopius laeviusculus		I			C
Caprella linearis		S			C
Caprella septentrionalis	I,S				C
Corophium acherusicum	S				DF
Corophium insidiosum	I,S	I,S	I,S	I,S	DF
Corophium sp.	S	S			DF (")
Gammarus lawrencianus	S	I,S	I,S	S	O
Gammarus mucronatus				S	O (")
Haustorius canadensis	I			I	SF (")
Hyale nilssoni			S		O
Jassa falcata		I	S	I,S	DF
Leptocheirus pinguis				S	SF
Melita dentata		S			O
Melita nitida	S	S	S	S	O (")
Paracaprella tenuis	S		S		C (")
Phoxocephalus holbolli		S	S	I	DF
Pontogeneia inermis		S	I,S		C
Protohaustorius deichmannae		S		S	SF
Psammonyx nobilis			S		O
Unciola sp.		I,S	S		SF (")
Order Decapoda					
Cancer borealis		S			C
Cancer irroratus	S				C
Carcinus maenas	I,S	I,S	I,S	S	C
Caridean unk.	S			S	
Crangon septemspinosa	I,S	I,S	S	S	C
Pagurus sp.				S	O
Phylum Echinodermata					
Class Asteroidea					
Asterias sp.	I				C
Class Echinoida					
Echinarachnius parma			S	I,S	DF
Strongylocentrotus droebachiensis		I			O

[a] I = Intertidal, S = Subtidal

[b] DF = Deposit Feeder O = Omnivore
H = Herbivore SF = Suspension Feeder
C = Carnivore

TABLE 2.2-19

PERCENT COMPOSITIONS OF DOMINANT SPECIES (AUGUST SAMPLES) FROM THE HAMPTON-SEABROOK ESTUARY.

	STATION 3 75-76	STATION 3 76-77	STATION 6 75-76	STATION 6 76-77	STATION 7 75-76	STATION 7 76-77	STATION 8* 75-76	STATION 8* 76-77
Intertidal								
Streblospio benedicti	15.57	61.19	1.15	0.00	73.84	65.06	---	9.40
Mya arenaria	1.58	2.90	78.86	32.00	3.05	1.56	---	65.22
Nereis diversicolor-virens	44.33	19.23	0.00	8.00	4.80	1.88	---	0.00
Capitella capitata	2.64	1.40	0.00	0.00	8.14	13.57	---	0.00
Mytilidae	1.32	0.53	0.00	0.00	1.45	1.95	---	10.59
Macoma balthica	6.86	4.04	0.00	8.00	3.20	4.29	---	1.57
Subtidal								
Mya arenaria	2.13	9.26	17.43	2.32	5.56	2.48	---	2.04
Streblospio benedicti	4.26	40.54	0.00	3.29	0.00	17.15	---	27.67
Mytilidae	4.26	5.08	3.87	19.02	5.56	25.83	---	45.16
Capitella capitata	4.26	0.40	0.24	26.59	0.00	4.96	---	5.18
Gemma gemma	2.13	3.49	0.48	0.12	11.11	1.03	---	0.00
Nereis diversicolor-virens	4.26	2.19	0.00	1.46	2.78	0.21	---	0.08
Tellina agilis	0.00	0.00	23.24	19.63	5.56	2.48	---	0.59

*Station 8 not sampled in 1975-76

TABLE 2.2-20
(Sheet 1 of 2)

LIST OF ALGAL SPECIES FROM INTERTIDAL GENERAL COLLECTIONS AND QUANTITATIVE SAMPLES.

SPECIES	STATIONS					LONGEVITY
	1 MSL	1 MLW	4 MHW	4 MSL	4 MLW	
Chlorophyceae						
**Blidingia minima*			GQ			A
**Calothrix* sp.			G			A
**Chaetomorpha atrovirens*		GQ	GQ		G	P
**Chaetomorpha cannabina*		GQ			GQ	P
Chaetomorpha linum		GQ		GQ	GQ	P
Chaetomorpha melagonium		G				P
Cladophora gracilis					GQ	A
Cladophora sericea	GQ	GQ	GQ			A
**Codiolum pusillum*			G	G		A
Enteromorpha compressa			G			A
Enteromorpha intestinalis			GQ		GQ	A
Enteromorpha prolifera			G			A
**Monostroma fuscum*	Q	Q				A
Monostroma grevillei		G		G	G	A
**Monostroma pulchrum*		Q				A
Rhizoclonium tortuosum		GQ	Q			A
Spongomorpha arcta		GQ				A/PSP
Ulothrix flacca	G		G	GQ		A
Ulva lactuca	GQ	GQ	G	G	GQ	P
**Urospora collabens*			G			A
Urospora penicilliformis		GQ	GQ	GQ		A
**Urospora wormskjoldii*		GQ				A
Subtotal	4	13	13	6	7	
Phaeophyceae						
·*Ascophyllum nodosum*	G	G	GQ	GQ	GQ	P
**Chordaria flagelliformis*					G	P
Ectocarpus siliculosus			G			A
Ectocarpus sp.					G	A
Elachistea fucicola	GQ	G		GQ	GQ	P
Fuscus distichus ssp. *edentatus*	GQ	GQ				P
**Fucus distichus* ssp. *evanescens*		G			G	P
Fucus sp.	GQ			GQ	GQ	P
Fucus spiralis			G	G		P
Fucus vesiculosus	GQ	GQ	GQ	GQ	GQ	P
**Fucus vesiculosus* v. *spiralis*			GQ		G	P
Laminaria digitata		G			G	P
Laminaria saccharina		G			G	P
Petalonia fascia			G	G		A
Pylaiella littoralis	GQ			GQ	GQ	P

TABLE 2.2-20
(Sheet 2 of 2)

SPECIES	STATIONS					LONGEVITY
	1 MSL	1 MLW	4 MHW	4 MSL	4 MLW	
Ralfsia verrucosa				G		P
Scytosiphon lomentaria			GQ	G		A
Subtotal	6	7	7	9	11	
Rhodophyceae						
Ahnfeltia plicata		GQ			G	P
Bangia atropurpurea		G				A
**Callithamnion tetragonum*		GQ				A
**Callophyllis cristata*		GQ				P
**Ceramium rubriforme*		G				P
Ceramium rubrum	G	GQ			G	P
**Ceratocolax hartzii*		GQ				A
Chondrus crispus	GQ	GQ	GQ	GQ	GQ	P
**Choreocolax polysiphoniae*					GQ	P
**Colaconema secundata*	G	G				A
Corallina officinalis	G	GQ			GQ	P
Cystoclonium purpureum v. cirrhosum		GQ			GQ	P
**Dermatolithon pustulatum*		G		G	G	P
Dumontia incrassata			G	G	G	A
**Erythrotrichia carnea*		GQ				P
Gigartina stellata	GQ	GQ	GQ	G	GQ	P
Palmeria palmata	GQ	GQ				P
Phycodrys rubens		GQ				P
Polysiphonia lanosa	GQ	GQ	GQ	GQ	GQ	P
Polysiphonia sp.		GQ				P
Polysiphonia urceolata	GQ	GQ	GQ	GQ		P
**Porphyra linearis*			G			A
Porphyra umbilicalis	GQ	GQ		G		A
**Porphyra umbilicalis f. epiphytica*					GQ	A
Porphyra umbilicalis f. linearis					G	A
Rhodomela confervoides		G			G	A
Subtotal	9	21	6	7	13	TOTAL/METHOD
Total Q (Quantitative)	14	29	14	11	17	41
Total G (General collection)	18	39	25	22	31	63
Total Number	19	41	26	22	31	65

A = Annual
P = Perennial
PSP = Pseudoperennial
G = General collection
Q = Quantitative collection

* - Indicates species not found 1975-1976.

TABLE 2.2-21

SUMMARY OF PERTINENT INTERTIDAL MACROALGAE DATA FROM TWO YEARS OF STUDY.

STATION	DEPTH	TOTAL NO. OF TAXA[a]		$\bar{x}$ BIOMASS[b]		DOMINANT SPECIES (% COMPOSITION)[c]			
		1975-76	1976-77	1975-76	1976-77	1975-1976		1976-1977	
1	MSL	29	24	2171	1053	*Fucus* spp.	45%	*Fucus* spp.	96%
						Ascophyllum nodosum	53%		
1	MLW	39	51	582	779	*Chondrus crispus*	84%	*Chondrus crispus*	75%
								Gigartina stellata	17%
4	MHW	21	26	17	63	*Fucus* spp.	94%	*Ascophyllum nodosum*	95%
4	MSL	17	27	1960	1970	*Fucus* spp.	52%	*Fucus* spp.	55%
						Ascophyllum nodosum	48%	*Ascophyllum nodosum*	44%
4	MLW	23	27	3547	2108	*Ascophyllum nodosum*	91%	*Ascophyllum nodosum*	88%

a. From all collection methods

b. gms (dry wt.)/m^2

c. Yearly average

TABLE 2.2-22
(Sheet 1 of 2)

OCCURRENCE OF MACROALGAE AT EIGHT SUBTIDAL STATIONS IN 1976-1977.

TAXON	STATION 2	12	13	19	23	26	27	31	NEW THIS YEAR
CHLOROPHYCEAE									
Chaetomorpha atrovirens	G	QG		QG	QG	QG	QG	QG	*
Chaetomorpha cannabina			Q						*
Chaetomorpha linum		QG	Q		QG	Q	QG	Q	
Chaetomorpha melagonium		QG			QG	QG	QG		
Cladophora sp.			Q						*
Entocladia viridis			G						*
Monostroma fuscum f. blytii						G	QG		*
Ulva lactuca						G	QG	G	
SUBTOTAL	1	3	4	1	3	5	5	3	
PHAEOPHYCEAE									
Agarum cribrosum	G	G	GI	GI	GI	G	G	GI	
Alaria esculenta							G	G	
Desmarestia aculeata		QG	G		G	QG	QG	QG	
Desmarestia viridis						QG	G		
Laminaria digitata		G	I	GI	GI	G	G	GI	
Laminaria saccharina		G	GI	GI	GI	G	G	GI	
Laminaria sp.								G	
Saccorhiza dermatodea							G		
Sphacelaria cirrosa								G	*
SUBTOTAL	1	4	4	3	4	5	7	7	
RHODOPHYCEAE									
Ahnfeltia plicata							G		
Antithamnion cruciatum				QG					
Antithamnion floccosum	QG	QG	QG	QG		QG	G	QG	
Audouinella purpurea								G	*
Bonnemaisonia hamifera					QG		G		
Callithamnion tetragonum							QG		
Callocolax neglectus				QG			G		
Callophyllis cristata	QG	QG	QGI	QGI	QGI	QG	QG	QGI	
Ceramium rubrum		QG	Q	QG	QGI	QG	QG	QGI	
Ceratocolax hartzii		QG	QG	QG	QG	QG	QG	QG	
Chondrus crispus		QG	I	QG	QGI	QG	QG	QGI	
Clathomorphum circumscriptum			G						
Colaconema secundata				G				G	*

TABLE 2.2-22
(Sheet 2 of 2)

TAXON	STATION 2	12	13	19	23	26	37	31	NEW THIS YEAR
RHODOPHYCEAE (Continued)									
Corallina officinalis	G	QG	I	QGI	QGI	QG	QG	QGI	
Cystoclonium purpureum v. *cirrhosum*		QG	QG	QG	QGI	QG	QG	QG	
Dermatolithon pustulatum	G	G		G	G	G	G	G	
Erythropeltis discigera					G				
Leptophytum laeve						G			
Lithophyllum corallinae		G							
Lithothamnion glaciale		G	G		G	G	G		
Melobesia lejolisii	G	G	G	G	G	G	G	G	
Membranoptera alata	QG	QG	QGI	QGI	QGI	QG	QG	QGI	
Palmaria palmata			G			G	G	G	
Phycodrys rubens	G	QG	QGI	QGI	QGI	QG	QG	QGI	
Phyllophora sp.	Q	Q	QGI	QGI	QGI	QG	QG	QGI	
Phyllophora pseudoceranoides	G	G	G	G	G	G	G	G	
Phyllophora truncata	G	G	G	G	G	G	G	G	
Plumaria elegans								G	
Polyides caprinus							G		
Polyides rotundus							G		
Polysiphonia sp.			Q						
Polysiphonia nigra								G	*
Polysiphonia nigrescens				G				G	*
Polysiphonia urceolata	QG	QG	QG	QG	QG	QG	QG	QG	
Porphyra miniata						G			
Porphyra umbilicalis							G		*
Porphyropsis coccinea					G				*
Ptilota serrata	QG	QG	QGI	QGI	QGI	QG	QG	QGI	
Rhodomela confervoides		QG					G	QGI	
Rhodophyllis dichotoma	G	G	QG						
Scagelia pylaisaei	QG	QG	QG	QG	QG				
SUBTOTAL	14	21	22	20	20	21	26	23	
TOTAL	16	28	30	24	27	30	38	33	

G = from general collections
Q = quantitative biomass collections
I = *in situ* identifications

TABLE 2.2-23

SUMMARY OF PERTINENT SUBTIDAL MACROALGAE DATA FROM TWO YEARS OF STUDY.

STATION	DEPTH (FT BELOW MLW)	TOTAL NO. OF TAXA[a] 1975-76	TOTAL NO. OF TAXA[a] 1976-77	$\overline{X}$ BIOMASS[b] 1975-76	$\overline{X}$ BIOMASS[b] 1976-77	H' (JUL)[c] 1976	H' (JUL)[c] 1977	DOMINANT UNDERSTORY SPECIES (% COMP.)[d] 1975-1976	DOMINANT UNDERSTORY SPECIES (% COMP.)[d] 1976-1977
27	17'	34	37	580.57	582.63	1.53	1.24	*Chondrus* (71) *Phyllophora* (13)	*Chondrus* (67) *Phyllophora* (17)
26	20'	34	32	765.28	497.43	1.71	2.01	*Corallina* (52) *Chondrus* (33)	*Chondrus* (36) *Corallina* (31)
31	30'	31	42	216.44	245.43	2.21	1.97	*Phyllophora* (40) *Chondrus* (30)	*Corallina* (42) *Phyllophora* (31)
23	35'	25	32	134.86	143.69	2.23	2.18	*Phyllophora* (53) *Phycodrys* (15)	*Phyllophora* (51) *Phycodrys* (18)
19	40'	28	30	114.20	81.21	1.70	1.48	*Phyllophora* (59) *Corallina* (22)	*Phyllophora* (63) *Ptilota* (9)
12	50'	28	29	48.82	40.39	1.35	1.01	*Phyllophora* (81) *Phycodrys* (8)	*Phyllophora* (84) *Corallina* (5)
13	60'	23	33	21.53	31.70	2.09	1.21	*Phyllophora* (48) *Ptilota* (35)	*Phyllophora* (66) *Ptilota* (27)
2	80'	15	16	5.86	1.77	0.54	1.55	*Ptilota* (83) *Phyllophora* (8)	*Ptilota* (48) *Phyllophora* (47)

[a] from all collection methods

[b] gms dry wt./m^2

[c] Shannon-weaver diversity
based on biomass collections only

[d] percent composition, yearly average

TABLE 2.2-24
(Sheet 1 of 2)

FISH SPECIES ENCOUNTERED IN MARINE AND ESTUARINE WATERS NEAR THE HAMPTON-SEABROOK ESTUARY FROM JULY 1975 THROUGH DECEMBER 1978.

SCIENTIFIC NAME	COMMON NAME	LIFE STAGES ENCOUNTERED		
		JUVENILE AND/OR ADULT	LARVAE	EGGS
Chondrichthyes-Cartilaginous fishes				
Squaliformes				
Carcharhinidae-requiem sharks				
Mustelus canis	Smooth dogfish	✓		
Squalidae-dogfish sharks				
Squalus acanthias	Spiny dogfish	✓		
Rajiformes				
Rajidae-skates				
Raja binoculata	Big skate	✓		
Raja erinacea	Little skate	✓		
Raja radiata	Thorny skate	✓		
Osteichthyes-Bonyfishes				
Anguilliformes				
Anguillidae-freshwater eels				
Anguilla rostrata	American eel	✓	✓	
Clupeiformes				
Clupeidae-herrings				
Alosa aestivalis	Blueback herring	✓		
Alosa mediocris	Hickory shad	✓		
Alosa pseudoharengus	Alewife	✓	✓	
Alosa sapidissima	American shad	✓		
Brevoortia tyrannus	Atlantic menhaden	✓	✓	✓
Clupea harengus	Altantic herring	✓	✓	
Engraulidae-anchovies				
Anchoa hepsetus	Striped anchovy	✓		
Salmoniformes				
Salmonidae-trouts				
Oncorhynchus kisutch	Coho salmon	✓		
Salmo gairdneri	Rainbow trout	✓		
Salmo trutta	Brown trout	✓		
Salvelinus fontinalis	Brook trout	✓		
Osmeridae-smelts				
Osmerus mordax	Rainbow smelt	✓	✓	
Lophiiformes				
Lophiidae-goosefishes				
Lophius americanus	Goosefish	✓	✓	
Gadiformes				
Gadidae-codfishes				
Brosme brosme	Cusk		✓	✓
Enchelyopus cimbrius	Fourbeard rockling	✓	✓	✓
Gadus morhua	Atlantic cod	✓	✓	✓
Melanogrammus aeglefinus	Haddock	✓	✓	✓
Merluccius bilinearis	Silver hake	✓	✓	✓
Microgadus tomcod	Tomcod	✓		
Pollachius virens	Pollock	✓	✓	✓
Urophycis chuss	Red hake	✓		
Urophycis tenuis	White hake	✓		
Urophycis spp.	Hakes		✓	✓
Zoarcidae-eelpouts				
Macrozoarces americanus	Ocean pout	✓	✓	
Atheriniformes				
Cyprinodontidae-killifishes				
Fundulus heteroclitus	Mummichog	✓		
Fundulus majalis	Striped killifish	✓		
Atherinidae-silversides				
Menidia menidia	Atlantic silversides	✓		
Gasterosteiformes				
Gasterosteidae-sticklebacks				
Apeltes quadracus	Fourspine stickleback	✓		
Gasterosteus aculeatus	Threespine stickleback	✓		
Pungitius pungitius	Ninespine stickleback	✓		
Syngnathidae-pipefishes and seahorses				
Syngnanthus fuscus	Northern pipefish	✓	✓	

TABLE 2.2-24
(Sheet 2 of 2)

SCIENTIFIC NAME	COMMON NAME	LIFE STAGES ENCOUNTERED		
		JUVENILE AND/OR ADULT	LARVAE	EGGS
Osteichthyes-Bonyfishes (Continued)				
Perciformes				
Percichthyidae-temperate basses				
Morone saxatilis	Striped bass	✓		
Serranidae-sea basses				
Centropristis striata	Black sea bass	✓		
Pomatomidae-bluefishes				
Pomatomus saltatrix	Bluefish	✓		
Sparidae-porgies				
Archosargus probatocephalus	Sheepshead	✓		
Stenotomus chrysops	Scup	✓		
Sciaenidae-drums				
Menticirrhus saxatilis	Northern kingfish	✓		
Labridae-wrasses				
Tautoga onitis	Tautog	✓	✓	✓
Tautogolabrus adspersus	Cunner	✓	✓	✓
Stichaeidae-pricklebacks				
Lumpenus lumpretaeformis	Snakeblenny		✓	
Ulvaria subbifurcata	Radiated shanny	✓	✓	
Pholidae-gunnels				
Pholis gunnellus	Rock gunnel	✓	✓	
Anarhichadidae-wolffishes				
Anarhichas lupus	Atlantic wolffish	✓		
Ammodytidae-sand lances				
Ammodytes americanus	American sand lance	✓	✓	
Scombridae-mackerels and tunas				
Scomber scombrus	Atlantic mackerel	✓	✓	✓
Stromataeidae-butterfishes				
Peprilus triacanthus	Butterfish	✓	✓	✓
Scorpaenidae-scorpionfishes				
Sebastes marinus	Redfish or ocean perch		✓	
Triglidae-searobins				
Prionotus carolinus	Northern searobin	✓		✓
Prionotus evolans	Striped searobin	✓		
Cottidae-sculpins				
Hemitripterus americanus	Sea raven	✓	✓	
Myoxocephalus aenaeus	Grubby	✓	✓	
Myoxocephalus octodecemspinosus	Longhorn sculpin	✓	✓	
Myoxocephalus scorpius	Shorthorn sculpin	✓		
Triglops murrayi	Moustache sculpin	✓		
Agonidae-poachers				
Aspidophoroides monopterygius	Alligatorfish	✓	✓	
Cyclopteridae-lumpfishes and snailfishes				
Cyclopterus lumpus	Lumpfish	✓	✓	
Liparis atlanticus	Seasnail	✓		
Liparis liparis	Striped seasnail	✓		
Liparis spp.	Seasnails		✓	
Pleuronectiformes				
Bothidae-lefteye flounders				
Paralichthys oblongus	Fourspot flounder	✓		
Scophthalmus aquosus	Windowpane	✓	✓	✓
Pleuronectidae-righteye flounders				
Glyptocephalus cynoglossus	Witch flounder		✓	✓
Hippoglossoides platessoides	American plaice	✓	✓	✓
Hippoglossus hippoglossus	Atlantic halibut	✓		
Limanda ferruginea	Yellowtail flounder	✓	✓	✓
Liopsetta putnami	Smooth flounder	✓	✓	
Pseudopleurcnectes americanus	Winter flounder	✓	✓	
	TOTAL:	67	36	17
	OVERALL TOTAL:		73	

TABLE 2.2-25

SEABROOK FINFISH ECOLOGICAL CATEGORIZATION.

BOTTOM FISH	NEAR BOTTOM & BROWSERS	PELAGIC PLANKTIVORES & PREDATORS
Winter flounder	Cunner	Atlantic mackerel
Yellowtail flounder	Tautog	Bluefish
Smooth flounder	Scup	Blueback herring
Atlantic halibut	Banded rudderfish	Alewife
American plaice	←	Striped bass
Windowpane	Pollock →	
Fourspot flounder	←	Rainbow smelt
Summer flounder	Black sea bass	Atlantic menhaden
Red hake	Atlantic cod	Atlantic herring
White hake	Atlantic tomcod	
Spotted hake	←	Atlantic silversides
Radiated shanny	Sand shark →	
Skates (Little, Big, Winter)		
Rock gunnel		
Grubby		
Longhorn sculpin		
Shorthorn sculpin		
←	Silver hake →	
←	Smooth dogfish	
←	Spiny dogfish	
Atlantic sturgeon		
Atlantic wolffish		
American sand lance		
Cusk		
Lumpfish		
Fourbeard rockling		
Witch flounder		
Seasnail		
Goosefish		
Snakeblenny		
Ocean pout		
←	Haddock	
Sea raven		
Striped sea robin		

TABLE 2.2-26

SPECIES RANK OF NEAR-BOTTOM FISHES BASED ON OTTER TRAWL CATCH.

SPECIES	1978 RANK	1978 % OF TOTAL	1976-1977 RANK	1976-1977 % OF TOTAL	1975-1976 RANK	1975-1976 % OF TOTAL	1974-1975 RANK	1973-1974 RANK
Limanda ferruginea	1	23	1	37	1	38	2	1
Osmerus mordax	4	10	10	3	2	17	1	2
Urophycis spp.	2	19	2	23	3	16	4	8
Gadus morhua	3	14	9	3	4	5	5	3
Merluccius bilinearis	7	4	4	6	5	5	11	18
Myoxocephalus octodecemspinosus	6	9	5	6	6	4	8	6
Pseudopleuronectes americanus	5	9	3	7	7	3	3	4
Macrozoarces americanus	8	3	8	3	8	2	9	14
Raja spp.	9	2	7	4	9	2	7	7
Scophthalmus aquosus	10	1	11	2	10	2	6	5

TABLE 2.2-27

SPECIES RANK OF PELAGIC FISHES BASED ON GILL NET CATCH.

SPECIES	1978 RANK	1978 % OF TOTAL	1976-1977 RANK	1976-1977 % OF TOTAL	1975-1976 RANK	1975-1976 % OF TOTAL	1974-1975 RANK	1973-1974 RANK
Clupea harengus	1	74	1	52	1	54	19	8
Merluccius bilinearis	3	2	2	19	2	12	ND	10
Alosa aestivalis	2	14	4	7	3	9	ND	6
Pollachius virens	6	1	5	3	4	7	1	1
Alosa pseudoharengus	4	2	7	2	5	5	15	9
Scomber scombrus	5	2	3	11	6	4	9	3
Osmerus mordax	7	<1	8	1	7	2	ND	7
Brevoortia tyrannus	11	<1	9	1	8	2	10	5
Gadus morhua	10	<1	10	<1	9	2	2	2
Urophycis spp.	8	<1	6	2	10	1	12	ND

ND = No Data

SB 1 & 2
ER-OLS

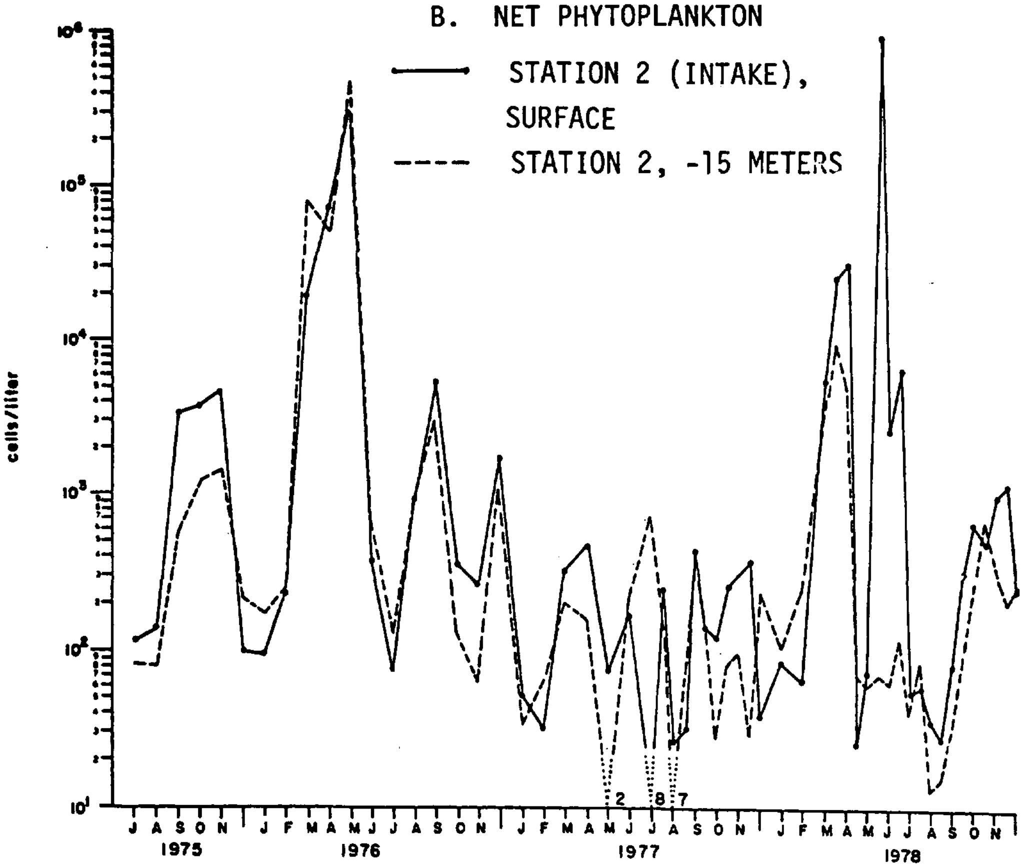
TABLE 2.2-28

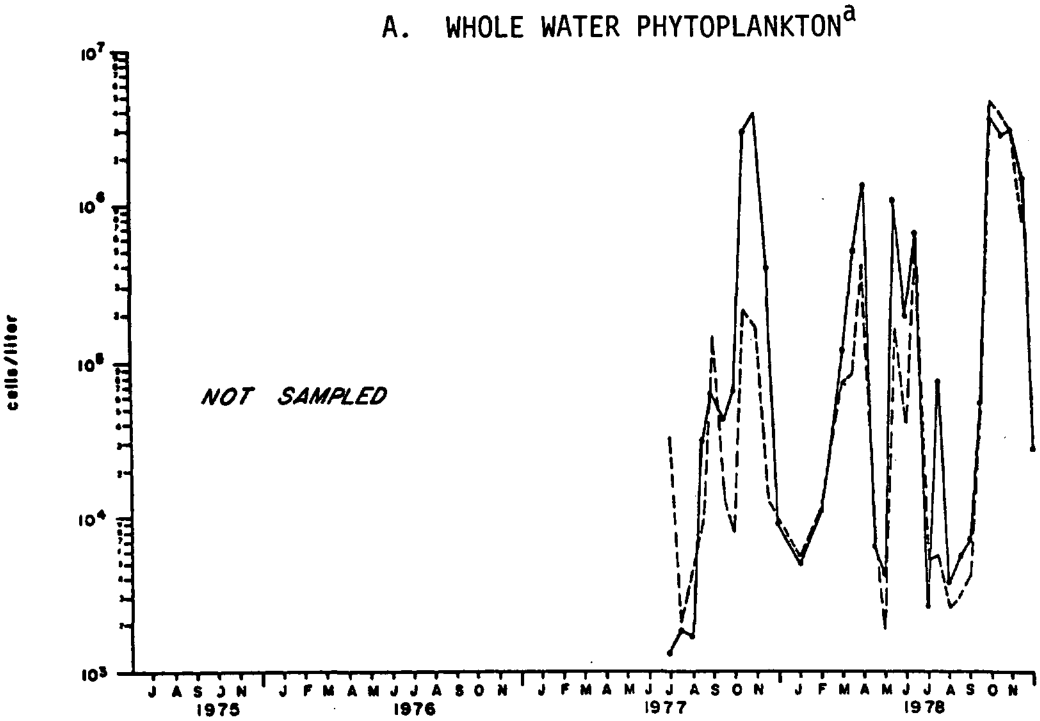
SPECIES RANK OF ESTUARINE FINFISH BASED ON BEACH SEINE CATCHES.[a]

SPECIES	1978 RANK	1978 % OF TOTAL	1976-1977 RANK	1976-1977 % OF TOTAL	1975-1976 RANK	1975-1976 % OF TOTAL	1974-1975 RANK	1974-1975 % OF TOTAL	1973-1974 RANK	1973-1974 % OF TOTAL
Menidia menidia	1	74.9	1	79.6	1	65.1	1	87.1	1	27.5
Ammodytes americanus	2	7.5	3	4.5	5	5.6	8	<1.0	4	11.5
Clupea harengus	3	5.4	12	<1.0	11	<1.0	NC[b]	---	13	<1.0
Fundulus spp.	4	4.7	2	9.6	4	5.8	3	3.6	3	21.7
Pseudopleuronectes americanus	5	1.7	7	<1.0	6	1.2	4	<1.0	5	4.8
Gasterosteus aculeatus	6	1.3	9	<1.0	12	<1.0	5	<1.0	7	1.8
Pollachius virens	7	1.2	8	<1.0	9	<1.0	NC	---	NC	---
Pungitius pungitius	8	1.1	4	1.6	7	1.1	7	<1.0	6	3.8
Alosa aestivalis	9	<1.0	10	<1.0	2	11.9	2	5.0	2	24.3
Liopsetta putnami	10	<1.0	17	<1.0	20	<1.0	10	<1.0	8	1.4
Osmerus mordax	14	<1.0	5	1.3	3	6.8	6	<1.0	11	<1.0

[a] April - November

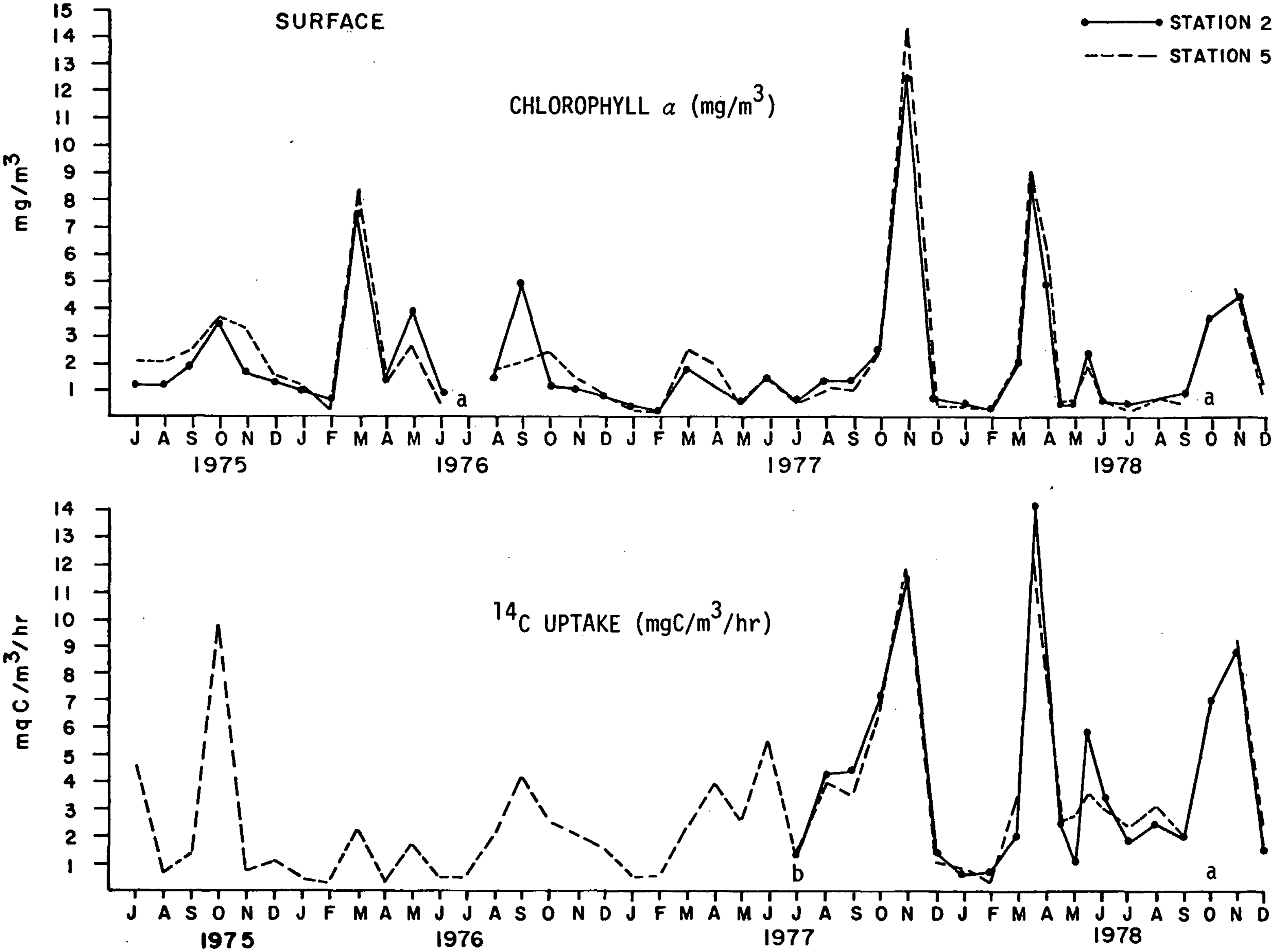
[b] NC = Not captured





[a] Data include only those sample dates when collections were made at both the surface and -15 m.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	NUMERICAL ABUNDANCE OF WHOLE WATER (A) AND NET PHYTOPLANKTON (B) IN THE INTAKE VICINITY FROM 1975-1978.
	FIGURE 2.2-1



[a] When no data shown means no samples taken. [b] 14C collections were not taken at Station 2 prior to July 1977

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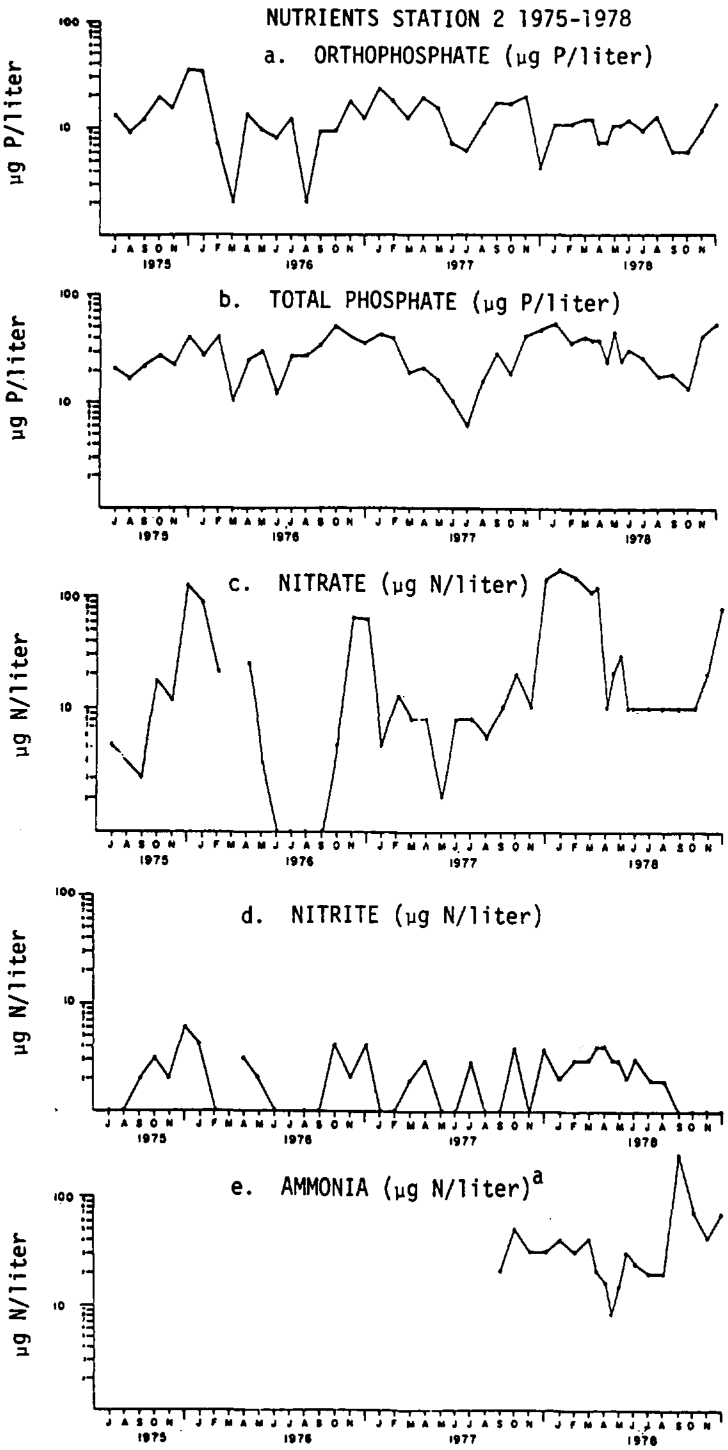
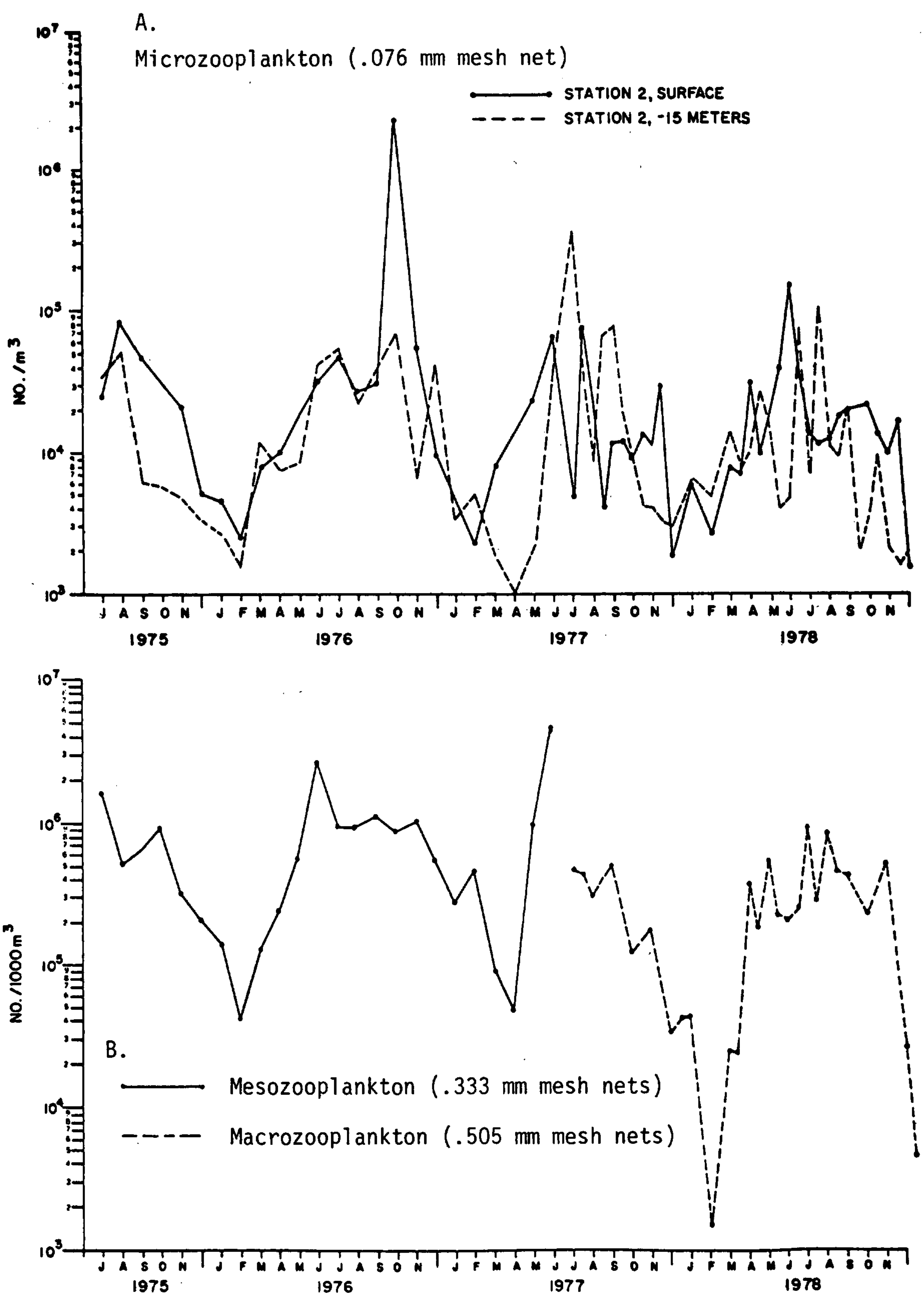
BIOMASS (CHLOROPHYLL a) AND PRODUCTIVITY (^{14}C UPTAKE) OF PHYTOPLANKTON IN THE VICINITY OF THE INTAKE (STA 2) AND DISCHARGE (STA 5) SITES FROM 1975-1978.

FIGURE 2.2-2

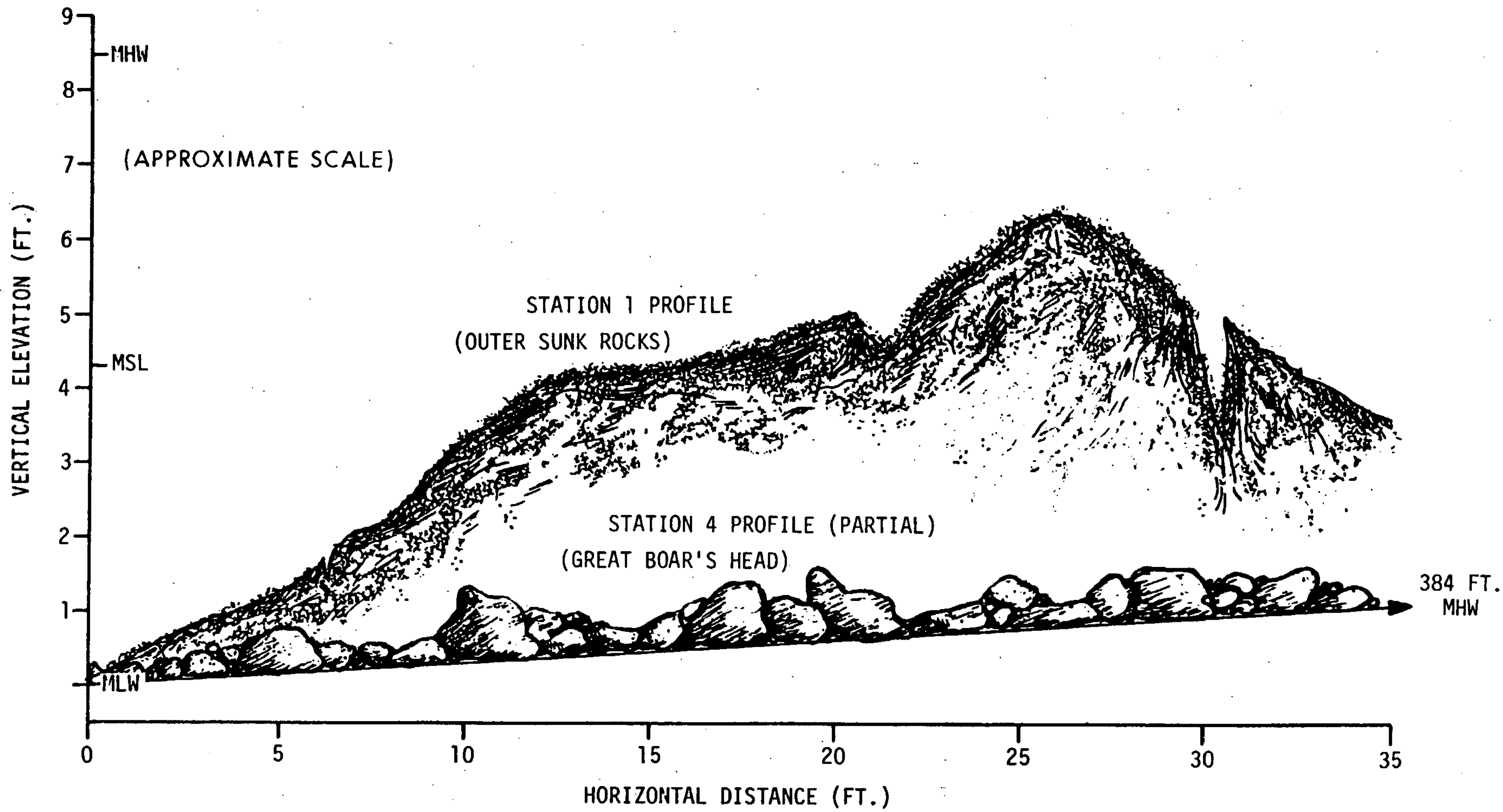


[a]Analyses for ammonia were not routinely carried out until July 1977

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	NUTRIENT LEVELS IN SEA WATER COLLECTED IN THE VICINITY OF THE INTAKE FROM 1975-1978.
	FIGURE 2.2-3



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	TEMPORAL DISTRIBUTION OF MICROZOOPLANKTON (A), MESOZOOPLANKTON AND MACROZOOPLANKTON (B) IN THE VICINITY OF THE INTAKE (STA 2) FROM JULY 1975-DECEMBER 1978.
	FIGURE 2.2-4



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
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COMPARISON OF ROCKY INTERTIDAL
STATION PROFILES.

FIGURE 2.2-5

FIGURE 2.2-6

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
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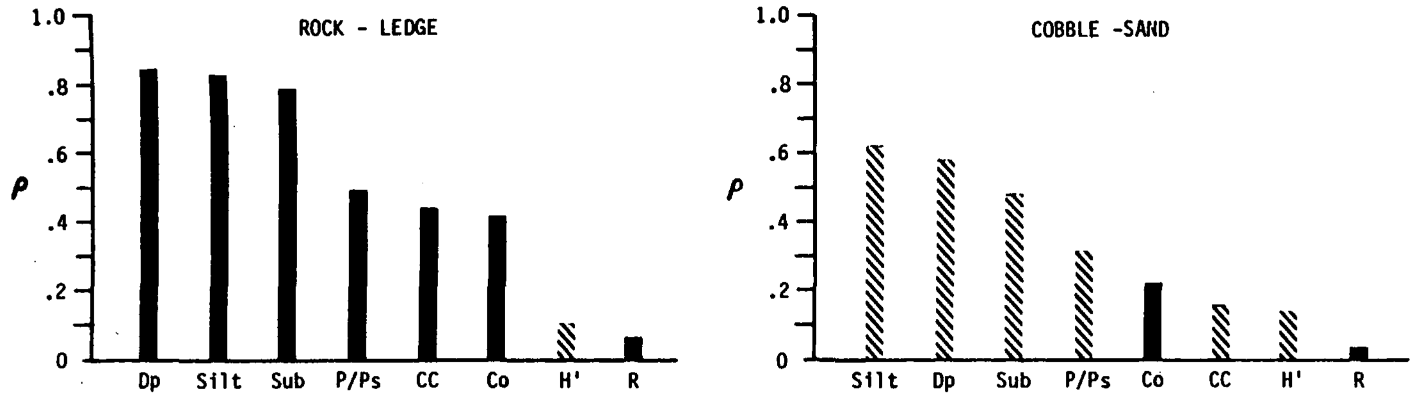
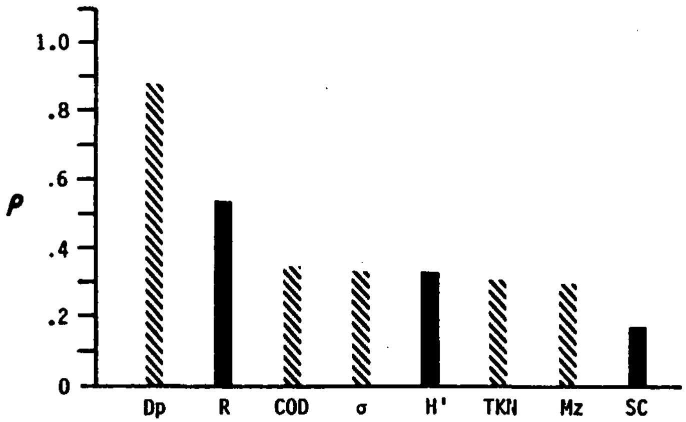
MEAN SPEARMAN'S RHO (ρ) VALUES OF PARAMETERS EFFECTIVE IN EXPLAINING THE SPATIAL TRENDS OF THE SEABROOK MARINE SUBTIDAL MACROFAUNAL COMMUNITIES.



HARD SUBSTRATE



SOFT SUBSTRATE

PARAMETER	+	-
Dp = Depth	Shallow	Deep
Silt = Siltation	Low	High
Sub = Substrate	Rock-ledge	Cobble-sand
P/Ps = *Phyllophora/ Ptilota*	Low occurrence	High occurrence
CC = *Chondrus crispus*	Low occurrence	High occurrence
CO = *Corallina* sp.	Low occurrence	High occurrence
H' = Diversity	Low	High
R = Redundancy	Low	High
COD = Chemical Oxygen Demand	Low	High
TKN = Total Kjeldahl Nitrogen	Low	High
Mz = Mean grain size	Low	High
σ = Sorting	Low	High
SC = Silt clay	Low	High

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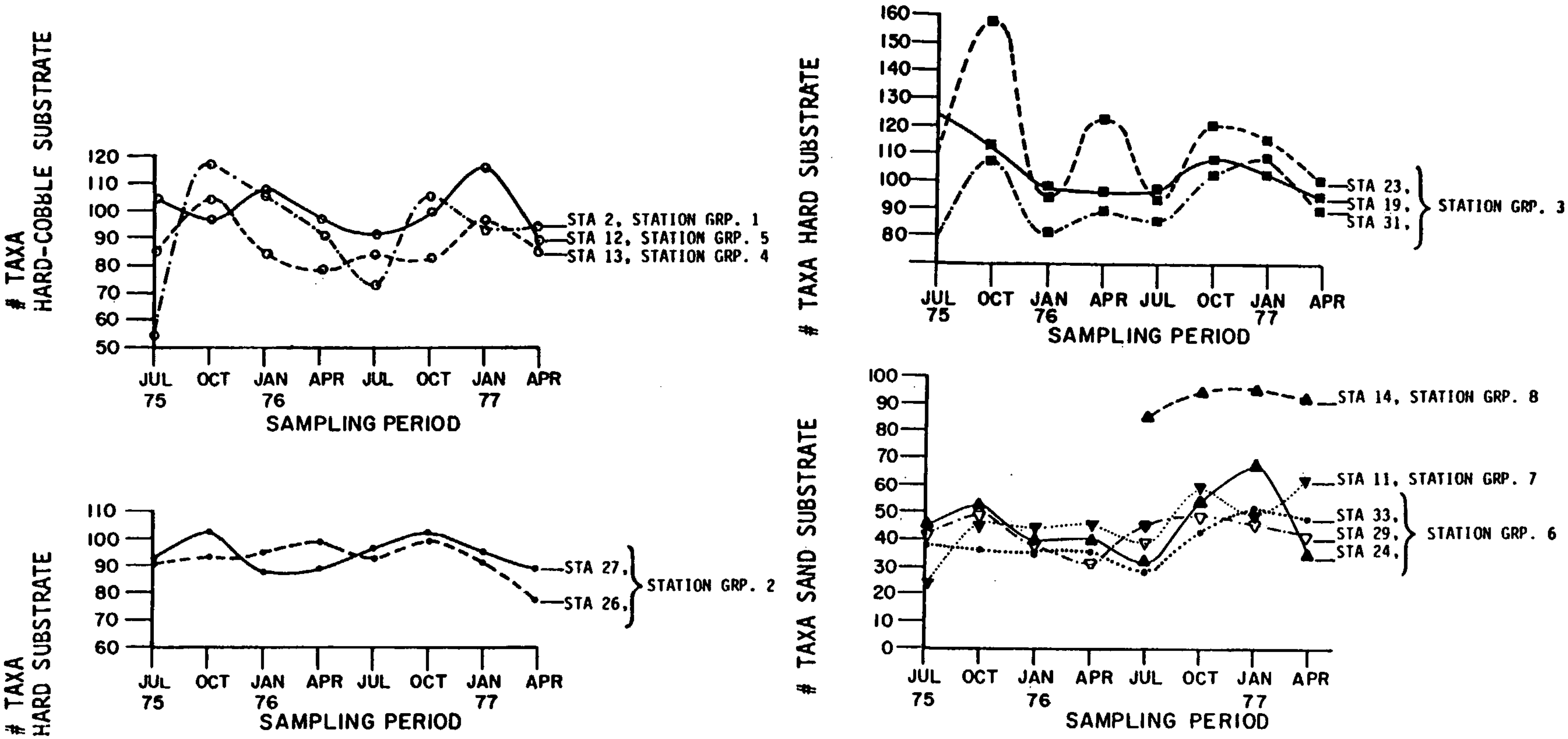
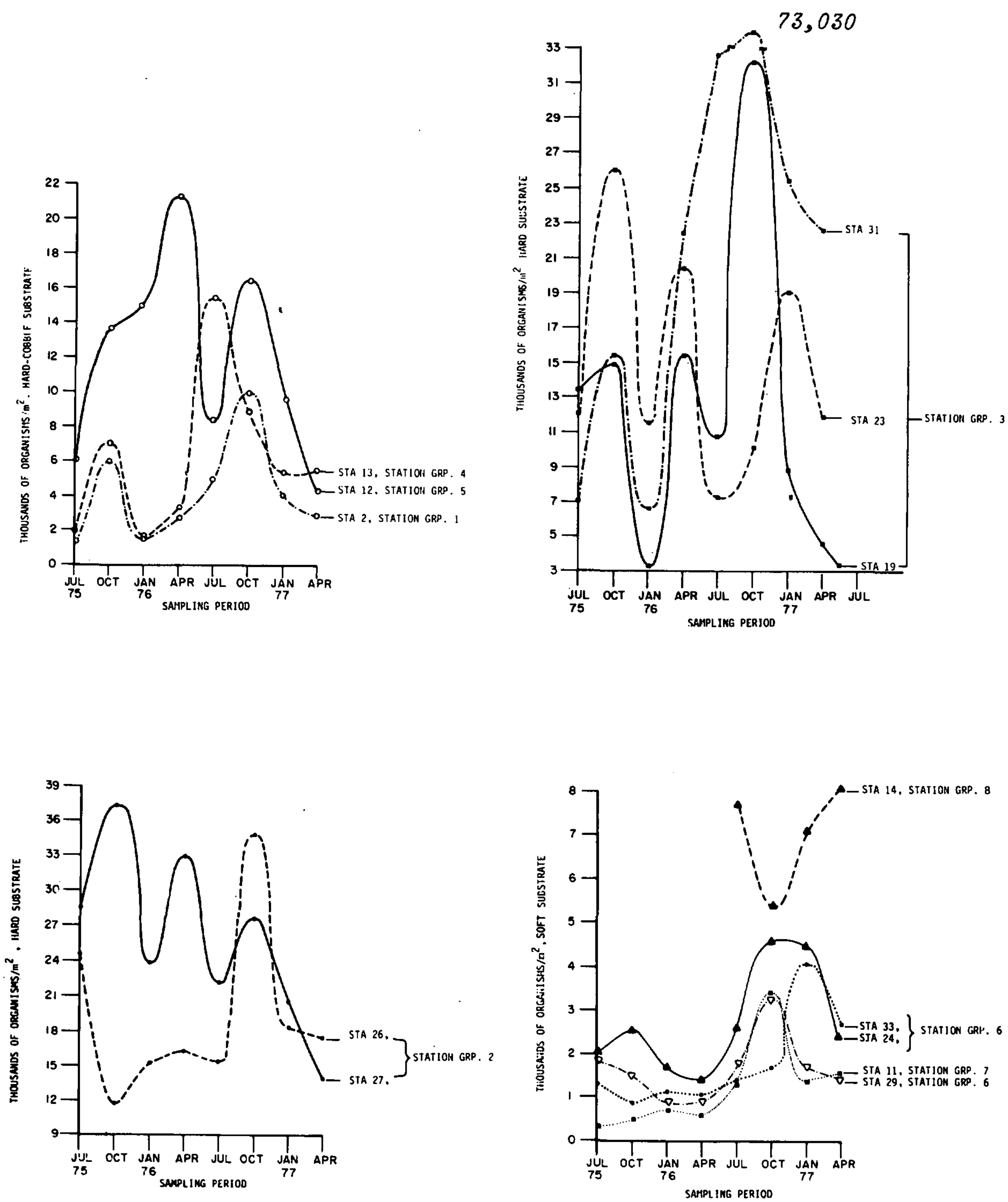


NUMBERS OF TAXA FOUND AT SEABROOK MARINE SUBTIDAL STATIONS FROM JULY 1975 THROUGH APRIL 1977.

FIGURE 2.2-7



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	NUMBER OF ORGANISMS/m^2 FOUND AT SEABROOK MARINE SUBTIDAL STATIONS FROM JULY 1975 THROUGH APRIL 1977
	FIGURE 2.2-8

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
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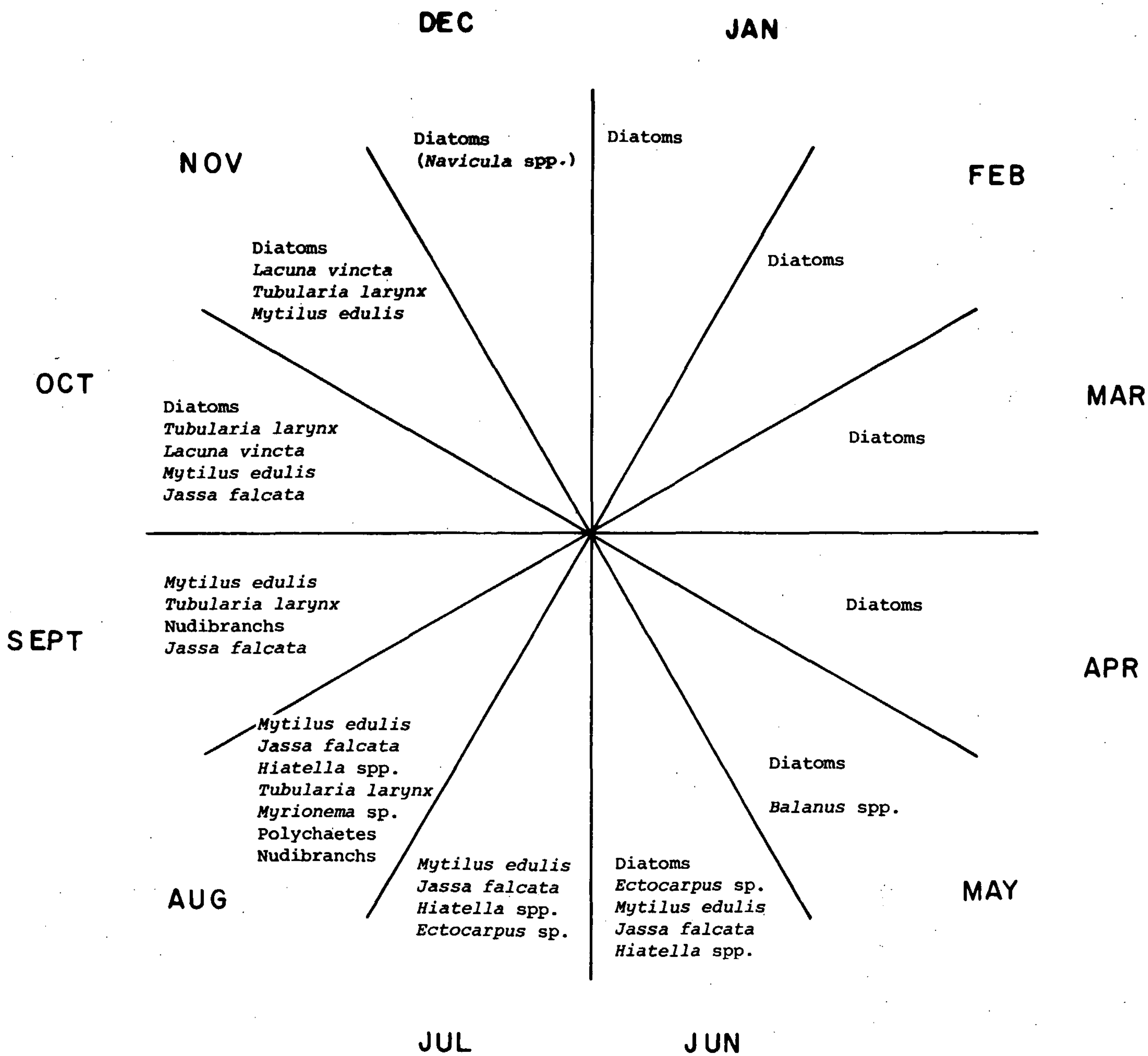
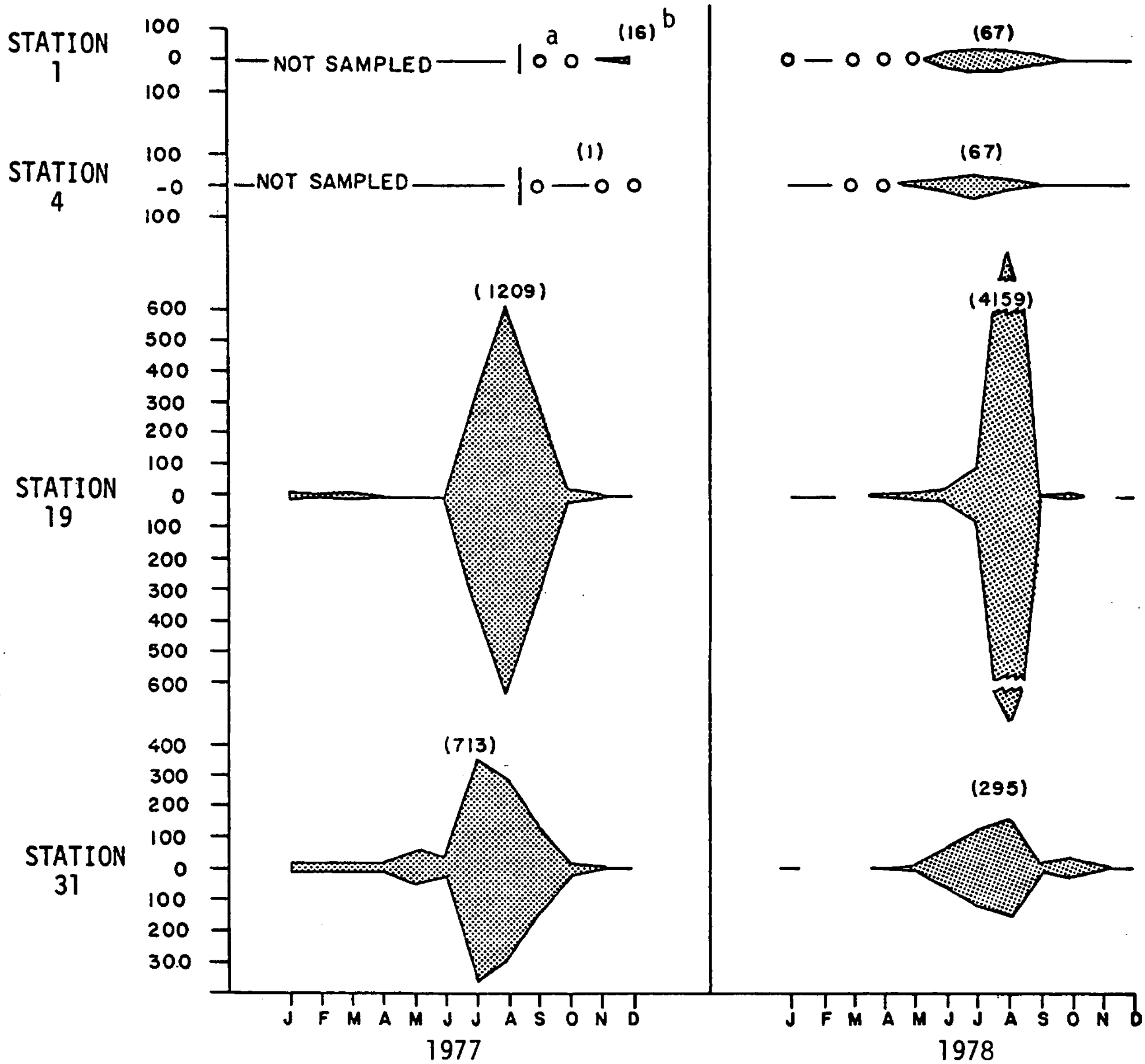


GENERAL SEASONAL SUCCESSION OF FOULING TAXA ON SURFACE PANELS ALONG THE COAST OF NEW HAMPSHIRE.

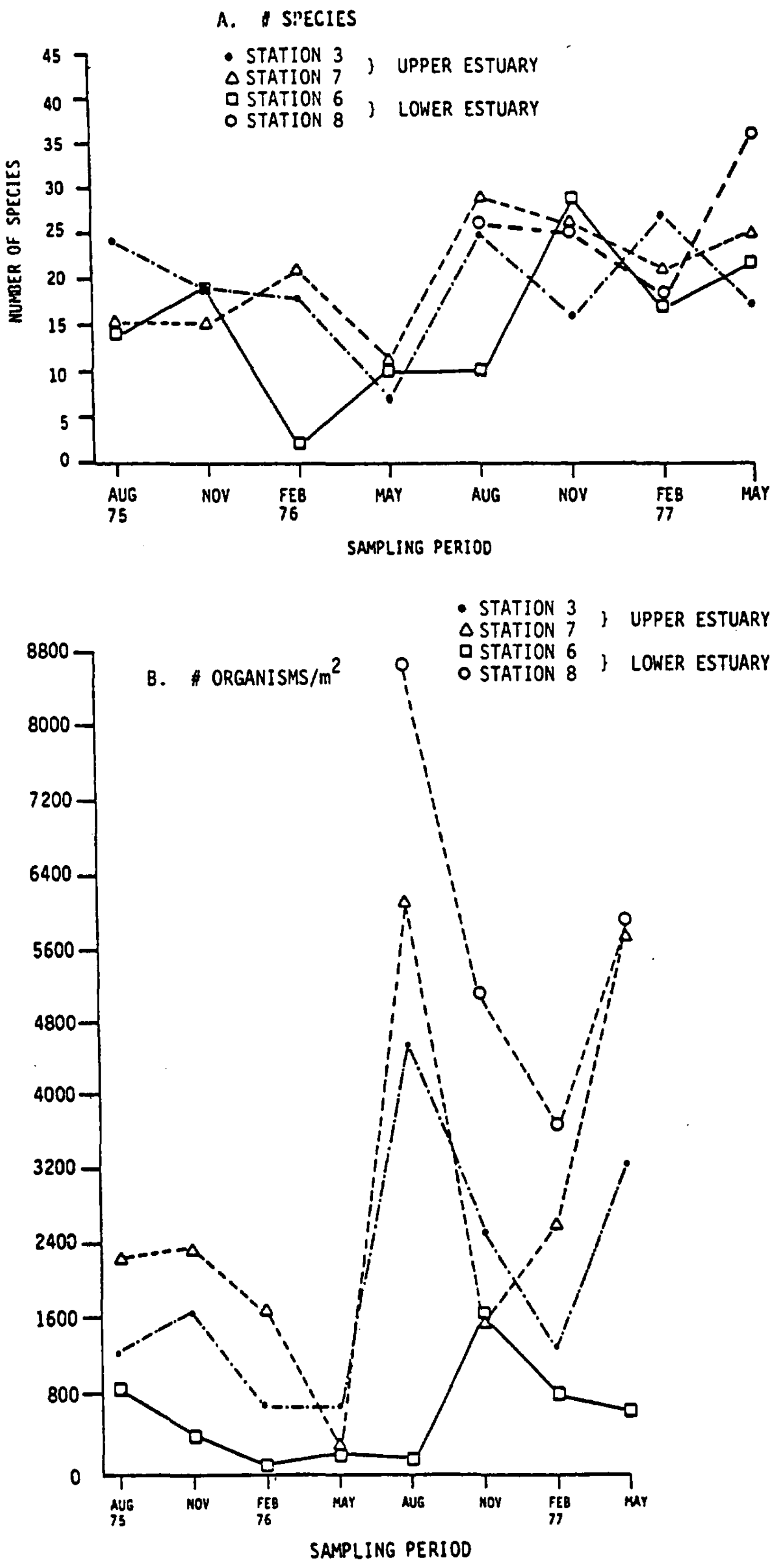
FIGURE 2.2-9



[a]none found

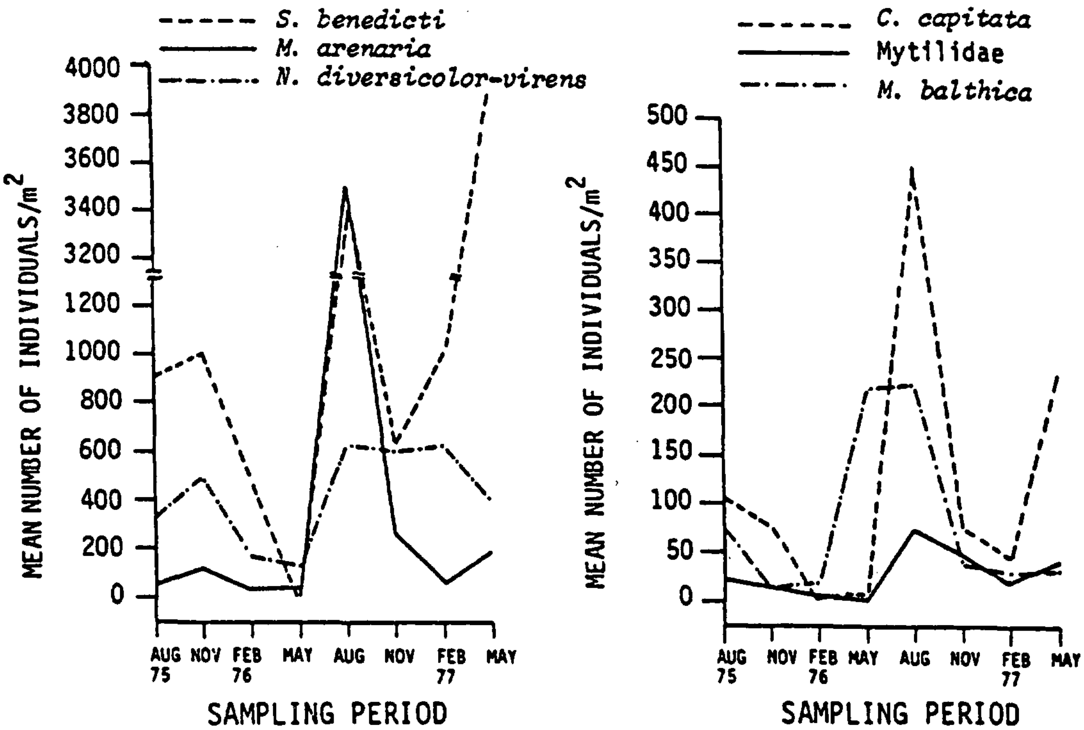
[b](16) = maximum number recorded.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	NUMERICAL DENSITIES OF MYTILUS EDULIS SPAT ON 30-DAY SETTLEMENT PANELS OFFSHORE OF HAMPTON BEACH, N.H. IN 1977 AND 1978. FIGURE 2.2-10

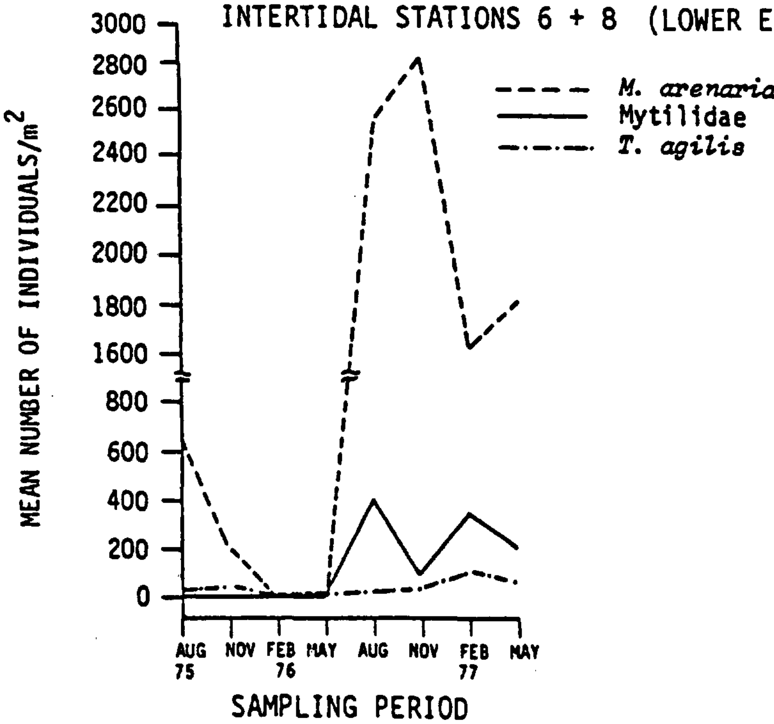


PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	NUMBER OF SPECIES (A) AND NUMBER OF ORGANISMS/M $_2$ (B) AT INTERTIDAL ESTUARINE STATIONS FROM AUGUST 1975 THROUGH MAY 1977.
	FIGURE 2.2-11

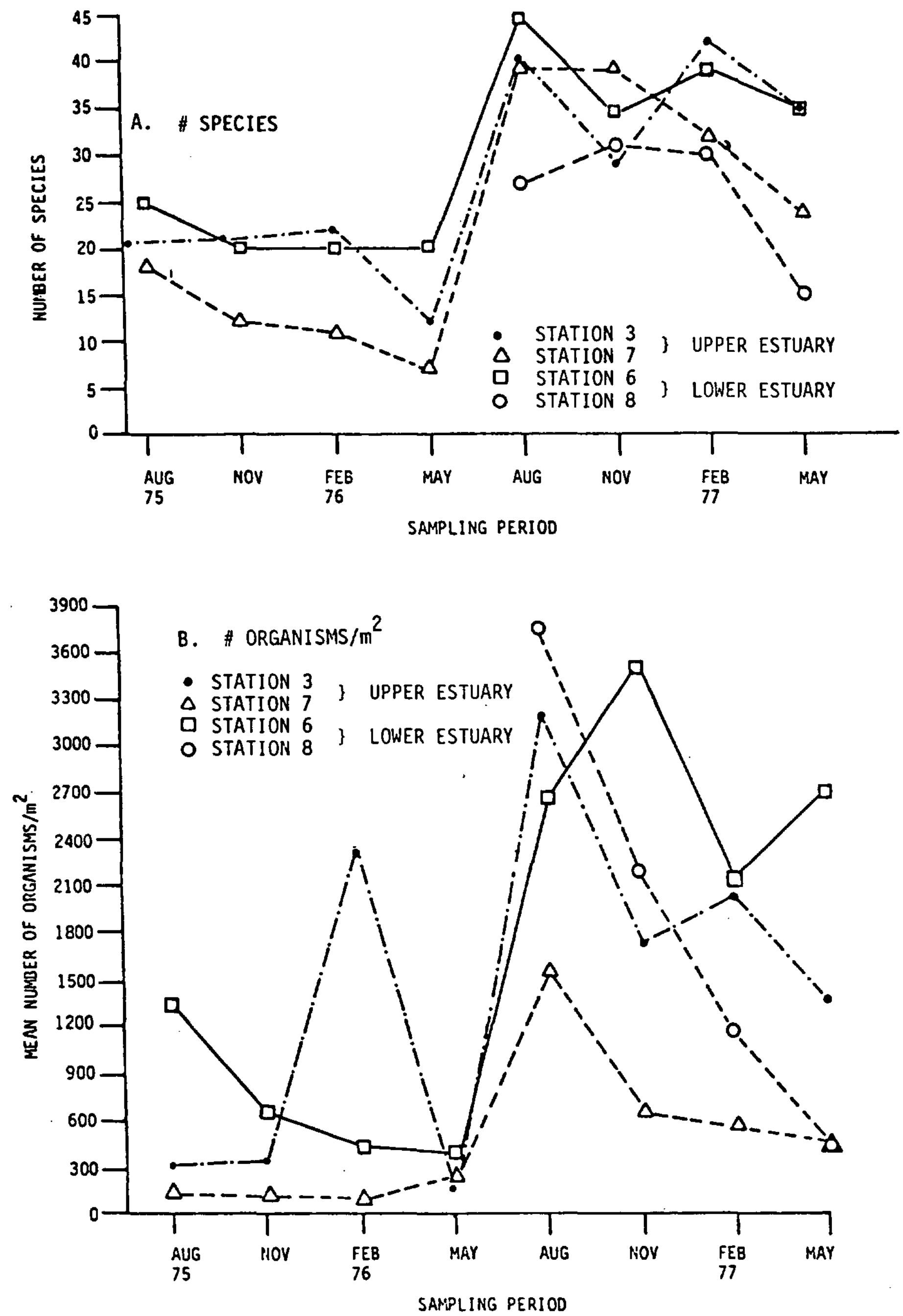
INTERTIDAL STATIONS 3 + 7 (UPPER ESTUARY)



INTERTIDAL STATIONS 6 + 8 (LOWER ESTUARY)



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	NUMBER OF INDIVIDUALS/M 2 OF SELECTED DOMINANT SPECIES COLLECTED AT ESTUARINE INTERTIDAL STATIONS FROM AUGUST 1975 THROUGH MAY 1977.
	FIGURE 2.2-12



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	NUMBER OF SPECIES (A) AND NUMBER OF ORGANISMS (B) FOUND AT THE SUBTIDAL ESTUARINE STATIONS FROM AUGUST 1975 THROUGH MAY 1977.
	FIGURE 2.2-13

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
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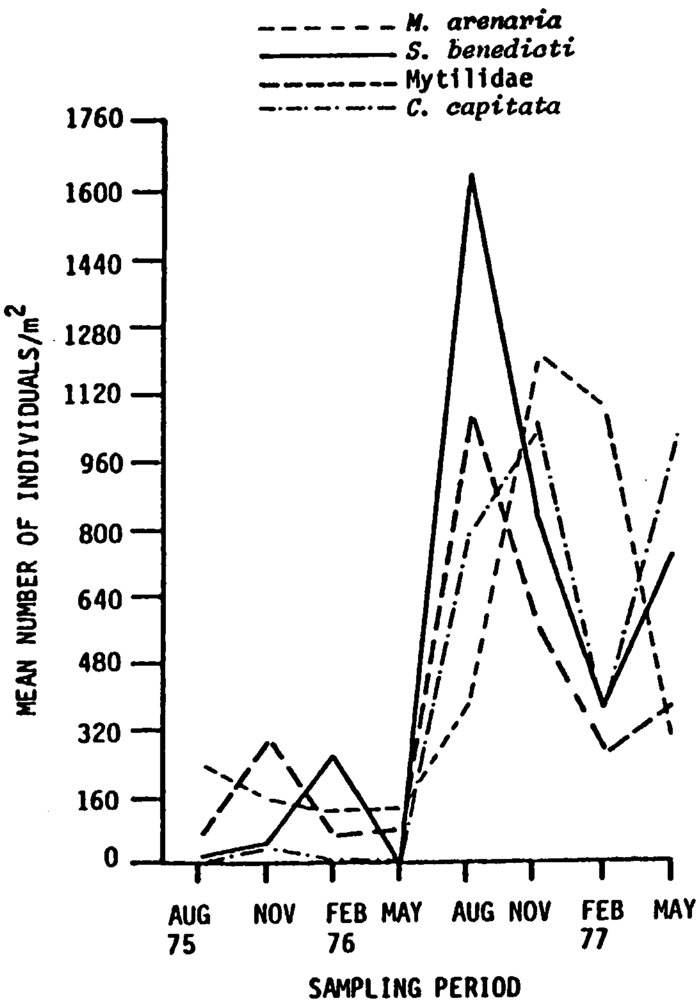
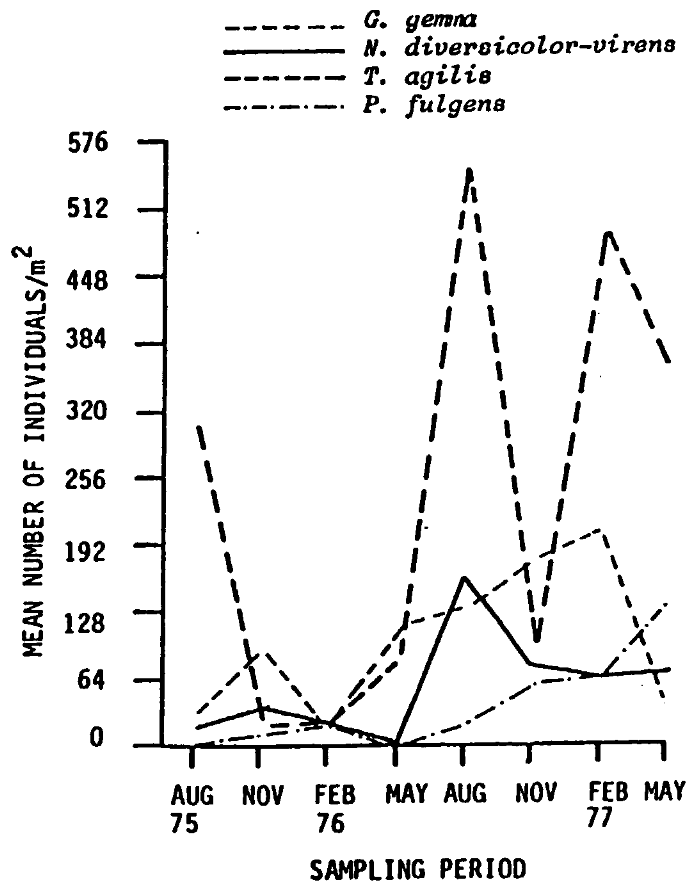
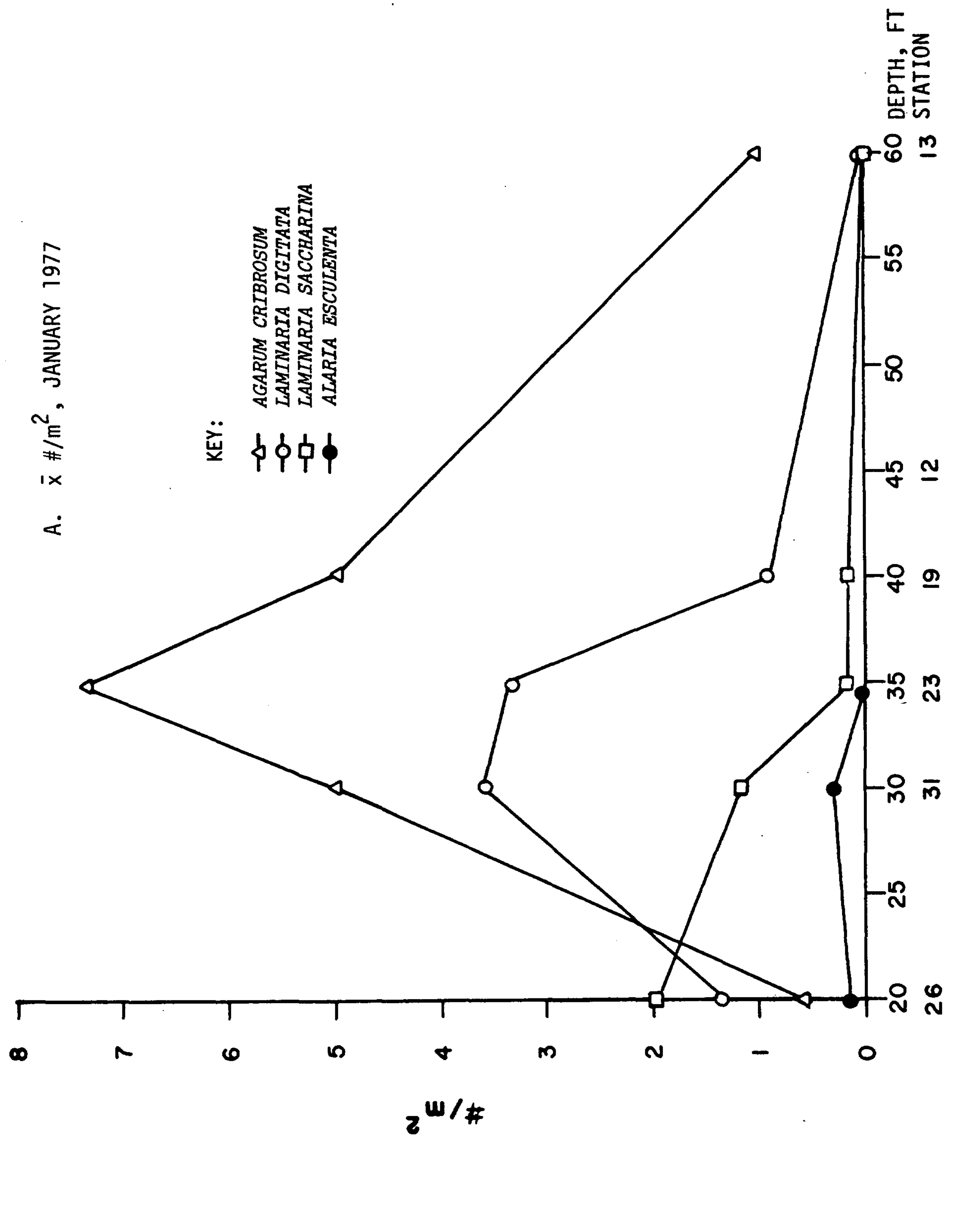


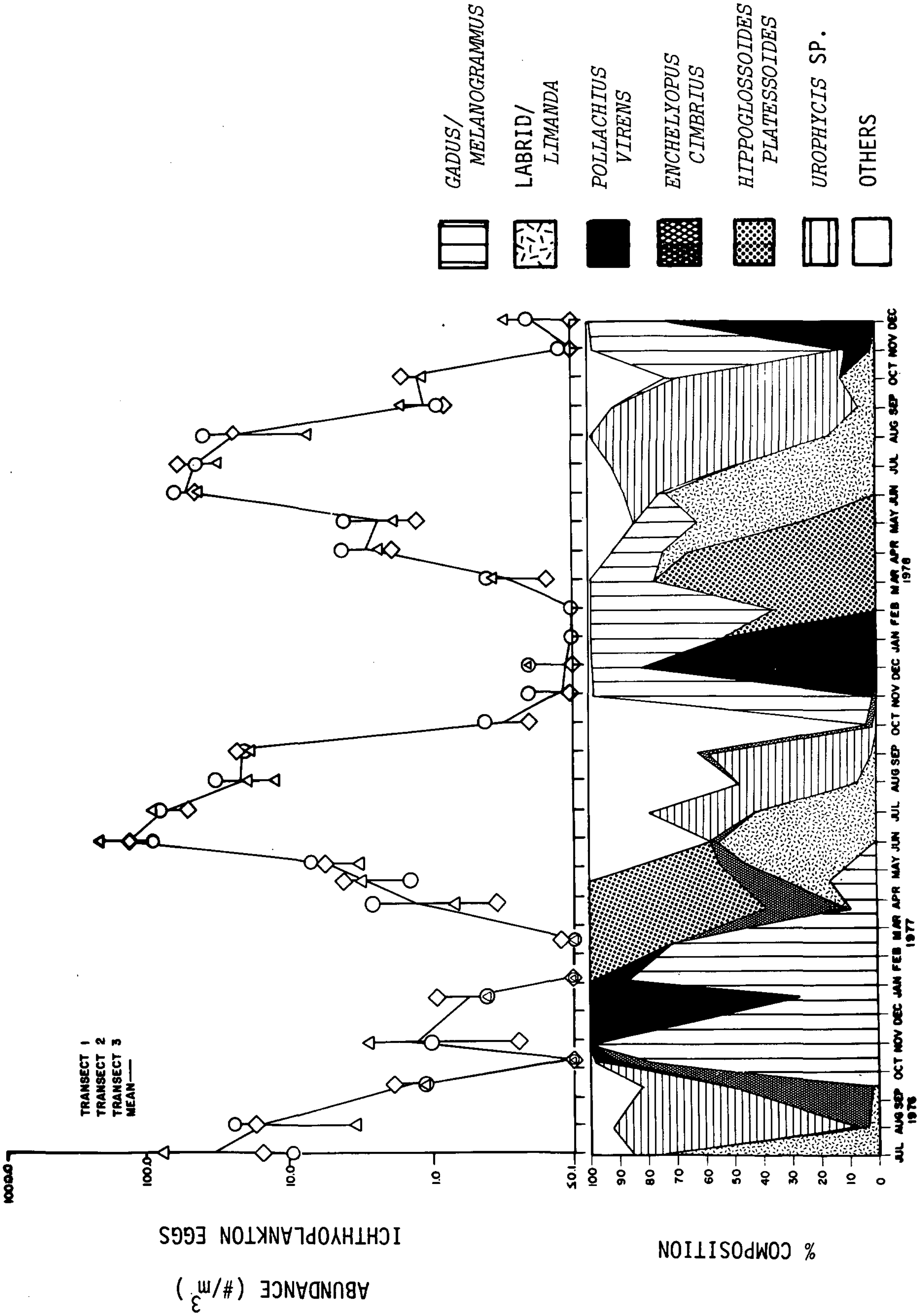


NUMBER OF INDIVIDUALS/M_2 OF SELECTED DOMINANT SPECIES COLLECTED AT ESTUARINE SUBTIDAL STATIONS FROM AUGUST 1975 THROUGH MAY 1977.

FIGURE 2.2-14



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	ABUNDANCE OF CANOPY KELP SPECIES AT SELECTED BENTHIC STATIONS OFF HAMPTON BEACH, N.H.
	FIGURE 2.2-15



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	ABUNDANCE AND PERCENT COMPOSITION OF FISH EGGS IN ICHTHYOPLANKTON COLLECTIONS FROM THE HAMPTON-SEABROOK REGION, JULY 1976 THROUGH DECEMBER 1978.
	FIGURE 2.2-16

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
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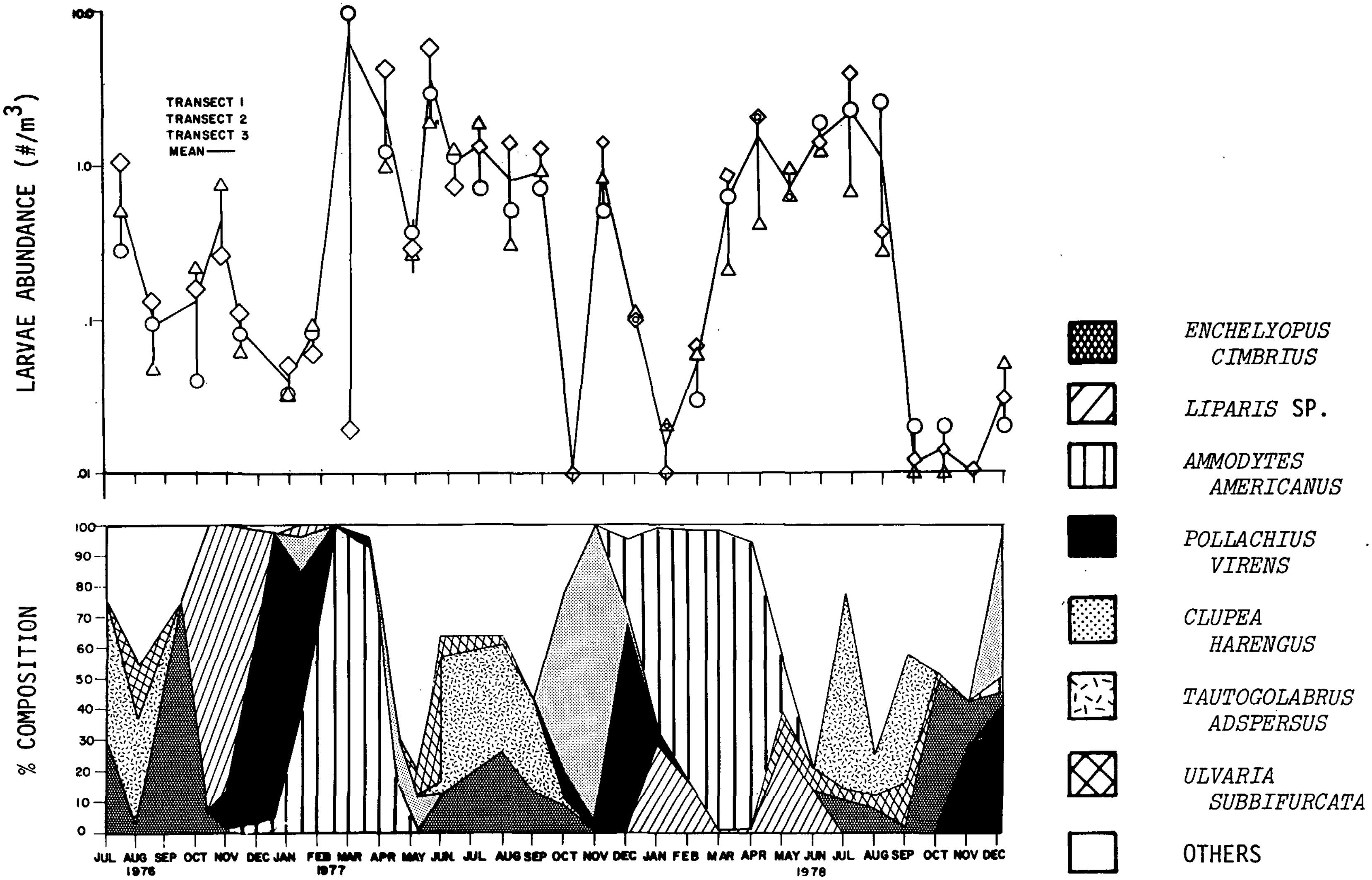

ABUNDANCE AND PERCENT COMPOSITION OF FISH LARVAE IN ICHTHYOPLANKTON COLLECTIONS FROM THE HAMPTON-SEABROOK REGION, JULY 1976 THROUGH DECEMBER 1978.

FIGURE 2.2-17

2.3 METEOROLOGY

2.3 METEOROLOGY

Basic meteorological information is presented in Section 2.6 of the Seabrook 1 and 2 Environmental Report - Construction Permit Stage (ER-CPS). Updated information is presented in the following paragraphs.

The primary sources of off-site climatic information in this section are the following National Weather Service (NWS) Stations:

(a) Boston Logan International Airport NWS Office (Boston), located about 38 miles south-southwest of the site on a landfill that extends into Boston Harbor.

(b) Portland International Jetport NWS Office (Portland), located about 59 miles north-northeast of the site just inland from the Atlantic Ocean.

Data presented in this report for the above NWS stations are taken primarily from annual meteorological summaries available from the National Oceanic and Atmospheric Administration (References 1 through 6), and from magnetic tapes of 3-hour observations available from the National Climatic Center in Asheville, North Carolina (References 7 and 8). These NWS stations are the nearest long-term first order NWS stations which, for most climatic statistics, are the most representative for the Seabrook region.

Additional sources of off-site climatic information used in this section are the following weather service stations (References 9 through 13):

(c) Concord Municipal Airport NWS Office (Concord), located about 40 miles west-northwest of the site.

(d) Portsmouth Cooperative Weather Service Station (Portsmouth), operated by the Department of Public works and located about 13 miles north-northeast of the site.

(e) Pease Air Force Base Station (Pease AFB), located also about 13 miles north-northeast of the site in Portsmouth.

The Seabrook ER-CPS contains on-site data summaries generally for the period November 1971 through October 1972. This information is updated in this report with on-site data summaries for the period April 1979 through March 1980. Estimates of short-term and long-term atmospheric dilution (CHI/Q) factors using the updated on-site data base were generated and are presented in Sections 7.1 and 5.2 of this report, respectively. A detailed description of the current meteorological monitoring program is presented in Subsection 6.1.3.

2.3.1 Regional Climatology

Information presented in this subsection supplements regional climatology information presented in Subsection 2.6.1 of the ER-CPS.

Ambient air quality in the area surrounding the Seabrook site is generally good. The site and all areas within approximately 10 miles of the site have been given the following attainment status designations with respect to National Ambient Air Quality Standards by the U.S. Environmental Protection Agency (EPA) (40CFR81):

(a) Sulfur Dioxide (SO_2) - better than national standards,

(b) Total Suspended Particulates (TSP) - better than national standards,

(c) Carbon Monoxide (CO) - cannot be classified or better than national standards,

(d) Nitrogen Dioxide (NO_2) - cannot be classified or better than national standards,

(e) Ozone (O_3) - do not meet national standards.

The exceedance of national standards for ozone is not a site specific problem but rather is region-wide; most of the northeast section of the U.S. has been designated by the EPA as not in attainment of national ozone standards.

It is expected that there are no unusual local conditions at the Seabrook site which will adversely affect station operation.

2.3.2 Dry Bulb Temperature

Information presented in this subsection updates and supplements temperature information presented in Subsection 2.6.2 of the ER-CPS.

Average and extreme dry bulb temperatures at Seabrook (43-foot level), Boston, Portland, and Concord for the period April 1979 through March 1980 are compared in Table 2.3-1 in order to show the degree of similarity of the on-site data to regional conditions. The annual average temperature for this time period for each of these four locations was 47.8°F at Seabrook, 51.9°F at Boston, 45.6°F at Portland, and 46.3°F at Concord. Differences in the average and extreme temperature values presented for each location in Table 2.3-1 are not unreasonable when such factors as the separation in geographical location and the difference in measurement technique are considered.

Long-term temperature data from regional weather stations are presented in Tables 2.3-2 and 2.3-3. The highest temperature recorded in the region as presented in Table 2.3-3 was 104°F at Boston in July 1911; the lowest temperature recorded was -39°F at Portland in February 1943. Data on the long-term monthly mean of daily maximum and minimum temperature conditions for the Seabrook site region are presented in Table 2.3-4.

2.3.3 Atmospheric Moisture

2.3.3.1 Dew-Point Temperature

Dew-point temperature is defined as the temperature to which air must be cooled to produce saturation with respect to water vapor, with pressure and water vapor content remaining constant.

Average and extreme dew-point temperatures at Seabrook, Boston, Portland, and Concord for the period April 1979 through March 1980 are presented in Table 2.3-5. The annual average dew-point temperatures measured at Seabrook, Boston, Portland, and Concord were 35.4°F, 40.0°F, 36.6°F, and 34.9°F, respectively; maximum dew-point values were 73°F, 75°F, 72°F, and 73°F, respectively; and the minimums were -11°F, -17°F, -19°F, and -18°F, respectively.

Long-term average and extreme dew-point temperature data for regional weather stations are presented in Tables 2.3-6 and 2.3-7. The highest dew-point temperature recorded in the region as presented in Table 2.3-7 was 77°F at both Boston and Portland; the lowest temperature recorded was -39°F at Portland.

2.3.3.2 Precipitation

Information presented in this subsection updates and supplements precipitation information presented in Subsection 2.6.4 of the ER-CPS.

a. Precipitation Measured as Water Equivalent

Precipitation totals at Seabrook, Boston, Portland, and Concord for the period April 1979 through March 1980 are compared in Table 2.3-8. Precipitation totals (water equivalent) for this time period for each of these four locations were 32.40 inches at Seabrook, 34.12 inches at Boston, 48.44 inches at Portland, and 32.62 inches at Concord.

Long-term monthly precipitation averages and extremes for area weather stations are presented in Tables 2.3-9 and 2.3-10. Regional maximum precipitation extremes during shorter periods of time are presented in Table 2.3-11 (Reference 14). Based on the data in Tables 2.3-10 and 2.3-11, a maximum monthly precipitation amount of about 14 inches and a maximum 24-hour precipitation amount of about 8 inches could be expected at the site.

The percent of time (based on hourly observations) precipitation of any kind was recorded at Portsmouth for the 5-year period April 1956 through March 1961 is presented in Table 2.3-12 (Reference 12). These data indicate that precipitation falls during approximately 13% of the total hours during the year.

b. Precipitation Measured as Snow or Ice Pellets

There is no on-site instrumentation for measuring precipitation as snow or ice pellets. Mean snowfall statistics from regional weather stations are presented in Table 2.3-13; maximum monthly and 24-hour snowfall data are presented in Table 2.3-14. Based on Portsmouth data, the average yearly snowfall which can be expected at the Seabrook site is approximately 72 inches.

2.3.4 Severe Weather

Information presented in this subsection updates and supplements severe weather information presented in Subsection 2.6.5 of the ER-CPS.

2.3.4.1 Heavy Snow

Maximum monthly and 24-hour snowfall statistics from regional weather stations are presented in Table 2.3-14. It can be seen from Table 2.3-14 that the maximum snowfall amounts for each weather station listed have generally been recorded in different years, indicating a substantial spatial variation in the snowfall in the region.

The February 6-7, 1978 snowstorm which struck New England was one of the most intense, persistent, severe winter storms on record (Reference 15). Hurricane force winds caused tides 3 to 5 feet above normal with widespread destruction of seawalls, homes, and businesses. Heavy snow with blizzard conditions resulted in mountainous drifts. Thirteen to twenty inches of snowfall was measured along the New Hampshire coast (Reference 15).

2.3.4.2 Strong Winds

Table 2.3-15 lists the fastest mile wind speeds recorded at Boston, Portland, and Concord. The data indicate that wind speeds over 40 mph can occur during any month of the year. During the winter these speeds are normally caused by northeasters that move up along the coast. During the warmer months, high winds are normally associated with thunderstorms and squall lines that pass through the area. Hurricanes could produce high wind speeds during the late summer and early fall.

2.3.4.3 Thunderstorms, Lightning, and Hail

Table 2.3-16 shows the mean number of days with thunderstorms for various weather stations in the general Seabrook area. Thunderstorms have occurred during every month of the year with the maximum during the summer. Pease AFB data can be considered most representative of the Seabrook site, showing a thunderstorm frequency of about 19 days per year with a maximum monthly mean of about 5 days in July (Reference 13).

Using the thunderstorm frequencies shown in Table 2.3-16 for Pease AFB and statistics relating to thunderstorm occurrence and to the probability of cloud-to-ground lightning (Reference 16), estimates of the frequency of occurrence of cloud-to-ground lightning were derived for the site on a seasonal and annual basis for objects extending to heights of 50, 100, 200 and 500 feet above grade. These results are as follows:

ESTIMATED FREQUENCY OF CLOUD-TO-GROUND LIGHTNING
(Number per Year)

	Height Above Ground (ft)			
Period	50	100	200	500
Dec - Feb	0.0	0.0	0.0	0.0
Mar - May	0.022	0.055	0.099	0.231
Jun - Aug	0.088	0.22	0.396	0.924
Sep - Nov	0.16	0.40	0.72	1.68
Annual	0.126	0.315	0.567	1.323

Table 2.3-17 lists the total number of days with hail over a 40 year period for Boston, Portland, and Concord (Reference 17). The data indicate that, on the average, the site should expect less than one day per year with hail. Hailstorms in the Seabrook area are seldom severe, although large hail has been reported. During the 13 year period between 1955 and 1967, an average of 0.2, 0.6 and 1.3 storms per year with hailstones 1.5 inches in diameter or larger have been reported for New Hampshire, Maine and Massachusetts, respectively (Reference 18).

2.3.4.4 Hurricanes

During the period 1871-1977, approximately 43 tropical cyclones passed within 100 nautical miles (115 statute miles) of the site. Of these, 22 storms were classified as hurricanes and only 3 have retained full hurricane stage within 100 nautical miles of the site (Reference 19).

2.3.4.5 Tornadoes and Waterspouts

Tornadoes have occurred in all the New England states. The mean annual number of tornadoes per 10,000 square miles for the period 1953-1976 in New Hampshire, Maine and Massachusetts are 2.5, 0.8 and 5.2, respectively (Reference 20).

A National Severe Storms Forecast Center (NSSFC) listing of tornadoes within a 50 mile radius of the site indicated that 69 tornadoes had occurred during the period 1950 through 1977 with a mean path area of 0.124 square miles (Reference 21).

A procedure for estimating the probability of a tornado striking any point from an analysis of mean path length and width and the frequency of tornado occurrence has been developed (Reference 22). Applying the procedure to the NSSFC data gives an annual probability of a tornado striking any point within 50 miles of the site of 7.8×10^{-5} with a mean recurrence interval of about 12,900 years. (The calculation excluded the water area within the area of interest.)

In an analysis of waterspout occurrences, a total of 14 waterspouts were reported off the coast between Boston and Portsmouth of which 3 were considered to have caused coastal damage (Reference 23). A waterspout coming ashore and striking the site would not have a destructive effect greater than that of a tornado. With exactly the same wind speeds, a waterspout would contain less solid debris than a tornado that had been traveling over land.

2.3.5 Diffusion Climatology

2.3.5.1 Winds

Monthly and annual wind roses for data collected on-site at the 43 foot level for the period April 1979 through March 1980 are provided in Figures 2.3-1 through 2.3-13; the annual wind rose for data collected for the same period at the 209 foot level is presented in Figure 2.3-14. Annual tabular wind rose data and wind direction persistence summaries during the same time period for both tower levels are presented in Tables 2.3-18 through 2.3-21.

Long-term annual wind roses from Boston and Portland for the time period January 1968 through December 1977 are provided in Figures 2.3-15 and 2.3-16, respectively. These same data are presented in tabular form in Tables 2.3-22 and 2.3-23, respectively.

2.3.5.2 Atmospheric Stability

On-site temperature difference data collected between different heights on the Seabrook meteorological tower are used to estimate atmospheric stability by relation with the temperature lapse rate (change of temperature with height). Pasquill stability categories are determined from the temperature lapse rate as defined in Regulatory Guide 1.23 (Reference 24). Monthly and annual Pasquill stability class frequency statistics derived from the 43'-150' delta temperature and 43'-209' delta temperature data bases at Seabrook are presented in Table 2.3-24 for the period April 1979 through March 1980. Examination of the stability data for Seabrook shows that the neutral, or D, stability class occurs most frequently, 41.54% of the time for the 43'-150' delta temperature data and 43.31% of the time for the 43'-209' delta temperature data. The frequency of occurrence of the stability classes on either side of stability class D taper off toward the extremes of stability and instability.

Long-term Pasquill stability class frequency statistics for Boston and Portland are compared to the Seabrook stability statistics in Table 2.3-25. The stability classifications for Boston and Portland are derived primarily from surface observations of net solar radiation and wind speed (References 25, 26). The long-term off-site data for Boston and Portland show a relatively high frequency of occurrence of the neutral stability class D when compared to the on-site Seabrook data. This is to be expected, since the estimation of stability classification from surface data generally leads to a bias toward neutral conditions and away from extremes of stability and instability when compared to stability classification estimates derived from temperature lapse rates.

Joint frequency distributions of each Pasquill stability class with corresponding wind speed and direction data for Seabrook during the period April 1979 through March 1980 are presented in Tables 2.3-26 and 2.3-27; Table 2.3-26 contains joint frequency distributions using 43'-150' delta temperature and 43-foot wind speed and direction data, while Table 2.3-27 contains joint frequency distributions using 43'-209' delta temperature and 209-foot wind speed and direction data. Long-term joint frequency distributions for Boston and Portland for the period January 1968 through December 1977 are presented in Tables 2.3-28 and 2.3-29, respectively.

2.3.5.3 Inversions and High Air Pollution Potential

The Seabrook site is not in an area of frequent air pollution episodes or alerts. A study of synoptic weather map analysis for 1936 through 1975 shows high pressure stagnation conditions lasting four days or more over the site occurring 12 times with an average of 4.4 stagnation days per case (Reference 27).

Holzworth (Reference 28) analyzed five years of data to determine occurrences in the United States of episodes of meteorological conditions unfavorable for atmospheric dispersion. Holzworth indicated episodes of high air pollution potential as periods with low mixing depth and light winds. A summary of the Holzworth data as it applies to the site appears in Table 2.3-30. The data indicate that prolonged periods with a combination of low wind speed and low mixing height are uncommon in the site area.

Holzworth (Reference 28) also plotted isopleths of mean seasonal and annual morning and afternoon mixing heights across the United States from the same five years of data. For the Seabrook site, the seasonal and annual values of the mean daily mixing heights occurred as follows:

MEAN DAILY MIXING HEIGHTS
(Meters)

Season	Morning	Afternoon
Spring	710	1400
Summer	450	1400
Autumn	590	1100
Winter	700	900
Annual	600	1200

The above data represent estimates of the average depth of vigorous vertical mixing, which give an indication of the vertical depth of atmosphere available for mixing and dispersion of effluents.

2.3.5.4 Topographic Description

A map showing the topography within a five-mile radius of the site is presented in Figure 2.3-17. Maximum elevation with distance is plotted in Figure 2.3-18 for each of 16 sections radiating from the site. The heights shown in these cross sections are for the highest representative terrain at that distance in the sector, and are not necessarily the exact height at the precise bearing and distance shown.

The immediate site area is tidal marsh with short grass, reeds and tidal channels. Short trees begin at the edge of the marsh as the terrain becomes slightly irregular. A few short ridges and hills occur within the first five miles from the site.

A map showing detailed topographic features within a 50 mile radius of the site is presented in Figure 2.3-19. The first hills and ridges of the White Mountains of New Hampshire occur 20-25 miles northwest, west and southwest of the site. Hilly terrain with peaks between 200 and 500 feet are found 25 to 40 miles from the site.

2.3.6 Atmospheric Diffusion Estimates

Hourly meteorological data collected on-site for the period of record April 1979 through March 1980, were used to calculate dose consequences for both short-term (accident) releases and long-term (routine) releases. The assumptions used to compute the consequences of accidental releases followed the methodology of CRAC (Calculation of Reactor Accident Consequences) as performed for the Reactor Safety Study (Reference 29). Both the description of the basic calculation scheme of the CRAC code and the modeling results are presented in Section 7.0. Estimates of annual average atmospheric transport and diffusion characteristics were calculated and are presented in Section 5.2 as annual diffusion factors. The assumptions used to compute the annual diffusion factors are outlined in Section 6.1.3.

2.3.7 REFERENCES

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TABLE 2.3-1
(Sheet 1 of 2)

COMPARISON OF SHORT-TERM DRY BULB TEMPERATURE DATA AT SEABROOK, BOSTON, PORTLAND, AND CONCORD
(Values in ^{o}F)

	Month	Seabrook	Boston	Portland	Concord
a.	Monthly Average				
	Apr 1979	43.4	48.7	42.2	44.2
	May	56.6	61.1	55.3	56.3
	Jun	63.7	68.2	62.7	63.8
	Jul	69.5	74.5	69.3	71.2
	Aug	66.3	71.7	64.8	67.5
	Sep	60.1	64.9	57.4	59.8
	Oct	50.0	52.7	47.5	47.4
	Nov	46.0	48.6	42.4	42.2
	Dec	33.3	36.7	29.8	29.4
	Jan 1980	26.9	29.4	22.7	22.4
	Feb	24.2	27.9	20.5	19.1
	Mar	34.2	36.9	32.0	31.8
	12-Month Average	47.8	51.9	45.6	46.3
b.	Extreme Highest				
	Apr 1979	70.0	77	70	77
	May	92.1	95	92	94
	Jun	89.6	95	91	93
	Jul	89.1	94	90	94
	Aug	87.6	91	88	92
	Sep	83.0	85	83	87
	Oct	82.1	83	81	86
	Nov	70.3	72	62	71
	Dec	64.3	68	64	67
	Jan 1980	57.8	57	51	59
	Feb	48.2	53	47	50
	Mar	58.7	59	54	61
	Record High	92.1	95	92	94

TABLE 2.3-1
(Sheet 2 of 2)

Month	Seabrook	Boston	Portland	Concord
c. Extreme Lowest				
Apr 1979	28.6	33	25	19
May	39.6	45	32	27
Jun	43.6	50	41	32
Jul	47.2	55	47	39
Aug	47.7	54	43	40
Sep	34.7	42	29	28
Oct	29.9	32	27	20
Nov	26.5	29	20	21
Dec	0.0	5	-1	-8
Jan 1980	6.4	11	-9	-2
Feb	5.6	9	-3	-10
Mar	1.9	7	-5	-11
Record Low	0.0	5	-9	-10

Period of Record: April 1979 - March 1980

References:	On-site Program	(3)	(6)	(11)

TABLE 2.3-2

LONG-TERM REGIONAL MONTHLY DRY BULB TEMPERATURE AVERAGES
(Values in °F)

Month	Boston	Portland	Concord	Portsmouth
Jan	29.2	21.5	20.6	22.9
Feb	30.4	22.9	22.6	23.9
Mar	38.1	31.8	32.3	32.1
Apr	48.6	42.7	44.2	42.5
May	58.6	52.7	55.1	53.5
Jun	68.0	62.2	64.7	63.1
Jul	73.3	68.0	69.7	68.1
Aug	71.3	66.4	67.2	66.1
Sep	64.5	58.7	59.5	58.6
Oct	55.4	49.1	49.3	49.2
Nov	45.2	38.6	38.0	39.3
Dec	33.0	25.7	24.8	25.8
Annual Average	51.3	45.0	45.6	45.4
Period of Record:	1941-1970	1941-1970	1941-1970	1954-1967
References:	(2)	(5)	(10)	(12)

TABLE 2.3-3

LONG-TERM REGIONAL MONTHLY DRY BULB TEMPERATURE EXTREMES
(Values in ^{o}F)

	Month	Boston	Portland	Concord	Portsmouth
a.	Extreme Highest				
	Jan	72(1950)	65(1906)	72(1876)	58(1966)
	Feb	68(1957)	64(1975)	68(1880)	64(1957)
	Mar	86(1945)	86(1946)	85(1977)	76(1962)
	Apr	94(1976)	89(1927)	95(1976)	92(1962)
	May	97(1880)	96(1937)	98(1911)	94(1964)
	Jun	100(1952)	97(1941)	101(1919)	96(1956)
	Jul	104(1911)	103(1911)	102(1966)	99(1963)
	Aug	102(1975)	103(1975)	101(1975)	98(1955)
	Sep	102(1881)	96(1939)	98(1953)	92(1965)
	Oct	90(1963)	88(1963)	92(1879)	88(1963)
	Nov	83(1950)	74(1974)	80(1950)	76(1959)
	Dec	70(1966)	65(1911)	65(1932)	60(1966)
	Record High	104(1911)	103(1975)	102(1966)	99(1963)
b.	Extreme Lowest				
	Jan	-13(1882)	-26(1971)	-35(1878)	-23(1957)
	Feb	-18(1934)	-39(1943)	-37(1943)	-15(1962)
	Mar	-8(1872)	-21(1950)	-16(1967)	-8(1967)
	Apr	11(1874)	8(1954)	7(1874)	10(1967)
	May	31(1882)	23(1956)	21(1966)	22(1967)
	Jun	41(1945)	33(1944)	30(1972)	35(1967)
	Jul	50(1879)	40(1965)	35(1965)	40(1956)
	Aug	46(1940)	33(1965)	29(1965)	33(1965)
	Sep	34(1914)	23(1941)	20(1941)	26(1962)
	Oct	25(1936)	15(1976)	10(1972)	14(1966)
	Nov	-2(1875)	-6(1875)	-17(1875)	11(1957)
	Dec	-17(1933)	-21(1963)	-24(1875)	-12(1962)
	Record Low	-18(1934)	-39(1943)	-37(1943)	-23(1957)
	Period of Record:	1872-1978	1872-1978	1871-1978	1954-1967
	References:	(1),(2)	(5)	(9),(10)	(12)

TABLE 2.3-4

LONG-TERM REGIONAL MONTHLY MEANS OF
DAILY MAXIMUM AND MINIMUM TEMPERATURES
(Values in °F)

Month	Boston	Portland	Concord	Portsmouth
a. Monthly Mean of Daily Maximum				
Jan	36	31	31	32
Feb	38	33	34	35
Mar	45	41	42	42
Apr	56	53	57	53
May	67	64	69	66
Jun	77	73	78	75
Jul	81	79	83	80
Aug	79	78	80	78
Sep	72	70	72	70
Oct	63	60	62	61
Nov	52	48	48	49
Dec	39	35	35	35
Annual Mean	58.7	55.3	57.5	56.4
b. Monthly Mean of Daily Minimum				
Jan	23	12	10	13
Feb	23	13	11	13
Mar	32	23	22	22
Apr	41	33	32	32
May	50	42	42	41
Jun	59	51	52	51
Jul	65	57	57	56
Aug	63	55	54	54
Sep	57	47	47	47
Oct	48	38	36	37
Nov	39	30	28	30
Dec	27	16	15	17
Annual Mean	43.8	34.7	33.7	34.4
Period of Record:	1941-1970	1941-1970	1941-1970	1954-1967
References:	(2)	(5)	(10)	(12)

TABLE 2.3-5
(Sheet 1 of 2)

COMPARISON OF SHORT-TERM DEW POINT TEMPERATURE DATA AT
SEABROOK, BOSTON, PORTLAND, AND CONCORD
(Values in °F)

	Month	Seabrook	Boston	Portland	Concord
a.	Monthly Average				
	Apr 1979	(a)	36	33	30
	May	50.5	50	45	44
	Jun	53.2	56	52	50
	Jul	57.5	64	60	59
	Aug	64.3	63	58	57
	Sep	55.2	56	50	49
	Oct	38.8	45	42	40
	Nov	37.6	40	37	34
	Dec	24.7	23	20	18
	Jan 1980	15.1	14	13	10
	Feb	12.4	9	9	7
	Mar	24.3	23	19	19
	12-Month Average	35.4	40.0	36.6	34.9
b.	Extreme Highest				
	Apr 1979	(a)	61	53	59
	May	64.1	65	61	63
	Jun	68.1	69	65	70
	Jul	67.7	74	72	71
	Aug	73.0	75	72	73
	Sep	70.6	73	67	71
	Oct	62.5	67	62	62
	Nov	63.3	62	58	60
	Dec	49.7	50	46	44
	Jan 1980	55.5	54	50	54
	Feb	34.4	30	31	28
	Mar	52.6	52	44	48
	Record High	73.0	75	72	73

TABLE 2.3-5
(Sheet 2 of 2)

Month	Seabrook	Boston	Portland	Concord
c. Extreme Lowest				
Apr 1979	(a)	10	16	5
May	28.5	20	11	13
Jun	31.6	36	34	30
Jul	38.0	41	38	37
Aug	44.1	42	41	36
Sep	39.4	28	28	25
Oct	21.1	22	23	19
Nov	7.1	6	9	5
Dec	-5.6	-11	-11	-14
Jan 1980	-11.0	-10	-12	-12
Feb	-8.7	-13	-17	-17
Mar	-7.5	-17	-19	-18
Record Low	-11.0	-17	-19	-18
Period of Record:	April 1979 - March 1980			
References:	On-site Program	(3)	(6)	(11)

(a) Collection of on-site dew point data did not begin until May 1979.

TABLE 2.3-6

LONG-TERM REGIONAL MONTHLY DEW POINT TEMPERATURE AVERAGES
(Values in °F)

Month	Boston	Portland
Jan	15.6	9.7
Feb	17.7	13.3
Mar	25.6	22.5
Apr	33.6	30.8
May	45.1	43.0
Jun	56.4	54.5
Jul	61.0	59.9
Aug	60.7	59.0
Sep	54.7	52.1
Oct	43.4	39.8
Nov	34.1	30.1
Dec	23.0	17.4
Annual Average	39.3	36.1

Period of Record: Jan 1968 - Dec 1977

References:	(7)	(8)

TABLE 2.3-7

LONG-TERM REGIONAL MONTHLY DEW POINT TEMPERATURE EXTREMES
(Values in °F)

Month	Extreme Highest		Extreme Lowest	
	Boston	Portland	Boston	Portland
Jan	59	48	-26	-33
Feb	55	49	-22	-30
Mar	59	54	-8	-16
Apr	67	59	-2	-2
May	68	72	8	7
Jun	73	75	21	27
Jul	75	75	34	38
Aug	77	77	35	31
Sep	73	75	30	22
Oct	69	64	8	7
Nov	66	64	3	-6
Dec	60	54	-23	-39
Record High/Low	77	77	-26	-39

Period of Record: Jan 1968 - Dec 1977

References:	(7)	(8)	(7)	(8)

TABLE 2.3-8

COMPARISON OF SHORT-TERM PRECIPITATION TOTALS AT SEABROOK, BOSTON, PORTLAND, AND CONCORD
(Values in Inches of Water)

Month	Seabrook	Boston	Portland	Concord
Apr 1979	2.69	3.19	6.48	3.10
May	3.47	4.24	5.15	4.86
June	0.71	0.86	1.97	0.64
Jul	2.87	2.36	5.90	3.45
Aug	3.87	5.02	5.53	4.20
Sep	3.75	3.61	3.28	3.15
Oct	4.75	3.14	6.71	3.79
Nov	3.33	3.29	3.95	2.92
Dec	1.59	1.42	2.59	1.93
Jan 1980	0.38	0.74	0.98	0.43
Feb	0.69	0.88	1.36	0.78
Mar	4.30	5.37	4.54	3.37
12-Month Total	32.40	34.12	48.44	32.62

Period of Record: April 1979 - March 1980

References:	On-site Program	(3)	(6)	(11)

TABLE 2.3-9

LONG-TERM REGIONAL MONTHLY PRECIPITATION AVERAGES
(Values in Inches of Water)

Month	Boston	Portland	Concord	Portsmouth
Jan	3.7	3.4	2.7	4.2
Feb	3.5	3.5	2.5	4.0
Mar	4.0	3.6	2.8	3.4
Apr	3.5	3.3	2.9	3.6
May	3.5	3.3	3.0	2.8
Jun	3.2	3.1	3.4	2.7
Jul	2.7	2.6	3.1	3.4
Aug	3.5	2.6	2.9	2.7
Sep	3.2	3.1	3.1	3.8
Oct	3.0	3.3	2.7	4.1
Nov	4.5	4.9	4.0	4.6
Dec	4.2	4.1	3.3	3.5
Yearly Average	42.5	40.8	36.2	42.6
Period of Record:	1941-1970	1941-1970	1941-1970	1954-1967
References:	(2)	(5)	(10)	(12)

TABLE 2.3-10

LONG-TERM REGIONAL MONTHLY PRECIPITATION EXTREMES
(Values in Inches of Water)

	Month	Boston	Portland	Concord	Portsmouth
a.	Maximum Monthly Totals				
	Jan	9.5(1958)	12.3(1935)	6.3(1978)	13.8(1958)
	Feb	7.1(1969)	9.3(1900)	5.9(1896)	5.8(1965)
	Mar	11.0(1953)	10.0(1953)	9.8(1936)	6.2(1956)
	Apr	9.1(1904)	9.9(1973)	7.4(1904)	6.5(1961)
	May	13.4(1954)	7.7(1948)	8.3(1954)	6.4(1967)
	Jun	9.1(1931)	10.9(1917)	10.1(1944)	6.3(1959)
	Jul	11.7(1921)	10.8(1915)	10.3(1915)	5.4(1959)
	Aug	17.1(1955)	8.3(1946)	9.0(1892)	6.7(1955)
	Sep	10.9(1933)	9.8(1954)	11.0(1888)	9.1(1954)
	Oct	8.8(1877)	12.3(1962)	8.8(1962)	10.8(1962)
	Nov	11.0(1876)	9.8(1963)	7.6(1937)	9.7(1963)
	Dec	9.7(1969)	9.7(1969)	7.6(1936)	6.4(1954)
b.	Minimum Monthly Totals				
	Jan	0.9(1970)	0.8(1970)	0.4(1970)	0.9(1955)
	Feb	0.5(1877)	0.4(1872)	0.4(1877)	1.3(1957)
	Mar	T(1915)	0.1(1915)	T(1915)	1.7(1965)
	Apr	0.9(1892)	0.7(1941)	0.4(1941)	1.4(1966)
	May	0.3(1944)	0.5(1965)	0.3(1899)	1.0(1964)
	Jun	0.3(1912)	0.5(1908)	0.1(1913)	0.8(1964)
	Jul	0.5(1952)	0.6(1965)	0.9(1910)	1.3(1955)
	Aug	0.4(1883)	0.3(1947)	0.4(1882)	1.4(1956)
	Sep	0.2(1914)	0.3(1948)	0.2(1914)	1.5(1964)
	Oct	0.1(1924)	0.1(1924)	0.1(1924)	1.9(1963)
	Nov	0.6(1917)	0.6(1939)	0.5(1939)	2.4(1965)
	Dec	0.7(1935)	0.9(1874)	0.6(1943)	1.0(1955)
	Period of Record:	1872-1978	1871-1978	1871-1978	1954-1967
	References:	(1),(2)	(5)	(9),(10)	(12)

T = Trace (less than 0.01 inch)

TABLE 2.3-11

REGIONAL MAXIMUM RECORDED SHORT PERIOD PRECIPITATION
(Values in Inches of Water)

	Time Period	Boston	Portland	Concord
a.	Minutes			
	5	0.56	0.51	0.66
	10	0.95	0.78	1.12
	15	1.25	1.09	1.60
	30	1.63	1.49	2.53
	Period of Record:	1896-1961	1896-1961	1905-1932; 1938-1961
b.	Hours			
	1	2.10	2.11	2.71
	2	2.85	3.40	2.73
	3	4.05	4.51	3.56
	6	5.46	5.84	3.82
	12	6.74	7.09	5.53
	Period of Record:	1892-1961	1893-1961	1902-1961
	24	8.4	7.7	6.0
	Period of Record:	1872-1978	1871-1978	1871-1978
	References:	(1),(2),(14)	(5),(14)	(9),(10),(14)

TABLE 2.3-12

FREQUENCY OF OCCURRENCE OF PRECIPITATION AT PORTSMOUTH
(Values in % of Time)

Month	Frequency
Jan	19.0
Feb	14.4
Mar	14.9
Apr	16.0
May	12.4
Jun	11.5
Jul	8.9
Aug	7.6
Sep	9.8
Oct	11.6
Nov	13.1
Dec	16.0
Yearly	12.9

Period of Record: 43,632 hourly observations from the 5-year period April 1956 through March 1961

Reference: (12)

TABLE 2.3-13

REGIONAL MONTHLY SNOWFALL AVERAGES
(Values in Inches of Snow)

Month	Boston	Portland	Concord	Portsmouth
Jan	12.8	18.5	17.7	17.7
Feb	12.2	19.3	15.3	18.9
Mar	8.2	13.8	11.6	16.3
Apr	0.7	3.0	2.2	1.9
May	T	0.2	0.2	T
Jun	0	0	0	0
Jul	0	0	0	0
Aug	0	0	0	0
Sep	0	T	0	0
Oct	T	0.3	0.1	T
Nov	1.2	3.3	4.1	1.8
Dec	8.0	16.1	14.4	15.6
Yearly Average	43.1	74.5	65.6	72.2
Period of Record:	1939-1978	1939-1978	1939-1978	1954-1967
References:	(2)	(5)	(10)	(12)

T = Trace (less than 0.1 inches)

TABLE 2.3-14

REGIONAL MAXIMUM SNOWFALL EXTREMES
(Values in Inches of Snow)

Month	Boston	Portland	Concord	Portsmouth
a. Maximum Monthly Total				
Jan	35.9(1978)	59.0(1935)	46.7(1935)	47.6(1966)
Feb	41.3(1969)	61.2(1969)	59.0(1893)	38.4(1967)
Mar	33.0(1916)	46.6(1956)	38.3(1956)	53.9(1956)
Apr	28.3(1874)	20.5(1906)	35.0(1874)	9.7(1956)
May	0.5(1977)	7.0(1945)	5.0(1945)	T(1963)
Jun	0.0	0.0	0.0	0.0
Jul	0.0	0.0	0.0	0.0
Aug	0.0	0.0	0.0	0.0
Sep	0.0	T(1959)	0.0	0.0
Oct	0.5(1884)	3.8(1969)	3.0(1884)	T(1963)
Nov	17.8(1898)	24.3(1921)	25.0(1873)	6.4(1961)
Dec	27.9(1970)	54.8(1970)	43.0(1876)	42.5(1956)
b. Maximum 24-Hour Total				
Jan	21.0(1978)	23.3(1935)	19.0(1944)	15.0(1966)
Feb	19.4(1958)	21.5(1969)	15.0(1929)	15.0(1966)
Mar	17.7(1960)	19.8(1939)	13.6(1959)	15.0(1956)
Apr	9.1(1917)	15.0(1906)	18.3(1933)	8.0(1956)
May	0.5(1977)	7.0(1945)	5.0(1945)	T(1963)
Jun	0.0	0.0	0.0	0.0
Jul	0.0	0.0	0.0	0.0
Aug	0.0	0.0	0.0	0.0
Sep	0.0	T(1959)	0.0	0.0
Oct	0.5(1884)	3.6(1969)	2.1(1969)	T(1963)
Nov	12.0(1898)	11.2(1898)	13.3(1938)	5.2(1961)
Dec	13.0(1960)	22.8(1970)	14.6(1946)	21.6(1954)
Period of Record:	1872-1978	1882-1978	1871-1978	1954-1967
References:	(1),(2)	(5)	(9),(10)	(12)

T = Trace (less than 0.1 inches)

TABLE 2.3-15

REGIONAL FASTEST MILE WIND SPEEDS
(Values in MPH)

Month	Boston	Portland	Concord
Jan	66(1945)	50(1951)	44(1972)
Feb	61(1978)	58(1952)	42(1950)
Mar	73(1947)	76(1947)	71(1950)
Apr	63(1935)	57(1946)	52(1945)
May	55(1935)	51(1921)	48(1945)
Jun	46(1935)	48(1925)	38(1971)
Jul	52(1935)	44(1941)	45(1971)
Aug	52(1947)	69(1954)	56(1934)
Sep	87(1938)	62(1960)	61(1938)
Oct	63(1933)	45(1963)	39(1944)
Nov	80(1950)	76(1945) (1947)	72(1950)
Dec	73(1934)	62(1957)	52(1962)
Maximum	87(1938)	76(1945) (1947)	72(1950)
Period of Record:	1918-1978	1900-1978	1938-1978
References:	(1),(2)	(5)	(9),(10)

TABLE 2.3-16

REGIONAL THUNDERSTORM OCCURRENCE
(Values in Number of Days per Year with Thunderstorms)

Month	Boston	Portland	Concord	Pease AFB
Jan	*	*	*	0
Feb	*	*	*	0
Mar	*	*	*	0
Apr	1	1	1	0.9
May	2	2	2	2.3
Jun	4	4	5	4.1
Jul	4	4	6	5.4
Aug	4	3	4	3.8
Sep	2	2	2	1.4
Oct	1	1	1	0.6
Nov	*	*	*	0.4
Dec	*	*	*	0
Yearly	19	18	20	18.9
Period of Record:	1936-1978	1941-1978	1942-1978	Apr. 1956-1970
References:	(2)	(5)	(10)	(13)

*Less than one half

TABLE 2.3-17

REGIONAL HAIL FREQUENCY
(Values in Total Number of Days with Hail)

Month	Boston	Portland	Concord
Jan	0	0	1
Feb	0	0	0
Mar	1	2	2
Apr	3	4	3
May	5	4	9
Jun	5	3	3
Jul	8	6	4
Aug	3	6	2
Sep	1	2	1
Oct	0	6	2
Nov	2	0	1
Dec	0	0	1
Total	28	33	29
Average per Year	0.70	0.83	0.83
Period of Record:	1904-1943	1904-1943	1904-1933; 1939-1943

Reference: (17)

TABLE 2.3-18

ANNUAL WIND ROSE FOR SEABROOK (43 FT. LEVEL)
APR. '79 - MAR. '80

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
(1)	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.02
(2)	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.02
C-3	67	55	48	80	70	50	47	65	93	77	88	145	187	210	132	95	0	1509
(1)	.78	.64	.56	.93	.82	.58	.55	.76	1.08	.90	1.03	1.69	2.18	2.45	1.54	1.11	0.00	17.58
(2)	.78	.64	.56	.93	.82	.58	.55	.76	1.08	.90	1.03	1.69	2.18	2.45	1.54	1.11	0.00	17.58
4-7	141	97	104	133	173	158	231	135	170	239	235	346	346	543	359	167	0	3577
(1)	1.64	1.13	1.21	1.55	2.02	1.84	2.69	1.57	1.98	2.78	2.74	4.03	4.03	6.33	4.18	1.95	0.00	41.67
(2)	1.64	1.13	1.21	1.55	2.02	1.84	2.69	1.57	1.98	2.78	2.74	4.03	4.03	6.33	4.18	1.95	0.00	41.67
8-12	105	61	123	80	127	134	131	94	93	169	296	232	229	438	215	67	0	2594
(1)	1.22	.71	1.43	.93	1.48	1.56	1.53	1.10	1.08	1.97	3.45	2.70	2.67	5.10	2.50	.78	0.00	30.22
(2)	1.22	.71	1.43	.93	1.48	1.56	1.53	1.10	1.08	1.97	3.45	2.70	2.67	5.10	2.50	.78	0.00	30.22
13-18	15	4	58	16	9	8	2	12	26	35	46	37	97	257	117	2	0	741
(1)	.17	.05	.68	.19	.10	.09	.02	.14	.30	.41	.54	.43	1.13	2.99	1.36	.02	0.00	8.63
(2)	.17	.05	.68	.19	.10	.09	.02	.14	.30	.41	.54	.43	1.13	2.99	1.36	.02	0.00	8.63
19-24	0	0	9	4	9	0	0	2	2	1	2	1	21	72	26	0	0	149
(1)	0.00	0.00	.10	.05	.10	0.00	0.00	.02	.02	.01	.02	.01	.24	.84	.30	0.00	0.00	1.74
(2)	0.00	0.00	.10	.05	.10	0.00	0.00	.02	.02	.01	.02	.01	.24	.84	.30	0.00	0.00	1.74
GT 24	0	0	3	5	0	0	0	0	0	0	0	0	2	1	1	0	0	12
(1)	0.00	0.00	.03	.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.02	.01	.01	0.00	0.00	.14
(2)	0.00	0.00	.03	.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.02	.01	.01	0.00	0.00	.14
ALL SPEEDS	328	218	345	318	388	350	411	308	384	522	667	761	882	1521	850	331	0	8584
(1)	3.82	2.54	4.02	3.70	4.52	4.08	4.79	3.59	4.47	6.08	7.77	8.87	10.27	17.72	9.90	3.86	0.00	100.00
(2)	3.82	2.54	4.02	3.70	4.52	4.08	4.79	3.59	4.47	6.08	7.77	8.87	10.27	17.72	9.90	3.86	0.00	100.00

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2.3-19

ANNUAL WIND ROSE FOR SEABROOK (209-FOOT LEVEL)
APR. '79 - MAR. '80

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	2	0	5
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	.01	0.00	0.00	.01	0.00	0.00	0.00	.02	0.00	.06
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	.01	0.00	0.00	.01	0.00	0.00	0.00	.02	0.00	.06
C-3	18	23	31	32	30	26	28	16	26	24	26	26	15	18	21	22	0	382
(1)	.21	.27	.36	.37	.35	.30	.32	.19	.30	.28	.30	.30	.17	.21	.24	.25	0.00	4.43
(2)	.21	.27	.36	.37	.35	.30	.32	.19	.30	.28	.30	.30	.17	.21	.24	.25	0.00	4.43
4-7	104	101	78	101	95	109	111	96	103	103	100	76	95	113	121	92	0	1598
(1)	1.20	1.17	.90	1.17	1.10	1.26	1.29	1.11	1.19	1.19	1.16	.88	1.10	1.31	1.40	1.07	0.00	18.51
(2)	1.20	1.17	.90	1.17	1.10	1.26	1.29	1.11	1.19	1.19	1.16	.88	1.10	1.31	1.40	1.07	0.00	18.51
8-12	186	142	120	99	102	143	159	177	222	291	356	256	262	368	372	180	0	3435
(1)	2.16	1.65	1.39	1.15	1.18	1.66	1.84	2.05	2.57	3.37	4.12	2.97	3.04	4.26	4.31	2.09	0.00	39.80
(2)	2.16	1.65	1.39	1.15	1.18	1.66	1.84	2.05	2.57	3.37	4.12	2.97	3.04	4.26	4.31	2.09	0.00	39.80
13-18	89	82	85	24	22	26	60	111	87	141	288	269	286	519	310	47	0	2446
(1)	1.03	.95	.98	.28	.25	.30	.70	1.29	1.01	1.63	3.34	3.12	3.31	6.01	3.59	.54	0.00	28.34
(2)	1.03	.95	.98	.28	.25	.30	.70	1.29	1.01	1.63	3.34	3.12	3.31	6.01	3.59	.54	0.00	28.34
19-24	25	22	30	8	9	4	12	34	18	17	25	32	70	181	79	0	0	566
(1)	.29	.25	.35	.09	.10	.05	.14	.39	.21	.20	.29	.37	.81	2.10	.92	0.00	0.00	6.56
(2)	.29	.25	.35	.09	.10	.05	.14	.39	.21	.20	.29	.37	.81	2.10	.92	0.00	0.00	6.56
GT 24	0	3	11	8	6	0	1	6	3	3	5	3	36	80	34	0	0	199
(1)	0.00	.03	.13	.09	.07	0.00	.01	.07	.03	.03	.06	.03	.42	.93	.39	0.00	0.00	2.31
(2)	0.00	.03	.13	.09	.07	0.00	.01	.07	.03	.03	.06	.03	.42	.93	.39	0.00	0.00	2.31
ALL SPEEDS	422	373	355	272	264	308	371	441	460	579	800	663	764	1279	937	343	0	8631
(1)	4.89	4.32	4.11	3.15	3.06	3.57	4.30	5.11	5.33	6.71	9.27	7.68	8.85	14.82	10.86	3.97	0.00	100.00
(2)	4.89	4.32	4.11	3.15	3.06	3.57	4.30	5.11	5.33	6.71	9.27	7.68	8.85	14.82	10.86	3.97	0.00	100.00

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2.3-20

WIND DIRECTION PERSISTENCE SUMMARY AT SEABROOK (43-FOOT LEVEL)
APR. '79 - MAR. '80

WIND DIRECTION PERSISTENCE SUMMARY - NUMBER OF OBSERVATIONS AND PERCENT PROBABILITY

DIRECTION PERSISTENCE (HOURS)

DIRECTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	GT.24	TOTAL
N	115	35	7	8	3	2	1	0	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	175
	66	86	90	94	96	97	98	98	98	98	99	99	99	99	99	99	99	99	99	100	0	0	0	0	0	
NNE	118	22	10	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157
	75	89	96	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NE	89	17	10	9	4	5	2	3	2	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	145
	61	73	80	86	89	92	94	96	97	98	99	99	99	99	99	99	99	99	100	0	0	0	0	0	0	
ENE	100	37	16	8	5	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	171
	58	80	89	94	97	98	98	99	99	99	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	
E	114	37	22	9	8	4	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	199
	57	76	87	91	95	97	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ESE	141	44	14	4	3	3	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	213
	66	87	93	95	97	98	99	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SE	155	60	14	8	8	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	249
	62	86	92	95	98	99	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SSE	157	39	10	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	214
	73	92	96	97	98	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
S	161	46	15	10	5	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	240
	67	86	92	97	99	99	100	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SSW	174	55	22	15	5	6	1	3	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	283
	61	81	89	94	96	98	98	99	99	99	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0	
SW	175	60	29	20	12	6	3	0	3	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	313
	56	75	84	91	95	96	97	97	98	99	99	99	100	100	100	100	100	100	0	0	0	0	0	0	0	
WSW	215	75	33	18	12	4	4	2	4	4	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	373
	58	78	87	91	95	96	97	97	98	99	99	99	100	0	0	0	0	0	0	0	0	0	0	0	0	
W	308	88	41	21	14	8	5	2	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	490
	63	81	89	93	96	98	99	99	100	100	100	100	100	100	0	0	0	0	0	0	0	0	0	0	0	
WNW	322	127	57	35	24	13	11	8	9	4	3	2	0	3	1	2	1	0	0	0	0	1	0	0	0	623
	52	72	81	87	91	93	95	96	97	98	98	99	99	99	99	100	100	100	100	100	100	100	0	0	0	
NW	274	100	45	22	12	6	3	2	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	467
	59	80	90	94	97	98	99	99	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NNW	158	33	16	9	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	219
	72	87	95	99	99	99	99	99	100	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	2776	875	361	204	119	63	41	22	27	12	8	5	5	4	1	2	1	2	1	1	0	1	0	0	0	4531

TABLE 2.3-21

WIND DIRECTION PERSISTENCE SUMMARY AT SEABROOK (209-FOOT LEVEL)
APR. '79 - MAR. '80

WIND DIRECTION PERSISTENCE SUMMARY - NUMBER OF OBSERVATIONS AND PERCENT PROBABILITY

DIRECTION PERSISTENCE (HOURS)

DIRECTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	GT.24	TOTAL
N	133	25	24	11	5	0	5	1	2	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	209
	64	76	87	92	95	95	97	98	99	99	99	99	99	99	99	100	100	0	0	0	0	0	0	0	0	
NNE	137	37	17	8	7	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	213
	64	82	90	93	97	98	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NE	95	28	15	10	7	7	1	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	167
	57	74	83	89	93	97	98	98	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ENE	84	31	10	11	6	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	144
	58	80	87	94	99	99	99	99	99	99	99	99	99	99	99	100	0	0	0	0	0	0	0	0	0	
E	93	36	10	6	1	2	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	152
	61	85	91	95	96	97	99	99	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ESE	103	33	15	7	4	2	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	168
	61	81	90	94	96	98	99	99	99	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SE	93	50	25	12	5	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	190
	49	75	88	95	97	98	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SSE	116	49	28	9	8	1	2	2	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	218
	53	76	89	93	96	97	98	99	100	100	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0	
S	131	52	29	11	1	4	2	1	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	235
	56	78	90	95	95	97	98	98	98	99	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	
SSW	170	66	30	14	11	8	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	303
	56	78	88	92	96	99	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SW	154	64	41	18	13	8	5	2	4	2	4	1	0	0	0	0	0	0	1	0	0	0	0	0	1 *	318
	48	69	81	87	91	94	95	96	97	98	99	99	99	99	99	99	99	99	100	100	100	100	100	100	100	
WSW	166	49	36	20	13	3	1	6	3	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	301
	55	71	83	90	94	95	96	98	99	99	99	99	99	100	0	0	0	0	0	0	0	0	0	0	0	
W	174	70	42	28	11	10	5	3	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	346
	50	71	83	91	94	97	98	99	99	99	99	99	99	100	100	100	100	0	0	0	0	0	0	0	0	
WNW	207	104	33	30	12	14	12	7	10	4	4	1	2	1	2	4	0	0	1	0	0	0	0	1	0	449
	46	69	77	83	86	89	92	93	96	96	97	98	98	98	99	100	100	100	100	100	100	100	100	100	0	
NW	189	79	48	30	14	9	9	5	4	3	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	393
	48	68	80	88	92	94	96	97	98	99	100	100	100	100	100	0	0	0	0	0	0	0	0	0	0	
NNW	118	48	22	7	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	202
	58	82	93	97	98	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	2163	821	425	232	121	76	53	33	30	14	14	4	3	4	3	6	2	0	2	0	0	0	0	1	1	4008

* THIS OCCURANCE LASTED 29 HOURS

TABLE 2.3-22

ANNUAL LONG-TERM WIND ROSE DATA FOR BOSTON
JAN. '68 - DEC. '77

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	268	268
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.31	.31
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.31	.31
C-3	283	233	193	221	310	260	260	185	346	144	141	182	197	132	124	127	0	3338
(1)	.32	.27	.22	.25	.36	.30	.30	.21	.40	.17	.16	.21	.23	.15	.14	.15	0.00	3.83
(2)	.32	.27	.22	.25	.36	.30	.30	.21	.40	.17	.16	.21	.23	.15	.14	.15	0.00	3.83
4-7	1282	631	496	621	899	800	901	678	1546	669	726	1063	923	765	835	604	0	13439
(1)	1.47	.72	.57	.71	1.03	.92	1.03	.78	1.78	.77	.83	1.22	1.06	.88	.96	.69	0.00	15.43
(2)	1.47	.72	.57	.71	1.03	.92	1.03	.78	1.78	.77	.83	1.22	1.06	.88	.96	.69	0.00	15.43
8-12	2454	718	834	1048	2038	1716	1339	751	2406	1718	1740	3156	2750	2904	2844	1937	0	30353
(1)	2.82	.82	.96	1.20	2.34	1.97	1.54	.86	2.76	1.97	2.00	3.62	3.16	3.33	3.27	2.22	0.00	34.86
(2)	2.82	.82	.96	1.20	2.34	1.97	1.54	.86	2.76	1.97	2.00	3.62	3.16	3.33	3.27	2.22	0.00	34.86
13-18	1704	562	925	962	1799	1436	517	251	1329	2054	2158	3580	4319	4178	3355	1825	0	30954
(1)	1.96	.65	1.06	1.10	2.07	1.65	.59	.29	1.53	2.36	2.48	4.11	4.96	4.80	3.85	2.10	0.00	35.55
(2)	1.96	.65	1.06	1.10	2.07	1.65	.59	.29	1.53	2.36	2.48	4.11	4.96	4.80	3.85	2.10	0.00	35.55
19-24	288	145	286	238	252	201	34	37	200	407	442	545	1262	1282	749	243	0	6611
(1)	.33	.17	.33	.27	.29	.23	.04	.04	.23	.47	.51	.63	1.45	1.47	.86	.28	0.00	7.59
(2)	.33	.17	.33	.27	.29	.23	.04	.04	.23	.47	.51	.63	1.45	1.47	.86	.28	0.00	7.59
GT 24	77	67	131	106	149	57	19	13	78	77	96	136	504	408	171	29	0	2118
(1)	.09	.08	.15	.12	.17	.07	.02	.01	.09	.09	.11	.16	.58	.47	.20	.03	0.00	2.43
(2)	.09	.08	.15	.12	.17	.07	.02	.01	.09	.09	.11	.16	.58	.47	.20	.03	0.00	2.43
ALL SPEEDS	6088	2356	2865	3196	5447	4470	3070	1915	5905	5069	5303	8662	9955	9669	8078	4765	268	87081
(1)	6.99	2.71	3.29	3.67	6.26	5.13	3.53	2.20	6.78	5.82	6.09	9.95	11.43	11.10	9.28	5.47	.31	100.00
(2)	6.99	2.71	3.29	3.67	6.26	5.13	3.53	2.20	6.78	5.82	6.09	9.95	11.43	11.10	9.28	5.47	.31	100.00

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .50 MPH)

TABLE 2.3-23

ANNUAL LONG-TERM WIND ROSE DATA FOR PORTLAND
JAN. '68 - DEC. '77

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4707	4707
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.42	5.42
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.42	5.42
C-3	1080	342	306	222	330	264	306	249	561	336	537	699	1125	750	783	903	0	8793
(1)	1.24	.39	.35	.26	.38	.30	.35	.29	.65	.39	.62	.80	1.29	.86	.90	1.04	0.00	10.12
(2)	1.24	.39	.35	.26	.38	.30	.35	.29	.65	.39	.62	.80	1.29	.86	.90	1.04	0.00	10.12
4-7	3171	1143	1026	882	1083	1182	708	726	1953	1287	1743	2367	3111	2121	1992	2451	0	26946
(1)	3.65	1.32	1.18	1.01	1.25	1.36	.81	.84	2.25	1.48	2.01	2.72	3.58	2.44	2.29	2.82	0.00	31.00
(2)	3.65	1.32	1.18	1.01	1.25	1.36	.81	.84	2.25	1.48	2.01	2.72	3.58	2.44	2.29	2.82	0.00	31.00
8-12	2790	1527	1065	876	1224	1290	555	828	3597	1866	1818	1629	2694	1725	1638	1806	0	26928
(1)	3.21	1.76	1.23	1.01	1.41	1.48	.64	.95	4.14	2.15	2.09	1.87	3.10	1.98	1.88	2.08	0.00	30.98
(2)	3.21	1.76	1.23	1.01	1.41	1.48	.64	.95	4.14	2.15	2.09	1.87	3.10	1.98	1.88	2.08	0.00	30.98
13-18	1641	807	465	465	483	279	153	396	2478	1302	717	960	2079	1086	1452	1671	0	16434
(1)	1.89	.93	.54	.54	.56	.32	.18	.46	2.85	1.50	.82	1.10	2.39	1.25	1.67	1.92	0.00	18.91
(2)	1.89	.93	.54	.54	.56	.32	.18	.46	2.85	1.50	.82	1.10	2.39	1.25	1.67	1.92	0.00	18.91
19-24	177	66	36	42	84	36	45	51	222	156	42	111	417	270	297	309	0	2361
(1)	.20	.08	.04	.05	.10	.04	.05	.06	.26	.18	.05	.13	.48	.31	.34	.36	0.00	2.72
(2)	.20	.08	.04	.05	.10	.04	.05	.06	.26	.18	.05	.13	.48	.31	.34	.36	0.00	2.72
GT 24	27	9	6	21	45	3	6	24	42	24	18	36	237	81	75	90	0	744
(1)	.03	.01	.01	.02	.05	.00	.01	.03	.05	.03	.02	.04	.27	.09	.09	.10	0.00	.86
(2)	.03	.01	.01	.02	.05	.00	.01	.03	.05	.03	.02	.04	.27	.09	.09	.10	0.00	.86
ALL SPEEDS	8886	3894	2904	2508	3249	3054	1773	2274	8853	4971	4875	5802	9663	6033	6237	7230	4707	86913
(1)	10.22	4.48	3.34	2.89	3.74	3.51	2.04	2.62	10.19	5.72	5.61	6.68	11.12	6.94	7.18	8.32	5.42	100.00
(2)	10.22	4.48	3.34	2.89	3.74	3.51	2.04	2.62	10.19	5.72	5.61	6.68	11.12	6.94	7.18	8.32	5.42	100.00

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .50 MPH)

TABLE 2.3-24

FREQUENCY OF PASQUILL STABILITY CLASSES AT SEABROOK
(Values in % of Time)

Month	Pasquill Stability Class A	B	C	D	E	F	G
a. 43'-150' Delta Temperature							
Apr 1979	5.99	7.16	4.68	47.08	20.32	8.48	6.29
May	7.67	11.58	7.67	45.41	15.79	5.11	6.77
Jun	8.27	9.40	7.29	43.34	20.06	5.05	6.59
Jul	14.52	15.21	7.19	30.01	18.12	9.54	5.39
Aug	10.98	15.45	6.10	36.99	18.97	6.64	4.88
Sep	5.84	13.07	5.70	28.51	25.17	10.99	10.71
Oct	4.44	6.86	5.65	39.84	27.05	8.48	7.67
Nov	1.27	4.23	4.23	42.11	31.27	9.30	7.61
Dec	0.41	2.84	3.65	46.28	38.16	5.41	3.25
Jan 1980	1.08	6.90	4.19	50.07	29.63	4.87	3.25
Feb	2.06	8.37	5.58	49.19	28.34	4.41	2.06
Mar	15.62	7.81	4.66	40.55	17.26	4.93	9.18
Yearly	6.52	9.06	5.53	41.54	24.25	6.94	6.14
b. 43'-209' Delta Temperature							
Apr 1979	1.27	2.11	3.80	49.65	29.40	7.88	5.91
May	1.20	2.86	4.82	52.86	26.51	5.27	6.48
Jun	2.92	6.69	12.26	39.83	25.49	6.13	6.69
Jul	4.90	6.94	11.56	29.12	28.84	12.65	5.99
Aug	2.91	4.71	9.97	43.07	26.59	7.34	5.40
Sep	1.25	7.64	11.81	30.69	27.36	10.83	10.42
Oct	0.81	2.96	5.79	39.30	34.05	10.09	7.00
Nov	0.00	0.56	4.76	43.92	34.83	9.37	6.57
Dec	0.00	0.41	2.70	47.03	41.35	5.81	2.70
Jan 1980	0.13	1.88	6.59	51.88	30.38	5.78	3.36
Feb	0.44	2.03	5.37	50.36	34.69	5.66	1.45
Mar	10.68	1.64	5.34	43.15	24.66	6.03	8.49
Yearly	2.22	3.37	7.08	43.31	30.38	7.76	5.87

Period of Record: April 1979 - March 1980

TABLE 2.3-25

COMPARISON OF FREQUENCY OF PASQUILL STABILITY CLASSES AT SEABROOK, BOSTON, AND PORTLAND
(Values in % of Time)

	Seabrook			
Stability Class	43'-150' Delta Temp	43'-209' Delta Temp	Boston	Portland
A	6.52	2.22	0.14	0.19
B	9.06	3.37	2.78	3.90
C	5.53	7.08	9.11	11.79
D	41.54	43.31	70.43	56.09
E	24.25	30.38	11.47	9.69
F	6.94	7.76	4.90	11.78
G	6.14	5.87	1.17	6.55
Period of Record:	Apr 1979-Mar 1980	Apr 1979-Mar 1980	Jan 68-Dec 77	Jan 68-Dec 77
References:	on-site program	on-site program	(7)	(8)

TABLE 2.3-26
(Sheet 1 of 7)

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED, WIND DIRECTION
AND PASQUILL STABILITY CLASS FOR SEABROOK (43-FOOT LEVEL)
APR. '79 - MAR. '80

STABILITY CLASS A - CLASS FREQUENCY (PERCENT) = 6.52

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	0	1	0	1	4	1	0	0	2	1	1	3	3	2	1	0	0	20
(1)	0.00	.18	0.00	.18	.71	.18	0.00	0.00	.36	.18	.18	.54	.54	.36	.18	0.00	0.00	3.57
(2)	0.00	.01	0.00	.01	.05	.01	0.00	0.00	.02	.01	.01	.03	.03	.02	.01	0.00	0.00	.23
4-7	3	6	4	17	15	15	26	3	2	3	4	6	8	12	10	7	0	141
(1)	.54	1.07	.71	3.04	2.68	2.68	4.64	.54	.36	.54	.71	1.07	1.43	2.14	1.79	1.25	0.00	25.18
(2)	.03	.07	.05	.20	.17	.17	.30	.03	.02	.03	.05	.07	.09	.14	.12	.06	0.00	1.64
8-12	7	11	17	18	18	14	61	14	2	14	20	18	22	28	23	6	0	293
(1)	1.25	1.96	3.04	3.21	3.21	2.50	10.89	2.50	.36	2.50	3.57	3.21	3.93	5.00	4.11	1.07	0.00	52.32
(2)	.08	.13	.20	.21	.21	.16	.71	.16	.02	.16	.23	.21	.26	.33	.27	.07	0.00	3.41
13-18	0	0	15	1	0	3	2	0	1	8	4	5	8	31	10	1	0	89
(1)	0.00	0.00	2.68	.18	0.00	.54	.36	0.00	.18	1.43	.71	.89	1.43	5.54	1.79	.18	0.00	15.89
(2)	0.00	0.00	.17	.01	0.00	.03	.02	0.00	.01	.09	.05	.06	.09	.36	.12	.01	0.00	1.04
19-24	0	0	0	0	1	0	0	0	0	0	0	0	1	10	3	0	0	15
(1)	0.00	0.00	0.00	0.00	.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.18	1.79	.54	0.00	0.00	2.68
(2)	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	.12	.03	0.00	0.00	.17
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.18	.18	0.00	0.00	0.00	.36
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	.01	0.00	0.00	0.00	.02
ALL SPEEDS	10	18	36	37	38	33	89	17	7	26	29	32	43	84	47	14	0	560
(1)	1.79	3.21	6.43	6.61	6.79	5.89	15.89	3.04	1.25	4.64	5.18	5.71	7.68	15.00	8.39	2.50	0.00	100.00
(2)	.12	.21	.42	.43	.44	.38	1.04	.20	.08	.30	.34	.37	.50	.98	.55	.16	0.00	6.52

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2.3-26
(Sheet 2 of 7)

STABILITY CLASS B - CLASS FREQUENCY (PERCENT) = 9.06

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	1	2	2	3	2	0	1	1	0	3	1	0	3	2	2	1	0	24
(1)	.13	.26	.26	.39	.26	0.00	.13	.13	0.00	.39	.13	0.00	.39	.26	.26	.13	0.00	3.08
(2)	.01	.02	.02	.03	.02	0.00	.01	.01	0.00	.03	.01	0.00	.03	.02	.02	.01	0.00	.28
4-7	12	8	4	19	20	25	32	8	0	5	13	9	18	18	27	9	0	227
(1)	1.54	1.03	.51	2.44	2.57	3.21	4.11	1.03	0.00	.64	1.67	1.16	2.31	2.31	3.47	1.16	0.00	29.18
(2)	.14	.09	.05	.22	.23	.29	.37	.09	0.00	.06	.15	.10	.21	.21	.31	.10	0.00	2.64
8-12	17	7	19	18	33	28	20	15	6	18	25	30	29	60	33	8	0	366
(1)	2.19	.90	2.44	2.31	4.24	3.60	2.57	1.93	.77	2.31	3.21	3.86	3.73	7.71	4.24	1.03	0.00	47.04
(2)	.20	.08	.22	.21	.38	.33	.23	.17	.07	.21	.29	.35	.34	.70	.38	.09	0.00	4.26
13-18	0	0	13	5	1	2	0	0	2	4	8	3	20	57	22	0	0	137
(1)	0.00	0.00	1.67	.64	.13	.26	0.00	0.00	.26	.51	1.03	.39	2.57	7.33	2.83	0.00	0.00	17.61
(2)	0.00	0.00	.15	.06	.01	.02	0.00	0.00	.02	.05	.09	.03	.23	.66	.26	0.00	0.00	1.60
19-24	0	0	1	0	0	0	0	0	0	0	0	0	3	17	2	0	0-	23
(1)	0.00	0.00	.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.39	2.19	.26	0.00	0.00	2.96
(2)	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.03	.20	.02	0.00	0.00	.27
GT 24	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(1)	0.00	0.00	.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.13
(2)	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01
ALL SPEEDS	30	17	40	45	56	55	53	24	8	30	47	42	73	154	86	18	0	778
(1)	3.86	2.19	5.14	5.78	7.20	7.07	6.81	3.08	1.03	3.86	6.04	5.40	9.38	19.79	11.05	2.31	0.00	100.00
(2)	.35	.20	.47	.52	.65	.64	.62	.28	.09	.35	.55	.49	.85	1.79	1.00	.21	0.00	9.06

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2.3-26
(Sheet 3 of 7)

STABILITY CLASS C - CLASS FREQUENCY (PERCENT) = 5.53

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	2	1	0	2	2	1	0	0	1	1	1	0	0	5	2	4	0	22
(1)	.42	.21	0.00	.42	.42	.21	0.00	0.00	.21	.21	.21	0.00	0.00	1.05	.42	.84	0.00	4.63
(2)	.02	.01	0.00	.02	.02	.01	0.00	0.00	.01	.01	.01	0.00	0.00	.06	.02	.05	0.00	.26
4-7	10	2	6	5	21	20	15	9	8	10	5	1	10	16	12	5	0	155
(1)	2.11	.42	1.26	1.05	4.42	4.21	3.16	1.89	1.68	2.11	1.05	.21	2.11	3.37	2.53	1.05	0.00	32.63
(2)	.12	.02	.07	.06	.24	.23	.17	.10	.09	.12	.06	.01	.12	.19	.14	.06	0.00	1.81
8-12	4	4	15	8	18	19	11	5	7	12	20	13	19	30	18	7	0	210
(1)	.84	.84	3.16	1.68	3.79	4.00	2.32	1.05	1.47	2.53	4.21	2.74	4.00	6.32	3.79	1.47	0.00	44.21
(2)	.05	.05	.17	.09	.21	.22	.13	.06	.08	.14	.23	.15	.22	.35	.21	.08	0.00	2.45
13-18	0	0	9	0	1	0	0	1	1	5	5	3	8	24	12	0	0	69
(1)	0.00	0.00	1.89	0.00	.21	0.00	0.00	.21	.21	1.05	1.05	.63	1.68	5.05	2.53	0.00	0.00	14.53
(2)	0.00	0.00	.10	0.00	.01	0.00	0.00	.01	.01	.06	.06	.03	.09	.28	.14	0.00	0.00	.80
19-24	0	0	0	0	0	0	0	1	1	0	0	1	2	10	3	0	0	18
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.21	.21	0.00	0.00	.21	.42	2.11	.63	0.00	0.00	3.79
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	.01	0.00	0.00	.01	.02	.12	.03	0.00	0.00	.21
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.21	0.00	0.00	0.00	0.00	.21
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	.01
ALL SPEEDS	16	7	30	15	42	40	26	16	18	28	31	18	40	85	47	16	0	475
(1)	3.37	1.47	6.32	3.16	8.84	8.42	5.47	3.37	3.79	5.89	6.53	3.79	8.42	17.89	9.89	3.37	0.00	100.00
(2)	.19	.08	.35	.17	.49	.47	.30	.19	.21	.33	.36	.21	.47	.99	.55	.19	0.00	5.53

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2.3-26
(Sheet 4 of 7)

STABILITY CLASS D - CLASS FREQUENCY (PERCENT) = 41.54

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	27	22	17	33	23	25	13	27	24	13	11	14	26	36	30	33	0	374
(1)	.76	.62	.48	.93	.64	.70	.36	.76	.67	.36	.31	.39	.73	1.01	.84	.93	0.00	10.49
(2)	.31	.26	.20	.38	.27	.29	.15	.31	.28	.15	.13	.16	.30	.42	.35	.38	0.00	4.36
4-7	92	69	77	66	90	78	102	71	87	100	87	103	82	127	124	88	0	1443
(1)	2.58	1.93	2.16	1.85	2.52	2.19	2.86	1.99	2.44	2.80	2.44	2.89	2.30	3.56	3.48	2.47	0.00	40.47
(2)	1.07	.80	.90	.77	1.05	.91	1.19	.83	1.01	1.16	1.01	1.20	.96	1.48	1.44	1.03	0.00	16.81
8-12	67	33	71	34	54	65	34	45	65	101	144	75	92	232	119	41	0	1272
(1)	1.88	.93	1.99	.95	1.51	1.82	.95	1.26	1.82	2.83	4.04	2.10	2.58	6.51	3.34	1.15	0.00	35.67
(2)	.78	.38	.83	.40	.63	.76	.40	.52	.76	1.18	1.68	.87	1.07	2.70	1.39	.48	0.00	14.82
13-18	13	4	20	7	7	3	0	11	14	13	21	22	53	127	66	1	0	382
(1)	.36	.11	.56	.20	.20	.08	0.00	.31	.39	.36	.59	.62	1.49	3.56	1.85	.03	0.00	10.71
(2)	.15	.05	.23	.08	.08	.03	0.00	.13	.16	.15	.24	.26	.62	1.48	.77	.01	0.00	4.45
19-24	0	0	8	4	7	0	0	1	0	1	2	0	15	31	18	0	0	87
(1)	0.00	0.00	.22	.11	.20	0.00	0.00	.03	0.00	.03	.06	0.00	.42	.87	.50	0.00	0.00	2.44
(2)	0.00	0.00	.09	.05	.08	0.00	0.00	.01	0.00	.01	.02	0.00	.17	.36	.21	0.00	0.00	1.01
GT 24	0	0	2	5	0	0	0	0	0	0	0	0	0	0	1	0	0	8
(1)	0.00	0.00	.06	.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.03	0.00	0.00	.22
(2)	0.00	0.00	.02	.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	.09
ALL SPEEDS	199	128	195	149	181	171	149	155	190	228	265	214	268	553	358	163	0	3566
(1)	5.58	3.59	5.47	4.18	5.08	4.80	4.18	4.35	5.33	6.39	7.43	6.00	7.52	15.51	10.04	4.57	0.00	100.00
(2)	2.32	1.49	2.27	1.74	2.11	1.99	1.74	1.81	2.21	2.66	3.09	2.49	3.12	6.44	4.17	1.90	0.00	41.54

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2.3-26
(Sheet 5 of 7)

STABILITY CLASS E - CLASS FREQUENCY (PERCENT) = 24.25

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(1)	0.00	.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.05
(2)	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01
C-3	16	12	9	13	23	11	15	23	43	35	22	44	52	33	22	22	0	395
(1)	.77	.58	.43	.62	1.10	.53	.72	1.10	2.07	1.68	1.06	2.11	2.50	1.59	1.06	1.06	0.00	18.97
(2)	.19	.14	.10	.15	.27	.13	.17	.27	.50	.41	.26	.51	.61	.38	.26	.26	0.00	4.60
4-7	20	10	10	24	23	18	40	37	65	102	104	165	167	219	120	46	0	1170
(1)	.96	.48	.48	1.15	1.10	.86	1.92	1.78	3.12	4.90	5.00	7.93	8.02	10.52	5.76	2.21	0.00	56.20
(2)	.23	.12	.12	.28	.27	.21	.47	.43	.76	1.19	1.21	1.92	1.95	2.55	1.40	.54	0.00	13.63
8-12	10	6	1	2	4	8	5	14	13	24	86	94	66	87	21	5	0	446
(1)	.48	.29	.05	.10	.19	.38	.24	.67	.62	1.15	4.13	4.51	3.17	4.18	1.01	.24	0.00	21.42
(2)	.12	.07	.01	.02	.05	.09	.06	.16	.15	.28	1.00	1.10	.77	1.01	.24	.06	0.00	5.20
13-18	2	0	1	3	0	0	0	0	8	5	8	4	8	18	7	0	0	64
(1)	.10	0.00	.05	.14	0.00	0.00	0.00	0.00	.38	.24	.38	.19	.38	.86	.34	0.00	0.00	3.07
(2)	.02	0.00	.01	.03	0.00	0.00	0.00	0.00	.09	.06	.09	.05	.09	.21	.08	0.00	0.00	.75
19-24	0	0	0	0	1	0	0	0	1	0	0	0	0	4	0	0	0	6
(1)	0.00	0.00	0.00	0.00	.05	0.00	0.00	0.00	.05	0.00	0.00	0.00	0.00	.19	0.00	0.00	0.00	.29
(2)	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	.05	0.00	0.00	0.00	.07
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	48	29	21	42	51	37	60	74	130	166	220	307	293	361	170	73	0	2082
(1)	2.31	1.39	1.01	2.02	2.45	1.78	2.88	3.55	6.24	7.97	10.57	14.75	14.07	17.34	8.17	3.51	0.00	100.00
(2)	.56	.34	.24	.49	.59	.43	.70	.86	1.51	1.93	2.56	3.58	3.41	4.21	1.98	.85	0.00	24.25

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2.3-26
(Sheet 6 of 7)

STABILITY CLASS F - CLASS FREQUENCY (PERCENT) = 6.94

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	13	6	12	16	3	10	10	8	14	21	28	25	46	41	26	16	0	295
(1)	2.18	1.01	2.01	2.68	.50	1.68	1.68	1.34	2.35	3.52	4.70	4.19	7.72	6.88	4.36	2.68	0.00	49.50
(2)	.15	.07	.14	.19	.03	.12	.12	.09	.16	.24	.33	.29	.54	.48	.30	.19	0.00	3.44
4-7	2	1	2	1	4	1	12	4	6	18	21	46	40	88	39	9	0	294
(1)	.34	.17	.34	.17	.67	.17	2.01	.67	1.01	3.02	3.52	7.72	6.71	14.77	6.54	1.51	0.00	49.33
(2)	.02	.01	.02	.01	.05	.01	.14	.05	.07	.21	.24	.54	.47	1.03	.45	.10	0.00	3.42
8-12	0	0	0	0	0	0	0	1	0	0	1	2	1	1	1	0	0	7
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.17	0.00	0.00	.17	.34	.17	.17	.17	0.00	0.00	1.17
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	.01	.02	.01	.01	.01	0.00	0.00	.08
13-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	15	7	14	17	7	11	22	13	20	39	50	73	87	130	66	25	0	596
(1)	2.52	1.17	2.35	2.85	1.17	1.85	3.69	2.18	3.36	6.54	8.39	12.25	14.60	21.81	11.07	4.19	0.00	100.00
(2)	.17	.08	.16	.20	.08	.13	.26	.15	.23	.45	.58	.85	1.01	1.51	.77	.29	0.00	6.94

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2.3-26
(Sheet 7 of 7)

STABILITY CLASS G - CLASS FREQUENCY (PERCENT) = 6.14

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.19
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01
C-3	8	11	8	12	13	2	8	6	9	3	24	59	57	91	49	19	0	379
(1)	1.52	2.09	1.52	2.28	2.47	.38	1.52	1.14	1.71	.57	4.55	11.20	10.82	17.27	9.30	3.61	0.00	71.92
(2)	.09	.13	.09	.14	.15	.02	.09	.07	.10	.03	.28	.69	.66	1.06	.57	.22	0.00	4.42
4-7	2	1	1	1	0	1	4	3	2	1	1	16	21	63	27	3	0	147
(1)	.38	.19	.19	.19	0.00	.19	.76	.57	.38	.19	.19	3.04	3.98	11.95	5.12	.57	0.00	27.89
(2)	.02	.01	.01	.01	0.00	.01	.05	.03	.02	.01	.01	.19	.24	.73	.31	.03	0.00	1.71
8-12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	10	12	9	13	13	3	12	9	11	5	25	75	78	154	76	22	0	527
(1)	1.90	2.28	1.71	2.47	2.47	.57	2.28	1.71	2.09	.95	4.74	14.23	14.80	29.22	14.42	4.17	0.00	100.00
(2)	.12	.14	.10	.15	.15	.03	.14	.10	.13	.06	.29	.87	.91	1.79	.89	.26	0.00	6.14

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2.3-27
(Sheet 1 of 7)

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED, WIND DIRECTION
AND PASQUILL STABILITY CLASS FOR SEABROOK (209-FOOT LEVEL)
APR. '79 - MAR. '80

STABILITY CLASS A - CLASS FREQUENCY (PERCENT) = 2.22

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	2
(1)	0.00	0.00	0.00	0.00	0.00	.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.52	0.00	0.00	0.00	1.04
(2)	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	.02
4-7	0	1	0	3	3	1	6	1	0	1	0	0	1	0	0	0	0	17
(1)	0.00	.52	0.00	1.56	1.56	.52	3.13	.52	0.00	.52	0.00	0.00	.52	0.00	0.00	0.00	0.00	8.85
(2)	0.00	.01	0.00	.03	.03	.01	.07	.01	0.00	.01	0.00	0.00	.01	0.00	0.00	0.00	0.00	.20
8-12	3	3	1	4	6	5	14	2	0	3	1	2	5	3	7	2	0	61
(1)	1.56	1.56	.52	2.08	3.13	2.60	7.29	1.04	0.00	1.56	.52	1.04	2.60	1.56	3.65	1.04	0.00	31.77
(2)	.03	.03	.01	.05	.07	.06	.16	.02	0.00	.03	.01	.02	.06	.03	.08	.02	0.00	.71
13-18	1	2	1	0	2	0	25	13	1	2	3	2	7	17	8	0	0	84
(1)	.52	1.04	.52	0.00	1.04	0.00	13.02	6.77	.52	1.04	1.56	1.04	3.65	8.85	4.17	0.00	0.00	43.75
(2)	.01	.02	.01	0.00	.02	0.00	.29	.15	.01	.02	.03	.02	.08	.20	.09	0.00	0.00	.97
19-24	0	0	0	0	0	0	0	2	0	0	1	0	1	9	2	0	0	15
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.04	0.00	0.00	.52	0.00	.52	4.69	1.04	0.00	0.00	7.81
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.02	0.00	0.00	.01	0.00	.01	.10	.02	0.00	0.00	.17
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	1	12	0	0	0	13
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.52	6.25	0.00	0.00	0.00	6.77
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	.14	0.00	0.00	0.00	.15
ALL SPEEDS	4	6	2	7	11	7	45	18	1	6	5	4	15	42	17	2	0	192
(1)	2.08	3.13	1.04	3.65	5.73	3.65	23.44	9.37	.52	3.13	2.60	2.08	7.81	21.88	8.85	1.04	0.00	100.00
(2)	.05	.07	.02	.08	.13	.08	.52	.21	.01	.07	.06	.05	.17	.49	.20	.02	0.00	2.22

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2.3-27
(Sheet 2 of 7)

STABILITY CLASS B - CLASS FREQUENCY (PERCENT) = 3.37

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	3
(1)	0.00	0.00	0.00	0.00	0.00	0.00	.34	0.00	.34	0.00	0.00	.34	0.00	0.00	0.00	0.00	0.00	1.03
(2)	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	.01	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	.03
4-7	0	0	1	5	1	2	6	0	0	1	1	1	5	3	3	2	0	31
(1)	0.00	0.00	.34	1.72	.34	.69	2.06	0.00	0.00	.34	.34	.34	1.72	1.03	1.03	.69	0.00	10.65
(2)	0.00	0.00	.01	.06	.01	.02	.07	0.00	0.00	.01	.01	.01	.06	.03	.03	.02	0.00	.36
8-12	1	1	1	12	9	13	25	10	1	2	10	10	8	8	7	5	0	123
(1)	.34	.34	.34	4.12	3.09	4.47	8.59	3.44	.34	.69	3.44	3.44	2.75	2.75	2.41	1.72	0.00	42.27
(2)	.01	.01	.01	.14	.10	.15	.29	.12	.01	.02	.12	.12	.09	.09	.08	.06	0.00	1.43
13-18	1	4	4	2	0	1	6	12	2	7	10	10	13	19	15	2	0	108
(1)	.34	1.37	1.37	.69	0.00	.34	2.06	4.12	.69	2.41	3.44	3.44	4.47	6.53	5.15	.69	0.00	37.11
(2)	.01	.05	.05	.02	0.00	.01	.07	.14	.02	.08	.12	.12	.15	.22	.17	.02	0.00	1.25
19-24	0	0	0	0	0	0	2	0	0	0	2	3	2	10	2	0	0	21
(1)	0.00	0.00	0.00	0.00	0.00	0.00	.69	0.00	0.00	0.00	.69	1.03	.69	3.44	.69	0.00	0.00	7.22
(2)	0.00	0.00	0.00	0.00	0.00	0.00	.02	0.00	0.00	0.00	.02	.03	.02	.12	.02	0.00	0.00	.24
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	5
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.03	.69	0.00	0.00	1.72
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.03	.02	0.00	0.00	.06
ALL SPEEDS	2	5	6	19	10	16	40	22	4	10	23	25	28	43	29	9	0	291
(1)	.69	1.72	2.06	6.53	3.44	5.50	13.75	7.56	1.37	3.44	7.90	8.59	9.62	14.78	9.97	3.09	0.00	100.00
(2)	.02	.06	.07	.22	.12	.19	.46	.25	.05	.12	.27	.29	.32	.50	.34	.10	0.00	3.37

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2.3-27
(Sheet 3 of 7)

STABILITY CLASS C - CLASS FREQUENCY (PERCENT) = 7.08

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	0	0	5	4	1	0	0	0	1	0	0	3	0	0	0	0	0	14
(1)	0.00	0.00	.82	.65	.16	0.00	0.00	0.00	.16	0.00	0.00	.49	0.00	0.00	0.00	0.00	0.00	2.29
(2)	0.00	0.00	.06	.05	.01	0.00	0.00	0.00	.01	0.00	0.00	.03	0.00	0.00	0.00	0.00	0.00	.16
4-7	3	2	2	5	6	20	10	5	4	1	5	1	10	7	18	8	0	107
(1)	.49	.33	.33	.82	.98	3.27	1.64	.82	.65	.16	.82	.16	1.64	1.15	2.95	1.31	0.00	17.51
(2)	.03	.02	.02	.06	.07	.23	.12	.06	.05	.01	.06	.01	.12	.08	.21	.09	0.00	1.24
8-12	10	4	3	8	16	26	28	15	3	13	14	15	18	19	23	8	0	223
(1)	1.64	.65	.49	1.31	2.62	4.26	4.58	2.45	.49	2.13	2.29	2.45	2.95	3.11	3.76	1.31	0.00	36.50
(2)	.12	.05	.03	.09	.19	.30	.32	.17	.03	.15	.16	.17	.21	.22	.27	.09	0.00	2.58
13-18	4	1	6	5	3	1	2	13	1	5	19	14	29	48	33	0	0	184
(1)	.65	.16	.98	.82	.49	.16	.33	2.13	.16	.82	3.11	2.29	4.75	7.86	5.40	0.00	0.00	30.11
(2)	.05	.01	.07	.06	.03	.01	.02	.15	.01	.06	.22	.16	.34	.56	.38	0.00	0.00	2.13
19-24	0	1	4	0	0	0	0	0	1	1	1	3	5	30	12	0	0	58
(1)	0.00	.16	.65	0.00	0.00	0.00	0.00	0.00	.16	.16	.16	.49	.82	4.91	1.96	0.00	0.00	9.49
(2)	0.00	.01	.05	0.00	0.00	0.00	0.00	0.00	.01	.01	.01	.03	.06	.35	.14	0.00	0.00	.67
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	5	17	3	0	0	25
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.82	2.78	.49	0.00	0.00	4.09
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.06	.20	.03	0.00	0.00	.29
ALL SPEEDS	17	8	20	22	26	47	40	33	10	20	39	36	67	121	89	16	0	611
(1)	2.78	1.31	3.27	3.60	4.26	7.69	6.55	5.40	1.64	3.27	6.38	5.89	10.97	19.80	14.57	2.62	0.00	100.00
(2)	.20	.09	.23	.25	.30	.54	.46	.38	.12	.23	.45	.42	.78	1.40	1.03	.19	0.00	7.08

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2.3-27
(Sheet 4 of 7)

STABILITY CLASS D - CLASS FREQUENCY (PERCENT) = 43.31

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	5	8	7	10	13	10	5	4	10	14	6	5	6	5	7	10	0	125
(1)	.13	.21	.19	.27	.35	.27	.13	.11	.27	.37	.16	.13	.16	.13	.19	.27	0.00	3.34
(2)	.06	.09	.08	.12	.15	.12	.06	.05	.12	.16	.07	.06	.07	.06	.08	.12	0.00	1.45
4-7	53	56	35	47	47	48	54	40	26	22	35	26	37	47	48	49	0	670
(1)	1.42	1.50	.94	1.26	1.26	1.28	1.44	1.07	.70	.59	.94	.70	.99	1.26	1.28	1.31	0.00	17.92
(2)	.61	.65	.41	.54	.54	.56	.63	.46	.30	.25	.41	.30	.43	.54	.56	.57	0.00	7.76
8-12	101	82	68	53	46	83	59	73	86	107	139	78	78	121	128	70	0	1372
(1)	2.70	2.19	1.82	1.42	1.23	2.22	1.58	1.95	2.30	2.86	3.72	2.09	2.09	3.24	3.42	1.87	0.00	36.70
(2)	1.17	.95	.79	.61	.53	.96	.68	.85	1.00	1.24	1.61	.90	.90	1.40	1.48	.81	0.00	15.90
13-18	52	46	66	14	15	16	10	37	33	76	120	75	99	251	121	18	0	1049
(1)	1.39	1.23	1.77	.37	.40	.43	.27	.99	.88	2.03	3.21	2.01	2.65	6.71	3.24	.48	0.00	28.06
(2)	.60	.53	.76	.16	.17	.19	.12	.43	.38	.88	1.39	.87	1.15	2.91	1.40	.21	0.00	12.15
19-24	23	19	24	5	9	4	5	13	11	10	15	18	54	113	56	0	0	379
(1)	.62	.51	.64	.13	.24	.11	.13	.35	.29	.27	.40	.48	1.44	3.02	1.50	0.00	0.00	10.14
(2)	.27	.22	.28	.06	.10	.05	.06	.15	.13	.12	.17	.21	.63	1.31	.65	0.00	0.00	4.39
GT 24	0	3	9	7	6	0	1	5	3	3	5	3	27	44	27	0	0	143
(1)	0.00	.08	.24	.19	.16	0.00	.03	.13	.08	.08	.13	.08	.72	1.18	.72	0.00	0.00	3.83
(2)	0.00	.03	.10	.08	.07	0.00	.01	.06	.03	.03	.06	.03	.31	.51	.31	0.00	0.00	1.66
ALL SPEEDS	234	214	209	136	136	161	134	172	169	232	320	205	301	581	387	147	0	3738
(1)	6.26	5.72	5.59	3.64	3.64	4.31	3.58	4.60	4.52	6.21	8.56	5.48	8.05	15.54	10.35	3.93	0.00	100.00
(2)	2.71	2.48	2.42	1.58	1.58	1.87	1.55	1.99	1.96	2.69	3.71	2.38	3.49	6.73	4.48	1.70	0.00	43.31

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2.3-27
(Sheet 5 of 7)

STABILITY CLASS E - CLASS FREQUENCY (PERCENT) = 30.38

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	3
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.04	.04	0.00	0.00	0.00	0.00	0.00	0.00	.04	0.00	.11
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	.01	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	.03
C-3	5	6	9	9	9	10	12	6	8	5	7	6	4	6	9	6	0	117
(1)	.19	.23	.34	.34	.34	.38	.46	.23	.31	.19	.27	.23	.15	.23	.34	.23	0.00	4.46
(2)	.06	.07	.10	.10	.10	.12	.14	.07	.09	.06	.08	.07	.05	.07	.10	.07	0.00	1.36
4-7	25	24	22	26	30	33	29	29	33	42	32	16	22	31	31	15	0	440
(1)	.95	.92	.84	.99	1.14	1.26	1.11	1.11	1.26	1.60	1.22	.61	.84	1.18	1.18	.57	0.00	16.78
(2)	.29	.28	.25	.30	.35	.38	.34	.34	.38	.49	.37	.19	.25	.36	.36	.17	0.00	5.10
8-12	40	41	32	18	24	16	31	64	83	115	137	114	104	145	141	57	0	1162
(1)	1.53	1.56	1.22	.69	.92	.61	1.18	2.44	3.17	4.39	5.23	4.35	3.97	5.53	5.38	2.17	0.00	44.32
(2)	.46	.48	.37	.21	.28	.19	.36	.74	.96	1.33	1.59	1.32	1.20	1.68	1.63	.66	0.00	13.46
13-18	26	23	8	3	2	8	17	32	40	37	112	141	116	140	76	13	0	794
(1)	.99	.88	.31	.11	.08	.31	.65	1.22	1.53	1.41	4.27	5.38	4.42	5.34	2.90	.50	0.00	30.28
(2)	.30	.27	.09	.03	.02	.09	.20	.37	.46	.43	1.30	1.63	1.34	1.62	.88	.15	0.00	9.20
19-24	2	2	2	3	0	0	5	19	6	6	6	8	8	19	7	0	0	93
(1)	.08	.08	.08	.11	0.00	0.00	.19	.72	.23	.23	.23	.31	.31	.72	.27	0.00	0.00	3.55
(2)	.02	.02	.02	.03	0.00	0.00	.06	.22	.07	.07	.07	.09	.09	.22	.08	0.00	0.00	1.08
GT 24	0	0	2	1	0	0	0	1	0	0	0	0	3	4	2	0	0	13
(1)	0.00	0.00	.08	.04	0.00	0.00	0.00	.04	0.00	0.00	0.00	0.00	.11	.15	.08	0.00	0.00	.50
(2)	0.00	0.00	.02	.01	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	.03	.05	.02	0.00	0.00	.15
ALL SPEEDS	98	96	75	60	65	67	94	152	171	205	294	285	257	345	266	92	0	2622
(1)	3.74	3.66	2.86	2.29	2.48	2.56	3.59	5.80	6.52	7.82	11.21	10.87	9.80	13.16	10.14	3.51	0.00	100.00
(2)	1.14	1.11	.87	.70	.75	.78	1.09	1.76	1.98	2.38	3.41	3.30	2.98	4.00	3.08	1.07	0.00	30.38

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2.3-27
(Sheet 6 of 7)

STABILITY CLASS F - CLASS FREQUENCY (PERCENT) = 7.76

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.15	0.00	0.00	0.00	0.00	0.00	.15
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	.01
C-3	5	2	6	6	5	3	6	4	3	2	8	4	2	2	1	0	0	59
(1)	.75	.30	.90	.90	.75	.45	.90	.60	.45	.30	1.19	.60	.30	.30	.15	0.00	0.00	8.81
(2)	.06	.02	.07	.07	.06	.03	.07	.05	.03	.02	.09	.05	.02	.02	.01	0.00	0.00	.68
4-7	11	11	8	8	3	5	5	13	26	17	14	11	8	13	10	11	0	174
(1)	1.64	1.64	1.19	1.19	.45	.75	.75	1.94	3.88	2.54	2.09	1.64	1.19	1.94	1.49	1.64	0.00	25.97
(2)	.13	.13	.09	.09	.03	.06	.06	.15	.30	.20	.16	.13	.09	.15	.12	.13	0.00	2.02
8-12	13	5	6	4	0	0	1	10	32	33	27	23	30	42	37	21	0	284
(1)	1.94	.75	.90	.60	0.00	0.00	.15	1.49	4.78	4.93	4.03	3.43	4.48	6.27	5.52	3.13	0.00	42.39
(2)	.15	.06	.07	.05	0.00	0.00	.01	.12	.37	.38	.31	.27	.35	.49	.43	.24	0.00	3.29
13-18	3	3	0	0	0	0	0	2	8	12	15	22	18	23	39	7	0	152
(1)	.45	.45	0.00	0.00	0.00	0.00	0.00	.30	1.19	1.79	2.24	3.28	2.69	3.43	5.82	1.04	0.00	22.69
(2)	.03	.03	0.00	0.00	0.00	0.00	0.00	.02	.09	.14	.17	.25	.21	.27	.45	.06	0.00	1.76
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	32	21	20	18	8	8	12	29	69	64	64	61	58	80	87	39	0	670
(1)	4.78	3.13	2.99	2.69	1.19	1.19	1.79	4.33	10.30	9.55	9.55	9.10	8.66	11.94	12.99	5.82	0.00	100.00
(2)	.37	.24	.23	.21	.09	.09	.14	.34	.80	.74	.74	.71	.67	.93	1.01	.45	0.00	7.76

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2.3-27
(Sheet 7 of 7)

STABILITY CLASS G - CLASS FREQUENCY (PERCENT) = 5.87

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.20	0.00	.20
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	.01
C-3	3	7	4	3	2	2	4	2	3	3	5	7	3	4	4	6	0	62
(1)	.59	1.38	.79	.59	.39	.39	.79	.39	.59	.59	.99	1.38	.59	.79	.79	1.18	0.00	12.23
(2)	.03	.08	.05	.03	.02	.02	.05	.02	.03	.03	.06	.08	.03	.05	.05	.07	0.00	.72
4-7	12	7	10	7	5	0	1	8	14	19	13	21	12	12	11	7	0	159
(1)	2.37	1.38	1.97	1.38	.99	0.00	.20	1.58	2.76	3.75	2.56	4.14	2.37	2.37	2.17	1.38	0.00	31.36
(2)	.14	.08	.12	.08	.06	0.00	.01	.09	.16	.22	.15	.24	.14	.14	.13	.08	0.00	1.84
8-12	18	6	9	0	1	0	1	3	17	18	28	14	19	30	29	17	0	210
(1)	3.55	1.18	1.78	0.00	.20	0.00	.20	.59	3.35	3.55	5.52	2.76	3.75	5.92	5.72	3.35	0.00	41.42
(2)	.21	.07	.10	0.00	.01	0.00	.01	.03	.20	.21	.32	.16	.22	.35	.34	.20	0.00	2.43
13-18	2	3	0	0	0	0	0	2	2	2	9	5	4	21	18	7	0	75
(1)	.39	.59	0.00	0.00	0.00	0.00	0.00	.39	.39	.39	1.78	.99	.79	4.14	3.55	1.38	0.00	14.79
(2)	.02	.03	0.00	0.00	0.00	0.00	0.00	.02	.02	.02	.10	.06	.05	.24	.21	.08	0.00	.87
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	35	23	23	10	8	2	6	15	36	42	55	47	38	67	62	38	0	507
(1)	6.90	4.54	4.54	1.97	1.58	.39	1.18	2.96	7.10	8.28	10.85	9.27	7.50	13.21	12.23	7.50	0.00	100.00
(2)	.41	.27	.27	.12	.09	.02	.07	.17	.42	.49	.64	.54	.44	.78	.72	.44	0.00	5.87

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2.3-28
(Sheet 1 of 7)

LONG-TERM JOINT FREQUENCY DISTRIBUTION OF WIND SPEED,
WIND DIRECTION AND PASQUILL STABILITY CLASS FOR BOSTON (10-FOOT LEVEL)
JAN. '68 - DEC. '77

STABILITY CLASS A - CLASS FREQUENCY (PERCENT) = .14

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	7
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.56	5.56
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	.01
C-3	1	0	2	1	7	2	6	3	4	1	0	4	4	1	1	3	0	40
(1)	.79	0.00	1.59	.79	5.56	1.59	4.76	2.38	3.17	.79	0.00	3.17	3.17	.79	.79	2.38	0.00	31.75
(2)	.00	0.00	.00	.00	.01	.00	.01	.00	.00	.00	0.00	.00	.00	.00	.00	.00	0.00	.05
4-7	4	0	1	1	5	7	17	5	7	2	4	8	7	5	5	1	0	79
(1)	3.17	0.00	.79	.79	3.97	5.56	13.49	3.97	5.56	1.59	3.17	6.35	5.56	3.97	3.97	.79	0.00	62.70
(2)	.00	0.00	.00	.00	.01	.01	.02	.01	.01	.00	.00	.01	.01	.01	.01	.00	0.00	.09
8-12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	5	0	3	2	12	9	23	8	11	3	4	12	11	6	6	4	7	126
(1)	3.97	0.00	2.38	1.59	9.52	7.14	18.25	6.35	8.73	2.38	3.17	9.52	8.73	4.76	4.76	3.17	5.56	100.00
(2)	.01	0.00	.00	.00	.01	.01	.03	.01	.01	.00	.00	.01	.01	.01	.01	.00	.01	.14

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .50 MPH)

TABLE 2.3-28
(Sheet 2 of 7)

STABILITY CLASS B - CLASS FREQUENCY (PERCENT) = 2.78

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	23
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.95	.95
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.03	.03
C-3	51	21	22	13	34	28	25	24	34	23	18	34	44	36	17	22	0	446
(1)	2.11	.87	.91	.54	1.40	1.16	1.03	.99	1.40	.95	.74	1.40	1.82	1.49	.70	.91	0.00	18.41
(2)	.06	.02	.03	.01	.04	.03	.03	.03	.04	.03	.02	.04	.05	.04	.02	.03	0.00	.51
4-7	49	17	20	42	80	81	150	56	57	27	39	95	115	48	44	28	0	948
(1)	2.02	.70	.83	1.73	3.30	3.34	6.19	2.31	2.35	1.11	1.61	3.92	4.75	1.98	1.82	1.16	0.00	39.14
(2)	.06	.02	.02	.05	.09	.09	.17	.06	.07	.03	.04	.11	.13	.06	.05	.03	0.00	1.09
8-12	19	15	9	49	144	110	173	38	44	16	37	88	129	69	39	26	0	1005
(1)	.78	.62	.37	2.02	5.95	4.54	7.14	1.57	1.82	.66	1.53	3.63	5.33	2.85	1.61	1.07	0.00	41.49
(2)	.02	.02	.01	.06	.17	.13	.20	.04	.05	.02	.04	.10	.15	.08	.04	.03	0.00	1.15
13-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	119	53	51	104	258	219	348	118	135	66	94	217	288	153	100	76	23	2422
(1)	4.91	2.19	2.11	4.29	10.65	9.04	14.37	4.87	5.57	2.73	3.88	8.96	11.89	6.32	4.13	3.14	.95	100.00
(2)	.14	.06	.06	.12	.30	.25	.40	.14	.16	.08	.11	.25	.33	.18	.11	.09	.03	2.78

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .50 MPH)

TABLE 2.3-28
(Sheet 3 of 7)

STABILITY CLASS C - CLASS FREQUENCY (PERCENT) = 9.11

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.38	.38
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.03	.03
C-3	38	33	22	29	25	38	38	21	42	12	26	29	29	17	14	21	0	434
(1)	.48	.42	.28	.37	.32	.48	.48	.26	.53	.15	.33	.37	.37	.21	.18	.26	0.00	5.47
(2)	.04	.04	.03	.03	.03	.04	.04	.02	.05	.01	.03	.03	.03	.02	.02	.02	0.00	.50
4-7	118	37	41	29	97	61	115	69	96	37	58	110	133	98	94	56	0	1249
(1)	1.49	.47	.52	.37	1.22	.77	1.45	.87	1.21	.47	.73	1.39	1.68	1.24	1.19	.71	0.00	15.75
(2)	.14	.04	.05	.03	.11	.07	.13	.08	.11	.04	.07	.13	.15	.11	.11	.06	0.00	1.43
8-12	206	65	82	186	520	472	438	89	190	127	191	355	617	418	411	227	0	4594
(1)	2.60	.82	1.03	2.34	6.56	5.95	5.52	1.12	2.40	1.60	2.41	4.48	7.78	5.27	5.18	2.86	0.00	57.92
(2)	.24	.07	.09	.21	.60	.54	.50	.10	.22	.15	.22	.41	.71	.48	.47	.26	0.00	5.28
13-18	22	2	18	42	296	187	80	7	54	58	91	174	239	115	89	37	0	1511
(1)	.28	.03	.23	.53	3.73	2.36	1.01	.09	.68	.73	1.15	2.19	3.01	1.45	1.12	.47	0.00	19.05
(2)	.03	.00	.02	.05	.34	.21	.09	.01	.06	.07	.10	.20	.27	.13	.10	.04	0.00	1.74
19-24	0	1	5	6	4	7	0	0	8	9	10	15	25	10	4	1	0	105
(1)	0.00	.01	.06	.08	.05	.09	0.00	0.00	.10	.11	.13	.19	.32	.13	.05	.01	0.00	1.32
(2)	0.00	.00	.01	.01	.00	.01	0.00	0.00	.01	.01	.01	.02	.03	.01	.00	.00	0.00	.12
GT 24	0	0	3	0	0	0	0	0	0	0	4	1	1	0	0	0	0	9
(1)	0.00	0.00	.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.05	.01	.01	0.00	0.00	0.00	0.00	.11
(2)	0.00	0.00	.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.00	.00	.00	0.00	0.00	0.00	0.00	.01
ALL SPEEDS	384	138	171	292	942	765	671	186	390	243	380	684	1044	658	612	342	30	7932
(1)	4.84	1.74	2.16	3.68	11.88	9.64	8.46	2.34	4.92	3.06	4.79	8.62	13.16	8.30	7.72	4.31	.38	100.00
(2)	.44	.16	.20	.34	1.08	.88	.77	.21	.45	.28	.44	.79	1.20	.76	.70	.39	.03	9.11

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .50 MPH)

TABLE 2.3-28
(Sheet 4 of 7)

STABILITY CLASS D - CLASS FREQUENCY (PERCENT) = 70.43

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72	72
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.12	.12
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.08	.08
C-3	95	77	91	95	125	95	94	67	118	39	33	32	28	26	44	27	0	1086
(1)	.15	.13	.15	.15	.20	.15	.15	.11	.19	.06	.05	.05	.05	.04	.07	.04	0.00	1.77
(2)	.11	.09	.10	.11	.14	.11	.11	.08	.14	.04	.04	.04	.03	.03	.05	.03	0.00	1.25
4-7	627	365	316	397	482	442	400	317	659	211	217	296	289	228	289	266	0	5801
(1)	1.02	.60	.52	.65	.79	.72	.65	.52	1.07	.34	.35	.48	.47	.37	.47	.43	0.00	9.46
(2)	.72	.42	.36	.46	.55	.51	.46	.36	.76	.24	.25	.34	.33	.26	.33	.31	0.00	6.66
8-12	1615	551	663	735	1274	1014	632	499	1609	1053	846	1410	1080	1101	1242	990	0	16314
(1)	2.63	.90	1.08	1.20	2.08	1.65	1.03	.81	2.62	1.72	1.38	2.30	1.76	1.80	2.03	1.61	0.00	26.60
(2)	1.85	.63	.76	.84	1.46	1.16	.73	.57	1.85	1.21	.97	1.62	1.24	1.26	1.43	1.14	0.00	18.73
13-18	1682	560	907	920	1503	1249	437	244	1275	1996	2067	3406	4080	4063	3266	1788	0	29443
(1)	2.74	.91	1.48	1.50	2.45	2.04	.71	.40	2.08	3.25	3.37	5.55	6.65	6.62	5.33	2.92	0.00	48.01
(2)	1.93	.64	1.04	1.06	1.73	1.43	.50	.28	1.46	2.29	2.37	3.91	4.69	4.67	3.75	2.05	0.00	33.81
19-24	288	144	281	232	248	194	34	37	192	398	432	530	1237	1272	745	242	0	6506
(1)	.47	.23	.46	.38	.40	.32	.06	.06	.31	.65	.70	.86	2.02	2.07	1.21	.39	0.00	10.61
(2)	.33	.17	.32	.27	.28	.22	.04	.04	.22	.46	.50	.61	1.42	1.46	.86	.28	0.00	7.47
GT 24	77	67	128	106	149	57	19	13	78	77	92	135	503	408	171	29	0	2109
(1)	.13	.11	.21	.17	.24	.09	.03	.02	.13	.13	.15	.22	.82	.67	.28	.05	0.00	3.44
(2)	.09	.08	.15	.12	.17	.07	.02	.01	.09	.09	.11	.16	.58	.47	.20	.03	0.00	2.42
ALL SPEEDS	4384	1764	2386	2485	3781	3051	1616	1177	3931	3774	3687	5809	7217	7098	5757	3342	72	61331
(1)	7.15	2.88	3.89	4.05	6.16	4.97	2.63	1.92	6.41	6.15	6.01	9.47	11.77	11.57	9.39	5.45	.12	100.00
(2)	5.03	2.03	2.74	2.85	4.34	3.50	1.86	1.35	4.51	4.33	4.23	6.67	8.29	8.15	6.61	3.84	.08	70.43

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .50 MPH)

TABLE 2.3-28
(Sheet 5 of 7)

STABILITY CLASS E - CLASS FREQUENCY (PERCENT) = 11.47

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-7	125	69	42	61	99	75	95	92	264	124	87	140	77	81	71	43	0	1545
(1)	1.25	.69	.42	.61	.99	.75	.95	.92	2.64	1.24	.87	1.40	.77	.81	.71	.43	0.00	15.47
(2)	.14	.08	.05	.07	.11	.09	.11	.11	.30	.14	.10	.16	.09	.09	.08	.05	0.00	1.77
8-12	614	87	80	78	100	120	96	125	563	522	666	1303	924	1316	1152	694	0	8440
(1)	6.15	.87	.80	.78	1.00	1.20	.96	1.25	5.64	5.23	6.67	13.05	9.25	13.18	11.54	6.95	0.00	84.53
(2)	.71	.10	.09	.09	.11	.14	.11	.14	.65	.60	.76	1.50	1.06	1.51	1.32	.80	0.00	9.69
13-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	739	156	122	139	199	195	191	217	827	646	753	1443	1001	1397	1223	737	0	9985
(1)	7.40	1.56	1.22	1.39	1.99	1.95	1.91	2.17	8.28	6.47	7.54	14.45	10.03	13.99	12.25	7.38	0.00	100.00
(2)	.85	.18	.14	.16	.23	.22	.22	.25	.95	.74	.86	1.66	1.15	1.60	1.40	.85	0.00	11.47

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .50 MPH)

TABLE 2.3-28
(Sheet 6 of 7)

STABILITY CLASS F - CLASS FREQUENCY (PERCENT) = 4.90

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	40
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.94	.94
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.05	.05
C-3	29	31	15	24	41	46	38	24	45	30	17	23	20	7	7	14	0	411
(1)	.68	.73	.35	.56	.96	1.08	.89	.56	1.05	.70	.40	.54	.47	.16	.16	.33	0.00	9.63
(2)	.03	.04	.02	.03	.05	.05	.04	.03	.05	.03	.02	.03	.02	.01	.01	.02	0.00	.47
4-7	359	143	76	91	136	134	124	139	463	268	321	414	302	305	332	210	0	3817
(1)	8.41	3.35	1.78	2.13	3.19	3.14	2.91	3.26	10.85	6.28	7.52	9.70	7.08	7.15	7.78	4.92	0.00	89.43
(2)	.41	.16	.09	.10	.16	.15	.14	.16	.53	.31	.37	.48	.35	.35	.38	.24	0.00	4.38
8-12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	388	174	91	115	177	180	162	163	508	298	338	437	322	312	339	224	40	4268
(1)	9.09	4.08	2.13	2.69	4.15	4.22	3.80	3.82	11.90	6.98	7.92	10.24	7.54	7.31	7.94	5.25	.94	100.00
(2)	.45	.20	.10	.13	.20	.21	.19	.19	.58	.34	.39	.50	.37	.36	.39	.26	.05	4.90

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .50 MPH)

TABLE 2.3-28
(Sheet 7 of 7)

STABILITY CLASS G - CLASS FREQUENCY (PERCENT) = 1.17

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	96	96
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.44	9.44
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.11	.11
C-3	69	71	41	59	78	51	59	46	103	39	47	60	72	45	41	40	0	921
(1)	6.78	6.98	4.03	5.80	7.67	5.01	5.80	4.52	10.13	3.83	4.62	5.90	7.08	4.42	4.03	3.93	0.00	90.56
(2)	.08	.08	.05	.07	.09	.06	.07	.05	.12	.04	.05	.07	.08	.05	.05	.05	0.00	1.06
4-7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8-12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	69	71	41	59	78	51	59	46	103	39	47	60	72	45	41	40	96	1017
(1)	6.78	6.98	4.03	5.80	7.67	5.01	5.80	4.52	10.13	3.83	4.62	5.90	7.08	4.42	4.03	3.93	9.44	100.00
(2)	.08	.08	.05	.07	.09	.06	.07	.05	.12	.04	.05	.07	.08	.05	.05	.05	.11	1.17

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .50 MPH)

TABLE 2.3-29
(Sheet 1 of 7)

LONG-TERM JOINT FREQUENCY DISTRIBUTION OF WIND SPEED, WIND DIRECTION AND PASQUILL STABILITY CLASS FOR PORTLAND (10-FOOT LEVEL) JAN. '68 - DEC. '77

STABILITY CLASS A - CLASS FREQUENCY (PERCENT) = .19

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48	48
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.57	28.57
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.06	.06
C-3	3	0	3	0	6	0	3	9	0	0	3	0	0	0	0	3	0	30
(1)	1.79	0.00	1.79	0.00	3.57	0.00	1.79	5.36	0.00	0.00	1.79	0.00	0.00	0.00	0.00	1.79	0.00	17.86
(2)	.00	0.00	.00	0.00	.01	0.00	.00	.01	0.00	0.00	.00	0.00	0.00	0.00	0.00	.00	0.00	.03
4-7	0	0	6	0	9	21	9	9	12	0	3	6	0	0	12	3	0	90
(1)	0.00	0.00	3.57	0.00	5.36	12.50	5.36	5.36	7.14	0.00	1.79	3.57	0.00	0.00	7.14	1.79	0.00	53.57
(2)	0.00	0.00	.01	0.00	.01	.02	.01	.01	.01	0.00	.00	.01	0.00	0.00	.01	.00	0.00	.10
8-12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	3	0	9	0	15	21	12	18	12	0	6	6	0	0	12	6	48	168
(1)	1.79	0.00	5.36	0.00	8.93	12.50	7.14	10.71	7.14	0.00	3.57	3.57	0.00	0.00	7.14	3.57	28.57	100.00
(2)	.00	0.00	.01	0.00	.02	.02	.01	.02	.01	0.00	.01	.01	0.00	0.00	.01	.01	.06	.19

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .50 MPH)

TABLE 2.3-29
(Sheet 2 of 7)

STABILITY CLASS B - CLASS FREQUENCY (PERCENT) = 3.90

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	297	297
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.76	8.76
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.34	.34
C-3	90	24	15	24	30	48	39	18	51	54	33	63	93	93	81	57	0	813
(1)	2.65	.71	.44	.71	.88	1.42	1.15	.53	1.50	1.59	.97	1.86	2.74	2.74	2.39	1.68	0.00	23.98
(2)	.10	.03	.02	.03	.03	.06	.04	.02	.06	.06	.04	.07	.11	.11	.09	.07	0.00	.94
4-7	72	27	39	51	141	186	87	57	69	27	51	78	102	66	75	54	0	1182
(1)	2.12	.80	1.15	1.50	4.16	5.49	2.57	1.68	2.04	.80	1.50	2.30	3.01	1.95	2.21	1.59	0.00	34.87
(2)	.08	.03	.04	.06	.16	.21	.10	.07	.08	.03	.06	.09	.12	.08	.09	.06	0.00	1.36
8-12	39	24	12	30	120	204	60	84	201	27	30	51	51	63	45	57	0	1098
(1)	1.15	.71	.35	.88	3.54	6.02	1.77	2.48	5.93	.80	.88	1.50	1.50	1.86	1.33	1.68	0.00	32.39
(2)	.04	.03	.01	.03	.14	.23	.07	.10	.23	.03	.03	.06	.06	.07	.05	.07	0.00	1.26
13-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	201	75	66	105	291	438	186	159	321	108	114	192	246	222	201	168	297	3390
(1)	5.93	2.21	1.95	3.10	8.58	12.92	5.49	4.69	9.47	3.19	3.36	5.66	7.26	6.55	5.93	4.96	8.76	100.00
(2)	.23	.09	.08	.12	.33	.50	.21	.18	.37	.12	.13	.22	.28	.26	.23	.19	.34	3.90

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .50 MPH)

TABLE 2.3-29
(Sheet 3 of 7)

STABILITY CLASS C - CLASS FREQUENCY (PERCENT) = 11.79

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	423	423
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.13	4.13
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.49	.49
C-3	120	30	21	30	36	42	21	33	93	24	60	36	108	93	96	108	0	951
(1)	1.17	.29	.20	.29	.35	.41	.20	.32	.91	.23	.59	.35	1.05	.91	.94	1.05	0.00	9.28
(2)	.14	.03	.02	.03	.04	.05	.02	.04	.11	.03	.07	.04	.12	.11	.11	.12	0.00	1.09
4-7	225	66	63	102	129	156	75	63	147	102	147	201	339	318	294	318	0	2745
(1)	2.19	.64	.61	1.00	1.26	1.52	.73	.61	1.43	1.00	1.43	1.96	3.31	3.10	2.87	3.10	0.00	26.78
(2)	.26	.08	.07	.12	.15	.18	.09	.07	.17	.12	.17	.23	.39	.37	.34	.37	0.00	3.16
8-12	384	114	102	123	237	378	108	279	942	186	195	207	519	381	405	342	0	4902
(1)	3.75	1.11	1.00	1.20	2.31	3.69	1.05	2.72	9.19	1.81	1.90	2.02	5.06	3.72	3.95	3.34	0.00	47.82
(2)	.44	.13	.12	.14	.27	.43	.12	.32	1.08	.21	.22	.24	.60	.44	.47	.39	0.00	5.64
13-18	57	6	9	9	21	48	18	45	405	48	45	81	102	78	99	87	0	1158
(1)	.56	.06	.09	.09	.20	.47	.18	.44	3.95	.47	.44	.79	1.00	.76	.97	.85	0.00	11.30
(2)	.07	.01	.01	.01	.02	.06	.02	.05	.47	.06	.05	.09	.12	.09	.11	.10	0.00	1.33
19-24	3	0	0	0	0	0	0	0	27	15	0	6	15	0	0	0	0	66
(1)	.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.26	.15	0.00	.06	.15	0.00	0.00	0.00	0.00	.64
(2)	.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.03	.02	0.00	.01	.02	0.00	0.00	0.00	0.00	.08
GT 24	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	6
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.03	.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.06
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.00	.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01
ALL SPEEDS	789	216	195	264	423	624	222	420	1617	378	447	531	1083	870	894	855	423	10251
(1)	7.70	2.11	1.90	2.58	4.13	6.09	2.17	4.10	15.77	3.69	4.36	5.18	10.56	8.49	8.72	8.34	4.13	100.00
(2)	.91	.25	.22	.30	.49	.72	.26	.48	1.86	.43	.51	.61	1.25	1.00	1.03	.98	.49	11.79

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .50 MPH)

TABLE 2.3-29
(Sheet 4 of 7)

STABILITY CLASS D - CLASS FREQUENCY (PERCENT) = 56.09

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1092	1092
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.24	2.24
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.26	1.26
C-3	309	159	132	108	189	90	102	96	150	75	102	123	138	105	126	198	0	2202
(1)	.63	.33	.27	.22	.39	.18	.21	.20	.31	.15	.21	.25	.28	.22	.26	.41	0.00	4.52
(2)	.36	.18	.15	.12	.22	.10	.12	.11	.17	.09	.12	.14	.16	.12	.14	.23	0.00	2.53
4-7	1527	699	684	621	717	678	390	414	1122	660	588	621	753	555	498	834	0	11361
(1)	3.13	1.43	1.40	1.27	1.47	1.39	.80	.85	2.30	1.35	1.21	1.27	1.54	1.14	1.02	1.71	0.00	23.30
(2)	1.76	.80	.79	.71	.82	.78	.45	.48	1.29	.76	.68	.71	.87	.64	.57	.96	0.00	13.07
8-12	1839	1209	867	705	843	699	378	447	2232	1290	1062	735	1164	741	678	897	0	15786
(1)	3.77	2.48	1.78	1.45	1.73	1.43	.78	.92	4.58	2.65	2.18	1.51	2.39	1.52	1.39	1.84	0.00	32.38
(2)	2.12	1.39	1.00	.81	.97	.80	.43	.51	2.57	1.48	1.22	.85	1.34	.85	.78	1.03	0.00	18.16
13-18	1584	801	456	456	462	231	135	351	2073	1254	672	879	1977	1008	1353	1584	0	15276
(1)	3.25	1.64	.94	.94	.95	.47	.28	.72	4.25	2.57	1.38	1.80	4.06	2.07	2.78	3.25	0.00	31.34
(2)	1.82	.92	.52	.52	.53	.27	.16	.40	2.39	1.44	.77	1.01	2.27	1.16	1.56	1.82	0.00	17.58
19-24	174	66	36	42	84	36	45	51	195	141	42	105	402	270	297	309	0	2295
(1)	.36	.14	.07	.09	.17	.07	.09	.10	.40	.29	.09	.22	.82	.55	.61	.63	0.00	4.71
(2)	.20	.08	.04	.05	.10	.04	.05	.06	.22	.16	.05	.12	.46	.31	.34	.36	0.00	2.64
GT 24	27	9	6	21	45	3	6	24	39	21	18	36	237	81	75	90	0	738
(1)	.06	.02	.01	.04	.09	.01	.01	.05	.08	.04	.04	.07	.49	.17	.15	.18	0.00	1.51
(2)	.03	.01	.01	.02	.05	.00	.01	.03	.04	.02	.02	.04	.27	.09	.09	.10	0.00	.85
ALL SPEEDS	5460	2943	2181	1953	2340	1737	1056	1383	5811	3441	2484	2499	4671	2760	3027	3912	1092	48750
(1)	11.20	6.04	4.47	4.01	4.80	3.56	2.17	2.84	11.92	7.06	5.10	5.13	9.58	5.66	6.21	8.02	2.24	100.00
(2)	6.28	3.39	2.51	2.25	2.69	2.00	1.22	1.59	6.69	3.96	2.86	2.88	5.37	3.18	3.48	4.50	1.26	56.09

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .50 MPH)

TABLE 2.3-29
(Sheet 5 of 7)

STABILITY CLASS E - CLASS FREQUENCY (PERCENT) = 9.69

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-7	441	138	126	66	48	72	75	93	249	186	249	357	411	258	240	273	0	3282
(1)	5.24	1.64	1.50	.78	.57	.85	.89	1.10	2.96	2.21	2.96	4.24	4.88	3.06	2.85	3.24	0.00	38.96
(2)	.51	.16	.14	.08	.06	.08	.09	.11	.29	.21	.29	.41	.47	.30	.28	.31	0.00	3.78
8-12	528	180	84	18	24	9	9	18	222	363	531	636	960	540	510	510	0	5142
(1)	6.27	2.14	1.00	.21	.28	.11	.11	.21	2.64	4.31	6.30	7.55	11.40	6.41	6.05	6.05	0.00	61.04
(2)	.61	.21	.10	.02	.03	.01	.01	.02	.26	.42	.61	.73	1.10	.62	.59	.59	0.00	5.92
13-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	969	318	210	84	72	81	84	111	471	549	780	993	1371	798	750	783	0	8424
(1)	11.50	3.77	2.49	1.00	.85	.96	1.00	1.32	5.59	6.52	9.26	11.79	16.27	9.47	8.90	9.29	0.00	100.00
(2)	1.11	.37	.24	.10	.08	.09	.10	.13	.54	.63	.90	1.14	1.58	.92	.86	.90	0.00	9.69

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .50 MPH)

TABLE 2.3-29
(Sheet 6 of 7)

STABILITY CLASS F - CLASS FREQUENCY (PERCENT) = 11.78

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	657	657
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.42	6.42
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.76	.76
C-3	174	45	57	24	24	27	45	21	81	72	132	111	177	66	99	141	0	1296
(1)	1.70	.44	.56	.23	.23	.26	.44	.21	.79	.70	1.29	1.08	1.73	.64	.97	1.38	0.00	12.66
(2)	.20	.05	.07	.03	.03	.03	.05	.02	.09	.08	.15	.13	.20	.08	.11	.16	0.00	1.49
4-7	906	213	108	42	39	69	72	90	354	312	705	1104	1506	924	873	969	0	8286
(1)	8.85	2.08	1.05	.41	.38	.67	.70	.88	3.46	3.05	6.89	10.78	14.71	9.02	8.53	9.46	0.00	80.93
(2)	1.04	.25	.12	.05	.04	.08	.08	.10	.41	.36	.81	1.27	1.73	1.06	1.00	1.11	0.00	9.53
8-12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	1080	258	165	66	63	96	117	111	435	384	837	1215	1683	990	972	1110	657	10239
(1)	10.55	2.52	1.61	.64	.62	.94	1.14	1.08	4.25	3.75	8.17	11.87	16.44	9.67	9.49	10.84	6.42	100.00
(2)	1.24	.30	.19	.08	.07	.11	.13	.13	.50	.44	.96	1.40	1.94	1.14	1.12	1.28	.76	11.78

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .50 MPH)

TABLE 2.3-29
(Sheet 7 of 7)

STABILITY CLASS G - CLASS FREQUENCY (PERCENT) = 6.55

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2190	2190
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.48	38.48
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.52	2.52
C-3	384	84	78	36	45	57	96	72	186	111	207	366	609	393	381	396	0	3501
(1)	6.75	1.48	1.37	.63	.79	1.00	1.69	1.27	3.27	1.95	3.64	6.43	10.70	6.91	6.69	6.96	0.00	61.52
(2)	.44	.10	.09	.04	.05	.07	.11	.08	.21	.13	.24	.42	.70	.45	.44	.46	0.00	4.03
4-7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8-12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	384	84	78	36	45	57	96	72	186	111	207	366	609	393	381	396	2190	5691
(1)	6.75	1.48	1.37	.63	.79	1.00	1.69	1.27	3.27	1.95	3.64	6.43	10.70	6.91	6.69	6.96	38.48	100.00
(2)	.44	.10	.09	.04	.05	.07	.11	.08	.21	.13	.24	.42	.70	.45	.44	.46	2.52	6.55

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .50 MPH)

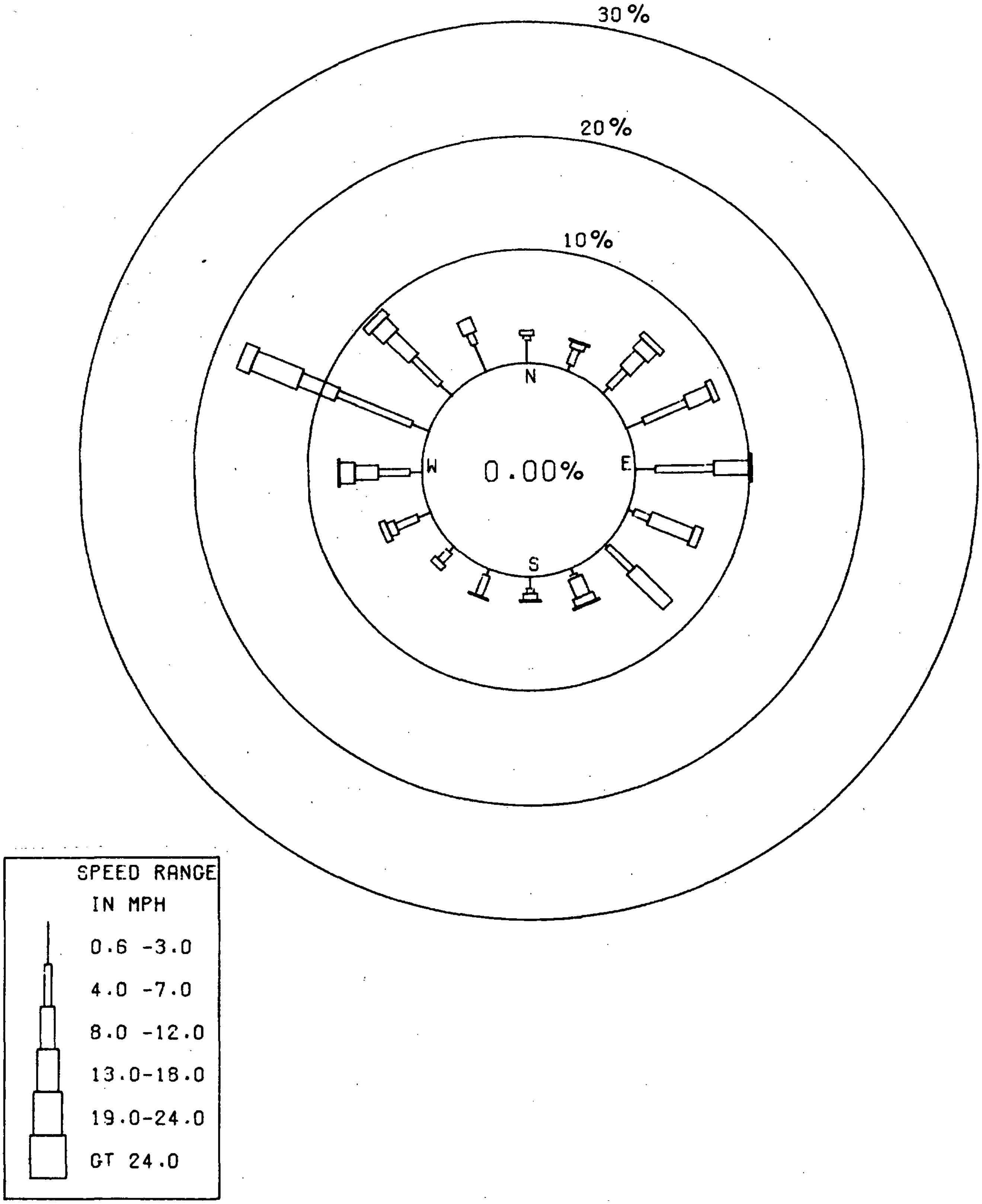
TABLE 2.3-30

REGIONAL EPISODES WITH METEOROLOGICAL CONDITIONS UNFAVORABLE FOR ATMOSPHERIC DISPERSION

Episode Specifications			
Maximum Mixing Height (Feet)	Maximum Wind Speed (mph)	Minimum Episode Duration (Days)	Number Episodes in 5 Years
1640	4.5	2	0
1640	9.0	2	1
1640	13.4	2	2
3280	4.5	2	0
3280	9.0	2	3
3280	13.4	2	15
1640	9.0	5	0
1640	13.4	5	0
3280	9.0	5	0
3280	13.4	5	1

Period of Record: 1960-1964

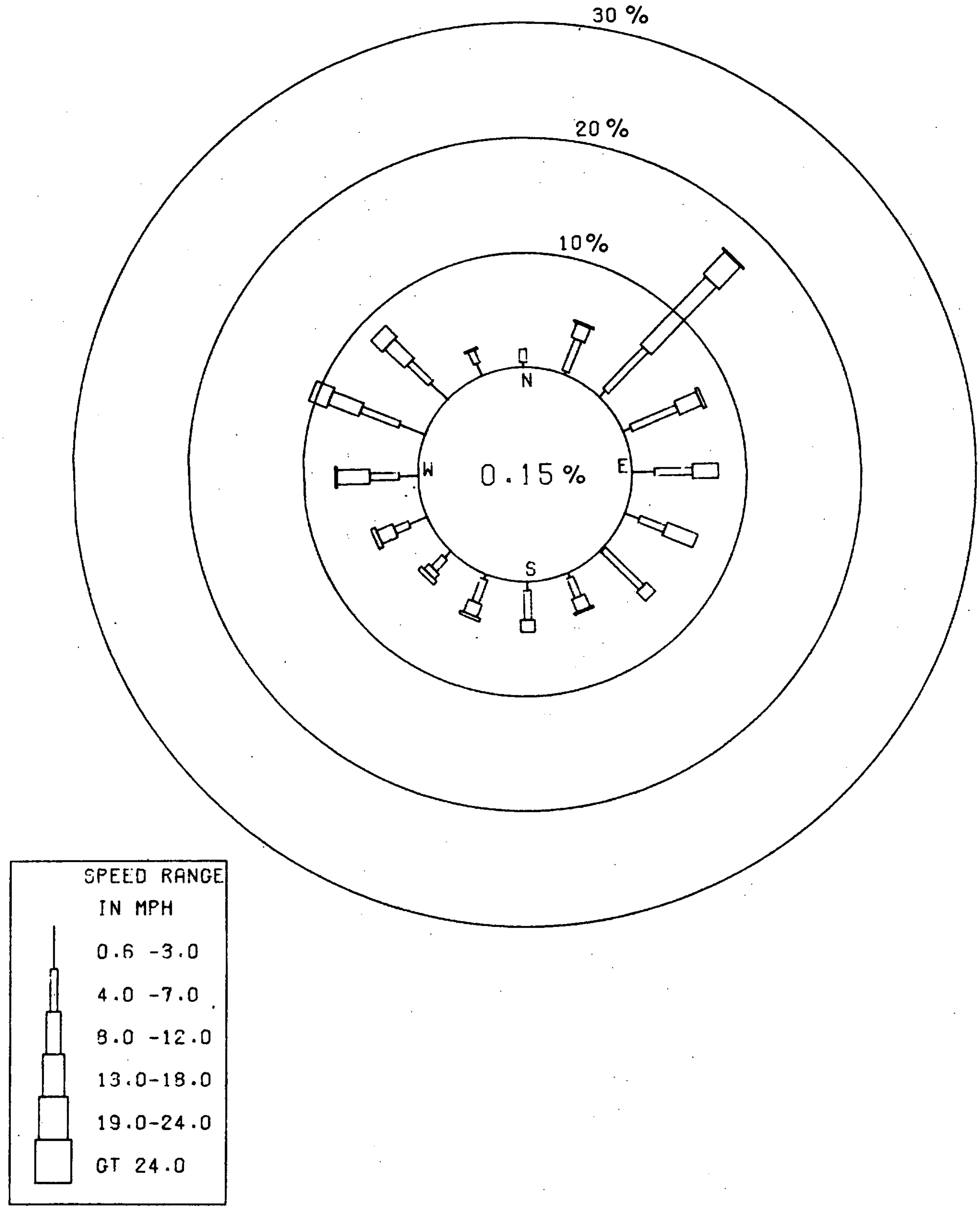
Reference: (28)



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

SEABROOK 43 FT LEVEL WIND ROSE
APRIL 1979

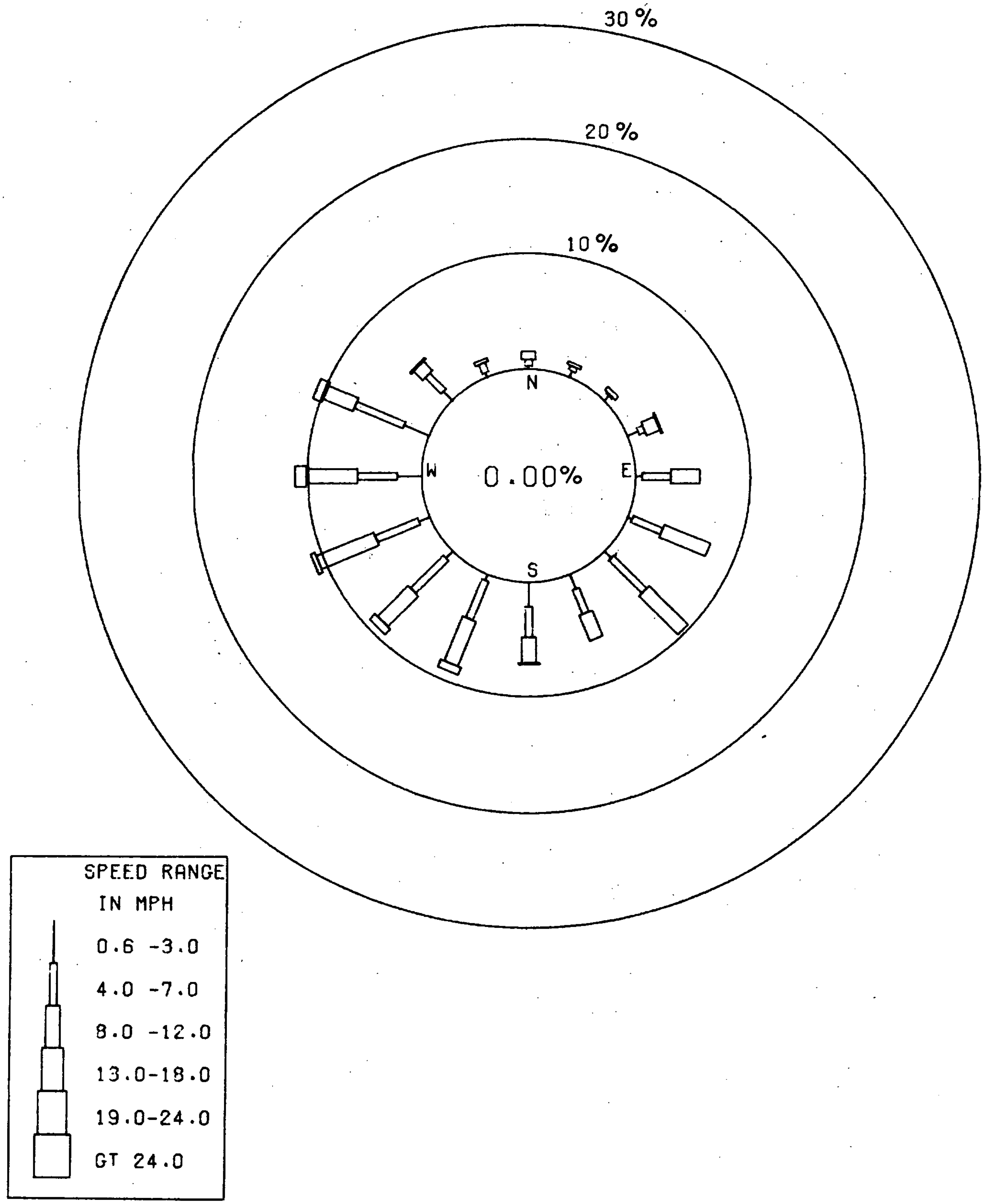
FIGURE 2.3-1



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

SEABROOK 43 FT LEVEL WIND ROSE
MAY 1979

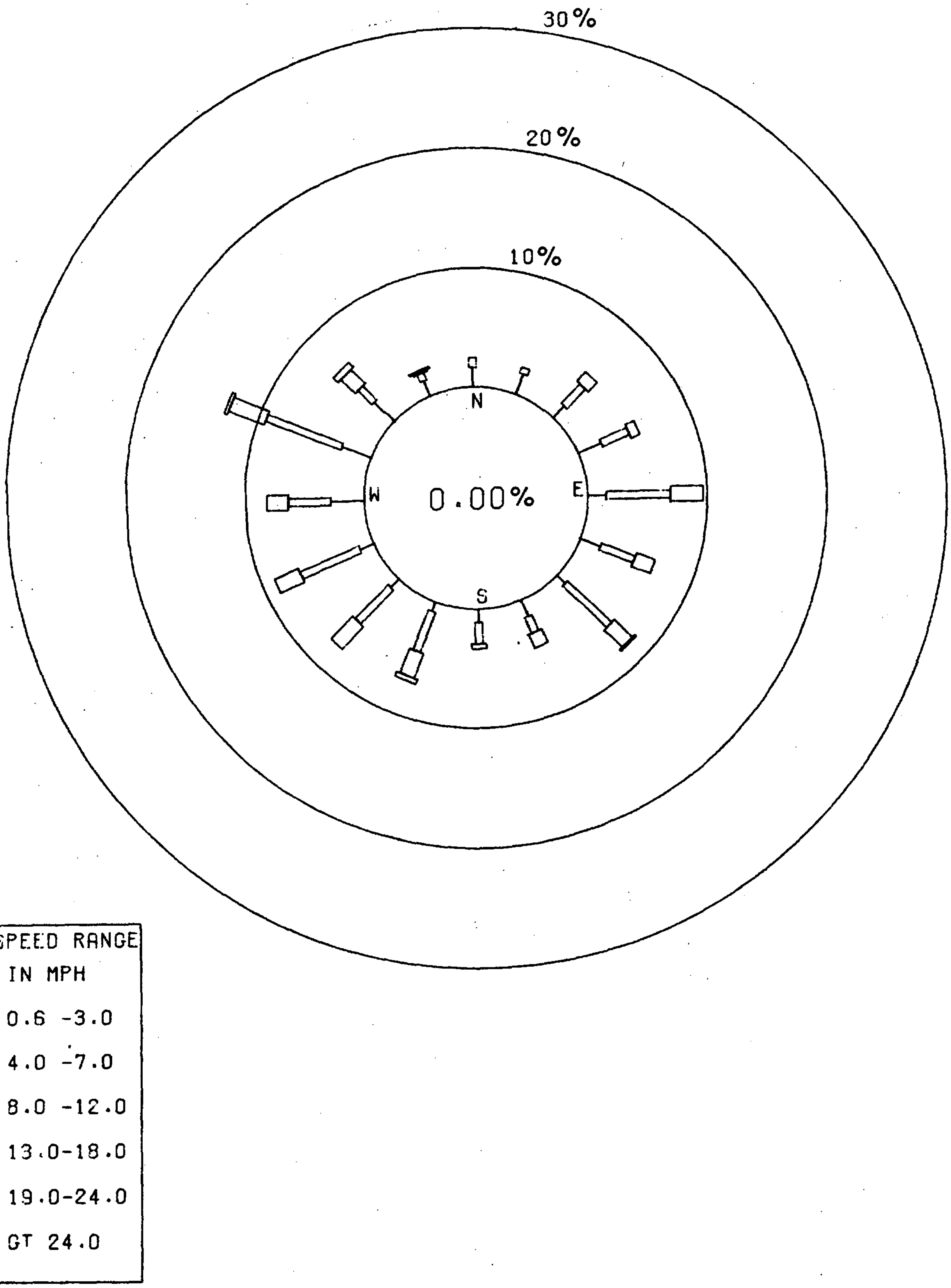
FIGURE 2.3-2



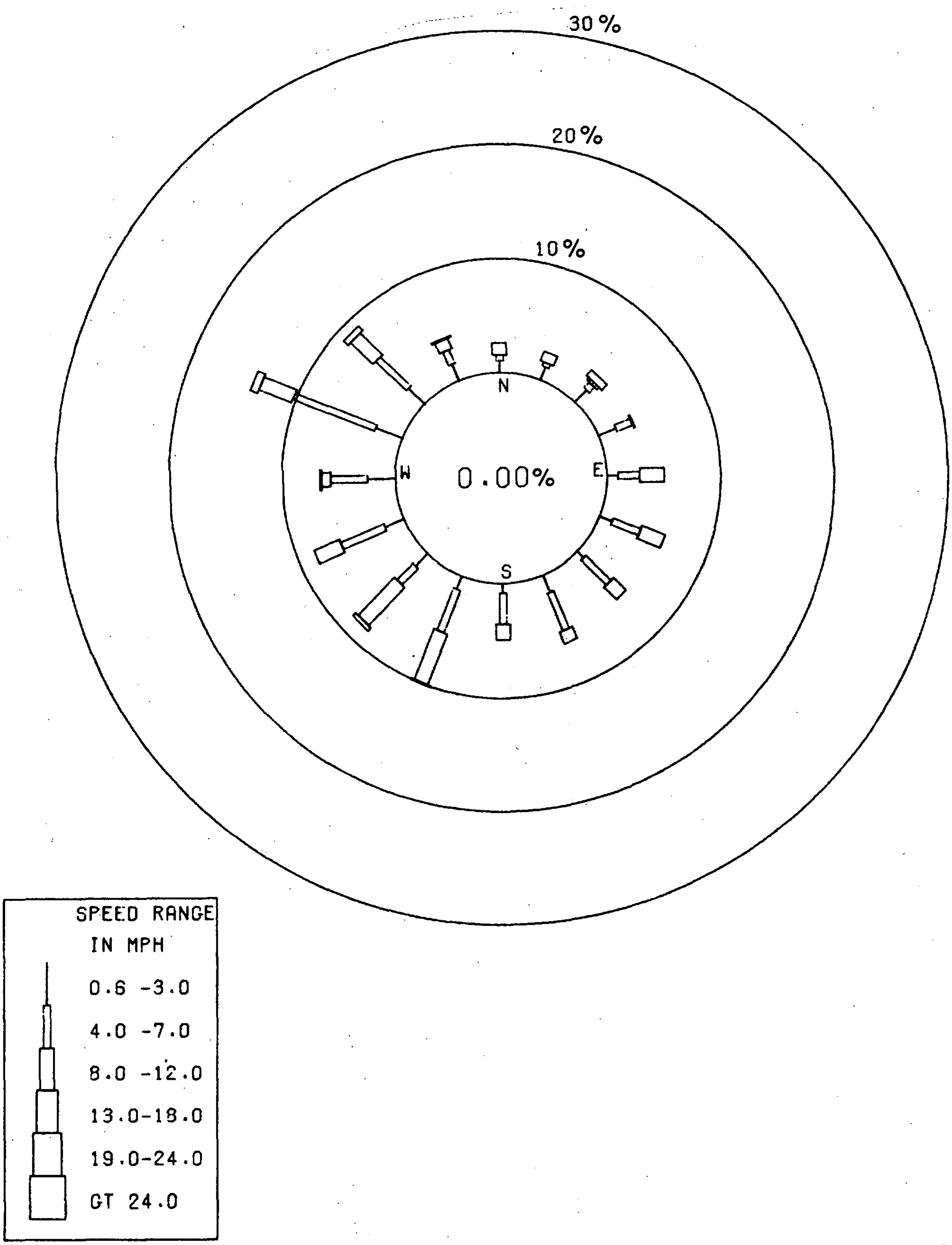
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

SEABROOK 43 FT LEVEL WIND ROSE
JUNE 1979

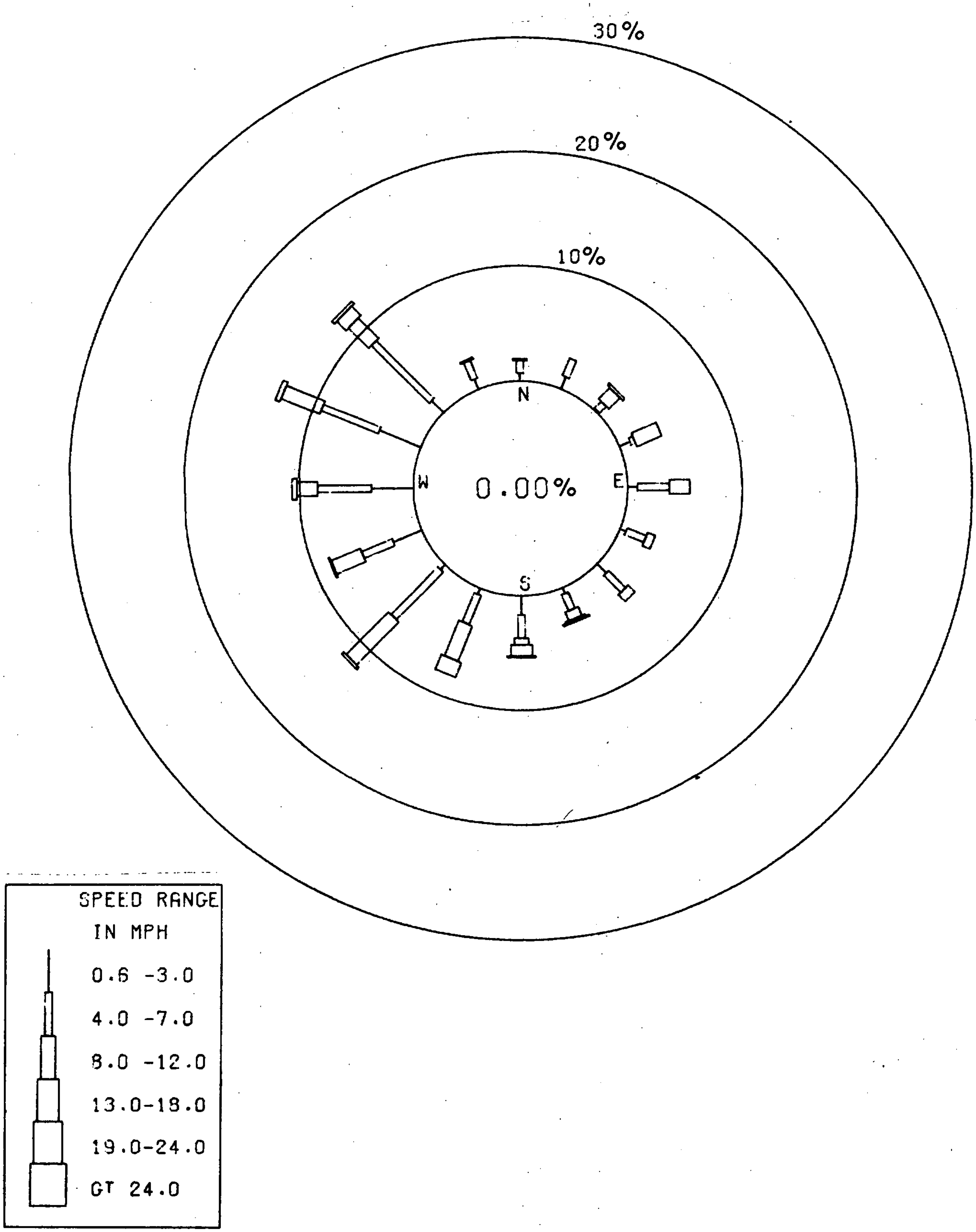
FIGURE 2.3-3



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	SEABROOK 43 FT LEVEL WIND ROSE JULY 1979
	FIGURE 2.3-4



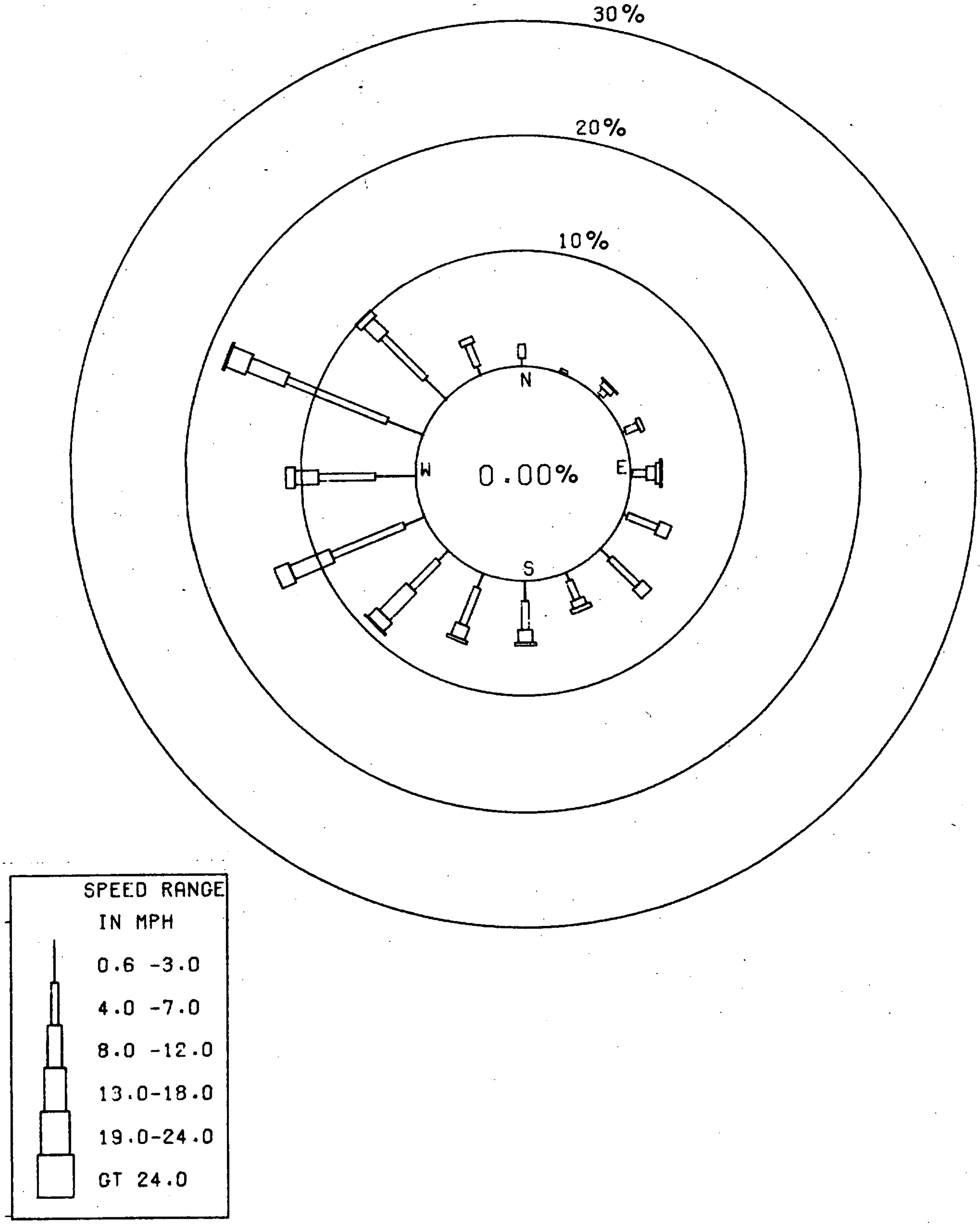
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	SEABROOK 43 FT LEVEL WIND ROSE AUGUST 1979 FIGURE 2.3-5



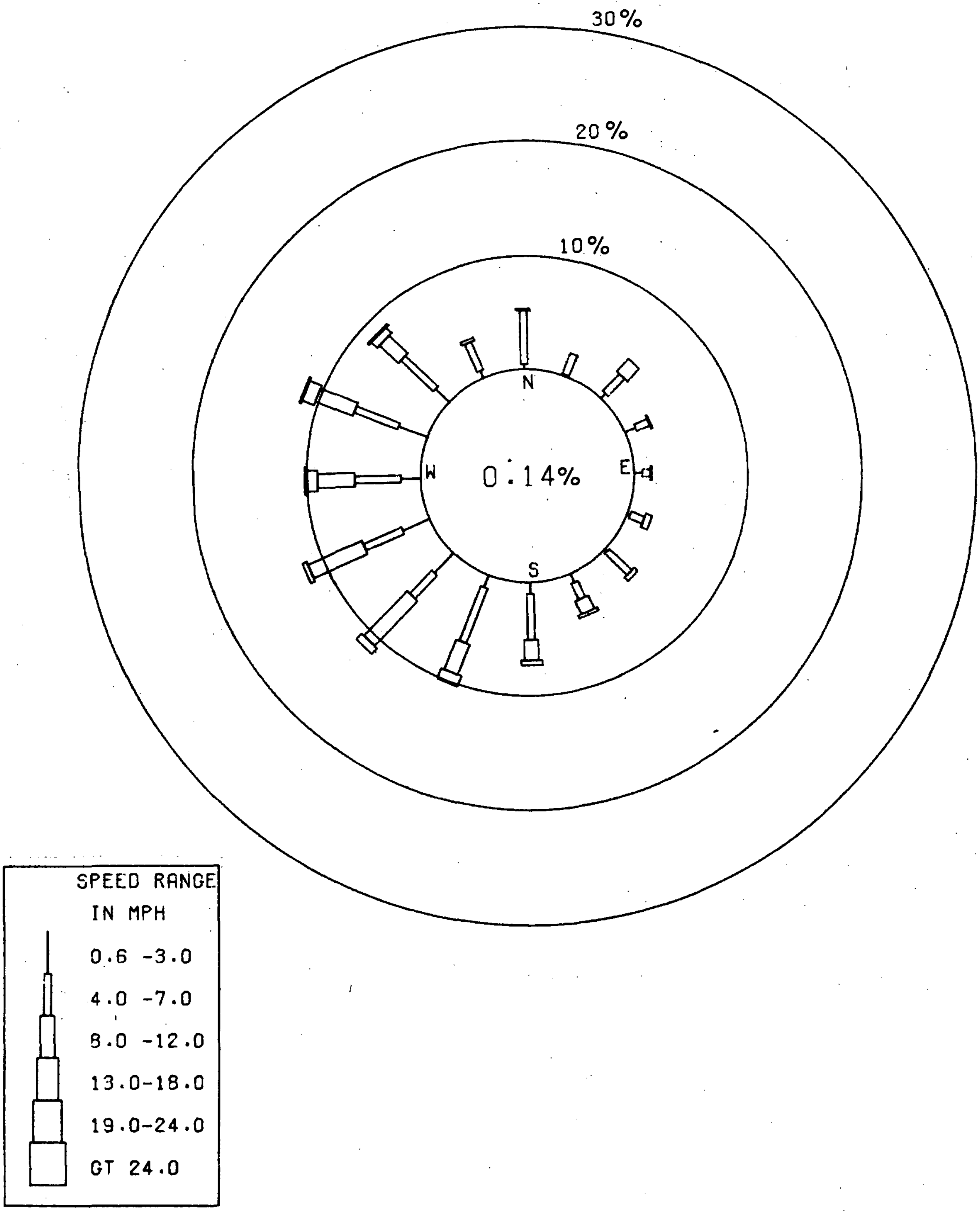
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

SEABROOK 43 FT LEVEL WIND ROSE
SEPTEMBER 1979

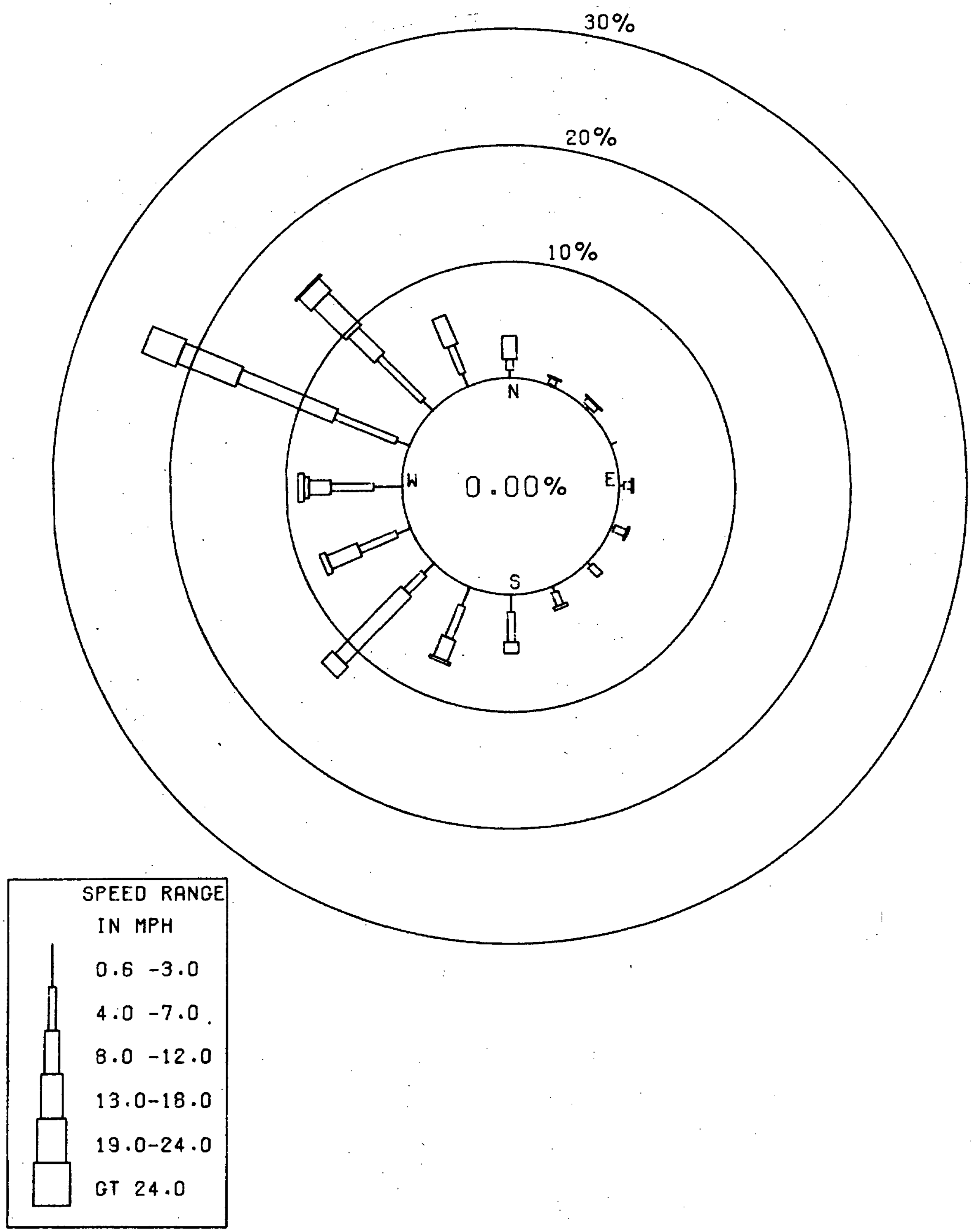
FIGURE 2.3-6



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	SEABROOK 43 FT LEVEL WIND ROSE OCTOBER 1979
	FIGURE 2.3-7



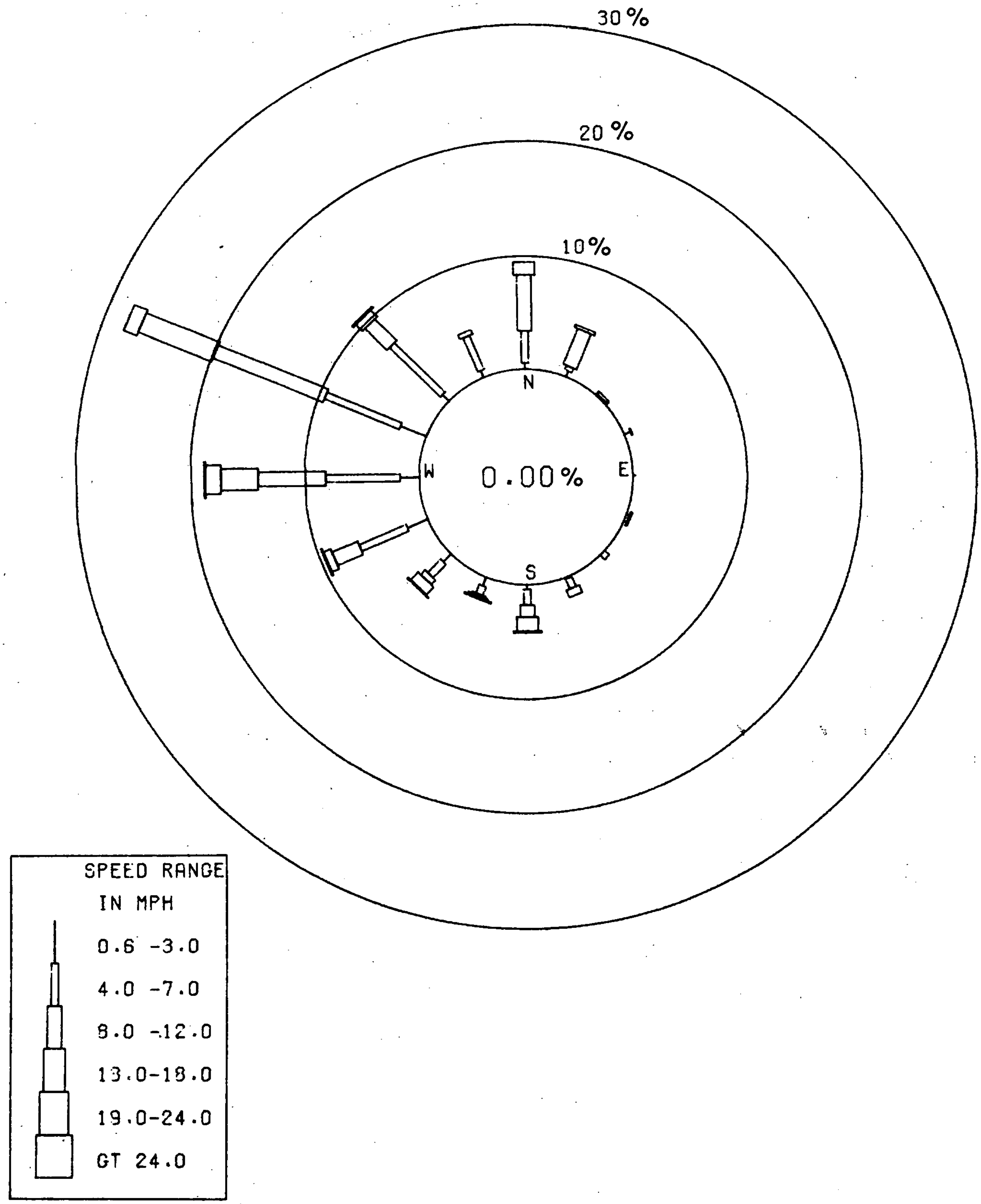
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	SEABROOK 43 FT LEVEL WIND ROSE NOVEMBER 1979
	FIGURE 2.3-8



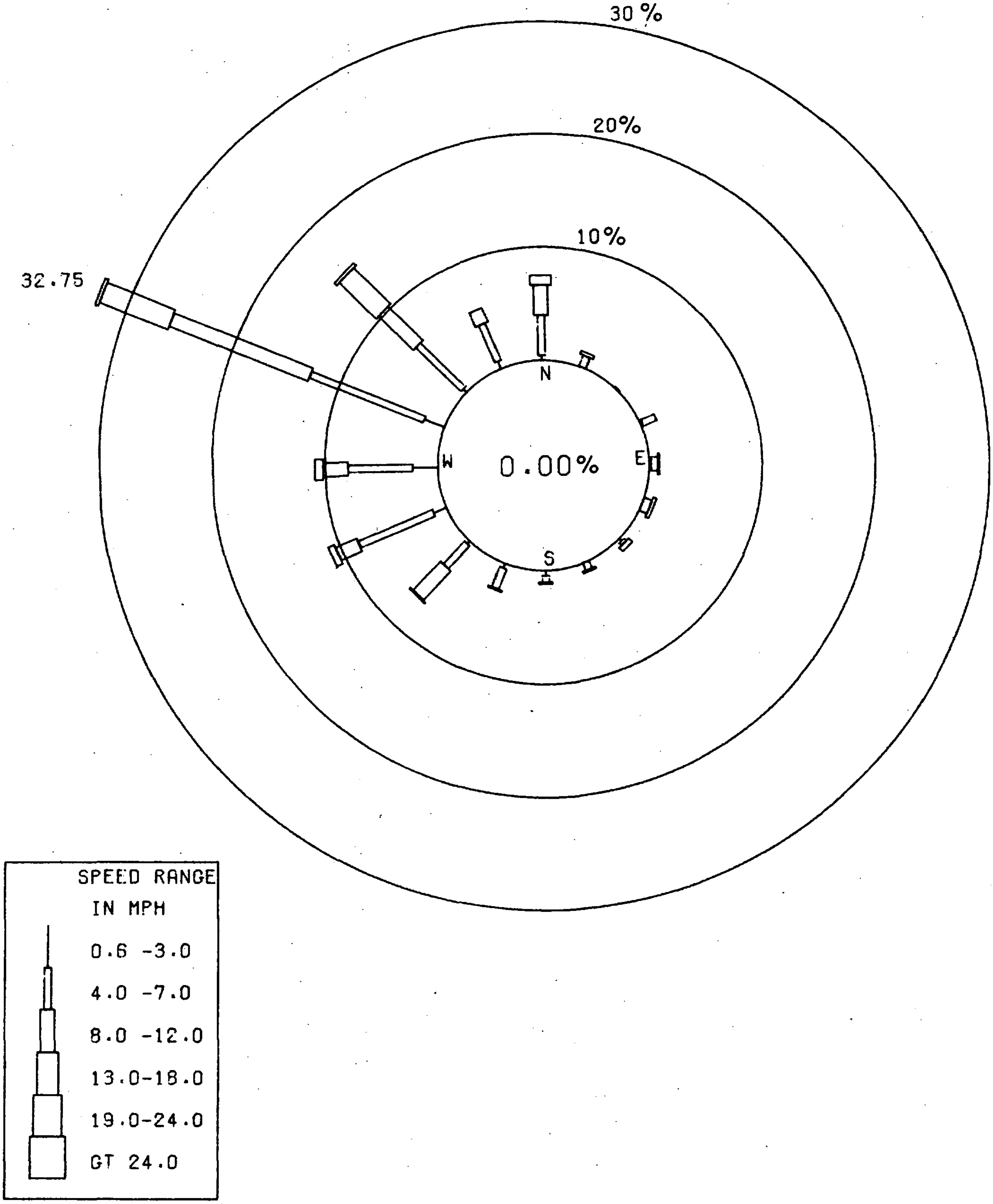
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

SEABROOK 43 FT LEVEL WIND ROSE
DECEMBER 1979

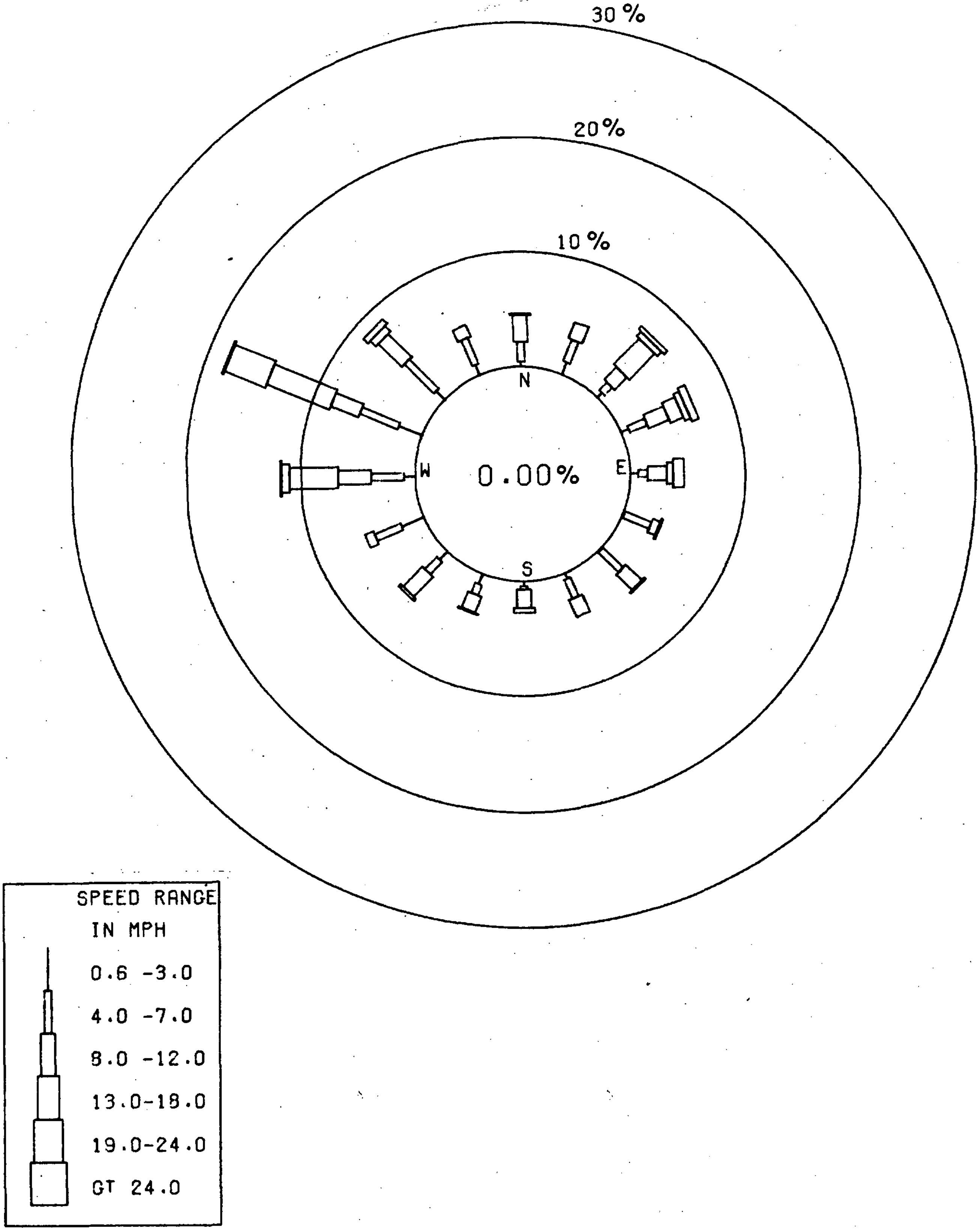
FIGURE 2.3-9



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	SEABROOK 43 FT LEVEL WIND ROSE JANUARY 1980
	FIGURE 2.3-10



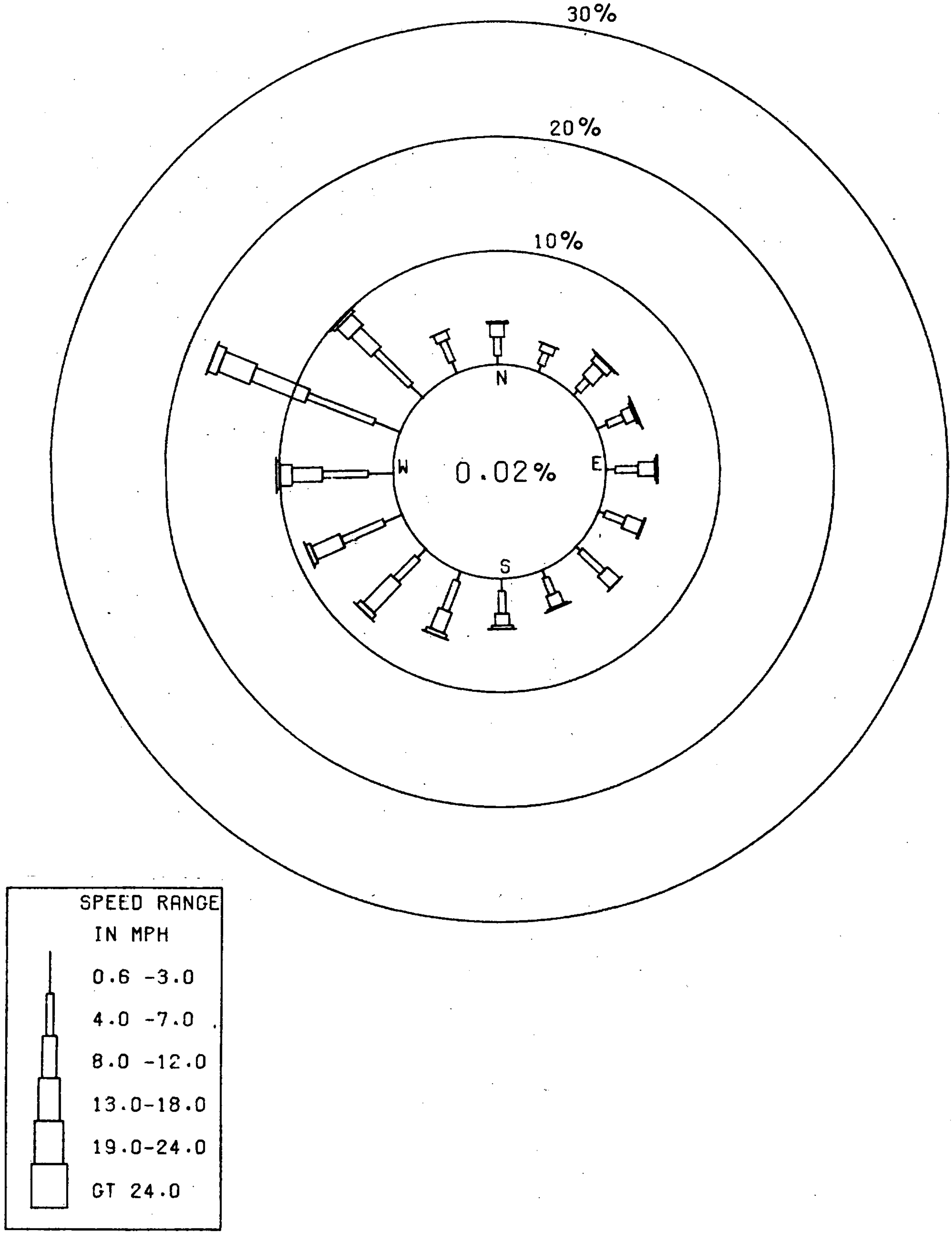
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	SEABROOK 43 FT LEVEL WIND ROSE FEBRUARY 1980
	FIGURE 2.3-11



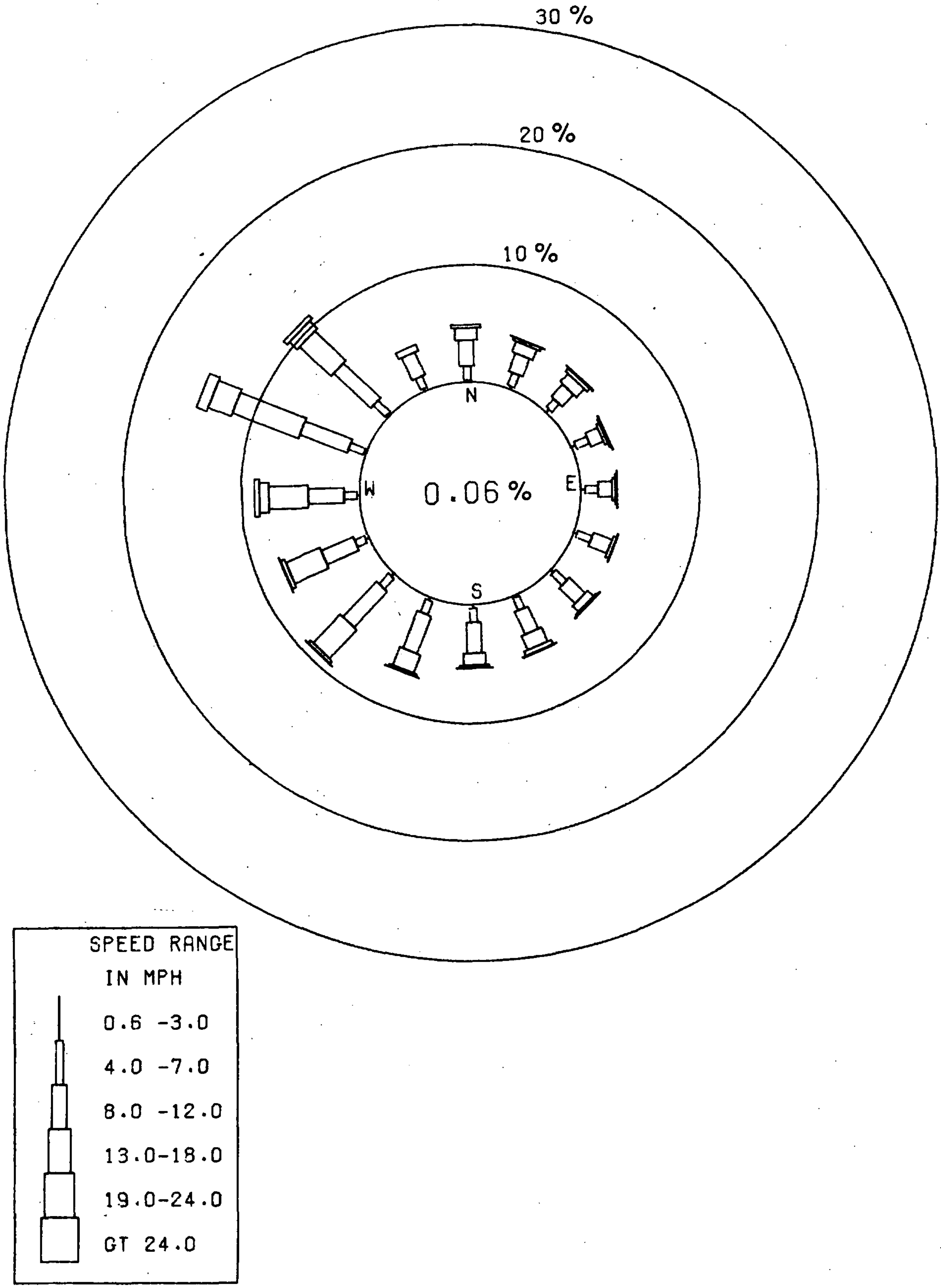
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

SEABROOK 43 FT LEVEL WIND ROSE
MARCH 1980

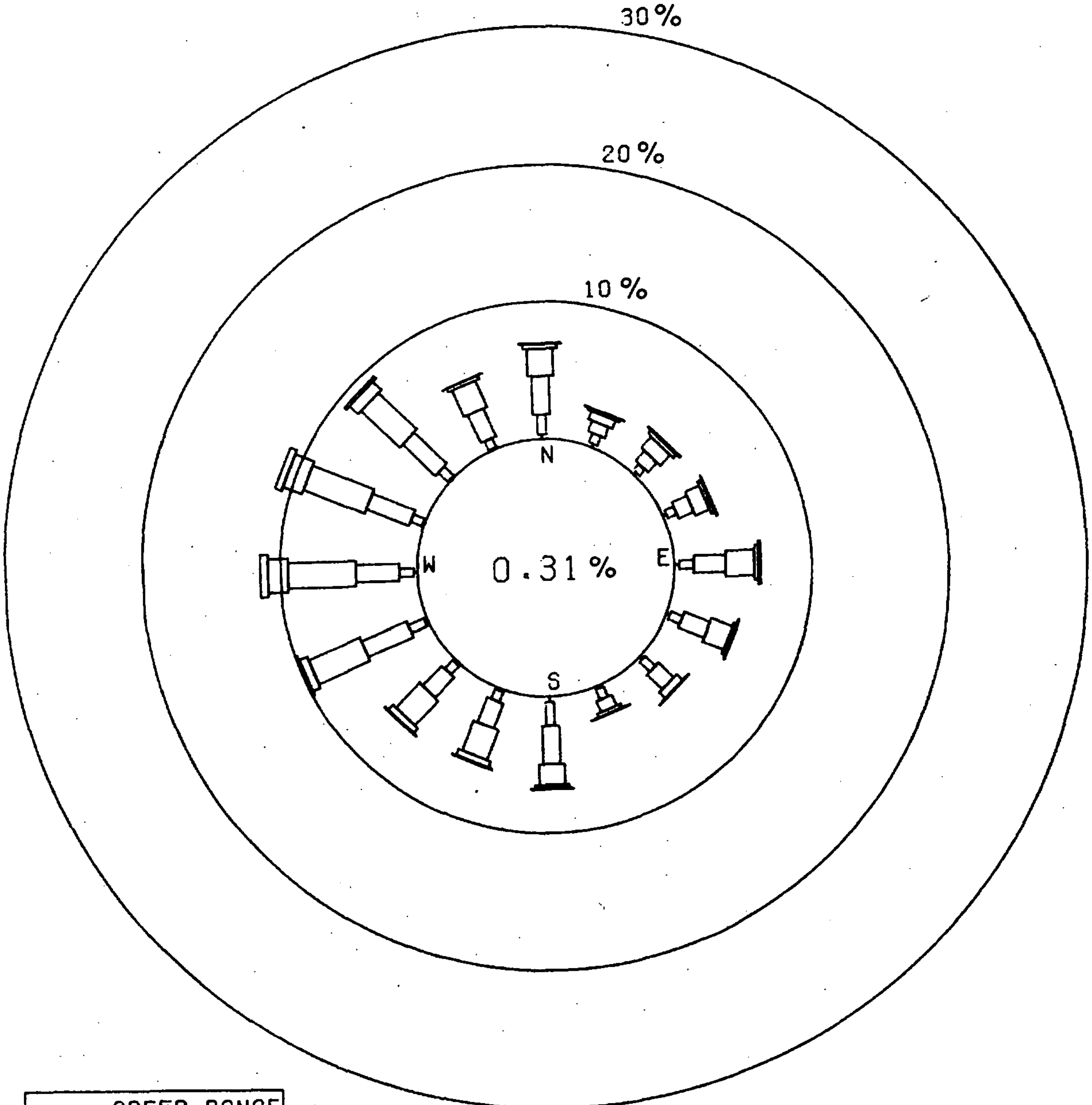
FIGURE 2.3-12

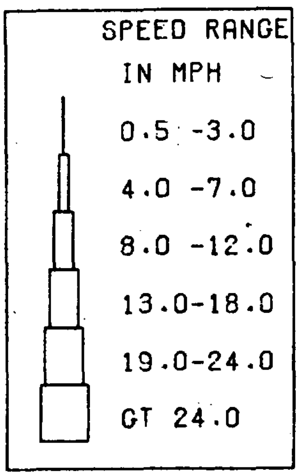


PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	SEABROOK 43 FT LEVEL WIND ROSE ANNUAL (APRIL 1979 - MARCH 1980)
	FIGURE 2.3-13

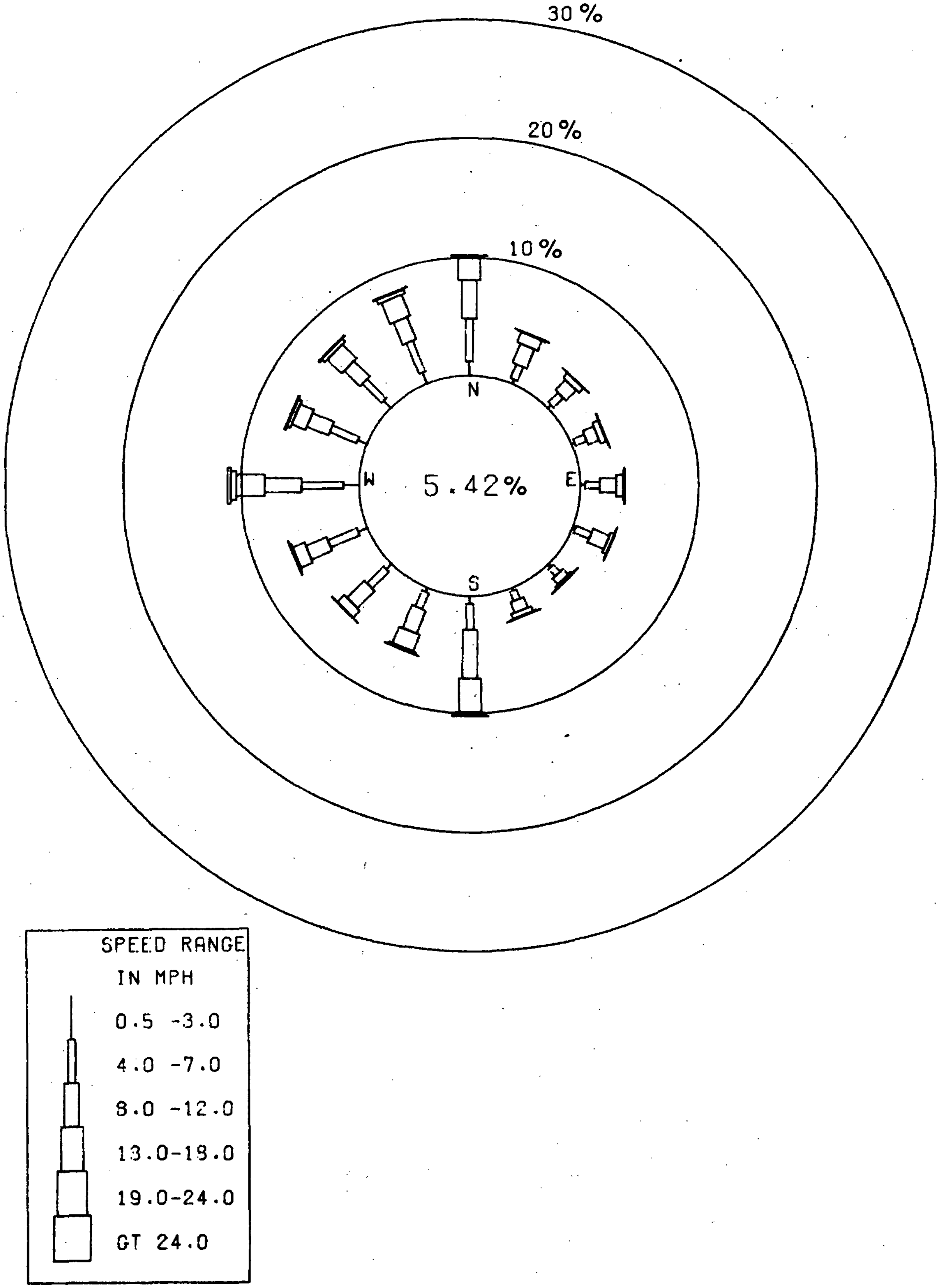


PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	SEABROOK 209 FT. LEVEL WIND ROSE ANNUAL (APRIL 1979 - MARCH 1980)
	FIGURE 2.3-14





PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	BOSTON WIND ROSE ANNUAL (1968 - 1977)
	FIGURE 2.3-15



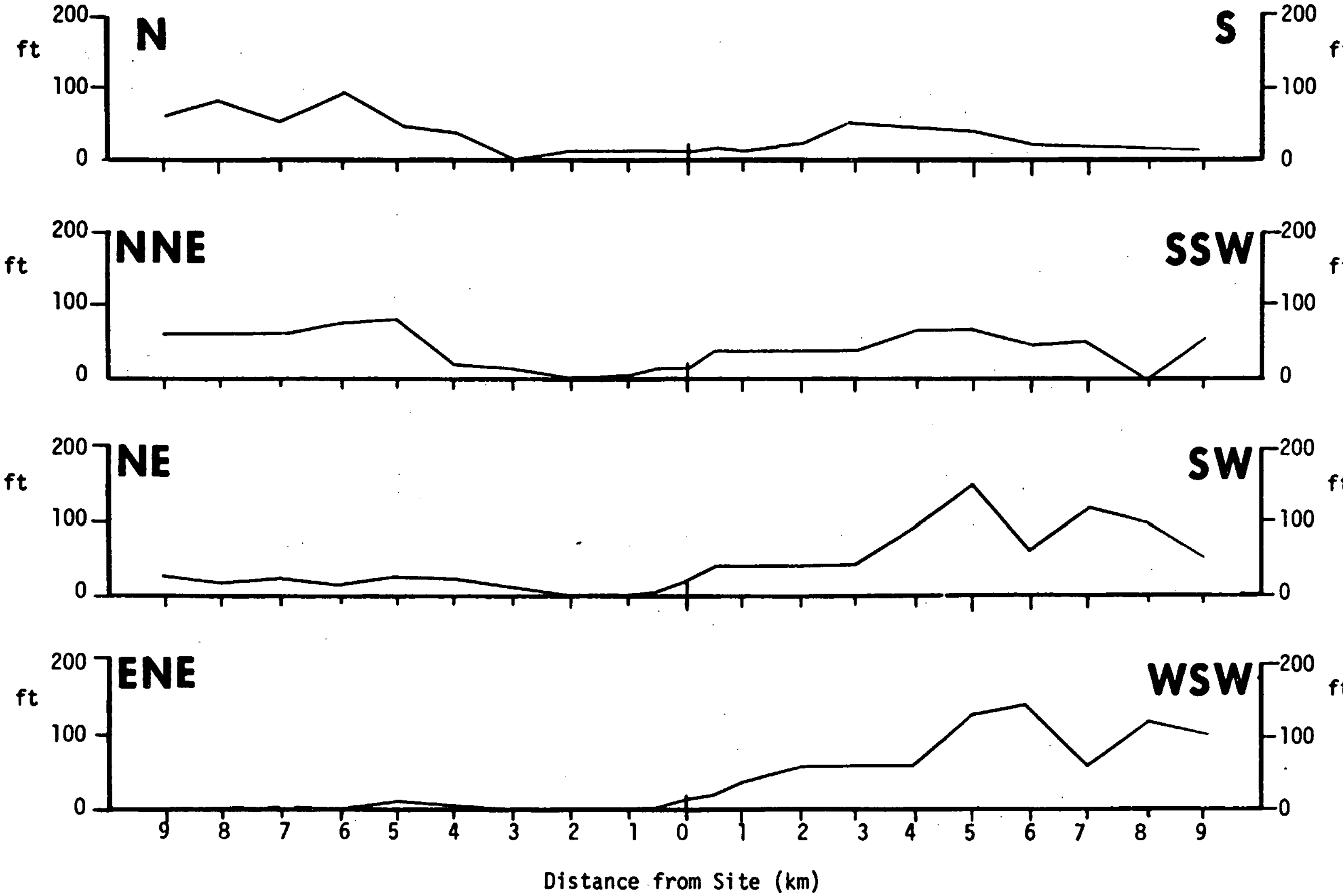
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	PORTLAND WIND ROSE ANNUAL (1968 - 1977)
	FIGURE 2.3-16

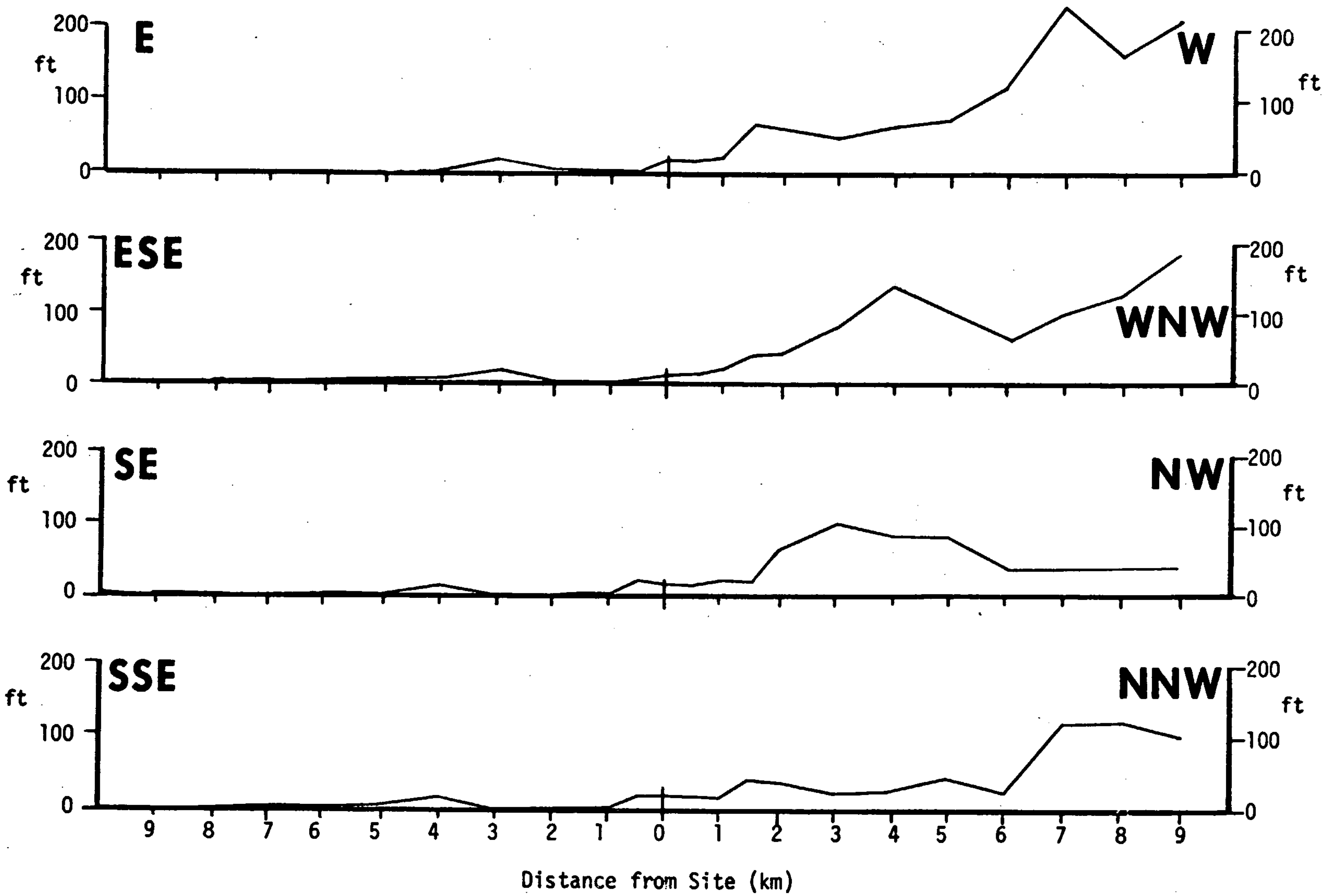
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	TOPOGRAPHIC MAP WITHIN A FIVE MILE RADIUS OF THE SEABROOK SITE
	FIGURE 2.3-17

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

TERRAIN CROSS SECTION

FIGURE 2.3-18, SH. 1

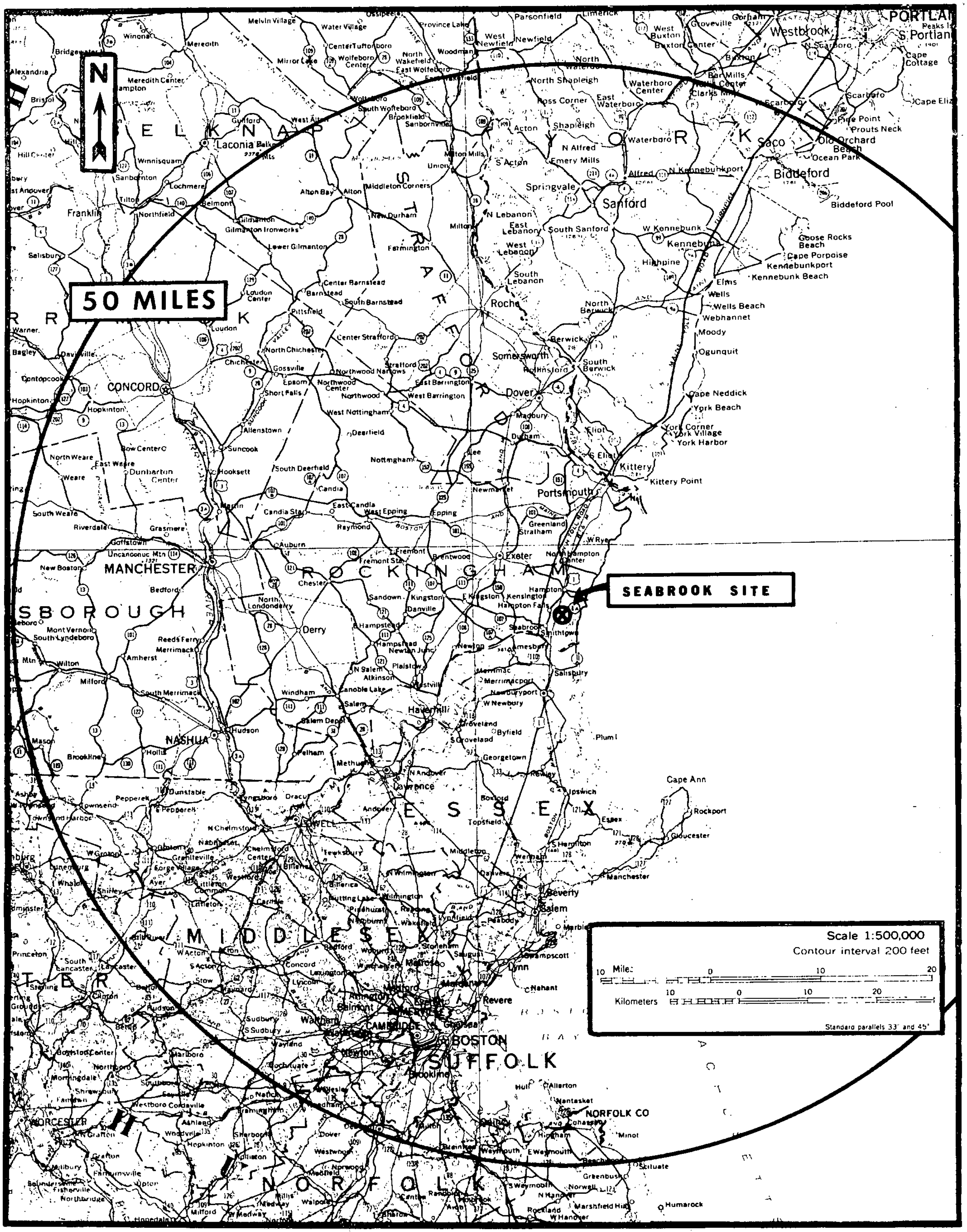




PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

TERRAIN CROSS SECTION

FIGURE 2.3-18, SH. 2



SEABROOK SITE—50 MILE RADIUS
REGIONAL CLIMATOLOGICAL DATA STATIONS

FIGURE 2.3-19

2.4 HYDROLOGY

2.4 HYDROLOGY

2.4.1 Surface Waters

The material contained in this section (formerly presented in ER-CPS Section 2.5, but relocated to Section 2.4 of the ER-OLS to conform with the format outlined by Regulatory Guide 4.2, Revision 2, dated July 1977) is basically unchanged. However, the original information, which was based on data acquired from 1969 to 1972 and emphasized the immediate vicinity of the Hampton Harbor estuary has been greatly expanded to include the greater Hampton, N.H. coastal and offshore region in the Gulf of Maine. Starting in September 1972 and continuing to the present, numerous studies and reports have been conducted and prepared by Normandeau Associates, Inc., (NAI), the Applicants' hydrographic consultant. The most comprehensive and recent of these reports, which number over fifty, include the Summary Document [1] and annual technical reports for 1974 through 1978 [2,3,4,5,6]. The resultant has been the design and construction of a state-of-the-art circulating water system employing the best available technology principle (refer to Subsection 3.4.2).

The NAI documents and ER-CPS Section 2.4 present a complete description of the surface hydrology in the vicinity of Seabrook Station. Included is the large-scale physiographic characteristics, bathymetry, circulation, and physical parameters (both seasonal and temporal). However, as a summary of this voluminous data base, Table 2.4-1 and the following subsections have been prepared to highlight important features or present a compilation of selected physical parameters not previously reported.

2.4.1.1 Currents

a. Principal Flow Patterns

The waters off Hampton Beach include three types of flow (six variants) derived from the superimposition of a persistant unidirectional flow on the ebb and flood of the tidal circulation (see Table 2.4-2).

The most common type of flow is the transient or tidal flow, which dominates about 43 percent of the time. Reversing flood and ebb tidal currents comprise 23 percent of this type, whereas weak tidal flows account for the remaining 20 percent. The two other flow types, unidirectional currents to the south and to the north, are nearly equally persistent (28.8 percent to the south and 28.4 percent to the north). Within each type, moderate current speeds (0.2 to 0.3 kn) are more common, while strong current speeds (greater than 0.3 kn and as high as 1.0 kn) occur less frequently. These unidirectional flows essentially mask out the tidal currents and frequently persist unabated for days at a time. Southerly flows are generally the result of northeasterly storms and occasional periods of strong northwesterly winds. Northward flows, correspondingly, generally occur in conjunction with strong south-to-southwest winds.

The seasonal effect for each flow type is illustrated in Figure 2.4-1. As shown, tidal flows predominate during the summer months, whereas unidirectional flows occur more frequently during the fall and winter months when stronger winds and storm conditions are prevelant. The largest occurrence of flow type is to the north in the fall at mean speeds of 0.17 to 0.44 kn. Flows in other directions are generally about 0.10 to 0.19 kn. The coastal waters also demonstrate a two-layer flow reinforced by ambient stratification of temperature and salinity (see below). This stratification, which occurs during the spring, summer, and early fall, creates the two-layer flow regime within the water column and enables the wind to drive the near-surface waters downwind whenever the winds have been strong and persistent enough. This is the basic phenomenon that accounts for the southward or northward unidirectional flows in near-surface currents. Flows at depth, however, tend to parallel the coast under more tidal influence or move shoreward.

b. <u>Net (Nontidal) Drift</u>

Calculations of daily net drift (from current meter data) and return information from drifter releases further demonstrate the dynamic nature of the Hampton, N.H. coastal waters. These data show that there is always some net drift and that seasonal drift patterns, which correspond to the summer, fall and winter months, occur. Typically, near-surface waters move southward and offshore out past Cape Ann as part of the large-scale Gulf of Maine gyre. Near-bottom waters within 6 n mi of the coast, in contrast, almost always move southwestward toward shore. Beyond 6 n mi, near-bottom waters tend to move southward past Cape Ann into Massachusetts Bay. Drift rates generally range from 1 to 3 n mi per day for near-surface flows to about 0.1 n mi per day or less for near-bottom flows [1].

2.4.1.2 Tides

Tides, which were measured continuously from 1973 through 1978, agree closely with NOAA-NOS predicted values. They are of the mixed, semidiurnal type with small diurnal inequality (1 to 2 ft). In general, the mean range is about 8.3 ft; spring tides range as high as 12.5 ft, whereas neap tides range as low as 6.0 ft [1]. The change in tide height (high or low water) and tidal-current direction usually occurs 15 to 30 minutes earlier offshore than inside Hampton Harbor.

2.4.1.3 Water Temperature

The information presented in the ER-CPS is basically unchanged, but has been complemented by continuous data acquisition from 1973 through the present. Figure 2.4-2 is a summary of these data and illustrates the annual temperature variability at various points in the water column for the coastal waters off Hampton Beach, including both the intake and discharge sites.

As reported by NAI, water temperatures show pronounced daily, seasonal and annual variability. Coldest temperatures typically occur in February, lagging about 30 days behind the coldest air temperatures. During the spring months temperatures gradually rise and a seasonal thermocline becomes established. By midsummer the thermocline may be 30 to 40 ft (9 to 12 m) thick, but rapidly dissipates by early fall (September). Highest temperatures are generally reached during August. Temperature data show daily variations of 1° to $11^{\circ}F$ (0.5 to $6^{\circ}C$) during the summertime and 1 to $7^{\circ}F$ (0.5 to $4^{\circ}C$) during the wintertime [3,4,5,6].

Water temperatures in the Hampton Harbor estuary show the same seasonal cycle as the coastal waters, but have a larger range. Temperatures, for instance, are generally higher (by as much as $10^{\circ}F$) in the estuary than offshore during the summer and colder during the winter (by about $2-4^{\circ}F$). Short-term variations, especially due to tidal effects, are also present. These variations also have greater ranges than for coastal waters. The water column, however, is well mixed and little vertical stratification occurs.

2.4.1.4 Salinity

Data collected since 1973 corroborate the information presented in the ER-CPS. These data also document the spatial and temporal variations in both the Hampton Harbor estuary and adjacent coastal waters [3,4,5,6].

In general, offshore water salinities exhibit a modest seasonal cycle with highest values occurring in the winter and lowest values in the spring or fall. As a result, a halocline forms in both spring and fall with surface to bottom variations of up to 2 ppt. Near-surface values usually range from 31 to 32 ppt to around 28 or 29 ppt. Near-bottom salinities are less variable and range from 31 to nearly 33 ppt.

In the Hampton Harbor estuary, by contrast, values as low as 12 ppt have been observed. In addition, variations of as much as 13 ppt within a tidal cycle may occur; more typical variations, however, are from 2 to 6 ppt per tidal cycle.

2.4.1.5 Dissolved Oxygen

Data collected in the offshore coastal waters subsequent to the ER-CPS show the highest values occur during the winter and spring (about 10 to 11 mg/1), whereas lowest values occur during the late summer and autumn (down to 7.5 mg/1). No consistent pattern has been observed between tidal stage or water depth, suggesting that dissolved oxygen follows a seasonal cycle related to planktonic photosynthesis, temperature and salinity [1]. During the winter and spring, dissolved oxygen distributions are homogeneous, but near-surface waters have higher concentrations during the summer. Winter and spring percentage saturation range from about 95 to 112 percent. In the summertime, however, near-surface waters became highly supersaturated (up to 115%), whereas near-bottom waters were generally undersaturated (down to 88%).

2.4.1.6 Sedimentological Conditions

Suspended sediments information, as presented in the ER-CPS, remains unchanged. Subsequent measurements of the exposed heights of paired sediment stakes at eight locations off Hampton Beach have provided data on relative bottom stability and possible sediment transport over more than three years of monthly observations [2,3]. All of the sediment stakes have documented numerous erosional and depositional cycles of up to 9 in. (22.9 cm), but these have generally resulted in little net change at most locations. The most pronounced changes have been associated with northeast storms when strong near-bottom currents and large waves affect the sea floor; however, the storm effects are compensated by transport processes which tend to accumulate sediment under non-storm conditions. Thus, the sea floor off Hampton Beach appears to be in a state of dynamic equilibrium.

2.4.1.7 Regional Freshwater Streams and Characteristics

Material regarding regional freshwater stream, originally presented in ER-CPS Subsection 2.5.1.3, Inland Surface Waters, is unchanged. Additional information on surface water resources within 50 miles of the site can be found in ER-OLS Section 2.1.3.

2.4.1.8 References

1. NAI, 1977. "Summary Document: Assessment of Anticipated Impacts of Construction and Operation of Seabrook Station on the Estuarine, Coastal and Offshore Waters Hampton-Seabrook, New Hampshire", prepared for Public Service Company of NH, Manchester.

2. NAI, 1975. "Seabrook Ecology Study 1974 Summary Report of Hydrographic Studies Off Hampton Beach, NH, Including Hampton Harbor Estuary and the Western Gulf of Maine, September 1972 to March 1975", Technical Report VI-8.

3. NAI, 1977. "Annual Summary Report for 1975 Hydrographic Studies Off Hampton Beach, NH", Technical Report VII-2.

4. NAI, 1979. "Annual Summary Report for 1976 Hydrographic Studies Off Hampton Beach, NH", Technical Report VIII-1.

5. NAI, 1979. "Annual Summary Report for 1977 Hydrographic Studies Off Hampton Beach, NH", Technical Report X-1.

6. NAI, 1980. "Annual Summary Report for 1978 Hydrographic Studies Off Hampton Beach, NH", Technical X-2.

2.4.2 Groundwater

The information in this section remains unchanged from the presented in Section 2.5.2 of the Seabrook Station ER-CPS except as noted below. Additional information is also presented.

2.4.2.1 Utilization of Groundwater by the Plant

Groundwater is used during operation of Seabrook Station for potable, sanitary and non-safety related purposes. The total estimated demand is 110 x 10^6 gallons per year or about 200 gallons per minute.

The town of Seabrook supplies 50,000 gallons per day or 35 gallons of groundwater per minute to Seabrook Station from the Seabrook water supply system. Additional demand will be met by a series of bedrock wells at two well fields located approximately 2,000 and 3,000 feet to the west and north of the site, respectively. Well locations are shown in Figure 2.4-3 and specific well data in Table 2.4-3. 2

2.4.2.2 Local Groundwater Wells

Figure 2.4-3 and Table 2.4-3 provide information on wells in the immediate vicinity of the site. The two nearest well fields are located approximately 2,000 and 3,000 feet to the west and north of the site, respectively.

TABLE 2.4-1

SUMMARY OF HYDROGRAPHIC CHARACTERISTICS OF THE COASTAL ENVIRONMENT OFF HAMPTON BEACH, NEW HAMPSHIRE, 1973 THRU 1978

SEASON	WIND	AIR TEMPERATURE	CURRENTS	WATER TEMPERATURE	SALINITY	DISSOLVED OXYGEN
WINTER (JANUARY, FEBRUARY, MARCH)	Predominantly from West 9.2 kn NW 7.3 kn SW 8.9 kn Highest average speeds from E 9.4 kn NE 10.1 kn	Jan 25°F (-4°C) Feb 27°F (-3°C) Mar 35°F (2°C)	Southern flows predominant S 37% Tidal 34.6% N 28.3% Net drift southward.	Lowest temperature in February. Temperatures vary between 32°F and 38°F at surface; water column nearly isothermal, surface sometime colder.	Surface salinities average 31-33 ppt; near-bottom values average 32-33.5 ppt.	10.0-11.5 mg/l 90-100% saturated.
SPRING (APRIL, MAY JUNE)	Predominantly from W 7.1 kn NW 7.0 kn S 6.5 kn Highest average speeds from NE 10.0 kn	April 46°F (8°C) May 56°F (13°C) June 65°F (18°C)	Tidal flows most frequent Tidal 47.5% S 34.8% N 17.7% Net drift south.	Development of a seasonal thermocline. Temperatures rise rapidly to 40°F-50°F at surface; 35°F-45°F near bottom.	Greatest variation between surface and bottom 3-5 ppt. Surface salinities generally 28 to 31 ppt. Bottom salinities generally 32 to 34 ppt.	10.5-11.3 mg/l. With spring bloom, decrease to 9.0-10.0 mg/l. When 9.0-11.5 mg/l saturated to supersaturated. Near-surface value higher than near-bottom.
SUMMER (JULY, AUGUST SEPTEMBER)	Calm and variable; predominantly W 6.1 kn SW 7.8 kn NW 5.5 kn Average speeds in all directions $\pm$5 kn	July 71°F (22°C) Aug 69°F (21°C) Sept 62°F (17°C)	Currents primarily tidal Tidal 58.6% S 22.2% N 19.2% Net drift south	Highest temp. in August. Temperatures at surface >60°F; little variation over the 3 months, $\pm$2-3°F. Temperature differences surface-bottom greatest, $\pm$6°F-10°F.	Surface 29-32 ppt; near bottom 32-34 ppt in depths greater than 100 ft. Values at surface and bottom nearly equal in depths of 30-60 ft.	8.0-10.0 mg/l. Lowest values in late summer >7.8 mg/l. Near-surface supersaturated 100-120%. Near-bottom 80-100%.
AUTUMN (OCTOBER, NOVEMBER DECEMBER)	Predominantly from W 8.1 kn SW 8.6 kn S 7.7 kn Highest average speeds from E 9.7 kn NE 9.7 kn	Oct 52°F (11°C) Nov 42°F (6°C) Dec 30°F (-1°C)	Northerly flows prevalent N 48.2% Tidal 29.6% S 22.2% Net drift south.	Decline steadily from 50°F to 40°F. Water becomes well mixed --little variation between surface and bottom.	Vertical breakdown of stratification generally late October or early November. Salinities generally 31 to 32 ppt.	Lowest of year. 7.5-10 mg/l values rise sharply in autumn. Slightly subsaturated 90-100%.

Source: NAI, 1980. Annual Summary Report for 1978 Hydrographic Studies off Hampton Beach, New Hampshire [6].

TABLE 2.4-2

SUMMARY OF CURRENT FLOW TYPES IN COASTAL WATERS OFF HAMPTON, NEW HAMPSHIRE FOR 1973-1978

		Percentage (%)					
		Tidal Effects		Flow to South		Flow to North	
Month	No. of Days	Weak	Reversing	Moderate 0.2 - 0.3 kn	Strong >0.3 kn	Moderate 0.2 - 0.3 kn	Strong >0.3 kn
January	162	14.2	13.9	22.8	13.6	31.5	4.0
February	154	15.6	17.5	25.6	15.6	23.7	1.9
March	173	20.9	21.6	18.0	15.6	20.2	3.8
April	180	15.9	25.1	27.0	10.6	15.3	6.1
May	186	23.7	23.7	23.1	9.7	14.8	5.0
June	180	25.5	28.6	25.1	8.8	11.0	1.0
July	186	28.0	39.7	19.1	2.7	8.6	1.2
August	186	27.2	32.4	22.4	4.8	11.8	1.8
September	180	21.7	26.8	14.7	2.8	26.7	7.3
October	186	13.6	16.6	11.2	8.2	37.8	12.7
November	180	12.0	15.9	18.8	0.6	42.4	10.4
December	186	16.9	13.8	21.3	6.5	37.8	3.7
TOTAL	2139	19.7	23.1	20.7	8.1	23.4	5.0
		(42.8)		(28.8)		(28.4)	

TABLE 2.4-3
(Sheet 1 of 2)

DRILLED WELL SUMMARY SHEET
SEABROOK STATION

WELL NO.	MAG. GRID LOCATION PLANT GRID LOCATION N. COORD.	E. COORD.	GROUND[1] ELEV.	DEPTH (FT.)	BOTTOM ELEV.	INFLOW DEPTH(S)	INFLOW ELEV.(S)	EST. YIELD (GPM)	TEST[2] YIELD (GPM)	SOIL DEPTH (FT.)	CASING DEPTH (FT.)	HOLE DIAM. (IN.)
1	MG 23698 PG 13143	79683 7000	22 50	143	-120.5	130	-107.5	80	70.8	6	21	6.0
2	MG 23466 PG 13029	79325 6589	16.00	205	-189	100 130 160	-84 -114 -144	15 20 45	90.0	20	42	6.5
3	MG 23480 PG 12910	79765 7013	13.00	175	-162	170	-157	80	100.2	27?	27	6.5
4	MG 23874 PG 13339	79589 6964	17.50	205	-187.5	?	?	12	---	21?	21	6.5
5	MG 21338 PG 12012	75974 2752	40.67	310	-269.3	160 160+	-119	15 5	27	32	43	6.5
6	MG 21035 PG 11405	77027 3664	31.86	295	263.1	85 265	-53 -233	2 to 3 25	33.3	11	21	6.5
7	MG 20676 PG 11083	76962 3494	36.76	400	-363.2	?	?	1	---	45±	68	6.5
8	MG 19665 PG 10428.2	75937 2212.3	43.51	400	-356.5	340	-296	45	40	62	92	6.0
9	MG 19653 PG 10565.6	75446 1739.7	45.16	400	-354.8	220±	-175	2	---	78	127	6.0

TABLE 2.4-3
(Sheet 2 of 2)

DRILLED WELL SUMMARY SHEET
SEABROOK STATION

WELL NO.	MAG. GRID PLANT GRID N. COORD.	LOCATION LOCATION E. COORD.	GROUND[1] ELEV.	DEPTH (FT.)	BOTTOM ELEV.	INFLOW DEPTH(S)	INFLOW ELEV.(S)	EST. YIELD (GPM)	TEST[2] YIELD (GPM)	SOIL DEPTH (FT.)	CASING DEPTH (FT.)	HOLE DIAM. (IN.)
	MG 19644	76394				150±	-110	2.0				
10	PG 10269.9	2641.0	39.89	400	-360.1	150±		1.5	---	8	30	6.0
						75	-55.8	2				
						115	-95.8	3				
						135	-115.8	5				
11	PG 14968.2	7130.7	19.24	246	-220.8	230	-210.8	10	---	41	51	6.0
12	PG 14973.2	7147.8	18.39	41	-22.6	---	---	1.5	---	41	Set screen @251	6.0
13	PG 13671.3	6515.3	21.97	240	-218	68	-46	7				
						102	-80	5	---	34	41	6.0
						60	-47.5	0.5				
						80	-67.5	12+				
						125	-112.5	10+				
14	PG 12761.5	7465.4	12.51	200	-187.5	140	-127.5	10+	---	6	21	6.0
15	MG 23665	79467				115	-97.3					
15	PG 13176	6784	17.75	200	-182.3	152	-134.3	---	---	33	35	6.5

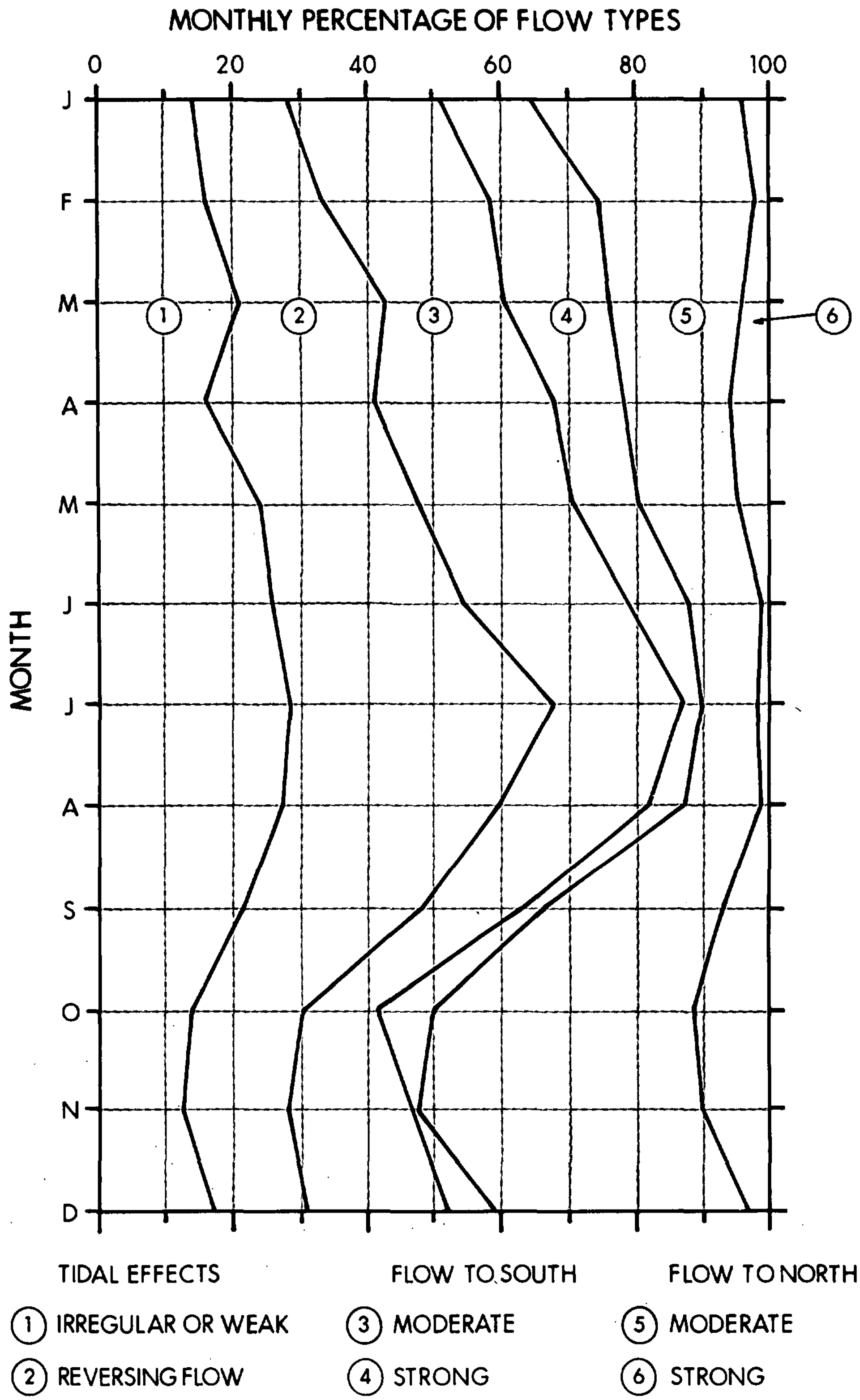
2

1. Top of Casing

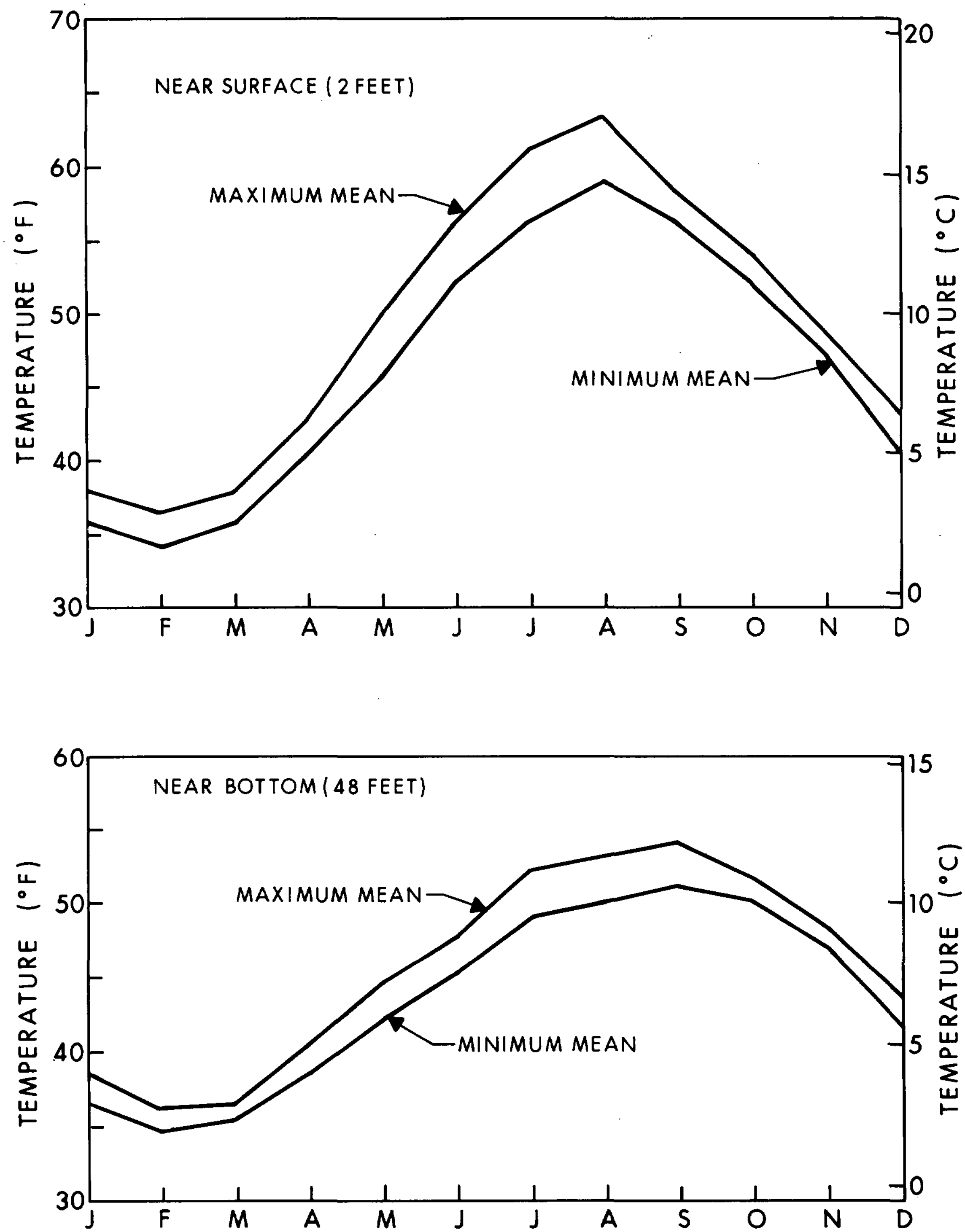
2. 48-Hour Specific Capacity Pump Test

Wells 4, 13 and 14 for observational purposes only.

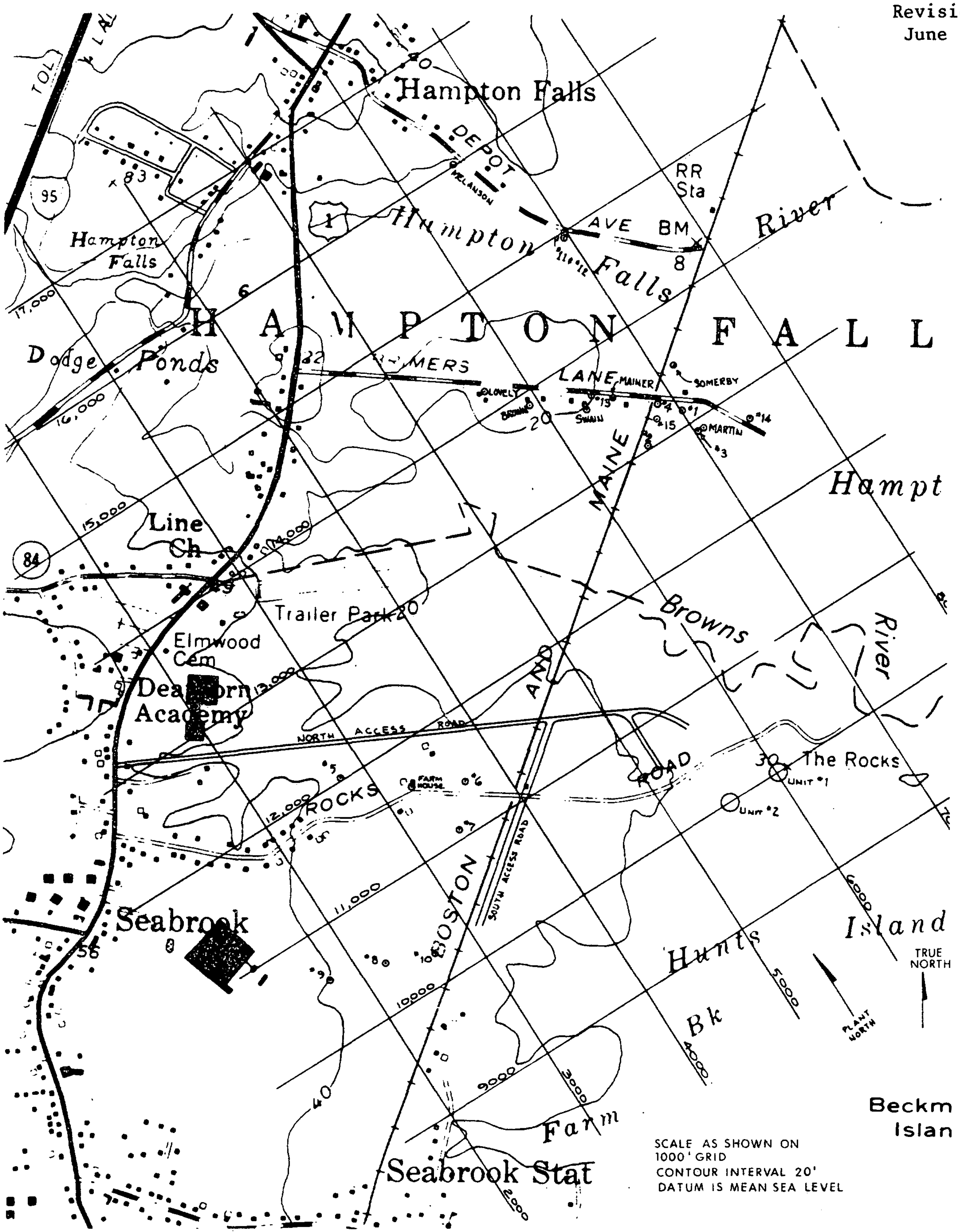
Wells 7, 9, 10, 11 and 12 not developed due to insufficient water.



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	MONTHLY PERCENTAGES OF FLOW TYPES OFF HAMPTON BEACH, NEW HAMPSHIRE 1973-1978
	FIGURE 2.4-1



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	WATER TEMPERATURE FOR COASTAL WATERS OFF HAMPTON BEACH, NEW HAMPSHIRE FIGURE 2.4-2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	SITE VICINITY WELLS
	FIGURE 2.4-3

2.5 GEOLOGY

2.5 GEOLOGY

2.5.1 Regional Geology

2.5.1.1 Regional Physiography

The Seabrook Station lies in the central part of the Seaboard Lowland section of the New England physiographic province (Figure 2.5-1). The Seaboard Lowland is a 40-mile wide, northeast trending zone which is bordered on the north by the New England Upland, and bordered on the southeast, beneath the waters of the Gulf of Maine, by the Coastal Plain. The southeasterly half of the Seaboard Lowland in the general site area is also submerged beneath the ocean.

The Seaboard Lowland is characterized by subdued, gently rolling topography, ranging in elevation on land from sea level to about 500 feet elevation at its inland boundary with the New England Upland. Local relief within the Lowland rarely exceeds 200 feet. Paleozoic crystalline bedrock in the lowland area is veneered by thin glacial till, which is in turn, locally overlain by granular ice-contact deposits and sandy outwash. In the area of low elevations bordering the ocean, postglacial marine clay-silt deposits underlie and interlayer with outwash deposits.

2.5.1.2 Regional Geologic Setting

The bedrock basement within 200 miles of the Seabrook site ranges in geological age from Late Precambrian to Upper Mesozoic, and consists predominantly of hard, crystalline metamorphic and igneous rock types. Mildly metamorphosed to unmetamorphosed well-consolidated sedimentary and volcanic bedrock types of Carboniferous and Triassic age occur locally in basin structures in the crystalline basement in the Connecticut River Valley, the Narragansett and Boston Basins, and in other apparently isolated basins within the Gulf of Maine area. Loosely-consolidated Coastal Plain sediments of upper Mesozoic and lower Cenozoic age blanket the crystalline basement rocks and basins in wide areas on the Continental Shelf and in scattered patches near-shore within the Gulf of Maine. The entire area is widely covered by a thin veneer of loose, unconcolidated sediments of Quarternary age, derived from continental glaciation and post-glacial deposition.

The geologic structure of this broad province is characterized essentially by northeast-trending foldbelts of metamorphic rocks, predominantly steeply-dipping schistose rocks, intruded by large subconcordant, commonly foliated plutonic masses. Major fault structures strike through the region, trending subparallel with the structural fabric of the older basement rocks. The primary regional northeasterly structure was initiated early in the Paleozoic era, and the rocks were then compressed, folded, metamorphosed, recrystallized and faulted, largely to their present configuration, by the

Acadian orogeny in Upper Devonian time, around 350 million years ago. Superimposed on the characteristic northeastly-trending foldbelt structure of the region are northeast- to east-trending rift basins formed by post-orogenic crustal adjustment in Late Paleozoic time, and north- to northeast-trending rift basins formed during renewed crustal uplift and tensional separation in Lower Mesozoic time. Finally, during Middle and Upper Mesozoic time, the last major structural modification of the area occurred with the emplacement of scattered plutonic intrusives within a northwesterly-striking zone which transected normal regional structure from the Gulf of Maine to Montreal, Quebec. For roughly the last 100 million years since the close of the Mesozoic era, the region has experienced only minor structural adjustment in the limited form of successive broad isostatic uplifts followed by depression and rebound under continental glaciation and deglaciation.

Numerous major fault structures of great lateral extent are found throughout the region, commonly reflecting the northeasterly pattern of the folded bedrock structure. Faulting in the region ranges in age of development from early Paleozoic to Upper Mesozoic; Paleozoic faulting is commonly characterized by low-angle thrusts associated with regional orogenic compression, while Late Paleozoic and Mesozoic faulting is more frequently defined as high-angle normal faulting associated with post-orogenic crustal uplift and tensional separation. There are no known or inferred tectonic faults displacing Quaternary glacial deposits or post-glacial and recent sediments, nor has any tectonic fault structure been reported or inferred to have occurred in the region in the past 100 million years since the close of the Mesozoic era.

2.5.2 Site Geology

2.5.2.1 Site Physiography

The physiographic configuration of the site area is characterized by broad open areas of level tidal marshes, dissected by numerous meandering tidal creeks and man-made linear drainage ditches, and interrupted locally by wooded "islands" or peninsulas which rise to elevations of 20 to 30 feet above sea level. The site is located on a wooded peninsula held up by quartz diorite bedrock to a maximum of about 30 feet above sea level. The groundwater table conforms with the topography, normally lying 5 to 10 feet below ground surface. No major groundwater aquifers are inferred for the area, and groundwater migration is slow. Changes in ocean tide levels have little effect on water table levels within the bedrock at the site.

2.5.2.2 Site Bedrock Geology

Bedrock formations in the areas of the Seabrook Station include quartzitic and schistose rocks of the Merrimack Group of Ordovician-Silurian (?) age, intruded by dioritic igneous rocks of the Newburyport and Exeter plutons of Upper Devonian (?) age. In addition to the larger plutons, small granitic intrusives also invaded the area during the time of folding, faulting and igneous activity of the Acadian orogeny. Thin diabase dikes were emplaced, largely along northeast-trending tensional joint openings, during periods of crustal uplift in late Paleozoic and Mesozoic time. Foundations for plant structures were excavated in the Newburyport quartz diorite intrusive which included two large xenoliths of Kittery quartzite. The site itself lies a few hundred feet to the south of the contact between the Newburyport and the Kittery formation. The Newburyport is a hard, strong crystalline igneous rock consisting of a medium-to coarse-grained quartz diorite matrix intimately enclosing inclusions of dark gray, fine-grained diorite. The Kittery formation in the area is a fine-grained impure, locally foliated quartzite. The intrusive contact between the Newburyport and Merrimack rocks is welded, tight and interfingering; lens-like remnants of the Kittery formation typically occur enclosed as isolated blocks within the Newburyport intrusive mass.

The bedrock structure at the plant site is controlled by the attitude of Acadian folding along the south-plunging nose of the Rye anticline, and is characterized by near-vertical schistosity in the Kittery formation and subparallel foliation in the gneissoid Newburyport quartz diorite. The contact between the Newburyport and Kittery trends irregularly east-west and is interpreted to dip steeply south, roughly conforming with the layering of the adjacent bedrock structure. The bedrock is characteristically cut by numerous high-angle joints at intervals spaced from a few inches to greater than 10 feet. Northeast-striking joints are common in the Newburyport while northwest-striking joints are more typical in the Kittery. North-northwest and east-striking joints are generally less common.

No evidence or inference of surface faulting is known for the area, and extensive drilling on the site and mapping in site excavations has not revealed the presence of any subsurface structures or conditions suggestive of recent tectonic activity. A number of small-scale fault structures were mapped in site excavations, although this faulting was found to be both very limited in scale and very ancient. Within a few miles of the site, some faults of significant displacement are present or have been inferred to occur within the bedrock. All of these features are associated with the structural development of the region during the Paleozoic and Mesozoic eras.

The degree of bedrock weathering in the site area is commonly slight, consisting of thin rusty coatings on high-angle joint surfaces. The bedrock material between the weathered surfaces is normally fresh at or within a few feet below the bedrock surface, although slight to moderate weathering effects associated with fractures extend locally to 100 feet or more below ground surface. No discrete continuous zones or wide-area masses of severely weathered bedrock are known or inferred to exist in the site area. Pre-Quarternary subaerial weathering in the area affected the Kittery formation to greater depths than it did the Newburyport quartz diorite. Subsequent Pleistocene glacial scouring removed the residual soils derived from the earlier period of weathering to leave an undulating bedrock surface underlain by essentially fresh rock. Because of its relative resistance to the earlier weathering, the Newburyport quartz diorite subsequent to glacial scouring, commonly forms topographic highs, knobs and ridges on the bedrock surface.

The less resistant Kittery schist underlies topographic lows, depressions, and valleys on the bedrock surface.

2.5.2.3 Site Surficial Geology

Unconsolidated deposits of variable thickness mantle the bedrock in the plant site area. These deposits consist of glacial drift including till, marine deposits, and outwash of Pleistocene age and recent alluvial, beach and marsh deposits.

Glacial till is an unsorted mixture of rock particles ranging in size from gravel to boulders in a matrix of clay and silt. It has a high proportion of silt and sand in relation to clay. The upper part of the till is frequently oxidized and has a yellow-brown color while the lower part is gray-blue. The till, averaging less than 20 feet thick, discontinuously overlies an irregular bedrock surface as a ground moraine. Where the ground moraine is missing, younger marine deposits often rest directly on bedrock.

Marine deposits are the most widespread of the surficial materials in the area. They underlie most of the outwash, marsh and beach deposits. They, like the till, are divided into an upper oxidized unit of olive-drab sand, silt and clay and a lower blue-gray, silty clay. The upper zone is laminated with layers of sand and silty clay. The lower zone is more massive and consists of clay and silt with some bedding near the top of the section. Marine deposits underlie outwash deposits west of the site and surround the till and bedrock complex of the site itself. They are buried by organic material in the tidal marshes and by recent estuarine silts and sands in Hampton Harbor Inlet.

Glacial outwash deposits overlie marine sediments in the western part of the site. These outwash deposits form a sand plain which extends to the west and southwest of the site. The outwash deposits are usually less than 25 feet thick and are composed mostly of fine to very fine sand in the vicinity of the site. To the east of the site and under Hampton Harbor, these deposits, which may include old shore deposits, are up to 40 feet or more thick and are relatively coarse textured.

Marsh deposits consist of organic material in various stages of decay mixed with silt, sand, and in some cases, gravel. These deposits almost wholly occupy tidal marshes and support a growth of salt grass cover. They are cut by a series of natural drainage channels and man-made ditches which subject them to tidal action.

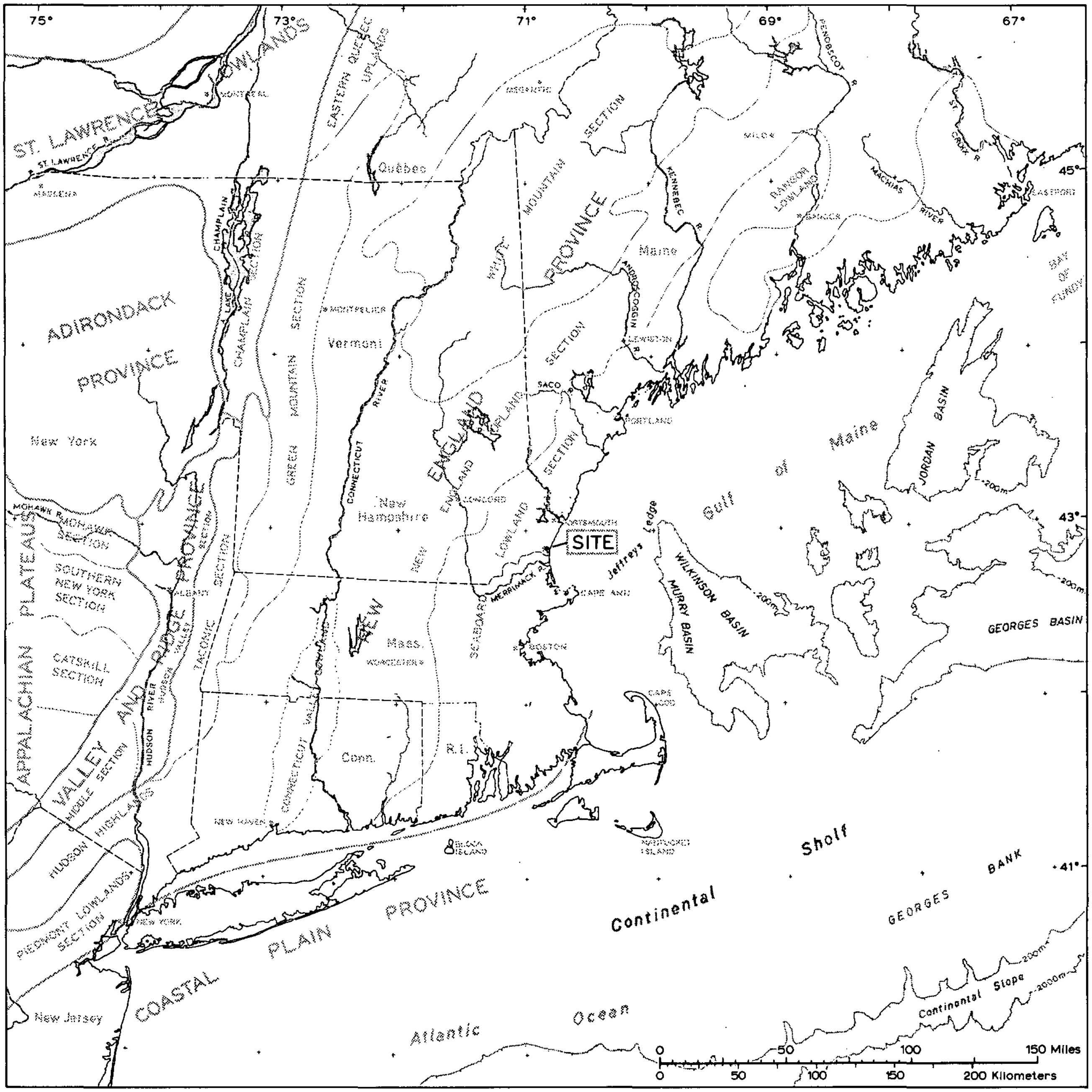
The marsh deposits generally overlie marine and outwash deposits although in some places, they rest directly on till or bedrock. They average less than 10 feet thick but have been encountered by borings to a maximum thickness of 28 feet.

Beach deposits consist of fine to medium sand with a few areas of cobbles where they are subjected to wave action. They overlie the marine deposits along Hampton Beach where their average thickness is about 45 feet.

No major site buildings are founded on in-situ, unconsolidated deposits. Over much of the site these deposits have been removed to allow founding of all major structures on bedrock.

2.5.3 Summary

In summary, the site is located in a geologically ancient and stable region. The area at and around the site has been extensively studied and shows no evidence of subsurface structures or conditions suggestive of recent tectonic activity. Bedrock supporting structures at the site consists of very hard, fresh, intact igneous and metamorphic rock types. Surficial deposits of variable thickness consisting of Pleistocene till, marine clay and silt, and outwash mantle the bedrock in the site area. Recent alluvial, beach and marsh deposits are also present.



REFERENCES: FENNEMAN, 1938; UCHUPI, 1965; BOSTOCK, 1970.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	REGIONAL PHYSIOGRAPHIC MAP
	FIGURE 2.5-1

2.6 REGIONAL HISTORIC, SCENIC, CULTURAL, AND NATURAL FEATURES

2.6 REGIONAL HISTORIC AND NATURAL LANDMARKS

The publications from which the listing of historic and natural landmarks in the ER-CPS was derived, have not been updated with the exception of the National Register of Historic Places - U.S. Department of Interior. The additions to that list include the Governor Meshech Weare House in Hampton Falls. The Station is not visible from this landmark.

The transmission line described in the ER-CPS as spanning Cedar Swamp will now circumvent the wetland area removing the visual impact of the once-proposed Cedar Swamp crossing.

2.7 AMBIENT NOISE

2.7 NOISE

No section was included in the ER-CPS specifically addressing the subject of ambient acoustic noise. This subject was discussed in other sections of the ER-CPS, however. Reference may be made to Sections 3.9.1, 4.1.1, 10.1.5, and to the Supplement for the response to AEC interrogatory question 2.6 of May 7, 1973. Reference may also be made in the AEC Environmental Impact Statement for Construction of Seabrook Station to Sections 4.1.1, 4.3.2.1, 4.4, 4.5.1, 4.5.2, 6.1.2.2, 10.4.2.2, and Appendix pages A-12 and A-15.

There are no differences between currently projected ambient acoustic noise effects in the Station area and the effects discussed in the ER-CPS.

CHAPTER 3
THE STATION

CHAPTER 3

THE STATION

CONTENTS

CONTENTS (Continued)

CHAPTER 3

THE STATION

TABLES

TABLES (Continued)

CHAPTER 3

THE PLANT

FIGURES

2

3.1 EXTERNAL APPEARANCE

CHAPTER 3

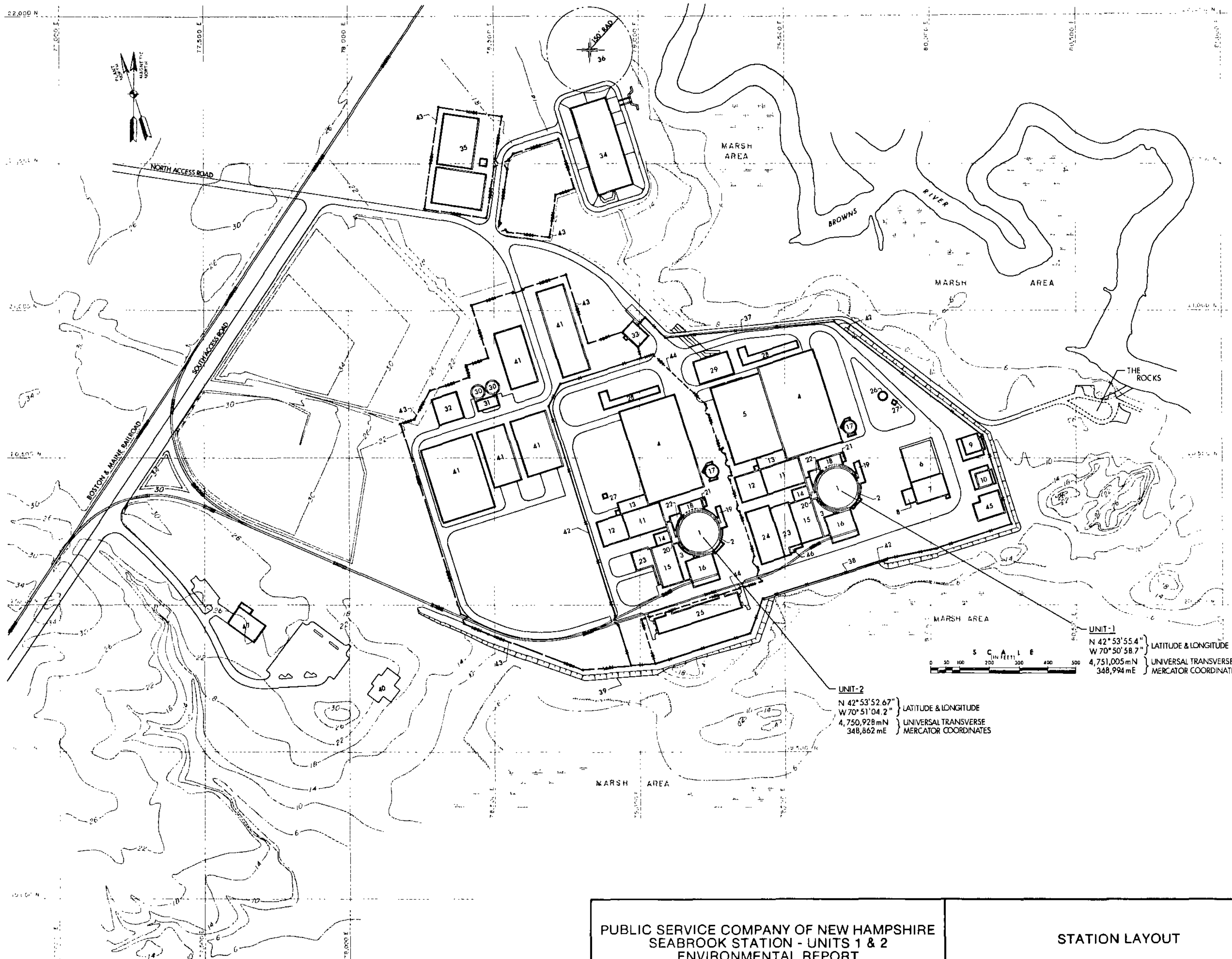
THE STATION

This chapter describes the operating station and transmission system. In particular, since environmental effects are of primary concern in this report, the station effluents and station-related systems that interact with the environment are described in detail.

3.1 EXTERNAL APPEARANCE

The information for this section remains unchanged from that presented in Section 3.1 of the Seabrook Station ER-CPS except as noted below. Figure 3.1-1 is revised to show the arrangement of structures within the plant area, and Figure 3.1-2 shows the plant as it will appear upon completion. As described in the ER-CPS, the concrete of the containment structures is left natural. The flush siding on the turbine and lower buildings is a light beige and the channeled siding is an earth-tone gold.

Although more of the upland portion of the site has been cleared for construction than was contemplated in the ER-CPS, a border of trees at the marsh perimeter has generally been maintained. Post-construction restorative measures have not been foreclosed and are planned as described in the ER-CPS. Some of the pre-engineered steel construction buildings will be used by the plant operating staff after construction is completed. The buildings will be incorporated into the restoration plan.



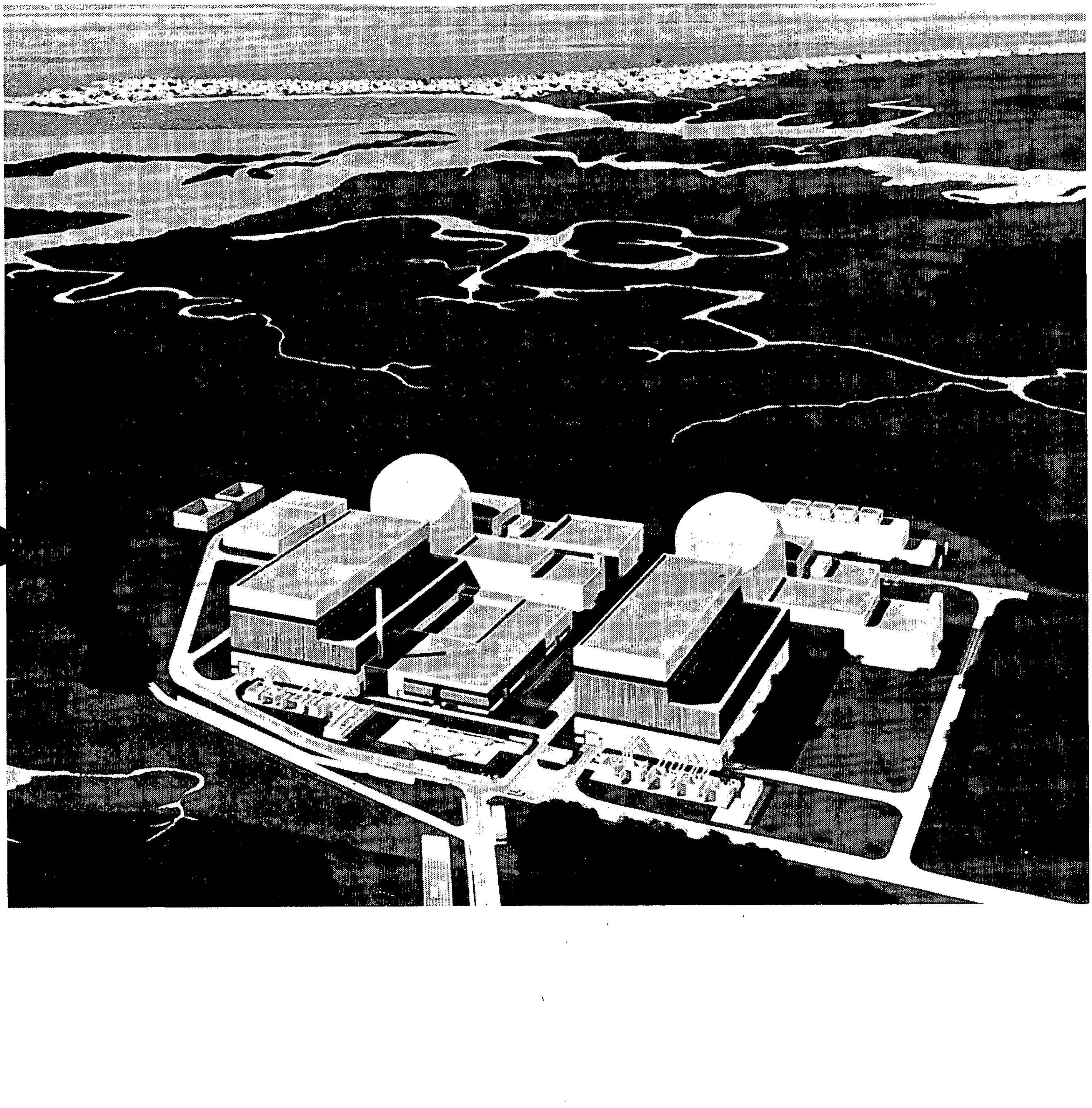
PRINCIPLE STATION STRUCTURES

1 CONTAINMENT STRUCTURE
2 CONTAINMENT ENCLOSURE AREA
3 CONTAINMENT ENCLOSURE VENTILATION AREA
4 TURBINE BUILDING AND HEATER BAY
5 ADMINISTRATION AND SERVICE BUILDING
6 CIRCULATING WATER PUMPHOUSE
7 SERVICE WATER PUMPHOUSE
8 ELECTRICAL CONTROL ROOM
9 INTAKE TRANSITION STRUCTURE
10 DISCHARGE TRANSITION STRUCTURE
11 CONTROL BUILDING
12 DIESEL GENERATOR BUILDING
13 NON-ESSENTIAL SWITCHGEAR ROOM
14 RHR SPRAY EQUIPMENT VAULT
15 PRIMARY AUXILIARY BUILDING
16 FUEL STORAGE BUILDING
17 CONDENSATE STORAGE TANK
18 EMERGENCY FEEDWATER PUMPHOUSE
19 STEAM & FEEDWATER PIPE CHASE (EAST)
20 STEAM & FEEDWATER PIPE CHASE (WEST)
21 PRE-ACTION VALVE BUILDING
22 PERSONNEL HATCH AREA
23 TANK FARM AREA
24 WASTE PROCESSING BUILDING
25 SERVICE WATER COOLING TOWER
26 DEMINERALIZED WATER STORAGE TANK
27 CONTROL BUILDING MAKE-UP AIR INTAKE STRUCTURE
28 TRANSFORMER AREA
29 SWITCHING STATION (SUBSTATION)
30 FIRE PROTECTION TANKS
31 FIRE PUMP HOUSE
32 FUEL OIL STORAGE TANK
33 GUARD HOUSE
34 SETTLING BASIN
35 SEWAGE TREATMENT & LAGOON AREA
36 METEORLOGICAL TOWER
37 RETAINING WALL
38 SEAWALL
39 RIPRAP
40 EDUCATION CENTER
41 MISC NON-OPERATIONAL STRUCTURES
42 PERMAMENT SECURITY FENCE FOR OPERATING UNITS 1 AND 2
43 SUPPLEMENTARY FENCE FOR PROTECTION OF ANCILLARY PLANT STRUCTURES
44 TEMPORARY SECURITY FENCE ISOLATING OPERATING UNIT 1 DURING CONSTRUCTION OF UNIT 2
45 CHLORINATION BUILDING
46 STEAM GENERATOR BLOWDOWN BUILDING
47 TRAINING CENTER

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

STATION LAYOUT

FIGURE 3.1-1



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

SEABROOK STATION

FIGURE 3.1-2

3.2 REACTOR AND STEAM ELECTRIC SYSTEM

3.2 REACTOR AND STEAM ELECTRIC SYSTEM

The majority of the information for this section is unchanged from the information presented in Section 3.2 of the Seabrook Station ER-CPS. The reactor core fuel information has changed.

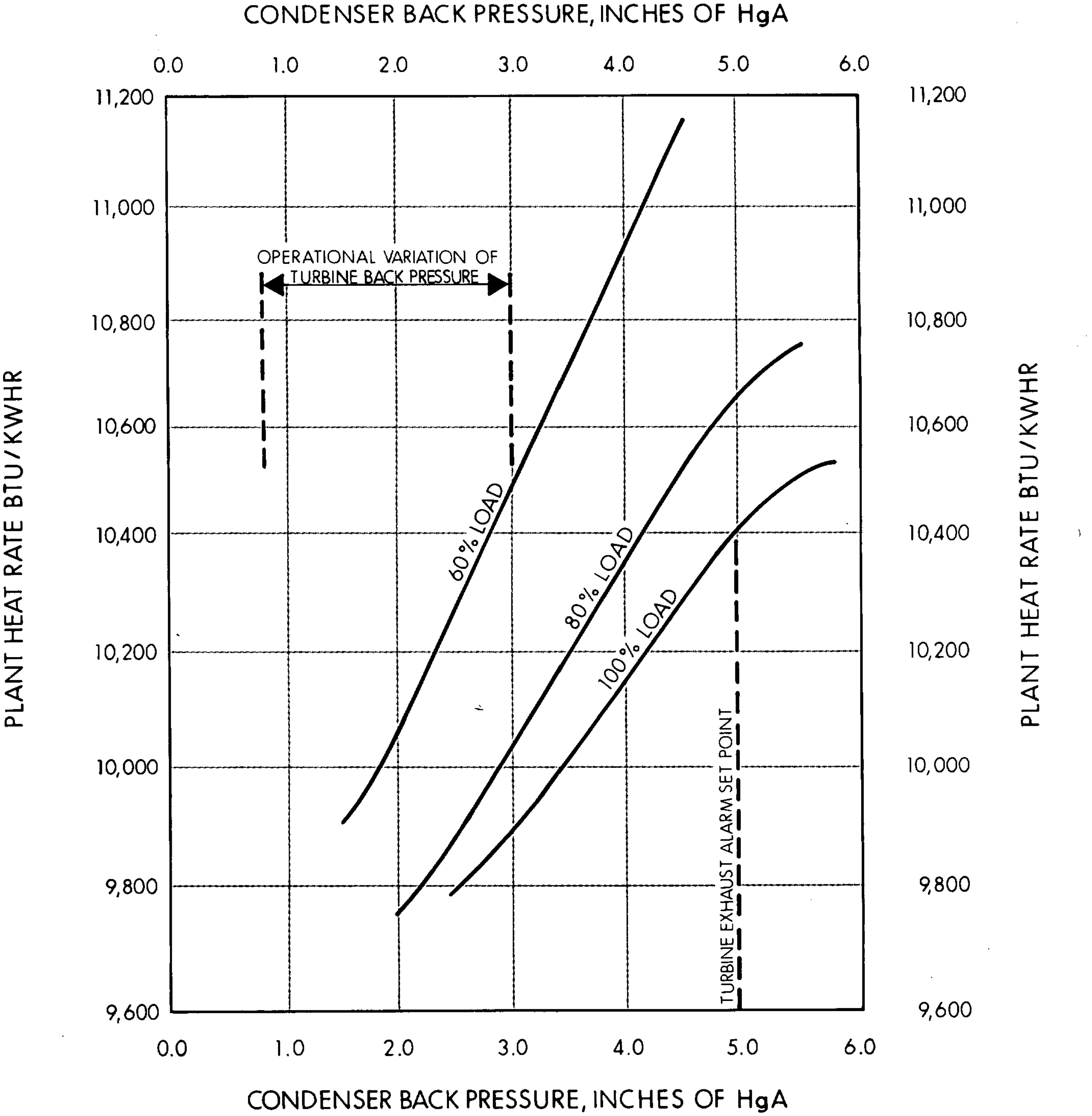
The reactor core contains 193 fuel assemblies. Each assembly contains 264 fuel rods. The rods contain slightly enriched uranium dioxide pellets enclosed in Zircaloy-4 tubes. The initial enrichment varies according to the core region as follows:

a. Region 1 (inner) contains 65 fuel assemblies enriched to approximately 1.60 percent U-235 by weight.

b. Region 2 contains 64 fuel assemblies enriched to approximately 2.40 percent U-235 by weight.

c. Region 3 contains 64 fuel assemblies enriched to approximately 3.10 percent U-235 by weight.

The relationship of plant heat rate to the expected variation of turbine back pressure for 100%, 80%, and 60% unit load is shown on Figure 3.2-1 for the design circulating water flow. The design operating life of the plant is 40 years. This information is furnished now, since it was not included in the Seabrook Station ER-CPS.



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	PLANT HEAT RATE VS CONDENSER BACK PRESSURE
	FIGURE 3.2-1

3.3 PLANT WATER USE

3.3 PLANT WATER USE

The information in this section remains unchanged from that presented in Section 3.3 of the Seabrook Station ER-CPS except as noted below.

Seabrook plant water use has been modified slightly as shown in revised Table 3.3-1 and Figure 3.3-1.

Fresh water is now obtained from two sources; from wells located on-site and from the town of Seabrook municipal water supply. The on-site wells are used as the primary source of freshwater. Additional water, up to 50,000 gallons per day, is available as required from the Seabrook municipal water supply.

During operation large amounts of water are conserved by the use of a steam generator blowdown recovery system which is capable of processing up to 335 gpm during plant start-up.

The consumptive use of fresh water during plant operation averages 120,000 gallons per day.

TABLE 3.3-1

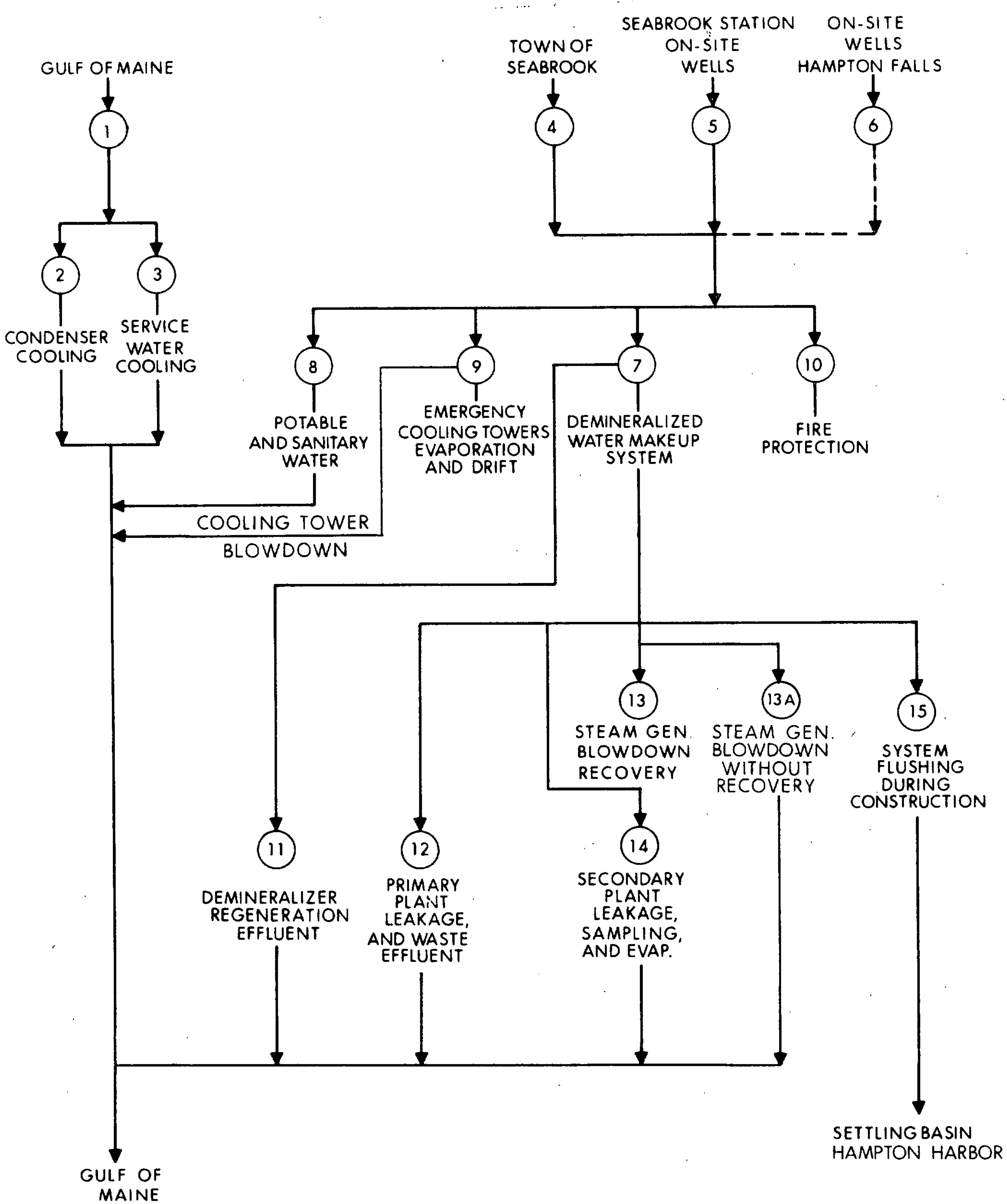
PLANT WATER USE

Point*	Condition A Flows	Condition B Flows	Condition C Flows	Condition D Flows	Notes
1	824,000 gpm	824,000 gpm	412,000 gpm	0-824,000	Continuous flow
2	780,000 gpm	780,000 gpm	390,000 gpm	0-780,000	Continuous flow
3	44,000 gpm	44,000 gpm	22,000 gpm	0-44,000	Continuous flow
4	47,240	47,240	20,490	50,000	Max. allocation is 50,000 gpd
5	72,000	72,000	72,000	72,000	1/2 of 48 hr. drawdown test
6	-	-	-	138,000	
7	53,600	53,600	26,850	120,000	480,000 gpd max. capacity
8	15,200	15,200	15,200	140,000	Maximum during construction
9	39,300	39,300	39,300	-	20 days use per year assumed, at 358,600 gpd per unit
10	As Req.	As Req.	As Req.	As Req.	In event of fire, two 500,000 gal. storage tanks available
11	6,400	6,400	3,200	-	Intermittent operation (with blowdown recovery in operation)
12	5,700	5,700	2,850	-	Variable due to batch releases
13	160,000	483,200	403,200	-	The steam generator blowdown recovery system greatly reduces the water use by processing and recycling blowdown.
14	41,500	41,500	20,800	-	Continuous during operating
15	-	-	-	120,000 (avg)	Storage used for maximum flow during flushing sequences

1
1
1

*Refer to Figure 3.3-1

NOTES: All flow rates in gal/day unless noted otherwise.
Condition A Two units operating full load 80% C.F.
B One unit full load, one unit start-up
C One unit start-up
D Station construction



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	PLANT WATER USE DIAGRAM
	FIGURE 3.3-1

3.4 HEAT DISSIPATION SYSTEM

3.4 HEAT DISSIPATION SYSTEM

3.4.1 System Concept and Reasons For Selection

The information presented in the Seabrook Station 1 & 2 ER-CPS regarding the once-through system concept and reasons for selection is unchanged. Some changes, however, have been made to system specifications resulting from regulatory actions [9, 10, 11] and are described below.

3.4.2 Description of Heat Dissipation System

3.4.2.1 General Specifications

The quantity of heat dissipated by each of the two units at Seabrook Station, the resultant circulating water condensor temperature rise, and the quantity of ocean water provided to each unit, including the additional flow for the service water heat exchanger, are the same as originally proposed (ER-CPS, Section 3.4.2). The location of the intake and discharge structures, as well as the tunnel diameters, however, have changed.

As illustrated in Figure 3.4-1, the intake and discharge tunnels, each with a 19 foot inside diameter, extend to about 7,000 and 5,500 feet offshore from Hampton Beach, respectively. Travel time through the 17,160 foot long intake tunnel from the intake structure to the pumphouse is 44 minutes at the nominal flow rate of about 6.5 ft/sec, which is 412,000 gpm for each unit, including 22,000 gpm per unit for the service water (824,000 gpm total). The nominal discharge tunnel travel time is 42 minutes from the condenser to the discharge structure 16,500 feet away at 6.5 ft/sec. Travel time across the condenser is only 16 seconds.

A cross-sectional profile of both the intake and discharge systems is shown in Figure 3.4-2. Each tunnel is constructed with a 0.5 percent slope toward the land to allow for gravity flow of water seepage toward the plant during construction and, if necessary, during dewatering of the tunnel. The intake and discharge tunnels, for example, have centerline elevations of -175 and -163 feet below mean sea level (MSL) respectively at the ocean end, whereas the respective centerline elevations at the plant for the intake and discharge tunnels are -248 and -250 feet MSL. Each tunnel is connected to the surface at the plant by a vertical riser shaft.

3.4.2.2 Intake System

The "velocity cap" concept originally proposed in the ER-CPS has been maintained, and was chosen because of its low potential for fish entrapment as experienced for similar coastal structures [1, 2, 3, 4].

Figure 3.4-1 illustrates the general layout of the intake structures in relationship to the discharge structure, whereas Figure 3.4-3 presents the dimensions as well as the elevation and plan views of the structures.

The nominal flow rate at the outer edge of the "velocity cap" is 1.0 fps. Each of the three intake structures is connected to the 19 foot ID intake tunnel by a 10 foot ID riser shaft. The pumphouse circulating water pumps, general layout, etc., are unchanged from that outlined in ER-CPS Section 3.4.2.2.

3.4.2.3 Discharge System

Various hydrothermal model studies [6, 7, 8] have resulted in the selection of a submerged multiport diffuser as the discharge structure. Figure 3.4-1 shows the general layout of the discharge system and its relationship to the intake system, whereas Figure 3.4-4 illustrates the diffuser design.

As shown, the 1000 foot long diffuser is connected to the 19 foot ID discharge tunnel by eleven vertical riser shafts, each 4.5 feet in diameter, spaced about 100 feet apart. Atop each riser shaft are two 2.65 foot ID nozzles, which in turn are approximately 7 to 10 feet above the sea floor in depths of water from 50 to 60 feet. The discharge flow rate through each of the 22 nozzles is 15 fps.

3.4.2.4 Minimization of Thermal Shock to Marine Life

Refer to ER-OLS Section 5.1, Effects of Operation of the Heat Dissipation System.

3.4.2.5 Control of Marine Fouling and Debris Removal

Refer to ER-OLS Section 3.6 for a complete description of marine fouling control; debris removal is unchanged from that presented in the ER-CPS.

3.4.2.6 Disposal of Debris Collected in the Circulating Water System

Information for this section is unchanged from that presented in the same section of the ER-CPS.

3.4.2.7 Service Water System

During normal operation, the service water system operation is unchanged from that described in the ER-CPS. However, during heat treatment (backflushing) operation, the service water is valved to perform independently of the circulating water system as a completely closed system utilizing a mechanical draft evaporative cooling tower. FSAR Sections 9.2.1 and 9.2.5 contain a complete description of the cooling tower and its operation.

3.4.3 Hydrographic Survey and Hydrothermal Model Studies

Refer to ER-OLS Sections 2.4.1 and 6.1.1.1 for a description of hydrographic results and surveys conducted for the heat dissipation system, and Section 5.1.2 for a description of hydrothermal model results and studies performed.

3.4.4 References

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2. Downs, D. D. and Meddock, K. R., "Engineering Application of Fish Behavior Studies in the Design of Intake Systems for Coastal Generating Stations", Paper delivered to Amer. Soc. of Chem. Eng. Conference, January 1974.

3. Schuler, V. J. and Larson, L. E., "Experimental Studies Evaluating Aspects of Fish Behavior as Parameters in the Design of Generating Station Intake Systems", Paper delivered to the Amer. Soc. Chem. Eng. Conference, January 1974.

4. Schuler, V. J. and Larson, L. E., "Improved Fish Protection at Intake Systems", Jour. Env. Eng. Div. ASCE. 101(EEG), 1975.

5. March, Patrick A. and Nyquist, Roger G., "Experimental Study of Intake Structures, Public Service Company of New Hampshire Seabrook Station, Units 1 and 2", Alden Research Laboratories Report 131-76/M296DF, November 1976.

6. Teyssandier, R. G., Durgin, W. W., and Hecker, G. E., "Hydrothermal Studies of Diffuser Discharge in the Coastal Environment: Seabrook Station", Alden Research Laboratory Report 86-74/M252B, August 1974.

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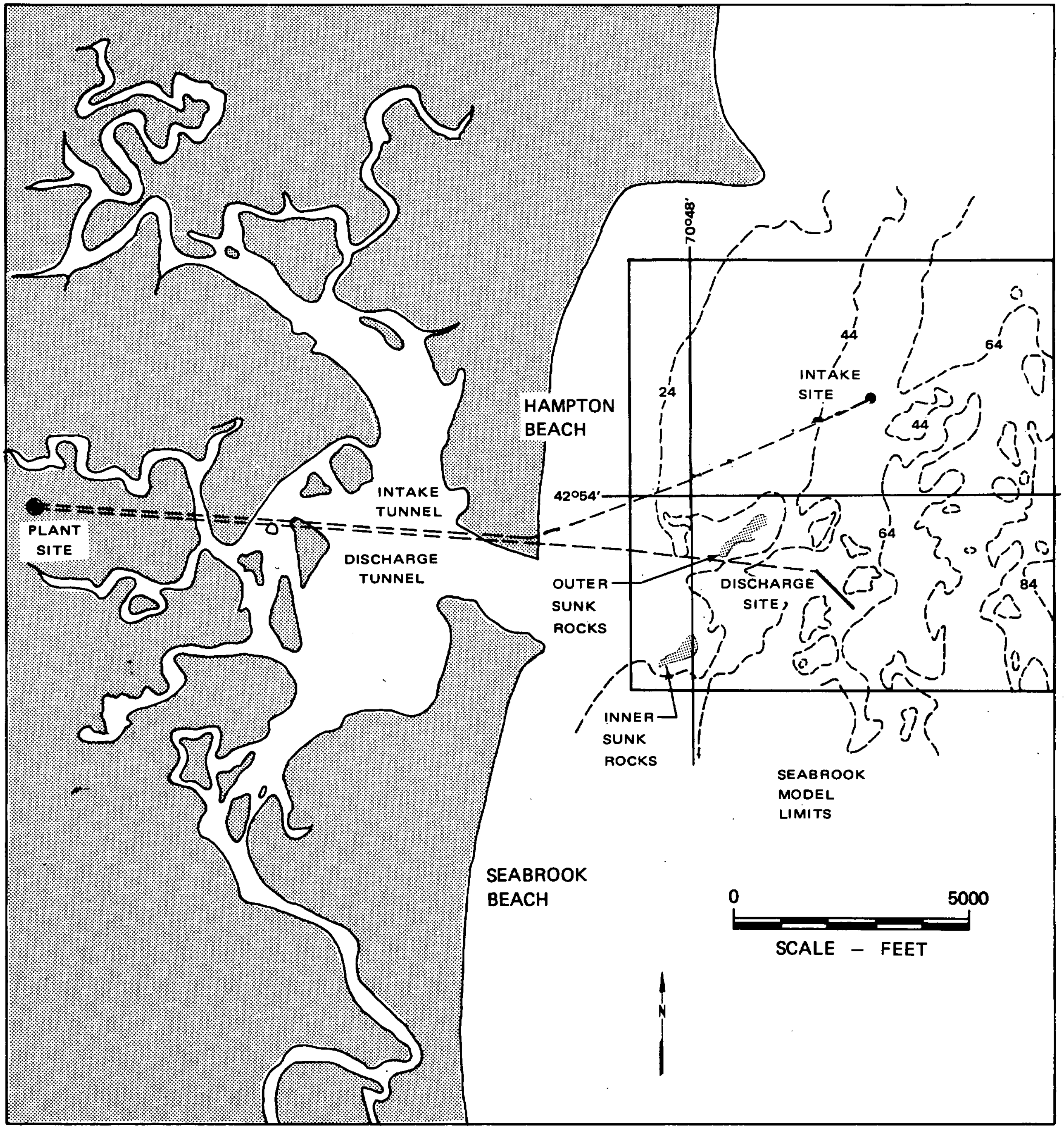
8. Nyquist, Roger G., Durgin, William W., and Hecker, George E., "Hydrothermal Studies of Bifurcated Diffuser Nozzles and Thermal Backwashing: Seabrook Station", Alden Research Laboratory Report 101-77/M296BF, July 1977.

9. U.S. Environmental Protection Agency, "Decision of the Administrator, Case No. 76-7, Public Service Company of New Hampshire, et al.", Douglas Costle, Administrator, Washington, D.C., June 10, 1977.

10. U.S. Environmental Protection Agency, "Modifications of Determinations, Case No. 76-7, Public Service Company of New Hampshire, et al.", Douglas Costle, Administrator, Washington, D.C., November 7, 1977.

11. U.S. Environmental Protection Agency, "Decision on Remand, Case No. 76-7, Public Service Company of New Hampshire, et al.", Douglas Castle, Administrator, Washington, D.C., August 4, 1978.



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	LOCATION OF SEABROOK STATION INTAKE AND DISCHARGE STRUCTURES FIGURE 3.4-1

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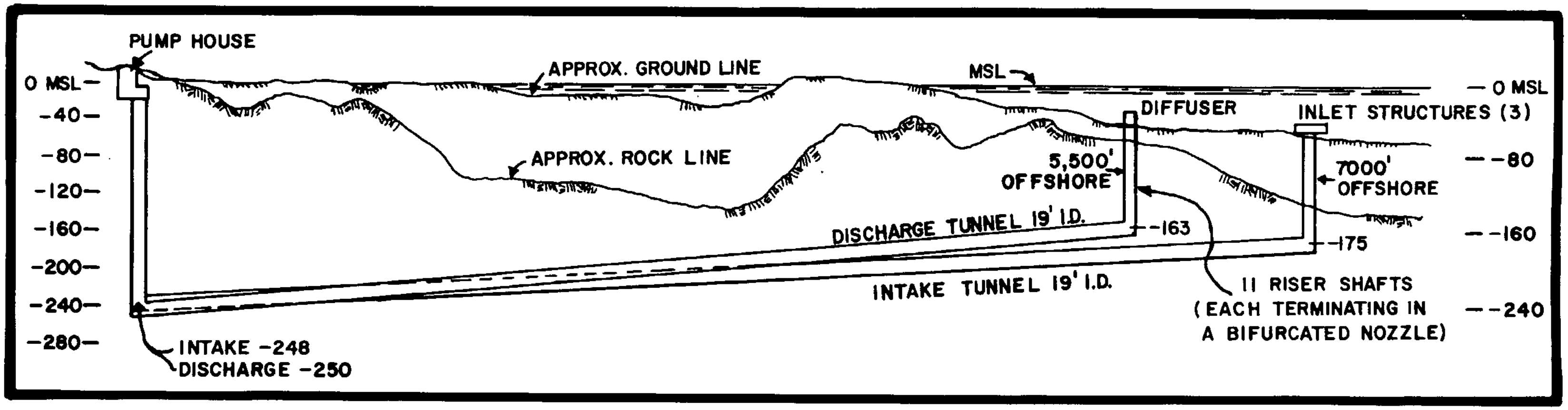
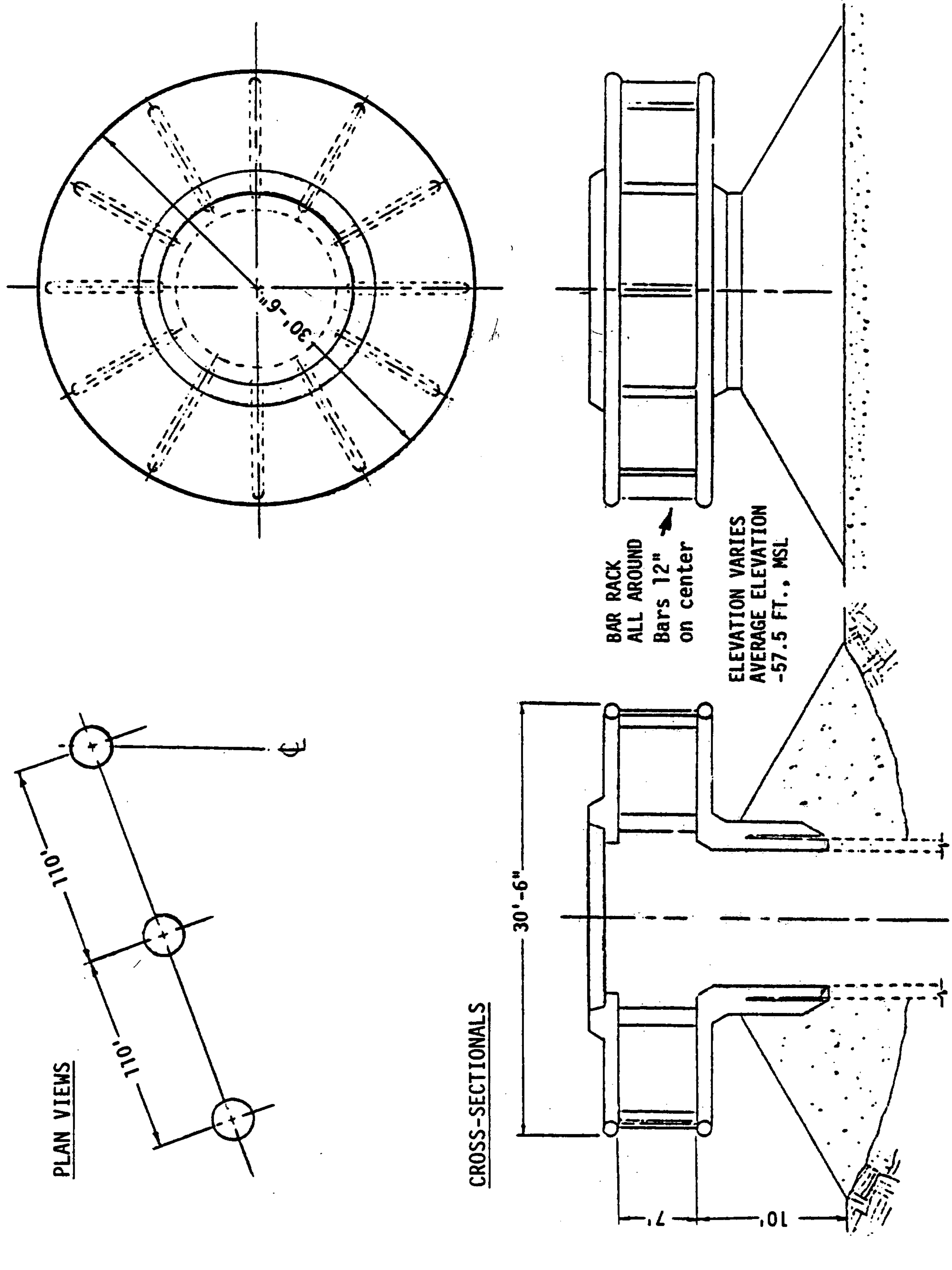


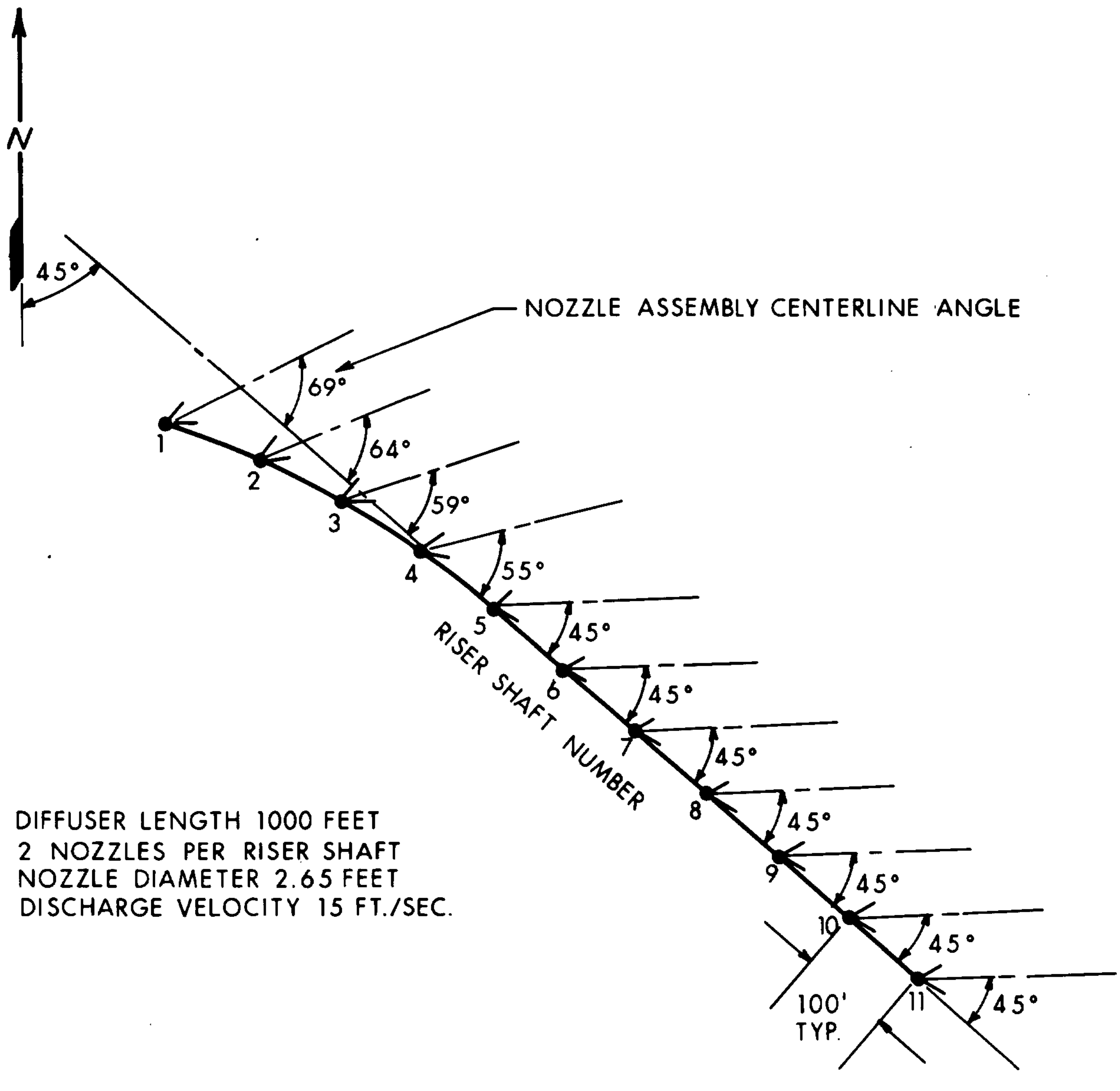
NOTE: THIS DRAWING NOT TO SCALE

PROFILE OF SEABROOK STATION CIRCULATING WATER SYSTEM

FIGURE 3.4-2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	DIAGRAM SHOWING SEABROOK STATION VELOCITY CAP INTAKE STRUCTURES	
		FIGURE 3.4-3



DIFFUSER LENGTH 1000 FEET
2 NOZZLES PER RISER SHAFT
NOZZLE DIAMETER 2.65 FEET
DISCHARGE VELOCITY 15 FT./SEC.

REFERENCE: UE & C DRAWING 9763-F-103000

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	DIAGRAM SHOWING SEABROOK STATION MULTIPORT DIFFUSER
	FIGURE 3.4-4

3.5 RADWASTE SYSTEMS AND SOURCE TERM

3.5 RADWASTE SYSTEMS AND SOURCE TERM

The majority of Section 3.5, unless otherwise stated, has changed from the information presented in the Seabrook Station - Units 1 and 2 Environmental Report - Construction Permit Stage (Seabrook ER-CPS). The Seabrook ER-CPS based the identification of source terms on .2% failed fuel fraction. The realistic source term identification in this report is based on the model and assumptions listed in RG 1.112 (PWR-Gale Code). Additional changes are due to engineering modifications to the liquid and gaseous radwaste subsystems.

3.5.1 Source Terms

3.5.1.1 Primary Source Terms

The concept of failed fuel determines what fraction (or percentage) of the reactor core fission product inventory is assumed to be released to and contained within the primary coolant system. Two sets of source terms (reactor coolant radionuclide concentrations) have been determined. The first is a conservative design base, used for systems and shielding calculations, in which the coolant radionuclide concentrations are based on a 1% failed fuel fraction. The mathematical model used is described in the FSAR Section 11.1.2. The assumptions and parameters are listed in Table 3.5-1 and the results are summarized in Table 3.5-2.

The second source term is based on a realistic model in which the reactor coolant radionuclide concentrations are based on a .12% failed fuel. The model used is described in Regulatory Guide 1.112, "Calculation of Releases of Radioactive Materials in Liquid and Gaseous Effluents from Pressurized Water Reactors (PWR's), and NUREG-0017 which contains the USNRC PWR Gale Code. Specific parameters used in the calculation are given in Appendix A and are summarized in Table 3.5-3. The resulting radioactivity concentrations in the reactor coolant are listed in Table 3.5-2. The inventories calculated in this manner represent "expected basis" activities and will be used for the evaluation of environmental impact during routine operation.

The concentrations of activated corrosion products in the reactor coolant are based on values given in Table 2-12, NUREG-0017, April 1976. The values are deduced from a comparison of concentrations reported in Final Safety Analyses Reports representing designs by the three manufacturers of PWR nuclear steam supply systems. The recommended values are those considered by the ANS 18.1 Working Group to be representative of operating reactors. Since the activated corrosion products are independent of failed fuel fraction, design basis and realistic basis concentrations are assumed to be the same.

The liquid waste system design principle of recycling all the reactor coolant from letdown and leakage that meets the reactor water chemistry specifications has potential long-term ramifications in regard to tritium levels within the plant systems. Tritium is produced in the reactor mainly through ternary fission. Additional contributions come from the interaction of neutrons with burnable poison rods, soluble boron in the coolant, lithium and deuterium. Some of the tritium formed within fuel materials will be present in the reactor coolant due to diffusion and leakage through the fuel cladding. Analysis shows that the tritium buildup in reactor coolant, as a result of recycling a certain quantity of reactor coolant, must be curbed by a tritium control plan so that containment accessibility is not unduly limited. For Seabrook 1 and 2, the tritium control plan is to feed and bleed the reactor coolant system over a protracted time period in preparation for each refueling shutdown, process the reactor coolant letdown in the boron recovery system and discharge it as described in the FSAR Subsection 11.2. The total annual tritium release through the combined liquid and vapor pathway is .4 Ci/yr/MWt based on NUREG-0017.

The quantity of tritium released through the liquid pathway is based on the calculated liquid release volume, assuming a tritium concentration in the release liquid of 1.0 μCi/cc. Secondary system wastes are excluded. In accordance with Regulatory Guide 1.112, only a maximum of 50% of the total quantity of tritium calculated to be available for release can be assumed to be released via the liquid pathway. The remainder of the tritium is assumed to be released through the vapor pathway.

Radioactivity enters the spent fuel pool due to contamination by reactor coolant during refueling operations and possible fission product releases from spent fuel during the storage period. These radionuclides are continuously removed through the spent fuel pool purification train and the building ventilation filtration system. Activity concentrations in the fuel pool and atmosphere are listed in Table 3.5-4.

3.5.1.2 Transported Source Terms

Normal plant operation is anticipated to result in a certain degree of radioactivity within the secondary coolant systems through primary to secondary steam generator tube leakage. The concentration of radionuclides in the secondary coolant system is calculated according to the PWR Gale Code given in NUREG-0017. The parameters used for the realistic analysis are given in Appendix A and are summarized in Table 3.5-3. The results are shown in Table 3.5-5. The radioactivity present in the reactor coolant and secondary coolant are transported through various radwaste systems and become source terms for environmental releases. A schematic diagram of radiation transport is provided in Figure 3.5-1.

Liquid Source Terms

The following sources are considered in calculating the release of radioactive materials in liquid effluents from normal operations, including anticipated operational occurrences:

a. Processed water from the boron recovery system (BRS) and liquid release for tritium control,

b. Non-recyclable liquid release from the liquid waste system (LWS),

c. Unprocessed liquid waste from the turbine building floor drain sumps, and

d. Non-recyclable liquid release from the steam generator blowdown system (SGBD).

The radioactivity input to the liquid radwaste treatment system is based on the flow rates of the liquid waste streams, a plant capacity factor of 80% as defined in NUREG-0017, and the radioactivity levels expressed as a fraction of the primary coolant activity. Table 3.5-6 lists the liquid waste flow rates and associated activity levels. The source terms not included in the above are either completely recycled or negligible.

Expected basis isotopic distribution for each source term is shown in Table 3.5-7 for the liquid waste system and Tables 3.5-8 for the boron recovery system, respectively. The radioactivities listed in these tables represent activities prior to treatment and will be reduced significantly due to decontamination and isotopic decay while passing through treatment systems.

Gaseous Source Terms

The following sources are considered in calculating the releases of radioactive materials (noble gases and iodines) in gaseous effluents from normal operation:

a. Containment purges,

b. Non-condensible gases from the gaseous waste system,

c. Primary auxiliary building ventilation,

d. Turbine building ventilation,

e. Main condenser vacuum pump exhaust.

Any leakage of primary coolant or the process stream either in the containment or in the auxiliary buildings are collected in the buildings and vented through filtration systems to the environment. Any steam/water leakages in the turbine buildings are directly vented to the environment. The noncondensible gases will be also discharged through the main condenser vacuum system exhaust.

The estimated releases, by isotope, from each source, are shown in Table 3.5-10 for normal operation. This table is based on the expected basis source term information presented above, assumptions and parameters in Table

3.5-9, and an overall operating capacity factor of 80%.

Solid Source Terms

The following sources are considered in calculating the solid waste generated at Seabrook 1 & 2. Solidified radioactive waste results from the processing of materials from the following sources:

a. Evaporator concentrates from:

   1. Waste evaporator (includes processed steam generator blowdown concentrates)

   2. Boron recovery evaporators

b. Spent resin from:

   1. Spent fuel pool demineralizer

   2. CVCS demineralizer

   3. Liquid waste system demineralizer

   4. Boron recovery system demineralizer

c. Liquid from detergent decontamination solutions

d. Spent radioactive filter cartridges from various plant filtering systems and other solid non-compressible radioactive waste.

In addition to solidified materials, solid waste is also generated as the result of compacting low-activity compressible waste such as paper, rags and polyethylene bags. Table 3.5-11 summarizes the generated solid wastes.

3.5.2 Radioactive Liquid Processing Systems

3.5.2.1 System Description and Operational Procedure

The principal objective in designing the Seabrook 1 & 2 radioactive liquid processing systems is to provide collection and processing capability that will allow recycling of as much of the liquid extracted from the reactor coolant system as practicable. Reuse criteria for reactor coolant include limits on chemical purity and dissolved gas content. The primary treatment system that is designed to collect and process recyclable liquids is the boron recovery system. The liquid waste system collects and processes non-recyclable primary and miscellaneous system wastes that are discharged from the site via the circulating water system.

Normal plant operation is anticipated to result in a certain degree of radioactivity within the secondary coolant systems of the Seabrook 1 & 2 units through primary-to-secondary steam generator tube leakage. Blowdown and leakage of secondary coolant constitutes radioactive liquid effluents. The radioactivity contents are reduced and/or accounted for by the steam generator blowdown processing system and the condensate leakage collection system. Thus, radioactive liquid wastes are generated within both the primary and secondary coolant systems at each of the Seabrook 1 & 2 units, and the wastes extracted from the primary systems are either recyclable or non-recyclable. The collection and treatment systems are provided accordingly.

Figure 3.5-2 depicts in simplified flow-diagram form the sources of radioactive liquids; where they are directed for treatment among the above mentioned systems, the interrelationships between the systems for the Seabrook 1 & 2 units, and the discharge pathway for those radioactive liquids that are released to the environment. The discussions that follow describe the design and operation of each of these systems in more detail with estimates of radioactivity releases for those systems discharging to the environment.

Liquid Waste System

The liquid waste system (LWS), Figure 3.5-3, is located in the waste processing building, which is a structure common to both Seabrook units. The processing is common, but redundant storage and transfer capabilities are provided. Back-up processing capability is available from the boron recovery system (BRS) evaporators. System flow rates, listed in Appendix A , are used in determining environmental releases according to NUREG-0017. The actual liquid volume through the system under normal plant operating conditions will be much lower. Collection of the liquid is continual as the waste is generated. Processing is accomplished in the batch mode. No feed occurs from the floor drain tanks into the evaporator when the concentrated liquid is being discharged. The system can be used during normal operation, plant start-up, shutdown, and refueling operations as long as electrical power and component cooling water systems do not fail. No emergency power or cooling water are available to this system. The system is designed to maintain, during normal operation, the radioactivity content of liquid effluents from the Seabrook site within the concentration limits expressed in 10CFR20, Appendix B, Table II, Column 2, on an instantaneous release basis and on an annual average release basis to maintain the radioactive liquid effluents such that the dose guidelines expressed in the Appendix I to 10CFR50 are not exceeded. The system capacity and processing equipment are sufficient to maintain radioactivity in liquid effluents during anticipated operational occurrences within the applicable flexibility provisions of Appendix I to 10CFR50.

The following liquid sources pass through a strainer of the LWS and are stored in the floor drain tanks (FDT) for further processing:

1. Liquid from the chemical drain treatment tanks,

2. Effluent from the resin sluicing system,

3. Liquid from the steam generator blowdown system when that system requires additional processing capacity,

4. Liquid from boron waste storage tanks when that liquid is unacceptable for reuse in the reactor plant,

5. Recycled effluent from liquid waste evaporation, testing and demineralization subsystems when reprocessing is required,

6. Demineralized water for system start-up and flushing operations,

7. Waste liquid from the spent fuel pool skimmer pump,

8. All sumps in contaminated plant areas for both units, including the administration and service building.

Each floor drain tank has a capacity of 10,000 gallons which provides approximately six weeks hold-up time for the liquid input. From the floor drain tanks, liquid is transferred by one of the two floor drain tank pumps to one of the following:

1. The normal mode of operation is to route the liquid to the waste evaporator for processing.

2. If the quality and radioactivity levels are within acceptable limits the liquid is transferred to the waste test tanks of the testing and demineralization subsystem for direct discharge off-site.

3. If the waste evaporator is inoperative, the liquid can be directly transferred to the boron recovery system evaporator.

4. If processing in the evaporators is not practical, the liquid can be transferred to the radwaste hopper of the waste solidification system.

Overflow and recirculation lines are provided on the floor drain tanks. The operation is manual, except for the automatic shutdown of the floor drain tank pump on low liquid level in the tank.

The evaporation equipment of the liquid waste system is identical to the boron recovery system, except that one evaporator is employed versus two for the BRS. The function of the liquid waste evaporator subsystem is to remove non-volatile and, to some extent, volatile radioactive contaminants from the FDT liquid prior to its transfer to the liquid waste testing and demineralization subsystem and to concentrate the residual contaminants up to 12% total disolved solids (TDS) prior to transfer to the waste solidification system. The waste evaporator has a design processing capacity of 25 gpm.

The liquid waste evaporator distillate is the normal source of liquid to the testing and demineralization subsystem. Additional sources of liquid which enter the 25,000 gallon capacity waste test tanks are:

1. Liquid directly from the floor drain tanks when that liquid does not require processing in the evaporator,

2. Distillate from the boron recovery evaporator when the BRS evaporator is substituting for the waste evaporator,

3. Distillate from the steam generator blowdown system evaporators and flash steam condensers when that system must discharge liquid off-site.

A radiation detector monitors the liquid entering the waste test tanks. Liquid collected in the tanks is transferred by one of two waste test tank pumps to the circulating water system for discharge off-site. In addition to the system inputs listed above, liquid from the BRS testing and demineralization subsystem and blowdown from the SGB flash tank can be directly transferred via the LWS discharge piping to the circulating water system when water quality permits. Radiation levels and flow rates are monitored on the discharge side. If purification is required prior to release, the liquid is circulated through the waste demineralizer and filter. If reprocessing is required, the waste test tank contents are pumped back to the floor drain tanks. Operation of the testing subsystem is essentially manual, except for securing of the waste test tank pumps on low test tank level and termination of off-site discharge at high radiation levels which are both automatic protective functions. Figure 3.5-4 is a P&I Drawing of the liquid waste system.

Boron Recovery System

The boron recovery system (BRS), Figure 3.5-5, is located in the waste processing building and is common to both Seabrook units. The system stores and processes reactor coolant effluent and reactor coolant grade drainage for reuse as primary grade water and boric acid, or for disposal off-site. When the effluent is used in the reactor plant the system supplies distilled, demineralized water of less than 5 ppm boron to the reactor makeup water system and concentrated boric acid, 4% by weight to the chemical and volume control system (CVCS). When the effluent is discharged offsite, the distilled demineralized water is discharged via the liquid waste system and the concentrated boric acid, approximately 12% by weight, is transferred to the waste solidification system. Additional functions of the BRS include providing backup processing capability for the liquid waste system, cleanup capability for the reactor makeup water system, and storage capacity for liquid from the spent fuel pool cooling and cleanup system.

Liquid entering the BRS is categorized as either degassed or non-degassed. Degassed liquid is collected in the boron waste storage tanks after passing through the cesium removal ion exchangers and recovery filters. Non-degassed liquid is collected in the primary drain tanks (PDT), degassified in the primary drain tank degassifier and then passed through the ion exchangers and filters to the boron waste storage tanks.

Liquid enters the boron recovery degassification subsystem from the following sources in each reactor unit:

1. Discharge from the reactor coolant drain tank pumps,

2. Letdown from the reactor coolant letdown filter of the chemical and volume control system when the letdown degassifier is inoperative,

3. Flushing water from the discharge of the boron injection recirculation pumps and safety injection accumulators of the safety injection system,

4. Discharge from the relief valves of the chemical volume control tank and charging pumps of the chemical and volume control system,

5. Discharge from the combined relief valve header of the safety injection and residual heat removal system,

6. Drainage from the iodine guard beds, purge gas condenser, and the gas chiller of the radioactive gaseous waste system, and

7. Drainage from the sample system.

The function of the degassification subsystem is to remove hydrogen, nitrogen, krypton, xenon, and other gaseous constituents dissolved in the liquids that enter the BRS. The degassification subsystem is designed to process up to 120 gpm on a continual basis, with a minimum degassifier decontamination factor (DF) of approximately 10,000. At the normal letdown flow of 80 gpm, the degassifier DF increases to 100,000.

The boron recovery storage subsystem provides demineralization, filtration, and storage of the degassified reactor coolant grade effluent. Sources of liquid to the storage subsystem are as follows:

1. Letdown from the chemical volume control system (CVCS) letdown degassifiers during adjustment of reactor coolant boron concentration for core burnup and coolant boration, dilution and volume control operations associated with reactor plant start-up and shutdown,

2. Effluent from the PDT degassifier whenever sufficient volume has been collected in the PDT to warrant processing,

3. Boric acid from the CVCS boric acid storage tanks during maintenance periods or when unacceptable boric acid must be discarded or recycled,

4. Recycled liquid from the boron recovery evaporator subsystem and the boron recovery testing and demineralization subsystem when additional processing is required, and

5. Liquid from the spent fuel pool cooling and cleanup system during maintenance periods.

Liquid entering the storage system passes either directly to the boron waste storage tanks or through cesium removal ion exchangers and recovery filters prior to entry into the tanks. Each of the two tanks has a holding capacity of 225,000 gallons. From the boron recovery storage subsystem, the normal path for liquid transferral is to the recovery evaporator in the boron recovery evaporator subsystem. An alternative pathway is to the floor drain tanks in the liquid waste system.

The recovery evaporator subsystem utilizes two 25 gpm forced circulation type evaporators designated as A and B. They are designed to produce distillate containing less than 5 ppm boron and liquid concentrate of up to 12% weight boric acid. The decontamination factor is 10^6 for non-volatiles. Feed to the evaporators is normally provided from the BRS storage subsystem. When substituting for the liquid waste evaporator, evaporator A can receive liquid from the FDT of the LWS. Distillate from the evaporator subsystem is normally directed to the recovery test tanks of the recovery testing and demineralization subsystem. If reprocessing is required, the distillate can be returned to the boron waste storage tanks. For evaporator A only, distillate can also be transferred to the waste test tanks of the LWS. Concentrated bottoms from the evaporator subsystem are normally sent to the boric acid tanks of the CVCS, but can be transferred for disposal to the waste concentrates tank of the Waste Solidification System.

Distillate from the evaporator subsystem is collected in either of two recovery test tanks of the testing and demineralization subsystem. A radiation detector monitors the incoming liquid. From the tanks the liquid is transferred by one of two recovery test tank pumps either to the LWS discharge piping for disposal off-site, if radioactivity content of the liquid is within limits expressed in 10CFR20, or to the reactor makeup water storage tanks for reuse in the plant. If necessary, the liquid from the recovery test tank is purified by circulation through the recovery demineralizer and filters. If reprocessing in the evaporator subsystem is required, the tank contents are pumped back to the boron waste storage tanks.

The control of tritium levels in the reactor coolant system necessitates the discharge of reactor coolant letdown after processing by the boron recovery system. The total annual volume of processed reactor coolant to be discharged is approximately 200,000 gallons per unit prior to the annual refueling shutdown. Thus 400,000 gallons per year are released from the site. This processed liquid is discharged to the environment (Atlantic Ocean) instead of recycled in order to maintain reactor coolant tritium levels such that containment access during both power operation and refueling shutdowns is not unduly limited. Figure 3.5-6 is a P&I drawing of the boron recovery system.

Steam Generator Blowdown System

The steam generator blowdown system, Figure 3.5-7, is designed to remove dissolved impurities and suspended solids from the secondary side of the steam generators. Each reactor unit has its own blowdown system with the major components located within the primary auxiliary buildings and waste processing building.

The system accomplishes its function by a continuous blowdown of fluid from the shell side of the steam generators to the blowdown flash tank subsystem which controls the blowdown flow rate, liquid temperature and pressure by flashing and recovers as much blowdown liquid as practical. When no primary to secondary leak exists, the maximum blowdown rate is 400 gpm (100 gpm per steam generator). An estimated average primary to secondary leak rate of 100 lb per day, based on information given in NUREG-0017 PWR Gale Code, has an associated total steam generator blowdown of 75 gpm per unit (30 gpm from the leaking steam generator and up to 15 gpm from each of the others). These values are used in the calculation of secondary side radionuclide release from the SGBS.

As a result of pressure reduction in the flash tanks, 29% of the liquid mass flashes to steam. The normal pathway for the overhead steam is either to the number three feedwater heater or to the main turbine condenser. An alternate pathway is through the flash tank condenser cooler and then to the waste test tank of the LWS. If there is no primary to secondary leakage, the overhead steam can be directly vented to the atmosphere. The remaining 71% of the flash tank inlet mass is passed to the blowdown evaporator subsystem. The overheads of the evaporators are sent to the waste test tanks of the LWS and the concentrated bottom liquid is transferred to the waste solidification system. If there is no primary to secondary leakage, the flash tank effluent can be directly discharged to the ocean via the circulating water system. Figure 3.5-8 is a P&I diagram of the steam generator blowdown system.

Secondary System Condensate Leakage Collection

With radioactivity present in the secondary sides of the steam generators, moisture carryover brings some radioactivity to the remainder of the secondary coolant system. Consequently, leakage of secondary system condensate, approximately 7200 gallons/day per unit at secondary steam activity, forms a potential radioactive liquid release source. The amount of radioactivity reaching condensate leakage points is minimized by the high quality of the steam exiting the steam generators so that no processing of condensate leakage before discharge is required. The liquid is collected in the turbine building sumps where the radioactivity content is sampled and analyzed. The liquid is then directed to an oil separator and transferred to the circulating water system for discharge off-site.

3.5.2.2 Liquid Release to the Environment

The main assumptions and parameters used in estimating the magnitude of radioactive release are as follows:

1. The radionuclides and their concentrations within the reactor coolant system are listed in Table 3.5-2 under the heading of 0.12% clad defects,

2. The radionuclides and their concentrations within the secondary side of the steam generators are listed in Table 3.5-5. The feed and condensate system activities are equivalent to the steam activities, excluding noble gases,

3. The decontamination factors (DF's) within the boron recovery system, the liquid waste system, and the steam generator blowdown system are given in Appendix A,

4. The times of radioactive decay between collection, processing and discharge are listed in Appendix A,

5. Each unit is assumed to be operating at 3654 MWt, with an 80% capacity factor.

Release from Boron Recovery System

As described in Section 3.5.2.1, approximately 200,000 gallons per year for each unit of reactor coolant letdown will be discharged after processing by the boron recovery system for tritium control. With the input liquid containing radionuclides at Table 3.5-2 values (0.12% clad defects), the processing DF's and the radioactive decay times, the annual release for each unit from this source is .033 Ci/year, except tritium. The release is shown by radionuclide in Table 3.5-12.

Non-Recyclable Release from Liquid Waste System

The total input rate to the floor drain tank from each unit is 1355 gallons/day with an effective composite primary coolant activity (PCA) fraction of 0.061 PCA. With the processing DF's and radioactive decay times in Appendix C.2, the annual release from each unit from this source is 0.035 Ci/year, except tritium. This release is shown by radionuclide in Table 3.5-13.

Steam Generator Blowdown

The secondary side equilibrium steam generator radionuclide concentration is listed in Table 3.5-5. As discussed in Section 3.5.2.1, the flash tank overhead steam is normally re-used in the reactor coolant secondary system, although a potential release pathway does exist via the waste test tanks of the LWS. The evaporator overheads are also sent to the waste test tanks which will ultimately be discharged via the circulating water system. No credit for collection and processing decay times have been assumed to calculate the liquid release from this pathway. With the decontamination factors presented in Appendix A for the blowdown evaporators, the annual release from each unit from this system is 0.005 Ci/year, except tritium. This release is shown by radionuclide in Table 3.5-14.

Secondary System Condensate Leakage

The estimated average liquid leakage rate of the secondary system is 7200 gallons/day at the main steam activity. This liquid is collected in the turbine building floor drain and then discharged from the plant unprocessed, which results in an annual release per unit of .00658 Ci/year, except tritium. This release is shown by radionuclide in Table 3.5-15.

Summary of Radioactive Liquid Release from Normal Operation

The total estimated radioactivity to be released from each unit due to the generation and release of the above described liquid streams is listed in Table 3.5-16. A total annual release of 0.08 Ci except tritium and 730 Ci of tritium are the expected discharge levels from each unit due to normal operation.

3.5.2.3 Releases from Anticipated Operational Occurrences and Design Basis Fuel Leakage

The additional unplanned liquid release due to anticipated operational occurrences is estimated to be 0.15 Ci/year/reactor based on reactor operating data over a 2.5 year period, representing 102 reactor-years of operation (NUREG-0017). The annual release is shown by radionuclide in Table 3.5-17.

Table 3.5-18 shows the total annual release by radionuclide from normal and anticipated operational occurrences. The discharge concentrations are compared with (MPC)w, the concentration limits of 10CFR Part 20, Appendix B, Table II, Column 2.

3.5.3 Radioactive Gaseous Treatment Systems

3.5.3.1 System Description and Operational Procedure

The Radioactive Gaseous Waste Treatment Systems at Seabrook 1 & 2 consist of a gaseous waste processing system for removal and treatment of radioactive gases from the reactor coolant system, a filter system for processing the potentially radioactive condenser vacuum pump discharge and ventilation filter systems for those areas that contain radioactive systems. Of these systems, only the gaseous waste processing system is shared by the two units. Figure 3.5-9 is a schematic diagram showing the gaseous release paths from the site.

Gaseous Waste Processing System

The Radioactive Gaseous Waste System is designed to collect and process fission product gases from the reactor coolant letdown stream and from the liquids collected in the reactor coolant drain tank and primary drain tank. The system is also used to recycle hydrogen as well as introduce makeup hydrogen from the storage system.

The Gaseous Waste Processing System (GWPS), Figure 3.5-10, processes gases from seven sources which are two letdown degassifiers, primary drain tank degassifier, two hydrogenated vent headers, and two pressurizer relief tank sample vessel purges. Dissolved gases are separated from the liquid in each degassifier. Figure 3.5-11 is a P&I drawing of the gaseous waste system.

Effluent gases from the letdown degassifiers are the major input to the radioactive gaseous waste system. The gases from the hydrogenated vent header are processed as GWPS capacity is available. During normal operation, the expected influent flow rate from the degassifiers is 0.8 scfm. This allows approximately 0.4 scfm for processing the hydrogenated vent header gas. The influent gases consist primarily of hydrogen and water vapor with trace amounts of xenon, krypton and iodine. From the degassifiers the gases are cooled to 40°F by a chiller unit. The gas then enters the iodine guard bed to reduce the radiation levels on downstream components. The effluent gas is directed to a drying unit which consists of a three-bed dehydration system. Each bed is capable of operating at a maximum anticipated system flow. Normally, one bed is in operation, the second bed is heated for regeneration, and the third bed is in standby.

The dried gas then goes to the carbon delay beds. A total of five carbon beds, each containing 42.4 ft^3 (1600 lbs) of 6x8 mesh type MBQ carbon, are used. Each bed provides 12 days of xenon delay and 17 hours of krypton delay based on conservatively estimated dynamic adsorption coefficients of 772.5 cc/gm atm for xenon and 45.4 cc/gm atm for krypton at a design flow rate of 1.2 scfm. The beds operate in series to provide a total delay of 60 days for xenon and 85 hours for krypton under design flow conditions. In the event of an upset condition in the dryer, the first and second carbon beds can be operated in parallel, or the first bed can be by-passed. By-passing of more than one bed is not permitted and would require shut-off of all input streams.

The particulate filter downstream of the carbon delay beds is designed to remove 99.97% of all 0.3 micron particles released from the delay beds. Two HEPA filters are provided for redundancy. The waste gas stream is then compressed by a single-stage diaphragm compressor. The compressed waste gas stream can be either:

1. Returned directly to the reactor coolant system via the volume control tank,

2. Stored in the hydrogen surge tank,

3. Released to the environment via the equipment vent system, or

4. Recycled to the hydrogenated vent header as makeup gas.

Main Condenser Exhaust Filter System

Radioactive gases will be released with condenser vacuum pump discharge when the combination of failed fuel and primary-to-secondary steam generator leakage exists. The main condenser exhaust is routed to the PAB filter system prior to release to the environment via the unit plant vent. The PAB filter system consists of both high efficiency particulate (HEPA) filters and charcoal adsorbers.

During startup the noncondensible gases are not expected to be radioactive and will be discharged directly through the turbine building vent to the atmosphere.

Ventilation Filter Systems

Those areas in the station that have the potential for leaking reactor coolant have filter systems on the ventilation exhaust. These filter systems contain HEPA filters and charcoal adsorbers. The charcoal adsorber will have a minimum gas residence time of 0.25 sec, and will be impregnated with an agent for the removal of organic iodines. The containment and the primary auxiliary building contain filter systems of this type.

3.5.3.2 Gaseous Release to the Environment

The design of the Radioactive Gaseous Waste System is based on continuous operation with reactor coolant radioactivities associated with 1% failed fuel at rated thermal power. The estimated releases for normal operating conditions, however, are based on continuous operation with reactor coolant activites associated with 0.12% failed fuel at rated core thermal power.

The sources of radioactive gaseous releases due to normal operation are as follows:

1. Containment venting,

2. Primary auxiliary building (PAB) vent,

3. Main condenser air evacuation pumps,

4. Turbine building leakage, and

5. Waste gas system release.

The release assumptions and parameters for each source are listed in Table

3.5-9.

The estimated releases, by isotope, from each source, are shown in Table 3.5-10 for normal operation.

3.5.3.3 Releases from Anticipated Operational Occurrences

The potential operational occurrences considered include the following:

a. Operation at 0.5% failed fuel for one year,

b. Operation with 500 gallons/day of steam generator tube leakage for 90 days,

c. Operation with 1 gallon/minute of hot reactor coolant leakage to the containment for 12 days, followed by a containment purge,

d. Operation with 200 gallons/day of reactor coolant leakage to the auxiliary building for 90 days.

Each of the above occurrences have been evaluated by assuming that all the other parameters remain the same. The release rates per nuclide from anticipated operational occurrences based on one unit are shown in Tables 3.5-19 to 3.5-22.

3.5.4 Solid Radioactive Waste System

A single solid waste processing system, Figure 3.5-12, is provided for both Seabrook units. This processing system provides four basic functions:

a. To completely solidify all evaporator bottoms and all resin wastes from various radioactive ion exchange systems. As necessary, solidification of other liquid waste (i.e., detergent decontamination solutions) is possible.

b. To provide solidification capability for non-compressible, contaminated items, such as spent filter cartridges and other items generated during plant operation and maintenance.

c. To provide a means of compacting low-activity, compressible waste (e.g., paper, rags, and polyethylene bags).

d. To package the solidified radioactive waste containers for transportation to a licensed burial site.

All operations are conducted by remote means, where necessary, to minimize personnel exposure to radiation.

Material for the solidification system comes from four basic sources: (1) waste evaporator concentrates, (2) spent resins, (3) detergent decontamination solutions, and (4) both solid compressible and, non-compressible radioactive waste, including filter cartridges.

The waste concentrates subsystem consists of a 6000 gallon collection tank that receives concentrated non-recyclable wastes from:

a. Boron recovery evaporators,

b. Liquid waste evaporator,

c. Steam generator blowdown evaporators, and the

d. Waste hopper of the radwaste solidification and handling subsystem.

The concentrates subsystem also provides for mixing and agitation of the tank contents to produce a more homogeneous mixture. The contents are sampled and either caustic or acid chemicals are added to produce a pH compatible with the solidification process. The pH compatible concentrate is then transferred to the waste hopper for solidification.

Radioactive spent resins are flushed from the respective demineralizer by the spent resin sluicing pump to the spent resin storage tank. The sluicing pump recirculates the water used for flushing to minimize the amount of waste water generated. When all the resin has been transferred to the storage tank, the recirculating flush flow is stopped. A single spent resin storage tank is used for both units and has a capacity of approximately 800 cu ft.

The liquid waste streams are collected in the radwaste hopper which is a flat topped, conical bottomed vertical tank equipped with a motor-driven agitator and has a total capacity of 140 cu ft. The radwaste hopper collects wastes from the:

a. Waste concentrates tank,

b. Spent resin sluice tank,

c. Chemical drain treatment tanks, and

d. Floor drain tanks.

The contents of the tank can be monitored for pH and radiation level. If necessary, the water content and pH are adjusted for compatibility with the solidification process. In the solidification process two inline static mixers that are part of the cask loading sleeve mix the radwaste from the radwaste hopper with polymer and catalyst. Polymer (urea-formaldehyde) is stored in six 550 gallon portable tanks. Each tank is vented to the plant vent via the aerated vent header. Polymer is transferred from the tanks to the loading sleeve by the polymer pump. Catalyst is stored in a 300 gallon fiberglass tank equipped with an agitator for preparing a uniform catalyst solution. The required catalyst is an acidic solution which is prepared by adding sodium bisulphate crystals or concentrated sulfuric acid to plant demineralized water. The catalyst feed pump meters catalyst to the loading sleeve.

Mixing of waste and polymer occurs in the first mixer. Downstream, the second mixer combines the waste/polymer mixture with catalyst. The catalyzed mixture is immediately discharged into the disposal container. The loading sleeve is provided with a rubber gasket to seal the top of the disposal containers to prevent spread of airborne contamination. A vent connection from the loading sleeve to the aerated vent header is provided to control the air displaced from the container.

Interlocks are provided on waste transfer pumps, and monitors are provided on solidification agent transfer pumps, to ensure a solid matrix in the container after a reasonable "set-up" time. Under special conditions, when solid material such as filter cartridges are to be solidified, the material may be placed directly into the container and pure solidifying agent added. In either case, approximately 3% of the final container volume will be filled with pure solidifying agent. The system is designed to prevent inadvertent release of radioactive material during radwaste packaging. Under abnormal conditions during the packaging process, the radwaste, polymer, and catalyst process streams automatically revert to a recirculation mode which stops flow to the disposal container.

Two modes of flushing the filling system with demineralized water are provided: the primary flush and the secondary flush. Both are initiated from the control panel. After completion of the container filling operation, the primary flush is substituted for the radwaste stream and cleans all radwaste piping down to the filling station. The secondary flush cleans the static mixers and loading sleeve with a finite quantity of demineralized water after packaging is completed. This flush initiates automatically on loss of power and/or system malfunctions. The flush water is directed or pumped back to their respective source tanks.

Shipping containers of either 75 cu ft. or 170 cu ft. volume are used. The selected size shipping container is positioned by self-centering lugs on a 30 ton transfer dolly mounted on rails located in a filling aisle. The dolly is designed such that the container can only be set in one particular position. The dolly with the container may be positioned at four locations in the filling aisle:

a. Dolly loading,

b. Container filling,

c. Capping, or

d. Decontamination and swiping.

When the containers are being filled, the fill cap is removed and a filling sleeve is lowered into position. Alignment is verified with the use of mirrors. Liquid and/or resin waste material is thoroughly mixed with the solidifying agent and fed into the shipping container at the loading position. Upon completion of the filling operation, the containers are capped and decontaminated if a spill occurs. If decontamination is necessary, the dolly is moved to the decontamination station. Demineralized water is sprayed over the surface of the container and collected by the floor drain system. All containers are swiped prior to storage or shipping.

Solidification of non-compressible contaminated items, such as spent filter cartridges, is carried out by the spent filter encapsulation and filter transfer cask subsystem. The filter transfer cask recovers the spent filter cartridge from the filter cubicle and serves as a personnel radiation shield in the transfer of the cartridge to the radwaste solidification at minimum radiation exposure to the operators. The spent filter cartridges are centrally positioned in a shipping container by means of a wire cage and the solidifying agent is poured around the cage. The capping and decontamination is carried out as described above.

Solid compressible waste such as paper, rags, plastics, etc., are processed directly in unshielded 55 gallon steel drums. The material is placed into the drums and when sufficient material has accumulated, a force of 19,000 pounds is applied by a hydraulic ram to achieve a reduction in material volume of 50 to 70%. The compactor is equipped with a hood exhaust blower and a HEPA filler to control the escape of any dust into the working area. After compaction, the drum is sealed and transferred to a storage area in the Waste Processing Building.

3.5.4.1 Expected Volumes

The volume of solid radioactive waste generated for shipment off-site by both units is estimated to be 13,800 ft^3 per year (including compressible waste). Table 3.5-11 delineates the expected annual average volume of solid waste. A 50% increase in volume is assumed for spent resins and evaporator bottoms due to the addition of a solidifying agent. A 300% increase in volume is assumed for solid, non-compressible wastes that are solidified. A factor of 4 reduction in the volume of compressible waste is assumed by hydraulic baling. In addition, the following operational characteristics have been assumed.

a. Each non-regenerable ion exchanger is changed annually,

b. Thirty filter cartridges are shipped from both units annually,

c. Plant availability is 80%,

d. The addition of a second unit linearly increases the volume of all waste except compressible waste. A 50% increase in compressible waste is assumed for the second unit.

Curie content associated with this waste volume is also delineated in Table 3.5-11. The radioactive concentrations vary considerably depending upon plant operating conditions. However, radiation monitoring (and related interlocks) within the solidification system insure that all shipments will comply with federal and state regulations (i.e., radiation levels and gross weight of shipping vehicle).

3.5.4.2 Solid Release to the Environment

Solid wastes will be shipped from the site for burial at a NRC licensed burial site. The containers used for solid waste shipments will meet the requirements of 44CFR170-189 (Department of Transportation Radioactivity Material Regulations), and 10CFR71 (Packaging of Radioactive Materials for Transport). Table 3.5-11 summarizes the expected annual average total shipment of solid radioactive waste from both units.

3.5.5 Process and Effluent Monitoring

The process and effluent radiation monitoring system consists of 17 independent channels which continuously monitor liquid and gaseous process and effluent streams during all modes of plant operation. The functions of this system include the following:

a. Provide local indication and alarms,

b. Provide contact outputs to actuate valves and remote alarms, and

c. Provide radiation data to the radiation data management system (RDMS) host computer for computation report generation displays at the health physics and control room consoles.

3.5.5.1 Gaseous Waste Processing System Monitors

Three radiation detectors at three different locations measure the radioactivity of the GWPS. The first detector is located upstream of the ambient pressure carbon beds. The second one is located downstream of ambient carbon bed and the third one is located on the common discharge header of the compressor. The functions of these detectors are to:

a. Monitor carbon delay bed performance,

b. Monitor radioactive gas release to the atmosphere,

c. Provide local alarm and indication,

d. Automatically terminate atmospheric release when radioactivity exceeds setpoint, and

e. Provide data to the RDMS host computer for alarm display and documentation processing.

3.5.5.2 Condenser Air Monitor

This channel monitors the radioactivity of condenser air at the common discharge header of the mechanical vacuum pumps. The function of the detector is to:

a. Detect tube leaks in the steam generator,

b. Under certain operating conditions monitor discharge to the atmosphere,

c. Provide local alarm and indication, and

d. Provide data to the RDMS host computer for alarm, display and documentation processing.

3.5.5.3 Boron Recovery System Monitors

Two radiation detectors measure the radioactivity of this system. One detector is used to measure the radioactivity of fluids being transferred to the boron waste storage tanks. The other detector monitors the fluid being transferred to the recovery test tanks. Both detectors receive tank level information and calculates the radioactivity in microcuries per cubic centimeter then transfers the information to the RDMS computer for storage. The alarm setpoint is set to indicate when the radiation concentration exceeds a predetermined value, indicating a potential problem upstream or a need to filter the contents of the tank or add water to the tanks to reduce the radioactive concentration. A high radiation reading will activate a local alarm and an alarm on the consoles of the main control room and health physics. The detectors do not perform any control functions.

3.5.5.4 Primary Component Cooling Liquid Monitors

The primary component cooling water system (PCCW) is constantly monitored for radioactivity. Such radioactivity is indicative of a leak from the reactor coolant system or one of the radioactive systems which exchange heat with the primary component cooling water system. Two detectors, one each at PCCW Loop A and B, monitor the radioactivity at the inlet of the PCCW head tanks. The two detectors receive PCCW flow information via the RDMS computer and calculate the radioactivity in terms of microcuries per cubic centimeter. A high radiation reading will activate a local alarm and alarms via the RDMS computer. The detectors do not perform any control functions.

3.5.5.5 Liquid Waste Test Tank Monitors

Two detectors continuously monitor all waste processing system liquid releases from the station. One detector measures the radioactivity of fluids transferred to the waste test tanks. The alarm setpoint is set to indicate when the radioactivity concentration exceeds a predetermined value, indicating a potential problem upstream or a need to filter the tank contents or add water to the tanks to reduce the radioactive concentration. A high radioactivity reading will activate alarms via the RDMS computer. This detector does not perform any control functions.

The second detector monitors the radioactivity of fluids being discharged off-site. Discharge (a batch operation) will not be possible unless the detector is in operation or other suitable means are available to monitor the discharge. The detector receives flow information via the RDMS computer and calculates the radioactivity in microcuries per cubic centimeter. The alarm setpoint is set to indicate when the radioactivity exceeds a predetermined value, indicating a potential problem upstream, or a need to filter the contents of the tank, or add water to the tanks to reduce the radioactive concentration. A high radioactivity reading will activate a local alarm and activate alarms via the RDMS computer, at which point liquid discharge to the environment is automatically shutoff by control valves in the discharge line.

3.5.5.6 Steam Generator Blowdown Sample Monitors

Five detectors monitor radioactivity concentrations of the liquid phase of the secondary side of the steam generator. The functions of these detectors are to:

a. Measure the radioactivity in the steam generator blowdown samples,

b. Measure the radioactivity of the effluent from the flash tank and provide automatic isolation of the discharge stream to the environment,

c. Provide data to the RDMS computer for alarm, display and documentation,

d. Provide local alarm and indication, and

e. Provide data to assist in detecting leaks in the steam generator.

3.5.5.7 Reactor Coolant Letdown Gross Activity Monitor

Two monitors are used to monitor reactor coolant samples taken from the letdown line. The design intent of the reactor coolant letdown monitoring system is to provide on-scale indication of primary coolant gross radionuclide concentration over a wide range of operating conditions, from initial startup through a 1% failed fuel condition. A high radiation level activates an alarm in the monitor and on the control room and health physics consoles via the RDMS computer. These radiation monitors do not perform any control function.

3.5.5.8 Turbine Building Drains Liquid Effluent Monitor

Piping and electrical connections are provided for a future turbine building drains liquid effluent monitor located in the turbine building.

TABLE 3.5-1

PARAMETERS USED IN THE CALCULATION OF FISSION PRODUCT ACTIVITY IN REACTOR (DESIGN BASIS)

1.	Ultimate core thermal power [MWt]	3,654
2.	Clad defects, as a percent of rated core thermal power being generated by rods with clad defects [1%]	1.0
3.	Reactor coolant liquid volume [ft^3]	12,100
4.	Reactor coolant full power average temperature [°F]	590
5.	Purification flow rate (normal) [gpm]	80
6.	Effective cation demineralizer flow rate [gpm]	7.5
7.	Fission product escape rate coefficients:	
	a. Noble gas isotopes [sec^{-1}]	6.5×10^{-8}
	b. Br, Rb, I and Cs isotopes [sec^{-1}]	1.3×10^{-8}
	c. Te, Se, Tc, Sn and Sb isotopes [sec^{-1}]	1.0×10^{-9}
	d. Mo isotopes [sec^{-1}]	2.0×10^{-9}
	e. Sr and Ba isotopes [sec^{-1}]	1.0×10^{-11}
	f. Y, Zr, Nb, Ru, Rh, La, Ce, Pr, Nd and Pm isotopes [sec^{-1}]	1.6×10^{-12}
8.	Mixed bed demineralizer decontamination factors:	
	a. Noble gases and Cs, Y and Mo	1.0
	b. All other isotopes including corrosion products	10.0
9.	Cation bed demineralizer decontamination factor for Cs, Y and Mo	10.0
10.	Degassifier noble gas stripping fractions	1.0

TABLE 3.5-2
(Sheet 1 of 3)

REACTOR COOLANT RADIONUCLIDE CONCENTRATIONS

Radionuclide	Concentration (μCi/gm) 0.12% Clad Defects	1% Clad Defects
H-3	1.00E+00*	-
N-16	4.00E+01	-
I-130	2.10E-03	-
I-131	2.70E-01	2.5E+00
I-132	1.00E-01	9.1E-01
I-133	3.99E-01	4.0E+00
I-134	-	5.8E-01
I-135	1.90E-01	2.2E+00
Kr-83m	2.03E-02	4.3E-01
Kr-85m	8.61E-02	1.7E+00
Kr-85	2.03E-03	1.3E-01
Kr-87	6.14E-02	1.3E+00
Kr-88	1.78E-01	3.4E+00
Kr-89	5.82E-03	-
Xe-131m	5.29E-03	6.7E-02
Xe-133m	3.83E-02	5.7E-01
Xe-133	1.59E+00	2.5E+01
Xe-135m	1.48E-02	8.2E-01
Xe-135	2.02E-01	3.1E+00
Xe-137	1.05E-02	1.7E-01
Xe-138	4.99E-02	7.1E-01

* 1.00E+00 = 1.00×10^{0}

TABLE 3.5-2
(Sheet 2 of 3)

REACTOR COOLANT RADIONUCLIDE CONCENTRATIONS

Radionuclide	Concentration (µCi/gm) 0.12% Clad Defects	1% Clad Defects
Br-83	4.80E-03*	-
Rb-86	8.50E-05	-
Sr-89	3.50E-04	4.1E-03
Sr-90	1.00E-05	1.8E-04
Sr-91	-	3.1E-02
Y-90	-	2.2E-04
Y-91	-	5.8E-03
Y-92	-	1.0E-03
Zr-95	-	6.7E-04
Nb-95	-	6.8E-04
Mo-99	8.4E-02	3.3E+00
Tc-99m	4.80E-02	-
Te-127m	2.80E-04	-
Te-127	8.50E-04	-
Te-129m	1.40E-03	-
Te-129	1.60E-03	-
Te-131m	2.50E-03	-
Te-132	1.7E-02	2.6E-01
Cs-134	2.5E-02	4.4E-01
Cs-136	1.3E-02	2.2E-01
Cs-137	1.8E-02	2.2E+00

* 4.80E-03 = 4.80 x 10-3

TABLE 3.5-2
(Sheet 3 of 3)

REACTOR COOLANT RADIONUCLIDE CONCENTRATIONS

Radionuclide	Concentration (μCi/gm) 0.12% Clad Defects	Concentration (μCi/gm) 1% Clad Defects
Ba-137m	1.6E-02*	-
Ba-140	2.2E-04	4.5E-03
La-140	1.5E-04	1.4E-03
Ce-144	-	4.4E-04
Np-239	1.2E-03	-
All others	2.5E-01	-

Corrosion Products

Radionuclide	Concentration (μCi/gm)**
Mn-54	3.1E-04
Mn-56	-
Co-58	1.6E-02
Co-60	2.0E-03
Fe-59	1.0E-03
Cr-51	1.9E-03
Fe-55	1.6E-03

* 1.60E-02 = 1.60×10^{-2}

** Corrosion product activities based on values given in Table 2-12, NUREG-0017, April 1976

TABLE 3.5-3
(Sheet 1 of 2)

PRINCIPAL PARAMETERS USED IN ESTIMATING REALISTIC RELEASES OF RADIOACTIVE MATERIAL IN EFFLUENTS FROM SEABROOK 1 AND 2

Reactor Power Level, megawatts thermal	3,654
Plant Capacity factor	0.80
Operating Power Fission Product Source Term, percent clad defects	0.12
Primary System	
Mass of coolant, pounds	505,000
Letdown Rate to Chemical and Volume Control System, (lbs/hr)	4.01×10^4
Equipment leakage and Shim bleed rate, (lbs/hr)	4.16×10^2
Leakage rate to secondary system, pounds per day	100
Leakage rate to auxiliary area, pounds per day	160
Frequency of degassing (cold shutdown), times per year	2
Flow through the purification cation dem. (gpm)	7.5
Secondary System	
Steam flow rate, pounds per hour	15.14×10^6
Mass of steam in each generator, pounds	5,700
Mass of liquid in each generator, pounds	95,500
Mass of secondary coolant, pounds	1.8×10^6
Rate of steam leakage to turbine building, pounds per hour	1,700
Steam generator blowdown flow rate [gpm]	75
Degasifier noble gas stripping fractions	1.0
Steam generator moisture carryover for non-volatiles	0.1%
Steam generator moisture carryover for halogens	1.0%

TABLE 3.5-3
(Sheet 2 of 2)

PRINCIPAL PARAMETERS USED IN ESTIMATING REALISTIC RELEASES OF RADIOACTIVE MATERIAL IN EFFLUENTS FROM SEABROOK 1 AND 2

Containment Building Volume, cubic feet	2.715×10^6
Frequency of Containment Purges, times per year	4 (refueling and maintenance)
Continuous Ventilation Rate, ft^3/min	1,000
Turbine Building Leak Rate, gallons per day	7,200
Iodine Partition Factors	
Steam generator internal partition	0.01
Primary coolant leak to auxiliary area	0.0075
Condenser/vacuum pump (volatile species)	0.15
Iodine Decontamination Factor for Ventilation Systems Charcoal adsorbers	10
Particulate Decontamination Factors for Ventilation System HEPA Filters	100

Liquid Waste Processing Systems

System	Input Flow Rate gallons per day	Decontamination Factors Iodine	Cesium, Rubidium	Others
Miscellaneous Waste	1360	10^3	10^4	10^4
Equipment Drain	302	10^4	2×10^4	10^5
Turbine Building Sump Waste	7200	1	1	1
Boron Recovery	878	10^3	2×10^3	10^4
Steam Generator Blowdown System	1.08×10^5	10^3	10^4	10^4

TABLE 3.5-4

AVERAGE RADIOACTIVITY CONCENTRATIONS IN THE SPENT FUEL POOL AREA

Isotope	Pool Water (μCi/gm)	Open Area (μCi/cc)
H-3	6.3×10^{-1}	4.7×10^{-7}
Kr-85	Nil	1.2×10^{-11}
Xe-131m	Nil	5.4×10^{-12}
Xe-133m	Nil	1.8×10^{-11}
Xe-133	Nil	1.5×10^{-9}
Xe-135	Nil	2.7×10^{-13}
I-131	2.0×10^{-6}	1.1×10^{-14}
I-130	7.2×10^{-9}	4.0×10^{-17}
Mo-99	1.3×10^{-6}	Nil
Tc-99m	1.3×10^{-6}	Nil
Sr-89	3.9×10^{-9}	Nil
Y-91	2.3×10^{-8}	Nil
Cs-134	2.5×10^{-6}	Nil
Cs-136	8.7×10^{-7}	Nil
Cs-137	1.9×10^{-6}	Nil
Ba-137m	1.9×10^{-6}	Nil
Ba-140	2.0×10^{-9}	Nil
La-140	2.0×10^{-9}	Nil
Te-129m	1.6×10^{-8}	Nil
Te-131m	1.5×10^{-9}	Nil
Cr-51	2.0×10^{-8}	Nil
Mn-54	3.7×10^{-9}	Nil
Fe-55	2.0×10^{-8}	Nil
Fe-59	1.1×10^{-8}	Nil
Co-58	1.8×10^{-7}	Nil
Co-60	2.4×10^{-8}	Nil

Notes:
1) Assuming the spent fuel pool stores 1/3 of core for one year.
2) Total liquid mass = 2.8×10^{6} lb.
3) Open area volume = 1.92×10^{5} ft^3.
4) Evaporation rate = 120 lb/hr.
5) Pool clean-up rate = 120 gpm.
6) Area ventilation rate = 4.3×10^{4} cfm.

TABLE 3.5-5
(Sheet 1 of 6)

STEAM GENERATOR SECONDARY SIDE EQUILIBRIUM RADIONUCLIDE CONCENTRATIONS (WATER)

Radionuclide	Concentration (μCi/gm) Expected Values[1] .12% Clad Defects	Design Values[2] .25% Clad Defects
H-3	1.00E-03*	-
N-16	1.00E-06	-
I-130	1.45E-07	-
I-131	3.33E-05	1.6E-04
I-132	1.04E-05	1.1E-05
I-133	3.51E-05	1.8E-04
I-134	-	2.9E-06
I-135	1.01E-05	5.8E-05
Br-83	1.41E-07	-
Rb-86	1.02E-08	-
Sr-89	4.91E-08	3.1E-07
Sr-90	-	9.4E-09
Sr-91	-	1.0E-06
Y-90	-	9.9E-09
Y-91	-	4.1E-07
Y-92	-	1.6E-08
Zr-95	-	4.5E-08
Nb-95	-	4.9E-08
Mo-99	9.88E-06	2.0E-04
Tc-99m	2.24E-05	-
Te-127m	2.18E-08	-

* 1.00E-03 = 1.00×10^{-3}
Note[1] of Table 3.5-5 (Sheet 6)
Note[2] of Table 3.5-5 (Sheet 6)

TABLE 3.5-5
(Sheet 2 of 6)

STEAM GENERATOR SECONDARY SIDE EQUILIBRIUM RADIONUCLIDE CONCENTRATIONS (WATER)

	Concentration (μCi/gm)	
Radionuclide	Expected Values[1] .12% Clad Defects	Design Values[2] .25% Clad Defects
Te-127	1.29E-07*	-
Te-129m	1.49E-07	-
Te-129	6.28E-07	-
Te-131m	2.09E-07	-
Te-132	2.54E-06	1.60E-05
Cs-134	2.88E-06	2.8E-05
Cs-136	1.30E-06	1.4E-05
Cs-137	1.92E-06	1.3E-04
Ba-140	2.35E-08	3.0E-07
La-140	3.04E-08	7.0E-08
Ce-144	-	2.9E-08
Mn-54	4.82E-08	2.60E-07
Mn-56	-	2.0E-06
Co-58	1.17E-06	8.8E-06
Co-60	2.16E-07	2.6E-07
Fe-59	1.23E-07	3.5E-08
Cr-51	2.00E-07	3.3E-07
Fe-55	1.68E-07	-
Np-239	1.03E-07	-
All Others	2.29E-06	-

*1.29E-07 = 1.29×10^{-7}
Note[1] of Table 3.5-5 (Sheet 6)
Note[2] of Table 3.5-5 (Sheet 6)

TABLE 3.5-5
(Sheet 3 of 6)

STEAM GENERATOR SECONDARY SIDE EQUILIBRIUM RADIONUCLIDE CONCENTRATIONS (STEAM)

Radionuclide	Concentration (μCi/gm) Expected Values[1] .12% Clad Defects	Design Values[2] .25% Clad Defects
H-3	1.0E-03*	1.3E-04
N-16	1.0E-07	-
I-130	1.45E-09	-
I-131	3.33E-07	1.6E-06
I-132	1.04E-07	1.1E-07
I-133	3.51E-07	1.8E-06
I-134	-	2.9E-08
I-135	1.01E-07	5.8E-07
Kr-83m	5.56E-09	5.1E-08
Kr-85m	2.41E-08	2.0E-07
Kr-85	5.63E-10	1.5E-08
Kr-87	1.62E-08	3.9E-07
Kr-88	4.85E-08	3.9E-07
Kr-89	1.61E-09	-
Xe-131m	1.48E-09	7.8E-09
Xe-133m	1.07E-08	6.4E-08
Xe-133	4.37E-07	2.9E-06
Xe-135m	4.06E-09	9.7E-08
Xe-135	5.54E-08	3.6E-07
Xe-137	2.88E-09	2.0E-08

*1.0E-03 = 1.0 x 10-3
Note[1] of Table 3.5-5 (Sheet 6)
Note[2] of Table 3.5-5 (Sheet 6)

TABLE 3.5-5
(Sheet 4 of 6)

STEAM GENERATOR SECONDARY SIDE EQUILIBRIUM RADIONUCLIDE CONCENTRATIONS (STEAM)

Radionuclide	Concentration (μCi/gm) Expected Values[1] .12% Clad Defects	Design Values[2] .25% Clad Defects
Xe-138	1.35E-08*	8.3E-08
Br-83	1.41E-09	-
Rb-86	1.02E-11	-
Sr-89	4.91E-12	3.1E-10
Sn-90	-	9.4E-12
Sr-91	-	1.0E-09
Y-90	-	9.9E-12
Y-91	-	4.1E-10
Y-92	-	1.6E-11
Zr-95	-	4.5E-11
Nb-95	-	4.9E-11
Mo-99	9.88E-09	2.0E-07
Te-99m	2.24E-08	-
Te-127m	2.18E-11	-
Te-127	1.29E-10	-
Te-129m	1.49E-10	-
Te-129	6.28E-10	-
Te-131m	2.09E-10	-
Te-132	2.54E-09	1.6E-08
Cs-134	2.88E-09	2.8E-08

*1.35E-08 = 1.35×10^{-8}
Note[1] of Table 3.5-5 (Sheet 6)
Note[2] of Table 3.5-5 (Sheet 6)

TABLE 3.5-5
(Sheet 5 of 6)

STEAM GENERATOR SECONDARY SIDE EQUILIBRIUM RADIONUCLIDE CONCENTRATIONS (STEAM)

	Concentration (μCi/gm)	
Radionuclide	Expected Values[1] .12% Clad Defects	Design Values[2] .25% Clad Defects
Cs-136	1.30E-09*	1.4E-08
Cs-137	1.92E-09	1.3E-07
Ba-140	2.35E-11	3.0E-10
La-140	3.09E-11	7.0E-11
Ce-144	-	2.9E-11
Mn-54	4.82E-11	2.6E-10
Mn-56	-	2.0E-09
Co-58	1.71E-09	8.8E-09
Co-60	2.16E-10	2.6E-10
Fe-59	1.23E-10	3.5E-11
Cr-51	2.00E-10	3.3E-10
Fe-55	1.68E-10	-
Np-239	1.03E-10	-
All Others	2.29E-09	

*1.0E-09 = 1.0 x 10-9
Note[1] of Table 3.5-5 (Sheet 6)
Note[2] of Table 3.5-5 (Sheet 6)

TABLE 3.5-5
(Sheet 6 of 6)

STEAM GENERATOR SECONDARY SIDE EQUILIBRIUM RADIONUCLIDE CONCENTRATIONS

1. Bases: .12% clad defects
100 lbs day^{-1} primary-to-secondary leak rate
75 gpm steam generator blowdown rate
95.5×10^3 lbm per steam generator
3654 MWt
0.1% moisture carryover for non-volatiles
1.0% moisture carryover for halogens

2. Bases: 0.25% clad defects
20 gal/day primary-to-secondary leak rate
50 gpm steam generator blowdown rate
97,000 lbm per steam generator
3654 MWt
0.25% moisture carryover for non-volatiles
1.0% moisture carryover for halogens

TABLE 3.5-6

LIQUID WASTE RELEASE SOURCE TERMS
(PER UNIT)

Source	Flow Rate	Activity
Containment Bldg. Sump	40 gpd	PCA
Auxiliary Bldg. Floor Drain	200 gpd	0.1 PCA
Laboratory Drains	400 gpd	0.002 PCA
Sampling Drains	15 gpd	PCA
Miscellaneous Sources	700 gpd	0.01 PCA
Turbine Bldg. Floor Drain	7200 gpd	Steam activity in the secondary system (Reference Table 3.5-5)
Steam Generator Blowdown	1.08×10^5 gpd	Secondary side activity levels (water) (Reference Table 3.5-5)
Tritium Control Releases	2.0×10^5 gal/yr	PCA

PCA = primary coolant activity

TABLE 3.5-7

ACTIVITY INPUT TO THE LIQUID WASTE SYSTEM (CURIES/YEAR)
EXPECTED BASIS

Isotope	Containment Bldg. Sump	Auxiliary Bldg. Floor Drain	Laboratory Drains	Sampling Drain	Miscellaneous Sources
Br-83	2.12×10^{-1}	1.06×10^{-1}	4.24×10^{-3}	7.95×10^{-2}	3.7×10^{-2}
I-130	9.28×10^{-2}	4.64×10^{-2}	1.86×10^{-3}	3.48×10^{-2}	1.62×10^{-2}
I-131	1.19×10^{1}	5.96	2.39×10^{-1}	4.47	2.09
I-132	4.42	2.21	8.83×10^{-2}	1.66	7.73×10^{-1}
I-133	1.76×10^{-1}	8.81	3.52×10^{-1}	6.61	3.08
I-134	-	-	-	-	-
I-135	8.39	4.20	1.68×10^{-1}	3.15	1.47
Rb-86	3.75×10^{-3}	1.88×10^{-3}	7.51×10^{-5}	1.41×10^{-3}	6.57×10^{-4}
Cs-134	1.10	5.52×10^{-1}	2.21×10^{2}	4.14×10^{-1}	1.93×10^{-1}
Cs-136	5.74×10^{-1}	2.87×10^{-1}	1.15×10^{-2}	2.15×10^{-1}	1.00×10^{-1}
Cs-137	7.95×10^{-1}	3.98×10^{-1}	1.59×10^{-2}	2.98×10^{-1}	1.39×10^{-1}
Cr-51	8.39×10^{-2}	4.20×10^{-2}	1.68×10^{-3}	3.15×10^{-2}	1.47×10^{-2}
Mn-54	1.37×10^{-2}	6.85×10^{-3}	2.74×10^{-4}	5.13×10^{-3}	2.40×10^{-3}
Mn-56	-	-	-	-	-
Fe-55	7.07×10^{-2}	3.53×10^{-2}	1.41×10^{-3}	2.65×10^{-2}	1.24×10^{-2}
Fe-59	4.42×10^{-2}	2.21×10^{-2}	8.83×10^{-4}	1.66×10^{-2}	7.73×10^{-3}
Co-58	7.07×10^{-1}	3.53×10^{-1}	1.41×10^{-2}	2.65×10^{-1}	1.24×10^{-1}
Co-60	8.83×10^{-2}	4.42×10^{-2}	1.77×10^{-3}	3.31×10^{-2}	1.55×10^{-2}
Sr-89	1.55×10^{-2}	7.73×10^{-3}	3.09×10^{-4}	5.80×10^{-3}	2.71×10^{-3}
Sr-90	4.42×10^{-4}	2.21×10^{-4}	8.83×10^{-6}	1.66×10^{-4}	7.73×10^{-5}
Sr-91	-	-	-	-	-
Y-90	-	-	-	-	-
Y-91	-	-	-	-	-
Y-92	-	-	-	-	-
Zr-95	-	-	-	-	-
Nb-95	-	-	-	-	-
Mo-99	3.71	1.86	7.42×10^{-2}	1.39	6.49×10^{-1}
Tc-99m	2.12	1.06	4.24×10^{-2}	7.95×10^{-1}	3.71×10^{-1}
Te-127m	1.24×10^{-2}	6.18×10^{-3}	2.47×10^{-4}	4.64×10^{-3}	2.16×10^{-3}
Te-127	3.75×10^{-2}	1.88×10^{-2}	7.51×10^{-4}	1.41×10^{-2}	6.57×10^{-3}
Te-129m	6.18×10^{-2}	3.09×10^{-2}	1.24×10^{-3}	2.32×10^{-2}	1.08×10^{-2}
Te-129	7.07×10^{-2}	3.53×10^{-2}	1.41×10^{-3}	2.65×10^{-2}	1.24×10^{-2}
Te-131m	1.10×10^{-1}	5.52×10^{-2}	2.21×10^{-3}	4.14×10^{-2}	1.93×10^{-2}
Te-132	7.51×10^{-1}	3.75×10^{-1}	1.50×10^{-2}	2.82×10^{-1}	1.31×10^{-1}
Ba-137m	7.07×10^{-1}	3.53×10^{-1}	1.41×10^{-2}	2.65×10^{-1}	1.24×10^{-1}
Ba-140	9.72×10^{-3}	4.86×10^{-3}	1.94×10^{-4}	3.64×10^{-3}	1.70×10^{-3}
La-140	6.63×10^{-3}	3.31×10^{-3}	1.33×10^{-4}	2.48×10^{-3}	1.16×10^{-3}
Ce-144	-	-	-	-	-
Np-239	5.3×10^{-2}	2.65×10^{-2}	1.06×10^{-3}	1.99×10^{-2}	9.28×10^{-3}
All Others	1.10×10^{1}	5.52	2.21	4.14	1.93

TABLE 3.5-8

ACTIVITY INPUT TO THE BORON RECOVERY SYSTEM
FOR TRITIUM CONTROL PER UNIT (CURIES/YEAR)
EXPECTED BASIS

Isotope	Activity (Ci/yr)	Isotope	Activity (Ci/yr)
Br-83	3.63	Zr-95	-
		Nb-95	-
		Mo-99	6.35×10^{1}
		Tc-99m	3.63×10^{1}
I-130	1.59		
I-131	2.04×10^{2}		
I-132	7.57×10^{1}		
I-133	3.02×10^{2}		
I-134	-		
I-135	1.44×10^{2}		
Rb-86	6.43×10^{-2}	Te-127m	2.12×10^{-1}
		Te-127	6.44×10^{-1}
		Te-129m	1.06
Cs-134	1.89×10^{1}	Te-129	1.21
Cs-136	9.84	Te-131m	1.89
Cs-137	1.36×10^{1}		
		Te-132	1.29×10^{1}
Cr-51	1.44		
Mn-54	2.35×10^{-1}	Ba-137m	1.21×10^{1}
Mn-56	-		
Fe-55	1.21	Ba-140	1.67×10^{-1}
Fe-59	7.57×10^{-1}	La-140	1.14×10^{-1}
Co-58	1.21×10^{1}		
Co-60	1.51		
Sr-89	2.65×10^{-1}	Ce-144	2.50×10^{-2}
Sr-90	7.57×10^{-3}		
Sr-91	-		
Y-90	-		
Y-91	-	Np-239	9.08×10^{-1}
Y-92	-	All Others	1.89×10^{2}

TABLE 3.5-9
(Sheet 1 of 2)

GASEOUS WASTE RELEASE SOURCES AND ASSUMPTIONS

1. Containment Purge;

Reactor coolant leakage

Noble gases released - 1% of the total reactor coolant daily

Iodine released - 0.001% of the total reactor coolant daily

Charcoal filter efficiency - 90%

Containment vent - 4 purges per year, during shutdown in addition to an on-line purge system operating at a continuous 1000 scfm purge rate during power operation.

Containment free volume - 2.715×10^6 ft^3

2. Auxiliary Building;

Reactor coolant leakage - 160 lb/day

Noble gases released - 100%

Iodine released - 0.75%

Venting mode - instantaneous release through charcoal filter

Charcoal filter efficiency - 90%

3. Main condenser Vacuum Pump;

Steam generator tube leak - 100 lb/day

Carry-over in the steam generator - 100% for noble gases
1% for iodines
.1% other nuclides

Fraction of main stream which reaches the main condenser - 65%

Partition factor of noble gases in the main condenser - 1.0

Partition factor of iodine in the main condenser - 0.15

Partition factor of non-volatiles in the main condenser - 0.0

Charcoal filter efficiency - 90%

TABLE 3.5-9
(Sheet 2 of 2)

GASEOUS WASTE RELEASE SOURCES AND ASSUMPTIONS

Vacuum pump flow rate - 60 cfm

4. Turbine Building Leakage;

Secondary steam leakage - 1700 lb/hr

Noble gases released - 100% of the leakage

Iodine released - 100% of the leakage

5. Waste Gas System Releases;

Continuous stripping plus two reactor volume degassed per year.

All go through the GWS

Delay time in the charcoal bed - 60 days for Xenon
85 hours for Krypton

TABLE 3.5-10
(Sheet 1 of 2)

ANNUAL GASEOUS EFFLUENTS RELEASE (Ci/yr)

Radionuclide	Containment Purge	PAB Venting	Turbine Venting	Main Condenser Off-Gas System	Gaseous Waste System	Total (1 Unit)
H-3	3.7E+02*	3.7E+02	c	c	c	7.4E+02
C-14	1.0E+00	a	a	a	7.0E+00	8.0E+00
Ar-41	2.5E+01	a	a	a	a	2.5E+01
Kr-83M	a	a	a	a	a	a
Kr-85M	7.0E+00	2.0E+00	a	1.0E+00	a	1.0E+01
Kr-85	1.0E+00	a	a	a	2.6E+02	2.6E+02
Kr-87	2.0E+00	1.0E+00	a	a	a	3.0E+00
Kr-88	1.0E+01	4.0E+00	a	2.0E+00	a	1.6E+01
Kr-89	a	a	a	a	a	a
Xe-131M	3.0E+00	a	a	a	2.0E+01	2.3E+01
Xe-133M	1.6E+01	a	a	a	a	1.6E+01
Xe-133	8.6E+02	3.4E+01	a	2.1E+01	7.7E+01	9.9E+02
Xe-135M	a	a	a	a	a	a
Xe-135	3.1E+01	4.0E+00	a	3.0E+00	a	3.8E+01
Xe-137	a	a	a	a	a	a
Xe-138	a	1.0E+00	a	a	a	1.0E+00

* 3.7E+02 = 3.7×10^2
(a) Less than 1.0 Ci/yr/unit for Noble Gases and C-14
(b) Less than 0.0001 Ci/yr/unit for Iodine
(c) Less than 1.0 percent of total for this nuclide

TABLE 3.5-10
(Sheet 2 of 2)

ANNUAL GASEOUS EFFLUENTS RELEASE (Ci/yr)

Radionuclide	Containment Purge	PAB Venting	Turbine Venting	Main Condenser Off-Gas System	Gaseous Waste System	Total (1 Unit)
I-130	b	b	b	b	b	b
I-131	1.5E-02	4.3E-03	1.8E-03	2.7E-02	b	4.8E-02
I-132	b	b	b	b	b	b
I-133	1.1E-02	6.3E-03	1.9E-03	4.0E-02	b	5.9E-02
I-134	b	b	b	b	b	b
I-135	b	b	b	b	b	b
Mn-54	2.2E-04	1.8E-04	c	c	4.5E-05	4.4E-04
Fe-59	7.4E-05	6.0E-05	c	c	1.5E-05	1.5E-04
Co-58	7.4E-04	6.0E-04	c	c	1.5E-04	1.5E-03
Co-60	3.3E-04	2.7E-04	c	c	7.0E-05	6.7E-04
Sr-89	1.7E-05	1.3E-05	c	c	3.3E-06	3.3E-05
Sr-90	2.9E-06	2.4E-06	c	c	6.0E-07	5.9E-06
Cs-134	2.2E-04	1.8E-04	c	c	4.5E-05	4.4E-04
Cs-137	3.7E-04	3.0E-04	c	c	7.5E-05	7.4E-04

* 3.7E+02 = 3.7 $\times 10^2$

(a) Less than 1.0 Ci/yr/unit for Noble Gases and C-14

(b) Less than 0.0001 Ci/yr/unit for Iodine

(c) Less than 1.0 percent of total for this nuclide

TABLE 3.5-11

ANNUAL SOLID WASTE GENERATION VOLUMES FOR BOTH REACTOR UNITS

Type	Quantity	Curie Content	Shipping Volume	Average Curie Per Package	Number of Containers
Spent Resin	1430 ft^3	16,100 Ci[(1)]	2145 ft^3	555	29
Evaporator Bottoms and Other Liquid Waste	3979 ft^3	65.5 Ci	5969 ft^3	.819	80
Non-Compressible Solid Waste	200 ft^3	0.2 - 4 Ci	800 ft^3	0.364	11
Compressible Waste	-	0.5 - 2 Ci	4860 ft^3	0.00296	675 - (55 gal. drum)
Total	5609 ft^3	16,200 Ci	13,774 ft^3	-	675 - 55 gal. drum 120 - 75 ft^3 container[(2)]

(1) After 180 days of decay
(2) Storage facilities are capable of storing 60-75 ft^3 containers of high level waste for six months

SB 1 & 2
ER-OLS

TABLE 3.5-12

BORON RECOVERY SYSTEM RELEASES
(Each Unit)

Radionuclide	Annual Release (Ci/Year)
I-131	1.57E-02*
I-132	4.00E-05
I-133	8.00E-05
Rb-86	1.00E-05
Sr-89	1.00E-05
Mo-99	9.00E-05
Tc-99m	8.00E-05
Te-127m	1.00E-05
Te-127	1.00E-05
Te-129m	2.00E-05
Te-129	1.00E-05
Te-132	4.00E-05
Cs-134	6.33E-03
Cs-136	7.60E-04
Cs-137	4.78E-03
Ba-137m	4.48E-03
Cr-51	3.00E-05
Mn-54	1.00E-05
Fe-55	4.00E-05
Fe-59	2.00E-05
Co-58	3.10E-04
Co-60	5.00E-05
All Others	1.00E-05
Total (Except Tritium)	3.30E-02

---

* 1.55E-02 = 1.55×10^{-2}

TABLE 3.5-13

NON-RECYCLABLE RELEASES FROM LIQUID WASTE SYSTEM (Each Unit)

Radionuclide	Annual Release (Ci/Year)
I-130	2.00E-05*
I-131	2.37E-02
I-132	5.20E-04
I-133	7.67E-03
I-135	8.40E-04
Mo-99	4.80E-04
Tc-99m	4.50E-04
Te-129m	2.00E-05
Te-129	1.00E-05
Te-131m	1.00E-05
Te-132	1.70E-04
Cs-134	2.90E-04
Cs-136	1.30E-04
Cs-137	2.10E-04
Ba-137m	1.90E-04
Cr-51	2.00E-05
Fe-55	2.00E-05
Fe-59	1.00E-05
Co-58	1.80E-04
Co-60	2.00E-05
Np-239	1.00E-05
All Others	1.00E-05
Total (Except Tritium)	3.50E-02

* $2.00E-05 = 2.00 \times 10^{-5}$

TABLE 3.5-14

STEAM GENERATOR BLOWDOWN LIQUID RELEASES
(Each Unit)

Radionuclide	Annual Release (Ci/Year)
I-130	1.0E-05*
I-131	1.57E-03
I-132	5.40E-04
I-133	1.62E-03
I-134	3.0E-05
I-135	5.3E-04
Br-83	1.0E-05
Mo-99	5.0E-05
Tc-99m	1.2E-04
Te-132	1.0E-05
Cs-134	2.0E-05
Cs-136	1.0E-05
Cs-137	1.0E-05
Ba-137m	5.0E-05
All Others	Negligible
Total (Except Tritium)	4.6E-03

* 1.0E-05 = 1.0×10^{-5}

TABLE 3.5-15

NORMAL SECONDARY SYSTEM CONDENSATE LEAKAGE RELEASES
(Each Unit)

Radionuclide	Annual Release (Ci/Year)
I-130	1.00E-05*
I-131	2.93E-03
I-132	1.90E-04
I-133	2.53E-03
I-135	5.40E-04
Mo-99	9.00E-05
Tc-99m	1.50E-04
Te-132	2.00E-05
Cs-134	3.00E-05
Cs-136	1.00E-05
Cs-137	2.00E-05
Ba-137m	2.00E-05
Co-58	2.00E-05
Total (Except Tritium)	6.58E-03

* 1.00E-05 = 1.00×10^{-5}

TABLE 3.5-16

SUMMARY OF NORMAL RADIOACTIVE LIQUID RELEASES
(Each Unit)

Radionuclide	Annual Release (Ci/Year)
I-130	4.00E-05*
I-131	4.40E-02
I-132	1.30E-04
I-133	1.19E-02
I-135	1.91E-03
Br-83	1.00E-05
Rb-86	1.00E-05
Sr-89	1.00E-05
Mo-99	7.10E-04
Tc-99m	8.00E-04
Te-127m	1.00E-05
Te-127	1.00E-05
Te-129m	4.00E-05
Te-129	2.00E-05
Te-131m	1.00E-05
Te-132	2.30E-04
Cs-134	6.66E-03
Cs-136	9.10E-04
Cs-137	5.02E-03
Ba-137m	4.74E-03
Cr-51	5.00E-05
Mn-54	1.00E-05
Fe-55	6.00E-05
Fe-59	3.00E-05
Co-58	5.20E-04
Co-60	8.00E-05
Np-239	1.00E-05
All Others	2.00E-05
Total (Except Tritium)	7.92E-02

* 4.00E-05 = 4.00×10^{-5}

TABLE 3.5-17

RADIOACTIVE LIQUID RELEASES DUE TO ANTICIPATED OPERATIONAL OCCURRENCES
(Each Unit)

Radionuclide	Annual Release (Ci/Year)
I-130	7.56E-05*
I-131	8.33E-02
I-132	2.46E-03
I-133	2.26E-02
I-134	5.68E-05
I-135	3.62E-03
Br-83	1.89E-05
Rb-86	1.89E-05
Sr-89	1.89E-05
Mo-99	1.34E-03
Tc-99m	1.51E-03
Te-127m	1.89E-05
Te-127	1.89E-05
Te-129m	7.57E-05
Te-129	5.68E-05
Te-131m	1.89E-05
Te-132	4.54E-04
Cs-134	1.26E-02
Cs-136	1.72E-03
Cs-137	9.51E-03
Ba-137m	8.98E-03
Ba-140	1.00E-05
La-140	1.00E-05
Cr-51	2.84E-04
Mn-54	7.57E-05
Fe-55	3.60E-04
Fe-59	1.70E-04
Co-58	2.97E-03
Co-60	4.36E-04
Np-239	5.68E-05
All Others	3.79E-05
Total (Except Tritium)	1.50E-01

* 7.57E-05 = 7.57 x 10^{-5}

TABLE 3.5-18
(Sheet 1 of 2)

RADIONUCLIDE DISCHARGE CONCENTRATIONS
NORMAL LIQUID RELEASES - INCLUDING ANTICIPATED OPERATIONAL OCCURRENCES

Nuclide	Total Annual Release (Ci/yr/unit)	Discharge Concentration (μCi/ml)	(MPC)w (μCi/ml)	Fraction of (MPC)w
H-3	7.30E+02*	1.1E-06	3E-03	3.7E-04
I-130	1.2E-04	1.8E-13	3E-06	6.1E-08
I-131	1.3E-01	2.0E-10	3E-07	6.6E-04
I-132	3.9E-03	5.9E-12	8E-06	7.4E-07
I-133	3.6E-02	5.5E-11	1E-06	5.5E-05
I-134	1.0E-04	1.5E-13	2E-05	7.5E-09
I-135	5.8E-03	8.8E-12	4E-06	2.2E-06
Br-83	4.0E-05	6.1E-14	1E-07	6.1E-07
Rb-86	2.0E-05	3.1E-14	2E-05	1.5E-09
Sr-89	3.0E-05	4.6E-14	3E-06	1.5E-08
Mo-99	2.1E-03	3.2E-12	4E-05	8.0E-08
Tc-99m	2.4E-03	3.7E-12	3E-03	1.2E-08
Te-127m	3.0E-05	4.6E-14	5E-05	9.2E-10
Te-127	3.0E-05	4.6E-14	2E-04	2.3E-10
Te-129m	1.2E-04	1.8E-13	2E-05	9.2E-09
Te-129	9.0E-05	1.4E-13	8E-04	1.8E-10
Te-131m	3.0E-05	4.6E-14	4E-05	1.1E-09
Te-132	7.3E-04	1.1E-12	2E-05	5.6E-08
Cs-134	2.0E-02	3.0E-11	9E-06	3.4E-06
Cs-136	2.7E-03	4.1E-12	6E-05	6.9E-08
Cs-137	1.5E-02	2.1E-11	2E-05	1.2E-06

* 7.30E+02 = 7.30 x 10^2

TABLE 3.5-18
(Sheet 2 of 2)

RADIONUCLIDE DISCHARGE CONCENTRATIONS
NORMAL LIQUID RELEASES - INCLUDING ANTICIPATED OPERATIONAL OCCURRENCES

Nuclide	Total Annual Release (Ci/yr/unit)	Discharge Concentration (μCi/ml)	(MPC)w (μCi/ml)	Fraction of (MPC)w
Ba-137m	1.4E-02	2.1E-11	1E-07	2.1E-04
Ba-140	1.0E-05	1.5E-14	2E-05	7.6E-10
La-140	1.0E-05	1.5E-14	2E-05	7.6E-10
Cr-51	1.5E-04	2.3E-13	2E-03	1.1E-10
Mn-54	4.0E-05	6.1E-14	1E-04	6.1E-10
Fe-55	1.9E-05	2.9E-13	8E-04	3.6E-11
Fe-59	9.0E-05	1.4E-13	5E-05	2.7E-10
Co-58	1.6E-03	2.4E-12	9E-05	2.7E-08
Co-60	2.3E-04	3.5E-13	3E-05	1.2E-08
Np-239	3.0E-05	4.6E-14	1E-04	4.6E-10
All Others	6.0E-05	9.2E-14	1E-07	9.2E-07
Total (Except Tritium)	2.4E-01	3.6E-10	-	9.3E-04

TABLE 3.5-19

GASEOUS RELEASES WITH 0.5% FAILED FUEL (ONE UNIT)

Radionuclide	Total, Off-Normal Unit Release Rate (Ci/year)
Kr-85M	4.2E+01
Kr-85	1.1E+03
Kr-87	1.3E+01
Kr-88	6.7E+01
Xe-131M	9.6E+01
Xe-133M	6.7E+01
Xe-133	4.1E+03
Xe-135	1.6E+02
Xe-138	4.2E+00
I-131	2.0E-01
I-133	2.5E-01

TABLE 3.5-20

GASEOUS RELEASES WITH 500 GAL/DAY STEAM GENERATOR TUBE LEAKAGE FOR 90 DAYS (ONE UNIT)

Radionuclide	Total, Off-Normal Unit Release Rate (Ci/year)
Kr-85M	1.6E+01
Kr-85	2.6E+02
Kr-87	3.0E+00
Kr-88	2.8E+01
Xe-131M	2.3E+01
Xe-133M	1.6E+01
Xe-133	1.1E+03
Xe-135	5.6E+01
Xe-138	1.0E+00
I-131	2.2E-01
I-133	3.1E-01

TABLE 3.5-21

GASEOUS RELEASES WITH 1 GAL/MIN OF REACTOR COOLANT LEAKAGE TO CONTAINMENT FOR 12 DAYS, FOLLOWED BY A CONTAINMENT PURGE (ONE UNIT)

Radionuclide	Total, Off-Normal Unit Release Rate (Ci/year) (1)
Kr-85M	1.0E+01
Kr-85	2.6E+02
Kr-87	3.0E+00
Kr-88	1.6E+01
Xe-131M	2.3E+01
Xe-133M	1.7E+01
Xe-133	1.0E+03
Xe-135	3.9E+01
Xe-138	1.0E+00
I-131	5.6E-02
I-133	6.1E-02

(1) Total release from all sources for 1 unit operating with 1 gpm of reactor coolant leakage in the containment for 12 days prior to purge and the following assumptions:

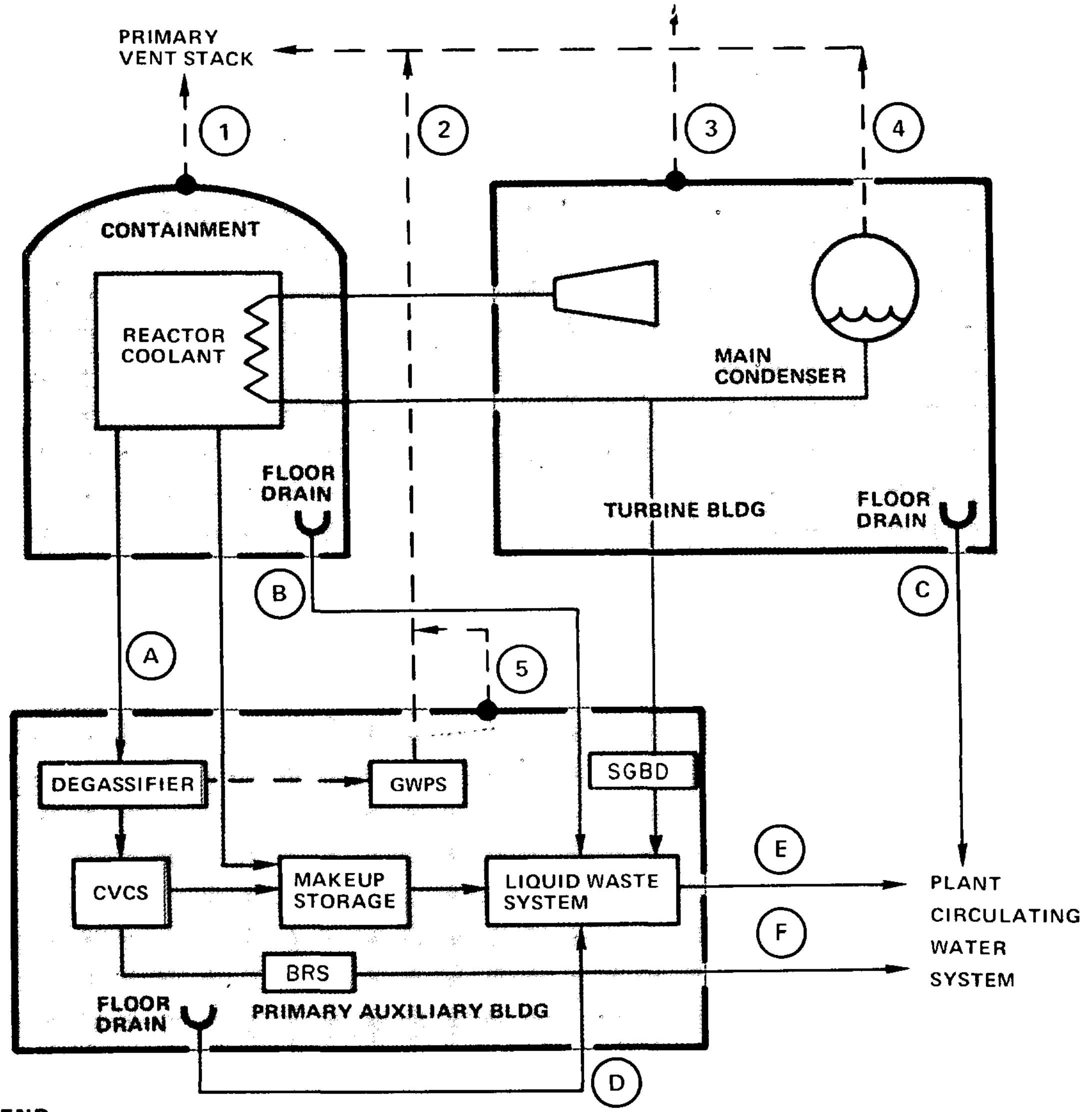
a. Iodine partition factor = 0.0075

b. Carbon filter efficiency = 90%

TABLE 3.5-22

GASEOUS RELEASES WITH 200 GAL/DAY REACTOR
COOLANT LEAKAGE TO AUXILIARY BUILDING FOR 90 DAYS (ONE UNIT)

Radionuclide	Total, Off-Normal Unit Release Rate (Ci/year)
Kr-85M	1.4E+01
Kr-85	2.6E+02
Kr-87	5.2E+00
Kr-88	2.5E+01
Xe-131M	2.3E+01
Xe-133M	1.6E+01
Xe-133	1.1E+03
Xe-135	4.7E+01
Xe-138	3.2E+00
I-131	5.8E-02
I-133	7.3E-02



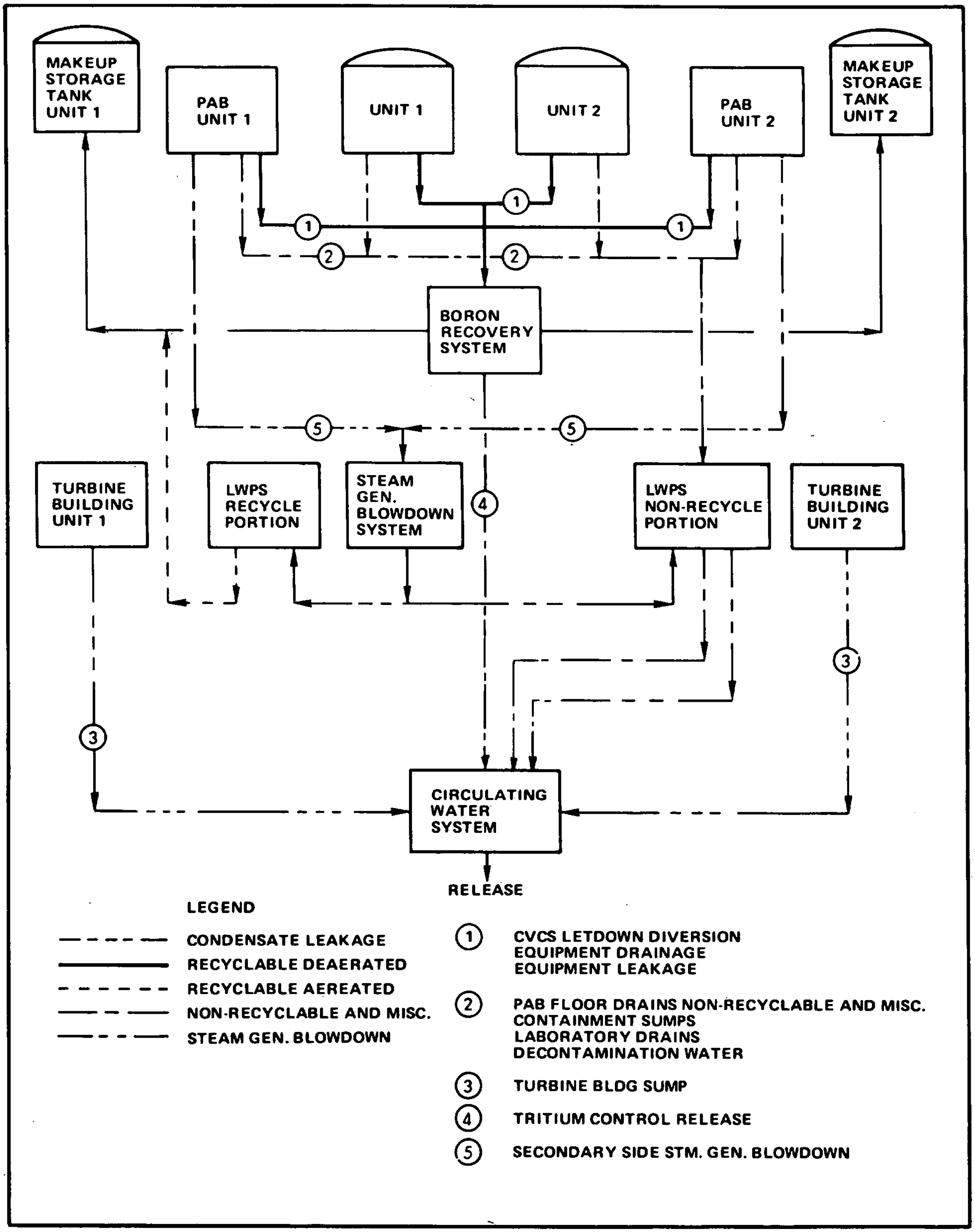
LEGEND

——— LIQUID ROUTE

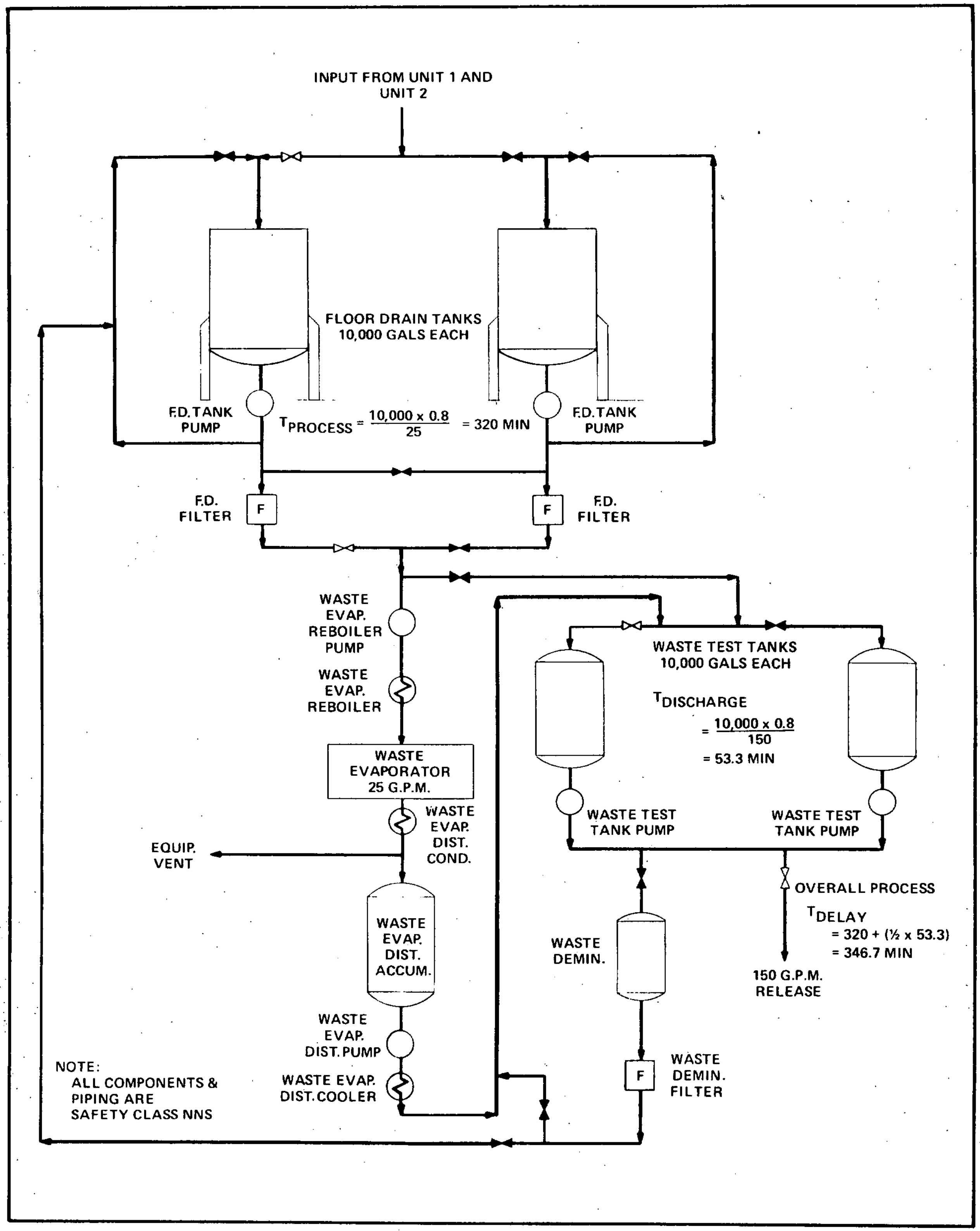
- - - - GASEOUS ROUTE

1	CONTAINMENT PURGE OFFGAS	A	REACTOR COOLANT LETDOWN
2	GASEOUS PROCESSING SYSTEM OFFGAS	B	CONTAINMENT BLDG. FLOOR DRAIN
3	TURBINE BLDG. VENTILATION OFFGAS	C	TURBINE BLDG. FLOOR DRAIN
4	MAIN CONDENSER OFFGAS	D	PRIMARY AUXILIARY BLDG. FLOOR DRAIN
5	PRIMARY AUXILIARY BLDG. VENTILATION OFFGAS	E	NON-RECYCLEABLE LIQUID WASTE DISCHARGE
		F	TRITIUM CONTROL RELEASE

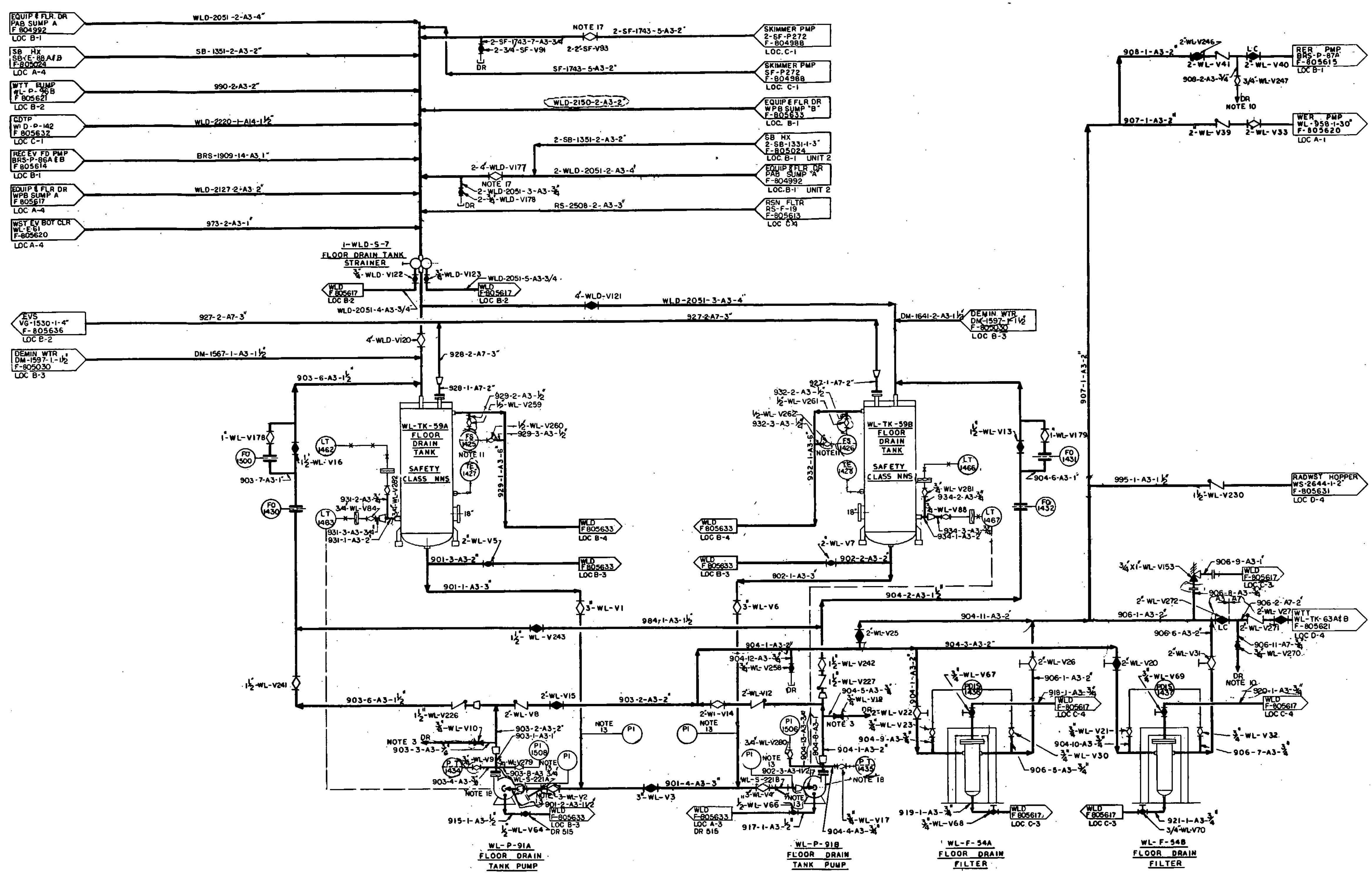
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	RADIATION TRANSPORT SCHEMATIC
	FIGURE 3.5-1



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	RADIOACTIVE LIQUID RELEASE POINTS FIGURE 3.5-2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	LIQUID WASTE SYSTEM SCHEMATIC
	FIGURE 3.5-3



GENERAL NOTES

1- DELETED

2- ALL PIPING IS SAFETY CLASS NNS, NON-SEISMIC CATEGORY I UNLESS OTHERWISE NOTED.

3- FLUSH, VENT, AND/OR SAMPLE CONNECTION; PIPE TO LOCAL DRAIN FUNNEL.

4- VALVE IS 316SS; PIPE IS ALLOY 20. SEE UE & C SPECIFICATION 9763-006-248-51 FOR WELDING REQUIREMENTS.

5- VALVE IS ALLOY 20; PIPE IS INCOLOY 825. SEE UE & C SPECIFICATION 9763-006-248-51 FOR WELDING REQUIREMENTS.

6- TUBESHEET IS INCOLOY 825; PIPE IS ALLOY 20. SEE UE & C SPECIFICATION 9763-006-248-51 FOR WELDING REQUIREMENTS.

7- ALLOY 20 TO INCOLOY 825 PIPE JOINT. SEE UE & C SPECIFICATION 9763-006-248-51 FOR WELDING REQUIREMENTS.

8- RESIN FILL TK. (TYP.) AS SHOWN ON DWG. F-805624

9- LOCATE TEMP. TRANSMITTER BETWEEN BOTTOMS CLR. OUTLET AND FIRST BRANCH LINE.

10- TELL TALE DRAIN PIPE TO LOCAL DRAIN FUNNEL

11- PROVIDE CONNECTION TO FS AT BOTTOM OF MAIN HORIZONTAL OVERFLOW LINE

12- DELETED

13- PROVIDE 3/4" PRESSURE TAP & PLUG FOR PI'S. START UP ENGINEERING TO PROVIDE PIPING, VALVE & PI'S; ALSO STRAINER BLOW OFF PIPING & VALVES FOR INITIAL FLUSHING OPERATION. STRAINER SCREEN TO BE REMOVED AFTER START UP

14- INSTALL WITH WL UNDER SEAT OM ON STEM SIDE

15- CROSBY DRIP PAN ELBOW OR EQUAL

16- CHEMICAL ADDITION AND REMOVAL CONNECTIONS

17- LOCK CLOSED DURING UNIT 2 CONSTRUCTION

18- SEE 9763-F-805627 FOR WATER SUPPLY TO PUMP DOUBLE MECHANICAL SEALS

THE SYSTEM PREFIX FOR THIS DRAWING IS "WL" UNLESS OTHERWISE NOTED.

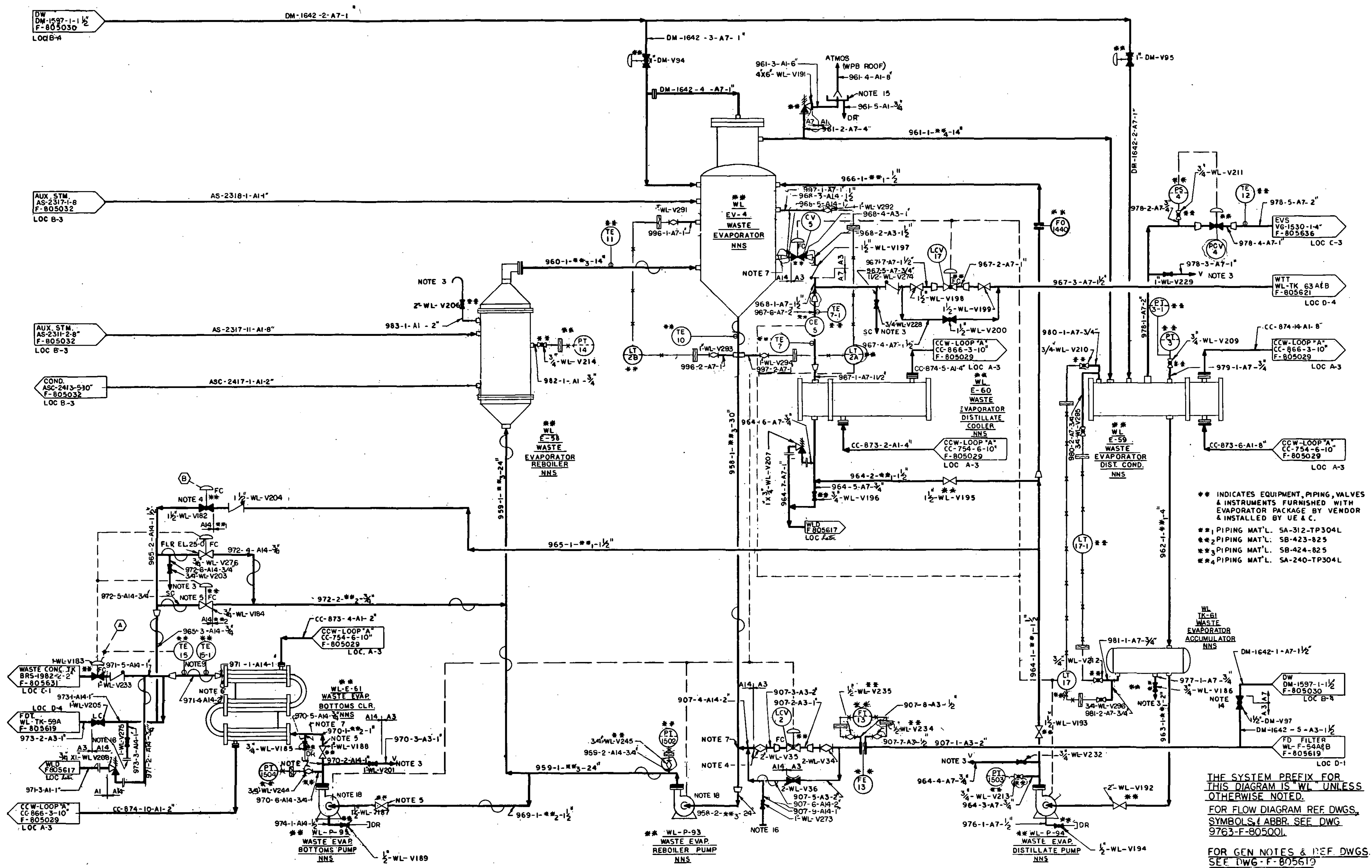
FOR FLOW DIAGRAM REF. DWGS., SYMBOLS, & ABBR. SEE DWG 9763-F-805001.

SD NO. 32

REFERENCE DRAWINGS

9763-F-805620 LIQUID WASTE SYS., EVAP EV-4 P&ID
9763-F-805621 LIQUID WASTE SYS., TEST DEMIN P&ID
9763-M-506920 INSTR CONTROL LOOP DIAGRAM INDEX
9763 M 504050 LOGIC DIAGRAM INDEX

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	LIQUID WASTE SYSTEM STORAGE AND FILTRATION P & I DIAGRAM	
	9763-F-805619	FIGURE 3.5-4, SH. 1



THE SYSTEM PREFIX FOR THIS DIAGRAM IS "WL" UNLESS OTHERWISE NOTED.

FOR FLOW DIAGRAM REF. DWGS, SYMBOLS & ABBR. SEE DWG 9763-F-805001.

FOR GEN NOTES & REF. DWGS. SEE DWG - F-805619

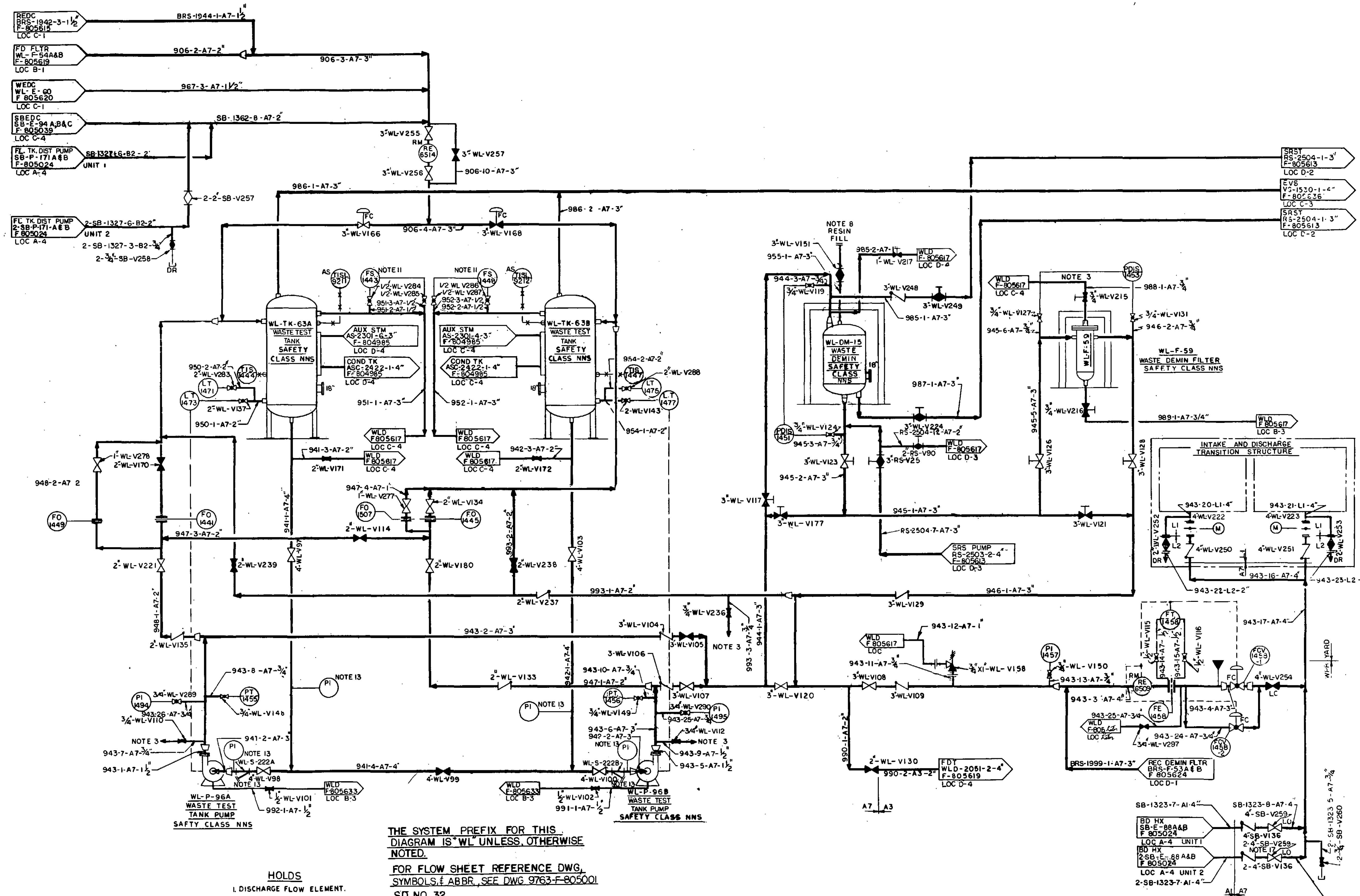
SD NO. 32

INSTRUMENTATION SYMBOLS

(A) HIGH WASTE CONCENTRATES TANK WS-TK-76 & HIGH COOLER OUTLET TEMPERATURE AND LOW EV4 LEVEL DISCHARGE INTERLOCK

(B) WL-P-95, DISTILLATE FLUSH V182 INTERLOCK

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	LIQUID WASTE SYSTEM EVAPORATOR EV-4 P & I DIAGRAM	
	9763-F-805620	FIGURE 3.5-4, SH. 2



THE SYSTEM PREFIX FOR THIS DIAGRAM IS "WL" UNLESS OTHERWISE NOTED.

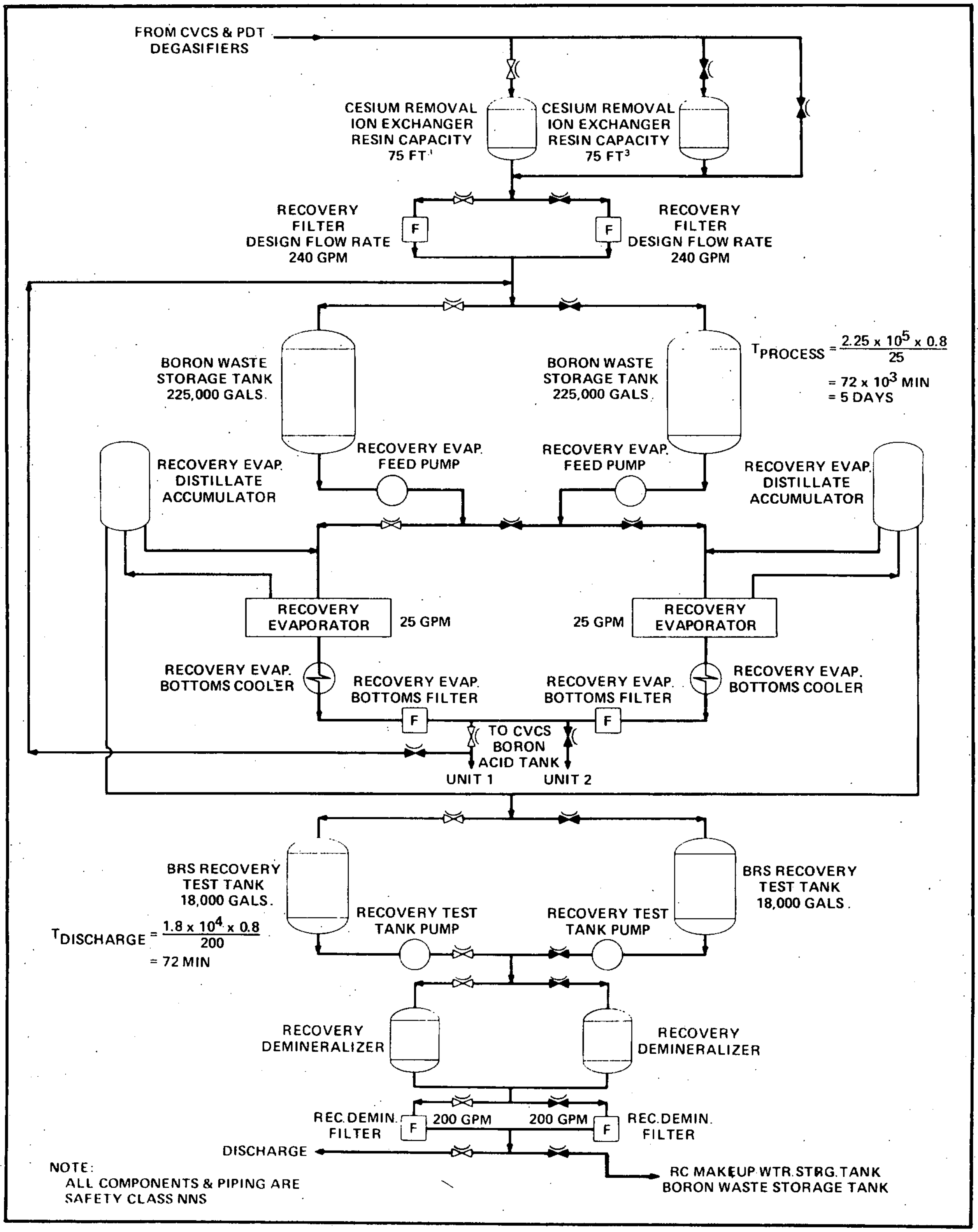
FOR FLOW SHEET REFERENCE DWG, SYMBOLS & ABBR., SEE DWG 9763-F-805001 SD. NO. 32

FOR GEN. NOTES & REF. DWGS SEE DWG. F-805619

HOLDS

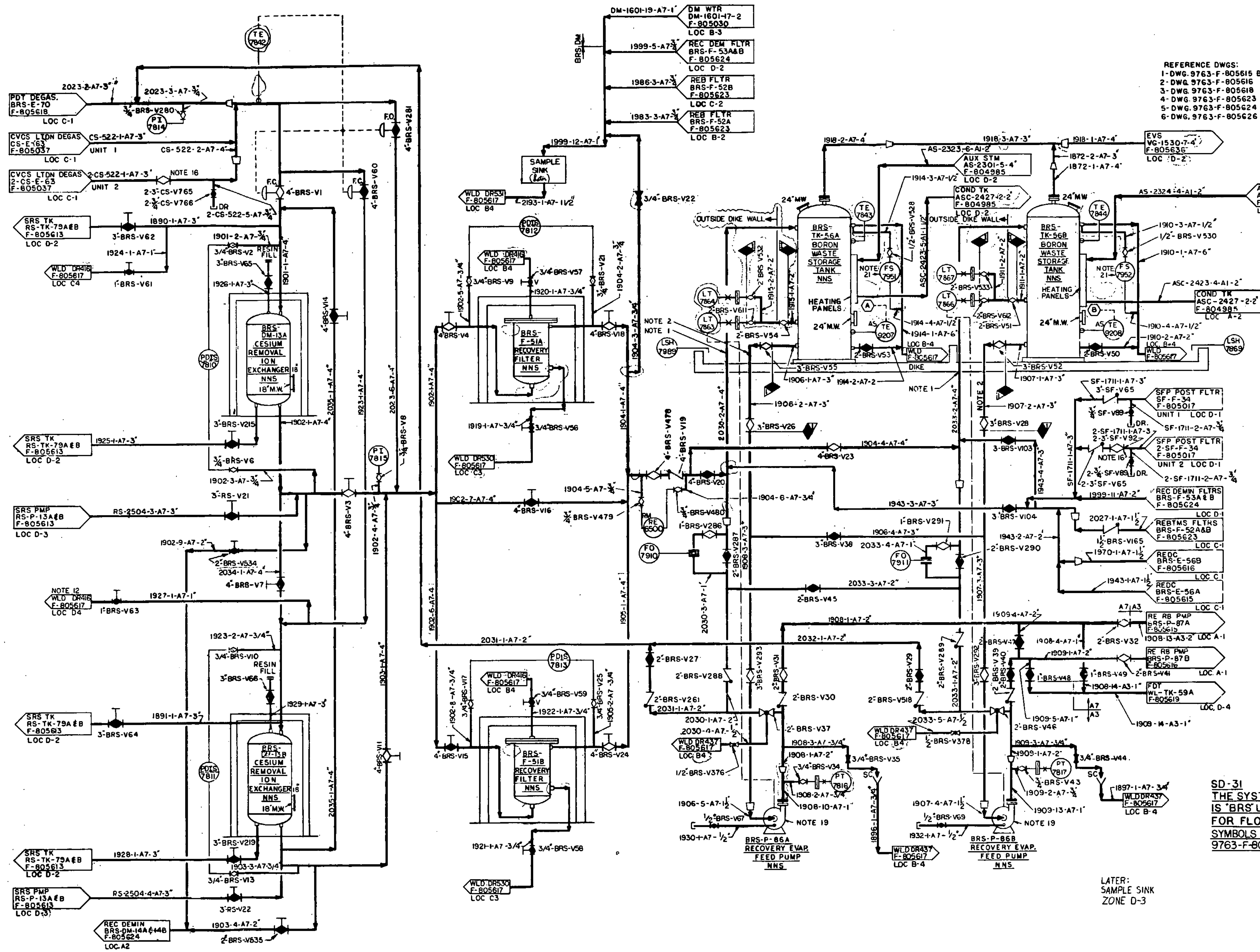
1. DISCHARGE FLOW ELEMENT.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	LIQUID WASTE SYSTEM DEMINERALIZATION AND TESTING P & I DIAGRAM
	9763-F-805621 / FIGURE 3.5-4, SH. 3



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	BORON RECOVERY SYSTEM SCHEMATIC
	FIGURE 3.5-5

REFERENCE DWGS:
1-DWG. 9763-F-805615 BORON RECOVERY SYS., EVAP-3A P&ID
2-DWG. 9763-F-805616 " " " EVAP-3B P&ID
3-DWG. 9763-F-805618 " " " DEGAS P&ID
4-DWG. 9763-F-805623 " " " EVAP BOT P&ID
5-DWG. 9763-F-805624 " " " TEST & DEMIN
6-DWG. 9763-F-805626 " " " PDT P&ID



INSTRUMENTATION SYMBOLS
(A) TO F-804985-TV-9207
(B) TO F-804985-TV-9208

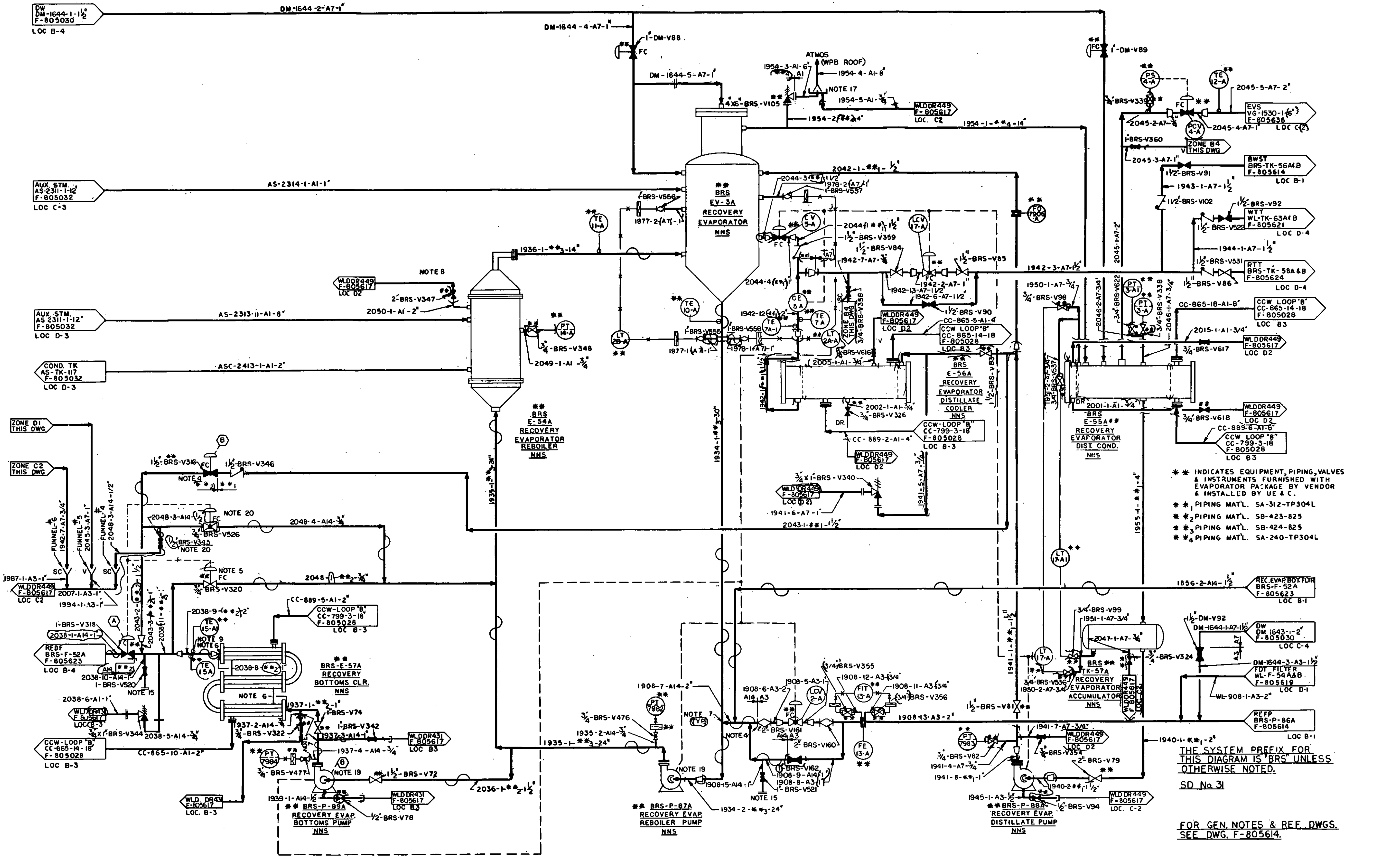
SD-31
THE SYSTEM PREFIX FOR THIS DIAGRAM IS "BRS" UNLESS OTHERWISE NOTED.
FOR FLOW SHEET REFERENCE DRAWINGS SYMBOLS ABBREVIATIONS SEE DWG. 9763-F-805001

LATER:
SAMPLE SINK
ZONE D-3

NOTES

1- WALL PENETRATION SHALL BE ABOVE MAXIMUM LOADED LEVEL OF DIKE AREA.
2- WALL PENETRATION SHALL BE SEALED BETWEEN WALL AND PIPE.
3- ALL PIPING IS SAFETY CLASS NNS, NON-SEISMIC CATEGORY I UNLESS OTHERWISE NOTED.
4- VALVE IS 316SS, PIPE IS ALLOY 20. SEE UE&C SPEC. 9763-006-248-51 FOR WELDING REQUIREMENTS.
5- VALVE IS ALLOY 20. PIPE IS INCOLOY 825 SEE UE&C SPEC. 9763-006-248-51 FOR WELDING REQUIREMENTS.
6- TUBESHEET IS INCOLOY 825. PIPE IS ALLOY 20 SEE UE&C SPEC. 9763-006-248-51 FOR WELDING REQUIREMENTS.
7- ALLOY 20 TO INCOLOY 825 PIPE JOINT SEE UE&C SPEC. 9763-006-248-51 FOR WELDING REQUIREMENTS
8- FLUSH, VENT AND/OR SAMPLE CONNECTIONS; PIPE TO LOCAL DRAIN FUNNEL.
9- LOCATE TEMPERATURE TRANSMITTERS BETWEEN BOTTOMS COOLER OUTLET AND FIRST BRANCH LINE.
10 DELETED
11- VALVE IS ALLOY 20. PIPE IS 304SS. SEE UE&C SPEC. 9763-006-248-51 FOR WELDING REQUIREMENTS.
12- DEMINERALIZERS ARE VENTED TO FLOOR DRAIN TANK HEADER.
13- THESE ITEMS SUPPLIED BY DEGASIFIER VENDOR. BUT NOT MOUNTED ON SKID
14- HEAVY LINES NOT PROVIDED BY DEGASIFIER VENDOR.
15- CHEMICAL ADDITION AND REMOVAL CONNECTIONS.
16- VALVE IS CLOSED DURING UNIT 2 CONSTRUCTION.
17- CROSBY DRIP PAN ELBOW OR APPROVED EQUAL
18- COMPONENTS INSIDE PACKAGE PROVIDED BY DEGASIFIER VENDOR.
19- SEE DRAWING (9763-F-805627) FOR WATER SUPPLY TO PUMP DOUBLE MECHANICAL SEALS.
20- THE RECIRCULATION SAMPLE LINE GATE VALVE 3/4"-BRS-V526 & 3/4"-BRS-V527 & CONNECTION 3/4"-BRS-V346 & 3/4"-BRS-V369 TO BE ABOVE FLOOR ELEVATION +25-0".
21- LOCATE FS INSTRUMENT & VALVE NEAR FLOOR ELEVATION
22- SUPPLIED BY TANK VENDOR

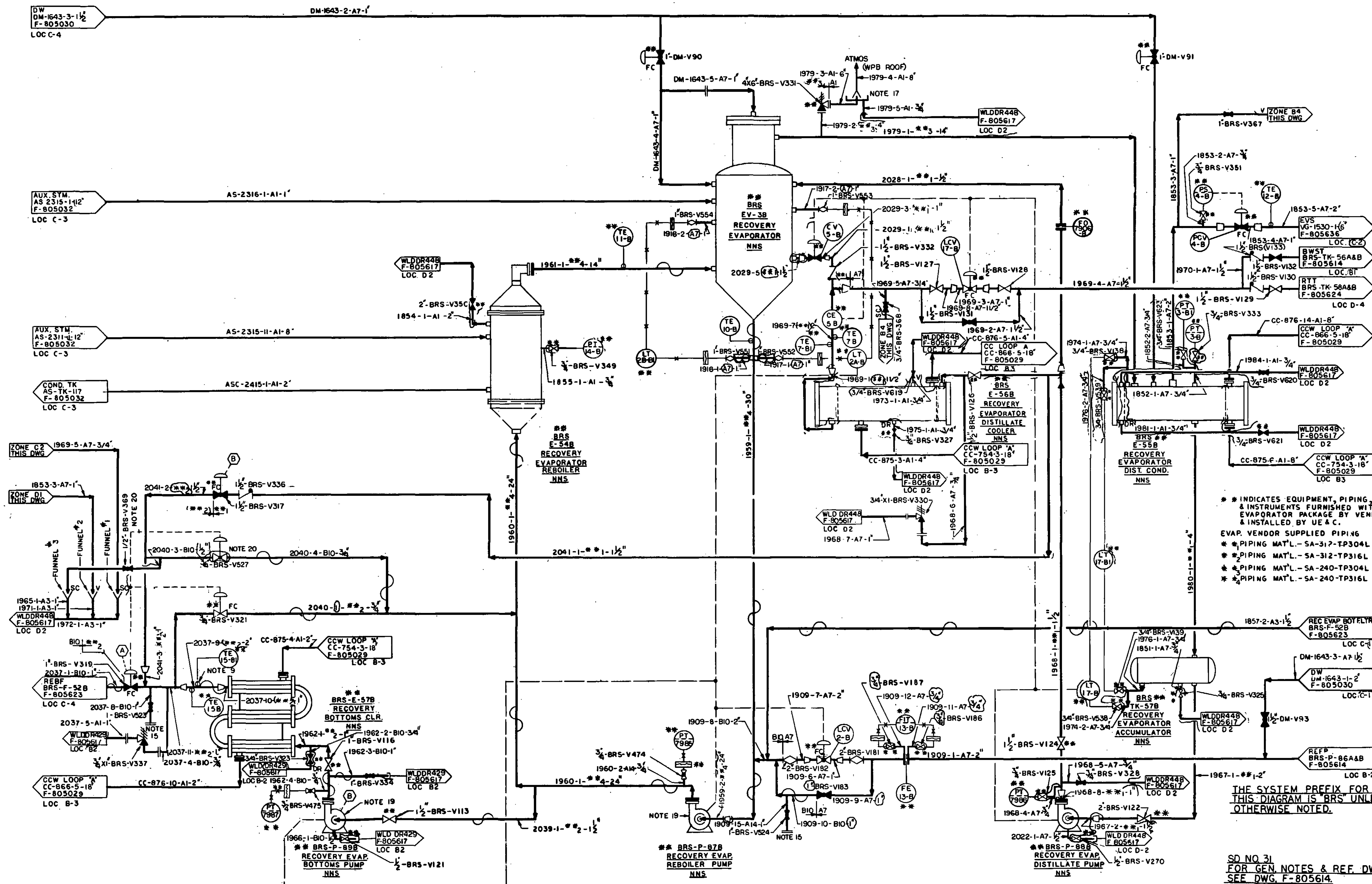
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	BORON RECOVERY SYSTEM FILTRATION AND STORAGE P & I DIAGRAM
	9763-F-805614
	FIGURE 3.5-6, SH. 1



(A) HIGH E-57A OUTLET TEMP HIGH WS-TK-76 LEVEL AND LOW EV-3B LEVEL WS-TK-76 TRANSFER VALVE INTERLOCK

(B) BRS-P-89A, DISTILLATE FLUSH V316 INTERLOCK

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	BORON RECOVERY SYSTEM EVAPORATOR EV-3A P & I DIAGRAM
	9763-F-805615 / FIGURE 3.5-6, SH. 2



** INDICATES EQUIPMENT, PIPING, VALVES & INSTRUMENTS FURNISHED WITH EVAPORATOR PACKAGE BY VENDOR & INSTALLED BY UE & C.

EVAP. VENDOR SUPPLIED PIPING

* *1 PIPING MAT'L. – SA-312-TP304L

* *2 PIPING MAT'L. – SA-312-TP316L

* *3 PIPING MAT'L. – SA-240-TP304L

* *4 PIPING MAT'L. – SA-240-TP316L

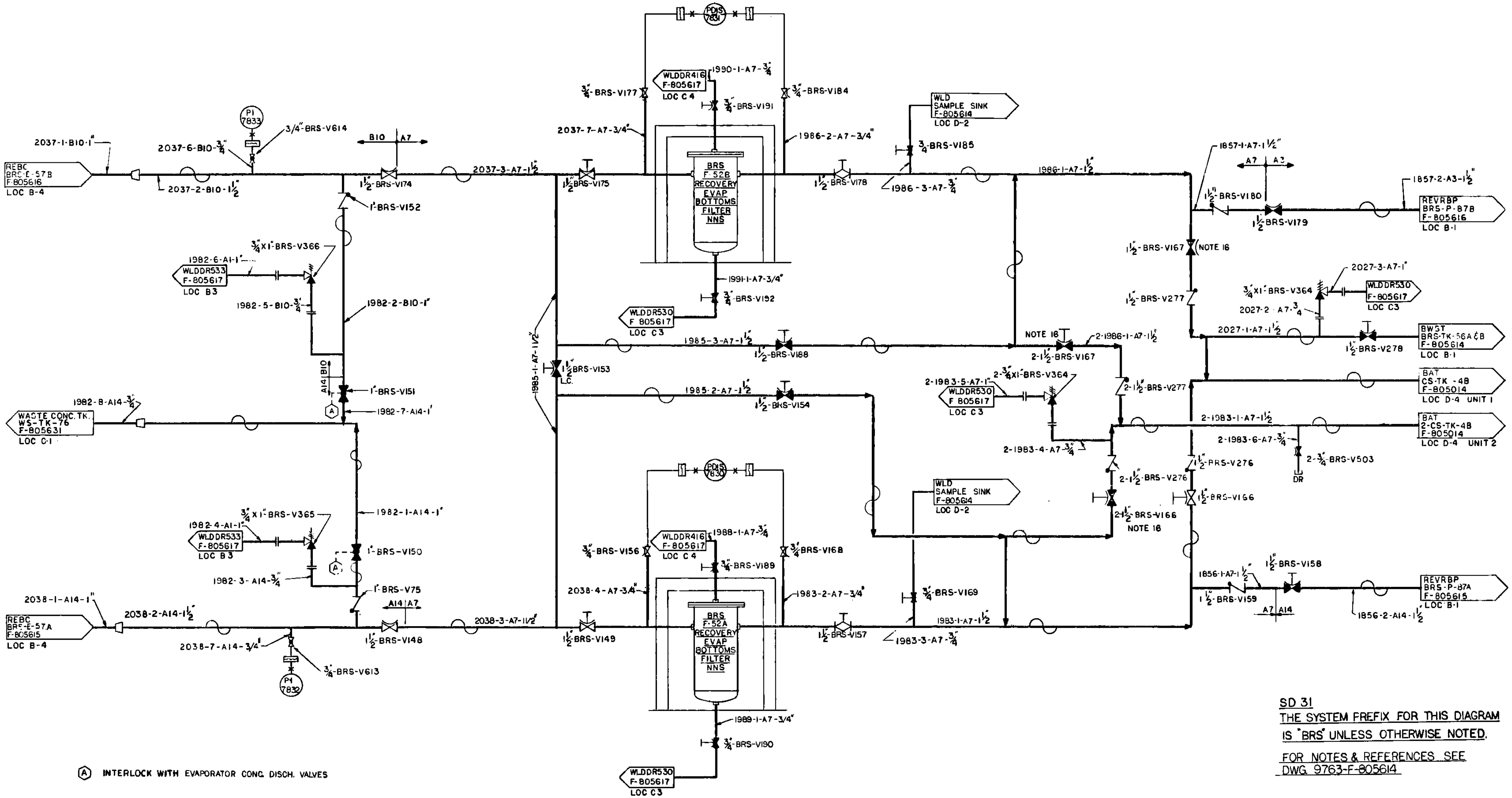
THE SYSTEM PREFIX FOR THIS DIAGRAM IS "BRS" UNLESS OTHERWISE NOTED.

SD NO. 31
FOR GEN. NOTES & REF. DWGS, SEE DWG. F-805614.

(A) HIGH E-57B OUTLET TEMP
HIGH WS-TK-76 LEVEL AND
LOW EV-3B LEVEL WS-TK-76
TRANSFER VALVE INTERLOCK

(B) BRS-P-89B DISTILLATE FLUSH
V317 INTERLOCK

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	BORON RECOVERY SYSTEM EVAPORATOR EV-3B P & I DIAGRAM
9763-F-805616	FIGURE 3.5-6, SH. 3



SD 31
THE SYSTEM PREFIX FOR THIS DIAGRAM IS "BRS" UNLESS OTHERWISE NOTED.

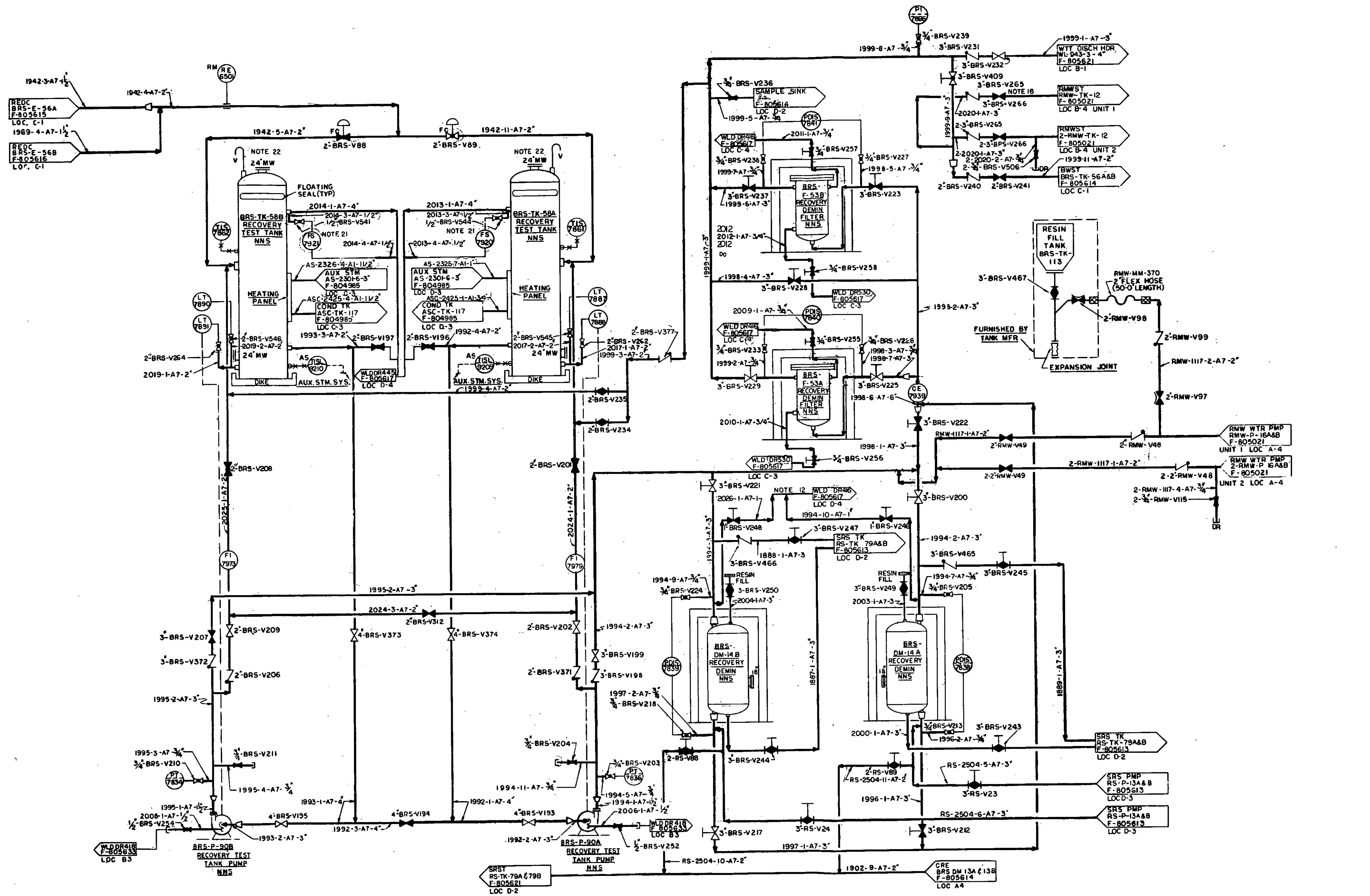
FOR NOTES & REFERENCES SEE DWG. 9763-F-805614

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

BORON RECOVERY SYSTEM
EVAPORATOR BOTTOMS
P & I DIAGRAM

9763-F-805623

FIGURE 3.5-6, SH. 4

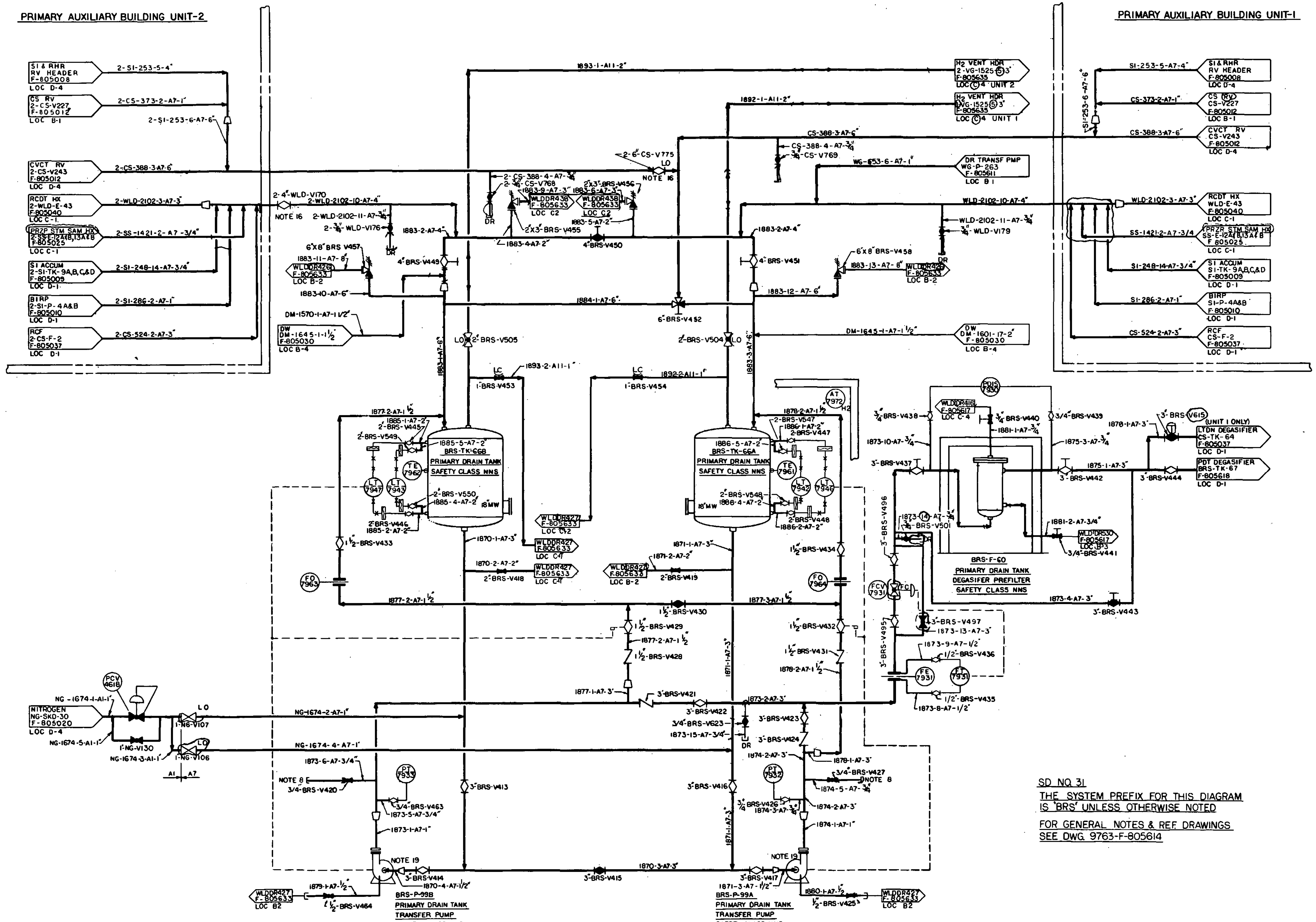


THE SYSTEM PREFIX FOR THIS DIAGRAM IS BRS UNLESS OTHERWISE NOTED

FOR NOTES AND REFERENCES SEE DWG. 9763-F-805614.

SD NO 31

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	BORON RECOVERY SYSTEM TESTING AND DEMINERALIZATION P & I DIAGRAM	
	9763-F-805624	FIGURE 3.5-6, SH. 5

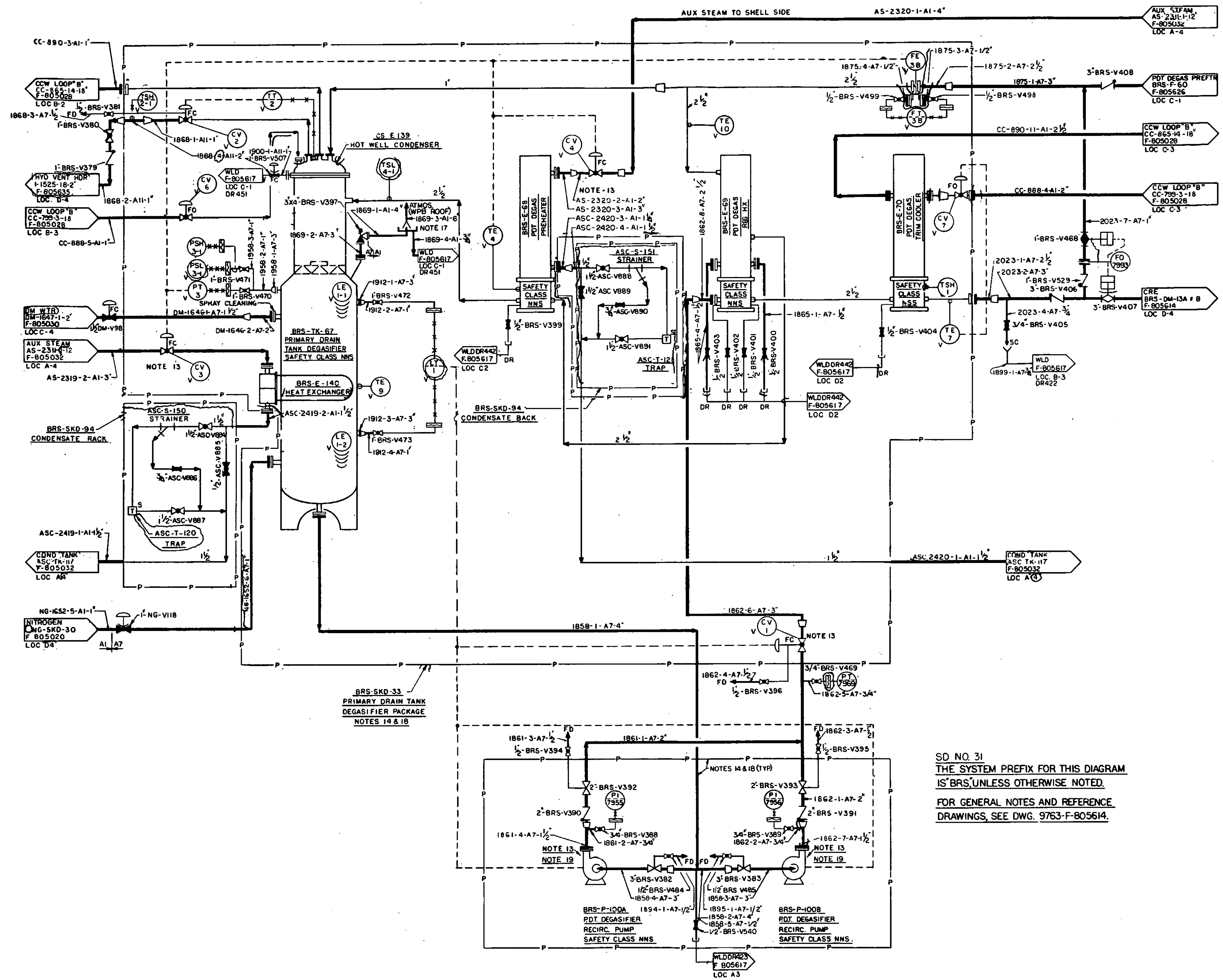


SD NO. 31

THE SYSTEM PREFIX FOR THIS DIAGRAM IS 'BRS' UNLESS OTHERWISE NOTED

FOR GENERAL NOTES & REF. DRAWINGS SEE DWG. 9763-F-805614

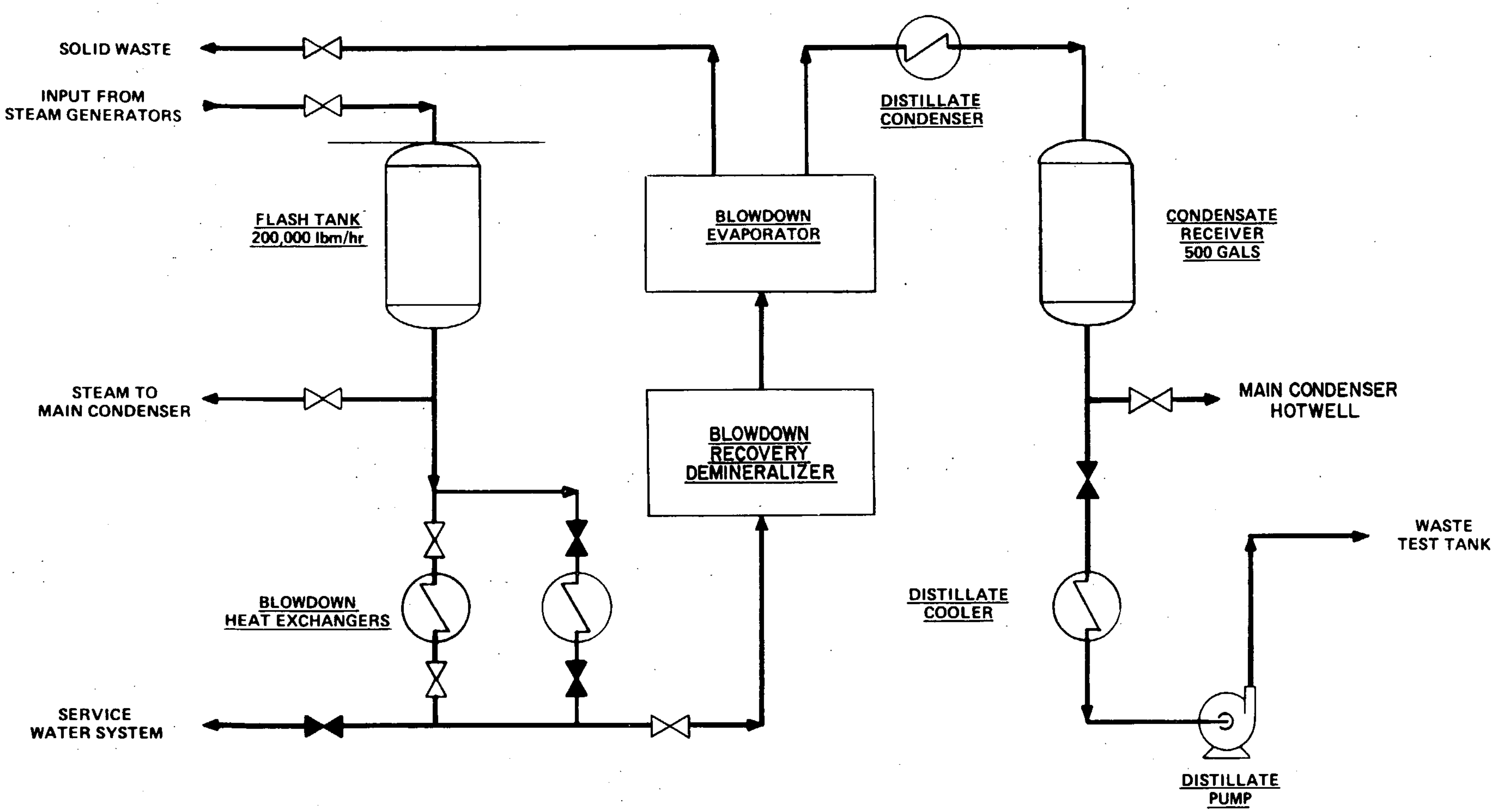
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	BORON RECOVERY SYSTEM PRIMARY DRAIN TANKS P & I DIAGRAM	
	9763-F-805626	FIGURE 3.5-6, SH. 6



SD NO. 31
THE SYSTEM PREFIX FOR THIS DIAGRAM IS "BRS" UNLESS OTHERWISE NOTED.

FOR GENERAL NOTES AND REFERENCE DRAWINGS, SEE DWG. 9763-F-805614.

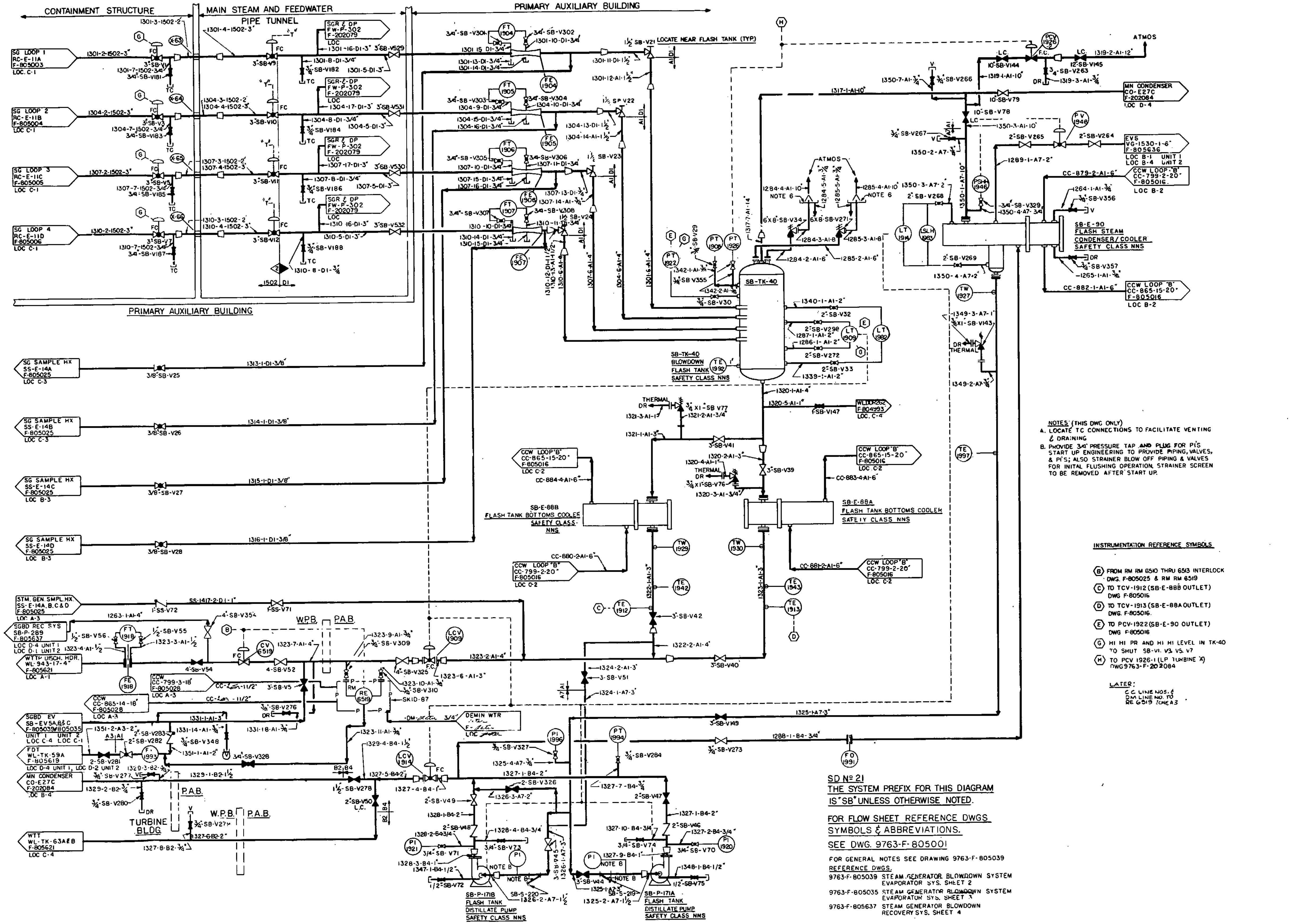
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	BORON RECOVERY SYSTEM PRIMARY DRAIN TANK DEGASIFIER P & I DIAGRAM
	9763-F-805618 — FIGURE 3.5-6, SH. 7



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

STEAM GENERATOR BLOWDOWN SYSTEM SCHEMATIC

FIGURE 3.5-7

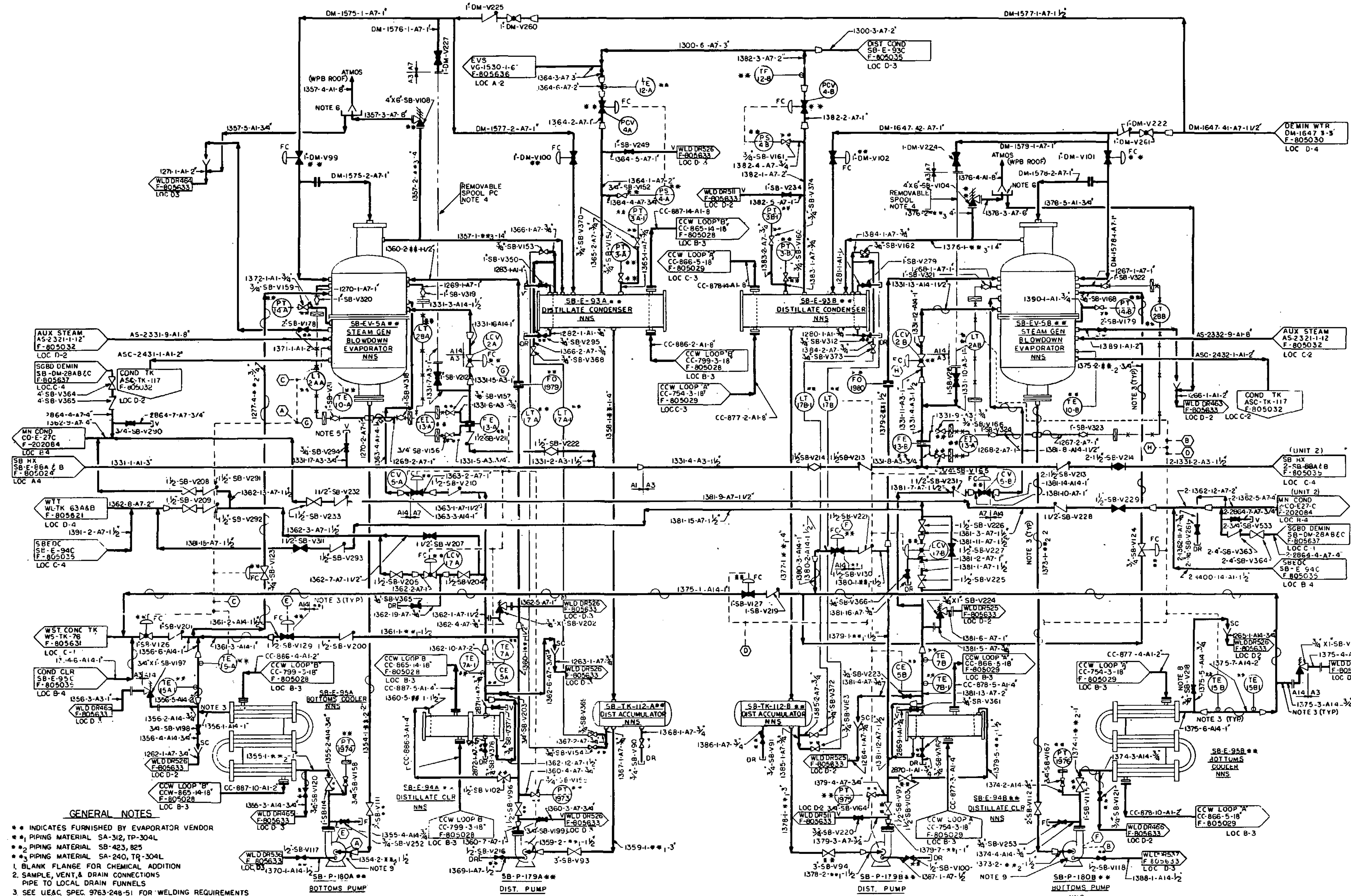


PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

STEAM GENERATOR BLOWDOWN SYSTEM
P & I DIAGRAM

9763-F-805024

FIGURE 3.5-8, SH. 1



GENERAL NOTES

- ** INDICATES FURNISHED BY EVAPORATOR VENDOR
- $**_1$ PIPING MATERIAL SA-312, TP-304L
- $**_2$ PIPING MATERIAL SB-423, 825
- $**_3$ PIPING MATERIAL SA-240, TP-304L

1. BLANK FLANGE FOR CHEMICAL ADDITION
2. SAMPLE, VENT, & DRAIN CONNECTIONS PIPE TO LOCAL DRAIN FUNNELS
3. SEE UE&C SPEC. 9763-248-51 FOR WELDING REQUIREMENTS FOR CLASS A14 AND VENDOR $**_2$ CLASS PIPING
4. FLUSH AND CHEMICAL ADDITION CONNECTION
5. NITROGEN PURGE CONNECTION FOR DRY LAYUP
6. CROSBY DRIP PAN ELBOW OR EQUAL
7. ALL PIPING NNS UNLESS OTHERWISE NOTED
8. SAMPLE VALVE LOCATED IN DISTILLATE EQUIPMENT AREA; PIPE TO LOCAL DRAIN FUNNEL
9. SEE DRAWING 9763-F-805627 FOR WATER SUPPY TO PUMP DOUBLE MECHANICAL SEALS
10. SEE DRAWING 9763-F-805001, NOTE 1

INSTRUMENT REF NOTES

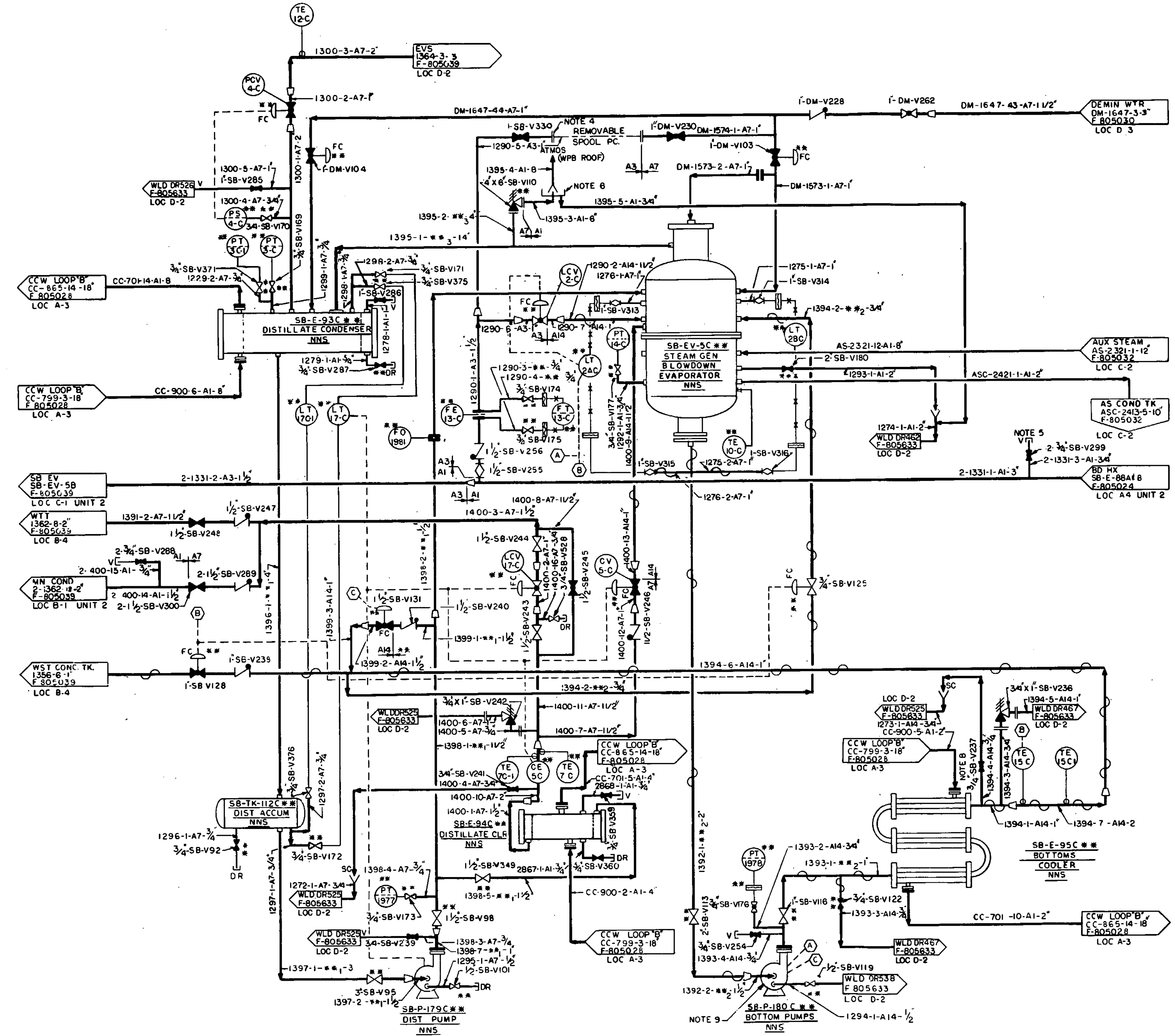
- (A) LOW LOW EV-5A INTERLOCK WITH P-180A
- (B) LOW LOW EV-5B INTERLOCK WITH P 180 B
- (C) HIGH E-95A OUTLET TEMP, HIGH WS-TK-76 LEVEL, AND LOW DISCHARGE EV-5A INTERLOCK
- (D) HIGH E-95B OUTLET TEMP HIGH WS-TK-76 LEVEL AND LOW DISCHARGE EV-5B INTERLOCK
- (E) DISTILLATE FLUSH V129, P-180 A
- (F) DISTILLATE FLUSH V130, P-180 B
- (G) EV-5A HI HI LVL, LCV 2A INTERLOCK
- (H) EV-5B HI HI LVL, LCV-2B INTERLOCK

SD No. 21

THE SYSTEM PREFIX FOR THIS DIAGRAM IS 'SB' UNLESS OTHERWISE NOTED

FOR REFERENCE DWGS. SEE DWG. 9763-F-805024

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	STEAM GENERATOR BLOWDOWN EVAPORATOR SYSTEM P & I DIAGRAM	
	9763-F-805039	FIGURE 3.5-8, SH. 2



INSTRUMENT REF NOTES

(A) LOW LOW EV-5C INTERLOCK WITH P-180C

(B) HIGH E-95C OUTLET TEMP, HIGH WS-TK-76 LEVEL, LOW LEVEL EV-5C INTERLOCK

(C) DISTILLATE FLUSH V-131, P-180C INTERLOCK

SD No. 21

THE SYSTEM PREFIX FOR THIS DRAWING IS 'SB' UNLESS OTHERWISE NOTED

FOR REFERENCE DWGS SEE DWG 9763-F-805024

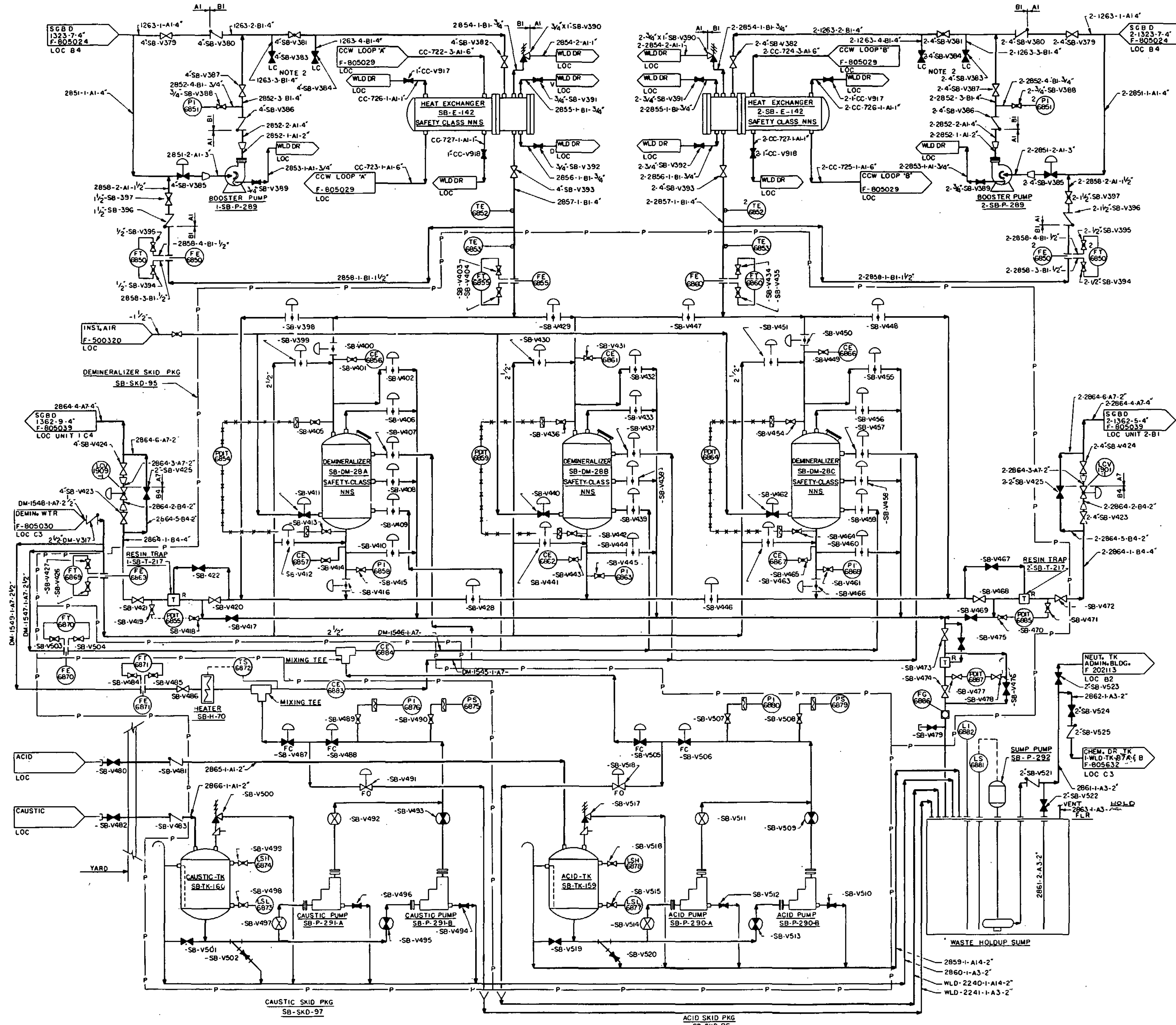
FOR GENERAL NOTES SEE DWG 9763-F-805039

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

STEAM GENERATOR BLOWDOWN
EVAPORATOR SYSTEM
P & I DIAGRAM

9763-F-805035

FIGURE 3.5-8, SH. 3



NOTES

1- ALL EQUIPMENT, VALVE, LINE AND INSTRUMENT NUMBERS ARE FOR UNIT 1 UNLESS OTHERWISE NOTED.

2- CONNECTIONS FOR FUTURE INSTALLATION TO EM FILTER IF REQUIRED.

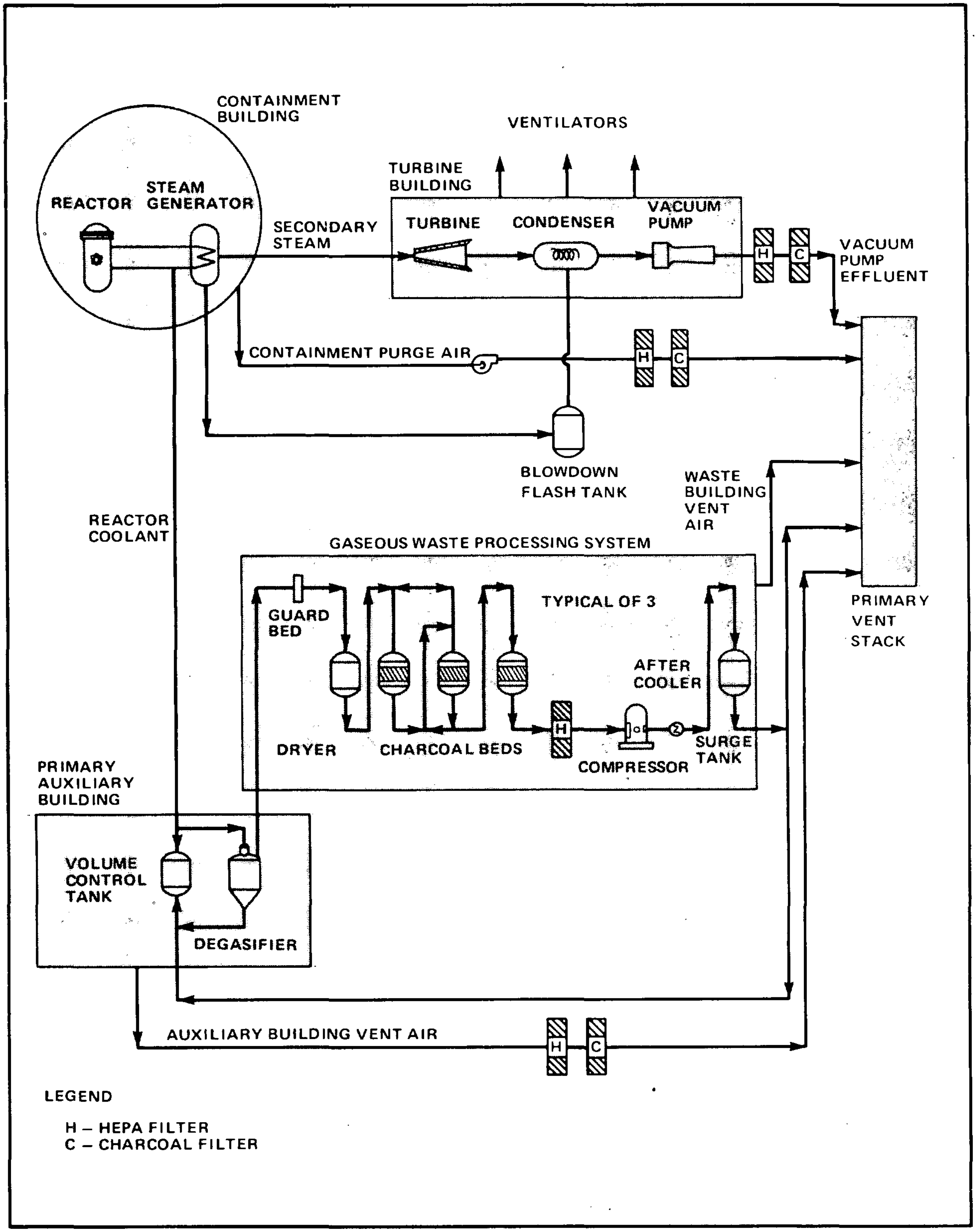
SD No. 21

THE SYSTEM PREFIX FOR THIS DIAGRAM IS 'SB' UNLESS OTHERWISE NOTED

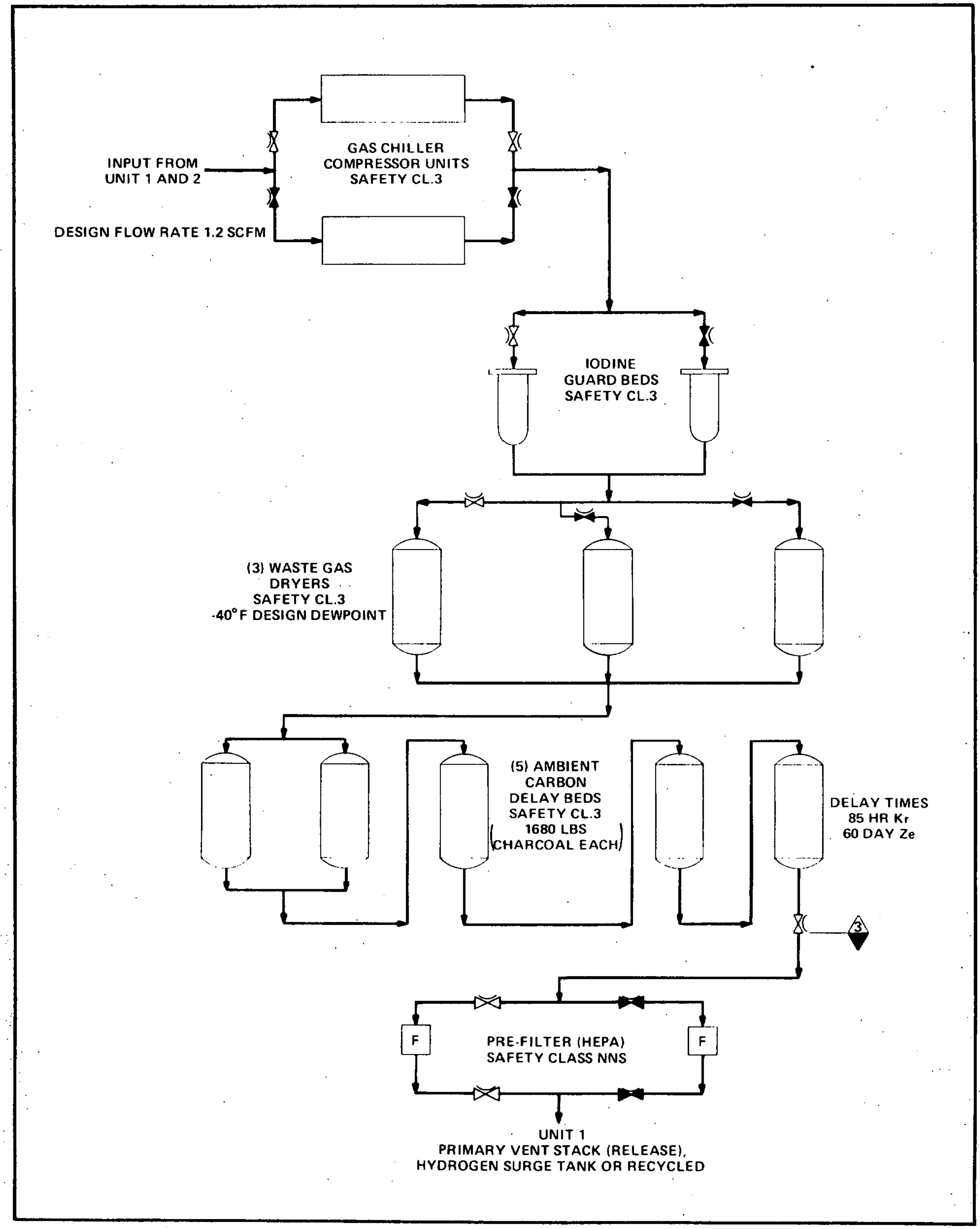
FOR REFERENCE DWG SEE DWG 9763-F-805024

FOR GENERAL NOTES SEE DWG 9763-F-805039

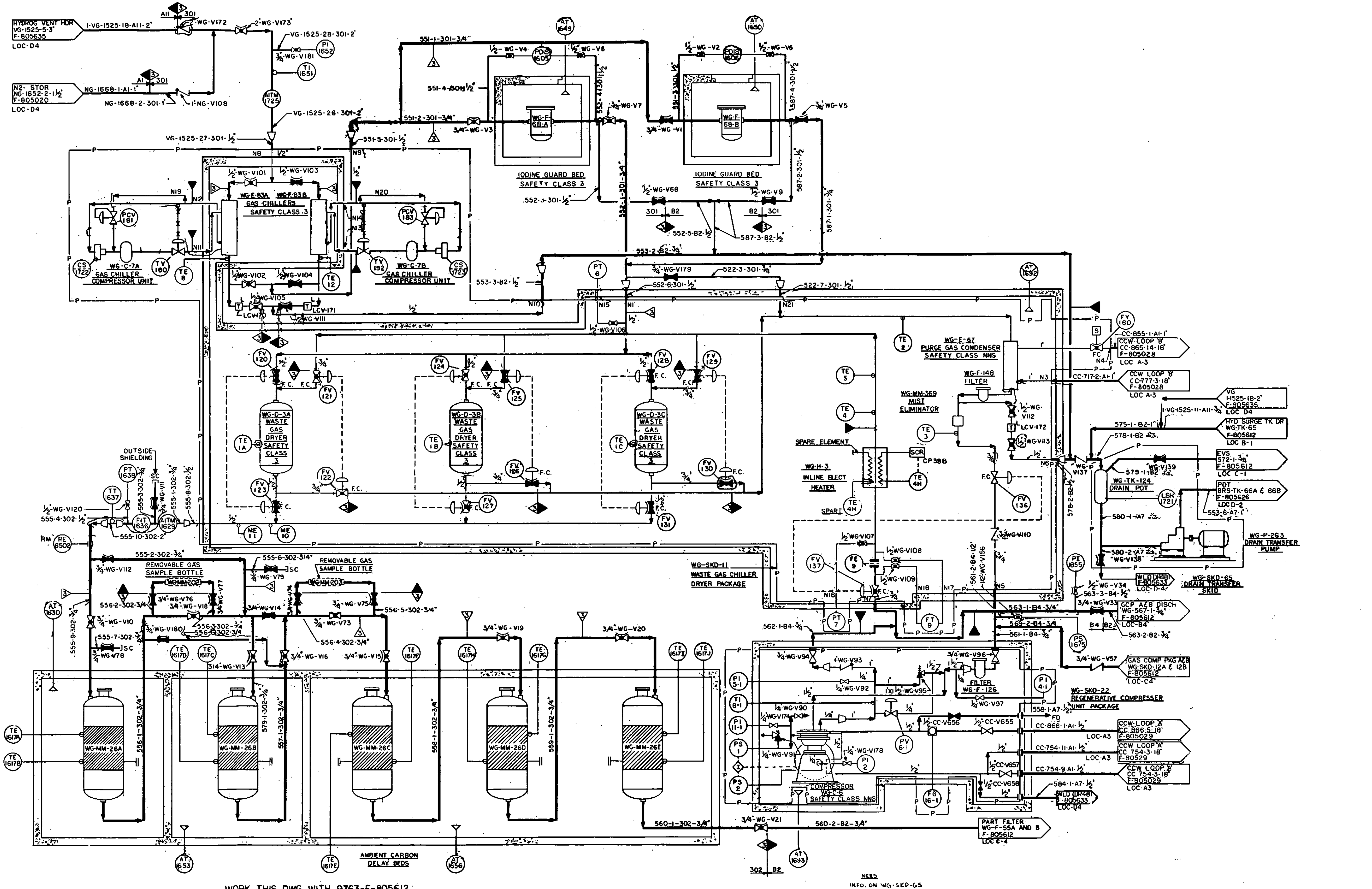
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	STEAM GENERATOR BLOWDOWN RECOVERY SYSTEM P & I DIAGRAM	
	9763-F-805637	FIGURE 3.5-8, SH. 4



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	SOURCES OF GASEOUS WASTE
	FIGURE 3.5-9



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	GASEOUS WASTE SYSTEM SCHEMATIC FIGURE 3.5-10



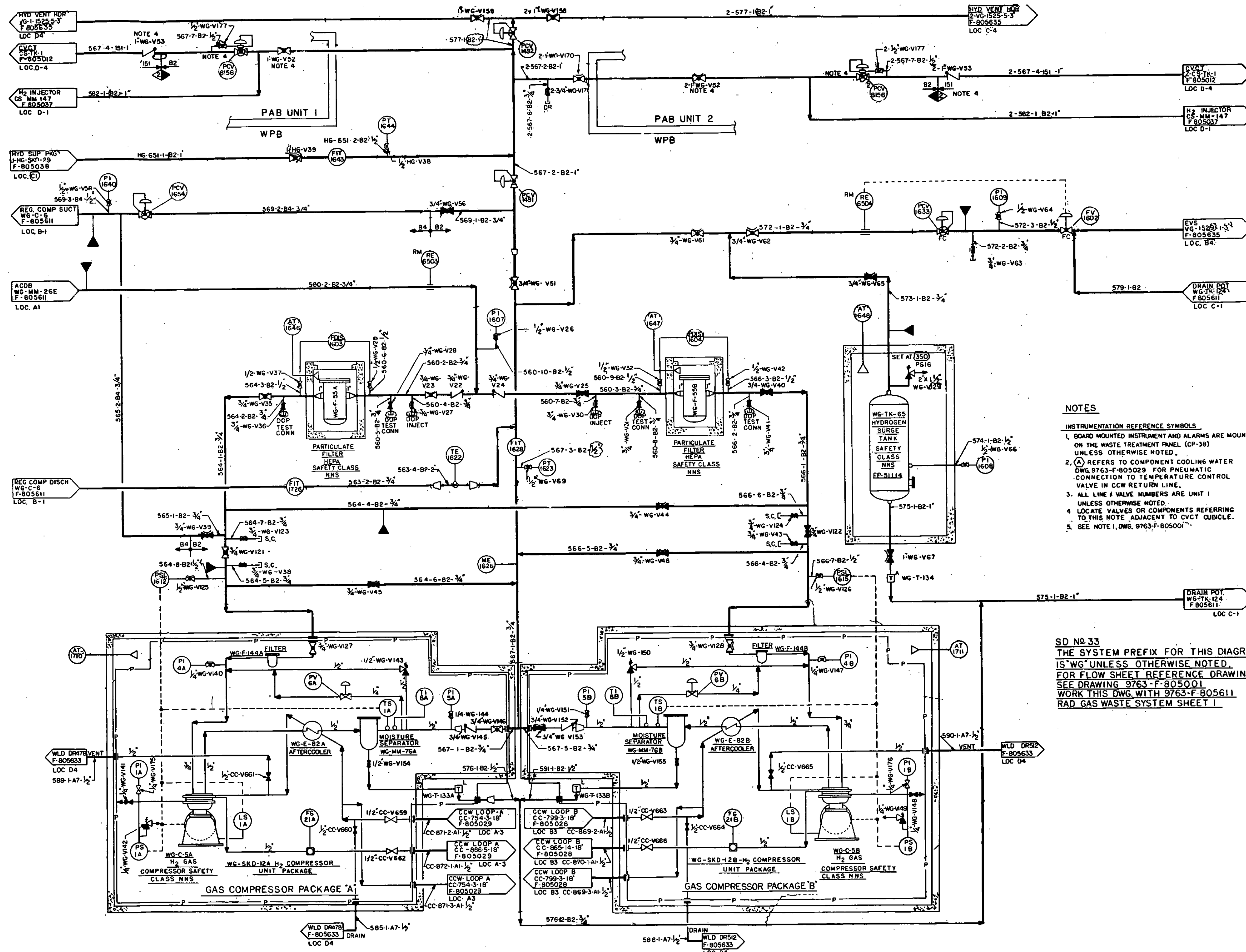
WORK THIS DWG WITH 9763-F-805612, RAD GAS WASTE SYSTEM SHEET 2

THE SYSTEM PREFIX FOR THIS DIAGRAM IS "WG" UNLESS OTHERWISE NOTED

FOR FLOW SHEET REFERENCE DRAWING, SEE DRAWING 9763-F-805001

SD. Nº 33

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	RADIOACTIVE GAS-WASTE SYSTEM P & I DIAGRAM
9763-F-805611	FIGURE 3.5-11, SH. 1



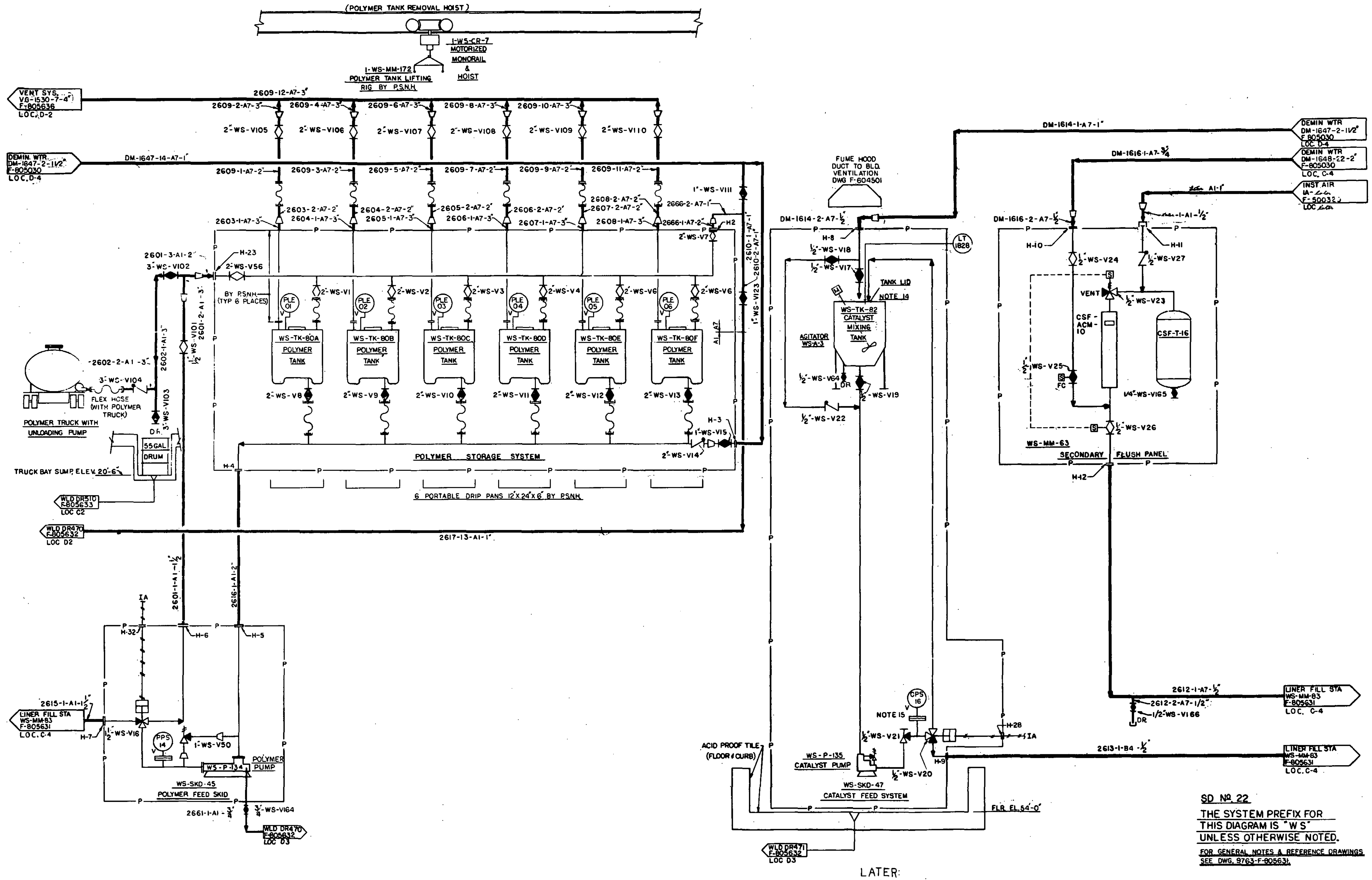
NOTES

INSTRUMENTATION REFERENCE SYMBOLS

1. BOARD MOUNTED INSTRUMENT AND ALARMS ARE MOUNTED ON THE WASTE TREATMENT PANEL (CP-38) UNLESS OTHERWISE NOTED.
2. (A) REFERS TO COMPONENT COOLING WATER DWG. 9763-F-805029 FOR PNEUMATIC CONNECTION TO TEMPERATURE CONTROL VALVE IN CCW RETURN LINE.
3. ALL LINE & VALVE NUMBERS ARE UNIT 1 UNLESS OTHERWISE NOTED.
4. LOCATE VALVES OR COMPONENTS REFERRING TO THIS NOTE ADJACENT TO CVCT CUBICLE.
5. SEE NOTE 1, DWG. 9763-F-805001

SD No. 33
THE SYSTEM PREFIX FOR THIS DIAGRAM IS "WG" UNLESS OTHERWISE NOTED.
FOR FLOW SHEET REFERENCE DRAWING SEE DRAWING 9763-F-805001
WORK THIS DWG. WITH 9763-F-805611
RAD GAS WASTE SYSTEM SHEET 1

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	RADIOACTIVE GAS WASTE SYSTEM P & I DIAGRAM
9763-F-805612	FIGURE 3.5-11, SH. 2

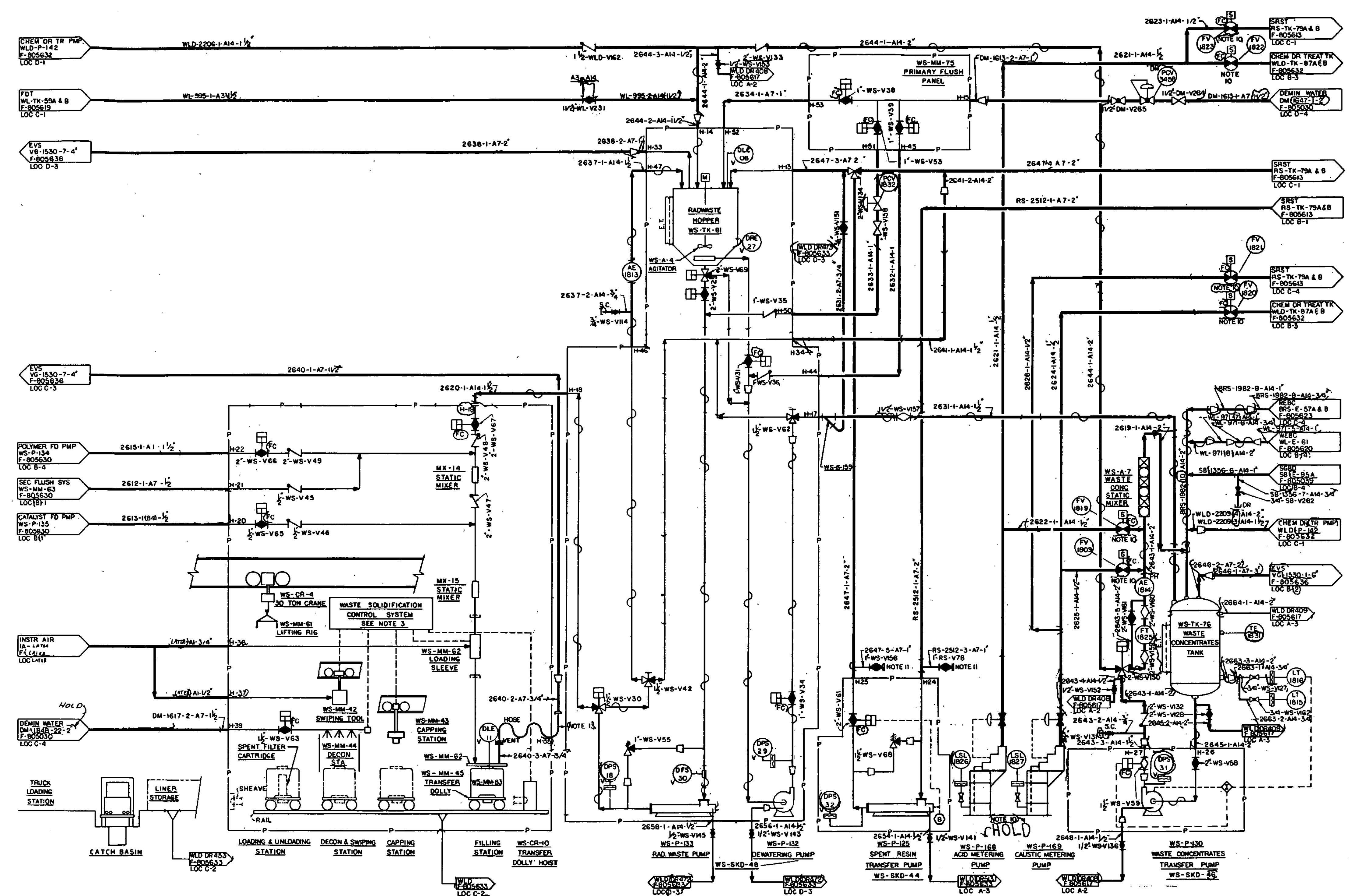


PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

WASTE SOLIDIFICATION SYSTEM
P & I DIAGRAM

9763-F-805630

FIGURE 3.5-12, SH. 1



INSTRUMENTATION REFERENCE SYMBOLS

(A) RECIRCULATION LOGIC 9763-M-LATER

(B) HNDC LOGIC FP-50636 THRU 50640

NOTES

1- DELETED

2- DELETED

3- FOR DETAILS OF OPERATION REFER TO HNDC LOGIC DIAGRAMS FP-50636 THRU 50640

4- DELETED

5- ALL EQUIPMENT AND PIPING IN PACKAGES (P——P) ARE SUPPLIED BY HITTMAN, UNLESS OTHERWISE NOTED.

6- ALL EQUIPMENT & INSTRUMENT TAG NUMBERS SHOWN WITH "V" IN 3RD QUADRANT ARE VENDOR TAG NUMBERS.

7- ALL HEAT TRACING BY UE&C

8- HITTMAN P&I REF. DWGS.
#FP-50778
#FP-50779

9- HITTMAN I&C REF. DWGS.
#FP-50796
#FP-50797

10- ON HOLD, CHEM. ADDITION PKG TO BE SPECIFIED BY I&C

11- LOCATE AIR SUPPLY LINES ON TOP OF PIPE & AS CLOSE TO PUMP AS POSSIBLE.

12- ALL AIR OPERATORS ARE TO BE ASSEMBLED TO VALVES SUCH AS TO RETURN TO "SAFE" THAT IS, "CLOSED" OR RECIRCULATE POSITION IN CASE OF AIR OR POWER FAILURE (FP. 50798.09)

13- 3/4" DIA. 150# AIR HOSE

14- DRY CATALYST IS ADDED TO CATALYST MIXING TANK BY HAND IN WEIGHED QUANTITIES.

15- SEAL SUPPLIED WITH PRESSURE SWITCH.

16- ALL PIPING & COMPONENTS ARE SAFETY CLASS NNS, NON-SEISMIC CATEGORY I UNLESS OTHERWISE NOTED.

HOLD:
1- ZONE A-2 & NOTE 10 (6 PLACES) IN ZONES B1, C1 & D1
2- ZONE B4

GET:
1- ZONE B4, INSTR. AIR

SD. № 22

THE SYSTEM PREFIX FOR THIS DIAGRAM IS "WS" UNLESS OTHERWISE NOTED

FOR FLOW SHEET REFERENCE DRAWINGS, SYMBOLS & ABBREVIATIONS) SEE DWG. 9763-F-805001.

WORK THIS DWG WITH 9763-F-805630

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	WASTE SOLIDIFICATION SYSTEM P & I DIAGRAM
	9763-F-805631 / FIGURE 3.5-12, SH. 2

3.6 CHEMICAL AND BIOCIDE SYSTEMS

3.6 CHEMICAL AND BIOCIDE SYSTEMS

3.6.1 Circulating and Service Water Systems

The information in this subsection is changed from that presented in the Seabrook Station ER-CPS as noted below.

The preferred biofouling control method for the Seabrook Station circulating and service water systems is continuous low-level chlorination. Seabrook Station is designed with the ability to control biofouling by either thermal backflushing or chlorination.

Sodium hypochlorite solution, the biocide to be utilized in chlorination, will be produced on-site by four hypochlorite generators using 1,200 gpm of seawater taken from the circulating water system. ~~These generators are capable of producing a total of about 848 pounds of equivalent chlorine per hour in a hypochlorite solution. This will be injected at a dosage of about 2 mg/1 of equivalent chlorine into the circulating water system.~~ A block diagram showing water usage, chlorination injection points and residence times is provided in Figure 3.6-1.

The main injection point of the hypochlorite solution will be at the throats of the three offshore intakes approximately three miles from the site. In addition, other injection points are available in the intake transition structure, the circulating water pump house, the service water pump house and the discharge transition structure should it be necessary to inject booster doses of hypochlorite solution to maintain the chlorine residual high enough to prevent biofouling of circulating and service water systems.

There is the possibility that the injection of 2.0 mg/1 of equivalent chlorine in a sodium hypochlorite solution continuously at the intake structures may not be sufficient to prevent fouling in some areas of the cooling and service water systems. The decay of chlorine in ambient seawater could reduce residual levels below those required for effective biofouling control. As a result, the addition of booster doses at the circulating and service water pumps may be required to maintain these portions of the system free of fouling organisms. While the frequency and duration of booster dosage will be dependent on operational experience, it is expected that these will occur primarily during the warm water months when settling of fouling organisms is highest. A chlorine minimization program is expected to be conducted at Seabrook Station. Here the level of oxidant will be monitored to provide effective control of fouling organisms within the cooling water systems with minimal release of oxidant to the receiving waters. If it is determined that chlorination is not completely effective in the control of fouling in the intake tunnel, backflushing will be utilized occasionally to provide additional fouling control.

Chlorine will be injected at a rate such that a concentration of 0.2 mg/1 total residual oxidant and measured as equivalent Cl_2 is not exceeded in the discharge transition structure. During the 43-minute transit time (one unit operation transit time approximately twice as long) from the discharge transition structure to the discharge diffuser, the total residual oxidant 2 will continue to decrease through increased decay at elevated water temperatures. The total residual oxidant concentration will then be diluted by the diffuser flow, approximately 10 to 1, and further reduced through additional chemical reactions with ambient water. 2

Antifouling paint has been applied to the intake structures and accompanying vertical riser shafts to reduce biofouling prior to plant operation. These structures will not be subject to fouling until they are opened near the designated station start-up.

The extreme dilution and the slow leaching rate of the copper ions from the antifouling paint will produce very low concentrations.

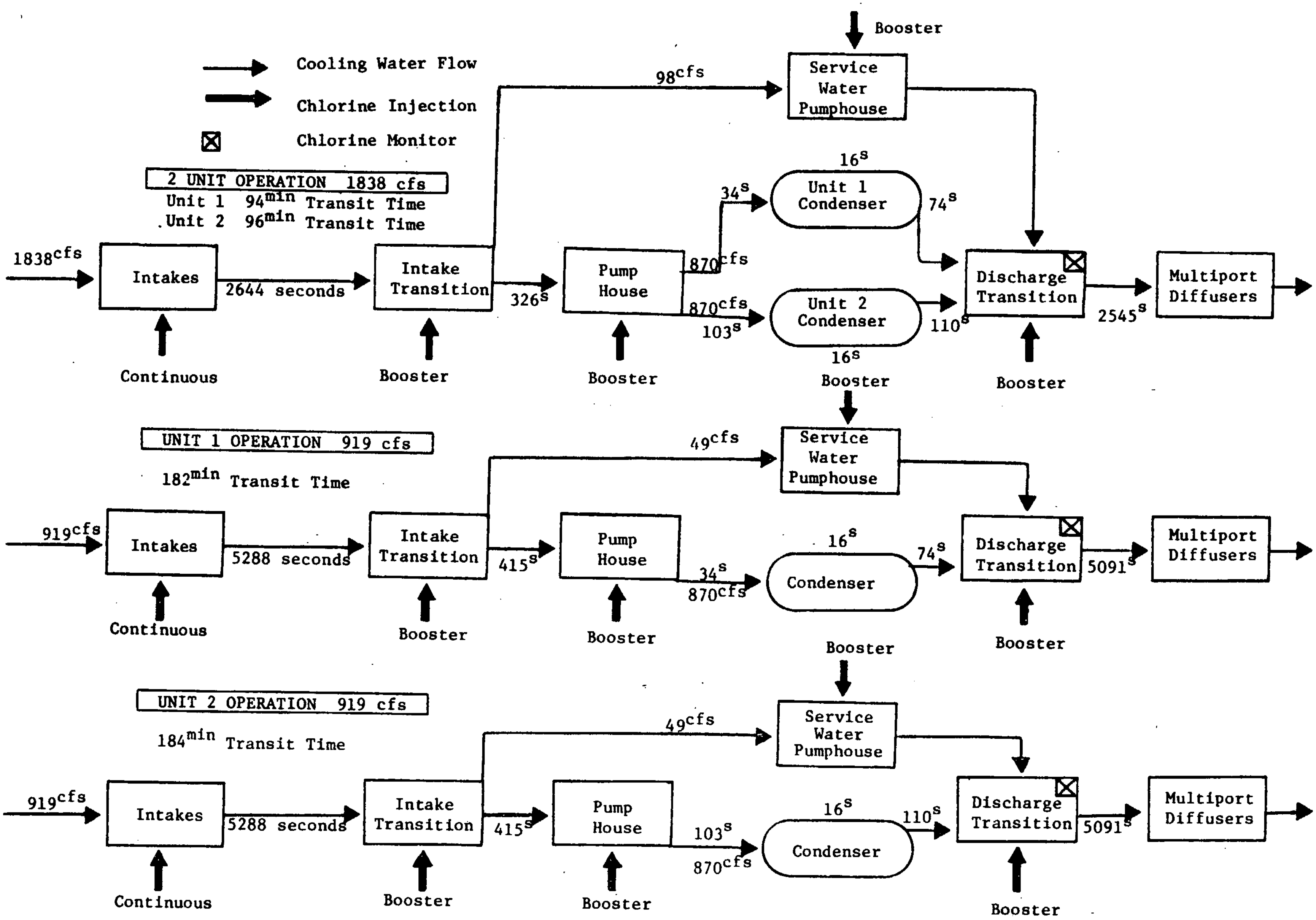
Biofouling control for the exterior of the offshore intake structure has been provided by the use of copper-nickel sheathing. As with the copper based paints, the leaching rate of copper ions from the Cu-Ni sheathing is not expected to produce any detrimental environmental effects. The discharge nozzles will also be maintained free of marine fouling; the control method, however, has not yet been established.

Information on the chemicals discharged during the preoperational and operational stages of the Seabrook Station and their effects on the environment can be found in Sections 3.6 and 5.5.2.3 of the Final Environmental Statement (FES) and Section 5.3 of the ER-OLS for the Seabrook Station.

3.6.2 Industrial Waste System

The information in this subsection remains unchanged from information presented in the Seabrook Station ER-CPS.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE



BLOCK DIAGRAM OF CHLORINATION OF COOLING WATER SYSTEM

FIGURE 3.6-1

Revision 2
June 1982

3.7 SANITARY AND OTHER WASTE SYSTEMS

3.7 SANITARY AND OTHER WASTE SYSTEMS

The information for this section is unchanged from information presented in Section 3.7 of the Seabrook Station 1 & 2 ER-CPS except as noted below.

3.7.1 Sanitary Waste System

As stated in Section 3.7 of the ER-CPS, during station operation the wastes from the sanitary waste treatment facility will be discharged through the circulating water system. This will eliminate their discharge to the Brown's River and the settling basin. Storm water runoff will still pass through the basin. Water Quality Requirements for settling basin effluents are described in Table 3.7-1 and for the Sanitary Waste Treatment Facility in Table 3.7-2.

3.7.2 Origin, Quantity and Nature of Gaseoous Waste System

Due to changes in design for the auxiliary boilers and emergency diesel generators, the gaseous emissions information contained in Section 3.7.2 of the ER-CPS is revised as follows.

The two auxiliary boilers for this facility are fired with No. 2, low sulphur (0.3 percent) fuel oil with a minimum heating value of 137,000 BTU per gallon. Each boiler has a maximum output capacity of 80,000 lbs. of steam per hour with a maximum fuel use rate of 12 gallons per minute. Emissions from both auxiliary boilers are released through a common 142-foot AGL stack. Boiler stack exit temperature is approximately 560°F, and with one operating at 100 percent capacity, stack exit velocity is approximately 840 feet per minute.

The four emergency diesel generators are designed for a continuous electrical output of 6083 kW per diesel generator. They burn the same fuel as the auxiliary boilers and each has a maximum expected fuel consumption of 7.7 gallons per minute. Each diesel generator has a separate stack 80 feet AGL. At full operating capacity, each diesel generator stack has an exit temperature of 890°F and an exit velocity of 8270 feet per minute.

The U.S. Environmental Protection Agency's emission factors for fuel oil combustion and diesel industrial engines (Reference 1) were used to derive the following hourly pollution emission rates, assuming continuous operation at full capacity:

Pollutant	Each Auxiliary Boiler	Each Diesel Generator
Particulates	1.44 lbs/hr	15.5 lbs/hr
Sulfur Dioxide	30.67 lbs/hr	14.4 lbs/hr
Carbon Monoxide	3.60 lbs/hr	47.1 lbs/hr
Hydrocarbons (total, as CH_4)	0.72 lbs/hr	17.3 lbs/hr
Nitrogen Oxides (total, as NO_2)	15.84 lbs/hr	216.7 lbs/hr

1

The auxiliary boilers and diesel generators are designed to meet applicable standards for release of gaseous effluents to the environment.

3.7.3 References

1. U.S. Environmental Protection Agency, Compilation of Air Pollutant Emission Factors, Third Edition (including Supplements 1-7), AP-42, August 1977. 1

TABLE 3.7-1
WATER QUALITY REQUIREMENTS ON SETTLING BASIN EFFLUENTS

Physico-Chemical Parameter	Limitation	Source
Turbidity	10 JTU	EPA-NPDES Permit No. NH0020330
pH	6.5-8	EPA-NPDES Permit No. NH0020330
Dissolved Oxygen	Not less than 75% saturated	EPA-NPDES Permit No. NH0020338
Total Coliform Bacteria	Not more than 70 MPN	EPA-NPDES Permit No. NH0020338
Oil Slick, Odors & Floating Solids	None	EPA-NPDES Permit No. NH0020338
Toxic Substances	None in toxic concentrations	EPA-NPDES Permit No. NH0020338
Flow at Weir	45.022 MGD	EPA-NPDES Permit No. NH0020338
Total Suspended Solids	30.0 mg/l ave. 100.0 mg/l max.	EPA-NPDES Permit No. NH0020338
Oil & Grease	15.0 mg/l ave. 20.0 mg/l max.	EPA-NPDES Permit No. NH0020338
Total Residual Chlorine	0.2 mg/l ave. 0.5 mg/l max.	EPA-NPDES Permit No. NH0020338

TABLE 3.7-2

EFFLUENT REQUIREMENTS OF SANITARY WASTE TREATMENT FACILITY

Physico-Chemical Parameters	Limitation	Source
BOD_5	10.0 mg/l ave. 10.0 mg/l max.	EPA-NPDES Permit No. NH0020338
Total Suspended Solids	5.0 mg/l ave. & max.	EPA-NPDES Permit No. NH0020338
Total Residual Chlorine	5.0 mg/l max.	EPA-NPDES Permit No. NH0020338
Oil & Grease	None visible	EPA-NPDES Permit No. NH0020338
Total Coliform Bacteria	70/100 ml. max.	EPA-NPDES Permit No. NH0020338

3.8 REPORTING OF RADIOACTIVE MATERIAL MOVEMENT

3.8 REPORTING OF RADIOACTIVE MATERIAL MOVEMENT

The transportation of new fuel to the reactor and irradiated fuel from the spent fuel pool to an off-site fuel reprocessing plant and the transportation of solid radioactive wastes from the radwaste storage area to waste disposal grounds are within the scope of paragraph(g) of Title 10 of the Code of Federal Regulations Section 51.20 (10 CFR 51.20). The contribution of the environmental effects of such transportation to the environmental impact of licensing the nuclear power reactor is given in Summary Table S-4 of 10 CFR 51.

3.9 TRANSMISSION FACILITIES

3.9 TRANSMISSION FACILITIES

The information in this section remains unchanged from that presented in Section 3.9 of the Seabrook Station ER-CPS except as noted below.

Each transmission line has a continuous rating of 1500 MVA.

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CHAPTER 4
ENVIRONMENTAL EFFECTS OF SITE PREPARATION, STATION CONSTRUCTION AND TRANSMISSION FACILITIES

CHAPTER 4

ENVIRONMENTAL EFFECTS OF SITE PREPARATION, STATION CONSTRUCTION AND TRANSMISSION FACILITIES

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CHAPTER 4

ENVIRONMENTAL EFFECTS OF SITE PREPARATION, STATION CONSTRUCTION AND TRANSMISSION FACILITIES

FIGURES

4.1 SITE PREPARATION
AND
PLANT CONSTRUCTION

CHAPTER 4

ENVIRONMENTAL EFFECTS OF SITE PREPARATION STATION CONSTRUCTION AND TRANSMISSION FACILITIES

This chapter discusses the expected effects of site preparation and station and transmission facilities construction. The effects are presented in terms of their physical impact on the resources and populations described in Chapter 2.

4.1 SITE PREPARATION AND PLANT CONSTRUCTION

In general, the environmental effects of construction which were predicted in the ER-CPS have been consistent with field conditions. Methods utilized to construct the facility were those detailed in the ER-CPS except that tunnel boring machines were used in the production drilling of the cooling water tunnels. There have been some changes in the magnitude of predicted impacts. These are described in the following paragraphs in the same order that they appear in the ER-CPS.

It has been possible to maintain a tree belt at the edge of the marsh at nearly all points with two exceptions. On the south side of unit one, a sea wall was required for protection against storm runup. For a distance of 300 feet, there is not a tree screen where the wall was constructed. On the north of unit one, the perimeter was not totally preserved due to station space requirements and natural attrition of the remaining trees. ~~Security regulations may force further removal of the trees in the periphery.~~

In addition to the new access road described in the ER-CPS on the north of Rocks Road, it became desirable to provide a second access road on the south to connect more directly with Routes 107 and 95. This reduced local traffic impacts during construction. Approximately 10 acres of mixed woodland were cleared to install the additional paved road.

Connections to the Seabrook municipal water system have been made in two locations to supply the station with fresh water. The municipal requirements have increased faster than the development of new sources in Seabrook. Consequently, industries including Seabrook Station, were asked to develop their own sources and recycling or conservation measures. During construction, deep rock wells were driven on the station property. These, with the allocation from the town, have furnished the fresh water requirements for construction. Water for station operation will be taken from the municipal system as it is available and from the station wells when demand exceeds the municipal water availability.

Rock excavation has exceeded the predicted quantities. At the same time, anticipated uses and buyers for the excavated materials have not yet materialized. Consequently, rock has been stockpiled on site as described in the ER-CPS, but in larger quantities. A rock storage area of 40 acres has been used. The slopes of the pile have been designed to avoid erosion and a tree screen surrounds the area. The top of the pile was graded for equipment laydown. Efforts continue to find purchasers of the stockpiled rock.

Additional clearing of upland woods has been required for equipment laydown and construction facilities beyond the 55 acres predicted in the ER-CPS. While clearing the additional land, the same environmental precautions were observed to eliminate impacts on air and water quality. The additional space cleared amounts to about 130 acres of which approximately 100 acres was for laydown of construction materials. Some of this additional laydown space resulted from underestimating requirements for a project of this scope. However, a major fraction of the addition can be directly attributed to the construction schedule which was delayed and perturbed by the state and federal licensing and rate-making process.

It was desirable for dust control reasons, to pave construction and plant roads early, so this was done in advance of the ER-CPS timetable.

An education center was opened in 1978 which has been used by dozens of school and community groups. Access to the rocks is planned by a road which will skirt the station security barrier. Residents of Seabrook will be allowed access by security personnel commensurate with plant conditions and other operating license requirements. Expanded construction faciltiies for laydown, storage and operations staff have pre-empted space contemplated for municipal recreations facilities. At this time, there does not appear to be a need for these facilities and plans have been dropped for any public recreation facilities.

4.2 TRANSMISSION FACILITIES CONSTRUCTION

4.2 TRANSMISSION FACILITIES CONSTRUCTION

The information in this subsection remains unchanged from that presented in the Seabrook Station ER-CPS except as noted below.

Transmission right-of-way construction procedures and effects are generally compatible with those described in ER-CPS Section 4.2. One departure, however, was the extra effort applied to areas that were graded as a result of construction. Where areas have been graded, erosion control measures have been employed for drainage and proper stabilization of the soil. This consists of installing water bars to prevent soil erosion from occurring. Graded areas that will not reseed naturally will be reseeded, fertilized, and mulched.

Reel and pulling "setups" are graded where necessary and top soil has been stock piled separately from the subsoil so that it can be spread back over the area and allowed to reseed or will be reseeded and mulched. Upon completion of work around structures and setup locations, the area has been cleaned up and allowed to revert to natural conditions or if necessary will be reseeded.

4.2.1 Transmission Line Routings

The transmission line routings in New Hampshire have been determined after a series of meetings with town and city officials including conservation commissions and planning boards in those towns and cities through which the lines cross. The various meetings held are enumerated in Section 12.4 of the ER-CPS. Similar meetings were held in Massachusetts. Also, the Massachusetts Energy Facilities Siting Council approved construction of the Seabrook to Tewksbury Line, contingent upon Seabrook Station construction.

The Seabrook-Newington Line previously described as being 18.0 miles long is in fact 17.0 miles in total length. The portion of this line that parallels U.S. Route I-95 has a buffer strip of varying width up to a maximum of 100 feet to reduce its visual impact on travelers. Construction of the plant get-away line along an existing rail bed, was accomplished without intrusion into the salt marsh that lies adjacent to it.

The Seabrook-Scobie Line earlier identified as being 28.75 miles is now more accurately measured at 29.75 miles long. The increase in length has resulted because of rerouting around a natural area - Cedar Swamp in Kingston, New Hampshire. The line now follows a dog-leg about one mile long around the northern boundary of this swamp. The structures to be used are the H-frame type which are the same as that used on the rest of the line.

Due to the conflict between decisions of two regulatory bodies, a delay in obtaining the right-of-way and, therefore, the design of this portion of the line is reflected in the description of what is proposed for this dog-leg.

The crossing of the Pow Wow River on the northerly segment of the dog-leg is a span of approximately 550 feet with a minimum clearance over the water of 45 feet. The westerly segment of the dog-leg may require one structure to be installed in a wet area which would only be done after the design determines this would minimize the visual effect of this short crossing.

The H-frame structures used on the dog-leg result in minimum visual impact on the swamp because the set back from the edge results in natural screening of the line except for the small area on the westerly segment and the river crossing.

The dog-leg route will have little effect on the stands of eastern white cedar in the area.

Disposition of cleared vegetation from line construction was accomplished by various means. Marketable logs were left, neatly piled at the right-of-way edge for the land owner. Slash was handled as described earlier in the ER-CPS except that the compacted piles were spaced at least 20 feet apart (rather than 10 feet).

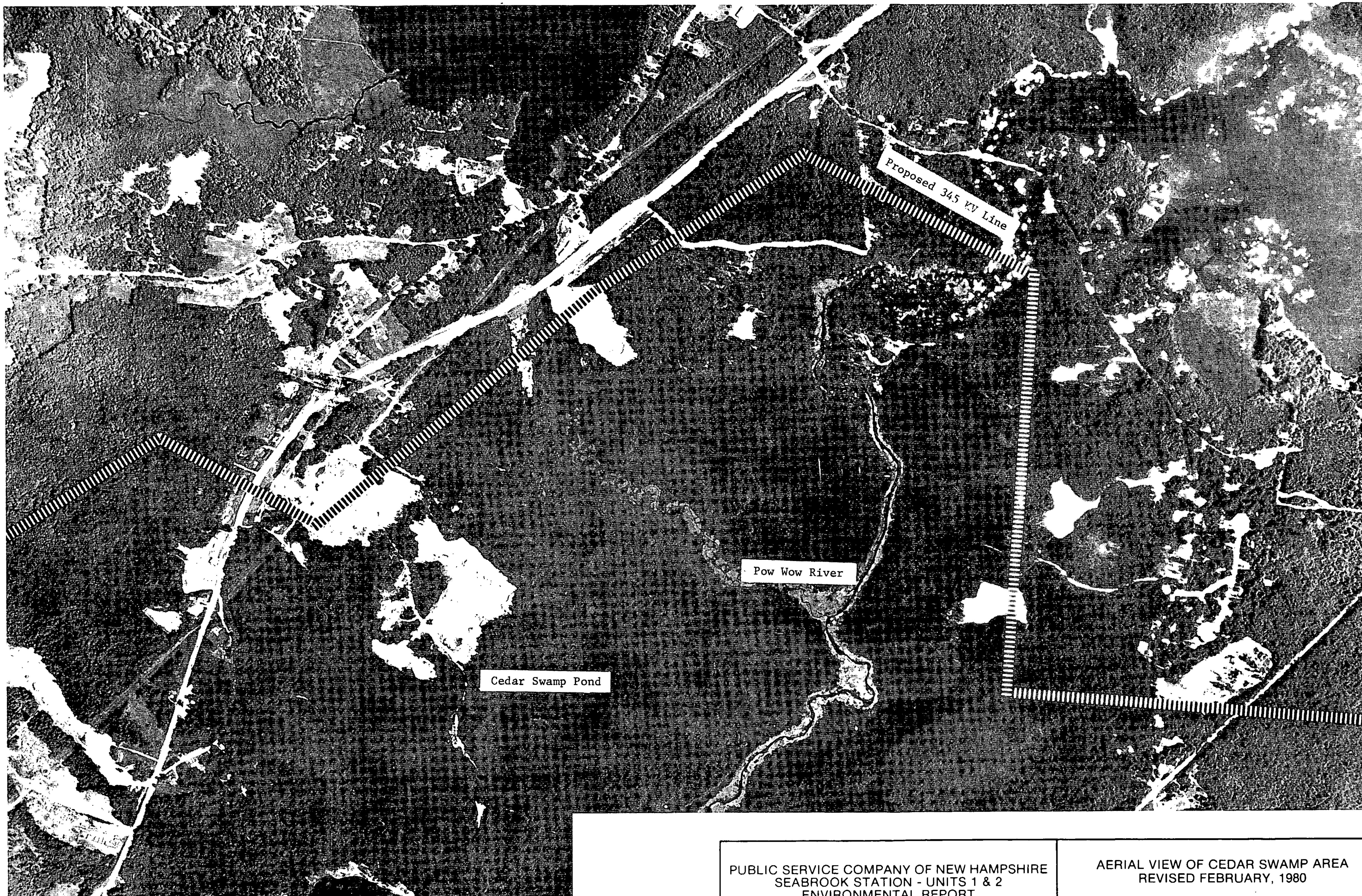
4.2.2 Construction Access

Construction access was accomplished as described in ER-CPS Section 4.2.2 except as noted below. In Massachusetts, it was previously stated that three of the total 32 miles did not have an access road. In fact, the three miles was along a cleared unoccupied transmission right-of-way, therefore, access was available after some improvement of the overgrown roadway created during the initial clearing activity.

In addition to the procedures previously outlined for control of corridor erosion (grading, seeding, mulching, plus periodic aerial line inspection), it should be noted that properly spaced water bars have also been constructed on steep slopes.

4.2.3 Protection of Wildlife

The information contained in ER-CPS is unchanged from that presented in the Seabrook Station ER-CPS.



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	AERIAL VIEW OF CEDAR SWAMP AREA REVISED FEBRUARY, 1980
	FIGURE 4.2-1

4.3 RESOURCES COMMITTED

4.3 RESOURCES COMMITTED

The information in this section remains unchanged from that presented in Section 4.3 of the Seabrook Station ER-CPS except as noted below.

The routing of the Seabrook-Scobie 345 kV transmission line will be routed around Cedar Swamp and not span it as described in the ER-CPS.

The demands for water in the Town of Seabrook have grown faster than predicted at the time the ER-CPS was written. Since 1973, growth has been greater than expected and new near-surface groundwater sources have not shown the productivity of the wells in existence in 1973. The net result has been that the municipal water department requested that Seabrook Station limit its demands on the municipal system during periods of shortage or high demand. To compensate for this reduction, Seabrook Station has drilled six bedrock wells which have been tested and have supplied the difference between the Station requirements and the municipal supply.

The water requirements for the operating units will be about 200 gpm which can be supplied from the Station's deep rock wells and the municipal system when it has sufficient capacity above the town's demand.

4.4 RADIOACTIVITY

4.4 RADIOACTIVITY

The estimated average annual dose to construction workers at various locations in SB Unit 2 construction area from SB Unit 1 operation has been calculated to be 0.064 rem. The model, assumptions and input data used to arrive at this estimate are provided in SB FSAR Section 12.4.3. Annual man-rem doses to Unit 2 construction workers from Unit 1 operation are difficult to project at this time, due to the uncertainties involved with the SB Unit 2 construction time schedule. It is estimated however, that a total of 4,650,000 man hours of labor will be required for Unit 2 construction after Unit 1 is in operation. Based on this estimate and the average annual dose (above), the projected average total dose to Unit 2 construction workers is calculated to be 150 man-rem.

4.5 CONSTRUCTION IMPACT CONTROL PROGRAM

4.5 CONSTRUCTION IMPACT CONTROL PROGRAM

4.5.1 Background

The information for this section can be found in part, in Section 4.1 of the Seabrook Station ER-OLS and Section 4.5 of the Seabrook Station Final Environmental Statement. Additional information is contained in the following paragraphs.

An Environmental Protection Program was established by Public Service of New Hampshire which provided for environmental protection during construction of Seabrook Station. Quarterly reviews were performed by members of an Environmental Review Board staffed by the site managers and environmental personnel to evaluate program effectiveness.

4.5.2 Responsibilities

The Environmental Protection Program was the responsibility of the Manager of Nuclear Projects, Public Service Company of New Hampshire, and it was he who was authorized to implement the appropriate procedures. This was accomplished through advice received from the Environmental Review Board and by observations by other construction personnel. The Site Manager and UE&C Resident Construction Manager had responsibility for the day to day adherence to the environmental protection program procedures.

4.5.3 Procedures

Control procedures developed through the Environmental Protection Program to monitor construction activities with respect to environmental factors of the site included monitoring of effluents from the settling basins (which includes rainwater runoff, tunnel dewatering and treated sanitary wastes), control of land clearing and general construction surveillance. An oil spill prevention control and countermeasure plan (SPCC) and accompanying procedures were also developed for inspections to ensure that all sources of oil and lubricants are monitored periodically. The SPCC plan will remain in effect through the operating phase of the plant.

The environmental monitoring procedures established weekly site inspections to prevent degradation of the site's environment. Such areas as erosion, turbid or greasy water runoff, tree cutting activities, dust problems and noise were monitored within a framework which enabled proper protection of the site and prompt action to any problem.

Traffic

Traffic during the construction phase of the plant entered by one of two access roads that were constructed to divert traffic from the Rocks Road. This posed no problems to the residents along the Rocks Road. On-site traffic utilized defined roads and laydown areas which eliminated the need to enter the existing natural habitat on site.

Groundwater

Groundwater developed and supplied by wells was utilized for drinking, sanitary water systems, and concrete production. It now serves as a source of makeup water for the mechanical draft cooling towers. No chemicals or pollutants are discharged to the land for possible intrusion into the groundwater aquifer. No long-term detrimental effects to groundwater are expected as a result of dewatering or other construction activities due to high soil permeability.

Surface Water

Discharges to surface waters during construction were through the settling basin. Effluent characteristics described in Section 3.7 of the ER-OLS prevented any adverse effects to the Brown's River, the point of discharge. Effluent parameters from the system were on specific monitoring schedules as they will continue to be through operation of the plant as set forth by the NPDES permit and applicable site specific procedures.

Land Use Protection/Restoration

Land use was controlled through procedures developed to monitor the clearing of trees for construction activities. Use of areas designated as environmentally significant in both the ER-CPS Section 4.1 and FES Sections 4.4 and 4.5 for the Seabrook Station were minimized. Restoration activities were implemented after construction. During restoration activities, advice was solicited from the New Hampshire Fish and Game Department.

Water Use Protection/Restoration

As mentioned in Section 3.7 of the ER-OLS, liquid effluents leaving the site during construction were through the settling basin to Brown's River. Samples measuring numerous waste water characteristics were taken in accordance with NPDES Permit No. NH0020338 following predesignated procedures and on a regular basis before discharge.

Terrestrial Ecosystem Impacts

Terrestrial impacts are outlined in Section 4.1 of the ER-OLS and Sections 4.1, 4.3 and 4.5 of the FES for the Seabrook Station.

Aquatic Ecosystem Impacts

No long-term detrimental effects are expected as a result of construction activities. Applicable procedures developed to monitor effluents entering Brown's River, as well as specific parameters in the river, substantially reduced possible adverse effects. A haybale perimeter was also set up to filter site rainwater runoff into adjacent waters during early site development. After the site drainage system was put into operation, the perimeter haybales were no longer needed.

Socioeconomic Impacts

Socioeconomic impacts as a result of station construction are presented in Section 4.1 of the ER-CPS and Section 4.4 of the FES.

Noise

A study, conducted by New England Power Service Company in February, 1977 to analyze noise produced during construction, determined that the noises during major construction periods would not be above normal construction activity levels.

Erosion

Erosion was prevented through proper site construction activities. All areas prone to erosion problems were subject to periodic inspection through the Environmental Protection Program procedures resulting in prompt action to mitigate problem areas. In addition, site drainage was directed to collection points which feed into the settling basin. The haybale perimeter prevented material from moving into adjacent waters during early site development.

Dust

During certain periods of construction, dust became a problem. A water truck was available and used "as required" to spray dusty areas with a water/coherex dust suppressant mixture. This procedure is outlined in Section 4.1 of the ER-CPS. Problem areas were periodically inspected through the Environmental Protection Program procedures.

Effluents

Liquid effluent characteristics are described in Section 3.6, 3.7 and 5.4 of the Seabrook Station ER-OLS and were monitored through the Environmental Protection Program procedures in accordance with state and federal regulations. Gaseous effluents are described in Section 5.5 of the ER-OLS. Solid waste from the sewage treatment facility is not expected to occur due to the design of the waste treatment facility. The disposal of effluents is not expected to produce adverse environmental affects. Additional monitoring programs and procedures such as the SPCC plan and the Seabrook Station Hazardous Waste Compliance Manual, provide additional monitoring for oil, lubricants and other materials stored on site.

CHAPTER 5
ENVIRONMENTAL EFFECTS
OF
STATION OPERATION

CHAPTER 5

ENVIRONMENTAL EFFECTS OF STATION OPERATION

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CONTENTS (Continued)

CHAPTER 5

ENVIRONMENTAL EFFECTS OF STATION OPERATION

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CHAPTER 5

ENVIRONMENTAL EFFECTS OF STATION OPERATION

FIGURES

2

5.1 EFFECTS OF OPERATION OF HEAT DISSIPATION SYSTEMS

CHAPTER 5

ENVIRONMENTAL EFFECTS OF STATION OPERATION

This chapter describes the interaction of the station and its various systems (radiological and nonradiological) discussed in Chapter 3 and the environment discussed in Chapter 2.

5.1 EFFECTS OF OPERATION OF HEAT DISSIPATION SYSTEM

This section has changed with regard to information presented in the ER-CPS in that extensive hydrothermal model studies and field monitoring programs have been performed beyond those conducted during the baseline study. This information in some cases contains over six years of in situ data acquisition. The following subsections describe the interaction of Seabrook Station operation and the environment utilizing the analysis of data collected during these studies, which are described in greater detail in ER-OLS Sections 2.2, 2.3 and 2.4.

5.1.1 Effluent Limitations and Water Quality Standards

The discharge from Seabrook Station, as described in ER-CPS Section 5.1.2, has been designed to comply with the thermal standards of both federal (Environmental Protection Agency) and state (New Hampshire Water Supply and Pollution Control Commission) agencies in accordance with the Federal Water Pollution Control Act (FWPCA) and its Amendments. Accordingly, the following subsections summarize the thermal discharge criteria for each government agency.

5.1.1.1 Federal Thermal Criteria

Under Section 316 of the FWPCA, that part of the Act which relates to the cooling water from electric generating stations, the Administrator of EPA has established determinations [1, 2, 3]. The following specific determinations are relevant to the discharge of cooling water:

1. Except for discharge during backflushing for fouling control, the discharge shall not increase the temperature of the receiving water more than $5^{o}F$, except that in the near-field jet mixing region (defined to be the waters within 300 feet of the submerged diffuser in the direction of discharge), the $5^{o}F$ limit shall apply only at the surface.

2. Backflushing operations for fouling control shall be performed only during times when meteorological and hydrological conditions are such that the plume flows offshore and/or temperature increases are minimized at the Sunk Rocks.

5.1.1.2 New Hampshire Thermal Criteria

Pursuant to the New Hampshire Revised Statutes Annotated, Chapter 149: 8-III (supp.) and Section 401 of the FWPCA, the NHWSPCC has certified and granted a permit on January 23, 1974 to discharge controlled volumes of cooling water from the station. The thermal criteria of the permit, which are for Class B tidal waters, are as follows:

1. Discharge shall not be in amounts greater than 1900 cfs at mean sea level at the temperature of 45^{o} above ambient receiving water temperature.

2. Except in emergency situations, any shutdown or start-up of the station shall be in such a manner that the rate of temperature change in receiving waters is no more than 1^{o} per hour measured at a point or points to be established by the Commission in the mixing zone.

3. The maximum increase in temperature in the receiving water, outside a mixing zone to be delineated by the Commission, shall not exceed those temperatures required for a cold water fishery by the U.S. EPA or by the water quality standards adopted by the Commission pursuant to New Hampshire statutes.

5.1.2 Physical Effects

The Seabrook Station discharge system, which is described in ER-OLS Section 3.4, was designed to meet the regulatory thermal discharge criteria summarized in ER-OLS Section 5.1.1 above. Extensive hydrothermal model testing, performed by Alden Research Laboratories (ARL) of Worcester Polytechnic Institute, Worcester, Massachusetts, has led to a state-of-the-art design that meets these criteria.

The model tests [4,5,6,7,8] and the physical effects of the thermal discharge system under various ambient and operation conditions are contained in the Summary Document [9]. The results and discussion presented therein remain unchanged. 1

5.1.3 Biological Effects

Biological effects of plant construction and operation were discussed in Section 5.0 of the Summary Document [9]. The information remains unchanged.

5.1.4 Effects of Heat Dissipation Facilities

The information contained in this section is unchanged from that presented in the same section for the ER-CPS. In addition, the operation of the once-through system will not result in any significant fogging or icing conditions. Some "sea smoke" or "sea fog", however, could form in the immediate vicinity of the discharge, or intake during backflush operation, under certain meteorological conditions, but would rapidly dissipate as it left the area of the thermal plume. Therefore, no hazard to transportation (air or boat) is anticipated.

Similarly, some short-term localized icing and fogging effects could result from operation of the mechanical draft evaporation cooling tower used for the service water system during backflushing. These short-lived (of the order of hours) effects would occur only in the immediate vicinity of the cooling tower and thus no hazard to ground or air transportation is anticipated.

Lastly, no hazards will exist for ship/boat transportation by the operation of either the intake or discharge structures because they are outside major shipping lanes and at depths deep enough to avoid an obstruction to small boat traffic.

5.1.5 References

1. U.S. Environmental Protection Agency, "Decision of the Administration, Case No. 76-7, Public Service Company of New Hampshire et al.," June 10, 1977, Washington, D.C.

2. U.S. Environmental Protection Agency, "Modification of Determinations, Case No. 76-7, Public Service Company of New Hampshire et al.," November 7, 1977, Washington, D.C.

3. U.S. Environmental Protection Agency, "Decision on Remand, Case No. 76-7, Public Service Company of New Hampshire et al.," August 4, 1978, Washington, D.C.

4. Alden Research Laboratories, "Hydrothermal Studies of Diffuser Discharge in the Coastal Environmental: Seabrook Station," prepared for Public Service Company of New Hampshire and United Engineers & Constructors, Inc., Report No. 86-74/M252F, August 1974.

5. Alden Research Laboratories, "Dynamics of Offshore Buoyant Plumes Produced by a Submerged Diffuser, Farfield Analytical Model for the Seabrook Station," prepared for Public Service Company of New Hampshire and Yankee Atomic Electric Company, Report No. 30-75/M296AF, March 1975.

6. Alden Research Laboratories, "Experimental Study of Discharge Structures, Public Service Company of New Hampshire, Seabrook Station Units 1 & 2," prepared for Yankee Atomic Electric Company, Report No. 131-76/M296DF, November 1976.

7. Alden Research Laboratories, "Experimental Study of Intake Structures, Public Service Company of New Hampshire, Seabrook Station Units 1 & 2," prepared for Yankee Atomic Electric Company, Report No. 131-76/M296DF, November 1976.

8. Alden Research Laboratories, "Hydrothermal Studies of Bifurcated Diffuser Nozzles and Thermal Backwashing, Seabrook Station," prepared for Public Service Company of New Hampshire and Yankee Atomic Electric Company, Report No. 101-77/M296BF, July 1977.

9. Normandeau Associates, Inc., "Summary Document: Assessment of Anticipated Impacts of Construction and Operation of Seabrook Station on the Estuarine, Coastal and Offshore Waters Hampton-Seabrook, New Hampshire", December 1977.

5.2 RADIOLOGICAL IMPACT FROM ROUTINE OPERATIONS

5.2 RADIOLOGICAL IMPACT FROM ROUTINE OPERATIONS

The radioactive waste management systems, as discussed in Section 3.5, are designed such that the radiological impacts due to the normal operational releases from Seabrook 1 & 2 are within guidelines established in Appendix I to 10CFR50. This section evaluates the impacts of radioactive effluents on human beings and other biota inhabiting the general vicinity of the site. Possible exposure pathways to man are examined and evaluated according to the mathematical model described in Regulatory Guide 1.109. The exposure pathways to biota other than man are examined and evaluated according to the models described in Section 5.2.3 of this report.

5.2.1 Exposure Pathways

5.2.1.1 Exposure Pathways to Local Flora and Fauna

The information for this section is unchanged from the information presented in Section 5.2.1 of the Seabrook 1 & 2 ER-CPS except as noted in the following paragraph.

The various possible pathways for radiation exposure to local flora and local and migratory fauna are illustrated in Figure 5.2-1.

5.2.1.2 Exposure Pathways to Man

The information for this section is unchanged from the information presented in Section 5.3.1 of the Seabrook 1 & 2 ER-CPS except as noted in the following paragraphs.

The various possible pathways for radiation exposure to man are illustrated in Figure 5.2-2.

Dose estimates for the major pathways of radiation exposure are discussed in Section 5.2.4 and summarized in Section 5.2.5.

5.2.2 Radioactivity in Environment

This subsection describes quantitatively the distribution in the environment of the small releases of radioactivity from Seabrook Units 1 & 2. The releases are contained within the liquid and gaseous effluents discharged from the station.

5.2.2.1 Surface Water Models

Anticipated annual release of radioactive liquid materials is presented in Section 3.5, Table 3.5-18 of this report. The plant waste liquids are released to the service water system which discharges to the circulating water system. The radioactive liquid wastes reach the environment via the circulating water discharge line. The discharge route provides on-site dilution by the combined flow of the service and circulating water systems--412,000 gpm per unit. With the assumption of 80 percent operating capacity of circulating water systems, the system flow dilutes the normal liquid radioactivity releases of 0.24 Ci/year except tritium, to 3.6×10^{-10} μCi/ml per unit. Tritium liquid releases of 730 Ci/year are diluted to 1.11×10^{-6} μCi/ml per unit.

Further dilution of the circulating water discharge plume will occur after leaving the discharge pipe. A near-field dilution factor of ten was used for calculating estimated doses, and is based on the minimum dilution found from multiport, deep water discharge physical model test results described in Section 5.1 of this report.

The dilution of effluents increases substantially with increasing distance from the discharge due to mixing and advection by tidal and wind-driven currents. The far-field dilution of continuously discharged effluents was calculated using tidally averaged far-field dispersion model [1]. The model was applied using zero net drift even though field surveys have shown that substantial net drift exists in the discharge area and using no radioactive decay during the effluent transit time to 50 miles. Because of this the average dilution of 247 to 1 calculated for the area to 50 miles is conservative. The dilution for a short-term release of effluents will be substantially greater.

The ability of suspended and bottom sediments to absorb and adsorb radioactive nuclides from solution is recognized as contributing to important pathways to man through the sediment's ability to concentrate otherwise dilute species of ions. The pathways of importance in the site area are by direct contact with the populace, such as those persons engaged in shoreline activities, and by transfer to aquatic food chains. Direct ingestion of suspended sediments in water is not considered since the effluent discharge is to a saltwater environment which is not used for drinking or irrigation purposes.

The models used to determine the concentration of radioactivity in sediments and aquatic foods for the purpose of estimating doses were taken from the Nuclear Regulatory Guide 1.109, Appendix A. The concentration of radioactivity in the sediment is assumed to be dependent upon the concentration of activity in the water column, plus a transfer constant from water to sediment. The calculated sediment concentration by isotope at various times after station startup is shown in Table 5.2-1.

5.2.2.2 Ground Water Models

No radionuclides will be released into any groundwater supply; therefore, the use of a groundwater model was not required.

5.2.2.3 Gaseous Effluents

Anticipated annual release of radioactive gaseous material is presented in Section 3.5, Table 3.5-10, of this report. The gaseous effluent is transported and diluted in a manner determined by the prevailing meteorological conditions. Section 6.1.3 of this report discusses the meteorology modeling which has been used for all dose estimates. Annual average atmospheric dilution factors (Chi/Q values) were estimated from a twelve-month on-site meteorological survey and are summarized in Tables 5.2-2 and 5.2-3. The dilution factors used for calculating annual maximum individual doses and potential site boundary exposure rates are given in Tables 5.2-4 and 5.2-5. The gaseous source term for each unit originates from two separate and distinct locations: the plant unit vent which is located on top of the containment, and the turbine building ventilators located on the turbine building roof. As such, two separate sets of dilution factors are used for calculating the maximum individual doses from gaseous effluents.

5.2.3 Dose Rate Estimates for Biota Other Than Man

The equations used for the calculation of internal doses to biota other than man are outlined below.

The dose to a primary organism (one for which bioaccumulation factors are known) is given by:

$$D_1 = .0187\, U_p\, M_p \sum_i E_i\, C_{iw}\, BF_i, \qquad \text{(Eq. 1)}$$

Where, D_1 = internal dose rate due to isotope i (m rad/yr),

.0187 = conversion constant (kg-mrad-dis/pCi-yr-Mev),

$= \dfrac{(1.17\text{x}10^6 \text{ dis/yr-pCi})\ (1\text{x}10^{-3} \text{ kg/g})\ (1.6\text{x}10^6 \text{ erg/Mev})}{(10^{?} \text{ g-mrad/erg})}$,

U_p = usage factor for exposure time associated with pathway p, (hr/yr)

M_p = mixing ratio (reciprocal of the dilution factor) dimensionless,

E_i = effective absorbed energy fraction as a function of organism effective radius (Mev/dis),

C_{iW} = discharge concentration of nuclide i in water (pCi/liter), and

BF_i = bio-accumulation factor (pCi/kg per pCi/liter).

The dose to a secondary organism (one which consumes primary organisms) can be obtained from Equation 2.

$$D_2 = .0187 \sum_i E_i b_2, \qquad \text{(Eq. 2)}$$

Where, D_2 = internal dose rate due to isotope i (mrad/yr),

b_2 = specific body burden of the secondary organism (pCi/kg),

$$= \frac{1.44\, b_1 P_2 f_{w2} T2 (1-e^{-\lambda 2 t})}{M_2},$$

b_1 = specific body burden of the primary organism (pCi/kg),

= $C_{iw} U_p M_p BF_i$,

P_2 = consumption rate of primary organism by secondary organism (gm/day),

f_{w2} = fraction of ingested nuclide retained in secondary organism,

M_2 = mass secondary organism (gm),

$\lambda 2$ = effective decay constant in secondary organism

= $\lambda r + \lambda B_2$ (day^{-1}),

λB_2 = biological removal constant in secondary organism,

$T2$ = $\ln 2/\lambda_2$ (day),

t = exposure time (day), and

1.44 = $(\ln 2)^{-1}$.

Assumptions used for biota dose estimates are based on information presented in Appendix F of Reference 2. Table 5.2-6 is a listing of the specific assumptions and parameters used in the analysis. Values of bioaccumulation factors and effective absorbed energy fractions as a function of organism effective radius were obtained from the above reference and are listed in Tables 5.2-7 and 5.2-8. The effective half-life ($T2$) and retention fractions (f_{w2}) of radionuclides in secondary organisms were taken to be equal to those for the whole body of standard man, since specific animal data are lacking. A listing of these values may be found in Table 5.2-9 and were obtained from the ICRP Publication 2, 1959 report of Committee II. The annual discharge concentrations of nuclides (C_{iw}) released in the liquid effluent were taken from Section 3.5, Table 3.5-18 of this report. Dilution of the discharge plume was based on the near-field dilution factor of 8 as discussed in Section 5.2.2.1.

The 50-year internal dose commitment to biota can be found in Table 5.2-

10. The doses are based on continuous intake over a one-year environmental exposure period. The dose to a secondary organism was based on radionuclide body burdens of primary organisms listed in Table 5.2-11. The highest biota dose was to a muskrat and was calculated to be 2.33 mrem/yr.

Additional pathways that cause exposure to biota are external submersion in receiving waters, floating on water surfaces, and direct irradiation from nuclides concentrated in bottom and shoreline sediments. Table 5.2-12 is a listing of shoreline and immersion dose factors for skin or surface doses and dose factors for the total body. The values were obtained from the WASH 1258 Report, Reference 2. The dose rate factors for skin include emitted beta and gamma energies capable of penetrating seven milligrams per square centimeter of tissue. The dose rate factors for the total body were calculated for a tissue depth of five centimeters. These criteria for dose factors are intended for use with human exposure and eliminate low energy radiation not capable of penetrating the epidermal layer. Because of this, only the surface or skin dose rate factors can be applied in the calculation of external submersion and ground plane irradiation to biota.

The submersion dose to biota and water surface dose was calculated according to Equation 3.

$$D_i = U_p \, M_p \sum_i C_{iw} \, D_{ip} \qquad \text{mrem/yr} \qquad \text{(Eq. 3)}$$

The dose rate factor for pathway p and nuclide i is designated as D_{ip}, and the other values are as defined previously. The water surface dose can be taken to be one half of the submerison dose according to methodology in Reference 2.

The dose from shoreline and bottom deposits was calculated according to models described in Regulatory Guide 1.109, Appendix A. The shore width factor was set equal to 2.0, which conservatively accounts for the increased gamma exposure rate at the surface compared to the exposure rate at a height of one meter which is given by the dose factor, Di, for man. The nuclide concentration in sediment was calculated based on 15 years of exposure to 12.5% plant effluent.

The external skin dose to representative primary and secondary organisms can be found in Table 5.2-10. The highest dose was received by water plants and mollusks and was calculated to be .15 mrem/yr.

In addition to exposure from liquid effluents, some external exposure to primary organisms will occur from submersion in the station's gaseous effluent. Doses received by biota via external exposure can be deduced from those received by people at nearby locations. External doses can be assumed to be independent of body size and, therefore, the same for man and animals. Doses received by man are discussed in the following subsections.

5.2.4 Dose Rate Estimates For Man

5.2.4.1 Liquid Pathways

Dose rates for the maximum individual via the liquid pathways were evaluated based on the models and dose factors given in Regulatory Guide 1.109, and according to the assumptions listed in Table 5.2-13. The annual liquid discharge concentration of nuclides was obtained from Section 3.5, Table 3.5-18 of this report. The pathways considered in the dose analysis were ingestion of finfish and invertebrates, external exposure from swimming and boating, and exposure from shoreline activities. The swimming dose was calculated using Equation 3 and dose factors from Reference 2. The boating dose was equal to one half of the calculated swimming dose. The usage factors for both boating and swimming activities were obtained from Reference 3. The usage factor given in Regulatory Guide 1.109 for adult shoreline activities was increased from 12 hr/yr to 334 hr/yr to account for individuals harvesting clams on mud flats in the Hampton Harbor area. The maximum individual total body and organ doses are tabulated in Table 5.2-14.

5.2.4.2 Gaseous Pathways

Dose rates for the maximum individual via the gaseous pathways are evaluated based on the models and dose factors given in Regulatory Guide 1.109, and according to assumptions listed in Table 5.2-15. The annual gaseous discharge concentration used in the dose analysis was obtained from Section 3.5 of this report, Table 3.5-12.

The maximum individual dose from noble gas releases is calculated at the worst residential location in the ESE sector, 2398 meters, and at a recreational site in the salt marsh that surrounds the plant. The recreation site, which is used mainly for fishing and boating, is referred to as the Rocks and is located in the ENE sector, 318 meters from Unit 1. Access to the Rocks is controlled from the Seabrook Station gatehouse. The dose results are shown in Table 5.2-16 along with beta and gamma air dose rate estimates. All projected dose estimates are within numerical design objectives of 10CFR50, Appendix I.

Airborne radioiodines and particulates are carried away by the prevailing wind and deposited on soil, feed forage and vegetables which lead to human exposure. The maximum individual doses are calculated and tabulated according to total body and significant organ doses in Table 5.2-17. The maximum individual thyroid and bone doses are reported separately by pathway in Table 5.2-18. The highest organ dose was to the child bone and was calculated to be 0.233 mrem/yr, which is 1.5% of the Appendix I dose objectives.

5.2.4.3 Direct Radiation From Facility

The shielding of plant structures has been designed in such a way that the maximum direct radiation dose rates external to the reactor, the primary

auxiliary building, and the waste processing building are less than 0.5 mrem/hour. The shielding design is based on a conservative assumption of a 1% failed fuel fission product source term. More realistically, the expected radiation levels in these areas will be significantly less than the design value. Exposure to an individual at the site boundary would be further reduced due to air and building attenuation and the inverse-distance-square law. Therefore, individual exposure at the site boundary based only on inverse square, would result in a dose rate of less than 0.2 mrem/year. The 2
dose rate at the Rocks, conservatively calculated assuming no air or building attenuation, and 100% occupancy would not exceed 1.5 mrem/year.

The principal sources of radioactivity not stored in plant structures are the radioactive liquids stored in the reactor makeup water storage tanks and the refueling water tanks, located in the tank farm area. The maximum expected radionuclide inventories based on 1% failed fuel and 80% tank capacities, results in direct radiation dose rate at the site boundary of less than 2.5 mrem/year per unit. Assuming 100% occupancy and air attenuation, the dose 2
rate at the Rocks would not exceed 1.0 mrem/year.

The nearest residential house is located approximately 0.63 miles SW of the station. The direct radiation dose rate at this location, using the very conservative assumption of no air or structural attenuation, will not exceed 2.0 mrem/year. There are no schools or hospitals identified within a one-mile radius of the plant site.

5.2.4.4 Annual Population Doses

Liquid Pathway Population Doses

Annual population doses due to liquid plant effluents were calculated for the 50-mile population through the major existing pathways. These are ingestion of fish, shellfish, and direct exposure to shoreline deposits. Shoreline deposits were allowed to build up for 15 years in order to calculate the plant lifetime average exposure rate. Population doses from boating and swimming do not make a significant contribution to the total dose when compared to the major pathways. Since the plant discharge is to the ocean, potable water and irrigated food pathways are not considered.

A far-field dilution factor of 247 explained in Section 5.2.2.1, was uniformly applied to the 50-mile area for the purpose of estimating population doses. No credit for radioactive decay in transit of effluents was taken, but a seven day distribution transport time for all aquatic food between the time caught and the time consumed was applied. This delay period is the recommended value for population sport fishing according to Regulatory Guide 1.109, which is more conservative than the suggested 10-day delay time recommended for population commercial fishing. Recommended values for usage factors for the average individual were also obtained from the same reference.

An estimate of total population for the year 2000 was obtained from Section 2.1, Tables 2.1-2 and 2.1-3 of this report. Population fractions by age group were based on 1970 populations for Maine, Massachusetts and New Hampshire and are 0.016, 0.204, 0.132 and 0.648 for infants, children, teenagers and adults, respectively.

Section 2.1.3.5 of this report provides estimates of annual fish and invertebrate harvests in the six counties within the 50-mile radius of the site. The total quantity of fish is estimated to be 9.9×10^7 Kg/year and 6.4×10^6 Kg/year for invertebrates. Comparing these quantities against the total amount which could be consumed by the 50-mile population, using the average individual usage factors, it can be seen that more fish and 2
invertebrates are harvested than can be consumed locally. It was thus assumed that all seafood consumption consisted of foods obtained locally. The excess fish and invertebrates that are harvested have been assumed to be consumed by a fraction of the U.S. population. The dose via this pathway is discussed under United States population doses.

The population doses to the 50-mile population due to liquid effluents are shown in Table 5.2-19. The total whole body and thyroid doses are estimated to be 0.044 man-rem/year and 0.451 man-rem/year, respectively.

Gaseous Pathway Population Doses

Annual 50-mile population doses due to routine gaseous effluents have been calculated through the major pathways of exposure. These include external irradiation from activity deposited onto the ground surface, inhalation, submersion in gaseous cloud, and ingestion of vegetables, meat and milk products which have been exposed to plant effluents.

Meteorological dispersion coefficients used in the dose analysis can be found in Tables 5.2-2 and 5.2-3. Two separate calculations were done according to the gaseous release point, either the unit stack or the turbine building vent.

Agricultural characteristics of the area within 50 miles of the site are described in Section 2.1. Tables 5.2-20 through 5.2-22 indicate the distribution and production of milk, meat and vegetables by sector for a 50-mile radius. Comparing the 50-mile food production against what could be consumed by the 50- mile population, it is seen that the site area produces only about 10% of the milk, 2% of the meat, and 3% of the vegetables which are required. Therefore, the entire 50-mile agricultural food production was assumed to be consumed within the 50 miles.

The dose models used for estimating the population doses from gaseous effluents are the same as those which are described in Regulatory Guide 1.109. Distribution and transport times were taken from Table E-15, and usage factors for the average individual were obtained from Table E-4 of the above reference.

The population doses due to noble gas effluents within the 50-mile radius are shown in Table 5.2-23. The total whole body and skin dose are 0.490 man-rem/year and 1.15 man-rem/year, respectively. The population whole body and thyroid doses due to iodine and particulate gaseous release are listed in Table 5.2-24 according to pathway and age group. The total whole body dose and thyroid dose to the population within the 50-mile radius were calculated to be 0.872 man-rem/year and 1.47 man-rem/year, respectively.

United States Population Doses

The U.S. population doses, as presented in Table 5.2-25, were calculated by summing the 0-50-mile population doses with the total population doses from long-lived radionuclides. The models used for the long-lived nuclides generally follow those of the uranium fuel cycle [4,5]. The EPA calculates a world-wide dose, which includes a "first pass" dose over the eastern half of the U.S. and a world mixing dose. Since the Seabrook 1 & 2 site is located on the east coast of the U.S. (with prevailing westerly winds) no "first pass" dose has been assumed. The radionuclide I-129 is not expected to be released in significant quantities from the Seabrook 1 & 2 site and most of that released would be deposited in the Atlantic Ocean. No U.S. population thyroid dose has, therefore, been calculated for this isotope.

Tritium: The equation below was used to calculate the dose commitment to the U.S. population from gaseous and liquid tritium releases. It assumes that the tritium mixes uniformly in the hydrological cycle of the northern hemisphere and is subsequently distributed uniformly throughout the body proportional to the hydrogen content, including tissues.

$$DCF = \frac{(100)(10^6)(3 \times 10^8)}{(1.35 \times 10^{22})} \int_0^{100} e^{-\lambda t}\, dt$$

where:

DCF	=	100 year dose commitment, man-rem/Ci
100	=	rem/year per $\mu Ci/cm^3$ (Reference 5)
10^6	=	$\mu Ci/ci$
3×10^8	=	estimated U.S. population in year 2025 (Ref. 5)
1.35×10^{22}	=	gms circulating water in northern hemisphere (Ref. 5)
λ	=	radiological decay constant, $years^{-1}$

The total tritium release (gas and liquid) is estimated to be 1470 Ci/yr from one unit, which results in a U.S. population dose commitment of 0.057

man-rem.

Krypton-85: The equation below was used to calculate the dose commitment to the U.S. population from gaseous releases of Kr-85. It assumes that the Kr-85 uniformly disperse in the world's atmosphere.

$$DCF = \frac{(1.5 \times 10^4)(1290)(3 \times 10^8)}{(5.14 \times 10^{21})} \int_0^{100} e^{-\lambda t} \, dt$$

where:

DCF	=	100 year dose commitment, man-rem/Ci
1.5×10^4	=	rem/year per Ci/m^3 (Reference 5)
1290	=	gms air/m^3
5.14×10^{21}	=	gms air in atmosphere (Reference 5)
3×10^8	=	estimated U.S. population in year 2025 (Reference 5)
λ	=	radiological decay constant, years^{-1}

The total Kr-85 released is estimated to be 260 Ci/year from one unit which results in a U.S. population dose commitment of 4.6×10^{-3} man-rem.

Carbon-14: The calculation of dose commitment to the U.S. population from C-14 was based on the model described in Reference 6. This is a multireservoir exchange model which calculates the C-14 to C-12 ratio in the various compartments and then assumes that this specific activity of C-14 is the same in man as in the troposphere. A dose rate conversion factor of 0.21 mrem/year per pCi C-14/gmC-12 is then used to generate a worldwide 100 year dose commitment of 57.1 man-rem/Ci to the total body. This value is based on the releases taking place in the year 2000, which is approximately the midpoint of plant operation. It was assumed that the U.S. population was 5 percent of the world population (Reference 5) and based on an estimated C-14 release of 8 Ci/year from one unit, a U.S. population dose commitment of 23 man-rem was calculated.

For comparison, radioactive tritium and carbon-14 are both produced in nature by the interaction of cosmic rays with the earth's atmosphere. This results in an annual whole body dose to an individual of about 0.004 mrem and 1.5 mrem, respectively. Therefore, for a U.S. population 300,000,000 persons, the annual dose from naturally occurring tritium and carbon-14 is about 1000 man-rem and 400,000 man-rem, respectively.

The dose commitment to the United States population from ingestion of fish and invertebrates has been calculated based on the seafood harvest within a 50-mile radius of Seabrook Station that is not consumed by the 50-mile population. The values have been conservatively calculated based on Regulatory Guide 1.109, fish and invertebrate consumption rates for an average individual. The resultant whole body dose to the U.S. population for both fish and invertebrate ingestion was calculated to be 0.55 man-rem.

5.2.5 Summary of Annual Radiation Doses

A summary of 10CFR Part 50, Appendix I, dose objectives and a comparison to calculated values for Seabrook Station can be found in Table 5.2-26. The 50 mile population doses from liquid and gaseous effluents can be found in Tables 5.2-19, 5.2-23 and 5.2-24.

5.2.6 References

1. Brocard, D., and Kirby, 1978. Far-Field Model for Waste Heat Discharge in the Coastal Zone, Proceedings of the Second Conference on Waste Heat Management and Utilization, Miami, Florida.

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3. HERMES. A Digital Computer Code for Estimating Regional Radiological Effects from the Nuclear Power Industry. December 1971, HEDL.

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5. Englehart, R.W., D.E. Martin, R.A. Martineit, J.F. Pang, B.J. Rechman, and E.R. Smith, 1976. Technical Assessment of Specific Aspects of EPA Proposed Environmental Radiation Standard for the Uranium Fuel Cycle and Its Associated Documentation. Prepared by NUS Corporation for the Atomic Industrial Forum, Inc., AIF/NESP-011, February 1976.

6. Fowler, T.W., R.L. Clark, J.W. Gruklke, and J.L. Russell, 1976. Public health consideration of carbon-14 discharges from the light-water-cooled nuclear power reactor industry. U.S. Environmental Protection Agency Technical Note. ORP/TAD-76-3, July 1976.

TABLE 5.2-1

AVERAGE SURFACE CONCENTRATION BY NUCLIDE (pCi/m^2) IN SEDIMENT AT VARIOUS TIMES AFTER STATION STARTUP

	Years After Startup				
Nuclide	1 Year	5 Years	15 Years	30 Years	40 Years
H-3	$1.71x10^{6}$	$7.65x10^{6}$	$1.78x10^{7}$	$2.55x10^{7}$	$2.8x10^{7}$
I-130	$5.83x10^{-4}$	$5.83x10^{-4}$	$5.83x10^{-4}$	$5.83x10^{-4}$	$5.83x10^{-4}$
I-131	$1.01x10^{1}$	$1.01x10^{1}$	$1.01x10^{1}$	$1.01x10^{1}$	$1.01x10^{1}$
I-132	$3.51x10^{-3}$	$3.51x10^{-3}$	$3.51x10^{-3}$	$3.51x10^{-3}$	$3.51x10^{-3}$
I-133	$2.98x10^{-1}$	$2.98x10^{-1}$	$2.98x10^{-1}$	$2.98x10^{-1}$	$2.98x10^{-1}$
I-134	$3.40x10^{-5}$	$3.40x10^{-5}$	$3.40x10^{-5}$	$3.40x10^{-5}$	$3.40x10^{-5}$
I-135	$1.54x10^{-2}$	$1.54x10^{-2}$	$1.54x10^{-2}$	$1.54x10^{-2}$	$1.54x10^{-2}$
Br-83	$3.81x10^{-5}$	$3.81x10^{-5}$	$3.81x10^{-5}$	$3.81x10^{-5}$	$3.81x10^{-5}$
Rb-86	$3.61x10^{-3}$	$3.61x10^{-3}$	$3.61x10^{-3}$	$3.61x10^{-3}$	$3.61x10^{-3}$
Sr-89	$1.44x10^{-2}$	$1.45x10^{-2}$	$1.45x10^{-2}$	$1.45x10^{-2}$	$1.45x10^{-2}$
Mo-99	$5.55x10^{-2}$	$5.55x10^{-2}$	$5.55x10^{-2}$	$5.55x10^{-2}$	$5.55x10^{-2}$
Tc-99m	$5.8x10^{-1}$	$5.8x10^{-1}$	$5.8x10^{-1}$	$5.8x10^{-1}$	$5.8x10^{-1}$
Te-127m	$2.83x10^{-2}$	$3.14x10^{-2}$	$3.14x10^{-2}$	$3.14x10^{-2}$	$3.14x10^{-2}$
Te-127	$1.11x10^{-4}$	$1.11x10^{-4}$	$1.11x10^{-4}$	$1.11x10^{-4}$	$1.11x10^{-4}$
Te-129m	$3.84x10^{-2}$	$3.84x10^{-2}$	$3.84x10^{-2}$	$3.84x10^{-2}$	$3.84x10^{-2}$
Te-129	$4.20x10^{-5}$	$4.20x10^{-5}$	$4.20x10^{-5}$	$4.20x10^{-5}$	$4.20x10^{-5}$
Te-131m	$3.59x10^{-4}$	$3.59x10^{-4}$	$3.59x10^{-4}$	$3.59x10^{-4}$	$3.59x10^{-4}$
Te-132	$2.24x10^{-2}$	$2.24x10^{-2}$	$2.24x10^{-2}$	$2.24x10^{-2}$	$2.24x10^{-2}$
Cs-134	$4.03x10^{1}$	$1.15x10^{2}$	$1.40x10^{2}$	$1.40x10^{2}$	$1.40x10^{2}$
Cs-136	$3.34x10^{-1}$	$3.34x10^{-1}$	$3.34x10^{-1}$	$3.34x10^{-1}$	$3.34x10^{-1}$
Cs-137	$3.29x10^{1}$	$1.56x10^{2}$	$4.21x10^{2}$	$7.19x10^{2}$	$8.68x10^{2}$
Ba-140	$1.14x10^{-3}$	$1.14x10^{-3}$	$1.14x10^{-3}$	$1.14x10^{-3}$	$1.14x10^{-3}$
La-140	$1.58x10^{-4}$	$1.58x10^{-4}$	$1.58x10^{-4}$	$1.58x10^{-4}$	$1.58x10^{-4}$
Cr-51	$3.99x10^{-2}$	$3.99x10^{-2}$	$3.99x10^{-2}$	$3.99x10^{-2}$	$3.99x10^{-2}$
Mn-54	$6.61x10^{-2}$	$1.17x10^{-1}$	$1.20x10^{-1}$	$1.20x10^{-1}$	$1.20x10^{-1}$
Fe-55	$4.05x10^{-1}$	1.29	1.75	1.79	1.79
Fe-59	$3.89x10^{-2}$	$3.90x10^{-2}$	$3.90x10^{-2}$	$3.90x10^{-2}$	$3.90x10^{-2}$
Co-58	1.04	1.08	1.08	1.08	1.08
Co-60	$5.19x10^{-1}$	2.03	3.63	4.13	4.19
Np-239	$6.76x10^{-4}$	$6.76x10^{-4}$	$6.76x10^{-4}$	$6.76x10^{-4}$	$6.76x10^{-4}$
TOTAL	$1.71x10^{6}$	$7.65x10^{6}$	$1.78x10^{7}$	$2.55x10^{7}$	$2.80x10^{7}$

TABLE 5.2-2
(Sheet 1 of 8)

SEABROOK ANNUAL AVERAGE CHI/Q BEFORE DEPLETION (SEC/M^3)
PRIMARY VENT STACK RELEASE

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) .25	.50	.75	1.00	1.50	2.00	2.50	3.00
N	386	1.849E-07	7.524E-08	5.809E-08	5.886E-08	6.420E-08	6.174E-08	5.614E-08	6.236E-08
NNE	525	3.040E-07	1.287E-07	9.499E-08	8.867E-08	8.578E-08	7.811E-08	7.778E-08	8.300E-08
NE	670	4.493E-07	1.885E-07	1.341E-07	1.181E-07	1.041E-07	9.067E-08	7.852E-08	7.551E-08
ENE	763	4.768E-07	1.915E-07	1.303E-07	1.158E-07	1.103E-07	1.019E-07	9.139E-08	9.455E-08
E	891	5.156E-07	2.170E-07	1.512E-07	1.330E-07	1.231E-07	1.124E-07	1.005E-07	8.908E-08
ESE	1530	1.090E-06	4.472E-07	3.018E-07	2.513E-07	2.068E-07	1.758E-07	1.505E-07	1.299E-07
SE	658	5.483E-07	2.363E-07	1.655E-07	1.422E-07	1.225E-07	1.066E-07	9.265E-08	8.072E-08
SSE	334	1.430E-07	6.303E-08	4.878E-08	4.922E-08	5.375E-08	5.206E-08	4.774E-08	4.531E-08
S	328	1.706E-07	7.351E-08	5.803E-08	5.655E-08	5.542E-08	6.447E-08	5.505E-08	4.958E-08
SSW	221	9.877E-08	4.252E-08	3.324E-08	3.371E-08	3.630E-08	5.328E-08	4.595E-08	3.962E-08
SW	348	2.378E-07	1.007E-07	7.444E-08	7.722E-08	6.729E-08	6.768E-08	5.881E-08	7.346E-08
WSW	316	1.715E-07	8.123E-08	6.102E-08	6.536E-08	7.211E-08	7.241E-08	6.174E-08	1.225E-07
W	385	2.213E-07	1.086E-07	9.479E-08	1.054E-07	1.076E-07	1.017E-07	8.182E-08	9.351E-08
WNW	351	2.030E-07	1.096E-07	8.406E-08	8.561E-08	8.369E-08	6.893E-08	1.016E-07	8.967E-08
NW	411	2.458E-07	1.190E-07	8.477E-08	8.506E-08	1.026E-07	9.464E-08	7.800E-08	7.187E-08
NNW	309	1.682E-07	7.335E-08	5.399E-08	6.074E-08	7.142E-08	6.310E-08	5.447E-08	4.698E-08
AVERAGE	8626	3.268E-07	1.410E-07	1.018E-07	9.542E-08	9.169E-08	8.534E-08	7.704E-08	7.797E-08

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 3.50	4.00	4.50	5.00	7.50	10.00	15.01	20.00
N	386	6.588E-08	6.234E-08	5.763E-08	5.079E-08	3.111E-08	2.184E-08	1.311E-08	9.167E-09
NNE	525	7.119E-08	6.199E-08	5.499E-08	5.233E-08	3.255E-08	2.306E-08	1.404E-08	9.904E-09
NE	670	6.579E-08	5.808E-08	5.174E-08	4.655E-08	3.041E-08	2.219E-08	1.402E-08	1.014E-08
ENE	763	8.345E-08	7.444E-08	6.689E-08	6.060E-08	4.064E-08	3.023E-08	1.960E-08	1.442E-08
E	891	7.947E-08	7.149E-08	6.473E-08	5.899E-08	4.013E-08	3.004E-08	1.964E-08	1.454E-08
ESE	1530	1.136E-07	1.008E-07	9.027E-08	8.160E-08	5.455E-08	4.057E-08	2.636E-08	1.953E-08
SE	858	7.116E-08	6.347E-08	5.710E-08	5.180E-08	3.491E-08	2.603E-08	1.694E-08	1.254E-08
SSE	334	4.044E-08	3.630E-08	3.276E-08	2.975E-08	1.990E-08	1.467E-08	9.334E-09	6.783E-09
S	328	4.291E-08	3.765E-08	3.336E-08	2.988E-08	1.927E-08	1.392E-08	8.641E-09	6.191E-09
SSW	221	3.455E-08	3.050E-08	2.717E-08	2.443E-08	1.593E-08	1.157E-08	7.226E-09	5.184E-09
SW	348	6.095E-08	5.687E-08	4.873E-08	4.249E-08	2.519E-08	1.733E-08	1.016E-08	7.008E-09
WSW	316	9.934E-08	8.288E-08	7.047E-08	6.802E-08	3.857E-08	2.603E-08	1.504E-08	1.026E-08
W	385	8.440E-08	7.110E-08	7.610E-08	6.696E-08	3.778E-08	2.542E-08	1.463E-08	9.968E-09
WNW	351	7.175E-08	5.923E-08	4.990E-08	4.290E-08	2.434E-08	1.632E-08	9.257E-09	6.254E-09
NW	411	7.812E-08	6.603E-08	5.669E-08	4.947E-08	2.936E-08	2.023E-08	1.188E-08	8.188E-09
NNW	309	4.921E-08	4.274E-08	4.050E-08	3.839E-08	2.338E-08	1.634E-08	9.762E-09	6.795E-09
AVERAGE	8626	6.952E-08	6.099E-08	5.494E-08	4.968E-08	3.113E-08	2.224E-08	1.373E-08	9.805E-09

TABLE 5.2-2
(Sheet 2 of 8)

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 25.00	30.00	35.00	40.00	45.00	50.00
N	386	6.959E-09	5.575E-09	4.619E-09	3.923E-09	3.402E-09	2.991E-09
NNE	525	7.566E-09	6.087E-09	5.062E-09	4.312E-09	3.750E-09	3.304E-09
NE	670	7.884E-09	6.414E-09	5.385E-09	4.625E-09	4.051E-09	3.592E-09
ENE	763	1.134E-08	9.299E-09	7.859E-09	6.790E-09	5.978E-09	5.327E-09
E	891	1.148E-08	9.439E-09	7.997E-09	6.924E-09	6.107E-09	5.450E-09
ESE	1530	1.544E-08	1.270E-08	1.077E-08	9.339E-09	8.245E-09	7.367E-09
SE	858	9.906E-09	8.145E-09	6.902E-09	5.978E-09	5.273E-09	4.707E-09
SSE	334	5.285E-09	4.305E-09	3.619E-09	3.112E-09	2.729E-09	2.423E-09
S	328	4.777E-09	3.866E-09	3.232E-09	2.765E-09	2.414E-09	2.134E-09
SSW	221	4.002E-09	3.240E-09	2.709E-09	2.318E-09	2.024E-09	1.790E-09
SW	348	5.256E-09	4.191E-09	3.460E-09	2.929E-09	2.532E-09	2.221E-09
WSW	316	7.675E-09	6.111E-09	5.037E-09	4.258E-09	3.675E-09	3.218E-09
W	385	7.529E-09	5.996E-09	4.945E-09	4.184E-09	3.616E-09	3.170E-09
WNW	351	4.607E-09	3.647E-09	2.992E-09	2.518E-09	2.168E-09	1.892E-09
NW	411	6.058E-09	4.842E-09	4.004E-09	3.393E-09	2.936E-09	2.576E-09
NNW	309	5.108E-09	4.087E-09	3.382E-09	2.869E-09	2.465E-09	2.182E-09
AVERAGE	8626	7.555E-09	6.122E-09	5.124E-09	4.390E-09	3.837E-09	3.396E-09

TABLE 5.2-2
(Sheet 3 of 8)

Seabrook Annual Average Chi/Q After Depletion (sec/m^3)
Primary Vent Stack Release

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DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) .25	.50	.75	1.00	1.50	2.00	2.50	3.00
N	386	1,760E-07	7,104E-08	5,531E-08	5,678E-08	6,270E-08	6,040E-08	5,481E-08	6,068E-08
NNE	525	2,899E-07	1,221E-07	9,061E-08	8,537E-08	8,344E-08	7,608E-08	7,567E-08	8,044E-08
NE	670	4,277E-07	1,786E-07	1,276E-07	1,131E-07	1,006E-07	8,777E-08	7,587E-08	7,281E-08
ENE	763	4,513E-07	1,803E-07	1,230E-07	1,103E-07	1,065E-07	9,872E-08	8,847E-08	9,138E-08
E	891	4,913E-07	2,059E-07	1,438E-07	1,275E-07	1,193E-07	1,092E-07	9,756E-08	8,620E-08
ESE	1530	1,035E-06	4,226E-07	2,860E-07	2,395E-07	1,988E-07	1,692E-07	1,447E-07	1,245E-07
SE	858	5,215E-07	2,241E-07	1,577E-07	1,364E-07	1,185E-07	1,032E-07	8,960E-08	7,784E-08
SSE	334	1,301E-07	5,985E-08	4,671E-08	4,765E-08	5,261E-08	5,102E-08	4,670E-08	4,419E-08
S	328	1,631E-07	6,990E-08	5,564E-08	5,474E-08	5,410E-08	6,310E-08	5,370E-08	4,818E-08
SSW	221	9,458E-08	4,049E-08	3,191E-08	3,270E-08	3,556E-08	5,238E-08	4,502E-08	3,866E-08
SW	348	2,274E-07	9,563E-08	7,107E-08	7,465E-08	6,543E-08	6,590E-08	5,707E-08	7,093E-08
WSW	316	1,646E-07	7,791E-08	5,879E-08	6,364E-08	7,077E-08	7,105E-08	6,038E-08	1,188E-07
W	385	2,128E-07	1,045E-07	9,200E-08	1,032E-07	1,058E-07	9,970E-08	7,981E-08	9,054E-08
WNW	351	1,958E-07	1,060E-07	8,164E-08	8,371E-08	8,214E-08	6,750E-08	9,868E-08	8,618E-08
NW	411	2,366E-07	1,148E-07	8,199E-08	8,291E-08	1,008E-07	9,281E-08	7,618E-08	6,984E-08
NNW	309	1,605E-07	6,978E-08	5,163E-08	5,894E-08	7,002E-08	6,180E-08	5,317E-08	4,567E-08
AVERAGE	8626	3,115E-07	1,340E-07	9,721E-08	9,194E-08	8,919E-08	8,312E-08	7,484E-08	7,543E-08

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 3.50	4.00	4.50	5.00	7.50	10.00	15.01	20.00
N	386	6,369E-08	5,985E-08	5,493E-08	4,812E-08	2,860E-08	1,949E-08	1,105E-08	7,315E-09
NNE	525	6,863E-08	5,944E-08	5,242E-08	4,954E-08	2,993E-08	2,061E-08	1,187E-08	7,943E-09
NE	670	6,317E-08	5,551E-08	4,923E-08	4,408E-08	2,810E-08	2,002E-08	1,206E-08	8,334E-09
ENE	763	8,032E-08	7,132E-08	6,378E-08	5,751E-08	3,763E-08	2,732E-08	1,688E-08	1,186E-08
E	891	7,664E-08	6,868E-08	6,193E-08	5,619E-08	3,735E-08	2,733E-08	1,707E-08	1,209E-08
ESE	1530	1,086E-07	9,591E-08	8,554E-08	7,700E-08	5,036E-08	3,664E-08	2,281E-08	1,621E-08
SE	858	6,839E-08	6,077E-08	5,446E-08	4,920E-08	3,245E-08	2,369E-08	1,478E-08	1,050E-08
SSE	334	3,928E-08	3,511E-08	3,155E-08	2,852E-08	1,864E-08	1,342E-08	8,168E-09	5,684E-09
S	328	4,151E-08	3,626E-08	3,199E-08	2,852E-08	1,797E-08	1,269E-08	7,536E-09	5,170E-09
SSW	221	3,356E-08	2,950E-08	2,615E-08	2,341E-08	1,491E-08	1,058E-08	6,316E-09	4,337E-09
SW	348	5,852E-08	5,426E-08	4,622E-08	4,006E-08	2,306E-08	1,540E-08	8,516E-09	5,543E-09
WSW	316	9,571E-08	7,930E-08	6,695E-08	6,240E-08	3,368E-08	2,167E-08	1,141E-08	7,142E-09
W	385	8,118E-08	6,799E-08	7,161E-08	6,154E-08	3,320E-08	2,138E-08	1,131E-08	7,112E-09
WNW	351	6,844E-08	5,608E-08	4,690E-08	4,004E-08	2,194E-08	1,423E-08	7,586E-09	4,835E-09
NW	411	7,525E-08	6,321E-08	5,393E-08	4,676E-08	2,689E-08	1,795E-08	9,918E-09	6,441E-09
NNW	309	4,755E-08	4,108E-08	3,865E-08	3,636E-08	2,150E-08	1,459E-08	8,233E-09	5,425E-09
AVERAGE	8626	6,690E-08	5,839E-08	5,227E-08	4,683E-08	2,851E-08	1,981E-08	1,159E-08	7,871E-09

TABLE 5.2-2
(Sheet 4 of 8)

DOWNWIND SECTOR	NO. OBS	25.00	30.00	35.00	40.00	45.00	50.00
		DISTANCE FROM RELEASE POINT (MILES)					
N	386	5.262E-09	3.999E-09	3.146E-09	2.539E-09	2.095E-09	1.753E-09
NNE	525	5.764E-09	4.410E-09	3.491E-09	2.834E-09	2.351E-09	1.978E-09
NE	670	6.186E-09	4.807E-09	3.857E-09	3.168E-09	2.654E-09	2.252E-09
ENE	763	8.904E-09	6.967E-09	5.623E-09	4.641E-09	3.904E-09	3.325E-09
E	891	9.129E-09	7.178E-09	5.820E-09	4.824E-09	4.075E-09	3.484E-09
ESE	1530	1.230E-08	9.698E-09	7.886E-09	6.556E-09	5.553E-09	4.760E-09
SE	858	7.957E-09	6.274E-09	5.099E-09	4.237E-09	3.587E-09	3.074E-09
SSE	334	4.244E-09	3.313E-09	2.671E-09	2.204E-09	1.856E-09	1.583E-09
S	328	3.820E-09	2.961E-09	2.371E-09	1.944E-09	1.627E-09	1.379E-09
SSW	221	3.205E-09	2.484E-09	1.989E-09	1.631E-09	1.365E-09	1.158E-09
SW	348	3.924E-09	2.956E-09	2.307E-09	1.848E-09	1.513E-09	1.258E-09
WSW	316	4.895E-09	3.597E-09	2.744E-09	2.153E-09	1.730E-09	1.414E-09
W	385	4.922E-09	3.635E-09	2.788E-09	2.199E-09	1.778E-09	1.461E-09
WNW	351	3.331E-09	2.496E-09	1.943E-09	1.555E-09	1.275E-09	1.062E-09
NW	411	4.453E-09	3.360E-09	2.627E-09	2.108E-09	1.730E-09	1.441E-09
NNW	309	3.856E-09	2.927E-09	2.300E-09	1.855E-09	1.529E-09	1.279E-09
AVERAGE	8626	5.759E-09	4.441E-09	3.541E-09	2.894E-09	2.414E-09	2.041E-09

TABLE 5.2-2

(Sheet 5 of 8)

Seabrook Annual Average Deposition Rates ($1/m^3$)

Primary Vent Stack Release

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) .25	.50	.75	1.00	1.50	2.00	2.50	3.00
N	386	9.452E-10	3.852E-10	2.862E-10	2.650E-10	2.450E-10	2.142E-10	1.833E-10	1.865E-10
NNE	525	1.590E-09	6.667E-10	4.768E-10	4.182E-10	3.579E-10	3.017E-10	2.788E-10	2.739E-10
NE	670	2.387E-09	1.008E-09	7.074E-10	5.995E-10	4.854E-10	3.970E-10	3.277E-10	2.967E-10
ENE	763	2.298E-09	9.353E-10	6.280E-10	5.311E-10	4.530E-10	3.887E-10	3.316E-10	3.216E-10
E	891	3.074E-09	1.290E-09	8.673E-10	7.084E-10	5.604E-10	4.608E-10	3.841E-10	3.239E-10
ESE	1530	7.115E-09	2.914E-09	1.909E-09	1.504E-09	1.099E-09	8.567E-10	6.898E-10	5.683E-10
SE	858	3.466E-09	1.466E-09	9.798E-10	7.846E-10	5.884E-10	4.651E-10	3.776E-10	3.127E-10
SSE	334	6.006E-10	2.653E-10	2.015E-10	1.906E-10	1.815E-10	1.612E-10	1.395E-10	1.255E-10
S	328	8.266E-10	3.568E-10	2.767E-10	2.561E-10	2.242E-10	2.284E-10	1.834E-10	1.552E-10
SSW	221	4.708E-10	2.006E-10	1.518E-10	1.427E-10	1.313E-10	1.565E-10	1.259E-10	1.032E-10
SW	348	1.578E-09	6.609E-10	4.667E-10	4.398E-10	3.318E-10	2.887E-10	2.312E-10	2.313E-10
WSW	316	9.861E-10	4.457E-10	3.131E-10	2.976E-10	2.679E-10	2.332E-10	1.857E-10	2.490E-10
W	385	1.123E-09	5.428E-10	4.503E-10	4.508E-10	3.919E-10	3.322E-10	2.557E-10	2.464E-10
WNW	351	9.952E-10	5.290E-10	3.972E-10	3.818E-10	3.299E-10	2.543E-10	2.933E-10	2.377E-10
NW	411	1.116E-09	5.416E-10	3.788E-10	3.576E-10	3.742E-10	3.183E-10	2.522E-10	2.200E-10
NNW	309	8.746E-10	3.784E-10	2.680E-10	2.699E-10	2.636E-10	2.142E-10	1.750E-10	1.451E-10
AVERAGE	8626	1.840E-09	7.866E-10	5.474E-10	4.749E-10	3.928E-10	3.294E-10	2.759E-10	2.499E-10

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 3.50	4.00	4.50	5.00	7.50	10.00	15.01	20.00
N	386	1.825E-10	1.646E-10	1.465E-10	1.268E-10	7.261E-11	4.828E-11	2.651E-11	1.724E-11
NNE	525	2.284E-10	1.943E-10	1.685E-10	1.544E-10	8.974E-11	6.018E-11	3.344E-11	2.192E-11
NE	670	2.503E-10	2.149E-10	1.868E-10	1.644E-10	9.895E-11	6.777E-11	3.872E-11	2.589E-11
ENE	763	2.756E-10	2.396E-10	2.105E-10	1.870E-10	1.161E-10	8.133E-11	4.796E-11	3.268E-11
E	891	2.778E-10	2.420E-10	2.131E-10	1.896E-10	1.184E-10	8.314E-11	4.925E-11	3.376E-11
ESE	1530	4.788E-10	4.114E-10	3.584E-10	3.164E-10	1.935E-10	1.346E-10	7.891E-11	5.406E-11
SE	858	2.643E-10	2.276E-10	1.986E-10	1.755E-10	1.075E-10	7.471E-11	4.370E-11	2.987E-11
SSE	334	1.083E-10	9.456E-11	8.330E-11	7.409E-11	4.589E-11	3.169E-11	1.848E-11	1.247E-11
S	328	1.291E-10	1.095E-10	9.429E-11	8.234E-11	4.839E-11	3.258E-11	1.812E-11	1.196E-11
SSW	221	8.624E-11	7.348E-11	6.346E-11	5.556E-11	3.295E-11	2.232E-11	1.251E-11	8.287E-12
SW	348	1.849E-10	1.591E-10	1.332E-10	1.138E-10	6.269E-11	4.066E-11	2.160E-11	1.383E-11
WSW	316	1.977E-10	1.620E-10	1.355E-10	1.196E-10	6.414E-11	4.105E-11	2.148E-11	1.352E-11
W	385	2.085E-10	1.716E-10	1.560E-10	1.336E-10	7.160E-11	4.577E-11	2.392E-11	1.509E-11
WNW	351	1.871E-10	1.523E-10	1.267E-10	1.077E-10	5.825E-11	3.741E-11	1.968E-11	1.253E-11
NW	411	2.156E-10	1.795E-10	1.520E-10	1.309E-10	7.366E-11	4.855E-11	2.643E-11	1.707E-11
NNW	309	1.400E-10	1.187E-10	1.074E-10	9.768E-11	5.575E-11	3.701E-11	2.031E-11	1.320E-11
AVERAGE	8626	2.135E-10	1.822E-10	1.585E-10	1.393E-10	8.188E-11	5.545E-11	3.131E-11	2.064E-11

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TABLE 5.2-2
(Sheet 6 of 8)

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 25.00	30.00	35.00	40.00	45.00	50.00
N	386	1.227E-11	9.269E-12	7.263E-12	5.847E-12	4.819E-12	4.031E-12
NNE	525	1.569E-11	1.191E-11	9.370E-12	7.572E-12	6.262E-12	5.256E-12
NE	670	1.881E-11	1.443E-11	1.146E-11	9.337E-12	7.779E-12	6.572E-12
ENE	763	2.404E-11	1.857E-11	1.483E-11	1.213E-11	1.013E-11	8.579E-12
E	891	2.496E-11	1.937E-11	1.554E-11	1.277E-11	1.072E-11	9.110E-12
ESE	1530	4.003E-11	3.111E-11	2.501E-11	2.060E-11	1.732E-11	1.476E-11
SE	858	2.209E-11	1.715E-11	1.378E-11	1.134E-11	9.532E-12	8.121E-12
SSE	334	9.114E-12	7.020E-12	5.597E-12	4.576E-12	3.824E-12	3.240E-12
S	328	8.618E-12	6.578E-12	5.207E-12	4.233E-12	3.521E-12	2.971E-12
SSW	221	5.987E-12	4.576E-12	3.625E-12	2.949E-12	2.454E-12	2.071E-12
SW	348	9.640E-12	7.246E-12	5.659E-12	4.545E-12	3.741E-12	3.127E-12
WSW	316	9.227E-12	6.860E-12	5.303E-12	4.221E-12	3.445E-12	2.859E-12
W	385	1.042E-11	7.783E-12	6.046E-12	4.836E-12	3.966E-12	3.307E-12
WNW	351	8.426E-12	6.359E-12	4.991E-12	4.031E-12	3.338E-12	2.809E-12
NW	411	1.142E-11	8.647E-12	6.796E-12	5.489E-12	4.538E-12	3.810E-12
NNW	309	9.201E-12	6.963E-12	5.468E-12	4.411E-12	3.644E-12	3.056E-12
AVERAGE	8626	1.500E-11	1.149E-11	9.121E-12	7.430E-12	6.190E-12	5.230E-12

SB 1 & 2
ER-OLS

TABLE 5.2-2
(Sheet 7 of 8)
Seabrook Annual Average Effective Gamma Chi/Q (sec/m^3)
Primary Vent Stack Release

1

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) .25	.50	.75	1.00	1.50	2.00	2.50	3.00
N	386	4.806E-07	2.459E-07	1.712E-07	1.345E-07	9.667E-08	7.581E-08	6.204E-08	5.918E-08
NNE	525	6.193E-07	3.143E-07	2.162E-07	1.679E-07	1.183E-07	9.140E-08	7.914E-08	7.408E-08
NE	670	7.674E-07	3.872E-07	2.644E-07	2.035E-07	1.413E-07	1.082E-07	8.725E-08	7.735E-08
ENE	763	9.780E-07	4.930E-07	3.357E-07	2.585E-07	1.807E-07	1.396E-07	1.136E-07	1.043E-07
E	891	1.112E-06	5.594E-07	3.805E-07	2.928E-07	2.041E-07	1.574E-07	1.278E-07	1.072E-07
ESE	1530	1.720E-06	8.555E-07	5.763E-07	4.395E-07	3.009E-07	2.289E-07	1.839E-07	1.532E-07
SE	858	1.037E-06	5.222E-07	3.545E-07	2.717E-07	1.876E-07	1.434E-07	1.157E-07	9.664E-08
SSE	334	4.617E-07	2.370E-07	1.640E-07	1.281E-07	9.157E-08	7.171E-08	5.876E-08	5.121E-08
S	328	4.093E-07	2.090E-07	1.449E-07	1.133E-07	8.053E-08	7.198E-08	5.780E-08	4.938E-08
SSW	221	3.049E-07	1.553E-07	1.073E-07	8.399E-08	6.026E-08	5.910E-08	4.758E-08	3.957E-08
SW	348	3.891E-07	1.980E-07	1.368E-07	1.149E-07	8.010E-08	6.726E-08	5.502E-08	5.630E-08
WSW	316	4.199E-07	2.189E-07	1.517E-07	1.276E-07	9.672E-08	7.937E-08	6.357E-08	7.811E-08
W	385	4.820E-07	2.539E-07	1.910E-07	1.609E-07	1.201E-07	9.743E-08	7.678E-08	7.341E-08
WNW	351	4.086E-07	2.196E-07	1.541E-07	1.281E-07	9.455E-08	7.142E-08	7.483E-08	6.288E-08
NW	411	4.966E-07	2.594E-07	1.776E-07	1.468E-07	1.173E-07	9.288E-08	7.342E-08	6.312E-08
NNW	309	3.765E-07	1.930E-07	1.340E-07	1.139E-07	8.742E-08	6.722E-08	5.415E-08	4.506E-08
AVERAGE	8626	6.540E-07	3.326E-07	2.288E-07	1.804E-07	1.286E-07	1.014E-07	8.321E-08	7.444E-08

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 3.50	4.00	4.50	5.00	7.50	10.00	15.01	20.00
N	386	5.621E-08	5.086E-08	4.577E-08	4.040E-08	2.494E-08	1.763E-08	1.072E-08	7.548E-09
NNE	525	6.260E-08	5.402E-08	4.748E-08	4.380E-08	2.730E-08	1.943E-08	1.191E-08	8.444E-09
NE	670	6.583E-08	5.716E-08	5.031E-08	4.486E-08	2.864E-08	2.069E-08	1.293E-08	9.282E-09
ENE	763	8.930E-08	7.794E-08	6.890E-08	6.168E-08	3.997E-08	2.921E-08	1.859E-08	1.350E-08
E	891	9.205E-08	8.055E-08	7.140E-08	6.405E-08	4.178E-08	3.063E-08	1.956E-08	1.424E-08
ESE	1530	1.308E-07	1.139E-07	1.006E-07	9.000E-08	5.825E-08	4.251E-08	2.699E-08	1.961E-08
SE	858	8.268E-08	7.214E-08	6.379E-08	5.712E-08	3.706E-08	2.707E-08	1.720E-08	1.249E-08
SSE	334	4.401E-08	3.850E-08	3.410E-08	3.055E-08	1.979E-08	1.439E-08	9.047E-09	6.514E-09
S	328	4.189E-08	3.626E-08	3.182E-08	2.830E-08	1.792E-08	1.284E-08	7.912E-09	5.630E-09
SSW	221	3.369E-08	2.926E-08	2.575E-08	2.295E-08	1.463E-08	1.053E-08	6.533E-09	4.663E-09
SW	348	4.673E-08	4.150E-08	3.579E-08	3.138E-08	1.898E-08	1.324E-08	7.902E-09	5.509E-09
WSW	316	6.441E-08	5.452E-08	4.696E-08	4.320E-08	2.581E-08	1.795E-08	1.072E-08	7.477E-09
W	385	6.319E-08	5.370E-08	5.027E-08	4.433E-08	2.642E-08	1.833E-08	1.093E-08	7.596E-09
WNW	351	5.155E-08	4.342E-08	3.723E-08	3.248E-08	1.927E-08	1.328E-08	7.792E-09	5.359E-09
NW	411	5.945E-08	5.058E-08	4.374E-08	3.843E-08	2.335E-08	1.634E-08	9.807E-09	6.841E-09
NNW	309	4.248E-08	3.662E-08	3.339E-08	3.066E-08	1.889E-08	1.334E-08	8.084E-09	5.678E-09
AVERAGE	8626	6.418E-08	5.569E-08	4.921E-08	4.401E-08	2.769E-08	1.984E-08	1.229E-08	8.773E-09

TABLE 5.2-2
(Sheet 8 of 8)

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 25.00	30.00	35.00	40.00	45.00	50.00
N	386	5.761E-09	4.635E-09	3.855E-09	3.283E-09	2.855E-09	2.515E-09
NNE	525	6.473E-09	5.225E-09	4.357E-09	3.720E-09	3.241E-09	2.861E-09
NE	670	7.179E-09	5.831E-09	4.888E-09	4.194E-09	3.667E-09	3.249E-09
ENE	763	1.052E-08	8.598E-09	7.244E-09	6.242E-09	5.480E-09	4.871E-09
E	891	1.113E-08	9.103E-09	7.679E-09	6.623E-09	5.820E-09	5.178E-09
ESE	1530	1.530E-08	1.251E-08	1.055E-08	9.100E-09	7.994E-09	7.112E-09
SE	858	9.739E-09	7.959E-09	6.709E-09	5.783E-09	5.077E-09	4.515E-09
SSE	334	5.046E-09	4.101E-09	3.440E-09	2.952E-09	2.583E-09	2.289E-09
S	328	4.327E-09	3.497E-09	2.920E-09	2.495E-09	2.175E-09	1.921E-09
SSW	221	3.590E-09	2.904E-09	2.426E-09	2.075E-09	1.810E-09	1.600E-09
SW	348	4.133E-09	3.311E-09	2.744E-09	2.331E-09	2.021E-09	1.777E-09
WSW	316	5.542E-09	4.451E-09	3.696E-09	3.145E-09	2.730E-09	2.403E-09
W	385	5.489E-09	4.404E-09	3.655E-09	3.109E-09	2.700E-09	2.377E-09
WNW	351	3.685E-09	2.939E-09	2.427E-09	2.054E-09	1.776E-09	1.557E-09
NW	411	4.743E-09	3.814E-09	3.170E-09	2.699E-09	2.345E-09	2.065E-09
NNW	309	4.205E-09	3.381E-09	2.809E-09	2.392E-09	2.078E-09	1.830E-09
AVERAGE	8626	6.679E-09	5.417E-09	4.536E-09	3.887E-09	3.397E-09	3.008E-09

TABLE 5.2-3
(Sheet 1 of 8)

SEABROOK ANNUAL AVERAGE CHI/Q BEFORE DEPLETING (SEC/M^3)
TURBINE BUILDING RELEASE

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) .25	.50	.75	1.00	1.50	2.00	2.50	3.00
N	384	6.017E-06	2.016E-06	1.092E-06	7.135E-07	3.867E-07	2.544E-07	1.842E-07	1.420E-07
NNE	522	7.057E-06	2.335E-06	1.256E-06	8.240E-07	4.489E-07	2.954E-07	2.140E-07	1.652E-07
NE	667	8.983E-06	2.907E-06	1.544E-06	1.009E-06	5.500E-07	3.650E-07	2.662E-07	2.065E-07
ENE	761	1.409E-05	4.436E-06	2.334E-06	1.512E-06	8.204E-07	5.523E-07	4.074E-07	3.184E-07
E	882	1.563E-05	4.914E-06	2.577E-06	1.672E-06	9.085E-07	6.106E-07	4.499E-07	3.513E-07
ESE	1521	2.208E-05	6.935E-06	3.607E-06	2.324E-06	1.255E-06	8.448E-07	6.233E-07	4.865E-07
SE	850	1.383E-05	4.381E-06	2.282E-06	1.472E-06	7.943E-07	5.328E-07	3.919E-07	3.052E-07
SSE	331	7.012E-06	2.262E-06	1.189E-06	7.678E-07	4.136E-07	2.761E-07	2.023E-07	1.570E-07
S	328	5.119E-06	1.704E-06	9.041E-07	5.865E-07	3.158E-07	2.079E-07	1.507E-07	1.160E-07
SSW	218	4.299E-06	1.419E-06	7.519E-07	4.842E-07	2.592E-07	1.719E-07	1.253E-07	9.681E-08
SW	345	4.155E-06	1.378E-06	7.263E-07	4.719E-07	2.547E-07	1.678E-07	1.216E-07	9.365E-08
WSW	318	5.191E-06	1.692E-06	8.893E-07	5.776E-07	3.129E-07	2.080E-07	1.518E-07	1.175E-07
W	388	5.192E-06	1.722E-06	9.171E-07	5.905E-07	3.166E-07	2.100E-07	1.530E-07	1.183E-07
WNW	350	3.670E-06	1.247E-06	6.668E-07	4.355E-07	2.358E-07	1.543E-07	1.111E-07	8.520E-08
NW	411	4.616E-06	1.527E-06	8.125E-07	5.309E-07	2.892E-07	1.915E-07	1.394E-07	1.078E-07
NNW	308	4.318E-06	1.459E-06	7.870E-07	5.135E-07	2.777E-07	1.823E-07	1.318E-07	1.014E-07
AVERAGE	8584	8.204E-06	2.646E-06	1.396E-06	9.053E-07	4.899E-07	3.266E-07	2.390E-07	1.856E-07

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 3.50	4.00	4.50	5.00	7.50	10.00	15.01	20.00
N	384	1.140E-07	9.433E-08	7.970E-08	6.872E-08	3.940E-08	2.672E-08	1.549E-08	1.061E-08
NNE	522	1.327E-07	1.100E-07	9.302E-08	8.026E-08	4.617E-08	3.139E-08	1.825E-08	1.252E-08
NE	667	1.665E-07	1.384E-07	1.175E-07	1.016E-07	5.902E-08	4.039E-08	2.374E-08	1.639E-08
ENE	761	2.582E-07	2.158E-07	1.840E-07	1.598E-07	9.383E-08	6.481E-08	3.871E-08	2.695E-08
E	882	2.849E-07	2.380E-07	2.028E-07	1.762E-07	1.034E-07	7.142E-08	4.262E-08	2.966E-08
ESE	1521	3.945E-07	3.296E-07	2.812E-07	2.445E-07	1.438E-07	9.936E-08	5.936E-08	4.136E-08
SE	850	2.470E-07	2.061E-07	1.756E-07	1.525E-07	8.945E-08	6.165E-08	3.666E-08	2.548E-08
SSE	331	1.267E-07	1.055E-07	8.970E-08	7.776E-08	4.533E-08	3.110E-08	1.836E-08	1.272E-08
S	328	9.302E-08	7.703E-08	6.517E-08	5.626E-08	3.241E-08	2.201E-08	1.276E-08	8.748E-09
SSW	218	7.786E-08	6.462E-08	5.480E-08	4.739E-08	2.743E-08	1.870E-08	1.093E-08	7.528E-09
SW	345	7.512E-08	6.223E-08	5.269E-08	4.550E-08	2.626E-08	1.784E-08	1.034E-08	7.089E-09
WSW	318	9.470E-08	7.871E-08	6.685E-08	5.787E-08	3.361E-08	2.295E-08	1.342E-08	9.237E-09
W	388	9.511E-08	7.892E-08	6.689E-08	5.780E-08	3.329E-08	2.260E-08	1.312E-08	8.998E-09
WNW	350	6.808E-08	5.619E-08	4.740E-08	4.080E-08	2.325E-08	1.562E-08	8.888E-09	6.024E-09
NW	411	8.674E-08	7.201E-08	6.106E-08	5.276E-08	3.041E-08	2.064E-08	1.194E-08	8.167E-09
NNW	308	8.125E-08	6.719E-08	5.674E-08	4.889E-08	2.798E-08	1.891E-08	1.089E-08	7.433E-09
AVERAGE	8584	1.498E-07	1.247E-07	1.059E-07	9.179E-08	5.344E-08	3.663E-08	2.159E-08	1.493E-08

TABLE 5.2-3
(Sheet 2 of 8)

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 25.00	30.00	35.00	40.00	45.00	50.00
N	384	7.954E-09	6.331E-09	5.219E-09	4.412E-09	3.811E-09	3.339E-09
NNE	522	9.397E-09	7.485E-09	6.172E-09	5.219E-09	4.507E-09	3.948E-09
NE	667	1.236E-08	9.881E-09	8.174E-09	6.931E-09	5.998E-09	5.264E-09
ENE	761	2.046E-08	1.645E-08	1.367E-08	1.165E-08	1.012E-08	8.910E-09
E	882	2.251E-08	1.810E-08	1.504E-08	1.280E-08	1.111E-08	9.786E-09
ESE	1521	3.142E-08	2.528E-08	2.103E-08	1.792E-08	1.557E-08	1.371E-08
SE	850	1.933E-08	1.553E-08	1.290E-08	1.098E-08	9.531E-09	8.389E-09
SSE	331	9.619E-09	7.712E-09	6.396E-09	5.436E-09	4.713E-09	4.144E-09
S	328	6.568E-09	5.234E-09	4.317E-09	3.652E-09	3.154E-09	2.763E-09
SSW	218	5.672E-09	4.533E-09	3.750E-09	3.181E-09	2.754E-09	2.419E-09
SW	345	5.302E-09	4.227E-09	3.487E-09	2.950E-09	2.547E-09	2.231E-09
WSW	318	6.894E-09	5.516E-09	4.565E-09	3.873E-09	3.352E-09	2.943E-09
W	388	6.604E-09	5.282E-09	4.373E-09	3.713E-09	3.218E-09	2.829E-09
WNW	350	4.342E-09	3.447E-09	2.834E-09	2.391E-09	2.060E-09	1.801E-09
NW	411	5.935E-09	4.739E-09	3.917E-09	3.319E-09	2.870E-09	2.518E-09
NNW	308	5.515E-09	4.384E-09	3.609E-09	3.049E-09	2.631E-09	2.303E-09
AVERAGE	8584	1.124E-08	9.008E-09	7.466E-09	6.342E-09	5.496E-09	4.831E-09

TABLE 5.2-3
(Sheet 3 of 8)
Seabrook Annual Average Chi/Q After Depletion (sec/m^3)
Turbine Building Release

1

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) .25	.50	.75	1.00	1.50	2.00	2.50	3.00
N	384	5.572E-06	1.834E-06	9.800E-07	6.326E-07	3.353E-07	2.159E-07	1.534E-07	1.162E-07
NNE	522	6.543E-06	2.126E-06	1.128E-06	7.306E-07	3.890E-07	2.506E-07	1.782E-07	1.352E-07
NE	667	8.251E-06	2.617E-06	1.369E-06	8.836E-07	4.700E-07	3.048E-07	2.177E-07	1.657E-07
ENE	761	1.275E-05	3.916E-06	2.028E-06	1.295E-06	6.853E-07	4.496E-07	3.239E-07	2.477E-07
E	882	1.416E-05	4.348E-06	2.244E-06	1.436E-06	7.604E-07	4.981E-07	3.586E-07	2.741E-07
ESE	1521	1.995E-05	6.118E-06	3.129E-06	1.988E-06	1.046E-06	6.858E-07	4.940E-07	3.772E-07
SE	850	1.254E-05	3.864E-06	1.991E-06	1.266E-06	6.661E-07	4.355E-07	3.129E-07	2.385E-07
SSE	331	6.384E-06	2.016E-06	1.044E-06	6.650E-07	3.496E-07	2.277E-07	1.630E-07	1.239E-07
S	328	4.731E-06	1.547E-06	8.095E-07	5.185E-07	2.728E-07	1.758E-07	1.248E-07	9.440E-08
SSW	218	3.942E-06	1.276E-06	6.668E-07	4.239E-07	2.218E-07	1.437E-07	1.025E-07	7.769E-08
SW	345	3.843E-06	1.251E-06	6.507E-07	4.174E-07	2.202E-07	1.420E-07	1.009E-07	7.631E-08
WSW	318	4.767E-06	1.523E-06	7.895E-07	5.063E-07	2.681E-07	1.742E-07	1.246E-07	9.467E-08
W	388	4.787E-06	1.559E-06	8.193E-07	5.215E-07	2.758E-07	1.778E-07	1.271E-07	9.657E-08
WNW	350	3.442E-06	1.151E-06	6.080E-07	3.925E-07	2.084E-07	1.340E-07	9.500E-08	7.179E-08
NW	411	4.283E-06	1.392E-06	7.311E-07	4.722E-07	2.520E-07	1.636E-07	1.170E-07	8.909E-08
NNW	308	4.014E-06	1.333E-06	7.099E-07	4.576E-07	2.422E-07	1.559E-07	1.107E-07	8.374E-08
AVERAGE	8584	7.498E-06	2.368E-06	1.231E-06	7.879E-07	4.163E-07	2.709E-07	1.940E-07	1.477E-07

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 3.50	4.00	4.50	5.00	7.50	10.00	15.01	20.00
N	384	9.174E-08	7.478E-08	6.223E-08	5.289E-08	2.842E-08	1.818E-08	9.475E-09	5.913E-09
NNE	522	1.069E-07	8.719E-08	7.264E-08	6.179E-08	3.333E-08	2.138E-08	1.119E-08	7.004E-09
NE	667	1.312E-07	1.072E-07	8.949E-08	7.623E-08	4.118E-08	2.640E-08	1.378E-08	8.563E-09
ENE	761	1.969E-07	1.613E-07	1.349E-07	1.151E-07	6.218E-08	3.982E-08	2.070E-08	1.273E-08
E	882	2.178E-07	1.785E-07	1.493E-07	1.274E-07	6.886E-08	4.413E-08	2.296E-08	1.415E-08
ESE	1521	2.995E-07	2.454E-07	2.053E-07	1.752E-07	9.465E-08	6.054E-08	3.136E-08	1.925E-08
SE	850	1.891E-07	1.548E-07	1.294E-07	1.104E-07	5.964E-08	3.813E-08	1.975E-08	1.215E-08
SSE	331	9.810E-08	8.016E-08	6.692E-08	5.701E-08	3.071E-08	1.960E-08	1.013E-08	6.241E-09
S	328	7.442E-08	6.063E-08	5.050E-08	4.295E-08	2.313E-08	1.477E-08	7.655E-09	4.763E-09
SSW	218	6.135E-08	5.005E-08	4.173E-08	3.551E-08	1.911E-08	1.220E-08	6.309E-09	3.908E-09
SW	345	6.019E-08	4.907E-08	4.091E-08	3.481E-08	1.880E-08	1.202E-08	6.231E-09	3.881E-09
WSW	318	7.493E-08	6.125E-08	5.118E-08	4.362E-08	2.360E-08	1.510E-08	7.838E-09	4.863E-09
W	388	7.640E-08	6.242E-08	5.211E-08	4.438E-08	2.394E-08	1.531E-08	7.968E-09	4.966E-09
WNW	350	5.660E-08	4.614E-08	3.845E-08	3.271E-08	1.768E-08	1.133E-08	5.918E-09	3.725E-09
NW	411	7.063E-08	5.783E-08	4.837E-08	4.124E-08	2.239E-08	1.439E-08	7.540E-09	4.729E-09
NNW	308	6.606E-08	5.384E-08	4.482E-08	3.810E-08	2.052E-08	1.313E-08	6.839E-09	4.277E-09
AVERAGE	8584	1.170E-07	9.566E-08	7.990E-08	6.808E-08	3.676E-08	2.353E-08	1.223E-08	7.570E-09

TABLE 5.2-3
(Sheet 4 of 8)

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 25.00	30.00	35.00	40.00	45.00	50.00
N	384	4.073E-09	2.995E-09	2.291E-09	1.806E-09	1.461E-09	1.202E-09
NNE	522	4.835E-09	3.561E-09	2.728E-09	2.152E-09	1.742E-09	1.435E-09
NE	667	5.867E-09	4.289E-09	3.261E-09	2.554E-09	2.053E-09	1.679E-09
ENE	761	8.624E-09	6.229E-09	4.681E-09	3.624E-09	2.880E-09	2.330E-09
E	882	9.600E-09	6.946E-09	5.228E-09	4.054E-09	3.225E-09	2.613E-09
ESE	1521	1.302E-08	9.397E-09	7.054E-09	5.458E-09	4.333E-09	3.505E-09
SE	850	8.242E-09	5.964E-09	4.491E-09	3.485E-09	2.775E-09	2.252E-09
SSE	331	4.241E-09	3.076E-09	2.322E-09	1.807E-09	1.443E-09	1.173E-09
S	328	3.273E-09	2.402E-09	1.834E-09	1.444E-09	1.166E-09	9.591E-10
SSW	218	2.673E-09	1.952E-09	1.485E-09	1.164E-09	9.375E-10	7.686E-10
SW	345	2.652E-09	1.949E-09	1.491E-09	1.175E-09	9.503E-10	7.826E-10
WSW	318	3.260E-09	2.387E-09	1.819E-09	1.428E-09	1.151E-09	9.447E-10
W	388	3.260E-09	2.405E-09	1.848E-09	1.464E-09	1.190E-09	9.856E-10
WNW	350	2.460E-09	1.834E-09	1.424E-09	1.138E-09	9.334E-10	7.789E-10
NW	411	3.089E-09	2.292E-09	1.769E-09	1.407E-09	1.148E-09	9.539E-10
NNW	308	2.912E-09	2.149E-09	1.650E-09	1.306E-09	1.060E-09	8.760E-10
AVERAGE	8584	5.130E-09	3.739E-09	2.836E-09	2.217E-09	1.778E-09	1.452E-09

TABLE 5.2-3
(Sheet 5 of 8)
Seabrook Annual Average Depletion Rates ($1/m^3$)
Turbine Building Release

DOWNWIND SECTOR	NO. OBS	.25	.50	.75	1.00	1.50	2.00	2.50	3.00
		DISTANCE FROM RELEASE POINT (MILES)							
N	384	1.308E-08	4.485E-09	2.427E-09	1.565E-09	8.249E-10	5.261E-10	3.709E-10	2.795E-10
NNE	522	1.678E-08	5.700E-09	3.068E-09	1.983E-09	1.048E-09	6.676E-10	4.708E-10	3.550E-10
NE	667	2.275E-08	7.582E-09	4.051E-09	2.609E-09	1.376E-09	8.810E-10	6.237E-10	4.717E-10
ENE	761	3.037E-08	9.724E-09	5.144E-09	3.308E-09	1.752E-09	1.134E-09	8.100E-10	6.165E-10
E	882	3.352E-08	1.074E-08	5.640E-09	3.617E-09	1.908E-09	1.233E-09	8.797E-10	6.688E-10
ESE	1521	5.637E-08	1.806E-08	9.393E-09	5.980E-09	3.132E-09	2.024E-09	1.443E-09	1.095E-09
SE	850	3.033E-08	9.841E-09	5.126E-09	3.261E-09	1.704E-09	1.098E-09	7.811E-10	5.914E-10
SSE	331	1.166E-08	3.882E-09	2.051E-09	1.313E-09	6.889E-10	4.420E-10	3.131E-10	2.363E-10
S	328	1.015E-08	3.513E-09	1.866E-09	1.189E-09	6.185E-10	3.929E-10	2.763E-10	2.071E-10
SSW	218	6.791E-09	2.314E-09	1.222E-09	7.767E-10	4.035E-10	2.577E-10	1.819E-10	1.367E-10
SW	345	9.484E-09	3.253E-09	1.705E-09	1.082E-09	5.609E-10	3.562E-10	2.506E-10	1.878E-10
WSW	318	9.269E-09	3.117E-09	1.646E-09	1.056E-09	5.571E-10	3.585E-10	2.547E-10	1.927E-10
W	388	1.061E-08	3.630E-09	1.938E-09	1.243E-09	6.561E-10	4.222E-10	2.999E-10	2.268E-10
WNW	350	9.063E-09	3.133E-09	1.672E-09	1.075E-09	5.681E-10	3.636E-10	2.572E-10	1.939E-10
NW	411	1.084E-08	3.619E-09	1.925E-09	1.248E-09	6.701E-10	4.349E-10	3.114E-10	2.375E-10
NNW	308	9.615E-09	3.296E-09	1.769E-09	1.138E-09	6.000E-10	3.837E-10	2.711E-10	2.045E-10
AVERAGE	8584	1.817E-08	5.993E-09	3.165E-09	2.028E-09	1.067E-09	6.860E-10	4.872E-10	3.669E-10

DOWNWIND SECTOR	NO. OBS	3.50	4.00	4.50	5.00	7.50	10.00	15.01	20.00
		DISTANCE FROM RELEASE POINT (MILES)							
N	384	2.196E-10	1.784E-10	1.480E-10	1.255E-10	6.725E-11	4.295E-11	2.241E-11	1.411E-11
NNE	522	2.793E-10	2.271E-10	1.886E-10	1.601E-10	8.611E-11	5.521E-11	2.901E-11	1.838E-11
NE	667	3.718E-10	3.028E-10	2.519E-10	2.140E-10	1.152E-10	7.389E-11	3.880E-11	2.447E-11
ENE	761	4.882E-10	3.990E-10	3.328E-10	2.833E-10	1.528E-10	9.809E-11	5.142E-11	3.211E-11
E	882	5.292E-10	4.324E-10	3.606E-10	3.070E-10	1.658E-10	1.064E-10	5.582E-11	3.494E-11
ESE	1521	8.660E-10	7.071E-10	5.899E-10	5.023E-10	2.712E-10	1.738E-10	9.083E-11	5.677E-11
SE	850	4.667E-10	3.806E-10	3.173E-10	2.700E-10	1.456E-10	9.324E-11	4.863E-11	3.043E-11
SSE	331	1.860E-10	1.514E-10	1.259E-10	1.070E-10	5.754E-11	3.675E-11	1.911E-11	1.196E-11
S	328	1.623E-10	1.316E-10	1.092E-10	9.262E-11	4.970E-11	3.169E-11	1.644E-11	1.037E-11
SSW	218	1.073E-10	8.716E-11	7.244E-11	6.150E-11	3.307E-11	2.110E-11	1.095E-11	6.891E-12
SW	345	1.472E-10	1.195E-10	9.936E-11	8.436E-11	4.548E-11	2.909E-11	1.519E-11	9.662E-12
WSW	318	1.521E-10	1.241E-10	1.035E-10	8.814E-11	4.774E-11	3.063E-11	1.604E-11	1.014E-11
W	388	1.789E-10	1.459E-10	1.217E-10	1.036E-10	5.602E-11	3.592E-11	1.883E-11	1.193E-11
WNW	350	1.527E-10	1.243E-10	1.036E-10	8.807E-11	4.766E-11	3.059E-11	1.608E-11	1.025E-11
NW	411	1.886E-10	1.547E-10	1.297E-10	1.107E-10	6.039E-11	3.899E-11	2.064E-11	1.312E-11
NNW	308	1.609E-10	1.310E-10	1.089E-10	9.248E-11	4.979E-11	3.187E-11	1.666E-11	1.052E-11
AVERAGE	8584	2.911E-10	2.373E-10	1.977E-10	1.682E-10	9.071E-11	5.814E-11	3.043E-11	1.913E-11

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TABLE 5.2-3
(Sheet 6 of 8)

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 25.00	30.00	35.00	40.00	45.00	50.00
N	384	9.821E-12	7.299E-12	5.646E-12	4.498E-12	3.678E-12	3.057E-12
NNE	522	1.286E-11	9.607E-12	7.464E-12	5.972E-12	4.901E-12	4.088E-12
NE	667	1.704E-11	1.267E-11	9.795E-12	7.801E-12	6.375E-12	5.297E-12
ENE	761	2.211E-11	1.624E-11	1.242E-11	9.775E-12	7.899E-12	6.493E-12
E	882	2.413E-11	1.777E-11	1.362E-11	1.075E-11	8.712E-12	7.183E-12
ESE	1521	3.915E-11	2.882E-11	2.208E-11	1.744E-11	1.413E-11	1.166E-11
SE	850	2.103E-11	1.551E-11	1.191E-11	9.429E-12	7.659E-12	6.334E-12
SSE	331	8.272E-12	6.111E-12	4.700E-12	3.725E-12	3.030E-12	2.508E-12
S	328	7.236E-12	5.398E-12	4.193E-12	3.356E-12	2.756E-12	2.303E-12
SSW	218	4.797E-12	3.569E-12	2.766E-12	2.209E-12	1.811E-12	1.511E-12
SW	345	6.680E-12	5.028E-12	3.940E-12	3.181E-12	2.634E-12	2.219E-12
WSW	318	6.703E-12	5.021E-12	3.914E-12	3.144E-12	2.591E-12	2.172E-12
W	388	7.582E-12	5.722E-12	4.495E-12	3.637E-12	3.018E-12	2.547E-12
WNW	350	6.550E-12	4.972E-12	3.927E-12	3.193E-12	2.662E-12	2.256E-12
NW	411	8.215E-12	6.205E-12	4.875E-12	3.944E-12	3.272E-12	2.761E-12
NNW	308	7.110E-12	5.310E-12	4.128E-12	3.306E-12	2.716E-12	2.270E-12
AVERAGE	8584	1.308E-11	9.703E-12	7.492E-12	5.960E-12	4.865E-12	4.041E-12

TABLE 5.2-3
(Sheet 7 of 8)

Seabrook Annual Average Effective Gamma Chi/Q (sec/m^3)
Turbine Building Release

DOWNWIND SECTOR	NO. OBS	.25	.50	.75	1.00	1.50	2.00	2.50	3.00
		DISTANCE FROM RELEASE POINT (MILES)							
N	384	1.949E-06	8.501E-07	5.214E-07	3.676E-07	2.210E-07	1.539E-07	1.159E-07	9.201E-08
NNE	522	2.304E-06	9.921E-07	6.031E-07	4.244E-07	2.549E-07	1.774E-07	1.338E-07	1.063E-07
NE	667	2.733E-06	1.175E-06	7.131E-07	5.022E-07	3.024E-07	2.115E-07	1.602E-07	1.278E-07
ENE	761	3.805E-06	1.638E-06	9.996E-07	7.062E-07	4.283E-07	3.026E-07	2.310E-07	1.854E-07
E	882	4.288E-06	1.839E-06	1.117E-06	7.876E-07	4.764E-07	3.359E-07	2.562E-07	2.055E-07
ESE	1521	6.014E-06	2.576E-06	1.557E-06	1.093E-06	6.580E-07	4.633E-07	3.530E-07	2.828E-07
SE	850	3.893E-06	1.668E-06	1.006E-06	7.054E-07	4.234E-07	2.971E-07	2.258E-07	1.805E-07
SSE	331	2.030E-06	8.787E-07	5.337E-07	3.749E-07	2.251E-07	1.576E-07	1.194E-07	9.516E-08
S	328	1.667E-06	7.208E-07	4.355E-07	3.043E-07	1.811E-07	1.255E-07	9.439E-08	7.474E-08
SSW	218	1.342E-06	5.783E-07	3.497E-07	2.447E-07	1.460E-07	1.017E-07	7.672E-08	6.090E-08
SW	345	1.376E-06	5.896E-07	3.541E-07	2.476E-07	1.474E-07	1.022E-07	7.687E-08	6.085E-08
WSW	318	1.648E-06	7.088E-07	4.288E-07	3.012E-07	1.808E-07	1.263E-07	9.551E-08	7.595E-08
W	388	1.752E-06	7.570E-07	4.610E-07	3.239E-07	1.943E-07	1.357E-07	1.025E-07	8.141E-08
WNW	350	1.377E-06	5.922E-07	3.586E-07	2.518E-07	1.507E-07	1.044E-07	7.839E-08	6.199E-08
NW	411	1.636E-06	7.023E-07	4.264E-07	3.004E-07	1.810E-07	1.264E-07	9.548E-08	7.589E-08
NNW	308	1.464E-06	6.373E-07	3.898E-07	2.741E-07	1.643E-07	1.142E-07	8.589E-08	6.805E-08
AVERAGE	8584	2.455E-06	1.056E-06	6.409E-07	4.506E-07	2.709E-07	1.897E-07	1.438E-07	1.147E-07

DOWNWIND SECTOR	NO. OBS	3.50	4.00	4.50	5.00	7.50	10.00	15.01	20.00
		DISTANCE FROM RELEASE POINT (MILES)							
N	384	7.555E-08	6.373E-08	5.471E-08	4.780E-08	2.861E-08	1.987E-08	1.183E-08	8.239E-09
NNE	522	8.743E-08	7.383E-08	6.346E-08	5.549E-08	3.334E-08	2.323E-08	1.389E-08	9.700E-09
NE	667	1.053E-07	8.920E-08	7.687E-08	6.738E-08	4.082E-08	2.862E-08	1.729E-08	1.215E-08
ENE	761	1.537E-07	1.308E-07	1.131E-07	9.954E-08	6.100E-08	4.319E-08	2.653E-08	1.883E-08
E	882	1.703E-07	1.448E-07	1.253E-07	1.102E-07	6.749E-08	4.777E-08	2.932E-08	2.080E-08
ESE	1521	2.341E-07	1.989E-07	1.721E-07	1.513E-07	9.267E-08	6.554E-08	4.016E-08	2.849E-08
SE	850	1.491E-07	1.265E-07	1.093E-07	9.601E-08	5.858E-08	4.130E-08	2.516E-08	1.779E-08
SSE	331	7.843E-08	6.639E-08	5.723E-08	5.018E-08	3.042E-08	2.133E-08	1.289E-08	9.068E-09
S	328	6.126E-08	5.162E-08	4.431E-08	3.871E-08	2.318E-08	1.608E-08	9.537E-09	6.635E-09
SSW	218	5.002E-08	4.222E-08	3.630E-08	3.175E-08	1.909E-08	1.329E-08	7.932E-09	5.540E-09
SW	345	4.988E-08	4.203E-08	3.608E-08	3.153E-08	1.889E-08	1.310E-08	7.765E-09	5.400E-09
WSW	318	6.248E-08	5.282E-08	4.547E-08	3.982E-08	2.402E-08	1.676E-08	1.002E-08	6.999E-09
W	388	6.693E-08	5.653E-08	4.862E-08	4.253E-08	2.548E-08	1.767E-08	1.049E-08	7.277E-09
WNW	350	5.077E-08	4.275E-08	3.667E-08	3.200E-08	1.901E-08	1.309E-08	7.659E-09	5.263E-09
NW	411	6.239E-08	5.269E-08	4.530E-08	3.962E-08	2.376E-08	1.648E-08	9.763E-09	6.767E-09
NNW	308	5.580E-08	4.701E-08	4.033E-08	3.521E-08	2.102E-08	1.455E-08	8.605E-09	5.965E-09
AVERAGE	8584	9.459E-08	8.011E-08	6.907E-08	6.057E-08	3.671E-08	2.574E-08	1.555E-08	1.093E-08

TABLE 5.2-3
(Sheet 8 of 8)

DOWNWIND SECTOR	NO. OBS	DISTANCE FROM RELEASE POINT (MILES) 25.00	30.00	35.00	40.00	45.00	50.00
N	384	6.244E-09	5.003E-09	4.147E-09	3.523E-09	3.056E-09	2.687E-09
NNE	522	7.365E-09	5.910E-09	4.904E-09	4.169E-09	3.618E-09	3.183E-09
NE	667	9.273E-09	7.470E-09	6.218E-09	5.302E-09	4.611E-09	4.065E-09
ENE	761	1.447E-08	1.172E-08	9.804E-09	8.396E-09	7.329E-09	6.484E-09
E	882	1.598E-08	1.294E-08	1.082E-08	9.267E-09	8.088E-09	7.154E-09
ESE	1521	2.189E-08	1.774E-08	1.484E-08	1.271E-08	1.110E-08	9.817E-09
SE	850	1.364E-08	1.103E-08	9.218E-09	7.885E-09	6.875E-09	6.077E-09
SSE	331	6.927E-09	5.587E-09	4.656E-09	3.975E-09	3.461E-09	3.054E-09
S	328	5.027E-09	4.028E-09	3.338E-09	2.836E-09	2.458E-09	2.161E-09
SSW	218	4.210E-09	3.381E-09	2.808E-09	2.390E-09	2.076E-09	1.828E-09
SW	345	4.040E-09	3.238E-09	2.684E-09	2.280E-09	1.976E-09	1.737E-09
WSW	318	5.088E-09	4.094E-09	3.405E-09	2.902E-09	2.521E-09	2.222E-09
W	388	4.935E-09	3.963E-09	3.292E-09	2.803E-09	2.435E-09	2.146E-09
WNW	350	3.488E-09	2.784E-09	2.299E-09	1.947E-09	1.683E-09	1.476E-09
NW	411	4.544E-09	3.649E-09	3.029E-09	2.577E-09	2.237E-09	1.969E-09
NNW	308	4.368E-09	3.493E-09	2.890E-09	2.452E-09	2.124E-09	1.865E-09
AVERAGE	8584	8.219E-09	6.627E-09	5.522E-09	4.713E-09	4.103E-09	3.620E-09

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TABLE 5.2-4

ANNUAL AVERAGE PRIMARY VENT STACK DILUTION FACTORS AND DEPOSITION RATES FOR SELECTED MAXIMUM RECEPTOR LOCATIONS

Receptor	Downwind Sector	Distance (meters)	X/Q (undepleted sec/m^3)	X/Q (depleted sec/m^3)	Gamma X/Q (sec/m^3)	D/Q (1/m^2)
Nearest Residence and Vegetable Garden	ESE	2398	2.08E-07[1]	2.00E-07	3.03E-07	1.11E-09
Milk Cow	NNE	3862	8.01E-08	7.80E-08	8.24E-08	2.90E-10
Milk Goat	NW	3862	8.10E-08	7.92E-08	7.67E-08	2.64E-10
Meat Animal	W	3219	1.02E-07	9.97E-08	9.74E-08	3.32E-10
Site Boundary	ESE	914	3.90E-07	3.68E-07	7.55E-07	2.52E-09
The "Rocks" (Recreational Site)	ENE	318	6.98E-07	6.63E-07	1.24E-06	3.36E-09

(1) 2.08E-07 = 2.08×10^{-7}

TABLE 5.2-5

ANNUAL AVERAGE TURBINE BUILDING DILUTION FACTORS AND DEPOSITION RATES FOR SELECTED MAXIMUM RECEPTOR LOCATIONS

Receptor	Downwind Sector	Distance (meters)	X/Q (undepleted sec/m^3)	X/Q (depleted sec/m^3)	Gamma X/Q (sec/m^3)	D/Q ($1/m^2$)
Nearest Resident and Vegetable Garden	ESE	2398	1.27E-06(1)	1.06E-06	6.64E-07	3.17E-09
Milk Cow	NNE	3862	2.27E-07	1.90E-07	1.41E-07	5.02E-10
Milk Goat	NW	3862	1.48E-07	1.25E-07	1.01E-07	3.31E-10
Meat Animal	W	3219	2.10E-07	1.78E-07	1.36E-07	4.22E-10
Site Boundary	ESE	914	5.65E-06	4.96E-06	2.20E-06	1.47E-08
The "Rocks" (Recreational Site)	ENE	318	2.14E-05	1.95E-05	5.08E-06	4.62E-08

(1) 1.27E-06 = 1.27×10^{-6}

TABLE 5.2-6
(Sheet 1 of 2)

ASSUMPTIONS USED FOR BIOTA DOSE ESTIMATES [1]

Fish	Ua = 0 Us = 4383 hr/yr Ui = 8766 hr/yr Uws = 0 Effective radius = 2 cm
Crustacea	Ua = 0 Us = 4383 hr/yr Ui = 8766 hr/yr Uws = 0 Effective radius = 2 cm
Mollusks	Ua = 0 Us = 8766 hr/yr Ui = 0 Uws = 8766 hr/yr Effective radius = 2 cm
Water Plants	Ua = 0 Us = 8766 hr/yr Ui = 8766 hr/yr Uws = 0 Effective radius = 2 cm
Muskrat	Ua = 2922 hr/yr Us = 2922 hr/yr Ui = 2922 hr/yr Uws = 0 Effective radius = 7 cm Body mass = 1 kg Consumes 100 g/d water plants
Raccoon	Ua = 8766 hr/yr Us = 2192 hr/yr Ui = 0 Uws = 0 Effective radius = 10 cm Body mass = 12 kg Consumes 100 g/d crustacea and 100 g/d mollusks

TABLE 5.2-6
(Sheet 2 of 2)

Heron	Ua = 8766 hr/yr Us = 2922 hr/yr Ui = 0 Uws = 2922 hr/yr Effective radius = 10 cm Body mass = 4.6 kg Consumes 600 g/d fish
Duck	Ua = 8766 hr/yr Us = 4383 hr/yr Ui = 0 Uws = 4383 hr/yr Effective radius = 5 cm Body mass = 1 kg Consumes 100 g/d water plants

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[1] Ua = usage factor for exposure via air submersion

Us = usage factor for exposure via direct irradiation from sediment

Ui = usage factor for exposure via immersion in 12.5% effluent cooling water

Uws = usage factor for exposure via water surface of 12.5% effluent cooling water

TABLE 5.2-7

BIOACCUMULATION FACTORS

Salt Water

(pCi/kg per pCi/liter)

Element	Fish	Crustacea	Mollusks	Algae
H	1	1	1	1
Na	1	1	1	1
P	10000	10000	10000	100000
Cr	100	1000	1000	1000
Mn	3000	10000	50000	10000
Fe	1000	4000	20000	6000
Co	100	10000	300	100
Ni	500	100	100	100
Rb	30	50	10	10
Sr	1	1	1	20
Y	30	100	100	300
Zr	30	100	100	1000
Nb	100	200	200	100
Mo	10	100	100	100
Tc	10	100	100	1000
Ru	3	100	100	1000
Rh	10	100	100	100
Te	10	10	100	1000
I	20	100	100	10000
Cs	30	50	10	10
Ba	3	3	3	100
La	30	100	100	300
Ce	30	100	100	300
Pr	100	1000	1000	1000
Nd	100	1000	1000	1000
W	10	10	100	100
U	10	10	10	67
Np	10	10	10	6
Br	3	10	10	100

TABLE 5.2-8

EFFECTIVE ABSORBED ENERGY (MEV/DISINTEGRATION) AS A FUNCTION OF ORGANISM EFFECTIVE RADIUS

Nuclide	Effective Radius (cm) 1.4	2	3	5	7	10	20	30
H-3	.01	.01	.01	.01	.01	.01	.01	.01
C-14	.05	.05	.05	.05	.05	.05	.05	.05
Cr-51	.00222	.00276	.00363	.00529	.00685	.00901	.0149	.0191
Mn-54	.0364	.0514	.0758	.122	.166	.227	.392	.512
Fe-55	.00726	.00726	.00726	.00726	.00726	.00726	.00726	.00726
Fe-59	.171	.191	.224	.286	.346	.428	.655	.824
Co-58	.0728	.0905	.119	.174	.226	.297	.492	.633
Co-60	.195	.237	.306	.437	.560	.732	1.21	1.56
Br-83	.363	.363	.364	.364	.364	.365	.366	.367
Rb-86	.666	.668	.671	.676	.680	.687	.705	.719
Sr-89	.564	.564	.564	.564	.564	.564	.564	.564
Sr-90	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Mo-99	.419	.423	.430	.444	.457	.475	.524	.561
Tc-99m	.132	.134	.138	.144	.150	.158	.181	.199
Te-127m	.00197	.00197	.00197	.00198	.00199	.00200	.00203	.00205
Te-127	.223	.223	.223	.223	.223	.224	.224	.224
Te-129m	.599	.601	.605	.612	.619	.627	.651	.667
Te-129	.535	.538	.541	.548	.555	.563	.585	.601
Te-131m	.269	.291	.327	.396	.460	.550	.796	.978
Te-132	.121	.125	.131	.143	.154	.169	.211	.242
I-130	.388	.427	.490	.611	.724	.881	1.31	1.61
I-131	.206	.213	.224	.245	.266	.293	.368	.422
I-132	.581	.624	.693	.826	.950	1.12	1.59	1.94
I-133	.467	.478	.497	.533	.566	.613	.738	.829
I-134	.779	.838	.934	1.12	1.29	1.53	2.19	2.67
I-135	.481	.514	.566	.667	.761	.893	1.26	1.53
Cs-134	.230	.259	.306	.396	.480	.596	.913	1.14
Cs-136	.233	.273	.337	.458	.573	.732	1.17	1.49
Cs-137	.257	.267	.284	.316	.346	.388	.500	.582
Ba-140	.315	.320	.328	.343	.357	.376	.428	.465
La-140	.698	.734	.793	.907	1.01	1.16	1.58	1.89
Np-239	.212	.213	.216	.220	.225	.231	.248	.260

TABLE 5.2-9

EFFECTIVE HALF-LIFE (^{T}) AND RETENTION FRACTION (f_w)
FOR STANDARD MAN (whole body)

Nuclide	(day)	f_w
H-3	12	1.0
C-14	10	1.0
Cr-51	26.6	.005
Mn-54	5.6	0.1
Fe-55	463	0.1
Fe-59	42.7	0.1
Co-58	8.4	0.3
Co-60	9.5	0.3
Br-83	.099	1.0
Rb-86	13.2	1.0
Sr-89	50.3	0.3
Sr-90	5700	0.3
Mo-99	1.8	0.8
Tc-99m	0.2	0.5
Te-127m	13	0.25
Te-127	0.38	0.25
Te-129m	10	0.25
Te-129	0.051	0.25
Te-131m	1.15	0.25
Te-132	2.6	0.25
I-130	.511	1.0
I-131	7.6	1.0
I-132	0.097	1.0
I-133	0.87	1.0
I-134	0.036	1.0
I-135	0.28	1.0
Cs-134	65	1.0
Cs-136	11	1.0
Cs-137	70	1.0
Ba-140	10.7	0.05
La-140	1.68	$1x10^{-4}$
Np-239	2.33	$1x10^{-4}$

TABLE 5.2-10

BIOTA DOSE (mrem/yr per unit)

Internal Dose

Fish	3.1E-2
Crustacea	5.4E-2
Mollusks	4.7E-2
Plant	1.8
Muskrat	2.3
Raccoon	1.4E-2
Heron	8.6E-2
Duck	1.4

External Water Submersion, Water Surface, and Sediment Skin Dose

Fish	7.4E-2
Crustacea	7.4E-2
Mollusks	1.5E-1
Plant	1.5E-1
Muskrat	4.9E-2
Raccoon	3.6E-2
Heron	4.9E-2
Duck	7.3E-2

TABLE 5.2-11

RADIONUCLIDE BODY BURDEN OF PRIMARY ORGANISMS (pCi/kg)

Nuclide	bl Fish	bl Crust	bl Moll	bi Algae
H-3	139.04	139.04	139.04	139.04
I-130	$4.51x10^{-4}$	$2.25x10^{-3}$	$2.25x10^{-3}$	.225
I-131	.50	2.50	2.50	250
I-132	$1.47x10^{-2}$	$7.38x10^{-2}$	$7.38x10^{-2}$	7.38
I-133	.138	.688	.688	68.8
I-134	$3.75x10^{-4}$	$1.88x10^{-3}$	$1.88x10^{-3}$	.188
I-135	$2.21x10^{-2}$	.110	.110	11.0
Br-83	$2.28x10^{-5}$	$7.63x10^{-5}$	$7.63x10^{-5}$	$7.63x10^{-4}$
Rb-86	$1.16x10^{-4}$	$1.94x10^{-4}$	$3.88x10^{-5}$	$3.88x10^{-5}$
Sr-89	$5.76x10^{-6}$	$5.76x10^{-6}$	$5.76x10^{-6}$	$1.15x10^{-4}$
Mo-99	$4.01x10^{-3}$	$4.01x10^{-2}$	$4.01x10^{-2}$	$4.01x10^{-2}$
Tc-99m	$4.63x10^{-3}$	$4.63X10^{-2}$	$4.63x10^{-2}$	$4.63x10^{-1}$
Te-127m	$5.75x10^{-5}$	$5.75x10^{-5}$	$5.75x10^{-4}$	$5.75x10^{-3}$
Te-127	$5.76x10^{-5}$	$5.76x10^{-5}$	$5.76x10^{-4}$	$5.76x10^{-3}$
Te-129m	$2.25x10^{-4}$	$2.25x10^{-4}$	$2.25x10^{-3}$	$2.25x10^{-2}$
Te-129	$1.75x10^{-4}$	$1.75x10^{-4}$	$1.75x10^{-3}$	$1.75x10^{-2}$
Te-131m	$5.75x10^{-5}$	$5.75x10^{-5}$	$5.75x10^{-4}$	$5.75x10^{-3}$
Te-132	$1.38x10^{-3}$	$1.38x10^{-3}$	$1.38x10^{-2}$	.138
Cs-134	.113	.188	.038	.038
Cs-136	$1.54x10^{-2}$	$2.57x10^{-2}$	$5.13x10^{-3}$	$5.13x10^{-3}$
Cs-137	$7.89x10^{-2}$	$1.31x10^{-1}$	$2.62x10^{-2}$	$2.62x10^{-2}$
Ba-137m	---	---	---	---
Ba-140	$5.63x10^{-6}$	$5.63x10^{-6}$	$5.63x10^{-6}$	$1.87x10^{-4}$
La-140	$5.63x10^{-5}$	$1.88x10^{-4}$	$1.88x10^{-4}$	$5.63x10^{-4}$
Cr-51	$2.89x10^{-3}$	$2.89x10^{-2}$	$2.89x10^{-2}$	$2.89x10^{-2}$
Mn-54	$2.29x10^{-2}$	$7.64x10^{-2}$	.382	$7.64x10^{-2}$
Fe-55	$3.63x10^{-2}$	$1.45x10^{-1}$	$7.25x10^{-1}$	$2.18x10^{-1}$
Fe-59	$1.75x10^{-2}$	$7.0x10^{-2}$	$3.50x10^{-1}$	$1.05x10^{-1}$
Co-58	$3.0x10^{-2}$	3.00	$8.98x10^{-2}$	$3.0x10^{-2}$
Co-60	$4.38x10^{-3}$	$4.38x10^{-1}$	$1.31x10^{-2}$	$4.38x10^{-3}$
Np-239	$5.75x10^{-5}$	$5.75x10^{-5}$	$5.75x10^{-5}$	$3.46x10^{-5}$

TABLE 5.2-12

SHORELINE AND IMMERSION DOSE FACTORS
(mrem/hr per pCi/liter)

Element	Shoreline Skin	Shoreline Body	Immersion Skin	Immersion Body
H-3	0	0	0	0
Cr-51	2.6E-10	2.2E-10	6.4E-8	5.2E-8
Mn-54	6.8E-9	5.8E-9	1.8E-6	1.5E-6
Fe-55	0	0	3.6E-10	6.4E-11
Fe-59	9.4E-9	8.0E-9	2.6E-6	2.2E-6
Co-58	8.2E-9	7.0E-9	2.3E-6	1.8E-6
Co-60	2.0E-8	1.7E-8	5.4E-6	4.6E-6
Br-83	9.3E-11	6.4E-11	3.1E-7	1.7E-8
Rb-86	7.2E-10	6.3E-10	8.5E-7	1.7E-7
Sr-89	6.5E-13	5.6E-13	5.4E-7	4.6E-9
Mo-99	2.2E-9	1.9E-9	9.1E-7	4.7E-7
Tc-99m	1.1E-9	9.6E-10	2.7E-7	2.4E-7
Te-127m	1.3E-12	1.1E-12	1.8E-9	2.6E-10
Te-127	1.1E-11	1.0E-11	1.7E-7	2.8E-9
Te-129m	9.0E-10	7.7E-10	7.4E-7	2.1E-7
Te-129	8.4E-10	7.1E-10	7.0E-7	1.9E-7
Te-131m	9.9E-9	8.4E-9	2.7E-6	2.2E-6
Te-132	2.0E-9	1.7E-9	4.8E-7	4.0E-7
I-130	1.7E-8	1.4E-8	4.8E-6	3.9E-6
I-131	3.4E-9	2.8E-9	9.3E-7	6.8E-7
I-132	2.0E-8	1.7E-8	5.5E-6	4.4E-6
I-133	4.5E-9	3.7E-9	1.5E-6	9.6E-7
I-134	1.9E-8	1.6E-8	5.5E-6	4.2E-6
I-135	1.4E-8	1.2E-8	4.0E-6	3.3E-6
Cs-134	1.4E-8	1.2E-8	3.5E-6	2.9E-6
Cs-136	1.7E-8	1.5E-8	4.8E-6	4.1E-6
Cs-137	4.9E-9	4.2E-9	1.4E-6	1.0E-6
Ba-140	2.4E-9	2.1E-9	7.6E-7	4.9E-7
La-140	1.7E-8	1.5E-8	5.3E-6	4.1E-6
Np-239	1.1E-9	9.5E-10	3.7E-7	2.4E-7

TABLE 5.2-13
(Sheet 1 of 2)

ASSUMPTIONS USED IN ESTIMATING DOSES TO THE MAXIMUM INDIVIDUAL FROM THE LIQUID PATHWAY

Fish

Transit Time Before Consumption: 24 hours
Body Burden: based on 100% immersion in 12.5% effluent cooling water
Human Consumption Rates (kg/yr): Adult = 21.0
Teen = 16.0
Child = 6.9
Infant = 0.0

Invertebrate (Crustacea, Mollusks)

Transit Time Before Consumption: 24 hours
Body Burden: based on 100% immersion in 12.5% effluent cooling water
Human Consumption Rates (kg/yr): Adult = 5.0
Teen = 3.8
Child = 1.7
Infant = 0.0

Swimming

Transit Time: 0.0 hours
Dilution Factor: 12.5% effluent cooling water
Usage Factors (hr/yr): Adult = 8.0
Teen = 45.0
Child = 28.0
Infant = 0.0

Boating

Transit Time: 0.0 hours
Dilution Factor: 12.5% effluent cooling water
Usage Factors (hr/yr): Adult = 29.0
Teen = 52.0
Child = 52.0
Infant = 0.0

TABLE 5.2-13
(Sheet 2 of 2)

Shoreline Activities (Sunbathing, Picnicking, Clam Digging)

Transit Time: 0.0 hours
Shore Width Factor: .5
Sediment Concentration: based on 15 years exposure to 12.5% effluent cooling water
Usage Factors (hr/yr):

Adult	=	334.0
Teen	=	67.0
Child	=	14.0
Infant	=	0.0

TABLE 5.2-14

MAXIMUM INDIVIDUAL DOSE DUE TO LIQUID EFFLUENT

Pathway	Bone	Liver	Kidney	Lung	GI-LLI	Thyroid	Whole Body	Skin
Adult Dose (mrem/yr/unit)								
Fish	4.36E-04	1.11E-03	5.99E-04	3.75E-04	3.67E-04	1.02E-02	8.99E-04	--
Invertebrate	3.99E-04	3.97E-04	1.74E-03	8.85E-05	5.57E-03	1.20E-02	3.04E-04	--
Shoreline Activity	--	--	--	--	--	--	1.30E-03	1.51E-03
Swimming	--	--	--	--	--	--	3.78E-07	5.04E-07
Boating	--	--	--	--	--	--	1.89E-07	2.52E-07
Total	8.35E-04	1.51E-03	2.34E-03	4.64E-04	5.94E-03	2.22E-02	2.50E-03	1.51E-03
Teenager Dose (mrem/yr/unit)								
Fish	4.57E-04	1.06E-03	5.39E-04	3.24E-04	2.79E-04	9.50E-03	5.82E-04	--
Invertebrate	4.24E-04	3.92E-04	1.81E-03	7.51E-05	3.96E-03	1.12E-02	2.55E-04	--
Shoreline Activity	--	--	--	--	--	--	2.60E-04	3.03E-04
Swimming	--	--	--	--	--	--	2.13E-06	2.84E-06
Boating	--	--	--	--	--	--	1.07E-06	1.42E-06
Total	8.81E-04	1.45E-03	2.35E-03	3.99E-04	4.24E-03	2.07E-02	1.10×10^{-3}	3.07E-04
Child Dose (mrem/yr/unit)								
Fish	5.63E-04	9.09E-04	4.51E-04	2.63E-04	2.04E-04	9.81E-03	3.38E-04	--
Invertebrate	5.55E-04	3.59E-04	1.63E-03	6.34E-05	1.29E-03	1.21E-02	2.42E-04	--
Shoreline Activity	--	--	--	--	--	--	5.43E-05	6.34E-05
Swimming	--	--	--	--	--	--	1.32E-06	1.76E-06
Boating	--	--	--	--	--	--	6.60E-07	8.80E-07
Total	1.12E-03	1.27E-03	2.08E-03	3.26E-04	1.49E-03	2.19E-02	6.36E-04	6.60E-05

TABLE 5.2-15

ASSUMPTIONS USED IN ESTIMATING DOSES TO THE MAXIMUM INDIVIDUAL FROM THE GASEOUS PATHWAYS PER UNIT

Noble Gas Submersion Dose

2 π geometry used for external beta dose.

Gamma doses resulting from elevated (plant vent) and ground level (Turbine Building vents) gaseous release are calculated based on the semi-infinite cloud model.

Noble gas release is through the plant vent only.

Highest residential dose location is 2398 meters in the ESE sector.

Highest site boundary location is 914 meters in the ESE sector.

Doses calculated at a recreational site "The Rocks" 318 meters in the ENE sector, based on inhalation and direct radiation pathways.

Radioiodine and Particulate Dose

Pathways to the maximum individual include inhalation ingestion and direct radiation.

Doses calculated based on elevated and ground level gaseous release.

Doses calculated at a recreational site "The Rocks" 318 meters in the ENE sector, based on inhalation and direct radiation pathways.

Maximum Individual

1. Resides at the worst residential location 2398 meters, ESE sector, and consumes vegetables harvested from a backyard garden. The following pathways are evaluated at this location, inhalation, direct radiation and ingestion of vegetables.

2. Consumes goat milk from the NW sector, 3862 meters from the site.

3. Consumes meat from the west sector, 3219 meters from the site.

TABLE 5.2-16

ESTIMATED MAXIMUM DOSES FROM NOBLE GAS RELEASE VIA THE STACK VENTS PER UNIT

	Gamma Air Dose		Beta Air Dose	
Location	Annual Dose Rate (mrad/yr)	Fraction of Appendix I[1]	Annual Dose Rate (mrad/yr)	Fraction of Appendix I
Site Boundary ESE, 914 meters	1.18E-02	1.18E-03	2.31E-02	1.16E-03
Recreational Site "The Rocks" ENE, 318 meters	2.11E-02	2.11E-03	4.15E-02	2.08E-03
	Total Body Dose		Skin Dose	
Worst Residential Location, ESE, 2398 meters	4.42E-03	8.84E-04	1.04E-02	6.93E-04
Recreational Site "The Rocks" ENE, 318 meters	1.49E-02	2.98E-03	3.48E-02	2.32E-03

(1) Numerical design of objectives 10CFR50, Appendix I are:

Gamma air dose = 10 mrad/yr, beta air dose = 20 mrad/yr
Total body = 5 mrem/yr, skin dose = 15 mrem/yr

TABLE 5.2-17

ESTIMATED MAXIMUM INDIVIDUAL ANNUAL DOSE RATES[1] (mrem/yr/unit) FROM RADIOIODINES AND OTHER RADIONUCLIDES DUE TO STACK AND TURBINE VENT RELEASE

Maximum[1] Individual	Bone	Liver	Kidney	Lung	GI-LLI	Thyroid	Whole Body	Skin
Adult	6.29E-02	3.41E-02	3.39E-02	3.35E-02	3.36E-02	7.24E-02	3.40E-02	1.10E-03
Teen	9.84E-02	4.41E-02	4.35E-02	4.31E-02	4.32E-02	8.95E-02	4.35E-02	1.10E-03
Child	2.33E-01	7.99E-02	7.91E-02	7.84E-02	7.83E-02	1.58E-01	7.87E-02	1.10E-03
Infant	7.03E-02	2.93E-02	2.87E-02	2.81E-02	2.80E-02	1.53E-01	2.82E-02	1.10E-03
Recreational Site-"The Rocks"	**Bone**	**Liver**	**Kidney**	**Lung**	**GI-LLI**	**Thyroid**	**Whole Body**	**Skin**
Adult	6.18E-03	2.43E-02	2.43E-02	2.43E-02	2.42E-02	5.40E-02	2.42E-02	3.37E-03
Teen	7.61E-03	2.47E-02	2.49E-02	2.47E-02	2.46E-02	6.19E-02	2.47E-02	3.37E-03
Child	9.40E-03	2.26E-02	2.28E-02	2.26E-02	2.25E-02	6.54E-02	2.26E-02	3.37E-03
Infant	7.68E-03	1.46E -02	1.46E-02	1.45E-02	1.44E-02	5.37E-02	1.45E-02	3.37E-03

(1) The highest organ dose is to the child bone, .233 mrem/yr Fraction of Appendix I dose objectives (15 mrem/yr) = .0155.

TABLE 5.2-18

MAXIMUM INDIVIDUAL THYROID AND BONE DOSES FROM STACK AND TURBINE VENT RELEASE (mrem/yr/unit)

Pathway	Infant	Child	Teen	Adult
Thyroid				
Inhalation	1.02E-02	1.31E-02	1.29E-02	1.15E-02
Vegetables				
Stored	0.0	5.71E-02	2.77E-02	1.90E-02
Leafy	0.0	2.16E-02	1.44E-02	1.80E-02
Goat Milk	1.42E-01	6.15E-02	3.12E-02	1.99E-02
Meat	0.0	3.96E-03	2.35E-03	3.10E-03
Ground Plane	9.39E-04	9.39E-04	9.39E-04	9.39E-04
Total	1.53E-01	1.58E-01	8.95E-02	7.24E-02
Bone				
Inhalation	1.41E-03	1.92E-03	1.39E-03	9.75E-04
Vegetables				
Stored	0.0	1.76E-01	7.15E-02	4.13E-02
Leafy	0.0	5.85E-03	3.17E-03	3.38E-03
Goat Milk	6.79E-02	3.47E-02	1.41E-02	7.67E-03
Meat	0.0	1.38E-02	7.33E-03	8.67E-03
Ground Plane	9.39E-04	9.39E-04	9.39E-04	9.39E-04
Total	7.02E-02	2.33E-01	9.84E-02	6.29E-02

TABLE 5.2-19

POPULATION DOSES DUE TO LIQUID EFFLUENTS WITHIN 50-MILE RADIUS PER UNIT (man-rem/year)

Pathway	Age Group	Whole Body Dose	Thyroid Dose
Fish Ingestion	Adult	2.57E-02	1.76E-01
	Teen	3.33E-03	3.28E-02
	Child	2.91E-03	5.09E-02
Invertebrate Ingestion	Adult	3.99E-03	1.24E-01
	Teen	6.19E-04	2.31E-02
	Child	8.05E-04	3.77E-02
Shoreline Activities	Adult	2.84E-03	2.84E-03
	Teen	3.28E-03	3.28E-03
	Child	1.02E-03	1.02E-03
Total Population Dose		4.44E-02	4.51E-01

TABLE 5.2-20

MILK PRODUCTION kg/year PER SECTOR

Sector	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
						Distance (miles)				
N	0	0	14116	19751	25401	212000	935000	1340000	1370000	1760000
NNE	0	0	14116	19751	25401	212000	847000	978000	1370000	1760000
NE	0	0	0	0	25401	212000	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	654000	727000	0	0
S	0	0	0	19751	25401	212000	1310000	1100000	1550000	1900000
SSW	0	0	14116	19751	25401	212000	1310000	1640000	775000	1300000
SW	0	0	14116	19751	25401	212000	1310000	1640000	1550000	1990000
WSW	0	0	21807	30512	39239	327000	1310000	1380000	1720000	1850000
W	0	0	0	0	0	327000	847000	1410000	1890000	2430000
WNW	0	0	21807	30512	39239	327000	847000	1410000	1800000	1850000
NW	0	0	0	0	0	0	847000	1410000	1370000	1760000
NNW	0	13080	21807	30512	39239	327000	935000	1700000	2390000	1690000

TABLE 5.2-21

MEAT PRODUCTION kg/year PER SECTOR

Sector	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
					Distance (miles)					
N	0	0	989	1384	1780	14800	59300	76500	75800	97400
NNE	0	0	0	0	0	0	59300	54100	75800	97400
NE	0	0	0	0	0	0	59300	0	75800	97400
ENE	0	0	0	0	0	0	59300	0	75800	97400
E	0	0	0	0	0	0	59300	0	75800	97400
ESE	0	0	0	0	0	0	59300	0	75800	97400
SE	0	0	0	0	0	0	59300	0	75800	97400
SSE	0	0	0	0	0	0	59300	68400	75800	97400
S	0	0	0	0	0	0	123000	103000	287000	370000
SSW	0	0	0	0	0	0	123000	205000	144000	246000
SW	0	0	0	2874	3696	30800	123000	205000	287000	370000
WSW	0	0	0	2874	3696	30800	123000	98900	213000	274000
W	0	593	989	1384	1780	14800	59300	98900	138000	178000
WNW	0	0	0	0	0	0	59300	98900	138000	178000
NW	0	0	0	0	0	0	59300	98900	138000	178000
NNW	0	0	989	1384	1780	14800	59300	98900	138000	178000

TABLE 5.2-22

VEGETABLE PRODUCTION kg/year PER SECTOR

	Distance (miles)									
Sector	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	67.6	203	339	474	609	5080	20300	153000	4230000	5440000
NNE	0	0	339	474	0	0	20300	3020000	4230000	5440000
NE	0	0	0	0	609	5080	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0
SSE	67.6	0	0	0	0	0	0	95000	0	0
S	67.6	203	1430	3520	4520	37700	151000	143000	352000	452000
SSW	67.6	203	2510	3520	4520	37700	151000	285000	176000	301000
SW	67.6	203	2510	3520	4520	37700	151000	285000	352000	452000
WSW	0	203	1430	3520	4520	37700	151000	33900	200000	257000
W	67.6	203	339	474	609	5080	20300	33900	47400	61000
WNW	67.6	203	339	474	609	5080	20300	33900	47400	61000
NW	67.6	203	339	474	609	5080	20300	33900	47400	61000
NNW	67.6	203	339	474	609	5080	20300	33900	47400	61000

TABLE 5.2-23

POPULATION DOSES DUE TO NOBLE GAS EFFLUENTS WITHIN 50-MILE RADIUS PER UNIT (man-rem/year)

Sector	Whole Body Dose	Skin Dose
N	7.59E-04	1.78E-03
NNE	3.32E-03	7.77E-03
NE	1.61E-02	3.76E-02
ENE	1.32E-02	3.10E-02
E	1.17E-02	2.75E-02
ESE	5.81E-03	1.36E-02
SE	6.19E-03	1.45E-02
SSE	1.47E-02	3.43E-02
S	2.49E-02	5.83E-02
SSW	4.84E-02	1.13E-01
SW	4.92E-02	1.15E-01
WSW	1.65E-02	3.86E-02
W	9.67E-02	2.26E-01
WNW	9.31E-02	2.18E-01
NW	2.33E-02	5.46E-02
NNW	6.64E-02	1.56E-01
Total	4.90E-01	1.15E+00

TABLE 5.2-24

POPULATION DOSES DUE TO IODINE AND PARTICULATE GASEOUS RELEASE WITHIN 50-MILE RADIUS PER UNIT (man-rem/year)

Pathway	Age Group	Whole Body Dose	Thyroid Dose
Ground Plane	Adult	2.43E-02	2.43E-02
	Teen	4.96E-03	4.96E-03
	Child	7.68E-03	7.68E-03
	Infant	6.01E-04	6.01E-04
Inhalation	Adult	4.56E-01	7.12E-01
	Teen	9.46E-02	1.60E-01
	Child	1.32E-01	2.49E-01
	Infant	6.01E-03	1.45E-02
Stored Vegetables	Adult	1.96E-02	2.60E-02
	Teen	6.05E-03	8.09E-03
	Child	1.94E-02	2.58E-02
	Infant	0	0
Cow Milk	Adult	2.68E-02	6.54E-02
	Teen	1.21E-02	2.97E-02
	Child	4.04E-02	9.56E-02
	Infant	1.18E-02	3.23E-02
Meat	Adult	6.02E-03	6.14E-03
	Teen	9.89E-04	1.01E-03
	Child	2.61E-03	2.65E-03
	Infant	0	0
Total		8.72E-01	1.47E+00

TABLE 5.2-25

U.S. POPULATION DOSE FROM BOTH LIQUID AND GASEOUS EFFLUENTS (1)

	Man-Rem	
	Whole Body	Thyroid
0-50 mile(2)	1.41E+00	2.40E+00
Fish and Invertebrate Ingestion(3)	5.50E-01	
H-3	5.70E-02	---
Kr-85	4.60E-03	---
C-14	2.3E+01	---
Total	2.50E+01	2.40E+00

(1) 100 year dose commitment to U.S. population from one year's liquid and gaseous releases from one unit

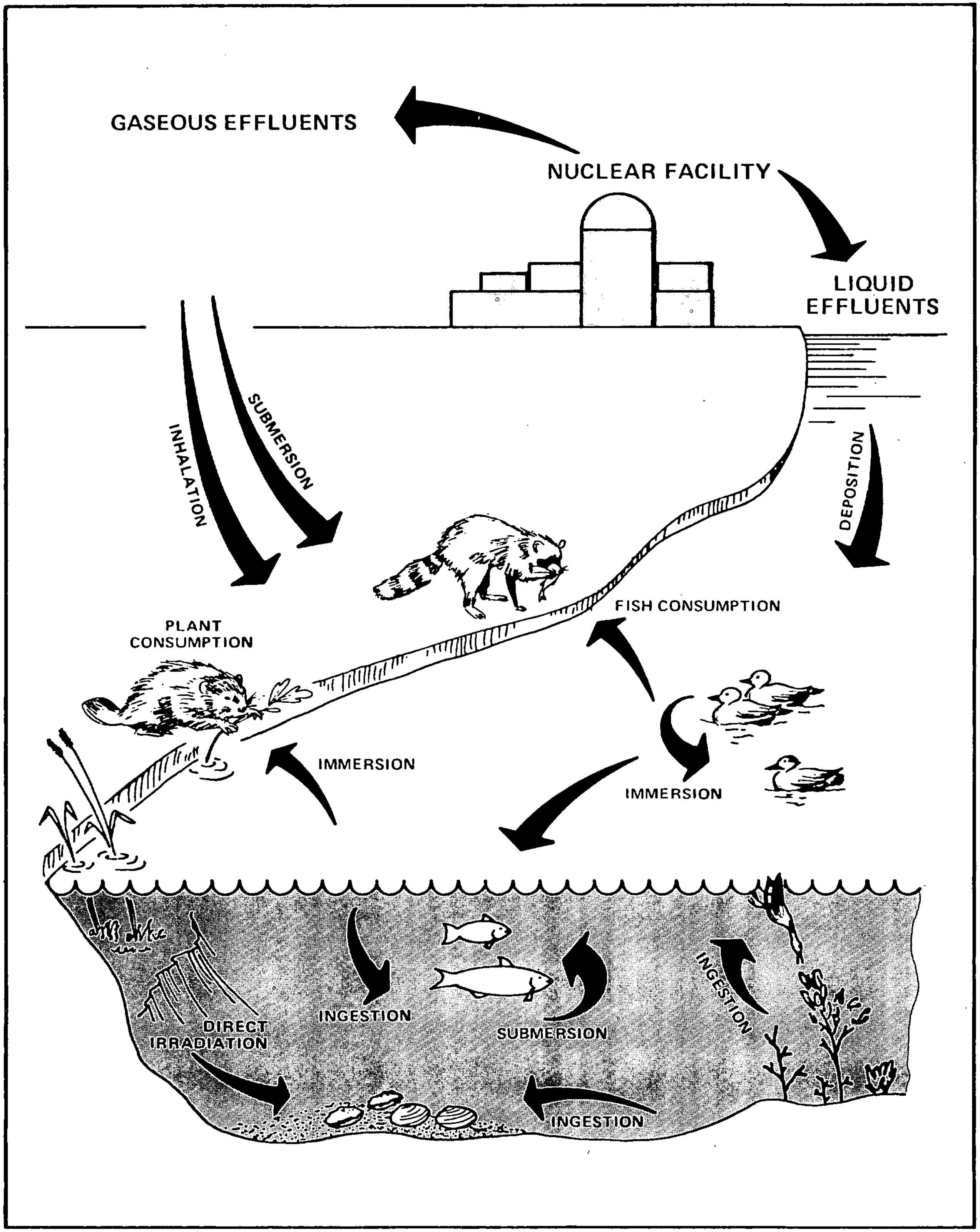
(2) From all radionuclides

(3) Dose from ingestion of fish and invertebrates caught within 50 miles of Seabrook Station that are ingested outside the 50-mile population area.

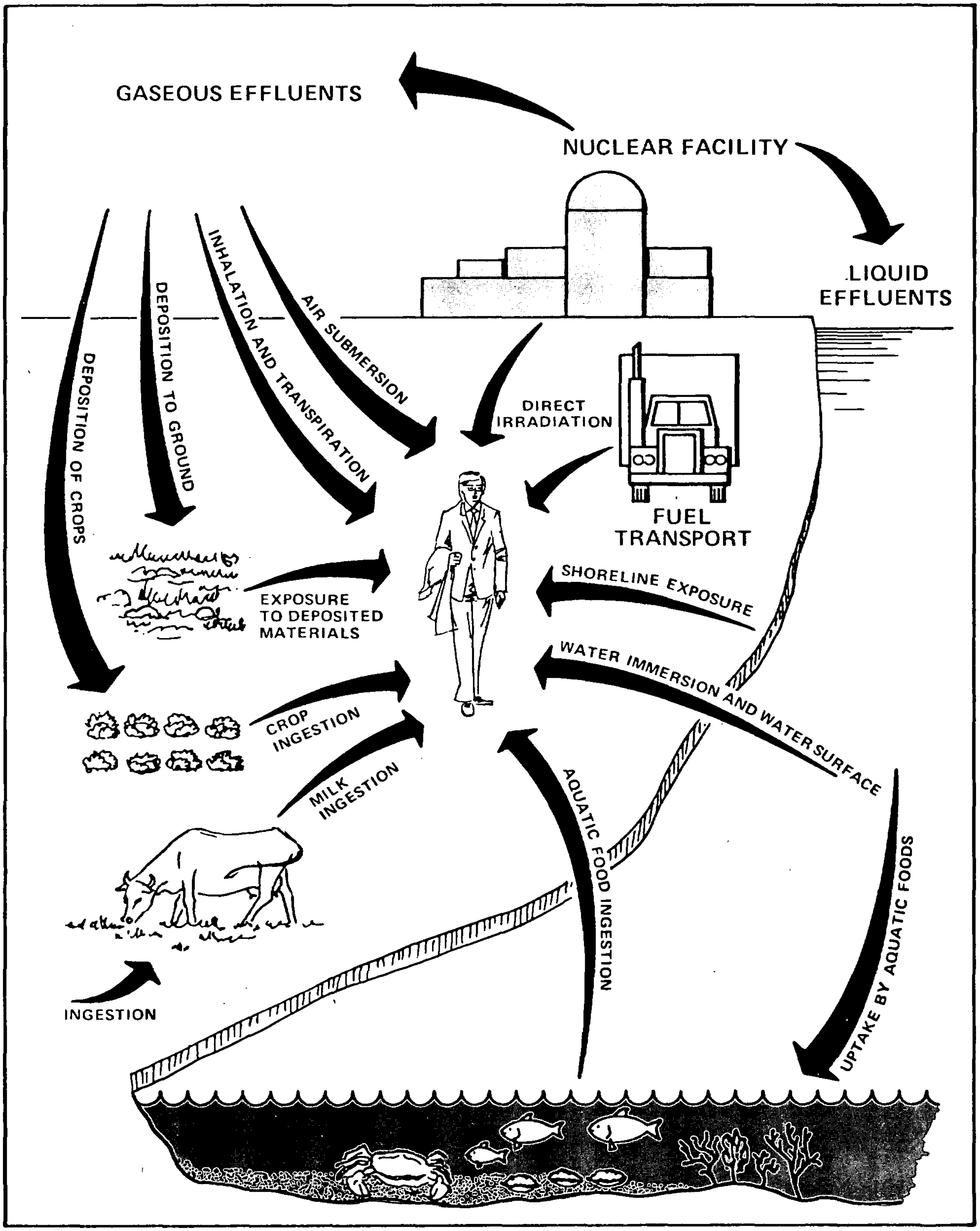
TABLE 5.2-26

COMPARISON OF SEABROOK 1 & 2 WITH APPENDIX I TO 10CFR PART 50

Criterion	Appendix I Design Objectives	Maximum Calculated Dose (1 Unit)
Liquid Effluents		
Dose to total body from all pathways	3 mrem/yr/unit	.0025 mrem/yr/unit
Dose to any organ from all pathways	10 mrem/yr/unit	.022 mrem/yr/unit
Noble Gas Effluents		
Gamma dose in air	10 mrad/yr/unit	.021 mrad/yr/unit
Beta dose in air	20 mrad/yr/unit	.042 mrad/yr/unit
Dose to total body of an individual	5 mrem/yr/unit	.015 mrem/yr/unit
Dose to the skin of an individual	15 mrem/yr/unit	.035 mrem/yr/unit
Radioiodine and Particulates Gaseous		
Dose to any organ from all pathways	15 mrem/yr/unit	.233 mrem/yr/unit



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	EXPOSURE PATHWAYS TO BIOTA
	FIGURE 5.2-1



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	EXPOSURE PATHWAYS TO MAN
	FIGURE 5.2-2

5.3 EFFECTS OF CHEMICAL AND BIOCIDE DISCHARGES

5.3 EFFECTS OF CHEMICAL AND BIOCIDE DISCHARGES

The information in this section is changed from that presented in Section 5.4 of the Seabrook Station ER-CPS as noted below.

5.3.1 Chemical and Biocide Discharges

The effects of the chemical constituents being discharged through the circulating water system were discussed in the ER-CPS Section 5.4 for Seabrook Station. Additional information on the discharge concentrations of these chemicals as well as their effects is available in the Seabrook Station Final Environmental Statement Section 3.6 and Section 5.5.2.3, respectively.

Discharge of all chemicals will be in accordance with applicable regulatory agency permits.

The chlorination of seawater results in an immediate conversion of hypochlorous acid (HOCl) to both hypobromous acid (HOBr) and hypoiodous acid (HOI), yielding chloride ions (Cl^-). This results in no loss of oxidizing capacity. EPRI (1980) reviewed literature referencing the reactions of chlorine in seawater. Here, Johnson (1977) reported this reaction to proceed to 50% completion within 0.01 minutes while Sugam and Helz (1977) indicated it to be essentially 99% complete within 10 seconds. References by EPRI to Sugawara and Terada (1958) and Carpenter and Macaldy (1976) revealed that iodine in seawater is in an oxidized state, as iodate, and unavailable to react with hypochlorous acid. Bromide on the other hand is described as being in ample supply, estimated at 68 mg/l, and able to consume more than 27 mg/l of chlorine according to Lewis (1966).

Hypobromous acid under the conditions found at Seabrook, partially dissociates into hypobromite ions (OBr^-). Both items are considered to be free available or residual oxidant. Free residual bromine is more reactive than free residual chlorine, yet enters into the same type reactions.

The decay of chlorine in natural seawater is extremely variable. J. C. Goldman, et al. (1978) indicated that losses due to chlorine demand occurred in two stages; a first very rapid and significant demand followed by a continuous loss at a reduced rate. They indicated that in natural seawater, the 2- minute chlorine demand ranged from 0.42 - 0.50 mg/l following an initial chlorine dose of 1.02 mg/l and 2.88 mg/l, respectively. Hostgaard-Jensen (1977) indicated that in Denmark, seawater reduced an initial chlorine dose of 2.0 mg/l to 0.5 mg/l within 10 minutes, and to 0.2 mg/l after 60 minutes. Fava and Thomas (1977) described recent studies on chlorine demand, giving a value for the demand in clean seawater of 1.5 mg/l in 10 minutes, and values from 0.035 mg/l to 0.41 mg/l for a 5-minute contact time to values of 0.50 to 5.0 mg/l with a 3-hour contact time in coastal waters.

Frederick (1979) examined the decay rate of equivalent chlorine in seawater samples at Seabrook. It was found that the decayed amount at any time appeared to vary from month to month over a narrow range and that the amount of equivalent chlorine decayed rose with either time or an increased innoculation level, indicating that there may not be a fixed chlorine demand 2 level. Based on a 2.0 mg/l injection dose, the data indicates that the chlorine decay in seawater after a 120-minute period averages 1.0 mg/l over a twelve-month period. Values ranged from 0.8 mg/l to 1.24 mg/l, a decay of 40 to 62%, respectively. Further decay at Seabrook Station is expected to occur due to the elevated temperatures within the cooling water system. Operational experience, however, will allow quantification of the chlorine decay in seawater. In any case, the chlorine injection rate will be such that 0.2 mg/l or less total residual oxidant will be maintained at the discharge transition structure.

The products from chlorination depend upon pH, salinity, the concentration of ammonia-nitrogen and organic carbon in the cooling water, temperature, pressure, and the concentration of the applied chlorine. Normally, the conversion of hypochlorite to hypobromite prevents the production of chloramines, yielding bromamine analogs.

With the exception of temperature, the physical and chemical parameters of the Atlantic Ocean at the intake and discharge structures do not vary significantly throughout the year (Table 5.3-1). In the marine environment, pH generally remains constant due to natural buffering capacities; however, even within the narrow range of pH values at Seabrook (roughly 7.8-8.4), the proportions of hypobromous acid and hypobromite ions can be affected.

The presence of ammonia in chlorinated seawater has a significant effect on the concentration of residual oxidants. Sugam and Helz (1977), as referenced by EPRI (1980), determined that at pH 8.0 and with a 35 ppt salinity, seawater containing 0.15 mg/l ammonia dosed at 0.5 mg/l chlorine, would result in an equal formation of chloramines and hypobromous acid-hypobromite. A decrease in either pH or ammonia-nitrogen reduces the rate of chloramine production. Sugam and Helz also found that in seawater with ammonia concentrations of 0.01 mg/l, tribromamine is the only combined bromine residual formed. At ammonia concentrations of 1.0 mg/l and a pH of 8.0, the residual was computed to be entirely that of combined bromine (70% dibromamine, 25% monobromamine and 5% tribromamine). In normal seawater, the major residual oxidants from chlorination would be either free bromine and tribromamine or dibromamine and monochloramine depending upon the ammonia concentration and halogen-to-nitrogen ratios.

At Seabrook Station, free bromine and tribromamine will dominate as ammonia-nitrogen levels are relatively low, 0.01 mg/l to 0.09 mg/l (Frederick 1979). Both dibromamine and tribromamine are unstable, decomposing to nitrogen gas and bromide ions or nitrogen gas, bromide ions and hypobromous acid, respectively. Decomposition from tribomamine results in roughly 90% decay in approximately 30 minutes depending upon environmental conditions. Based on the chemical reactivity of residual bromine, the oxidation of organic carbon (amino acids) with free bromine to form organic bromamines is another possible reaction.

Envirosphere (1981) indicated that salinity and the toxicity to chlorinated seawater were positively correlated, described as a lower 24-hour and 48-hour LC50 (the concentration at which there is 50% mortality of a species over a 24- or 48-hour exposure period. The causes of these lower values are unknown 2 but suspected to be related to the chemical interactions at higher salinities and the physiology of the species. EPRI (1980) also reviewed data pertinent to salinity and toxicity. It was indicated that an evaluation between the two was complicated by the fact that the chemical form, concentration and duration of residual oxidant species are also affected by salinity. At Seabrook Station the salinity is relatively high and stable, however the dilution and chemical reactions of biocides with ambient waters upon discharge and the subsequent limited period of exposure reduces these effects.

Wong (1980) indicated that for a given dosage and contact time, residual chlorine concentrations were seen to decrease systematically with increased temperatures. Higher temperatures were found to yield higher chlorine demands. He suggested that this increase in demand represents reactions with organic compounds that normally do not react at lower temperatures.

Various affects of temperature on the toxicity of chlorinated cooling water have also been reported. Investigations have found temperature effects to range from producing no change in toxicity to where increased temperatures have increased toxicity. EPRI (1980) suggests that the synergistic interaction between temperature and chlorinated cooling water would not be great for species residing in the area of the thermal plume.

The halogenated compounds expected to be released include small concentrations of hypobromous acid, hypobromite ions, tribromamine, dibromamine and monochloramine. The actual concentrations are expected to be extremely small and the percentages are expected to vary depending upon the environmental conditions, chemical reactions through renewed ambient demands, dilution and photochemical conversions.

Biocides entering the receiving waters via the Seabrook Station discharge are diluted by a factor of 10 to 1, as described in Sections 5.1 and 5.3 of the ER-OLS. As previously mentioned, a total residual oxidant concentration of 0.2 mg/l, measured at the discharge transition structure, will further decay during the 43-minute transit time through the discharge tunnel. Additional reduction through the decay of oxidant is expected to occur upon the release from the cooling system into the receiving waters. Losses of total residuals are expected through renewed ambient chlorine decay throughout the water column and reactions between the oxidant and ultraviolet light which results in a light-induced oxidation of hypobromite to bromate reducing the concentration of free bromine.

Thus, in consideration of the total dilution factor and the reductions associated with chemical interactions within the receiving water, an equivalent chlorine concentration of 0.02 mg/l is expected at the surface approximately 70 seconds after discharge. Beyond this area, the concentrations would steadily drop off with increased dilution. Chemical and photochemical reactions promoted by solar irradiance will further reduce oxidant concentration in the receiving water.

Estimates of other effluent concentrations at various distances from the discharge structure are derived in the same fashion as those for thermal 2 discharges described in Section 5.1 of the ER-OLS. A dilution of roughly 10:1 as described for the thermal plume in Section 5.1 from its point of origin to the point where the plume reaches the surface can be applied to chemical and biocide wastes. Whereas regulatory effluent limitations are set at levels considered safe for typical biota present in the receiving water, this additional dilution provided by the discharge diffuser, provides greater environmental protection. In addition, discharged chemicals reacting with other constituents in the discharged water and receiving water, further reduce adverse environmental effects. 2

Fouling Community

Marine fouling organisms can be divided into two general categories, macrofoulers and microfoulers.

Macrofoulers are those that cause substantial hydraulic restrictions to cooling water flow (primarily the blue mussel, Mytilus edulis; the horse mussel, Modiolus modiolus; barnacles, Balanus spp.; and hydroids, Tubularia spp.). The microfoulers are those organisms which form mats or films on heat exchange surfaces. In the New England region, the blue mussel is generally regarded as the macrofouling organism of greatest concern. Microfoulers, microscopic organic and inorganic particles, microbes and microscopic animals and plants are also of concern, especially in condensers and heat exchangers.

Mytilus, the major macrofouling organism found at Seabrook Station, is present as a planktonic settling larvae from early May through late October. Heavy sets of larvae in February, however, have been reported north of Portland, Maine. As with all biological components, the frequency and magnitude of larval set is dependent on the previously mentioned physical parameters of the aquatic environment (most notably temperature).

Mytilus spawns primarily when the water temperature rises to between 10^{o} and $15^{o}C$. After spawning, they remain as planktonic larvae for 2 to 3 weeks or as long as 3 months during cold water periods. Settling generally occurs at this temperature range, but can be seen at temperatures as low as 8^{o} to $9^{o}C$. Also, resettlement has been found to occur after detachment from a surface. Control of fouling is usually initiated in the spring when temperatures rise above $7.2^{o}C$ and continues until water temperatures drop below this value in the fall.

Environmental Assessment

A level of 0.2 mg/l total residual oxidant or less will be maintained at the discharge transition structure. While the concentration of chlorine injected to maintain this level depends upon organism settling and the chlorine demand of ambient water, it is essential that the cooling and service water systems be maintained free of fouling organisms. The concentration of chlorine at the lip of the diffuser is expected to be lower than the 0.2 mg/l measured at the discharge transition structure. An immediate reduction in concentration due to discharge dilution further reduces the toxicity of the chlorine in ambient waters. 2

To evaluate the effect of biocides on the biota in the vicinity of Seabrook Station, a review of toxicity data from open literature for local species was performed (Table 5.3-2). An evaluation of this data has deteremined that the continuous release of total residual oxidants at concentrations of 0.2 mg/l or less at the discharge transition structure will not present unmanageable stress or alter the local indigenous populations upon release to ambient waters. Table 5.3-3 and Figure 5.3-1 provided in the Final Environmental Statement for Seabrook Station, summarize additional chlorine toxicity data on marine life. The lines enclosing the data points were arbitrarily drawn by the NRC staff and depict the short duration and chronic toxicity thresholds for the species reviewed.

To evaluate the toxicity of released chlorine to marine organisms, the exposure time must be considered. At the lip of the diffuser, exposure time is extremely limited. Here, rapidly entrained ambient seawater and a discharge velocity of 15 feet per second (7.5 feet per second for 1 unit operation) will prevent organisms from inhabiting this location. Entrained phytoplankton, zooplankton and ichthyoplankton, are unable to maintain themselves within the discharge plume or at the diffuser lip over extended periods of time. Larger marine life cannot maintain themselves adjacent to the discharge in the direct path of the plume. Therefore, a combination of very low concentrations, and limited exposure periods prevents toxic effects from occurring as a result of biocide discharge. Organisms entrained into the plume will be carried away from the discharge structures where chlorine concentrations will be continually lowered through dilution and chemical reaction.

The concentration of total residual oxidant released by Seabrook Station is expected to be below that required to produce lethal effects (Tables 5.3-2 and 5.3-3). Rapid mixing, dilution and chemical reaction of released biocide with ambient water will further reduce any possible toxic concentrations. With increased distance from the discharge, chlorine concentration will drop as additional mixing, dilution and reactions occur. Planktonic organisms which passively drift into the discharge plume will not be subjected to lethal concentrations for long enough durations to be affected. With rapid dilution and a diffuser designed to avoid bottom impact, benthic organisms will not be exposed to continuous levels of chlorine. Fish species are expected to be subjected to limited exposure times and minimal concentration which will mitigate possible effects to discharged biocides.

Mattice and Zittel report that mussel attachment is prevented at concentrations of 0.02 to 0.05 mg/l of chlorine, however no mention is made as to the method of analysis which could allow for considerable variation. Since the integrity of both the cooling and service water systems depends upon them remaining free of obstructions, organisms entering the intake tunnel should not be allowed to settle. A consideration of the power plant entrainment time, the ambient chlorine decay, and the delta-temperature which enhances halogen dissociation, allows for the injection of 2.0 mg/l of equivalent chlorine to effectively control biofouling while releasing minimal non-toxic levels of oxidant into the environment.

It is concluded that the environmental impact of the continuous release of 2 oxidant at Seabrook Station will not adversely affect the local indigenous marine populations. Operating experience coupled with a consideration of the cyclic nature of fouling organisms may minimize the use of biocides during periods when biofouling is not as significant a problem. Sections 3.6, 5.3 and 10.5 of the Seabrook Station ER-OLS have been revised accordingly to reflect the above information. 2

5.3.2 Cooling Tower Discharges

A mechanical draft cooling tower as described in Section 9.2.5 of the Final Safety Analysis Report (FSAR) for Seabrook Station serves as an ultimate heat sink. Two principal discharges occur as the result of cooling tower operation; blowdown of concentrated dissolved solids water due to evaporative water losses and a release of a fog-like plume associated with the evaporative losses.

Blowdown from the tower results in the release of an effluent which is high in dissolved solids. The concentration of dissolved solids is related to the type of makeup water utilized where for the same cycles of concentration saltwater makeup results in a higher dissolved solids content than would fresh water.

During normal station operation, the cooling tower is tested on a periodic basis with fresh water in the system. Under these limited conditions, no blowdown would occur. During backflushing, the service water system is placed onto the cooling towers resulting in increased solids concentration. During an emergency situation as described in Section 9.2.5 of the FSAR, blowdown could be discharged through the circulating water system where the concentration of dissolved solids would be significantly reduced through dilution. Discharge of blowdown could also be provided through portable hoses to storm drains where it would enter the settling basin which could regulate the discharge to the Brown's River.

During normal use of a mechanical draft cooling tower, heat is transferred from the cooling water to the air by both sensible and latent (evaporation) heat transfer. As a result, water vapor within the cooling tower plume may condense to form small water droplets producing a fog condition making part of it visible. The testing of the cooling towers is not expected to produce a vapor plume due to the lack of evaporative heat.

Under emergency conditions the plume dissolved solids concentration is directly dependent on tower water concentrations. It can be assumed that use of towers at this time will not result in release of substantial concentrations due to the limited duration of its use and therefore lower operation will have negligible effects.

5.3.3 References

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TABLE 5.3-1

Seawater Sample Parameters

Date	Kjeldahl-N (mg N/1)	Temp. (°C)	Salinity ppt	pH	Ammonia-N (mg N/1)	Total Organic Carbon (mg C/1)
6/29/76	.12	15.00	32.16	8.4	.09	1.0
7/29/76	.17	9.71	33.34	8.3	.07	1.0
8/26/76	.11	14.92	33.87	8.15	.04	8.5
9/28/76	.11	12.42	33.61	8.3	.07	24.0
10/26/76	.16	8.54	34.42	8.0	.08	18.0
11/30/76	.12	6.92	35.13	7.8	.09	2.5
12/30/76	.09	2.34	35.12	7.9	.07	7.0
1/26/77	.16	0.50	36.06	7.8	.09	3.0
2/23/77	.09	0.00	34.76	8.35	.05	1.0
3/29/77	.05	1.80	33.70	7.95	.01	1.0
4/27/77	.07	5.68	34.16	8.1	.02	16.0
5/26/77	.07	5.99	33.34	8.2	.01	3.5
6/30/77	.06	10.99	33.24	7.85	.04	9.0

Source: Frederick, 1979

TABLE 5.3-2

Toxicity of Chlorinated Seawater to Aquatic Biota

(Sheet 1 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Phytoplankton						
Skeletonema costatum		0.095	1,440	20	50% decrease in growth	TRW (1978)/Gentile, et al. (1976)*
		0.6	1.7		50% decrease in growth	TRW (1978)/Gentile, et al. (1976)*
		0.4-0.65	5		Reduced growth	Becker & Thatcher (1973)
Chaetoceros dicipiens		0.14	1,440		50% decrease in growth	TRW (1978)
Chaetoceros didymum		0.125	1,440	10	50% decrease in growth	Gentile, et al. (1976)*
Thalassiosira nordemskioldii		0.195	1,440		50% decrease in growth	TRW (1978)
Thalassiosira rotula		0.330	1,440	10	50% decrease in growth	TRW (1978)/Gentile, et al. (1976)*

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
1 Total Residual Oxidant
2 Combined Residuals (chloramines)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (^oC)	Effect	Reference
Benthic Algae						
Cladophora sp.		1.0	1,440	30	Slight mortality	Betzer & Knott (1969)*
		1.0	4,320	30	Slight mortality	Betzer & Knott (1969)*
		3.0	2,880	30	90% mortality	Betzer & Knott (1969)*
		5.0	4,320	30	100% mortality	Betzer & Knott (1969)*
		10.0	2	30	100% mortality	Betzer & Knott (1969)*
Enteromorpha intestinalis		0.1			Abundant	Betzer & Knott (1969)*
Bivalves						
Mytilus edulis		2.5 [1]	7,200		100% mortality	Turner, et al. (1948)*/ TRW (1978)
		1.0 [1]	21,600		100% mortality	Turner, et al. (1948)*/ TRW (1978)
		0.25			Prevented attachment @ 0.4 m/sec velocities	Turner, et al. (1948)*/ TRW (1978)
Mulinia lateralis	Embryos	0.07	2	18-28	50% mortality	Roberts, et al. (1979)
		0.01-0.10	2,880	18-28	50% mortality	Roberts, et al. (1979)

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
1 Total Residual Oxidant
2 Combined Residuals (chloramines)

TABLE 5.3-2

(Sheet 3 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Crustaceans						
Copepods						
Acartia tonsa		0.75	2	20	30% mortality	Dressel (1971)*
		0.75	2	25	70% mortality	Dressel (1971)*
		1.15	2	20	100% mortality	Dressel (1971)*
		0.11-0.44	20		65.2% mortality	Lanza, et al. (1975)*
		0.11-0.44	1,440		100% mortality	Lanza, et al. (1975)*
		2.5	5		> 90% mortality	McLean (1973)
		0.03	2,880		50% mortality	Roberts, et al. (1979)
		0.028-0.175	>10,000	15	50% mortality	Heinla & Beaven (1977)*
		1.0	120		50% mortality	Gentile, et al. (1976)*
		2.5	5		50% mortality	Gentile, et al. (1976)*
		0.75	2	20	30% mortality	TRW (1978)
		0.75	2	25	70% mortality	TRW (1978)
		1.0	120		50% mortality	TRW (1978)
		10.0	.07		50% mortality	TRW (1978)
		2.5	5		90% mortality	TRW (1978)
		0.12	2,880	20	50% mortality	Roberts & Gleeson (1978)*
		0.11	2,880	25	50% mortality	Roberts & Gleeson (1978)*
		0.067	2,880	20	50% mortality	Roberts & Gleeson (1978)*
		0.029	2,880	25	50% mortality	Roberts & Gleeson (1978)*

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
1 Total Residual Oxidant
2 Combined Residuals (chloramines)

TABLE 5.3-2

(Sheet 4 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Copepods (cont'd)						
Eurytemora affinis		0.11-0.44	1,440		70% mortality	Lanza, et al. (1975)*
		1.0	360		50% mortality	Gentile, et al. (1976)*
		2.5	9		50% mortality	Gentile, et al. (1976)*
Amphipods						
Melita nitida		2.5	5		4% mortality	McLean (1973)
		2.5	180		97.2% mortality	McLean (1973)
Gammarus sp.		2.5	180		25% mortality	McLean (1973)/TRW (1978)
Corophium sp.		10.0	410		0% mortality	McLean (1973)/TRW (1978)
Barnacles						
Balanus sp.	Nauplii	2.5	5		80% mortality	McLean (1973)/TRW (1978)

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
1 Total Residual Oxidant
2 Combined Residuals (chloramines)

TABLE 5.3-2

(Sheet 5 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Decapods						
Crangon septemspinosus		0.15-0.25	1,080		50% mortality	Patrick and McLean (1970)*/ TRW (1978)
		0.90-1.00	180		50% mortality	Patrick and McLean (1970)*/ TRW (1978)
		5.0	10		42% mortality	Gentile, et al. (1976)*/ TRW (1978)
		10.0	5		60% mortality	Gentile, et al. (1976)*/ TRW (1978)
		0.05-0.09			Avoidance	Ichthylogical Assoc. (1974)
Pagurus longicarpus		0.062-0.102	5,760		50% mortality	Roberts (1978)*/Roberts, et al. (1979)
Homarus americanus	Stage I	2.89	30-60	20	40% mortality	Goldman & Ryther (1976)*
	Stage I	0.41	30-60	25	50% mortality	Goldman & Ryther (1976)*
	Stage I	0.69	30-60	30	50% mortality	Goldman & Ryther (1976)*
	Stage I	0.32	30-60	20	50% mortality	Goldman & Ryther (1976)*
	Stage I	0.06	30-60	25	50% mortality	Goldman & Ryther (1976)*
	Stage IV	3.95	60	30	50% mortality	Goldman & Ryther (1976)*

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
1 Total Residual Oxidant
2 Combined Residuals (chloramines)

TABLE 5.3-2

(Sheet 6 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Fish						
Osmerus mordax		1.27	30		50% mortality	Seegert & Brooks (1978)*
Alosa pseudoharangus		2.15	30	10	50% mortality	Seegert & Brooks (1978)*
		1.70	30	20	50% mortality	Seegert & Brooks (1978)*
		0.297	30	30	50% mortality	Seegert & Brooks (1978)*
Alosa aestivalis	Egg	0.57	--		100% mortality	Morgan & Prince (1977)*
	Egg	0.33	4,800		50% mortality	Morgan & Prince (1977)*
	1 day larvae	0.28	1,440		50% mortality	Morgan & Prince (1977)*
	1 day larvae	0.24	2,880		50% mortality	Morgan & Prince (1977)*
	2 day larvae	0.32	1,440		50% mortality	Morgan & Prince (1977)*
	2 day larvae	0.25	2,880		50% mortality	Morgan & Prince (1977)*
		1.20	15		50% mortality	Engstrom & Kirkwood (1974)*
		0.56	120		50% mortality	Engstrom & Kirkwood (1974)*
		0.67	60		50% mortality	TRW (1978)
		1.20	15		50% mortality	TRW (1978)

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
1 Total Residual Oxidant
2 Combined Residuals (chloramines)

TABLE 5.3-2

(Sheet 7 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Fish (cont'd)						
Brevoortia tyrannus	Larvae	0.3	8		0% mortality	Hoss, et al. (1975)*
	Larvae	0.3	5	ΔT10°	40% mortality	Hoss, et al. (1975)*
	Larvae	0.3	8	ΔT10°	100% mortality	Hoss, et al. (1975)*
	Larvae	0.5	5		40% mortality	Hoss, et al. (1975)*
	Larvae	0.5	3	ΔT10°	100% mortality	Hoss, et al. (1975)*
	Larvae	0.5	10		100% mortality	Hoss, et al. (1975)*
		1.20	30		50% mortality	Engstrom and Kirkwood (1974)*
		0.21	300		50% mortality	Engstrom and Kirkwood (1974)*
		0.70	10		50% mortality	Fairbanks, et al. (1971)*
		0.22	60		50% mortality	Fairbanks, et al. (1971)*
		0.22	2,880		50% mortality	Roberts & Gleeson (1978)*
		0.12 [1]	5,760	25	50% mortality	Gullans, et al. (1977)*
		0.22	60		50% mortality	TRW (1978)
		0.7	10		50% mortality	TRW (1978)
		0.21	300		50% mortality	TRW (1978)
		1.20	30		50% mortality	TRW (1978)
	Larvae	0.5	3		0% mortality	TRW (1978)

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
1 Total Residual Oxidant
2 Combined Residuals (chloramines)

TABLE 5.3-2

(Sheet 8 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Fish (cont'd)						
Pseudopleuronectes americanus	Juvenile	0.20 [1]			Stress	Capuzzo, et al. (1977)*
	Juvenile	0.55 [1]			100% mortality	Capuzzo, et al. (1977)*
	Juvenile	1.50 [1]			Stress	Capuzzo, et al. (1977)*
	Juvenile	2.55 [1]			100% mortality	Capuzzo, et al. (1977)*
		2.5	15		50% mortality	TRW (1978)/Gentile, et al. (1976)*
		10.0	0.3		50% mortality	TRW (1978)/Gentile, et al. (1976)*
	Egg	10.0	20		0% mortality	TRW (1978)/Gentile, et al. (1976)*
Limanda ferruginea		0.20	1,440		50% mortality	Gentile, et al. (1976)*
		0.10	1,440		50% mortality	Gentile, et al. (1976)*
		2.5	1,440		50% mortality	TRW (1978)
Menidia menidia		0.095	1,440		50% mortality	Roberts, et al. (1975)*
		0.037	5,760		50% mortality	Roberts, et al. (1975)*
		1.20	30		50% mortality	Engstrom & Kirkwood (1974)*
		0.55	120		50% mortality	Engstrom & Kirkwood (1974)*
	Young	0.13	1		4% mortality	Hoss, et al. (1977)*
	Young	0.13	3		46% mortality	Hoss, et al. (1977)*

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
1 Total Residual Oxidant
2 Combined Residuals (chloramines)

TABLE 5.3-2

(Sheet 9 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Fish (cont'd)						
Menidia menidia (cont'd)	Young	0.13	5		63% mortality	Hoss, et al. (1977)*
	Young	0.13	7		80% mortality	Hoss, et al. (1977)*
	2-hr. Egg	0.38 [1]	1,440		50% mortality	Morgan & Prince (1977)*
	2-hr. Egg	0.30 [1]	2,880		50% mortality	Morgan & Prince (1977)*
	2-hr. Egg	0.12	1,440		5% mortality	Morgan & Prince (1977)*
	2-hr. Egg	1.23	1,440		95% mortality	Morgan & Prince (1977)*
	2-hr. Egg	0.16	2,880		5% mortality	Morgan & Prince (1977)*
	2-hr. Egg	0.56	2,880		95% mortality	Morgan & Prince (1977)*
		0.08-0.25			Preference	Ichthyological Assoc. (1974)
		0.59			Death	Ichthyological Assoc. (1974)
		0.58	90		50% mortality	TRW (1978)
		1.20	30		50% mortality	TRW (1978)
Morone saxatilis	1 week larvae	0.50	1,440		50% mortality	Hughes (1970)*
	1 month fingerling	0.30	1,440		50% mortality	Hughes (1970)*
		0.04-0.16	60	ΔT 6.9°	>50% mortality	Lanza, et al. (1975)*

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
1 Total Residual Oxidant
2 Combined Residuals (chloramines)

TABLE 5.3-2

(Sheet 10 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Fish (cont'd)						
Morone saxatilis (cont'd)	Embryo	0.07 [1]	--		3.5% hatched	Middaugh, et al. (1977)
	2 day prolarvae	0.04	--		50% mortality	Middaugh, et al. (1977)
	12 day larvae	<0.07	--		50% mortality	Middaugh, et al. (1977)
	30 day juvenile	0.04	--		50% mortality	Middaugh, et al. (1977)
	<13 hour larvae	0.20	2,880		50% mortality	Morgan & Prince (1977)*
	24-40 hour larvae	0.22	2,880		50% mortality	Morgan & Prince (1977)*
	24 hour larvae	0.20	1,440		50% mortality	Morgan & Prince (1977)*
	70 hour larvae	0.19	1,440		50% mortality	Morgan & Prince (1977)*
	Larvae	0-2.47	--		<30% mortality	Ginn & O'Conner (1978)*
	Larvae	0-2.47	--	ΔT	60-85% mortality	Ginn & O'Conner (1978)*
	Egg	0.3 [2]	4.8	ΔT	50% mortality	Burton, et al. (1979)*
	Egg	0.22 [2]	120	ΔT	50% mortality	Burton, et al. (1979)*
	Egg	0.14 [2]	240	ΔT	50% mortality	Burton, et al. (1979)*

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
[1] Total Residual Oxidant
[2] Combined Residuals (chloramines)

TABLE 5.3-2

(Sheet 11 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Fish (cont'd)						
Morone saxatilis (cont'd)	Prolarvae	0.04 [2]	4.8	ΔT	50% mortality	Burton, et al. (1979)*
	Prolarvae	0.03 [2]	120	ΔT	50% mortality	Burton, et al. (1979)*
	Prolarvae	0.03 [2]	240	ΔT	>50% mortality	Burton, et al. (1979)*
Oncorhynchus kisutch	Juvenile	0.141	2,880	7.7	100% mortality	Holland, et al. (1960)*
	Juvenile	0.08	7,920	7.7	50% mortality	Holland, et al. (1960)*
	Juvenile	0.08	10,080	7.7	100% mortality	Holland, et al. (1960)*
	Juvenile	0.04	12,960	7.7	0% mortality	Holland, et al. (1960)*
	Juvenile	0.04	5,760	15-77	50% mortality	Rosenberger (1972)*
		0.01 [2]	5,760	15-77	50% mortality	Rosenberger (1972)*
		0.04 [2]	5,760	15-77	50% mortality	Rosenberger (1972)*
		0.560	30	10	50% mortality	Brooks & Seegert (1977)*
		0.287	30	20	50% mortality	Brooks & Seegert (1977)*
Stenotomus versicolor		0.67	30		100% mortality	Capuzzo, et al. (1977)*
		3.10 [2]	30		100% mortality	Capuzzo, et al. (1977)*
Gasterosteus aculeatus		0.09-0.13	5,760		50% mortality	TRW (1978)

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
1 Total Residual Oxidant
2 Combined Residuals (chloramines)

Table 5.3-3 (Sheet 1 of 2)

Summary of chlorine toxicity data on marine life

Point	Species name: Scientific	Species name: Common	Chlorine concentration (mg/liter)	Time	Effect	Footnote
	Plants					
	Chlorophyta					
21	Dunaliella tertiolecta		0.11	24 hr	50% stop growth	a
35	Chlamydomonas sp.		1.5	5–10 min	Time lag in growth effect recovered in 9 days	c
	Chrysophyta					
	Bacillariophyceae					
19	Skeletonema costatum		0.095	24 hr	50% stop growth	a
36	Skeletonema costatum		0.4–0.65	5 min	Adverse effect on growth	c
			1.5–2.3	5 min	Death	
23	Cyclotella nana		0.075	24 hr	50% stop growth	a
24	Chaetoceros decipiens		0.14	24 hr	50% stop growth	a
25	Thalassiosira nordensholkii		0.195	24 hr	50% stop growth	a
26	Thalassiosira rotula		0.33	24 hr	50% stop growth	a
27	Asterionella japonica		0.25	24 hr	50% stop growth	a
28	Chaetoceros didymum		0.125	24 hr	50% stop growth	a
29	Detonula confervacea		0.2	24 hr	50% stop growth	a
30	Asterionella japonica		0.4	16 sec	50% stop growth	a
31	Cyclotella nana		0.2	410 sec	50% stop growth	a
32	Skeletonema costatum		0.5	145 sec	50% stop growth	a
33	Detonula confervacea		0.4	5000 sec	50% stop growth	a
	Chrysophyceae					
20	Rhodomonas baltica		0.11	24 hr	50% stop growth	a
22	Monochrysis lutheri		0.2	24 hr	50% stop growth	a
	Phaeophyta					
5	Macrocystis pyrifera	giant kelp	5–10	2 days	10–15% photosynthesis reduction	b
			5–10	5–7 days	50–70% photosynthesis reduction	b
	Animals					
	Cnidaria					
	Bimeria franciscana	Hydroid	4.5	3 hr	None	d
		Sea anemone	1.0	15 days	None	e
	Mollusca					
3	Mytilus edulis	Mussel	1.0	15 days	100% mortality	e
			2.5	5 days	100% mortality	e
			10.0	5 days	100% mortality	e
	Crassostria virginica	Oyster	0.05	?	Pumping reduced	f
			1.0	?	No pumping	f
37	Ostrea edulis larvae	Oyster	0.5		After 2 min stop swimming	g
			1.0		After 2 min stop swimming	g
			2.0		Stop swimming immediately	g
			3.0		Stop swimming immediately	g
	Arthropoda					
	Corophium sp.	Tube dwelling amphipod	2.5	410 min	0 mortality after 24 hr	h
			5.0	410 min	0 mortality after 24 hr	h
			10.0	410 min	0 mortality after 24 hr	
14	Melita nitida	Amphipod	2.5	2 hr	50% mortality. Some deaths after 5 min	i
15	Gammarus tigrinus	Amphipod	2.5	3 hr	25% mortality after 96 hr	i
7	Acartia tonsa	Copepod	1	60 min	17% mortality	
			2.5	5 min	37.5% mortality	h
			5.0	0.5 min	20% mortality	h
			10.0	0.5 min	32% mortality	h

Table 5.3-3

(Sheet 2 of 2)

(continued)

Point	Species name: Scientific	Species name: Common	Chlorine concentration (mg/liter)	Time	Effect	Footnote
11	Acartia tonsa	Copepod	2.5	5 min	90% mortality measured after 3 hr	i
	Pseudodiaptomus coronidae	Copepod	1.0	24 hr	No deaths	h
			2.5	30 min	19% mortality	h
			5.0	5 min	6% mortality	h
			10.0	2.5 min	24% mortality	h
34	Eurytemora affinis	Copepod	1.0	360 min	51% mortality	h
	Elminius modestus	Barnacle	0.5	10 min	Little effect	g
		Nauplii	1.0	10 min	Heavy losses. No growth	g
12	Balanus improvisus	Barnacle	2.5	5 min	80% mortality after 3 hr	i
18		Barnacles	1.0	15 days	Most dead	e
6	Crangon septemspinosus larvae	Sand shrimp	5	10 min	37% mortality	h
			10	5 min	55% mortality	h
13	Palaemonetes pugio	Grass shrimp	2.5	3 hr	98% mortality after 96 hr	i
	Ectoprocta					
2	Bugula sp.		2.5	48 hr	100% mortality	e
			10.0	24 hr	100% mortality	e
	Chordata					
	Ascidiacia					
4	Molgula sp.		1.0	3 days	100% mortality	e
			2.5	1 day	100% mortality	e
			10.0	1 day	100% mortality	e
	Tunicata					
1	Botryllus sp.		10	24 hr	100% mortality	e
	Pisces					
8	Pseudopleuronectes americanus	Winter flounder	1	0.1 min	9% mortality	h
			2.5	0.1 min	6% mortality	h
			5.0	0.1 min	15% mortality	h
			10.0	0.25 min	32% mortality	h
	Pseudopleuronectes americanus eggs	Winter flounder	10.0	0.33 min	0% mortality	h
10	Pleuronectes platessa larvae	Plaice	0.05	460 min	50% mortality	h
	Pleuronectes platessa larvae	Plaice	0.13	70 min	50% mortality	j
	Pleuronectes platessa eggs		0.25	3 days	Critical level	j
17	Oncorhynchus kitsutch	Coho salmon	0.1	3 days	Critical level	k
39	Oncorhynchus tshawytocha	Chinook	0.05	23 days	Critical level	k
40	Oncorhynchus gorbuscha		0.05	23 days	Critical level	
	Marine fish		1.0		Slight irritant response	l

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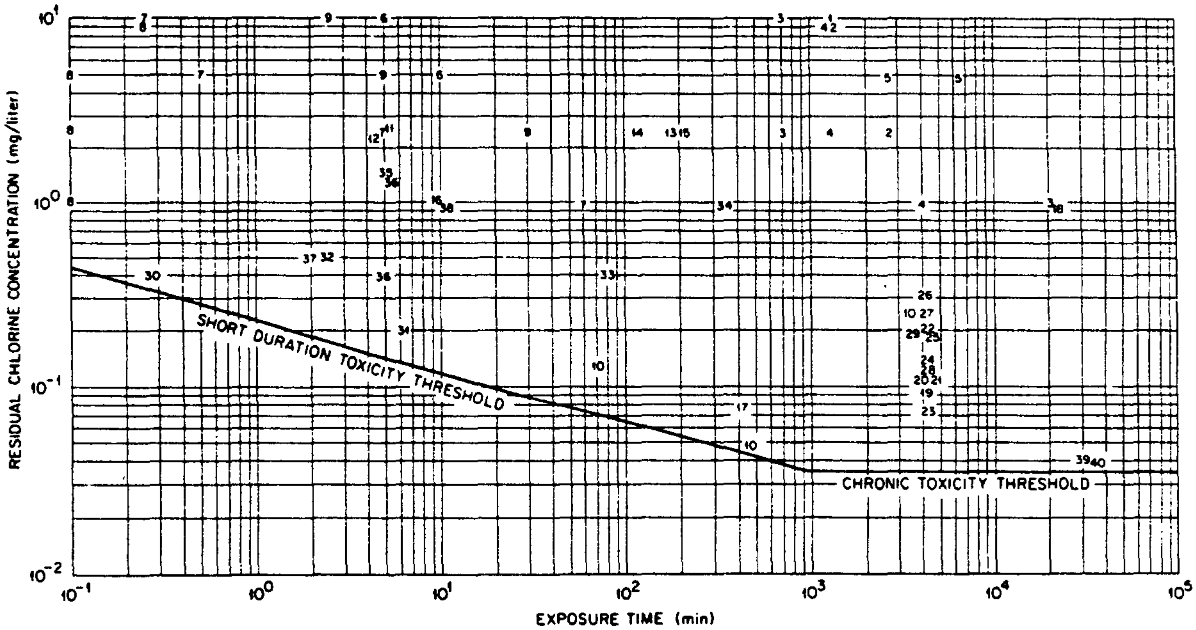
Source: Seabrook Station FES; 1974



Source: Seabrook Station FES; 1974

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	SUMMARY OF CHLORINE TOXICITY DATA ON MARINE LIFE FIGURE 5.3-1

5.4 EFFECTS OF SANITARY WASTE DISCHARGES

5.4 EFFECTS OF SANITARY AND OTHER WASTE DISCHARGES

The information in this section remains unchanged from that presented in Section 5.5 of the Seabrook Station ER-CPS except as noted below.

5.4.1 Sanitary Waste System

The effluent from the sanitary waste system will be discharged through the circulating water system as described in Section 5.5.1 of the ER-CPS and will meet secondary treatment standards as depicted in Table 3.7-2 of the ER-OLS.

Solid waste is not expected to occur in quantities requiring disposal due to the design of the aerated lagoon and as such, will pose no adverse environmental effects as a result of its disposal.

5.4.2 Other Waste Systems

5.4.2.1 Auxiliary Boilers

Due to changes in design for the auxiliary boilers and emergency diesel generators, information contained in Section 5.4.2 of the ER-CPS is no longer applicable. Updated information on the auxiliary boilers and emergency diesel generators is provided in Section 3.7.2 of the ER-OLS. 1

5.5 EFFECTS OF OPERATION AND MAINTENANCE OF THE TRANSMISSION SYSTEM

5.5 EFFECTS OF OPERATION AND MAINTENANCE OF THE TRANSMISSION SYSTEM

The information in this section remains unchanged from that presented in Section 5.6 of the Seabrook Station ER-CPS except as noted below.

References to brandnames and mixtures of chemicals have been removed to allow for the use of generic chemicals and associated mixtures. 1

5.6 OTHER EFFECTS

5.6 OTHER EFFECTS

The Applicant knows of no other potential effects which the plant may have beyond those discussed in the previous sections of this chapter or below.

5.6.1 Groundwater

Information on groundwater and the effect of groundwater withdrawal on groundwater resources in the vicinity of the station are discussed in Subsection 2.4.2.

5.6.2 Noise

No noise section was included in the Environmental Report - Construction Permit Stage specifically addressing the subject of acoustic noise from station operation. This subject was discussed in Section 5.6 of the ER-CPS, however, as part of the environmental impact of transmission lines. Reference may also be made in the AEC Environmental Impact Statement for Construction of Seabrook Station to Sections 5.1.2, 5.6, 11.9.2.1, and 11.9.2.2.

There are no differences between currently projected environmental effects of acoustic noise from Seabrook Station and the effects discussed in the ER-CPS.

5.7 RESOURCES COMMITTED

5.7 RESOURCES COMMITTED

The information in this section remains unchanged from information presented in Section 5.8 of the Seabrook Station 1 & 2 ER-CPS.

5.8 DECOMMISSIONING AND DISMANTLING

5.8 DECOMMISSIONING AND DISMANTLING

5.8.1 General

Specific plans for the decommissioning of a nuclear power plant are not normally developed at the operating license stage. However, there are several options available from which a satisfactory decommissioning plan can be developed during the life of the plant, allowing sufficient lead time to take full advantage of the state of technology in order to minimize environmental impact. At the appropriate time in the future, Public Service Company of New Hampshire will select the best decommissioning plan based upon current information that balances the intended future use of the site, safety standards, environmental goals and economic considerations.

The design of Seabrook Station has emphasized reliability and ease of maintenance. Accordingly, those components and systems that need periodic maintenance have been arranged and designed for easy handling. Some typical considerations include crane capabilities, removable shield walls and cubical covers, and equipment laydown space. These design objectives will facilitate component maintenance and replacement and, near the end of the useful life of the plant, will also facilitate the removal or encapsulation of plant equipment.

5.8.2 Decommissioning Alternatives

At the present time three primary decommissioning alternatives and two combination alternatives for light water reactors have received serious consideration. The actual method chosen for decommissioning will be influenced by the sources and levels of radiation and the resulting occupational doses to personnel, the chemical and physical characteristics of the contamination, the physical access to components and equipment and the availability of advanced dismantling technology. Consideration will also be given to the environmental acceptability of the alternatives and to the land use objectives for the site at the time of decommissioning. The following is a brief description of these decommissioning alternatives.

a. Mothballing places the station in a state of protective storage. In general, the station is left intact except that all fuel assemblies and radioactive fluids and wastes are removed from the site. Adequate radiation monitoring, environmental surveillance, and appropriate security procedures are established, including control of all access to the site, reporting of any abnormal occurrences, maintaining logs, and submitting status reports to the appropriate regulatory agencies under a possession-only license to ensure that the health and safety of the public are preserved.

b. Entombing entails the shipping of all fuel assemblies, radioactive fluids and wastes and certain selected components off the site followed by the sealing of all the remaining highly radioactive or contaminated components within a structure integral with the biological shield. The plant structures provide integrity over the period that significant quantities of radioactivity remain with the material in the entombment. An appropriate and continuing environmental and access control surveillance program is established under a possession-only license.

c. Prompt Removal/Dismantling involves the removal from the site of all fuel assemblies, radioactive fluids and wastes, and other materials having activity above accepted unrestricted levels. The station owner then has unrestricted use of the site with no requirement for a possession-only license. If the station owner so desires, the remainder of the reactor facility may be dismantled and all vestiges removed.

d. Mothballing - Delayed Removal/Dismantling Combination involves initial mothballing of the station as described in part a. This is followed by a delay of a sufficient period to allow the gamma radiation levels due to activated materials in the work environment, most importantly Cobalt 60 and Iron 55, to decay to sufficiently low levels to permit manual removal of all of the activated materials which would require remote handling, if prompt dismantling was performed, with the possible exception of the reactor vessel and internal parts. This delay will reduce the man-rem radiation exposure received, compared with prompt dismantling. It will also reduce the cost of dismantlement since the use of remote handling equipment is minimized.

e. Entombment - Delayed Removal/Dismantling Combination involves initial entombment of the structure as described in part b. and eventual dismantlement as described in part d.

5.8.3 Future Site Use

The decision as to which of the preceding alternatives or combination of alternatives will be employed cannot be made at this time. There are too many unknowns; the most obvious, which will be paramount in the selection process, is the future long-term use of the Seabrook site. Applicant believes, however, that the Seabrook site will continue to be used for the generation of electrical energy in the long term, beyond the expected useful life of the presently proposed generating facilities, assuming that experience gained through operation of Seabrook Station determines that the site can support power generation facilities with acceptable environmental impact.

If the site is retained for further power generation development after the completion of the useful lives of Seabrook Units 1 and 2; then any of the alternatives could be selected. The choice would be based primarily on the siting requirements of any future generating systems along with the usual economic considerations.

If the situation, at the time, is that further generating system development is not foreseeable at Seabrook, then an assessment of the costs and benefits of the various alternatives will have to be made. An appropriate decision will be made in light of the then current long-term land use prognosis for the Seabrook site.

5.8.4 Environmental Impact

The ultimate decision regarding the long-term use of the Seabrook site will be a major factor influencing the eventual environmental impact. The trade-off between continued production of electricity, new use of the site, and environmental impact must all be balanced. A preliminary assessment indicates the following:

a. Continued use of the Seabrook site for power generation facilities will have a minimal environmental impact when compared to the effects associated with development of a new generation site required to replace the retired Seabrook units. Transmission corridors and cooling water intake and discharge tunnels will exist at the Seabrook site upon retirement of Units 1 and 2.

b. If the long-term use of the Seabrook site for the generation of electrical energy is terminated, the effects of this use on the environment as described in Chapter 5 would also come to an end.

c. Table 5.8-1 compares the alternatives in terms of monetary costs based on a study of reactor decommissioning costs and the amount of land irretrievably committed.

TABLE 5.8-1

APPROXIMATE COMPARATIVE DECOMMISSIONING COSTS (1) PER UNIT

(1978 $)

	Mothballing	Entombing	Dismantling
Monetary Cost Estimate	42,800,000	21,000,000(2) to 27,000,000	33,300,000
Annual Maintenance Charge (Surveillance and Security)	2,200,000	40,000	0
Land Committed (Acres)	25	25	5.8(3)*

(1) Source: NUREG-0586. Draft Generic environmental Input Statement on Decommissioning of Nuclear Facilities, January 1981.

(2) Cost estimates depend on whether the pressure vessel internals are entombed along with other radioactive material, or are removed, dismantled, and transported to a radioactive waste repository.

(3) Land surface area would be restored to natural state by grading and replanting. Approximately 5.8 acres of the site subsurface area would be irreversibly committed due to presence of large subgrade concrete foundations.

5.9 THE URANIUM FUEL CYCLE

5.9 THE URANIUM FUEL CYCLE

The effects of the uranium fuel cycle, including the effects of uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, the reprocessing of irradiated fuel, the transportation of radioactive materials, and the management of low-level and high-level wastes related to the uranium fuel activities are as set forth in Table S-3 ("Summary of Environmental Considerations for Uranium Fuel Cycle") of 10CFR Part 51, §51.20.

CHAPTER 6
EFFLUENT AND ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

CHAPTER 6

EFFLUENT AND ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

CONTENTS

CONTENTS (Continued)

CHAPTER 6

EFFLUENT AND ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

TABLES

1

6.1 APPLICANT'S PRE-OPERATIONAL ENVIRONMENTAL PROGRAMS

CHAPTER 6

EFFLUENT AND ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

This chapter describes in detail the means by which baseline data presented in Chapter 2 were collected. In addition, the preoperational and operational programs are also described.

6.1 APPLICANT'S PREOPERATIONAL ENVIRONMENTAL PROGRAMS

6.1.1 Surface Waters

6.1.1.1 Physical Parameters

The information and results presented in Section 2.4 were prepared from nearly a decade of data acquisition. From 1969 through 1972, Normandeau Associates, Inc. (NAI) conducted preliminary hydrographic surveys in the Hampton Harbor estuary, emphasizing summertime conditions, and from September 1972 through the present has continued extensive estuarine and offshore studies year round. Although most of the information regarding these studies and the techniques employed are unchanged from that presented in ER-CPS Section 6.1.1.1, numerous reports have since been prepared which outline the continuing broad-base Seabrook Station hydrographic program. The Summary Document [1] and NAI annual reports for 1975 through 1978 [2,3,4] contain a comprehensive description. These documents detail the parameters measured, the sampling program rationale, and the spatial, temporal, and seasonal coverage. Table 6.1-1 contains a summary of the type and amount of data collected and analyzed.

6.1.1.2 Ecological Parameters

A review of the ecological studies program conducted from 1969 to 1977 is presented in Section 2.0 of the Summary Document [1]. The most recent program, designed for preoperational monitoring, is summarized in Table 6.1-2, and includes sampling for the total community as well as "indicator" species. The rationale for selection of the indicator species is given in Section 4.0 of the Summary Document [1]. Inherent variability of organisms in the community is presented in technical documents referenced earlier in Section 2.2.2 Aquatic Ecology.

Taxonomic identifications of all species collected from the above programs are based on standard biological taxonomic keys for the region. Voucher specimens of all species are verified by outside consultants who are experts in specific taxonomic fields. There is an ongoing documented quality control program that ensures proper processing and identification of all samples collected.

Discussions of environmental stresses as well as physiological and behavioral responses of species to station operation were presented in Seabrook Station's ER-CPS (Section 5.1.3) and in Section 5.0 of the Summary Document [1]. These discussions remain unchanged.

6.1.2 Groundwater

The information is this section remains unchanged from that presented in Section 6.1.2 of the Seabrook Station ER-CPS except as noted below.

Refer to Subsection 2.4.2.1 for a description of groundwater usage for Seabrook Station.

6.1.2.1 Physical and Chemical Parameters

The two closest well fields to the Seabrook Station lie approximately 2000 feet west and approximately 3000 feet north of the site. The monitoring program will include monitoring of representative wells from these fields to assure adequate protection for present and future groundwater users.

Groundwater samples taken from site wells No. 5, 6 and 8 (see Figure 2.4-1) were analyzed and determined to be satisfactory for a potable water supply. The groundwater drawn in the vicinity of Seabrook is of good quality, as it generally is throughout the whole southeastern New Hampshire region.

6.1.2.2 Models

There is no evidence to indicate that accidental releases at the site could contaminate any existing well supplies in the area, since groundwater is moving toward neighboring tidewater bodies and away from populated inland areas. Moreover, public supply wells are located inland in areas beyond reasonable limits of goundwater travel from the site area.

Contaminants released on the site could conceivably reach nearby tidewater bodies. Groundwater movement in the site area is toward adjoining tidal areas and essentially normal to the water table contours (see Figure 2.5-74, Water Table Contours of the Seabrook Station ER-CPS). Local modifications in flow lines are the results of variations in permeability of water bearing materials and of topography. The maximum rate of groundwater movement will occur under conditions of maximum permeability and maximum water table gradient. Table 6.1-3 lists the range and mean values of permeability determined in the various soil samples taken in the vicinity of the site.

Assuming the release of a contaminant near the southern boundary of the site, the maximum rate of travel to the marsh via a groundwater path can be determined. Borings near the southern boundary of the site or just south of the site on the marsh show that the soils are primarily silty sands. These soils correspond to the till and marine (silty phase) deposits in

Table 6.1-3 for which a maximum permeability of 25 gpd/ft^2 is reported.

Assuming a water table gradient of 0.06 feet per foot as observed during high water table conditions and a porosity of 0.3, the maximum rate of groundwater movement along a flow path moving southward from the southern portion of the site is 0.7 ft/day. The shortest distance from a site location at which a radioactive liquid spill could hypothetically occur to the marsh is about 200 feet. Therefore, it will require at least 290 days for a liquid contaminant release at the site to reach the marsh. Furthermore, a part of such contamination would be absorbed on clay or silt particles in the till and marine deposits.

The nearest point of body-contact water activity to the site is in the marsh and estuary of Hampton Harbor. Once a liquid radioactive release had entered the marsh, it would reach Hampton Harbor during a normal tidal cycle. Therefore, as above, it would require at least 290 days for a liquid radioactive release at the site to reach the nearest point of body-contact water activity. The release would be greatly diluted before reaching Hampton Harbor.

6.1.3 Air

To determine actual atmospheric conditions experienced at the site, an initial on-site meteorological monitoring program was started at the Seabrook 1 & 2 site in November 1971. This monitoring program, which utilized an instrumented 150 foot high tower, suspended operation in June 1974. A description of this initial on-site monitoring program is presented in Subsection 6.1.3.1 of the Seabrook 1 & 2 Environmental Report - Construction Permit Stage (ER-CPS). Models used to calculate diffusion estimates from the initial on-site program data are described in Subsection 6.1.3.2 of the Seabrook 1 & 2 ER-CPS, and the resulting data summaries are provided in Section 2.6 and in Appendix H of the Seabrook 1 & 2 ER-CPS.

Meteorological data collection was resumed in April 1979 with the erection of a new 210 foot high tower at the same location as the old tower. A description of the existing meteorological monitoring program is given in the following subsections. The models used to calculate estimates of gaseous effluent dispersion with data from the existing meteorological program are discussed in Subsection 6.1.3.2.

Except for backflush operations during which an ultimate heat sink cooling tower may be utilized, plant operation will not include the use of cooling towers or open bodies of cooling water. As a result, it is anticipated that normal plant operation will have no significant effect on local meteorology. Fogging and icing on the plant environs are not predicted.

6.1.3.1 Existing On-site Meteorological Measurements Program

A new 210 foot instrumented meteorological monitoring tower has been erected at the same location as the old tower and became fully operational in April

1979. A description of the existing tower's location remains unchanged from the description of the initial tower's location as presented in Subsection 6.1.3.1 of the Seabrook 1 & 2 ER-CPS.

The sensors and data processing procedures for the existing program, as described below, meet the requirements for time averaged values as specified in NRC Regulatory Guide 1.23. A meteorological program consistent with NRC Regulatory Guides for on-site meteorology programs will be maintained throughout the life of the plant.

a. Instrumentation

The existing tower is instrumented for wind measurements at heights of 43 feet and 209 feet above the tower base. Wind speed and direction are observed by Climatronics F460 wind systems, which have a starting speed of less than 1.0 mile per hour.

Ambient temperature difference is measured on the tower between 150 and 43 feet and between 209 and 43 feet. These data are obtained by Rosemount platinum temperature sensors and precision resistance bridges. Ambient temperature is also measured by this system for the 43 foot level.

The temperature and delta-T sensors are installed in Teledyne Geotech aspirated shields.

Dew point was initially measured at the 43 foot level on the tower by a General Eastern Model 1200 APS dew point system. The General Eastern dew point system was replaced in May 1981 with a Climatronics lithium chloride dew point system. 1

A heated tipping bucket precipitation gauge and an Eppley pyranometer are also installed on the ground near the base of the tower.

A digital recording system is the primary data collection mechanism for the Seabrook Meteorological System. Through the use of a MODCOMP minicomputer located on-site, each meteorological parameter is scanned once per second and stored on disc as four 15 minute averages per hour. Analog strip charts are also utilized as a backup source of data and for quality control analysis. Wind data are recorded on Esterline-Angus Model L11S2S strip chart recorders; the temperature, delta-temperature, dew point, precipatation, and solar radiation data are recorded on an Esterline-Angus E1124E multichannel recorder.

Table 6.1-4 presents the equipment components, performance specifications, and system error analyses for both the analog and digital data systems. Presented values are summaries from manufacturer's specification sheets.

b. Equipment Maintenance and Calibration

The descriptions of the equipment maintenance and calibration procedures described in Subsection 6.1.3.1 of the Seabrook 1 & 2 ER-CPS for the initial on-site measurements program remain unchanged for the existing monitoring program.

c. Data Analysis Procedures

Data analysis begins with the telecommunication of the 15 minute data averages automatically every six hours from the on-site MODCOMP minicomputer to Yankee Atomic Electric Company in Westboro, Massachusetts. A hard copy data printout is routinely generated at Yankee, and is reviewed to detect unrepresentative or missing data. Corrective action is initiated if any of the meteorological instrumentation is determined to be malfunctioning.

Analog charts and station logs are periodically mailed to Yankee. The strip charts are logged in and reviewed for discrepancies. Analog data are manually abstracted and compared with the corresponding digital data record on a random basis. Gaps in the digital data base are replaced with corresponding manually-abstracted analog data whenever possible, and unrepresentative data are then edited from the digital data base. The first 15 minute averages for each hour are then used in analytical computer programs.

6.1.3.2 Atmospheric Diffusion Models

Hourly meteorological data collected onsite for the period of record April 1979 through March 1980 were used to calculate dose consequences for both short-term (accident) releases and long-term (routine) releases. The assumptions used to compute the consequences of accidental releases followed the methodology of CRAC (Calculation of Reactor Accident Consequences) as performed for the Reactor Safety Study (Reference 12). A description of the basic calculation scheme of the CRAC code is outlined in Section 7.0.

Realistic estimates of annual average atmospheric transport and diffusion characteristics were calculated using a dispersion model which makes use of the following:

- hourly meteorological data
- straight-line trajectory with sector-averaged Gaussian dispersion
- fumigation and trapping
- part-time ground-level and part-time elevated releases (mixed mode release model)
- momentum plume rise
- terrain elevation
- depletion in transit, and

- multiple eddy reflections from both ground and stable inversion layers aloft.

The method of analysis involves computation of the following parameters on an hourly basis:

(CHI/Q) the nondepleted dilution factor for evaluating ground level concentrations of noble gases, tritium, carbon 14 and non-elemental iodines,

$(CHI/Q)_D$ the depleted dilution factor for evaluating ground level concentrations of elemental radioiodines and other particulates,

$(CHI/Q)_\partial$ an effective gamma dilution factor for evaluating gamma dose rates from a sector-averaged finite cloud (multiple-energy undepleted source), and

(D/Q) the deposition factor for evaluating dry deposition of elemental radioiodines and other particulates.

Average dilution and deposition factors were determined from:

$$(\overline{F})_\ell = \frac{1}{N} \sum_{j=1}^{m} (F)_{\ell j}$$

where F is any one of the four factors listed above, is the sector identification number, m is the number of hourly values computed for the sector, and N is the total number of values for all sectors.

The fundamental equations used are based on Regulatory Guide 1.111 and are described in detail in Section 2.3.5 of the Seabrook FSAR. The resulting dispersion estimates are presented in Section 5.2 of this report.

6.1.4 Land

6.1.4.1 Geology and Soils

In addition to the information presented in the Seabrook ER-CPS, further geologic studies were done from 1973 through 1981. Rock and soil properties and condition will not be affected by plant operation, and has not and will not be affected by plant construction.

These later studies consist of a number of various investigations done for foundation engineering, seismic evaluations, cooling water tunnel design, detailed geologic investigations of some site soils, bedrock conditions in site foundations and of bedrock in cooling water tunnels. All of these together form a sizable body of new information which gives considerably greater definition to the rock and soil units beneath and surrounding the site. The bedrock is the principal focus of these studies because all site foundations are excavated to or into rock. Included in these studies are data from some 55 additional borings on the site itself and 116 borings done along several possible cooling tunnel alignments extending three miles to the east of the site. Besides soil and rock descriptions, logs of these borings include engineering descriptions of subsurface materials and such parameters as Torvane shear strengths and water contents for all fine grained soils, n-values (blow counts) for all soils, recovery and RQD measurements on rock cores, and in many cases rock coring rates and borehole core orientation data for joints, foliation, dikes and other planar rock features. For most borings done for tunnel alignments borehole permeability tests were done in bedrock.

To fully substantiate the complete absence of detrimental residual stresses, field measurements were taken by overcoring techniques in site bedrock. Further confirmation of a lack of any overstressed conditions was gained from observations made during detailed mapping of site bedrock foundation excavations.

Geologic mapping in site bedrock foundation excavations for all Safety-Related structures was done at a very detailed scale of 1 inch to 4 feet. The balance of exposed site bedrock was mapped at 1 inch to 32 feet. Soils were mapped in trenches and excavations at the site both prior to and during construction for geological purposes. Geologic mapping is also in progress in the two three-mile long 22 foot diameter cooling water tunnels which extend through bedrock from the site's east end to points over a mile out under the ocean. This mapping program, scheduled for completion by mid-1981 produces maps scaled at 1 inch to 10 feet.

All pertinent rock and soil properties and conditions defined in these additional studies were found equal to or better than what was originally concluded based on the 1969 and 1972 studies. Groundwater seepage into site foundation excavations for example, was far less than originally expected for such deep excavations (up to 66 feet below sea level) in near proximity to the coast (skirting a tidal marsh). The conclusion is that the bedrock underlying plant structures is highly impermeable and a very effective barrier to any fluids.

In 1973 the ground acceleration value for the plant was changed to 0.25g. This change was accompanied by appropriate changes to the attendant parameters of peak particle velocity and earthquake duration as dictated by applicable design response spectra. Details of all investigations can be found in the Final Safety Analysis Report. A summary of this information is in Section 2.5, Geology, of this document.

6.1.4.2 Land Use and Demographic Surveys

A description of existing land use in a five-mile area surrounding the Seabrook Station was made through an interpretation of 1978 aerial photos in conjunction with U.S. Department of the Interior Geological Survey maps of land use for 1973-1975 (Map L-83; Portland, Maine; New Hampshire). It was found that no significant changes in land use had occurred since the ER-CPS and that future land use was regulated by local zoning ordinances described in Section 2.1.3.1 of the ER-OLS. Information on water and land resources and agricultural uses is referenced in Section 2.1.3 of the ER-OLS.

Demographic data for the region was obtained from several sources. Estimates of the resident population within the 50-mile study area of the site are based on U.S. Bureau of the Census data for 1970, and where available, more recent state and regional population estimates as referenced in Section 2.1.2. For distances out to 1.25 miles from the site, the resident population size and distribution was determined by use of aerial photos and house counts made during field surveys. Average household occupancy factors based on 1970 census data were applied in order to estimate the size of the population.

The distribution of the resident population within five miles was based on the distribution of residential dwelling electric meters located in the study area. From five to fifty miles, the resident population distribution was based on an area allocation derived by superimposing a grid network, as denoted on Tables 2.1-2 and 2.1-4 for distances greater than five miles, on a topographical map of the area and ratioing the town populations by the fractional area of the towns within each grid section.

Population projections for the 50-mile study area throughout station life were taken from the most recently available state projections for Maine, New Hampshire, and Massachusetts and extrapolated where necessary to the year 2025, as referenced in Section 2.1.2.

The transient population within ten miles of the Station was determined by dividing the transients into several categories and performing field studies to estimate the size and spacial distribution of each. The transient population categories include seasonal residents, overnight visitors in local hotels, motels and campgrounds, and summer daily transients, who utilize local beaches by driving into the area each day and returning home each night.

The size and distribution of the summer resident population was determined in part by review of electric use patterns of individual dwelling units over a twelve month period. All dwellings which exhibited little or no electrical consumption during winter months, as opposed to increased use during the summer months, were classified as summer cottages. This data was supplemented with 1970 U.S. Census of Housing enumeration district data on vacant-seasonal and migratory units, and information collected from town assessors and building inspectors. This housing inventory was combined with occupancy data derived from beach area housing surveys in order to estimate the size of the seasonal resident category.

The overnight visitor population was determined based on field surveys of the number, size, and location of all hotel, motels, guesthouses, and campgrounds in the areas of interest.

The size and location of the daily transients who drive into the beach area each day during the summer season was determined from review of several series of aerial photographs of beach area, which showed the auto loadings and capacities of the various parking facilities, including street parking, in the area. Average auto occupancy factors were derived from field surveys of the number of people per car who were using beach area parking facilities. These two determinations were combined to give the size of the daily transient population.

The transient population estimates are given in Section 2.1.2.3. The methodology applied in assessing the transients is described in greater detail in the Seabrook FSAR, Section 2.1.3.3.

6.1.4.3 Ecological Parameters

The information presented in Section 6.1.4.3 of the ER-CPS remains unchanged. Greater familiarity with the terrestrial biota as a result of station construction has confirmed the condition of the site as presented in the ER-CPS. A comparison of the list of endangered and threatened species with one developed by the state of New Hampshire indicates that no individuals occupy the site and that possible transients in the adjacent marshes will not be affected as a result of station operation.

6.1.5 Radiological Monitoring

There has been new guidance and requirements in the area of radiological environmental surveillance since 1973, when the preoperational radiological monitoring program was first described in the construction permit stage of the Environmental Report. The guidance provided in USNRC Regulatory Guides (References 5,6,8,10) and USNRC Branch Technical position on radiological monitoring (Reference 7) were used to modify the proposed ER-CPS preoperational surveillance program. The updated environmental radiological surveillance program is described below.

A preoperational radiological environmental surveillance program will be initiated two years prior to startup of Unit I to:

1. provide information on background radiation levels, their variations in environmental media and to document seasonal variations or trends,

2. evaluate procedures, equipment and techniques necessary for sample collection and analysis,

3. provide a sufficient data base of man-made and natural activity for comparison with operational data,

4. provide experience to personnel.

The program is designed to establish correlation between levels of radiation and radioactive materials in the environment and radioactive releases from plant operation by comparison of operational measurements between indicator and control locations. Indicator locations are those sampling stations situated within five miles of the plant site, and are considered to reflect increases in the environment due to plant operation. Control locations are situated ten to twenty miles from the plant usually in the least prevalent wind direction, and are considered to be outside the influence of plant operation. Comparison of indicator and control station measurements allows for differentiation between levels of radiation caused by fallout, seasonal variations, and plant operation.

6.1.5.1 Sample Locations

A census is carried out six months prior to the start of the preoperational environmental surveillance program to identify:

1. the nearest milk producing animals within a three mile distance from the plant,

2. the nearest garden greater than 500 square feet producing broad leafy vegetation within three miles of the plant,

3. the most abundant food crop in the area and estimates of local consumption rates.

Upon completion of the census, a critical pathway analysis is performed utilizing site specific meteorological data to identify critical population groups along with selection of sample media and locations which would contribute the most significant radiation exposure to the public. Table 6.1-6 outlines the Radiological Environmental Program and Sections 6.1.5.3 to 6.1.5.10 give a description of each sampling pathway. 1

6.1.5.2 Analytical Sensitivity

Table 6.1-5 indicates the detection capabilities for environmental samples that will be achieved by the radioanalytical laboratory. These analytical sensitivities for radioactive material in environmental samples are calculated using the lower limits of detection (LLDs). The LLD is the smallest concentration of radioactive material in a sample that will yield a count greater than background corresponding to a 95 percent confidence level.

$$LLD = \frac{4.66 * S_b}{E*V*2.22*\exp(-\lambda t)}$$

Where:

S_b = the standard deviation of the background counting rate
E = the counting efficiency (in counts/disintegration)

V = the sample size (in units of mass or volume)
2.22 = the number of disintegrations per minute per picocurie
λ = the radioactive decay constant
t = the time between sample collection and time of analysis

6.1.5.3 Airborne Monitoring

Air monitoring stations are established at a total of five locations. Four of these are indicator stations, in which three air samplers are located in different sectors at the highest calculated off-site annual average ground level air concentrations based on annual meteorology data. The remaining indicator station is situated in the vicinity of a population center having the highest calculated annual average ground level concentration. A control station is located 10 to 20 miles from the facility. Consideration for locating all air monitoring stations was given to restrictions of year-round access to the location and availability of power. Preoperational monitoring of the control stations provides data on background air concentration levels relative to indicator stations, and documents any seasonal variations or trends in airborne activity. This information is used in assessing any increase in airborne activity after plant startup by comparison of indicator to control concentrations.

Airborne particulates and radioiodines are collected by passing air through a fiberglass filter in series with an iodine adsorption media. The air sampler pumps operate continuously and a dry gas meter is incorporated into the sampling stream to measure the total amount of air sampled in a given interval. The sampling equipment is housed in a locked enclosure to provide weather protection and security for filters and equipment.

The air particulate filters are collected and analyzed weekly for gross beta activity for one year during the preoperational program. The most common source of background counts on the filter is from naturally occurring radon and thoron daughter products. These daughter products adhere to particulate matter and are trapped by the air sampling filters. The filters are held for at least 100 hours before being analyzed to allow for decay of radon and thoron daughter products. Weekly composite air filters from each location are analyzed quarterly for gamma emitting nuclides. Charcoal cartridges are collected and analyzed weekly for I-131 activity for six months during the preoperational program.

6.1.5.4 Gamma Radiation Monitoring

Thermoluminescent dosimeters (TLDs) are located in two concentric rings around the facility. The inner ring of stations are located in the general area of the site boundary, while an outer ring of stations are located located four to five miles from the plant. The rings are divided into sixteen standard windrose sectors with an arc of 22.5 degrees. Each sector, except sectors located over the ocean, contains a TLD station. Additional TLD stations are located in population areas, nearby residence, schools, public interest and control locations. A badge or pack of TLDs consisting of four or more TLD chips will be placed in each station. This allows for a more accurate measurement of gamma radiation at each location by averaging the values, and permits rapid detection of faulty dosimeters. Performance specifications, general testing, calibration, field and reporting procedures for environmental dosimeters are performed according to criteria specified in ANSI 545N (Reference 11) and Regulatory Guide 4.13 (Reference 10). The TLDs are read out monthly or quarterly for both years of the preoperational program.

6.1.5.5 Milk Monitoring

Milk is sampled at three indicator locations having the highest dose potential within a three mile distance from the plant. A census of the nearest milk producing animals (cows and goats) is conducted six months prior to the start of the preoperational program to determine these milk sampling locations. If no milk producing animals exist within three miles of the station, then milk is sampled from animals in each of three areas between three to five miles from the plant where doses are calculated to be greater than one mrem per year. The indicator stations compared to a control station located 10 to 20 miles from the plant.

Milk is sampled and analyzed for gamma emitters biweekly when milk animals are on pasture, and monthly at other times for one year during the preoperational program. Iodine 131 activity is also analyzed biweekly for six months during the pasture season. The samples are preserved with 37 percent formalin to prevent souring and curdling, and methimazole is added to prevent the process of iodine protein-binding after sampling.

6.1.5.6 Groundwater Monitoring

Groundwater is collected quarterly from two indicator locations in the immediate area of the plant. Grab samples from these locations are analyzed for gamma emitters and tritium. All groundwater samples are analyzed for one year during the preoperational program. Analytical sensitivities for tritium and gamma emitters in water are indicated in Table 6.1-5.

6.1.5.7 Surface Water

Grab samples are collected from the discharge area and a control location. The control station is located outside the area of plant influence to provide background data for comparison with data from the discharge area location. All surface water samples are analyzed for gamma emitting nuclides monthly and a tritium analysis is performed quarterly on monthly composite samples.

6.1.5.8 Food Crops and Vegetation Monitoring

Representative samples of three principle food crops from three indicator locations are compared to a control location. Food crops including samples of tuberous and root food products are collected, and a gamma isotopic analysis is performed on edible portions at harvest time. If milk samples are not available within a three-mile distance of the plant, then three samples of broad leafy vegetation grown nearest the off-site location, with the highest calculated annual average ground level D/Q, are analyzed when available for I-131 during growing season. All food product samples are analyzed for both years of the preoperational sampling program.

6.1.5.9 Sediment Monitoring

Sediment samples are collected from three indicator and one control location. The indicator stations include beach and recreational areas in the vicinity of the discharge area, plus a location in the discharge area. The control station is located outside the influence of the station's effluents. Bottom sediment samples will be collected using a 1.5 to 2 inch coring device. Six core sections, each having a minimum core depth of six inches, are collected per sampling site. All sediment samples are analyzed for gamma emitters semi-annually for both years during the preoperational program.

6.1.5.10 Fish and Invertebrate Monitoring

Representative samples of three commercially and recreationally important species in the vicinity of the discharge point are collected seasonally or semi-annually if they are not seasonal. The same species collected in the vicinity of the discharge point are also sampled in control areas not influenced by the plant discharge. Only edible portions of fish and invertebrates are analyzed for gamma emitters for both years during the preoperational program.

6.1.5.11 Quality Control Program

A quality control program is established to cover all levels of the environmental surveillance program. Written procedures are developed for calibration of all sampling equipment. The equipment is calibrated on a regular basis, so that the accuracy of the equipment can be checked, and if necessary, adjusted to bring the equipment within established specifications.

Procedures for sampling, preserving, shipping and storing environmental media are established to insure that representative samples are being collected in a uniform manner and are being preserved, packaged and stored to maintain the integrity of the sample from time of collection to time of analysis.

The radioanalytical laboratory is required to participate in an environmental radioactivity laboratory cross-check program. This provides an independent check of accuracy and precision of the laboratory analysis. If results of a cross-check analysis fall outside the control limit, an investigation is made to determine the cause of the problem and corrective action is taken.

The radioanalytical laboratory maintains an intralaboratory quality control program to assure the validity and reliability of the data. This program includes quality control of laboratory equipment, use of reference standard for calibration, determination of counting efficiencies and analysis of blank and spiked samples. The records of the quality control program are reviewed and corrective measures are taken whenever applicable.

A blind duplicate sample program is established. Samples are prepared from split or homogenous media and sent to the laboratory for analysis. The results from the analysis are used to check for precision in-laboratory analyses.

6.1.5.12 Reporting Requirement

A report on the radiological environmental surveillance program for the previos calendar year is submitted to the Director of the NRC Regional Office as a separate document by May 1 of each year. The report is first submitted on May 1 following the date of initial criticality and includes summarized and tabulated results in the format of Table 6.1-7 of all radiological environmental samples taken during the report period. In the event that some results are not available, the report is submitted, noting and explaining the reason for the missing results. The missing data is submitted as soon as possible in a supplementary report.

The Annual Radiological Environmental Report includes interpretations and an analysis of trends for the results of the radiological environmental surveillance activities for the report period, including a comparison with operational controls, preoperational studies and previous environmental surveillance reports and an assessment of the observed impacts of the station on the environment. The report also includes a summary description of the radiological enviromental monitoring program, a map of all sampling locations keyed to a table giving distances and direction from one reactor, the results of the land use census, and the results of licensee participation in the quality assurance program.

If a confirmed measured radionuclide concentration in an environmental sampling medium averaged over any calendar quarter sampling period exceeds the reporting levels of Table 6.1-8, a written report is submitted to the Director of the NRC Regional Office within 30 days from the receipt of the laboratory analyses, but not in any case more than 60 days from the end of the affected calendar quarter. When more than one of the radionuclides in Table 6.1-8 are detected in the sampling medium, the reporting level is exceeded if:

$$\frac{\text{Concentration (1)}}{\text{Reporting Level (1)}} + \frac{\text{Concentration (2)}}{\text{Reporting Level (2)}} + \ldots \geq 1$$

If radionuclide other than those in Table 6.1-8 are detected and are the result of plant effluents, a reporting level is exceeded if the potential annual dose to an individual is equal to or greater than the design objective 1 doses of 10CFR Part 50, Appendix I. This report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such an event, the condition shall be reported and described in the Annual Radiological Environmental Operating Report. 1

6.1.6 References

1. Normandeau Associates, Inc., 1977. "Summary Document: Assessment of Anticipated Impacts of Construction and Operation of Seabrook Station on the Estuarine, Coastal, and Offshore Waters, Hampton-Seabrook, New Hampshire", prepared for Public Service Co. of N.H., Manchester.

2. Normandeau Associates, Inc., 1979a. "Annual Summary Report for 1976 Hydrographic Studies Off Hampton Beach, New Hampshire", Technical Report VII-1.

3. Normandeau Associates, Inc., 1977b. "Annual Summary Report for 1977 Hydrographic Studies Off Hampton Beach, New Hampshire", Technical Report X-1.

4. Normandeau Associates, Inc., 1980. "Annual Summary Report for 1978 Hydrographic Studies Off Hampton Beach, New Hampshire", Technical Report X-2.

5. USNRC Regulatory Guide 4.1, Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants, Revision 1, April 1975.

6. USNRC Regulatory Guide 4.8, Environmental Technical Specifications for Nuclear Power Plants, December 1975.

7. USNRC Branch Technical Position, An Acceptable Radiological Environmental Monitoring Program, July 1979.

8. USNRC Regulatory Guide 4.15, Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment, Revision 1, February 1979.

9. NUREG-0475, Radiological Environmental Monitoring by NRC Licensees for Routine Operations of Nuclear Facilities, October 1978.

10. USNRC Regulatory Guide 4.13, Performance Testing, and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Applications, Revision 1, July 1977.

11. American National Standards, Performance, Testing, and Procedural Specifications for Thermoluminescence Dosimetry (Environmental Applications), August 1975.

12. WASH-1400, (NUREG-75/014), The Reactor Safety Study, An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants, NRC, October 1975.

TABLE 6.1-1

SEABROOK STATION SURFACE WATER DATA COLLECTED
PHYSICAL PARAMETERS
(Sheet 1 of 2)

I. Continuous Monitoring of Oceanographic Parameters from Fixed Points:

A. Mooring Deployment: More than 30 different specially designed mooring systems to serve as instrumentation platforms have been deployed on a year-round basis.

B. Current Measurements: For nearly 7 years continuous water current speed and direction measurements have been obtained from the various offshore moorings compiling a data base, exceeding 40 current-meter mooring years.

C. Temperature Measurements: For nearly 7 years continuous water temperature measurements have been obtained from the various offshore moorings as well as from around the Inner and Outer Sunk Rocks and the Hampton Harbor estuary, documenting nearly 30 temperature monitoring years of data.

D. Tide Elevation Measurements: For 6 years tide elevation was monitored continuously in the Hampton Harbor estuary.

II. Oceanographic Cruises:

A. Plankton Cruises: Essentially monthly oceanographic cruises to survey plankton distribution, hydrographic parameters, and net circulation patterns (drifter releases) in the western gulf of Maine out to almost 25 n mi offshore.

B. Slack Water Surveys: Monthly to semi-monthly hydrographic surveys to document low-water and high-water "slack" distributions of ambient temperature, salinity, density and dissolved oxygen at stations in Hampton Harbor and offshore around the various proposed intake and discharge sites.

C. Special Temperature Studies: Over a 1-year period intensive temperature surveys (including *in situ* monitoring and tide-pool measurements) were made around the Inner and Outer Sunk Rocks off the mouth of Hampton Harbor.

TABLE 6.1-1
(Sheet 2 of 2)

III. Anchor Station Studies:

Periodic surveys over a tidal cycle at selected stations to document ambient currents, temperature, salinity, density and dissolved oxygen; frequently included in situ streamer observations and drogue studies.

IV. Drifter Studies:

More than 4 years of drifter releases including some 12,000 drift bottles and nearly 15,000 drogue and sea-bed drifters with an overall recovery of about 25 to 40%, depending upon the drifter type; included a special study to determine the probability of coastal waters entering the Hampton Harbor estuary and neighboring estuaries as a function of distance and depth offshore.

V. Sedimentological Studies:

A. Sediment Stakes: Monthly height measurements of stakes jetted into the sea floor were used to document long-term, net-sediment erosion and/or deposition.

B. Sediment Trap: This device was used to document seasonal aspects of near-bottom suspended sediment transport at the nearshore intake site;

C. Turbidity Survey: Two special surveys were conducted to measure ambient turbidity levels in Hampton Harbor estuary under "typical" and "post-storm" conditions.

TABLE 6.1-2
(Sheet 1 of 6)

PREOPERATIONAL ECOLOGICAL STUDY PROGRAM,
SEABROOK STATION

SAMPLE TYPE	GEAR TYPE	# STATIONS	FREQUENCY	SAMPLE SIZE OR DURATION	REPLICATION	DEPTH	DATA COLLECTED
A. Finfish							
1. Gill nets	100'x8' net with 4 mesh sizes	3	biweekly	two 24 hr periods	none	surface, off-bottom	number, length and weight of each species
2. Otter trawl	30' shrimp trawl	3	monthly	10 minute tows	4	bottom	number, length and weight of each species
3. Seining	100'x9' net with 2 mesh sizes	3 (e)[a]	biweekly (Apr-Nov)	-	2	-	number, length and weight of each species
4. Indicator species							
a. Cunner Age & growth[c]	Diver seine	1	1 per year	-	250 indiv.	off-bottom	length, weight, sex and age of each specimen
b. Alewife Spawning run	none	1 (e)	3 x per week	6 weeks (Apr-May)	-	-	counts of individuals passing fish ladder per hour
5. Ichthyoplankton							
a. Regular	505µ, 1m net	3	biweekly	10 minute tows	4	oblique	number of all species; lengths of larvae

TABLE 6.1-2
(Sheet 2 of 6)

b. Diel-indicator species, cunner & winter flounder	505µ, 1m net	1	twice per year (Apr-Jul)	10 minute tows 4 times in 24 hours	2	surface, mid-depth and bottom	April-number and length of winter flounder larvae, July-number of cunner eggs and larvae
c. Rainbow smelt	50'x8' net with 2 mesh sizes	4	monthly	two 24 hr periods	none	mid-depth, off-bottom	number, length and weight of each species
B. Plankton							
1. Phytoplankton[b]	Niskin	3	biweekly, monthly Dec-Feb	0.8 Liter	2	surface	species counts
2. Productivity/ biomass	Niskin	3	biweekly, monthly Dec-Feb	0.25 L 0.9 L	2	surface	mg carbon uptake/m^3/hr mg chl A/m^3
3. Water quality	Niskin	3	biweekly, monthly Dec-Feb	0.5 L	none	variable	mg TPo_4, ortho Po_4, NO_2, NO_3, NH_4/1; mg O_2/1; midomhos of conductivity; temperature °C
4. Microzooplankton[b]	76µ, 0.16m net (pumped)	1	biweekly, monthly Dec-Feb	100 L	4	surface, off-bottom	species counts
5. Macrozooplankton[b]	505µ, 1m nets	3	biweekly	10 minute tow	3	oblique	species counts, lengths of key species meristic & seasonal data on Neomysis

TABLE 6.1-2
(Sheet 3 of 6)

a. Diel[b]	505 μ, 1m nets	1	1 per year (Oct)	10 minute tow	2	surface, mid-depth and bottom	counts and staging of <u>Neomysis americana</u>
6. Meroplankton	76 μ, 0.5m net (towed)	1	weekly (Apr-Oct)	2 minute tow	2	oblique	bivalve larvae species count
7. Neuston[b]	1mm, 1x2m net	1	biweekly (May-Oct)	30 minute tow	none	surface	countys and staging of Homarus americana larvae
8. Physical data							
a. Temporal	in situ recorders	1	continuous (20 min interval)	continuous	-	subsurface, mid-depth and bottom	temperature, all depths current speed and direction, subsurface
b. Spatial	salinometer	4	biweekly monthly-winter	-	-	all depths (2m intervals)	temperature (^{o}C) conductivity (micromhos)
C. Benthos							
1. M;arine intertidal							
a. Nondestructives	random quadrats	3	5 x per yr	$0.25m^2$	10	mean sea level	number or % cover of dominant fauna & flora
b. Destructives	scraped sample	3	3 x per yr	$0.0625m^2$	5	mean low water	number of all fauna species in August; number of dominant fauna in May, December; dry weight biomass of flora in all collections
c. Indicator species	scraped sample	2	bimonthly (except winter)	100-250 individuals	-	mean low water	staging and meristics of Amphithoe rubricata live/dead ratio of Mytilus edulis staging of Chondrus crispus

TABLE 6.1-2
(Sheet 4 of 6)

2. Marine subtidal								
a. Nondestructive		random quadrats	4	3 x per yr	1m^2	2	-20' to -60' below MLW	% cover and frequency of occurence of dominant understory algae
b. Transects		random transects	5	3 x per yr	1x10m^2	6	-20' to -60' below MLW	#,% cover of dominant kelps; number of Modiolus modiolus
c. Destructives-macrofauna & macroflora		diver operated airlift	12	3 x per yr	0.0625m^2	5	-10' to -80' below MLW	number of all fauna species in August; number of dominant fauna in May, December; dry weight biomass of flora in all collections
d. Destructives-meiofauna		diver operated airlift	6	monthly	50cm^2	3	-10' to -60' below MLW	number of all taxonomic groups present; number of all harpactacoid copepod species
e. Settling communities								
1) Surface	5	plexiglass & wood panel	4	monthly, 3 x per yr, yearly	103.2cm^2	2	-10' below MLW	number or % cover of dominant fauna and flora; staging of Mytilus edulis; staging and meristic data on Jassa falcata
2) Bottom		bluestone panel	5	3 x per yr and 1,2,3 years	0.0624m^2	4	-45' to-80' below MLW	counts or % cover of the dominant fauna & flora dry weight biomass of flora on yearly panels

TABLE 6.1-2
(Sheet 5 of 6)

f. Indicator species							
1) Hard substrate organisms	diver operated airlift	5	bimonthly (except winter)	100-250 individuals	-	-10' to 60' below MLW	staging of Chondrus crispus, live/dead ratio of <u>Mytilus</u> <u>edulis</u>; meristic data on selected amphipods
2) Algae growth & reproduction	in situ tagged plants	2	monthly (except winter)	30 individuals	-	10' below MLW	linear or areal changes in plant size and reproductive status
3) <u>Arctica</u> <u>islandica</u>[c] reproduction	random diver collection	1	biweekly (Oct-Dec)	20-40 individuals	-	-50' below MLW	reproductive status
4) <u>Homarus</u> <u>americanus</u>	conventional traps	2	3 x per wk	Jun-Nov	5	-50' below MLW	number, size and sex of all individuals; data also collected for cancer crabs
3. Estuarine							
a. Destructives	diver operated airlift	4 subtidal (e) 4 intertidal (e)	3 x per yr	$0.0625m^2$	5	subtidal intertidal	number of all species present
b. Carcinus maenas	conventional traps	4(e)	biweekly	Mar-Dec	2	subtidal	number, size and sex of all individuals
c. Sediments	core	6 subtidal (e) 6 intertidal (e)	3 x per yr		5-grain size 1-LOI	subtidal intertidal	grain size analysis organic carbon estimate from LOI (loss on ignition)

TABLE 6.1-2
(Sheet 6 of 6)

d. Temperature & salinity	Niskin, thermometer	2(e)	3 x per wk	Jan-Dec	none	subsurface	temperature (°C) conductivity (micromhos)
D. Mya arenaria							
1. Adults	clam fork	5 flats (e)	yearly	$0.186m^2$	14 to 72 (flat dependent)	intertidal	number and size of all individuals
2. Spat	core	3-5/site, 3 sites (e)	3 x per yr	$81cm^2$	3	intertidal	number and size of all individuals
3. Larvae							
a. Regular	76μ, 0.5m net	1	biweekly (Apr-Oct)	2 minute tow	2	oblique	number of individuals
b. Intensive	76μ, 0.5m net	12	2 x per yr (Aug-Sept)	2 minute tow	2	oblique	number of individuals when densities are highest

a. (e) = estuarine sites; all others marine

b. Includes indicator species

c. Adequate data collected; program suspended until operational phase

TABLE 6.1-3

SUMMARY OF FIELD PERMEABILITY
FOR GLACIAL AND BEDROCK MATERIALS
IN THE SEABROOK AREA

Type of Material	Number of Samples	Permeability in gpd/sq. ft. Range	Mean
Outwash	6	17 - 130	50
Marine (silty phase)	2	0.3 - 0.6	0.4
Till	21	0.3 - 25	5
Bedrock	9	1 - 51*	4

*Large fracture, not used in mean

Reference: Groundwater Hydrology for the Proposed Seabrook Nuclear Station, by Weston Geophysical Research, Inc., 1969.

Table 6.1-4

EXISTING ONSITE METEOROLOGICAL INSTRUMENTATION SPECIFICATIONS

PARAMETERS	SYSTEM ACCURACY ROOT-SUM-SQUARED TIME AVERAGED	SENSORS				TRANSLATORS		ANALOG RECORDER		A/D CONVERTOR	
		MANUFACTURER & MODEL	RANGE	ACCURACY	THRESHOLD OR SENSITIVITY	MANUFACTURER & MODEL	ACCURACY	MANUFACTURER & MODEL	ACCURACY	MANUFACTURER & MODEL	ACCURACY
Wind Speed	<± 0.5mph	Climatronics F460 Transmitter	0 to 100mph	± 0.15mph or 1%	0.58mph Threshold	Climatronics 100078	± 0.2%	Esterline Angus L1152S	± 0.25%		
Wind Direction	<± 5.0°	Climatronics F460 Transmitter	0° to 540°	± 3°	0.58mph Threshold	Climatronics 100077	± 0.05%	4½" Chart			
Temperature and Delta Temp.	Temp: <± 0.9°F Delta T: <± 0.18°F	Teledyne Geotech 127 Asp. Shield Rosemont 78 Platinum Sensors Rosemont 414L Temp Bridge	Temp: -30° to +110°F Delta T: -10° to ±18°F	Sensor: ± 0.47°F @ 0°C ± 0.95°F @ 100°C Bridge: ± 0.1% of Span	Temp: ± 0.2°F Maximum Radiation Effect	Climatronics 100142 100143	± 0.05%	Esterline Angus E1124E	± 0.3%	Mod Comp 1400 Analog Input Subsystem	± 0.05%
Dew Point	<± 0.9°F	Gen. Eastern 1200 APS (a)	-30° to +110°F	± 0.36°F	N/A	Climatronics 100089	± 0.05%	8 Channel Multipoint			
Precipitation	± 0.01 inch (Instantaneous)	Belfort 5-405H Precip.	N/A	± 1% to ± 6%	± 0.01 inch Sensitivity	Climatronics 100157	± 0.05%	10" Chart			
Solar Radiation	<± 0.1 Cal/cm^2-min	Eppley 8-48 Pyranometer	0 to 2 Cal/cm^2-min	± 5%	75 mV per Cal/cm^2-min Sensitivity	Climatronics 100144	± 0.05%				

(a) The General Eastern dew point system was replaced in May 1981 with a Climatronics Model DP-10 lithium chloride dew point system with a range from -40° to +107°F and an accuracy of ± 0.9°F.

TABLE 6.1-5

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS (LLD)

Analysis	Water (pCi/l)	Airborne Particulate or Gas (pCi/m^3)	Fish (pCi/kg,wet)	Milk (pCi/l)	Food Products (pCi/kg,wet)	Sediment (pCi/kg,dry)
gross beta	2[b]	1×10^{-2}				
^{3}H	2000 (1000[b])					
^{54}Mn	15		130			
^{59}Fe	30		260			
$^{58,60}Co$	15		130			
^{65}Zn	30		260			
89 Sr				10		
90 Sr				2		
^{95}Zr	10					
^{131}I	1.0[c]	7×10^{-2}		1.0[c]	60[c,d]	
$^{134,137}Cs$	15 (10[b])	1×10^{-2}	130	15	60	150
^{140}Ba	15			15		

b - LLD for drinking water
c - LLD for I-131 in water, milk and food products
d - LLD for leafy vegetables

TABLE 6.1-6

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
(Sheet 1 of 3)

Exposure Pathway and/or Sample	Number of Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
1. AIRBORNE			
Radioiodine and Particulates	*Samples from 3 off-site locations (in different sectors) with the highest calculated annual ground level D/Q. 1 sample from the vicinity of a population center having the highest calculated annual average ground level D/Q. 1 sample from a control location 15-30 km distance. *Consideration for location of air monitoring stations was given to year round access to the location, availability of power, and population in the area.	Continuous operation of sampler with sample collection as required by dust loading but at least once per 7 days.	Radioiodine canister. Analyze at least once per 7 days for I-131. Particulate sampler. Analyze for gross beta radioactivity $\geq$24 hours following filter change. Perform gamma isotopic analysis on each sample when gross beta activity is $>$ 10 times the yearly mean of control samples. Perform gamma isotopic analysis on composite (by location) sample at least once per 92 days.

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TABLE 6.1-6
(Sheet 2 of 3)

Exposure Pathway and/or Sample	Number of Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
2. DIRECT RADIATION	32 stations with two or more dosimeters placed in two concentric rings around the plant. 8 stations with two or more dosimeters placed at control locations, population centers and nearby residences	At least once per 92 days.	Gamma dose. At least once per 92 days.
3. WATERBORNE			
a. Surface	1 sample in the area of the discharge. 1 sample from a control location.	At least once per 31 days.	Gamma isotopic analysis of each sample. Tritium analysis of composite samples at least once per 92 days.
b. Ground	2 samples from sources likely to be affected.	At least once per 92 days.	Gamma isotopic and tritium analyses of each sample.
c. Sediment	3 samples from beach locations near the discharge area. 1 sample from a control location.	At least once per 184 days.	Gamma isotopic analysis of each sample.

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TABLE 6.1-6
(Sheet 3 of 3)

Exposure Pathway and/or Sample	Number of Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
4. INGESTION			
a. Milk	3 samples from locations within 3 miles distance from the plant having the highest dose potential. 1 sample from a control location.	At least once per 15 days when animals are on pasture; at least once per 31 days at other times.	Gamma isotopic and I-131 analysis of each sample.
b. Fish and Invertebrates	1 sample from the discharge area. 1 sample from a control location.	One sample in season, or at least once per 184 days if not seasonal of 3 commercially and recreationally important species.	Gamma isotopic analysis on edible portions.
c. Food	1 sample from 3 farms or gardens having the highest dose potential. 1 sample from a control location.	At time of harvest. One sample of 3 principal classes of food products grown in the area.	Gamma isotopic analysis on edible portion.

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TABLE 6.1-7

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING SUMMARY

Name of Facility________________________ Docket No.____________________

Location of Facility____________________ Reporting Period______________

MEDIUM: MILK UNITS: PCI/LITER

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	NOMINAL LLD***	INDICATOR STATIONS MEAN, RANGE, AND NO. DETECTED**	STA.	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LOCATIONS MEAN, RANGE, AND NO. DETECTED**
K-40 (48) (0)	2.0E+02	(1.4 ± .0) E 3 (1.1 - 1.6) E 3 *(36/36)*	13	(1.4 ± .0) E 3 (1.2 - 1.6) E 3 *(12/12)*	(1.3 ± 0) E 3 (1.3 - 1.4) E 3 *(12/12)*
I-131 (48) (0)	.5	(1.8 ± .6) E -2 (-6.6 - 8.8) E -2 *(0/36)*	13	(2.2 ± .8) E -2 *(0/12)*	(2.2 ± 1.6) E -2 (-4.6 - 12.7) E -2 *(0/12)*
CS-134 (48) (0)	9.	(-1.2 ± .2) E 0 (-3.6 - 1.4) E 0 *(0/36)*	12	(-9.7 ± 3.5)E -1 *(0/12)*	(-1.3 ± .3) E 0 (-3.2 - .3) E 0 *(0.12)*
CS-137 (48) (0)	9.	(4.1 ± .2) E 0 (1.5 - 67.7) E -1 *(27/36)*	21	(8.6 ± 1.3) E 0 (9.5-189.0) E-1 *(11/12)*	(8.6 ± 1.3) E 0 (9.5-189.0) E -1 *(11/12)*

* Non-routine refers to the number of separate measurements which were greater than ten (10) times the average background for the period of the report.

** The fraction of sample analyses yielding detectable measurements (i.e., > 3 sigma) is indicated within *( )*.

*** Nominal Lower Limit of Detection (LLD) as defined in table notation a. of ER-OLS Table 6.1-5, Specification 6.1-5.

a. Note: The example data provided in this table are for illustrative purposes only.

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TABLE 6.1-8

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Reporting Levels

Analysis	Water (pCi/l)	Airborne Particulate or Gases (pCi/m^3)	Fish (pCi/Kg, wet)	Milk (pCi/l)	Food Products (pCi/Kg, wet)
H-3	2×10^4 (a)				
Mn-54	1×10^3		3×10^4		
Fe-59	4×10^2		1×10^4		
Co-58	1×10^3		3×10^4		
Co-60	3×10^2		1×10^4		
Zn-65	3×10^2		2×10^4		
Zr-Nb-95	4×10^2 (b)				
I-131	2	0.9		3	1×10^2
Cs-134	30	10	1×10^3	60	1×10^3
Cs-137	50	20	2×10^3	70	2×10^3

(a) For drinking water samples. This is 40 CFR Part 141 value.

(b) Total for parent and daughter.

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6.2 APPLICANT'S PROPOSED OPERATIONAL MONITORING PROGRAMS

6.2 APPLICANT'S PROPOSED OPERATIONAL MONITORING PROGRAMS

6.2.1 Radiological Monitoring

6.2.1.1 Station Radiation Monitoring System

a. General Description

The Radiation Data Management System (RDMS) is a real time digital computer based system. The system consists of front end microprocessors (which convert the pulse type detector signals into engineering units, provide local indication, alarm/control functions and transmit data to the host computer), a redundant Central Processing Unit (CPU) host computer and various operator/programmer interface devices. Gaseous and liquid effluent monitoring is accomplished by using monitors which are part of the RDMS. The manner in which this monitoring is provided is described in the following sections.

b. Gaseous Effluent Monitoring

There are three monitors in the waste gas system. Two of the three monitors are used as indicators of carbon bed performance. One monitor is located upstream and the other downstream of the carbon delay bed. The third monitor maintains a running inventory of the total activity vented to the atmosphere. This monitor automatically closes the waste gas discharge valve upon an indication of high radiation levels.

Gaseous activity that might result from a primary to secondary system leak would be detected at the condenser air evacuation vent. Under certain operating conditions, the detector at this location would monitor the discharge of radioactive material to the atmosphere. The discharge of the condenser air evacuation system is normally unfiltered, but may be manually redirected to filters on receipt of a high radiation alarm.

The plant vent radiation monitor measures the radioactivity of the air exhausted (from the waste process building, fuel storage building and the containment enclosure) to the unit plant vent.

Air from the vent is drawn by a pumping system through two isokinetic probes. Each probe is equipped with a flow element that provides a signal to the radiation monitors to calculate the microcuries per cubic centimeter flowing in the duct, microcuries per second and the integrated microcuries released through the plant vent.

The air collected by the isokinetic probe is passed through a combined moving paper filter, iodine cartridge and a noble gas radiation monitor sample chamber. The range of the noble gas radiation monitor is 10^{-7} to 10^{5} $\mu Ci/cm^3$.

In addition, airborne radioactivity monitors are located in the administration building fume hood exhaust, fuel storage building exhaust, containment enclosure exhaust, PAB ventilation exhaust, waste process building ventilation exhaust, and the exhaust from the administration building, the controlled area locker room and the counting room.

c. Liquid Effluent Monitoring

The monitors in the liquid waste effluent system maintain inventory totals of radioactivity stored and discharged from each tank, as well as liquids transferred into the tanks. A high radiation reading on the monitor in the system discharge will isolate the stop valves in the discharge line.

The monitors in the steam generator blowdown sample system measure radioactivity in the steam generator blowdown samples. An additional monitor isolates the blowdown sample tank discharge to the environment when high radiation is detected.

6.2.1.2 Environmental Radiological Monitoring

Except for surface water monitoring, the operational radiological environmental surveillance program will be an extension of the preoperational program described in Section 6.1.5 of this report. This is to ensure that data from both programs are compatible for evaluation of radiological impact from plant operation on the surrounding environment, and to assure that a smooth transition between programs can be achieved. Installation of composite samplers for surface water from the discharge area and a control location will be accomplished before the start of the operational program.

A yearly census will be conducted within three miles of the facility to determine locations of all milk animals and gardens greater than 500 square feet producing broad leafy vegetation. If the census reveals that milk animals or gardens exist at locations that would yield calculated thyroid doses greater than existing sampling locations, then these locations would be added to the surveillance program.

A report on the operational environmental surveillance program will be prepared and submitted to the Director of the NRC Regional Office on a yearly basis. This report will include: a description of the radiological environmental monitoring program; results of analysis for each media with comparison to controls and preoperational analysis; results from milk animal and garden census; a map of all sampling locations with a table giving distance and location from one reactor; results of the contractor's analytical laboratory participation in an environmental radioactivity intercomparison cross-check program; and an assessment of observed impacts of the facility operation on the environment.

6.2.2 Surface Waters

The operational phase receiving water thermal effluent monitoring program will

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be designed to determine compliance with those federal and state regulatory criteria described in ER-OLS, Section 5.1.1, "Effluent Limitations and Water Quality Standards". The program outlined below addresses both the routine (day-to-day) and backflush phases of station operation, and includes a description of the proposed continuous in situ monitoring and periodic field surveillance plan. The description, however, is limited in scope to program objectives and technical approach. Program specifications will be detailed prior to station operation.

Superceded
Submitted to EPA
SB 1987
9/24/85

6.2.2.1 Routine Operation Monitoring

The thermal monitoring program for the day-to-day phase of station operation will be directed at the measurement of temperatures inside and outside the discharge jet mixing region. In each case, in situ recorded temperatures will be compared to a farfield reference station to determine station induced temperature rise in the receiving waters. The reference station will be quantitatively established from the many years of temperature data recorded in the region. It will be located in a region unaffected by the station discharge plume or other thermal effects (such as the Hampton Harbor discharge), but in an area with similar bathymetry and response to like meteorological and hydrographical conditions, as in the discharge region.

Inside the jet mixing region, defined as "within 300 feet of the submerged diffuser in the direction of discharge", a daily (24 hours) temperature average will be computed from an in situ surface (-2 feet) monitor. To determine compliance, the daily average discharge temperature will be compared to the daily average value, plus 5°F (the maximum permitted temperature rise), for the same location as determined from the reference station.

Similarly, for compliance outside the jet mixing region, the daily average temperature for in situ monitors at the surface (-2 feet), mid-depth (-25 feet), and bottom (+2 feet) will be compared to the daily average values, plus 5°F, for the same depths determined from the reference station.

An annual report tabulating monitoring results for each month will be prepared and forwarded to appropriate regulatory agencies.

6.2.2.2 Backflush Operation Monitoring

Thermal monitoring during backflush operations will be directed at the periodic surveillance of temperatures in the region of the Sunk Rocks. The objective will be to demonstrate that the backflush plume flows offshore and/or temperature increases are minimized at the Sunk Rocks, a condition proposed by the U.S. EPA Region I. Since the "worse case" conditions for causing increased temperatures at the Sunk Rocks are during a flood tide or "northeaster" storm, backflush operations will not commence at the beginning of a flood tide nor during northeast storm wind conditions.

To determine compliance, a large-area synoptic field measurement survey will be performed over no more than two complete backflush cycles each year, provided that backflushing is implemented by the station in that year. Differential surface isothermal contours will be constructed for the region at various phases of the backflush cycle, depicting the spread of the backflush plume as well as naturally occurring plumes, such as the Hampton Harbor discharge.

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Results will be submitted with the annual report (see Section 6.2.2.1).

6.2.3 Meteorological Monitoring

It is currently planned that the existing meteorological tower and instrumentation will be used during the operational phase of the Seabrook Station. In addition, a 10m backup tower instrumented with wind speed and direction is planned to be located approximately 300 feet SSE of the existing tower prior to station operation. The meteorological data from both the primary and backup towers will be scanned and recorded as 15-minute averages by the plant's process computer. Strip chart recorders will continue to serve as a backup source of data.

A Class A dispersion model will be available on a plant computer to produce initial transport and diffusion estimates for the plume exposure Emergency Planning Zone. The model shall use automatically supplied meteorological data from the primary monitoring system to produce plume dimensions and position, location and magnitude of the peak relative concentration, and relative concentrations at several downwind locations. Using effluent release information and a finite cloud external gamma dose model, estimates of near-real-time dose rates and accumulative sector average doses will also be available. The model will have the graphics capability of drawing relative concentrations and dose isopleths over a background map of the site.

6.2.4 Other Programs 1

No other environmental monitoring programs are planned at this time. If future circumstances indicate a need for additional investigation, details will be provided as supplementary information to the ER-OLS.

6.3 RELATED ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS

6.3 RELATED ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS

Environmental monitoring programs within the Hampton-Seabrook region other than those being conducted or planned by the applicant are varied. In evaluating this subject a thorough canvas was made of those local, state, and federal agencies deemed likely to be involved in such efforts. In addition, nearby educational institutions were contacted and queried as to possible scientific research projects within the study area. In establishing the applicability of related studies to those of the applicant, a determination was made of comparable parameters and location. Below are discussed those study programs which because of their subjects and sampling locations are considered related to the environmental programs of the applicant.

Dr. Larry Harris, of the University of New Hampshire, is studying hard substrate communities at Jeffrey's Ledge and the Isles of Shoals and fouling communities at New Castle Harbor. Although his sampling sites are about 10 to 15 miles from the applicant's study area, the biological communities involved are similar. At the Isles of Shoals, Dr. Harris is studying hard substrate communities at 25, 60 and 100 foot depths with emphasis on the distribution of sea anemones. One of Dr. Harris' graduate students, A. Hulbert, is studying starfish; and another student, J. Wisman, is studying Modiolus communities. The Jeffrey's Ledge project is being conducted in conjunction with the Ocean Pulse program of the National Marine Fisheries service. Hard substrate communities studied are at 100 and 125 foot depths.

Dr. Robert Croker at the University of New Hampshire has studied sandy beach communities in New Hampshire and southern Maine since 1971. At one time, his sample sites included stations within the Hampton-Seabrook estuary and at an outer beach close to the inlet. Dr. Croker has discontinued sampling these sites, however his remaining sampling sites have similar communities.

Jackson Estuarine Laboratory of the University of New Hampshire was contacted relative to their research efforts within the Hampton-Seabrook area. The applicant is assured by the laboratory director, Dr. Arthur Mathieson, that no one at this facility is presently engaged in studies at Hampton-Seabrook.

The Department of Earth Sciences at the University of New Hampshire was contacted. Although Dr. T. Loder, Dr. W. B. Lyons, Dr. H. Gaudette and Dr. W. Brown are all studying various processes within the Piscataqua River-Great Bay Estuary, no one in this department is currently studying the Hampton-Seabrook area.

The New Hampshire Public Health Department along with personnel at the Departments of Zoology and Biochemistry at the University of New Hampshire assisted by New Hampshire Fish and Game Department are presently engaged in a monitoring program involving toxic effects of red tide (paralytic shellfish poisoning) affected soft-shell clams on laboratory mice. This program was initiated in the fall of 1972 when a bloom of the dinoflagellate

Gonyaulax occurred. Two species of clams, Mytilus edulis and Mya arenaria, are sampled weekly from Hampton Harbor and processed for bioassay. It is expected that this monitoring effort will continue at least until clam toxicity levels decrease to a point which indicates they have definitely purged themselves of the paralytic shellfish poisoning factor. The applicant is also in contact with New Hampshire Fish and Game Department that is involved in this program.

The New Hampshire Fish and Game Department is involved in collecting fisheries statistics. Anadromous fish are studied in coastal waters and include smelt, alewives, shad, blueback herring, coho salmon , chinook salmon and Atlantic salmon. In addition, the department collects statistics on marine recreational fisheries from party boats and shore fisheries. The department is proposing monitoring work in the Piscataqua River-Great Bay Estuary to update baselines for comparisons in future oil spills. The study will concentrate on factors impacting species of commercial value.

The New Hampshire Water Supply and Pollution Control Commission is involved in a continuing program of water quality assessment for the coastal waters of the state. The principal water quality parameters of interest are those which relate to contamination from sanitary waste discharges (e.g., M. P. N. Coliforms, dissolved oxygen, BOD). Other routine physio-chemical parameters monitored are temperature, chlorides, color and pH. Water and biological specimens are also collected for background radiological monitoring. Some of the sampling sites are located within the Hampton Seabrook Study area, one station is located adjacent to the intake site.

The Maine Department of Marine Resources studies soft-shell clams in several locations in southern Maine. Clams are monitored for PSP (paralytic shellfish poisoning) levels. In addition, relative abundance of green crabs and their predation on young clams is monitored.

According to Arthur Chesmore, the Massachusetts Division of Marine Fisheries is involved in a number of marine studies off the northern Massachusetts coast including: 1) monitoring of PCB's and hydrocarbon, 2) research and management of lobster populations, 3) resource assessment of ground fish populations, and 4) examination of shellfish in contaminated areas.

Dr. Roland Wigley at the National Marine Fisheries Service office in Woods Hole, Massachusetts is involved in two programs of fish assessment on the Georges Bank. Fish stomach contents are analyzed for sources of food. Ground fish populations are surveyed using stratified random samples. Plankton are also monitored in the Gulf of Maine.

John Clay, of Ecology and Environment, Inc., has indicated that his company is involved in baseline studies of several harbors including the Piscataqua River-Great Bay Estuary for future oil assessment. They are looking at hydrocarbons in sediments and how they affect benthic communities. They are also constructing resource inventory maps of important ecological and recreational areas for decision making by the Oil and Hazardous Materials Division of the E.P.A.

A joint project funded by the Atomic Energy Commission (now Nuclear Regulatory Commission), New England Electric System and the Middlesex - Essex Power Pool developed a computer model for prediction of nuclear power plant effects on nearshore coastal waters. The work was done by EG&G of Bedford, Massachusetts. From the analysis of data on ocean currents, temperature, salinity, wind direction and velocity, etc., as well as a review of the extensive literature on ocean environments, the study constructed a model to predict both thermal and radiological effects. The area under study was generally off the Massachusetts coast. However, the northern most EG&G sample stations overlap the southerly stations of the applicant's environmental study program. This program resulted in a final report in 1976.

6.4 PRE-OPERATIONAL ENVIRONMENTAL RADIOLOGICAL MONITORING DATA

6.4 PREOPERATIONAL ENVIRONMENTAL RADIOLOGICAL MONITORING DATA

Seabrook's preoperational environmental radiological monitoring program is scheduled to start two years prior to the startup of Unit I. Monitoring data from this program will be submitted as a later supplement to the Environmental Report - Operating License Stage. The preoperational monitoring program planned for the site is described in Section 6.1.5 of this report.

CHAPTER 7
ENVIRONMENTAL EFFECTS OF ACCIDENTS

CHAPTER 7
ENVIRONMENTAL EFFECTS OF ACCIDENTS

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CHAPTER 7
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CHAPTER 7

ENVIRONMENTAL EFFECTS OF ACCIDENTS

FIGURES

7.1 INTRODUCTION

CHAPTER 7

ENVIRONMENTAL EFFECTS OF ACCIDENTS

7.1 INTRODUCTION

The design and construction of the Seabrook Station has included considerable effort to product a highly reliable and safe plant. This is achieved through correct design, manufacture, and installation of basic plant structures and components, within the context of an effective quality assurance program. Similar emphasis is placed on the operational aspects in terms of developing detailed procedures and providing for quality training of plant operating and maintenance personnel. Furthermore, in the very unlikely event that serious accidents might occur, the station is equipped with a complement of emergency safety features for mitigating the effects and consequences of such accidents.

In this chapter the potential environmental effects of postulated accidents at the Seabrook Station are assessed. The assessment is done in a risk analysis format; that is, the probabilities of realizing various levels of consequences from a wide spectrum of possible accidents and associated environmental conditions are considered. The intent of such an analysis is to produce an assessment which realistically reflects the environmental risk from postulated accidents and which is responsive to the recent interim policy statement issued by the USNRC regarding nuclear power plant accident assessments under NEPA (Reference 1).

The next section of the chapter, Section 7.2, discusses the general approach and defines the scope of the analysis which as been performed. This is followed by Section 7.3 which describes the methods used and presents the results obtained in determining the frequencies of certain radioactivity releases from postulated accidents. Section 7.4 outlines the methodology used to evaluate potential off-site environmental consequences of the releases in a probabilistic manner, presents the risk results, and discusses specific matters related to the analysis. Supplementary information and data are supplied in the final section, Section 7.5.

7.2 GENERAL APPROACH AND SCOPE OF ANALYSIS

7.2 GENERAL APPROACH AND SCOPE OF ANALYSIS

7.2.1 Background Discussion

Two previous comprehensive risk assessments of commercial nuclear power plants have been done which provide valuable benchmarks for establishing the scope of the present analysis. The first of these is the Reactor Safety Study (Reference 2) which was completed in late 1975. In this study, extensive use was made of probabilistic analysis methods to identify potential accident sequences, evaluate their expected frequencies, and estimate the public impacts in a statistical manner. The methodology involved a heavy use of logic diagrams (event trees and fault trees) to trace or lay out a host of possible accident sequences which were then subjected to various levels of quantitative analysis to define a collection of potentially significant risk contributors. The expected frequencies of these accident sequences were evaluated on the basis of available data, and representative sequences from the collection were analyzed to estimate the radioactivity releases that would result. This allowed a grouping of the accident sequences into a system of radioactivity release categories which in turn identified those sequences that were the dominant probabilistic contributors to each category. The radiological consequences of the releases for each category were assessed using a system of composite population distributions and a statistical sampling of weather data derived from actual nuclear power plant sites throughout the United States. These results were then combined probabilistically to produce a generic risk envelope for U.S. commercial light water reactors. Very similar risk envelopes were obtained for both PWR and BWR class plants. One of the more significant observations resulting from this study was that the assessed risk envelope was dominated by severe accidents; that is, accidents involving core melt. These accidents, often referred to as Class 9 accidents, result from the possible degradation or failure of one or more redundant emergency safety systems, and hence are beyond the design basis limits for nuclear power plants. The other relevant risk assessment was performed subsequent to the Reactor Safety Study (RSS), but it concentrated on investigating the risk from lower classes of accidents (Reference 3). Since the work constituted a risk assessment of a PWR for Class 3-8 accidents, it provides a check of the RSS observation that these less severe accidents are probably minor contributors to total risk. The Class 3-8 study estimated risk to the public using methodology which was similar to that used in RSS. However, in general the effort was able to rely more on actuarial data and less on engineering analyses of accident probabilities than in the RSS because the frequency of the less severe accidents is higher. Extensive use was made of Licensee Event Reports (LER's) and some new approaches in methodology were employed during the study. This included the application of a technique known as "partial failure analysis" to treat a continuous spectrum of potential failure modes. Another unique feature was the derivation and use of a system of radionuclide weighting factors which allowed accident releases to be expressed in iodine-131 equivalent curies and simplified the consequence analysis process. The results of the study led to the conclusion that Class 3-8 accidents, as reviewed, provide a small contribution to risk in comparison with Class 9 accidents. This conclusion was found to be relatively insensitive to uncertainties in the risk estimates and it confirms the earlier observations of the Reactor Safety Study.

7.2.2 Procedure for Seabrook Evaluation

The two generic risk assessments discussed in the previous subsection clearly indicate that the risk from LWR power plants is dominated by the severe accidents. Since the observation is based upon a comparative evaluation rather than upon absolute assessed risk, it should be applicable to any particular LWR power plant. Accordingly, the scope of the present analysis for the Seabrook Station emphasizes consideration of environmental effects from postulated severe accidents.

The analysis utilizes the probabilistic approach for assessing the frequencies and consequences of a broad collection of Class 9 type accidents. Because of this the effort uses as much of the methodology from the RSS as possible. The general procedure involves adoption of the PWR radioactivity release categories as defined in WASH-1400 (Reference 2), but a disciplined investigation is performed to modify the category frequencies to reflect the specific design of the Seabrook Station. In addition, the final definition of release category frequencies does not use the smoothing technique that was incorporated in the WASH-1400 generic work. The smoothing process is an arbitrary procedure which tends to obscure the detail of the analysis.

The off-site consequences of the specified releases are evaluated in this study using the same calculational mechanism as was used in WASH-1400, but the weather data file and the population distributions used are specific to the Seabrook site. The treatment of evacuation in the analysis also utilizes population movement data that have been developed from actual site survey studies.

The particular methodologies employed in both the accident frequency determinations and in the consequence assessment portions of the analysis are discussed in more detail in the following sections. The combined risk assessment results for all accident release categories are displayed in probabilistic format near the end of the chapter. These results adopt many of the measures of risk that are customarily used in probabilistic risk assessments of nuclear facilities.

7.3 DETERMINATION OF RELEASE CATEGORY PROBABILITIES

7.3 DETERMINATION OF RELEASE CATEGORY PROBABILITIES

7.3.1 Methodology

The methodology employed in this study for determining the accident sequences and evaluating them probabilistically is identical to the methodology used in WASH-1400, the Reactor Safety Study (RSS). Event trees were constructed for the same initiating events considered in the RSS. The only changes made to the event trees reflect the specific features of the Seabrook Station or improvements in event tree construction learned as a result of the RSS.

Notably, for improvements, electric power is not considered a system in itself on the event trees developed, and sodium hydroxide addition was dropped from the event tree because it has no effect on determining release category assignment of the accident sequences. Electric power failures will be considered in the system fault trees.

Due to the capabilities of the emergency core cooling subsystems, the LOCA initiating event has been subdivided into five parts in this study as compared to three in the RSS. The event trees constructed for Seabrook appear in Section 7.3.3.

Fault tree models were constructed for electric power, emergency core cooling injection, emergency core cooling recirculation, containment spray injection, containment spray recirculation, component cooling, service water, and emergency feedwater systems. The level of detail of the fault trees is consistent with the RSS detailed trees. The systems modeled are also consistent with the RSS with the exception of the Reactor Protection System (RPS). The RPS evaluation was based on the RPS model in the RSS with an updated failure data base.

The fault trees were evaluated using the RSS failure data base with the exception of the RPS already mentioned and the loss of off-site power. Site specific data was used to evaluate the frequency of loss of off-site power. Data from other plants, including non-nuclear, tied to the same grid were used to make this evaluation. The containment failure modes used in this study are identical to the RSS.

The core melt accident sequences were assigned to release categories by comparing Seabrook sequences to RSS sequences. The release categories were evaluated probabilistically by summing the accident sequence probabilities of the sequences assigned to the release category. The accident sequence probabilities were obtained by evaluating the intersection of the appropriate system fault trees making up the sequences. This was accomplished using the WAM series of fault tree evaluation codes developed by the Electric Power Research Institute.

7.3.2 System Description

This section includes brief descriptions of the systems that were modeled by fault trees.

7.3.2.1 Containment Spray Injection and Recirculation System

The Containment Spray Injection System (CSIS) is actuated by a containment spray actuation signal (CSAS), which is initiated by high pressure in the containment. The CSIS pumps water from the Refueling Water Storage Tank (RWST) to the spray nozzles located high in the containment building. The RWST contains a minimum of 435,000 gallons of borated water at a maximum temperature of 86°F, and provides cooling for a minimum of 21.9 minutes after an accident, based upon maximum pumps in operation at maximum flow rates. The CSIS is a two redundant train system. The CSIS pumps are horizontal centrifugal pumps designed to deliver 3010 gpm each, and selected to supply the design spray flow rate at containment design pressure. Upon a low level signal from the RWST (approximately 350,000 gallons removed), the suction of the CSIS pumps automatically realign to take suction from the containment recirculation sump. The pumps are designed to take suction from the containment sumps at the most limiting NPSH condition (atmospheric pressure and a temperature of 212°F) and pump it back into the containment through spray nozzles. Each train is equipped with a heat exchanger to remove heat from the recirculated water. Each heat exchanger is designed for 100% heat removal capacity.

7.3.2.2 Emergency Core Cooling System

The Emergency Core Cooling System (ECCS) consists of the centrifugal charging pumps, safety injection pumps, a boron injection tank, a refueling water storage tank, the residual heat removal pumps, the residual heat removal heat exchangers, the safety injection accumulators, and the associated valves and piping. The primary function of the ECCS following an accident is to maintain the core in a flooded condition and to remove the stored and fission product decay heat from the reactor core such that fuel rod damage, to the extent that it would impair effective cooling of the core, is prevented.

The reliability of the ECCS has been considered in selection of the functional requirements, selection of the particular components and location of components and connected piping. Redundant components are provided where the loss of one component would impair reliability. Valves are provided in series where isolation is desired, and in parallel when flow paths are to be established for ECCS performance. Redundant sources of the safety injection actuation signal are available so that the proper and timely operation of the ECCS will be ensured. Sufficient instrumentation is available so that a failure of an instrument will not impair readiness of the system. The active components of the ECCS are powered from separate buses which are energized from off-site power supplies. In addition, redundant sources of auxiliary on-site power are available through the use of the emergency diesel generators to ensure adequate power for all ECCS requirements. Each generator is capable of driving all pumps, valves, and necessary instruments associated with one train of the ECCS.

All valves required to be actuated during ECCS operation are located to prevent vulnerability to flooding. Repositioning of valves due to spurious actuation coincident with a LOCA has been analyzed and is not considered credible for a design basis.

Upon the initiation of a safety injection "S" signal, the following automatic actions are initiated to commence the injection phase of emergency core cooling:

1. Centrifugal charging pumps start

2. Refueling water storage tank suction valves to charging pumps open

3. Boron injection tank inlet and outlet parallel isolation valves open

4. Normal charging path valves close

5. Charging pump miniflow valves close

6. Boron injection tank recirculation valves close

7. Boron injection tank recirculation pumps stop

8. Safety injection pumps start

9. Residual heat removal pumps start

10. Any closed accumulator isolation valves open. These valves will open only if power is available to the normally de-energized motor control Centers, E 522 and E 622

11. Volume control tank outlet isolation valves close

During the injection phase, two centrifugal charging pumps (CCP's) operate to inject concentrated boric acid stored in the boron injection tank into the cold legs of all four loops. The source water to the CCP's is the refueling water storage tank (RWST).

Once the Reactor Coolant System (RCS) pressure is below the shutoff head of the two safety injection pumps (SIP's), they begin to take borated water from the RWST and deliver it to the cold legs of the four loops. This is done through the residual heat removal (RHR) injection/accumulator discharge lines. In the case of a steam line break or small RCS break, the system pressure remains high for a long period of time, and the CCP's and SIP's supply core cooling.

When the RCS pressure drops below the pressure of the four safety injection accumulator tanks, they discharge their contents into the four RCS cold legs. These accumulators contain borated water and are pressurized with nitrogen. This portion of the ECCS is most effective in the case of large RCS breaks where system pressure drops rapidly to the accumulator pressure.

The two residual heat removal pumps (RHRP's) take water from the RWST and inject it into the cold legs of all four RCS loops via the accumulator discharge lines once system pressure drops below the shutoff head of the pumps. Therefore, upon the initiation of the safety injection "S" signal, borated water is injected into the RCS via the CCP's, SIP's, accumulator tanks and RHRP's. The point at which these various injection modes commence operating is controlled by the rate at which the reactor coolant is lost and system pressure drops.

The RWST supplies the borated water used for the injection phase of the ECCS. When the RWST water level drops to the low-low-1 level alarm point, the injection phase is discontinued and the cold leg recirculation phase is initiated.

The changeover from the injection mode to recirculation mode is initiated automatically and completed manually by operator action from the main control room. Protection logic is provided to automaticaly open the two containment recirculating sump isolation valves when two out of four refueling water storage tank level channels indicate a refueling water storage tank level less than a low-low-1 level setpoint in conjunction with the initiation of the engineered safeguards actuation signal ("S" signal). This automatic action would align the two residual heat removal pumps to take suction from the containment sump and to deliver directly to the RCS. It should be noted that the residual heat removal pumps would continue to operate during this changeover from injection mode to recirculation mode.

The two charging pumps and the two safety injection pumps would continue to take suction from the refueling water storage tank following the above automatic action, until manual operator action is taken to align these pumps in series with the residual heat removal pumps.

The refueling water storage tank level protection logic consists of four level channels, with each level channel assigned to a separate process control protection set. Four refueling water storage tank level transmitters provide level signals to corresponding normally de-energized level channel bistables. Each level channel bistable would be energized on receipt of a refueling water storage tank level signal less than the low-low-1 level setpoint.

The two out of four coincident logic is utilized on both protection cabinets, A and B, to ensure a trip signal in the event that two out of the four level channel bistables are energized. This trip signal, in conjunction with the "S" signal, provides the actuation signal to automatically open the corresponding containment sump isolation valves.

The low-low-1 refueling water storage tank level signal is also alarmed to inform the operator to initiate the manual action required to realign the charging and safety injection pumps for the recirculation mode. Following the automatic and manual switchover sequence, the two residual heat removal pumps would take suction from the containment sump and deliver borated water directly to the RCS cold legs. A portion of the Number 1 residual heat removal pump discharge flow would be used to provide suction to the two charging pumps which would also deliver directly to the RCS cold Legs. A portion of the discharge flow from the Number 2 residual heat removal pump would be used to provide suction to the two safety injection pumps, which would also deliver directly to the RCS cold legs. As part of the manual switchover procedure, the suctions of the safety injection and charging pumps are cross connected so that one residual heat removal pump can deliver flow to the RCS and both safety injection and charging pumps, in the event of the failure of the second residual heat removal pump.

After approximately 18 hours, cold leg recirculation is terminated and hot leg recirculation is initiated. This is done to terminate any boiling in the core should the break be in one of the RCS cold legs. During this phase of recirculation, the SIP's discharge is aligned to supply water to all four RCS hot legs. The CCP's do not have the capability to feed the hot legs and continue to supply the cold legs. However, the RHR pumps can be aligned to feed the hot legs of loops 1 and 3.

In this analysis, heat removal has been considered as part of the RHR system. Each train of the RHR has a heat exchanger in it designed for 100% heat removal capacity. These heat exchangers, along with the CSIS heat exchangers, are cooled by the component cooling water system.

7.3.2.3 Component Cooling Water System

The Component Cooling Water (CCW) system supplies flow to the following safeguard components which are required for safe shutdown and/or to ameliorate the consequences of an accident:

a. Containment spray pumps

b. Containment spray heat exchangers

c. Residual heat removal pumps

d. Residual heat removal heat exchangers

e. Safety injection pumps

f. Centrifugal charging pumps

g. Containment enclosure coolers

The system serves as an intermediate fluid barrier between the reactor coolant and service water systems assuring that leakage of radioactive fluid from the components being cooled is not released to the environment.

The CCW system consists of two independent and redundant flow loops. Each loop supplies component cooling water to one of the redundant components performing engineered safeguard functions and other non-safeguard loads.

The system is designed to perform its safety function while accommodating a single failure of any component coincident with a loss of off-site power.

A passive failure in one loop will not jeopardize flow in the redundant loop. Protection is provided for the primary component cooling water pumps from water jets which might be caused by pipe ruptures in the redundant header.

The CCW system consists of two independent flow loops, each of which supplies component cooling water to one of the redundant components performing engineered safeguard functions and to various non-safeguard components. One of the two 100% (accident conditions) CCW pumps connected in parallel supplies flow to each loop. One CCW heat exchanger in each loop transfers the heat loads from the plant components to the service water system.

A single CCW pump providing flow to the CCW heat exchanger in its loop is capable of removing the total heat during the recirculation phase following a loss of coolant accident occuring simultaneously with a loss of off-site electrical power.

7.3.2.4 Service Water System

The function of the station service water system is to transfer the heat loads from various sources in both the primary and secondary portions of the plant to the ultimate heat sink. The system has been designed to supply sufficient cooling water to its heat loads under all possible operating conditions. Each unit has an identical service water system with no active components shared between the two units.

The ultimate heat sink for all operating and accident heat loads is normally the Atlantic Ocean. The station service water system, as described in this section, pertains to the normal heat sink. The service water system normally uses seawater at a design temperature of 65°F from the ultimate heat sink as a source of cooling water.

In the unlikely event that seawater flow to the service water pumphouse is restricted (> 95% blockage) due to seismically induced damage to the circulating water (seawater) intake and discharge tunnels, a mechanical draft evaporative cooling tower is provided to dissipate shutdown and accident heat loads.

The system for each unit consists of two completely independent and redundant flow trains, each of which supplies cooling water to a primary component cooling water heat exchanger, a diesel generator jacket water cooler, the secondary component cooling water heat exchangers and the condenser water box priming pump seal water heat exchangers.

Flow in each redundant train is supplied by two redundant service water pumps. Each service water pump is capable of supplying 100% of the flow required by each flow train to dissipate plant heat loads during normal full power operation. Thus, for full power operation, two pumps per unit (one pump per flow train) will be required.

The four service water pumps, provided for each plant, take suction from a common bay in the service water pumphouse. Seawater flow is supplied to the service water pumphouse from the Atlantic Ocean due to the static head of the ocean above the elevation of the service water pumps' suction. Water levels above the pump suction exceed pump submergence requirements of 4.5 feet above the lip of the pump bell providing adequate NPSH under all expected operating conditions.

7.3.2.5 Emergency Feedwater System

Upon loss of normal feedwater flow, the reactor is tripped, and the decay and sensible heat is transferred to the steam generators by the reactor coolant system via the reactor coolant pumps or by natural circulation when the pumps are not operational.

Heat is removed from the steam generators via the main condensers or the main steam safety and/or relief valves. Steam generator water inventory is maintained by water make-up from the emergency feedwater system. The system will supply feedwater to the steam generators to remove sufficient heat to prevent the overpressurization of the reactor coolant system, and to allow for eventual system cooldown.

The emergency feedwater system is comprised of two full-sized pumps (one motor-driven and one turbine-driven), whose water source is the condensate storage tank. Suction lines are individually run from the tank to each pump, with a common return line which is used for recirculation and pump testing. Both pumps feed a common discharge header, which in turn supplies four lines to the main feedwater headers. Each emergency feed line is connected to one of the main feedwater headers downstream of the feedwater isolation valve. The combined feed line enters the containment through a single penetration and feeds a single steam generator. A minimum of 200,000 gallons of demineralized water is maintained in the lower half of the condensate storage tank for the exclusive use of the emergency feedwater system. Make-up to the tank is provided by the demineralized water make-up system.

The motor-driven pump and pump controls are powered from an emergency bus. Steam for the turbine-driven pump is supplied from either of two main steam headers via branch lines connected upstream of the main steam isolation valves. Each branch line includes an air-operated, fail-open valve.

The pumps discharge into a common header which has four branch connections for lines to the steam generators via the main feedwater headers. The discharge header includes normally open gate valves between each branch connection to provide isolation in the event of a pipe break.

The branch lines to each steam generator include an air-operated flow isolation valve and a flow restricting venturi. The flow isolation valves are normally in the open position when the system is not operating, and will fail to the open position on loss of air. The open position of these valves will be set to insure the minimum required flow to each steam generator for the most limiting case. Each flow isolation valve is provided with a handwheel for manual operation. The flow restricting venturis are sized to limit flow to 750 gpm in the event of an isolation valve failure coupled with a downstream pipe break.

7.3.2.6 Electric Power System

There are two 4160 volt AC emergency buses. Each bus is fed by a unit auxiliary transformer and a reserve auxiliary transformer. These transformers are fed by on-site and off-site power. In the event of loss of off-site power, each bus can be fed by a diesel-driven generator. These 4160 volt buses (E5 and E6) supply power to all the electrically-driven pumps mentioned in the previous system descriptions. The loads on the two buses is such that loss of one of the buses will not cause complete loss of any of the systems previously described. The E5 bus has three stepdown transformers as part of its load which supply power to 460V AC buses. The E6 bus has four such loads. The 460V AC buses supply power to the valves in the previously described systems. Stepdown transformers from some of these 460V AC buses supply the 120V AC vital instrumentation and control power system. The 120V AC is used also to operate the battery chargers which can supply the redundant DC buses. The DC buses are also fed by the batteries. Throughout the entire electrical system, redundancy is maintained so that the loss of any bus or train of buses will not cause the complete loss of any engineered safety feature.

7.3.3 Event Tree/Fault Tree Models

Event trees have been developed for the same general initiating events as in the RSS. The event trees have been changed as required to reflect the site specifics of Seabrook and to incorporate improvements in the methodology since the RSS. Initiating events considered were as follows:

a. LOCA's

b. Vessel rupture

c. Interfacing LOCA

d. Anticipated transients

Also, the containment failure mode of the RSS was retained as is. The LOCA event trees were subdivided into five, as compared to three in the RSS). This was due to the additional capabilities and combinations of successful pump outputs for the Emergency Core Cooling System.

7.3.3.1 Large LOCA Event Tree

The large LOCA event tree is shown in Figure 7.3-1. Comparing it to the equivalent event tree in the RSS, the major differences are no electric power system and sodium hydroxide system failures. Electric power failures were modeled in the system fault trees as failure modes for the components requiring electrical power. As mentioned previously, sodium hydroxide did not affect the outcome of the accident sequences in the RSS. The only other difference is that the RSS considered Emergency Core Recirculation (ECR) and containment heat removal as separate systems. This was unique to the Surry design. In the Seabrook event tree, heat removal from the containment is carried out by either ECR or CSR. Throughout the event trees developed for the Seabrook station, the system successes are carried through the accident sequences and are noted by the dash over the letter.

In Sequences 5 and 6 on the event tree, it has been assumed that failure of the emergency core functionability will induce failure of the ECR. There is no reason to believe that if the core was disrupted, preventing successful emergency core injection (ECI), that it would not also affect the recirculation mode. Similarly, in Sequences 7 and 8, failure of ECI will cause failure of ECR because the same basic systems are involved with the exception of the source of water. Sequences 13, 14, and 15 reflect the same assumptions.

7.3.3.2 Medium LOCA Event Trees

Figure 7.3-2 shows the event tree developed for the M_1, M_2 and M_3 sized LOCA's. The difference between these three event trees is the success criteria for the ECI and ECR. This criteria is shown in Table 7.3-1. The medium-sized LOCA event trees show the addition of the reactor protection system (RPS) and dropping of the ECF, as compared to the large LOCA tree. This is consistent with the RSS small LOCA event tree.

The ECI/ECR dependency discussed for the large LOCA event tree is reflected in Sequences 5 and 6. Sequence 11 reflects the assumption that if both the CSIS and ECI fail, there will be inadequate water collected in the containment sump for the SCRS or ECR to function. Sequences 12 through 15 reflect the assumption that failure of the RPS causes failure of the ECI and subsequent failure of the ECR. If SCRAM does not occur, pressure of the primary system will be too great for successful operation of the ECI. This assumption is based on a study performed by Westinghouse (Reference 4).

7.3.3.3 Small LOCA Event Tree

The small LOCA event tree is shown in Figure 7.3-3. Compared to the medium LOCA event tree, it has the addition of the Emergency Feedwater System (EFWS), which is required to remove decay heat from the primary system in order to maintain a low enough pressure of the primary system for successful ECI. Again, Sequences 5 and 6 reflect the dependency of ECR on a successful ECI. Sequence 11 reflects the need for CSIS and ECI before CSRS and ECR can be considered. Sequences 12 through 17 indicate that the primary system pressure must be controlled for successful ECI. If RPS fails, the primary system pressure will be too great for ECI to be successful. If the EFWS fails, the primary system pressure will increase due to decay heat and ECI cannot be successful. These assumptions are based on the Westinghouse study mentioned earlier.

Section 7.5 contains a glossary of terms for the LOCA event trees.

7.3.3.4 Anticipated Transient Event Tree

Figure 7.3-4 shows the transient event tree for Seabrook. It is identical to the transient event tree developed in the RSS.

Section 7.5 contains a glossary of terms for the transient event tree.

7.3.3.5 Reactor Vessel Rupture Event Tree

The Reactor Vessel Rupture event tree is shown in Figure 7.3-5. The equivalent event tree in the RSS had just the CSIS and CSRS. The Seabrook Station has the RHRS added. At Seabrook, both the CSRS and RHRS are capable of removing containment heat. At the Surry plant analyzed in the RSS, the CSRS was the only system with heat exchangers.

A glossary of terms for this event tree also appears in Section 7.5.

7.3.3.6 Interfacing LOCA Event Tree

The interfacing LOCA event tree is shown in Figure 7.3-6. It should be noted that the Seabrook design includes one of the three Standard Review Plan designs suggested for the check valves between the primary system cold legs and the low pressure injection system. This improved design, as compared to the Surry design at the time of the RSS, will be reflected in the probability of the interfacing LOCA initiator discussed later in this section. The Seabrook RHR design allows for circulation of hot leg water through the heat exchangers and back to the cold legs. This mode is used to go from hot shutdown to cold shutdown, once the primary system pressure is adequately reduced. To accomplish this, two motor-operated valves in series must be opened. This requires operator action and satisfaction of the pressure interlock. Failure modes allowing the opening of these valves at primary system pressure will result in an interfacing LOCA.

The event tree itself reflects the systems capable of delaying the eventual outcome of a core melt. This event tree is in agreement with the RSS event tree for the same initiating event.

7.3.3.7 Containment Failure Mode Event Tree

To complete the accident sequences, the containment failure modes are needed. No new work was done in this area. The containment event tree developed in the RSS was used. It is shown in Figure 7.3-7, for which a glossary of terms appears in Section 7.5.

7.3.3.8 Fault Tree Models

Fault tree models were developed for the six systems described in Section 7.3.2. As mentioned earlier, the fault trees were developed to a level of detail consistent with the RSS detailed fault trees. All events were included in the fault trees. Test and maintenance events evaluated outside the fault trees in the RSS were included directly in the fault trees for Seabrook by means of "NOT" gates reflecting the dependencies.

The ECI and ECR were developed as one fault tree model. The operational modes were controlled by means of house events which allow only one operational mode at a time. The CSIS and CSRS were modeled in a similar manner. The Component Cooling Water System (CCWS) fault tree was fed into the ECCS and containment spray system trees as required for pump cooling and heat exchanger cooling. The service water system fault tree was input to the CCWS tree to reflect the path to the ultimate heat sink. Finally, the electric power system fault tree was fed into all of the above trees as required.

Assumptions made in the fault trees were consistent with the assumptions made in the RSS. The major assumptions included were as follows:

1. Hot leg injection has been assumed to fail Low Pressure Injection System (LPIS) if it occurs during the injection or cold leg recirculation.

2. The opening of motor-operated valves to the containment spray pumps has been assumed to fail LPIS if it occurs duing the injection phase.

3. It has been assumed that the acceptable individual system performance is achieved with only one of the four cold leg flow paths providing flow to the reactor coolant system.

4. Contribution of the hot leg circulation phase to the overall system performance has been assumed to be negligible considering the fact that the simultaneous cold leg-hot leg recirculation is not

initiated until approximately 19 hours into the accident.

5. The inadvertent opening of the valves betwwen the LPIS and the High Pressure Injection System (HPIS) pipings has been assumed to fail LPIS and HPIS if it occurs during the injection phase.

6. It has been assumed that any rupture equal to or larger than one-fourth the size of the main stream pipe will cause insufficient flow in the main stream.

7. It has been assumed that no isolation of leakage will take place in the RHR pipings by the operator due to very short available time in the event of a large LOCA.

8. It has been assumed that the LOCA in one of the primary loops will only fail the cooling provided for the same loop and will not have any effect on the cooling provided for the other loops.

9. It has been assumed that no interface between Unit 1 and Unit 2 exists except for the emergency power system.

10. No failure has been assumed due to inadvertent signal from Engineered Safety Features Actuation System (ESFAS).

11. It has been assumed that the operator will have a chance to start the necessary parts of the safety systems given that no automatic actuation has occured. The time available to the operator for this action will vary with the respect to the size and location of the break in the primary system, and it will be very short in the event of a large LOCA.

12. No additional model was developed for instrumentation.

13. No possibility for repair of damaged components has been assumed during the accident.

14. It has been assumed that a change in the status of the primary system or plant operation (such as power level, temperature, or density changes) will not interfere with the performance of the safety systems.

15. It has been assumed that failure of the electrical heater at the suction of each safety injection or centrifugal charging pump will fail the respective pumps due to insolubility of boric acid in the water at low temperature.

16. No failure of the components has been assumed due to structural failure or other adverse environmental conditions based on their location.

17. No detailed failure modes were identified for the refueling water storage tank boron injection tank or condensate storage tank, such as failure associated with heat control devices or heaters.

18. It has been assumed that failure to isolate centrifugal charging pumps from the rest of the Chemical and Volume Control System (CVCS) during a LOCA will cause insufficient cooling from centrifugal charging pumps to be delivered to the primary coolant system.

19. Safety systems performance has been assumed to be independent of the location of the break in the primary system.

20. Technical specifications would be met regarding maintenance allowable outages.

21. It has been assumed that enough coolant supply is available to the emergency feedwater pumps from the condensate storage tank which, if depleted, is suppled water from the demineralized water make-up system.

22. It is assumed that EFW pumps cannot pump against high pressure if all SG safety and relief valves and secondary steam relief valves in the intact steam generator and steam line fail to relieve the pressure.

23. No cooling for EFW, CCW and SW pumps from CCW system is necessary. Failure of the self-cooler system of EFW pumps was included in the model.

24. It has been assumed that failure to isolate each CCW flow loop from non-emergency components (such as waste processing, fuel storage building, etc.) will fail that loop.

7.3.3.9 Model Evaluations

The fault tree models were evaluated using the WAM-BAM (Reference 5) and WAMCUT (Reference 6) codes developed by the Electric Power Research Institute (EPRI). WAM-BAM gives a point estimate evaluation of the tree. WAMCUT gives the dominant cut sets ordered probabilistically. The WAMCUT output was used to help verify the fault tree models. When an accident sequence involved more than one system, the complete sequence was evaluated by the codes to assure that all dependencies included in the models were evaluated.

The component failure data used in the evaluations was taken from the RSS with two exceptions. The RPS was evaluated based on the data collected for the EPRI RPS evaluation for their Anticipated Transient Without SCRAM (Reference 7) studies. Loss of off-site power was evaluated using data from plants attached to the same grid that Seabrook will use, including fossil fuel plants.

7.3.4 Accident Sequence Identification

The accident sequences resulting from the event trees discussed earlier were compared to equivalent accident sequences in the RSS. They were assigned the same containment failure modes as the equivalent sequence in the RSS. The accident sequences with containment failure modes were assigned to the same release categories as their equivalents in the RSS. Some accident sequences involving C (CSIS), such as SCH and SCHF, appeared in this study which were not included in RSS (due to specific Surry design, SC was an accident sequence). In such cases, it was assumed that those sequences were equivalent to SH and SHF of RSS respectively, and they were assigned to the same release categories as SH and SHF, respectively. The results of the release category assignments will be given later in the tables developed to display the probabilistic results.

7.3.4.1 Probabilistic Results

Tables 7.3-2 through 7.3-6 give the probabilistic results for the LOCA initiated accident sequences and the associated release category results for these initiators. Of these sequences, the sequences involving SHF appear to dominate the results. The RSS evaluated the combination HF at 2×10^{-6} per small-small LOCA. This study has evaluated HF at 3.7×10^{-4}, almost two orders of magnitude more likely. This sequence represents failure of the ECR and CSRS. The Surry plant studied in the RSS, relied on a gravity fed pond for a heat sink. The Seabrook design relies on the CCWS and SWS to accomplish this same function. The end result is more combinations of component failures to fail the heat removal function at Seabrook as compared to Surry. This accounts for the difference in results. It appears more serious with the small-small LOCA initiator as compared to the larger LOCA's. This is due to the probabilities used for the initiators.

Table 7.3-7 gives the probabilistic results for the transient initiated accident sequences and the associated release category results for this initiator. The dominating sequences are TML-δ in release category 2, and TKQ-α in release category 3. In this study, TML-δ was evaluated at 1.7×10^{-6}. This sequence includes the factor for recovery of off-site power and is therfore equivalent to the TMLB'-δ in the RSS. The TMLB'-δ was evaluated at 2×10^{-6} in the RSS.

The RSS evaluated TKQ-α at 3×10^{-8} per year. This study has evaluated it at 5.1×10^{-8}. The EPRI report referenced earlier was unable to duplicate the RSS number and actually obtained a higher probability, but subsequently reduced it by considering a larger data base.

Table 7.3-8 gives the probabilistic results for the vessel rupture initiated accident sequences. The results are consistent with the RSS results.

The interfacing LOCA sequences were evaluated based on an EPRI report (Reference 8) on interfacing LOCA. Because of the check valve testing scheme employed at Seabrook, the probability of this event has been evaluated at 5.5×10^{-9} per year assuming four shutdowns per year. This is compared to the 4×10^{-6} per year found in the RSS. The motor-operated valves betweeen the RHR suction and the hot leg failing open at pressure or being inadvertently opened was evaluated at 2×10^{-8} per year. Summing the two potential interfacing LOCA's results in 2.6×10^{-8} per year.

7.3.5 Summary of Probabilistic Results

Table 7.3-9 summarizes the dominant sequences by release categories for all accident initiators. Comparing these results with the RSS results shows a slight increase in categories 4 and 6. Categories 1, 2, 3, 5 and 7 show a slight decrease, while the non-core melt categories 8 and 9 are basically the same. Due to the evaluation of the SHF sequences, the small LOCA's play a more significant role in the Seabrook results for categories 1, 2, and 6. The interfacing LOCA becomes minor contributor to Seabrook category 2.

7.3.6 Discussion of Influence of External Events

The probabilities for the accident sequences previously discussed are caused by some intrinsic failure which is initiated within the plant (except for loss of off-site power). However, potential failure due to some large external event is possible, which might affect the response of the plant. These external events can cause an accident in the form of one of the previously discussed accident sequences.

The above evaluation has not included external events such as earthquakes, floods, hurricanes, tornadoes, aircraft, turbine missiles, etc. Some external events may only affect a few sequences while others may affect all the sequences. It is anticipated that such external events will increase the sequence probabilities. The increase will be dependent on the probability of the external event and its severity. However, when compared to the intrinsic events previously evaluated, it is believed that the increase may not be noticeable. This coincides with the conclusion reached in WASH-1400 regarding the significance of these type of events.

7.3.7 Discussion of the Uncertainties

As mentioned earlier, the RSS component failure data was used to evaluate the Seabrook accident sequences. Therefore, it is anticipated that the uncertainties in the results of this study will be within the same range of uncertainty as RSS results.

TABLE 7.3-1

DEFINITION OF ECCS EQUIPMENT SUCCESS REQUIREMENTS FOR LOCA EVENTS

LOCA SIZE (equivalent dia.)	INJECTION MODE (ECI)	RECIRCULATION MODE (ECR)
LARGE LOCA Breaks > 10"	1/2 LPIS* + 3/4 ACC	1/2 LPIS*
MEDIUM (M_1) LOCA 10" > Breaks > 6"	1/2 LPIS + 3/4 ACC	1/2 LPIS
MEDIUM (M_2) LOCA 6" $\geq$ Breaks > 3"	1/2 CP + 1/2 SIP + 3/4 ACC <u>or</u> 2/2 SIP + 3/4 ACC	1/2 CP + 1/2 SIP <u>or</u> 2/2 SIP <u>or</u> 1/2 LPIS*
MEDIUM (M_3) LOCA 3" $\geq$ Breaks > (∿) 1.5"	1/2 CP + 1/2 SIP <u>or</u> 2/2 SIP	1/2 CP + 1/2 SIP <u>or</u> 2/2 SIP
SMALL LOCA (∿) 1.5" $\geq$ Breaks > 0.5"	1/2 CP + 1/2 SIP <u>or</u> 2/2 SIP <u>or</u> 2/2 CP	1/2 CP + 1/2 SIP <u>or</u> 2/2 SIP <u>or</u> 2/2 CP

* RHR pumps are used for LPIS (i.e., there are no separate LPIS pumps)

TABLE 7.3-2

LARGE LOCA (A) SEQUENCES

CORE MELT							NO CORE MELT	
CATEGORY 1	CATEGORY 2	CATEGORY 3	CATEGORY 4	CATEGORY 5	CATEGORY 6	CATEGORY 7	CATEGORY 8	CATEGORY 9
AHF-α 3.7×10^{-11} ACE-α --- ACEF-α --- ACD-α 1.8×10^{-11}	AHF-β 7.4×10^{-12} AHF-γ 4.4×10^{-10} AEF-β --- AEF-β --- AHF-δ 3.0×10^{-10} ACHF-δ 1.5×10^{-9} ACHF-γ --- ACEF-γ --- ACEF-β --- ACEF-δ 3.6×10^{-12} ADF-β 1.4×10^{-10} ADF-δ	AH-α 7.8×10^{-11} ACHF-α 2.6×10^{-11} ACH-α 2.6×10^{-11} AD-α 1.0×10^{-10} AE-α --- ADF-α 1.8×10^{-11} AEF-α ---	ACE-β --- ACD-β 3.6×10^{-12}	AH-β 1.6×10^{-11} AE-β --- AD-β 2.0×10^{-11} ACH-β 5.2×10^{-12} ACHF-β 5.2×10^{-12}	AHF-ε 2.9×10^{-9} AEF-ε --- ADF-ε 1.8×10^{-9} ACEF-ε ---	AH-ε 7.7×10^{-9} AE-ε --- ACH-ε 2.6×10^{-9} ACHF-ε 4.9×10^{-10} ACD-ε 1.8×10^{-9} AD-ε 9.9×10^{-9} ACE-ε ---	A-β 2.0×10^{-8} AC-β 1.3×10^{-11} AF-β 1.2×10^{-10} ACF-β 1.3×10^{-11}	A 10^{-5} AC 6.7×10^{-9} AF 5.9×10^{-8} ACF 6.7×10^{-9}
5.5×10^{-11}	3.0×10^{-9}	2.5×10^{-10}	3.6×10^{-12}	4.6×10^{-11}	4.7×10^{-9}	2.2×10^{-8}	2.0×10^{-8}	1.0×10^{-5}

TABLE 7.3-3

MEDIUM (M_1) LOCA SEQUENCES

CORE MELT							NO CORE MELT	
CATEGORY 1	CATEGORY 2	CATEGORY 3	CATEGORY 4	CATEGORY 5	CATEGORY 6	CATEGORY 7	CATEGORY 8	CATEGORY 9
MCD-α 1.8×10^{-10} MHC-α 2.6×10^{-10} MCHF-α 2.6×10^{-10} MKC-α 3.4×10^{-14} MKCF-α 3.4×10^{-14} MHF-α 3.7×10^{-10}	MHF-δ 3.0×10^{-9} MCHF-β 5.2×10^{-11} MCHF-γ 6.2×10^{-9} MCHF-δ 1.5×10^{-8} MKF-β 6.0×10^{-14} MHF-β 7.4×10^{-11} MDF-β 3.6×10^{-11} MKCF-β 6.8×10^{-15} MKCF-γ 4.1×10^{-13}	MD-α 1.0×10^{-9} MH-α 7.8×10^{-10} MK-α 5.1×10^{-11} MDF-α 1.8×10^{-10} MCH-α 2.6×10^{-10} MKF-α 3.0×10^{-13}	MCD-β 3.6×10^{-11} MKC-β 6.8×10^{-15}	MH-β 1.6×10^{-10} MD-β 2.0×10^{-10} MCH-β 5.2×10^{-11} MK-β 1.0×10^{-11}	MDF-ε 1.8×10^{-8} MHF-ε 2.9×10^{-8} MCHF-ε 4.9×10^{-9} MKCF-ε 3.0×10^{-12}	MD-ε 9.9×10^{-8} MH-ε 7.7×10^{-8} MCH-ε 2.6×10^{-8} MCD-ε 1.8×10^{-8} MK-ε 5.1×10^{-9} MKC-ε 3.0×10^{-12}	M-β 2.0×10^{-7} MC-β 1.3×10^{-10} MF-β 1.2×10^{-9} MCF-β 1.2×10^{-9}	M_1 10^{-4} MC 6.7×10^{-8} MF 5.9×10^{-7} MCF 6.7×10^{-8}
1.1×10^{-9}	2.4×10^{-8}	2.3×10^{-9}	3.6×10^{-11}	4.2×10^{-10}	5.2×10^{-8}	2.3×10^{-7}	2.0×10^{-7}	1.0×10^{-4}

TABLE 7.3-4

MEDIUM (M_2) LOCA SEQUENCES

CORE MELT							NO CORE MELT	
CATEGORY 1	CATEGORY 2	CATEGORY 3	CATEGORY 4	CATEGORY 5	CATEGORY 6	CATEGORY 7	CATEGORY 8	CATEGORY 9
MCD-α 2.1×10^{-10} MHC-α 2.6×10^{-10} MCHF-α 3.3×10^{-14} MKC-α 3.3×10^{-14} MKCF-α 3.7×10^{-10}	MHF-δ 3.0×10^{-9} MCHF-β 5.2×10^{-11} MCHF-γ 6.3×10^{-9} MCHF-δ 1.5×10^{-8} MKF-β 6.0×10^{-14} MHF-β 7.3×10^{-11} MDF-β 4.3×10^{-11} MKCF-β 6.7×10^{-15} MKCF-γ 4.0×10^{-13}	MD-α 8.8×10^{-10} MH-α 1.8×10^{-9} MK-α 5.1×10^{-11} MDF-α 2.2×10^{-10} MCH-α 2.6×10^{-10} MKF-α 3.0×10^{-13}	MCD-β 4.3×10^{-11} MKC-β 6.7×10^{-15}	MH-β 3.6×10^{-10} MD-β 1.8×10^{-10} MCH-β 5.2×10^{-11} MK-β 1.0×10^{-11}	MDF-ε 1.8×10^{-8} MHF-ε 2.9×10^{-8} MCHF-ε 5.2×10^{-9} MKCF-ε 3.0×10^{-12}	MD-ε 8.8×10^{-8} MH-ε 1.8×10^{-7} MCH-ε 2.6×10^{-8} MCD-ε 2.1×10^{-8} MK-ε 5.1×10^{-9} MKC-ε 3.0×10^{-12}	M-β 2.0×10^{-7} MC-β 1.3×10^{-10} MF-β 1.2×10^{-9} MCF-β 1.2×10^{-9}	M_2 1.0×10^{-4} MC 6.5×10^{-8} MF 5.9×10^{-7} MCF 6.5×10^{-8}
1.1×10^{-9}	2.4×10^{-8}	3.2×10^{-9}	4.3×10^{-11}	6.0×10^{-10}	5.2×10^{-8}	3.2×10^{-7}	2.0×10^{-7}	1.0×10^{-4}

TABLE 7.3-5

MEDIUM (M_3) LOCA SEQUENCES

CORE MELT							NO CORE MELT	
CATEGORY 1	CATEGORY 2	CATEGORY 3	CATEGORY 4	CATEGORY 5	CATEGORY 6	CATEGORY 7	CATEGORY 8	CATEGORY 9
MCD-α 4.2×10^{-10} MHC-α 5.2×10^{-10} MCHF-α 5.2×10^{-10} MKC-α 6.6×10^{-14} MKCF-α 6.6×10^{-14} MHF-α 7.3×10^{-10}	MHF-δ 5.9×10^{-9} MCHF-β 1.1×10^{-10} MCHF-γ 1.3×10^{-8} MCHF-δ 2.9×10^{-8} MKF-β 1.2×10^{-13} MHF-β 1.5×10^{-10} MDF-β 8.8×10^{-11} MKCF-β 1.3×10^{-14} MKCF-γ 8.0×10^{-13}	MD-α 1.7×10^{-9} MH-α 3.6×10^{-9} MK-α 1.0×10^{-10} MDF-α 4.4×10^{-10} MCH-α 5.2×10^{-10} MKF-α 6.0×10^{-13}	MCD-β 8.7×10^{-11} MKC-β 1.3×10^{-14}	MH-β 7.2×10^{-10} MD-β 3.6×10^{-10} MCH-β 1.0×10^{-10} MK-β 2.1×10^{-11}	MDF-ε 3.6×10^{-8} MHF-ε 5.8×10^{-8} MCHF-ε 1.0×10^{-8} MKCF-ε 6.0×10^{-12}	MD-ε 1.7×10^{-7} MH-ε 3.6×10^{-7} MCH-ε 5.2×10^{-8} MCD-ε 4.2×10^{-8} MK-ε 1.0×10^{-8} MKC-ε 6.0×10^{-12}	M-β 4.0×10^{-7} MC-β 2.6×10^{-10} MF-β 2.4×10^{-9} MCF-β 2.4×10^{-9}	M_3 2.0×10^{-4} MC 1.3×10^{-7} MF 1.2×10^{-6} MCF 1.3×10^{-7}
2.2×10^{-9}	4.8×10^{-8}	6.4×10^{-9}	8.7×10^{-11}	1.2×10^{-9}	1.0×10^{-7}	6.3×10^{-7}	4.0×10^{-7}	2.0×10^{-4}

TABLE 7.3-6

SMALL (S) LOCA SEQUENCES

CORE MELT							NO CORE MELT	
CATEGORY 1	CATEGORY 2	CATEGORY 3	CATEGORY 4	CATEGORY 5	CATEGORY 6	CATEGORY 7	CATEGORY 8	CATEGORY 9
SHF-α $3.6\text{x}10^{-9}$ SCD-α $2.1\text{x}10^{-9}$ SLC-α $4.5\text{x}10^{-13}$ SKC-α $3.3\text{x}10^{-13}$ SHCF-α $2.6\text{x}10^{-10}$	SHF-β $7.2\text{x}10^{-10}$ SKC-γ --- SKC-β $6.6\text{x}10^{-14}$ SKF-β $6.0\text{x}10^{-13}$ SLF-β $1.1\text{x}10^{-12}$ SLC-β $9.0\text{x}10^{-14}$ SCD-β $4.2\text{x}10^{-10}$ SCD-δ --- SLC-δ $4.5\text{x}10^{-11}$ SHF-β $4.3\text{x}10^{-8}$ SDF-β $4.2\text{x}10^{-10}$ SHF-γ $2.9\text{x}10^{-8}$ SHCF-δ $1.5\text{x}10^{-7}$ SHCF-β $5.2\text{x}10^{-11}$ SHCF-γ $6.2\text{x}10^{-8}$	SD-α $5.5\text{x}10^{-9}$ SH-α $1.2\text{x}10^{-8}$ SDF-α $2.1\text{x}10^{-9}$ SL-α $1.2\text{x}10^{-9}$ SLF-α $5.7\text{x}10^{-12}$ SK-α $5.1\text{x}10^{-10}$ SKF-α $3.0\text{x}10^{-12}$ SCH-α $2.6\text{x}10^{-9}$		SD-β $1.1\text{x}10^{-9}$ SH-β $2.4\text{x}10^{-9}$ SL-β $2.4\text{x}10^{-10}$ SK-β $1.0\text{x}10^{-10}$ SCH-β $7.2\text{x}10^{-10}$	SCD-ε $2.1\text{x}10^{-7}$ SHF-ε $2.8\text{x}10^{-7}$ SDF-ε $2.1\text{x}10^{-7}$ SLF-ε $5.6\text{x}10^{-10}$ SKF-ε $3.0\text{x}10^{-10}$ SKC-ε $3.3\text{x}10^{-11}$ SHCF-ε $4.9\text{x}10^{-8}$	SD-ε $5.4\text{x}10^{-7}$ SH-ε $1.2\text{x}10^{-6}$ SL-ε $1.2\text{x}10^{-7}$ SK-ε $5.0\text{x}10^{-8}$ SCH-ε $2.6\text{x}10^{-7}$	SC-β $1.3\text{x}10^{-9}$ SF-β $1.2\text{x}10^{-8}$ SCF-β $1.3\text{x}10^{-9}$ S-β $2.0\text{x}10^{-6}$	S 10^{-3} SC $6.5\text{x}10^{-7}$ SF $5.9\text{x}10^{-6}$ SCF $6.5\text{x}10^{-7}$
$6.0\text{x}10^{-9}$	$2.9\text{x}10^{-7}$	$2.4\text{x}10^{-8}$		$4.6\text{x}10^{-9}$	$7.5\text{x}10^{-7}$	$2.2\text{x}10^{-6}$	$2.0\text{x}10^{-6}$	$1.0\text{x}10^{-3}$

TABLE 7.3-7
(Sheet 1 of 3)

TRANSIENT (T) SEQUENCES

CORE MELT							NO CORE MELT	
CATEGORY 1	CATEGORY 2	CATEGORY 3	CATEGORY 4	CATEGORY 5	CATEGORY 6	CATEGORY 7	CATEGORY 8	CATEGORY 9
TMLQF-α 1.4×10^{-12}	TMLQF-β 2.8×10^{-15}	TML-α 3.0×10^{-8}		TML-β 6.0×10^{-10}	TMLQF-ε ---	TML-ε 5.7×10^{-7}		
TMLQCF-α 1.2×10^{-13}	TMLQF-γ ---	TKQ-α 5.1×10^{-8}		TKQ-β 5.1×10^{-10}	TMLQCF-ε ---	TKQ-ε 5.0×10^{-6}		
TMLQC-α 1.1×10^{-13}	TMLQF-δ 1.4×10^{-10}	TKMQ-α 1.3×10^{-10}		TMLP-β 1.8×10^{-14}	TMLQC-ε ---	TKMQ-ε 5.0×10^{-8}		
TMLQKC-α 5.8×10^{-11}	TMLQCF-β 2.4×10^{-15}	TMLP-α 9.0×10^{-13}		TKP-β 1.5×10^{-11}	TMLQKF-ε ---	TMLP-ε 9.0×10^{-11}		
TKQF-α 3.0×10^{-10}	TMLQCF-γ ---	TKP-α 1.5×10^{-10}		TKQU-β 5.6×10^{-13}	TMLQKC-ε ---	TKP-ε 1.5×10^{-8}		
TKQCF-α 3.3×10^{-11}	TMLQCF-δ 1.2×10^{-11}	TKQU-α 5.6×10^{-11}		TKMU-β 1.4×10^{-13}	TKQF-ε ---	TKQU-ε 5.6×10^{-9}		
TKQC-α 3.3×10^{-11}	TMLQC-β 2.2×10^{-15}	TKMU-α 1.4×10^{-11}		TKMQU-β 1.4×10^{-15}	TKQCF-ε ---	TKMU-ε 5.6×10^{-9}		
TKMQF-α 7.6×10^{-13}	TMLQC-δ 1.1×10^{-11}	TKMP-α 3.8×10^{-13}		TKML-β 1.5×10^{-14}	TKQC-ε ---	TKMQU-ε 5.6×10^{-11}		
TKMQCF-α 8.2×10^{-14}	TMLQKF-β 1.5×10^{-18}	TKMQU-α 1.4×10^{-13}		TMLQU-β 6.6×10^{-15}	TKMQCF-ε ---	TKMP-ε 1.5×10^{-10}		
TKMQC-α 8.2×10^{-14}	TMLQKC-β 1.1×10^{-19}	TKML-α 1.5×10^{-12}		TKMLP-β 4.6×10^{-19}	TKMQC-ε ---	TKML-ε 6.1×10^{-10}		
TKQUF-α 1.2×10^{-11}	TMLQKC-γ ---	TMLQU-α 3.2×10^{-13}		TMLQ-β 6.0×10^{-12}	TKMQF-ε ---	TMLQU-ε 3.2×10^{-11}		
TKQUCF-α 1.1×10^{-11}	TKQF-β 3.0×10^{-11}	TKMLP-α 4.6×10^{-17}		TMLQC-β 2.2×10^{-15}	TKQUF-ε 1.2×10^{-9}	TKMLP-ε 1.8×10^{-14}		
TKQUC-α 1.1×10^{-11}	TKQF-γ ---	TMLQ-α 3.0×10^{-10}		TMLQK-β 3.0×10^{-16}	TKQUCF-ε 1.1×10^{-9}	TMLQ-ε 3.0×10^{-8}		
TMLQUF-α 4.8×10^{-14}	TKQF-δ 3.0×10^{-8}	TMLQF-α 1.4×10^{-12}		TKQC-β 3.3×10^{-13}	TKQUC-ε 1.1×10^{-9}	TMLQC-ε 1.1×10^{-11}		
TMLQUCF-α 4.8×10^{-14}	TKQCF-β 3.3×10^{-13}	TMLQC-α 1.1×10^{-13}		TKMQ-β 1.0×10^{-10}	TMLQUCF-ε 4.7×10^{-12}	TMLQK-ε 6.1×10^{-12}		
TMLQUC-α 4.8×10^{-14}	TKQCF-γ ---	TMLQK-α 1.5×10^{-14}		TKMQC-β 8.2×10^{-16}	TMLQUC-ε 4.7×10^{-12}	TKQC-ε ---		
TMLQUKC-α 2.4×10^{-18}	TKQCF-δ 3.3×10^{-9}	TMLQKF-α 7.2×10^{-17}		TKQUC-β 1.1×10^{-13}	TMLQUF-ε 4.7×10^{-12}	TKMQC-ε ---		
TKMQU-α 1.4×10^{-11}	TKQC-β 3.3×10^{-13}	TKQF-α 3.0×10^{-10}		TMLQUC-β 9.6×10^{-16}	TMLQUKF-ε 2.4×10^{-16}	TKQUC-ε ---		
TKMQUF-α 3.0×10^{-12}	TKQC-δ 3.3×10^{-9}	TKQC-α 3.3×10^{-11}		TMLQUK-β 3.4×10^{-19}	TMLQUKC-ε 2.4×10^{-16}	TMLQUC-ε ---		
TKMQUCF-α 2.8×10^{-14}	TKMQF-β 7.6×10^{-15}	TKMQF-α 7.6×10^{-13}		TKMQUC-β 2.8×10^{-16}	TKMQUF-ε 2.9×10^{-12}	TMLQUK-ε ---		
TKNQUC-α 2.8×10^{-14}	TKMQF-γ ---	TKMQC-α 8.2×10^{-14}			TKMQUC-ε 2.8×10^{-12}	TKMQU-ε ---		
	TKMQF-δ 7.6×10^{-11}	TKQUF-α 1.2×10^{-11}				TKMQUC-ε ---		
	TKMQCF-β 8.4×10^{-16}	TKQUC-α 1.1×10^{-11}						
	TKMQCF-γ ---							
	TKMQCF-δ 8.2×10^{-12}							
	TML-γ 7.2×10^{-7}							
	TML-δ 1.7×10^{-6}							

TABLE 7.3-7
(Sheet 2 of 3)

CORE MELT							NO CORE MELT	
CATEGORY 1	CATEGORY 2	CATEGORY 3	CATEGORY 4	CATEGORY 5	CATEGORY 6	CATEGORY 7	CATEGORY 8	CATEGORY 9
	TKMQC-β 1.7×10^{-14}	TMLQUF-α 4.8×10^{-14}			TKMQUCF-ε 1.1×10^{-11}			
	TKMQC-δ 8.2×10^{-12}	TMLQUC-α 4.8×10^{-14}						
		TMLQUK-α 1.7×10^{-17}						
	TKMQC-δ 3.3×10^{-11}	TMLQUKF-α 2.4×10^{-18}						
	TKQUF-β 1.2×10^{-13}	TKMQUC-α 1.1×10^{-13}						
	TKQUF-γ ---							
	TKQUF-δ 1.2×10^{-9}							
	TKQUCF-β 1.1×10^{-13}							
	TKQUCF-γ ---							
	TKQUCF-δ 1.1×10^{-9}							
	TKQUC-β 1.1×10^{-13}							
	TKQUC-δ 1.1×10^{-9}							
	TKQUC-γ ---							
	TMLQUF-β 9.5×10^{-16}							
	TMLQUF-γ ---							
	TMLQUF-δ 4.8×10^{-12}							
	TMLQUCF-β 9.5×10^{-16}							
	TMLQUCF-γ ---							
	TMLQUCF-δ 4.8×10^{-12}							
	TMLQUC-β 9.5×10^{-16}							
	TMLQUC-δ 4.8×10^{-12}							
	TMLQUKF-β 4.8×10^{-20}							
	TMLQUKC-β 4.8×10^{-20}							
	TMLQUKC-γ ---							
	TKMQUF-β 1.2×10^{-15}							

TABLE 7.3-7
(Sheet 3 of 3)

CORE MELT							NO CORE MELT	
CATEGORY 1	CATEGORY 2	CATEGORY 3	CATEGORY 4	CATEGORY 5	CATEGORY 6	CATEGORY 7	CATEGORY 8	CATEGORY 9
	TKMQUF-δ 1.2×10^{-11} TKMQUCF-β 1.1×10^{-15} TKMQUCF-γ ----- TKMQUCF-δ 1.1×10^{-11} TKMQUC-β 1.1×10^{-15} TKMQUC-δ 1.1×10^{-11}							
4.2×10^{-10}	2.4×10^{-6}	8.2×10^{-8}		1.2×10^{-9}	3.4×10^{-9}	5.7×10^{-6}		

TABLE 7.3-8

VESSEL RUPTURE SEQUENCES

CORE MELT						
CATEGORY 1	CATEGORY 2	CATEGORY 3	CATEGORY 4	CATEGORY 5	CATEGORY 6	CATEGORY 7
RE-α 7.8×10^{-13} RC-α 6.5×10^{-13} RCF-α 6.5×10^{-13} RCE-α 2.6×10^{-13}	RF-δ 5.9×10^{-10} RC-γ 3.2×10^{-11} RC-δ 3.3×10^{-11} RCF-γ 3.2×10^{-11} RCF-δ 3.3×10^{-11} RCE-γ 1.3×10^{-11} RCE-δ 1.3×10^{-11} RC-β 1.3×10^{-13} RCF-β 1.5×10^{-13} RCE-β 5.2×10^{-14}	R-α 1.0×10^{-9}				R-ϵ 1.0×10^{-7}
2.3×10^{-12}	7.5×10^{-10}	1.0×10^{-9}				1.0×10^{-7}

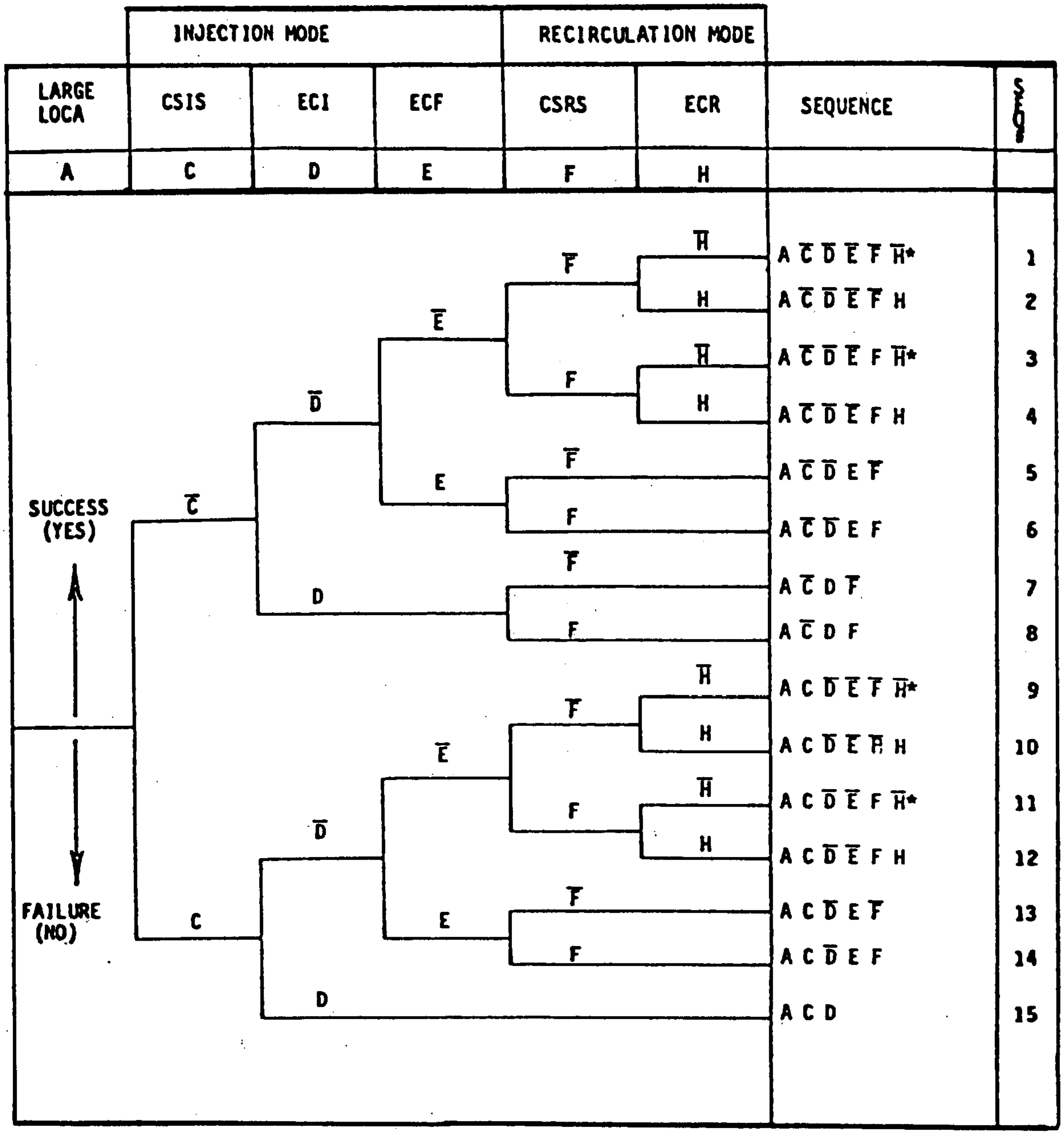
TABLE 7.3-9
(Sheet 1 of 2)

SUMMARY OF DOMINANT SEQUENCES BY RELEASE CATEGORIES

	RELEASE CATEGORIES CORE MELT							NO CORE MELT	
	1	2	3	4	5	6	7	8	9
LARGE LOCA A	AHF-α 3.7×10^{-11} ACD-α 1.8×10^{-11}	ACHF-δ 1.5×10^{-9} ACHF-γ 6.2×10^{-9} AHF-[illegible] 4.4×10^{-9} ADF-δ 1.4×10^{-10}	AD-α 1.0×10^{-10} AH-α 7.8×10^{-11} ACH-α 2.6×10^{-11} ACHF-α 2.6×10^{-11} ADF-α 1.8×10^{-11}	ACD-β 3.6×10^{-12}	AD-β 2.0×10^{-11} AH-β 1.6×10^{-11} ACH-β 5.2×10^{-12} ACHF-β 5.2×10^{-12}	AHF-ε 2.9×10^{-9} ADF-ε 1.8×10^{-9}	AD-ε 9.9×10^{-9} AH-ε 7.7×10^{-9} ACH-ε 2.6×10^{-9} ACD-ε 1.8×10^{-9} ACHF-ε 4.9×10^{-10}	A-β 2×10^{-8}	A 10^{-5}
A	5.5×10^{-11}	3.0×10^{-9}	2.5×10^{-10}	3.6×10^{-12}	4.6×10^{-11}	4.7×10^{-9}	2.2×10^{-8}	2.0×10^{-8}	1.0×10^{-5}
MEDIUM LOCA M_1	M_1HF-α 3.6×10^{-10} M_1HC-α 2.6×10^{-10} M_1HCF-α 2.6×10^{-10} M_1CD-α 2.1×10^{-10}	M_1HCF-δ 1.5×10^{-8} M_1CHF-γ 6.2×10^{-9} M_1HF-δ 3.0×10^{-9}	M_1D-α 1.0×10^{-9} M_1H-α 7.8×10^{-10} M_1CH-α 2.6×10^{-10} M_1DF-α 1.8×10^{-10} M_1K-α 5.1×10^{-11}	M_1CD-β 3.6×10^{-11}	M_1D-β 2.0×10^{-10} M_1H-β 1.6×10^{-10} M_1CH-β 5.2×10^{-11} M_1K-β 1.0×10^{-11}	M_1HF-ε 2.9×10^{-8} M_1DF-ε 1.8×10^{-8} M_1CHF-ε 4.9×10^{-9}	M_1D-ε 9.9×10^{-8} M_1H-ε 7.7×10^{-8} M_1CH-ε 2.6×10^{-8} M_1CD-ε 1.8×10^{-8} M_1K-ε 5.1×10^{-9}	M_1-β 2.0×10^{-7}	M_1 10^{-4}
M_1	1.1×10^{-9}	2.4×10^{-8}	2.3×10^{-9}	3.6×10^{-11}	4.2×10^{-10}	5.2×10^{-8}	2.3×10^{-7}	2.0×10^{-7}	1.0×10^{-4}
MEDIUM LOCA M_2	M_2HF-α 3.7×10^{-10} M_2HC-α 2.6×10^{-10} M_2CHF-α 2.6×10^{-10} M_2CD-α 2.1×10^{-10}	M_2CHF-δ 1.5×10^{-8} M_2CHF-γ 6.2×10^{-9} M_2HF-δ 3.0×10^{-9}	M_2H-α 1.8×10^{-9} M_2D-α 8.8×10^{-10} M_2CH-α 2.6×10^{-10} M_2DF-α 2.2×10^{-10} M_2K-α 5.1×10^{-11}	M_2CD-β 4.2×10^{-11}	M_2H-β 3.6×10^{-10} M_2D-β 1.8×10^{-10} M_2CH-β 5.2×10^{-11}	M_2HF-ε 2.9×10^{-8} M_2DF-ε 1.8×10^{-8} M_2CHF-ε 4.9×10^{-9}	M_2H-ε 1.8×10^{-7} M_2D-ε 8.8×10^{-8} M_2CH-ε 2.6×10^{-8} M_2CD-ε 2.1×10^{-8} M_2K-ε 5.1×10^{-9}	M_2-β 2.0×10^{-7}	M_2 10^{-4}
M_2	1.1×10^{-9}	2.4×10^{-8}	3.2×10^{-9}	4.2×10^{-11}	5.9×10^{-10}	5.2×10^{-8}	3.2×10^{-7}	2.0×10^{-7}	1.0×10^{-4}
MEDIUM LOCA M_3	M_3HF-α 7.4×10^{-10} M_3CH-α 5.2×10^{-10} M_3CHF-α 5.2×10^{-10} M_3CD-α 4.2×10^{-10}	M_3CHF-δ 3.0×10^{-8} M_3CHF-γ 1.2×10^{-8} M_3HF-δ 5.9×10^{-9}	M_3H-α 3.6×10^{-9} M_3D-α 1.7×10^{-9} M_3CH-α 5.2×10^{-10} M_3DF-α 4.4×10^{-10} M_3K-α 1.0×10^{-10}	M_3CD-β 8.4×10^{-11}	M_3H-β 7.2×10^{-10} M_3D-β 3.6×10^{-10} M_3CH-β 1.0×10^{-10}	M_3HF-ε 5.8×10^{-8} M_3DF-ε 3.6×10^{-8} M_3CHF-ε 9.8×10^{-9}	M_3H-ε 3.6×10^{-7} M_3D-ε 1.7×10^{-7} M_3CH-ε 5.2×10^{-8} M_3CD-ε 4.2×10^{-8} M_3K-ε 1.0×10^{-8}	M_3-β 4.0×10^{-7}	M_3 2.0×10^{-4}
M_3	2.2×10^{-9}	4.8×10^{-8}	6.4×10^{-9}	8.4×10^{-11}	1.2×10^{-9}	1.0×10^{-7}	6.4×10^{-7}	4.0×10^{-7}	2.0×10^{-4}
SMALL LOCA S	SHF-α 3.6×10^{-9} SCD-α 2.1×10^{-9} SCHF-α 2.6×10^{-10}	SCHF-δ 1.5×10^{-7} SCHF-γ 6.2×10^{-8} SHF-δ 4.3×10^{-8} SHF-γ 2.9×10^{-8} SHF-ε 7.2×10^{-10} SCD-β 4.2×10^{-10}	SH-α 1.2×10^{-8} SD-α 5.5×10^{-9} SCH-α 2.6×10^{-9} SDF-α 2.1×10^{-9} SL-α 1.2×10^{-9} SK-α 5.1×10^{-10}		SH-β 2.4×10^{-9} SD-β 1.1×10^{-9} SCH-β 7.2×10^{-10} SL-β 2.4×10^{-10} SK-β 1.0×10^{-10}	SHF-ε 2.8×10^{-7} SCD-ε 2.1×10^{-7} SDF-ε 2.1×10^{-7} SCHF-ε 4.9×10^{-8}	SH-ε 1.2×10^{-6} SD-ε 5.4×10^{-7} SCH-ε 2.6×10^{-7} SL-ε 1.2×10^{-7} SK-ε 5.0×10^{-8}	S-β 2.0×10^{-6}	S 10^{-3}
S	6.0×10^{-9}	2.9×10^{-7}	2.4×10^{-8}		4.6×10^{-9}	7.5×10^{-7}	2.2×10^{-6}	2.0×10^{-6}	1.0×10^{-3}

TABLE 7.3-9
(Sheet 2 of 2)

VESSEL RUPTURE R	RE-α $7.8x10^{-13}$ RC-α $6.5x10^{-13}$ RCF-α $6.5x10^{-13}$ RCE-α $2.6x10^{-13}$	RF-δ $5.9x10^{-10}$ RC-δ $3.3x10^{-11}$ RCF-δ $3.3x10^{-11}$ RC-γ $3.2x10^{-11}$ RCF-γ $3.2x10^{-11}$ RCE-δ $1.3x10^{-11}$ RCE-γ $1.3x10^{-11}$	R-α $1.0x10^{-9}$				R-ε $1.0x10^{-7}$	R-β $2.0x10^{-10}$	R $1.0x10^{-7}$
R	$2.3x10^{-12}$	$7.5x10^{-10}$	$1.0x10^{-9}$				$1.0x10^{-7}$	$2.0x10^{-10}$	$1.0x10^{-7}$
INTERFACING LOCA (CV + MOV)		V $2.6x10^{-8}$							
V		$2.6x10^{-8}$							
TRANSIENT T	TKQF-α $3.0x10^{-10}$ TKQC-α $3.3x10^{-11}$ TKQCF-α $3.3x10^{-11}$ TKMQU-α $1.4x10^{-11}$ TKQUF-α $1.2x10^{-11}$ TKQUC-α $1.1x10^{-11}$ TKQUCF-α $1.1x10^{-11}$	TML-δ $1.7x10^{-6}$ TML-γ $7.2x10^{-7}$	TKQ-α $5.1x10^{-8}$ TML-α $3.0x10^{-8}$		TML-β $6.0x10^{-10}$ TKQ-β $5.1x10^{-10}$ TKMQ-β $1.0x10^{-10}$	TKQUF-ε $1.2x10^{-9}$ TKQUC-ε $1.1x10^{-9}$ TKQUCF-ε $1.1x10^{-9}$	TKQ-ε $5.0x10^{-6}$ TML-ε $5.7x10^{-7}$ TKMQ-ε $5.0x10^{-8}$ TMLQ-ε $3.0x10^{-8}$ TKP-ε $1.5x10^{-8}$		T
T	$4.2x10^{-10}$	$2.4x10^{-6}$	$8.2x10^{-8}$		$1.2x10^{-9}$	$3.4x10^{-9}$	$5.7x10^{-6}$		
TOTAL	$1.1x10^{-8}$	$2.8x10^{-6}$	$1.2x10^{-7}$	$1.7x10^{-10}$	$8.1x10^{-9}$	$9.6x10^{-7}$	$9.2x10^{-6}$	$2.8x10^{-6}$	$1.5x10^{-3}$



*NO CORE MELT

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
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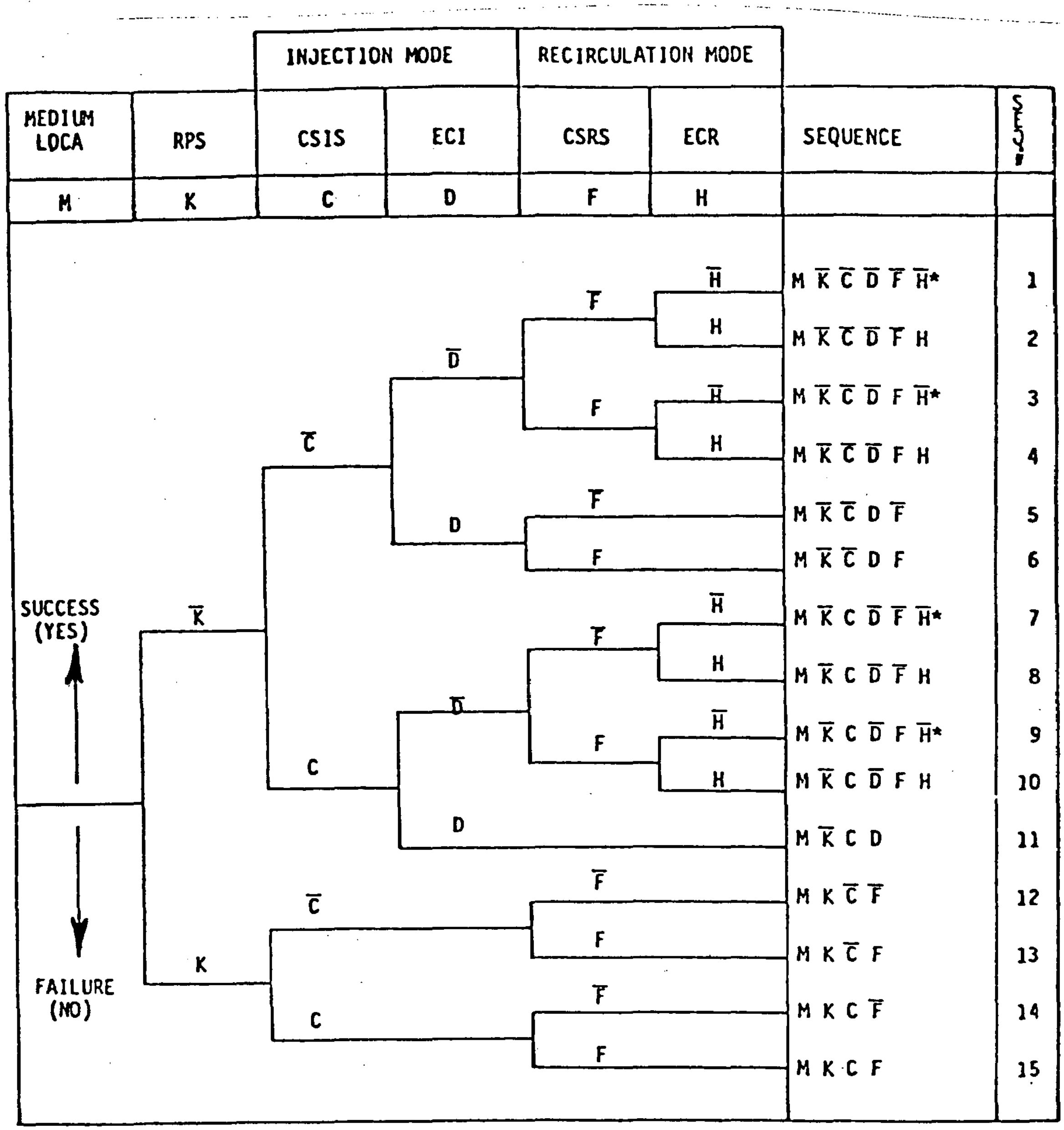
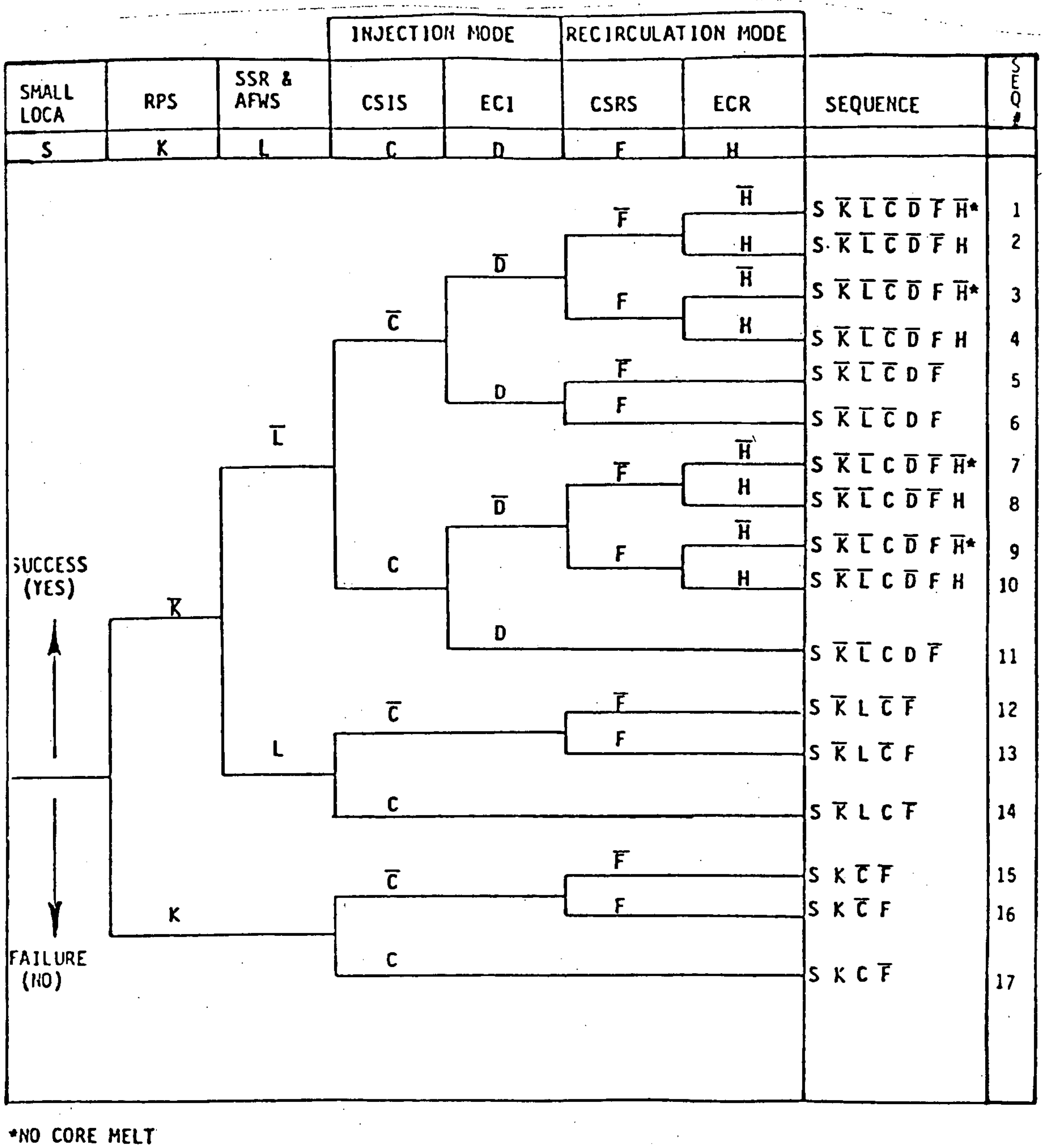
LARGE (A) LOCA EVENT TREE

FIGURE 7.3-1

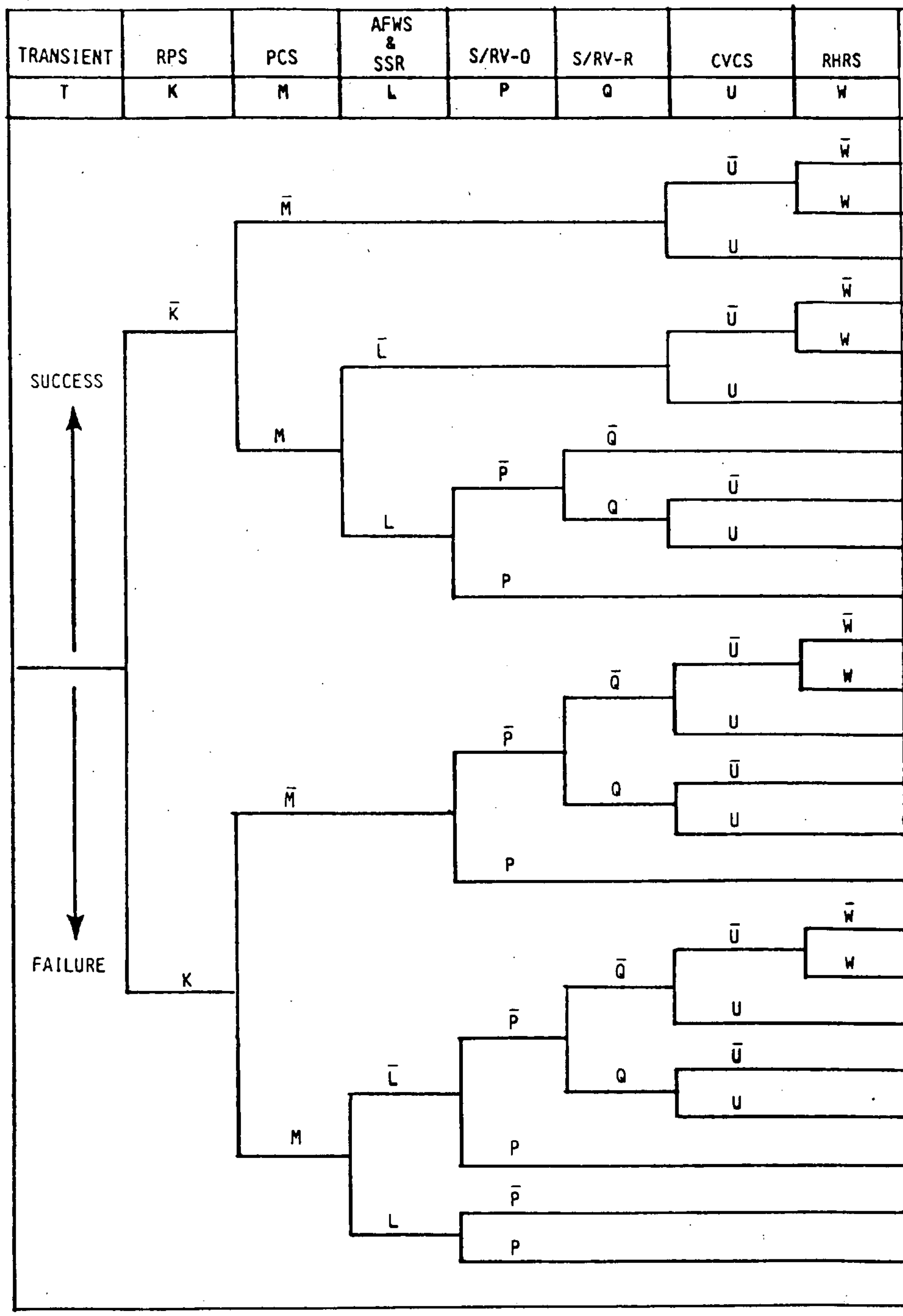


*NO CORE MELT

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	MEDIUM (M_1 , M_2 , M_3) LOCA EVENT TREE FIGURE 7.3-2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	SMALL (S) LOCA EVENT TREE FIGURE 7.3-3



SEQUENCE	CM	SEQ	
$T \bar{K} \bar{M} \bar{U} \bar{W}$	N	1	
$T \bar{K} \bar{M} \bar{U} W$	N	2	
$T \bar{K} \bar{M} U$	N	3	
$T \bar{K} M \bar{L} \bar{U} \bar{W}$	N	4	
$T \bar{K} M \bar{L} \bar{U} W$	N	5	
$T \bar{K} M \bar{L} U$	N	6	
$T \bar{K} M L \bar{P} \bar{Q}$	Y	7	
$T \bar{K} M L \bar{P} Q \bar{U}$	Y	8	(1)
$T \bar{K} M L \bar{P} Q U$	Y	9	(1)
$T \bar{K} M L P$	Y	10	
$T K \bar{M} \bar{P} \bar{Q} \bar{U} \bar{W}$	N	11	
$T K \bar{M} \bar{P} \bar{Q} \bar{U} W$	N	12	
$T K \bar{M} \bar{P} \bar{Q} U$	N	13	
$T K \bar{M} \bar{P} Q \bar{U}$	Y	14	(1)
$T K \bar{M} \bar{P} Q U$	Y	15	(1)
$T K \bar{M} P$	Y	16	
$T K M \bar{L} \bar{P} \bar{Q} \bar{U} \bar{W}$	N	17	
$T K M \bar{L} \bar{P} \bar{Q} \bar{U} W$	N	18	
$T K M \bar{L} \bar{P} \bar{Q} U$	N	19	
$T K M \bar{L} \bar{P} Q \bar{U}$	Y	20	(1)
$T K M \bar{L} \bar{P} Q U$	Y	21	(1)
$T K M \bar{L} P$	Y	22	
$T K M L \bar{P}$	Y	23	
$T K M L P$	Y	24	

(1) These sequences, although marked as core melt, realistically feed into the appropriate LOCA event tree.

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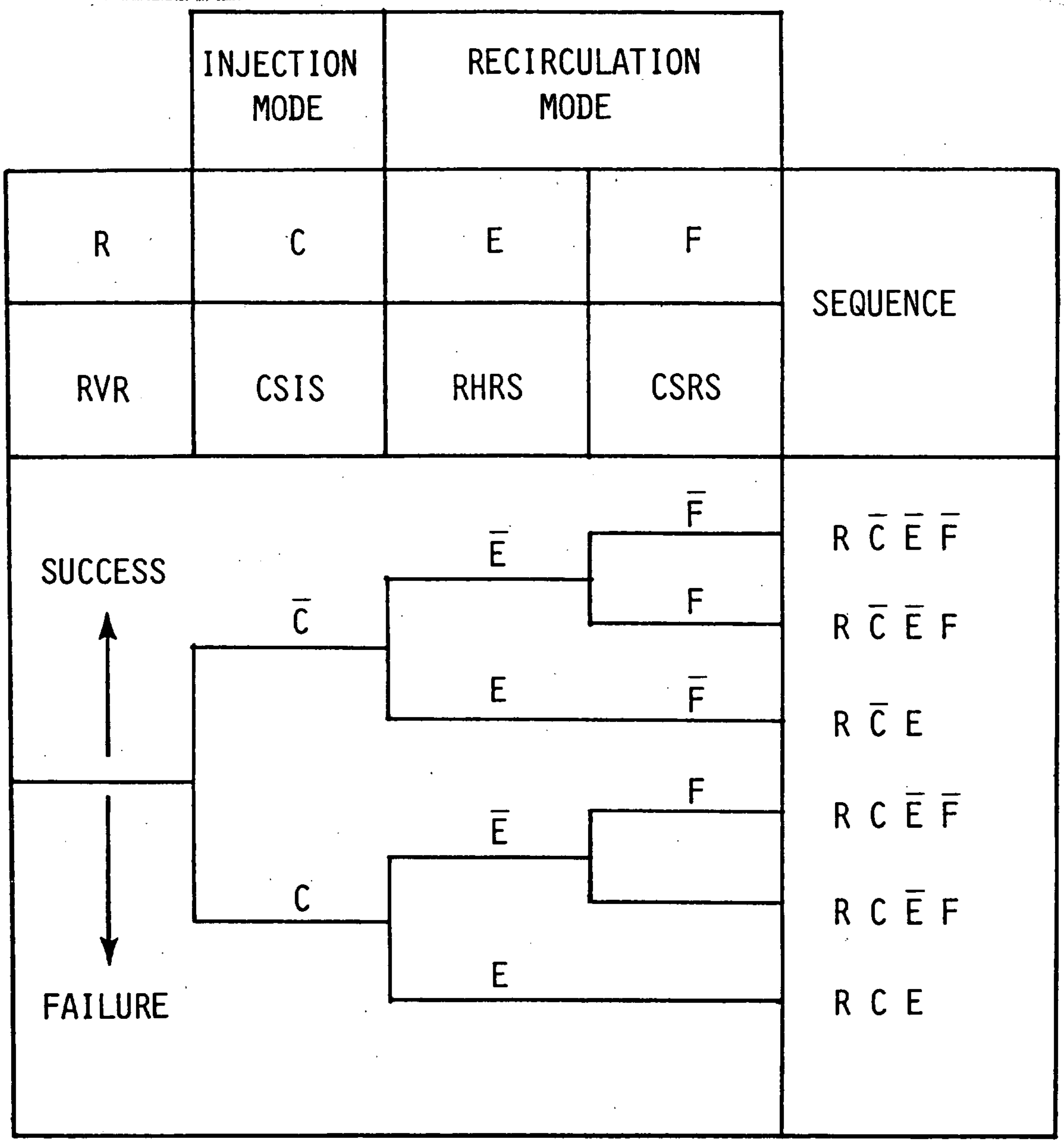
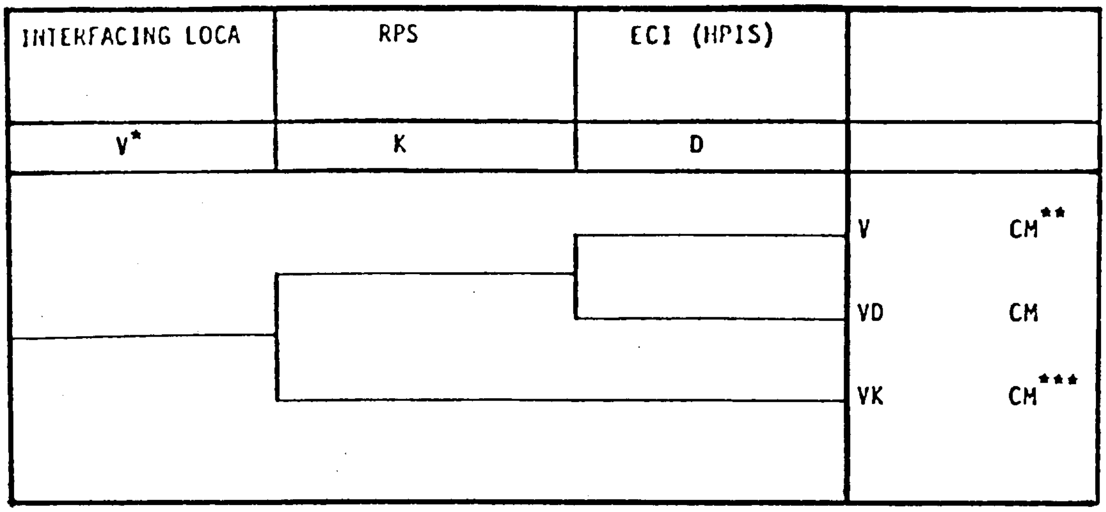
TRANSIENT (T) EVENT TREE

FIGURE 7.3-4



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	REACTOR VESSEL RUPTURE EVENT TREE
	FIGURE 7.3-5



*a) Leakage or ruptures of check valves at the injection header of low pressure system to the cold leg.

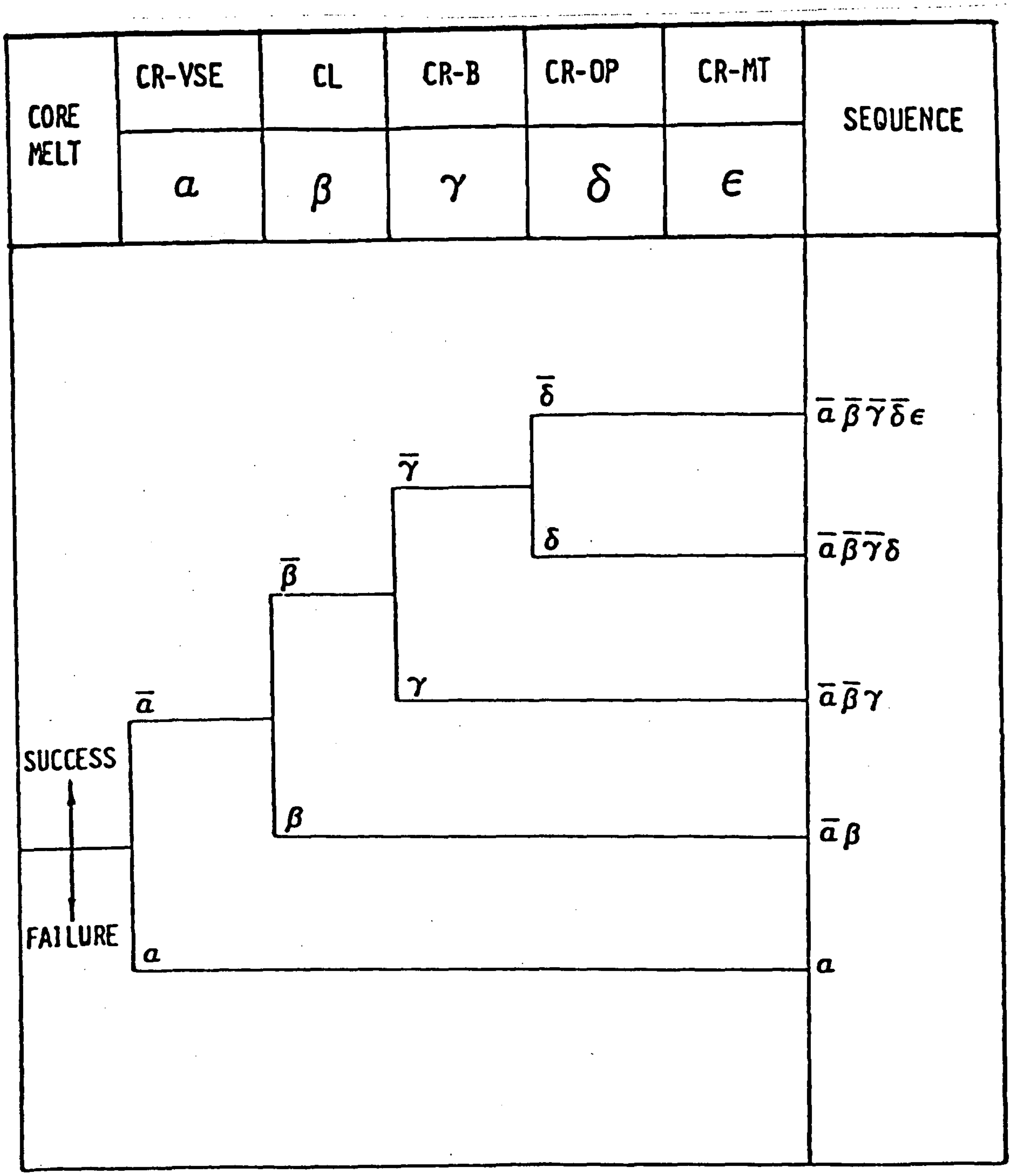
b) Rupture or opening of both motor operated valves at the suction head of low pressure pumps from hot leg (used for hot leg circulation to bring the reactor to cold shutdown).

**If the accumulations and high pressure injection system operates, core melt could be delayed until RWST is depleted (about 3 hours if all HPI pumps operate and up to 11 hours if only two charging pumps operate).

***Core melt will be initiated sooner in the event of RPS failure.

INTERFACING LOCA EVENT TREE

FIGURE 7.3-6



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CONTAINMENT EVENT TREE

FIGURE 7.3-7

7.4 DETERMINATION OF RELEASE CATEGORY CONSEQUENCES

7.4 DETERMINATION OF RELEASE CATEGORY CONSEQUENCES

7.4.1 Outline of Basic Methodology

The general procedure for calculation of risk from hypothetical plant accidents follows the assessment methodology of CRAC (Calculation of Reactor Accident Consequences) as performed for the Reactor Safety Study (RSS). This section presents a brief description of the basic calculation scheme of the CRAC code. A complete and detailed discussion may be found in Appendix VI of WASH-1400 (Reference 2).

7.4.1.1 General Calculational Procedure of CRAC

The methodology in CRAC may be summarized in the schematic of data and models of the consequence calculations shown in Figure 7.4-1 as published in WASH-1400. Input data include the accident release data, weather data, and population data.

The calculation of reactor accident consequences starts with the postulated breach of containment and release of radioactivity. Following the postulated release, the dispersion of the radioactivity, cloud depletion, and ground contamination is calculated from atmospheric dispersion models. Using the resulting air and ground contamination, the dosimetric models determine the doses to individuals. Early and chronic doses to individuals are determined from a number of exposure pathways. Early doses accrue from exposure to the passing cloud (direct radiation and inhalation), and early exposure to the ground contamination. Chronic doses accrue from exposure accumulated at later times including doses from ingestion of contaminated food and/or milk products, inhalation of resuspended ground contamination, and long-term direct exposure to ground contamination (greater than 7 days).

The health effects are then determined based on the calculated doses and the population distribution around the plant. Several mitigation measures including population evacuation and relocation, food, and/or land interdiction are considered in the determination of the population doses and health effects. The health effects in CRAC may be divided into three categories: acute, latent, and genetic effects. Acute health effects refer to injuries and fatalities occurring within a year of the accident. The latent effects refer to the somatic effects which later are manifested in the form of cancer during a plateau period assumed to be about 30 years. Genetic effects refer to effects seen in subsequent generations. Last, the economic impacts are calculated in terms of property damage and costs. Property damage is specified in terms of interdicted areas of land, crops, and/or milk, while costs include the estimated costs of such interdiction, as well as the direct costs of ground decontamination, and population evacuation or relocation.

The results of the CRAC consequence model are displayed as a set of complementary cumulative distribution functions (ccdf) for specific consequences. These distributions are determined from the calculated magnitude of each consequence for each combination of postulated accident release, weather, and population, as well as the probability of each such combination.

The basic CRAC methodology, the dosimetric models, the health effects models, and the interdiction, models were adopted for this analysis. Some minor modifications were made to adapt CRAC to the Seabrook site specific requirements, and some post-processors were utilized to permit some sensitivity analysis and to obtain special output options (e.g., dose vs. distance), without running the whole problem more than once. Those changes will be discussed in a later section.

7.4.1.2 Accident Release Categories

There are basically three input data requirements in CRAC that are specific to the plant being analyzed: the accident release data, the weather data, and the population data. The accident release data will be discussed in this section as they are essentially the same set of accident sequences of the prototype PWR in the Reactor Safety Study. The weather and population data will be discussed at a later section as they constitute refinements to the basic methodology of the RSS consequence calculations.

The range of postulated accidents, defined in WASH-1400 as PWR 1 through 9 release categories, represent the spectrum of severe accidents analyzed for the Seabrook plant. The nine release categories, including the calculated probabilities per reactor year (see Section 7.3) are shown in Table 7.4-1. Characteristics of these accident release categories, which are pertinent to the off-site consequences, are also shown in the table. The leakage fractions, multiplied by the radionuclide inventories, determine the release magnitude. The radioactive inventory source assumed for the Seabrook plant used the WASH-1400 3200 MW_{th} PWR core isotopic composition, modified by a factor of 1.14 to reflect the larger capacity of the Seabrook facility. The rest of the accident parameters, including the timing and duration of the releases, as well as the warning time for evacuation, have been retained.

PWR categories 1 through 7 represent the accident sequences that lead to total or partial core melt while PWR 8 and 9 are non-core melt sequences. Of the core melt accidents, PWR 6 and 7 lead to postulated melt-through of the base mat as the only containment failure mode. If an aquifer exists beneath the power plant, subsequent release of the radioactive material directly into the hydrosphere through contact with groundwater could lead to potential water exposure pathways. Since the rate of travel of these materials through the aquifer, to a downstream discharge or withdrawal point, is much slower than the air transport of the accompanying atmospheric release, this exposure pathway was not studied in great detail. This procedure is consistent with the approach used in RSS, and in a recent study of liquid pathway impacts (Reference 9), it was observed that substantial holdup and mitigation in the vicinity of the containment would be expected in the event of core melt-through at land-based nuclear plants. Also, the direction of groundwater flow at the Seabrook site is away from inland wells and towards the ocean (Reference 10).

7.4.2 Refinements to Basic Methodology

Seabrook site specific parameters were utilized in this analysis, where available. Environmental parameters for the site have been used and include the following:

a. A full year of meteorological data for the site
b. Population distribution for the year 1980
c. Habitable land fraction within 500 miles
d. Land use and agricultural data within 500 miles

In addition to the above, preliminary emergency preparedness studies have also been utilized in modeling the evacuation for various areas surrounding the Seabrook facility.

7.4.2.1 Seabrook Environmental Parameters

A general overview of the climatology of the region may be found in Chapter 2 of this report. In the evaluation of the off-site consequences, the weather data is defined in terms of wind speed, stability, wind direction, and rain or no rain condition. In CRAC, the atmospheric condition following the accident may be treated as an invariant weather or a time variant weather condition. The latter option was exercised in these calculations. This option requires the input of hourly weather conditions (wind speed, stability class and rain/no indicator) for one full year. A series of start times are selected (the time at which the accident release is assumed to occur) and the chronological hourly weather conditions trace the movement of the cloud downwind. This hourly file of annual meteorology was derived from on-site meteorological data collected at Seabrook from the time period, April 1979 through March 1980, reduced to a format compatible with CRAC. Since the CRAC consequence model by default uses a calendar year period, the CRAC code had to be modified to reflect the Seabrook site data period.

The on-site meteorological data tower is instrumented for wind measurements and ambient temperature differences at 43 feet and 209 feet above the base. Both heights were used in the CRAC calculations. The upper elevation data file defined the weather condition for the elevated release and high energy release rate accident (PWR 1), while the lower elevation data file was used for the ground-level release accidents. This insured the use of representative weather data for the two elevations of accident release. The corresponding seasonal wind rose for both heights was likewise used.

The wind rose provides the frequency of the wind blowing toward the 16 compass directions around the site. This frequency, on a seasonal basis, defines the probability of exposure of the downwind sector population distribution to the radioactive cloud as a function of the time of the year. Thus, seasonal variations of the wind direction are accounted for. Data summaries of the weather conditions at the Seabrook facility are presented in Appendix 2B of the FSAR (Reference 10).

7.4.2.2 Seabrook Site Specific Population Data

7.4.2.2.1 Permanent Resident Population

Table 7.4-2 lists the permanent U.S. and Canadian population within a 500 mile radius of the plant, broken down into 16 directional sectors and 34 distance intervals (a total of 544 spatial regions). The population data for the first 24 intervals (0 to 50 miles) were taken from the Seabrook FSAR, Tables 2.1-2 and 2.1-4, which constitute 1980 estimates (Reference 10). These population data were distributed among the 24 intervals, described in Table 7.4-2, in proportion to the surface areas of the particular spatial regions. For example, the 5-10 mile interval population data is given as one number for each sector in Reference (10). This number was distributed between the 5-6, 6-7, 7-8.5, and 8.5-10 mile spatial regions shown in Table 7.4-2, according to their respective surface areas.

The last 10 distance intervals of Table 7.4-2 contain the U.S. or Canadian permanent population for each sector between 50 and 500 miles. Only intervals beyond 150 miles contain Canadian population because this is the shortest distance to the Canadian border from the Seabrook site. The population data for regions in the last 10 intervals were obtained from tabulations of the population for all counties lying in those regions. The county data used 1979 population estimates from Rand McNally (Reference 11). For the state of Virginia, which contains a number of independent cities, the 1970 U.S. Census of Population (Reference 12) was used. All Canadian data were obtained from the 1976 Canadian Census of Population (Reference 13).

The following procedure was used for all large counties which were divided by an interval or a sector boundary. The population of counties crossed by a boundary was distributed according to the surface fraction of each such county which lay on each side of the intersecting boundary. The population of any large city (over 500,000 persons) was subtracted from its county population and then added back to the proper region containing the city. In cases where a boundary also bisected a large city, its population was divided equally between the two adjacent regions.

7.4.2.2.2. Transient Population Within 10 Miles

The transient population data used are given in Table 7.4-3. The numbers in Table 7.4-3 represent the summer vacation population living within 10 miles of the site for the months of July and August. The data are the actual weekday peak transient population for these months. During summer weekend days about 30% more people would be present than is given in the table. However, during summer weekend nights the number of people would be equal to the data given in Table 7.4-3 (i.e., the weekday peak). On the other hand, during weekday nights there would be less people present near the site (about 20% less than in Table 7.4-3). Thus, using the weekday peak data represents a conservative average for the transient population present in the summer months near the site on a total time basis. The CRAC code was adapted to the Seabrook site as follows: the weather data were sampled each 4 days from April 1, 1979 to March 31, 1980 (91 start times during the year, representing 91 possible accident occurrences). The population data from Table 7.4-2 was used for all accidents occurring in the spring, autumn, or winter months. However, the sum of the population data in Tables 7.4-2 and 7.4-3 was used for all accidents occurring during the summer months of July and August 1979.

7.4.2.3 Agricultural Land Use and Economic Data

The land use and economic data for regions between 0 and 50 miles were extracted from 1978 Census of Agriculture data for New Hampshire, Massachusetts, and Maine (Reference 14). For the 50 to 500 mile regions, the 1974 CRAC data for different U.S. states were used. These data contain some 1974 dollar values, which were adjusted to 1978 dollar values by using an inflation factor 1.314. This factor was obtained by calculating the ratio of the consumer price index (CPI) for September 1974 to that for September 1978, i.e.,

$$\frac{CPI(1974)}{CPI(1978)} = 1.314 \text{(Reference 15)}$$

Agricultural data for counties within 50 miles of the Seabrook site and for states lying between 50 and 500 miles from Seabrook are given in Table 7.4-4 (1978 data). In this table the states, counties, and Canadian provinces are simply arranged according to the order in which they are identified in the CRAC code input format. The farm land fractions and the dairy product land fractions define the agricultural usage patterns for the analysis. The annual farm sales (dollars per acre) and value of farm properties (dollars per acre) represent 1978 data for the U.S. counties and states as described above. In the case of the Canadian provinces, U.S. data for the state of Maine was used as representative. For each Canadian province, the fraction of farm land for Maine (i.e., 0.097) was multiplied by the fraction of province surface not covered by lakes to obtain the actual fraction of total province surface used for farming. Maine data for annual sales and farm value were used to approximate Canadian province economic conditions.

7.4.2.4 Updated Economic Factors for CRAC

In addition to the agricultural economic data described in the previous subsection, the CRAC code employs other economic factors in its assessment of accident impacts. The 1974 data in the standard CRAC input file for these factors were also updated to 1978 values using the same inflation multiplier (i.e., 1.314), as was used for agricultural economic data. The specific economic factors affected and the new values obtained from making the indicated correction are given in Table 7.4-5.

7.4.2.5 Emergency Protective Measures

The risk reduction benefits of evacuation were considered in the consequence calculations. The evacuation model in WASH-1400 (Reference 2) moves the population within 25 miles radially outward from the site at selected evacuation speeds until they are overtaken by the radioactive cloud. At that point, the evacuating persons are subject to ground and cloud exposure.

The model does not provide a realistic description of the movement of evacuating persons in a particular area. Evacuation speeds were derived from the study of evacuation data assembled by the U.S. Environmental Protection Agency, as reported in Appendix VI of WASH-1400 (Reference 2).

In order to provide more realistic estimates of evacuation times for the Seabrook station, a preliminary analysis (Reference 16) on evacuation clear times for various study areas was used as a basis for the evacuation model parameters. Effective evacuation speeds were derived for various areas surrounding the Seabrook facility and a zone-by-zone consequence calculation was performed. A summary of the time estimates for the evacuation cases used is presented in Table 7.4-6.

As shown in this table, there are time estimates for two area conditions. The first column shows estimates made for the off-season, typical weekday population condition, and the second column shows estimates made for the fair weather summer weekend during which the peak population condition for the area is experienced. These estimates considered transportation and road networks, but assumed no formal traffic control measures would be in effect, existing traffic patterns would prevail, and no specified evacuation routings would be enforced. In addition, no delay times from notification to initiation of evacuation were considered.

The effective evacuation speed was calculated for each zone by dividing the total radial distance of the evacuation area by the estimated clear time. The consequence calculations made on a zone-by-zone basis, therefore, had an evacuation speed that was a function of the area being evacuated, as well as the time of the year during which the accident evacuation is assumed to occur. Thus, the increased population destribution within 10 miles due to the transient seasonal residents would be evacuated according to the estimates for the summer weekend peak population condition. With respect to this aspect of the calculation, a more realistic estimate of the consequences is approached, on the conservative side, since peak summer weekend estimates were used for the summer season instead of a typical summer weekday.

7.4.3 Presentation of Results and Risk Measures

The health and economic consequences calculated for the various postulated accidental releases from the Seabrook Station are presented in this section. Calculated health effects include early fatalities and latent cancer deaths predicted to arise from potential radiological exposures to persons within 500 miles of the Seabrook site. Economic effects include the direct costs of emergency action undertaken during the accident and the estimated costs of mitigation actions that might be taken following the accident.

The health effects and economic consequences for all of the nine PWR release categories are presented in two statistical categories:

1) The mean value for all trials* including all those leading to zero effects (Table 7.4-7).

2) Probability distributions for the following specific effects:

   a. acute fatalities (Figure 7.4-2)
   b. latent fatalities (Figure 7.4-3)
   c. mitigation costs (Figure 7.4-4)
   d. total man-rems (Figure 7.4-5)

In addition, whole body doses to individuals and cumulative population doses as a function of distance from the plant are presented in Figures 7.4-6 and 7.4-7. These individual and population doses are "average" values which consider the probabilities of all Class 9 accidents.

7.4.4 Discussion of Results

7.4.4.1 Health and Economic Impacts

The consequences of a nuclear reactor accident can vary from minor to severe depending on several factors. Minor consequences could occur if the amount of radioactive release is small, or if the release is blown toward the sea. Severe consequences could occur if the amount of release is large and the contamination is deposited in a region of large population or high productivity.

The health and economic impacts presented in Section 7.4.3, in the form of probability distributions, show the range of predicted consequences for the Seabrook nuclear plant. All nine PWR release categories contribute to the results, the consequences from each being weighted by its associated probability of occurrence (see Table 7.3-4).

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*A trial in CRAC is defined as the result of a combination of accident release category, weather condition start time, and a downwind population sector.

The probability distribution for acute fatalities (Figure 7.4-2) is determined overall by PWR category 2, except for the very high consequences where the probability of occurrence is less than $1x10^{-11}$ per reactor year. This peak value occurs from PWR category 1, which is characterized by a high energy release. The thermal energy causes lofting of the plume at the point of release such that cloud depletion is less effective in limiting radionuclide concentrations at more distant locations. (Note that the results in Figure 7.4-2 are truncated at a probability of 10^{-9} per year.) The amount of radioactivity released is particularly critical to the prediction of acute fatalities because the CRAC code uses a threshold level for acute deaths, below which none can occur. Thus, the high activity releases from PWR categories 1, 2, and 3 result in early fatalities, while the lower releases from PWR categories 4 through 9, result in no early fatality consequence. On the average, the early fatalities are predicted to occur within 15 miles from the plant, and in no instance does the fatality radius exceed 50 miles.

For the latent fatalities (Figure 7.4-3), the probability distribution is determined by several release categories. The very high consequence region of the curve is determined by PWR category 2, while PWR catagories 2, 7, 8, and to a lesser extent, PWR 6, determine the remainder of the curve.

Latent cancer fatalities result from smaller doses, and lower dose rates, than those that produce early fatalities. These are integral effects over a large area and are accumulated over long periods of time after the accident. Continued exposure to contaminated land would contribute to the long-term doses. These long-term doses would therefore depend on the interdiction strategy. For population groups that would be located relatively close to the reactor, the interdiction strategy may require permanent relocation. Therefore, no long-term exposure to contaminated land would occur for these persons. Only the inhaled radionuclides would determine their dose commitment, and in such cases, only persons who were directly exposed to the plume would contribute to the latent cancer fatalities.

The total economic costs include the costs of evacuation or relocation of the population, as well as decontamination of land and interdiction of agricultural products and/or land. The probability distribution (Figure 7.4-4) of the economic costs is essentially determined by PWR category 7 up to the mid-range of the curve, although PWR categories 2 and 8 contribute equally to some extent in this region. The high consequence region is again determined by PWR category 2.

It is interesting to note that the economic impact curve is almost horizontal up to 10 million dollars. The probability that at least 10 million dollars would be incurred is essentially equal to the sum of the probabilities of PWR accident categories 2 and 7. This is due to the assumed evacuation that is undertaken for all core melt accidents. PWR category 8 contributes only in the interdiction, decontamination, and relocation costs, which are at least 100 thousand dollars. For the high consequence region, PWR category 2 interdiction and decontamination costs are the significant cost contributors.

The economic and interdiction consequences are also partially sensitive to the amount of radioactivity released. The choice of an interdiction criterion can control the economic costs. For example, the total economic costs given an accident would be 1.3 million dollars if land decontamination is undertaken, or about 5 million dollars if no land decontamination is undertaken. This is because the cost of interdicting land is very high if no decontamination is done. CRAC assumes a decontamination factor of greater than 20 before permanent interdiction of land is calculated. The interdiction levels used in these calculations are basically those which were used in the Reactor Safety Study.

The demography and wind pattems of the Seabrook site are such that there is roughly a 50% probability that a release would be blown completely or partially in the direction of nonpopulated areas; i.e., the sea. Thus, calculated consequences for the Seabrook plant, hypothetical accidents are made up mostly of the other 50% of the cases in which releases would be blown over land. There is little doubt that releases toward the sea should result in considerably lower health consequences because little or no direct contact between radioactivity and people would take place. Indirect contact could be minimized by interrupting seafood intake and by interdicting the use of nearby beaches, if necessary. On the other hand, these interdiction measures, if implemented, would produce some socioeconomic impacts. Because of the size of the water body involved with the appreciable dilution of contamination that should occur, it appears unlikely that these impacts would be large enough to significantly alter the economic cost results that have been calculated in this analysis.

The individual and population doses shown in Figures 7.4-6 and 7.4-7 may be compared (see Table 7.4-8) with the anticipated annual doses due to normal operation of the plant (Reference 17). The maximum whole body dose from an accident occurs at 400 meters from the plant. The comparison shows that the maximum individual dose from an accident is around seventy times that due to normal operation. The population doses within 50 miles of the plant are about twenty times those from normal operation, while the population doses over an extended region are only about twice those from normal operation.

7.4.4.2 Uncertainties

The discussions in the preceeding section have provided insight into the risk from hypothetical accidents from the Seabrook nuclear power facility under annual average meteorological conditions. The methodology has been based on the Reactor Safety Study. The study has been reviewed subsequently, and several findings and recommendations concerning the RSS were issued. The more significant finding was that the methodology was sound.

The source of uncertainties in the accident probabilities have been outlined in a previous section, and uncertainties in the consequence analysis will be discussed in this section. In the RSS, uncertainties were considered in two broad groups; the dispersion-dosimetric model, and the dose response criteria. The first group includes uncertainties in the release fractions, probabilities, and physical characteristics of the accidents and the atmospheric dispersion. The second group includes individual dose-responses and cost parameters. These factors affect only their corresponding consequences. The various uncertainties will be discussed as they apply to the Seabrook plant.

In general, the calculation of early fatalities is most sensitive to the first group of uncertainties, especially the release magnitude. The release fractions and other accident parameters were based on an accident analysis of another PWR design. The mitigating effects of the substantial engineered safety features of the Seabrook Station design, particularly the complete secondary containment with a filtered vent for accident conditions, were not considered. Just how effective the Seabrook safety features would be, has not been determined, but it is worth noting that an arbitrary reduction of the release fractions for the iodine and particulate fission products, by approximately a factor of 10, would likely result in a prediction of no early fatalities.

The other consequences, latent cancer fatalities and property damage, appear to be less sensitive to the first group of uncertainties. These constitute integral effects over a large area and are more a function of the total population and cost parameters than of accident characteristics.

The estimation of latent cancer fatalities was based on the 1972 BEIR Report and dose effectiveness factors to reduce the "effective" dose for low doses and low dose rate exposure. Recently, the 1979 BEIR committee (Reference 18) released their latest positions on the biological effects of ionizing radiation. Limited concensus was attained, and ranges, rather than single risk values, were provided. The 1979 BEIR committee suggested dose-cancer fatality conversion factors ranging from 70 to 350 per million man-rems, compared with the WASH-1400 value of 122 per million man-rem. A lack of information was acknowledged regarding the effects of low dose rates, indicative of the continuued uncertainties in cancer risk estimates.

TABLE 7.4-1

SUMMARY OF RELEASE CATEGORIES REPRESENTING HYPOTHETICAL ACCIDENTS

Release Category	Probability ($Reactor-yr^{-1}$)	Time of Release (hr)	Duration of Release (hr)	Warning Time for Evacuation (hr)	Elevation of Release[f] (meters)	Energy Release (10^6 BTU/hr)	Fraction of Core Inventory Released[a]							
							Xe-Kr	Organic I[b]	I[b]	Cs-Rb	Te-Sb	Ba-Sr	Ru[c]	La[d]
PWR 1	1.1×10^{-8}	2.5	0.5	1.0	25	520	0.9	6×10^{-3}	0.7	0.4	0.4	0.05	0.4	3×10^{-3}
PWR 2	2.8×10^{-6}	2.5	0.5	1.0	0	170	0.9	7×10^{-3}	0.7	0.5	0.3	0.06	0.02	4×10^{-3}
PWR 3	1.2×10^{-7}	5.0	1.5	2.0	0	6	0.8	6×10^{-3}	0.2	0.2	0.3	0.02	0.03	3×10^{-3}
PWR 4	$1\text{-}7 \times 10^{-10}$	2.0	3.0	2.0	0	1	0.6	2×10^{-3}	0.09	0.04	0.03	5×10^{-3}	3×10^{-3}	4×10^{-4}
PWR 5	8.1×10^{-9}	2.0	4.0	1.0	0	0.3	0.3	2×10^{-3}	0.03	9×10^{-3}	5×10^{-3}	1×10^{-3}	6×10^{-4}	7×10^{-5}
PWR 6	9.6×10^{-7}	12.0	10.0	1.0	0	N/A	0.3	2×10^{-3}	8×10^{-4}	8×10^{-4}	1×10^{-3}	9×10^{-5}	7×10^{-5}	1×10^{-5}
PWR 7	9.2×10^{-6}	10.0	10.0	1.0	0	N/A	6×10^{-3}	2×10^{-5}	2×10^{-5}	1×10^{-5}	2×10^{-5}	1×10^{-6}	1×10^{-6}	2×10^{-7}
PWR 8	2.8×10^{-6}	0.5	0.5	N/A[e]	0	N/A	2×10^{-3}	5×10^{-6}	1×10^{-4}	5×10^{-4}	1×10^{-6}	1×10^{-8}	0	0
PWR 9	1.5×10^{-3}	0.5	0.5	N/A	0	N/A	3×10^{-6}	7×10^{-9}	1×10^{-7}	6×10^{-7}	1×10^{-9}	1×10^{-11}	0	0

(a) Background on the isotope groups and release mechanisms is presented in Appendix VII of WASH-1400.

(b) Organic iodine is combined with elemental iodine in the calculations. Any error is negligible since its release fraction is relatively small for all large release categories.

(c) Includes Ru, Rh, Co, Mo, Tc.

(d) Includes Y, La, Zr, Mb, Ca, Pr, Md, Mp, Pu, Am, Cm.

(e) Not applicable.

(f) A 10 meter elevation is used in place of zero representing the mid-point of a potential containment break. Any impact on the results would be slight and conservative.

TABLE 7.4-2

PERMANENT RESIDENT POPULATION FOR THE SEABROOK SITE

Radius (Mi) (Increment)	Sector / Interval	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.5(0.5)	1	5	0	0	0	0	0	0	3	30	63	15	0	28	43	5	8
1.0	2	15	0	0	0	0	0	0	8	90	187	45	0	83	128	15	23
1.5	3	33	0	29	180	197	381	21	37	103	115	275	275	279	29	90	111
2.0	4	47	0	41	260	283	549	30	53	148	165	395	395	401	41	130	159
2.5	5	212	765	356	369	0	0	239	117	243	189	176	293	122	113	68	63
3.0	6	259	935	435	451	0	0	292	143	297	231	215	358	149	138	83	77
3.5	7	315	908	619	50	0	0	0	151	261	234	105	138	147	32	55	78
4.0	8	385	1,072	731	60	0	0	0	179	309	276	125	163	173	38	65	92
4.5	9	328	174	385	0	0	0	0	244	464	188	1,543	1,581	305	305	56	136
5.0(1.0)	10	372	197	435	0	0	0	0	276	526	212	1,747	1,790	345	345	64	154
6.0	11	653	1,202	144	0	0	0	0	638	1,120	1,323	1,723	1,113	323	391	947	512
7.0(1.5)	12	768	1,415	170	0	0	0	0	751	1,318	1,557	2,028	1,310	386	460	1,114	602
8.5	13	1,376	2,536	304	0	0	0	0	1,345	2,362	2,790	3,633	2,347	691	825	1,996	1,079
10.0(2.5)	14	1,643	3,027	363	0	0	0	0	1,606	2,819	3,330	4,336	2,801	825	984	2,383	1,288
12.5	15	4,264	5,722	393	0	0	0	1,515	2,506	3,478	3,777	12,398	4,881	2,917	1,477	1,496	2,599
15.0	16	5,244	7,038	483	0	0	0	1,863	3,082	4,278	4,646	15,249	6,003	3,588	1,817	1,840	3,197
17.5	17	6,202	8,323	571	0	0	0	2,203	3,645	5,059	5,494	18,034	7,099	4,243	2,149	2,176	3,781
20.0(5.0)	18	7,091	9,517	653	0	0	0	2,519	4,167	5,785	6,282	20,619	8,117	4,852	2,457	2,488	4,323
25.0	19	13,680	4,635	0	0	0	0	360	9,900	77,130	72,495	83,5[illegible]0	42,750	21,420	5,805	1,620	8,325
30.0	20	16,717	5,664	0	0	0	0	440	12,098	94,253	88,589	102,061	52,240	26,175	7,094	1,980	10,173
35.0	21	9,280	7,656	0	0	0	0	0	0	45,240	403,216	81,664	52,757	39,394	28,490	4,779	6,589
40.0	22	10,720	8,844	0	0	0	0	0	0	52,260	465,784	94,336	60,943	45,506	32,910	5,520	7,611
45.0	23	2,926	18,361	0	0	0	0	0	0	97,562	378,308	60,086	16,378	10,148	15,718	7,599	2,549
50.0	24	3,292	20,656	0	0	0	0	0	0	109,758	425,597	67,596	18,426	11,417	17,682	8,549	2,867
55.0	25	7,388	12,928	0	0	0	0	0	0	3,983	103,450	155,850	24,080	32,937	16,673	22,687	4,440
60.0	26	7,388	46,628	0	0	0	0	0	0	3,983	103,450	103,725	24,080	32,937	16,673	7,587	4,440
65.0	27	6,242	72,328	0	0	0	0	0	0	3,983	103,450	103,725	24,080	6,283	9,653	7,587	4,440
70.0 (15)	28	9,043	9,233	0	0	0	0	0	7,610	3,983	80,987	196,900	24,080	6,283	7,858	8,258	3,537
85	29	18,417	36,933	24,800	0	0	0	0	30,440	3,983	415,000	185,754	107,170	39,950	33,849	13,160	11,065
100 (50)	30	19,173	90,530	28,075	0	0	0	0	76,100	459,350	265,800	189,125	115,010	32,573	31,683	24,784	17,433
150	31	55,853	137,965	62,850	0	0	0	0	6,600	9,400	380,650	1,416,050	772,058	310,579	121,936	188,826	52,103
200 (150)	32	40,163	49,313	67,908	0	0	0	0	0	0	220,183	3,308,093	603,253	624,412	88,641	258,973	269,036
350	33	388,506	225,194	266,563	189,104	0	0	0	0	0	0	12,986,287	4,545,813	2,449,775	761,820	3,856,538	590,092
500	34	513,525	313,070	410,825	432,159	0	0	0	0	0	0	6,377,817	4,277,284	5,951,951	1,146,257	139,345	514,727

TABLE 7.4-3

TRANSIENT POPULATION WITHIN TEN MILES FOR THE SEABROOK SITE

Radius (Mi) (Increment)	Sector / Interval	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.5	1	0	0	0	0	0	0	0	0	3	3	2	0	2	0	0	0
1.0	2	0	0	0	0	0	0	0	0	8	8	3	0	3	0	0	0
1.5	3	22	0	137	3726	2881	1319	38	7	170	9	93	465	252	2	20	54
2.0	4	31	0	192	5209	4028	1913	54	9	237	13	131	651	353	3	27	76
2.5	5	376	133	386	2814	0	0	968	210	44	40	14	79	13	12	24	19
3.0	6	459	162	471	3439	0	0	1183	244	53	49	18	97	15	15	30	24
3.5	7	185	51	2643	168	0	0	0	1535	42	20	5	10	10	5	20	18
4.0	8	214	94	3054	193	0	0	0	1773	49	23	6	12	12	6	23	20
4.5	9	110	24	1146	0	0	0	0	3154	576	27	621	130	28	28	586	13
5.0	10	179	27	1277	0	0	0	0	3514	642	31	691	145	31	31	652	14
6.0	11	189	75	437	0	0	0	0	1113	328	433	121	203	60	60	315	119
7.0	12	222	88	514	0	0	0	0	1309	385	510	143	239	71	71	370	140
8.5	13	398	158	922	0	0	0	0	2346	691	913	256	428	127	127	663	251
10.0	14	475	189	1100	0	0	0	0	2801	824	1090	306	511	151	151	792	300

TABLE 7.4-4

AGRICULTURAL LAND USE AND ECONOMIC DATA FOR THE SEABROOK SITE

CODE NUMBER	POLITICAL ENTITY	SEEDING MONTH	HARVESTING MONTH	FARM LAND FRACTION	DAIRY PRODUCT FRACTION	ANNUAL SALES $/ACRE	VALUE OF FARM $/ACRE
1	MAINE	MAY	SEPTEMBER	.097	.171	235.6000	536.0000
2	N.H.	MAY	SEPTEMBER	.107	.418	151.6000	912.0000
3	VT	MAY	SEPTEMBER	.323	.811	145.0000	618.0000
4	MASS	MAY	SEPTEMBER	.151	.284	294.7000	1440.0000
5	R.I.	MAY	SEPTEMBER	.107	.258	447.0000	1997.0000
6	CONN	MAY	SEPTEMBER	.174	.298	526.0000	2536.0000
7	N.Y.	MAY	SEPTEMBER	.342	.552	184.0000	683.0000
8	N.J.	MAY	SEPTEMBER	.215	.202	407.0000	2970.0000
9	PA	MAY	SEPTEMBER	.309	.420	210.0000	1038.0000
10	OHIO	MAY	SEPTEMBER	.652	.181	145.0000	815.0000
11	PLYMOUTH CO.	MAY	SEPTEMBER	.173	.146	306.5700	1173.0000
12	NORFOLK CO.	MAY	SEPTEMBER	.046	.053	423.7000	2211.0000
13	SUFFOLK CO.	MAY	SEPTEMBER	0.000	0.000	0.0000	NOT APPLICABLE
14	MIDDLESEX CO.	MAY	SEPTEMBER	.082	.071	983.0000	3127.0000
15	ESSEX CO.	MAY	SEPTEMBER	.092	.219	395.3400	2563.0000
16	WORCESTER CO.	MAY	SEPTEMBER	.131	.392	284.8600	1123.0000
17	HILLSBOROUGH CO.	MAY	SEPTEMBER	.058	.204	318.5600	1248.0000
18	ROCKINGHAM CO.	MAY	SEPTEMBER	.103	.254	224.4800	1488.0000
19	MERRIMACK CO.	MAY	SEPTEMBER	.115	.543	164.1000	811.0000
20	BELKNAP CO.	MAY	SEPTEMBER	.087	.359	82.2400	999.0000
21	STRAFFORD CO.	MAY	SEPTEMBER	.113	.255	275.3000	1229.0000
22	DEL	APRIL	OCTOBER	.531	.052	368.0000	1038.0000
23	MD	APRIL	OCTOBER	.439	.245	237.0000	1603.0000
24	VA	APRIL	OCTOBER	.418	.176	104.0000	730.0000
25	W.VA	APRIL	OCTOBER	.282	.220	47.0000	394.0000
26	CARROL CO.	MAY	SEPTEMBER	.045	.530	81.6300	618.0000
27	YORK CO.	MAY	SEPTEMBER	.125	.200	257.7700	769.0000
28	ONTARIO	MAY	SEPTEMBER	.091	.171	223.0000	447.0000
29	QUEBEC	MAY	SEPTEMBER	.092	.171	223.0000	447.0000
30	NOVA SCOTIA	MAY	SEPTEMBER	.089	.171	223.0000	447.0000
31	NEW BRUNSWICK	MAY	SEPTEMBER	.089	.171	223.0000	447.0000

TABLE 7.4-5

UPDATED ECONOMIC FACTORS (1978) FOR THE SEABROOK SITE

CRAC PARAMETER	ECONOMIC FACTOR AND UNIT OF MEASURE	VALUE (1978 DOLLARS)
DCFLD	Decontamination Cost of Farm Fields ($/Acre)	3.020E+02
DCRBP	Decontamination Cost of Residential, Business, and Public Area ($/Person)	2.234E+03
VRBP	Value of Residential, Business, and Public Area ($/Person)	2.234E+04
CRELOC	Relocation Cost ($/Person)	3.811E+03
CONMLK	Cost of Milk Consumption ($/Person)	4.860E+01
CONCRP	Cost of Non-Dairy Products Consumed ($/Person)	3.154E+02
EVACON	Evacuation Direct Costs ($/Evacuee)	1.250E+02

TABLE 7.4-6

ESTIMATES OF EVACUATION CLEAR TIMES (HOURS/MINUTES)

Zones	Off Season Weekday Fair Weather	Summer Weekend Fair Weather
1. Sectors 1-4[a] (10 miles)	2/00	4/30
2. Sectors 5-6[b] (2 miles)	2/40	3/45
3. Sectors 7-10 (10 miles)	3/00	3/50
4. Sectors 11-12 (10 miles)	3/10	3/45
5. Sectors 13-16 (10 miles)	3/00	3/40

(a) Sixteen $22\frac{1}{2}^{0}$ sectors with sector 1 centered on the north counting clockwise.

(b) This is an average of the 180^{0} N and 180^{0} S, 2 mile radius data encompassing sectors 5 and 6.

TABLE 7.4-7

SUMMARY OF CALCULATED ENVIRONMENTAL IMPACTS

Environmental Effect	Mean Value (Effect/Year)
Early Fatalities	4.7×10^{-4}
Latent Cancer Fatalities/Year	1.3×10^{-4}
Total Man-Rem (500 Miles)	4.5×10^{1}
Direct Costs of Mitigation ($)	2.0×10^{3}

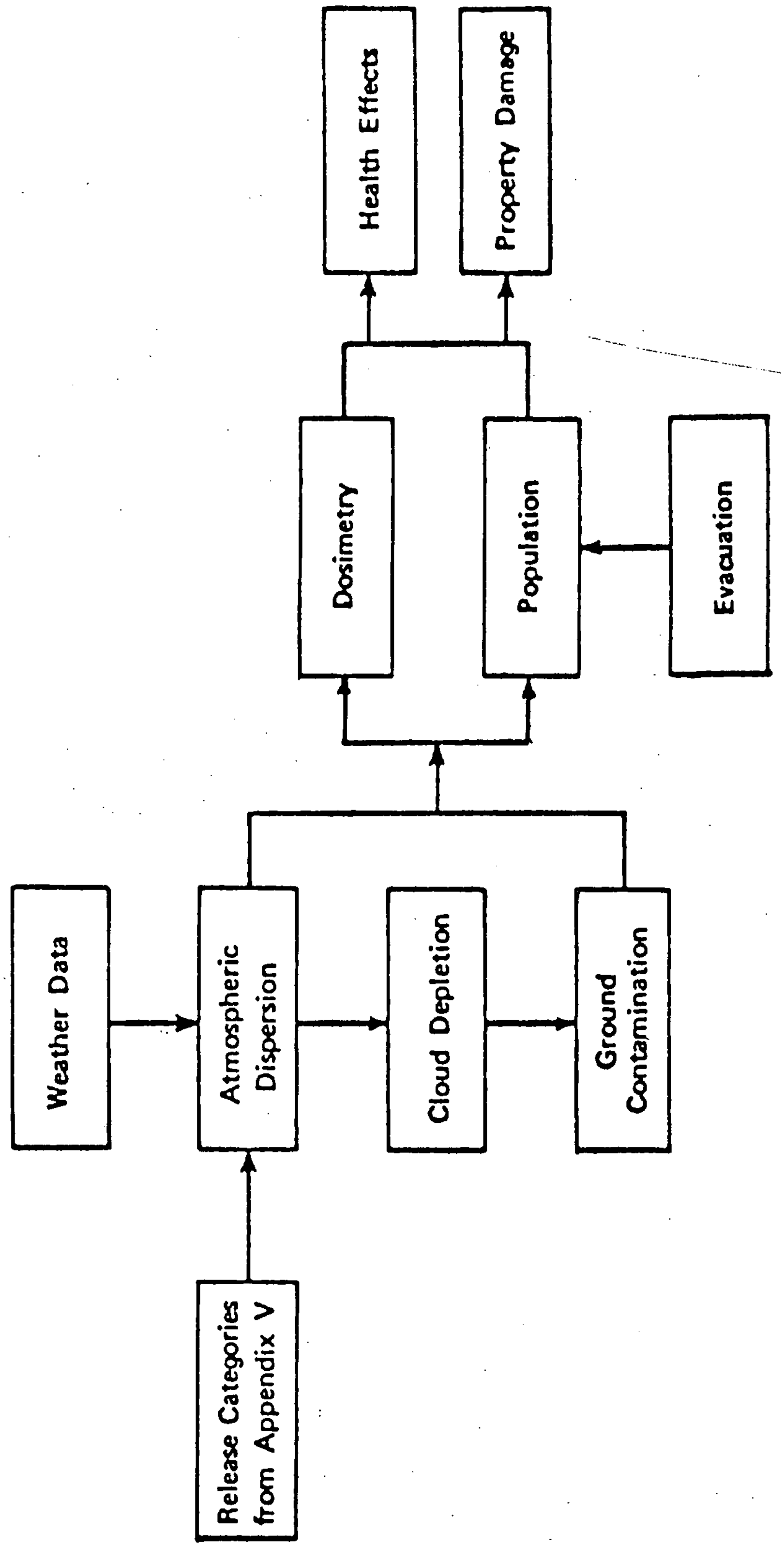
TABLE 7.4-8

COMPARISON OF SEABROOK ACCIDENT DOSES WITH NORMAL OPERATION

Conditions	Accident Categories PWR 1-9	Normal Operation
Whole Body Maximum Dose	17 mrem/year/unit	0.25 mrem/year/unit
Population Doses (0-50 Miles)	31 man-rem/year/unit	1.41 man-rem/year/unit
Population Doses	44.9 man-rem/year/unit[a]	24.5 man-rem/year/unit[b]

[a] Whole body dose commitment of greater than 80 years to the Seabrook Population within 500 miles.

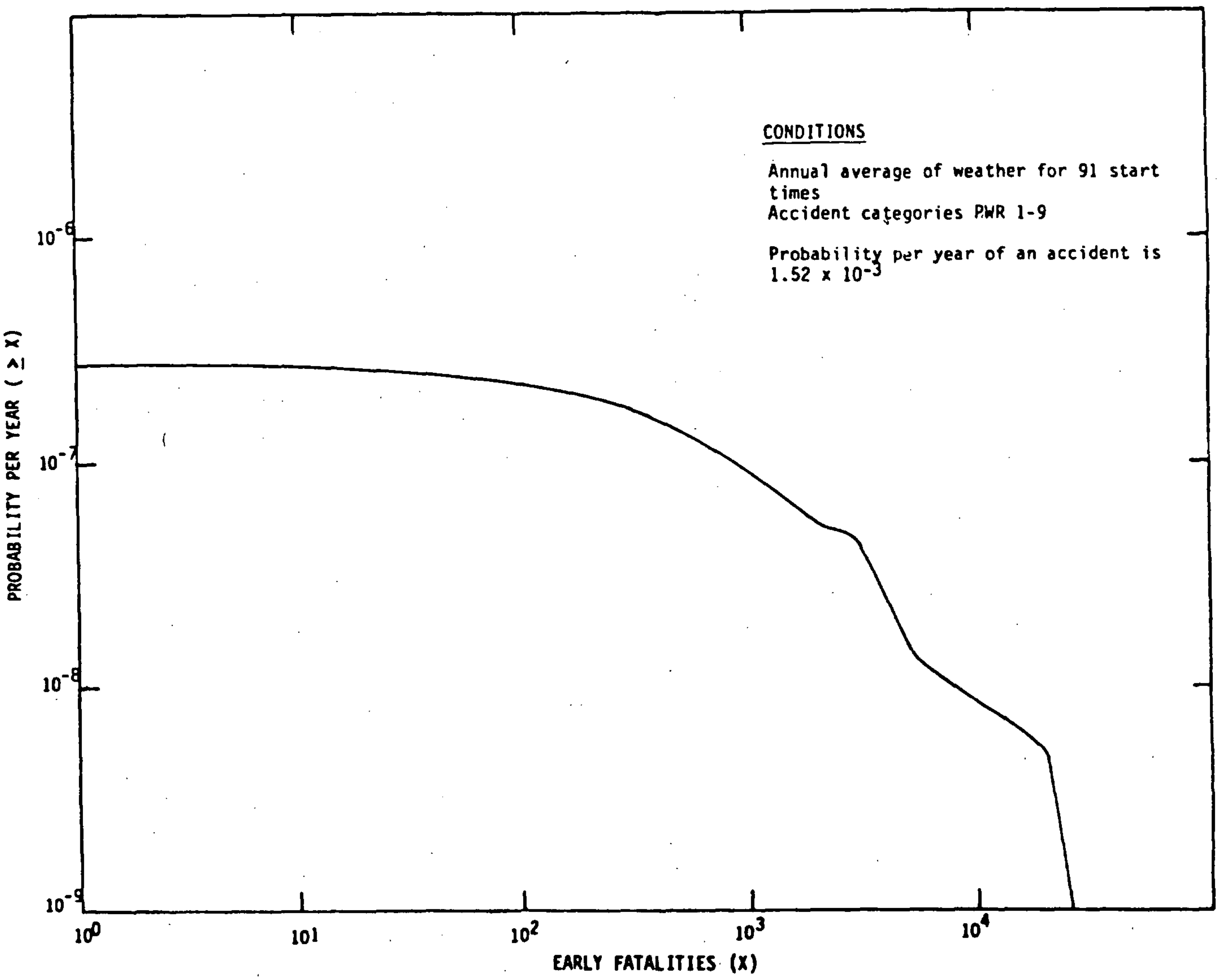
[b] Whole body dose commitment of 100 years to the U.S. population from all sources.



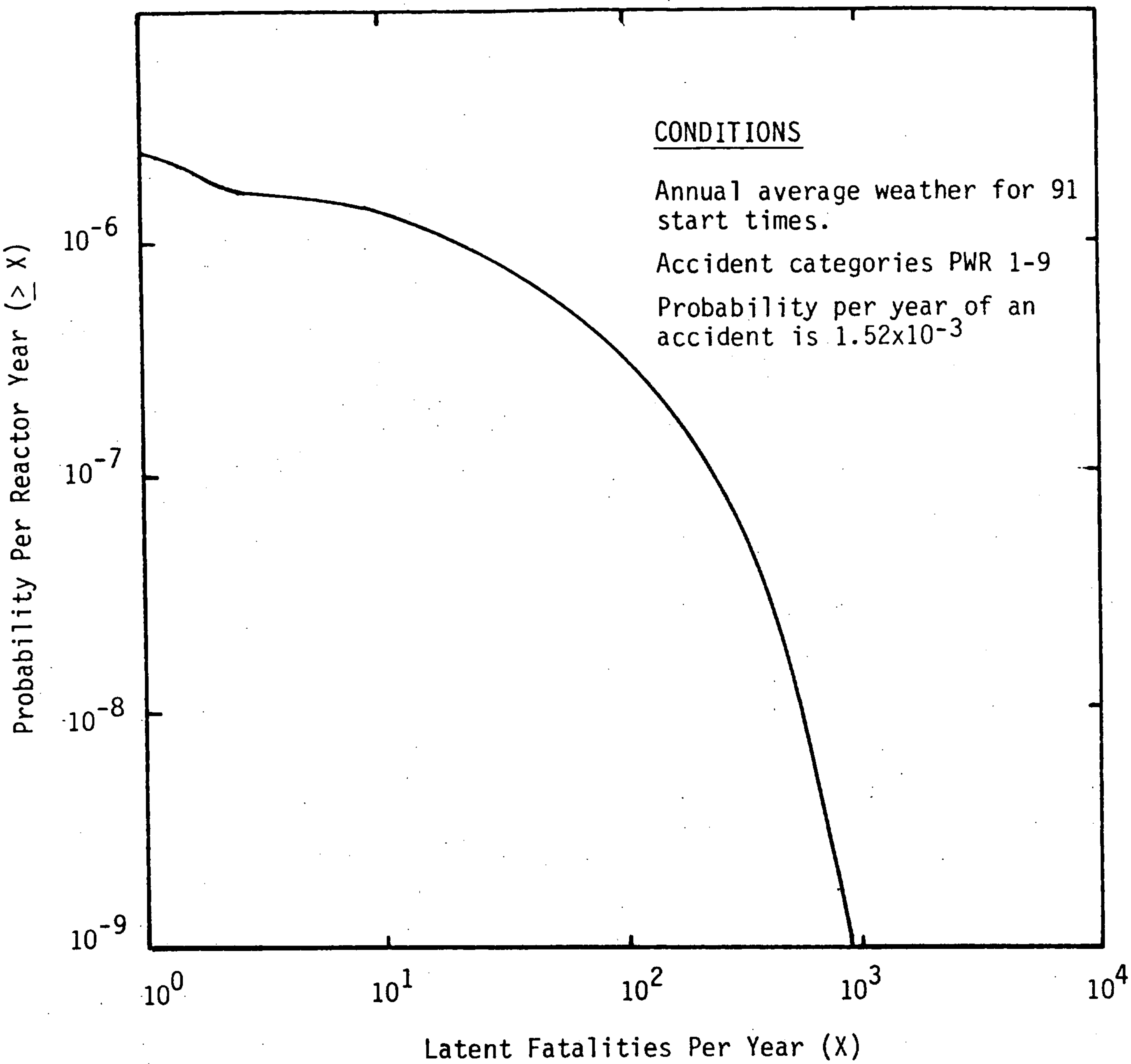
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

SCHEMATIC OUTLINE OF CONSEQUENCE MODEL (CRAC)

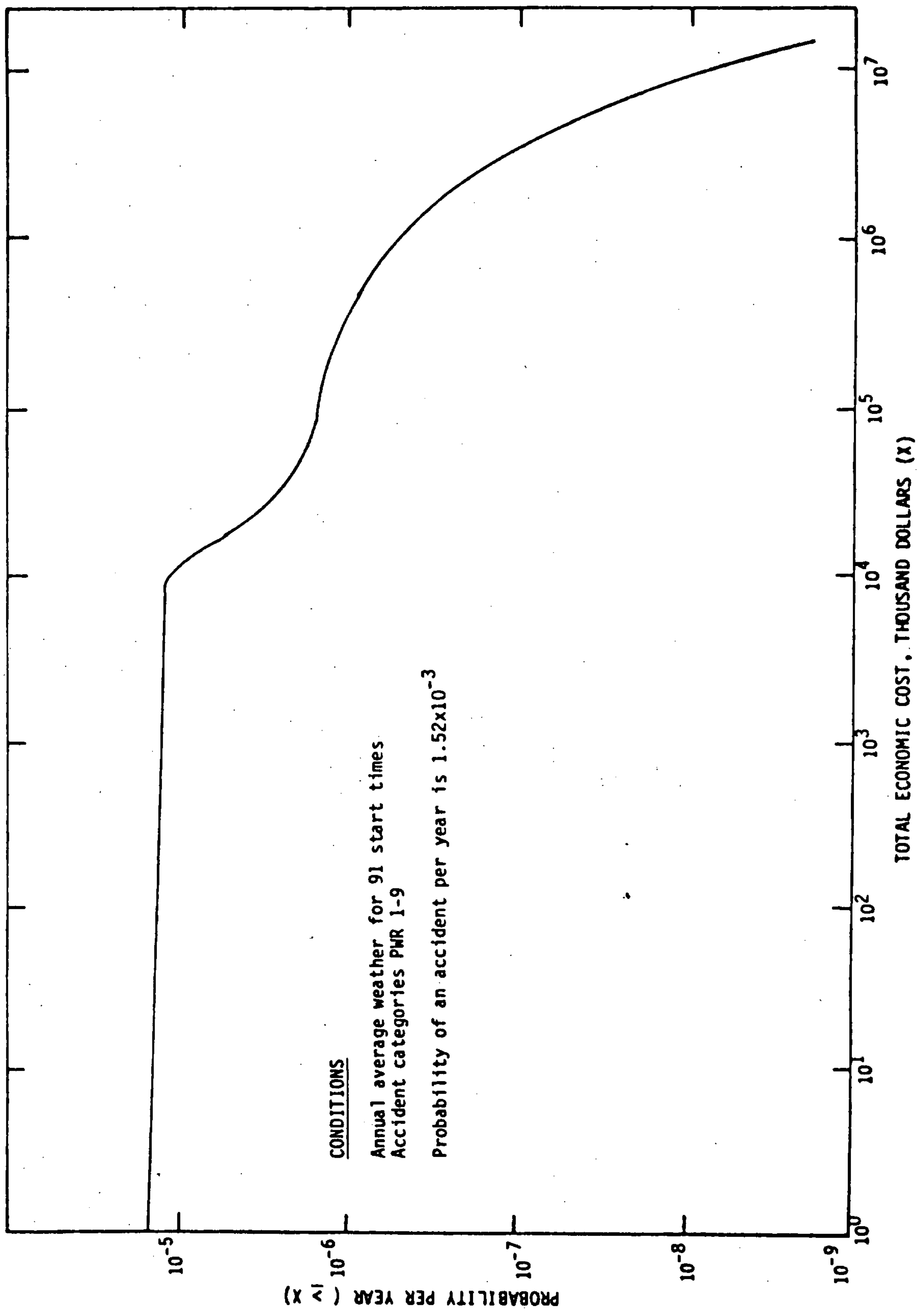
FIGURE 7.4-1



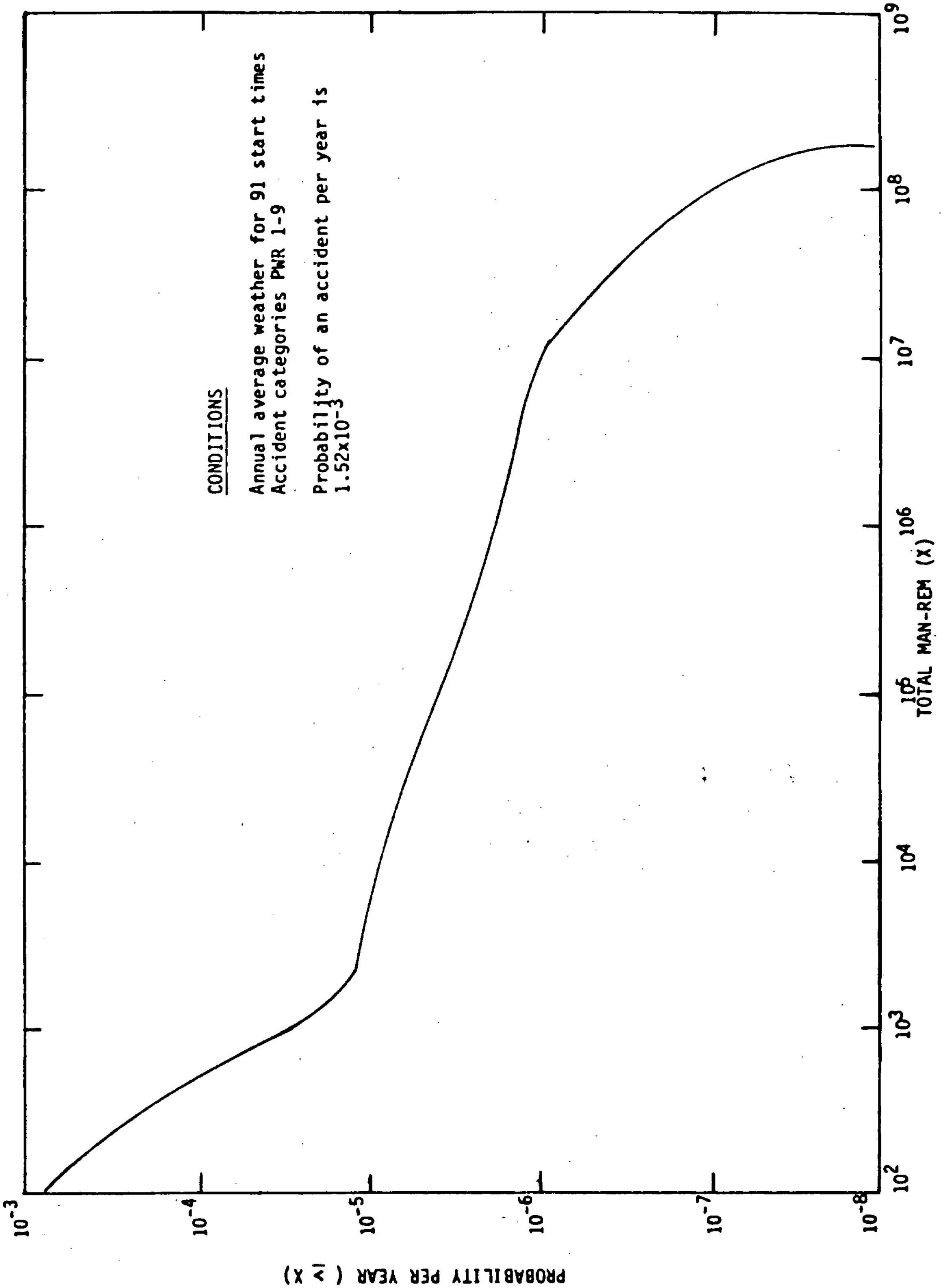
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	ACUTE FATALITIES PROBABILITY DISTRIBUTION
	FIGURE 7.4-2



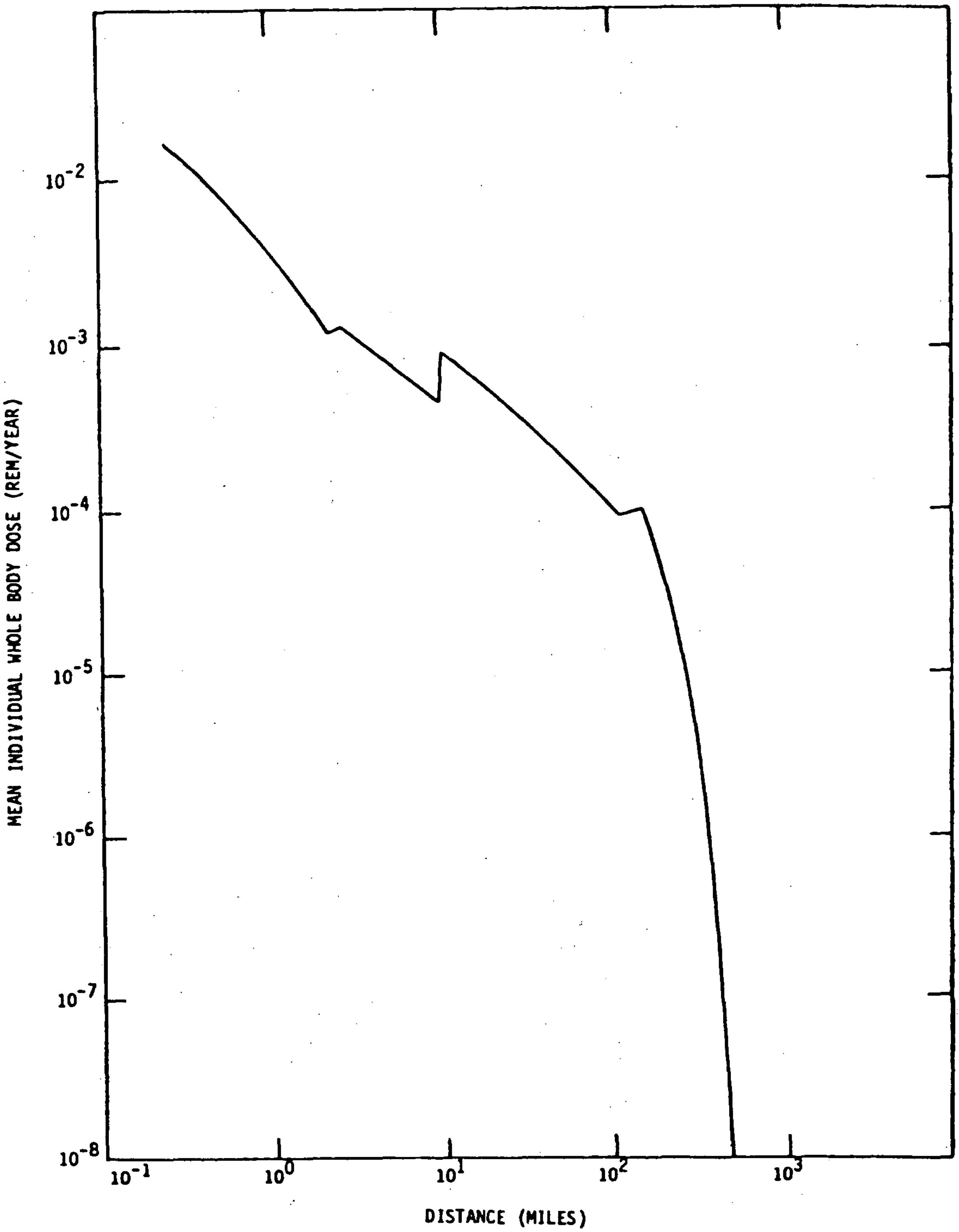
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	LATENT FATALITIES PROBABILITY DISTRIBUTION
	FIGURE 7.4-3



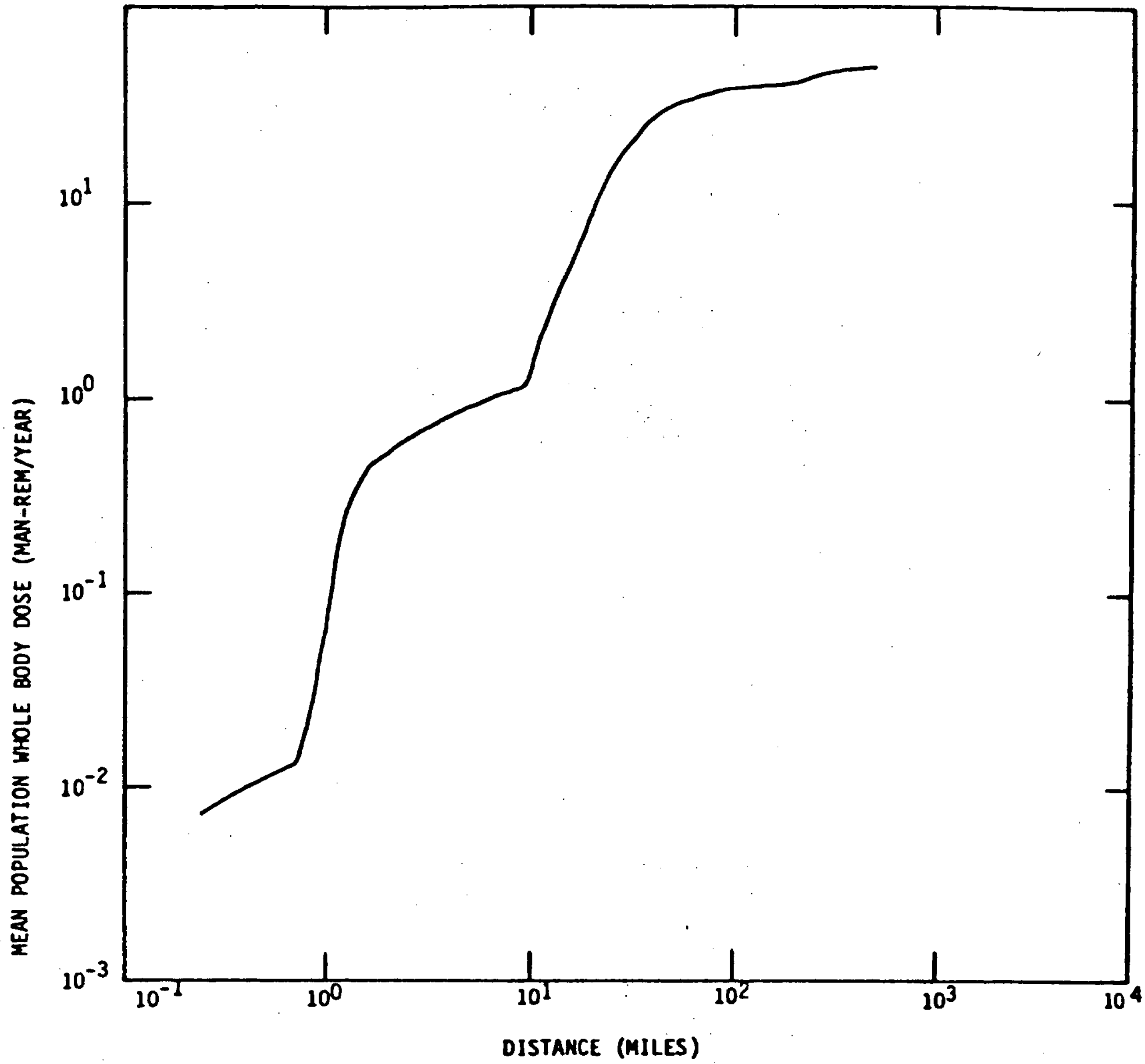
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	DIRECT COSTS OF MITIGATION PROBABILITY DISTRIBUTION FIGURE 7.4-4



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	WHOLE BODY POPULATION DOSE PROBABILITY DISTRIBUTION
	FIGURE 7.4-5



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	DOWNWIND WHOLE BODY DOSE FIGURE 7.4-6



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	DOWNWIND CUMULATIVE POPULATION DOSE
	FIGURE 7.4-7

7.5 GLOSSARY OF TERMS USED IN EVENT TREES

7.5 GLOSSARY OF TERMS USED IN EVENT TREES

7.5.1 Definition of Events Used On the LOCA Event Trees

EVENT	NAME	DESCRIPTION
LOCA Sizes:		
A	LARGE LOCA	Large LOCA - A rupture of primary coolant piping equivalent to the break of a single pipe whose diameter is greater than 10 inches, but which does not, in and of itself, negate the effectiveness of the ECC systems required to prevent core melt.
M_1	MEDIUM (M_1) LOCA	Medium LOCA - A rupture of primary coolant piping equivalent to the break of a single pipe whose diameter is greater than 6 inches but less than or equal to 10 inches.
M_2	MEDIUM (M_2) LOCA	Medium LOCA - A rupture of primary coolant piping equivalent to the break of a single pipe whose diameter is greater than 3 inches (approximately) but less than or equal to 6 inches.
M_3	MEDIUM (M_3) LOCA	Medium LOCA A rupture of primary coolant piping equivalent to the break of a single pipe whose diameter is greater than 1.5 inches but less than or equal to 3 inches.
S	SMALL LOCA	Small LOCA - A rupture of primary coolant piping equivalent to the break of a single pipe whose diameter is greater than 0.5 inches (approximately) but less than or equal to 1.5 inches.
LOCA Events:		
C	CSIS	Containment Spray Injection System - The CSIS is designed to remove heat from the containment atmosphere to prevent overpressurization during the injection phase of a LOCA. The heat removed from the steam is passed to the service water system. The CSIS consists of two containment spray pumps (motor-driven) which deliver water from the RWST to

spray headers in the containment. This spray condenses the steam in the containment atmospheres.

Success is defined as at least one out of two containment spray pumps delivering water to the containment atmosphere through the nozzles of its respective spray headers.

D ECI

Emergency Coolant Injection - The ECI system is designed to replenish the water lost from the reactor coolant system (RCS) through the LOCA break.

o ECI for Large and Medium-1 LOCA's - ECI consists of four accumulators filled with borated water (held at 600 psi by pressurized nitrogen) which inject into the RCS cold legs, and two RHR pumps injecting water from the RWST into the RCS cold legs.

  Success is defined as injection into the RCS cold legs of at least one out of two PHR pumps (taking suction from the RWST), and at least three out of four accumulators.

o ECI for Medium-2 LOCA - ECI consists of four accumulators filled with borated water (held at 600 psi by pressurized nitrogen) which inject into the RCS cold legs, along with two CP and two SIP injecting water from the RWST into the RCS cold legs.

  Success is defined as injection into the RCS cold legs of (a) two out of two SIP (taking suction from the RWST) and at least three out of four accumulators, or (b) at least one out of two CP and one out of two SIP (taking suction from the RWST) and at least three out of four accumulators.

o ECI for Medium-3 LOCA - ECI consists of two CP and two SIP, injecting water from the RWST into the RCS cold legs.

Success is defined as injection into the RCS cold legs of (a) at least one out of two CP and one out of two SIP, or (b) two out of two SIP, taking suction from the RWST.

- ECI for Small LOCA - ECI consists of two CP and two SIP, injecting water from the RWST into the RCS cold legs.

  Success is defined as injection into the RCS cold legs of (a) one out of two CP and one out of two SIP, or (b) two out of two CP, or (c) two out of two SIP, taking suction from the RWST.

F	CSRS	Containment Spray Recirculation System - The CSRS is designed to remove heat from the containment atmosphere to help prevent containment overpressure during the recirculation phase of a LOCA. The CSRS consists of two containment spray pumps delivering water from the containment sump to spray headers in the containment atmosphere. Success is defined as at least one out of two containment spray pumps delivering water from the containment sump to the containment atmosphere through the nozzles of its respective spray headers.
H	ECR	Emergency Coolant Recirculation - The ECR system is designed to recycle the water spilled to the containment sump back to the core in order to keep it covered and continue to remove decay heat from the core during the recirculation phase of a LOCA, and to therefore help prevent core melt. o ECR for Large and Medium-1 LOCA's - ECR consists of two RHR pumps injecting water from the containment sump into the RCS cold legs. Success is defined as at least one out of two RHR pumps taking suction from the containment sump and discharging to the RCS cold legs.

- <u>ECR for Medium-2 LOCA</u> - ECR consists of two RHR pumps, two SIP, and two CP injecting water from the containment sump into the RCS cold legs.

  Success is defined as (a) at least one out of two RHR pumps, or (b) two out of two SIP, or (c) at least one out of two CP and one out of two SIP, taking suction from the containment sump and discharging to the RCS cold legs.

- <u>ECR for Medium-3 LOCA</u> - ECR consists of two CP and two SIP injecting water from the containment sump into the RCS cold legs.

  Success is defined as (a) at least one out of two CP and one out of two SIP, or (b) two out of two SIP, taking suction from the containment sump and discharging to the RCS cold legs.

- <u>ECR for Small LOCA</u> - ECR consists of two CP and two SIP, injecting water from the containment sump into the RCS cold legs.

  Success is defined as (a) one out of two CP and one out of two SIP, or (b) two out of two CP, or (c) two out of two SIP, taking suction from the containment sump and discharging to the RCS cold legs.

E	ECF	<u>Emergency Core Functionability</u> - This event is not a system, but is included to take into account the possibility that even if ECI succeeds, it may be ineffective at cooling the core. This could occur, for example, as a result of serious core damage which occurs prior to or during ECI. Such an event is assumed only under severe stresses due to blowdown in the case of a large LOCA.

Success is defined as the ability of ECI to cool the core, given that ECI is successful.

K	RPS	<u>Reactor Protection System</u> - The RPS is designed to shut down the nuclear reaction in the core if an abnormal condition exists, in order to reduce the amount of heat which is produced and make it possible to put the plant in a safe condition. Success is defined as bringing the reactor to a subcritical (shutdown) condition.
L	AFWS & SSR	<u>Auxiliary Feedwater System and Secondary Steam Relief</u> - The AFWS and SSR is designed to remove heat from the RCS to help prevent core melt. Water is added to the system generators by two AFW pumps (one motor-driven, one steam turbine-driven) which take suction from the condensate storage tank. The water is allowed to boil in the steam generator, removing heat from the RCS. This steam is then released through the SSR valves. Success is defined as at least one out of two AFW pumps delivering water to the steam generators from the condensate storage tank and release of the created steam through the SSR valves.

7.5.2 Definition of Events Used On Transient Event Trees

EVENT	NAME	DESCRIPTION
T	TRANSIENTS	Transients - Any abnormal condition in the plant which requires that the plant be shut down, but which does not qualify as a LOCA (i.e., it does not involve a rupture of primary coolant piping equivalent to the break of a single pipe whose diameter is greater than 0.5 inches).
K	RPS	Reactor Protection System - The RPS is designed to shut down the nuclear reaction in the core if an abnormal condition exists, in order to reduce the amount of heat which is produced and make it possible to put the plant in a safe condition. Success is defined to be bringing the reactor to a subcritical (shutdown) condition.
M	PCS	Power Conversion System - Designed as the normal method of removing heat from the RCS. Steam created in the steam generators is sent through the main steam lines to the main turbine or turbine bypass and on to the condenser. The condensate is then pumped through the condensate and feedwater systems and returned to the steam generator to be turned into steam again. For a transient, success is defined as the steam from the steam generators being sent to the condenser by way of the turbine bypass, condensed, and the condensate returned to the steam generator by the condensate and feedwater pumps.
L	AFWS & SSR	Auxiliary Feedwater System and Secondary Steam Relief - The AFWS and SSR is designed to remove heat from the RCS to help prevent core melt. Water is added to the steam generators by two AFW pumps (one motor-driven, one steam turbine-driven) which take suction from

the condensate storage tank. The water is allowed to boil in the steam generator, removing heat from the RCS. This steam is then released through the SSR valves.

Success is defined as at least one out of three AFW pumps delivering water to the steam generators from either the condensate storage tank or the service water system, and release of the created steam through the SSR valves.

P S/RV-O <u>Safety/Relief Valves - Open</u> - The pressurizer S/RVs are designed to relieve excess pressure in the RCS in order to prevent overpressurization and therefore to prevent possible subsequent damage to the RCS piping and vessels. Small amounts of excess pressure are relieved by one or both of the two power operated relief valves (PORVs). If the pressure spike is excessive, or the PORVs fail to open, pressure will be relieved by one, two, or three of the three safety valves (SVs).

Success is defined as the opening of the necessary number of S/RVs to prevent RCS overpressurization.

Q S/RV-R <u>Safety/Relief Valves - Reclose</u> - The pressurizer S/RVs are also designed to reclose once the excess RCS pressure has been relieved. This reclosing keeps most of the water inventory within the RCS, preventing a LOCA type accident.

Success is defined as the reclosing of all the S/RVs which opened, once the excess RCS pressure is relieved. (If any PORVs are stuck open, the operator can manually close a motor-operated block valve if he realizes what is happening, which will stop flow through the PORVs. This valve closure will satisfy the success criteria.)

U CVCS <u>Chemical and Volume Control System</u> - The CVCS is designed to maintain water inventory in the RCS for most normal operations and transients. Excess water is drained from the RCS and eventually brought to the volume control tank. If water is needed it is added from the volume control tank by three charging pumps.

During a transient, success is defined as maintaining water inventory in the RCS about the core.

W RHRS <u>Residual Heat Removal System</u> - The RHRS is designed to bring the reactor to cold shutdown once the RCS temperature and pressure have been brought down to about 350°F and 400 psi respectively. The RCS is cooled by passing the RCS water through heat exchangers which cool the water by passing the heat to the component cooling water system, and from there to the service water system. The RHRS consists of two RHR pumps taking suction from the Loop A hot leg, two RHR heat exchangers which take discharge from the pumps (and which themselves discharge back to the RCS), the component cooling water system which circulates water in a closed loop, taking heat from the RHR heat exchangers and passing it out from the component cooling water heat exchangers, and the service water system, which takes heat from the component cooling water system and discharges it to the environment.

Success is defined as at least one out of two RHR pumps delivering water from the Loop A hot leg through its respective RHR heat exchanger and on back to the RCS, the component cooling water system passing water through the same heat exchanger and removing heat, and the service water system taking the heat from the component cooling water system.

7.5.3 Definition Of Events Used On Vessel Rupture Event Tree

R RVR <u>Reactor Vessel Rupture</u> - A vessel rupture large enough to negate the effectiveness of the ECC systems required to prevent core melt, or rupture of sufficient primary coolant piping in a pattern that negates the effectiveness of those same ECC systems.

C CSIS

Containment Spray Injection System (Injection Phase) - The CSIS is designed to remove heat from the containment atmosphere to prevent overpressurization during the injection phase of a LOCA. The heat removed from the steam is passed to the service water system. The CSIS consists of two containment spray pumps (motor-driven) which deliver water from the RWST to spray headers in the containment. This spray condenses the steam in the containment atmosphere.

Success is defined as at least one out of two containment spray pumps delivering water to the containment atmosphere through the spray nozzles of its respective spray headers.

G CSRS

Containment Spray Recirculation System - The CSRS is designed to remove heat from the containment atmosphere to help prevent containment overpressure during the recirculation phase of a LOCA. The CSRS consists of two containment spray pumps delivering water from the containment sump to spray headers in the containment. This spray condenses the steam in the containment atmosphere.

Success is defined as at least one out of two containment spray pumps delivering water from the containment sump to the containment atmosphere through the spray nozzles of its respective spray headers.

E RHRS

Residual Heat Removal System - The RHRS is designed to remove heat from the containment to help prevent core melt and containment overpressure. The heat is removed by passing the water which has accumulated in the containment sump through heat exchangers which cool the water by passing the heat to the component cooling water system, and from there to the service water system. The RHRS consists of two RHR pumps taking suction from the containment sump, two RHR heat exchangers which take discharge from the pumps, the component cooling water system, which circulates water through in a closed loop, taking heat from the RHR heat exchangers and passing it out from component cooling water heat exchangers, and the service water system, which takes heat from the component cooling water system and discharges it to the environment.

Success is defined as at least one out of two RHR pumps delivering water from the containment sump through its respective RHR heat exchanger, the component cooling water system passing water through the same heat exchanger and removing the heat, and the service water system taking the heat from the component cooling water system.

7.5.4 Definition of Events Used On Containment Event Tree

α	CR-VSE	Containment Rupture - Vessel Steam Explosion - Steam flashing caused by the interaction of the molten core with water in the bottom of the reactor vessel causes vessel overpressure and subsequent shattering of the vessel. Missiles created by the shattered vessel rupture the containment.
β	CL	Containment Leakage - Failure of the containment to completely isolate.
γ	CR-B	Containment Rupture - Burning - Hydrogen accumulated in the containment ignites, causing instantaneous overpressure which ruptures the containment.
δ	CR-OP	Containment Rupture - Overpressure - Steam created in the core and released to the containment is not condensed by the containment ESF systems, slowly building up containment pressure until overpressure occurs, rupturing the

containment.

ε	CR-MT	Containment Rupture - Melt-Through - The molten core melts through the bottom of the reactor vessel and the containment base mat, thus breaching the containment.

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CHAPTER 8
ECONOMIC AND SOCIAL EFFECTS OF CONSTRUCTION AND OPERATION

CHAPTER 8

ECONOMICS AND SOCIAL EFFECTS OF CONSTRUCTION AND OPERATION

CONTENTS

8.1 ECONOMIC EFFECTS

CHAPTER 8

ECONOMICS AND SOCIAL EFFECTS OF CONSTRUCTION AND OPERATION

This chapter discusses the effects associated on a local and state level with the operation of Seabrook Station, Units 1 and 2. The following data reflects changes and updated information from that previously presented in the ER-CPS Chapters 8 and 11, which dealt primarily with the effects of plant construction. All information presented below assumes both units are operational with all construction completed. Since benefits and costs beyond 10 years would be very difficult to estimate, and also would tend to favor the operation of the plant, all economic data is estimated for the first 10 years of operation and presented in 1986 dollars for compatibility and comparison purposes. The discount rate used throughout this section is 15.5%.

8.1 ECONOMIC EFFECTS

The economic effect of the facility will be mainly due to the supply of electricity from the station, the revenue produced from sale of electricity, additional area employment, and increased local taxes.

8.1.1 Station Electrical Output

Over its expected lifetime in excess of 30 years, the Seabrook Station units will supply not only New Hampshire but all of New England with a base supply of electricity, free from foreign interference. Based upon a conservative 65% average annual capacity factor, the yearly generation per unit will be 6,548,100 MWH, or 13,096,200 MWH for the facility. The lifetime generation of Seabrook Station should be over 390 million MWH.

Projections into the future, especially over 30 years, are very difficult, but if the usage of electricity from Seabrook is similar to that of PSNH in 1979, the following is an estimate of the distribution among the various classes of customers:

Residential	30.0%
Commercial (General)	9.6%
Industrial	30.7%
Other	22.8%
Losses	6.9%

8.1.2 Electrical Revenues

The primary benefit to the owners of Seabrook Station is the value of the electricity sold from the units. Based upon PSNH 1980 average operating revenue of 5.638 cents/KWH, this revenue would be about $740 million/year. Future projection of generating revenues are based upon the 1980 average electric revenue escalated at 8%/yr and presented in 1986 dollars. The value of the first 10 years of plant operation is $8,838 million.

8.1.3 State and Local Taxes

The operation of Seabrook Station will affect the tax revenues received locally and within the state. At this time, the state has neither a sales tax nor a state income tax; therefore, revenue from local property taxes is extremely important for support of municipal services.

Real estate taxes on utility plants are levied by the municipality in which the property is located. There have been bills before the state legislature to tax generating facilities by the state but they have not been passed into law. The success or failure of future bills will have a substantial effect upon the taxes which must be earned and paid by the Seabrook facility.

In 1980, Seabrook Station was taxed approximately $4 million in local real estate tax. This figure reflects in the doubling of the town budget between 1977 and 1979. Although it is very difficult to project, it would appear that over the long-term, taxes on the site in the order of $4-$5 million/year (in 1980 dollars) would adequately support the town government.

If, however, Seabrook Station is taxed upon a state-wide basis, the amount of real estate taxes will increase drastically. Based upon the 1979 state average real estate tax rate of 2.5%, the average annual tax on Seabrook would be approximately $90 million. Real estate taxes are considered part of the fixed charges on the facility.

8.1.4 Earnings

Public Service must also pay a franchise tax to the state amounting to 9% of net earnings after all taxes including the franchise tax. The estimated state franchise tax for the first full year of operation is $5 million for PSNH 35.2+% per share. This tax will decline in each subsequent year as the earning requirements will be less as net plant decreases. Franchise taxes are considered part of the fixed charges on the facility.

8.1.5 Personal Taxes

It would be extremely difficult to measure the burdens placed on local government jurisdictions by the employees of the plant. We, therefore, propose that tax payments by those employees not be considered as part of the benefits of the plant, but rather as an offset to local and state services extended to them. For the same reason, we do not propose to estimate the property tax payments of the employees in their respective communities.

8.1.6 Employment

The station is expected to employ about 500 personnel plus 100 contract guards, most of whom will live outside of the town of Seabrook but within 10 - 15 miles of the site. The combined annual payroll will be approximately $29 million (in 1986 dollars). This payroll includes certain fringe benefits which are eventually spent in the area of the employee's residence. 2

8.1.7 Plant Operation Costs

The annual operation and maintenance cost is estimated at about $45 million per year/per unit (in 1986 dollars), which includes plant payroll. Expenses in this item also include plant expenses and small non-capital purchases. It is expected that few of the purchases will be made locally, and therefore, they should have no effect in the surrounding areas. Employment costs are a benefit to the area but a cost to the facility.

8.1.8 Plant Capital Costs

Based upon the current cost estimate and completion schedule, the annual fixed cost on the plant investment is estimated at approximately $863 million. The investment in the station will be completed prior to the operation of the plant, and therefore, will have to be repaid regardless of whether the facility runs or not. To be conservative, real estate taxes have been estimated at 2.5% of net investment.

8.1.9 Fuel Costs

Ten year fuel costs are shown below for Units 1 and 2. Very little of this money will be spent in the local area. Total present value of ten years of fuel expense = $774 million.

Annual Nuclear Fuel Cost by Year of Operation ($/MWH)

Year	Unit 1	Unit 2	Year	Unit 1	Unit 2
1	$9.67	$10.43	6	$ 10.27	$ 10.97
2	8.97	9.48	7	10.43	11.52
3	9.26	10.09	8	10.98	12.15
4	9.76	10.32	9	11.62	12.32
5	10.02	10.48	10	12.25	13.53
	10 Year Present Value @ 15.5%			$56.76	$61.41

8.1.10 Transmission Facilities

Total transmission costs including interest associated with the station are estimated at $46 million. While there may be some local disruption and environmental costs during construction of these facilities, operation of the line should cause no additional effects. The present value of ten years of fixed charges on these lines, including operation and maintenance charges, is estimated at $58 million.

8.2 SOCIAL EFFECTS

8.2 SOCIAL EFFECTS

The social effects of operating nuclear facilities are generally minimal. While some impact may be expected from 450 additional workers in the area, this should be more than offset by the benefit from employee payroll and increased tax revenue.

8.2.1 Local Impact

Due to the small numbers of permanent employees at the site, and the dispersion of these families throughout the area, little impact is expected on the local housing, school or municipal services. In addition, these employees have moved into the area gradually over a 5-6 year period.

The plant site itself should impose very little, if any, local impact on municipal services since it is basically self-contained, using only portions of the municipal water system.

Local impact of travel by employees and equipment and supply shipment again should be minimal relative to the size of local commerce related travel.

8.2.2 Environmental Impact

The station, which is subject to state and federal water, air, solid waste and radiation requirements, will, during normal operation, have a very small if measurable impact on the local environment.

8.2.3 Educational Facilities

The Seabrook Station Education Center has been in operation and open to the public, individually and in groups, since 1978. This facility has served to inform and educate the public not only on the various aspects of the station, such as construction, operation, safety, waste disposals, etc., but also on the area environment. No cost benefit is estimated.

CHAPTER 9
ALTERNATIVE ENERGY SOURCES AND SITES

CHAPTER 9

ALTERNATE ENERGY SOURCES AND SITES

CONTENTS

9.1 ALTERNATIVES OF NOT REQUIRING THE CREATION OF NEW GENERATING CAPACITY

CHAPTER 9

ALTERNATIVE ENERGY SOURCES AND SITES

The most recent projections for energy and demand growth on the Public Service system are described in Chapter 1. The projected peak loads, capabilities and reserves for New England are also described. These data show the need for the two Seabrook Station units to provide capability and additionally to reduce oil imports and burning to mandated levels.

9.1 ALTERNATIVES NOT REQUIRING THE CREATION OF NEW GENERATING CAPACITY

The effects, as they may best be estimated, of pricing and conservation upon demand are incorporated in the forecasting methodology and in the results. It is unrealistic to expect that wise-use programs and improved customer energy utilization could reduce demand so much that the need for Seabrook Station will be eliminated or delayed.

The projected capacity retirements on the NEPOOL system between 1981 and 1986 total 187 MW. Rescheduling these retirements will not affect the need for Seabrook Station.

Purchased power from Canada continues to be investigated. Current estimates are that to transmit firm power to New England if it were to become available, would require a 8-year construction program. Imported power cannot be counted upon to displace the need for Seabrook Station.

9.2 ALTERNATIVES REQUIRING CREATION OF NEW GENERATING CAPACITY

9.2 ALTERNATIVES REQUIRING THE CREATION OF NEW GENERATING CAPACITY

The information in Section 9.2 of the Seabrook Station ER-CPS has not changed significantly. There are no new generation alternatives to Seabrook Station.

9.3 COMPARISON OF PRACTICAL ALTERNATIVES AND THE PROPOSED FACILITY

9.3 COMPARISON OF PRACTICABLE ALTERNATIVES AND THE PROPOSED FACILITY

As discussed previously, there are no practicable alternatives to Seabrook Station. The conclusions reached in the Seabrook Station ER-CPS remain unchanged.

CHAPTER 10
STATION DESIGN ALTERNATIVES

CHAPTER 10

STATION DESIGN ALTERNATIVES

CONTENTS

CHAPTER 10

STATION DESIGN ALTERNATIVES

10.0 INTRODUCTION

This chapter compares the economic and environmental costs and engineering considerations of feasible alternative station systems with the selected station systems. The major station systems that were considered include the circulating, intake, discharge, chemical, biocide, sanitary waste, liquid radwaste, gaseous radwaste, transmission, and other systems.

10.1 CIRCULATING SYSTEM

CHAPTER 10

STATION DESIGN ALTERNATIVES

This chapter compares the economic and environmental costs and engineering considerations of feasible alternative station systems with the selected station systems. The major station systems that were considered include the circulating, intake, discharge, chemical, biocide, sanitary waste, liquid radwaste, gaseous radwaste, transmission, and other systems.

10.1 CIRCULATING SYSTEM

The information for this section is unchanged from the information presented in Section 10.1 of the Seabrook Station 1 & 2 ER-CPS.

10.2 INTAKE SYSTEM

10.2 INTAKE SYSTEM

The information for this section remains unchanged from the information presented in Section 10.2 of the Seabrook Station 1 & 2 ER-CPS.

10.3 DISCHARGE SYSTEM

10.3 DISCHARGE SYSTEM

The information for this section remains unchanged from the information presented in Section 10.3 of the Seabrook Station 1 & 2 ER-CPS.

10.4 CHEMICAL SYSTEMS

10.4 CHEMICAL SYSTEMS

The information in this section remains unchanged from information presented in the Seabrook Station 1 & 2 ER-CPS.

10.5 BIOCIDE SYSTEMS

10.5 BIOCIDE SYSTEMS

The information in this section has changed from that presented in the Seabrook Station 1 and 2 ER-CPS, as noted below.

The method of biofouling control selected for the circulating and service water systems for Seabrook Station is continuous low-level chlorination. As described in Section 3.6 of the ER-OLS for the Seabrook Station, sodium hypochlorite solution will be produced on site by four hypochlorite generators using 1,200 gpm of seawater taken from the circulating water system. Injection of about 2 mg/l of equivalent chlorine as hypochlorite solution at the throats of the three offshore intake structures will provide for the main injection points. Additional injection points are located in the transition structure, the circulating water pump house, the service water pump house and the discharge transition structure should it be necessary to inject booster doses to maintain an effective antifoulant chlorine residual.

A cost analysis for both generating units indicates that backflushing on a schedule of twice a month during the fouling season and once a month during the rest of the year would cost approximately $3 million per year. If a schedule of backflushing only once a month during the biofouling season is possible, the cost will be reduced to approximately $1.5 million per year. Continuous low- level chlorination during a similar fouling season at an injection level of 2.0 mg/l will cost approximately $1.4 million per year. Sodium hypochlorite will be injected at such a rate as to maintain a level of 0.2 mg/l or less of total residual oxidant measured as equivalent Cl_2 in the discharge transition structure.

While the costs for backflushing and chlorination are similar for the minimum expected treatment, backflushing poses the potential of a much greater economic loss. The procedure to reverse the circulating water flow is complex and has the potential of inducing hydraulic and thermal transients which could result in a plant shutdown. The resulting loss of electrical generation could be considerable, approaching $1 million just to bring the two units back to 100% power. Additional losses could also be incurred including the delay required to realign mechanical and electrical systems before the plant could resume full power operation.

Additional information is presented in Sections 3.6 and 5.3 of the ER-OLS for Seabrook Station. 2

10.6 SANITARY WASTE SYSTEM

10.6 SANITARY WASTE SYSTEM

The information in this section remains unchanged from information presented in the Seabrook Station 1 & 2 ER-CPS.

10.7 LIQUID RADWASTE SYSTEM

10.7 LIQUID RADWASTE SYSTEMS

At the ER-CPS stage, the amount of radioactivity in liquid effluents from the Seabrook site, as described in Subsection 3.5.1, was within the numerical guides for design objectives and limiting conditions of operation set forth in the proposed Appendix I to 10 CFR 50. Thus, no analysis of liquid radwaste treatment system alternatives was required.

The off-site doses calculated for the ER-OLS, as described in Subsection 5.2.4, are also within the numerical guides of the formally adopted version of Appendix I to 10 CFR 50. No analysis of liquid radwaste treatment system alternatives is, therefore, required.

10.8 GASEOUS RADWASTE SYSTEM

10.8 GASEOUS RADWASTE SYSTEMS

At the ER-CPS stage, the amount of radioactivity in gaseous effluents from the Seabrook site, as described in Subsection 3.5.2, was within the numerical guides for design objectives and limiting conditions of operation set forth in the proposed Appendix I to 10 CFR 50. Thus, no analysis of gaseous radwaste treatment system alternatives was required.

The off-site doses calculated for the ER-OLS, as described in Subsection 5.2.4, are also within the numerical guides of the formally adopted version of Appendix I to 10 CFR 50. Accordingly, no analysis of gaseous radwaste treatment system alternatives is required.

10.9 TRANSMISSION FACILITIES

10.9 TRANSMISSION FACILITIES

The information in this section remains unchanged from that presented in Section 10.9 of the Seabrook Station ER-CPS except as noted below.

The description of Alternative 1 requires that one line to Tewksbury electrically bypasses Scobie Substation:

1 - 345 KV Line - Seabrook Substation to Newington Substation

1 - 345 KV Line - Seabrook Substation to Scobie Substation

1 - 345 KV Line - Seabrook Substation to Tewksbury via Scobie Substation, and

1 - 345 KV Line - Scobie Substation to Tewksbury Substation

Alternative 2 requires that the Sandy Pond Line electrically bypasses the Tewksbury Substation to maintain a stable system.

The description of Alternative 2 should read as follows:

1 - 345 KV Line - Seabrook Substation to Newington Substation

1 - 345 KV Line - Seabrook Substation to Tewksbury Substation

1 - 345 KV Line - Seabrook Substation to Sandy Pond Substation

1 - 345 KV Line - Scobie Substation to Tewksbury Substation

Alternative 2 requires 52.1 miles of additional line be constructed and an additional 36.4 miles of right-of-way be purchased.

The total cost for Alternate 2 is $18,405,000.

10.10 OTHER SYTEMS

10.10 OTHER SYSTEMS

Material originally contained in this section, as well as Section 10.11, as part of the ER-CPS has been relocated to adhere to the format outlined in Regulatory Guide 4.2, Revision 2, dated July 1976. However, for consistency, original ER-CPS sections are referenced below with their new ER-OLS section locations.

Otherwise, there were no other systems considered for Seabrook Station.

10.10.1 Service Water Alternatives

The alternate service water systems concepts considered for Seabrook Station has been changed, most notably by the incorporation of one alternative - cooling towers - as the proposed system. ER-OLS Section 3.4 describes these changes.

10.10.2 The Proposed Plant

The benefits and costs of Seabrook Station, partially described in ER-CPS Section 10.11, are now fully described in ER-OLS Chapter 8, Sections 8.1 and 8.2, respectively.

CHAPTER 11
SUMMARY BENEFIT – COST ANALYSIS

CHAPTER 11

SUMMARY BENEFIT-COST ANALYSIS

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CHAPTER 11

SUMMARY BENEFIT-COST ANALYSIS

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11.1 BENEFITS

CHAPTER 11

SUMMARY BENEFIT-COST ANALYSIS

A facility like Seabrook Station affects both the region in which it exists and also the nation as well. Presented below is an analysis of the overall effect of the quantifiable items on a national basis. This analysis is based upon the first ten years of operation of the plant; data beyond that point becomes increasingly difficult to the project, and subject to forces which may not even today be recognizable. However, the analysis is conservative since the plant fixed costs decrease rapidly after ten years, and therefore, a longer study would only increase the facilities' benefits.

11.1 BENEFITS

The primary benefit of the station consists of the value of the electricity generated. Using an estimate of 1986 generating revenue of 8.95 cents/KWH escalated at 8%/yr and presently valued to 1986 at 15.5% interest, the revenue benefits for the entire station over the first ten years of operation equals $8,838 million.

The nation will also benefit from the reduction of approximately 25 million barrels of imported oil annually that can be avoided through electrical generation by this facility.

TABLE 11.1

NATIONAL BENEFIT-COST ANALYSIS

Benefits	1986 Present Value
Power Revenue	$8,838 Million
Total	$8,838 Million
Costs	
Unit 1 and Common	$2,533 Million
Unit 2	1,594 Million
Fuel	774 Million
Operation and Maintenance	665 Million
Transmission Investment	58 Million
Total	$5,624 Million
Total Net Benefits	$3,214 Million
Total Benefits to Total Cost Ratio	1.57

Notes:
1) Benefits and Costs are calculated over the first ten years of plant operation and present valued back to 1986 at 15.5%.

2) Revenues and Operation and Maintenance are assumed to escalate at 8%/yr from 1986.

3) If revenues are assumed to grow at 4%/yr beyond 1986, total revenues = $7,617 million and the benefit - cost ratio = 1.35.

11.2 COSTS

11.2 COSTS

The estimated construction cost for Seabrook Station is currently $2,470 million plus $1,090 million in construction interest. The present value of the fixed charges to repay the expenses of Unit 1 and common is $2,533 million and for Unit 2 is $1,594 million for the first ten years of operation. These figures are based upon PSNH costs of money with the present value calculated at 15.5% interest.

Operation and maintenance costs have been escalated at 8% from the 1986 figure of $45 million per unit and present value calculated at 15.5% interest. The resulting ten year figure is $665 million.

Detailed nuclear fuel projections were used over ten years of operation to determine the 1986 value of ten years of operation of $774 million.

The investment in transmission facilities is estimated at $46 million and the value of the first ten years of operation is $58 million.

11.3 BENEFITS – COST RATIO

11.3 BENEFIT-COST RATIO

A summary of the various benefits and costs are shown in Table 11.1. The net benefit ratio is calculated at 1.57. It should be noted that if revenues grow only 4%/yr beyond 1986, total revenues decrease to $7,617 million, reducing the benefit-cost ratio to 1.35.

11.4 SUMMARY OF COSTS

11.5 BALANCING OF BENEFITS AND COSTS

CHAPTER 12
ENVIRONMENTAL APPROVALS AND CONSULTATION

CHAPTER 12

ENVIRONMENTAL APPROVALS AND CONSULTATIONS

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12.1 ENVIRONMENTAL APPROVALS AND CONSULTATION

CHAPTER 12

ENVIRONMENTAL APPROVALS AND CONSULTATIONS

The licenses, permits, and other approvals required by local, state, and federal governments to ensure environmental protection for construction activities and operation of Seabrook Station, including the associated facilities, are listed below:

Agency Issuing Permit	Item Requiring Permission	Status
Nuclear Regulatory Commission (NRC), formerly Atomic Energy Commission (AEC)	Construction permit	Granted 7/7/76
NRC	Operating license	Submitted
U.S. Environmental Protection Agency (EPA)	Approval of once-through cooling system by Determination granted under Section 316 of Fed. Water Pollution Control Act, as amended	Granted 6/77, 8/78
EPA	National Pollutant Discharge Elimination System Permit NH0020338 for settling basin effluent during construction	Granted 7/20/76
EPA	National Pollutant Discharge Elimination System Permit for plant effluents during operation	Submitted
U.S. Army Corps of Engineers (COE)	Permission to install all temporary and permanent structures that may be a hazard to navigation or anchorage	Granted 9/76
COE	Permission to dredge and dispose of dredged material for the installation of intake and discharge facilities	Granted 9/76

Agency Issuing Permit	Item Requiring Permission	Status
COE	Permission to dredge and dispose of dredged material for the installation of barge landing facilities	Granted 9/76
N.H. Public Utilities Commission N.H. Site Evaluation Committee (PUC and SEC)	Certificate of site and facility	Granted 1/29/74
N.H. PUC - SEC	Revised transmission line and tunnel routing	Granted 12/13/79
N.H. PUC	Transmission water crossing license	Granted 1/29/74
N.H. PUC	License for water conduits and intake pumping facility on state-owned land and under or across public waters	Granted 1/29/74
N.H. PUC	Zoning variances for Hampton Falls on 1) tunnels, 2) transmission lines and 3) well water	1) and 2) granted 3) applied for
N.H. Special Board	Permission to construct discharge facilities for yard and roof drains	Granted 7/31/73
N.H. Special Board	Permission to take soil samples and core borings below mean high water	Granted 7/31/73
N.H. Special Board	Permission to build temporary road in marsh	Granted 7/31/73
N.H. Special Board and Water Resources	Permission to install intake pipes and pump facilities from ocean to plant	Granted 7/31/73
N.H. Special Board and Water Resources	Permission to construct temporary roads and install buried ground wire through certain surface waters	Granted 1/29/74

Agency Issuing Permit	Item Requiring Permission	Status
N.H. Special Board and Water Resources	Permission to fill existing freshwater pond on-site	Granted 1/29/74
N.H. Special Board and Water Resources	Permission to excavate marsh to ascertain vegetation recovery	Granted 6/4/76
N.H. Water Supply and Pollution Control Commission (NHWS&PCC)	Permission to construct individual sewage disposal system on-site	Granted 7/31/73
NHWS&PCC	Permission to discharge yard and roof drains to the surface waters of the State	Granted 7/31/73
NHWS&PCC	Permission to take soil samples and core borings below mean high water	Granted 7/31/73
NHWS&PCC	Permission to construct temporary roads and install buried ground wire through certain surface waters	Granted 7/31/73
NHWS&PCC	Permission to install intake pipes and pump facilities from ocean to plant	Granted 7/31/80
NHWS&PCC	Permission to discharge heated water and waste into surface waters and permission to operate said facilities	Granted 1/29/74
NHWS&PCC	Permission to fill existing freshwater pond on site	Granted 1/29/74
NHWS&PCC	Certification of EPA determinations in accordance with FWPCA §401	Granted 10/9/75
NHWS&PCC	Permission to excavate marsh to ascertain vegetation recovery	Granted 6/4/76
N.H. Dept. of Public Works and Highways	License for overhead wires crossing state roadways	Granted 1/29/74

Agency Issuing Permit	Item Requiring Permission	Status
N.H. Air Pollution control Agency (NHAPCA)	Permission to operate radioactive waste gas discharge	Granted 1/29/74
NHAPCA	Permission to run auxiliary boilers and diesel generators	Granted 1/29/74
Town of Seabrook	Building permit for plant, substation, and circulating water system	Granted 9/30/74
NHAPCA	Approval of application to construct temporary parking lot	Granted 11/24/75
NHAPCA	Temporary permit to operate four boilers	Granted 11/28/77
NHAPCA	Temporary permit to operate a boiler	Granted 2/15/78
NHAPCA	Temporary permit to operate a boiler	Granted 1/13/78
Town of Hampton Falls	Building permit for part of circulating water system	Granted 7/79
Town of Hampton	Building permit for part of circulating water system	Granted 7/2/79

12.2 EXPLANATION OF JURISDICTION OF COASTAL RESOURCES MANAGEMENT COUNCIL

APPENDICS

APPENDIX A

APPENDIX A

DATA BASE FOR SEABROOK 1 & 2

10CFR50, APPENDIX I (REALISTIC) SOURCE TERMS

APPENDIX A

DATA BASE FOR SEABROOK 1 & 2 10CFR50, APPENDIX I (REALISTIC) SOURCE TERMS

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10CFR50, APPENDIX I (REALISTIC) SOURCE TERMS

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APPENDIX A

DATA BASE FOR SEABROOK 1 & 2 10CFR50, APPENDIX I (REALISTIC) SOURCE TERM

The following information is presented to comply with Appendix E of Regulatory Guide 4.2, Revision 2, for Seabrook Units 1 & 2. The information constitutes the basic data required to identify the source terms and calculate the releases of radioactive material in liquid and gaseous effluents. All numerical values are on a per unit basis unless otherwise stated.

A.1 General

1. The maximum core thermal power (MWt) evaluated for safety considerations in the FSAR.

Response 1. Thermal power is 3654 MWt.

2. Core Properties

a. The total mass (lb) of uranium and plutonium in an equilibrium core (metal weight).

Response 2a. The equilibrium cycle burnup will be 10,950 MWD/MTU utilizing a 3.0 zone fuel management scheme. The mass of uranium and plutonium at the beginning of the core (BOC) and end of core (EOC) for an equilibrium core are as follows:

	BOC	EOC
Total Mass of U (lbs)	193,305	190,419
Total Mass of Pu (lbs)	797	1,407

b. The percent enrichment of uranium in reload fuel.

Response 2b. 3.1% (% enrichments in core operation are 2.1% (65 cells), 2.6% (64 cells), and 3.1% (64 cells)).

c. The percent of fissile plutonium in reload fuel.

Response 2c. None

3. Calculational Model

The analytical methods and parameters described in Regulatory Guide 1.112 and NUREG-0017, "Calculation of Release of Radioactive Materials in Gaseous and Liquid Effluents from Light-Water-Cooled Power Reactors," are extensively used in the source term calculation. Radioactive concentrations in the primary and secondary coolant systems are evaluated on the basis of a Pressurized Water Reactor (PWR) with recirculating U-tube steam generators. Volatile treatment is applied to control secondary system chemistry. A more detailed description is presented in Section 11.1 of the FSAR.

a. Station Capacity Factor

Response 3a. 80%

b. Fraction of fuel releasing radioactivity in the primary coolant.

Response 3b. .12% with Zircaloy cladding (expected basis).

c. Concentration of fission, activation, and corrosion products in the primary and secondary coolant (Ci/g). Provide the bases for the values used.

Response 3c. Response can be found in Tables A-1 and A-2. Values were calculated according to NUREG-0017.

4. The quantity of tritium released in liquid and gaseous effluents (Ci/yr per reactor).

Response 4. A total tritium release of .4 curies per MWt per year is recommended in NUREG-0017 for a PWR with moderate tritium control. Accordingly, 1,462 curies of tritium are expected to be released from each reactor per year. One-half of the total release is assumed to be through the liquid pathway and one-half through the gaseous pathway.

A.2 Primary System

1. The total mass (lb) of coolant in the primary system, excluding the pressurizer and primary coolant purification system at full power.

Response 1. Total primary coolant mass is 5.05×10^5 lbs.

2. The average primary system letdown rate (gpm) to the primary coolant purification system.

Response 2. 80 gallons per minute (4.01×10^4 lbs/hr).

3. The average flow rate (gpm) through the primary coolant purification system cation demineralizers. (Note: The letdown rate should include the fraction of time the cation demineralizers are in service.)

Response 3. Letdown flow through the primary coolant purification system cation demineralizers is used intermittently only when additional purification of the reactor coolant is required. No credit for cation demineralizer cleanup is assumed in the source term calculations.

4. The average shim bleed flow (gpm).

Response 4. The shim bleed and other clean recyclable waste (e.g., Primary Drain System) are processed through the boron recovery system. A detailed description and operational procedure are presented in Section 3.5 of the Seabrook Station ER-OLS and Subsection 9.3.5 of the FSAR. A schematic flow diagram is shown in Figure C.2-1. The shim bleed is diverted from the normal chemical and volume control flow path (purification letdown) after the stream has been degassified. It has two components (computed on an annualized average) which are:

1) Reactor coolant diverted for boron recovery in the amount of 116 lb/hr (.23 gpm).

2) Reactor coolant diverted for tritium control in the amount of 194 lb/hr (.38 gpm).

The shim bleed is then routed to the cesium ion removal exchangers of the boron recovery system where it is treated through filtration and evaporation. Provisions for demineralization are included as shown in Figure C.2-1; however, this is an optional pathway used for the recycle mode of operation and as such, is not included when calculating plant releases. Equipment leakages and valve steam leak-offs are collected through the primary drain tank in an estimated amount of 300 gpd (.21 gpm). The primary drain tank inventory is processed through the primary drain tank degassifier and routed to the boron recovery system joining with the shim bleed.

The radioactivity level for shim bleed and primary leakages is the same as the reactor coolant. Flow patterns for these sources are intermittent in nature. A combined flow rate of 4.16×10^2 lbs/hr (0.82 gpm) is estimated on an annual average basis.

To control the tritium level within the primary coolant system, 200,000 gallons of reactor coolant is expected to be discharged annually through the boron recovery system. Therefore, the release fraction amounts to 46% of reactor coolant processed through the BRS annually.

System decontamination factors (DF) are conservatively assumed to be 10^3 for iodines and 10^4 for other nuclides due to evaporation and demineralization.

Holdup time is calculated to be a minimum 5 days on the basis of the capacities of two boron waste storage tanks (225,000 gallons each) and two recovery test tanks (18,000 gallons each).

A.3 Secondary System

1. The number and type of steam generators and the carryover factor used in the evaluation for iodine and non-volatiles.

   Response 1. Four vertical, recirculating, inverted U-tube steam generators per unit. Volatile chemistry will be used to control secondary side chemistry. Carry over factors: 1% for iodines, .1% for nonvolatiles.

2. The total steam flow (lb/hr) in the secondary system.

   Response 2. 1.514×10^7 lbs/hr.

3. The mass of steam in each steam generator (lb) at full power.

   Response 3. 5.7×10^3 lbs.

4. The mass of liquid in each steam generator (lb) at full power.

   Response 4. 9.55×10^4 lbs.

5. The total mass of coolant in the secondary system (lb) at full power. For recirculating U-tube steam generators, do not include the coolant in the condenser hotwell.

   Response 5. 1.8×10^6 lbs.

6. The primary to secondary system leakage rate (lb/day) used in the evaluation.

   Response 6. 100 lbs per day

7. Description of the steam generator blowdown and blowdown purification systems. The average steam generator blowdown rate (lb/hr) used in the applicant's evaluation. The parameters used for steam generator blowdown rate (lb/hr).

   Response 7. Secondary system wastes are processed through the steam generator blowdown system. Blowdown is processed through the blowdown flash tank and blowdown evaporator. Evaporator bottoms are solidified and distillate is sent to the waste test tanks of the LWS which will ultimately be discharged to the environment via the circulating water system.

   The primary-to-secondary leakage rate is assumed to be 100 lb/d and an average steam generator blowdown rate of 75 gpm (3.75 x 10^4 lbs/hr) is assumed for the analysis. The steam generator blowdown system is described in Subsection 10.4.8 of the FSAR. A schematic flow diagram of the steam generator blowdown system is shown in Figure C.2-2.

8. The fraction of the steam generator feedwater processed through the condensate demineralizers and the decontamination factors (DF) used in the evaluation for the condensate demineralizer system.

   Response 8. Not applicable; Seabrook does not utilize a condensate demineralizer system.

9. Condensate demineralizers:

   a. Average flow rate (lb/hr),

   b. Demineralizer type (deep bed or powdered resin),

   c. Number and size (ft^3) of demineralizers,

   d. Regeneration frequency,

   e. Indicate whether ultrasonic resin cleaning is used and the waste liquid volume associated with its use, and

   f. Regenerant volume (gal/event) and activity.

   Response 9 (a-f). Not applicable; Seabrook does not utilize a condensate demineralizer system.

A.4 Liquid Waste Processing Systems

1. For each liquid waste processing system (including the shim bleed, steam generator blowdown, and detergent waste processing systems), provide in tabular form the following information:

   a. Sources, flow rates (gpd), and expected activities (fraction of primary coolant activity, PCA) for all inputs to each system,

   b. Holdup times associated with collection, processing, and discharge of all liquid streams,

   c. Capacities of all tanks (gal) and processing equipment (gpd) considered in calculating holdup times,

   d. Decontamination factors for each processing step,

   e. Fraction of each processing stream expected to be discharged over the life of the station,

f. For demineralizer regeneration provide: time between regenerations, regenerant volumes and activities, treatment of regenerants, and fraction of regenerant discharged (include parameters used in making these determinations), and

g. Liquid source term by radionuclide in Ci/yr for normal operation, including anticipated operational occurrences.

Response 1 (a-g). Non-recyclable dirty wastes are collected and processed through the liquid waste system. A schematic flow diagram of the liquid waste system is shown in Figure C.2-3. Sources are determined according to NUREG-0017. They are;

Source	Flow Rate	Fraction of Primary Coolant Activity
Containment Building	40 gpd	1.0
Auxiliary Building Flow Drain	200 gpd	0.1
Laboratory Drains	400 gpd	0.002
Sampling Drains	15 gpd	1.0
Miscellaneous Sources	700 gpd	0.01

Detailed descriptions of system and operation procedures are presented in Section 3.5 of the ER-OLS and 11.2 of the FSAR. The above dirty wastes are collected in the Floor Drain Tanks and treated through filtration, evaporation, and demineralization if necessary. Since these sources are non-recyclable wastes, the total amount is expected to be discharged (100% of discharge fraction). Liquid waste processing parameters are presented in Table A-3.

The system DF's are conservatively assumed to be 10^3 for iodines and 10^4 for other nuclides.

The holdup time is estimated to be 334 minutes based upon capacities of the floor drain tanks (two tanks, 10,000 gallons each) and waste test tanks (two tanks, 5,000 gallons each).

In addition to the above sources, liquid wastes from the turbine building drains are assumed to be released without treatment. A flow rate of 7,200 gpd with secondary coolant main steam activity is assumed for this source.

Liquid source term by radionuclide (Ci/yr) for normal operation, including anticipated operational occurrences are presented in Table A-4.

2. Piping and instrumentation diagrams (P&ID's) and process flow

diagrams for the liquid radwaste systems along with all other systems influencing the source-term calculations.

Response 2. Piping and instrumentation diagrams and process flow diagrams for the liquid radwaste systems are provided in Figures C.2-4 through C.2-6.

A.5 Gaseous Waste Processing System

1. The volumes (ft^3/yr) of gases stripped from the primary coolant.

   Response 1. 1.68×10^5 ft^3/yr.

2. Description of the process used to hold up gases stripped from the primary system during normal operations and reactor shutdown. If pressurized storage tanks are used, include a process flow diagram of the system indicating the capacities (ft^3), number, and design and operating storage pressures for the storage tanks.

   Response 2. Not applicable. The Seabrook gaseous waste processing system is described under item 5 below.

3. Description of the normal operation of the system, e.g., number of tanks held in reserve for back-to-back shutdown, fill time for tanks. Indicate the minimum holdup time used in the applicant's evaluation and the basis for this number.

   Response 3. Not applicable. See item 5 below.

4. If HEPA filters are used downstream of the pressurized storage tanks, provide the decontamination factor used in the evaluation.

   Response 4. Not applicable. See item 5 below.

5. If a charcoal delay system is used, describe this system and indicate the minimum holdup times for each radionuclide considered in the evaluation. List all parameters, including mass of charcoal (lb), flow rate (cfm), operating and dew point temperatures, and dynamic adsorption coefficients for Xe and Kr used in calculating holdup times.

   Response 5. Fission gases from the primary coolant are stripped through the letdown degassifier. Average letdown flow of 80 gpm (4.01×10^4 lbs/hr) is processed through the degassifier with a gas stripping fraction of 1. In addition to the above continuous process, two volumes of primary coolant are assumed to be degassed during cold shutdown. The reactor will operate in a base-load mode. Detailed descriptions are presented in Section 11.3 of the FSAR.

Stripped gases from the primary coolant are processed through the gaseous waste processing system (GWPS) during normal operation and shutdown. A detailed description of the GWPS and operational procedures are given in Section 3.5 of the Seabrook Station Environmental Report and 11.3 of the FSAR. A schematic flow diagram is shown in Figure C.2-7. The GWPS consists of chillers, compressors, iodine guard beds, dryers, ambient carbon delay beds and filters. The ambient carbon delay system includes five (5) charcoal delay beds with 1,680 lbs of charcoal in each bed. Design flow rate through the adsorbers is 1.2 scfm. Normal expected flow is 0.8 scfm.

The minimum holdup time used for evaluation/dynamic adsorption coefficients:

Krypton isotopes: 85 hours/45.4 cc per gm atm.

Xenon isotopes: 60 days/772.5 cc per gm atm.

Operating and dew point temperatures are ambient (70^{o}F) and 40^{o}F, respectively.

6. Piping and instrumentation diagrams (P&ID's) and process flow diagrams for the gaseous radwaste systems, along with other systems influencing the source-term calculations.

   Response 6. A piping and instrument diagram for the gaseous radwaste systems is provided in Figure C.2-8.

A.6 Ventilation and Exhaust Systems

For each building housing systems that contain radioactive materials, the steam generator blowdown system vent exhaust, and the main condenser air removal system, provide the following:

1. Provisions incorporated to reduce radioactivity releases through the ventilation or exhaust systems.

   Response 1. Primary Auxiliary Building.

   The primary coolant leak rate to the auxiliary building is assumed to be 160 lb/day. The temperature of the primary coolant in the letdown line as it enters the auxiliary building is 290^{o}F. Release of 0.75% of the iodine is assumed.

   The auxiliary building ventilation system pipes all air from potentially contaminated areas through charcoal filters at a flow rate of 36,000 cfm.

   Waste Processing Building.

The waste processing building exhaust air is filtered by HEPA filters prior to release to the environment via the Unit 1 plant vent. No significant releases are anticipated from this building, and therefore is not included as a source of gaseous release. Provisions are included in the waste processing building ventilation system for the inclusion of carbon filters, if operational experience and releases indicate that they are required.

Turbine Building and Turbine Building Heater Bay Roof Vents.

Turbine building exhaust air is vented directly to the atmosphere, unfiltered, through roof vents.

Main Condenser Off-Gas System.

Effluent from the main condenser during the normal mode of operation (holding mode) is routed through the primary auxiliary building filter system which contains carbon filters to reduce potential iodine releases. Main condenser effluent during startup operations (hogging mode) is released directly to the atmosphere via the turbine building vents.

2. Decontamination factors assumed and the bases (including charcoal adsorbers, HEPA filters, mechanical devices).

Response 2. Decontamination factors of 10 for iodine removal by charcoal adsorbers. Decontamination factors of 100 for particulate removal by HEPA filtration.

Bases: NUREG-0017

3. Release rates for radioiodine, noble gases, and radioactive particulates (Ci/yr), and the bases.

Response 3. See Table A-5.

Bases: NUREG-0017 and PWR-Gale Code.

4. Release points to the environment, including height, effluent temperature, and exit velocity.

Response 4. See Table A-6.

5. For the containment building, provide the building free volume (ft^3) and a thorough description of the internal recirculation system (if provided), including the recirculation rate, charcoal bed depth, operating time assumed, and mixing efficiency. Indicate the expected purge and venting frequencies and duration and continuous purge rate (if used).

Response 5. The containment free air volume used for the analysis is 2.715×10^6 ft^3.

The atmosphere inside the containment is assumed to be circulated through charcoal filters with a 4" bed depth and 90% efficiency for 16 hours prior to personnel entry or purge. A mixing efficiency of 70% is used. The recirculation flow is 4,000 cfm. A detailed description of the containment internal recirculation system is given in FSAR Subsection 9.4.5.

Experience with operating PWR's indicates a purge frequency of 4/year, during shutdown for a duration of 24 hours per purge. The purge flow is 15,000 cfm and is filtered through 4" deep charcoal filter beds with assumed iodine removal efficiency of 90%. Primary coolant leakage is assumed to be 1% per day for noble gases and 0.001% per day for iodine. An on-line purge system is available for use during power operation. The continuous purge rate used to evaluate plant releases is 1,000 scfm, and is filtered through 4" deep charcoal filter beds with assumed iodine removal efficiency of 90%.

A.7 Solid Waste Processing Systems

1. In tabular form, provide the following information concerning all inputs to the solid waste processing system: source, volume (ft^3/yr per reactor), and activity (Ci/yr per reactor) of principal radionuclides, along with bases for values used.

Response 1. The solid waste system receives waste from four (4) basic sources:

1. Waste evaporator concentrates,
2. Spent resins,
3. Detergent decontamination solutions,
4. Non-compressible radioactive wastes such as filter cartridges.

The volume of solid radioactive waste generated by both units is estimated to be 13,800 ft^3 per year (including compressible waste) and is delineated in Table A-7. The annual volume has been calculated using operational data from all domestic PWR's through December 31, 1972. The value for solid waste volume is consistent with NRC estimations for large PWR's.

The curie content of solid waste has been calculated using operational data from all domestic PWR's through December 31, 1972. The principal nuclides contained in the solid waste shipments will include the following:

Nuclide	Half-Life
Cs^{134}	2.0 years
Cs^{137}	30.0 years
Fe^{55}	2.6 years
Co^{58}	71.4 days
Co^{60}	5.3 years
Mn^{54}	303 days
Fe^{59}	45.6 days

2. Provide information on on-site storage provisions (location and capacity) and expected on-site storage times for all solid wastes prior to shipment.

Response 2. Spent resins and evaporator concentrates are held in 800 ft^3 tanks prior to solidification. Detergent wastes are held in floor drain tanks having a combined capacity of 20,000 gallons.

Material to be solidified is mixed with solidifying agent in 75 ft^3 containers and solidified. Completed containers are shipped to a disposal site after approximately two months. Storage capacity is available to provide 6 months decay of solid waste. A complete description of the solid waste processing system is given in Section 3.5 of the ER and 11.5 of the PSAR.

3. Provide piping and instrumentation diagrams (P&ID's) for the solid radwaste system.

Response 3. A P&I diagram is provided in Figure C.2-9.

TABLE A-1
(Sheet 1 of 3)

REACTOR COOLANT RADIONUCLIDE CONCENTRATIONS

Radionuclide	Concentration (μCi/gm) 0.12% Clad Defects	1% Clad Defects
H-3	1.00E+00*	-
N-16	4.00E+01	-
I-130	2.10E-03	-
I-131	2.70E-01	2.5E+00
I-132	1.00E-01	9.1E-01
I-133	3.99E-01	4.0E+00
I-134	-	5.8E-01
I-135	1.90E-01	2.2E+00
Kr-83m	2.03E-02	4.3E-01
Kr-85m	8.61E-02	1.7E+00
Kr-85	2.03E-03	1.3E-01
Kr-87	6.14E-02	1.3E+00
Kr-88	1.78E-01	3.4E+00
Kr-89	5.82E-03	-
Xe-131m	5.29E-03	6.7E-02
Xe-133m	3.83E-02	5.7E-01
Xe-133	1.59E+00	2.5E+01
Xe-135m	1.48E-02	8.2E-01
Xe-135	2.02E-01	3.1E+00
Xe-137	1.05E-02	1.7E-01
Xe-138	4.99E-02	7.1E-01

* 1.00E+00 = 1.00×10^0

TABLE A-1
(Sheet 2 of 3)

REACTOR COOLANT RADIONUCLIDE CONCENTRATIONS

Radionuclide	Concentration (µCi/gm) 0.12% Clad Defects	1% Clad Defects
Br-83	4.80E-03*	-
Rb-86	8.50E-05	-
Sr-89	3.50E-04	4.1E-03
Sr-90	1.00E-05	1.8E-04
Sr-91	-	3.1E-02
Y-90	-	2.2E-04
Y-91	-	5.8E-03
Y-92	-	1.0E-03
Zr-95	-	6.7E-04
Nb-95	-	6.8E-04
Mo-99	8.4E-02	3.3E+00
Tc-99m	4.80E-02	-
Te-127m	2.80E-04	-
Te-127	8.50E-04	-
Te-129m	1.40E-03	-
Te-129	1.60E-03	-
Te-131m	2.50E-03	-
Te-132	1.7E-02	2.6E-01
Cs-134	2.5E-02	4.4E-01
Cs-136	1.3E-02	2.2E-01
Cs-137	1.8E-02	2.2E+00

* 4.80E-03 = 4.80×10^{-3}

TABLE A-1
(Sheet 3 of 3)

REACTOR COOLANT RADIONUCLIDE CONCENTRATIONS

Radionuclide	Concentration (μCi/gm) 0.12% Clad Defects	1% Clad Defects
Ba-137m	1.6E-02*	-
Ba-140	2.2E-04	4.5E-03
La-140	1.5E-04	1.4E-03
Ce-144	-	4.4E-04
Np-239	1.2E-03	-
All others	2.5E-01	-

Corrosion Products

Radionuclide	Concentration (μCi/gm)**
Mn-54	3.1E-04
Mn-56	-
Co-58	1.6E-02
Co-60	2.0E-03
Fe-59	1.0E-03
Cr-51	1.9E-03
Fe-55	1.6E-03

* 1.60E-02 = 1.60×10^{-2}

** Corrosion product activities based on values given in Table 2-12, NUREG-0017, April 1976.

TABLE A-2
(Sheet 1 of 6)

STEAM GENERATOR SECONDARY SIDE EQUILIBRIUM RADIONUCLIDE CONCENTRATIONS (WATER)

Radionuclide	Concentration (μCi/gm) Expected Values[1] .12% Clad Defects	Design Values[2] .25% Clad Defects
H-3	1.00E-03*	-
N-16	1.00E-06	-
I-130	1.45E-07	-
I-131	3.33E-05	1.6E-04
I-132	1.04E-05	1.1E-05
I-133	3.51E-05	1.8E-04
I-134	-	2.9E-06
I-135	1.01E-05	5.8E-05
Br-83	1.41E-07	-
Rb-86	1.02E-08	-
Sr-89	4.91E-08	3.1E-07
Sr-90	-	9.4E-09
Sr-91	-	1.0E-06
Y-90	-	9.9E-09
Y-91	-	4.1E-07
Y-92	-	1.6E-08
Zr-95	-	4.5E-08
Nb-95	-	4.9E-08
Mo-99	9.88E-06	2.0E-04
Tc-99m	2.24E-05	-
Te-127m	2.18E-08	-

*1.00E-03 = 1.00×10^{-3}
Note[1] of Table A-2 (Sheet 6)
Note[2] of Table A-2 (Sheet 6)

TABLE A-2
(Sheet 2 of 6)

STEAM GENERATOR SECONDARY SIDE EQUILIBRIUM RADIONUCLIDE CONCENTRATIONS (WATER)

Radionuclide	Concentration (μCi/gm) Expected Values[1] .12% Clad Defects	Design Values[1,2] .25% Clad Defects
Te-127	1.29E-07*	-
Te-129m	1.49E-07	-
Te-129	6.28E-07	-
Te-131m	2.09E-07	-
Te-132	2.54E-06	1.60E-05
Cs-134	2.88E-06	2.8E-05
Cs-136	1.30E-06	1.4E-05
Cs-137	1.92E-06	1.3E-04
Ba-140	2.35E-08	3.0E-07
La-140	3.04E-08	7.0E-08
Ce-144	-	2.9E-08
Mn-54	4.82E-08	2.60E-07
Mn-56	-	2.0E-06
Co-58	1.71E-06	8.8E-06
Co-60	2.16E-07	2.6E-07
Fe-59	1.23E-07	3.5E-08
Cr-51	2.00E-07	3.3E-07
Fe-55	1.68E-07	-
Np-239	1.03E-07	-
All Others	2.29E-06	-

*1.29E-07 = 1.29×10^{-7}
Note[1] of Table A-2 (Sheet 6)
Note[2] of Table A-2 (Sheet 6)

TABLE A-2
(Sheet 3 of 6)

STEAM GENERATOR SECONDARY SIDE EQUILIBRIUM RADIONUCLIDE CONCENTRATIONS (STEAM)

Radionuclide	Concentration (μCi/gm) Expected Values[1] .12% Clad Defects	Design Values[2] .25% Clad Defects
H-3	1.0E-03*	1.3E-04
N-16	1.0E-07	-
I-130	1.45E-09	-
I-131	3.33E-07	1.6E-06
I-132	1.04E-07	1.1E-07
I-133	3.51E-07	1.8E-06
I-134	-	2.9E-08
I-135	1.01E-07	5.8E-07
Kr-83m	5.56E-09	5.1E-08
Kr-85m	2.41E-08	2.0E-07
Kr-85	5.63E-10	1.5E-08
Kr-87	1.62E-08	3.9E-07
Kr-88	4.85E-08	3.9E-07
Kr-89	1.61E-09	-
Xe-131m	1.48E-09	7.8E-09
Xe-133m	1.07E-08	6.4E-08
Xe-133	4.37E-07	2.9E-06
Xe-135m	4.06E-09	9.7E-08
Xe-135	5.54E-08	3.6E-07
Xe-137	2.88E-09	2.0E-08

*1.0E-03 = 1.0×10^{-3}
Note[1] of Table A-2 (Sheet 6)
Note[2] of Table A-2 (Sheet 6)

TABLE A-2
(Sheet 4 of 6)

STEAM GENERATOR SECONDARY SIDE EQUILIBRIUM RADIONUCLIDE CONCENTRATIONS (STEAM)

	Concentration (μCi/gm)	
Radionuclide	Expected Values[1] .12% Clad Defects	Design Values[2] .25% Clad Defects
Xe-138	1.35E-08*	8.3E-08
Br-83	1.41E-09	-
Rb-86	1.02E-11	-
Sr-89	4.91E-12	3.1E-10
Sn-90	-	9.4E-12
Sr-91	-	1.0E-09
Y-90	-	9.9E-12
Y-91	-	4.1E-10
Y-92	-	1.6E-11
Zr-95	-	4.5E-11
Nb-95	-	4.9E-11
Mo-99	9.88E-09	2.0E-07
Te-99m	2.24E-08	-
Te-127m	2.18E-11	-
Te-127	1.29E-10	-
Te-129m	1.49E-10	-
Te-129	6.28E-10	-
Te-131m	2.09E-10	-
Te-132	2.54E-09	1.6E-08
Cs-134	2.88E-09	2.8E-08

*1.35E-08 = 1.35×10^{-8}
Note[1] of Table A-2 (Sheet 6)
Note[2] of Table A-2 (Sheet 6)

TABLE A-2
(Sheet 5 of 6)

STEAM GENERATOR SECONDARY SIDE EQUILIBRIUM RADIONUCLIDE CONCENTRATIONS (STEAM)

Radionuclide	Concentration (µCi/gm) Expected Values[1] .12% Clad Defects	Design Values[2] .25% Clad Defects
Cs-136	1.30E-09*	1.4E-08
Cs-137	1.92E-09	1.3E-07
Ba-140	2.35E-11	3.0E-10
La-140	3.09E-11	7.0E-11
Ce-144	-	2.9E-10
Mn-54	4.82E-11	2.6E-10
Mn-56	-	2.0E-09
Co-58	1.71E-09	8.8E-09
Co-60	2.16E-10	2.6E-10
Fe-59	1.23E-10	3.5E-11
Cr-51	2.00E-10	3.3E-10
Fe-55	1.68E-10	-
Np-239	1.03E-10	-
All Others	2.29E-09	-

*1.30E-09 = 1.30×10^{-9}
Note[1] of Table A-2 (Sheet 6)
Note[2] of Table A-2 (Sheet 6)

TABLE A-2
(Sheet 6 of 6)

STEAM GENERATOR SECONDARY SIDE EQUILIBRIUM RADIONUCLIDE CONCENTRATIONS

1 Bases: .12% clad defects
100 lbs day^{-1} primary-to-secondary leak rate
75 gpm steam generator blowdown rate
95.5 x 10^3 lbm per steam generator
3654 MWt
0.1% moisture carryover for non-volatiles
1.0% moisture carryover for halogens

2 Bases: 0.25% clad defects
20 gal/day primary-to-secondary leak rate
50 gpm steam generator blowdown rate
97,000 lbm per steam generator
3654 MWt
0.25% moisture carryover for non-volatiles
1.0% moisture carryover for halogens

TABLE A-3

LIQUID WASTE PROCESSING SYSTEMS

System	Input Flow Rate (gal per day)	Decontamination Factors Iodine	Cesium, Rubidium	Others	Fraction of Primary Coolant Activity (PCA)	Holdup Times (days) Collection	Processing & Discharge	Fraction Discharge
Miscellaneous Waste	1360	10^3	10^4	20^4	0.061	5.9	0.23	1.0
Equipment Drain	302	10^3	$2x10^3$	10^4	1.0	2.3	5.03	0.464
Turbine Building Sump Waste	7200	1.0	1.0	1.0	(a)	0.0	0.0	1.0
Boron Recovery System (Includes Shim Bleed)	878	10^3	$2x10^3$	10^4	1.0	152.8	5.03	0.464
Steam Generator Blowdown System	1.08×10^5	10^3	10^4	10^4	-	0.0	0.0	0.7

(a) Activity levels are based on secondary side main steam inventories.

(b) Capacities of tanks (gal) and processing equipment (gal/day) are given in Figure A-3.

TABLE A-4
(Sheet 1 of 2)

RADIONUCLIDE DISCHARGE CONCENTRATIONS
NORMAL LIQUID RELEASES - INCLUDING ANTICIPATED OPERATIONAL OCCURRENCES

Nuclide	Total Annual Release (Ci/yr/unit)	Discharge Concentration (μCi/ml)	(MPC)w (μCi/ml)	Fraction of (MPC)w
H-3	7.30E+02*	1.1E-06	3E-03	3.7E-04
I-130	1.2E-04	1.8E-13	3E-06	6.1E-08
I-131	1.3E-01	2.0E-10	3E-07	6.6E-04
I-132	3.9E-03	5.9E-12	8E-06	7.4E-07
I-133	3.6E-02	5.5E-11	1E-06	5.5E-05
I-134	1.0E-04	1.5E-13	2E-05	7.5E-09
I-135	5.8E-03	8.8E-12	4E-06	2.2E-06
Br-83	4.0E-05	6.1E-14	1E-07	6.1E-07
Rb-86	2.0E-05	3.1E-14	2E-05	1.5E-09
Sr-89	3.0E-05	4.6E-14	3E-06	1.5E-08
Mo-99	2.1E-03	3.2E-12	4E-05	8.0E-08
Tc-99m	2.4E-03	3.7E-12	3E-03	1.2E-08
Te-127m	3.0E-05	4.6E-14	5E-05	9.2E-10
Te-127	3.0E-05	4.6E-14	2E-04	2.3E-10
Te-129m	1.2E-04	1.8E-13	2E-05	9.2E-09
Te-129	9.0E-05	1.4E-13	8E-04	1.8E-10
Te-131m	3.0E-05	4.6E-14	4E-05	1.1E-09
Te-132	7.3E-04	1.1E-12	2E-05	5.6E-08
Cs-134	2.0E-02	3.0E-11	9E-06	3.4E-06
Cs-136	2.7E-03	4.1E-12	6E-05	6.9E-08
Cs-137	1.5E-02	2.1E-11	2E-05	1.2E-06

* 7.30E+02 = 7.30×10^2

TABLE A-4
(Sheet 2 of 2)

RADIONUCLIDE DISCHARGE CONCENTRATIONS
NORMAL LIQUID RELEASES - INCLUDING ANTICIPATED OPERATIONAL OCCURRENCES

Nuclide	Total Annual Release (Ci/yr/unit)	Discharge Concentration (μCi/ml)	(MPC)w (μCi/ml)	Fraction of (MPC)w
Ba-137m	1.4E-02	2.1E-11	1E-07	2.1E-04
Ba-140	1.0E-05	1.5E-14	2E-05	7.6E-10
La-140	1.0E-05	1.5E-14	2E-05	7.6E-10
Cr-51	1.5E-04	2.3E-13	2E-03	1.1E-10
Mn-54	4.0E-05	6.1E-14	1E-04	6.1E-10
Fe-55	1.9E-05	2.9E-13	8E-04	3.6E-11
Fe-59	9.0E-05	1.4E-13	5E-05	2.7E-10
Co-58	1.6E-03	2.4E-12	9E-05	2.7E-08
Co-60	2.3E-04	3.5E-13	3E-05	1.2E-08
Np-239	3.0E-05	4.6E-14	1E-04	4.6E-10
All Others	6.0E-05	9.2E-14	1E-07	9.2E-07
Total (Except Tritium)	2.4E-01	3.6E-10	-	9.3E-04

TABLE A-5
(Sheet 1 of 2)

ANNUAL GASEOUS EFFLUENTS RELEASE (Ci/yr)

Radionuclide	Containment Purge	PAB Venting	Turbine Venting	Main Condenser Off-Gas System	Gaseous Waste System	Total (1 Unit)
H-3	3.7E+02*	3.7E+02	c	c	c	7.4E+02
C-14	1.0E+00	a	a	a	7.0E+00	8.0E+00
Ar-41	2.5E+01	a	a	a	a	2.5E+01
Kr-83m	a	a	a	a	a	a
Kr-85m	7.0E+00	2.0E+00	a	1.0E+00	a	1.0E+01
Kr-85	1.0E+00	a	a	a	2.6E+02	2.6E+02
Kr-87	2.0E+00	1.0E+00	a	a	a	3.0E+00
Kr-88	1.0E+01	4.0E+00	a	2.0E+00	a	1.6E+01
Kr-89	a	a	a	a	a	a
Xe-131m	3.0E+00	a	a	a	2.0E+01	2.3E+01
Xe-133m	1.6E+01	a	a	a	a	1.6E+01
Xe-133	8.6E+02	3.4E+01	a	2.1E+01	7.7E+01	9.9E+02
Xe-135m	a	a	a	a	a	a
Xe-135	3.1E+01	4.0E+00	a	3.0E+00	a	3.8E+01
Xe-137	a	a	a	a	a	a
Xe-138	a	1.0E+00	a	a	a	1.0E+00

* 3.7E+02 = 3.7×10^2
(a) Less than 1.0 Ci/yr/unit for Noble Gases and C-14
(b) Less than 0.0001 Ci/yr/Unit for Iodine
(c) Less than 1.0 percent of total for this nuclide

TABLE A-5
(Sheet 2 of 2)

ANNUAL GASEOUS EFFLUENTS RELEASE (Ci/yr)

Radionuclide	Containment Purge	PAB Venting	Turbine Venting	Main Condenser Off-Gas System	Gaseous Waste System	Total (1 Unit)
I-130	b	b	b	b	b	b
I-131	1.5E-02	4.3E-03	1.8E-03	2.7E-02	b	4.8E-02
I-132	b	b	b	b	b	b
I-133	1.1E-02	6.3E-03	1.9E-03	4.0E-02	b	5.9E-02
I-134	b	b	b	b	b	b
I-135	b	b	b	b	b	b
Mn-54	2.2E-04	1.8E-04	c	c	4.5E-05	4.4E-04
Fe-59	7.4E-05	6.0E-05	c	c	1.5E-05	1.5E-04
Co-58	7.4E-04	6.0E-04	c	c	1.5E-04	1.5E-03
Co-60	3.3E-04	2.7E-04	c	c	7.0E-05	6.7E-04
Sr-89	1.7E-05	1.3E-05	c	c	3.3E-06	3.3E-05
Sr-90	2.9E-06	2.4E-06	c	c	6.0E-07	5.9E-06
Cs-134	2.2E-04	1.8E-04	c	c	4.5E-05	4.4E-04
Cs-137	3.7E-04	3.0E-04	c	c	7.5E-05	7.4E-04

* $3.7E+02 = 3.7 \times 10^2$
(a) Less than 1.0 Ci/yr/unit for Noble Gases and C-14
(b) Less than 0.0001 Ci/yr/unit for Iodine
(c) Less than 1.0 percent of total for this nuclide

TABLE A-6

VENT RELEASE INFORMATION FOR GASEOUS RELEASES

	UNIT PLANT VENTS		TURBINE BUILDING ROOF VENTS (10)		T.B. HEATER BAY ROOF VENTS (10)	
	UNIT 1	UNIT 2	UNIT 1	UNIT 2	UNIT 1	UNIT 2
Height above grade (ft)	185	185	151	151	100	100
Height above adjacent structures (ft)	5.5	5.5	0	0	0	0
Exit temperature (°F) Summer/Winter	104°/50°		145°/100°		145°100°	
Exit flow rate (cfm)	153,200	102,200	50,000	50,000	40,000	40,000
Exit velocity (ft/min)	1,950	1,300	1,470	1,470	1,290	1,290
Vent size and shape	10 diameter stack open to the environment		10 mushroom type vents - 5.5 ft diameter (Exit gas is deflected downward towards the roof)		10 mushroom type vents- 5 ft diameter (Exit gas is deflected downward towards the roof)	
Deflectors or diffusers?	No	No	Yes	Yes	Yes	Yes

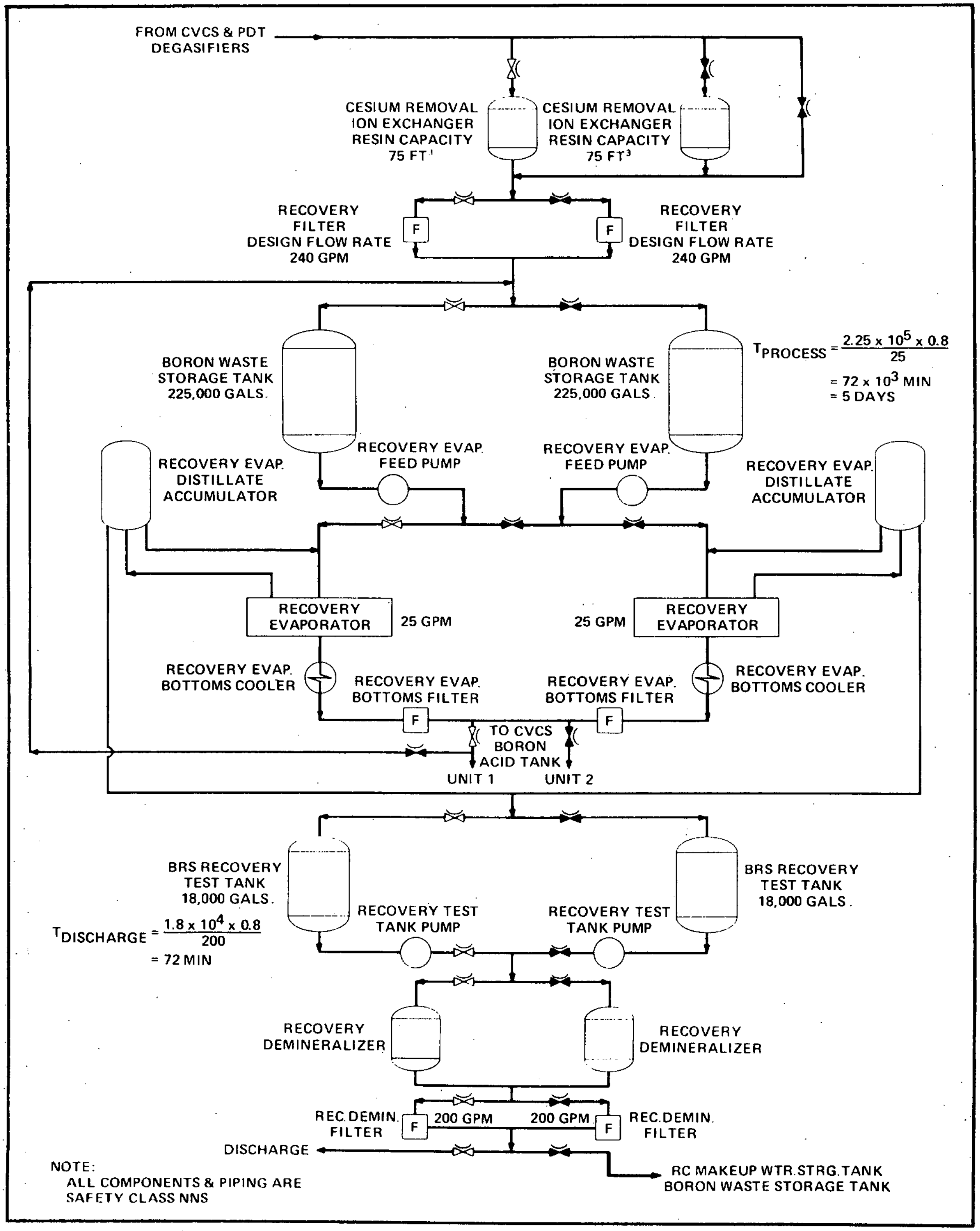
TABLE A-7

ANNUAL SOLID WASTE GENERATION VOLUMES FOR BOTH REACTOR UNITS

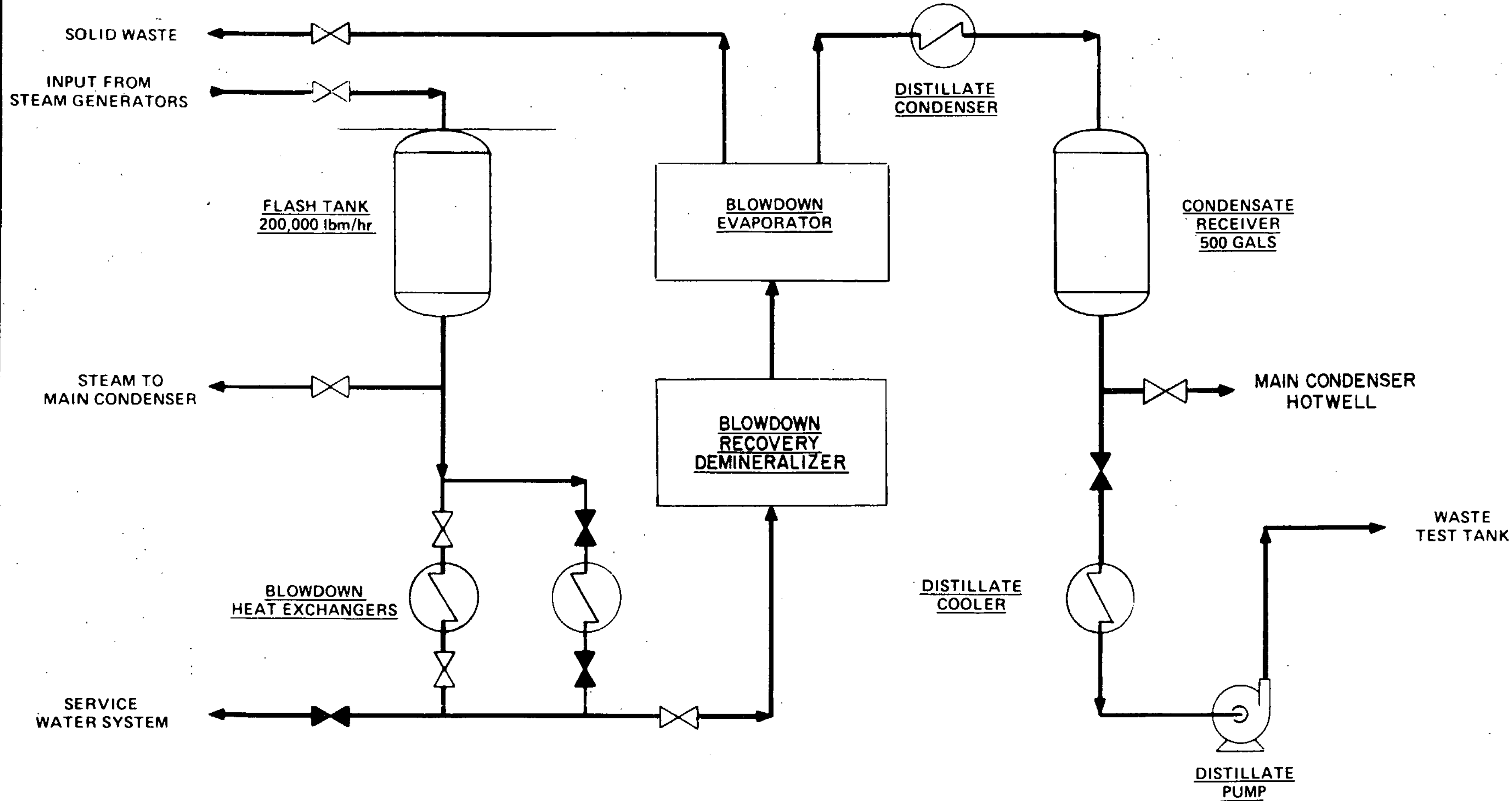
Type	Quantity	Curie Content	Shipping Volume	Average Curie Per Container	Number of Containers
Spent Resin	1430 ft^3	1.61×10^4 Ci[1]	2145 ft^3	5.55×10^2	29
Evaporator Bottoms and Other Liquid Waste	3979 ft^3	65.5 Ci	5969 ft^3	8.91×10^{-1}	80
Non-Compressible Solid Waste	200 ft^3	.2 - 4 Ci	800 ft^3	3.64×10^{-1}	11
Compressible Waste	-----	.5 - 2 Ci	4860 ft^3	2.96×10^{-3}	675 - (55 gal drum)
Total	5609 ft^3	1.62×10^4 Ci	13,774 ft^3	-----	675 - 55 gal drum 120 - 75 ft^3 containers[2]

(1) After 180 days of decay

(2) Storage facilities are capable of storing 60-75 ft^3 containers of high level waste for six (6) months (refer to PSAR Subsection 11.5.6)



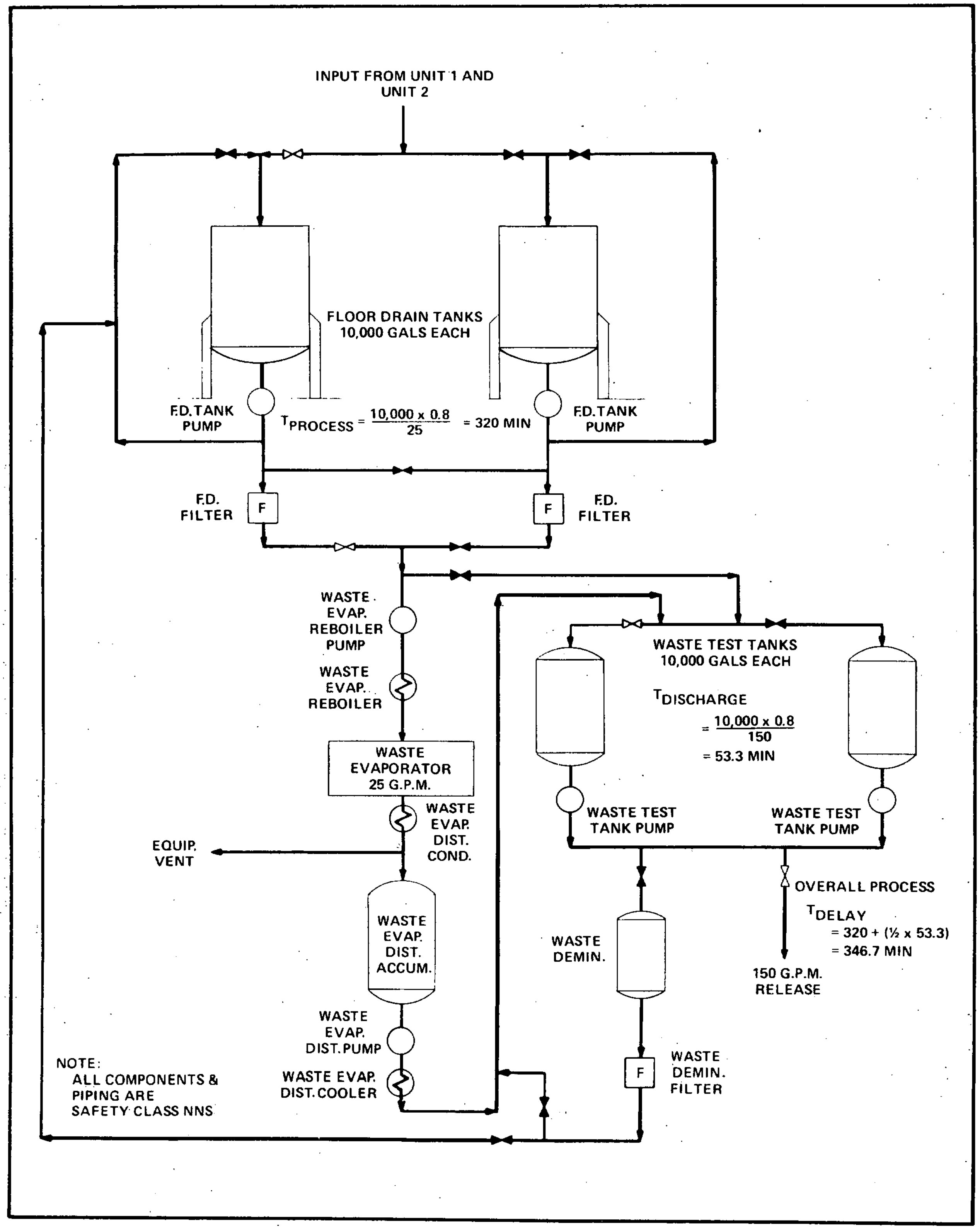
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	BORON RECOVERY SYSTEM SCHEMATIC
	FIGURE C.2-1



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

STEAM GENERATOR BLOWDOWN
SYSTEM SCHEMATIC

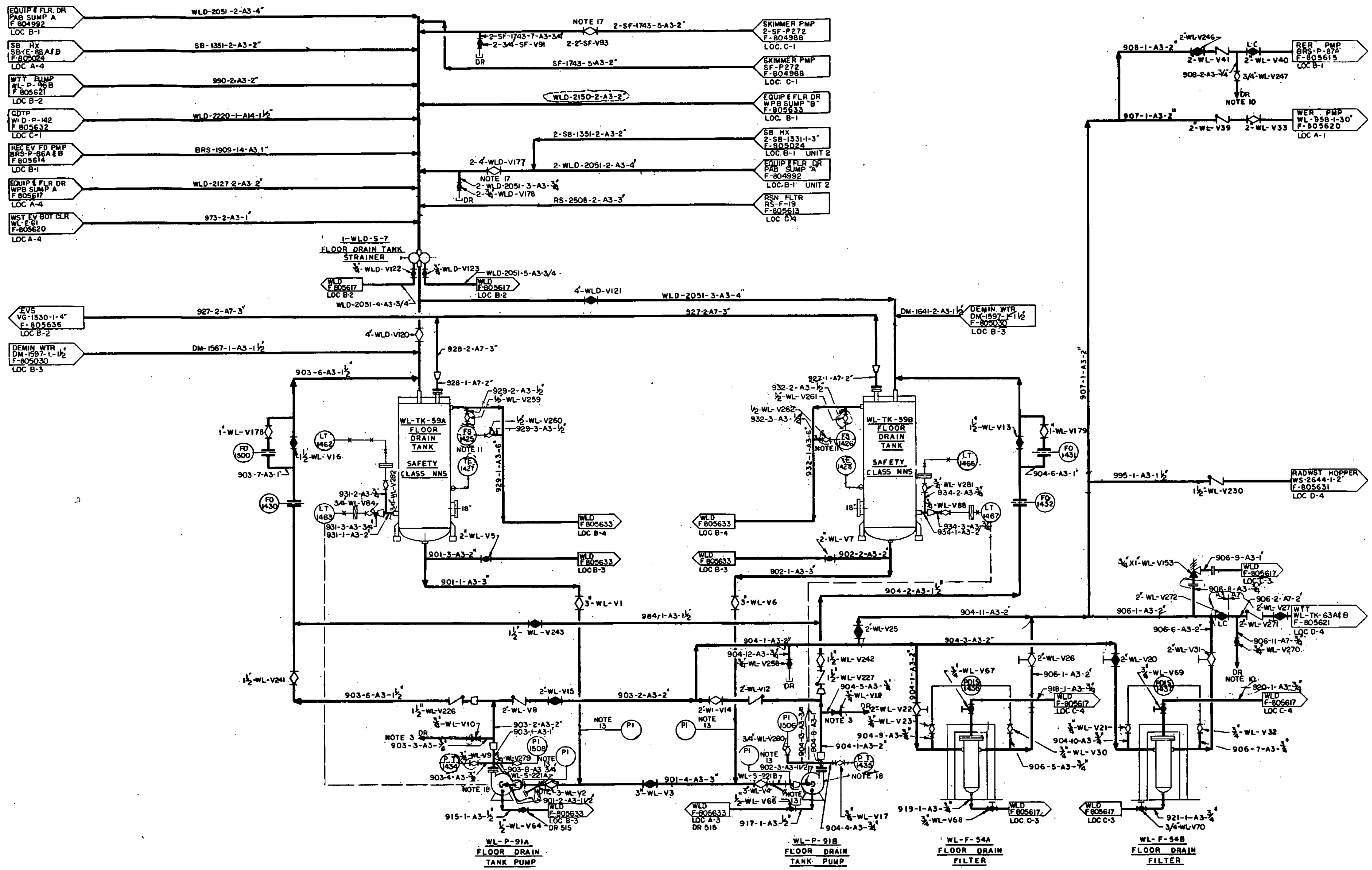
FIGURE C.2-2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

LIQUID WASTE SYSTEM SCHEMATIC

FIGURE C.2-3



GENERAL NOTES

1- DELETED

2- ALL PIPING IS SAFETY CLASS NNS, NON-SEISMIC CATEGORY I UNLESS OTHERWISE NOTED.

3- FLUSH, VENT, AND/OR SAMPLE CONNECTION; PIPE TO LOCAL DRAIN FUNNEL.

4- VALVE IS 316SS; PIPE IS ALLOY 20. SEE UE & C SPECIFICATION 9763-006-248-51 FOR WELDING REQUIREMENTS.

5- VALVE IS ALLOY 20; PIPE IS INCOLOY 825. SEE UE & C SPECIFICATION 9763-006-248-51 FOR WELDING REQUIREMENTS.

6- TUBESHEET IS INCOLOY 825; PIPE IS ALLOY 20. SEE UE & C SPECIFICATION 9763-006-248-51 FOR WELDING REQUIREMENTS.

7- ALLOY 20 TO INCOLOY 825 PIPE JOINT. SEE UE & C SPECIFICATION 9763-006-248-51 FOR WELDING REQUIREMENTS.

8- RESIN FILL TK. (TYP.) AS SHOWN ON DWG. F-805624

9- LOCATE TEMP. TRANSMITTER BETWEEN BOTTOMS CLR. OUTLET AND FIRST BRANCH LINE.

10- TELL TALE DRAIN PIPE TO LOCAL DRAIN FUNNEL

11- PROVIDE CONNECTION TO FS AT BOTTOM OF MAIN HORIZONTAL OVERFLOW LINE

12- DELETED

13- PROVIDE 3/4" PRESSURE TAP & PLUG FOR PI'S. START UP ENGINEERING TO PROVIDE PIPING, VALVE & PI'S; ALSO STRAINER BLOW OFF PIPING & VALVES FOR INITIAL FLUSHING OPERATION. STRAINER SCREEN TO BE REMOVED AFTER START UP

14- INSTALL WITH WL UNDER SEAT DM ON STEM SIDE

15- CROSBY DRIP PAN ELBOW OR EQUAL

16- CHEMICAL ADDITION AND REMOVAL CONNECTIONS

17- LOCK CLOSED DURING UNIT 2 CONSTRUCTION

18- SEE 9763-F-805627 FOR WATER SUPPLY TO PUMP DOUBLE MECHANICAL SEALS

THE SYSTEM PREFIX FOR THIS DRAWING IS "WL" UNLESS OTHERWISE NOTED.

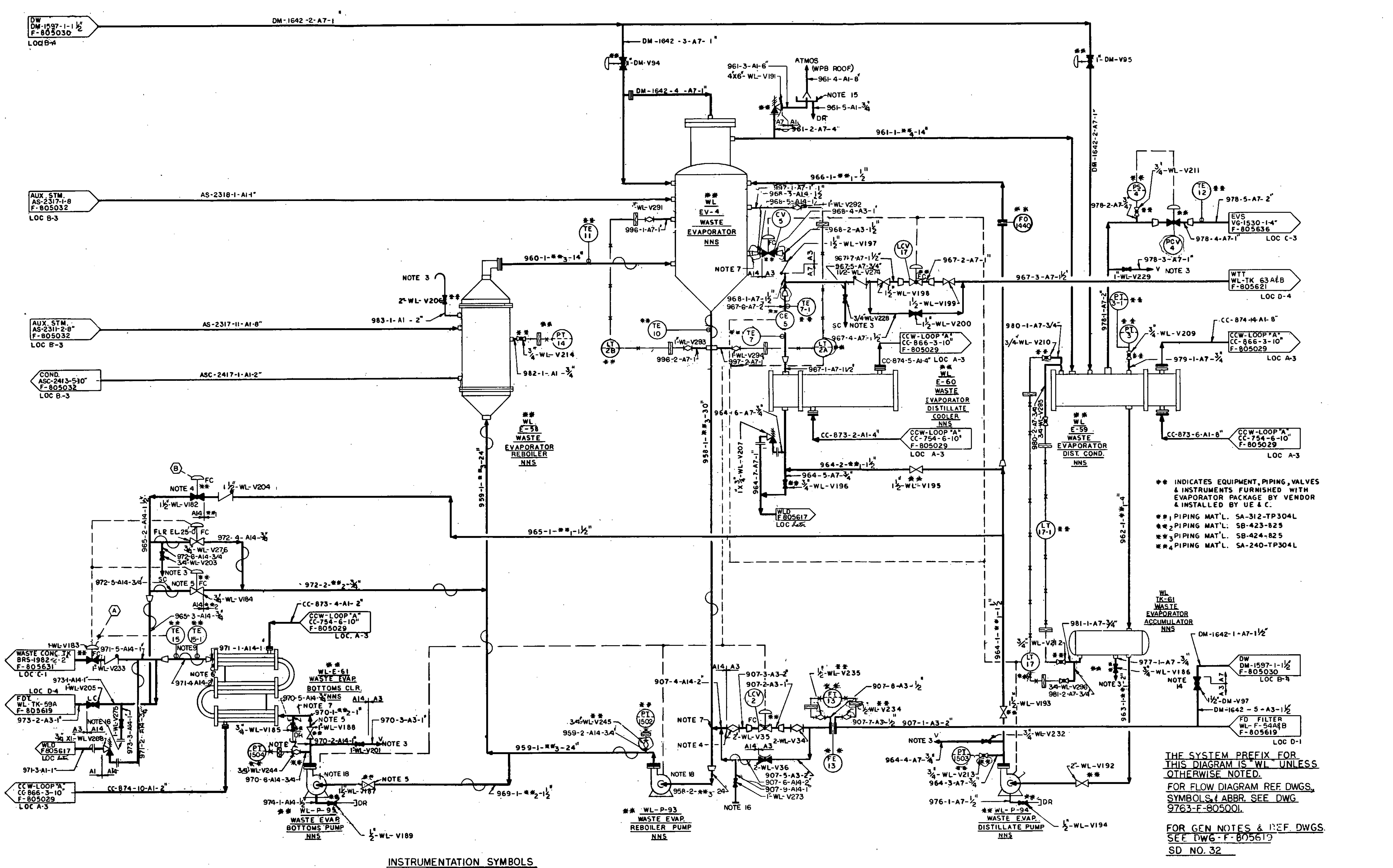
FOR FLOW DIAGRAM REF. DWGS., SYMBOLS & ABBR. SEE DWG 9763-F-805001

SD. NO. 32

REFERENCE DRAWINGS

9763-F-805620 LIQUID WASTE SYS., EVAP EV-4 P&ID
9763-F-805621 LIQUID WASTE SYS., TEST DEMIN P&ID
9763-M-506920 INSTR CONTROL LOOP DIAGRAM INDEX
9763 M 504050 LOGIC DIAGRAM INDEX

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	LIQUID WASTE SYSTEM STORAGE AND FILTRATION P & I DIAGRAM
9763-F-805619	FIGURE C.2-4, SH. 1

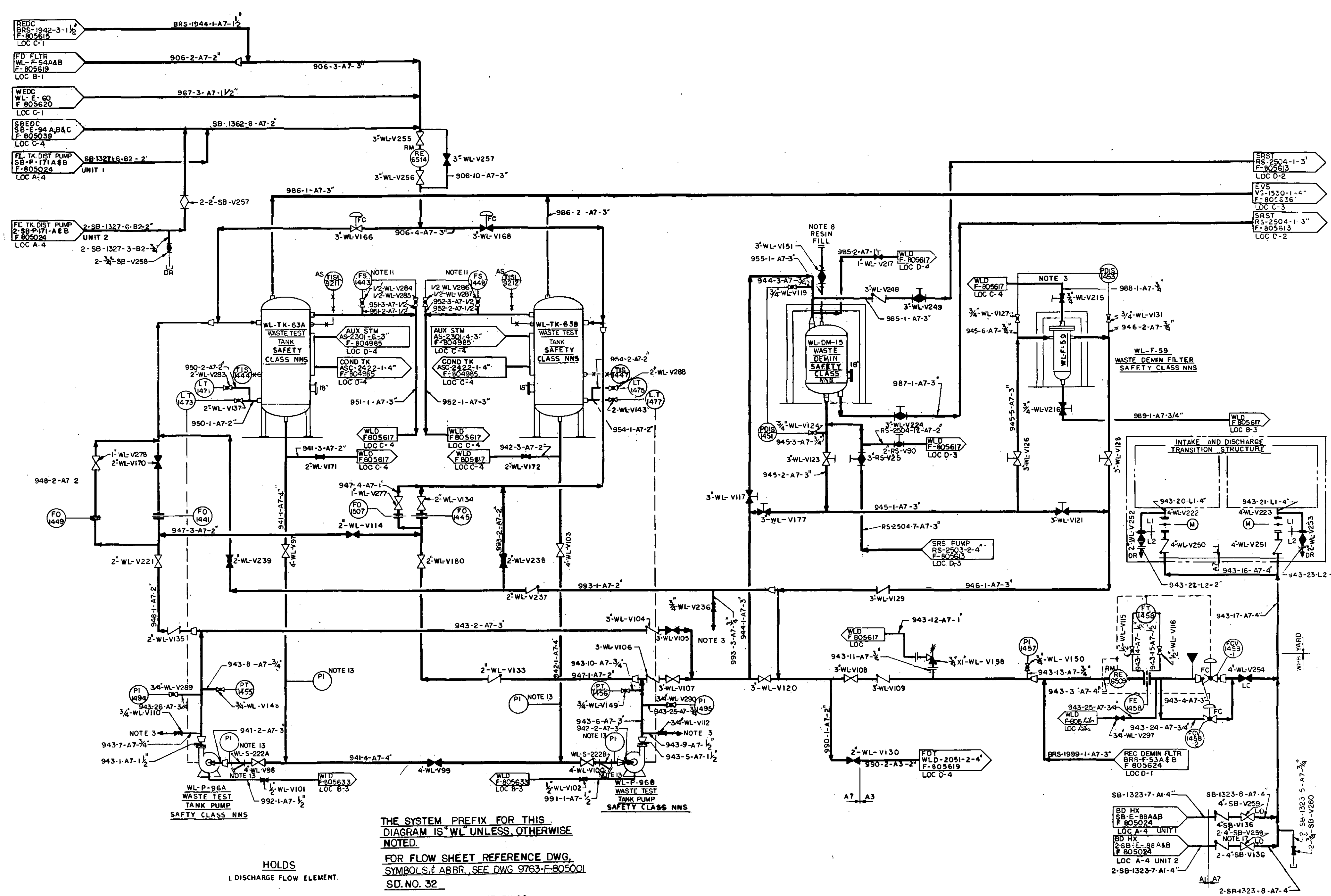


PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

LIQUID WASTE SYSTEM
EVAPORATOR EV-4
P & I DIAGRAM

9763-F-805620

FIGURE C.2-4, SH. 2



HOLDS

I DISCHARGE FLOW ELEMENT.

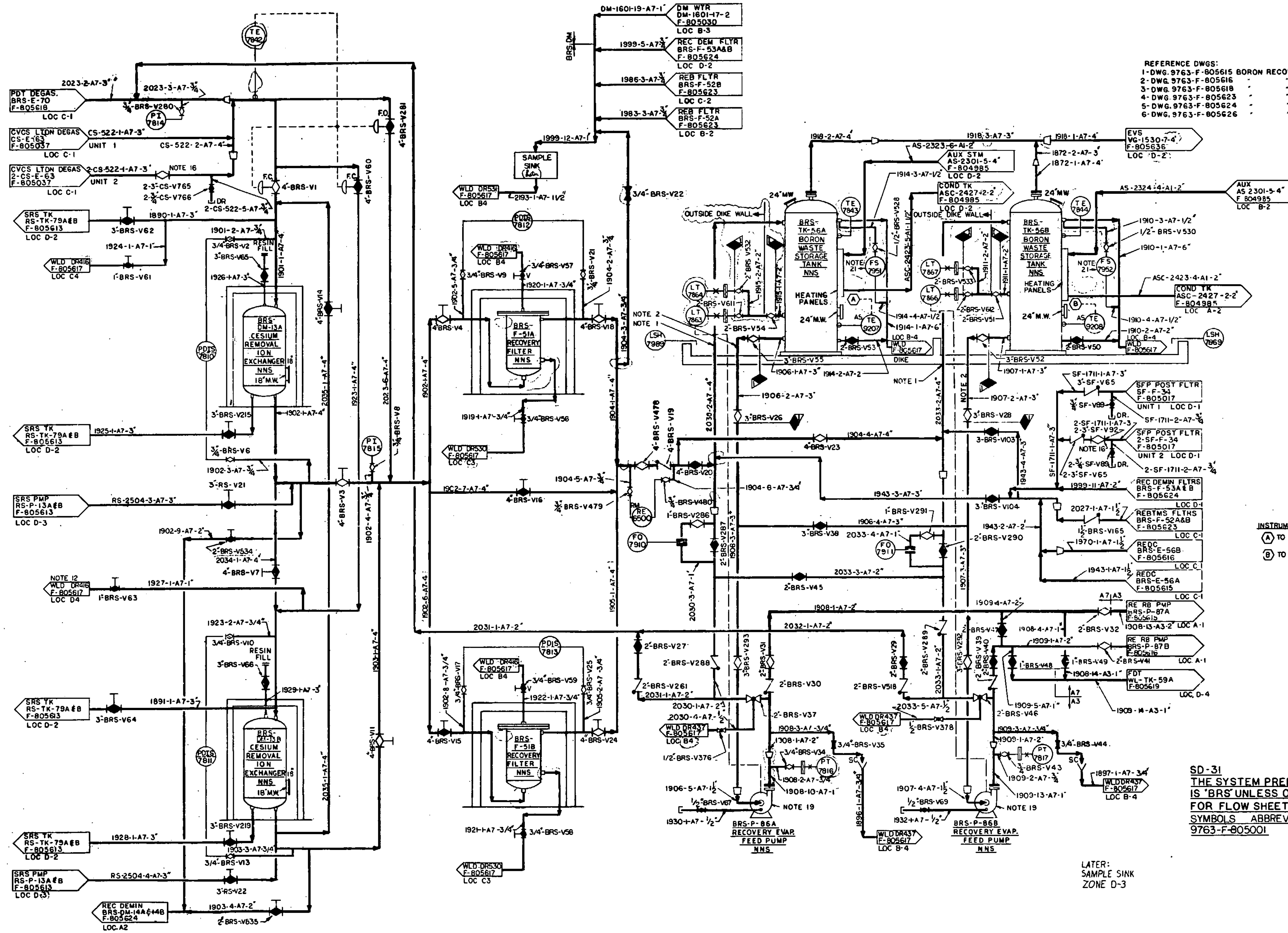
THE SYSTEM PREFIX FOR THIS DIAGRAM IS "WL" UNLESS OTHERWISE NOTED.

FOR FLOW SHEET REFERENCE DWG, SYMBOLS, & ABBR., SEE DWG 9763-F-805001

SD. NO. 32

FOR GEN. NOTES & REF. DWGS SEE DWG F-805619

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	LIQUID WASTE SYSTEM DEMINERALIZATION AND TESTING P & I DIAGRAM
	9763-F-805621 | FIGURE C.2-4, SH. 3



REFERENCE DWGS:
1-DWG. 9763-F-805615 BORON RECOVERY SYS., EVAP-3A P & ID
2-DWG. 9763-F-805616 " " " EVAP-3B P & ID
3-DWG. 9763-F-805618 " " " DEGAS P & ID
4-DWG. 9763-F-805623 " " " EVAP BOT P & ID
5-DWG. 9763-F-805624 " " " TEST & DEMIN
6-DWG. 9763-F-805626 " " " PDT P & ID

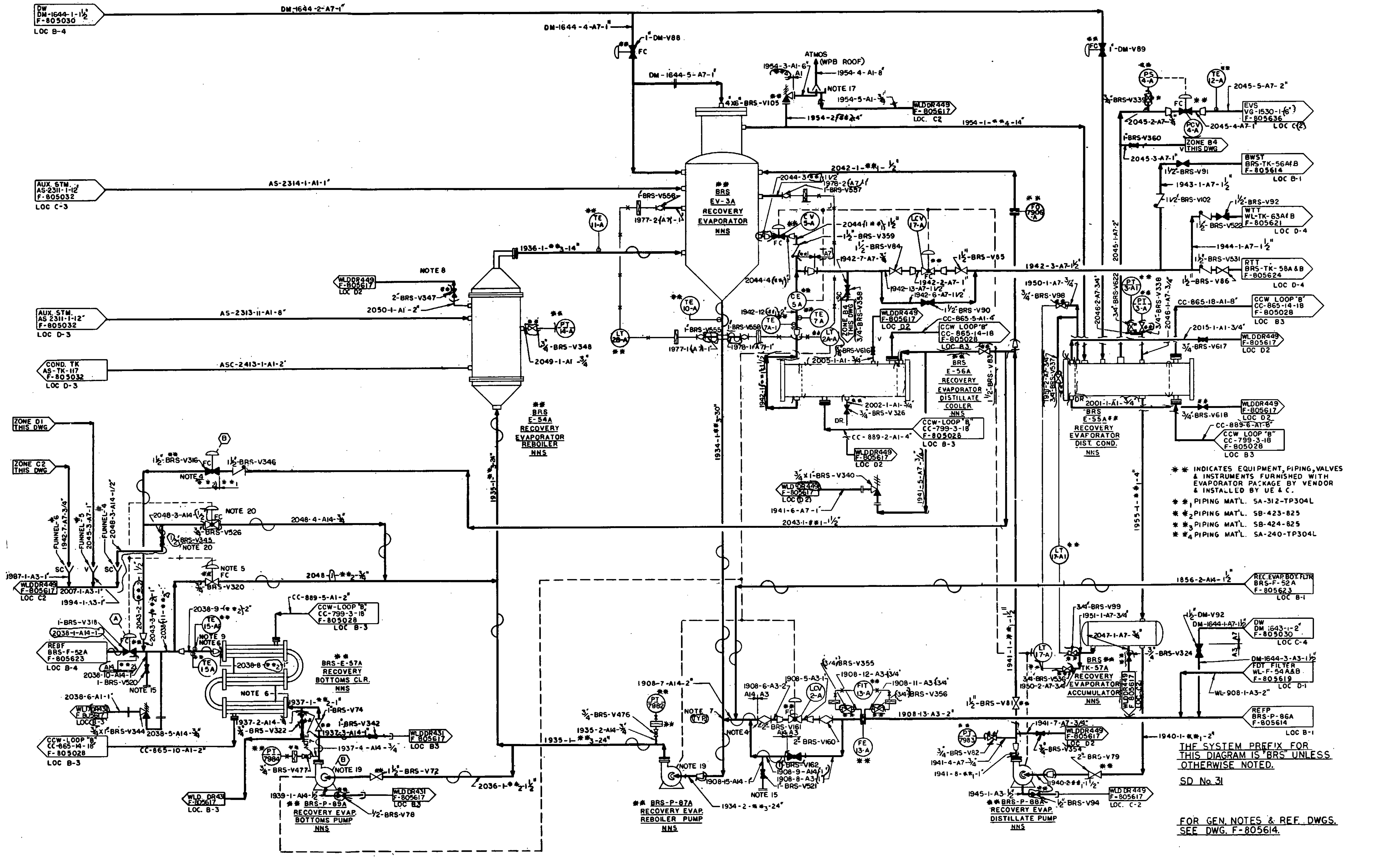
INSTRUMENTATION SYMBOLS
(A) TO F-804985-TV-9207
(B) TO F-804985-TV-9208

SD-31
THE SYSTEM PREFIX FOR THIS DIAGRAM IS 'BRS' UNLESS OTHERWISE NOTED.
FOR FLOW SHEET REFERENCE DRAWINGS SYMBOLS ABBREVIATIONS SEE DWG. 9763-F-805001

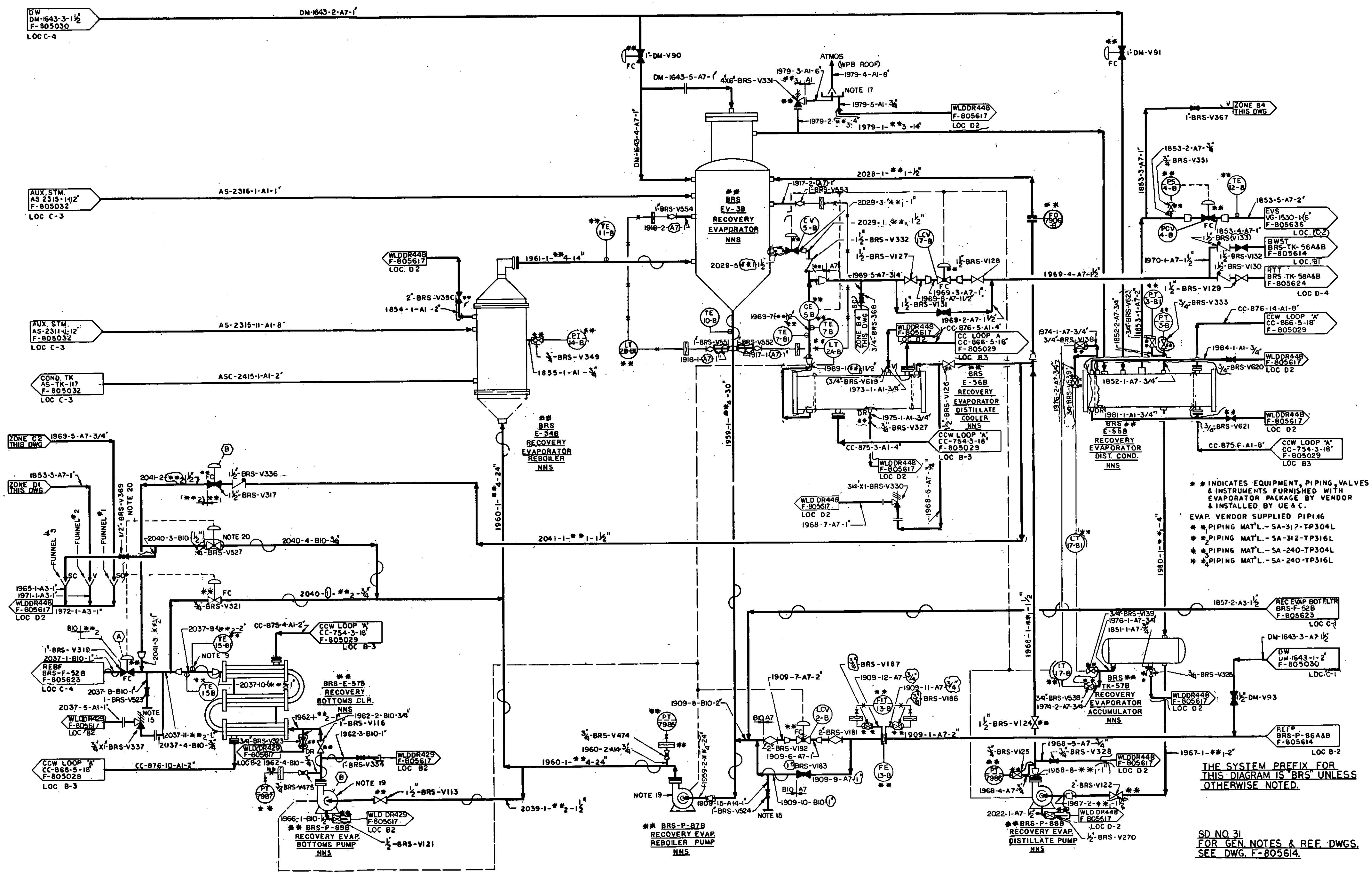
NOTES

1-WALL PENETRATION SHALL BE ABOVE MAXIMUM LOADED LEVEL OF DIKE AREA.
2-WALL PENETRATION SHALL BE SEALED BETWEEN WALL AND PIPE.
3-ALL PIPING IS SAFETY CLASS NNS, NON-SEISMIC CATEGORY I UNLESS OTHERWISE NOTED.
4-VALVE IS 316SS, PIPE IS ALLOY 20. SEE UE&C SPEC. 9763-006-248-51 FOR WELDING REQUIREMENTS.
5-VALVE IS ALLOY 20. PIPE IS INCOLOY 825 SEE UE&C SPEC. 9763-006-248-51 FOR WELDING REQUIREMENTS.
6-TUBESHEET IS INCOLOY 825. PIPE IS ALLOY 20 SEE UE&C SPEC. 9763-006-248-51 FOR WELDING REQUIREMENTS.
7-ALLOY 20 TO INCOLOY 825 PIPE JOINT SEE UE&C SPEC. 9763-006-248-51 FOR WELDING REQUIREMENTS
8-FLUSH, VENT AND/OR SAMPLE CONNECTIONS; PIPE TO LOCAL DRAIN FUNNEL.
9-LOCATE TEMPERATURE TRANSMITTERS BETWEEN BOTTOMS COOLER OUTLET AND FIRST BRANCH LINE.
10 DELETED
11-VALVE IS ALLOY 20. PIPE IS 304SS. SEE UE&C SPEC. 9763-006-248-51 FOR WELDING REQUIREMENTS.
12-DEMINERALIZERS ARE VENTED TO FLOOR DRAIN TANK HEADER.
13-THESE ITEMS SUPPLIED BY DEGASIFIER VENDOR. BUT NOT MOUNTED ON SKID
14-HEAVY LINES NOT PROVIDED BY DEGASIFIER VENDOR.
15-CHEMICAL ADDITION AND REMOVAL CONNECTIONS.
16-VALVE IS CLOSED DURING UNIT 2 CONSTRUCTION.
17-CROSBY DRIP PAN ELBOW OR APPROVED EQUAL
18-COMPONENTS INSIDE PACKAGE PROVIDED BY DEGASIFIER VENDOR.
19-SEE DRAWING (9763-F-805627) FOR WATER SUPPLY TO PUMP DOUBLE MECHANICAL SEALS.
20-THE RECIRCULATION SAMPLE LINE GATE VALVE 3/4"-BRS-V526 & 3/4"-BRS-V527 & CONNECTION 3/4"-BRS-V346 & 3/4"-BRS-V369 TO BE ABOVE FLOOR ELEVATION +25'-0".
21-LOCATE FS INSTRUMENT & VALVE NEAR FLOOR ELEVATION
22-SUPPLIED BY TANK VENDOR

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	BORON RECOVERY SYSTEM FILTRATION AND STORAGE P & I DIAGRAM
	9763-F-805614 | FIGURE C.2-5, SH. 1



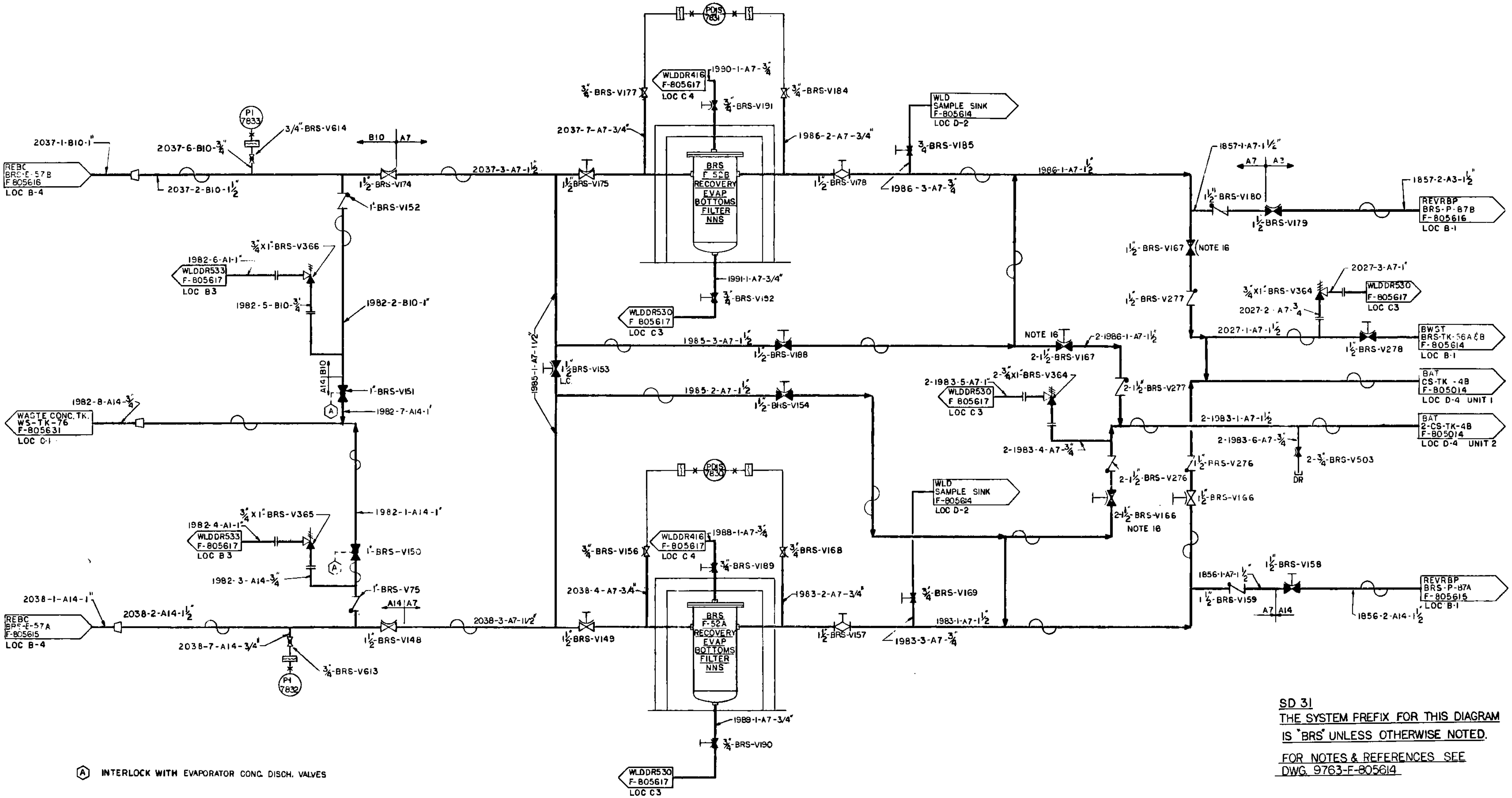
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	BORON RECOVERY SYSTEM EVAPORATOR EV-3A P & I DIAGRAM	
	9763-F-805615	FIGURE C. 2-5, SH. 2



Ⓐ HIGH E-57B OUTLET TEMP HIGH WS-TK-76 LEVEL AND LOW EV-3B LEVEL WS-TK-76 TRANSFER VALVE INTERLOCK

Ⓑ BRS-P-89B DISTILLATE FLUSH V317 INTERLOCK

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	BORON RECOVERY SYSTEM EVAPORATOR EV-3B P & I DIAGRAM	
	9763-F-805616	FIGURE C.2-5, SH. 3

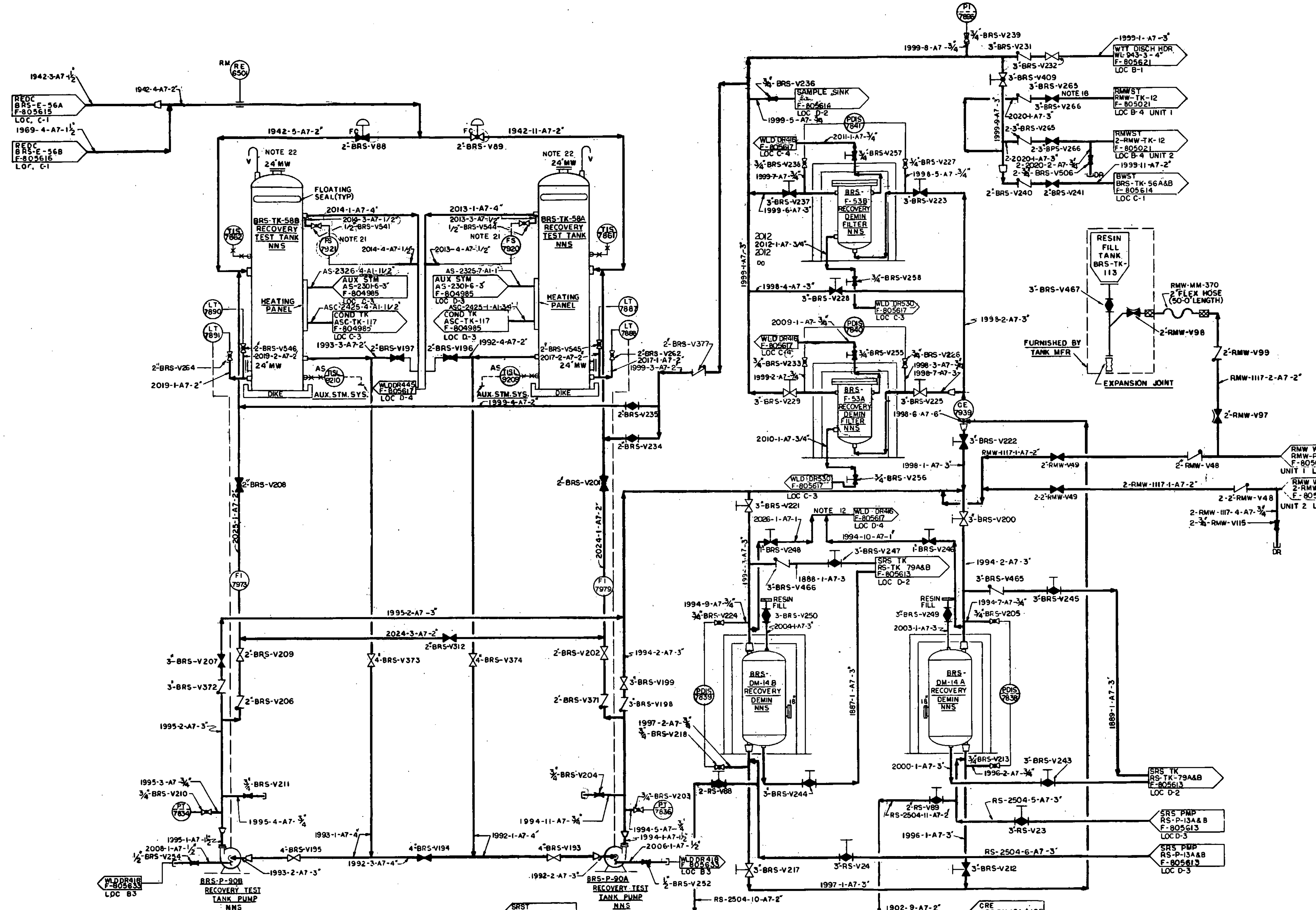


SD 31

THE SYSTEM PREFIX FOR THIS DIAGRAM IS "BRS" UNLESS OTHERWISE NOTED.

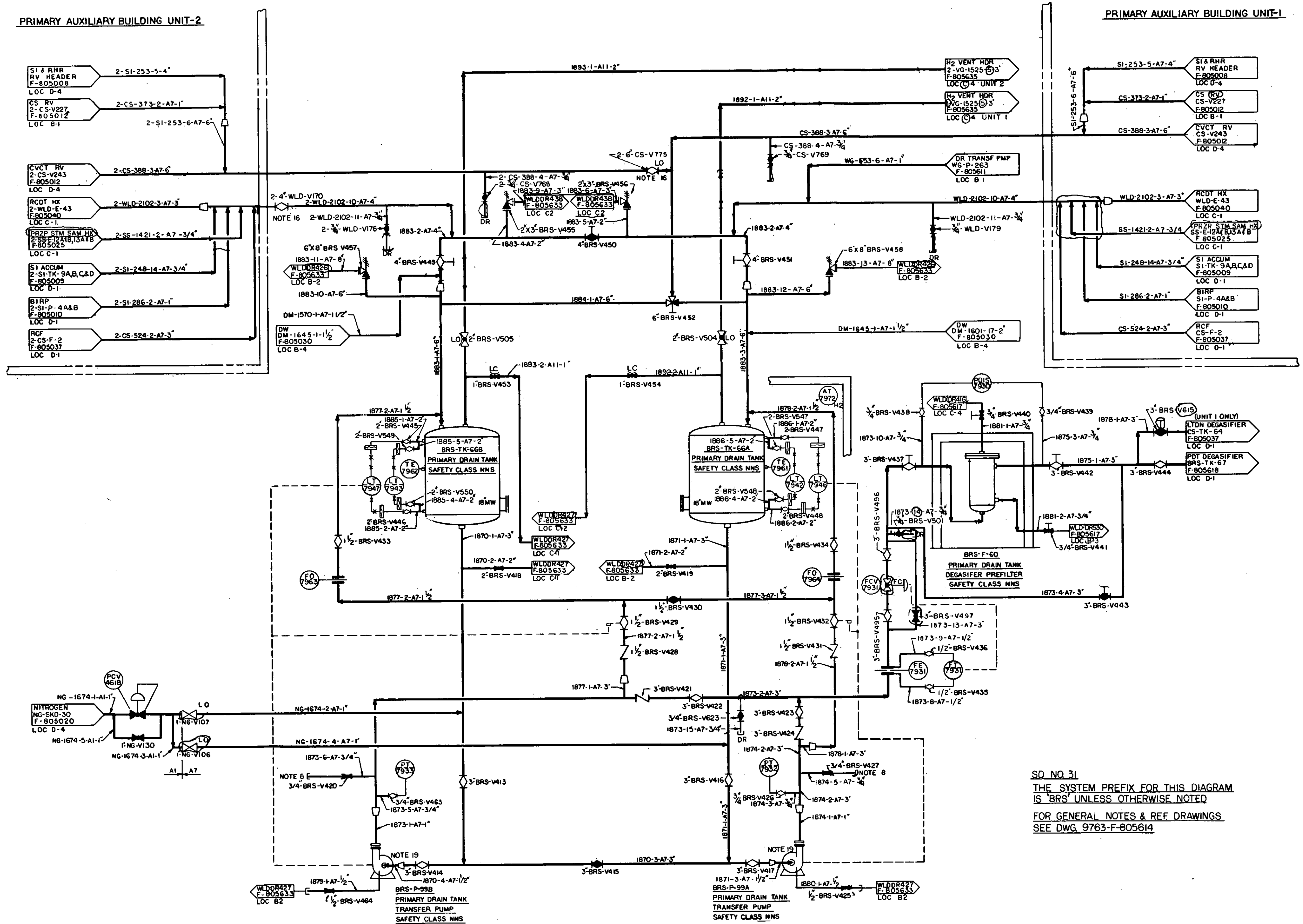
FOR NOTES & REFERENCES SEE DWG. 9763-F-805614

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	BORON RECOVERY SYSTEM EVAPORATOR BOTTOMS P & I DIAGRAM	
	9763-F-805623	FIGURE C.2-5, SH. 4



THE SYSTEM PREFIX FOR THIS DIAGRAM IS BRS UNLESS OTHERWISE NOTED
FOR NOTES AND REFERENCES SEE DWG. 9763-F-805614.
SD NO 31

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	BORON RECOVERY SYSTEM TESTING AND DEMINERALIZATION P & I DIAGRAM
	9763-F-805624 — FIGURE C.2-5, SH. 5

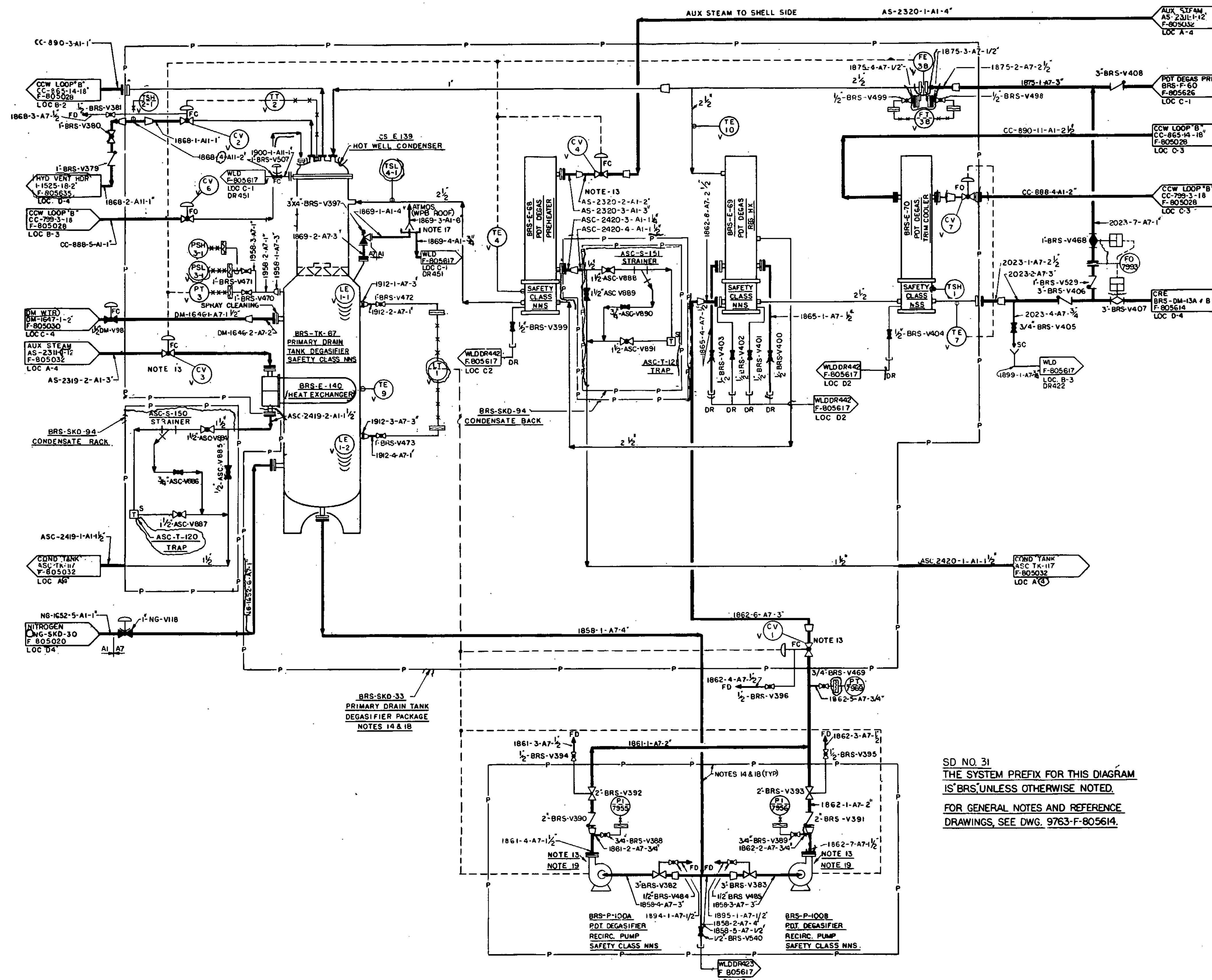


PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

BORON RECOVERY SYSTEM
PRIMARY DRAIN TANKS
P & I DIAGRAM

9763-F-805626

FIGURE C.2-5, SH. 6

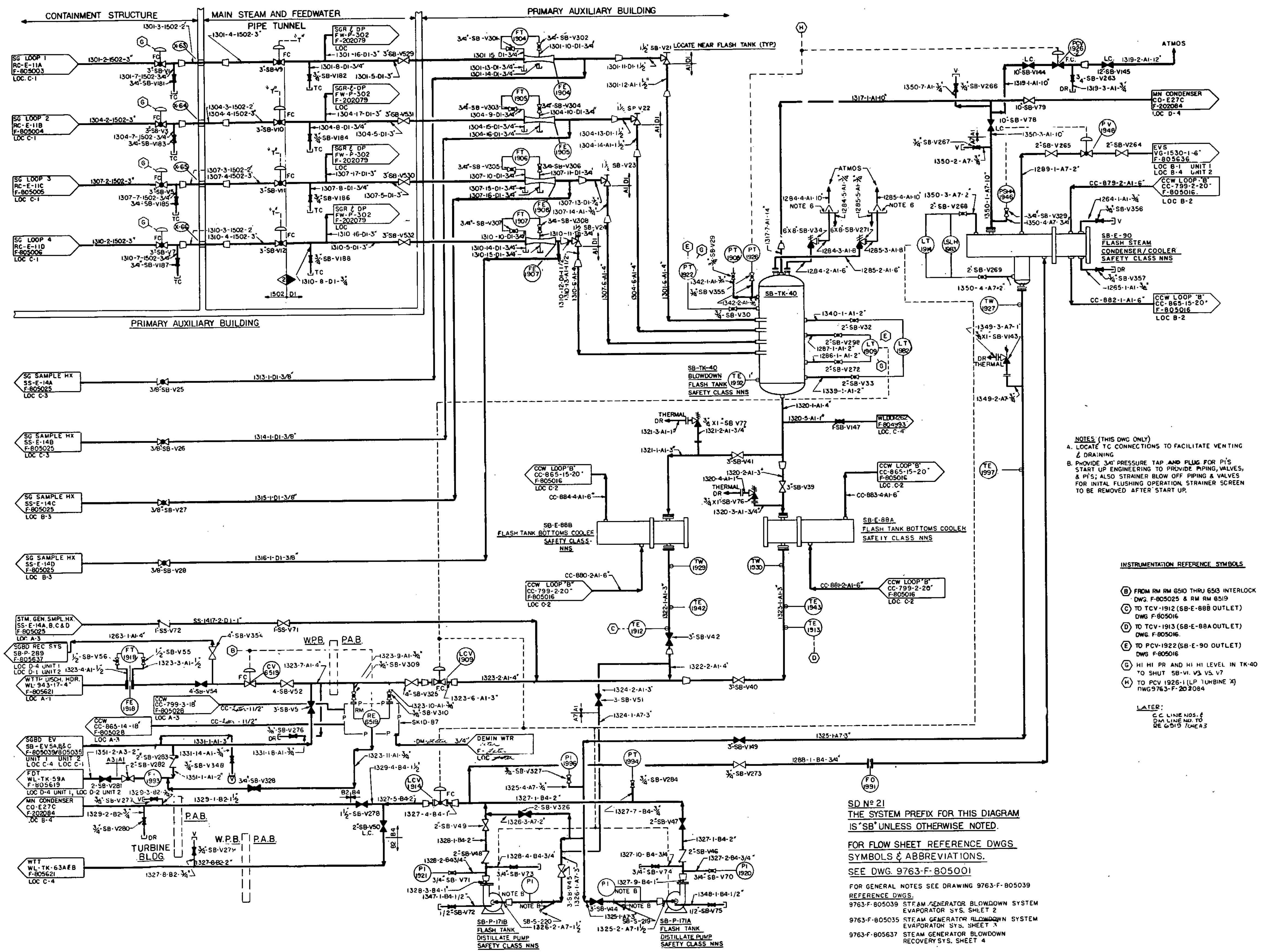


PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

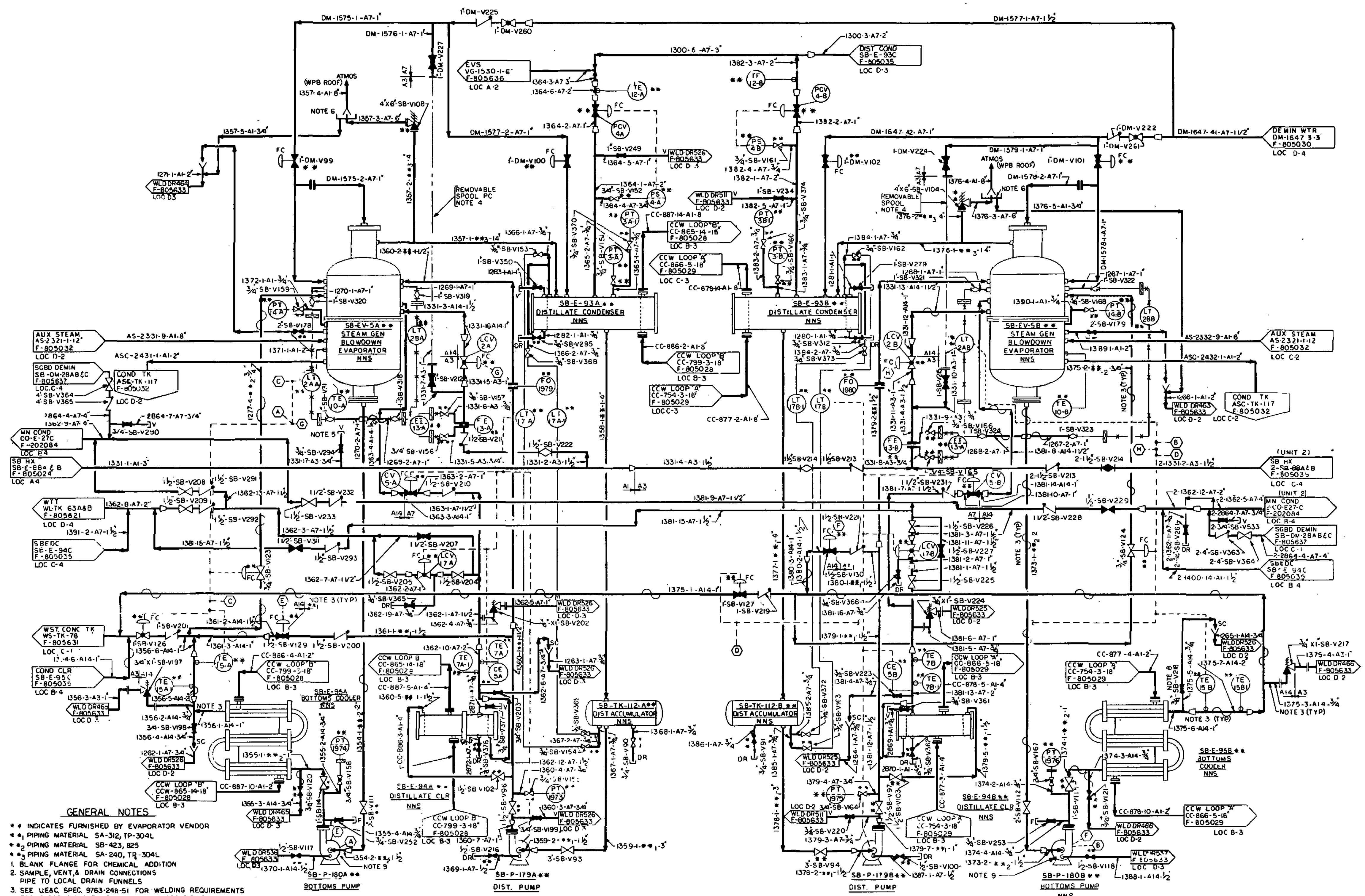
BORON RECOVERY SYSTEM
PRIMARY DRAIN TANK DEGASIFIER
P & I DIAGRAM

9763-F-805618

FIGURE C.2-5, SH. 7



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	STEAM GENERATOR BLOWDOWN SYSTEM P & I DIAGRAM	
	9763-F-805024	FIGURE C.2-6, SH. 1



GENERAL NOTES

- ** INDICATES FURNISHED BY EVAPORATOR VENDOR
- $**_1$ PIPING MATERIAL SA-312, TP-304L
- $**_2$ PIPING MATERIAL SB-423, 825
- $**_3$ PIPING MATERIAL SA-240, TR-304L

1. BLANK FLANGE FOR CHEMICAL ADDITION
2. SAMPLE, VENT, & DRAIN CONNECTIONS PIPE TO LOCAL DRAIN FUNNELS
3. SEE UE&C SPEC. 9763-248-51 FOR WELDING REQUIREMENTS FOR CLASS A14 AND VENDOR $**_2$ CLASS PIPING
4. FLUSH AND CHEMICAL ADDITION CONNECTION
5. NITROGEN PURGE CONNECTION FOR DRY LAYUP
6. CROSBY DRIP PAN ELBOW OR EQUAL
7. ALL PIPING NNS UNLESS OTHERWISE NOTED
8. SAMPLE VALVE LOCATED IN DISTILLATE EQUIPMENT AREA; PIPE TO LOCAL DRAIN FUNNEL
9. SEE DRAWING 9763-F-805627 FOR WATER SUPPY TO PUMP DOUBLE MECHANICAL SEALS
10. SEE DRAWING 9763-F-805001, NOTE 1

INSTRUMENT REF NOTES

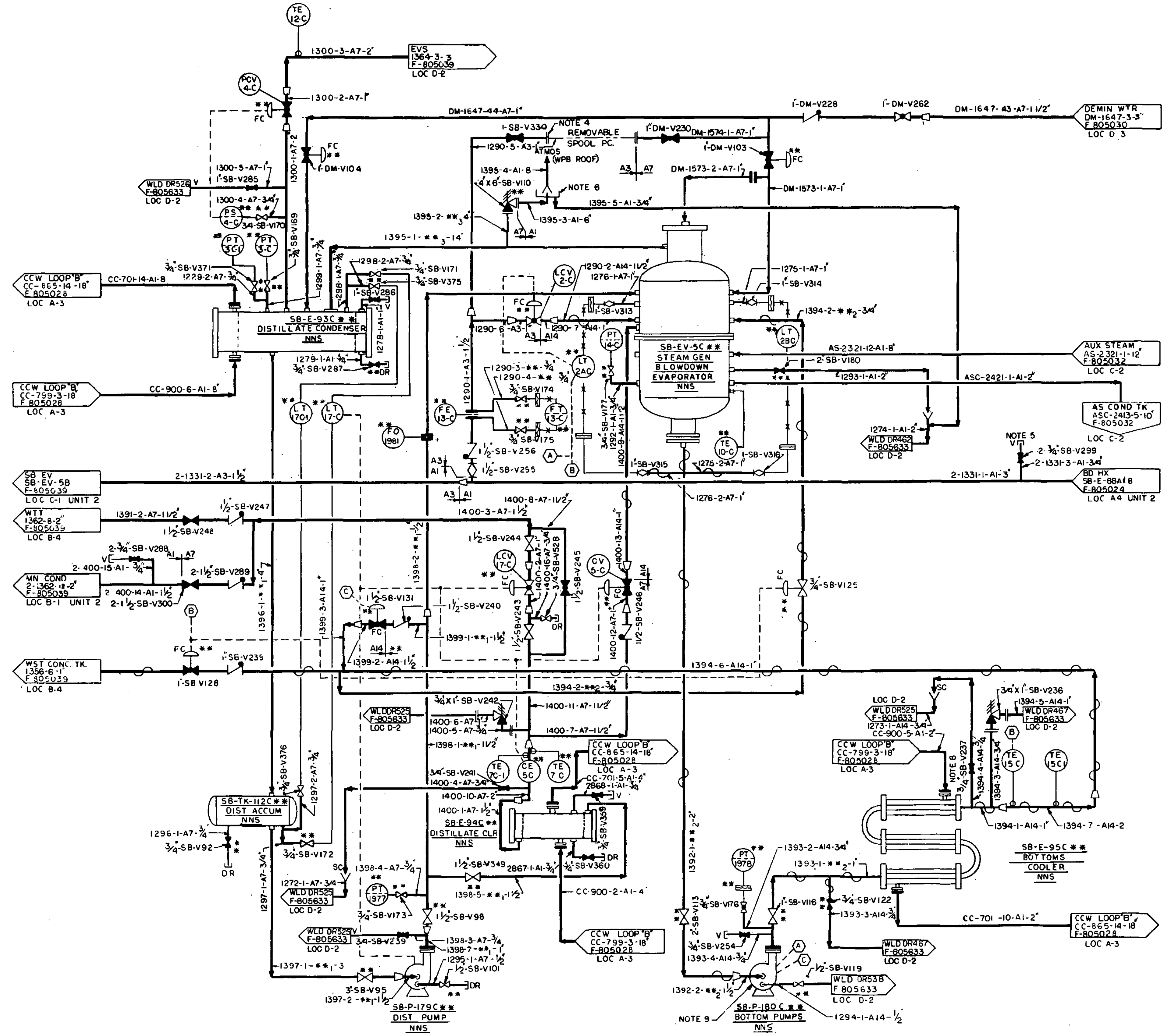
- A LOW LOW EV-5A INTERLOCK WITH P-180 A
- B LOW LOW EV-5B INTERLOCK WITH P 180 B
- C HIGH E-95 A OUTLET TEMP, HIGH WS-TK-76 LEVEL, AND LOW DISCHARGE EV-5A INTERLOCK
- D HIGH E-95 B OUTLET TEMP HIGH WS-TK-76 LEVEL AND LOW DISCHARGE EV-5B INTERLOCK
- E DISTILLATE FLUSH V129, P-180 A
- F DISTILLATE FLUSH V130, P-180 B
- G EV-5A HI HI LVL, LCV 2A INTERLOCK
- H EV-5B HI HI LVL, LCV-2B INTERLOCK

SD No. 21

THE SYSTEM PREFIX FOR THIS DIAGRAM IS 'SB' UNLESS OTHERWISE NOTED

FOR REFERENCE DWGS. SEE DWG. 9763-F-805024

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	STEAM GENERATOR BLOWDOWN EVAPORATOR SYSTEM P & I DIAGRAM
	9763-F-805039 FIGURE C.2-6, SH. 2



INSTRUMENT REF NOTES

(A) LOW LOW EV-5C INTERLOCK WITH P-180C

(B) HIGH E-95C OUTLET TEMP, HIGH WS-TK-76 LEVEL, LOW LEVEL EV-5C INTERLOCK

(C) DISTILLATE FLUSH V-131, P-180C INTERLOCK

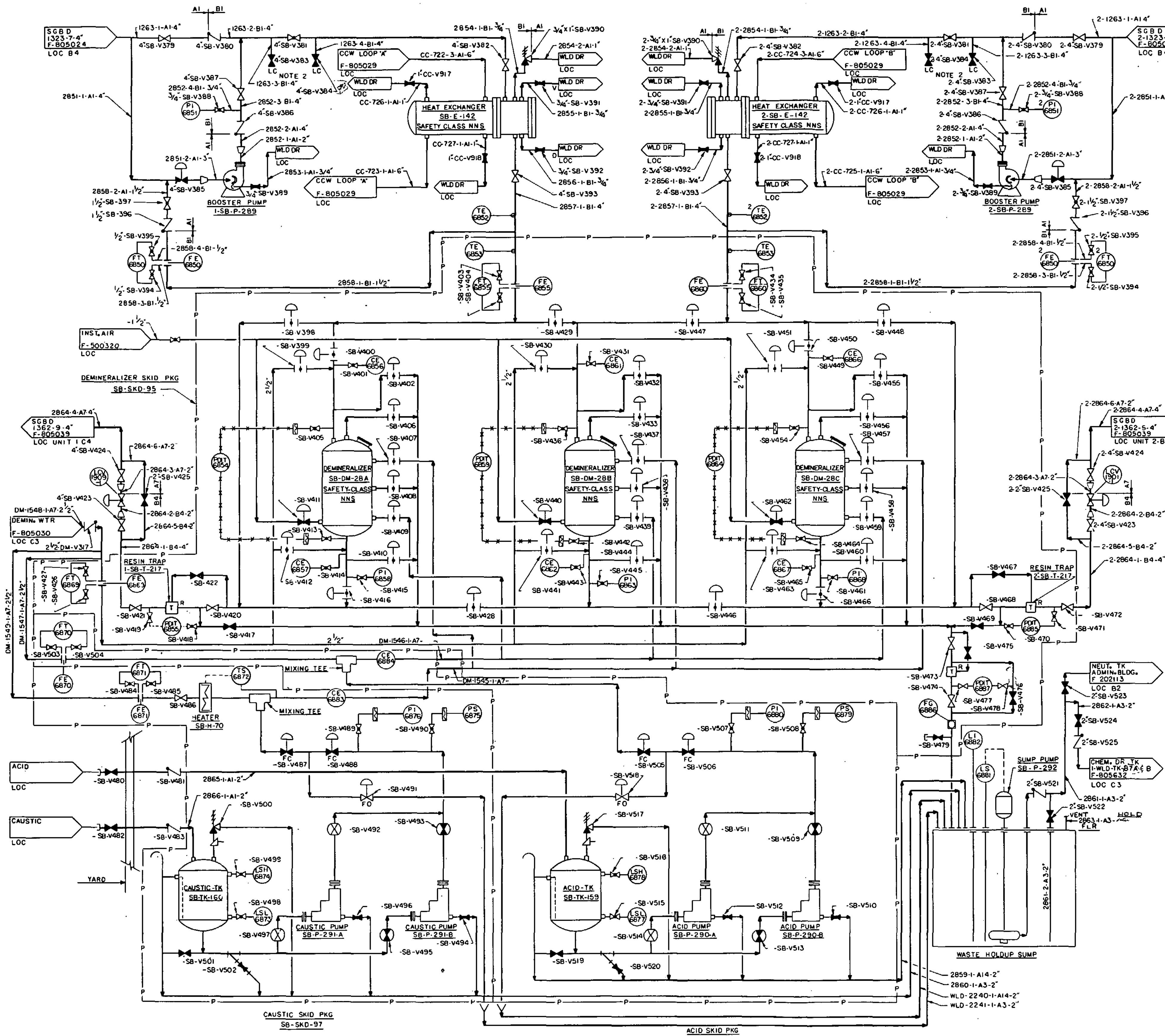
SD No. 21

THE SYSTEM PREFIX FOR THIS DRAWING IS "SB" UNLESS OTHERWISE NOTED

FOR REFERENCE DWGS SEE DWG 9763-F-805024

FOR GENERAL NOTES SEE DWG 9763-F-805039

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	STEAM GENERATOR BLOWDOWN EVAPORATOR SYSTEM P & I DIAGRAM	
	9763-F-805035	FIGURE C.2-6, SH. 3



NOTES

1- ALL EQUIPMENT, VALVE, LINE AND INSTRUMENT NUMBERS ARE FOR UNIT 1 UNLESS OTHERWISE NOTED.

2- CONNECTIONS FOR FUTURE INSTALLATION TO EM FILTER IF REQUIRED.

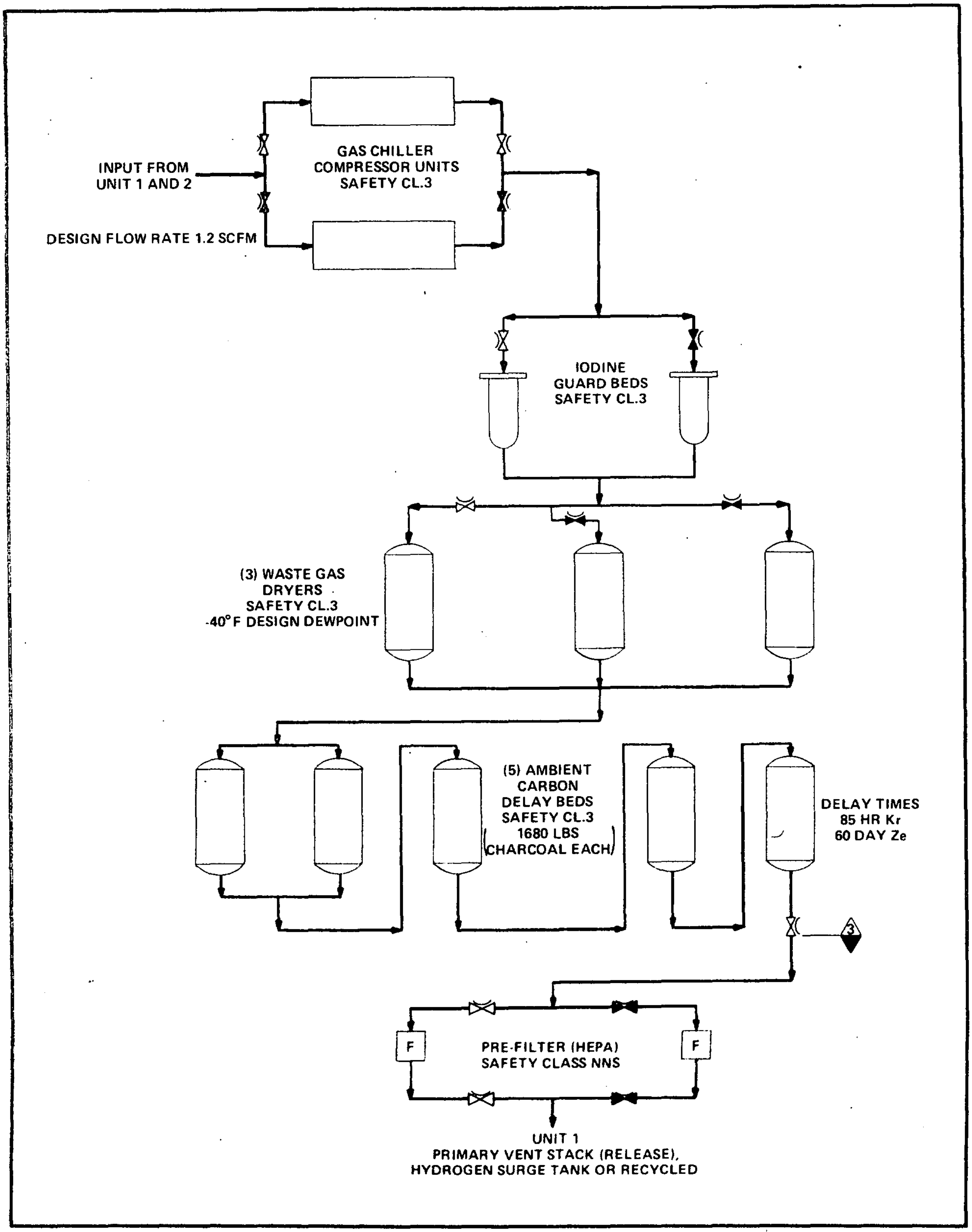
SD No. 21

THE SYSTEM PREFIX FOR THIS DIAGRAM IS "SB" UNLESS OTHERWISE NOTED

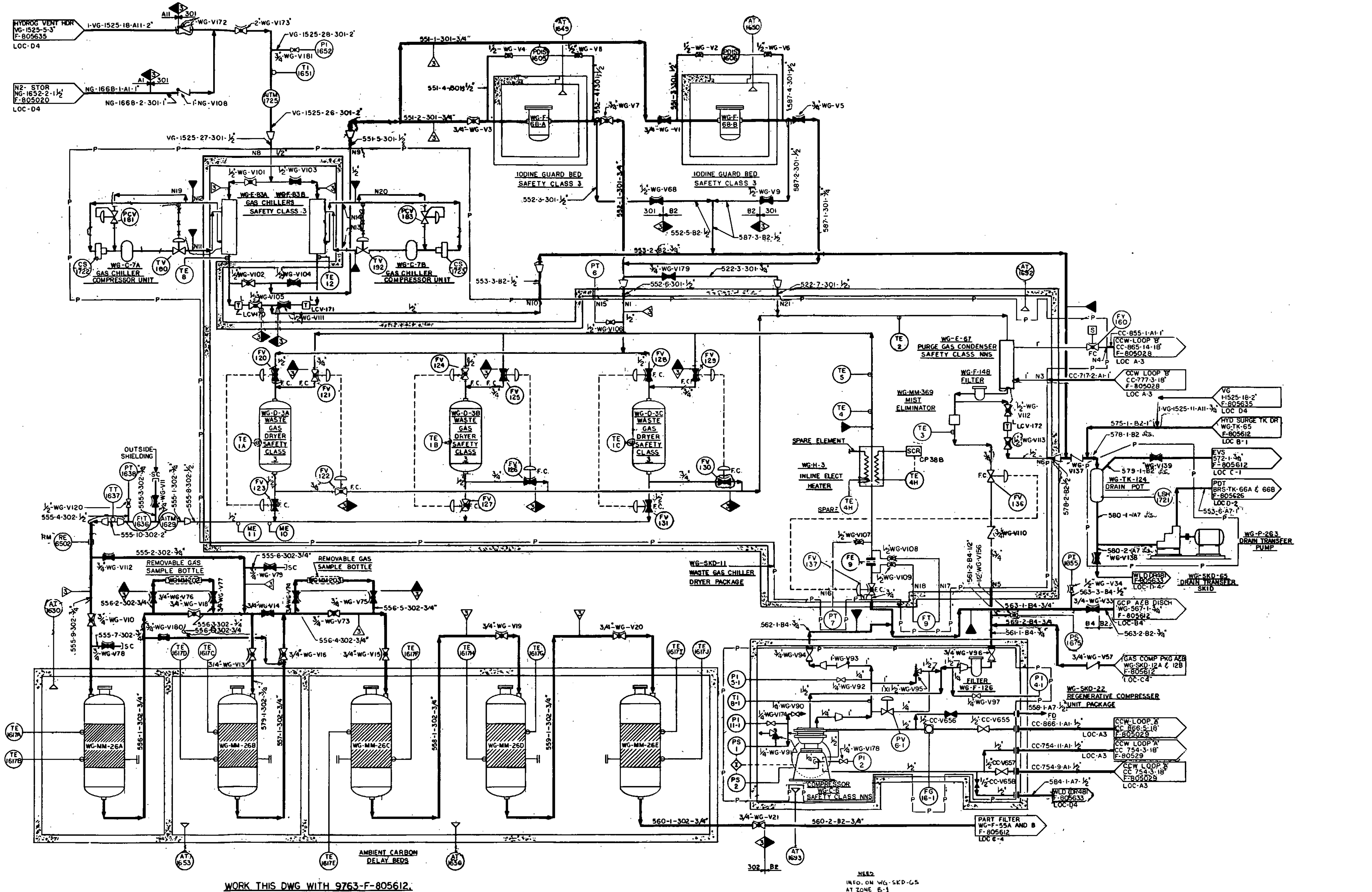
FOR REFERENCE DWG SEE DWG 9763-F-805024

FOR GENERAL NOTES SEE DWG 9763-F-805039

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	STEAM GENERATOR BLOWDOWN RECOVERY SYSTEM P & I DIAGRAM	
	9763-F-805637	FIGURE C.2-6, SH. 4



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	GASEOUS WASTE SYSTEM SCHEMATIC
	FIGURE C.2-7



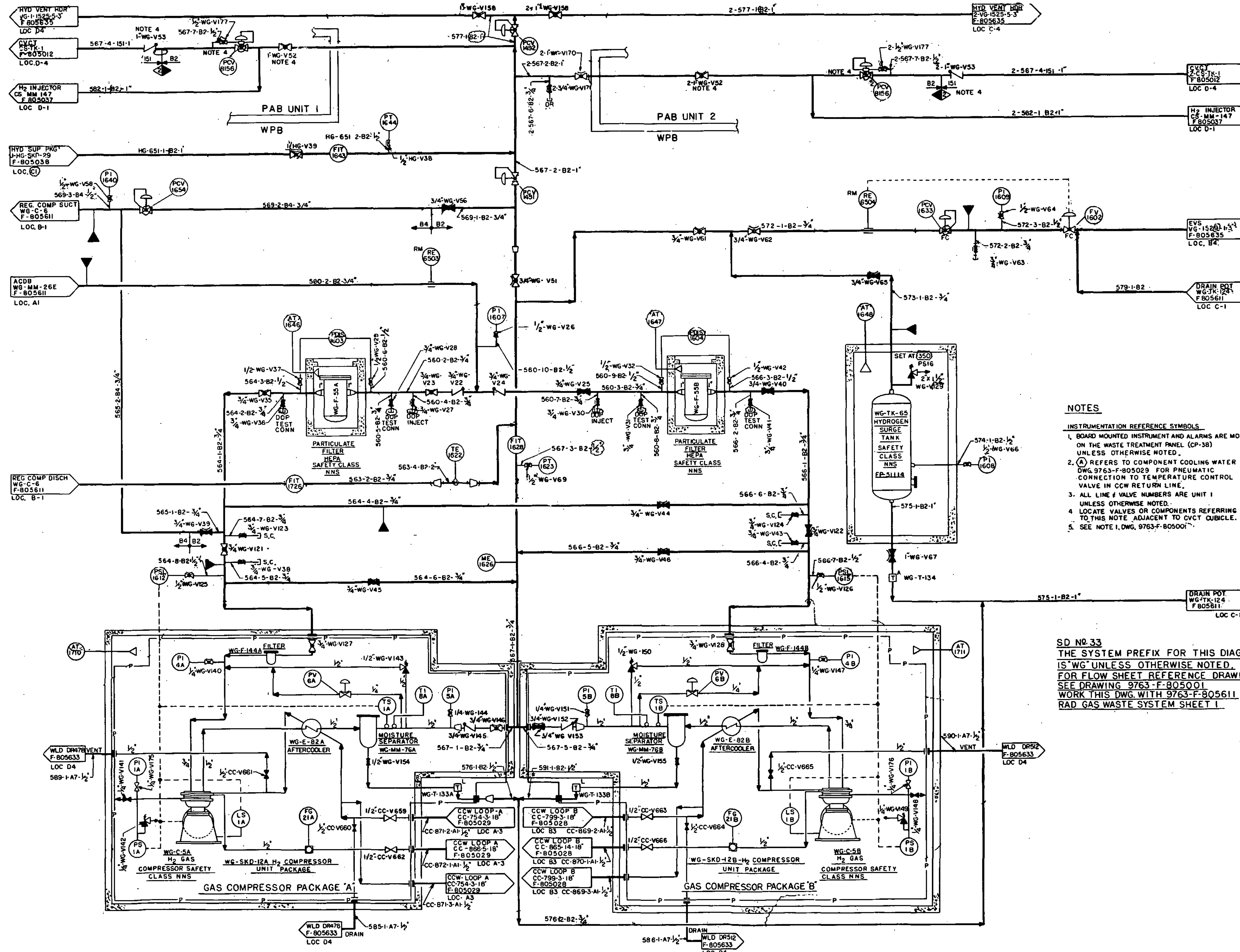
WORK THIS DWG WITH 9763-F-805612, RAD GAS WASTE SYSTEM SHEET 2

THE SYSTEM PREFIX FOR THIS DIAGRAM IS "WG" UNLESS OTHERWISE NOTED

FOR FLOW SHEET REFERENCE DRAWING, SEE DRAWING 9763-F-805001

SD. NO 33

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	RADIOACTIVE GAS-WASTE SYSTEM P & I DIAGRAM
9763-F-805611	FIGURE C.2-8, SH. 1



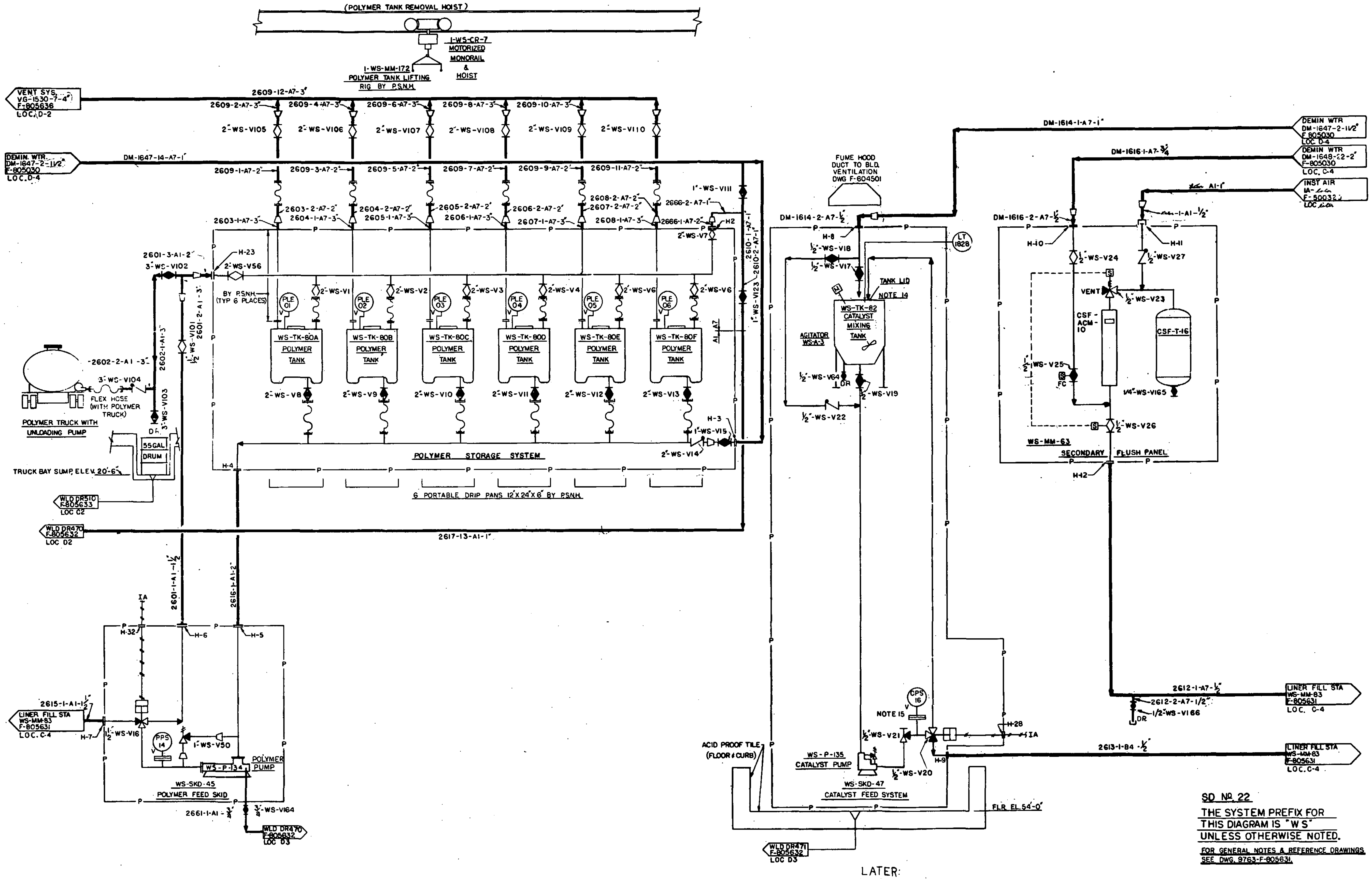
NOTES

INSTRUMENTATION REFERENCE SYMBOLS

1. BOARD MOUNTED INSTRUMENT AND ALARMS ARE MOUNTED ON THE WASTE TREATMENT PANEL (CP-38) UNLESS OTHERWISE NOTED.
2. (A) REFERS TO COMPONENT COOLING WATER DWG. 9763-F-805029 FOR PNEUMATIC CONNECTION TO TEMPERATURE CONTROL VALVE IN CCW RETURN LINE.
3. ALL LINE & VALVE NUMBERS ARE UNIT 1 UNLESS OTHERWISE NOTED.
4. LOCATE VALVES OR COMPONENTS REFERRING TO THIS NOTE ADJACENT TO CVCT CUBICLE.
5. SEE NOTE 1, DWG. 9763-F-805001

SD NO. 33
THE SYSTEM PREFIX FOR THIS DIAGRAM IS "WG" UNLESS OTHERWISE NOTED.
FOR FLOW SHEET REFERENCE DRAWING SEE DRAWING 9763-F-805001
WORK THIS DWG. WITH 9763-F-805611
RAD GAS WASTE SYSTEM SHEET 1

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	RADIOACTIVE GAS WASTE SYSTEM P & I DIAGRAM
	9763-F-805612 — FIGURE C.2-8, SH. 2

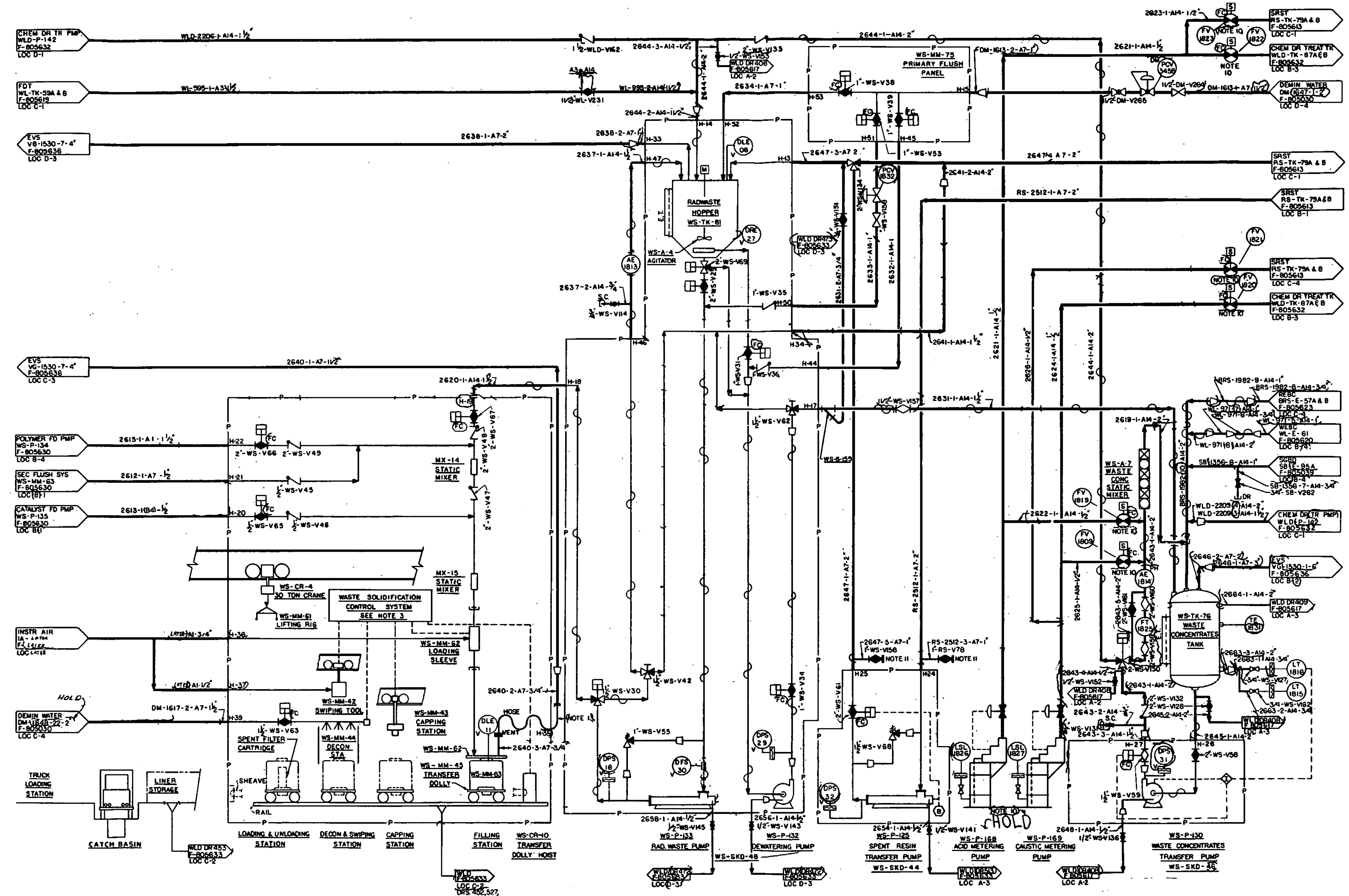


SD No 22

THE SYSTEM PREFIX FOR THIS DIAGRAM IS "WS" UNLESS OTHERWISE NOTED.

FOR GENERAL NOTES & REFERENCE DRAWINGS SEE DWG. 9763-F-805631.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	WASTE SOLIDIFICATION SYSTEM P & I DIAGRAM	
	9763-F-805630	FIGURE C.2-9, SH. 1



INSTRUMENTATION REFERENCE SYMBOLS

(A) RECIRCULATION LOGIC 9763-M-LATER

(B) HNDC LOGIC FP-50636 THRU 50640

NOTES

1- DELETED

2- DELETED

3- FOR DETAILS OF OPERATION REFER TO HNDC LOGIC DIAGRAMS FP-50636 THRU 50640

4- DELETED

5- ALL EQUIPMENT AND PIPING IN PACKAGES (P——P) ARE SUPPLIED BY HITTMAN, UNLESS OTHERWISE NOTED.

6- ALL EQUIPMENT & INSTRUMENT TAG NUMBERS SHOWN WITH "V" IN 3RD QUADRANT ARE VENDOR TAG NUMBERS.

7- ALL HEAT TRACING BY UE&C

8- HITTMAN P&I REF. DWGS.
#FP-50778
#FP-50779

9- HITTMAN I&C REF. DWGS.
#FP-50796
#FP-50797

10- ON HOLD, CHEM. ADDITION PKG TO BE SPECIFIED BY I&C

11- LOCATE AIR SUPPLY LINES ON TOP OF PIPE & AS CLOSE TO PUMP AS POSSIBLE.

12- ALL AIR OPERATORS ARE TO BE ASSEMBLED TO VALVES SUCH AS TO RETURN TO "SAFE": THAT IS, "CLOSED" OR RECIRCULATE POSITION IN CASE OF AIR OR POWER FAILURE (FP. 50796.09)

13- 3/4" DIA. 150' AIR HOSE.

14- DRY CATALYST IS ADDED TO CATALYST MIXING TANK BY HAND IN WEIGHED QUANTITIES.

15- SEAL SUPPLIED WITH PRESSURE SWITCH.

16- ALL PIPING & COMPONENTS ARE SAFETY CLASS NNS, NON-SEISMIC CATEGORY I UNLESS OTHERWISE NOTED.

HOLD:
1- ZONE A-2 & NOTE 10 (6 PLACES) IN ZONES B1, C1 & D1
2- ZONE B4

GET:
1- ZONE B4, INSTR. AIR

SD. № 22

THE SYSTEM PREFIX FOR THIS DIAGRAM IS "WS" UNLESS OTHERWISE NOTED

FOR FLOW SHEET REFERENCE DRAWINGS, SYMBOLS & ABBREVIATIONS SEE DWG. 9763-F-805001

WORK THIS DWG WITH 9763-F-805630

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	WASTE SOLIDIFICATION SYSTEM P & I DIAGRAM
	9763-F-805631 | FIGURE C.2-9, SH. 2

APPENDIX B

APPENDIX B

NEW ENGLAND

LOAD AND CAPACITY REPORT

1981 - 1996

April 1, 1981

NEPLAN

New England Power Planning

174 BRUSH HILL AVENUE
WEST SPRINGFIELD, MASSACHUSETTS 01089
TELEPHONE (413) 785-5871

JAMES R. SMITH
DIRECTOR

March 20, 1981

NEPOOL Planning Committee Members

Gentlemen:

This "New England Load and Capacity Report - 1981-1996" dated April 1, 1981 summarizes forecasts of electrical peak load, capabilities and reserves for the period and the 1980 summer and the 1980/81 winter peak information. The summer peak of 14986 MW occurred on July 21, 1980 and the 1980/81 winter peak of 15620 MW occurred on January 12, 1981.

The "NEPOOL Model for Long Range Forecasting of Electric Energy and Demand" has been used to produce this regional forecast, incorporating some load management concepts. Specifically, controlled storage-type electrical space heating and water heating are assumed for the region resulting in about a 950 MW decrease in the otherwise expected 1996/97 winter peak. The resultant annual compound growth rate for 1980 through 1996 is 2.4% for summer peak, 2.6% for winter peak and 2.7% for energy, compared to 2.0%, 2.7% and 2.6% in the April 1, 1980 report.

Adequate reserves are indicated for the expected peak loads through 1992/93 assuming all "NEPOOL Planned" units are in service as scheduled, even though two units do not, as yet, have construction permits. Additional capacity will be required for 1994/95 and beyond.

However, with approximately 60% of the existing capacity in oil-fired units, energy deficiencies could occur in the mid 1980s. It is especially critical that all non-oil-fired capacity be built as scheduled, that coal conversions be encouraged where economic, and that conservation and load management efforts be continued to prevent energy deficiencies and to achieve the lowest possible price for electric energy.

Appendix "B" details the schedule of "NEPOOL Planned" units, as well as some of NEPOOL's planned commitments to other than oil-fired generation (such as hydro, wood and coal).

This report includes the latest data available at the time of publication and is intended as a long-range planning guide to meet the future electrical energy and demand requirements of New England.

Sincerely,

J R Smith

James R. Smith, Secretary
NEPOOL Planning Committee

JRS:dv
Attachment

NEW ENGLAND

LOAD AND CAPACITY REPORT

1981 - 1996

INDEX

April 1, 1981

SUMMARY

SYSTEM CAPABILITIES AND ESTIMATED PEAK LOAD - WINTER - 1981/82 - 1996/97

MW

	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97
Total Capability *	21910	22192	23359	23340	24366	25518	26537	26537	27104	27106	27106	27082	27060	27058	27058	27058
Total Peak Load	15920	16350	16810	17260	17680	18130	18640	19200	19780	20360	20980	21590	22130	22610	23060	23530
Reserve before Maintenance (MW)	5990	5842	6549	6080	6686	7388	7897	7337	7324	6746	6126	5492	4930	4448	3998	3528
(%)	37.6	35.7	39.0	35.2	37.8	40.8	42.4	38.2	37.0	33.1	29.2	25.4	22.3	19.7	17.3	15.00
Scheduled Maintenance	1270	600	1290	1900	800	500	500	500	500	500	500	500	500	500	500	500
Reserve After Maintenance (MW)	4720	5242	5259	4180	5886	6888	7397	6837	6824	6246	5626	4992	4430	3948	3498	3028
(%)	29.6	32.1	31.3	24.2	33.3	38.0	39.7	35.6	34.5	30.7	26.8	23.1	20.9	17.5	15.2	12.9

* Additions include only "NEPOOL Planned" and Company authorized generation capacity. Also refer to the notes on page 2.

SUMMARY - GENERATION ADDITIONS, RERATINGS AND RETIREMENTS - WINTER (MW)
PRELIMINARY DATA FOR 4/81 LOAD AND CAPACITY REPORT

	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Existing Capability	21436	21252	21349	21348	21329	21217	21219	21088
Retirements	-95	-45	0	-6	0	0	-130	0
Reratings	+27	0	0	-1	+2	+2	-1	0
Purchase & Sales Adjust-ments	-121	+142	-1	-12	-2	0	-1	0
MEPCO/NB PURCHASE CHANGE					-133			
NET CAPABILITY(ACTIVE)(1)	21247	21349	21348	21329	21196	21219	21088	21088
Deactivated Reserve	305	300	300	300	300	279	279	279
COMPANY AUTHORIZED SMALL UNITS								
Bantam&Lawrence 1,2HY(3+7/81)	17	17	17	17	17	17	17	17
Brunswick Topsham HY(3/82)		12	12	12	12	12	12	12
Shawmut HY (4/82)		3	3	3	3	3	3	3
Hadley Falls #2HY (6/83)			15	15	15	15	15	15
Proctor 5 HY (11/83)			3	3	3	3	3	3
Hiram HY (4/85)					9	9	9	9
NEPOOL PLANNED UNITS								
Stony Brook CC (11/81)	341	341	341	341	341	341	341	341
Stony Brook GT (11/82)		170	170	170	170	170	170	170
Seabrook #1 NP (4/83) (2)			1150	1150	1150	1150	1150	1150
Seabrook #2 NP (2/85) (2)					1150	1150	1150	1150
Millstone #3 NP (5/86)						1150	1150	1150
Pilgrim #2 NP (11/87) (3)							1150	1150
Sears Island #1 COL (11/89)								
TOTAL CAPABILITY(1)	21910	22192	23359	23340	24366	25518	26537	26537

	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97
Existing Capability	21086	21087	21089	21089	21065	21043	21041	21041
Retirements	0	0	0	-23	-22	0	0	0
Reratings	-1	+2	0	-1	0	-1	0	0
Purchase & Sales Adjust-ments	0	0	0	0	0	-1	0	0
MEPCO/NB PURCHASE CHANGE								
NET CAPABILITY(ACTIVE)(1)	21087	21089	21089	21065	21043	21041	21041	21041
Deactivated Reserve	279	279	279	279	279	279	279	279
COMPANY AUTHORIZED SMALL UNITS								
Bantam&Lawrence 1,2HY(3+7/81)	17	17	17	17	17	17	17	17
Brunswick Topsham HY(3/82)	12	12	12	12	12	12	12	12
Shawmut HY (4/82)	3	3	3	3	3	3	3	3
Hadley Falls #2HY (6/83)	15	15	15	15	15	15	15	15
Proctor 5 HY (11/83)	3	3	3	3	3	3	3	3
Hiram HY (4/85)	9	9	9	9	9	9	9	9
NEPOOL PLANNED UNITS								
Stony Brook CC (11/81)	341	341	341	341	341	341	341	341
Stony Brook GT (11/82)	170	170	170	170	170	170	170	170
Seabrook #1 NP (4/83) (2)	1150	1150	1150	1150	1150	1150	1150	1150
Seabrook #2 NP (2/85) (2)	1150	1150	1150	1150	1150	1150	1150	1150
Millstone #3 NP (5/86)	1150	1150	1150	1150	1150	1150	1150	1150
Pilgrim #2 NP (11/87) (3)	1150	1150	1150	1150	1150	1150	1150	1150
Sears Island #1 COL (11/89)	568	568	568	568	568	568	568	568
TOTAL CAPABILITY(1)	27104	27106	27106	27082	27060	27058	27058	27058

(1) ALL FIGURES ARE ROUNDED TO THE NEAREST WHOLE NUMBER.
(2) The owners of the Seabrook Plant have the schedule under review and a delay announcement is expected.
(3) The indicated schedule is for planning purposes only, the Boston Edison Company is continuing its efforts to obtain a construction permit for Pilgrim Unit 2. However, the Nuclear Regulatory Commission has not resumed the granting of such permits following the accident at Three Mile Island. No firm date can be established at this time for either the commencement of construction or commercial operation of Pilgrim unit #2.

2.

I. NEW ENGLAND AREA SYSTEM CAPABILITIES AND PEAK LOADS

MW

	SUMMER 1980 ACTUAL	WINTER 1980/81 ACTUAL
1. NOMINAL CONVENTIONAL THERMAL CAPABILITY	12277.	12288.
2. CONVENTIONAL THERMAL CAPABILITY REDUCTION	208.	0.
3. CONVENTIONAL THERMAL CAPABILITY (1-2)		
BANGOR HYDRO ELECTRIC COMPANY	57.	60.
BOSTON EDISON COMPANY	1741.	1815.
BRAINTREE ELECTRIC LIGHT DEPARTMENT	32.	13.
CENTRAL MAINE POWER COMPANY	989.	999.
CONNECTICUT MUNICIPALS	20.	20.
EASTERN UTILITIES ASSOC.	324.	341.
FITCHBURG GAS + ELECTRIC LIGHT CO.	21.	21.
HOLYOKE GAS + ELECTRIC DEPARTMENT	25.	25.
MAINE PUBLIC SERVICE COMPANY	23.	23.
NEW ENGLAND ELECTRIC SYSTEM	2585.	2638.
NEW ENGLAND GAS + ELECTRIC ASSOC.	1300.	1322.
NEWPORT ELECTRIC CORPORATION	13.	14.
NORTHEAST UTILITIES SERVICE COMPANY	2448.	2489.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	1095.	1096.
TAUNTON MUNICIPAL LIGHT DEPARTMENT	25.	25.
UNITED ILLUMINATING COMPANY	1341.	1356.
VERMONT GROUP	31.	31.
TOTAL CONVENTIONAL THERMAL CAPABILITY	12069.	12288.
4. NOMINAL NUCLEAR CAPABILITY	4314.	4314.
5. NUCLEAR CAPABILITY REDUCTION	85.	0.
6. NUCLEAR CAPABILITY (4-5)		
BOSTON EDISON COMPANY	670.	670.
NEW ENGLAND YANKEE NUCLEAR UNITS	2040.	2114.
NORTHEAST UTILITIES SERVICE COMPANY	1518.	1530.
TOTAL NUCLEAR CAPABILITY	4228.	4314.

I. NEW ENGLAND AREA SYSTEM CAPABILITIES AND PEAK LOADS

MW

	SUMMER 1980 ACTUAL	WINTER 1980/81 ACTUAL
7. NOMINAL COMBUSTION TURBINE CAPABILITY	1450.	1450.
8. COMBUSTION TURBINE CAPABILITY REDUCTION	297.	0.
9. COMBUSTION TURBINE CAPABILITY (7-8)		
BOSTON EDISON COMPANY	254.	305.
CENTRAL MAINE POWER COMPANY	34.	43.
CONNECTICUT MUNICIPALS	16.	18.
EASTERN UTILITIES ASSOC.	40.	48.
FITCHBURG GAS + ELECTRIC LIGHT CO.	22.	28.
HOLYOKE GAS + ELECTRIC DEPARTMENT	9.	10.
NEW ENGLAND ELECTRIC SYSTEM	38.	51.
NEW ENGLAND GAS + ELECTRIC ASSOC.	38.	48.
NORTHEAST UTILITIES SERVICE COMPANY	475.	606.
PEABODY MUNICIPAL LIGHT DEPARTMENT	15.	21.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	88.	111.
UNITED ILLUMINATING COMPANY	17.	22.
VERMONT GROUP	108.	140.
TOTAL COMBUSTION TURBINE CAPABILITY	1153.	1450.
10. NOMINAL COMBINED CYCLE CAPABILITY	205.	206.
11. COMBINED CYCLE CAPABILITY REDUCTION	22.	0.
12. COMBINED CYCLE CAPABILITY (10-11)		
BRAINTREE ELECTRIC LIGHT DEPARTMENT	80.	96.
TAUNTON MUNICIPAL LIGHT DEPARTMENT	103.	110.
TOTAL COMBINED CYCLE CAPABILITY	183.	206.

I. NEW ENGLAND AREA SYSTEM CAPABILITIES AND PEAK LOADS

Mw

	SUMMER 1980 ACTUAL	WINTER 1980/81 ACTUAL
13. NOMINAL DIESEL CAPABILITY	258.	266.
14. DIESEL CAPABILITY REDUCTION	7.	0.
15. DIESEL CAPABILITY(13-14)		
BANGOR HYDRO ELECTRIC COMPANY	23.	24.
BRAINTREE ELECTRIC LIGHT DEPARTMENT	3.	5.
CENTRAL MAINE POWER COMPANY	4.	5.
CONNECTICUT MUNICIPALS	15.	15.
HUDSON LIGHT + POWER DEPARTMENT	20.	20.
IPSWICH MUNICIPAL LIGHT DEPARTMENT	9.	9.
MAINE PUBLIC SERVICE COMPANY	12.	12.
MARBLEHEAD MUNICIPAL LIGHT DEPT.	6.	6.
NEW ENGLAND ELECTRIC SYSTEM	77.	79.
NEW ENGLAND GAS + ELECTRIC ASSOC.	14.	14.
NEWPORT ELECTRIC CORPORATION	16.	16.
NORTHEAST UTILITIES SERVICE COMPANY	6.	6.
PEABODY MUNICIPAL LIGHT DEPARTMENT	10.	10.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	3.	3.
SHREWSBURY ELECTRIC LIGHT DEPT.	14.	14.
VERMONT GROUP	21.	21.
TOTAL DIESEL CAPABILITY	251.	266.
16. NEW GENERATION TYPES	0.	0.
17. NOMINAL HYDRO CAPABILITY	1318.	1318.
18. HYDRO CAPABILITY REDUCTION	72.	41.
19. DEPENDABLE ADVERSE HYDRO CAPABILITY (17-18)		
BANGOR HYDRO ELECTRIC COMPANY	25.	29.
CENTRAL MAINE POWER COMPANY	301.	301.
CONNECTICUT MUNICIPALS	0.	1.
HOLYOKE GAS + ELECTRIC DEPARTMENT	3.	3.
MAINE PUBLIC SERVICE COMPANY	2.	2.
NEW ENGLAND ELECTRIC SYSTEM	592.	586.
NORTHEAST UTILITIES SERVICE COMPANY	232.	234.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	52.	52.
VERMONT GROUP	41.	70.
TOTAL DEPENDABLE ADVERSE HYDRO CAPABILITY	1246.	1276.

I. NEW ENGLAND AREA SYSTEM CAPABILITIES AND PEAK LOADS

MW

	SUMMER 1980 ACTUAL	WINTER 1980/81 ACTUAL
20. NOMINAL PUMPED STORAGE CAPABILITY	1631.	1631.
21. PUMPED STORAGE CAPABILITY REDUCTION	0.	0.
22. DEPENDABLE PUMPED STORAGE CAPABILITY(20-21)		
NEW ENGLAND ELECTRIC SYSTEM	602.	602.
NORTHEAST UTILITIES SERVICE COMPANY	1029.	1029.
TOTAL DEPENDABLE PUMPED STORAGE CAPABILITY	1631.	1631.
23. FIRM PURCHASES WITHIN THE NEW ENGLAND AREA		
BOSTON EDISON COMPANY	1.	1.
CENTRAL MAINE POWER COMPANY	6.	6.
TOTAL FIRM PURCHASES WITHIN THE NEW ENGLAND AREA	7.	7.
24. FIRM PURCHASES OUTSIDE THE NEW ENGLAND AREA		
CENTRAL MAINE POWER COMPANY	400.	133.
MAINE PUBLIC SERVICE COMPANY	33.	31.
VERMONT GROUP	188.	188.
TOTAL FIRM PURCHASES OUTSIDE THE NEW ENGLAND AREA	621.	352.
25. FIRM OBLIGATIONS OUTSIDE THE NEW ENGLAND AREA		
NORTHEAST UTILITIES SERVICE COMPANY	0.	50.
TOTAL FIRM OBLIGATIONS OUTSIDE THE NEW ENGLAND AREA	0.	50.

I. NEW ENGLAND AREA SYSTEM CAPABILITIES AND PEAK LOADS

MW

	SUMMER 1980 ACTUAL	WINTER 1980/81 ACTUAL
* 26. TOTAL CAPABILITY (3.+6.+9.+12.+15.+19.+22.+23.+24.AND -25)	21389.	21741.
27. COINCIDENT LOAD	14986. 7/21/80 1400 HR.	15620. 1/12/81 1800 HR.
28. UNAVAILABLE CAPACITY	4463.	4425.
29. RESERVE MARGIN AFTER MAINTENANCE	1940.	1696.
30. PERCENT RESERVE AFTER MAINTENANCE	12.9	10.9

*All figures are shown rounded to the nearest whole number. Thus, summing the rounded capabilities by company and category may differ from the indicated totals.

II. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	MAR. 1981	APR. 1981	MAY 1981	JUNE 1981	JULY 1981	AUG. 1981	SEP. 1981	OCT. 1981	NOV. 1981	DEC. 1981
1. NOMINAL CONVENTIONAL THERMAL CAPABILITY	12263.	12263.	12245.	12245.	12245.	12245.	12245.	12245.	12245.	12245.
2. CONVENTIONAL THERMAL CAPABILITY REDUCTION	0.	0.	0.	167.	167.	167.	167.	0.	0.	0.
3. CONVENTIONAL THERMAL CAPABILITY (1-2)										
BANGOR HYDRO ELECTRIC COMPANY	60.	60.	60.	57.	57.	57.	57.	60.	60.	60.
BOSTON EDISON COMPANY	1790.	1790.	1790.	1765.	1765.	1765.	1765.	1790.	1790.	1790.
BRAINTREE ELECTRIC LIGHT DEPARTMENT	13.	13.	13.	32.	32.	32.	32.	13.	13.	13.
CENTRAL MAINE POWER COMPANY	999.	999.	999.	973.	973.	973.	973.	999.	999.	999.
CONNECTICUT MUNICIPALS	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
EASTERN UTILITIES ASSOC.	341.	341.	341.	334.	334.	334.	334.	341.	341.	341.
FITCHBURG GAS + ELECTRIC LIGHT CO.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.
HOLYOKE GAS + ELECTRIC DEPARTMENT	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.
MAINE PUBLIC SERVICE COMPANY	23.	23.	23.	23.	23.	23.	23.	23.	23.	23.
NEW ENGLAND ELECTRIC SYSTEM	2638.	2638.	2638.	2581.	2581.	2581.	2581.	2638.	2638.	2638.
NEW ENGLAND GAS + ELECTRIC ASSOC.	1322.	1322.	1304.	1283.	1283.	1283.	1283.	1304.	1304.	1304.
NEWPORT ELECTRIC CORPORATION	14.	14.	14.	13.	13.	13.	13.	14.	14.	14.
NORTHEAST UTILITIES SERVICE COMPANY	2489.	2489.	2489.	2448.	2448.	2448.	2448.	2489.	2489.	2489.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	1096.	1096.	1096.	1095.	1095.	1095.	1095.	1096.	1096.	1096.
TAUNTON MUNICIPAL LIGHT DEPARTMENT	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.
UNITED ILLUMINATING COMPANY	1356.	1356.	1356.	1353.	1353.	1353.	1353.	1356.	1356.	1356.
VERMONT GROUP	31.	31.	31.	31.	31.	31.	31.	31.	31.	31.
TOTAL CONVENTIONAL THERMAL CAPABILITY	12263.	12263.	12245.	12078.	12078.	12078.	12078.	12245.	12245.	12245.
4. NOMINAL NUCLEAR CAPABILITY	4314.	4314.	4314.	4314.	4314.	4314.	4314.	4314.	4338.	4338.
6. NUCLEAR CAPABILITY (4-5)										
BOSTON EDISON COMPANY	670.	670.	670.	670.	670.	670.	670.	670.	670.	670.
NEW ENGLAND YANKEE NUCLEAR UNITS	2114.	2114.	2114.	2040.	2040.	2040.	2040.	2114.	2138.	2138.
NORTHEAST UTILITIES SERVICE COMPANY	1530.	1530.	1530.	1518.	1518.	1518.	1518.	1530.	1530.	1530.
TOTAL NUCLEAR CAPABILITY	4314.	4314.	4314.	4228.	4228.	4228.	4228.	4314.	4338.	4338.

II. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	MAR. 1981	APR. 1981	MAY 1981	JUNE 1981	JULY 1981	AUG. 1981	SEP. 1981	OCT. 1981	NOV. 1981	DEC. 1981
7. NOMINAL COMBUSTION TURBINE CAPABILITY	1450.	1450.	1398.	1398.	1398.	1398.	1398.	1398.	1398.	1398.
8. COMBUSTION TURBINE CAPABILITY REDUCTION	0.	0.	0.	393.	393.	393.	393.	0.	0.	0.
9. COMBUSTION TURBINE CAPABILITY (7-8)										
BOSTON EDISON COMPANY	305.	305.	305.	146.	146.	146.	146.	305.	305.	305.
CENTRAL MAINE POWER COMPANY	43.	43.	43.	34.	34.	34.	34.	43.	43.	43.
CONNECTICUT MUNICIPALS	18.	18.	18.	15.	15.	15.	15.	18.	18.	18.
EASTERN UTILITIES ASSOC.	48.	48.	48.	40.	40.	40.	40.	48.	48.	48.
FITCHBURG GAS + ELECTRIC LIGHT CO.	28.	28.	28.	22.	22.	22.	22.	28.	28.	28.
HOLYOKE GAS + ELECTRIC DEPARTMENT	10.	10.	10.	9.	9.	9.	9.	10.	10.	10.
NEW ENGLAND ELECTRIC SYSTEM	51.	51.	51.	38.	38.	38.	38.	51.	51.	51.
NEW ENGLAND GAS + ELECTRIC ASSOC.	48.	48.	48.	38.	38.	38.	38.	48.	48.	48.
NORTHEAST UTILITIES SERVICE COMPANY	606.	606.	554.	435.	435.	435.	435.	554.	554.	554.
PEABODY MUNICIPAL LIGHT DEPARTMENT	21.	21.	21.	15.	15.	15.	15.	21.	21.	21.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	111.	111.	111.	88.	88.	88.	88.	111.	111.	111.
UNITED ILLUMINATING COMPANY	22.	22.	22.	17.	17.	17.	17.	22.	22.	22.
VERMONT GROUP	140.	140.	140.	108.	108.	108.	108.	140.	140.	140.
TOTAL COMBUSTION TURBINE CAPABILITY	1450.	1450.	1398.	1005.	1005.	1005.	1005.	1398.	1398.	1398.
10. NOMINAL COMBINED CYCLE CAPABILITY	206.	206.	206.	206.	206.	206.	206.	206.	547.	547.
11. COMBINED CYCLE CAPABILITY REDUCTION	0.	0.	0.	23.	23.	23.	23.	0.	0.	0.
12. COMBINED CYCLE CAPABILITY (10-11)										
BRAINTREE ELECTRIC LIGHT DEPARTMENT	96.	96.	96.	80.	80.	80.	80.	96.	96.	96.
MASS. MUNICIPAL WHOLESALE ELECTRIC	0.	0.	0.	0.	0.	0.	0.	0.	341.	341.
TAUNTON MUNICIPAL LIGHT DEPARTMENT	110.	110.	110.	103.	103.	103.	103.	110.	110.	110.
TOTAL COMBINED CYCLE CAPABILITY	206.	206.	206.	183.	183.	183.	183.	206.	547.	547.

II. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	MAR. 1981	APR. 1981	MAY 1981	JUNE 1981	JULY 1981	AUG. 1981	SEP. 1981	OCT. 1981	NOV. 1981	DEC. 1981
13. NOMINAL DIESEL CAPABILITY	266.	266.	266.	263.	263.	263.	263.	263.	263.	263.
14. DIESEL CAPABILITY REDUCTION	0.	0.	0.	4.	4.	4.	4.	0.	0.	0.
15. DIESEL CAPABILITY(13-14)										
BANGOR HYDRO ELECTRIC COMPANY	24.	24.	24.	20.	20.	20.	20.	21.	21.	21.
BRAINTREE ELECTRIC LIGHT DEPARTMENT	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
CENTRAL MAINE POWER COMPANY	5.	5.	5.	4.	4.	4.	4.	5.	5.	5.
CHICOPEE LIGHT DEPARTMENT	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
CONNECTICUT MUNICIPALS	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
HUDSON LIGHT + POWER DEPARTMENT	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
IPSWICH MUNICIPAL LIGHT DEPARTMENT	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.
MAINE PUBLIC SERVICE COMPANY	12.	12.	12.	12.	12.	12.	12.	12.	12.	12.
MARBLEHEAD MUNICIPAL LIGHT DEPT.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
NEW ENGLAND ELECTRIC SYSTEM	79.	79.	79.	77.	77.	77.	77.	79.	79.	79.
NEW ENGLAND GAS + ELECTRIC ASSOC.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
NEWPORT ELECTRIC CORPORATION	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
NORTHEAST UTILITIES SERVICE COMPANY	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
PEABODY MUNICIPAL LIGHT DEPARTMENT	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
SHREWSBURY ELECTRIC LIGHT DEPT.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
VERMONT GROUP	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.
TOTAL DIESEL CAPABILITY	266.	266.	266.	259.	259.	259.	259.	263.	263.	263.
16. NEW GENERATION TYPES										
17. NOMINAL HYDRO CAPABILITY	1318.	1318.	1318.	1318.	1335.	1335.	1335.	1335.	1341.	1341.
18. HYDRO CAPABILITY REDUCTION	119.	122.	85.	62.	80.	72.	75.	64.	34.	32.
19. DEPENDABLE ADVERSE HYDRO CAPABILITY (17-18)										
BANGOR HYDRO ELECTRIC COMPANY	28.	24.	25.	28.	26.	25.	24.	23.	27.	28.
CENTRAL MAINE POWER COMPANY	301.	301.	301.	301.	301.	301.	301.	301.	301.	301.
CONNECTICUT MUNICIPALS	1.	2.	2.	1.	0.	0.	0.	1.	1.	1.
HOLYOKE GAS + ELECTRIC DEPARTMENT	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
MAINE PUBLIC SERVICE COMPANY	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
NEW ENGLAND ELECTRIC SYSTEM	505.	515.	542.	592.	609.	609.	609.	609.	609.	609.
NORTHEAST UTILITIES SERVICE COMPANY	234.	234.	232.	232.	232.	232.	232.	232.	234.	234.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	52.	52.	52.	52.	52.	52.	52.	52.	57.	57.
VERMONT GROUP	75.	65.	77.	47.	31.	41.	37.	50.	74.	74.
TOTAL DEPENDABLE ADVERSE HYDRO CAPABILITY	1199.	1196.	1234.	1256.	1255.	1263.	1260.	1271.	1307.	1309.

II. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	MAR. 1981	APR. 1981	MAY 1981	JUNE 1981	JULY 1981	AUG. 1981	SEP. 1981	OCT. 1981	NOV. 1981	DEC. 1981
20. NOMINAL PUMPED STORAGE CAPABILITY	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.
21. PUMPED STORAGE CAPABILITY REDUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
22. DEPENDABLE PUMPED STORAGE CAPABILITY(20-21)										
NEW ENGLAND ELECTRIC SYSTEM	602.	602.	602.	602.	602.	602.	602.	602.	602.	602.
NORTHEAST UTILITIES SERVICE COMPANY	1029.	1029.	1029.	1029.	1029.	1029.	1029.	1029.	1029.	1029.
TOTAL DEPENDABLE PUMPED STORAGE CAPABILITY	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.
23. FIRM PURCHASES WITHIN THE NEW ENGLAND AREA										
BOSTON EDISON COMPANY	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
CENTRAL MAINE POWER COMPANY	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TOTAL FIRM PURCHASES WITHIN THE NEW ENGLAND AREA	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
24. FIRM PURCHASES OUTSIDE THE NEW ENGLAND AREA										
CENTRAL MAINE POWER COMPANY	133.	133.	133.	133.	133.	133.	133.	133.	133.	133.
MAINE PUBLIC SERVICE COMPANY	31.	31.	31.	31.	31.	31.	31.	31.	31.	31.
VERMONT GROUP	188.	159.	159.	191.	191.	191.	191.	159.	159.	159.
TOTAL FIRM PURCHASES OUTSIDE THE NEW ENGLAND AREA	352.	323.	323.	355.	355.	355.	355.	323.	323.	323.
25. FIRM OBLIGATIONS OUTSIDE THE NEW ENGLAND AREA										
NORTHEAST UTILITIES SERVICE COMPANY	50.	50.	50.	0.	0.	0.	0.	50.	142.	142.
TOTAL FIRM OBLIGATIONS OUTSIDE THE NEW ENGLAND AREA	50.	50.	50.	0.	0.	0.	0.	50.	142.	142.

II. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	MAR. 1981	APR. 1981	MAY 1981	JUNE 1981	JULY 1981	AUG. 1981	SEP. 1981	OCT. 1981	NOV. 1981	DEC. 1981
*26. TOTAL CAPABILITY (3,+6,+9,+12,+15,+19, +22,+23,+24,AND -25)	21639.	21606.	21573.	21002.	21001.	21009.	21005.	21608.	21917.	21919.
27. COINCIDENT LOAD	13570.	12640.	12220.	14240.	14050.	14780.	13480.	13430.	14810.	15920.
28. SCHEDULED MAINTENANCE	1194.	2684.	3816.	2042.	1299.	1545.	2780.	2984.	2147.	1270.
29. RESERVE MARGIN AFTER MAINTENANCE	6875.	6282.	5537.	4720.	5652.	4684.	4745.	5194.	4960.	4729.
30. PERCENT RESERVE AFTER MAINTENANCE	50.7	49.7	45.3	33.1	40.2	31.7	35.2	38.7	33.5	29.7

*All figures are shown rounded to the nearest whole number. Thus, summing the rounded capabilities by company and category may differ from the indicated totals.

III. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	JAN. 1982	FEB. 1982	MAR. 1982	APR. 1982	MAY 1982	JUNE 1982	JULY 1982	AUG. 1982	SEP. 1982	OCT. 1982	NOV. 1982	DEC. 1982
1. NOMINAL CONVENTIONAL THERMAL CAPABILITY	12245.	12245.	12245.	12245.	12245.	12245.	12245.	12245.	12245.	12245.	12241.	12241.
2. CONVENTIONAL THERMAL CAPABILITY REDUCTION	0.	0.	0.	0.	0.	167.	167.	167.	167.	0.	0.	0.
3. CONVENTIONAL THERMAL CAPABILITY (1-2)												
BANGOR HYDRO ELECTRIC COMPANY	60.	60.	60.	60.	60.	57.	57.	57.	57.	60.	60.	60.
BOSTON EDISON COMPANY	1790.	1790.	1790.	1790.	1790.	1765.	1765.	1765.	1765.	1790.	1790.	1790.
BRAINTREE ELECTRIC LIGHT DEPARTMENT	13.	13.	13.	13.	13.	32.	32.	32.	32.	13.	13.	13.
CENTRAL MAINE POWER COMPANY	999.	999.	999.	999.	999.	973.	973.	973.	973.	999.	999.	999.
CONNECTICUT MUNICIPALS	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
EASTERN UTILITIES ASSOC.	341.	341.	341.	341.	341.	334.	334.	334.	334.	341.	341.	341.
FITCHBURG GAS + ELECTRIC LIGHT CO.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.
HOLYOKE GAS + ELECTRIC DEPARTMENT	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.
MAINE PUBLIC SERVICE COMPANY	23.	23.	23.	23.	23.	23.	23.	23.	23.	23.	23.	23.
NEW ENGLAND ELECTRIC SYSTEM	2638.	2638.	2638.	2638.	2638.	2581.	2581.	2581.	2581.	2638.	2638.	2638.
NEW ENGLAND GAS + ELECTRIC ASSOC.	1304.	1304.	1304.	1304.	1304.	1283.	1283.	1283.	1283.	1304.	1304.	1304.
NEWPORT ELECTRIC CORPORATION	14.	14.	14.	14.	14.	13.	13.	13.	13.	14.	14.	14.
NORTHEAST UTILITIES SERVICE COMPANY	2489.	2489.	2489.	2489.	2489.	2448.	2448.	2448.	2448.	2489.	2489.	2489.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	1096.	1096.	1096.	1096.	1096.	1095.	1095.	1095.	1095.	1096.	1096.	1096.
TAUNTON MUNICIPAL LIGHT DEPARTMENT	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.
UNITED ILLUMINATING COMPANY	1356.	1356.	1356.	1356.	1356.	1353.	1353.	1353.	1353.	1356.	1356.	1356.
VERMONT GROUP	31.	31.	31.	31.	31.	31.	31.	31.	31.	31.	27.	27.
TOTAL CONVENTIONAL THERMAL CAPABILITY	12245.	12245.	12245.	12245.	12245.	12078.	12078.	12078.	12078.	12245.	12241.	12241.
4. NOMINAL NUCLEAR CAPABILITY	4338.	4338.	4338.	4338.	4338.	4338.	4338.	4338.	4338.	4338.	4338.	4338.
5. NUCLEAR CAPABILITY REDUCTION	0.	0.	0.	0.	0.	109.	109.	109.	109.	0.	0.	0.
6. NUCLEAR CAPABILITY (4-5)												
BOSTON EDISON COMPANY	670.	670.	670.	670.	670.	670.	670.	670.	670.	670.	670.	670.
NEW ENGLAND YANKEE NUCLEAR UNITS	2138.	2138.	2138.	2138.	2138.	2040.	2040.	2040.	2040.	2138.	2138.	2138.
NORTHEAST UTILITIES SERVICE COMPANY	1530.	1530.	1530.	1530.	1530.	1518.	1518.	1518.	1518.	1530.	1530.	1530.
TOTAL NUCLEAR CAPABILITY	4338.	4338.	4338.	4338.	4338.	4228.	4228.	4228.	4228.	4338.	4338.	4338.

III. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	JAN. 1982	FEB. 1982	MAR. 1982	APR. 1982	MAY 1982	JUNE 1982	JULY 1982	AUG. 1982	SEP. 1982	OCT. 1982	NOV. 1982	DEC. 1982
7. NOMINAL COMBUSTION TURBINE CAPABILITY	1398.	1398.	1398.	1398.	1398.	1398.	1398.	1398.	1398.	1398.	1562.	1562.
8. COMBUSTION TURBINE CAPABILITY REDUCTION	0.	0.	0.	0.	0.	393.	393.	393.	393.	0.	0.	0.
9. COMBUSTION TURBINE CAPABILITY (7-8)												
BOSTON EDISON COMPANY	305.	305.	305.	305.	305.	146.	146.	146.	146.	305.	305.	305.
CENTRAL MAINE POWER COMPANY	43.	43.	43.	43.	43.	34.	34.	34.	34.	43.	43.	43.
CONNECTICUT MUNICIPALS	18.	18.	18.	18.	18.	15.	15.	15.	15.	18.	18.	18.
EASTERN UTILITIES ASSOC.	48.	48.	48.	48.	48.	40.	40.	40.	40.	48.	48.	48.
FITCHBURG GAS + ELECTRIC LIGHT CO.	28.	28.	28.	28.	28.	22.	22.	22.	22.	28.	27.	27.
HOLYOKE GAS + ELECTRIC DEPARTMENT	10.	10.	10.	10.	10.	9.	9.	9.	9.	10.	10.	10.
MASS. MUNICIPAL WHOLESALE ELECTRIC	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	170.	170.
NEW ENGLAND ELECTRIC SYSTEM	51.	51.	51.	51.	51.	38.	38.	38.	38.	51.	51.	51.
NEW ENGLAND GAS + ELECTRIC ASSOC.	48.	48.	48.	48.	48.	38.	38.	38.	38.	48.	48.	48.
NORTHEAST UTILITIES SERVICE COMPANY	554.	554.	554.	554.	554.	435.	435.	435.	435.	554.	554.	554.
PEABODY MUNICIPAL LIGHT DEPARTMENT	21.	21.	21.	21.	21.	15.	15.	15.	15.	21.	21.	21.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	111.	111.	111.	111.	111.	88.	88.	88.	88.	111.	111.	111.
UNITED ILLUMINATING COMPANY	22.	22.	22.	22.	22.	17.	17.	17.	17.	22.	22.	22.
VERMONT GROUP	140.	140.	140.	140.	140.	108.	108.	108.	108.	140.	134.	134.
TOTAL COMBUSTION TURBINE CAPABILITY	1398.	1398.	1398.	1398.	1398.	1005.	1005.	1005.	1005.	1398.	1562.	1562.
10. NOMINAL COMBINED CYCLE CAPABILITY	547.	547.	547.	547.	547.	547.	547.	547.	547.	547.	547.	547.
11. COMBINED CYCLE CAPABILITY REDUCTION	0.	0.	0.	0.	0.	85.	85.	85.	85.	0.	0.	0.
12. COMBINED CYCLE CAPABILITY (10-11)												
BRAINTREE ELECTRIC LIGHT DEPARTMENT	96.	96.	96.	96.	96.	80.	80.	80.	80.	96.	96.	96.
MASS. MUNICIPAL WHOLESALE ELECTRIC	341.	341.	341.	341.	341.	279.	279.	279.	279.	341.	341.	341.
TAUNTON MUNICIPAL LIGHT DEPARTMENT	110.	110.	110.	110.	110.	103.	103.	103.	103.	110.	110.	110.
TOTAL COMBINED CYCLE CAPABILITY	547.	547.	547.	547.	547.	462.	462.	462.	462.	547.	547.	547.

III. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	JAN. 1982	FEB. 1982	MAR. 1982	APR. 1982	MAY 1982	JUNE 1982	JULY 1982	AUG. 1982	SEP. 1982	OCT. 1982	NOV. 1982	DEC. 1982
13. NOMINAL DIESEL CAPABILITY	263.	263.	263.	263.	263.	263.	263.	263.	263.	263.	263.	263.
14. DIESEL CAPABILITY REDUCTION	0.	0.	0.	0.	0.	4.	4.	4.	4.	0.	0.	0.
15. DIESEL CAPABILITY(13-14)												
BANGOR HYDRO ELECTRIC COMPANY	21.	21.	21.	21.	21.	20.	20.	20.	20.	21.	21.	21.
BRAINTREE ELECTRIC LIGHT DEPARTMENT	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
CENTRAL MAINE POWER COMPANY	5.	5.	5.	5.	5.	4.	4.	4.	4.	5.	5.	5.
CHICOPEE LIGHT DEPARTMENT	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
CONNECTICUT MUNICIPALS	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
HUDSON LIGHT + POWER DEPARTMENT	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
IPSWICH MUNICIPAL LIGHT DEPARTMENT	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.
MAINE PUBLIC SERVICE COMPANY	12.	12.	12.	12.	12.	12.	12.	12.	12.	12.	12.	12.
MARBLEHEAD MUNICIPAL LIGHT DEPT.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
NEW ENGLAND ELECTRIC SYSTEM	79.	79.	79.	79.	79.	77.	77.	77.	77.	79.	79.	79.
NEW ENGLAND GAS + ELECTRIC ASSOC.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
NEWPORT ELECTRIC CORPORATION	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
NORTHEAST UTILITIES SERVICE COMPANY	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
PEABODY MUNICIPAL LIGHT DEPARTMENT	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
SHREWSBURY ELECTRIC LIGHT DEPT.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
VERMONT GROUP	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.
TOTAL DIESEL CAPABILITY	263.	263.	263.	263.	263.	259.	259.	259.	259.	263.	263.	263.
16. NEW GENERATION TYPES												
17. NOMINAL HYDRO CAPABILITY	1341.	1341.	1353.	1357.	1357.	1357.	1357.	1357.	1357.	1357.	1357.	1357.
18. HYDRO CAPABILITY REDUCTION	41.	89.	119.	122.	85.	62.	80.	72.	75.	64.	34.	32.
19. DEPENDABLE ADVERSE HYDRO CAPABILITY (17-18)												
BANGOR HYDRO ELECTRIC COMPANY	29.	28.	28.	24.	25.	28.	26.	25.	24.	23.	27.	28.
CENTRAL MAINE POWER COMPANY	301.	301.	313.	316.	316.	316.	316.	316.	316.	316.	316.	316.
CONNECTICUT MUNICIPALS	1.	1.	1.	2.	2.	1.	0.	0.	0.	1.	1.	1.
HOLYOKE GAS + ELECTRIC DEPARTMENT	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
MAINE PUBLIC SERVICE COMPANY	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
NEW ENGLAND ELECTRIC SYSTEM	603.	561.	522.	532.	559.	609.	609.	609.	609.	609.	609.	609.
NORTHEAST UTILITIES SERVICE COMPANY	235.	235.	235.	235.	233.	233.	233.	233.	233.	233.	235.	235.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	57.	57.	57.	57.	57.	57.	57.	57.	57.	57.	57.	57.
VERMONT GROUP	70.	66.	75.	65.	77.	47.	31.	41.	37.	50.	74.	74.
TOTAL DEPENDABLE ADVERSE HYDRO CAPABILITY	1300.	1252.	1235.	1235.	1273.	1296.	1278.	1286.	1282.	1294.	1324.	1325.

III. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	JAN. 1982	FEB. 1982	MAR. 1982	APR. 1982	MAY 1982	JUNE 1982	JULY 1982	AUG. 1982	SEP. 1982	OCT. 1982	NOV. 1982	DEC. 1982
20. NOMINAL PUMPED STORAGE CAPABILITY	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.
21. PUMPED STORAGE CAPABILITY REDUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
22. DEPENDABLE PUMPED STORAGE CAPABILITY(20-21)												
NEW ENGLAND ELECTRIC SYSTEM	602.	602.	602.	602.	602.	602.	602.	602.	602.	602.	602.	602.
NORTHEAST UTILITIES SERVICE COMPANY	1029.	1029.	1029.	1029.	1029.	1029.	1029.	1029.	1029.	1029.	1029.	1029.
TOTAL DEPENDABLE PUMPED STORAGE CAPABILITY	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.
23. FIRM PURCHASES WITHIN THE NEW ENGLAND AREA												
BOSTON EDISON COMPANY	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
CENTRAL MAINE POWER COMPANY	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TOTAL FIRM PURCHASES WITHIN THE NEW ENGLAND AREA	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
24. FIRM PURCHASES OUTSIDE THE NEW ENGLAND AREA												
CENTRAL MAINE POWER COMPANY	133.	133.	133.	133.	133.	133.	133.	133.	133.	133.	133.	133.
MAINE PUBLIC SERVICE COMPANY	31.	31.	31.	31.	31.	31.	31.	31.	31.	31.	31.	31.
VERMONT GROUP	159.	159.	159.	159.	159.	196.	196.	196.	196.	159.	159.	159.
TOTAL FIRM PURCHASES OUTSIDE THE NEW ENGLAND AREA	323.	323.	323.	323.	323.	360.	360.	360.	360.	323.	323.	323.
25. FIRM OBLIGATIONS OUTSIDE THE NEW ENGLAND AREA												
NORTHEAST UTILITIES SERVICE COMPANY	142.	142.	142.	142.	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL FIRM OBLIGATIONS OUTSIDE THE NEW ENGLAND AREA	142.	142.	142.	142.	0.	0.	0.	0.	0.	0.	0.	0.

16.

III. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	JAN. 1982	FEB. 1982	MAR. 1982	APR. 1982	MAY 1982	JUNE 1982	JULY 1982	AUG. 1982	SEP. 1982	OCT. 1982	NOV. 1982	DEC. 1982
* 26. TOTAL CAPABILITY (3.,+6.,+9.,+12.,+15.,+19., +22.,+23.,+24.,AND -25)	21910.	21862.	21845.	21845.	22025.	21325.	21307.	21315.	21311.	22046.	22235.	22237.
27. COINCIDENT LOAD	15830.	15480.	13940.	13000.	12560.	14610.	14410.	15170.	13840.	13780.	15200.	16350.
28. SCHEDULED MAINTENANCE	864.	864.	1035.	2200.	4052.	800.	100.	1300.	2100.	2600.	500.	600.
29. RESERVE MARGIN AFTER MAINTENANCE	5216.	5518.	6870.	6645.	5413.	5915.	6797.	4845.	5371.	5666.	6535.	5287.
30. PERCENT RESERVE AFTER MAINTENANCE	33.0	35.6	49.3	51.1	43.1	40.5	47.2	31.9	38.8	41.1	43.0	32.3

*All figures are shown rounded to the nearest whole number. Thus, summing the rounded capabilities by company and category may differ from the indicated totals.

IV. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	WINTER 1982/83	SUMMER 1983	WINTER 1983/84	SUMMER 1984	WINTER 1984/85	SUMMER 1985	WINTER 1985/86	SUMMER 1986	WINTER 1986/87	SUMMER 1987
1. NOMINAL CONVENTIONAL THERMAL CAPABILITY	12241.	12241.	12241.	12241.	12241.	12241.	12241.	12241.	12243.	12243.
2. CONVENTIONAL THERMAL CAPABILITY REDUCTION	0.	167.	0.	167.	0.	167.	0.	167.	0.	169.
3. CONVENTIONAL THERMAL CAPABILITY (1-2)										
BANGOR HYDRO ELECTRIC COMPANY	60.	57.	60.	57.	60.	57.	60.	57.	60.	57.
BOSTON EDISON COMPANY	1790.	1765.	1790.	1765.	1790.	1765.	1790.	1765.	1790.	1765.
BRAINTREE ELECTRIC LIGHT DEPARTMENT	13.	32.	13.	32.	13.	32.	13.	32.	13.	32.
CENTRAL MAINE POWER COMPANY	999.	973.	999.	973.	999.	973.	999.	973.	999.	973.
CONNECTICUT MUNICIPALS	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
EASTERN UTILITIES ASSOC.	341.	334.	341.	334.	341.	334.	341.	334.	341.	334.
FITCHBURG GAS + ELECTRIC LIGHT CO.	21.	21.	21.	21.	21.	21.	21.	21.	23.	21.
HOLYOKE GAS + ELECTRIC DEPARTMENT	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.
MAINE PUBLIC SERVICE COMPANY	23.	23.	23.	23.	23.	23.	23.	23.	23.	23.
NEW ENGLAND ELECTRIC SYSTEM	2638.	2581.	2638.	2581.	2638.	2581.	2638.	2581.	2638.	2581.
NEW ENGLAND GAS + ELECTRIC ASSOC.	1304.	1283.	1304.	1283.	1304.	1283.	1304.	1283.	1304.	1283.
NEWPORT ELECTRIC CORPORATION	14.	13.	14.	13.	14.	13.	14.	13.	14.	13.
NORTHEAST UTILITIES SERVICE COMPANY	2489.	2448.	2489.	2448.	2489.	2448.	2489.	2448.	2489.	2448.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	1096.	1095.	1096.	1095.	1096.	1095.	1096.	1095.	1096.	1095.
TAUNTON MUNICIPAL LIGHT DEPARTMENT	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.
UNITED ILLUMINATING COMPANY	1356.	1353.	1356.	1353.	1356.	1353.	1356.	1353.	1356.	1353.
VERMONT GROUP	27.	27.	27.	27.	27.	27.	27.	27.	27.	27.
TOTAL CONVENTIONAL THERMAL CAPABILITY	12241.	12074.	12241.	12074.	12241.	12074.	12241.	12074.	12243.	12075.
4. NOMINAL NUCLEAR CAPABILITY	4338.	5488.	5488.	5488.	5488.	6638.	6638.	7788.	7788.	7788.
5. NUCLEAR CAPABILITY REDUCTION	0.	109.	0.	109.	0.	109.	0.	109.	0.	109.
6. NUCLEAR CAPABILITY (4-5)										
BOSTON EDISON COMPANY	670.	670.	670.	670.	670.	670.	670.	670.	670.	670.
NEW ENGLAND YANKEE NUCLEAR UNITS	2138.	2040.	2138.	2040.	2138.	2040.	2138.	2040.	2138.	2040.
NORTHEAST UTILITIES SERVICE COMPANY	1530.	1518.	1530.	1518.	1530.	1518.	1530.	2668.	2680.	2668.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	0.	1150.	1150.	1150.	1150.	2300.	2300.	2300.	2300.	2300.
TOTAL NUCLEAR CAPABILITY	4338.	5378.	5488.	5378.	5488.	6528.	6638.	7678.	7788.	7678.

19.

IV. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	WINTER 1982/83	SUMMER 1983	WINTER 1983/84	SUMMER 1984	WINTER 1984/85	SUMMER 1985	WINTER 1985/86	SUMMER 1986	WINTER 1986/87	SUMMER 1987
7. NOMINAL COMBUSTION TURBINE CAPABILITY	1526.	1526.	1526.	1526.	1519.	1519.	1521.	1521.	1521.	1521.
8. COMBUSTION TURBINE CAPABILITY REDUCTION	0.	425.	0.	425.	0.	424.	0.	424.	0.	424.
9. COMBUSTION TURBINE CAPABILITY (7-8)										
BOSTON EDISON COMPANY	305.	146.	305.	146.	305.	146.	305.	146.	305.	146.
CENTRAL MAINE POWER COMPANY	43.	34.	43.	34.	43.	34.	43.	34.	43.	34.
CONNECTICUT MUNICIPALS	18.	15.	18.	15.	18.	15.	18.	15.	18.	15.
EASTERN UTILITIES ASSOC.	48.	40.	48.	40.	48.	40.	48.	40.	48.	40.
FITCHBURG GAS + ELECTRIC LIGHT CO.	27.	21.	27.	21.	26.	20.	28.	22.	28.	22.
HOLYOKE GAS + ELECTRIC DEPARTMENT	10.	9.	10.	9.	10.	9.	10.	9.	10.	9.
MASS. MUNICIPAL WHOLESALE ELECTRIC	170.	130.	170.	130.	170.	130.	170.	130.	170.	130.
NEW ENGLAND ELECTRIC SYSTEM	51.	38.	51.	38.	51.	38.	51.	38.	51.	38.
NEW ENGLAND GAS + ELECTRIC ASSOC.	48.	38.	48.	38.	48.	38.	48.	38.	48.	38.
NORTHEAST UTILITIES SERVICE COMPANY	518.	407.	518.	407.	518.	407.	518.	407.	518.	407.
PEABODY MUNICIPAL LIGHT DEPARTMENT	21.	15.	21.	15.	21.	15.	21.	15.	21.	15.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	111.	88.	111.	88.	111.	88.	111.	88.	111.	88.
UNITED ILLUMINATING COMPANY	22.	17.	22.	17.	22.	17.	22.	17.	22.	17.
VERMONT GROUP	134.	103.	134.	103.	129.	99.	129.	99.	129.	99.
TOTAL COMBUSTION TURBINE CAPABILITY	1526.	1101.	1526.	1101.	1519.	1096.	1521.	1097.	1521.	1097.
10. NOMINAL COMBINED CYCLE CAPABILITY	547.	547.	547.	547.	547.	547.	547.	547.	547.	547.
11. COMBINED CYCLE CAPABILITY REDUCTION	0.	85.	0.	85.	0.	85.	0.	85.	0.	85.
12. COMBINED CYCLE CAPABILITY (10-11)										
BRAINTREE ELECTRIC LIGHT DEPARTMENT	96.	80.	96.	80.	96.	80.	96.	80.	96.	80.
MASS. MUNICIPAL WHOLESALE ELECTRIC	341.	279.	341.	279.	341.	279.	341.	279.	341.	279.
TAUNTON MUNICIPAL LIGHT DEPARTMENT	110.	103.	110.	103.	110.	103.	110.	103.	110.	103.
TOTAL COMBINED CYCLE CAPABILITY	547.	462.	547.	462.	547.	462.	547.	462.	547.	462.

IV. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	WINTER 1982/83	SUMMER 1983	WINTER 1983/84	SUMMER 1984	WINTER 1984/85	SUMMER 1985	WINTER 1985/86	SUMMER 1986	WINTER 1986/87	SUMMER 1987
13. NOMINAL DIESEL CAPABILITY	263.	263.	263.	263.	263.	263.	263.	263.	263.	263.
14. DIESEL CAPABILITY REDUCTION	0.	4.	0.	4.	0.	4.	0.	4.	0.	4.
15. DIESEL CAPABILITY(13-14)										
BANGOR HYDRO ELECTRIC COMPANY	21.	20.	21.	20.	21.	20.	21.	20.	21.	20.
BRAINTREE ELECTRIC LIGHT DEPARTMENT	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
CENTRAL MAINE POWER COMPANY	5.	4.	5.	4.	5.	4.	5.	4.	5.	4.
CHICOPEE LIGHT DEPARTMENT	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
CONNECTICUT MUNICIPALS	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
HUDSON LIGHT + POWER DEPARTMENT	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
IPSWICH MUNICIPAL LIGHT DEPARTMENT	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.
MAINE PUBLIC SERVICE COMPANY	12.	12.	12.	12.	12.	12.	12.	12.	12.	12.
MARBLEHEAD MUNICIPAL LIGHT DEPT.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
NEW ENGLAND ELECTRIC SYSTEM	79.	77.	79.	77.	79.	77.	79.	77.	79.	77.
NEW ENGLAND GAS + ELECTRIC ASSOC.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
NEWPORT ELECTRIC CORPORATION	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
NORTHEAST UTILITIES SERVICE COMPANY	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
PEABODY MUNICIPAL LIGHT DEPARTMENT	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
SHREWSBURY ELECTRIC LIGHT DEPT.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
VERMONT GROUP	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.
TOTAL DIESEL CAPABILITY	263.	259.	263.	259.	263.	259.	263.	259.	263.	259.
16. NEW GENERATION TYPES										
17. NOMINAL HYDRO CAPABILITY	1357.	1372.	1375.	1375.	1375.	1384.	1384.	1384.	1384.	1384.
18. HYDRO CAPABILITY REDUCTION	41.	72.	41.	72.	41.	72.	41.	72.	41.	72.
19. DEPENDABLE ADVERSE HYDRO CAPABILITY (17-18)										
BANGOR HYDRO ELECTRIC COMPANY	29.	25.	29.	25.	29.	25.	29.	25.	29.	25.
CENTRAL MAINE POWER COMPANY	316.	316.	316.	316.	316.	325.	325.	325.	325.	325.
CONNECTICUT MUNICIPALS	1.	0.	1.	0.	1.	0.	1.	0.	1.	0.
HOLYOKE GAS + ELECTRIC DEPARTMENT	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
MAINE PUBLIC SERVICE COMPANY	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
NEW ENGLAND ELECTRIC SYSTEM	603.	609.	603.	609.	603.	609.	603.	609.	603.	609.
NORTHEAST UTILITIES SERVICE COMPANY	235.	248.	250.	248.	250.	248.	250.	248.	250.	248.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	57.	57.	57.	57.	57.	57.	57.	57.	57.	57.
VERMONT GROUP	70.	41.	73.	44.	73.	44.	73.	44.	73.	44.
TOTAL DEPENDABLE ADVERSE HYDRO CAPABILITY	1316.	1301.	1334.	1304.	1334.	1312.	1343.	1312.	1343.	1312.

20.

21.

IV. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	WINTER 1982/83	SUMMER 1983	WINTER 1983/84	SUMMER 1984	WINTER 1984/85	SUMMER 1985	WINTER 1985/86	SUMMER 1986	WINTER 1986/87	SUMMER 1987
20. NOMINAL PUMPED STORAGE CAPABILITY	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.
21. PUMPED STORAGE CAPABILITY REDUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
22. DEPENDABLE PUMPED STORAGE CAPABILITY(20-21)										
NEW ENGLAND ELECTRIC SYSTEM	602.	602.	602.	602.	602.	602.	602.	602.	602.	602.
NORTHEAST UTILITIES SERVICE COMPANY	1029.	1029.	1029.	1029.	1029.	1029.	1029.	1029.	1029.	1029.
TOTAL DEPENDABLE PUMPED STORAGE CAPABILITY	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.
23. FIRM PURCHASES WITHIN THE NEW ENGLAND AREA										
BOSTON EDISON COMPANY	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
CENTRAL MAINE POWER COMPANY	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TOTAL FIRM PURCHASES WITHIN THE NEW ENGLAND AREA	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
24. FIRM PURCHASES OUTSIDE THE NEW ENGLAND AREA										
CENTRAL MAINE POWER COMPANY	133.	133.	133.	133.	133.	133.	0.	0.	0.	0.
MAINE PUBLIC SERVICE COMPANY	31.	31.	30.	30.	30.	30.	30.	30.	30.	30.
VERMONT GROUP	159.	198.	159.	201.	148.	192.	146.	146.	146.	146.
TOTAL FIRM PURCHASES OUTSIDE THE NEW ENGLAND AREA	323.	362.	322.	364.	311.	355.	176.	176.	176.	176.
25. FIRM OBLIGATIONS OUTSIDE THE NEW ENGLAND AREA										
TOTAL FIRM OBLIGATIONS OUTSIDE THE NEW ENGLAND AREA	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

IV. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	WINTER 1982/83	SUMMER 1983	WINTER 1983/84	SUMMER 1984	WINTER 1984/85	SUMMER 1985	WINTER 1985/86	SUMMER 1986	WINTER 1986/87	SUMMER 1987
*26. TOTAL CAPABILITY (3,+6,+9,+12,+15,+19,+22,+23,+24,AND -25)	22192.	22575.	23359.	22580.	23340.	23723.	24366.	24696.	25518.	24697.
27. COINCIDENT LOAD	16350.	15550.	16810.	15920.	17260.	16250.	17680.	16620.	18130.	17020.
28. SCHEDULED MAINTENANCE	600.	1100.	1290.	1500.	1900.	1200.	800.	1200.	500.	1200.
29. RESERVE MARGIN AFTER MAINTENANCE	5242.	5925.	5259.	5160.	4180.	6273.	5886.	6876.	6888.	6477.
30. PERCENT RESERVE AFTER MAINTENANCE	32.1	38.1	31.3	32.4	24.2	38.6	33.3	41.4	38.0	38.1

*All figures are shown rounded to the nearest whole number. Thus, summing the rounded capabilities by company and category may differ from the indicated totals.

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23.

V. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	WINTER 1987/88	SUMMER 1988	WINTER 1988/89	SUMMER 1989	WINTER 1989/90	SUMMER 1990	WINTER 1990/91	SUMMER 1991	WINTER 1991/92	SUMMER 1992
1. NOMINAL CONVENTIONAL THERMAL CAPABILITY	12114.	12114.	12114.	12114.	12682.	12682.	12682.	12682.	12682.	12682.
2. CONVENTIONAL THERMAL CAPABILITY REDUCTION	0.	163.	0.	163.	0.	163.	0.	163.	0.	163.
3. CONVENTIONAL THERMAL CAPABILITY (1-2)										
BANGOR HYDRO ELECTRIC COMPANY	60.	57.	60.	57.	60.	57.	60.	57.	60.	57.
BOSTON EDISON COMPANY	1790.	1765.	1790.	1765.	1790.	1765.	1790.	1765.	1790.	1765.
BRAINTREE ELECTRIC LIGHT DEPARTMENT	13.	32.	13.	32.	13.	32.	13.	32.	13.	32.
CENTRAL MAINE POWER COMPANY	977.	952.	977.	952.	1545.	1520.	1545.	1520.	1545.	1520.
CONNECTICUT MUNICIPALS	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
EASTERN UTILITIES ASSOC.	341.	334.	341.	334.	341.	334.	341.	334.	341.	334.
FITCHBURG GAS + ELECTRIC LIGHT CO.	23.	21.	23.	21.	23.	21.	23.	21.	23.	21.
HOLYOKE GAS + ELECTRIC DEPARTMENT	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MAINE PUBLIC SERVICE COMPANY	23.	23.	23.	23.	23.	23.	23.	23.	23.	23.
NEW ENGLAND ELECTRIC SYSTEM	2638.	2581.	2638.	2581.	2638.	2581.	2638.	2581.	2638.	2581.
NEW ENGLAND GAS + ELECTRIC ASSOC.	1304.	1283.	1304.	1283.	1304.	1283.	1304.	1283.	1304.	1283.
NEWPORT ELECTRIC CORPORATION	14.	13.	14.	13.	14.	13.	14.	13.	14.	13.
NORTHEAST UTILITIES SERVICE COMPANY	2386.	2350.	2386.	2350.	2386.	2350.	2386.	2350.	2386.	2350.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	1096.	1095.	1096.	1095.	1096.	1095.	1096.	1095.	1096.	1095.
TAUNTON MUNICIPAL LIGHT DEPARTMENT	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.
UNITED ILLUMINATING COMPANY	1356.	1353.	1356.	1353.	1356.	1353.	1356.	1353.	1356.	1353.
VERMONT GROUP	27.	27.	27.	27.	27.	27.	27.	27.	27.	27.
TOTAL CONVENTIONAL THERMAL CAPABILITY	12114.	11951.	12114.	11951.	12682.	12519.	12682.	12519.	12682.	12519.
4. NOMINAL NUCLEAR CAPABILITY	8938.	8938.	8938.	8938.	8938.	8938.	8938.	8938.	8938.	8938.
5. NUCLEAR CAPABILITY REDUCTION	0.	109.	0.	109.	0.	109.	0.	109.	0.	109.
6. NUCLEAR CAPABILITY (4-5)										
BOSTON EDISON COMPANY	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.
NEW ENGLAND YANKEE NUCLEAR UNITS	2138.	2040.	2138.	2040.	2138.	2040.	2138.	2040.	2138.	2040.
NORTHEAST UTILITIES SERVICE COMPANY	2680.	2668.	2680.	2668.	2680.	2668.	2680.	2668.	2680.	2668.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	2300.	2300.	2300.	2300.	2300.	2300.	2300.	2300.	2300.	2300.
TOTAL NUCLEAR CAPABILITY	8938.	8828.	8938.	8828.	8938.	8828.	8938.	8828.	8938.	8828.

V. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	WINTER 1987/88	SUMMER 1988	WINTER 1988/89	SUMMER 1989	WINTER 1989/90	SUMMER 1990	WINTER 1990/91	SUMMER 1991	WINTER 1991/92	SUMMER 1992
7. NOMINAL COMBUSTION TURBINE CAPABILITY	1520.	1520.	1520.	1520.	1519.	1519.	1521.	1521.	1521.	1521.
8. COMBUSTION TURBINE CAPABILITY REDUCTION	0.	424.	0.	424.	0.	424.	0.	424.	0.	424.
9. COMBUSTION TURBINE CAPABILITY (7-8)										
BOSTON EDISON COMPANY	305.	146.	305.	146.	305.	146.	305.	146.	305.	146.
CENTRAL MAINE POWER COMPANY	43.	34.	43.	34.	43.	34.	43.	34.	43.	34.
CONNECTICUT MUNICIPALS	18.	15.	18.	15.	18.	15.	18.	15.	18.	15.
EASTERN UTILITIES ASSOC.	48.	40.	48.	40.	48.	40.	48.	40.	48.	40.
FITCHBURG GAS + ELECTRIC LIGHT CO.	27.	21.	27.	21.	26.	20.	28.	22.	28.	22.
HOLYOKE GAS + ELECTRIC DEPARTMENT	10.	9.	10.	9.	10.	9.	10.	9.	10.	9.
MASS. MUNICIPAL WHOLESALE ELECTRIC	170.	130.	170.	130.	170.	130.	170.	130.	170.	130.
NEW ENGLAND ELECTRIC SYSTEM	51.	38.	51.	38.	51.	38.	51.	38.	51.	38.
NEW ENGLAND GAS + ELECTRIC ASSOC.	48.	38.	48.	38.	48.	38.	48.	38.	48.	38.
NORTHEAST UTILITIES SERVICE COMPANY	518.	407.	518.	407.	518.	407.	518.	407.	518.	407.
PEABODY MUNICIPAL LIGHT DEPARTMENT	21.	15.	21.	15.	21.	15.	21.	15.	21.	15.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	111.	88.	111.	88.	111.	88.	111.	88.	111.	88.
UNITED ILLUMINATING COMPANY	22.	17.	22.	17.	22.	17.	22.	17.	22.	17.
VERMONT GROUP	129.	99.	129.	99.	129.	99.	129.	99.	129.	99.
TOTAL COMBUSTION TURBINE CAPABILITY	1520.	1097.	1520.	1097.	1519.	1096.	1521.	1097.	1521.	1097.
10. NOMINAL COMBINED CYCLE CAPABILITY	547.	547.	547.	547.	547.	547.	547.	547.	547.	547.
11. COMBINED CYCLE CAPABILITY REDUCTION	0.	85.	0.	85.	0.	85.	0.	85.	0.	85.
12. COMBINED CYCLE CAPABILITY (10-11)										
BRAINTREE ELECTRIC LIGHT DEPARTMENT	96.	80.	96.	80.	96.	80.	96.	80.	96.	80.
MASS. MUNICIPAL WHOLESALE ELECTRIC	341.	279.	341.	279.	341.	279.	341.	279.	341.	279.
TAUNTON MUNICIPAL LIGHT DEPARTMENT	110.	103.	110.	103.	110.	103.	110.	103.	110.	103.
TOTAL COMBINED CYCLE CAPABILITY	547.	462.	547.	462.	547.	462.	547.	462.	547.	462.

25.

V. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	WINTER 1987/88	SUMMER 1988	WINTER 1988/89	SUMMER 1989	WINTER 1989/90	SUMMER 1990	WINTER 1990/91	SUMMER 1991	WINTER 1991/92	SUMMER 1992
13. NOMINAL DIESEL CAPABILITY	263.	263.	263.	263.	263.	263.	263.	263.	263.	263.
14. DIESEL CAPABILITY REDUCTION	0.	4.	0.	4.	0.	4.	0.	4.	0.	4.
15. DIESEL CAPABILITY(13-14)										
BANGOR HYDRO ELECTRIC COMPANY	21.	20.	21.	20.	21.	20.	21.	20.	21.	20.
BRAINTREE ELECTRIC LIGHT DEPARTMENT	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
CENTRAL MAINE POWER COMPANY	5.	4.	5.	4.	5.	4.	5.	4.	5.	4.
CHICOPEE LIGHT DEPARTMENT	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
CONNECTICUT MUNICIPALS	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
HUDSON LIGHT + POWER DEPARTMENT	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
IPSWICH MUNICIPAL LIGHT DEPARTMENT	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.
MAINE PUBLIC SERVICE COMPANY	12.	12.	12.	12.	12.	12.	12.	12.	12.	12.
MARBLEHEAD MUNICIPAL LIGHT DEPT.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
NEW ENGLAND ELECTRIC SYSTEM	79.	77.	79.	77.	79.	77.	79.	77.	79.	77.
NEW ENGLAND GAS + ELECTRIC ASSOC.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
NEWPORT ELECTRIC CORPORATION	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
NORTHEAST UTILITIES SERVICE COMPANY	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
PEABODY MUNICIPAL LIGHT DEPARTMENT	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
SHREWSBURY ELECTRIC LIGHT DEPT.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
VERMONT GROUP	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.
TOTAL DIESEL CAPABILITY	263.	259.	263.	259.	263.	259.	263.	259.	263.	259.
16. NEW GENERATION TYPES										
17. NOMINAL HYDRO CAPABILITY	1384.	1384.	1384.	1384.	1384.	1384.	1384.	1384.	1384.	1384.
18. HYDRO CAPABILITY REDUCTION	41.	72.	41.	72.	41.	72.	41.	72.	41.	72.
19. DEPENDABLE ADVERSE HYDRO CAPABILITY (17-18)										
BANGOR HYDRO ELECTRIC COMPANY	29.	25.	29.	25.	29.	25.	29.	25.	29.	25.
CENTRAL MAINE POWER COMPANY	325.	325.	325.	325.	325.	325.	325.	325.	325.	325.
CONNECTICUT MUNICIPALS	1.	0.	1.	0.	1.	0.	1.	0.	1.	0.
HOLYOKE GAS + ELECTRIC DEPARTMENT	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
MAINE PUBLIC SERVICE COMPANY	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
NEW ENGLAND ELECTRIC SYSTEM	603.	609.	603.	609.	603.	609.	603.	609.	603.	609.
NORTHEAST UTILITIES SERVICE COMPANY	250.	248.	250.	248.	250.	248.	250.	248.	250.	248.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	57.	57.	57.	57.	57.	57.	57.	57.	57.	57.
VERMONT GROUP	73.	44.	73.	44.	73.	44.	73.	44.	73.	44.
TOTAL DEPENDABLE ADVERSE HYDRO CAPABILITY	1343.	1312.	1343.	1312.	1343.	1312.	1343.	1312.	1343.	1312.

V. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	WINTER 1987/88	SUMMER 1988	WINTER 1988/89	SUMMER 1989	WINTER 1989/90	SUMMER 1990	WINTER 1990/91	SUMMER 1991	WINTER 1991/92	SUMMER 1992
20. NOMINAL PUMPED STORAGE CAPABILITY	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.
21. PUMPED STORAGE CAPABILITY REDUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
22. DEPENDABLE PUMPED STORAGE CAPABILITY(20-21)										
NEW ENGLAND ELECTRIC SYSTEM	602.	602.	602.	602.	602.	602.	602.	602.	602.	602.
NORTHEAST UTILITIES SERVICE COMPANY	1029.	1029.	1029.	1029.	1029.	1029.	1029.	1029.	1029.	1029.
TOTAL DEPENDABLE PUMPED STORAGE CAPABILITY	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.
23. FIRM PURCHASES WITHIN THE NEW ENGLAND AREA										
BOSTON EDISON COMPANY	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
CENTRAL MAINE POWER COMPANY	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TOTAL FIRM PURCHASES WITHIN THE NEW ENGLAND AREA	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
24. FIRM PURCHASES OUTSIDE THE NEW ENGLAND AREA										
MAINE PUBLIC SERVICE COMPANY	29.	29.	29.	29.	29.	29.	29.	29.	29.	29.
VERMONT GROUP	146.	146.	146.	146.	146.	146.	146.	146.	146.	146.
TOTAL FIRM PURCHASES OUTSIDE THE NEW ENGLAND AREA	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
25. FIRM OBLIGATIONS OUTSIDE THE NEW ENGLAND AREA										
TOTAL FIRM OBLIGATIONS OUTSIDE THE NEW ENGLAND AREA	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

V. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	WINTER 1987/88	SUMMER 1988	WINTER 1988/89	SUMMER 1989	WINTER 1989/90	SUMMER 1990	WINTER 1990/91	SUMMER 1991	WINTER 1991/92	SUMMER 1992
*26. TOTAL CAPABILITY (3.+6.+9.+12.+15.+19. +22.+23.+24.AND -25)	26537.	25721.	26537.	25721.	27104.	26288.	27106.	26290.	27106.	26290.
27. COINCIDENT LOAD	18640.	17460.	19200.	17940.	19780.	18430.	20360.	18940.	20980.	19480.
28. SCHEDULED MAINTENANCE	500.	1000.	500.	1000.	500.	800.	500.	800.	500.	800.
29. RESERVE MARGIN AFTER MAINTENANCE	7396.	7261.	6836.	6781.	6823.	7058.	6245.	6550.	5625.	6010.
30. PERCENT RESERVE AFTER MAINTENANCE	39.7	41.6	35.6	37.8	34.5	38.3	30.7	34.6	26.8	30.9

*All figures are shown rounded to the nearest whole number. Thus, summing the rounded capabilities by company and category may differ from the indicated totals.

VI. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	WINTER 1992/93	SUMMER 1993	WINTER 1993/94	SUMMER 1994	WINTER 1994/95	SUMMER 1995	WINTER 1995/96	SUMMER 1996	WINTER 1996/97
1. NOMINAL CONVENTIONAL THERMAL CAPABILITY	12659.	12659.	12637.	12637.	12637.	12637.	12637.	12637.	12637.
2. CONVENTIONAL THERMAL CAPABILITY REDUCTION	0.	162.	0.	158.	0.	158.	0.	158.	0.
3. CONVENTIONAL THERMAL CAPABILITY (1-2)									
BANGOR HYDRO ELECTRIC COMPANY	60.	57.	60.	57.	60.	57.	60.	57.	60.
BOSTON EDISON COMPANY	1790.	1765.	1790.	1765.	1790.	1765.	1790.	1765.	1790.
BRAINTREE ELECTRIC LIGHT DEPARTMENT	13.	32.	13.	32.	13.	32.	13.	32.	13.
CENTRAL MAINE POWER COMPANY	1522.	1498.	1522.	1498.	1522.	1498.	1522.	1498.	1522.
CONNECTICUT MUNICIPALS	20.	20.	20.	20.	20.	20.	20.	20.	20.
EASTERN UTILITIES ASSOC.	341.	334.	341.	334.	341.	334.	341.	334.	341.
FITCHBURG GAS + ELECTRIC LIGHT CO.	23.	21.	23.	21.	23.	21.	23.	21.	23.
HOLYOKE GAS + ELECTRIC DEPARTMENT	20.	20.	20.	20.	20.	20.	20.	20.	20.
MAINE PUBLIC SERVICE COMPANY	23.	23.	23.	23.	23.	23.	23.	23.	23.
NEW ENGLAND ELECTRIC SYSTEM	2638.	2581.	2638.	2581.	2638.	2581.	2638.	2581.	2638.
NEW ENGLAND GAS + ELECTRIC ASSOC.	1304.	1283.	1283.	1266.	1283.	1266.	1283.	1266.	1283.
NEWPORT ELECTRIC CORPORATION	14.	13.	14.	13.	14.	13.	14.	13.	14.
NORTHEAST UTILITIES SERVICE COMPANY	2386.	2350.	2386.	2350.	2386.	2350.	2386.	2350.	2386.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	1096.	1095.	1096.	1095.	1096.	1095.	1096.	1095.	1096.
TAUNTON MUNICIPAL LIGHT DEPARTMENT	25.	25.	25.	25.	25.	25.	25.	25.	25.
UNITED ILLUMINATING COMPANY	1356.	1353.	1356.	1353.	1356.	1353.	1356.	1353.	1356.
VERMONT GROUP	27.	27.	27.	27.	27.	27.	27.	27.	27.
TOTAL CONVENTIONAL THERMAL CAPABILITY	12659.	12496.	12637.	12479.	12637.	12479.	12637.	12479.	12637.
4. NOMINAL NUCLEAR CAPABILITY	8938.	8938.	8938.	8938.	8938.	8938.	8938.	8938.	8938.
5. NUCLEAR CAPABILITY REDUCTION	0.	109.	0.	109.	0.	109.	0.	109.	0.
6. NUCLEAR CAPABILITY (4-5)									
BOSTON EDISON COMPANY	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.
NEW ENGLAND YANKEE NUCLEAR UNITS	2138.	2040.	2138.	2040.	2138.	2040.	2138.	2040.	2138.
NORTHEAST UTILITIES SERVICE COMPANY	2680.	2668.	2680.	2668.	2680.	2668.	2680.	2668.	2680.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	2300.	2300.	2300.	2300.	2300.	2300.	2300.	2300.	2300.
TOTAL NUCLEAR CAPABILITY	8938.	8828.	8938.	8828.	8938.	8828.	8938.	8828.	8938.

28.

29.

VI. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	WINTER 1992/93	SUMMER 1993	WINTER 1993/94	SUMMER 1994	WINTER 1994/95	SUMMER 1995	WINTER 1995/96	SUMMER 1996	WINTER 1996/97
7. NOMINAL COMBUSTION TURBINE CAPABILITY	1520.	1520.	1520.	1520.	1519.	1519.	1519.	1519.	1519.
8. COMBUSTION TURBINE CAPABILITY REDUCTION	0.	424.	0.	424.	0.	424.	0.	424.	0.
9. COMBUSTION TURBINE CAPABILITY (7-8)									
BOSTON EDISON COMPANY	305.	146.	305.	146.	305.	146.	305.	146.	305.
CENTRAL MAINE POWER COMPANY	43.	34.	43.	34.	43.	34.	43.	34.	43.
CONNECTICUT MUNICIPALS	18.	15.	18.	15.	18.	15.	18.	15.	18.
EASTERN UTILITIES ASSOC.	48.	40.	48.	40.	48.	40.	48.	40.	48.
FITCHBURG GAS + ELECTRIC LIGHT CO.	27.	21.	27.	21.	26.	20.	26.	20.	26.
HOLYOKE GAS + ELECTRIC DEPARTMENT	10.	9.	10.	9.	10.	9.	10.	9.	10.
MASS. MUNICIPAL WHOLESALE ELECTRIC	170.	130.	170.	130.	170.	130.	170.	130.	170.
NEW ENGLAND ELECTRIC SYSTEM	51.	38.	51.	38.	51.	38.	51.	38.	51.
NEW ENGLAND GAS + ELECTRIC ASSOC.	48.	38.	48.	38.	48.	38.	48.	38.	48.
NORTHEAST UTILITIES SERVICE COMPANY	518.	407.	518.	407.	518.	407.	518.	407.	518.
PEABODY MUNICIPAL LIGHT DEPARTMENT	21.	15.	21.	15.	21.	15.	21.	15.	21.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	111.	88.	111.	88.	111.	88.	111.	88.	111.
UNITED ILLUMINATING COMPANY	22.	17.	22.	17.	22.	17.	22.	17.	22.
VERMONT GROUP	129.	99.	129.	99.	129.	99.	129.	99.	129.
TOTAL COMBUSTION TURBINE CAPABILITY	1520.	1097.	1520.	1097.	1519.	1096.	1519.	1096.	1519.
10. NOMINAL COMBINED CYCLE CAPABILITY	547.	547.	547.	547.	547.	547.	547.	547.	547.
11. COMBINED CYCLE CAPABILITY REDUCTION	0.	85.	0.	85.	0.	85.	0.	85.	0.
12. COMBINED CYCLE CAPABILITY (10-11)									
BRAINTREE ELECTRIC LIGHT DEPARTMENT	96.	80.	96.	80.	96.	80.	96.	80.	96.
MASS. MUNICIPAL WHOLESALE ELECTRIC	341.	279.	341.	279.	341.	279.	341.	279.	341.
TAUNTON MUNICIPAL LIGHT DEPARTMENT	110.	103.	110.	103.	110.	103.	110.	103.	110.
TOTAL COMBINED CYCLE CAPABILITY	547.	462.	547.	462.	547.	462.	547.	462.	547.

VI. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	WINTER 1992/93	SUMMER 1993	WINTER 1993/94	SUMMER 1994	WINTER 1994/95	SUMMER 1995	WINTER 1995/96	SUMMER 1996	WINTER 1996/97
13. NOMINAL DIESEL CAPABILITY	263.	263.	263.	263.	263.	263.	263.	263.	263.
14. DIESEL CAPABILITY REDUCTION	0.	4.	0.	4.	0.	4.	0.	4.	0.
15. DIESEL CAPABILITY(13-14)									
BANGOR HYDRO ELECTRIC COMPANY	21.	20.	21.	20.	21.	20.	21.	20.	21.
BRAINTREE ELECTRIC LIGHT DEPARTMENT	5.	5.	5.	5.	5.	5.	5.	5.	5.
CENTRAL MAINE POWER COMPANY	5.	4.	5.	4.	5.	4.	5.	4.	5.
CHICOPEE LIGHT DEPARTMENT	8.	8.	8.	8.	8.	8.	8.	8.	8.
CONNECTICUT MUNICIPALS	15.	15.	15.	15.	15.	15.	15.	15.	15.
HUDSON LIGHT + POWER DEPARTMENT	20.	20.	20.	20.	20.	20.	20.	20.	20.
IPSWICH MUNICIPAL LIGHT DEPARTMENT	9.	9.	9.	9.	9.	9.	9.	9.	9.
MAINE PUBLIC SERVICE COMPANY	12.	12.	12.	12.	12.	12.	12.	12.	12.
MARBLEHEAD MUNICIPAL LIGHT DEPT.	6.	6.	6.	6.	6.	6.	6.	6.	6.
NEW ENGLAND ELECTRIC SYSTEM	79.	77.	79.	77.	79.	77.	79.	77.	79.
NEW ENGLAND GAS + ELECTRIC ASSOC.	14.	14.	14.	14.	14.	14.	14.	14.	14.
NEWPORT ELECTRIC CORPORATION	16.	16.	16.	16.	16.	16.	16.	16.	16.
NORTHEAST UTILITIES SERVICE COMPANY	6.	6.	6.	6.	6.	6.	6.	6.	6.
PEABODY MUNICIPAL LIGHT DEPARTMENT	10.	10.	10.	10.	10.	10.	10.	10.	10.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	3.	3.	3.	3.	3.	3.	3.	3.	3.
SHREWSBURY ELECTRIC LIGHT DEPT.	14.	14.	14.	14.	14.	14.	14.	14.	14.
VERMONT GROUP	21.	21.	21.	21.	21.	21.	21.	21.	21.
TOTAL DIESEL CAPABILITY	263.	259.	263.	259.	263.	259.	263.	259.	263.
16. NEW GENERATION TYPES									
17. NOMINAL HYDRO CAPABILITY	1384.	1384.	1384.	1384.	1384.	1384.	1384.	1384.	1384.
18. HYDRO CAPABILITY REDUCTION	41.	72.	41.	72.	41.	72.	41.	72.	41.
19. DEPENDABLE ADVERSE HYDRO CAPABILITY (17-18)									
BANGOR HYDRO ELECTRIC COMPANY	29.	25.	29.	25.	29.	25.	29.	25.	29.
CENTRAL MAINE POWER COMPANY	325.	325.	325.	325.	325.	325.	325.	325.	325.
CONNECTICUT MUNICIPALS	1.	0.	1.	0.	1.	0.	1.	0.	1.
HOLYOKE GAS + ELECTRIC DEPARTMENT	3.	3.	3.	3.	3.	3.	3.	3.	3.
MAINE PUBLIC SERVICE COMPANY	2.	2.	2.	2.	2.	2.	2.	2.	2.
NEW ENGLAND ELECTRIC SYSTEM	603.	609.	603.	609.	603.	609.	603.	609.	603.
NORTHEAST UTILITIES SERVICE COMPANY	250.	248.	250.	248.	250.	248.	250.	248.	250.
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	57.	57.	57.	57.	57.	57.	57.	57.	57.
VERMONT GROUP	73.	44.	73.	44.	73.	44.	73.	44.	73.
TOTAL DEPENDABLE ADVERSE HYDRO CAPABILITY	1343.	1312.	1343.	1312.	1343.	1312.	1343.	1312.	1343.

30.

VI. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	WINTER 1992/93	SUMMER 1993	WINTER 1993/94	SUMMER 1994	WINTER 1994/95	SUMMER 1995	WINTER 1995/96	SUMMER 1996	WINTER 1996/97
20. NOMINAL PUMPED STORAGE CAPABILITY	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.
21. PUMPED STORAGE CAPABILITY REDUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.
22. DEPENDABLE PUMPED STORAGE CAPABILITY(20-21)									
NEW ENGLAND ELECTRIC SYSTEM	602.	602.	602.	602.	602.	602.	602.	602.	602.
NORTHEAST UTILITIES SERVICE COMPANY	1029.	1029.	1029.	1029.	1029.	1029.	1029.	1029.	1029.
TOTAL DEPENDABLE PUMPED STORAGE CAPABILITY	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.	1631.
23. FIRM PURCHASES WITHIN THE NEW ENGLAND AREA									
BOSTON EDISON COMPANY	1.	1.	1.	1.	1.	1.	1.	1.	1.
CENTRAL MAINE POWER COMPANY	6.	6.	6.	6.	6.	6.	6.	6.	6.
TOTAL FIRM PURCHASES WITHIN THE NEW ENGLAND AREA	7.	7.	7.	7.	7.	7.	7.	7.	7.
24. FIRM PURCHASES OUTSIDE THE NEW ENGLAND AREA									
MAINE PUBLIC SERVICE COMPANY	29.	29.	29.	29.	28.	28.	28.	28.	28.
VERMONT GROUP	146.	146.	146.	146.	146.	146.	146.	146.	146.
TOTAL FIRM PURCHASES OUTSIDE THE NEW ENGLAND AREA	175.	175.	175.	175.	174.	174.	174.	174.	174.
25. FIRM OBLIGATIONS OUTSIDE THE NEW ENGLAND AREA									
TOTAL FIRM OBLIGATIONS OUTSIDE THE NEW ENGLAND AREA	0.	0.	0.	0.	0.	0.	0.	0.	0.

VI. NEW ENGLAND AREA SYSTEM CAPABILITIES AND ESTIMATED PEAK LOADS

MW

	WINTER 1992/93	SUMMER 1993	WINTER 1993/94	SUMMER 1994	WINTER 1994/95	SUMMER 1995	WINTER 1995/96	SUMMER 1996	WINTER 1996/97
*26. TOTAL CAPABILITY (3,+6,+9,+12,+15,+19, +22,+23,+24,AND -25)	27082.	26267.	27060.	26249.	27058.	26247.	27058.	26247.	27058.
27. COINCIDENT LOAD	21590.	19990.	22130.	20460.	22610.	20880.	23060.	21270.	23530.
28. SCHEDULED MAINTENANCE	500.	800.	500.	800.	500.	800.	500.	800.	500.
29. RESERVE MARGIN AFTER MAINTENANCE	4992.	5477.	4430.	4989.	3948.	4567.	3498.	4177.	3028.
30. PERCENT RESERVE AFTER MAINTENANCE	23.1	27.4	20.0	24.4	17.5	21.9	15.2	19.6	12.9

*All figures are shown rounded to the nearest whole number. Thus, summing the rounded capabilities by company and category my differ from the indicated totals.

APPENDIX A

EXPLANATION OF ITEMS BY NUMBER

1. Nominal Conventional Thermal Capability

is the maximum claimed full load net winter rating at which the owner will operate the unit for the duration of the peak (assumed to be two hours) and reflects values approved by the NEPOOL Operating Committee where it has jurisdiction.

2. Conventional Thermal Capability Reduction

is the difference between the maximum claimed full load winter ratings and similar full load net seasonal rating capabilities at which the owner will operate the unit for the duration of the peak (assumed to be eight (8) hours for June through September). This reflects values approved by the NEPOOL Operating Committee where it has jurisdiction.

These reductions are due to circulating water temperature, ambient temperature, kVA limits of generators, steam heating loads and other reductions necessary during certain periods of the year.

3. Conventional Thermal Capability - (1 - 2)

4. Nominal Nuclear Capability

is the maximum claimed full load net winter rating at which the owner will operate the unit for the duration of the peak (assumed to be two hours) and reflects values approved by the NEPOOL Operating Committee where it has jurisdiction.

5. Nuclear Capability Reduction

is the difference between the maximum claimed full load winter ratings and similar full load net seasonal rating capabilities at which the owner will operate the unit for the duration of the peak (assumed to be eight (8) hours for June through September). This reflects values approved by the NEPOOL Operating Committee where it has jurisdiction.

These reductions are due to circulating water temperature, ambient temperature, kVA limits of generator and deratings prior to refueling of the reactor.

6. Nuclear Capability - (4 - 5)

7. Nominal Combustion Turbine Capability

is the maximum claimed full load net winter rating capability at 20°F which the owner will operate the unit for the duration of the peak (assumed to be two hours) and reflects values approved by the NEPOOL Operating Committee where it has jurisdiction.

8. Combustion Turbine Capability Reduction

is the difference between the maximum claimed full load net winter ratings and similar full load net seasonal rating capabilities based on 90°F and at which the owner will operate the unit for the duration of the peak (assumed to be eight (8) hours for June through September). This reflects values approved by the NEPOOL Operating Committee where it has jurisdiction.

These reductions are due to ambient temperature, kVA limits of generators and other reductions necessary during certain periods of the year.

9. Combustion Turbine Capability - (7 - 8)

10. Nominal Combined Cycle Capability

is the maximum claimed full load net winter rating at which the owner will operate the unit for the duration of the peak (assumed to be two hours) and reflects values approved by the NEPOOL Operating Committee where it has jurisdiction. The gas turbine portion of the plant is rated on a 20°F ambient in the winter.

11. Combined Cycle Capability Reduction

is the difference between the maximum claimed full load net winter ratings and similar full load net seasonal rating capabilities at which the owner will operate the unit for the duration of the peak (assumed to be eight (8) hours for June through September). This reflects values approved by the NEPOOL Operating Committee where it has jurisdiction.

The combustion turbine portion of the plant is rated on a 90°F ambient temperature in the summer months of June through September.

These reductions are due to ambient temperature, kVA limits of generators and other reductions necessary during certain periods of the year.

12. Combined Cycle Capability - (10 - 11)

13. Nominal Diesel Capability

is the maximum claimed full load net winter rating at which the owner will operate the unit for the duration of the peak (assumed to be two hours) and reflects values approved by the NEPOOL Operating Committee where it has jurisdiction.

14. Diesel Capability Reduction

is the difference between the maximum claimed full load winter ratings and similar full load net seasonal rating capabilities at which the owner will operate the unit for the duration of the peak (assumed to be eight (8) hours for June through September). This reflects values approved by the NEPOOL Operating Committee where it has jurisdiction.

The reductions are due to ambient temperature, kVA limits of generators, and other reductions necessary during certain periods of the year.

15. Diesel Capability - (13 - 14)

16. New Generating Types

includes fuel cells and other new types.

17. Nominal Hydro Capability

gives the total installed potential capability of the company's hydroelectric plants under the specific flow conditions of the nameplate rating without respect to the energy available or the characteristics of the load.

18. Hydro Capability Reduction

reflects the difference between the nameplate hydro capability and the dependable adverse hydro capacity.

19. Dependable Adverse Hydro Capacity - (17 - 18)

gives the hydro capacity under adverse flow conditions based on stream flows equivalent to the year giving the most adverse flow conditions on record during the critical period of system operation. Capacity in any month is that capacity that can be relied upon for serving system load and firm power commitments on the basis of the energy available in that month and its use as limited by the characteristics of the load to be served.

20. Nominal Pumped Storage Capability

gives the total installed potential capability of the company's pumped storage hydro plants under the specified flow conditions.

21. Pumped Storage Capability Reduction

reflects the difference between the nameplate pumped storage capability and the dependable pumped storage capacity.

22. Dependable Pumped Storage Capacity - (20 - 21)

gives the pumped storage capacity which can be relied upon to carry system load or provide dependable reserve capacity at the usual time of annual system peak, taking into account such factors as limitations in plant capability due to reservoir drawdown, the energy equivalent of storage in the upper reservoir, and the available pumping energy on a daily or weekly pumping cycle.

23. Firm Purchases Within the New England Area

shows the amount stated in the contract of firm power which is intended to be available at the usual time of the annual and monthly company peaks from non-municipals, industries, etc., within the New England area that are not otherwise included in the report.

24. Firm Purchases Outside the New England Area

shows the amount stated in the contract of firm power which is intended to be available at the time of the annual system peak, from utilities outside the New England area.

25. Firm Obligations Outside the New England Area

shows the amount as stated in the contract of firm power committed or obligated which is intended to be available at the usual time of the respondents system peak to other systems.

26. Total Capability

sum of Items #3, #6, #9, #12, #15, #16, #19, #22, #23, #24, minus #25.

27. Total New England Loads (MW)

coincident peak load for total New England.

28. Scheduled Maintenance

shows the maintenance affecting capability at the time of peak loads.

29. Reserve Margin After Maintenance - (26-27-28)

30. Percent Reserve After Maintenance - (29 ÷ 27 x 100)

37.

APPENDIX B

ACTUAL CHANGES IN GENERATION CAPACITY SINCE LAST REPORT

ACTUAL RETIREMENTS

JANUARY 1980 THROUGH DECEMBER 1980

COMPANY	STATION	TYPE #	FUEL ##	CHANGES IN MAX. CLAIMED MW SUMMER	WINTER	MONTH - YEAR
CENTRAL MAINE POWER COMPANY	FARMINGDALE	GT	F02	2.90	3.70	3/31/1980
BANGOR HYDRO ELECTRIC COMPANY	GRAHAM GT	GT	F02	0.00	4.45	6/ 1/1980

APPENDIX B

ACTUAL CHANGES IN GENERATION CAPACITY SINCE LAST REPORT

ACTUAL RERATING

JANUARY 1980 THROUGH DECEMBER 1980

COMPANY	STATION	TYPE #	FUEL ##	CHANGES IN MAX. CLAIMED MW SUMMER	WINTER	MONTH - YEAR
NEW ENGLAND GAS + ELECTRIC ASSOC.	CANAL 1	ST	F06	0.00	3.00	1/ 1/1980
EASTERN UTILITIES ASSOC.	SOMERSET STEAM 5	ST	F06	0.00	8.44	1/ 1/1980
EASTERN UTILITIES ASSOC.	SOMERSET STEAM 5	ST	F06	0.00	2.33	2/ 1/1980
CENTRAL MAINE POWER COMPANY	MASON 1	ST	F06	0.00	-1.00	3/ 1/1980
CENTRAL MAINE POWER COMPANY	CMP OTHER HYDRO	HY		.48	.48	3/ 1/1980
FITCHBURG GAS + ELECTRIC LIGHT CO.	FITCHBURG 7	GT	F02	-.01	1.31	3/ 1/1980
NORTHEAST UTILITIES SERVICE COMPANY	ROCKY RIVER	PS		-2.00	-2.00	3/ 1/1980
CENTRAL MAINE POWER COMPANY	CMP OTHER HYDRO	HY		-1.25	-1.25	4/ 1/1980
VERMONT GROUP	VERGENNES DIESELS	IC	F02	0.00	-.40	4/ 1/1980
VERMONT GROUP	BURLINGTON JET	JE	F02	0.00	.80	4/ 1/1980
NEW ENGLAND ELECTRIC SYSTEM	SALEM HARBOR 1	ST	F06	0.00	.50	4/ 1/1980
NEW ENGLAND ELECTRIC SYSTEM	SALEM HARBOR 3	ST	F06	0.00	.50	4/ 1/1980
NEW ENGLAND ELECTRIC SYSTEM	BRAYTON POINT 3	ST	F06	0.00	1.50	4/ 1/1980
NEW ENGLAND ELECTRIC SYSTEM	MANCHESTER STREET 11	ST	F06	0.00	.50	4/ 1/1980
NEW ENGLAND ELECTRIC SYSTEM	SOUTH STREET STEAM	ST	F06	0.00	1.25	4/ 1/1980
NEW ENGLAND ELECTRIC SYSTEM	UXBRIDGE 1	GT	F02	0.00	-.40	4/ 1/1980
NEW ENGLAND ELECTRIC SYSTEM	UXBRIDGE 2	GT	F02	0.00	-2.75	4/ 1/1980
NEW ENGLAND ELECTRIC SYSTEM	BELLOWS FALLS	HY		1.00	1.00	4/ 1/1980
NEW ENGLAND ELECTRIC SYSTEM	COMERFORD	HY		.50	.50	4/ 1/1980
NEW ENGLAND ELECTRIC SYSTEM	WILDER	HY		1.50	1.50	4/ 1/1980
BOSTON EDISON COMPANY	MYSTIC STEAM 4	ST	F06	-.03	0.00	4/ 1/1980

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APPENDIX B

ACTUAL CHANGES IN GENERATION CAPACITY SINCE LAST REPORT

ACTUAL RERATING

JANUARY 1980 THROUGH DECEMBER 1980

COMPANY	STATION	TYPE #	FUEL ##	CHANGES IN MAX. CLAIMED MW SUMMER	WINTER	MONTH - YEAR
BOSTON EDISON COMPANY	NEW BOSTON 2	ST	F06	0.00	-.35	4/ 1/1980
BOSTON EDISON COMPANY	MYSTIC STEAM 7	ST	F06	0.00	-19.35	4/ 1/1980
BOSTON EDISON COMPANY	MYSTIC STEAM 7	ST	F06	.10	0.00	5/ 1/1980
BRAINTREE ELECTRIC LIGHT DEPARTMENT	POTTER CC	CC	F02	0.00	-1.40	5/ 1/1980
EASTERN UTILITIES ASSOC.	SOMERSET STEAM 6	ST	F06	0.00	-3.34	5/ 1/1980
CENTRAL MAINE POWER COMPANY	CMP OTHER HYDRO	HY		.40	.40	7/ 1/1980
BOSTON EDISON COMPANY	MYSTIC STEAM 4	ST	F06	34.93	7.45	8/ 1/1980
BOSTON EDISON COMPANY	MYSTIC STEAM 5	ST	F06	23.10	.05	8/ 1/1980
BOSTON EDISON COMPANY	MYSTIC STEAM 6	ST	F06	7.06	.05	9/ 1/1980
BOSTON EDISON COMPANY	MYSTIC STEAM 7	ST	F06	0.00	.10	9/ 1/1980
BRAINTREE ELECTRIC LIGHT DEPARTMENT	POTTER CC	CC	F02	0.00	1.40	9/ 1/1980
EASTERN UTILITIES ASSOC.	SOMERSET STEAM 5	ST	F06	11.92	.42	9/ 1/1980
BOSTON EDISON COMPANY	MYSTIC STEAM 7	ST	F06	8.75	11.10	10/ 1/1980
UNITED ILLUMINATING COMPANY	STEEL POINT 9	ST	F06	.93	0.00	10/ 1/1980
CONNECTICUT MUNICIPALS	NORTH MAIN	GT	F02	.70	-1.50	10/ 1/1980
CENTRAL MAINE POWER COMPANY	MASON 1	ST	F06	-.28	0.00	11/ 1/1980
CENTRAL MAINE POWER COMPANY	YARMOUTH 4	ST	F06	-15.17	0.00	11/ 1/1980
NEW ENGLAND ELECTRIC SYSTEM	SALEM HARBOR 4	ST	F06	-2.17	0.00	11/ 1/1980
NEW ENGLAND ELECTRIC SYSTEM	BRAYTON POINT 2	ST	F06	.72	0.00	11/ 1/1980
NEW ENGLAND ELECTRIC SYSTEM	BRAYTON POINT 3	ST	F06	1.05	0.00	11/ 1/1980
NEW ENGLAND ELECTRIC SYSTEM	SOUTH STREET STEAM	ST	F06	-3.50	0.00	11/ 1/1980

APPENDIX B

ACTUAL CHANGES IN GENERATION CAPACITY SINCE LAST REPORT

ACTUAL RERATING

JANUARY 1980 THROUGH DECEMBER 1980

COMPANY	STATION	TYPE#	FUEL##	CHANGES IN MAX. CLAIMED MW SUMMER	WINTER	MONTH - YEAR
NEW ENGLAND ELECTRIC SYSTEM	UXBRIDGE 2	GT	F02	-.70	0.00	11/ 1/1980
BOSTON EDISON COMPANY	MYSTIC STEAM 4	ST	F06	6.00	0.00	11/ 1/1980
BOSTON EDISON COMPANY	MYSTIC STEAM 5	ST	F06	7.60	0.00	11/ 1/1980
BOSTON EDISON COMPANY	NEW BOSTON 2	ST	F06	10.29	0.00	11/ 1/1980
BOSTON EDISON COMPANY	MEDWAY 1	JE	F01	-56.50	0.00	11/ 1/1980
BOSTON EDISON COMPANY	MEDWAY 3	JE	F01	-51.00	0.00	11/ 1/1980
EASTERN UTILITIES ASSOC.	SOMERSET STEAM 6	ST	F06	-2.11	0.00	11/ 1/1980
UNITED ILLUMINATING COMPANY	BRIDGEPORT HARBOR 3	ST	F06	-27.00	0.00	11/ 1/1980
CONNECTICUT MUNICIPALS	NORTH MAIN	GT	F02	.25	.25	11/ 1/1980
BRAINTREE ELECTRIC LIGHT DEPARTMENT	POTTER DIESEL 2	IC	F02	2.50	0.00	12/ 1/1980
CONNECTICUT MUNICIPALS	NORTH MAIN	GT	F02	-1.50	1.63	12/ 1/1980

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APPENDIX B

ACTUAL CHANGES IN GENERATION CAPACITY SINCE LAST REPORT

ACTUAL ADDITIONS

JANUARY 1980 THROUGH DECEMBER 1980

COMPANY	STATION	TYPE #	FUEL ##	CHANGES IN MAX. CLAIMED MW SUMMER	WINTER	MONTH - YEAR
CHICOPEE LIGHT DEPARTMENT	CHICOPEE DSLS 1-3	IC	F02	8.25	8.25	12/ 1/1980

APPENDIX B

PROPOSED CHANGES IN GENERATION CAPACITY

RETIREMENTS

JANUARY 1981 THROUGH JANUARY 1997

COMPANY	STATION	TYPE #	FUEL ##	CHANGES IN MAX. CLAIMED MW SUMMER	WINTER	MONTH - YEAR
BOSTON EDISON COMPANY	L STREET 1201	ST	F06	16.00	25.00	3/ 1/1981
NORTHEAST UTILITIES SERVICE COMPANY	EAST SPRINGFIELD 10	GT	F02	13.50	17.50	4/30/1981
NORTHEAST UTILITIES SERVICE COMPANY	SILVER LAKE 11	GT	F02	0.00	0.00	4/30/1981
NORTHEAST UTILITIES SERVICE COMPANY	DANIELSON 1	GT	F02	4.50	6.00	4/30/1981
NORTHEAST UTILITIES SERVICE COMPANY	THOMPSONVILLE 1	GT	F02	3.80	5.20	4/30/1981
NORTHEAST UTILITIES SERVICE COMPANY	THOMPSONVILLE 2	GT	F02	4.50	6.10	4/30/1981
NORTHEAST UTILITIES SERVICE COMPANY	TRACY 10	GT	F02	13.50	17.50	4/30/1981
NEW ENGLAND GAS + ELECTRIC ASSOC.	CANNON STREET 7	ST	F06	16.40	17.90	5/ 1/1981
VERMONT GROUP	MILTON STEAM	ST	F06	4.00	4.00	11/ 1/1982
VERMONT GROUP	RUTLAND 1 GT	GT	F02	4.54	5.55	11/ 1/1982
NORTHEAST UTILITIES SERVICE COMPANY	SILVER LAKE 10	GT	F02	14.00	17.80	12/31/1982
NORTHEAST UTILITIES SERVICE COMPANY	SILVER LAKE 13	GT	F02	14.00	17.80	12/31/1982
VERMONT GROUP	RUTLAND 2 GT	GT	F02	4.67	5.85	11/ 1/1984
HOLYOKE GAS + ELECTRIC DEPARTMENT	CABOT 9	ST	F06	4.80	4.80	10/30/1987
CENTRAL MAINE POWER COMPANY	MASON 1	ST	F06	21.12	21.90	11/ 1/1987
NORTHEAST UTILITIES SERVICE COMPANY	DEVON 4	ST	F06	50.00	52.00	12/31/1987
NORTHEAST UTILITIES SERVICE COMPANY	DEVON 5	ST	F06	48.00	51.00	12/31/1987
CENTRAL MAINE POWER COMPANY	MASON 2	ST	F06	22.20	22.80	11/ 1/1992
NEW ENGLAND GAS + ELECTRIC ASSOC.	BLACKSTONE 1	ST	F06	13.50	16.00	11/ 1/1993
NEW ENGLAND GAS + ELECTRIC ASSOC.	BLACKSTONE 3	ST	F06	1.78	2.90	11/ 1/1993
NEW ENGLAND GAS + ELECTRIC ASSOC.	BLACKSTONE 4	ST	F06	2.00	2.90	11/ 1/1993

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APPENDIX B

PROPOSED CHANGES IN GENERATION CAPACITY

RERATINGS

JANUARY 1981 THROUGH JANUARY 1997

COMPANY	STATION	TYPE #	FUEL ##	CHANGES IN MAX. CLAIMED MW SUMMER	WINTER	MONTH - YEAR
UNITED ILLUMINATING COMPANY	BRIDGEPORT HARBOR 3	ST	F06	37.67	0.00	5/17/1981
BANGOR HYDRO ELECTRIC COMPANY	BANGOR DIESELS	IC	F02	-3.00	-3.00	6/ 1/1981
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	GARVINS	HY		5.80	5.80	11/ 1/1981
NEW ENGLAND YANKEE NUCLEAR UNITS	MAINE YANKEE	NP	UR	0.00	24.00	11/ 1/1981
NORTHEAST UTILITIES SERVICE COMPANY	DWIGHT 2-4	HY		.50	.50	12/30/1981
NORTHEAST UTILITIES SERVICE COMPANY	TURNER FALLS	HY		.60	.60	5/ 1/1982
FITCHBURG GAS + ELECTRIC LIGHT CO.	FITCHBURG 7	GT	F02	-.79	-.91	11/ 1/1982
FITCHBURG GAS + ELECTRIC LIGHT CO.	FITCHBURG 7	GT	F02	-1.00	-1.00	11/ 1/1984
FITCHBURG GAS + ELECTRIC LIGHT CO.	FITCHBURG 7	GT	F02	1.90	2.00	11/ 1/1985
FITCHBURG GAS + ELECTRIC LIGHT CO.	FITCHBURG 6	ST	F06	.70	2.10	11/ 1/1986
FITCHBURG GAS + ELECTRIC LIGHT CO.	FITCHBURG 7	GT	F02	-.90	-1.00	11/ 1/1987
FITCHBURG GAS + ELECTRIC LIGHT CO.	FITCHBURG 7	GT	F02	-1.00	-1.00	11/ 1/1989
FITCHBURG GAS + ELECTRIC LIGHT CO.	FITCHBURG 7	GT	F02	1.90	2.00	11/ 1/1990
FITCHBURG GAS + ELECTRIC LIGHT CO.	FITCHBURG 7	GT	F02	-.90	-1.00	11/ 1/1992
FITCHBURG GAS + ELECTRIC LIGHT CO.	FITCHBURG 7	GT	F02	-1.00	-1.00	11/ 1/1994

APPENDIX B

PROPOSED CHANGES IN GENERATION CAPACITY

ADDITIONS

JANUARY 1981 THROUGH JANUARY 1997

COMPANY	STATION	TYPE#	FUEL##	STATUS[x] AUTHORIZED (A) PLANNED (P) UNDER STUDY (S)	CAPABILITY NOM. CAP. MW SUMMER	WINTER	MFG.	EXPECTED DATE OF OPERATION
NORTHEAST UTILITIES SERVICE COMPANY	BANTAM	HY		A	.32	.32		3/ 1/1981
NEW ENGLAND ELECTRIC SYSTEM	LAWRENCE 1+2	HY		A	17.00	17.00		7/ 1/1981
MASS. MUNICIPAL WHOLESALE ELECTRIC	STONYBROOK CC	CC	FO2	A*	279.00	341.00	GE	11/ 1/1981
CENTRAL MAINE POWER COMPANY	BRUNSWICK TOPSHAM	HY		A	12.00	12.00		3/ 1/1982
CENTRAL MAINE POWER COMPANY	SHAWMUT HYDRO	HY		A	3.44	3.44		4/ 1/1982
VERMONT GROUP	BOLTON FALLS	HY		P	2.90	5.00		5/ 1/1982
VERMONT GROUP	CHASE MILLS	HY		S	4.10	7.20		11/ 1/1982
MASS. MUNICIPAL WHOLESALE ELECTRIC	STONYBROOK GT	GT	FO2	A*	130.00	170.00	GE	11/ 1/1982
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	SEABROOK 1	NP	UR	A*	1150.00	1150.00		4/ 1/1983
VERMONT GROUP	BRADFORD	HY		P	.90	.90		5/ 1/1983
NORTHEAST UTILITIES SERVICE COMPANY	HADLEY FALLS 2	HY		A	15.00	15.00		6/ 1/1983
EASTERN UTILITIES ASSOC.	PAWTUCKET 2	HY		P	1.45	1.45		10/ 1/1983
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	MURPHY DAM	HY		P	1.90	1.90		11/ 1/1983
VERMONT GROUP	PROCTOR 5	HY		A	3.00	3.00		11/ 1/1983
VERMONT GROUP	J C MCNEIL 1	ST	WOD	P	46.00	46.00		11/ 1/1983
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	EASTMAN FALLS 2	HY		P	2.90	2.90		11/ 1/1983
VERMONT GROUP	FROG HOLLOW	HY		P	1.50	1.50		2/ 1/1984
VERMONT GROUP	BLACK RIVER	HY		P	13.40	23.20		5/ 1/1984
VERMONT GROUP	EAST GEORGIA	HY		P	8.00	13.30		11/ 1/1984
VERMONT GROUP	BARNET	HY		P	2.20	2.20		11/ 1/1984

APPENDIX B

PROPOSED CHANGES IN GENERATION CAPACITY

ADDITIONS

JANUARY 1981 THROUGH JANUARY 1997

COMPANY	STATION	TYPE #	FUEL ##	STATUS[x] AUTHORIZED (A) PLANNED (P) UNDER STUDY (S)	CAPABILITY NOM. CAP. MW SUMMER	WINTER	MFG.	EXPECTED DATE OF OPERATION
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	ERROL	HY		P	2.40	2.40		11/ 1/1984
PUBLIC SERVICE CO. OF NEW HAMPSHIRE	SEABROOK 2	NP	UR	A*	1150.00	1150.00		2/ 1/1985
CENTRAL MAINE POWER COMPANY	HIRAM HYDRO	HY		A	8.50	8.50		4/ 1/1985
VERMONT GROUP	MISSISQUOI PROJECT	HY		S	11.80	20.50		11/ 1/1985
NORTHEAST UTILITIES SERVICE COMPANY	MILLSTONE 3	NP	UR	A*	1150.00	1150.00	WEC/GEC	5/ 1/1986
VERMONT GROUP	NORTH HARTLAND	HY		S	1.80	3.10		11/ 1/1986
BOSTON EDISON COMPANY	BE FUEL CELL	FC	FO1	P	10.00	10.00	U.T.	5/ 1/1987
BOSTON EDISON COMPANY	PILGRIM 2 (1)	NP	UR	A*	1150.00	1150.00	CE/GE	11/ 1/1987(1)
CENTRAL MAINE POWER COMPANY	SEARS ISLAND	ST	COL	A*	568.00	568.00		11/ 1/1989
BOSTON EDISON COMPANY	EDGAR 7	ST	COL	S	800.00	800.00		11/ 1/1992
NEW ENGLAND GAS + ELECTRIC ASSOC.	CANAL 3	ST	COL	S	600.00	600.00		5/ 1/1993

(1) For planning purposes only. The company is continuing its efforts to obtain a construction permit for Pilgrim Unit #2. However, the Nuclear Regulatory Commission has not yet resumed the granting of such permits following the accident at Three Mile Island. No firm date can be established at this time for either the commencement of of construction or commercial operation of Pilgrim Unit #2.

APPENDIX B

PROPOSED CHANGES IN GENERATION CAPACITY

PURCHASES

JANUARY 1981 THROUGH JANUARY 1997

RECEIVING SYSTEM	SUPPLYING SYSTEM	TYPE#	FUEL##	NET CAPABILITY SUMMER	WINTER	EFFECTIVE DATE
CENTRAL MAINE POWER COMPANY	CMP INTERNAL PURCH.	PP		6.02	6.02	1/ 1/1981
BOSTON EDISON COMPANY	MDC PURCHASE	PP		1.00	1.00	1/ 1/1981
TOTAL PURCHASES FROM SOURCES INSIDE NEW ENGLAND				7.02	7.02	
MAINE PUBLIC SERVICE COMPANY	ME+NBEPCO LTD.	PP		31.00	31.00	1/ 1/1981
VERMONT GROUP	PASNY PURCHASE	PP		147.50	147.50	1/ 1/1981
VERMONT GROUP	SO. CANADA PURCHASE	PP		29.10	29.10	1/ 1/1981
VERMONT GROUP	ONTARIO 1	PP		11.79	11.79	1/ 1/1981
CENTRAL MAINE POWER COMPANY	MEPCO/NB PURCHASE 2	PP	F06	133.00	133.00*	1/ 1/1981
TOTAL PURCHASES FROM SOURCES OUTSIDE NEW ENGLAND				352.39	352.39	

CHANGES TO PURCHASES

RECEIVING SYSTEM	SUPPLYING SYSTEM	TYPE#	FUEL##	SUMMER	WINTER	EFFECTIVE DATE
VERMONT GROUP	SO. CANADA PURCHASE	PP		2.90	-29.10	4/ 1/1981
VERMONT GROUP	SO. CANADA PURCHASE	PP		5.00	0.00	4/ 1/1982
VERMONT GROUP	SO. CANADA PURCHASE	PP		2.00	0.00	4/ 1/1983
MAINE PUBLIC SERVICE COMPANY	ME+NBEPCO LTD.	PP		-1.00	-1.00	11/ 1/1983
VERMONT GROUP	SO. CANADA PURCHASE	PP		3.00	0.00	4/ 1/1984
VERMONT GROUP	ONTARIO 1	PP		-11.79	-11.79	12/ 2/1984
VERMONT GROUP	SO. CANADA PURCHASE	PP		4.00	0.00	4/ 1/1985
VERMONT GROUP	PASNY PURCHASE	PP		-1.75	-1.75	7/ 1/1985

*Changed from 400 MW to 133 MW on 1/1/81.

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APPENDIX B

PROPOSED CHANGES IN GENERATION CAPACITY

PURCHASES

JANUARY 1981 THROUGH JANUARY 1997

RECEIVING SYSTEM	SUPPLYING SYSTEM	TYPE #	FUEL ##	NET CAPABILITY SUMMER	NET CAPABILITY -WINTER	EFFECTIVE DATE
VERMONT GROUP	SO. CANADA PURCHASE	PP		-46.00	0.00	10/31/1985
CENTRAL MAINE POWER COMPANY	MEPCO/NB PURCHASE 2	PP	F06	-133.00	-133.00	11/ 1/1986
MAINE PUBLIC SERVICE COMPANY	ME+NBEPCO LTD.	PP		-1.00	-1.00	11/ 1/1987
MAINE PUBLIC SERVICE COMPANY	ME+NBEPCO LTD.	PP		-1.00	-1.00	11/ 1/1994

SALES

RECEIVING SYSTEM	SUPPLYING SYSTEM	TYPE #	FUEL ##	NET CAPABILITY SUMMER	NET CAPABILITY -WINTER	EFFECTIVE DATE
NORTHEAST UTILITIES SERVICE COMPANY	NY STATE ELEC. + GAS	SP		0.00	50.00	1/ 1/1981
TOTAL SALES TO SOURCES OUTSIDE NEW ENGLAND				0.00	50.00	

CHANGES TO SALES

RECEIVING SYSTEM	SUPPLYING SYSTEM	TYPE #	FUEL ##	NET CAPABILITY SUMMER	NET CAPABILITY -WINTER	EFFECTIVE DATE
NORTHEAST UTILITIES SERVICE COMPANY	NY STATE ELEC. + GAS	SP		0.00	92.00	11/ 1/1981
NORTHEAST UTILITIES SERVICE COMPANY	NY STATE ELEC. + GAS	SP		0.00	-142.00	4/30/1982

APPENDIX B

LEGEND

x Description of abbreviations used under STATUS

Authorized	(A)	- Approved by Board of Directors.
Planned	(P)	- Facility which has been publicly announced.
Under Study	(S)	- Facility in early planning stages.
	(A*)	- "NEPOOL Planned" and approved by Board of Directors.

Description of abbreviations used under UNIT TYPE

PP	= Purchase Power
SP	= Sale of Power
ST	= Steam turbine - non nuclear
GT	= Combustion Turbine
IC	= Internal Combustion (Diesel)
NP	= Steam-PWR Nuclear
NB	= Steam-BWR Nuclear
CC	= Combined Cycle
FC	= Fuel Cell
HY	= Conventional Hydro
PS	= Pumped Storage Hydro
JE	= Jet Engine

Description of codes used under FUEL TYPE

COL	= Coal (general)
REF	= Refuse (solid waste)
OIL	= Oil (general)
FO1	= No. 1 Fuel Oil
FO2	= No. 2 Fueld Oil
FO6	= No. 6 Fuel Oil
JF	= Jet Fuel
UR	= Uranium
WOD	= Wood

UNITS IN DEACTIVATED RESERVE

INCLUDED IN THERMAL CAPABILITY OF INDIVIDUAL COMPANIES

COMPANY	STATION	TYPE #	CAPABILITY SUMMER	CAPABILITY WINTER	DATE
NORTHEAST UTILITIES SERVICE COMPANY	TURNER FALLS	HY	5.00	5.00	5/ 1/1975
UNITED ILLUMINATING COMPANY	STEEL POINT 1-3,5	ST	56.40	56.40	1/ 1/1976
EASTERN UTILITIES ASSOC.	SOMERSET STEAM 2	ST	40.90	44.00	5/ 1/1976
EASTERN UTILITIES ASSOC.	SOMERSET STEAM 1	ST	36.48	37.49	5/ 1/1976
NEW ENGLAND GAS + ELECTRIC ASSOC.	CANNON STREET 7	ST	16.40	17.90	7/ 1/1977
UNITED ILLUMINATING COMPANY	STEEL POINT 4,6-8,10	ST	49.40	49.40	8/13/1977
FITCHBURG GAS + ELECTRIC LIGHT CO.	FITCHBURG 6	ST	20.70	21.10	11/ 1/1978
BRAINTREE ELECTRIC LIGHT DEPARTMENT	ALLEN STREET 1	ST	10.00	0.00	12/ 1/1979
BRAINTREE ELECTRIC LIGHT DEPARTMENT	ALLEN STREET 3	ST	9.00	0.00	12/ 1/1979
EASTERN UTILITIES ASSOC.	SOMERSET STEAM 3+4	ST	61.20	64.77	1/ 1/1980
NEWPORT ELECTRIC CORPORATION	W. HOWARD 1-3	ST	13.00	14.00	5/ 1/1980
BRAINTREE ELECTRIC LIGHT DEPARTMENT	POTTER STEAM 1	ST	13.00	13.00	10/ 1/1980
			331.48	323.06	

RETIRED FROM DEACTIVATED RESERVE

NEW ENGLAND GAS + ELECTRIC ASSOC.	CANNON STREET 7	ST	16.40	17.90	5/ 1/1981

RETURNED TO SERVICE FROM DEACTIVATED RESERVE

NORTHEAST UTILITIES SERVICE COMPANY	TURNER FALLS	HY	5.00	5.00	5/ 1/1982
FITCHBURG GAS + ELECTRIC LIGHT CO.	FITCHBURG 6	ST	20.70	21.10	11/ 1/1986

Scheduled Unit Conversions to Coal Firing

Unit Name	Company	Estimated Completion	Estimated Converted Rating (MW)* Summer	Estimated Converted Rating (MW)* Winter	Pre-Conv. Rating Winter
Brayton Pt. #1	New England Electric System	March, 1981	247	256	256
Brayton Pt. #2	New England Electric System	June, 1981	253	265	265
Brayton Pt. #3	New England Electric System	December, 1981	642	643	643
Mt. Tom #1	Northeast Utilities	January, 1982	143	145	148
Mason #4	Central Maine Power Company	September, 1983	35	36	36
Mason #3	Central Maine Power Company	October, 1983	35	36	36
Mason #5	Central Maine Power Company	November, 1983	35	36	36
Schiller #4	Public Service Co. of N.H.	November, 1983	44	44	48
Schiller #5	Public Service Co. of N.H.	December, 1983	47	47	51
Schiller #6	Public Service Co. of N.H.	January, 1984	48	48	52
Salem Harbor #3	New England Electric System	July, 1984	150	150	150
Salem Harbor #2	New England Electric System	October, 1984	83	83	83
Norwalk Harbor #1	Northeast Utilities	January, 1985	158	160	164
Salem Harbor #1	New England Electric System	January, 1985	84	85	85
West Springfield #3	Northeast Utilities	January, 1985	106	107	108
Norwalk Harbor #2	Northeast Utilities	July, 1985	169	172	174
Devon #7	Northeast Utilities	January, 1986	105	107	109
Devon #8	Northeast Utilities	January, 1986	105	107	109
South Street #12	New England Electric System	January, 1986	98	103	103
West Springfield #1	Northeast Utilities	January, 1986	51	51	52
West Springfield #2	Northeast Utilities	January, 1986	51	51	52
		Estimated Total Converted Ratings:	2689	2732	2760

*Estimated reratings due to coal conversion have not been reflected in the report capability summaries.

NRC REQUESTS FOR ADDITIONAL INFORMATION (RAI)

NRC REQUESTS FOR ADDITIONAL INFORMATION

This section of the Seabrook Station ER-OLS contains formal Nuclear Regulatory Commission requests for additional information, resulting from the Commission's review of the Public Service Company of New Hampshire Application for an Operating License for Seabrook Station, Units 1 and 2. 2

Two indices are provided for ease of reference. The first index lists the RAIs by applicable ER-OLS section number; the second lists RAIs numerically. 2

INDEX

GROUPING OF RESPONSES TO RAIs BY APPLICABLE ER-OLS SECTION NUMBERS

INDEX

NUMERICAL LISTING OF RAIs AND RESPONSES

240.1
(ER)

The Summary and Conclusions section of the CP FES, numbers 7b and 7c, respectively, stipulated that a description and results of analyses or studies, and additional current and wind studies, be provided so that the staff could confirm the adequacy of the final design of the discharge diffuser, and that a study be undertaken (and provided) with the objective of determining means to minimize the discharge of total residual chlorine. Please provide the information in the appropriate sections of the ER and cross reference the FES.

RESPONSE:

Since publication of the CP FES in late 1974, numerous studies and data collection efforts have been conducted. ER-OLS Sections 2.3 and 6.1.3 describe the meteorological programs, whereas ER-OLS Sections 2.4.1 and 6.1.1.1 describe the hydrographic programs. This information in turn was used to design the heat dissipation system (described in ER-OLS Section 3.4) after extensive hydrothermal model testing (outlined in ER-OLS Section 5.1.2). The respective reference subsections to these ER sections lists the documents detailing the studies.

Likewise, the plant has been designed to limit total residual chlorine. As described in ER-OLS Section 3.6.1, injection concentrations will be managed to meet EPA effluent guidelines of 0.2 mg/l for the average level of free residual chlorine at the unit discharge conduit prior to mixing at the entrance to the discharge tunnels. Chlorine residuals in the immediate vicinity of diffuser, however, will be substantially lower because of mixing with non-chlorinated water within the discharge tunnel and the rapid mixing with ambient receiving waters promoted by the diffuser design (refer to ER-OLS Section 5.3.1).

Other techniques to minimize the discharge of total residual chlorine-heat treatment, antifouling paint, etc., will also be employed. These alternate techniques are also described in ER-OLS Section 3.6.1.

240.2
(2.4)
(ER)

Descriptions of floodplains, as required by Executive Order 11988, Floodplain-Management, have not been provided. The definition used in the Executive Order is:

<u>Floodplain</u>: The lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands, including at a minimum that area subject to a one percent or greater chance of flooding in any given year.

a. Provide descriptions of the floodplains adjacent to the site. On a suitable map(s) provide delineations of those areas that will be flooded during the one percent (100-year) flood, both before and after plant construction or operation.

b. Provide details of the methods used to determine the floodplains in response to a. above. Include your assumptions of, and basis for, the pertinent parameters used in the computation of the flood flows and water elevations.

If studies approved by the Federal Insurance Administration (FIA) are available for the site and other affected areas, the details of the analysis used in the reports need not be supplied. You can instead provide the reports from which you obtained the floodplain information.

c. Identify, locate on a map and describe all plant structures and topographic alterations in the floodplains.

d. Discuss the hydrologic effects of all items identified in response to c. above. Discuss the potential for altered flood flows and levels, offsite. Discuss the effects on offsite areas of debris generated from the site during flood events.

e. Provide the details of your analysis used in response to d. above. The level of detail is similar to that identified in item b. above.

RESPONSE: a. The floodplains adjacent to the site consist of the low lying areas surrounding the tidal zone in the estuary of Hampton Harbor. This broad, flat salt marsh zone adjoins the site to the north, east and south of the site and is identified as Hampton Flats. The western shore of Hampton Harbor lies approximately one mile east of the site.

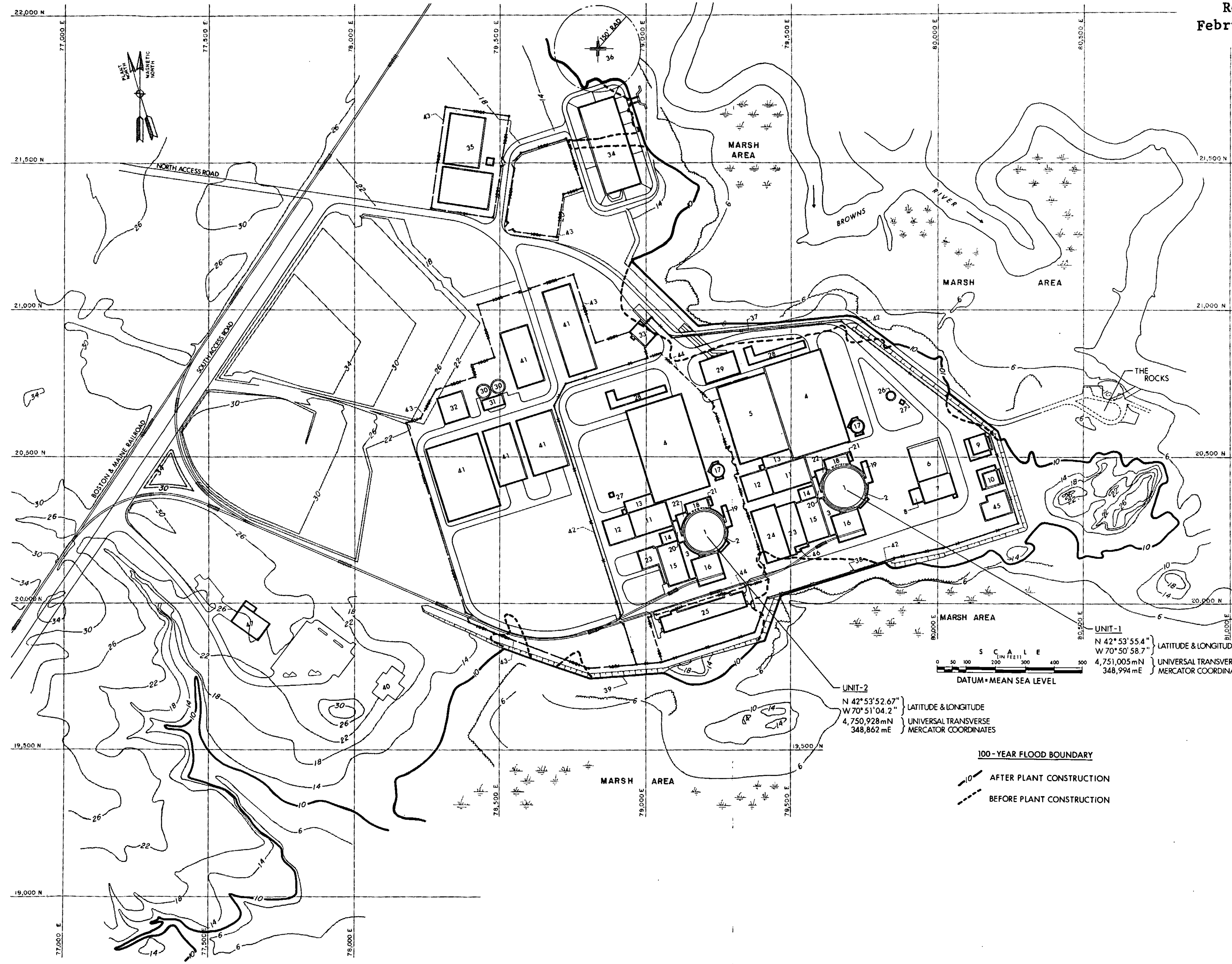
The areas that will be flooded by the one percent (100-year) flood are delineated on ER-OLS Figure 240.2-1. Specific areas where this boundary differs for before and after plant construction are also depicted on the figure.

b. To determine the 100-year flood elevation for the site, use was made of the Federal Insurance Administration (FIA) approved study for Salisbury, Massachusetts (a copy of this report has been provided to the NRC). This study performed by the U.S. Army Corps of Engineers includes a set of frequency - tide elevation curves for a coastal reach along the Atlantic Ocean from Ipswich, Massachusetts north to Portsmouth, New Hampshire (refer to Figure 2 of the FIA study). Using this figure, the 100-year tidal flood elevation for Seabrook, located approximately 14 miles north from Essex Bay, is 10-feet mean sea level (MSL). As a check on this value a comparison was made between 10-feet MSL and various storms of record along the New Hampshire coastal area.

The "northeast" storms of January and February 1978 are recorded as the worst storms of record for the New Hampshire coastal area. Tide elevations during the February storm reached unusually high levels as a result of exceptionally high winds measured in excess of 100 MPH offshore of the site and monthly spring tide. Wind and wave damage along the New Hampshire sea coast was substantial and resulted in the designation of several communities as natural disaster areas. The predicted astronomical tide maximum was 6.3-feet

PRINCIPLE STATION STRUCTURES

1. CONTAINMENT STRUCTURE
2. CONTAINMENT ENCLOSURE AREA
3. CONTAINMENT ENCLOSURE VENTILATION AREA
4. TURBINE BUILDING AND HEATER BAY
5. ADMINISTRATION AND SERVICE BUILDING
6. CIRCULATING WATER PUMPHOUSE
7. SERVICE WATER PUMPHOUSE
8. ELECTRICAL CONTROL ROOM
9. INTAKE TRANSITION STRUCTURE
10. DISCHARGE TRANSITION STRUCTURE
11. CONTROL BUILDING
12. DIESEL GENERATOR BUILDING
13. NON-ESSENTIAL SWITCHGEAR ROOM
14. RHR SPRAY EQUIPMENT VAULT
15. PRIMARY AUXILIARY BUILDING
16. FUEL STORAGE BUILDING
17. CONDENSATE STORAGE TANK
18. EMERGENCY FEEDWATER PUMPHOUSE
19. STEAM & FEEDWATER PIPE CHASE (EAST)
20. STEAM & FEEDWATER PIPE CHASE (WEST)
21. PRE-ACTION VALVE BUILDING
22. PERSONNEL HATCH AREA
23. TANK FARM AREA
24. WASTE PROCESSING BUILDING
25. SERVICE WATER COOLING TOWER
26. DEMINERALIZED WATER STORAGE TANK
27. CONTROL BUILDING MAKE-UP AIR INTAKE STRUCTURE
28. TRANSFORMER AREA
29. SWITCHING STATION (SUBSTATION)
30. FIRE PROTECTION TANKS
31. FIRE PUMP HOUSE
32. FUEL OIL STORAGE TANK
33. GUARD HOUSE
34. SETTLING BASIN
35. SEWAGE TREATMENT & LAGOON AREA
36. METEOROLOGICAL TOWER
37. RETAINING WALL
38. SEAWALL
39. RIPRAP
40. EDUCATION CENTER
41. MISC. NON-OPERATIONAL STRUCTURES
42. PERMAMENT SECURITY FENCE FOR OPERATING UNITS 1 AND 2
43. SUPPLEMENTARY FENCE FOR PROTECTION OF ANCILLARY PLANT STRUCTURES
44. TEMPORARY SECURITY FENCE ISOLATING OPERATING UNIT 1 DURING CONSTRUCTION OF UNIT 2
45. CHLORINATION BUILDING
46. STEAM GENERATOR BLOWDOWN BUILDING
47. TRAINING CENTER



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

100 YEAR FLOOD BOUNDARY

FIGURE 240.2-1

MSL combined with a surge height of 2.5 feet, resulting in a tidal elevation of 8.8-feet MSL.

Since the 100-year flood level of 10-feet MSL exceeds all recorded storm levels for Hampton Harbor and exceeds the storm of record (8.8-feet MSL) by 1.2 feet, the 10-foot MSL estimate of the 100-year flood is conservative. A FIA study for the town of Seabrook is presently underway, but will not be complete for approximately one year.

c. Refer to ER-OLS Figure 240.2-1 which depicts the location of all plant structures and all topographic alterations in the floodplain.

d. There are no hydrologic effects on the floodplain brought about by construction of the station. There is no potential for altered flood flows and levels offsite. There will be no debris generated from the site which would effect offsite areas during flood events.

e. The 100-year flood event for the site is caused by tidal flooding in the Hampton Harbor estuary and the adjoining salt marsh. Since the amount of encroachment by the station on the floodplain is negligible (refer to ER-OLS Figure 240.2-1) the effect on the flood level is also negligible.

The site drainage system was designed to accommodate the localized probable maximum precipitation without any significant ponding resulting within the plant area. Site grading is 0.5% minimum to encourage runoff. Since the site drainage system can handle precipitation up to and including the probable maximum, there will be no debris generated from the site which will affect offsite areas during flood events.

240.3 (2.4.1) (ER) — Surface Waters

Provide a narrative description of the ocean areas, Hampton Harbor and nearby streams with respect to the site.

RESPONSE: Both the ER-CPS, Section 2.5 and the "Summary Document Assessment of Anticipated Impacts of Construction and Operation of Seabrook Station..." prepared by Normandeau Associates in 1977 (Reference 1 in ER-OLS Section 2.4.1.8) and provided to the NRC (see Response to RAI 291.4), provide a detailed description of the Hampton Harbor vicinity and ocean area.

240.4 (2.4.1.1.a) (ER) — Principal Flow Patterns

a. Provide the period of record used tc estimate seasonal effects of different flow types, and discuss the extent to which conditions can be different.

b. (Para. 2) What are the units for stated flows in other directions?

c. (Para. 2) Are flows at depth in a shoreward direction, or do they have a shoreward component?

RESPONSE: a. ER-OLS Table 2.4-2 and Figure 2.4-1, which were compiled from the six-year period of record 1973-1978, summarize the annual current flow pattern. The seasonal effects can be clearly seen by reviewing the differences between the monthly values presented.

b. The unit for all measurements of flow is the knot (kn), which is 1.69 ft/sec (51.5 cm/sec).

c. Shoreward direction flows at depth were Eulerian measured values and not the shoreward component of a vector.

240.5
(2.4.1.2)
(ER)

Tides

Where were tides measured? Were they open coast measurements, or were measurements made in protected areas?

RESPONSE: Tides were measured in a protected area at the Hampton Harbor Marina, latitude 42°54'08"N, longitude 70°49'06"W. Refer to ER-OLS Figure 240.6-1.

240.6
(2.4.1.3)
(ER)

Water Temperature

Where were and are temperature measurements made? Provide information for both coastal and harbor areas.

RESPONSE: Refer to ER-OLS Figure 240.6-1. Although there have been other monitoring sites, this figure represents data collected from 1975 through most of 1979, at which time a single mooring unit was established along the 50-foot contour midway between the intake and the diffuser sites. The single mooring has been maintained continuously to date.

240.7
(2.4.1.4)
(ER)

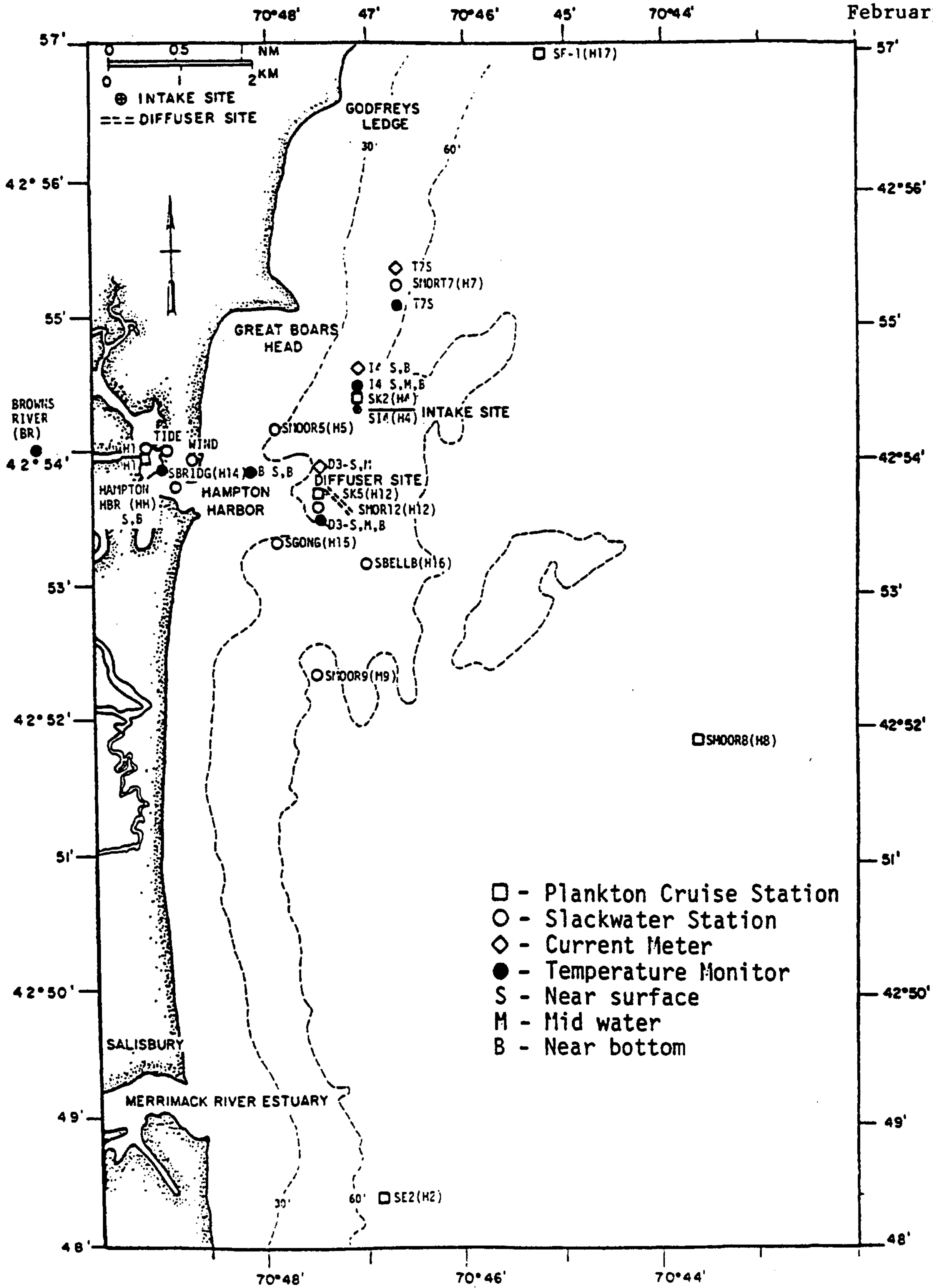
Salinity

a. Where were the data collected?

b. What were the ranges in salinity noted in Hampton Harbor, and what differences between seasons were noted?

c. To what extent was salinity stratification in Hampton Harbor noted?

RESPONSE: a. Refer to ER-OLS Figure 240.6-1. Salinities were measured at both the Plankton Cruise and Slackwater stations depicted on the figure.



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	LOCATION MAP OF HYDROGRAPHIC SAMPLING STATIONS OFF HAMPTON BEACH, NEW HAMPSHIRE
	FIGURE 240.6 -1

b. The range of salinity values in Hampton Harbor depends on the tide stage and location of measurement (ER-OLS Figure 240.6-1). Measurements at the harbor entrance, for example, can differ significantly from measurements observed at Browns River. Likewise, tidal variation can be large.

In general, Hampton Harbor salinities during high tide average between 30-32 ppt, with the lowest values occurring during the time of spring runoff (29-30 ppt). At low tide, values average about 28 ppt, but can be as low as 10-15 ppt during the spring. At Browns River, high tide salinity values do not vary greatly and are similar to those recorded at the harbor (30-32 ppt). Values observed during the spring, however, decrease to 10-15 ppt. Low tide salinities, by contrast, vary considerably. Values during most of the year range from 25-29 ppt. During spring runoff conditions, salinities dip to around 15-20 ppt, but may be as low as 5 ppt.

c. Little vertical stratification, if any, occurs in Hampton Harbor.

240.8 (2.4.1.5) (ER) Dissolved Oxygen

Where along the coast, and in Hampton Harbor were data collected?

RESPONSE: Refer to ER-OLS Figure 240.6-1. Dissolved oxygen measurements were made at both the Plankton Cruise and Slackwater stations shown on the figure.

240.9 (2.4.1.6) (ER) Sedimentological Conditions

a. Where were the eight stake locations?

b. What has been the experience with shoreline changes along the coast and in Hampton Harbor?

c. What has been the experience with sediment deposition in Hampton Harbor?

d. Have there been any projections of shoreline changes along the open coast, or in Hampton Harbor; or of deposition near the intake, discharge or Hampton Harbor? If so, what do they indicate?

RESPONSE: a. Refer to ER-OLS Figure 240.9-1 for the location of the eight pairs of sediment stakes.

b. Records from 1776 to 1935 when the Hampton Harbor entrance was stabilized by the construction of two jetties, show that the principal changes at Hampton and Seabrook Beaches were caused by migration of the Hampton Harbor entrance. This migration reversed itself periodically. For example, during northward migrations, the south end of Hampton Beach was rapidly eroded while sand spits and bars trailed northward from Seabrook Beach. During southward migrations, the north end of Seabrook Beach eroded while sand spits and bars trailed southward from Hampton Beach. The harbor, likewise, exhibited considerable shoreline meanders during this period, with no predominant trend. Subsequent to 1935, the shoreline along Hampton and Seabrook beaches has shown areas of both erosion and accretion. In general, the area north of Hampton Beach to roughly its middle point has experienced erosion and recession of the high water line. A number of shore protection projects, accordingly, have been undertaken in this area, including the present sea wall and riprap revetment constructed in 1947. The area south of Hampton Beach, including Hampton Harbor and Seabrook Beach, usually undergoes accretion, with some occurrence of erosion.

Since the harbor entrance was successfully stabilized in 1935, Hampton Harbor has generally experienced sediment deposition, resulting in the need for periodic dredging. Listed below is the amount of material dredged since 1965.

Hampton Harbor Dredging

Year	Cubic Yards
1965	31,000
1968	17,400
1971	15,000
1973	15,000
1974	17,500

Hampton Harbor Dredging
(Continued)

Year	Cubic Yards
1976	14,000
1977	7,000
1981	30,000 (estimated)

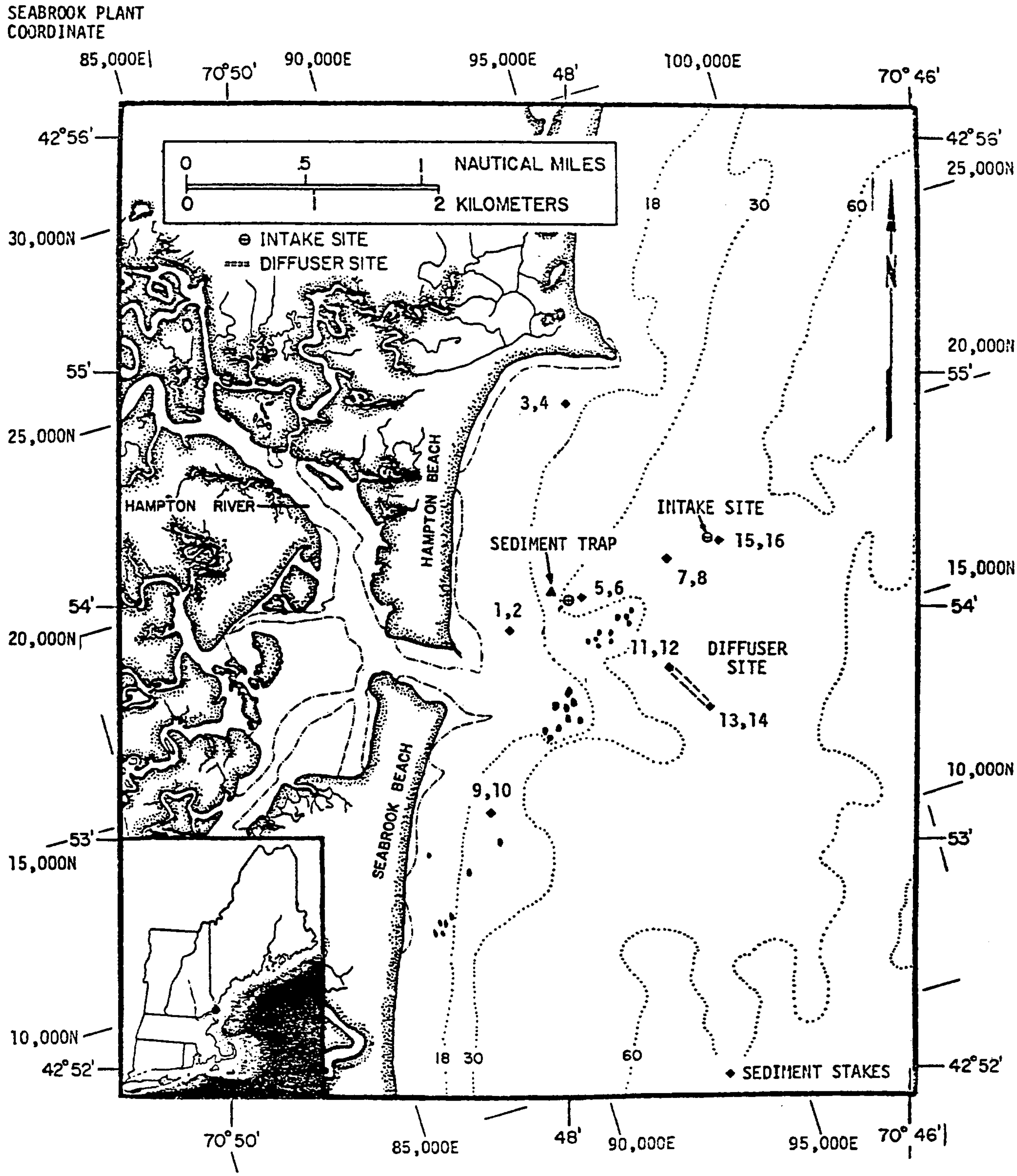
Source: U.S. Army Corps of Engineers, 1981

d. There have been no projections of shoreline changes other than the general trends mentioned in Item b above, and the apparent state of dynamic equilibrium of the sea floor near the intake and discharge areas as stated in ER-OLS Section 2.4.1.6.

240.10
(2.4.2.1)
(ER)

Utilization of Groundwater

a. How many wells have been developed, or are you intending to develop, onsite? Where are or will they be located, from which hydrologic formation will they draw water and at what elevations?



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	LOCATION MAP FOR SEDIMENT STAKES OFF HAMPTON BEACH, NEW HAMPSHIRE FIGURE 240.9-1

b. Where does the Town of Seabrook obtain its water?

c. During the CP no mention was made of obtaining fresh water from onsite wells. What is the reason for not supplying all the plant's freshwater needs from the Town of Seabrook and why does the change not constitute a significant environment impact?

RESPONSE: a. When it became apparent that the municipal water system would not supply all the water needs for the construction, an exploratory program for groundwater was begun on the project property. Four wells were drilled in the Hampton Falls part of the site and six more in the Seabrook part. Of these wells, three in each town were deemed capable of development and pumps were installed. The wells in Hampton Falls are located in schistose rocks of the Merrimack group and those in Seabrook lie in plutonic rocks of the Newburyport formation. In these wells, water-bearing fractures have been intercepted at depths of 130 to 170 feet. The static water level is about 10-feet below ground level.

b. The Town of Seabrook obtains its water from six wells located in the western part of town. These wells are all in glacial deposits. The town is presently developing a major new source of water from a bedrock structure on the western border of the town.

c. The Town of Seabrook unilaterally attempted to cut off all municipal water to the project in 1977. Negotations with the town which were embraced by court order, required the town to supply 50,000 gallons per day to the project. With that restriction on project use imposed at a level that would not support construction, an investigation into alternative sources was done. Sources evaluated included: trucking from several locations, piping water from other systems outside of town, saltwater and sewage effluent treatment and onsite groundwater. Test wells were drilled and proved feasible to meet the needs of construction.

The use of the groundwater does not constitute a significant impact since what impact may result from pumping will be more than offset by corrective measures. The only impact which could be considered significant in this case would be one in which another user's quantity or quality of water was degraded. Near the Seabrook portion of the site there are no other users of groundwater who could be influenced. In Hampton Falls, an extensive test program was conducted in cooperation with the town. During the test, one nearby residential dug well went dry. The Applicant installed a bedrock well and pump which has functioned since then. Two other nearby residences have the option to have wells drilled for them also if the need or desire arises.

Monitoring of groundwater levels and quality are required under an order from the N.H. Public Utility Commission.

Considering the care taken to insure water is available to nearby residents and the comprehensive monitoring program to insure quality is not degraded, the Applicant believes no significant impact will result.

240.11 (2.4) (ER) Tables and Figures

a. What are the titles for columns 2 and 3 of Table 2.4-3?

b. Where do the data presented on Figure 2.4-1 apply?

c. Where do the data presented on Figure 2.4-2 apply?

d. On Figure 2.4-3:

1. What is true north; plant north?

2. Does the grid system correspond with Table 2.4-3?

3. What are the contour intervals, and to what datum?

4. Where are adjacent water bodies (i.e., Hampton Harbor) located with respect to the plant?

RESPONSE: a. Column 2 shows the north coordinates for both the magnetic grid (MG) and the plant grid (PG) in feet. Column 3 shows the east coordinates for both the magnetic grid (MG) and the plant grid (PG) in feet.

To convert from plant grid to magnetic grid and vice versa use the following equations with N and E for the magnetic and N' and E' for the plant grid.

Converting PG to MG:

$$N = 9055.44 + N' (0.9533664) + E' (0.3018153)$$

$$E = 76975.95 - N' (0.3018153) + E' (0.9533664)$$

Converting MG to PG:

$$N' = 14599.36 + N (0.9533664) - E (0.3018153)$$

$$E' = -76119.36 + N (0.3018153) + E (0.9533664)$$

b. The data presented apply for the vicinity of the intakes and the diffuser and are a composite from records collected at stations located at these sites (see ER-OLS Figure 240.6-1).

c. Refer to the response for item b above.

d.1 True north is labeled as north in the lower right hand corner of the figure. Magnetic north has a 16° counterclockwise declination from true north. Plant north has a further

$17^{o}36'$ counterclockwise declination from magnetic north. Therefore, plant north has a $33^{o}34'$ counterclockwise declination from true north.

d.2 Yes, both magnetic and plant grid coordinates are listed in the ER-OLS Table 2.4-3 whereas; only plant grid is shown on ER-OLS Figure 2.4-3.

d.3 The contour interval is 20 feet and the datum is mean sea level.

d.4 The Browns River flows in an easterly direction north of the plant and discharges into Hampton Harbor approximately 1 mile east of the plant.

Also on ER-OLS Figure 2.4-3 note that the scale of 1" = 1000' does not apply due to shrinkage in reproduction. For scaling purposes use the 1000' grid spacing.

ER-OLS Figure 2.4-3 will be updated to incorporate these responses.

240.12
(3.3)
(ER)

Plant Water Use

a. The text indicates onsite wells and the Town of Seabrook are the two sources of freshwater. Figure 3.3-1, however, indicates Hampton Falls wells. Please explain this discrepancy.

b. Is the 120,000 gpm consumptive freshwater usage for one unit, or two?

c. Table 3.3-1 and numbers in the text do not appear to agree; please verify?

d. Will the emergency towers be operated at low flow rates in the winter to prevent freezing? If so, will blowdown be significant during such periods?

RESPONSE:

a. Figure 3.3-1 identifies onsite wells in the Town of Seabrook (circle 5) and onsite wells in the Town of Hampton Falls (circle 6).

b. The use of 120,000 gallons per day during construction is an average demand for the work on both units.

c. To the best of our ability to estimate average numbers, the numbers in Section 3.3 are consistent.

d. Occasionally the cooling tower may require de-icing. Since the Applicant currently plans to use freshwater for makeup, blowdown will be infrequent and minimal.

240.13 (ER) Table 3.3-1

a. Item 9 appears too high for the limited testing and use contemplated for the emergency cooling towers. Please verify.

b. Does the note for item 10 apply to one unit or two?

RESPONSE: a. Current estimates have been revised to 20 days use per year assuming a nominal possible use of cooling towers during thermal backflushing operations of every two weeks during the biofouling season and once monthly during the other portion of the year. Current FSAR Technical Specifications require operation of each cooling tower fan for at least once every 31 days; this will contribute negligible water use.

b. Two 500,000 gallon capacity storage tanks serve the station. Connections to the tanks reserve at least 300,000 gallons in each for fire fighting.

240.14 (ER) Figure 3.3-1

a. The text indicates cooling tower blowdown will be routed to the settling basin. If so, please amend the figure accordingly.

b. Please indicate the discharge from the settling basin into Hampton Harbor.

RESPONSE: a. The cooling tower blowdown will be routed to the circulating water system. ER-OLS Figure 3.3-1 has been revised accordingly. 1

b. ER-OLS Figure 3.3-1 will be amended to indicate the discharge from the settling basin into Hampton Harbor.

240.15 (3.4.2) (ER) Description of Heat Dissipation System

Please include a brief description of the emergency standby system, or cross-reference applicable text in other sections.

RESPONSE: For a description of the shutdown cooling system (cooling tower) see ER-OLS Section 5.3.2 and FSAR Sections 9.2.1 and 9.2.5.

240.16 (3.4.2.2) (ER) Intake System

Please clarify the number of intake structures; 1, 2 or 3.

RESPONSE: Refer to ER-OLS Section 3.4.2.2 and ER-OLS Figure 3.4-3. There are three (3) intake structures, each of which is connected to the intake tunnel by a 10-foot ID riser shaft.

240.17 (3.4.2.3) (ER) **Discharge System**

(Para. 2) Either the discharge flow rate or the numerical value given and its units are not correct. Please correct.

RESPONSE: Change "discharge flow rate" to "discharge velocity".

240.18 (ER) **Figure 3.4-1**

a. What are contour interval units, and to what datum?

b. Where is the diffuser?

c. Where are the three 3 (?) intakes?

RESPONSE:

a. The contour interval units are feet relative to MSL (Mean Sea Level).

b. The diffuser is located in the area marked "Discharge Site", which is approximately latitude 42°53'35"N, longitude 70°47'55"W.

c. The three intakes are located in the area marked "Intake Site", which is approximately latitude 42°54'20"N, longitude 70°47'10"W.

240.19 (ER) **Figure 3.4-3**

Why has the design of the intake structure(s) been altered over that presented in the CP ER?

RESPONSE: The intake design was changed from one intake structure to three intake structures to allow better construction techniques to be used.

240.20 (3.7) (ER) **Sanitary and Other Waste Systems**

What limitations have been imposed, or will you impose, on dissolved solids and temperature in settling basin effluents?

RESPONSE: No dissolved solid limitations have been imposed on the settling basin effluent. A maximum discharge temperature of 83°F during cooling tower operations is mandated by the NPDES Permit. However, during normal operation of the plant, only the storm water runoff and secondary floor drainage will pass through the basin. The cooling tower blowdown will be routed to the circulating water system. 1

240.21 (5.1.1.1) (ER) **Federal Thermal Criteria**

Discuss any consequences of mechanical draft tower blowdown through the settling basin.

RESPONSE: The cooling tower blowdown, if any, will be discharged to the circulating water system. Therefore, there will be no impact to the settling basin or Brown's River. 1

240.22 (5.1.1.2) (ER) **New Hampshire Thermal Criteria**

a. Under no. 2, where are the points established?

b. Under no. 3, what is the delineated mixing zone?

RESPONSE:

a. To date, the New Hampshire Water Supply Commission and Pollution Control Commission (NHWSPCC) has neither established temperature measurement points nor a mixing zone.

b. Refer to Item a. above.

240.23 (5.1.2) (ER) **Physical Effects**

a. Describe what, if any, activities will be undertaken to confirm the thermal design studies?

b. Reference 90 is wrong. Please correct.

RESPONSE:

a. The Applicant intends to conduct various hydrothermal discharge tests after station completion. These tests will be designed to verify that the discharge system will meet the requirements established by the EPA. Details of the type of tests or their scope, however, have not been finalized.

b. The correct reference number should be "9," not "90."

240.24 (5.3.2) (ER) **Cooling Tower Discharge**

See Question 240.12, para. d.

RESPONSE: Refer to response to RAI 240.12, para. d.

240.25 (7) (ER) **Environmental Effects of Accidents**

Calculate the radiological consequences of a liquid pathway release from a postulated core melt accident. The analysis should assume, unless otherwise justified, that there has been a penetration of the reactor basemat by the molten core mass, and that a substantial portion of radioactively contaminated sump water was released to the ground. Doses should be compared to those calculated in the Liquid Pathway Generic Study (NUREG-0440, 1978). Provide a summary of your analysis procedures and the values of parameters used (such as permeabilities, gradients, populations affected, water use). It is suggested that meetings with the staff of the Hydrologic Engineering Section be arranged so that we may share with you the body of information necessary to perform this analysis.

RESPONSE: The Liquid Pathway Generic Study (LPGS)(1) calculated the population doses from accidents involving liquid pathways for design basis events and for events greater than the design basis. One of the conclusions reached by this study was that doses from design basis events were much lower (in the order of several hundred man-rem to the thyroid) than from events involving core melt. This analysis for Seabrook has therefore concentrated on core melt events in determining the relative risk of Seabrook from accidents involving liquid pathways.

This determination of relative risk was made by identifying those parameters used in the LPGS analysis to calculate population doses and comparing their values at the LPGS ocean site with that at the Seabrook Station site. The ratio of each parameter is the "multiplier" relating population doses between the two sites (see ER-OLS Table 240.25-1). Multipliers were determined for the following parts of the liquid pathways:

A. Source term

B. Groundwater transport

1. Travel time of groundwater
2. Source availability
3. Retardation by sorption

C. Surface water transport

D. Usage of the water bodies

1. Aquatic food
2. Shoreline usage

The foundations of the Seabrook Station reactors are located in the bedrock of the site. A large portion of the site, including Unit 1, is founded on a gneissoid phase of the Newburyport quartz diorite intrusive; a hard, durable crystalline igneous rock consisting of medium-to-course-grained quartz diorite matrix intimately enclosing inclusions of dark gray, fine-grained diorite. A small portion of the site, including much of Unit 2, is founded on Merrimack Group metaquartzite and granulite which occurs as a large relict inclusion welded into the enclosing Newburyport igneous mass along a broad, transitional-intrusive contact zone. The physical, chemical and mechanical qualities of the rock in the Merrimack Group metamorphic inclusion are comparable to those of the Newburyport igneous rock. 1

Groundwater at the site generally occurs between 10 and 15 feet mean sea level (MSL). The basemats of the reactors, approximately -70 feet MSL, are below the water table.

The groundwater gradient in the region is clearly toward the ocean. There are no wells between the site and the ocean, so no drinking water pathway could be affected by an accidental contamination of the groundwater. There is virtually no possibility of a reversal of the groundwater gradient due to heavy pumping inland, particularly because such a reversal would, at the same time, cause an unacceptable intrusion of saltwater into the aquifer. Therefore, liquid radioactivity released from a core melt accident could only cause contamination by being transported through the groundwater and subsequently released to the Atlantic Ocean.

A conservative estimate of the shortest groundwater path to the nearest down-gradient water body, the Browns River, is estimated to be 1,000 feet through the bedrock followed by approximately 110 feet through marine and swamp deposits. A conservative estimate of the groundwater travel time would be 48 years, 10.3 years through the bedrock portion and 37.7 years through the soil portion. Groundwater travel time in the bedrock was estimated by applying Darcy's Law and checked using dewatering information from the major excavations on site. To estimate the groundwater travel time through the soil portion of the pathway, Darcy's Law was applied using the most conservative measured or estimated parameters.

Conservative values of the retardation factors, which reflect the effects of sorption on geologic materials, were estimated for the bedrock and soil, for the two radionuclides that were important contributors to the population dose in the LPGS, i.e., Sr-90 and Cs-137. In the bedrock, retardation factors of 8.6 for Sr-90 and 154 for Cs-137 were used for the fractured crystalline bedrock(3). In the soil underlying the marsh, the retardation factors were conservatively estimated to be 15 for Sr-90 and 141 for Cs-137. These retardation factors were estimated using Equation B-35 of the LPGS study. The equilibrium distribution coefficients for Sr and Cs were conservatively chosen as 2 and 20, respectively. The mean transport times from the Unit 1 reactor building to the Atlantic Ocean is, therefore, conservatively estimated to be about 650 years for Sr-90 and about 6,900 years for Cs-137. When these travel times are compared to 5.7 years for Sr-90 and 51 years for Cs-137 in the LPGS land-based ocean site case, virtually all of the Sr-90 and Cs-137 would have decayed before reaching the surface water. Parameters used to calculate radionuclide travel times and relative doses are listed in ER-OLS Table 240.25-2.

Contaminants released from the shoreline would disperse in the oceanic turbulence. The LPGS made no distinction between the turbulence that would be found in the east, Gulf, or west coasts of the United States. The only assumption which can be made

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without site-specific data is that the mixing at the Seabrook Station and LPGS sites is similar.

The two major liquid exposure pathways for an ocean site without a drinking water pathway, are aquatic food consumption and direct shoreline exposure. The commercial and recreational finfish and shellfish harvest for a rectangular block 80 km alongshore and stretching 40 km offshore from Seabrook Station has been estimated to be about 24.0×10^6 kg. This estimate is based on information and data obtained from the National Marine Fisheries Service. For comparison, the same size block using the LPGS ocean site fish catch densities would yield about 5.8×10^6 kg of finfish.

Therefore, fish production from the ocean in the vicinity of the Seabrook Station has been estimated to be approximately four times the generic ocean site in the LPGS. Most of the dose from fish consumption resulted from the two radionuclides discussed above however, and, since these will effectively decay the dose from this pathway will be much lower for Seabrook than for the LPGS site.

The annual population beach usage factor within the 50-mile radius of Seabrook was estimated in two parts. For the 0 to 10-mile radius of beach, the summer (June-August) transient population in the NNE through south sectors, with respect to the site, were derived from the seasonal resident, hotel/motel, campground and daily transient population groups as given on Figures 2.1-10, 2.1-11, 2.1-12, 2.1-13, 2.1-15 and 2.1-19 of the SB-FSAR. In the case of daily transients associated with beach parking lots and on-street parking, the maximum capacity figures given on FSAR Figures 2.1-15 and 2.1-19 were multiplied by 0.79 to represent the maximum observed population associated with these two categories in three years of observation. This single day (Sunday) peak observed beach population was then adjusted by applying the average observed daily population loading factor as derived from Figure 2.1-17 of the SB-FSAR. For weekdays, this factor represented 46% of the single day peak observed values, while the Saturdays' loading factor was estimated to be 66% of the Sunday observed peak. These results were then added to the other seasonal transient groups noted above. These daily population beach area inventories were then multiplied by the number of weekdays (64) or weekend days (13 Saturdays, 13 Sundays) assumed to represent the summer beach season. These values were then multiplied by a daily average beach population loading factor (0.27) which corrected the peak observed population values that relate to the maximum number of people on the beach during the height of the beach day to an hourly average value over an entire 24-hour period. This hourly loading factor was derived from the time-of-day vehicle distribution data in SB-FSAR Figure 2.1.16. Finally, a multiplier of 0.25 is used to estimate the fraction of time that beach users, while on the beach, are in the active area of radioactivity deposition at the ocean-shoreline interface. The resulting multiplication of peak observed population, times daily usage factor, times hourly average loading factor, times shoreline 1 exposure period gives an estimate of the number of person-hours/year of beach use. The total 0-10 mile population occupancy factor is estimated to be 9.8×10^6 person-hours/year.

The second part of the estimate involves the beach usage between 10 and 50 miles from the site. For beaches north of the site, an estimate of beach capacity of 33,148 persons (FSAR-Section 2.1.3.3.f.1.a.) was multiplied by 90 days per year summer season, the 0.27 average hourly loading factor per day, plus the 0.25 shoreline exposure fraction. For beaches south of the site, no specific beach capacity estimates were identified. Therefore for the 40 miles of beach area assumed to be south of the site, an average capacity loading of 1 person per 2 feet of beach was used to estimate the beach capacity, and this then corrected as noted above.

The beach usage factor for the 10-50 mile radius was estimated to be 2.0×10^7 person-hour per year. The total 0-50 mile radius beach usage population value is thus estimated to be 3.0×10^7 person-hours/year.

The shoreline usage factors discussed above show that the total man-hours may be slightly higher than was assumed in the LPGS. Essentially, all of the shoreline and swimming exposure in the LPGS ocean site came from Cs-137. However, since decay will remove Cs-137 before it reaches the ocean at Seabrook, this pathway can be eliminated.

The LPGS determined that accidents involving liquid pathways did not contribute significantly to public risk. This analysis has shown that liquid pathway accidents involving the Seabrook Station would be of much lower consequence than was reported for the LPGS site. Therefore these types of accidents are not expected to significantly increase the risk from the operation of Seabrook.

Mitigating actions which could be undertaken to decrease liquid pathway impacts following a core-melt accident include the following:

1. Injection or withdrawal of water;
2. Lowering of the watertable;
3. Installation of a grout curtain.

For Seabrook Station; the third method, installation of a grout curtain, would be the most reasonable approach to source interdiction. The first two methods would probably not be feasible due to the local topography, location of the melt debris, and proximity of the site to the ocean.

Injection of a chemical grout slurry curtain through holes slant-drilled to a depth below the core debris could be engineered to form an effective waterproof seal around the debris creating a permanent isolation barrier. 1

References to 240.25

1. U.S. Nuclear Regulatory Commission, 1978, "Liquid Pathway Generic Study", NUREG-0440, February 1978.

2. FSAR Seabrook Station, Units 1 and 2.

3. Draft Environmental Statement, V.C. Summer Station/Unit No. 1, NUREG-0534 Supplement, USNRC, November 1980. 1

240.26 (6.2.1.2) (ER) — Environmental Radiological Monitoring

Will settling pond effluents be monitored?

RESPONSE: Since there are no potential pathways for any liquid radioactive material in the settling pond during the preoperational phase of Seabrook, the effluents from the settling pond will not be monitored for radioactivity. During the operational phase, discharges of potentially radioactive effluent will be to the circulating water system. Seabrook Station will monitor all effluent pathways in accordance with Regulatory Guide 1.21.

240.27 (10.3) (ER) — Discharge System

See question 240.12, part d.

RESPONSE: Refer to response to RAI 240.12, part d.

240.28 (12) (ER) — Environmental Approvals and Consultations

What permits are required, and what is their status, for settling basin effluents?

RESPONSE: The settling basin discharges into the Browns River and therefore, a NPDES permit is required. Currently, this discharge is permitted under permit No. NH0020338. Application for renewal of this permit was made to EPA Region I on January 30, 1981, but because of delay in issuance of the Steam Electric Power Generating Point Source Category performance standards, the permit processing is stalled. The applicant is covered by the old permit under Administrative Procedures Act wording that allows an expired NPDES permit to remain in effect if reapplication has been made and if the permit is not reissued due to factors beyond the permittees control.

290.1 (ER Sec. 4.1) — Terrestrial Resources

Provide a site map indicating location of additional space cleared for equipment laydown and construction facilities, and provide an estimate of the amount of upland woods cleared.

RESPONSE: ER-OLS Figure 290.1-1 is an aerial black and white photograph of the site and its immediate environs. The areas cleared for construction and permanent plant structures are visible except for 9.2 acres cleared since the photograph was taken in June, 1981. In total, 193.5 acres have been cleared since the start of construction.

290.2 (ER Sec. 5.5) Provide a description of the grounding systems and line clearances which will be used to reduce operating induced voltages and currents in conducting objects such as fences and large vehicles,

TABLE 240.25-1

Summary of Factors in Seabrook and LPGS Ocean Site Comparison

Factor	LPGS	Seabrook	Multiplier
A. Source Term	3411 Mwth	3411 Mwth	Equal to unity
B. Groundwater Transport			
1. Travel time of water	6.7 ft/day	0.26 ft/day in bedrock 0.008 ft/day in soil	Much less than unity
2. Source availability	Source directly immersed in flowing groundwater	Source directly immersed in flowing groundwater	Equal to unity
3. Retardation coefficients	9.2 for Sr 83 for Cs	8.6 for Sr, bedrock 154 for Cs, bedrock 15 for Sr, soil 141 for Cs, soil	Less than unity
C. Surface Water Transport	-	-	Assumed equal to unity
D. Usage			
1. Aquatic food	5.8×10^6 kg finfish	24.0×10^6 kg finfish and shellfish	Approximately equal to 4
2. Shoreline usage	1.1×10^7 man-hrs/yr	3×10^7 man-hrs/yr	Approximately equal to 3

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TABLE 240.25-2

Parameters Used for Seabrook Station

Parameter	Value	
Permeabilities	$K_{bedrock}$ = 2.1 gpd/ft^2	
	K_{soil} = 0.6 gpd/ft^2	
Groundwater gradients	$I_{bedrock}$ = 0.014 ft/ft	
	I_{soil} = 0.02 ft/ft	
Distance from reactor to nearest surface water leading to ocean	$L_{bedrock}$ = 1,000 ft	
	L_{soil} = 110 ft	
	L_{total} = 1,110 ft	
Retardation factors for ion exchange in soil	Sr - 8.6 bedrock, 15 soil	
	Cs - 154 bedrock, 141 soil	
Porosity	Bedrock = 0.015	
	Soil = 0.2	
Fish harvest statistics		
Commercial	0-3 miles	214 kg/ha/yr
	3-12 miles	42 kg/ha/yr
	12-200 miles	17.3 kg/ha/yr
Recreational	0-3 miles	87 kg/ha/yr
	3-12 miles	26.5 kg/ha/yr
	12-25 miles	7.6 kg/ha/yr
Shoreline usage		
beach season duration	weekdays	64 days
	Saturdays	13 days
	Sundays	13 days
beach population (daily peak values)	weekdays (0-10 miles)	59,216 persons
	Saturdays (0-10 miles)	78,601 persons

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TABLE 240.25-2

Parameters Used for Seabrook Station
(Continued)

	Sundays (0-10 miles)	93,799 persons
	All days (10-50 miles)	138,748 persons
Shoreline usage		
average daily population beach loading factor		.27
fraction of time persons on beach are in active land-ocean interface zone		.25

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PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	AERIAL PHOTOGRAPH (JUNE 1981) OF THE SEABROOK SITE AND ITS IMMEDIATE ENVIRONS SHOWING AREAS CLEARED FOR CONSTRUCTION AND PERMANENT PLANT STRUCTURE
	FIGURE 290.1-1

in the vicinity of the right-of-way. Provide an estimation of the maximum electrical fields (in kilovolts per meter) at a one-meter height beneath the proposed transmission lines and at the edge of the right-of-way. Provide an assessment of the biological significance of the electric fields to be generated by operation of the Seabrook transmission facilities.

RESPONSE: The 345 kV transmission lines from Seabrook have local grounds at each structure with two overhead statics and a counterpoise. It is the intent to have the equivalent of a continuous counterpoise along the various routes.

These lines are designed for a minimum ground clearance of 35 feet with the conductor temperature of 100°C in New Hampshire, and a minimum of 30 feet ground clearance at 140°C conductor temperature in Massachusetts. Ground clearance over parking lots where vehicles could be parked is designed for a minimum of 50-foot with a conductor temperature of 100°C.

All fences in or along the right-of-way, regardless of orientation to the centerline of the transmission line, are grounded at 50 feet intervals. All gates are also grounded.

The electric field strength on the H-Frame portion of the lines is estimated to be a maximum 5.7 kV/meter at one-meter height beneath the proposed transmission lines at minimum design clearances noted above. At the edge of the right-of-way with the narrowest right-of-way, the estimated field strength will not be over 2.2 kV/meter. For most of the line, the estimated field strength at the edge of the right-of-way will not exceed 1.6 kV/meter.

The electric field strength for the single pole portion of the Seabrook-Newington line in Portsmouth is estimated to 3.8 kV/meter beneath the line and not over 0.9 kV/meter at the edge of the right-of-way. The field strength for the portion of line along the railroad right-of-way north from Seabrook, will be less than the Portsmouth area because the clearance above ground is greater due to required railroad clearances.

The maximum electrical fields at various points within and at the edge of the right-of-way are given above. Based on previous assessments of extra high voltage (EHV) transmission line health and environmental effects that have considered a wide range of potential problems, the applicant believes the 345 kV Seabrook lines will not produce any significant health or environmental risks.

This Seabrook transmission facility assessment relies heavily on two sources - a New York Public Service Commission (PSC) hearing on 765 kV power lines and a U.S. Environmental Protection Agency (EPA) document (ORP/SEPD 80-13). Both informational sources are comprehensive in their review of EHV environmental effects. The New York 765 kV hearings lasted nearly three years; considered the expert testimony of 31 witnesses; and yielded a record that runs over 17,000 pages. The EPA document is based on an agency review of over 150 technical papers. Although different in some ways, the purpose of the two evaluations was essentially similar - each was evaluating the potential health risks associated with operation of EHV transmission lines. To do this, both considered the following subjects:

1. Ozone - Ozone is a gas produced by the conductors of a transmission line whenever those conductors are in a corona stage, i.e., the effect produced from the attachment of foreign substances such as ice or raindrops. Ozone is produced largely under adverse weather conditions. In large amounts, ozone can produce adverse effects in both animals and plants.

2. Pacemakers - Implanted cardiac pacemakers may be adversely affected by electric or magnetic fields. Since high voltage transmission lines create such fields, the possible effect on pacemakers has received careful attention.

3. Electric Shock and Operating Experience - Electric fields surrounding transmission lines will induce an electric charge in conducting objects within the right-of-way. Persons who are partially or fully grounded and touch such objects may receive a spark discharge or be shocked by a steady current.

4. Noise - The corona stage for transmission line conductors produces a noise that is audible to the human ear at various distances. This noise is a wet conductor phenomenon which occurs during conditions of rain, fog, or snow. The effect of noise on persons and dwellings on or near the right-of-way has been the subject of some investigation.

5. Biological Effects of Magnetic and Electrical Fields - This area of inquiry is one that draws much attention. This category covers long-term effects due to the direct interaction of EHV fields with the body of the exposed organism. Effects evaluated are typically subtle and may involve investigation of behavioral, endocrinal, neurological, hematological, or epidemiological data.

Neither the New York PSC nor the EPA found EHV fields to pose a risk to human health. The recommended decision of the two administrative law judges who heard the New York case reads as follows on the specific concerns mentioned above:

Ozone - No substantial hazard from ozone is posed by EHV transmission lines.

Pacemakers - No substantial hazard to wearers of pacemakers is expected from EHV transmission lines.

Electric Shock - For EHV lines designed as proposed in this case, there is no risk of serious electric shock.

Audible Noise - No serious condition of audible noise will be caused by EHV lines constructed as proposed in this case.

Effects on Wildlife - No adverse effects upon wildlife will be caused by operation of the EHV lines proposed in this case.

Effects on Humans - Occasional exposure to the electric and magnetic fields of the EHV lines proposed in this case does not present a hazard to human health.

One further conclusion by these judges is pertinent. They state that, "None of the evidence in this proceeding indicates a need for the Commission to take any action with respect to transmission lines operating at voltages lower than the 765 kV." One should be reminded that at Seabrook we are talking about 345 kV lines with maximum field strengths that are substantially lower than the 765 kV field strengths evaluated by New York PSC.

The EPA evaluation of EHV fields contains the conclusory statement, "it also appears to be reasonably well-established that the normal environment produced by such transmission lines does not produce any significant health or environmental risk."

One final point, Public Service Company of New Hampshire has operated about 175 miles of 345 kV line for over 11 years. The design of this line is similar to that approved for Seabrook transmission facilities. Over this time, there have not been customer complaints associated with perceived electric field health impairments.

290.3
(ER Sec.
6.1.4.3) Provide the list of federal and state endangered and threatened plant and animal species referred to in ER Section 6.1.4.3.

RESPONSE: The list of New Hampshire endangered and threatened species is as follows:

Endangered

Atlantic Salmon
Sunapee Trout
Shortnose Sturgeon
Atlantic Sturgeon
Timber Rattlesnake
*Bald Eagle
*Peregrine
Lynx
*Indiana Bat

Threatened

Common Loon
Cooper's Hawk

Marsh Hawk
Red-shouldered Hawk
Golden Eagle
Osprey
Upland Sandpiper
Common Tern
Arctic Tern
Whip-poor-will
Purple Martin
Eastern Bluebird
Pine Marten
Bobcat
American Shad

A list of the federal endangered and threatened plant and animal species can be found in 50CFR17.11 and 50CFR17.12.

*Also appears on the Federal Endangered Species List

290.4 (ER) There is no discussion of audible noise in ER-OLS Section 3.9 as stated in ER-OLS Section 5.5.

RESPONSE: ER-OLS Section 5.5 incorrectly referenced ER-OLS Section 3.9 for a discussion of audible noise. The discussion of audible noise from the transmission lines remains unchanged from that presented in Section 5.6 of the Seabrook Station ER-CPS.

Terrestrial Resources

290.5 Please provide the staff with 1 set of suitable topographic maps showing the proposed Seabrook - Tewksbury and the Seabrook - Scobie Pond transmission lines.

RESPONSE: A set of topographic maps showing the Seabrook - Tewksbury and the Seabrook - Scobie Pond transmission line route has been provided to the NRC.

290.6 Provide a description of the methods to be used to insure continued stabilization of the rock storage area, including any efforts to promote natural re-vegetation of this area.

RESPONSE: The rock storage area contains material produced from two general activities, the excavation of native bed rock for placement of facility foundations, etc. (principally, the two containment structures and the screenhouse forebay), and tunnel construction. Both of these are completed to the point that they are no longer generating rock. Presently, the stored rock pile is stable, perimeter angles of repose are established, these slopes are not being disturbed, and it is not an area where foot traffic occurs. Some interior slopes are worked for removal of rock useful as fill on the site or for preparation of lay-down areas on the rock pile itself. 2

Continued stabilization of the area is insured by a continuation of the same reasonable site management practices as have been employed during the build-up of the pile. These include such measures as:

- Project notice prohibiting dumping on perimeter slopes
- Posted prohibition of dumping along rock pile perimeter
- Driver indoctrination sessions
- Weekly environmental surveillance
- Environmental checks by Site Environmental Review Board

In addition, natural re-vegetation is occurring and this will add to the overall stability to the rock pile. While there are no active efforts underway to promote natural re-vegetation, neither is it discouraged, and our observations show that except for continually disturbed portions, the rock storage area is becoming re-vegetated (see the photos, Figures 290.6-1 and 290.6-2). 2

TABLE 291.1-1

Estimated Total Number of Fish Caught by
Marine Recreational Fishermen, By Species and State
Jan. 1979 - Dec. 1979

Species	Maine	New Hampshire	Massachusetts
		Thousands	
Basses, Sea	*	*	330
Bluefish	_	_	969
Bonito, Atlantic	*	*	*
Catfishes, Sea	*	*	_
Catfishes, Freshwater	*	*	*
Cod, Atlantic	396	99	1,835
Cunner	_	57	914
Eel, American	_	*	73
Flounders, Summer	_	*	378
Flounders, Winter	179	252	10,249
Flounders	148	_	_
Hakes	_	_	57
Herrings	_	_	475
Mackerel, Atlantic	373	334	1,093
Mackerels and Tunas	*	*	_
Perch, White	_	*	103
Pinfish	*	*	_
Pollock	276	419	1,510
Porgies	*	*	_
Puffers	*	*	*
Scup	*	*	949
Sea Robins	_	_	118
Sharks	*	*	_
Sharks, Dogfish	_	_	87
Skates and Rays	_	_	130
Smelts	_	120	521
Striped Bass	_	*	59
Tautog	*	*	54
Toadfishes	*	*	*
Tomcod, Atlantic	_	_	698
Trigger and Filefishes	*	*	*
Weakfish	*	*	*
Windowpane	*	_	_
Other Fish	232	58	1,886
TOTALS	1,688	1,375	22,554

NOTE: An asterisk (*) denotes none reported.

NOTE: An underscore (_) denotes less than thirty thousand reported. However, the figure is included in column totals.

Source: National Marine Fisheries Service, 1980, Marine Recreational Fisheries Statistics Survey, Atlantic and Gulf Coast, 1979. Current Fisheries Statistics No. 8063, December 1980.

291.0 Aquatic Resources

Section 2.1.3.4 Recreational and Commercial Fisheries

This section states that anglers catch greater than one million pounds of striped bass anually from the marine waters within a 50-mile radius of Seabrook.

291.1 (ER) a. Provide similar estimates of annual angler harvests for the other major recreational finfish species noted in ER.

RESPONSE: a. Available estimates and most current data for major marine recreational finfish are presented in Table 291.1-1. Estimates for marine species listed in the ER-OLS and not in the table were not available.

The number of freshwater species stocked and described in Table 2.1-32 of the ER-OLS are assumed to be roughly the number harvested as this is a "put and take" fishery. Estimates for other freshwater species are not available.

291.2 (ER) b) Provide estimates of annual recreational harvests of soft clam (Mya) and lobster within the 50-mile radius;

RESPONSE: b) Estimates of soft-shell clam recreational harvests have been obtained from the most reliable sources available (ER-OLS Table 291.2-1). South of Portland, the recreational fishery in the State of Maine is limited, as is commercial harvesting, due to pollution. Almost two-thirds of the recreational harvest within the 50-mile radius occurs in northern Massachusetts. In contrast, the commercial harvest from Boston Harbor northwards is on the order of 200,000 bushels; thus, the recreational harvest is less than 6% of the total.

Lobster landings within a 50-mile radius are estimated at approximately 170,000 pounds annually (ER-OLS Table 291.2-2). The Commonwealth of Massachusetts each year publishes a booklet on coastal lobster fishery statistics (e.g., Anderson and Nash, 1980) which includes landings for "other" (i.e., non-commercial) license holders. The landings are itemized by county, and the three northernmost Massachusetts counties have been taken to represent the Massachusetts portion of the 50-mile radius area. In the State of Maine, no non-commercial licenses are issued. Non-commercial harvests in New Hampshire and Massachusetts comprise 0.75% and 4.5% of the total catch, respectively (see footnotes, ER-OLS Table 291.2-2).

References to 291.2

Anderson, C. O. and G. M. Nash (1980). 1979 Massachusetts Coastal Lobster Fishery Statistics. Mass. Div. of Marine Fisheries, Publ. #12199-24-200-11/80 C. R.

291.3 (ER) Provide estimates of finfish and shellfish harvests within Hampton-Seabrook estuary.

RESPONSE: The principal finfish species taken in Hampton-Seabrook estuary are winter flounder, Pseudopleuronectes americanus, and pollock, Pollachius virens (ER-OLS Table 291.3-1); while soft-shell clams (Mya arenaria) constitute the only substantial shell fishery (ER-OLS Table 291.3-2).

Angler harvest estimates for the estuary were obtained by: 1) adjusting downwards, the New Hampshire statewide marine recreational fishing survey catch estimates (N.H. Fish and Game Department, 1980, 1981) by the proportion of census coverage given to Hampton-Seabrook estuary relative to total coverage statewide (Bob Fawcett, N.H. Fish & Game Dept., pers. comm.); and 2) multiplying the adjusted total catch figures by the fraction of total catch representing each species reported caught. Species composition data were derived from the original field census forms filled out during fishermen interviews in Hampton-Seabrook estuary during 1979 and 1980 (provided by the N.H. Fish and Game Department). Winter flounder and pollock accounted for almost 90% of the total catch in both years (ER-OLS Table 291.3-1). Striped bass, Morone saxatilis, constituted a substantial proportion of the catch in the early 1970's (approximately 20% in 1973; NAI, 1974) but have declined in relative importance in recent years.

In Hampton-Seabrook estuary, as in the rest of New Hampshire, the soft-shell harvest season runs from early September through late May; the flats being closed to digging from Memorial Day through Labor Day. Only recreational digging is permitted and is restricted to Fridays and Saturdays. The limit is ten quarts (1.25 pecks) per day. Due to an abundance of clams seeded in 1976 and 1977, the harvest is presently at, or near, peak level (ER-OLS Table 291.3-2). As recently as 1977, the annual harvest was estimated to be below 1,000 bushels (NAI, 1978). While sales of clamming licenses are far from an all time high, the number of license holders has increased dramatically in the past few years, from 2,215 in 1979 to 5,062 in 1980; as of September, 7,780 licenses had been sold in 1980 with the number eventually expected to top 10,000 (Lee Welcome, N.H. Fish and Game Department, pers. comm.).

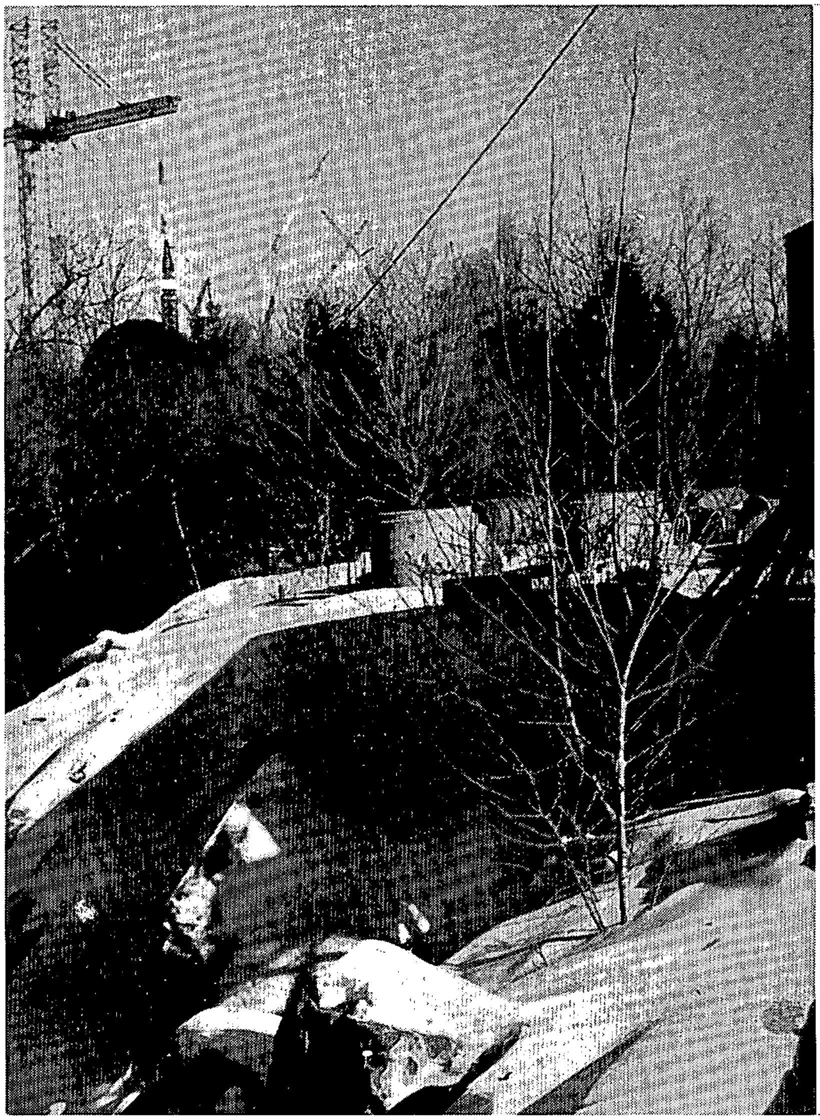
References to 291.3

New Hampshire Fish and Game Department (1980). Table 3. Marine Recreational Fishing Survey, 1979. IN: Annual Report of the Division of Inland and Marine Fisheries.

_____ (1981). Table 3. Marine Recreational Fishing Survey, 1980. IN: Annual Report of the Division of Inland and Marine Fisheries.

Normandeau Associates, Inc. 1974. Finfish ecology investigations at the Hampton-Seabrook Estuary, NH and adjoining coastal waters, 1973-74. Technical Report V-3.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2 ENVIRONMENTAL REPORT OPERATING LICENSE STAGE	OCCURRENCE OF NATURAL RE-VEGETATION OF THE ROCK STORAGE AREA
	FIGURE 290.6-1



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

OCCURRENCE OF NATURAL RE-VEGETATION OF THE ROCK STORAGE AREA

FIGURE 290.6-2

TABLE 291.2-1 SOFT SHELL CLAM ANNUAL RECREATIONAL HARVESTS WITHIN A 50-MILE RADIUS OF SEABROOK STATION.

NO. OF BUSHELS	AREAS	SOURCE(S)
700	Kennebunkport, ME	Warden - Kim Johnson (1980)
170	York, ME	Warden - Morris Payne (1980)
280	Wells, ME	Warden - Bert Perkins (1980)
350	Ogunquit, ME	DMR Regional Biologist, Brad Sterl (1980)
5,000	Hampton-Seabrook Estuary (NH)	NAI Clammer Census[(a)] data (Fall '80 - Spring '81)
1,000	Remainder of NH waters	Based on assumption of H-S estuary representing 80% of fishery (Ted Spurr, pers. comm., N.H. Fish & Game Dept.)
500-1,000 (750)	Essex, MA	DMF Marine Biologist, Pat Rule 1979-1980 harvests from ledger representing town records entries
600-800 (700)	Gloucester, MA	"
6,000-9,000 (7,500)	Ipswich, MA	"
1,300	Newbury, MA	"
700-1,000 (850)	Rowley, MA	"

(a)NAI unpublished data

TABLE 291.2-2 LOBSTER, HOMARUS AMERICANUS

TALLY OF 1979 NON-COMMERCIAL HARVESTS WITHIN A 50-MILE RADIUS OF SEABROOK, N.H.

NO. OF LBS.	AREA	SOURCE(S)
0[a]	All Maine	Walter Foster, Maine DMR
5,200[b]	All New Hampshire	Ted Spurr, N.H. Fish & Game Dept.
108,157[c]	Essex Co., MA	Table 7, MA Coastal Lobster Fishery Statistics, Anderson and Nash (1980)
24,075	Suffolk Co., MA	"
31,059	Norfolk Co., MA	"
170,000		

[a]Fishery restricted to commercial harvesting only.

[b]NH non-commercial harvest represents 0.75% of total catch.

[c]MA non-commercial harvest represents 4.5% of total catch.

_____. 1978. Studies on the soft-shelled clam, *Mya arenaria*, in the vicinity of Hampton-Seabrook Estuary, NH. Technical Report VIII-2.

_____. 1981. Soft-shell clam, *Mya arenaria* study. Technical Report XI-1.

Section 2.2.2 Aquatic Ecology

This section provides summary discussions on biota and studies since 1975, and references several documents. Provide copies of the following:

291.4 (ER) a. "Summary Document: Assessment of Anticipated Impact of Construction and Operation of Seabrook Station on the Estuarine, Coastal, and Off-shore Waters, Hampton-Seabrook, New Hampshire". Normandeau Associates, Inc., 1977.

RESPONSE: A copy of the "Summary Document" has been provided to the NRC.

291.5 (ER) b. Copies of environmental monitoring reports covering the period between that considered in the "Summary Document" and the present time.

RESPONSE: Single copies of all technical reports that have been produced following the preparation of the "Summary Document" have been provided to the NRC.

291.6 (ER) c. An updated and current revision of the March 1977 "Index to Environmental and Related Information (Biological, Hydrographic, Hydrothermal, Hydraulic, and Archaeological) Seabrook Nuclear Station".

RESPONSE: There has been no update or revision of this document.

291.7 (ER) Provide data on the occurrence (known or expected) of endangered marine animals (federal and state) in the Seabrook site vicinity.

RESPONSE: The shortnose sturgeon (Acipenser brevirostrum) appears on both federal and state of New Hampshire endangered species list. Public Service Company of New Hampshire's consultant has a National Marine Fisheries Permit (#213) which covers the incidental capture of this species; none have been captured in the study area to date and considering its scarcity in the Gulf of Maine, none are expected.

Both Atlantic sturgeon (A. oxyrhynchus) and Atlantic salmon (Salmo salar) are listed as endangered species by the State of New Hampshire. One Atlantic sturgeon was captured in a gill net near the intake site in November of 1973, but none have been captured since that time in continued monthly gill netting and otter trawling at three offshore sites. Although quite uncommon, their incidental capture in the study area could occur in the future.

No Atlantic salmon have been captured in the study area to date. Their incidental capture could occur in the future depending on the success of a restoration program in the Merrimack River by a cooperative effort of the N.H. Fish & Game Department,

TABLE 291.3-1

ESTIMATES OF THE MAXIMUM[1] SEASONAL
(JUNE THROUGH SEPTEMBER)
ANGLER LANDINGS OF DOMINANT SPECIES IN HAMPTON - SEABROOK ESTUARY
IN 1979 AND 1980

SPECIES	1979 RAW[2] COUNT	1979 ESTIMATED[3] SEASONAL CATCH	1979 % EST. SEASONAL CATCH	1980 RAW COUNT	1980 ESTIMATED SEASONAL CATCH	1980 % EST. SEASONAL CATCH
Winter Flounder	170	8,000	(34)	220	13,000	(33)
Pollock	393	13,000	(55)	410	22,000	(55)
Cunner	26	800	(3)	12	700	(2)
Hake (red, white, silver)	2	70	(<1)	16	1,200	(3)
Cod	15	300	(1)	39	1,000	(2)
Sculpin	23	700	(3)	17	900	(2)
Other Flounder (windowpane, smooth etc.)	2	70	(<1)	5	300	(1)
Sea Raven	2	70	(<1)	1	60	(< 1)
Coho Salmon	2	70	(<1)	6	300	(1)
Mackeral	3	30	(<1)	58	60	(< 1)
Smelt	14	400	(2)			
Skate	1	30	(<1)			
Black Sea Bass	3	100	(<1)	1	60	(< 1)
Bluefish	2	70	(<1)			
Silversides				6	300	(1)

1. It is assumed that the fishing effort is equal over the length of the day (14 hours per day average).

2. From N. H. Fish & Game Creel Census from Hampton-Seabrook area; assume all bridge/pier/jetty, all beach/bank and 1/3 of private boat (to account for estuary-only catch) counts. There is not a linear relationship between raw counts and seasonal catch because of relative differences in catch interpretation between the three fishing methods.

3. Estimated from N. H. Fish and Game Creel Census data. This assumes the catch in Hampton-Seabrook is proportional to the number of stations sampled in this area, compared with the state-wide catch and sampling effort.

TABLE 291.3-2. ESTIMATION OF SOFT-SHELL CLAM ANNUAL HARVEST IN HAMPTON-SEABROOK ESTUARY, SEPTEMBER 1980 THROUGH MAY 1981[a].

MONTHS	NO. OF CLAMMING DAYS IN MONTH	AVERAGE NO. OF PECKS PER DAY[c]	TOTAL PECKS[d]
Sep '80	8 (3)[b]	190	1520
Oct '80	9 (3)	190	1710
Nov '80	9 (0)	140 (assumed)	1260
Dec '80	8 (0)	110 (assumed)	880
Jan '81	10 (1)	40	400
Feb '81	8 (2)	250	2000
Mar '81	8 (2)	300	2400
Apr '81	8 (4)	340	2720
May '81	10 (3)	380	3800
			20000 pecks[e]
			= 5000 bushels

Represents single harvest season; fishery is non-commercial only and is[a] closed from Memorial Day through Labor Day.

[b]( ) days number of diggers were counted.

[c]Based on number of diggers observed on flats; assumes each digger takes legal limit of 1.25 peck.

[d]Column 2 times column 3.

[e]Adjusted upward by 20% to account for diggers leaving early and replaced by latecomers.

2

Massachusetts Division of Fish & Wildlife, U.S. Fish & Wildlife Service, and the National Marine Fisheries Service.

291.8
(ER)

Provide a bibliographic listing, and reprint copies of all journals and professional conference proceedings publications (by applicant and applicant's consultants) that have resulted from studies and monitoring of the coastal, estuarine, and freshwaters associated with Seabrook Station.

RESPONSE: Journal and professional conference proceedings publications that have resulted from Seabrook studies:

Coffin, W. L., 1978-1979. A list of harpacticoid copepods from Northern New England, U.S.A. Vie Milieu. 28-20 (Se'r AB): 589-595.

Hartwell, A. D., 1975. Hydrographic factors affecting the distribution and movement of toxic dinoflagellates in western Gulf of Maine. pp. 47-68 in Proceed. 1st Int'l Conf. on Toxic Dinoflagellate Blooms. MA Sci. and Tech. Found. 1975. Wakefield, MA. 541 pp.

_____. 1976. Effects of storms on coastal currents of the western Gulf of Maine. E.O.S. Trans. A.G.U. 57(4):261.

Lindsay, J. A., and N. B. Savage. 1978. Northern New England's threatened soft-shell clam populations. Environ. Man. 2(5):443-452.

Savage, N. B., and R. Goldberg. 1976. Investigation of practical means of distinguishing Mya arenaria and Hiatella sp. larvae in plankton samples. Proceed. Nat'l. Shellf. Assoc. 66:42-53.

Copies of these publications have been provided to the NRC.

291.9
(ER)

Section 3.4 Heat Dissipation System

Provide, in table form, a comparison of all system specifications as they now exist with those that were evaluated in the 1974 AEC FES-CP stage.

RESPONSE: A comparison of all heat dissipation system* specifications as they now exist with those that were evaluated in the 1974 AEC FES-CP stage is provided below.

	1974 FES-CP	1981 ER-OL
Heat Discharge Rate (Btu/hr)**	$16x10^9$	$16x10^9$
Flow Rate (gpm)**	824,000	824,000
Delta T (^oF)	38	39
Number of Intake Structures	1	3
Intake Structure Depth, MLW (ft)	30	50
Intake Structure Diameter (ft)	64	30.5
Intake Structure Height (ft)	8.4	7.0
Length of Intake Tunnel (ft)	13,000	17,160
Diameter of Intake Tunnel (ft)	18	19
Length of Discharge Tunnel (ft)	15,000	16,500
Diameter of Discharge Tunnel (ft)	18	19
Diffuser Depth, MLW (ft)	40	50 to 60
Length of Diffuser (ft)	550-1100***	1000
Number of Discharge Nozzles	---	22
Discharge Velocity (fps)**	12 to 15	15

2

*EPA approval August 4, 1978

**Values given are for 2-unit operation

***Design length of diffuser had not been finalized

291.10 (ER) Provide a brief historical discussion of the regulatory requirements that resulted in the present system specifications.

RESPONSE: The heat dissipation system design has been influenced by the regulations of state and federal agencies. Under New Hampshire law, approval for the system discharge conditions is granted by the Water Supply and Pollution Control Commission acting with the N.H. Fish and Game Department and other governmental agencies, boards and commissions whose chairmen form the N.H. Bulk Power Site Evaluation Committee.

The state review and hearing process investigated all aspects of the cooling system design and resulted in approval of the system as proposed by the Applicant. The state initially approved a once-through system having a single intake 3,000-feet offshore. Later when the EPA required that the intake be extended 4,000-feet further, the state reluctantly gave its approval to the extension. The state also concurred in a modification suggested by the Applicant to use three intakes rather than one to reduce cost and improve performance.

The EPA approval was not applied for until the state approval was granted and it was apparent that NRC approval of the basic design would be obtainable. The EPA requirements and procedures were the least defined of all agencies. However, approval of the once-through system proposed by the Applicant was obtained; but only after a somewhat arbitrary extension of the intake location

4,000 feet eastward. That approval was reversed, challenged and re-reversed over a lengthy period. However, no changes to the system design resulted from the legal process.

The cooling tower was added to the ultimate heat sink portion of the cooling system when the Applicant was unable to convince the NRC staff of the seismic capability of the bedrock tunnels. Together, the tunnel and cooling tower portions of the system qualify as the heat sink.

The chlorine minimization program of the EPA appears to be evolving to allow use of continuous low-level chlorination to control biofouling. State and EPA regional officials are aware that the cooling system has been designed and is being built to capitalize on the advantages of low-level chlorination as well as thermal backflushing.

A chronology of licensing events is provided in ER-OLS Table 291.10-1. Many issues intertwined and resulted in rehearing of previously disposed of issues. So it is only in the total context of the entire process that the impact on design can be understood. In conclusion, the hearing process had no effect on system design - only schedule and cost.

291.11 (ER) Provide the details of the proposed plan of study for 316(a) and 316(b) monitoring under the NPDES Permit.

RESPONSE: Section 6.2.2 indicates that the comprehensive preoperational monitoring program will continue after start-up, thereby providing the bases for assessment of plant operational effects. This information should meet, in large measure, the monitoring needs of 316(a).

In addition to the extensive program conducted in the receiving waters, there will be analysis of entrained plankton from samples collected twice each week with special attention to commercially valuable forms. Extrapolative estimates of <u>Mya arenaria</u>, lobster, and finfish larvae that are entrained by the circulating water system will result. Furthermore, a weekly assessment of intake entrapment of finfish and other nektonic marine organisms will be accomplished. Both the entrainment and entrapment monitoring are required by a State of New Hampshire permit.

291.12 (ER) Provide a copy of the NPDES Permit for plant operation submitted to EPA (as indicated in ER-OL Section 12).

RESPONSE: A copy of the January 30, 1981 application to the EPA for renewal of NPDES Permit NH0020338 has been provided to the NRC.

291.13 (ER) Provide a copy of the 401 Certification issued by the State of New Hampshire (as per Section 12).

RESPONSE: A copy of the Certification of Seabrook Station Discharge Systems under applicable state and federal requirements has been provided to the NRC.

291.14 (ER) Discuss any new information (i.e., since the publication of the FES-CP) on the existing water quality stresses in the Browns River or in the Gulf of Maine near the station intake and discharge structures.

RESPONSE: Additional information on possible water quality stresses in the Browns River can be found in the report, "A Survey of Possible Sources of Contamination into the Upper Reaches of the Browns River". A copy of this report has been provided to the NRC.

There are no new point source pollutants in the Gulf of Maine near the station intake and discharge structures.

291.15 (ER) Quantitatively discuss the ability of the municipal water supply of the Town of Seabrook to supply the station with freshwater. The discussion should address normal and drought periods.

RESPONSE: The Town of Seabrook operates a municipal water system including six wells which have an aggregate rating of 1,300 gallons per minute. In 1981, the town system pumped 347,127,690 gallons. By court order, the town is obligated to supply Seabrook Station 50,000 gallons per day. In 1980, the station obtained 15,400,600 gallons or an average of 42,770 gallons per day. This was 4% of the total town system sent out. In 1981 through August, station use has averaged 47,513 gallons per day. Both 1980 and 1981 have been years of lower-than-average groundwater table elevation. When the water table is low the wells' total capacity drops. At present (Fall, 1981), the system can develop 980 gpm. During the summer of 1981, deep-rock exploration by the town indicates a new source of water in the western part of town capable of producing over 1,000,000 gallons per day. Work is underway now to develop this source and connect it to the system.

If the new-found capacity is developed as expected, the municipal system should be able to satisfy the normal station requirements. Higher than normal demands or temporary reductions in the municipal supply will be accommodated by the station wells.

291.16 (ER) Indicate the expected frequency and duration of the circulating water system backflush operations. Characterize the effluent (e.g., cycles of concentration, physical and chemical characteristics) of the service water system discharged to the Browns River during this time.

RESPONSE: See ER-OLS Section 3.6.1 for the expected frequency of the circulating water system backflushing operation.

During the backflushing operation, which is infrequent and only takes 6 to 8 hours to complete, no blowdown to the settling basin will take place. Cooling tower blowdown, if any, will be discharged to the circulating water system. 1

291.17 (ER) Provide copies of NPDES Permits NH0020330 and NH0020338.

RESPONSE: A copy of NPDES Permit NH 0020338 has been provided to the NRC. There is no permit number NH0020330 applicable to Seabrook Station.

291.18 (ER) Provide a copy of the February 1977 noise survey by New England Power Service Company.

RESPONSE: The Construction Machinery Noise at the Seabrook Nuclear Site survey, dated March 23, 1977, was conducted at Seabrook Station entirely by New England Power Service Company personnel to determine the typical construction noises that would be generated at the construction of their proposed NEP 1 & 2 project, Charlestown, RI. While a copy of this report has been provided to the NRC, it should be emphasized that the results from this New England Power Service Company noise survey were for a construction site only, and are not applicable to an operating plant.

291.19 During the OL Stage Environmental Review site visit, the applicant indicated that a continuous low level chlorination system may be proposed for biofouling control in the station circulating water system. Provision for such a system is being made during the station's construction. This system would be used instead of the thermal backflushing system currently described as the biofouling control method in the ER. Provide a description of this chlorination system, as proposed, including:

- frequency of biocide application
- application points
- expected duration of application
- amount of biocide to be used during each application
- concentration of biocide to be attained in the system
- expected total residual oxidant to be present at the point of discharge
- if intermittent application of irregular (e.g., seasonal) applications are anticipated, so describe
- describe any supplemental biofouling control schemes (e.g., periodic shock chlorination of all or part of the system)

Provide a discussion and bases, therefore, of the expected environmental impact that this chlorination system would have during station operation.

RESPONSE: System Description

The preferred biofouling control method for the Seabrook Station circulating water system is continuous low-level chlorination. Seabrook Station is designed with the ability to control biofouling by either thermal backflushing or chlorination. A cost analysis for both generating units indicates that backflushing on a schedule of twice a month during the fouling season and once a month during the rest of the year would cost approximately $3 million per year. If a schedule of backflushing only once a month during the biofouling season is possible, the cost will be reduced to approximately $1.5 million per year. Continuous low level chlorination during a similar fouling season at an injection level of 2.0 mg/l will cost approximately $1.4 million per year.

While the costs for backflushing and chlorination are similar for the minimim expected treatment, backflushing poses the potential of a much greater economic loss. The procedure to reverse the circulating water flow is complex and has the potential of inducing hydraulic and thermal transients which could result in a plant shutdown. The resulting loss of electrical generation could be considerable, approaching $1 million just to bring the two units back to 100% power. Additional losses could also be incurred including the delay required to realign mechanical and electrical systems before the plant could resume full power operation.

Sodium hypochlorite solution, the biocide to be utilized in chlorination, will be produced on-site by four hypochlorite generators using 1,200 gpm of seawater taken from the circulating water system. These generators are capable of producing a total of about 848 pounds of equivalent chlorine per hour in a hypochlorite solution. This will be injected at a dosage of about 2.0 mg/l of equivalent chlorine into the circulating water system. A block diagram showing water usage, chlorination injection points and residence times is provided in Figure 291.19-1.

The main injection point of the hypochlorite solution will be at the throats of the three offshore intakes approximately three miles from the site. In addition, other injection points are available in the intake transition structure, the circulating water pump house, the service water pump house and the discharge transition structure should it be necessary to inject booster doses of hypochlorite solution to maintain the chlorine residual high enough to prevent biofouling of circulating and service water systems.

There is the possibility that the injection of 2.0 mg/l of equivalent chlorine in a sodium hypochlorite solution continuously at the intake structures may not be sufficient to prevent fouling in some areas of the cooling and service water systems. The decay of chlorine in ambient seawater could reduce residual levels below those required for effective biofouling control. As a result, the addition of booster "shock" doses at the circulating and service water pumps may be required to maintain these portions of the system free of fouling organisms. While the frequency and duration of booster dosage will be dependent on operational experience, it is expected that these will occur primarily during the warm water months when settling of fouling organisms is highest. A chlorine minimization program is expected to be conducted at Seabrook Station. Here the level of oxidant will be monitored to provide effective control of fouling organisms within the cooling water systems with minimal release of oxidant to the receiving waters. If it is determined that chlorination is not completely effective in the control of fouling in the intake tunnel, backflushing will be utilized occasionally to provide additional fouling control.

Chlorine will be injected at a rate such that a concentration of 0.2 mg/l total residual oxidant and measured as equivalent Cl_2 is not exceeded in the discharge transition structure. During the 43-minute transit time (for one unit operation, transit time is approximately twice as long) from the discharge transition structure to the discharge diffuser, the total residual oxidant will continue to decrease through increased decay at elevated water temperatures. The total residual oxidant concentration release will then be diluted by the diffuser flow, approximately 10 to 1, and further reduced through additional chemical reactions with ambient water.

Chlorination Chemistry

The chlorination of seawater results in an immediate conversion of hypochlorous acid (HOCl) to both hypobromous acid (HOBr) and hypoiodous acid (HOI), yielding chloride ions (Cl^-). This results in no loss of oxidizing capacity. EPRI (1980), reviewed literature referencing the reactions of chlorine in seawater. Here, Johnson (1977), reported this initial reaction to proceed to 50% completion within 0.01 minutes while Sugam and Helz (1977) indicated it to be essentially 99% complete within 10 seconds. References by EPRI to Sugawara and Terada (1958) and Carpenter and Macaldy (1976) revealed that iodine in seawater is in an oxidized state, as iodate, and unavailable to react with hypochlorous acid. Bromide, on the other hand, is described as being in ample supply, estimated at 68 mg/l, and able to consume more than 27 mg/l of chlorine according to Lewis (1966).

Hypobromous acid under the conditions found at Seabrook, partially dissociates into hypobromite ions (OBr^-). Both items are considered to be the free available or residual oxidant. Free residual bromine is more reactive than free residual chlorine, yet enters into the same type reactions. 2

The decay of chlorine in natural seawater is extremely variable. Goldman, et al. (1978) indicated that losses due to chlorine demand occurred in two stages; a first very rapid and significant demand followed by a continuous loss at a reduced rate. They indicated that in natural seawater, the two minute chlorine demand ranged from 0.42 - 0.50 mg/l following an initial chlorine dose of 1.02 mg/l and 2.88 mg/l, respectively. Hostgaard-Jensen (1977) indicated that in Denmark, seawater reduced an initial chlorine dose of 2.0 mg/l to 0.5 mg/l within 10 minutes, and to 0.2 mg/l after 60 minutes. Fava and Thomas (1977) described recent studies on chlorine demand, giving a value for the demand in clean seawater of 1.5 mg/l in 10 minutes, and values from 0.035 to 0.41 mg/l with a 5-minute contact time to values of 0.50 to 5.0 mg/l with a 3-hour contact time in coastal waters.

Frederick (1979) examined the decay rate of equivalent chlorine in seawater samples at Seabrook. It was found that the decayed amount at any time appeared to vary from month to month over a narrow range and that the amount of equivalent chlorine decayed, rose with either time or an increased innoculation, indicating that there may not be a fixed chlorine demand level. Based on a 2.0 mg/l injection dose, the data indicates that the chlorine decay in seawater after a 120-minute period averages 1.0 mg/l over a twelve-month period. Values ranged from 0.8 mg/l to 1.24 mg/l, a decay of 40 to 62%, respectively. Further decay at Seabrook Station is expected to occur due to the elevated temperatures within the cooling water system. Operational experience, however, will allow quantification of the chlorine decay in seawater. In any case, the chlorine injection rate will be such that 0.2 mg/l or less total residual oxidant will be maintained at the discharge transition structure. 2

The products from chlorination depend upon pH, salinity, the concentration of ammonia-nitrogen and organic carbon in the cooling water, temperature, pressure, and the concentration of the applied chlorine. Normally, the conversion of hypochlorite to hypobromite prevents the production of chloramines, yielding bromamine analogs. 2

With the exception of temperature, the physical and chemical parameters of the Atlantic Ocean at the intake and discharge structures do not vary significantly throughout the year (Table 291.19-1). In the marine environment, pH generally remains constant due to natural buffering capacities; however, even within the narrow range of pH values at Seabrook (roughly 7.8-8.4), the proportions of hypobromous acid and hypobromite ions can be affected.

The presence of ammonia in chlorinated seawater has a significant effect on the concentration of residual oxidants. Sugam and Helz (1977) as referenced in EPRI (1980), determined that at pH 8.0 and with a 35 ppt salinity, seawater containing 0.15 mg/l ammonia dosed at 0.5 mg/l chlorine, would result in an equal formation of 2 chloramines and hypobromous acid-hypobromite. A decrease in either pH or ammonia-nitrogen reduces the rate of chloramine production. Sugam and Helz also found that in seawater with ammonia concentrations of 0.01 mg/l, tribromamine is the only combined bromine residual formed. At ammonia concentrations of 1.0 mg/l and a pH of 8.0, the residual was computed to be entirely that of combined bromine (70% dibromamine, 25% monobromamine and 5% tribromamine). In normal seawater, the major residual oxidants from chlorination would be either free bromine and tribromamine or dibromamine and monochloramine depending upon the ammonia concentration and halogen-to-nitrogen ratios.

At Seabrook Station, free bromine and tribromamine will dominate
as ammonia-nitrogen levels are relatively low, 0.01 mg/l to 0.09
mg/l (Frederick, 1979). Both dibromamine and tribromamine are
unstable, decomposing to nitrogen gas and bromide ions or nitrogen
gas, bromide ions and hypobromous acid, respectively.
Decomposition from tribomamine results in roughly 90% decay in
approximately 30 minutes depending upon environmental conditions.
Based on the chemical reactivity of residual bromine, the
oxidation of organic carbon (amino acids) with free bromine to 2
form organic bromamines is another possible reaction.

Envirosphere (1981) indicated that salinity and the toxicity to chlorinated seawater were positively correlated, described as a lower 24-hour and 48-hour LC50 (the concentration at which there is 50% mortality of a species over a 24- or 48-hour exposure period. The causes of these lower values are unknown but suspected to be related to the chemical interactions at higher salinities and the physiology of the species. EPRI (1980) also reviewed data pertinent to salinity and toxicity. It was indicated that an evaluation between the two was complicated by the fact that the chemical form, concentration and duration of residual oxidant species are also affected by salinity. At Seabrook Station, the salinity is relatively high and stable, however, the dilution and chemical reactions of biocides with ambient waters upon discharge and the subsequent limited period of exposure reduces these effects.

Wong (1980) indicated that for a given dosage and contact time, residual chlorine concentrations were seen to decrease systematically with increased temperatures. Higher temperatures were found to yield higher chlorine demands. He suggested that this increase in demand represents reactions with organic compounds that normally do not react at lower temperatures.

Various affects of temperature on the toxicity of chlorinated
cooling water have also been reported. Investigations have found
temperature effects to range from producing no change in toxicity
to where increased temperatures have increased toxicity. EPRI
(1980) suggests that the synergistic interaction between 2
temperature and chlorinated cooling water would not be great for
species residing in the area of the thermal plume.

The halogenated compounds expected to be released include small concentrations of hypobromous acid, hypobromite ions, tribromamine, dibromamine and monochloramine. The actual concentrations are expected to be extremely small and the percentages are expected to vary depending upon the environmental conditions, chemical reactions through renewed ambient demands, dilution and photochemical conversions. 2

Biocides entering the receiving waters via the Seabrook Station discharge are diluted by a factor of 10 to 1, as described in Sections 5.1 and 5.3 of the ER-OLS. As previously mentioned, a total residual oxidant concentration of 0.2 mg/l, measured at the discharge transition structure, will further decay during the 43-minute transit time through the discharge tunnel. Additional reduction through the decay of oxidant is expected to occur upon the release from the cooling system into the receiving waters. Losses of total residuals are expected through renewed ambient chlorine decay throughout the water column and reactions between the oxidant and ultraviolet light which results in a light induced oxidation of hypobromite to bromate reducing the concentration of free bromine.

Thus, in consideration of the total dilution factor and the reductions associated with chemical interactions within the receiving water, an equivalent chlorine concentration of 0.02 mg/l is expected at the surface approximately 70 seconds after discharge. Beyond this area, the concentrations would steadily drop off with increased dilution. Chemical and photochemical reactions promoted by solar irradiance will further reduce oxidant concentration in the receiving water. 2

Fouling Community

Marine fouling organisms can be divided into two general categories, macrofoulers and microfoulers.

Macrofoulers are those that cause substantial hydraulic restrictions to cooling water flow (primarily the blue mussel, *Mytilus edulis*; the horse mussel, *Modiolus modiolus*; barnacles, *Balanus* spp.; and hydroids, *Tubularia* spp.). The microfoulers are those organisms which form mats or films on heat exchange surfaces. In the New England region, the blue mussel is generally regarded as the macrofouling organism of greatest concern. Microfoulers, microscopic organic and inorganic particles, microbes and microscopic animals and plants are also of concern, especially in condensers and heat exchangers. 2

Mytilus, the major macrofouling organism found at Seabrook Station, is present as a planktonic settling larvae from early May through late October. Heavy sets of larvae in February, however, have been reported north of Portland, Maine. As with all biological components, the frequency and magnitude of larval set is dependent on the previously mentioned physical parameters of the aquatic environment (most notably temperature).

Mytilus spawns primarily when the water temperature rises to between 10° and 15°C. After spawning, they remain as planktonic larvae for 2 to 3 weeks or as long as 3 months during cold water periods. Settling generally occurs at this temperature range, but can be seen at temperatures as low as 8° to 9°C. Also, resettlement has been found to occur after detachment from a surface. Control of fouling is usually initiated in the spring when temperatures rise above 7.2°C and continues until water temperatures drop below this value in the fall. 2

Environmental Assessment

A level of 0.2 mg/l total residual oxidant or less will be maintained at the discharge transition structure. While the concentration of chlorine injected to maintain this level depends upon organism settling and the chlorine demand of ambient water, it is essential that the system be maintained free of fouling organisms. The concentration of chlorine at the lip of the diffuser is expected to be lower than the 0.2 mg/l measured at the discharge transition structure. An immediate reduction in concentration due to discharge dilution further reduces the toxicity of the chlorine in ambient waters.

To evaluate the effect of this discharge on the biota in the 2
vicinity of Seabrook Station, a review of toxicity data from open literature for local species was performed (Table 291.19-2). An evaluation of this data has determined that the continuous release of total residual oxidants at concentrations of 0.2 mg/l or less at the discharge transition structure will not present unmanageable stress or alter the local indigenous marine populations. Table 291.19-3 and Figure 291.19-2, provided in the 1974 Final Environmental Statement for Seabrook Station, summarize additional chlorine toxicity data on marine life. The lines enclosing the data points were arbitrarily drawn by the NRC staff and depict the short duration and chronic toxicity thresholds for the species reviewed.

The exposure time must be considered in order to evaluate the toxicity of released chlorine to marine organisms. At the lip of the diffuser, exposure time is extremely limited. Here, rapidly entrained ambient seawater and a discharge velocity of 15 feet per second (7.5 feet per second for 1 unit operation) will prevent organisms from inhabiting this location. Entrained phytoplankton, zooplankton and ichthyoplankton, are unable to maintain themselves within the discharge plume or at the diffuser lip over extended periods of time. Larger marine life cannot maintain themselves adjacent to the discharge in the direct path of the plume due to high current velocities. Therefore, a combination of very low concentrations and limited exposure periods prevents toxic effects from occurring as a result of biocide discharge. Organisms entrained into the plume will be carried away from the discharge structures where chlorine concentrations will be continually lowered through dilution and chemical reaction. 2

The concentration of total residual oxidant released by Seabrook Station is expected to be below that required to produce lethal effects (Tables 291.19-2 and 291.19-3). Rapid mixing, dilution and chemical reaction of released biocide with ambient water will further reduce any possible toxic concentrations. With increased distance from the discharge, chlorine concentration will drop as additional mixing, dilution and reactions occur. Planktonic organisms which passively drift into the discharge plume will not be subjected to lethal concentrations for long enough durations to be affected. With rapid dilution and a diffuser designed to avoid bottom impact, benthic organisms will not be exposed to continuous levels of chlorine. Fish species are expected to be subjected to limited exposure times and minimal concentration which will mitigate possible effects to discharged biocides.

Mattice and Zittel report that mussel attachment is prevented at concentrations of 0.02 to 0.05 mg/l of chlorine, however no mention is made as to the method of analysis which could allow for considerable variation. Since the integrity of both the cooling and service water systems depend upon them remaining free of obstructions, organisms entering the intake tunnel should not be allowed to settle. A consideration of the power plant entrainment time, the ambient chlorine decay and the delta-temperature which enhances halogen dissociation, allows for the injection of 2.0 mg/l of equivalent chlorine to effectively control biofouling while releasing minimal non-toxic levels of oxidant into the environment.

It is concluded that the environmental impact of the continuous release of oxidant at Seabrook Station will not adversely affect the local indigenous marine populations. Operating experience coupled with a consideration of the cyclic nature of fouling organisms may minimize the use of biocides during periods when biofouling is not as significant a problem. Sections 3.6, 5.3 and 10.5 of the Seabrook Station ER-OLS have been revised accordingly to reflect the above information.

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TABLE 291.19-1

Seawater Sample Parameters

Date	Kjeldahl-N (mg N/1)	Temp. (°C)	Salinity ppt	pH	Ammonia-N (mg N/1)	Total Organic Carbon (mg C/1)
6/29/76	.12	15.00	32.16	8.4	.09	1.0
7/29/76	.17	9.71	33.34	8.3	.07	1.0
8/26/76	.11	14.92	33.87	8.15	.04	8.5
9/28/76	.11	12.42	33.61	8.3	.07	24.0
10/26/76	.16	8.54	34.42	8.0	.08	18.0
11/30/76	.12	6.92	35.13	7.8	.09	2.5
12/30/76	.09	2.34	35.12	7.9	.07	7.0
1/26/77	.16	0.50	36.06	7.8	.09	3.0
2/23/77	.09	0.00	34.76	8.35	.05	1.0
3/29/77	.05	1.80	33.70	7.95	.01	1.0
4/27/77	.07	5.68	34.16	8.1	.02	16.0
5/26/77	.07	5.99	33.34	8.2	.01	3.5
6/30/77	.06	10.99	33.24	7.85	.04	9.0

Source: Frederick, 1979

TABLE 291.19-2

Toxicity of Chlorinated Seawater to Aquatic Biota

(Sheet 1 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Phytoplankton						
Skeletonema costatum		0.095	1,440	20	50% decrease in growth	TRW (1978)/Gentile, et al. (1976)*
		0.6	1.7		50% decrease in growth	TRW (1978)/Gentile, et al. (1976)*
		0.4-0.65	5		Reduced growth	Becker & Thatcher (1973)
Chaetoceros dicipiens		0.14	1,440		50% decrease in growth	TRW (1978)
Chaetoceros didymum		0.125	1,440	10	50% decrease in growth	Gentile, et al. (1976)*
Thalassiosira nordemskioldii		0.195	1,440		50% decrease in growth	TRW (1978)
Thalassiosira rotula		0.330	1,440	10	50% decrease in growth	TRW (1978)/Gentile, et al. (1976)*

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
[1] Total Residual Oxidant
[2] Combined Residuals (chloramines)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Benthic Algae						
Cladophora sp.		1.0	1,440	30	Slight mortality	Betzer & Knott (1969)*
		1.0	4,320	30	Slight mortality	Betzer & Knott (1969)*
		3.0	2,880	30	90% mortality	Betzer & Knott (1969)*
		5.0	4,320	30	100% mortality	Betzer & Knott (1969)*
		10.0	2	30	100% mortality	Betzer & Knott (1969)*
Enteromorpha intestinalis		0.1			Abundant	Betzer & Knott (1969)*
Bivalves						
Mytilus edulis		2.5 [1]	7,200		100% mortality	Turner, et al. (1948)*/ TRW (1978)
		1.0 [1]	21,600		100% mortality	Turner, et al. (1948)*/ TRW (1978)
		0.25			Prevented attachment @ 0.4 m/sec velocities	Turner, et al. (1948)*/ TRW (1978)
Mulinia lateralis	Embryos	0.07	2	18-28	50% mortality	Roberts, et al. (1979)
		0.01-0.10	2,880	18-28	50% mortality	Roberts, et al. (1979)

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
[1] Total Residual Oxidant
[2] Combined Residuals (chloramines)

TABLE 291.19-2

(Sheet 3 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Crustaceans						
Copepods						
Acartia tonsa		0.75	2	20	30% mortality	Dressel (1971)*
		0.75	2	25	70% mortality	Dressel (1971)*
		1.15	2	20	100% mortality	Dressel (1971)*
		0.11-0.44	20		65.2% mortality	Lanza, et al. (1975)*
		0.11-0.44	1,440		100% mortality	Lanza, et al. (1975)*
		2.5	5		> 90% mortality	McLean (1973)
		0.03	2,880		50% mortality	Roberts, et al. (1979)
		0.028-0.175	> 10,000	15	50% mortality	Heinla & Beaven (1977)*
		1.0	120		50% mortality	Gentile, et al. (1976)*
		2.5	5		50% mortality	Gentile, et al. (1976)*
		0.75	2	20	30% mortality	TRW (1978)
		0.75	2	25	70% mortality	TRW (1978)
		1.0	120		50% mortality	TRW (1978)
		10.0	.07		50% mortality	TRW (1978)
		2.5	5		90% mortality	TRW (1978)
		0.12	2,880	20	50% mortality	Roberts & Gleeson (1978)*
		0.11	2,880	25	50% mortality	Roberts & Gleeson (1978)*
		0.067	2,880	20	50% mortality	Roberts & Gleeson (1978)*
		0.029	2,880	25	50% mortality	Roberts & Gleeson (1978)*

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
1 Total Residual Oxidant
2 Combined Residuals (chloramines)

TABLE 291.19-2

(Sheet 4 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Copepods (cont'd)						
Eurytemora affinis		0.11-0.44	1,440		70% mortality	Lanza, et al. (1975)*
		1.0	360		50% mortality	Gentile, et al. (1976)*
		2.5	9		50% mortality	Gentile, et al. (1976)*
Amphipods						
Melita nitida		2.5	5		4% mortality	McLean (1973)
		2.5	180		97.2% mortality	McLean (1973)
Gammarus sp.		2.5	180		25% mortality	McLean (1973)/TRW (1978)
Corophium sp.		10.0	410		0% mortality	McLean (1973)/TRW (1978)
Barnacles						
Balanus sp.	Nauplii	2.5	5		80% mortality	McLean (1973)/TRW (1978)

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
1 Total Residual Oxidant
2 Combined Residuals (chloramines)

TABLE 291.19-2

(Sheet 5 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Decapods						
Crangon septemspinosus		0.15-0.25	1,080		50% mortality	Patrick and McLean (1970)*/ TRW (1978)
		0.90-1.00	180		50% mortality	Patrick and McLean (1970)*/ TRW (1978)
		5.0	10		42% mortality	Gentile, et al. (1976)*/ TRW (1978)
		10.0	5		60% mortality	Gentile, et al. (1976)*/ TRW (1978)
		0.05-0.09			Avoidance	Ichthylogical Assoc. (1974)
Pagurus longicarpus		0.062-0.102	5,760		50% mortality	Roberts (1978)*/Roberts, et al. (1979)
Homarus americanus	Stage I	2.89	30-60	20	40% mortality	Goldman & Ryther (1976)*
	Stage I	0.41	30-60	25	50% mortality	Goldman & Ryther (1976)*
	Stage I	0.69	30-60	30	50% mortality	Goldman & Ryther (1976)*
	Stage I	0.32	30-60	20	50% mortality	Goldman & Ryther (1976)*
	Stage I	0.06	30-60	25	50% mortality	Goldman & Ryther (1976)*
	Stage IV	3.95	60	30	50% mortality	Goldman & Ryther (1976)*

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
1 Total Residual Oxidant
2 Combined Residuals (chloramines)

TABLE 291.19-2

(Sheet 6 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (^{o}C)	Effect	Reference
Fish						
Osmerus mordax		1.27	30		50% mortality	Seegert & Brooks (1978)*
Alosa pseudoharangus		2.15	30	10	50% mortality	Seegert & Brooks (1978)*
		1.70	30	20	50% mortality	Seegert & Brooks (1978)*
		0.297	30	30	50% mortality	Seegert & Brooks (1978)*
Alosa aestivalis	Egg	0.57	--		100% mortality	Morgan & Prince (1977)*
	Egg	0.33	4,800		50% mortality	Morgan & Prince (1977)*
	1 day larvae	0.28	1,440		50% mortality	Morgan & Prince (1977)*
	1 day larvae	0.24	2,880		50% mortality	Morgan & Prince (1977)*
	2 day larvae	0.32	1,440		50% mortality	Morgan & Prince (1977)*
	2 day larvae	0.25	2,880		50% mortality	Morgan & Prince (1977)*
		1.20	15		50% mortality	Engstrom & Kirkwood (1974)*
		0.56	120		50% mortality	Engstrom & Kirkwood (1974)*
		0.67	60		50% mortality	TRW (1978)
		1.20	15		50% mortality	TRW (1978)

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
1 Total Residual Oxidant
2 Combined Residuals (chloramines)

TABLE 291.19-2

(Sheet 7 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Fish (cont'd)						
Brevoortia tyrannus	Larvae	0.3	8		0% mortality	Hoss, et al. (1975)*
	Larvae	0.3	5	ΔT10°	40% mortality	Hoss, et al. (1975)*
	Larvae	0.3	8	ΔT10°	100% mortality	Hoss, et al. (1975)*
	Larvae	0.5	5		40% mortality	Hoss, et al. (1975)*
	Larvae	0.5	3	ΔT10°	100% mortality	Hoss, et al. (1975)*
	Larvae	0.5	10		100% mortality	Hoss, et al. (1975)*
		1.20	30		50% mortality	Engstrom and Kirkwood (1974)*
		0.21	300		50% mortality	Engstrom and Kirkwood (1974)*
		0.70	10		50% mortality	Fairbanks, et al. (1971)*
		0.22	60		50% mortality	Fairbanks, et al. (1971)*
		0.22	2,880		50% mortality	Roberts & Gleeson (1978)*
		0.12 [1]	5,760	25	50% mortality	Gullans, et al. (1977)*
		0.22	60		50% mortality	TRW (1978)
		0.7	10		50% mortality	TRW (1978)
		0.21	300		50% mortality	TRW (1978)
		1.20	30		50% mortality	TRW (1978)
	Larvae	0.5	3		0% mortality	TRW (1978)

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
[1] Total Residual Oxidant
[2] Combined Residuals (chloramines)

TABLE 291.19-2

(Sheet 8 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Fish (cont'd)						
Pseudopleuronectes americanus	Juvenile	0.20 [1]			Stress	Capuzzo, et al. (1977)*
	Juvenile	0.55 [1]			100% mortality	Capuzzo, et al. (1977)*
	Juvenile	1.50 [1]			Stress	Capuzzo, et al. (1977)*
	Juvenile	2.55 [1]			100% mortality	Capuzzo, et al. (1977)*
		2.5	15		50% mortality	TRW (1978)/Gentile, et al. (1976)*
		10.0	0.3		50% mortality	TRW (1978)/Gentile, et al. (1976)*
	Egg	10.0	20		0% mortality	TRW (1978)/Gentile, et al. (1976)*
Limanda ferruginea		0.20	1,440		50% mortality	Gentile, et al. (1976)*
		0.10	1,440		50% mortality	Gentile, et al. (1976)*
		2.5	1,440		50% mortality	TRW (1978)
Menidia menidia		0.095	1,440		50% mortality	Roberts, et al. (1975)*
		0.037	5,760		50% mortality	Roberts, et al. (1975)*
		1.20	30		50% mortality	Engstrom & Kirkwood (1974)*
		0.55	120		50% mortality	Engstrom & Kirkwood (1974)*
	Young	0.13	1		4% mortality	Hoss, et al. (1977)*
	Young	0.13	3		46% mortality	Hoss, et al. (1977)*

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
[1] Total Residual Oxidant
[2] Combined Residuals (chloramines)

TABLE 291.19-2

(Sheet 9 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Fish (cont'd)						
Menidia menidia (cont'd)	Young	0.13	5		63% mortality	Hoss, et al. (1977)*
	Young	0.13	7		80% mortality	Hoss, et al. (1977)*
	2-hr. Egg	0.38 [1]	1,440		50% mortality	Morgan & Prince (1977)*
	2-hr. Egg	0.30 [1]	2,880		50% mortality	Morgan & Prince (1977)*
	2-hr. Egg	0.12	1,440		5% mortality	Morgan & Prince (1977)*
	2-hr. Egg	1.23	1,440		95% mortality	Morgan & Prince (1977)*
	2-hr. Egg	0.16	2,880		5% mortality	Morgan & Prince (1977)*
	2-hr. Egg	0.56	2,880		95% mortality	Morgan & Prince (1977)*
		0.08-0.25			Preference	Ichthyological Assoc. (1974)
		0.59			Death	Ichthyological Assoc. (1974)
		0.58	90		50% mortality	TRW (1978)
		1.20	30		50% mortality	TRW (1978)
Morone saxatilis	1 week larvae	0.50	1,440		50% mortality	Hughes (1970)*
	1 month fingerling	0.30	1,440		50% mortality	Hughes (1970)*
		0.04-0.16	60	ΔT 6.9°	>50% mortality	Lanza, et al. (1975)*

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
1 Total Residual Oxidant
2 Combined Residuals (chloramines)

TABLE 291.19-2

(Sheet 10 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Fish (cont'd)						
Morone saxatilis (cont'd)	Embryo	0.07 [1]	--		3.5% hatched	Middaugh, et al. (1977)
	2 day prolarvae	0.04	--		50% mortality	Middaugh, et al. (1977)
	12 day larvae	< 0.07	--		50% mortality	Middaugh, et al. (1977)
	30 day juvenile	0.04	--		50% mortality	Middaugh, et al. (1977)
	<13 hour larvae	0.20	2,880		50% mortality	Morgan & Prince (1977)*
	24-40 hour larvae	0.22	2,880		50% mortality	Morgan & Prince (1977)*
	24 hour larvae	0.20	1,440		50% mortality	Morgan & Prince (1977)*
	70 hour larvae	0.19	1,440		50% mortality	Morgan & Prince (1977)*
	Larvae	0-2.47	--		<30% mortality	Ginn & O'Conner (1978)*
	Larvae	0-2.47	--	ΔT	60-85% mortality	Ginn & O'Conner (1978)*
	Egg	0.3 [2]	4.8	ΔT	50% mortality	Burton, et al. (1979)*
	Egg	0.22 [2]	120	ΔT	50% mortality	Burton, et al. (1979)*
	Egg	0.14 [2]	240	ΔT	50% mortality	Burton, et al. (1979)*

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
1 Total Residual Oxidant
2 Combined Residuals (chloramines)

TABLE 291.19-2

(Sheet 11 of 11)

Species	Stage**	Concentration*** (mg/l)	Duration (min)	Temp. (°C)	Effect	Reference
Fish (cont'd)						
Morone saxatilis (cont'd)	Prolarvae	0.04 [2]	4.8	ΔT	50% mortality	Burton, et al. (1979)*
	Prolarvae	0.03 [2]	120	ΔT	50% mortality	Burton, et al. (1979)*
	Prolarvae	0.03 [2]	240	ΔT	>50% mortality	Burton, et al. (1979)*
Oncorhynchus kisutch	Juvenile	0.141	2,880	7.7	100% mortality	Holland, et al. (1960)*
	Juvenile	0.08	7,920	7.7	50% mortality	Holland, et al. (1960)*
	Juvenile	0.08	10,080	7.7	100% mortality	Holland, et al. (1960)*
	Juvenile	0.04	12,960	7.7	0% mortality	Holland, et al. (1960)*
	Juvenile	0.04	5,760	15-77	50% mortality	Rosenberger (1972)*
		0.01 [2]	5,760	15-77	50% mortality	Rosenberger (1972)*
		0.04 [2]	5,760	15-77	50% mortality	Rosenberger (1972)*
		0.560	30	10	50% mortality	Brooks & Seegert (1977)*
		0.287	30	20	50% mortality	Brooks & Seegert (1977)*
Stenotomus versicolor		0.67	30		100% mortality	Capuzzo, et al. (1977)*
		3.10 [2]	30		100% mortality	Capuzzo, et al. (1977)*
Gasterosteus aculeatus		0.09-0.13	5,760		50% mortality	TRW (1978)

* Reference as cited in EPRI (1980)
** Adults unless otherwise noted.
*** Concentration as free residuals unless otherwise noted.
[1] Total Residual Oxidant
[2] Combined Residuals (chloramines)

TABLE 291.19-3
(Sheet 1 of 2)

Summary of chlorine toxicity data on marine life

Point	Species name: Scientific	Species name: Common	Chlorine concentration (mg/liter)	Time	Effect	Footnote
	Plants					
	Chlorophyta					
21	Dunaliella tertiolecta		0.11	24 hr	50% stop growth	a
35	Chlamydomonas sp.		1.5	5–10 min	Time lag in growth effect recovered in 9 days	c
	Chrysophyta					
	Bacillariophyceae					
19	Skeletonema costatum		0.095	24 hr	50% stop growth	a
36	Skeletonema costatum		0.4–0.65	5 min	Adverse effect on growth	c
			1.5–2.3	5 min	Death	
23	Cyclotella nana		0.075	24 hr	50% stop growth	a
24	Chaetoceros decipiens		0.14	24 hr	50% stop growth	a
25	Thalassiosira nordensholkii		0.195	24 hr	50% stop growth	a
26	Thalassiosira rotula		0.33	24 hr	50% stop growth	a
27	Asterionella japonica		0.25	24 hr	50% stop growth	a
28	Chaetoceros didymum		0.125	24 hr	50% stop growth	a
29	Detonula confervacea		0.2	24 hr	50% stop growth	a
30	Asterionella japonica		0.4	16 sec	50% stop growth	a
31	Cyclotella nana		0.2	410 sec	50% stop growth	a
32	Skeletonema costatum		0.5	145 sec	50% stop growth	a
33	Detonula confervacea		0.4	5000 sec	50% stop growth	a
	Chrysophyceae					
20	Rhodomonas baltica		0.11	24 hr	50% stop growth	a
22	Monochrysis lutheri		0.2	24 hr	50% stop growth	a
	Phaeophyta					
5	Macrocystis pyrifera	giant kelp	5–10	2 days	10–15% photosynthesis reduction	b
			5–10	5–7 days	50–70% photosynthesis reduction	b
	Animals					
	Cnidaria					
	Bimeria franciscana	Hydroid	4.5	3 hr	None	d
		Sea anemone	1.0	15 days	None	e
	Mollusca					
3	Mytilus edulis	Mussel	1.0	15 days	100% mortality	e
			2.5	5 days	100% mortality	e
			10.0	5 days	100% mortality	e
	Crassostria virginica	Oyster	0.05	?	Pumping reduced	f
			1.0	?	No pumping	f
37	Ostrea edulis larvae	Oyster	0.5		After 2 min stop swimming	g
			1.0		After 2 min stop swimming	g
			2.0		Stop swimming immediately	g
			3.0		Stop swimming immediately	g
	Arthropoda					
	Corophium sp.	Tube dwelling amphipod	2.5	410 min	0 mortality after 24 hr	h
			5.0	410 min	0 mortality after 24 hr	h
			10.0	410 min	0 mortality after 24 hr	
14	Melita nitida	Amphipod	2.5	2 hr	50% mortality. Some deaths after 5 min	i
15	Gammarus tigrinus	Amphipod	2.5	3 hr	25% mortality after 96 hr	i
7	Acartia tonsa	Copepod	1	60 min	17% mortality	
			2.5	5 min	37.5% mortality	h
			5.0	0.5 min	20% mortality	h
			10.0	0.5 min	32% mortality	h

TABLE 291.19-3
(Sheet 2 of 2)

Point	Species name		Chlorine concentration (mg/liter)	Time	Effect	Footnote
	Scientific	Common				
11	Acartia tonsa	Copepod	2.5	5 min	90% mortality measured after 3 hr	i
	Pseudodiaptomus coronidae	Copepod	1.0	24 hr	No deaths	h
			2.5	30 min	19% mortality	h
			5.0	5 min	6% mortality	h
			10.0	2.5 min	24% mortality	h
34	Eurytemora affinis	Copepod	1.0	360 min	51% mortality	h
	Elminius modestus	Barnacle	0.5	10 min	Little effect	g
		Nauplii	1.0	10 min	Heavy losses. No growth	g
12	Balanus improvisus	Barnacle	2.5	5 min	80% mortality after 3 hr	i
18		Barnacles	1.0	15 days	Most dead	e
6	Crangon septemspinosus larvae	Sand shrimp	5	10 min	37% mortality	h
			10	5 min	55% mortality	h
13	Palaemonetes pugio	Grass shrimp	2.5	3 hr	98% mortality after 96 hr	i
	Ectoprocta					
2	Bugula sp.		2.5	48 hr	100% mortality	e
			10.0	24 hr	100% mortality	e
	Chordata					
	Ascidiacia					
4	Molgula sp.		1.0	3 days	100% mortality	e
			2.5	1 day	100% mortality	e
			10.0	1 day	100% mortality	e
	Tunicata					
1	Botryllus sp.		10	24 hr	100% mortality	e
	Pisces					
8	Pseudopleuronectes americanus	Winter flounder	1	0.1 min	9% mortality	h
			2.5	0.1 min	6% mortality	h
			5.0	0.1 min	15% mortality	h
			10.0	0.25 min	32% mortality	h
	Pseudopleuronectes americanus eggs	Winter flounder	10.0	0.33 min	0% mortality	h
10	Pleuronectes platessa larvae	Plaice	0.05	460 min	50% mortality	h
	Pleuronectes platessa larvae	Plaice	0.13	70 min	50% mortality	j
	Pleuronectes platessa eggs		0.25	3 days	Critical level	j
17	Oncorhynchus kitsutch	Coho salmon	0.1	3 days	Critical level	k
39	Oncorhynchus tshawytocha	Chinook	0.05	23 days	Critical level	k
40	Oncorhynchus gorbuscha		0.05	23 days	Critical level	
	Marine fish		1.0		Slight irritant response	l

[a] C. S. Hegre, "Toxicity to Marine Organisms of Free Chlorine and Chlorinated Compounds in Sea Water," Environmental Protection Agency, National Marine Quality Lab. Progress Report, 1971.

[b] J. E. McKee and H. W. Wolf, "Water Quality Criteria," Publication No. 3-2, California Water Quality Control Board, 1963.

[c] K. Hirayama and R. Hirano, "Influences of High Temperature and Residual Chlorine on Marine Phytoplankton," *Mar. Biol.* 7: 205–213 (1970).

[d] R. I. McLean, "Chlorine Tolerance of the Colonial Hydroid," Bimeria franciscana *Chesapeake Sci.* 13: 229–230 (1972).

[e] H. J. Turner, D. M. Reynolds, and A. C. Redfield, "Chlorine and Sodium Pentachlorophenate as Fouling Preventatives in Sea Water Conduits," *Ind. Eng. Chem.* 40: 450–453 (1948).

[f] P. S. Galtsoff, "Reaction of Oysters to Chlorination," U.S. Fish and Wildlife Service, Dept. of Interior, Res. Rept. No. 11, 28 pp., 1946.

[g] G. D. Waugh, "Observations on the Effects of Chlorine on the Larvae of Oysters (*Ostrea edulis* L.) and Barnacles (*Elimimum modestus* Darwin)," *Ann. Appl. Biol.* 54: 423–40 (1964).

[h] J. H. Gentile, Unpublished Data, Environmental Protection Agency, National Marine Water Quality Laboratory, West Kingston, R.I., 1972.

[i] R. I. McLean, "Chlorine and Temperature Stress on Estuarine Invertebrates," *J. Water Pollut. Contr. Fed.* 45: 837–841 (1973).

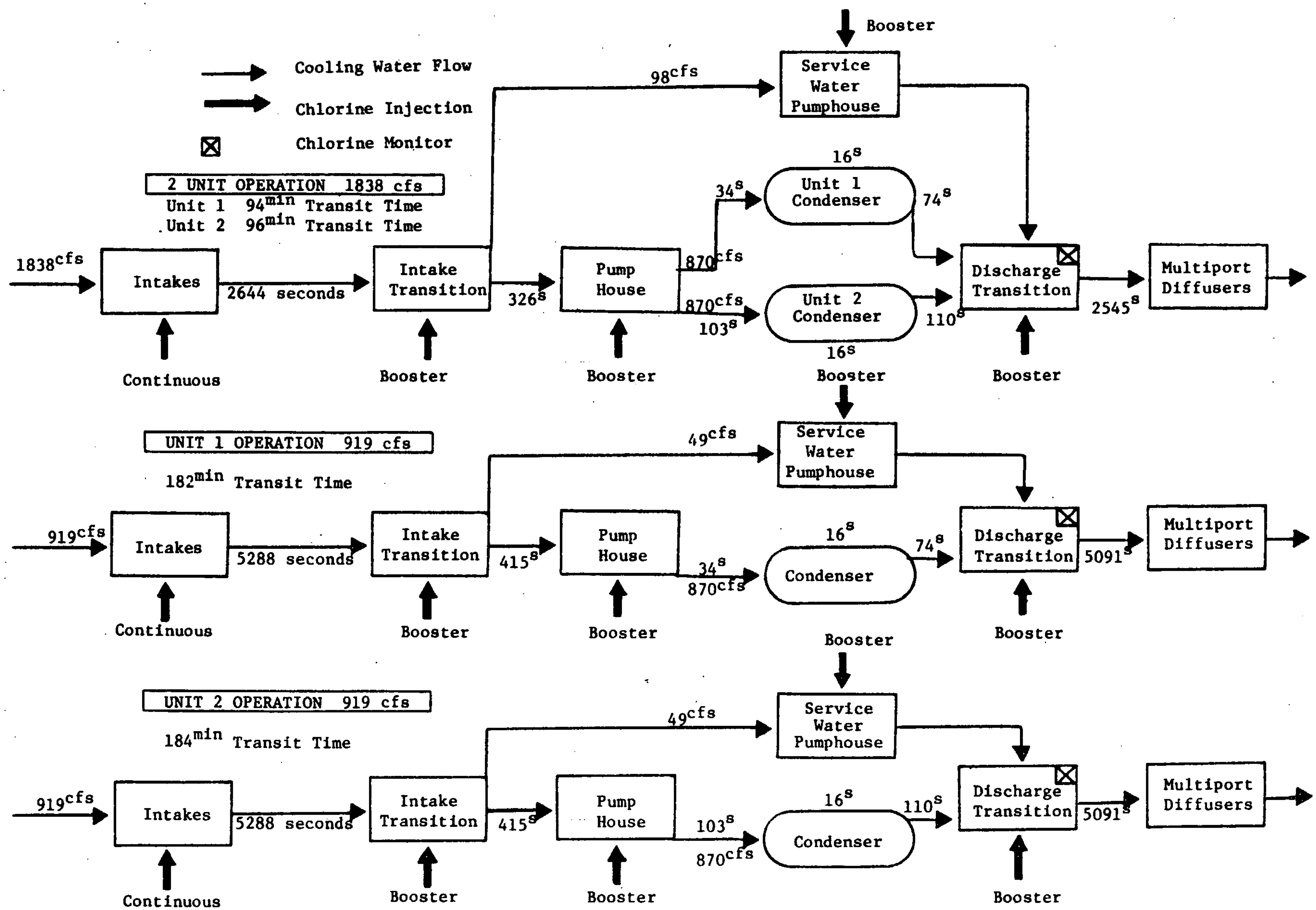
[j] R. Alderson, "Effects of Low Concentrations of Free Chlorine on Eggs and Larvae of Plaice, *Pleuronectes platessa* L.," pp. 312–315 in *Marine Pollution and Sea Life*, ed. by M. Riuvo, FAO, Fishing News (Books, Ltd.), Surrey, England, 1973.

[k] G. A. Holland, J. E. Lasater, E. D. Neumann, and W. E. Eldridge, "Toxic Effects of Organic and Inorganic Pollutants on Young Salmon and Trout," Wash. Dept. Fish., Res. Bull. No. 5, 264 pp., 1960.

[l] R. W. Hiatt, J. J. Naughton, and D. C. Matthews, "Relation of Chemical Structure to Irritant Responses in Marine Fish," *Nature* 172: 904–905 (1953).

Source: Seabrook Station FES; 1974

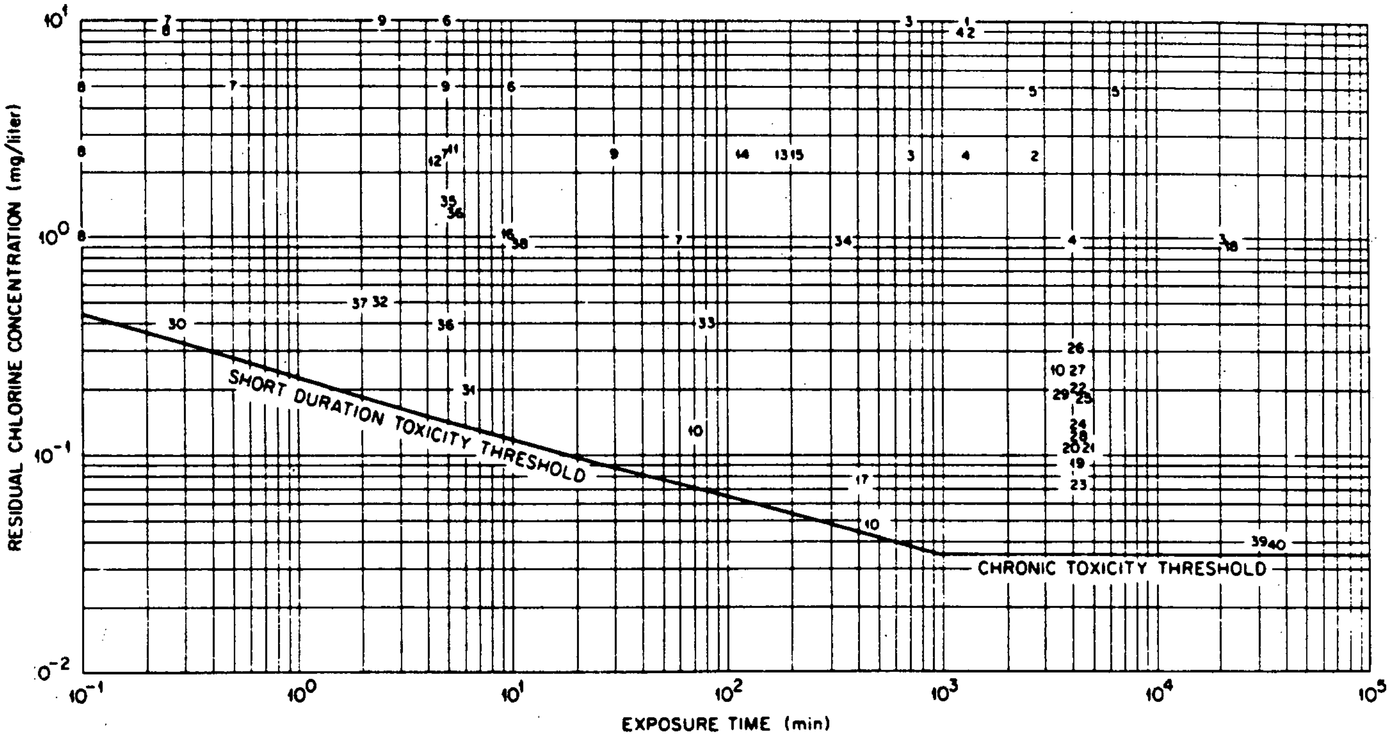
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE



BLOCK DIAGRAM OF CHLORINATION OF COOLING WATER SYSTEM

FIGURE 291.19-1

Revision 2
June 1982



Source: Seabrook Station FES; 1974

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

SUMMARY OF CHLORINE TOXICITY DATA ON MARINE LIFE

FIGURE 291.19-2

291.20 Characterize by volumetric flowrate, general composition and influent sources, the settling basin effluents during station operation.

RESPONSE: During normal operation of the station, the only influent sources to the settling basin will be treated sanitary wastes, storm water runoff and secondary floor drainage. The treated sanitary wastes, the characteristics of which are given in ER-OLS Table 3.7-2, will have an average flow rate of 50,000 gallons per day or less. The runoff and floor drainage are aperiodic and therefore difficult to characterize in terms of flowrate and composition.

Storm water runoff from rainfall or snowfall events will mainly be fresh water with small amounts of soil picked up during its overland flow to the storm drainage system. During transit of the settling basin, most of the soil is expected to settle out, so that the settling basin effluent during these events will be clear fresh water. The flow from the settling basin during these storm events will be proportional to the amount of rainfall which enters the storm drainage system.

Secondary floor drain effluents are from buildings and areas that do not contain radioactive materials. Where such drainage may contain oily wastes, the oil is separated from the floor drain water before it enters the storm drainage system. These flows are expected to be infrequent and of small volume (as compared to the volume of the settling basin and the volume expected from storm runoff). 2

291.21 Aquatic Resources

Update the discussion of projected impact of average and peak station use of groundwater on and off-site and of water from nearby public water systems on available water resources in the site area. Address the preoperational cleaning and testing and station operational phases.

RESPONSE: The projected water flows for various station conditions are described in ER-OLS Table 3.3-1 and Figure 3.3-1, and in RAI 240.12. Some of the numbers are reported as daily averages. The average use of treated water for flushes is shown to be 120,000 gpd. To meet the demands of the larger flushes, estimated at 400,000 gallons, storage will be manipulated and extra water drawn from the municipal supply.

Agreement has been reached with the Town of Seabrook to supply water in accordance with the schedule below:

" a. If the capability of the Well Field Site is 875,000 gallons per day or less, the Town agrees to supply to PSNH 175,000 gallons per day averaged over a calendar monthly period with a maximum of 215,000 gallons on any one day.

b. If the capability of the Well Field Site is between 875,000 gallons per day and 1,200,000 gallons per day, the amounts set forth in (a) shall be increased by an amount which is 20% of the excess over 875,000 gallons per day.

c. If the capability of the Well Field Site is 1,200,000 gallons per day or more, the Town agrees to supply PSNH 240,000 gallons per day averaged over a calendar monthly period with a maximum of 270,000 gallons on any one day.

d. The capability of the Well Field Site shall be determined for purposes of this agreement by pump tests on production wells to be performed as soon as such production wells are installed. The capability determination shall not be subsequently altered.

e. In the event that a prolonged drought or other act of God or a water system failure causes a water shortage requiring the Town to ration water, PSNH shall be treated on a non-discriminatory basis with other users.

3. The amounts of fresh water which the Town shall be obligated to supply hereunder are in addition to the 50,000 gallons per day which the Town agreed to supply to PSNH by agreement dated October 5, 1978, in settlement of <u>Public Service Company of New Hampshire vs. Town of Seabrook</u> (Rockingham County Superior Court Docket No. E 625-78), it being the intent of the parties that said agreement shall remain in full force and effect."

2

Three 10-inch wells have been drilled by the Town to the 500-foot depth. Prior to drilling the new wells, the Town's consultant estimated that the aquifer could support three 350-gallon per minute (approximately 1,500,000 gallons per day) wells. Initial surging of the wells indicates that the estimated capacity can be developed.

The Applicant plans to use municipal water (circle 4 in Figure 3.3-1) to the extent available and keep the site wells in reserve for station peaks or to accommodate the Town during heavy municipal system peaks or unscheduled outages.

The Station's demand on the municipal system will be spread over the new and existing Town wells. Since these well fields are separated by a considerable distance, PSNH's allotment should have no adverse impacts on the water resources in the site area. 2

310.1 (2.1.2.3) (ER) Section 2.1.2.3 notes four surveys (seasonal resident population, overnight accommodations, campgrounds, and parking lot capacities) which are neither described in terms of methodology or in terms of a reference citation. The Applicant should provide copies of these surveys to the NRC.

RESPONSE: Seabrook ER-OLS Section 6.1.4.2 outlines the methodology and general sources of information used in estimating size and distribution of the transient population as described in ER-OLS Section 2.1.2.3. Section 2.1.3.3 of the Seabrook FSAR describes in detail the surveys conducted by the Applicant, or reference citations, which provided the information which was used to assess the nature of the transient population in the site area. Unless otherwise referenced in Section 2.1.3.3 of the FSAR, the four surveys noted above are comprised of extensive data collection and field survey work conducted by the Applicant specifically for, and summarized in, the Seabrook Station FSAR and ER-OLS, and as such, no independent reference reports outside these licensing documents exist.

310.2 (3.9) (ER) Section 3.9 indicates that transmission line facilities remain unchanged from that presented in Section 3.9 of the Seabrook Station ER-CPS "except as noted below". In fact, Sections 2.6 and 4.2.1 indicate changes. The Applicant should reconsider the statement in Section 3.9 of the ER-OL and develop a full discussion which indicates the following: (1) all lines and corridors associated with Seabrook Station; (2) status of construction and planning; (3) potential visual and physical impact on historical and archeological resources which are either on or potentially eligible for inclusion on the National Register of Historic Places; (4) the status of hearings on transmission line planning and construction before state hearing bodies; and (5) the consistency of the Applicant's plans for transmission lines with the NRC's consideration of transmission line routes in the Seabrook FES-CP (12/74).

RESPONSE:

1.
   a. Seabrook-Newington - As noted in the hearings and the Construction Permit, Seabrook-Newington was relocated from filed route to cross Packer Bog away from a stand of Atlantic cedar. South of this point and on the west side of I-95, the route was relocated to more nearly parallel I-95 at some distance away from the highway to accommodate the wishes of local property owners. The same environmental considerations were maintained on this relocated portion as on the remainder of the section paralleling I-95. The corridor for this line remains essentially the same as that proposed during the ER-CPS.

   b. Seabrook-Tewksbury and Seabrook-Scobie have a common corridor westerly from Seabrook for approximately 5 miles. About 2.5 miles of this corridor has been the subject of intense negotiation with property owners to determine an acceptable deviation from the approved route. The problem has arisen because of homes which have been constructed very close to or within the proposed route. What appeared to be an acceptable solution has been recently negated by the Site Evaluation Committee of the State of New Hampshire. At the present time, PSNH is awaiting decision by the courts to determine the next course of action.

c. Seabrook-Tewksbury - The portion of this line south from the common corridor within New Hampshire has not been a part of the negotiation. However, local residents have been attempting to delay and possibly prohibit construction along the right-of-way presently owned by PSNH. In Massachusetts, hearings have been progressing before the Massachusetts Department of Public Utilities on the suitability of the route from Amesbury at the New Hampshire-Massachusetts state line to Tewksbury. One more public meeting in the Amesbury area is scheduled. Following this, a decision is expected from the MDPU.

d. Seabrook-Scobie - From the end of the joint corridor in Kensington, the only change in location on this line involves the Cedar Swamp dog-leg which was ordered when the Construction Permit was granted to PSNH. The remainder of this line is where the company proposed it would be.

One of the environmental considerations involved the type of structure to be used that would be compatible with the terrain and cover in the area. The type of structure chosen was the H-Frame, which allowed for flat construction with minimum height to present minimum visibility. Wood was discussed as being the support members which would be most compatible with the wooded areas through which the lines were passing.

When it came time to make the final design decisions, it became apparent that weathering steel should be considered for the support members in place of wood. Because the color was similar to wood and the members were of smaller dimension than wood, it was concluded that the environmental effects were equal or better than using wood.

After an evaluation which involved the consideration of the esthetics of the structure as well as the total owning costs, it was determined the direct embedded, weathering steel H-Frame structures would be used for the tangent structures on these lines.

2. Status of the three lines.

a. Seabrook-Newington line has been constructed and energized.

b. Seabrook-Tewksbury and Seabrook-Scobie, both lines are awaiting resolution of hearings and/or court cases, before final alignment can be determined. The tangent structures for the New Hampshire portion of these lines have been designed and purchased subject to a full size test by the supplier to be witnessed by PSNH personnel. At this time, the schedule of completion of Seabrook-Tewksbury is August 1983, and Seabrook-Scobie is November 1985.

3. Review of State of New Hampshire Inventory of Natural Scenic and Historical Areas revealed six locations near the corridors. This was followed by a ground inspection to ascertain the possible visual and physical impact that the transmission line might have on each specific historical feature. In all cases it was determined that the transmission line and its attendent structures would be imperceptible from the historic sites. No designated archeological resources were identified on or close to the transmission corridors.

   In order for historical and archeological resources to be eligible for inclusion on the National Register of Historic Places, they must be nominated by the state agency. A recent check with the State of New Hampshire Historic Preservation Office shows the Applicant that no pending nominations exist near the Seabrook corridors. There has, however, been several suggestions by citizens in the South Hampton area concerning features they believe are worthy of recognition because of their perceived historical significance. At this point, the State of New Hampshire Historic Preservation Office is reviewing the suggested locations.

4. Discussed in (1) above along with the relocations noted.

5. PSNH believes the routes for the three 345 kV lines as considered by the NRC are essentially the same as those planned or in the case of the Seabrook-Newington line, constructed.

310.3
(ER)

The Applicant should indicate the estimated property taxes to be paid during the first year of opertion by special district, local jurisdiction and state.

RESPONSE: Under current New Hampshire law, property taxes are levied only by towns and districts within a town. By the time Unit 1 goes into commercial operation it is expected that the laws will change and that generation facilities will be taxed by the state. On that basis, it is estimated that the taxes on Unit 1 will be $42,575,000. Unit 2, still under construction, would pay an estimated $3,900,000 to the Town of Seabrook.

310.4
(8.1.6)
(ER)

Section 8.1.6 indicates employment of 450 at the site. Does this figure include security, janitorial, and maintenance personnel? If not, these figures should be provided. How many existing residents does the Applicant estimate will be employed at the site? The Applicant should indicate the basis for the response.

RESPONSE: Please refer to FSAR Figure 13.1-3 which shows the station table of organization. The positions identified in the figure total 224. Not shown in the figure are additional projected positions totaling approximately 200 personnel. These additional positions fulfill needs in the areas of clerical, security supervision, janitorial, maintenance, and various technical support services. In addition, it is expected that there will be approximately 100 guards employed from the contract service.

It has been the Applicant's experience through construction that about 5% of the work force has come from the Town of Seabrook. On that basis, it is estimated that between three and five percent of the Operation's staff will be town residents.

310.5
(ER)

The Applicant should indicate the types of goods and services that will be purchased locally. The Applicant's response should indicate the dollar value of such purchases and the market area of purchase.

RESPONSE: The Applicant's policy is to purchase goods and services from the lowest qualified bidder. Purchase orders, either blanket or specific, are issued after bids are obtained from bidders who have been determined qualified to supply the items on the inquiry. It is also the Applicant's desire to place as much business locally as possible. However, the requirements of qualification and pricing are not set aside to favor local vendors. They must obtain their business based on qualification and competition in the marketplace.

All of that is a prelude to saying that a prediction now about how much business will be placed locally when production begins is subject to a great deal of variability. Within 15 miles of the site, what we would call the local area, there are a very limited number of suppliers for items, mostly consumables, which the plant will require. Local purchases are estimated to be between $250,000 and $500,000 annually.

310.6a The applicant should review the data, sector by sector, in ER Figure 2.1-5 and Figure B-1 in the report entitled, "Preliminary Evacuation Clear Time Estimates for Areas Near Seabrook Station" (CTE), because the data for the 1983 population differs in both figures. The Applicant should explain the methods used and assumptions made in developing the population data.

RESPONSE: The Seabrook Station Environmental Report (ER-OLS Figure 2.1-5) and the Preliminary Clear Time Estimates for Area Near Seabrook Station (CTE Figure B-1) both present estimates of the 1983 permanent resident population within 10 miles of Seabrook Station.

The ER-OLS distributions were based on the following:

- Between 0 and 1 Miles: Distribution of population within one mile of Seabrook Station was based on an aerial survey housing count supplemented by an on-site survey. The resident population was estimated from an aerial photomosaic supplemented by a count of houses made during a field survey conducted in December 1978. An average household occupancy factor based on 1970 U.S. Census of Housing data was applied. The rates used were 3.25 persons per household for Seabrook and 3.75 persons per household for Hampton Falls.

- Between 1 and 5 Miles: A system of concentric circles and radial lines was superimposed on a map of electric meter reading routes (or pattern areas) within towns between 1 and 5 miles of Seabrook Station, excluding a small portion of North Hampton located between 4-1/2 and 5 miles north of the site. The residential electric meter data, which broke down towns into relatively smaller geographical areas, provided the basis for allocation of the resident population to the defined sectors. Of the six towns within 5 miles of the site, the electric meter reading patterns divides this area into over 60 subsections. Portions of each meter reading routes were assigned to the various sectors, and counts of residential electric meters were made in order to estimate the number of residential dwelling units that were associated with each sector. The proportion or fraction of residential meters in a sector to those included within an entire town was determined. Population estimates on the town level were then multiplied by these same fractions to distribute the town's permanent population to each sector. For that portion of North Hampton within the 5-mile radius, equal area allocation was used to distribute the town's resident population, since electric meter data was not available.

- Between 5 and 10 Miles: The distribution of population between 5 and 10 miles of the site was based on equal area allocation in conjunction with a review of town boundaries as found on area maps. The fraction of a town's area within each sector defined by the grid of concentric circles and radial lines was determined. The same fraction of that town's total population was assigned to the particular sector.

2

The ER-OLS population distributions were modified for use in the CTE report, since more disaggregated data was required. The distribution of resident population presented in the CTE was based on the following:

- Between 0 and 5 Miles: The distribution of resident population between 0 and 5 miles of Seabrook Station was based on the previously used 1979 electric utility meter data, including the area between 1 and 5 miles,* thus applying a uniform methodology for distributing the area's population over the entire 5-mile radius.

- Between 5 and 10 Miles: Distribution of the 5 to 10-mile, in one mile increments, resident population was based on a combination of equal area allocation and a review of area topographical maps. Disaggregations were developed not only for sector divisions, but also along town boundaries. For those towns located both within and outside of the 5-mile radius, the population within 5 miles of the plant (estimated from the electric utility meter data) was subtracted from the town totals. The remaining population for each town was then distributed outside of the 5-mile area using the previously mentioned area allocation methodology. This accounting for each town's total population due to the changes in methodology at the 5-mile radius was not applied in the ER-OLS. For those towns located within 10 miles of the plant, but further away than 5 miles, equal area allocation and a review of area topographical maps were used to distribute the resident population.

Table 310.6a-1 presents the 1983 resident population estimates by sector as presented in both the ER-OLS and the CTE report. This table also presents a corrected CTE estimate, since a few typographical errors were included in Figure B-1 in the original CTE report. The clear time estimates in the CTE report are not affected by these typographical errors in the population data base.

Figure 2.1-5 in the ER-OLS contained one typographical error in the WNW Sector, between 4 and 5 miles of Seabrook Station. A population estimate of 740 residents was reported. The correct value is 470 persons (rounded). In addition, typographical errors which appeared in Figure B-1 of the CTE report are as follows:

- Sector NNW, 5-6 miles - within the Town of Hampton, 220 residents should have been reported.

- Sector NW, 5-6 miles - within the Town of Exeter, 67 residents should have been reported.

---

* Except that for the Town of Kensington, a further review of the data warranted a redistribution for that area within 4-5 miles of Seabrook Station (Sectors WNW and W).

2

- Sector WNW, 2-3 miles - the value of 257 residents should have been reported as 274 residents.

- Sector SW, 2-3 miles - the value of 60 residents within the Town of Seabrook should not have been included.

- Sector ESE, 1-2 miles - the value of 22 residents within the Town of Hampton should have been reported as 221 residents. 2

TABLE 310.6a-1
(Sheet 1 of 6)

1983 PERMANENT RESIDENT POPULATION ESTIMATE SUMMARY

		ER*	CTE1**	CTE2****
N	0- 1	20	0	0
	1- 2	80	82	82
	2- 3	530	528	528
	3- 4	800	798	798
	4- 5	470	466	466
	5- 6		2,061	2,061
	6- 7		1,471	1,471
	7- 8	5,190	566	566
	8- 9		507	507
	9-10		507	507
Subtotal		7,090		6,986
NNE	0- 1	0	0	0
	1- 2	0	0	0
	2- 3	1,930	1,928	1,928
	3- 4	2,250	2,247	2,247
	4- 5	430	429	429
	5- 6		589	589
	6- 7		839	839
	7- 8	8,820	770	770
	8- 9		2,262	2,262
	9-10		3,490	3,490
Subtotal		13,430		12,554
NE	0- 1	0	0	0
	1- 2	70	74	74
	2- 3	900	896	896
	3- 4	1,540	1,535	1,535
	4- 5	940	941	941
	5- 6		589	589
	6- 7		604	604
	7- 8	1,140	603	603
	8- 9		603	603
	9-10		604	604
Subtotal		4,590		6,449

TABLE 310.6a-1
(Sheet 2 of 6)

1983 PERMANENT RESIDENT POPULATION ESTIMATE SUMMARY

		ER*	CTE1**	CTE2****
ENE	0- 1	0	0	0
	1- 2	500	503	503
	2- 3	930	933	933
	3- 4	120	123	123
	4- 5	0	0	0
	5- 6		0	0
	6- 7		0	0
	7- 8	0	0	0
	8- 9		0	0
	9-10		0	0
Subtotal		1,550		1,559
E	0- 1	0	0	0
	1- 2	540	540	540
	2- 3	0	0	0
	3- 4	0	0	0
	4- 5	0	0	0
	5- 6		0	0
	6- 7		0	0
	7- 8	0	0	0
	8- 9		0	0
	9-10		0	0
Subtotal		540		540
ESE	0- 1	0	0	0
	1- 2	1,040	1,042	1,042
	2- 3	0	0	0
	3- 4	0	0	0
	4- 5	0	0	0
	5- 6		0	0
	6- 7		0	0
	7- 8	0	0	0
	8- 9		0	0
	9-10		0	0
Subtotal		1,040		1,042

TABLE 310.6a-1
(Sheet 3 of 6)

1983 PERMANENT RESIDENT POPULATION ESTIMATE SUMMARY

		ER*	CTE1**	CTE2****
SE	0- 1	0	0	0
	1- 2	60	60	60
	2- 3	570	567	567
	3- 4	0	0	0
	4- 5	0	0	0
	5- 6		0	0
	6- 7		0	0
	7- 8	0	0	0
	8- 9		0	0
	9-10		0	0
Subtotal		630		627
SSE	0- 1	10	0	0
	1- 2	100	100	100
	2- 3	280	279	279
	3- 4	330	330	330
	4- 5	520	524	524
	5- 6		0	0
	6- 7		1,355	1,355
	7- 8	4,420	216	216
	8- 9		0	0
	9-10		0	0
Subtotal		5,660		2,804
S	0- 1	140	174	174
	1- 2	270	274	274
	2- 3	600	592	592
	3- 4	580	577	577
	4- 5	1,010	1,011	1,011
	5- 6		0	0
	6- 7		5,100	5,100
	7- 8	7,760	1,303	1,303
	8- 9		1,087	1,087
	9-10		651	651
Subtotal		10,360		10,769

TABLE 310.6a-1
(Sheet 4 of 6)

1983 PERMANENT RESIDENT POPULATION ESTIMATE SUMMARY

		ER*	CTE1**	CTE2****
SSW	0- 1	280	174	174
	1- 2	310	307	307
	2- 3	440	436	436
	3- 4	510	514	514
	4- 5	400	404	404
	5- 6		6,012	6,012
	6- 7		2,839	2,839
	7- 8	9,160	929	929
	8- 9		443	443
	9-10		443	443
Subtotal		11,100		12,501
SW	0- 1	60	87	87
	1- 2	750	747	747
	2- 3	390	453***	393
	3- 4	230	231	231
	4- 5	3,350	3,345	3,345
	5- 6		1,220	1,220
	6- 7		1,203	1,203
	7- 8	11,930	1,276	1,276
	8- 9		1,648	1,648
	9-10		1,168	1,168
Subtotal		16,710		11,318
WSW	0- 1	0	0	0
	1- 2	750	747	747
	2- 3	710	714	714
	3- 4	310	313	313
	4- 5	3,420	3,422	3,422
	5- 6		7,574	7,574
	6- 7		737	737
	7- 8	7,800	1,049	1,049
	8- 9		2,036	2,036
	9-10		2,036	2,036
Subtotal		12,990		18,628

TABLE 310.6a-1
(Sheet 5 of 6)

1983 PERMANENT RESIDENT POPULATION ESTIMATE SUMMARY

		ER*	CTE1**	CTE2****
W	0- 1	120	160	160
	1- 2	750	754	754
	2- 3	290	293	293
	3- 4	360	288	288
	4- 5	740	735	735
	5- 6		179	179
	6- 7		172	172
	7- 8	2,560	444	444
	8- 9		1,411	1,411
	9-10		1,337	1,337
Subtotal		4,820		5,773
WNW	0- 1	180	80	80
	1- 2	80	79	79
	2- 3	270	257***	274
	3- 4	80	152	152
	4- 5	740***	470	470
	5- 6		146	146
	6- 7		146	146
	7- 8	2,960	383	383
	8- 9		414	414
	9-10		859	859
Subtotal		4,310		3,003
NW	0- 1	30	0	0
	1- 2	240	239	239
	2- 3	160	163	163
	3- 4	120	123	123
	4- 5	120	123	123
	5- 6		49***	116
	6- 7		1,776	1,776
	7- 8	6,760	4,380	4,380
	8- 9		3,650	3,650
	9-10		802	802
Subtotal		7,430		11,372

TABLE 310.6a-1
(Sheet 6 of 6)
1983 PERMANENT RESIDENT POPULATION ESTIMATE SUMMARY

		ER*	CTE1**	CTE2****
NNW	0- 1	30	0	0
	1- 2	280	284	284
	2- 3	160	156	156
	3- 4	200	196	196
	4- 5	330	332	332
	5- 6		339***	559
	6- 7		414	414
	7- 8	4,050	599	599
	8- 9		532	532
	9-10		713	713
Subtotal		5,050		3,785
TOTAL		107,300		109,710

* As presented in the Seabrook Station Environmental Report- OLS Figure 2.1-5

** As presented in the Preliminary Evacuation Clear Time Estimates for Areas Near Seabrook Station, Figure B-1

*** Typographical Errors

**** Correct Estimates

310.7 Which of the above figures most accurately portrays the projected 1983 population distribution?

RESPONSE: The distribution by sector of the 0-1 mile population, as shown on ER-OLS Figure 2.1-5, represents a more detailed estimation of the close-in population. However, in terms of disaggregated data by 1-mile increments out to 10 miles, the CTE population estimates presented in the right-hand column of Table 310.6a-1 portray the best overall estimation 1983 population projections. The distribution method used to develop these estimates is presented in our response to RAI 310.6a. 2

310.8 What is the reason for the discrepancy between ER-OLS Figure 2.1-18 and CTE Figure B-8? How does the Applicant explain a number less than 10 in the SSW Sector, 2-3 miles in ER-OLS, Figure 2.1-18?

RESPONSE: Figure B-8 in the CTE report included typographical errors in Sectors SW, 1-2 miles; SSW, 2-3 miles; S, 1-2 miles; and S, 7-8 miles. Employee estimates for these sectors are 98, 5, 80 and 72, respectively. The data presented on Figure 2.10-18 of the ER-OLS is correct. Table 310.8-1 presents this data in tabular form. In the SSW Sector between 2 and 3 miles, an estimate of 5 employees was developed for a small machinery company located within this sector. (Note: Major employment estimates for areas within 10 miles of Seabrook Station were updated for the FSAR per NRC Acception Review RAI 310.6. This updated listing is presented herein as Table 310.8-2. 2

TABLE 310.8-1

POPULATION OF MAJOR EMPLOYERS

Sector	0-1 Mi	1-2 Mi	2-3 Mi	3-4 Mi	4-5 Mi	6-6 Mi	6-7 Mi	7-8 Mi	8-9 Mi	9-10 Mi	Total
N	0	26	0	280	125	0	0	0	0	74	505
NNE	0	0	0	0	46	0	0	0	0	0	46
NE	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0	0	0	0	0
S	0	80	0	0	54	0	279	72	0	0	485
SSW	0	0	5	0	20	1409	497	0	0	0	1931
SW	0	98	0	0	938	396	302	0	0	0	1734
WSW	0	950	95	0	194	15	0	0	188	0	1442
W	0	411	12	0	0	0	0	0	0	0	423
WNW	0	0	0	0	0	0	0	0	0	0	0
NW	0	9	0	0	0	0	0	508	394	0	911
NNW	0	0	0	0	0	0	0	400	0	0	400
Totals	0	1574	112	280	1377	1820	1078	980	582	74	7877

TABLE 310.8-2
(Sheet 1 of 11)

MAJOR EMPLOYERS WITHIN 10 MILES OF THE SEABROOK SITE AND ESTIMATED NUMBER OF EMPLOYEES

Name of Firm	Address (Sector)	Type of Manufacturing	Approximate Number of Employees
Hampton			
J.D. Cahill Co.	Scott Road. (N 4-5)	Polyethylene coated paperboard	40
Charles Greenman Co.	70 High Street (NNE 4-5)	Leather and rubber soles	14
Hampton Machinery	Exeter Road (N 4-5)	Tannery equipment repairing	30
Hopkin Hunt Co.	Colonial Circle (N 4-5)	Special industrial machinery	3
Palmer & Sicard	Lafayette Road (N 3-4)	Sheet metal for heating and ventilating	62
Pearse Leather	7 Kershaw Avenue (NNE 4-5)	Contract leather finishing	35
Foss Manufacturing	Foss Road (N 3-4)	Non-woven textiles	12
Whites Welding	6 Kershaw Avenue (NNE 4-5)	Welding	1
Advanced Speaker	432 Lafayette Road (N 4-5)	Speakers	25
Exeter Instruments	70 High Street (NNE 4-5)	Medical instruments	5
Hampton Water Works	52 High Street (NNE 2-3)	Water and sewer	N/A
Wands Inc.	1 Lafayette Road (N 1-2)	Oil heating equipment	20
Wheelabrator-Frye Inc.	Liberty Lane (N 3-4)	Pollution control systems	180
Garnet Lumber Co.	5 Dearborn Avenue (NNE 3-4)	Lumber	4

TABLE 310.8-2
(Sheet 2 of 11)

Name of Firm	Address (Sector)	Type of Manufacturing	Approximate Number of Employees
Merrill Lumber Co.	5 Deaborn Avenue (NNE 3-4)	Lumber	6
Mibo, Inc.	12 Evergreen Road (N 3-4)	Buckles and bows	6
Rockingham County Newspapers	Depot Square (NNE 3-4)	Newspaper publishing	12
Stark-MacDonald, Inc.	40 Sweetbriar Lane (N 3-4)	Leather material	2
TDR Electronics	625 Lafayette Road (NNE 3-4)	Time delay relays	7
Hampton Falls			
Golden Eagle Coppersmiths	Lafayette Road (N 1-2)	Weathervanes and lanterns	10
Stillmeadow Glass Works	Lafayette Road (NW 1-2)	Blown glass for labs	9
Kensington			
None			
North Hampton			
Arc-Way Welding	203 Lafayette Road (N 4-5)	Steel fabrication	1
Giant Lift Equipment Co. Inc.	136 Lafayette Road (N 4-5)	Vertical lift equipment	16
LTP Enterprises Inc.	34 Lafayette Road (N 4-5)	Structure fiberglass	10
Hampton Pattern Works	91 Post Road (N 5-6)	Wood and metal patterns	6

Name of Firm	Address (Sector)	Type of Manufacturing	Approximate Number of Employees
Seabrook			
Adhesive Machinery Corp. (Ornsteen Chemicals)	Folly Mill Road (WSW 2-3)	Hot melt adhesives and applicating equipment	38
Cargocaire Engineering Corp.	Route 107 (W 2-3)	Industrial dehumidifiers	20
Circle Machine Co.	Stard Road (W 1-2)	Shoe Machinery	48
Hale Bros.	Stard Road (W 1-2)	Small chains	8
House of White Birches	Folly Mill Road (SW 1-2)	Publishing books and magazines	32
K.J. Quinn & Co.	Folly Mill Road (SW 1-2)	Industrial coatings and poly-urathane elastomers	40
Rockingham Fireworks Manufacturing Co.	Lafayette Road (W 1-2)	Fireworks	4
Spherex Inc.	Walton Road (S 1-2)	Light duty wheels	75
Tower Press Inc.	Folly Mill Road (SW 1-2)	Magazine publishing	50
USM, Bailey Division	Lafayette Road (WSW 1-2)	Plastic, rubber, and metal	930
Welpro Inc.	New Zealand Road (W 1-2)	Ladies shoes	350
Withey Press	Lafayette Road (SW 1-2)	Commercial printing	24
Protective Materials Corp.*	Folly Mill Road (WSW 2-3)	Firearms parts	25
D.G. O'Brien Inc.	1 Chase Park (W 1-2)	Electrical connector, atomic reactor parts	100
Amesbury Machine Shop	(W 1-2)		50

* Data from Town of Seabrook Planner

TABLE 310.8-2
(Sheet 4 of 11)

Name of Firm	Address (Sector)	Type of Manufacturing	Approximate Number of Employees
South Hampton			
None			
Salisbury			
Austin Precision Tool	40 Ferry Street (S 4-5)	Precision parts and gages	4
Barton Corp.	40 Ferry Street (S 4-5)	Custom shipping boxes and crates	25
Manson Boat Works	68 Bridge Road (S 4-5)	Boat building and repairing	25
Tucker Machine Corp.	284 Elm St. Rte. 110 (SSW 4-5)	Screw machine products	10
Vaughn Corp.	386 Elm Street (SW 4-5)	Stonelined water heaters and tanks, solar heaters	65
Vaughn Woodworking Inc.	386 Elm Street (SW 4-5)	Wirebound boxes and crates	9
Weld Machine Corp.	47 Lafayette Road (SSW 2-3)	Machining, prototype hand screw milling	5
Elm Knoll Farm	240 Main Street (SW 3-4)	Lumber	3
Handicapped Artists	8 Sandy Lane (S 4-5)	Prints, booklets, etc.	10
Amesbury			
Advanced Absorber Products	10 Morrill Street (SW 4-5)	Microwave absorbers and radomes	21
Amesbury Chair	63 Clinton Street (WSW 4-5)	Chairs	5
Amesbury Metal Products	39 Oakland Street (SW 4-5)	Metal stamping, fluorescent lighting fixtures, metal plating	100

TABLE 310.8-2
(Sheet 5 of 11)

Name of Firm	Address (Sector)	Type of Manufacturing	Approximate Number of Employees
Vulcan Plastic Inc.	Noel Street (SW 5-6)	Injection molder and finisher	200
Amesbury Tool & Die Corp.	24 Oakland Street (SW 4-5)	Tool and die stampings	11
Bartley Machine and Manufacturing	Water Street (SW 4-5)	Machinery parts	19
Bocra Engineering	R Street (WSW 4-5)	Special tools and dies, jigs and fixtures	24
Cado Fabricating	144 Elm Street (SW 4-5)	Transit cases, consoles (machine work only)	65
Cargocaire Engineering	6 Chestnut Street (SW 4-5)	Dehumidifiers, heat exchangers	150
New Plant Building	Monroe Street (SW 4-5)		150
Dalton Manufacturing	5 Clark Street (WSW 4-5)	Display fixtures and educational materials	6
Durasol Drug & Chemical	1 Oakland Street (SW 4-5)	Erasers, dental adhesives, cleaners	20
Henschel Corp.	14 Cedar Street (WSW 4-5)	Marine signal systems, communication systems	150
LeBaron-Bonney Co.	14 Washington (SW 4-5)	Upholstery and top product kits	55
MAT Reinforced Plastic	79 Elm Street (SW 4-5)	Molded fiberglass products	20
Merrimac Valley Foundry	58 Mill Street (SW 5-6)	Iron castings, brass, bronze, aluminum	50
North Shore Weeklies	21 Elm Street (SW 4-5)	Newspapers and printing	60
Oakland Industries	11 Oakland Street (SW 4-5)	Sheet metal fabrication	35
R&G Manufacturing (Amesbury Chair)	63 Clinton Street (SW 4-5)	Metal kitchen cabinets	65

TABLE 310.8-2
(Sheet 6 of 11)

Name of Firm	Address (Sector)	Type of Manufacturing	Approximate Number of Employees
Reid Foundry	Mill Street (SW 5-6)	Grey iron castings	25
Sagamore Industrial Finishes	Rocky Hill Road (SW 4-5)	Industrial finishes	11
Scandia Plastic	36 High Street (WSW 5-6)	Extrusion of plastic tubing	32
Alexander Syvinski	38 Collins Avenue (SW 4-5)	Leather tanning and finishing	99
Dreamboat Corp.	10 Merrill Street (WSW 4-5)	Boat building and repairing	9
Whittier Press and North Shore Weeklies	21 Elm Street (SW 4-5)	Commercial printing	4
Brazonics, Inc.	Haverhill Road (SW 6-7)	Primary metals	80
Flexaust Company	Chestnut Street (SW 5-6)	Flexible hose	50
Haverhill Gas Company	Hunt Road (SW 6-7)	Natural gas	139
Maple Wood Products Co. Inc.	60 Merrimac Street (SW 5-6)	Toys and furniture	56
Michele Silverware & Jewelry Co., Inc.	36 Main Street (SW 5-6)	Jewelry	40
Microfab, Inc.	Haverhill Road (SW 6-7)	Printed circuit boards	190
Christesen Machine Co. Inc.	Haverhill Road (SW 6-7)	Machinery and parts	3
Country Kitchens	34 Pond Street (SW 5-6)	Kitchen and bath vanity cabinets	2
Denis Brass Foundry	250 Main Street (SW 5-6)	Brass and aluminum castings	10
R.E. Kimball & Co.	73 Merrimac Street (SW 5-6)	Jellies, jams, and relishes	3

TABLE 310.8-2
(Sheet 7 of 11)

Name of Firm	Address (Sector)	Type of Manufacturing	Approximate Number of Employees
Lowell's Boat Shop	459 Main Street (SW 5-6)	Boats	6
Erikson-Hedlund Stamponic Co.	39 Oakland Street (SW 4-5)	Tools, dies	8
The Old Newbury Crafters, Inc.	36 Main Street (SW 5-6)	Silverware	10
Merrimac			
Metal Finishing, Inc.	2 Littles Court (WSW 8-9)	Metal finishing	23
Engel-Lewis Counter Co. Inc.	Liberty Street (WSW 8-9)	Shoe counters	150
Will-Mor Engineering Co. Inc.	27 East Main Street (WSW 8-9)	Tools and machine parts	15
Newbury			
Newburyport Press, Inc.	80 Hanover Street (S 7-8)	Printing	18
Parker River Marine	Route 1A (S 9-10)	Marine equipment	6
Newburyport			
A. Rhodes Co., Inc.	46 Water Street (S 6-7)	Shirts	27
Amesbury Specialty Co. Inc.	Parker Street (S 6-7)		50
Bay State Carbide Tool Corp.	126 Merrimac Street (SSW 5-6)	Tools	30
Berkshire Manufactured Products, Inc.	116 Parker Street (SSW 6-7)	Precision stampings	75

TABLE 310.8-2
(Sheet 8 of 11)

Name of Firm	Address (Sector)	Type of Manufacturing	Approximate Number of Employees
Circle Finishing, Inc.	Rt. 1 Traffic Circle (S 7-8)	Plating	22
Coca-Cola Bottling Co.	504 Merrimac Street (SSW 5-6)	Bottling	19
Contherm Corp.	Newburyport Trnpke. (S 7-8)	Heat exchangers	37
Geonautics, Inc.	44 Merrimac Street (SSW 5-6)	Plastic molds	40
Gould, Inc.	374 Merrimac Street (SSW 5-6)	Fuses	500
Kemtron Electron Products, Inc.	14 Prince Place (S 6-7)	Electronic components	25
Leary's Beverages, Inc.	504 Merrimac Street (SSW 5-6)	Bottling	80
M & V Electroplating Corp.	5 Greenleaf Street (S 6-7)	Electroplating	64
Newbury Tanning Corp.	12 Federal Street (S 6-7)	Leather finishing	80
Newburyport Daily News	23 Liberty Street (S 6-7)	Newspaper publishing	30
Owens-Illinois, Inc.	Parker Street (SSW 6-7)	Plastic products	200
S. Starensier, Inc.	5 Perkins Way (SSW 6-7)	Fabrics	99
Stride Rite Corp.	Perkins Way (SSW 6-7)	Footwear	100
Towle Mfg. Co.	200 Merrimac Street (SSW 5-6)	Silverware	1,800
Waverly News Co., Inc.	17 State Street (S 6-7)	Printing	22
Essex Tool & Die, Inc.	Bridge Road (SSW 5-6)	Precision tools and dies	5
International Light Inc.	Dexter Industrial Green (SSW 6-7)	Electro-optical instrumentation	19

TABLE 310.8-2
(Sheet 9 of 11)

Name of Firm	Address (Sector)	Type of Manufacturing	Approximate Number of Employees
Littlefield Press	2 Federal Street (S 6-7)	Commercial printing	9
Piel Craftsmen Co.	307 High Street (SSW 5-6)	Ship models	2
Rivco, Inc.	10 Prince Place (S 6-7)	Rivet setting tools	5
Stem Chemicals, Inc.	7 Mulliken Way (SSW 7-8)	Chemicals	16
Lewis D. Bartley	7 Spofford Street (SSW 5-6)	Metal stampings	3
Alfa-Laval, Inc.	Route 1 (SSW 6-7)	Heat exchangers	37
West Newbury			
None			
Exeter			
Alrose Shoe Co., Inc.	1 Rockingham Street (NW 8-9)	Footwear	150
Brockhouse Corporation	Exeter Industrial Park (NW 8-9)	Metal fabrication	200
Chemtan Co., Inc.	Hampton Road (NW 7-8)	Leather chemicals	20
Clemson Automotive Fabrics	Chestnut Street (NW 7-8)	Textile finishing	200
Exeter Footwear, Inc.	93 Court Street (NW 7-8)	Women's footwear	100
Exeter Machine Products	Court Street (NW 7-8)	Screw machine products	22
Exeter News-Letter Co.	255 Water Street (NW 7-8)	Newspaper publisher	58

TABLE 310.8-2
(Sheet 10 of 11)

Name of Firm	Address (Sector)	Type of Manufacturing	Approximate Number of Employees
Blue Ribbon Sports, Inc.	156 Front Street (NW 8-9)	Sport shoes	110
GTE Sylvania, Inc.	Portsmouth Avenue (NNW 7-8)	Electrical equipment	500
Ideal Tape Co.	Industrial Park, off Epping Road (NW 8-9)	Tapes and adhesives	12
Prescott RE Mfg. Co. Inc.	10 Railroad (NW 8-9)	Pump equipment	12
Vaporpak, Inc.	Hampton Road (NW 7-8)	Fuel catalyst system	20
Hampshire Controls	P.O. Box M (NW 7-8)	Electronic controls	N/A
Curtain Shop	43 Water Street (NW 7-8)	Draperies	5
Drew-It Corp.	256 Front Street (NW 8-9)	Can crushers	5
Miljo Chemical Co. Inc.	94 Epping Road (NW 8-9)	Leather coatings	3
Squamscott Press	17 Court Street (NW 7-8)	Printing	2
Tyco Laboratories, Inc.	Tyco Park (NW 7-8)	Electronic	33
Exeter & Hampton Electric Co.	225 Water Street (NW 7-8)	Electric light and power	139
Freedom Shoe Co., Inc.	15 Front Street (NW 7-8)	Sport shoes	N/A
Milliken & Company	Chestnut Street (NW 7-8)	Industrial cotton finishing	200
Wise Shoe Co., Inc.	156 Front Street (NW 8-9)	Shoes	300
Raw Thong Corp.	96 High Street (NW 7-8)	Rawhide laces	8

TABLE 310.8-2
(Sheet 11 of 11)

Name of Firm	Address (Sector)	Type of Manufacturing	Approximate Number of Employees
Donnelly Mfg. Co.	Industrial Park, Epping Road (NW 8-9)	Sheet metal fabrication	N/A
Import Leather, Inc.	Industrial Park, Epping Road (NW 8-9)	Leather imports	N/A
Laurel Farms Dairy, Inc.	Pickpocket Road (NW 8-9)	Dairy	13
Regall Coatings, Inc.	94 Epping Road (NW 8-9)	Coatings for plastics	4
Greenland			
GTE Sylvania, Inc.	Route 101 (N 10)	Glass tubing	74
Ocean and Forest Products Co.	755 Portsmouth Ave. (N 9-10)	Sweeping compounds	7

310.9 Information in ER-OLS, Section 2.1.2.3.e, and FSAR, Section 2.1.3.3.e, on Route 1 shopping center parking lot capacities differs from data in CTE Figure B-5. The Applicant should explain the reasons for the differences.

RESPONSE: Section 2.1.2.3.e in the ER-OLS, and Section 2.1.3.3.e in the FSAR, identified parking lot capacity estimates for the major shopping centers along Route 1, within the 10-mile EPZ. These estimates are as follows:

Shopping Center	Lot Vehicle Capacity* Estimate	Sector
• Seabrook Plaza	710	W, 0-1 miles
• Seabrook Southgate	730	SW, 1-2 miles
• Convenience Shopping Center	50	S, 3-4 miles
• Hampton Court	750	N, 3-5 miles
• North Hampton Village Shopping Center	140	N, 5-6 miles
• Southgate Plaza	550	NNE, 9-10 miles
Total	2,930	

In addition to these, the estimate developed for the Evacuation Time Estimate Study included restaurants and other smaller commercial establishments along Route 1**, identified in Table 310.9-1.

Accordingly, the total vehicle lot capacity estimate for shopping centers and minor commercial establishments is 5,150. Figure B-5 in the Evacuation Time Estimate Study presented this data in rose format.

* As noted in both the ER-OLS and FSAR, vehicles parked at these facilities were recorded for 10 days during the summer of 1979. Observations were made between 1:00 p.m. and 5:00 pm. on both weekday and weekend periods. Maximum vehicle observations were significantly lower than the capacity at all facilities.

** It should be emphasized that inclusion of these additional parking lot capacity estimates was an added conservatism used for the development of evacuation clear times. Although it is reasonable to assume that some double-counting in terms of vehicle demand is included, inclusion of this vehicle demand is considered appropriate for use in estimating clear times. 2

Table 310.9-1: Route 1 Parking Lot Capacity Estimate*

Establishment	Lot Vehicle Capacity* Estimate	Sector
• David's Fish Market	7	S, 4-5 mi.
• Ann's Diner	10	S, 4-5 mi.
• Kendrick's Restaurant	26	S, 3-4 mi.
• King of the Road Seafood	15	SW, 1-2 mi.
• Snack Bar	13	SW, 1-2 mi.
• Sunshine Fruit Stand	10	SW, 1-2 mi.
• Burger Chef Restaurant	66	SW, 1-2 mi.
• McDonald's Restaurant	86	SW, 1-2 mi.
• Food Shop	16	SW, 1-2 mi.
• Dunkin Donuts	12	WSW, 1-2 mi.
• Tony's Restaurant	40	SW, 1-2 mi.
• K's Country Rib House Restaurant	25	WSW, 1-2 mi.
• Bondi's Restaurant	35	W, 1-2 mi.
• Hawaiian Garden Restaurant	58	W, 1-2 mi.
• Muffi's Breakfast House	20	WNW, 0-1 mi.
• The Big Apple Farmer's House	15	WNW, 0-1 mi.
• Elegant Farmer Restaurant	43	NW, 1-2 mi.
• Silver Seahorse Gifts	24	NNW, 1-2 mi.
• Jerry's Restaurant and 4 Winds Lobster Pound	58	N, 1-2 mi.
• Galley Hatch Restaurant	81	NNE, 2-3 mi.
• Pizza Hut Restaurant	27	NNE, 2-3 mi.
• Friendly's Restaurant	47	NNE, 2-3 mi.
• Golden Hen Snack Bar/Grocery	12	NNE, 3-4 mi.
• Simone's House of Pancakes	10	NNE, 3-4 mi.
• Conversation Piece Gifts	9	NNE, 3-4 mi.
• Fisherman's Landing Restaurant	80	NNE, 3-4 mi.
• The Ship Restaurant	42	N, 4-5 mi.
• Newburyport Municipal Parking Lot	280	S, 6-7 mi.
• Newburyport Municipal Parking and Marina	250	S, 6-7 mi.
• Michael's Harborside	50	SSW, 5-6 mi.
• Italian Sub Base Restaurant	30	S, 5-6 mi.
• Clipper Marine Co. & Bait Shop	100	S, 5-6 mi.
• Riverview Restaurant	89	S, 5-6 mi.
• Blue Roof Restaurant	45	S, 5-6 mi.
• Soldati's Snack Bar	8	N, 5-6 mi.
• Hector's Country Kitchen	140	NNE, 7-8 mi.
• Red Lion Restaurant	120	NNE, 9-10 mi.
• Hector's Restaurant	82	NNE, 9-10 mi.
• Mr. Pancake Man Restaurant	50	NNE, 9-10 mi.
• Burger King Restaurant	89	NNE, 9-10 mi.
Total	2,220	

* Excludes Major Shopping Centers

310.10 Siting Analysis

What is the basis for the Applicant's conclusion that the station would not be visible from the Governor Mesheck Weare House in Hampton Falls (Section 2.6)?

RESPONSE: Personal observation from front of house.

2

310.11 Siting Analysis

The Applicant should supply studies and information which indicate the economic importance of beach-oriented activities to the towns within 10 miles of the station site and to the state.

RESPONSE: The towns which have ocean-beach frontage within 10 miles of Seabrook Station are Rye, North Hampton, Hampton and Seabrook, New Hampshire, and Salisbury, Newbury and Newburyport, Massachusetts.

From the Essex County Tourist Council in Peabody, Massachusetts, the Applicant learned that in 1979, Professor Norman Cournoyer of the University of Massachusetts estimated tourists in the entire Essex County area would spend $115 million annually. This estimate was based on 3.7 million visitor days at $30 per day. This estimate was not broken down by town.

The Applicant has not been able to obtain any study or data which is indicative of the economic contribution of the New Hampshire beach area commerce. Two taxes are levied by the state on businesses. They are the rooms and meals tax applied at the rate of 6% and the business profits tax collected at 8% of net income. The revenues go into the state general fund and are redistributed according to a formula in which net valuation and population are factors. Revenues collected by towns are not available to the Applicant.

The amount of redistributed revenues is available by towns. The Applicant judges the four seacoast towns as net producers of revenue for the state. To the extent that this is true, the redistributed revenues provide a crude low-side indication of the business level in the towns. The 1981 distributions to the seacoast towns were:

Town	Business Profits	Rooms & Meals
Hampton	$256,903	$65,575
North Hampton	77,801	17,082
Rye	55,527	21,003
Seabrook	112,440	26,722

2

310.12 Siting Analysis

The Applicant should comment on the following concerns raised at the Seabrook scoping meeting on December 2, 1981:

a. Even under normal operating conditions, the existence of the plant will represent a threat to some percentage of the summer beach-oriented population and will reduce beach attendance as a consequence. Hence, the economic foundation of specific towns and the state, which rely on tourism, could be threatened.

b. In the event of an accident which results in the release of radioactive material in the beach area, the beach economy would be permanently and adversely affected, even if the beach were decontaminated.

RESPONSE: a. The Applicant sees this as a valid concern for area businessmen but feels the viewpoint is pessimistic and unsupported by experiences elsewhere. In 1974, the Applicant contacted spokesmen in the vicinity of several nuclear plants. The findings were reported in Applicant's Direct Testimony No. 18, post-transcript page 590. A recent spot check by the author of that testimony found no negative change in the business activity previously reported at any of the locations checked.

For example, in the 10 miles around Oyster Creek, a building boom has been experienced producing many housing facilities especially for retired persons. Beach attendance in that area continues to grow and numbered about twice the New Hampshire beach attendance this past summer.

b. The Applicant feels that this concern is also valid but overstated. Many unfortunate experiences could discourage tourism including fish kills, oil spills, riots or a nuclear accident, but once the hazard is shown to be removed, tourists will forget and return. This is the case in the TMI area. Personal communication with local utility information manager indicates that tourism is not suffering from the TMI accident. In fact, attendance at the TMI information center is above the pre-accident numbers. 2

310.13 Siting Analysis

In response to Question 310.3, the Applicant indicated that Unit 1 would pay $42.6 million to the state and Unit 2 would pay 3.9 million to the Town of Seabrook. Does the $42.6 million payment include real estate taxes to the Town of Seabrook? Or is the Applicant suggesting that real estate tax payments would be made to local jurisdictions during the construction period, but such payments would be made only to the state during the operating period?

RESPONSE: Answer 310.3 was predicated on state taxing of completed facilities - an assumption. The Unit 1 figure was a payment to the state only based on that assumption. 2

310.14 Siting Analysis

At the present time, is the state legislature considering proposals to establish a state real estate tax on electric generating stations? If the state legislature is considering such proposals, would local jurisdictions retain any right to implement a real estate tax levy on generating stations? If they would retain such a right, what conditions would be imposed? If, under these tax proposals, local jurisdictions did not retain the right to tax, how would taxes be distributed to local governments?

Assuming no change in state laws governing local real estate tax policy, what is the Applicant's estimate of Unit 1's assessment in the Town of Seabrook during the startup year? What percent of the Town's total assessed value would Unit 1 represent in the startup year? What is the Applicant's estimate of Unit 2's assessment in the Town of Seabrook during its startup year? What percent of the Town's total assessed value would both units represent in that same (Unit 2's) startup year? The Applicant should provide all necessary assumptions in presenting the response.

RESPONSE:

a. No, the state legislature is not considering proposals to establish a state real estate tax on electric generating stations.

b. It must be said that any response to this question can be no more than an estimate. There are only assumptions to base an answer on. The applicant has tried unsuccessfully to determine the Town Assessor's basis for evaluation. Also, application has been made under New Hampshire Statute RSA 72:12-a to exempt approximately $140 million of pollution control equipment and structures from real estate taxes for 25 years. The determination of this application may not be made for several months. These two items alone introduce a substantial degree of uncertainty in this answer. 2

The Town recently engaged the Thoresen Group to review the town's growth patterns and to make suggestions for future town policy. To what extent the consultant's recommendations will be adopted is not known. The discussion on revenue generation and tax consequences from the Thoresen Report is provided as Table 310.14-1. The Applicant is interested in levelizing real estate taxes for a long-term period. The Town's position has not been made known. With those uncertainties, the Applicant makes the following estimates assuming the Town will assess the station facilities at approximately two-thirds their cost of construction and that the net valuation of other real estate in town will grow at 3% per year from 1980.

		Estimated Valuation
Unit 1 and Common	1984	$1,008,000
Unit 2	1985	580,413
Unit 1 & Unit 2	1986	1,588,413

In 1986, the estimated plant valuation is 95% of the estimated town net valuation.

310.15 Identify any impacts to cultural resources in the vicinity of the plant property and transmission line corridors which could potentially result from the operation and maintenance of the plant. Provide copies of any correspondence with the State Historic Preservation Office on this subject.

RESPONSE: Cultural resources have been reviewed in the town of Seabrook as well as within those communities through which the transmission lines associated with Seabrook Station pass. Historical sites were checked by review of the National Register of Historic Places plus Federal Register listings through to present. No historical site contained in the register is so close, either to the plant or the transmission line corridor, to be impacted by their operation and maintenance. In addition to actual placement on the National Register of Historic Places, an historic site may also be in the process of being evaluated as an historic place. The State Historic Preservation Office after review of locally prepared nominations and approval by the State Review Board, forwards the nomination to the National Register of Historic Places who makes a final determination on the proposed sites eligibility. To ascertain what sites, if any, are in the process of being designated by these means, the New Hampshire Historic Preservation Office was contacted. Discussions with Dr. Gary Hume of that office reveal that in the vicinity of the plant and transmission corridor two historic districts have been nominated by local citizens. These two are in South Hampton and they are located along the path of the approved transmission corridor. These districts are presently referenced as the Hilltop District and the Jewellton District. Their locations and the transmission line corridor are shown in the attached map (Figure 310.15-1). 2

[1]IEEE Committee Report, "A Comparison of Methods for Calculating Audible Noise of High Voltage Transmission Lines," presented at IEEE Power Engineering Society Winter Meeting, New York, Jan. 31 - Feb. 5, 1982.

The operation and maintenance of the line should have no unacceptable impact on these historical resources. In operation, the lines are silent except during inclement weather when under worst case conditions (heavy precipitation) corona associated noise could reach 50 to 55 dB(A)[1] at the transmission corridor edge. Whereas this noise level is the equivalent of moderate rainfall on foliage it is intuitively obvious that the imposition of this transmission line noise would be imperceptible over natural noises. It would also be highly unlikely that one would choose such weather to view the exterior features of such historical resources. Other transmission line operational impact potentials that typically receive consideration such as radio-television interference, ozone and electric field effects are not believed to be relevent to historic sites. Line maintenance will entail periodic control of corridor vegetation and possibly repair of line structures. In these instances the maintenance activities would be confined to the corridor and while it could present some distraction to viewers of the features of the historic district it would not, however, impact the tangible elements that compose the district.

Archaeological resources in the vicinity of the plant are known principally from the work of Dr. Charles Bolian and his co-workers who located and excavated several sites prior to construction.[2] The following archaeological sites are known to exist, or to have existed within the plant vicinity:

NH 47-20 - Hunts Island
NH 47-21 - Construction Site
NH 47-22 - Seabrook Marsh
NH 47-55 - Farm Lane Seabrook
NH 47-56 - Hampton Marsh Edge, Depot Rd., Hampton Falls
NH 47-58 - South Rock Storage Area

Of these six, the first three were excavated under contract to Public Service Company of New Hampshire in 1974 and 1975. Sites NH 47-55 and 56 that lie beyond the site have recovered some material there. Site NH 47-58 is located within the perimeter fencing of the site but it has not been systematically excavated. Currently it lies in an area where rock is stored. Plant operation should have no impact on the unexcavated archaeological sites on or adjacent to the site. No operational or maintenance activity requires disturbance of the soils in these areas.

Archaeological sites on the transmission line corridor are unknown at this time except for an area, in South Hampton known as Indian Ground Hill, that reportedly has produced some arrowheads. No systematic excavation has been performed in this area. Transmission line operation and maintenance will not disturb the topsoil and therefore should not impact archaelogical resources. Copies of written correspondence between Public Service Company of New Hampshire and the State Historic Preservation Office are attached (R-35k thru R-35n). 2

[2] C. E. Bolian, Archaeological Excavations at the Seabrook Station Sites, Final Report to Public Service Company of New Hampshire.

Discussion on Revenue Generation and Tax Consequences. Source: Seabrook Growth Analysis and Development Plan. Prepared by the Thoresen group, Portsmouth, New Hampshire for the Seabrook Planning Board and office of State Planning. June 1981.

REVENUE GENERATION AND TAX CONSEQUENCES

The single most dramatic impact that a nuclear generating facility (or any major energy generating facility) has on a community in New Hampshire is its ability to generate tax revenue for the municipality through the property tax.

A generating facility is a capital intensive investment which is taxed for its real estate value. A generating station in any community in New Hampshire is likely to be one of or the biggest single taxpayer in the municipality. In Seabrook this is especially true because of the size of the undertaking. While Seabrook does not have the highest equalized assessed value in the State, it could have by the time that Seabrook Station is complete.

Table 3.1 below shows the dramatic change over time of the public electric valuation in relationship to the total evaluation of the Town.

Table 3.1: PERCENT OF ELECTRIC UTILITY VALUATION OF TOTAL VALUATION

	1970	1979
Public Electric	$601,150	$221,505,500
Net Total Valuation	29,007,030	316,454,885
Electric as Percent of Total	2.1%	~~80~~.0% 70

Source: Annual Reports

The data shows that the public electric utility in ten years has grown from 2.1 percent to 70 percent of the total net valuation of the community. Furthermore, the net valuation has grown 991 percent in the decade. The public electric category grew a phenomenal 36,747 percent.

The tremendous increase in assessed value in turn allows the municipality to increase its revenue generating capability. Such an increase in the revenue base allows the community to choose to either (1) increase services greatly with a relatively constant tax rate, (2) maintain service levels with a reduced tax rate, or (3) adopt both a lower tax rate and a higher level of services. While these factors are easy to describe they are difficult to distinguish when looking at community data.

The tremendous increase in assessed value makes the tax burden much less onerous per dollar of expenditure. For example, in 1970 if Seabrook raised its tax rate $1.00 it would generate about $29,000 of tax revenue. In 1979, however, the same $1.00 increase would raise about $316,450 in tax revenue.

The total assessed value of Seabrook will continue to increase dramatically as Seabrook Station moves toward project completion. It is estimated by the Town's assessor that Seabrook Station may account for up to 90 percent of the total assessed value by the time it is complete.

The Town's increased revenue generating capacity has allowed it to increase expenditure levels significantly over the decade while still preserving a relatively low tax rate. Between 1970 and 1979, for example, expenditures for municipal purposes increased overall by 609 percent. During this time the tax rate decreased from $30.00 in 1970 to $13.70 in 1979.

In the last few years the Town Meeting has voted to expend funds on a variety of municipal projects that would have been difficult or impossible without Seabrook Station. For example, it voted to expend $680,000 for a new Town Hall, $1.5 million for a recreation center, $900,000 for exploration and development of new water sources and improvements to the system, $220,000 for purchase of beach and dune area, and $100,000 for the municipal building fund.

Community Impact: The short term impact of the construction of Seabrook Station is that the assessed value and revenues are likely to increase at a rate faster than municipal expenditures thus lowering taxes. Major municipal expenditures for capital facilities are likely to be made from current revenue rather than from long-term bonds.

Over the long term, however, the Town must take care to forecast its revenue and expenditure needs. Particularly important is to evaluate the assessment policies regarding a public utility. In general terms, assessment of a public utility is not like a house, a commercial or other industrial facility. Customarily over time, houses, commercial establishments, and industrial facilities increase in value.

Public utilities, on the other hand, take the position that generating stations depreciate in value over time. This occurs, they argue, because the equipment wears out and has to be replaced and because generating stations customarily are not sold thus there is no market value for the station. Therefore, on a number of occasions there has been disagreement between municipal assessing officials as to what constitutes fair market value of the generating station.

In order to help understand the different assessing approaches two concept graphs are provided below. The first one shows the assessed value if one follows the depreciating value approach. The second one shows an approach where the assessed value is leveled out over time.

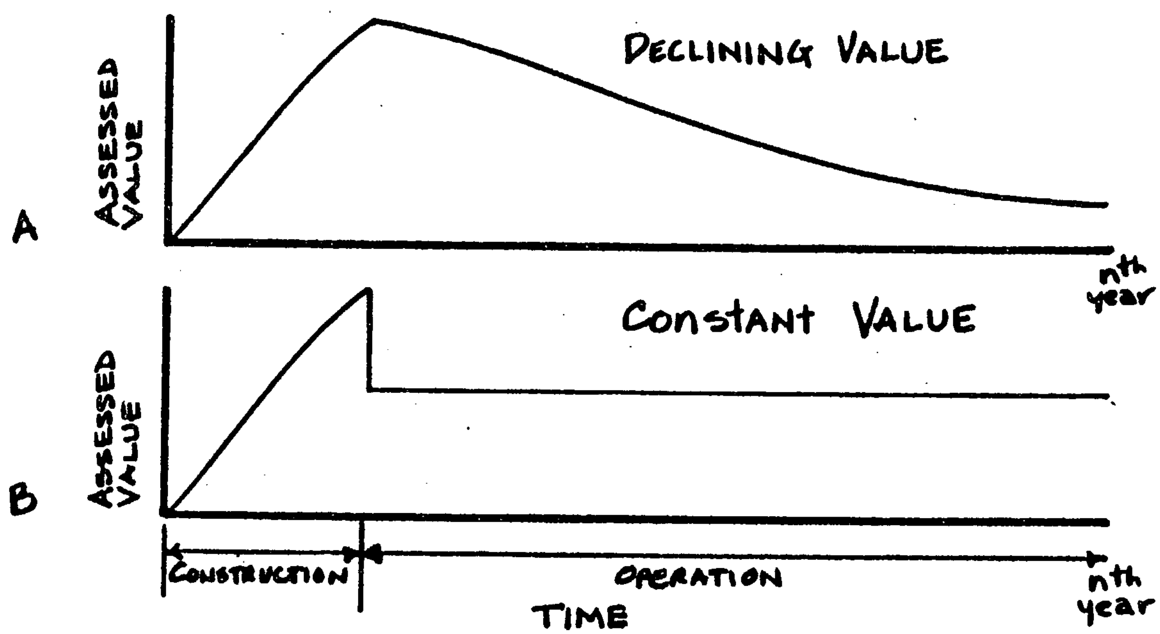


TABLE 310.14-1
(Sheet 4 of 4)

In each case, the assessed value increases up to the point when operation begins. Then under the first approach the assessed value of the plant declines as the plant ages. Under the other approach the assessed value drops to a levelized point and stays that way over time (provided that the utility does not alter the plant).

It is important to understand these differences primarily for the purpose of forecasting future revenues in relationship to community needs. For example, municipal facilities, like the new Town Offices, or services, like the water system, may require major capital improvements during the useful life of Seabrook Station. Deciding what assessing approach best meets community needs will help the Town plan wisely for its future.

STATE OF NEW HAMPSHIRE
DEPARTMENT of RESOURCES and ECONOMIC DEVELOPMENT

P. O. BOX 856 · · · STATE HOUSE ANNEX · · · CONCORD, NEW HAMPSHIRE · · · 03301

Office of the Commissioner

June 12, 1973

Mr. Donald E. Thomson
Engineering Technician
Public Service Company of New Hampshire
1087 Elm Street
Manchester, New Hampshire 03105

Dear Mr. Thomson:

This is to confirm our June 8 discussion concerning the Seabrook Nuclear Station Unit No. 1 and historic resources.

Commissioner George Gilman, as State Historic Preservation Officer for the National Historic Preservation Act of 1966 (P.L.89-665), is postponing a response until the New Hampshire State Site Evaluation Committee reports in August 1973.

Sincerely yours,

Mary M. Jeglum
Consultant in Historic
Preservation Planning

MMJ/jav

State of New Hampshire
Department of Resources & Economic Development
HISTORIC PRESERVATION OFFICE
6 Loudon Road Room 201
Box 856
Concord, New Hampshire 03301
603-271-3483

George Gilman, Commissioner
State Historic Preservation Officer

September 17, 1981

Paul Basiliere
Public Service Company of New Hampshire
1000 Elm Street
Manchester, New Hampshire 03101

Dear Mr. Basiliere:

As we discussed, the transmission line project is subject to the independent federal review requirements as implemented by the Advisory Council on Historic Preservation "Procedures for the Protection of Historic and Cultural Properties" (36 CFR 800). These procedures require the Historic Preservation Office to review and comment on all federally funded, assisted, and licensed projects in New Hampshire which might affect historical, architectural, archeological, and other cultural resources listed in, or eligible for, the National Register of Historic Places.

Timely compliance with 36 CFR 800 is necessary to avoid delays in project implementation. Depending on resources and potential impacts of the project on resources, the review process may require surveys and assessments to identify and evaluate resources which should be taken into account, as well as formal comment by the National Register and/or Advisory Council (for details see the enclosure, "Federal Cultural Resources Review Procedures...").

To activate the review process, it is recommended that the information described on the enclosure be forwarded to the Historic Preservation Office with the request for review of the potential impacts of the project. The initial review will be performed normally within three weeks of a request. A determination of "no effect" means the project has been recommended to proceed. If the determination is one of "adverse effect" or "potential adverse effect", the review letter will recommend conditions to be met before the adverse effect is avoided or adequately mitigated.

A summary of the Historic Preservation Office services and responsibilities is available upon request. As appropriate, or as requested, detailed information on the Advisory Council procedures, types of survey, rehabilitation standards, federal tax incentives for rehabilitation and preservation, and other guidelines and technical information will be provided.

Sincerely,

Christine Fonda for

Gary W. Hume, Archeologist
Compliance Coordinator

GWH:cc
cc: Joseph Hough, ACHP
Federal Agency ✓
Regional Planning Commission

State of New Hampshire
Department of Resources & Economic Development
HISTORIC PRESERVATION OFFICE
6 Loudon Road, Room [illegible]
Box [illegible]
Concord, New Hampshire [illegible]
[illegible]

George Gilman, Commissioner
State Historic Preservation Officer

October 9, 1981

Paul R. Basilliere
Environmental Technician
Public Service Co. of N.H.
Box 330
Manchester, N.H. 03105

Dear Paul:

I am enclosing with this letter pages 19-22 and 24-26 of the Cultural Resources Survey, Inventory, and Plan for South Hampton, New Hampshire, prepared March 1980 by the Strafford Rockingham REgional Council. These pages describe the architectural properties and scenic vistas of the Hilltop and Jewelltown Historic Districts. Both are local historic districts also proposed for the National Register of Historic Places. The accompany map shows the boundaries of these districts and the approximate position of the transmission line. Note that the line passes through the Hilltop district on the east and Jewelltown scenic vista on the south. Only one archeological site is shown on the map, the general area from which collectors have obtained prehistoric remains from Indian Ground Hill.

No other local historic districts will be effected by any of the transmission lines, but potentially eligible properties as now known for Kingston and other areas will be forwarded to you next week. The major area of impact and the greatest historic preservation compliance problem will remain in South Hampton, we believe.

Sincerely,
Gary
Gary W. Hume, Archeologist
Compliance Coordinator

State of New Hampshire
Department of Resources & Economic Development
HISTORIC PRESERVATION OFFICE
6 Loudon Road, Room 201
Box 856
Concord, New Hampshire 03301
603-271-3483

George Gilman, Commissioner
State Historic Preservation Officer

March 30, 1982

Bruce Smith
Public Service Co. of NH
1000 Elm Street
Manchester, NH 03101

Dear Mr. Smith:

As requested, I am attaching to this letter another copy of pages 19-22 and 24-26 of the Cultural Resources Survey, Inventory, and Plan for South Hampton, New Hampshire, and a map of the South Hampton multiple resource area (in preparation) showing the boundaries of four proposed districts, including the Hilltop and Jewelltown districts, as originally transmitted to Paul R. Basiliere on October 9, 1981. However, on this copy of the map I have not attempted to illustrate the approximate position of the proposed transmission line. Also, the excerpts from the report have handwritten editorial comments not present on the original copy; these were added by the office of Christopher Closs, Preservation Consultant, during a redraft of the content for a formal nomination of the multiple resource area to the National Register.

I have been informed that the nomination will be submitted to the Preservation Office in April or May, 1982, but that the present draft could be edited in a few days for purposes of a request for a determination of eligibility by the Keeper.

Sincerely,

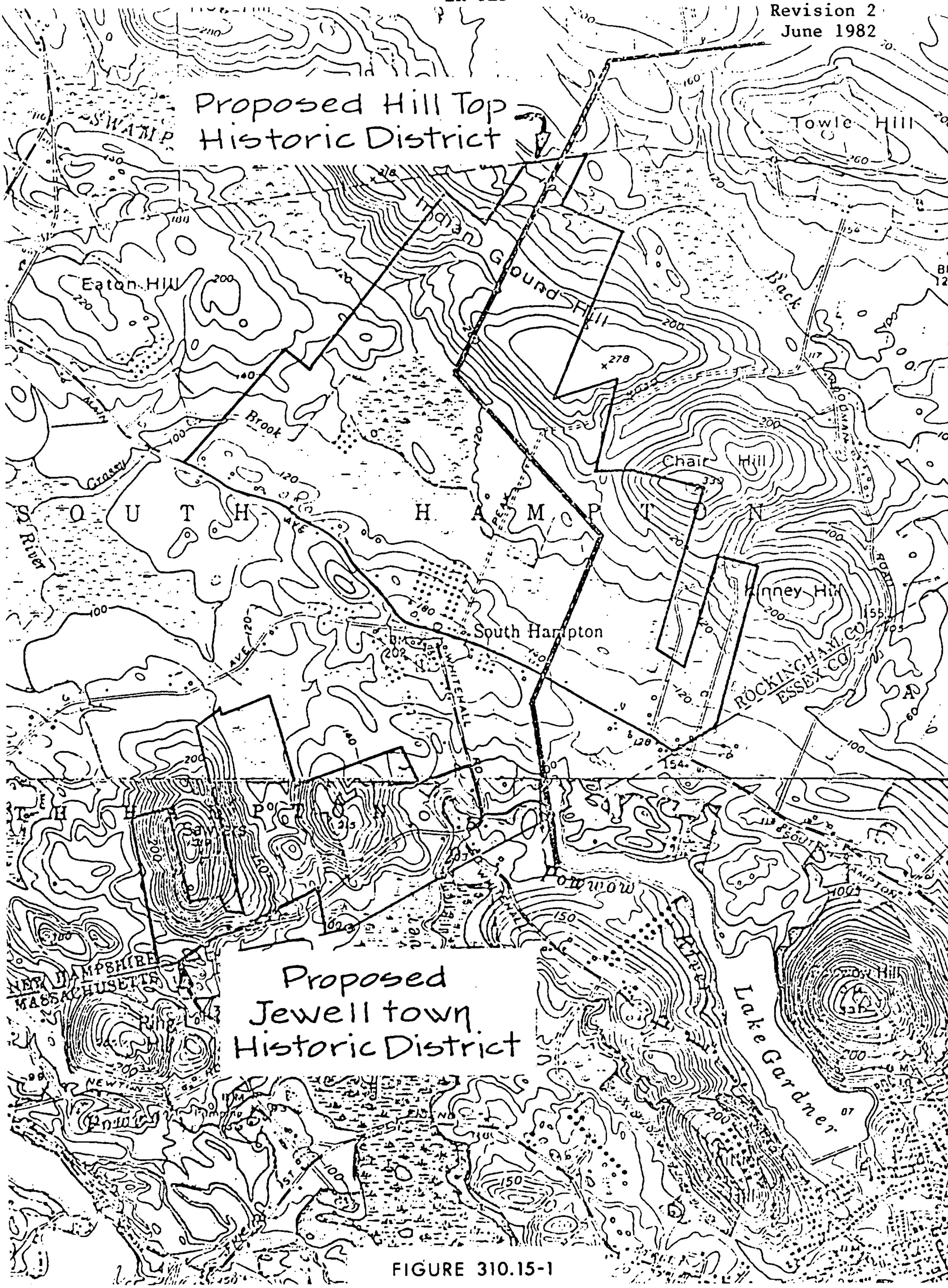


FIGURE 310.15-1

320.0 UTILITY FINANCE BRANCH

320.1 (ER) Explain the basis of the statement at p. 1.2-1 that "The production of electricity from this plant (Seabrook) will displace approximately 23,000,000 BBLS of oil per year..."

RESPONSE: This statement is based on Seabrook Station replacing oil generation with a 11,000 BTU/KWHR heat rate, oil with a BTU content of 6.2 MBTU/Barrel, and a Seabrook Station availability of 65%.

$$\frac{11{,}000\ (\text{BTU/KWHR}) \times 1000\ \frac{\text{KWHR}}{\text{MWHR}} \times .65 \times 2300\ (\text{MW}) \times 8760\ \frac{(\text{HOURS})}{\text{YEAR}}}{6{,}200{,}000\ (\text{BTU/BARREL})} = 23{,}235{,}194\ \frac{\text{BARRELS}}{\text{YEAR}}$$

320.2 (ER) Quantify the expected effect, if any, of Seabrook 1 and 2 on baseload consumption of coal.

RESPONSE: The following table lists the decrease in coal consumption with Seabrook 1 and 2 online.

	1984	1985	1986	1987	1988	1989	1990	1991
Decreased coal Consumption (tons x 10^3)	4.6	36.4	377.9	210.6	222.1	131.4	59.7	57.1

This is based on a NEPOOL Dispatch only. It is probable that the small decrease in coal-fired generation will not occur because of economy sales to the New York Power Pool.

320.3 (ER) For the year 1980 provide (a) a breakdown of electricity generated by fuel type (coal, nuclear, etc.), and (b) the average production cost by fuel type.

RESPONSE:

TYPE	1980 ENERGY (%) OF TOTAL	AVERAGE COST (MILLS/KWHR)
HYDRO	4.36	----
NUCLEAR	28.71	5.5
COAL	5.80	16.9
OIL	61.13	40.8

NOTE: This response is based on composite FERC Form 1 data from all New England utilities.

320.4 (ER) Indicate the proportion of the estimated capital costs for Seabrook 1 and 2 which has already been spent.

RESPONSE:

AREA	(%) EXPENDED AS OF JUNE 30, 1981
UNIT 1	63%
UNIT 2	36%
COMMON	59%
INDIRECTS	36%

320.5 (ER) Provide the following:

A production cost analysis which shows the difference in system production costs associated with the availability vs. unavailability of the proposed nuclear addition. Note, the resulting cost differential should be limited solely to the variable or incremental cost associated with generating electricity from the proposed nuclear addition and the sources of replacement energy. If, in your analysis, other factors influence the cost differential, explain in detail.

a. The analysis should provide results on an annual basis covering the period from initial operation of the first unit through five full years of operation of the last unit.

b. Where more than one utility shares ownership in the proposed nuclear addition, the analysis should include results for the aggregate of all participants. However, given that Seabrook 1 and 2 are expected to be centrally dispatched as NEPOOL units, this analysis may be performed for NEPOOL as a whole.

c. The analysis should assume electrical energy requirements grow at (1) the system's latest official forecasted growth rate, and (2) zero growth from latest actual annual energy requirements.

d. All underlying assumptions should be explicitly identified and explained.

e. For each year (and for each growth rate scenario), the following results should be clearly stated: (1) system production costs with the proposed nuclear addition available as scheduled; (2) system production costs without the proposed nuclear addition available; (3) the capacity factor assumed for the nuclear addition; (4) the average fuel cost and variable O & M for the nuclear addition, and the sources of replacement energy (by fuel type) - both expressed in mills per kWh; and (5) the proportion of replacement energy assumed to be provided by coal, oil, gas, etc.

RESPONSE: Since the ownership of Seabrook Station is split among NEPOOL members, the production cost analysis is for NEPOOL as a whole.

The only difference in input data between production cost runs on the same load forecast was Seabrook Station in or out of service and the unit maintenance schedule. Since maintenance is scheduled to levelize risk, the maintenance schedule was different with Seabrook Station in and out of service and with each load forecast. This maintenance schedule difference should have little effect on yearly production costs.

The following values were used for Seabrook 1 and 2 for all production cost runs:

Unit	Description	Year(19) 84	85	86	87	88	89	90	91
Seabrook 1	Capacity Factor(%)	59	63	64	69	68	74	73	74
Seabrook 1	Fuel Cost (MILLS/KWHR)	11	11	10	10	11	11	11	12
Seabrook 1	Fixed O&M ($M)	34[1]	42	46	50	55	60	65	70
Seabrook 2	Capacity Factor(%)	--	--	59	63	64	69	68	74
Seabrook 2	Fuel Cost (MILLS/KWHR)	--	--	12	11	11	11	11	12
Seabrook 2	Fixed O&M ($M)[2]	--	--	29[1]	50	55	60	65	70

[1]Partial Year Operation

[2]Capital additions are not included. This amount is 17 million in 1987.

The answers for part (e) based on the system's latest official forecast are shown in Table 320.5-1, and the answers for part (e) based on zero growth from the latest actual annual energy requirements (1980) are shown in Table 320.5-2.

In Table 320.5-1 and Table 320.5-2, the source of replacement energy to service load is the ultimate source of the power generated, therefore, pumped hydro generation is not shown as such.

The following assumptions were made for this analysis:

1. The Pilgrim 2 1150 MW nuclear unit was to be installed in December 1991. Since this analysis was completed, Pilgrim 2 has been cancelled. However, the quantitative impact of the cancellation of Pilgrim 2 on these values is negligible.

2. The Sears Island 568 MW coal unit was to be installed December 1991. This unit does not have a Construction Permit.

3. Energy banking was modeled with the Hydro Quebec system between March and November beginning in 1987. This transaction was modeled as a 600 MW pumped hydro site with the savings split 60/40 (New England/Hydro Quebec) between each system.

4. From January 1981 through January 1987, there were 21 units representing 2760 MW of capacity converted from oil to coal firing.

5. No economy transactions between pools were modeled.

451.01 (2.3) (ER)

a. To expedite the meteorological review, provide hour-by-hour meteorological data from the on-site meteorological measurements program for the period April 1979-March 1980, using the enclosed guidance on tape attributes.

b. One complete year (i.e., no missing hourly data) of data is used by the staff in the calculation of Reactor Accident Consequences (CRAC) computational procedure. Data recovery for the one-year period April 1979 - March 1980 was less than 100%, indicating that data needs to be substituted for the staff to perform the CRAC analysis. Provide substituted data for all missing periods, identify the source of substituted data, and provide a brief description of the bases for selecting substituted data.

RESPONSE:

a. A magnetic tape containing a file of hour-by-hour meteorological data from the on-site meteorological measurements program for the period April 1979 - March 1980 has been provided to the NRC.

b. A second file of hour-by-hour meteorological data with data substituted for all missing periods was provided on the same magnetic tape. This file represents the meteorological data used as input to the CRAC analysis presented in Chapter 7 of the ER-OLS. Missing data periods were replaced with data values from the previous valid hour.

451.02 (2.3) (ER)

For reviews of Operating License Applications, at least two years (preferably three or more) of on-site meteorological data are to be submitted with the Environmental Report (see Regulatory Guide 4.2, Revision 2). Only one year (April 1979 - March 1980) has been submitted with the Seabrook Environmental Report. Two years of data (December 1971 - November 1972 and December 1972 - November 1973) were submitted during review of the Construction Permit Application. However, after each one-year period of meteorological data collected at the Seabrook Site, the measurements program has been changed, preventing combination into a multi-year period of record.

a) Provide a comparison of data from the most recent one-year period with earlier periods, contrasting wind speed distributions, wind direction frequencies, and occurrences of atmospheric stability classes by annual cycles.

b) Provide comparisons of calculated short-term X/Q values (used in Chapter 7 of the ER) and annual X/Q values (used in Chapter 5 of the ER) for each one-year period of record.

c) Provide joint frequency distributions (or hour-by-hour data on magnetic tape) of wind speed and wind direction for the 43-foot level by temperature difference between the 43-foot and 150-foot levels for period April 1980 - March 1981.

TABLE 320.5-1 PRODUCTION COST ANALYSIS FOR SEABROOK STATION

APRIL 1, 1981 NEPOOL LOAD FORECAST

		1984	1985	1986	1987	1988	1989	1990	1991
1	TOTAL SYSTEM NET ENERGY REQUIREMENTS (GWH)	91659	93977	96472	99211	102125	105275	108526	111849
	TOTAL SYSTEM PRODUCTION COST ($M)								
2	Seabrook Station Not in Service	4312.3	4748.3	4978.6	5664.5	6649.3	7754.9	9159.2	10349.0
3	Seabrook Station In Service	4008.0	4339.7	4230.0	4522.6	5297.8	6019.5	7158.1	8003.9
4	Cumulative Penalty with Seabrook Station Not In Service	304.3	712.9	1461.5	2603.4	3954.9	5690.3	7691.4	10037.1
	AVERAGE FUEL COST (MILLS/KWHR) FOR REPLACEMENT SOURCES								
5	Coal-Seabrook Station Not In Service	29.7	32.8	36.5	40.2	44.2	48.7	53.5	57.9
6	Coal-Seabrook Station In Service	29.7	32.8	36.5	40.2	44.2	48.6	53.5	57.9
7	Oil-Seabrook Station Not In Service	76.7	85.4	95.0	106.4	119.1	133.7	149.7	164.0
8	Oil-Seabrook Station In Service	76.8	85.7	94.7	104.6	116.7	129.4	144.3	157.5
	VARIABLE O&M (MILLS/KWHR) FOR REPLACEMENT SOURCES								
9	Coal-Seabrook Station Not In Service	1.9	2.1	2.2	2.4	2.6	2.9	3.1	3.7
10	Coal-Seabrook Station in Service	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.7
11	Oil-Seabrook Station Not In Service	2.6	2.7	3.1	3.4	3.5	3.7	3.8	3.9
12	Oil-Seabrook Station In Service	2.8	3.1	3.8	4.1	4.3	4.5	4.7	5.1
	SOURCE OF REPLACEMENT ENERGY TO SERVICE LOAD (%)								
13	Coal	0.3	1.4	9.4	4.0	4.1	2.3	1.0	0.9
14	Oil	99.7	98.6	90.6	96.0	95.9	97.7	99.0	99.1
15	Total (13 & 14)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 320.5-2 PRODUCTION COST ANALYSIS FOR SEABROOK STATION

NO LOAD GROWTH BASED ON 1980 ACTUAL LOADS

		1984	1985	1986	1987	1988	1989	1990	1991
1	TOTAL SYSTEM ENERGY REQUIREMENTS (GWH)	84406	84406	84406	84406	84406	84406	84406	84406
	TOTAL SYSTEM PRODUCTION COST ($M)								
2	Seabrook Station Not In Service	3716.6	3873.8	3823.8	4070.9	4490.2	4889.6	5408.1	5701.6
3	Seabrook Station In Service	3434.3	3504.2	3216.7	3204.2	3507.5	3673.6	4078.6	4242.6
4	Cumulative Penalty With Seabrook Station Not In Service	282.3	651.9	1259.0	2125.7	3108.4	4324.4	5653.9	7112.8
	AVERAGE FUEL COST (MILLS/KWHR) FOR REPLACEMENT SOURCES								
5	Coal-Seabrook Station Not In Service	29.7	32.8	36.5	40.2	44.2	48.6	53.5	57.8
6	Coal-Seabrook Station In Service	29.7	32.8	36.4	39.9	43.8	48.3	53.0	57.3
7	Oil-Seabrook Station Not In Service	75.6	83.9	93.5	105.0	116.6	128.7	142.7	155.2
8	Oil-Seabrook Station In Service	76.0	85.1	94.4	106.9	117.4	128.5	143.0	156.5
	VARIABLE O&M (MILLS/KWHR) FOR REPLACEMENT SOURCES								
9	Coal-Seabrook Station Not In Service	1.9	2.1	2.2	2.4	2.7	2.9	3.2	3.7
10	Coal-Seabrook Station In Service	1.9	2.1	2.6	2.9	3.3	3.6	3.9	4.8
11	Oil-Seabrook Station Not In Service	2.7	3.1	3.9	4.5	4.8	5.4	5.7	6.6
12	Oil-Seabrook Station In Service	3.1	3.6	5.1	6.0	6.9	7.8	8.4	9.1
	SOURCE OF REPLACEMENT ENERGY TO SERVICE LOAD (%)								
13	Coal	0.8	0.4	30.7	30.2	32.9	32.4	32.4	37.3
14	Oil	99.2	99.6	69.3	69.8	67.1	67.6	67.6	62.7
15	Total (13 & 14)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

RESPONSE: a) ER-OLS Tables 451.02-1 through 451.02-3 compare wind speed, wind direction, and atmospheric stability class frequency distributions for a more recent one-year period (June 1980 - May 1981) with the earlier one-year period submitted in the Seabrook ER-OLS (April 1979 - March 1980). Data from April 1980 and May 1980 were excluded from the more recent one-year period of record because of temperature shield aspiration motor problems which occurred during this period.

The comparison between the wind speed distributions for these two one-year periods of record (ER-OLS Table 451.02-1) indicates that wind speeds during the first period were generally slightly lower than wind speeds during the second period. ER-OLS Table 451.02-2 indicates that the predominant wind direction continued to be from the WNW, and ER-OLS Table 451.02-3 shows that stable atmospheric conditions occurred more frequently during the first period of record when compared to the second period of record.

b) Short-term X/Q values were not used in Chapter 7 of the Seabrook ER-OLS to evaluate the potential environmental effects of postulated accidents at the Seabrook Station. Rather, Chapter 7 presents a risk analysis format for evaluating environmental effects of accidents; that is, the probabilities of realizing various levels of consequences from a wide spectrum of possible accidents and associated environmental conditions are considered. Meteorological conditions are considered by selecting a series of start times (the time at which the accident release is assumed to occur) and using chronological hourly weather conditions to trace the movement of the cloud away from the site. The probability of exposure in any given downwind sector is then defined by the seasonal wind direction frequency distribution.

The annual X/Q and D/Q values used in Chapter 5 of the Seabrook ER-OLS were calculated using the April 1979 - March 1980 meteorological data base. Tables 5.2-4 and 5.2-5 of the Seabrook ER-OLS present the X/Q and D/Q values used to determine the annual maximum individual doses and potential site boundary exposure rates. A comparison of these X/Q and D/Q values with X/Q and D/Q values generated using the June 1980 - May 1981 meteorological data base is provided in ER-OLS Tables 451.02-4 and 451.02-5. Ratios of the June 1980 - May 1981 X/Q and D/Q values to the April 1979 - May 1980 X/Q and D/Q values range from 0.64 to 1.29. This range of ratio values is not unreasonable and can be expected due to the difference in wind speed, wind direction, and atmospheric stability frequency distributions observed from year to year.

c) The 43-foot wind and 43-150 foot delta-temperature three-way joint frequency distribution for the period June 1980 - May 1981 is provided in ER-OLS Table 451.02-6.

451.03
(2.3)
(ER)

Section 2.3.1 of the ER provides a qualitative description of air quality in the vicinity of the site and states that these conditions will not "adversely affect station operation." Describe station sources of criteria air pollutants, including estimated emissions, and compare these emissions to the DeMinimus criteria established by the Environmental Protection Agency. If station emissions are in excess of the DeMinimus levels, provide a quantitative assessment of the station emissions on local air quality using current EPA guidelines on atmospheric dispersion modeling.

RESPONSE: The two auxiliary boilers for this facility are fired with No. 2, low sulphur (0.3 percent) fuel oil with a minimum heating value of 137,000 BTU per gallon. Each boiler has a maximum output capacity of 80,000 lbs of steam per hour with a maximum fuel use rate of 12 gallons per minute. Emissions from both auxiliary boilers are released through a common 142-foot AGL stack. Boiler stack exit temperature is approximately 560°F, and with one boiler operating at 100 percent capacity, stack exit velocity is approximately 840 feet per minute.

The four emergency diesel generators are designed for a continuous electrical output of 6083 kW per diesel generator. They burn the same fuel as the auxiliary boilers and each has a maximum expected fuel consumption of 7.7 gallons per minute. Each diesel generator has a separate stack 80 feet AGL. At full operating capacity, each diesel generator stack has an exit temperature of 890°F and an exit velocity of 8270 feet per minute.

The U.S. Environmental Protection Agency's emission factors for fuel oil combustion and diesel industrial engines (Reference 1) were used to derive the following hourly pollution emission rates, assuming continuous operation at full capacity:

Pollutant	Each Auxiliary Boiler	Each Diesel Generator
Particulates	1.44 lbs/hr	15.5 lbs/hr
Sulfur Dioxide	30.67 lbs/hr	14.4 lbs/hr
Carbon Monoxide	3.60 lbs/hr	47.1 lbs/hr
Hydrocarbons (total, as CH_4)	0.72 lbs/hr	17.3 lbs/hr
Nitrogen Oxides (total, as NO_2)	15.84 lbs/hr	216.7 lbs/hr

The auxiliary boilers and diesel generators are designed to meet applicable standards for release of gaseous effluents to the environment. ER-OLS Section 3.7 will be revised to include the above information on design of and gaseous emissions from the auxiliary boilers and emergency diesel generators.

During operation of Unit #1 and while Unit #2 is being constructed, it is expected that steam for heat and process work will normally be supplied from the main steam system, except for Unit #1 refueling periods during which the auxiliary boilers will be used to supply heating and process steam requirements. During Unit #1 refueling, it is expected that both single and dual auxiliary boiler operation can occur for a combined total of 80 days of boiler operation. During operation of both Unit #1 and Unit #2, steam for heat and process work will also normally be supplied from the main steam system. Use of the auxiliary boilers would be minimal, with their expected operation occurring only for maintenance purposes and for the unplanned event of having both Unit #1 and Unit #2 down simultaneously.

Operation of the diesel generators is only on an emergency and testing basis. It is expected that on-line testing will consist of operating each generator once a month for three hours. Refueling usage is expected to consist of a total of 53 hours of diesel operation per Unit refueling.

During station operation, highest annual emission levels are probable during a year when Unit #1 has a refueling outage and Unit #2 is still under construction. The estimated annual combined auxiliary boiler and diesel generator emissions during this time period are compared to the Environmental Protection Agency's DeMinimis levels in ER-OLS Table 451.03-1. As can be seen from ER-OLS Table 451.03-1, the expected combined auxiliary boiler and diesel generator emissions do not exceed DeMinimis levels.

Reference to 451.03

1. U.S. Environmental Protection Agency, Compilation of Air Pollutant Emission Factors, Third Edition (including Supplements 1-7), AP-42, August 1977.

451.04 (ER) The discussion of the effects of operation of the heat dissipation system (Section 5.1 of the ER) states that one of the "specific determinations relevant to the discharge of cooling water" is that "backflushing operations for fouling control shall be performed only during times when meteorological and hydrological conditions are such that the plume flows offshore and/or temperature increases are minimized at the Sunk Rocks." Furthermore, during backflushing a mechanical draft cooling tower would be used for the service water system.

a) Describe the procedure for integrating meteorological data into the procedure for initiating backflushing operations.

b) Indicate the expected frequency of operation of the mechanical draft cooling tower, and provide the basis for the statement that fogging and icing effects "would occur only in the vicinity of the cooling tower". Indicate if such fogging and icing effects would be confined to the station site.

RESPONSE: a) The EPA, in their November 7, 1977 Modifications of Determinations, state that, "The Applicant shall perform backflushing only during times when meteorological and hydrological conditions are such that the plume flows offshore and/or temperature increases are minimized at the Sunk Rocks". When a backflushing procedure has been developed by the Applicant and has been approved by the EPA, the ER-OLS will be revised to include this backflushing procedure.

b) The service water mechanical draft cooling tower will be operated during backflushing operations for biofouling control on the intake tunnel. The cooling tower is expected to operate once every two weeks from March through October and once a month from November through February. Each period of operation is expected to last between six to eight hours for a total annual operating time of approximately 150 hours.

The effect of the service water cooling tower on the formation of fog and icing conditions is a function of the location and quantity of moisture added to the atmosphere and existing atmospheric conditions. NUS Corporation performed an analysis in 1972 investigating potential environmental effects of alternative evaporative heat dissipation systems for Seabrook Station (Reference 1). Included in this analysis was the evaluation of a mechanical draft cooling tower system for use as the station's primary heat dissipation system. Regional meteorological data was examined to determine the probable frequency of induced fog occurrence. The study indicated that off-site induced fogging from a primary mechanical draft cooling tower system would occur less than 1% of the time annually. This frequency assumed continuous system operation at a heat load 35 times larger than the design heat load for the service water cooling tower.

TABLE 451.03-1

Comparison of Estimated Combined Auxiliary Boiler and Diesel Generator Emissions with U.S. EPA DeMinimis Levels

(All Values in Tons/Year)

Pollutant	Estimated Maximum Annual Emissions During Station Operation[a]	DeMinimis Levels[b]
Particulates	2.3	25
Sulfur Dioxide	30.3	40
Carbon Monoxide	6.3	100
Hydrocarbons (total, as CH_4)	1.7	40
Nitrogen Oxides (total, as NO_2)	28.1	40

(a) The estimated annual emissions were calculated using the emission rates presented above and assuming 1920 hours (80 days) of full capacity boiler operation and 119 hours of full capacity combined diesel generator operation.

(b) Reference: U.S. Environmental Protection Agency, Requirements for Preparation, Adoption, and Submittal of Implementation Plans; Approval and Promulgation of Implementation Plans, Federal Register, Vol. 45, No. 154, pp. 52676-52748, August 7, 1980.

The frequency of induced fog occurrence from the operation of the service water cooling tower will be significantly less than the above estimate. The moisture added to the atmosphere from the service water cooling tower will be considerably less and the tower will be operated during less than 2% of the total hours during the year, most of these hours being in the warmer months when the probability of induced fogging and icing is reduced. Therefore, induced off-site fogging and icing effects from operation of the service water cooling tower will be negligible.

References to 451.04

1. Koss, T. C., Evaluation of Environmental Effects from Evaporative Heat Dissipation Systems at the Seabrook Site, Environmental Safeguards Division, NUS Corporation, NUS-953, October 1972.

451.05 (6.1.3) (ER) The description of the current on-site meteorological measurements program states that the low-level wind speed and direction sensors and temperature difference sensors are located at a height of 43 feet above the surface. The standard height for low-level sensors is 10m (see Regulatory Guide 1.23, 1972, and proposed Revision 1, September 1980). Provide justification for this deviation from the recommended height of low-level instruments.

RESPONSE: The meteorological tower is located at an elevation of approximately 8 feet MSL, and as such, the low-level wind and temperature sensors are approximately 51 feet MSL. Since plant grade is 20 feet MSL, the low-level sensors are located at an elevation of approximately 10m above plant grade. The difference in values measured at the Regulatory Guide 1.23 recommended height of 33 feet (10m) AGL versus the actual 43 feet AGL height of Seabrook's sensors on the meteorological tower should not be significant.

451.06 (6.1.3) (ER) Four 15-minute averages are stored on disc for each hour of on-site data (see p. 6.1-4). Describe the procedure for determining an hourly average of each meteorological parameter (i.e., is an hourly average determined from one 15-minute average or through averaging of four 15-minute averages?).

RESPONSE: As reported in the Data Analysis Procedures Subsection of the Seabrook ER-OLS (p. 6.1-5), the first 15-minute average collected each hour is used to compile the hourly data base used to generate the on-site data summaries and other analytical analyses presented in the ER-OLS. The one exception is the hourly precipitation totals which are compiled by summing the four 15-minute precipitation totals recorded each hour.

451.07 (6.1.3) (ER) The description of the atmospheric dispersion model used for calculation of annual average relative concentration (X/Q) and relative deposition (D/Q) values requires additional clarification.

a) Describe how fumigation and trapping were considered (see p. 6.1-5).

b) Identify the points of release of radioactive material to the atmosphere and compare the release characteristics with the criteria in Regulatory Guide 1.111 for the determination of partially elevated and partially ground level releases.

c) Discuss the appropriateness of a straight-line trajectory model for use at the Seabrook site, considering spatial and temporal variations in air flow. Provide adjustments to the straight-line model, if necessary.

RESPONSE: a) At coastal sites, a thermal internal boundary layer (TIBL) can form under certain conditions during seabreeze or onshore gradient flow. TIBLs develop when cool and stable marine air is heated from below by the land surface and becomes unstable in the lower levels. In the routine release dispersion analysis, TIBLs were assumed to occur during sunny spring and summer days when the wind was onshore between 4.5 and 22.0 mph. The height of the TIBL was estimated as a function of wind speed and the distance from the shore along the wind trajectory.

During hours characterized by TIBL formation, releases occurring below the TIBL were assumed to be trapped within the TIBL. As a result, ground level concentrations increase due to multiple eddy reflections from the marine stable layer aloft. For releases occurring above the TIBL, the plume can begin to intercept the top of the TIBL as the plume travels further inland. If this occurs, the material in the plume is assumed to be mixed rapidly downward in the unstable air within the TIBL and high ground level concentrations result. This rapid downward mixing is referred to as fumigation. Specific quantitative details on the annual average atmospheric dispersion model in general and on trapping and fumigation in specific are provided in Section 2.3.5 of the SB FSAR.

b) All of the exhaust air from buildings housing systems containing radioactive materials, except that due to leakage in the turbine hall, is discharged to the environment through the primary vent. The primary vent consists of a stainless steel lined exhaust stack which runs up the side of the outer containment shell. It follows the contour of the containment dome and has an elbow directed up when it reaches the top. Because effluents are released slightly above the containment structures, releases from the primary vent were considered mixed mode (partially elevated and partially ground level releases) as a function of vent exit velocity and vent height wind speed as described in Regulatory Guide 1.111.

Gaseous waste from the turbine hall is released from wall and roof ventilators located in that building. For the purposes of calculating annual average doses, it is assumed that all gaseous releases from the turbine hall are from ground level.

Vent release information used in the annual average atmospheric dispersion model is outlined in Table A-6 of Appendix A of the Seabrook ER-OLS.

c) The categorization of air trajectories requires separation of those conditions where the large scale pressure gradients over hundreds of miles determine the trajectory from those conditions where local effects predominate. At level terrain coastal sites like Seabrook, the primary local effect is the differential heating between land and water surfaces which causes a diurnal oscillation between onshore and offshore flow.

Strong large-scale pressure gradients (usually accompanied by moderate to strong winds) do not allow localized diurnal wind direction reversals to form. Under these conditions, a straight-line trajectory assumption is a reasonable estimate since there are no local channeling effects such as those caused by deep canyons or mountain barriers.

Local effects dominate, however, when the pressure gradient over hundreds of miles is weak. Along the east coast of the United States, localized diurnal oscillations between onshore and offshore flows are most pronounced in late spring and early summer. The localized diurnal onshore-offshore wind regimes can be described as cellular circulations from the cooler to the warmer surface in the lower portion with a return aloft. The seabreeze is characteristically a daytime flow extending generally several miles inland with an occasional inland penetration up to as much as 20 miles. The nighttime land breeze reverses the cycle but usually as a less vigorous offshore flow. Air trajectories under these conditions, when extended beyond the time period of the daily heating cycle or to distances greater than the dimensions of the localized flow, can show trajectory reversals and along-shore movement patterns. However, any plume caught in this recirculation pattern will be highly diluted when it recrosses the shoreline and, as such, the contribution to ground level concentrations due to the recirculated effluents would be very small. The effect of spatial and temporal variations in effluent trajectories when integrated over an annual emission period are small enough so that fixed-point straight-line wind statistics can be used in a long-term diffusion model. (Reference: Van der Hoven, I., Atmospheric Transport and Diffusion at Coastal Sites, Nuclear Safety, Vol. 8, No. 5, September - October 1967.)

451.08 (6.2) (ER) The existing on-site meteorological measurements program is described in Section 6.1.3 as a pre-operational program. The meteorological program is not described as an operational program in Section 6.2. Describe the proposed operational meteorological measurements program, and compare the program with the pre-operational program described in Section 6.1.3.

RESPONSE: It is planned that the existing meteorological tower and instrumentation will be used during the operational phase of the Seabrook Station. In addition, a 10m backup tower instrumented with wind speed and direction is planned to be located approximately 300 feet SSE of the existing tower prior to station operation. The meteorological data from both the primary and backup towers will be scanned and recorded as 15-minute averages by the plant's process computer. Strip chart recorders will continue to serve as a backup source of data.

A Class A dispersion model will be available on a plant computer to produce initial transport and diffusion estimates for the plume exposure Emergency Planning zone. The model shall use automatically supplied meteorological data from the primary monitoring system to produce plume dimensions and position, location and magnitude of the peak relative concentration, and relative concentrations at several downwind locations. Using effluent release information and a finite cloud external gamma dose model, estimates of near-real-time dose rates and accumulative sector average doses will also be available. The model will have the graphics capability of drawing relative concentrations and dose isopleths over a background map of the site.

Section 6.2 will be revised to include this information on the proposed operational meteorological measurements program.

470.1 (ER) In accordance with 10CFR Part, 50 Appendix I, Section II.D, specify which option has been selected for use in calculating the population dose estimates.

RESPONSE: Seabrook Station's application for a Construction Permit was docketed July 9, 1973. The requirements of 10CFR Part 50, Appendix I, Section II.D, for a cost-benefit analysis do not apply.

The Atomic Safety and Licensing Board's Initial Decision of June 29, 1976 for Seabrook Station Construction Permit concluded that the expected quantity of radioactive materials released in liquid and gaseous effluents and the resultant doses meet the design objectives set forth in the RM-50-2 guidelines. The board found that the proposed design of Units 1 and 2 satisfied the criteria specified in the option provided by the Commission's September 4, 1975 amendment to Appendix I and therefore, meet the requirements of Section II.D of Appendix I-2, 10CFR50.

470.2 (ER) Provide the dates that the information contained in Tables 2.1-14 and Figures 2.1-9 through 18 are based on.

RESPONSE: ER-OLS Table 2.1-14 presents information concerning the location (in miles) of the nearest resident, garden, milk and beef animal in each of the sixteen compass sectors. The location of the nearest resident in each sector was extracted from aerial photographs of the site area taken during December, 1979. For conservatism, each of the nearest residents was assumed to maintain a vegetable garden during the growing season of at least 500 square feet. Milk goats, milk cows, and beef cows were inventoried during September and October of 1979, and the data used to supplement and update milk animal inventories taken in 1975.

ER-OLS Figures 2.1-9 through 2.1-18 indicate the existing size and spacial distribution of various components of the site areas demographic makeup.

ER-OLS Figure 2.1-9 provides an estimate of the number and distribution of seasonal dwelling units based primarily on annual (1978-1979) residential electric meter use histories for towns within 5 miles, excluding North Hampton, and 1970 U.S. Census of Housing data on vacant-seasonal and migratory units for towns between 5 and 10 miles of the station site, along with North Hampton. This information was supplemented with 1978 aerial photography, 1978 weekday/weekend beach housing occupancy surveys, and a 1979 telephone survey of town assessors and building inspectors. Section 2.1.3.3 of the SB-FSAR describes in greater detail the assessment of seasonal dwelling units and associated population.

ER-OLS Figures 2.1-10 and 2.1-11 indicate the estimated seasonal resident population based on the dwelling unit inventory as given in ER-OLS Figure 2.1-9. A summer 1978 beach area housing occupancy survey of the local area provided the beach housing occupancy factors used in the population estimate.

ER-OLS Figure 2.1-12, which gives the seasonal overnight population, was determined by survey work undertaken during the summer of 1978 for the 0 to 5 mile area. Information developed as part of survey work conducted during the summer of 1979 was used for the area from 5 to 10 miles.

The peak campground population in ER-OLS Figure 2.1-13 was assembled from several sources of information for the New Hampshire and Massachusetts portions of the 10-mile study area. References included 1979 local telephone directories, <u>1979 New Hampshire Camping Guide</u>, <u>1977 New Hampshire Outdoor Recreation Plan</u>, <u>New Hampshire Campground Owner's Association Guide - 1979</u>, Massachusetts Department of Environmental Management's <u>Space Inventory - 1978</u>, and <u>Massachusetts Outdoors - 1978</u>, Massachusetts Department of Environmental Management. Limited 1978 field observations (Exeter, Kingston, Hampton Falls, North Hampton, and Seabrook) and telephone communications (Rye and Exeter) with local town offices provided additional information on camping facilities.

ER-OLS Figure 2.1-14 indicates the maximum number of vehicles observed (July 22, 1979) in the beach area, during the summers of 1979 and 1980.

ER-OLS Figure 2.1-15 provides an estimate of the beach area population associated with the parking capacity of beach lots as determined from parking lot surveys conducted during the summer of 1978 and updated in the summer of 1979. The average automobile occupancy factor was determined from surveys conducted in July of 1978 at the Hampton and Salisbury beaches.

The beach area on-street vehicle parking capacity, as shown on ER-OLS Figure 2.1-16, was determined from a series of aerial photographs taken on July 8, 1979. The population estimate associated with this on-street parking as given on ER-OLS Figure 2.1-17 was derived by applying the summer 1978 automobile occupancy survey results for beach area parking lots (3.2 persons/vehicle) to the car capacity figures given on ER-OLS Figure 2.1-16.

Data on ER-OLS Figure 2.1-18 indicating the population of major employers in the area was derived from two primary sources of data: (1) "Made in New Hampshire", a Directory of Manufacturers 1978-1979 (with Supplement to May 1979); and (2) "Directory of Massachusetts Manufacturers - 1979".

470.3 (ER) Update Tables 2.1-10 to include the projected transient population for the year 2000.

RESPONSE: ER-OLS Table 2.1-10 provides an estimate of the current peak transient population within 10 miles of Seabrook Station. The components of transient population included in this table are seasonal residents, overnight visitors and daily transients. No projections or detailed information has been identified that would provide a basis for projecting the change in the 1980 transient population out to the year 2000. This conclusion was reached based on a review of available data and telephone communications with several individuals (References 1 through 10). Review of existing data on the major transient population components suggest that the transient population in the site area may be best described as being stable.

Seasonal Residents

No projections of seasonal housing units were available from the U.S. Department of Commerce (Bureau of the Census) or the States of New Hampshire and Massachusetts (References 1, 5, 6). Much of the existing seasonal residential development within ten miles of the site exists in the beach area and within the three communities of Hampton, Seabrook and Salisbury. Building inspectors in the two towns in New Hampshire (Hampton and Seabrook) were contacted to determine if substantial increases in the number of seasonal housing units had taken place in recent years, and to estimate the number which were now under construction or being planned. The building inspector in the Massachusetts community of Salisbury was similarly contacted on this subject (References 2, 3, 4).

It was determined that the towns did not differentiate between building permits issued to construct seasonal dwelling units and permanent or year-round dwelling units. This precludes the ability to determine the number of new seasonal dwelling units built by using building permit data. However, the local building inspectors contacted indicated that most, if not all, new units constructed in their towns in recent years have been permanent, year-round residences. Few summer/seasonal residences are being built (i.e., estimated at less than ten per town per year).

The building inspectors also noted that a substantial number of summer seasonal housing units have in more recent years been winterized to permit year-round use and have thus reduced the total number of seasonal housing units. The local building inspectors are of the general opinion that this conversion trend is expected to continue in the future.

In summary, new construction of seasonal housing units in recent years is believed quite limited. This conclusion is based on discussions with building inspectors in Hampton, Seabrook and Salisbury in September of 1981. No new major seasonal housing development projects were identified as being planned for construction in the same communities. Construction of seasonal units is considered limited to several per year in each of these communities, which contain the majority of existing seasonal units located within ten-miles of the site. Very limited land availability and construction costs are believed reasons why substantial increases in seasonal units are not anticipated in the near term. These conclusions are similar to those reached in our 10-mile radius survey of town officials in October of 1979.

Overnight Visitors

A substantial number of overnight accommodations such as hotels and motel facilities exist within 10-miles of Seabrook Station. Survey work was undertaken to identify major overnight accommodations and estimate their total capacity. This work was performed in 1978 and 1979 and involved review of available information and field observations. The results of this work, as indicated in the SB-FSAR, showed that the majority of the existing accommodations within approximately 5-miles of Seabrook Station are concentrated in the beach area. The greatest concentration of the overnight accommodations exists in the beach area of Hampton.

Table 2.1-5 in the SB-FSAR includes the resultant list of major overnight facilities identified in the area. Increases in the total number of overnight accommodations resulting from development of new facilities in recent years is believed to be small since few new developments have occurred recently in Hampton, Seabrook and Salisbury. No plans for such major new developments were identified. Likewise, projections of the number of new overnight accommodations were not identified as part of this review. This is based on discussions with the New Hampshire Office of Comprehensive Planning and the Massachusetts Department of Environmental Management staff (References 5, 6).

Similarly no projections of growth in area camping facilities were identified. An inventory of outdoor recreation facilities is presently being updated for New Hampshire and is expected to be available in late 1981. This work, which is being done by the New Hampshire Office of Comprehensive Planning, involves updating the 1976 New Hampshire Inventory of Outdoor Recreation Facilities (Reference 9). The most recent 1977 New Hampshire Outdoor Recreation Plan (Reference 8), indicates a possible stable or declining condition with respect to recreational activities of camping and swimming at State Parks. The plan indicates that a general downward trend in total State park attendance may be occurring (see pages 93 and 97 of the plan).

Daily Transients

During the summer season a substantial influx of daily transients occurs in the coastal beach area within approximately 10-miles of the site. The influx of daily transients has been observed to be greatest on fair weather weekends and on holidays. Smaller increases in total daily transient population are believed to occur during fair weather weekday dates. The largest concentration of daily transients, as indicated by a review of beach area parking facilities available to the general public, occurs in the Hampton-Seabrook-Salisbury beach area.

ER-OLS Table 2.1-10 provides an estimate of the daily transient population for 1980 based on a capacity estimate of available beach area parking facilities. Observations made as part of survey work during the summer periods of 1979, 1980 and 1981 did not indicate development of major new beach area parking facilities. Plans for such major new facilities were not identified. Likewise, no projections of transient population growth related to beach area activity were identified through contact with the New Hampshire Office of Comprehensive Planning and Massachusetts Department of Environmental Management.

It is not apparent from review of data in the 1977 New Hampshire Outdoor Recreation Plan (e.g., Hampton Beach's annual attendance 1970 to 1976, page 88) and from observations made during summer aerial surveys that substantial increases in overall beach area attendance occurred in recent years. A somewhat stable condition may best characterize near-term daily transient population growth.

References to 470.3

1. Telephone communication with Mr. Richard Ning, U.S. Department of Commerce, Bureau of the Census, Boston, 10 September 1981.

2. Telephone communication with Mr. Louis Janois and Mr. Ralph Eaton, Building Inspectors, Seabrook, 14 September 1981.

3. Telephone communication, Mr. Raymond Hutchinson, Building Inspector, Hampton, 14 September 1981.

4. Telephone communication, Mr. Ken Chase, Salisbury Building Inspector, 17 September 1981.

5. Telephone communication, Mr. David Hartman, New Hampshire Office of Comprehensive Planning, 9 September 1981.

6. Telephone communication, Mr. McLellan, Massachusetts Department of Environmental Management, 9 September 1981.

7. Seabrook Growth Analysis and Development Plan. The Thoresen Group, June 1981.

8. 1977 New Hampshire Outdoor Recreation Plan. N.H. Office of Comprehensive Planning, 1976.

9. Inventory of Outdoor Recreation Facilities. N.H. Office of Comprehensive Planning, 1976.

10. Massachusetts Outdoors, Massachusetts Department of Environmental Management, September 1978.

470.4 (ER) Table 2.1-17 and Tables 2.1-25 through 2.1-30 (based on 1974 and 1977 data, respectively) as well as other tables contained in the Seabrook Nuclear Station environmental report should be updated to reflect the latest information available.

RESPONSE: ER-OLS Table 2.1-17 is based on 1978 Census of Agriculture Preliminary Report data and is the latest available data. Survey data will not be re-collected by the U.S. Department of Commerce, Bureau of Census until 1982.

The latest data required to update ER-OLS Tables 2.1-25 through 2.1-30 was obtained from the U.S. Department of Commerce, NMFS and is presented in ER-OLS Tables 470.4-1 through 470.4-6.

470.5 (ER) Section 6.1.5 of the Environmental Report should be updated to include tables as illustrated in USNRC Branch Technical Position, "An Acceptable Radiological Environmental Monitoring Program", Revision 1, November 1979.

RESPONSE: ER-OLS Section 6.1.5 will be updated to include Tables 470.5-1 through 470.5-3 as illustrated in USNRC Branch Technical Position, "An Acceptable Radiological Environmental Monitoring Program", Revision 1, November 1979.

TABLE 470.4-1

1979 Commercial Fisheries
York County, Maine

SPECIES	HARVEST (lbs)	VALUE ($)
Alewives	7,000	$ 400
Anglerfish	169,400	97,286
Bluefish	56,500	11,522
Cod	2,679,800	730,493
Cunner	900	155
Cusk	228,800	51,225
Flounder, Blackback	138,200	48,493
Flounder, Dab, Sea	1,128,600	384,062
Flounder, Fluke	1,900	348
Flounder, Gray Sole	225,300	140,734
Flounder, Yellowtail	130,400	50,514
Haddock	1,025,800	456,763
Hake, Red	100	10
Hake, White	488,200	87,665
Halibut	4,600	7,685
Herring, Sea	100	14
Mackerel	77,800	16,974
Ocean Perch	62,500	12,621
Pollock	3,843,200	787,381
Salmon, Atlantic		11
Scups or Porgies	100	5
Shad	11,000	1,233
Sharks, Dogfish	375,900	20,059
Sharks, Unclassified	600	193
Skates	8,500	1,093
Striped Bass	100	63
Sturgeons, Common (Green and White)	800	118
Tautog	100	15
Tilefish		20
Tuna, Bluefin	23,500	29,059
Whiting, Round	51,700	6,460
Wolffish	34,100	4,409
Finfishes, Unclassified for Food	4,500	1,298
Lobster, American	1,042,300	1,880,784
Shrimp		2
Clams, Soft	32,000	47,218
Squid, Unclassified	2,100	207
Squid, Short-Finned	400	85
Squid, Long-Finned	300	42
Seaweed, Irish Moss	300,000	17,340
TOTAL FOR COUNTY	12,157,500	$4,894,153

Source: NMFS, Resource Statistics Division, Mr. B.G. Thompson, pers. comm.

TABLE 470.4-2

1979 Commercial Fisheries
Rockingham County, New Hampshire

SPECIES	HARVEST (lbs)	VALUE ($)
Anglerfish	56,980	$ 24,292
Bluefish	410	102
Cod	2,197,540	558,463
Cusk	196,000	41,029
Eels, Common	4,100	2,050
Flounder, Blackback	49,600	19,065
Flounder, Dab, Sea	1,409,240	505,000
Flounder, Gray Sole	246,070	148,750
Flounder, Yellowtail	28,750	10,529
Haddock	1,282,140	531,641
Hake, Red	20,800	2,080
Hake, White	515,080	77,956
Halibut	6,400	13,280
Mackerel	10,950	2,449
Ocean Perch	18,390	3,309
Pollock	1,362,810	243,906
Shad	7,310	657
Sharks, Dogfish	309,850	24,788
Sharks, Unclassified	4,180	587
Skates	36,670	4,766
Smelt	25,200	10,080
Sturgeons, Common (Green and White)	1,500	330
Tuna, Bluefin	6,398	8,508
Whiting, Round	44,870	4,482
Wolffish	15,000	1,693
Finfishes, Unclassified for Food	16,310	2,109
Crab, Green	30,700	3,110
Crab, At, Rock	37,800	5,934
Lobster, American	780,100	1,361,512
Scallop, Sea	61,350	196,320
Bloodworms	5,420	16,260
Sandworms	21,870	32,483
TOTAL FOR COUNTY	8,809,788	$3,857,520

Source: NMFS, Resource Statistics Division, Mr. B.G. Thompson, pers. comm.

TABLE 470.4-3

1979 Commercial Fisheries
Essex County, Massachusetts

SPECIES	HARVEST (lbs)	VALUE ($)
Alewives	300	20
Anglerfish	799,400	353,506
Bluefish	71,400	13,022
Butterfish	2,400	693
Cod	19,877,600	6,625,110
Cusk	1,334,300	291,330
Eels, Common	43,400	26,702
Flounder, Blackback	758,500	310,472
Flounder, Dab, Sea	7,546,100	2,855,771
Flounder, Fluke	3,700	1,229
Flounder, Gray Sole	1,720,000	1,078,364
Flounder, Lemon Sole	33,100	17,207
Flounder, Sand	14,400	2,501
Flounder, Yellowtail	2,511,600	1,147,157
Flounder, Unclassified	27,900	12,168
Gizzard Shad		12
Haddock	12,827,400	5,615,003
Hake, Red	1,692,700	258,682
Hake, White	1,984,700	426,085
Halibut	79,500	110,230
Herring, Sea	43,867,300	3,047,314
Hickory Shad		3
Launces	24,000	11,000
Mackerel	204,700	51,292
Menhaden	28,771,400	725,319
Ocean Perch	9,751,100	1,849,883
Ocean Pout	700	59
Pollock	11,490,000	2,231,755
Sea Basses		29
Shad	500	72
Sharks, Dogfish	2,815,100	204,946
Sharks, Unclassified	2,200	477
Skates	226,400	33,416
Smelt	300	25
Striped Bass	35,200	43,954
Sturgeons, Common (Green and White)	700	272
Swordfish	262,600	399,100
Tautog	200	58
Tilefish	28,800	5,937
Tuna, Bluefin	762,600	1,366,623
Whiting, Round	5,411,600	1,037,503
Wolffish	699,000	103,513
Finfishes, Unclassified for Food	1,137,500	371,577
Crab, Jonah	13,000	3,900

TABLE 470.4-3
(Continued)

1979 Commercial Fisheries
Essex County, Massachusetts

SPECIES	HARVEST (lbs)	VALUE ($)
Crab, Rock	32,000	9,600
Lobster, American	3,279,940	6,597,405
Shrimp, Unclassified	894,900	269,525
Clams, Soft	552,110	1,061,750
Scallop, Sea	174,200	589,787
Squid, Unclassified	25,300	3,168
Squid, Short-Finned	2,501,500	238,011
Squid, Long-Finned		2
Sandworms	10,000	22,500
TOTAL FOR COUNTY	167,574,750	$39,453,084

Source: NMFS, Resource Statistics Division, Mr. B.G. Thompson, pers. comm.

TABLE 470.4-4

1979 Commercial Fisheries
Suffolk County, Massachusetts

SPECIES	HARVEST (lbs)	VALUE ($)
Anglerfish	5,200	1,847
Bluefish	8,000	1,440
Cod	9,485,300	3,069,468
Cusk	586,700	140,451
Eels, Common	10,000	6,300
Flounder, Blackback	258,800	130,589
Flounder, Dab, Sea	879,200	459,075
Flounder, Gray Sole	244,100	179,925
Flounder, Lemon Sole	41,400	19,217
Flounder, Yellowtail	210,600	94,738
Haddock	7,448,800	3,597,089
Hake, Red	1,400	870
Hake, White	842,300	198,865
Halibut	100	200
Mackerel	2,000	400
Ocean Perch	6,377,800	1,765,745
Pollock	3,987,300	1,026,062
Skates	2,500	469
Striped Bass	4,500	5,625
Wolffish	237,800	42,074
Finfishes, Unclassified for Food	700	105
Crab, Rock	15,000	4,500
Lobster, American	1,194,247	2,374,300
Clams, Soft	47,957	88,536
Scallop, Sea	11,000	41,526
TOTAL FOR COUNTY	31,902,704	$13,249,416

Source: NMFS, Resource Statistics Division, Mr. B.G. Thompson, pers. comm.

TABLE 470.4-5

1979 Commercial Fisheries
Norfolk County, Massachusetts

SPECIES	HARVEST (lb)	VALUE ($)
Bluefish	6,000	$ 1,080
Cod	57,000	17,280
Eels, Common	8,000	4,800
Flounder, Blackback	40,000	16,800
Pollock	5,000	1,000
Striped Bass	4,000	5,000
Crab, Rock	6,000	1,900
Lobster, American	467,474	959,060
Clams, Soft	81,939	157,575
TOTAL FOR COUNTY	675,413	$1,164,495

Source: NMFS, Resource Statistics Division, Mr. B.G. Thompson, pers. comm.

TABLE 470.4-6

1979 Commercial Fisheries
Plymouth County, Massachusetts

SPECIES	HARVEST (lbs)	VALUE ($)
Anglerfish	90,900	$ 30,717
Bluefish	23,100	4,352
Butterfish	1,200	175
Cod	1,863,600	574,160
Cusk	4,200	653
Eels, Common	23,500	14,420
Flounder, Blackback	1,047,700	391,997
Flounder, Dab, Sea	466,100	180,084
Flounder, Fluke	41,800	36,840
Flounder, Gray Sole	227,300	114,955
Flounder, Lemon Sole	24,500	16,176
Flounder, Sand	37,600	5,720
Flounder, Yellowtail	1,148,200	538,163
Haddock	162,100	67,662
Hake, Red	37,800	3,059
Hake, White	14,900	2,063
Halibut	1,700	2,843
Mackerel	14,500	3,324
Ocean Perch	4,600	753
Pollock	528,200	119,562
Scups or Porgies	7,200	1,714
Sea Basses	500	274
Sharks, Dogfish	300	26
Skates	33,500	3,708
Striped Bass	65,100	81,305
Sturgeons, Common (Green and White)		8
Swordfish	452,400	753,662
Tautog	18,200	2,173
Tuna, Bluefin	102,600	203,756
Whiting, Round	237,700	20,704
Wolffish	27,700	1,828
Finfishes, Unclassified for Food	42,100	4,813
Crab, Rock	15,000	4,950
Lobster, American	1,603,236	3,272,473
Clams, Hard	55,957	193,042
Clams, Razor	800	300
Clams, Soft	31,512	58,176
Snails (Conchs)	26,775	24,990
Mussels, Sea	170,000	88,000
Oyster, Eastern	2,106	6,480
Scallop, Bay	60,564	259,560
Scallop, Sea	119,700	414,170

TABLE 470.4-6
(Continued)

1979 Commercial Fisheries
Plymouth County, Massachusetts

SPECIES	HARVEST (lbs)	VALUE ($)
Squid, Unclassified	100	40
Squid, Short-Finned	20,200	1,766
Squid, Long-Finned	91,000	35,295
Seaweed, Irish Moss	1,080,000	54,000
TOTAL FOR COUNTY	10,027,750	$7,594,891

Source: NMFS, Resource Statistics Division, Mr. B.G. Thompson, pers. comm.

TABLE 470.5-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
1. AIRBORNE			
Radioiodine and Particulates	*Samples from 3 off-site locations (in different sectors) with the highest calculated annual ground level D/Q.	Continuous operation of sampler with sample collection as required by dust loading but at least once per 7 days.	Radioiodine canister. Analyze at least once per 7 days for I-131.
	1 sample from the vicinity of a population center having the highest calculated annual average ground level D/Q.		Particulate sampler. Analyze for gross beta radioactivity ≥24 hours following filter change. Perform gamma isotopic analysis on each sample when gross beta activity is > 10 times the yearly mean of control samples. Perform gamma isotopic analysis on composite (by location) sample at least once per 92 days.
	1 sample from a control location 15-30 km distance.		
	*Consideration for location of air monitoring stations was given to year round access to the location, availability of power, and population in the area.		

TABLE 470.5-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
2. DIRECT RADIATION	32 stations with two or more dosimeters placed in two concentric rings around the plant.	At least once per 92 days.	Gamma dose. At least once per 92 days.
	8 stations with two or more dosimeters placed at control locations, population centers and nearby residences		
3. WATERBORNE			
a. Surface	1 sample in the area of the discharge.	At least once per 31 days.	Gamma isotopic analysis of each sample.
	1 sample from a control location.		Tritium analysis of composite samples at least once per 92 days.
b. Ground	2 samples from sources likely to be affected.	At least once per 92 days.	Gamma isotopic and tritium analyses of each sample.
c. Sediment	3 samples from beach locations near the discharge area.	At least once per 184 days.	Gamma isotopic analysis of each sample.
	1 sample from a control location.		

TABLE 470.5-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
4. INGESTION			
a. Milk	3 samples from locations within 3 miles distance from the plant having the highest dose potential. 1 sample from a control location.	At least once per 15 days when animals are on pasture; at least once per 31 days at other times.	Gamma isotopic and I-131 analysis of each sample.
b. Fish and Invertebrates	1 sample from the discharge area. 1 sample from a control location.	One sample in season, or at least once per 184 days if not seasonal of 3 commercially and recreationally important species.	Gamma isotopic analysis on edible portions.
c. Food	1 sample from 3 farms or gardens having the highest dose potential. 1 sample from a control location.	At time of harvest. One sample of 3 principal classes of food products grown in the area.	Gamma isotopic analysis on edible portion.

TABLE 470.5-2

REPORTING LEVELS FOR RADIOACTIVITY
CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Reporting Levels

Analysis	Water (pCi/l)	Airborne Particulate or Gases (pCi/m^3)	Fish (pCi/Kg, wet)	Milk (pCi/l)	Food Products (pCi/Kg, wet)
H-3	2×10^4 (a)				
Mn-54	1×10^3		3×10^4		
Fe-59	4×10^2		1×10^4		
Co-58	1×10^3		3×10^4		
Co-60	3×10^2		1×10^4		
Zn-65	3×10^2		2×10^4		
Zr-Nb-95	4×10^2 (b)				
I-131	2	0.9		3	1×10^2
Cs-134	30	10	1×10^3	60	1×10^3
Cs-137	50	20	2×10^3	70	2×10^3

(a) For drinking water samples. This is 40 CFR Part 141 value.

(b) Total for parent and daughter.

TABLE 470.5-3

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING SUMMARY

Name of Facility____________________ Docket No.____________________

Location of Facility____________________ Reporting Period____________________

MEDIUM: MILK

UNITS: PCI/LITER

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	NOMINAL LLD***	INDICATOR STATIONS MEAN, RANGE, AND NO. DETECTED**	STA.	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LOCATIONS MEAN, RANGE, AND NO. DETECTED**
K-40 (48) (0)	2.0E+02	(1.4 ± .0) E 3 (1.1 - 1.6) E 3 *(36/36)*	13	(1.4 ± .0) E 3 (1.2 - 1.6) E 3 *(12/12)*	(1.3 ± 0) E 3 (1.3 - 1.4) E 3 *(12/12)*
I-131 (48) (0)	.5	(1.8 ± .6) E -2 (-6.6 - 8.8) E -2 *(0/36)*	13	(2.2 ± .8) E -2 *(0/12)*	(2.2 ± 1.6) E -2 (-4.6 - 12.7) E -2 *(0/12)*
CS-134 (48) (0)	9.	(-1.2 ± .2) E 0 (-3.6 - 1.4) E 0 *(0/36)*	12	(-9.7 ± 3.5)E -1 *(0/12)*	(-1.3 ± .3) E 0 (-3.2 - .3) E 0 *(0.12)*
CS-137 (48) (0)	9.	(4.1 ± .2) E 0 (1.5 - 67.7) E -1 *(27/36)*	21	(8.6 ± 1.3) E 0 (9.5-189.0) E-1 *(11/12)*	(8.6 ± 1.3) E 0 (9.5-189.0) E -1 *(11/12)*

* Non-routine refers to the number of separate measurements which were greater than ten (10) times the average background for the period of the report.

** The fraction of sample analyses yielding detectable measurements (i.e., > 3 sigma) is indicated within *( )*.

*** Nominal Lower Limit of Detection (LLD) as defined in table notation a. of ER-OLS Table 6.1-5, Specification 6.1-5.

a. Note: The example data provided in this table are for illustrative purposes only.

470.9 Update Tables 5.2-13 and 5.2-15 to include all of the parameters and assumptions used to calculate both the maximum individual and population dose estimates from the liquid and gaseous pathways, respectively.

RESPONSE: See updated Seabrook ER-OLS Tables 5.2-13 and 5.2-15; attached as RAI Tables 470.9-1, 470.9-2. 2

470.10 Update Tables 5.2-20, 5.2-21 and 5.2-22 to include the latest information available and specify the date of the data used in preparing these tables.

RESPONSE: Tables 470.10-1, 470.10-2 and 470.10-3 reflect the latest available information on agricultural production within 50 miles of Seabrook Station and reflect updated data to that given in ER Tables 5.2-20, 5.2-21 and 5.2-22.

Table 470.10-1 indicates the estimated annual production of milk by sector. This information represents 1981 data as compiled on a county basis by the Massachusetts Department of Food and Agriculture, Dairy Division, Boston, MA.

Table 470.10-2 indicates the estimated annual meat production in the site area out to 50 miles. Meat as defined for Table 470.10-2 includes the number of cattle and calves, hogs and pigs, sheep and lambs, broiler chickens and turkeys sold on a county basis in 1978, as reported in the final 1978 Census of Agriculture Reports; Parts 19, 21 and 29 (Volume 1) for the states of Maine, Massachusetts and New Hampshire. These reports were issued in March 1981 by the U.S. Department of Commerce, Bureau of the Census. The total number of livestock sold as reported in the census data was multiplied by an estimate of the average dressed weight of each animal in order to determine the mass of meat production for each principal county within 50 miles of the site. The average dressed weight used for each of the various meat animals was:

Cattle (and calves)	265 Kg
Hogs (and pigs)	76 Kg
Sheep (and lambs)	23 Kg
Broilers	1.24 Kg
Turkeys	6.99 Kg

2

TABLE 470.9-1
(Sheet 1 of 3)

PARAMETERS AND ASSUMPTIONS USED TO CALCULATE BOTH MAXIMUM INDIVIDUAL AND POPULATION DOSE ESTIMATES FROM THE LIQUID PATHWAYS

Liquid Release Radionuclide Source Term:

Curies Released per Year per Unit		-	ER Table 3.5-18
Liquid Release Concentration (μCi/gm)		-	ER Table 3.5-18
Reconcentration Factor		-	0.0

Maximum Individual Specification and Usage Factors:

Shorewidth Factor		-	0.5
Dilution for Aquatic Foods		-	8.0
Dilution for Shoreline Activities		-	8.0
Dilution for Drinking Water		-	N/A
Discharge Transit Time (hr)		-	0.0
Transit Time to Drinking Water (hr)		-	N/A
Fish Consumption (Kg/yr)	Adult	-	21.0
	Teen	-	16.0
	Child	-	6.9
	Infant	-	0.0
Invertebrate Consumption (Kg/yr)	Adult	-	5.0
	Teen	-	3.8
	Child	-	1.7
	Infant	-	0.0
Algae Consumption (Kg/yr)	Adult	-	0.0
	Teen	-	0.0
	Child	-	0.0
	Infant	-	0.0
Water Usage (liters/yr)	Adult	-	N/A
	Teen	-	N/A
	Child	-	N/A
	Infant	-	N/A
Shoreline Usage (hr/yr)	Adult (1)	-	334.0
	Teen	-	67.0
	Child	-	14.0
	Infant	-	0.0
Swimming Usage (hr/yr)	Adult	-	8.0
	Teen	-	45.0
	Child	-	28.0
	Infant	-	0.0
Boating Usage (hr/yr)	Adult	-	29.0
	Teen	-	52.0
	Child	-	52.0
	Infant	-	0.0

TABLE 470.9-1
(Sheet 2 of 3)

PARAMETERS AND ASSUMPTIONS USED TO CALCULATE BOTH MAXIMUM INDIVIDUAL AND POPULATION DOSE ESTIMATES FROM THE LIQUID PATHWAYS

Selected Location Specification and Usage Factors: (Note 1)

Population Dose Specifications and Usage Factors:

Sport Fish Harvest (Kg/yr)		-	3.5×10^7
Dilution Factor		-	247.0
Transit Time (hr)		-	0.0
Distribution Time (days)		-	7.0
Location		-	(Note 2)
Commercial Fish Harvest (Kg/yr):		-	9.9×10^7
Dilution Factor		-	247.0
Transit Time (hr)		-	0.0
Distribution Time (days)		-	7.0
Location		-	(Note 2)
Sport Invertebrate Harvest (Kg/yr):		-	1.6×10^5
Dilution Factor		-	247.0
Transit Time (hr)		-	0.0
Distribution Time (days)		-	7.0
Location		-	(Note 2)
Commercial Invertebrate Harvest (Kg/yr):		-	1.4×10^7
Dilution Factor		-	247.0
Transit Time (hr)		-	0.0
Distribution Time (days)		-	7.0
Location		-	(Note 2)
Population Drinking Water:		-	N/A
Population Shoreline:			
Usage (man-hours/yr)	Adult	-	2.7×10^7
	Teen	-	2.8×10^7
	Child	-	7.5×10^6
	Infant	-	0.0
Dilution		-	247.0
Transit Time (hr)		-	0.0
Shorewidth Factor		-	0.5
Location			(Note 2)

TABLE 470.9-1
(Sheet 3 of 3)

PARAMETERS AND ASSUMPTIONS USED TO CALCULATE BOTH MAXIMUM INDIVIDUAL AND POPULATION DOSE ESTIMATES FROM THE LIQUID PATHWAYS

Population Swimming:

Usage (man-hours)	Adult	-	8.0
	Teen	-	45.0
	Child	-	28.0
	Infant	-	0.0
Dilution		-	247.0
Transit Time		-	0.0
Location		-	(Note 2)

Population Boating:

Boating doses = 1/2 swimming doses

Irrigated Foods; Population and Individual:	-	N/A

Note (1) - The adult shoreline usage factor has been increased from the nominal value of 12 hr/yr to 334 hr/yr to account for popular non-commercial clam digging within the immediate area. The basis is 2 hr/day for 167 day/yr.

Note (2) - An average dilution factor (247) has been determined for commercial and sport fishing and shoreline activities within a 50-mile radius, thus specific locations have not been used.

TABLE 470.9-2
(Sheet 1 of 3)

ASSUMPTIONS AND PARAMETERS USED TO ESTIMATE DOSES
TO THE MAXIMUM INDIVIDUAL AND POPULATION FROM THE GASEOUS PATHWAYS

Site Specific Information:

The distance from the facility to the NE corner of the US (MAINE) in miles.	-	250.00
Fraction of year leafy vegetables are grown (default value = 1.0).	-	0.50
Fraction of year cows are on pasture (default value = 1.0) [See Reg. Guide 1.109-8].	-	0.50
Fraction of crop from garden (default value = 0.76 from USDA) [See Reg. Guide 1.109-7].	-	0.76
Fraction of daily intake of cows derived from pasture while on pasture (default value = 1.0) [See Reg. Guide 1.109-28].	-	1.00
Absolute humidity over growing season, relative (%) value if T is supplied. When H and T are blanks a default value of 8.0 g/m^3 is used.	-	8.00
Average Temperature over growing season (deg. F).	-	N/A
Fraction of year goats are on pasture (default value = 1.0).	-	.50
Fraction of daily intake of goat from pasture while on pasture (default value = 1.0).	-	1.00
Fraction of year beef cattle are on pasture (default value = 1.0).	-	.50
Fraction of daily intake of beef cattle derived from pasture while on pasture (default value = 1.0).	-	1.00

Population Title Card:

Total population within 50 mile, plant name and year of projected population.	-	4,426,100 - Seabrook 1&2-2000 yr.

TABLE 470.9-2
(Sheet 2 of 3)

ASSUMPTIONS AND PARAMETERS USED TO ESTIMATE DOSES
TO THE MAXIMUM INDIVIDUAL AND POPULATION FROM THE GASEOUS PATHWAYS

Population Data Control Information:

Compass sector for starting data: 0 for north, 1 for south (defaults to north). The 50-mile region is divided into 160 subregions formed by sectors centered on the 16 compass points (N, NNE, NE, etc.) and annuli at distances of 1, 2, 3, 4, 5, 10, 20, 30, 40 and 50 miles from the center of the facility. Each sector will require 10 population data entries.	-	User option - 50 mile population data is presented in ER-OLS Tables 2.1-2 and Table 2.1-3.
Total No. of annular population values to be read for each sector: 0, or 10. If KT = 0 the 50 mile total will be uniformly distributed over all sectors and annuli and card 4.2 will follow (see below). Otherwise KT = 10 and 16 pairs of sector population data cards must follow.	-	10.00
Sector population data cards (16 pairs required, each with KC values).	-	See ER-OLS Tables 2.1-2, 2.1-3 for Sector population.
Annual Milk Production in Liters.	-	See ER-OLS Table 5.2-20 (revised Table in RAI 470.10)
Annual Meat Production in Kilograms.	-	See ER-OLS Table 5.2-21 (revised Table in RAI 470.10)
Annual Vegetation Production in Kilograms.	-	See ER-OLS Table 5.2-22 (revised Table in RAI 470.10)
Annual release in Ci. (Usually determined by GALE Codes or equivalent.)	-	See ER-OLS Table 3.5-10.
Data source, date, height, release point, etc.	-	Turbine Bldg. releases are ground level - all other sources are elevated from plant vent.

TABLE 470.9-2
(Sheet 3 of 3)

ASSUMPTIONS AND PARAMETERS USED TO ESTIMATE DOSES TO THE MAXIMUM INDIVIDUAL AND POPULATION FROM THE GASEOUS PATHWAYS

Sector X/Q data cards (16 required, each with KC values).	-	See ER-OLS Tables 5.2-2, 5.2-3 for 0-50 miles X/Q data - Table 5.2-4, 5.2-5 for maximum individual X/Q.
Special Location Card:		
Selected individual dose maximum of 5. These cards supply MET data.	-	Maximum individual resides at worst residential location 2398 meters, ESE sector, and consumes 100% vegetables harvested from a backyard garden. The following pathways were evaluated at this location, inhalation, direct radiation and ingestion of vegetables. Consumes goats milk from NW sector, 3862 meters and meat from W sector, 3219 meters.
Special Location Name	-	Rocks
Compass heading from site to special location.	-	ENE
Distance in miles.	-	0.20 miles
X/Q for this location (sec/m^3) X/Q decayed (sec/m^3) X/Q decayed and depleted (sec/m^3) Deposition (m^{-2})	- - - -	See ER-OLS Tables 5.2-3, 5.2-4 for "Rocks" meteorological data.
Controls Plume Pathway		
Ground	-	Yes
Vegetation	-	No
Meat	-	No
Cow	-	No
Goat	-	No
Inhalation	-	Yes
Direct Radiation	-	Yes

TABLE 470.10-1

MILK PRODUCTION Kg/YEAR PER SECTOR

SECTOR:	Distance (Miles) 0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	0	0	13,700	19,200	24,700	206,000	910,000	1,590,000	2,000,000	2,580,000
NNE	0	0	13,700	19,200	24,700	206,000	843,000	1,430,000	2,000,000	2,580,000
NE	0	0	13,700	9,630	6,200	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0	665,000	0	0
S	0	0	16,800	28,000	36,000	299,000	1,200,000	1,330,000	931,000	485,000
SSW	0	0	20,000	28,000	36,000	299,000	1,200,000	1,700,000	1,170,000	1,150,000
SW	0	0	20,000	28,000	36,000	299,000	1,200,000	1,550,000	1,550,000	2,000,000
WSW	0	0	16,800	28,000	36,000	299,000	1,010,000	1,600,000	2,040,000	2,620,000
W	0	0	13,700	19,300	24,700	206,000	826,000	1,380,000	2,530,000	3,250,000
WNW	0	0	13,700	19,300	24,700	206,000	826,000	1,380,000	2,230,000	2,400,000
NW	0	0	13,700	19,300	24,700	206,000	826,000	1,380,000	2,230,000	2,400,000
NNW	0	0	13,700	19,300	24,700	206,000	935,000	1,740,000	2,440,000	2,010,000
TOTALS	0	0	169,500	237,230	298,400	2,432,000	9,776,000	15,745,000	19,671,000	22,655,000

TOTAL ALL SECTORS: 70,984,130

Source: 1981 County Milk Production Data, Massachusetts Dept. Food and Agriculture; Dairy Division, Boston, MA

TABLE 470.10-2

MEAT PRODUCTION Kg/YEAR PER SECTOR

Sector:	Distance (Miles) 0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	0	0	1,400	1,900	2,400	20,400	133,000	264,000	580,000	745,000
NNE	0	0	1,400	1,900	2,400	20,400	165,000	414,000	580,000	745,000
NE	0	0	1,400	1,000	600	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0	68,000	0	0
S	0	0	1,700	2,900	3,700	30,600	122,000	136,000	95,000	53,000
SSW	0	0	2,000	2,900	3,700	30,600	122,000	215,000	248,000	194,000
SW	0	0	2,000	2,900	3,700	30,600	122,000	220,000	330,000	425,000
WSW	0	0	1,700	2,900	3,700	30,600	102,000	150,000	281,000	361,000
W	0	900	1,400	1,900	2,400	20,400	81,000	136,000	231,000	297,000
WNW	0	0	1,400	1,900	2,400	20,400	81,000	136,000	241,000	310,000
NW	0	0	1,400	1,900	2,400	20,400	81,000	136,000	196,000	242,000
NNW	0	0	1,400	1,900	2,400	20,400	75,000	113,000	159,000	182,000
TOTAL	0	900	17,200	24,000	29,800	244,800	1,084,000	1,938,000	2,941,000	3,554,000

Total All Sectors: 9,994,000

Source: 1978 Census of Agriculture, U.S. Department of Commerce, Bureau of the Census: State and County Data
Vol. 1, Part 19, Maine (AC78-A-19)
Vol. 1, Part 21, Massachusetts (AC78-A-21)
Vol. 1, Part 29, New Hampshire (AC78-A-29)

TABLE 470.10-3

VEGETABLE PRODUCTION Kg/YEAR PER SECTOR

	Distance (Miles)									
SECTOR	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	2,400	11,000	18,000	25,000	32,000	266,000	713,000	895,000	1,674,000	2,152,000
NNE	0	0	18,000	25,000	32,000	266,000	891,000	1,195,000	1,674,000	2,152,000
NE	0	0	18,000	12,000	8,000	0	0	0	0	0
ENE	0	11,000	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0	1,107,000	0	0
S	2,400	11,000	25,000	46,000	60,000	498,000	1,992,000	2,213,000	1,549,000	527,000
SSW	2,400	11,000	33,000	46,000	60,000	498,000	1,992,000	3,340,000	3,549,000	2,555,000
SW	2,400	11,000	33,000	46,000	60,000	498,000	1,992,000	3,350,000	4,731,000	6,083,000
WSW	0	11,000	25,000	46,000	60,000	498,000	1,528,000	2,861,000	5,130,000	6,596,000
W	2,400	11,000	18,000	25,000	32,000	266,000	1,064,000	1,774,000	5,529,000	7,108,000
WNW	0	11,000	18,000	25,000	32,000	266,000	1,064,000	1,774,000	2,963,000	3,810,000
NW	2,400	11,000	18,000	25,000	32,000	266,000	1,064,000	1,774,000	905,000	523,000
NNW	0	11,000	18,000	25,000	32,000	266,000	710,000	594,000	832,000	801,000
TOTAL	14,400	110,000	242,000	346,000	440,000	3,588,000	13,010,000	20,877,000	28,536,000	32,307,000

Total All Sectors: 99,470,000 Kg

SOURCE: 1978 Census of Agriculture, U.S. Department of Commerce, Bureau of the Census: State and County Data
Vol. 1, Part 19, Maine (AC78-A-19)
Vol. 1, Part 21, Massachusetts (AC78-A-21)
Vol. 1, Part 29, New Hampshire (AC78-A-29)

Table 470.10-3 gives an estimate of the annual vegetable production by sector for the site area. The source of this data is also the 1978 Census of Agriculture Reports noted above. Vegetable product as defined for Table 470.10-3 includes the following categories as listed in agricultural census: "Vegetables, melons and sweet corn", "Irish potatoes", and "Apples". The average yield (lbs/acre) for apples and potatoes as determined by the county data was used to estimate the mass of production for these food crops. An average yield value of 2.0 Kg per square meter (USNRC Regulatory Guide 1.109) was used to estimate the mass of vegetable production per acre for each county for the category of "Vegetables, melons and sweet corn".

An equal area allocation method was used to distribute the county production data by sector out to 50 miles from the site.

470.11 Update Table 2.1-14 to include any changes noted during the latest land use census conducted, including the beef cow pathway.

Response: ER-OLS Table 2.1-14 has been revised and updated to include the results of the latest site vicinity survey which was conducted by Station personnel during the fall of 1981 and Spring of 1982, for the purposes of identifying the nearest beef animal, vegetable, garden, milk cow and goat in each of the principal compass sectors.

470.12 Update Section 5.2.4.4 of the Environmental Report (OL) to conform with the information submitted in response to Acceptance Review Question 470.4 and to reflect the latest information available pertaining to the annual production rates (in Kg/yr) for fish and invertebrates.

RESPONSE: See revised Seabrook ER-OLS Section 5.2.4.4, page 5.2-8. The revisions reflect the changes to the total commercial fish and invertebrate harvest within the 50-mile radius of the Seabrook Site as presented in RAI Response 470.4. Although fish and invertebrate harvest values have increased, the 50-mile population dose remains unchanged since fish and invertebrate harvest exceeds consumption. The excess fish and invertebrate harvested are assumed to be consumed by a fraction of the U.S. population. The effect on the total U.S. population dose from both liquid and gaseous effluents as reported in ER-OLS Table 5.2-25 is less than 10%. The revised U.S. population doses are presented in Table RAI 470.12-1.

Revised milk, meat and vegetable production within the 50-mile radius of the site have been presented in RAI response 470.10. The effect of the increased production on the 50-mile population doses is less than 20% of the values reported in ER-OLS Table 5.2-24. The revised U.S. population and 0-50 mile population doses are presented in RAI Table 470.12-1 and Table 470.12-2, respectively. 2

TABLE 470.12-1

U.S. Population Dose From Both Liquid and Gaseous Effluents(1)

	Man-Rem	
	Whole Body	Thyroid
0-50 mile(2)	1.57E+00	2.60E+00
Fish and Invertebrate Ingestion(3)	6.42E-01	
H-3	5.70E-02	---
Kr-85	4.60E-03	---
C-14	2.30E+01	---
Total	2.53E+01	2.60E+00

(1) 100-year dose commitment to U.S. population from one year's liquid and gaseous releases from one unit.

(2) From all radionuclides.

(3) Dose from ingestion of fish and invertebrates caught within 50 miles of Seabrook Station that are ingested outside the 50-mile population area.

TABLE 470.12-2

Population Doses Due to Iodine and Particulate Gaseous Release
Within 50-Mile Radius Per Unit (man-rem/year)

Pathway	Age Group	Whole Body Dose	Thyroid Dose
Ground Plane	Adult	2.42E-02	2.42E-02
	Teen	4.93E-03	4.93E-03
	Child	7.62E-03	7.62E-03
	Infant	5.98E-04	5.98E-04
Inhalation	Adult	4.54E-01	6.98E-01
	Teen	9.42E-02	1.56E-01
	Child	1.32E-01	2.42E-01
	Infant	6.07E-03	1.40E-02
Stored Vegetables	Adult	8.81E-02	1.17E-01
	Teen	2.72E-02	3.65E-02
	Child	8.75E-02	1.16E-01
	Infant	0	0
Cow Milk	Adult	2.80E-02	6.65E-02
	Teen	1.27E-02	3.02E-02
	Child	4.22E-02	9.74E-02
	Infant	1.23E-02	3.27E-02
Meat	Adult	1.06E-02	1.08E-02
	Teen	1.75E-03	1.78E-03
	Child	4.61E-03	4.69E-03
	Infant	0	0
Total		1.04E+00	1.66E+00

EFFECTIVE PAGE LISTING

AMENDMENT HISTORY

PSNH PUBLIC SERVICE
Company of New Hampshire

SEABROOK STATION
Engineering Office:
1671 Worcester Road
Framingham, Massachusetts 01701
(617) - 872 - 8100

July 12, 1982
SBN-292
TF B.7.2.2

United States Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. Frank J. Miraglia, Chief
Licensing Branch No. 3
Division of Licensing

References:

(a) Construction Permit CPPR-135 and CPPR-136, Docket Nos. 50-443 and 50-444

(b) USNRC Letter, dated January 18, 1982, "Request Additional Information - Seabrook Station," F. J. Miraglia to W. C. Tallman

(c) PSNH Letter, dated February 10, 1982, "Submittal of Responses to Requests for Additional Information (RAI), Seabrook Station ER-OLS," J. DeVincentis to F. J. Miraglia

(d) PSNH Letter, dated February 12, 1982, "Submittal of Responses to Requests for Additional Information (RAI), Seabrook Station ER-OLS," J. DeVincentis to F. J. Miraglia

(e) USNRC Letter, dated March 26, 1982, "Request for Additional Information," F. J. Miraglia to W. C. Tallman

(f) PSNH Letter, dated April 1, 1982, "Response to Seabrook ER-OLS RAI 310.15," J. DeVincentis to F. J. Miraglia

Subject: Revision 2 - Seabrook Station ER-OLS

Dear Sir:

Pursuant to the Atomic Energy Act of 1954, the Commission's Rules and Regulations issued thereunder, and the National Environmental Policy Act of 1969, as implemental by 10CFR Part 51, Public Service Company of New Hampshire hereby submits 41 copies of Revision 2 to the Seabrook Station Environmental Report - Operating License Stage.

The following information is included in Revision 2:

i) System description and impact assessment for continuous low-level chlorination of circulating and service water systems.

ii) Responses [References (c), (d), and (f)] to NRC Requests for additional information (RAI) [References (b) and (c)].

iii) Update of various ER-OLS chapters to incorporate information provided in responses to RAI.

iv) Miscellaneous and minor editorial changes.

Respectfully submitted,

YANKEE ATOMIC ELECTRIC COMPANY

Wendell P. Johnson
Vice President

RM/klp

COMMONWEALTH OF MASSACHUSETTS)
)ss
MIDDLESEX COUNTY)

Then personally appeared before me, W. P. Johnson, who, being duly sworn, did state that he is a Vice President of Yankee Atomic Electric Company, that he is duly authorized to execute and file the foregoing request in the name and on the behalf of Public Service Company of New Hampshire and that the statements therein are true to the best of his knowledge and belief.

A. L. Legendre, Jr. Notary Public
My Commission Expires August 5, 1988

A. L. LEGENDRE JR. NOTARY PUBLIC MASSACHUSETTS

INSTRUCTIONS FOR UPDATING SEABROOK STATION ER-OLS

REVISION 2, JUNE 1982

The following tabulated pages, tables and figures are to be inserted either as replacements for existing ER-OLS pages, tables and figures or as new material.

VOLUME 1

Remove Front/Back	Insert Front/Back
2.0-v/2.0-vi	2.0-v/2.0-vi
2.1-1/2.1-2	2.1-1/2.1-2
T2.1-14/T2.1-15 (Sh. 1)	T2.1-14/T2.1-15 (Sh. 1)
T2.1-16 (Sh. 1)/ T2.1-16 (Sh. 2)	T2.1-16 (Sh. 1)/ T2.1-16 (Sh. 2)
T2.1-16 (Sh. 3)/ T2.1-16 (Sh. 4)	T2.1-16 (Sh. 3)/ T2.1-16 (Sh. 4)
T2.1-16 (Sh. 5)/ T2.1-17 (Sh. 1)	T2.1-16 (Sh. 5)/ T2.1-17 (Sh. 1)
T2.1-17 (Sh. 2)/ T2.1-17 (Sh. 3)	T2.1-17 (Sh. 2)/ T2.1-17 (Sh. 3)
T2.1-18/T2.1-19 (Sh. 1)	T2.1-18/T2.1-19 (Sh. 1)
F2.1-3/-	F2.1-3/-
F2.1-5/-	F2.1-5/-
2.4-5/2.5-6	2.4-5/2.4-6
T2.4-3 (Sh. 1)/ T2.4-3 (Sh. 2)	T2.4-3 (Sh. 1)/ T2.4-3 (Sh. 2)
F2.4-3/-	F2.4-3/-
3.0-v/-	3.0-v/-
F3.3-1/-	F3.3-1/-
3.6-1/3.6-2	3.6-1/3.6-2
-	F3.6-1

VOLUME 2

Remove Front/Back	Insert Front/Back
5.0-i/5.0-ii	5.0-i/5.0-ii
5.0-iii/5.0-iv	5.0-iii/5.0-iv
5.0-v/-	5.0-v/-
5.2-7/5.2-8	5.2-7/5.2-8
5.3-1/5.3-2	5.3-1/5.3-2
-	5.3-3/5.3-4
-	5.3-5/5.3-6
-	5.3-7/5.3-8
-	T5.3-1/T5.3-2 (Sh. 1)

VOLUME 2 (Cont'd)

Remove Front/Back	Insert Front/Back
-	T5.3-2 (Sh. 2)/ T5.3-2 (Sh. 3)
-	T5.3-2 (Sh. 4)/ T5.3-2 (Sh. 5)
-	T5.3-2 (Sh. 6)/ T5.3-2 (Sh. 7)
-	T5.3-2 (Sh. 8)/ T5.3-2 (Sh. 9)
-	T5.3-2 (Sh. 10)/ T5.3-2 (Sh. 11)
-	T5.3-3 (Sh. 1)/ T5.3-3 (Sh. 2)
-	F5.3-1/-
8.1-1/8.1-2	8.1-1/8.1-2
10.5-1/-	10.5-1/-

Material to be added behind tab "NRC Requests for Additional Information (RAI)"

Remove Front/Back	Insert Front/Back
R-i/R-ii	R-i/R-ii
R-iii/-	R-iii/-
R-21/R-22	R-21/R-22
-	R-22a/-
R-23/R-24	R-23/R-24
-	F290.6-1/-
-	F290.6-2/-
T291.3-1/T291.3-2	T291.3-1/T291.3-2
R-27/R-28	R-27/R-28
R-31/R-32	R-31/R-31a
-	R-31b/R-31c
-	R-31d/R-31e
-	R-31f/R-31g
-	R-31h/R-31i
-	T291.19-1/ T291.19-2 (Sh. 1)

Remove Front/Back	Insert Front/Back
	VOLUME 2 (Cont'd)
-	T291.19-2 (Sh. 2)/ T291.19-2 (Sh. 3)
-	T291.19-2 (Sh. 4)/ T291.19-2 (Sh. 5)
-	T291.19-2 (Sh. 6)/ T291.19-2 (Sh. 7)
-	T291.19-2 (Sh. 8)/ T291.19-2 (Sh. 9)
-	T291.19-2 (Sh. 10)/ T291.19-2 (Sh. 11)
-	T291.19-3 (Sh. 1)/ T291.19-3 (Sh. 2)
-	F291.19-1/-
-	F291.19-2/-
-	R-31j/R-31k
-	R-31l/R-32
-	R-33/R-34
R-35/R-36	R-35/R-35a
-	R-35b/R-35c
-	T310.6a-1 (Sh. 1)/ T310.6a-1 (Sh. 2)
-	T310.6a-1 (Sh. 3)/ T310.6a-1 (Sh. 4)
-	T310.6a-1 (Sh. 5)/ T310.6a-1 (Sh. 6)
-	R-35d/T310.8-1
-	T310.8-2 (Sh. 1)/ T310.8-2 (Sh. 2)
-	T310.8-2 (Sh.3)/ T310.8-2 (Sh. 4)
-	T310.8-2 (Sh. 5)/ T310.8-2 (Sh. 6)
-	T310.8-2 (Sh. 7)/ T310.8-2 (Sh. 8)
-	T310.8-2 (Sh. 9)/ T310.8-2 (Sh. 10)
-	T310.8-2 (Sh. 11)/ R-35e
-	T310.9-1/R-35f
-	R-35g/R-35h
-	R-35i/R-35j
-	T310.14-1 (Sh. 1)/ T310.14-1 (Sh. 2)
-	T310.14-1 (Sh. 3)/ T310.14-1 (Sh. 4)

Remove Front/Back	Insert Front/Back
	VOLUME 2 (Cont'd)
-	R-35k/R-35l
-	R-35m/R-35n
-	F310.5-1/-
R-37/R-38	R-36/-
R-39/R-40	R-37/R-38
-	R-55/T470.9-1 (Sh. 1)
-	T470.9-1 (Sh. 2)/ T470.9-1 (Sh. 3)
-	T470.9-2 (Sh. 1)/ T470.9-2 (Sh. 2)
-	T470.9-2 (Sh. 3)/ T470.10-1
-	T470.10-2/ T470.10-3
-	R-56/-
-	T470.12-1/T470.12-2

Material to be added behind tab "Amendment History" after Rev. 1 pages: Rev. 2 transmittal letter, followed by updating instructions.