PSNH PUBLIC SERVICE
Company of New Hampshire

SEABROOK STATION
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October 26, 1982
SBN - 347
T.F. - B7.1.2

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 Numbers 50-443 and 50-444
(b) USNRC Letter, dated October 1, 1982, "Request for Additional Information (PSB and EQB)", Janis Kerrigan to W. C. Tallman

Subject: Analysis on Associated Circuits

Dear Sir:

Transmitted herewith is the requested information by Reference (b) on the above subject.

This information is the result of meetings held with PSB representatives on September 10, October 20, and 21, 1982.

Very truly yours,

YANKEE ATOMIC ELECTRIC COMPANY

J. DeVincentis
Project Manager

GTs/JDeV/jl

B001

RAI 430.149

Provide the results of an analysis to prove that any challenges to Class 1E Circuits from associated circuits do not prevent the safe shutdown of the plant.

RESPONSE

A. General

The Seabrook Station complies with the requirements of FSAR Appendix 8A, IEEE 384-1974 and Regulatory Guide 1.75, Rev. 2. These documents describe acceptable methods of complying with IEEE 279-1971 and Criteria 3, 17, and 21 of Appendix A to 10 CFR Part 50 with respect to the physical independence of the circuits and electrical equipment comprising or associated with the Class 1E power system, the protection system, systems actuated or controlled by the protection system, and auxiliary or supporting systems that must be operable for the protection system and the systems it actuates to perform their safety-related functions.

In accordance with the provisions of Section 4.5a and 4.6.2 of FSAR Appendix 8A, Sections 4.5(1) and 4.6.1 of IEEE 384-1974, and Position C4 of Regulatory Guide 1.75, Revision 2, we have elected to associate all the Non-Class 1E circuits with Class 1E circuits. This application of associated circuits allows the plant to be designed with one less separation group; that is, instead of having five separation groups consisting of four safety-related separation groups and one non-safety-related separation group, Seabrook has only four separation groups. The major advantages of this approach are the ability to provide greater separation distances between the groups as well as to reduce the raceway system's exposure to fire.

As a result of this design, all plant circuits are specifically assigned to one of the following four separation groups as noted in Figure 1.

Group A - Train A, Channel I and Train A Associated Circuits
Group B - Train B, Channel II and Train B Associated Circuits
Group C - Channel III
Group D - Channel IV

The great majority of associated circuits are with Group A, a very limited number are with Group B, and none are with Groups C and D.

The circuits that are associated with Train A consist of:

1. Non-Class 1E power, control, and instrument circuits contained within the Nuclear Island.

2. Non-Class 1E power, control, and instrumentation circuits that traverse the Nuclear Island boundary.

3. Non-Class 1E power, control, and instrument circuits outside the Nuclear Island.

The circuits that are associated with Train B consist of:

1. Non-Class 1E power, control, and instrument circuits contained within the Nuclear Island.

2. Non-Class 1E power, control, and instrumentation circuits that traverse the Nuclear Island boundary.

The Nuclear Island boundary is shown in Figure 2. This figure denotes the buildings, structures, duct banks, etc., which are part of the Nuclear Island. All other buildings, structures, etc., are considered to be outside the Nuclear Island.

The following analysis examines the design features and modes of failure of associated circuits of each separation group to determine any interaction and challenges with other separation groups. The overall objective is to assure that the ability to achieve a safe plant shutdown under Design Basis Event (DBE) conditions is not compromised.

B. Train A Associated Circuit Analysis

1. Associated Circuits Contained within the Nuclear Island

Non-Class 1E circuits that remain within the Nuclear Island are permitted to share the same raceway as Train A Class 1E circuits. These circuits are classified as Train A Associated Circuits and are designed and installed to meet all the requirements placed on associated circuits as required by the compliance documents listed earlier.

Challenges to Class 1E circuits, because of failure in an associated circuit, have been examined and determined to have no detrimental effect because:

a. When Class 1E power supplies are utilized, failure of a Non-Class 1E motor, load, or device connected to this power supply will be promptly isolated by operation of Class 1E protective devices.

Non-Class 1E loads connected to Class 1E buses are in all cases protected by Class 1E devices. The breakers protecting Non-Class 1E loads are coordinated such that failure of all Non-Class 1E loads, with proper operation of their own breakers, will not result in tripping of the incoming breaker to the bus.

Further, in the few cases where credit is taken for the incoming bus feeder breaker to provide backup protection to meet Regulatory Guide 1.63, the associated bus is dedicated to Non-Class 1E loads only and therefore will not degrade a Class 1E bus.

b. In cases where Non-Class 1E power supplies, such as switchgear, motor control centers, and distribution panels, are utilized, these are of identical design to the Class 1E counterparts and have been purchased to the same specification requirements inclusive of quality control. Mounting of the Non-Class 1E power supplies within the Nuclear Island is identical to the mounting of their Class 1E counterparts; therefore, credit can be taken for this equipment to function under DBE conditions.

c. All Non-Class 1E protective circuit breakers will be periodically inspected approximately once every five years according to a program developed for the inspection of Non-Class 1E equipment.

Since Class 1E and Non-Class 1E protective devices are identical, any generic degradation such as setpoint drift, manufacturing deficiencies, and material defects will be detected and corrected as a result of the rigorous program performed on the Class 1E protective devices to satisfy the requirements of ANSI N-18.7-1976 and Regulatory Guide 1.63; therefore, credit can be taken for this equipment to function under DBE conditions.

d. The probability of an ensuing fire is minimized because all cables utilized for these associated circuits are specified, designed, manufactured, and installed to the same criteria as Class 1E cables. Factors that have been taken into consideration include flame retardancy, non-propagating and self-extinguishing properties, splicing restrictions, appropriate limitations on raceway fill, appropriate cable derating, and environmental qualifications.

e. Degradation of an associated circuit because of a raceway failure during a DBE, has been eliminated because all electrical raceway systems within the Nuclear Island are seismically analyzed.

f. Other design considerations that contribute to the integrity of these associated circuits are:

- Cables associated with one train are never routed in raceways containing Class 1E or associated cable of another train or channel.

- All cables for instrumentation circuits utilize shielded construction which minimize any unacceptable interaction between Class 1E and associated circuits.

- All circuits entering the reactor containment are provided with protective devices complying with Regulatory Guide 1.63.

Based on the above design features and analysis, we do not consider these associated circuits to pose any challenges to any Class 1E circuits. Therefore, the ability for safe plant shutdown under DBE conditions has not been jeopardized.

2. Train A Associated Circuits That Traverse the Nuclear Island Boundary

For analysis purposes, the associated circuits that traverse the Nuclear Island boundary can be further subdivided into two basic types: (a) those that have their protective device located in the Nuclear Island, and (b) those that have their protective device outside the Nuclear Island. It should be noted that there are a limited number of power cables in these categories.

a. Associated Circuits That Have Protective Device Located in the Nuclear Island

These circuits are also designed and installed to meet all the requirements as outlined in Sections B.1a, b, c, d and f. Though the raceway system outside the Nuclear Island is not seismically analyzed, this is of no concern because the circuit protective devices inside the Nuclear Island are assumed to perform their protective function. It is therefore concluded that the ability for safe plant shutdown under DBE conditions has not been jeopardized by these associated circuits.

b. Associated Circuits That Have Protective Device Outside the Nuclear Island

Non-Class 1E switchgear, motor control centers and distribution panels outside the nuclear island have been purchased to the same specification requirements as their Class 1E counterparts; therefore the probability of failure under DBE conditions is greatly minimized.

These protective devices which are not located in a LOCA environment are identical to Class 1E devices except for seismic requirements. Other design basis events such as pipe break, fire, flood, etc., will not cause failure of the protective device located outside the nuclear island simultaneously with the failure of load which is located in the nuclear island. Hence, credit can be taken for their proper operation.

However, if one postulates their misoperation under a seismic event, such an event is likely to disable the power source itself which is neither seismically qualified.

We conclude, therefore, that these circuits will not degrade Class 1E circuits, since the Non-Class 1E power supply is lost and all Non-Class 1E equipment becomes de-energized.

For the above reasons, the ability for the safe plant shutdown under DBE conditions has not been jeopardized by these circuits.

3. Train A Associated Circuits Outside the Nuclear Island

The design features, analyses, and conclusions listed under Section B.2.b are applicable to all these circuits.

C. Train B Associated Circuit Analysis

1. Associated Circuits Contained Within the Nuclear Island

Non-Class 1E circuits that remain within the Nuclear Island are permitted to share the same raceways as Train B Class 1E circuits. These circuits are classified as Train B Associated Circuits and are designed and installed to meet all the requirements placed on associated circuits as required by the compliance documents listed earlier. Challenges to Class 1E circuits because of failure in an associated circuit will have no detrimental effect because all Train B power supplies utilized by these circuits such as motor control centers, distribution panels, etc., and their protective devices are Class 1E equipment. Failure of a Non-Class 1E motor, load, or device connected to the Class 1E power supply will be promptly isolated by operation of a Class 1E protective device. Therefore utilizing the anlaysis performed for Train A associated circuits we conclude that the ability for the safe plant shutdown under DBE conditions has not been jeopardized by these circuits.

2. Associated Circuits That Traverse the Nuclear Island Boundary

For analysis purposes, the associated circuits that traverse the Nuclear Island boundary can be further subdivided into two basic types: (a) those that have the protective devices located in the Nuclear Island and (b) those that have their protective devices outside the Nuclear Island.

a. Associated Circuits That Have Protective Devices Located in the Nuclear Island

There are very few Train B associated circuits that traverse the Nuclear Island boundary. These circuits are unavoidable either because of plant design constraints, such as the need for interlocks and permissives for the preferred power supply circuits to Train B emergency buses, or because of features provided to improve plant reliability, such as power supply and control for the station service air compressors fed from Train B buses. The portion of these circuits which are outside the Nuclear Island are routed in dedicated embedded or exposed conduits; therefore, the potential of harmful interactions with other associated circuits is minimized.

The design features described in Section C.1 for associated circuits contained within the Nuclear Island are also applicable to these circuits. Though the conduit system outside the Nuclear Island is not seismically analyzed, this is of no concern because the circuit protective devices located in the Nuclear Island are assumed to perform their protective function.

Based on the above, we conclude that the ability for the safe plant shutdown under DBE conditions has not been jeopardized by these few circuits.

b. Associated Circuits That Have Protective Devices Outside the Nuclear Island

The only circuits under this category are the 15 kV cables to the reactor coolant pumps for motor feeders and potential transformers. These interlocked armor cables are routed in embedded conduit outside the Nuclear Island and are in dedicated seismically analyzed raceway systems in the Nuclear Island. Furthermore, the portion of the circuit entering the containment is protected by qualified fuses located in the electrical penetration area which would open the circuit in the event of a failure of a reactor coolant pump.

The 15 kV cables used on these circuits meet all the construction and material requirements placed on the 5 kV Class 1E cables, i.e., flame retardancy, etc., but do not have documented LOCA/MSLB qualifications.

Based on the above design features, we conclude that these circuits do not pose any challenges to Class 1E circuits.

D. Group C and D Circuits

Separation Groups C and D, which are comprised of circuits for Channels III and IV, do not have any associated circuits. Since these channels meet all requirements as defined in the compliance documents listed earlier, these channels are not susceptible to any challenges from any associated circuits; therefore, the ability for the safe plant shutdown under a DBE cannot be jeopardized.

E. Results of Analysis

Based on the above analysis and the fact that the associated circuits for both trains are designed and installed according to the requirements of IEEE 384-1974, FSAR Appendix 8A and Regulatory Guide 1.75, Rev. 2, it is concluded that the reliability of both trains has not been compromised and that under any Design Basis Event the safe shutdown capability of the plant has not been impaired.

CABLE SEPARATION GROUPS

CHANNEL and/or TRAIN	PURPOSE	INSULATION LEVEL	A	B	C	D
	POWER	15000 V	○ ⌊ ⌋	○ ⌊ ⌋		
		5000 V	○ ⌊ ⌋	○ ⌊ ⌋		
		600 V (1)	○ ⌊⌋	○ ⌊⌋		
		600 V (2)	○ ⌊⌋	○ ⌊ ⌋		
		600 V (3)	○ ⌊⌋			
	CONTROL	600 V	○ ⌊⌋	○ ⌊⌋	○ ⌊⌋	○ ⌊⌋
	LOW LEVEL INSTRU.	300 V	○ ⌈⌋	○ ⌈⌋	○ ⌈⌋	○ ⌈⌋
		SPECIAL	○	○	○	○
		CIRCUIT TYPES	TR A CH I A Associated	TR B CH II B Associated	CH III	CH IV
CABLE JACKET COLOR		Class 1E	Red	White	Blue	Yellow
		Associated	Black/Red	Black/White		

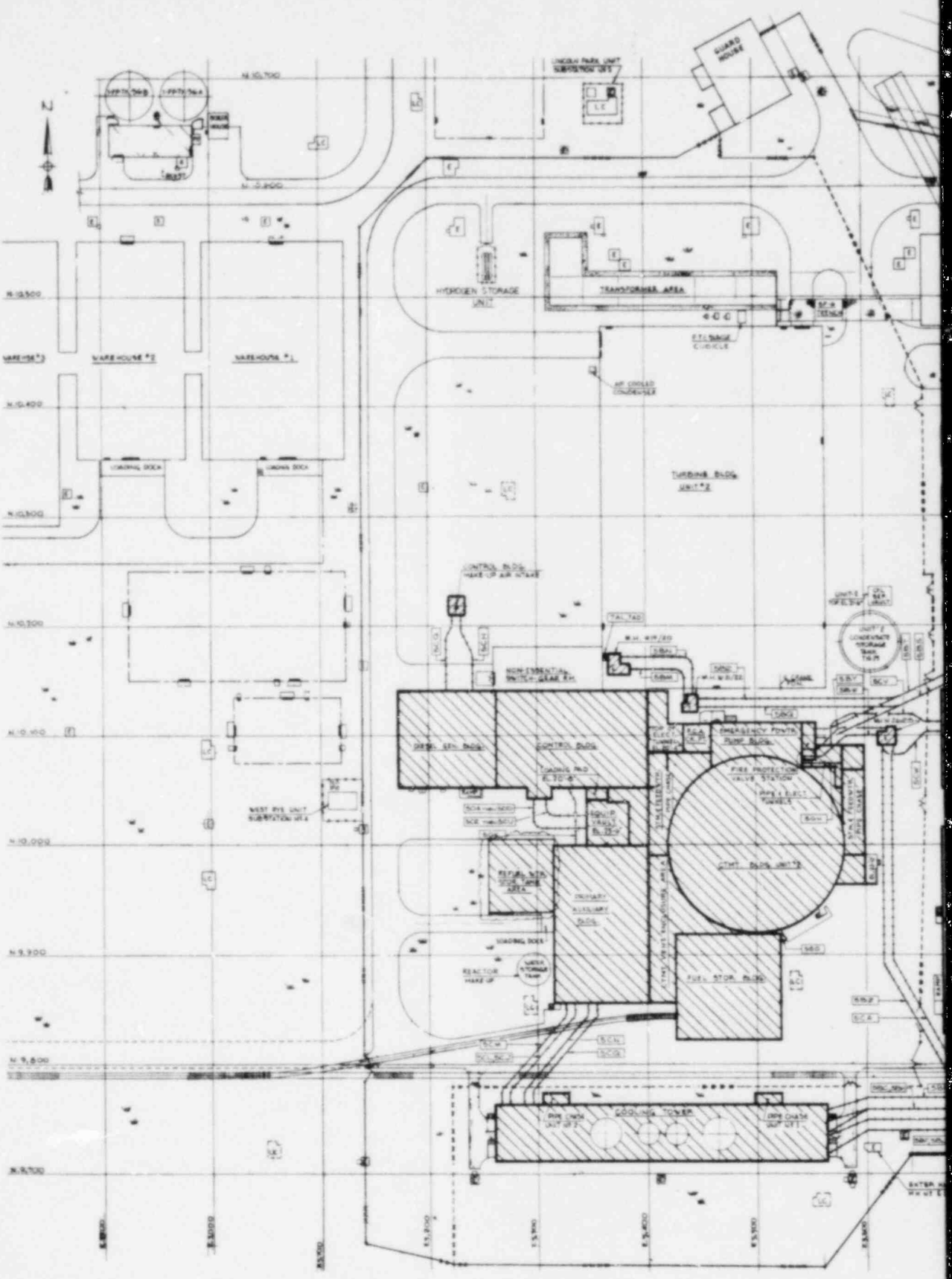
NOTES:

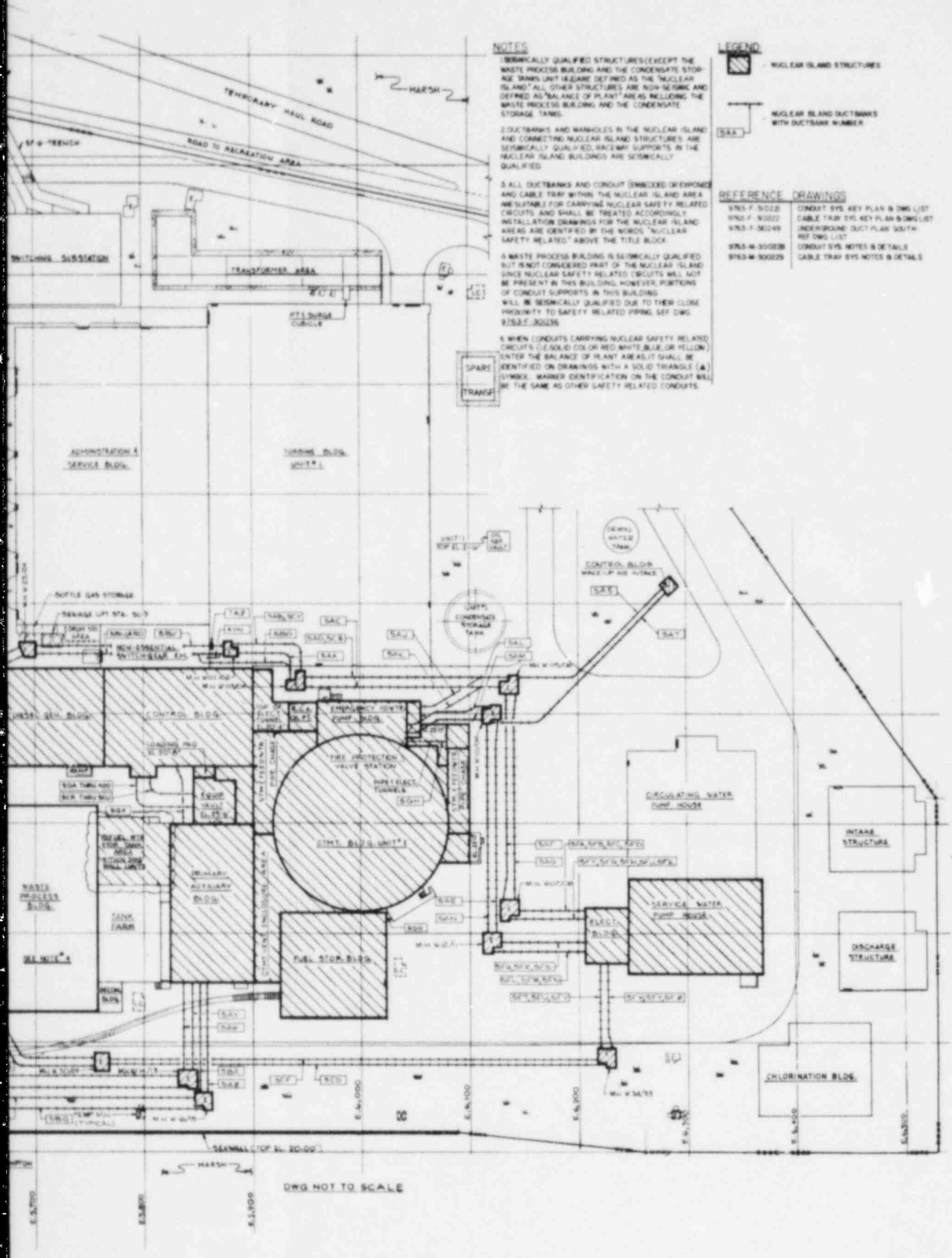
(1) For 480 VAC, 120 VAC & 125 VDC feeders requiring cables 4/0 AWG and larger.

(2) For 480 VAC, 120 VAC & 125 VDC feeders requiring cables 2/0 AWG and smaller.

(3) Reserved for Control Rod Drive power feeders only.

FIGURE 1


GUARD HOUSE
HYDROGEN STORAGE UNIT
TRANSFORMER AREA
TURBINE BLDG. UNIT #2
WAREHOUSE #3
WAREHOUSE #2
WAREHOUSE #1
CONTROL BLDG.
CONTROL BLDG. UNIT #2
FUEL STOR. BLDG.
REACTOR MAKE UP
N 10,700
N 10,500
N 10,400
N 10,300
N 10,100
N 10,000
N 9,900
N 9,800
N 9,700



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION - UNITS 1 & 2	KEY PLAN - NUCLEAR ISLAND AREA ELECTRICAL
	FIGURE 2