QUESTION 040.1

With respect to diesel generator alarms in the control room, a review of malfunction reports of diesel generators at operating nuclear plants has uncovered that in some cases the information available to the control room operator to indicate the operational status of the diesel generator may be imprecise and could lead to misinterpretation. This can be caused by the sharing of a single annunciator station to alarm conditions that render a diesel generator unable to respond to an automatic emergency start signal and to also alarm abnormal, but not disabling, conditions. Another cause can be the use of wording of an annunciator window that does not specifically say that a diesel generator is inoperable (i.e., unable at the time to respond to an automatic emergency start signal) when in fact it is inoperable for that purpose. Therefore:

(1) Provide the alarm and control circuitry logic for the diesel generators at your facility to determine how each condition that renders a diesel generator unable to respond to an automatic emergency start signal is alarmed in the control room. These conditions include not only the trips that lock out the diesel generator start and require manual reset, but also control switch or mode switch positions that block automatic start, loss of control voltage, insufficient starting air pressure or battery voltage, etc. This review should consider all aspects of possible diesel generator operational conditions for example test conditions and operation from local control stations. One area of particular concern is the unreset condition following a manual stop at the location station which terminates a diesel generator test and prior to resetting the diesel generator controls for enabling subsequent automatic operation.

(2) Provide the details of your evaluation including the results, conclusions, and a tabulation of the following information:

   (a) all conditions that render the diesel generator incapable of responding to an automatic emergency start signal for each operating mode as discussed above;

   (b) the wording on the annunciator window in the control room that is alarmed for each of the conditions identified in (a);

   (c) any other alarm signals not included in (a) above that also cause the same annunciator to alarm;

   (d) any condition that renders the diesel generator incapable of responding to an automatic emergency start signal which is not alarmed in the control room; and

   (e) any proposed modifications resulting from this evaluation.

<u>RESPONSE</u>:

Subsection 8.3.1.4.12, Table 8.3-16 and Dwg. E-31, Sh. 9 have been added to the FSAR to supply the requested information.

QUESTION 040.2

The staff requires that the following qualification test program information be provided for all Class 1E equipment:

(1) Identification of Equipment including,

(a) Manufacturer
(b) Manufacturer's type number
(c) Manufacturer's model number

(2) Equipment design specification requirements, including,

(a) The system safety function requirements
(b) An environmental envelope which includes all extreme parameters, both maximum and minimum values, expected to occur during plant shutdown, normal operation, abnormal operation, and any design basis event.
(c) Time required to fulfill its safety function when subjected to any of the extremes of the environmental envelope specified above.

(3) Test plan,
(4) Test set-up,
(5) Test procedures,
(6) Acceptability goals and requirements,
(7) Test results,
(8) Identification of the documents which include and describe the above items.
(9) The information requested above shall be provided for at least one item in each of the following groups of Class 1E equipment.

(a) Switchgear
(b) Motor control centers,
(c) Valve operators (in containment)
(d) Motors
(e) Logic equipment
(f) Cable
(g) Diesel generator control equipment
(h) Sensors
(i) Limit switches
(j) Heaters
(k) Fans
(l) Control boards
(m) Instrument racks and panels
(n) Connectors
(o) Penetrations
(p) Splices
(q) Terminal blocks

(10) In accordance with the requirements of Appendix B of 10 CFR 50, the staff requires a statement verifying: (a) that all Class 1E equipment has been qualified to the program described above, and (b) that the qualification information is available for an NRC audit.

RESPONSE:

The qualification test program information for Class 1E equipment is provided in the Susquehanna SES Environmental Qualification Report For Class 1E Equipment submitted under separate cover.

QUESTION 040.3

The Regulatory staff is currently requesting, of all plants in OL review, information on the use of polyethylene type cable in safety systems. These type cables were found to have degraded considerably after many years of installed operation at the Savannah fuel processing plant.

Identify all safety related cable used in your design that has polyethylene in its construction. Provide the following information for each type of cable identified:

(1) The type of cable by name and catalogue number
(2) The manufacturer
(3) The type of polyethylene used
(4) How is the polyethylene used in the cables' construction, i.e., insulation and/or jacket.
(5) The results of environmental qualification tests performed.

RESPONSE:

I. All NSSS Safety Related cables that utilize polyethylene are listed below with the requested information. It is important to note that these cables are all in the Control Structure environment.

A. 1. Coaxial Cable
5021F1031
7521D3339
7523D3339
2. Raychem
3. Cross-linked polyethylene
4. Jacket and insulation
5. Max. temp: 80°C
Radiation Resistance: 200 megarads
Flammability: FED-STD-228

B. 1. Multi Conductor Cable (SI-58779
2. General Electric
3. Vulkene - Cross-linked polyethylene
4. Insulation
5. Max. temp: 90°C
Flammability: Cable qualified to IPCEA S-19-81

C. 1. Multi Conductor
C51-0070
C51-0190
C53-0070
C53-0190

2. Rockbestos Firewall III
3. Cross-linked flame resistant polyethylene
4. Insulation
5. Max. temp: 90°C
   Flammability: Completed cable qualified to IEEE 383 part 2.5. Oxygen index of jacket and insulation material in cable is a minimum of 28%.

II. All non-NSSS supplied safety related cables that utilize polyethylene are listed below. The only polyethylene used is Hypalon. The manufacturer, the use and the test reports are also listed.

A. Instrumentation Cable

1. Instrumentation Cable Mfrs. Part No.

   1935-A0536-001
   1935-A0936-001
   1935-A4836-001
   1935-01233-001
   1935-02733-001
   1935-50433-001
   1935-60733-002
   1935-60933-001
   1935-61233-001
   1935-61433-001
   1935-63733-001
   1952-65380-001
   1952-68340-002
   1962-08340-001
   1962-68340-002
   1974-50233-001
   1974-50333-001
   1974-50733-001
   1974-50733-001
   1984-50333-001

   Thermocouple Extension Cable Mfrs. Part No.

   1902-01340-001
   1902-02340-001
   1902-03340-001
   1902-65340-001
   1920-01281-002
   1924-612A3-001

   Communication Cable Mfrs. Part No.

   1950-48610-001
   1950-88310-001
   1990-90038
   1990-90039

   Rod Position Indication Cable Mfrs. Part No.

   1990-90036

2. Samuel Moore & Co.

3. Hypalon (chlorosulfonated polyethylene)

4. Jacket

5. Certified by Isomedix, Inc. (Report dated May 1976) to qualify in accordance with IEEE 323-1974 and IEEE 383-1974, V/P 8856-E131-A-35-2.

B. <u>600 Volt Control Cable</u>

1. 600 volt, single-conductor and multi-conductor copper control cable. No catalog numbers available.

2. American Insulated Wire Co.

3. Hypalon (chlorosulforated polyethylene)

4. Jacket

5. Certified by the Franklin Institute (Report F-C4197-2, dated December 1975) to meet requirements of IEEE 323-1974 and IEEE 383-1974, V/P 8856-E130-A-10-1.

C. <u>600 Volt Power Cable</u>

1. 600 volt, single-conductor Aluminum power cable. No catalog Numbers Available.

2. The Okonite Company

3. Hypalon (Chlorosulfonated polyethylene)

4. Jacket

5. Certified by the Franklin Institute (Report No. F-63694-1, dated November 8, 1974) to meet requirements of IEEE 383-1974, V/P 8856-E130-B-5-2.

III. Safety-related cables used for the multi-pin quick disconnect connectors of motor-operated valves which utilize polyethylene are listed below.

A. 600 Volt Power, Control and Instrumentation Cables

1a. Power Cable: 3-conductor

<u>Mfrs. Product Code</u>

C51-0030
P62-0064
P62-0024

1b. Control Cable: multi-conductor

<u>Mfrs. Product Code</u>

C53-0020
C53-0030
C53-0050
C53-0070
C53-0120

1c. Instrumentation Cable: 1 pair, shielded

<u>Mfrs. Product Code</u>

I46 - 0021

2. Rockbestos

3,4. Chlorosulfonated Polyethylene (Hypalon) - Jacket

Cross-Linked Polyethylene - Insulation

5. Certified by Rockbestos qualification test reports QR-5804 and QR-5805 to meet requirements of IEEE 323-1974 and IEEE 383-1974.

QUESTION 040.4

Qualification of Penetrations

Describe how your design meets the recommendations of Regulatory Guide 1.63, Revision 1.

Identify each type of electrical circuit that penetrates containment. Describe the primary and backup over current protection systems provided for each type of circuit. Describe the fault-current-versus-time for which the primary and backup protection systems and the penetrations are designed and qualified.

Provide coordinated curves which demonstrate, for each circuit identified, that the maximum fault-current-versus-time condition to which the penetration and cable were qualified will not be exceeded.

Describe the provision for periodic testing under simulated fault conditions.

RESPONSE:

The discussion of Regulatory Guide 1.63 in FSAR Section 3.13 has been revised to include this information.

QUESTION 040.5

Potential Problem with Containment Electrical Penetration Assemblies

Recent operating experience at Millstone Unit No. 2 has shown that the deterioration of the epoxy insulation between splices has caused electrical shorts between conductors within a containment electrical penetration assembly. Indicate what tests and/or analysis that have been performed to demonstrate the acceptability of the design in this regard. Provide whatever information is required to perform an independent evaluation of this aspect of the electrical penetration design.

RESPONSE:

Susquehanna SES electrical cable penetrations are not subject to the same problems Millstone has experienced because Millstone's electrical cable penetrations were manufactured by General Electric while those at Susquehanna SES are of a different design and are manufactured by Westinghouse.

Westinghouse Report #75-7B5-BIGAL-R2 demonstrates by test and Arrhenius plotting that the epoxy used in the modular penetrations has an expected life of 40 years. The Westinghouse design has a coat of varnish on the conductor in the monitoring space. The cables have successfully passed the dialectric test as performed in accordance with Westinghouse Report #PEN-TR-76-07.

QUESTION 040.6

Recent operating experience has shown that adverse effects on the safety-related power system and safety related equipment and loads can be caused by sustained low or high grid voltage conditions. We therefore require that your design of the safety related electrical system meet the following staff positions. Supplement the description of your design in the FSAR to show how it meets these positions or provide appropriate analyses to justify non-conformance with these positions.

(1) We require that an additional level of voltage protection for the onsite power system be provided and that this additional level of voltage protection shall satisfy the following criteria:

 (a) The selection of voltage and time set points shall be determined from an analysis of the voltage requirements of the safety-related loads at all onsite system distribution levels;

 (b) The voltage protection shall include coincidence logic on a per bus basis to preclude spurious trips of the offsite power source;

 (c) The time delay selected shall be based on the following conditions:

  (i) The allowable time delay, including margin, shall not exceed the maximum time delay that is assumed in the FSAR accident analyses;

  (ii) The time delay shall minimize the effect of short-duration disturbances from reducing the availability of the offsite power source(s); and

  (iii) The allowable time duration of a degraded voltage condition at all distribution system levels shall not result in failure of safety systems or components;

   1) The voltage sensors shall automatically initiate the disconnection of offsite power sources whenever the voltage set point and time delay limits have been exceeded;

   2) The voltage sensors shall be designed to satisfy the applicable requirements of IEEE Std. 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations"; and

   3) The Technical Specifications shall include limiting condition for operation, surveillance requirements, trip set points with minimum and maximum limits, and allowable values for the second-level voltage protection sensors and associated time delay devices.

(2) We require that the current system designs automatically prevent load shedding of the emergency buses once the onsite sources are supplying power to all sequenced loads on the emergency buses. The design shall also include the capability of the load shedding feature to be automatically reinstated if the onsite source supply breakers are

tripped. The automatic bypass and reinstatement feature shall be verified during the periodic testing identified in Position 3.

In the event an adequate basis can be provided for retaining the load shed feature when loads are energized by the onsite power system, we will require that the setpoint value in the Technical Specifications, which is currently specific as "...equal to or greater than..." be amended to specify a value having maximum and minimum limits. Your bases for the selected setpoints and limits must be documented.

(3) We require that the Technical Specifications include a test requirement to demonstrate the full functional operability and independence of the onsite power sources at least once per 18 months during shutdown. The Technical Specifications shall include a requirement for tests: (1) simulating loss of offsite power; (2) simulating loss of offsite power in conjunction with a safety feature actuation signal; and (3) simulating interruption and subsequent reconnection of onsite power sources to their respective buses. Proper operation shall be determined by:

(a) Verifying that on loss of offsite power the emergency buses have been de-energized and that the loads have been shed from the emergency buses in accordance with design requirements.

(b) Verifying that on loss of offsite power the diesel generators start on the autostart signal, the emergency buses are energized with permanently connected loads, the auto-connected shutdown loads are energized through the load sequencer, and the system operates for five minutes while the generators are loaded with the shutdown loads.

(c) Verifying that on a safety feature's actuation signal (without loss of offsite power), the diesel generators start on the autostart signal and operate on standby for five minutes.

(d) Verifying that on loss of offsite power in conjunction with a safety features actuation signal the diesel generators start on the autostart signal, the emergency buses are energized with permanently connected loads, the auto-connected emergency (accident) loads are energized through the load sequencer, and the system operates for five minutes while the generators are loaded with the emergency loads.

(e) Verifying that on interruption of the onsite sources the loads are shed from the emergency buses in accordance with design requirements and that subsequent loading of the onsite sources is through the load sequencer.

(4) The voltage levels at the safety-related buses should be optimized for the full load and minimum load conditions that are expected throughout the anticipated range of voltage variations of the offsite power source by appropriate adjustment of the voltage tap settings of the intervening transformers. We require that the adequacy of the design in this regard be verified by actual measurement and by correlation of measured values with analysis results. Provide a description of the method for making this verification; before initial reactor power operation, provide the documentation required to establish that this verification has been accomplished.

RESPONSE:

I. Refer to Dwg. E-1, Sh. 1, E-4, Sh. 2, E-5, Sh. 1, and E-31, Sh. 5 for the discussion on undervoltage detection and transfer logic provided below:

The primary bus transfer on loss of offsite power is initiated at the 13.8 kV startup switchgear and at each Class 1E 4.16kV switchgear bus aligned to the lost offsite source. Refer to Subsection 8.3 for discussion on bus arrangement and the interconnection of the offsite power supplies and the on-site distribution system.

1. Each 13.8 kV startup bus is provided with an offsite power supply and the capability of connecting to the second offsite power supply by the closing of the 13.8 kV tie breaker (breaker 52-10502).

   The undervoltage detection system at each 13.8 kV switchgear bus consists of (1) incoming feeder (offsite power supply) undervoltage relays-device 27AI, (2) bus undervoltage relay-device 27A2, and (3) tie bus undervoltage relay-device 27A1.

   (a) Device 27AI-initiates tripping of the incoming feeder

   Device 27AI is a solid state type relay with pickup setting at 76.2 volts (66% of the rated 120 volts). Two independent single phase relays are used to monitor the A-B and B-C phase voltages. The incoming breaker is tripped on coincidence logic of the two undervoltage relays at 74 volts with a 30 cycle time delay.

   (b) Device 27A1 - Provides the permissive for closing of tie breaker

   Device 27A1 is a long time induction disc type undervoltage relay set at 105 volts (91% of rated) and time delay of 15 sec. Two single phase relay are provided for monitoring the availability of the alternate offsite power supply at the 13.8 kV level and provide a coincidence logic for the closing of the tie breaker.

   (c) Device 27A2 - initiates the bus transfer

   Device 27A2 is a 3 phase instantaneous plunger type relay with three full wave bridge rectifiers. The relay is set to drop out at 25 volt (22% of rated). Bus transfer is completed by the closing of the tie breaker (permissive by device 27A1).

2. Each 4.16 kV class 1E switchgear bus is provided with a preferred and an alternate (offsite) power supply and one diesel generator feeder as discussed in Subsection 8.3.1.3.

   The undervoltage detection and backup bus transfer on loss of offsite power or sustained degraded voltage on the bus is provided by (1) incoming feeder undervoltage relay-device 27AI, and (2) bus undervoltage relay-device 27A, and (3) degraded voltage protection relays devices 27B1, 27B2, 27B3, and 27B4.

The devices settings for the Class 1E bus undervoltage protection are summarized in the following Table 40.6-1.

(a) Device 27AI - provides the permissive for closing of the incoming breaker

Device 27AI is two single phase definite time delay relays set at 96.5% dropout voltage. These relays are used to monitor the availability of the offsite power supply at the class 1E 4.16 kV level.

(b) Device 27A - initiates the bus transfer

Device 27A is a 3 phase solid state type relay with three full wave rectifiers. The relay is set to drop out at 24 volts or 20% of rated bus voltage. The 4.16 kV bus transfer is initiated with a time delay of 10 cycles by tripping of the preferred incoming feeder breaker. The transfer is completed if the alternate offsite power supply to this 4.16 kV bus is available (permissive by device 27AI). In case the alternate offsite power is not available, the standby diesel generator is initiated to start with a 0.5 second delay.

(c) Devices 27B1, 27B2, 27B3, and 27B4 - initiate bus transfer and undervoltage alarm. These undervoltage relays are solid-state, single phase with definite time delays

The additional level voltage protection for each 4.16 kV Class 1E bus is provided to assure that voltage levels at all Class 1E distribution buses meet the minimum requirement of all safety-related equipment to the extent practical.

In the event of loss of voltage on the 4.16 kV Class 1E bus, the bus undervoltage relay (27A) initiates bus transfer per paragraph (b) above. In addition, relays 27B1, 27B2, 27B3, and 27B4 provide back up protection for alarms and initiating bus transfer.

If a degraded voltage condition occurs on the 4.16 kV Class 1E bus with no LOCA signal present (see Dwg. E-31, Sh. 5) which is below the setting of relays 27B1 and 27B2, an alarm (coincidence logic) will be initiated after 10 seconds. The relays will initiate the bus transfer after a 5 minute time delay during non-LOCA conditions. A LOCA signal bypasses the 5 minute time delay. The 10 second time delay is provided to preclude spurious alarms and trips for motor start transients. The 5 minute timer is provided so that operators can initiate corrective actions during non-LOCA conditions. Relays 27B1 and 27B2 initiate an alarm when the diesel generator is supplying power but do not trip the diesel generator breaker.

In addition, relays 27B3 and 27B4 trip the offsite supply breakers after a time delay of 3 seconds when the bus voltage falls below their settings. These two relays are also connected in a coincident logic. Their setting is based on coordination with overcurrent relays to prevent false trips due to transient voltage dips from fault currents. These relays have no function when the diesel generator is supplying bus power.

If the alternate offsite power is not available, the emergency diesel generator will be started automatically with a 0.5 second delay and connected to the respective bus within 10 seconds per section 8.3.1.4.1.

II. 1. Selection of all voltage relay settings is based on the onsite distribution system load flow study and is verified by preoperational tests. The continuous operating voltage at each distribution voltage level is maintained at ±10% of the rated voltage level over the entire transmission grid operating range.

Tripping of the offsite power supply at the 13.8 kV level is accomplished by a coincidence logic of two independent single phase undervoltage relays. The backup tripping of the same offsite power supply to the Class 1E 4.16 kV switchgear is provided by a 3 phase full wave rectifier type undervoltage relay for minimizing nuisance tripping such as loss of a single control fuse in the detection circuit. The total time delay allowed by restarting (starting) of class 1E equipment after a DBA is 13 seconds as shown on Table 8.3-1. 10 seconds is reserved for diesel generator starting. Therefore, 3 seconds is allocated for voltage sensing and bus transfer. Pre-operating tests will verify that the time delay on the bus transfer does not exceed the allowable time.

As discussed in (I) of above, offsite power supply is automatically disconnected at the 13.8 kV level. This forces a loss of power to the 4 kV buses connected to the offsite supply and a 4 kV transfer to the alternate offsite supply, if available, or to the diesel generators. The undervoltage detection sensors and circuits are designed in accordance with IEEE Std. 279-1971.

2. All loads on each 4.16 kV Class 1E switchgear bus except the 480 volt load center feeder are shed on loss of power to the bus. Once the bus is re-energized, the 4.16 kV Class 1E loads are loaded in accordance with the pre-set time delay. Load shedding and reloading of 4.16 kV class 1E loads are repeated as discussed above whenever the bus becomes de-energized.

3. Refer to Chapter 16 for Technical Specification.

4. Transformer tap settings are selected for optional operating voltage levels for all loading conditions under the anticipated voltage variation of the offsite power supplies. The continuous operating voltage at each level is maintained within ±10% of rated voltage. Pre-operational tests verify the actual voltage levels.

III. Relay Settings:

The function and settings of undervoltage relays are determined in consideration of the full load, minimum load, and the largest motor starting conditions that are expected throughout the anticipated range of voltage variations for the offsite power sources.

The settings of the degraded voltage protection relays are selected to prevent spurious trips of the offsite power supplies and to provide protection against damaging effects of degraded voltage. The settings are constrained by motor start transients and relay characteristics.

The following design criteria are used:

(1) The maximum allowable voltage at no load or the minimum load conditions is 110% of the motor rated voltage.

(2) The minimum voltage under the maximum running load condition is 90% of the bus rated voltage.

(3) The minimum starting voltage is 80% of motor rated voltage.

See Table 40.6-1.

TABLE 040.6-1

SETTING TABLE (4 KV BUS)

Device No.	Function	Alarm	Voltage Setting	Time Setting
27AI (preferred)	Permissive to close the preferred power incoming Breaker.	Yes	96.5% dropout	1 sec.
27AI (alternate)	Permissive to close the alternate incoming Breaker.	Yes	96.5% dropout	1 sec.
27A	Initiate bus transfer. Trip the incoming closed breaker.	Yes	20%	10 cycles
59/27	Bus over/under voltage (alarm only and located in load center).	Yes	110%/90%	10 sec.
27B1 27B2	Undervoltage alarm and initiate bus transfer with time delay relays.	Yes	93% dropout	10 sec.
27B1X 27B2X	Time delay relays with 27B1 and 27B2 to initiate bus transfer.	No	--	5 min.
27B3 27B4	Initiate bus transfer on LOCA condition.	No	65% dropout	3 sec.

QUESTION 040.7

Provide in Section 9.5.4 the means for indicating, controlling and monitoring the emergency diesel engine fuel oil temperature (SRP 9.5.4, Part III, Item 1).

RESPONSE

This information is contained in revised FSAR Subsection 9.5.4.5.

QUESTION 040.8

Section 9.5.4 of the FSAR does not locate the day tank associated with each diesel generator set. Provide the location of the fuel oil day tank. The day tank should be located at an elevation to assure a positive pressure at the engine fuel pumps. (SRP 9.5.4., Part III, Item 5c.)

RESPONSE:

The requested information is contained in revised FSAR Subsection 9.5.4.2.

QUESTION 040.9

The diesel engine generator sets should be capable of operation at less than full load for extended periods without degradation of performance or reliability. Provide a discussion of your diesel engine operating parameters, including minimum load requirements, and relate this to anticipated minimum loads under accident recover conditions and during accident standby operation when offsite power is available (SRP 9.5.5, Part III, Item 7).

RESPONSE:

Please see revised Subsection 8.3.1.4.

QUESTION 040.10

Provide a discussion of the measures taken in the design of the standby diesel generator air starting system to preclude the fouling of the starting air valve of filter with containment such as oil carry over and rust. (SRP 9.5.6, Part III, Item 1).

RESPONSE:

This discussion is contained in revised FSAR Subsection 9.5.6.2.

QUESTION 040.11

In regard to the diesel engine combustion air intake and exhaust system, discuss the precautionary measures taken to assure that the oxygen content of the incoming combustion air will not under any meteorological and accident conditions be diluted to an extent as to prevent the diesel from developing full rated power or causing engine shutdown. Include in the discussion the potential of fire extinguishing (gaseous) medium, recirculation of diesel combustion products, accidental releases of gases stored in the vicinity of the diesel intakes, restriction of inlet airflow, and air borne dust being drawn into the combustion air system of one or all diesel generators, thereby degrading their performance or possibly result in loss of emergency generator and loss of emergency power supply. (SRP 9.5.8, Part III, Item 3, 4, 5 and 6).

RESPONSE:

The required discussion is contained in revised FSAR Subsection 9.5.8.3.

QUESTION 040.12

Section 9.5.8 of the FSAR states that the diesel generator combustion air intake and exhaust systems are missile protected. Provide further description (with the aid of drawings) explaining how the openings in the diesel generator building for the air intake and exhaust are protected from tornado borne missiles.

RESPONSE:

Missile protection for the diesel generator combustion air intake and exhaust system are described in revised FSAR Subsection 9.5.8.3.

QUESTION 040.13

Provide a general discussion of the criteria and bases of the various steam and condensate instrumentation systems in Section 10.1 of the FSAR. The FSAR should differentiate between normal operation instrumentation and required safety instrumentation.

RESPONSE:

The various steam and condensate instrumentation systems used for normal operation are described in Section 10.4. See Subsections 10.4.1.5, 10.4.2.5, 10.4.3.5, etc. However, Section 7.2 describes specific instrumentation (turbine stop valve and turbine control valve closures) which are inputs to the RPS. These inputs, provided to meet safety related requirements, monitor and initiate protective actions. See Subsections 7.2.1.1.4.2, (d) and (e).

Display instrumentation for steam and power conversion systems is adapted to the ACR Operator Interface configuration described in Section 7.5. Specifically, this means that steam, condensate, feedwater and turbine generator systems display instrumentation each occupy a section of Unit Operating Benchboard (C651) or the Standby Information Panel (C652). Controls, hardwired displays and computer generated displays are located by system on these panels.

As described in Section 7.5, the basis of operation of these displays is that detailed system information is provided to computer displays and hardwired displays in parallel. The exception to this is the Standard General Electric, Mark I EHC instrumentation package which is provided and adapted to the ACR panel arrangement and does not have parallel information on the computer displays.

QUESTION 040.14

Discuss what protection will be provided the turbine overspeed control system equipment and associated electrical wiring and hydraulic lines from the effects of a high or moderate energy pipe failure so that the turbine overspeed protection system will not be damaged to preclude its safety function. (SRP 10.2, Part III, Item 8).

RESPONSE:

The turbine overspeed control system equipment and associated electrical wiring and hydraulic lines are not part of a safety related system and are therefore not subject to the requirements of SRP 10.2, Part III, Item 8. The overspeed equipment on Susquehanna SES does meet the applicable requirements of SRP 10.2. Susquehanna SES has an electro-hydraulic control system, a mechanical overspeed trip device and an independent and redundant backup electrical overspeed trip circuit as described in Subsection 10.2.2.6. In addition, the equipment and components related to the overspeed trip function would fail-safe if damaged by accident as described in Subsection 10.2.2.6. Finally, the equipment and components associated with the overspeed trip function have been so arranged as to minimize damage potential from accidents such as high or moderate energy pipe failures.

QUESTION 040.15

Provide your bases and justification for performing the grid transient stability studies using the 1980 50% of summer peak loads. Also provide a brief description of your operating philosophy with respect to Susquehanna Units 1 and 2 during light grid loading conditions and your projections of generation verses load for as far into the future as you have available and use for planning purposes.

RESPONSE:

The grid transient stability studies were performed on both the 1980 and 1982 systems. The studies were performed using the summer light load level (50% of summer peak loads) for both 1980 and 1982.

Under system light load conditions the electric supply system is characterized by decreased customer loads, lower voltage schedules, and reduced reactive output from generators. These conditions tend to make an electric supply system inherently less stable. Lower voltage levels and reduced generator reactive output are desirable under light load conditions to maintain balanced reactive conditions on the electric supply system.

To verify that light load conditions and not peak load conditions will present the worst case for system stability, a comparison of the relative system stability for summer light load (50% of summer peak) and system peak load (winter peak) conditions was performed. It was determined that the system is less stable under summer light load conditions and that the grid stability evaluation should be performed using the summer light load condition.

It is expected that under light load conditions Susquehanna Unit #1 and Unit #2 will continue to operate at rated continuous output of 1050 MW for each unit. The scheduled voltages on the Susquehanna 230 kV and 500 kV busses, which are regulated by the reactive output of Susquehanna Unit #1 and Unit #2 respectively will be lowered from the peak load voltage schedule values. The specific light load voltage schedules for the Susquehanna 230 kV and 500 kV busses will be set high enough to maintain system transient stability but low enough to aid in maintaining reactive balance on the system under light load conditions. The electric supply system is operated so that generating stations on the bulk power system are not exposed to voltage drops in excess of 10% from the scheduled voltage upon the occurrence of a normal contingency.

PP&L's most recent load projections (through the year 1990) were provided in PP&L's response to the first round of NRC questions on the Environmental Report - Operating License Stage (Question 11). The only post Susquehanna generation addition projected through 1990 is 63 MW of additional capacity at the Safe Harbor Hydroelectric Station. The Safe Harbor expansion (PP&L share 63 C) is projected to be effective in September 1985. This date is dependent on FERC approval of the Safe Harbor Water Power Corporation license application submitted April 1977.

QUESTION 040.16

Provide the approximate loading ($\pm$5 MVA) of the auxiliary and startup transformers at full unit power output assuming normal bus alignments as shown on Figure 8.3-1 of the FSAR. Identify the power sources for the forced cooling provided for these transformers.

RESPONSE:

The maximum loading of the unit auxiliary transformer at full unit power output is estimated at approximately 49 MVA.

The unit auxiliary transformer is provided with forced-oil-forced-air cooling equipment fed by two separate 480 volt, 3ϕ power supplies. One supply is designated as normal supply, and it is fed from a unit auxiliary 480 volt motor control center (MCC) 1B101 (2B101 for Unit 2). The other supply is designated as an alternate supply which is fed from another unit auxiliary motor control center 1B111 (2B111 for Unit 2). Loss of power is alarmed at the local transformer auxiliary cabinet when then retransmits a trouble alarm to the main control room. A local manual transfer switch is provided for transforming to the alternate supply in case the normal supply is lost.

The maximum loading of each startup transformer at full unit power output under the worst climate condition (worst HVAC loading condition) is estimated to be approximately 13 MVA.

Each startup transformer is provided with a forced-oil-forced-air cooling system similar to that of the unit auxiliary transformer. The normal and alternate power supplies for startup transformer 10 (OX103) are fed from MCC 1B101 and 1B111 respectively. Likewise, the normal and alternate power supplies for startup transformer 20 (OX104) are fed from MCC 2B101 and 2B111 respectively.

QUESTION 040.17

Provide note 4 for FSAR Figure 8.3-1 and describe the role of the Unit 1 main transformer circuit breaker.

RESPONSE:

Refer to Subsection 8.2.1.3.2 and Dwg. E-1, Sh. 1 for this information.

QUESTION 040.18

Describe the interlocking circuit that prevents automatic transfer of the startup busses to the alternate startup transformer when the unit auxiliary transformer is the source of power.

RESPONSE:

Subsection 8.3.1.2.1 has been revised to include this information.

QUESTION 040.19

For an offsite power system event that directly or indirectly removes the 500-230 kV switchyard bus tie, describe the provisions of the design of the onsite power system to prevent the typing together of the two offsite grids through the onsite power distribution system.

RESPONSE:

For response refer to revised Subsection 8.3.1.2.1.

QUESTION 040.20

It appears from your description in Section 8.3.1.3.10 that the emergency loads are sequenced with offsite preferred power available.

If this is true, provide your bases and justification. Provide a comparison on a bus by bus basis for all emergency busses of the voltage and motor starting transients associated with sequenced versus instantaneous loading for the condition of grid voltage at the low end of its normal range and maximum plant auxiliary load.

Provide a description of what would be required to remove this nonstandard design feature from your design and the associated safety implications, if any.

RESPONSE:

For information refer to revised Subsection 8.3.1.3.10, revised Table 8.3-1, and Table 8.3-1b.

QUESTION 040.21

FSAR Section 8.3.1.3.2 states that the 4 kV power feeder cables and the larger 480 volt cables are aluminum conductor. Provide a discussion as to how you will deal with any dissimilar metals interface problems.

RESPONSE:

Subsection 8.3.1.3.2 has been revised to include this information.

QUESTION 040.22

Describe the provisions of your design that alerts the Unit 1 and 2 control room operators as to which unit is supplying DC control power to each of the shared diesel generators.

RESPONSE:

Subsection 8.3.1.4 has been revised to include this information.

QUESTION 040.23

With respect to the acceptability of the use of swing busses as part of the LPCI system of BWR-4 plants, the staff has documented its position in NUREG 0138 Issue #3.

The staff position is that for those plants that can meet all Appendix K to 10 CFR Part 50 requirements assuming the total loss of LPCI system, the swing bus is an acceptable concept and the design is scrutinized during the review. For those plants that need some portion of the LPCI system in order to meet Appendix K requirements, the staff has required a redesign of this portion of the system. Please provide a discussion of how Susquehanna meets this position or provide the bases and justification for any noncompliance.

RESPONSE:

The response to this question is provided in revised Subsection 8.3.1.3.5.

QUESTION 040.24

Provide a detailed description of all of the various circuit isolation schemes used in your design and referenced in Section 8.1.6.1 (Regulatory Guide 1.75 (1/75), Part 2).

RESPONSE:

These descriptions are provided in Section 8.1.6.1 (Regulatory Guide 1.75 (1/75), Part 2).

QUESTION 040.25

It appears that diesel generator sequencing capability is based upon the assumption of simultaneous sequencer initiation on both safety busses fed by each generator. The assumption further being that one unit has a LOCA and the other goes to a shutdown condition. It is not clear from the limited description provided in the FSAR that this is truly the design basis nor that this is a conservative assumption. Provide a detailed description of this aspect of your design. This description should also address the following contingencies:

(1) The two safety busses for a given diesel might not be fed from the same startup transformers. This greatly increases the probability of a single failure causing the diesel generator to initially energize only one safety bus. Subsequent loss of offsite power would cause the second safety bus to initiate sequencing out of time phase with the first sequencer.

(2) A spurious accident signal in the second unit.

RESPONSE:

For information refer to revised Subsection 8.3.1.3.10, revised Table 8.3-1, and Table 8.3-1b.

QUESTION 040.26

Provide a listing of all motor operated valves within your design that require power lock out in order to meet the single failure criterion and provide the details of your design that accomplish this requirement.

RESPONSE:

There are no MOV's in Susquehanna SES which require electric power lockout in order to meet the single failure criterion as described in BTP EICSB 18.

QUESTION 040.27

Provide a description of the capability of the emergency power system battery chargers to properly function and remain stable upon the disconnection of the battery. Include in the description any foreseen modes of operation that would require battery disconnection such as when applying an equalizing charge.

RESPONSE:

See revised Subsection 8.3.2.1.1.4 for the requested discussion.

QUESTION 040.28

Provide the details of your design of the DC power system that assures equipment will be protected from damaging overvoltages from the battery chargers that may occur due to faulty regulation or operator error.

RESPONSE:

For this information see revised Subsection 8.3.2.

QUESTION 040.29

Provide the results of a review of your operating, maintenance, and testing procedures to determine the extent of usage of jumpers or other temporary forms of bypassing functions for operating, testing, or maintaining of safety related systems. Identify and justify any cases where the use of the above methods cannot be avoided. Provide the criteria for any use of jumpers for testing.

RESPONSE:

Commencing with the start of fuel load in the reactor, proceeding through power level testing and encompassing normal operations throughout the plant life, plant operations will be controlled under the plant administrative program. At the present time essentially all plant procedures are in preparation or in draft form. Their being incomplete means it is not currently possible to identify specific instances where use of temporary bypass measures would be required by operating, maintenance, or testing procedures. As currently envisioned, required usage of such bypasses will be limited to a small number of testing procedures for actions such as defeating interlock functions not being tested (to limit scope of testing) and providing simulated actuation signals.

Procedures requiring such a temporary modification to a safety-related system shall be prepared in accordance with AD-00-001, "Procedure Program," which stipulates PORC review prior to implementation. Control of placement and removal of these bypasses will either be provided directly by the procedure (requiring positive control of installation and removal) or will be controlled by shift supervision through adherence to AD-00-042, "Control of Temporary Modifications." The only exceptions to the above methods of control will be tests in the Start-up Test Program during the initial power ascension. Procedures in this program which would require a temporary modification to a safety-related system will also receive PORC review as stated in FSAR section 14.2.2.3. Such modifications will only be utilized to permit testing described in the FSAR test abstracts and they will have positive control of both installation and removal, either in the test procedure body or through adherence to AD-00-042.

QUESTION 040.30

We request that you perform a review of the electrical control circuits for all safety related equipment, so as to assure that disabling of one component does not, through incorporation in other inter locking or sequencing controls, render other components inoperable. All modes of test, operation, and failure should be considered. Describe and state the results of your review.

RESPONSE:

The class 1E electrical power distribution systems as well as non-NSSS control systems have been reviewed for interlocks which could provide a mechanism for disabling engineered safeguard equipment of more than one redundant load group due to a single failure, misoperation, component test, bypass or lockout. The review was made in view of determining satisfactory compliance of the safeguard systems and components to the single failure criterion. The review proved that we have no such disabling interlocks and that where interlocks do exist between redundant load groups, they are designed with separation and isolation devices so as to prevent a common mode failure.

There are a few schemes that require interlocking between redundant load groups. One is the emergency service water (ESW) diesel cooler valves automatic loop transfer, Ref. drawing E-146 Sh. 11 (Sect. 1.7). The ESW system has two loops, A&B, corresponding to Divisions I & II. Each of the four standby diesel generations are normally cooled from ESW loop A and on failure of this loop, an auto transfer is made to loop B. The transfer is made by opening the inlet and outlet valves associated with loop B. Check valves prevent flow from one water loop to the other. The valves are powered separately from the four redundant channels, but a common control circuit for the transfer operation exists and is powered from channel "A" battery. The control relays are in a fail safe mode so that loss of power supply results in an auto transfer. This control circuit receives inputs from redundant channels A, B, C & D to sense the condition of the channelized ESW pumps. To isolate the control circuit from the starter circuits of the channelized transfer valves and, in addition, to isolate it from the channelized inputs, isolation relays of the type described in our response to Question 040.24 (see Subsection 8.1.6.1.n) are utilized. No single power supply or component failure would prevent the safe operation of the above transfer scheme.

The remaining schemes involving interlocks between redundant channels may by grouped into one. These schemes are associated with the fault protection of the ESF transformers. A current differential relay located in each of the start-up switchgears take inputs from each of four current transformers located in the four class 1E switchgears sensing the current flow into each switchgear (Ref. Dwg. E-23 Sh. 1 & E-22 Sh. 2 Subsection 1.7). The transformer primary current is sensed by a current transformer at the startup bus. Each CT is mounted at the bus side of the circuit breaker connecting each bus to the ES transformer. The CT secondary circuits connect to the differential relay restraint coils by means of non-class 1E cabling. These non-class 1E cables are separated at the class 1E switchgear from class 1E cables by an isolating barrier. Similarly the wiring from the terminal block to the current transformer is isolated from wires having a safety related function. The CT itself is located in the power cubicle isolated from the control cubicle by fire barriers.

The differential relay mentioned above trips the transformer high-side breaker as well as all the incoming breakers of the class 1E switchgears (Ref. Dwg. E-102 Sh. 30). In order to provide isolation between the class 1E control circuitry of the class 1E breakers from the non-1E differential relay trip circuit, an isolating relay is employed at the class 1E switchgear. Switchgear wiring to the relay coil and the non-class 1E control cable is separated from all other wiring and cables in the switchgear by an isolating barrier.

QUESTION 040.31

The information regarding the onsite communications system (Section 9.5.2) does not adequately cover the system capabilities during transients and accidents. Provide the following information:

(1) Identify all working stations on the plant site where it may be necessary for plant personnel to communicate with the control room or the emergency shutdown panel during and/or following transients and/or accidents (including fires) in order to mitigate the consequences of the event and to attain a safe cold plant shutdown.

(2) Indicate the maximum sound levels that could exist at each of the above identified working stations for all transients and accident conditions.

(3) Indicate the types of communication systems available at each of the above identified working stations.

(4) Indicate the maximum background noise level that could exist at each working station and yet reliably expect effective communication with the control room using:

   (a) the public address communications system, and

   (b) any other additional communication system provided at that working station.

(5) Describe the performance requirements and tests that the above onsite working stations communication systems will be required to pass in order to be assured that effective communication with the control room or emergency shutdown panel is possible under all conditions.

(6) Identify and describe the power source(s) provided for each of the communications systems.

(7) Discuss the protective measures taken to assure a functionally operable onsite communication system. The discussion should include the considerations given to component failures, loss of power, and the severing of a communication line or trunk as a result of an accident or fire.

RESPONSE:

For this information see revised Subsections 9.5.2.2.1, 9.5.2.2.3, 9.5.2.2.4, 9.5.2.1, and 9.5.2.2.

QUESTION 040.32

In section 9.5.2.2 you describe the plant communications system provided. It is noted that use of radio (portable and fixed) communications has been excluded. As part of the plant defense-in-depth concept, in the event of an accident or fire in an area where fixed communications systems cannot be used, we require (as a minimum) that portable communications equipment be provided at strategic work stations in the plant for use by personnel under such conditions.

RESPONSE:

Refer to revised Subsection 9.5.2 and the response provided to Question 281.13.

QUESTION 040.33

Identify the vital areas and hazardous areas where emergency lighting is needed for safe shutdown of the reactor and the evacuation of personnel in the event of an accident (including fire). Tabulate the lighting systems provided in your design to accommodate those areas so identified.

RESPONSE:

For information refer to revised Subsection 9.5.3.

QUESTION 040.34

In section 9.5.3.2.3 you state that emergency lighting in remote buildings are areas where emergency dc lighting service is not available you are providing battery powered self-contained units. Identify the remote buildings and areas where this type of lighting is used.

As part of the plant defense-in-depth concept in addition to normal and emergency lighting systems we require emergency self-contained (including charger) sealed beam battery powered units with individual 8 hour minimum capacity. These units should be installed in the control room, all locations required to safely shutdown the plant, in stairways, and along exit routes from each floor throughout the plant. Provide a detailed description of the self contained battery power units, how they will be powered under normal plant conditions, and how they will be controlled under accident conditions in the absence of both the normal and emergency lighting systems.

RESPONSE:

For information refer to revised Subsection 9.5.3.

QUESTION 040.35

Section 9.5.4.1, Emergency Diesel Engine Fuel Oil Storage and Transfer System (EDEFSS), does not specifically reference ANSI Standard N195 "Fuel Oil Systems for Standby Diesel Generators". Indicate if you intend to comply with this standard in your design of the EDEFSS; otherwise provide justification for non-compliance. (SRP 9.5.4, Rev. 1, Part II, Item 12).

RESPONSE:

Subsection 9.5.4.1 has been revised to include this information.

QUESTION 040.36

In section 9.5.4.2 you state the diesel generator fuel oil storage tank has a 50,000 gallon capacity which is sufficient to operate the diesel generator for 7 days at full rated load, the fuel oil transfer pump has a suction strainer which is located 2 ft. above the bottom of the tank, and the transfer pump requires 1 ft. 6 inch NPSH. You also state the fuel oil storage tanks are designed to include the NPSH required by the pump. Clarify this statement.

Using the above stated data demonstrate by analysis that the volume of usable fuel oil (tank volume above pump NPSH level) in the fuel oil storage tank is sufficient to operate its diesel generator for a period of 7 days at full rated load.

RESPONSE:

Subsection 9.5.4.2 has been revised to include this information.

QUESTION 040.37

In Section 9.5.4.2 you state the diesel generator fuel oil storage tanks are filled and replenished from trucks through the fill connection which branches to each of the four tanks. Provide a drawing (plan and elevation) showing the location of the truck fill and tank vent connection and location of the fuel oil storage tanks with respect to the diesel generator building. Also provide a description of how the tank fill and vent connections are protected against tornado missiles and the precautions taken in your design of the emergency diesel engine fuel oil storage and transfer system to minimize the entrance of deleterious material into the system during recharging, by operator error or natural phenomena (SRP 9.5.4, Part III, item 1, 2 and 4).

RESPONSE:

Refer to revised Subsection 9.5.4.2 and Dwg. C-1006, Sh. 1 C-1007, Sh. 1, C-1032, Sh. 1 for this information.

QUESTION 040.38

Figure 9.5-19 shows the tank fill connection and branch fill lines to each fuel oil storage tank as non-seismic, Class D construction. Also figure 9.5-19 does not identify the piping classification of the tank vent line and other connections. It is our position that the fuel oil storage tank fill line from the tank interface up to and including the truck fill interface and all other tank connections should be seismic Category I, Class C construction. Revise your system design accordingly.

RESPONSE:

Refer to revised Subsection 9.5.4.2 and Dwgs. C-1006, Sh. 1, C-1007, Sh. 1, C-1032, Sh. 1 for this information.

QUESTION 040.39

In section 9.5.4.3 you state fuel oil for the diesel generators is delivered onsite for trucks and rail. Identify the sources where diesel quality fuel oil will be available and the distances required to be travelled from the sources to the plant. Also discuss how fuel oil will be delivered onsite under extremely unfavorable environmental conditions.

RESPONSE:

Subsection 9.5.4.3.a mentions that additional supplies of fuel oil for the diesel generators could be delivered to the site during the 7 day operation period provided by onsite supplies. Currently, no contractual arrangements have been made for supply of diesel fuel oil. However, a preliminary survey indicates that several fuel oil suppliers are located in proximity to the plant which might be utilized in an emergency situation. The survey showed five vendors located in an emergency situation. The survey showed five vendors located in the Berwick/Nescopeck area (5 miles southwest of the plant), two located in the Bloomsburg area (15 miles southwest of the plant) and six located in the Wilkes-Barre/Scranton area (30 miles northeast of the plant). It is not intended that this be a comprehensive listing of local suppliers, nor does it indicate any agreements with these suppliers.

The plant is located directly on US Rte. 11, a major highway which connects with Interstate Routes 80 and 81. These arteries should be available under extremely unfavorable environmental conditions, providing access to the site from surrounding population centers. Truck delivery via these routes would be the preferred method for emergency supply of fuel under extreme conditions.

QUESTION 040.40

Assume an unlikely event has occurred requiring operation of a diesel generator for a prolonged period that would require replenishment of fuel oil without interrupting operating of the diesel generator. What provision will be made in the design of the fuel oil storage fill system to minimize the creation of turbulence of the sediment in the bottom of the storage tank. Stirring of this sediment during addition of new fuel has the potential of causing the overall quality of the fuel to become unacceptable and could potentially lead to the degradation or failure of the diesel generator.

RESPONSE:

See revised Subsection 9.5.4.3 for this information.

QUESTION 040.41

Discuss the precautionary measures that will be taken to assure the quality and reliability of the fuel oil supply for emergency diesel generator operation. Include the type of fuel oil, impurity and quality limitations as well as diesel index number of its equivalent, cloud point, entrained moisture, sulfur, particulates and other deleterious insoluble substances; procedure for testing newly delivered fuel, periodic sampling and testing of on-site fuel oil (including interval between tests), interval of time between periodic removal of condensate from fuel tanks and periodic system inspection. In your discussion include reference to specific industry (or other standards which will be followed to assure a reliable fuel oil supply to the emergency generators.

RESPONSE:

Discussion included in Section 9.5.4.4 of the FSAR.

QUESTION 040.42

Discuss the means for detecting or preventing growth of algae in the diesel fuel storage tank. If it were detected, describe the method to be provided for cleaning the affected storage tank. (SRP 9.5.4, Part III, Item 4).

RESPONSE:

See revised Subsection 9.5.4.2 for this information.

QUESTION 040.43

Discuss what precautions have been taken in the design of the fuel oil system in locating the fuel oil piping with regard to possible exposure to ignition sources such as open flame and hot surfaces (SRP 9.5.4, Part III, Item 6).

RESPONSE:

These precautions are discussed in revised Subsection 9.5.4.3.

QUESTION 040.44

Identify all high and moderate energy lines and systems that will be installed in the diesel generator room. Discuss the measures that will be taken in the design of the diesel generator facility to protect the safety related systems, piping and components from the effects of high and moderate energy line failure to assure availability of the diesel generators when needed. (SRP 9.5.4, Part III, Item 8 SRP 9.5.5, Part III, Item 4, SRP 9.5.6, Part III, item 5, SRP 9.5.7, Part III, item 3, SRP 9.5.8, Part III, item 6c).

RESPONSE:

During normal plant conditions, the following piping systems in the diesel rooms are classified as moderate energy: diesel starting air, emergency service water (during reactor cooldown), service air, and sump pump discharge (intermittent). The other piping in the rooms is not pressurized under normal plant conditions (e.g., fire protection system) and there are no high energy lines in the rooms. Flood detectors are located in the rooms (See Dwg. M-111, Sh. 1) Figure 9.2-5A) to detect any leakage.

With a piping failure postulated in one of the emergency diesel generator rooms, capability to safely shutdown the reactor would still exist. This is because failure of the moderate energy piping existing in any diesel generator room would not directly result in turbine generator or reactor protection system trip. Hence, offsite power would be assumed to be available. This is in accordance with Branch Technical Position APCSB 3-1.

QUESTION 040.45

In section 9.5.5.2 you state that the diesel generator cooling water system includes a standpipe that serves as a reservoir, decorator and an expansion tank. Makeup water to the standpipe is from the non-seismically designed demineralized water system.

In addition to the items monitored, the standpipe is to provide for venting of air from the system, minor leaks at pump shaft seals, valve stems and other components and to maintain required NPSH on the system circulating pump. Provide the size of the standpipe, location and elevation relative to the diesel engine cooling system. Demonstrate by analysis that the standpipe size will be adequate to maintain required circulating pump NPSH and include a sufficient volume of water for system leaks for seven days continuous operation of the diesel engine at full rated load without makeup, or provide a seismic Category I, safety Class C makeup water supply to the standpipe.

RESPONSE:

For response see Subsection 9.5.5.

QUESTION 040.46

Describe the provisions made in the design of the diesel generator cooling water system to assure all components and piping are filled with water. (SRP 9.5.5, Part III, item 2).

RESPONSE:

For response see revised Subsection 9.5.5.5.

QUESTION 040.47

In section 8.3.4.1 you state the diesel generators are capable of continuous operation with no load. This statement should be expanded and clarified. In the event of a LOCA it may be necessary to operate diesel generator(s) for a period of 30 days or more. The diesel generators are automatically started and run unloaded during a LOCA condition when offsite power is available to the Class 1E buses. Should a LOCA occur with availability of offsite power, provide a detailed discussion on how long the diesel generator(s) are capable of operating unloaded without degradation of engine performance or reliability. (SRP 9.5.5, Part III, Item 7).

RESPONSE:

See revised Subsection 8.3.1.4 for this information.

QUESTION 040.48

What protective measures have been incorporated in the design of the lubrication oil system to maintain the required quality of lubricating oil during diesel engine operation, and during standby conditions. (SRP 9.5.7, Part III, item 1).

RESPONSE:

Refer to revised Subsection 9.5.7.2 for this information.

QUESTION 040.49

What system design precautions have been taken to prevent entry of deleterious materials into the diesel engine lubrication oil system due to operator error during recharging of lubrication oil or normal operation (SRP 9.5.7, Part III, item 1c).

RESPONSE:

See Subsection 9.5.7.2 for this information.

QUESTION 040.50

What protective measures have been taken to prevent unacceptable crankcase explosions and to mitigate the consequences of such an event. Identify and discuss the protective measures and describe how the protective measures will mitigate the consequences of a crankcase explosion.

RESPONSE:

See revised Subsection 9.5.7.3 for this information.

QUESTION 040.51

Describe the instrumentation, controls, sensors, and alarms provided in the design of the diesel engine combustion air intake and exhaust system to warn the operators when design parameters are exceeded. (SRP 9.5.8, Part III, item 1 and 4).

RESPONSE:

Refer to Subsection 9.5.8 for this response.

QUESTION 040.52

Indicate which system components in the diesel generator air intake and exhaust system are exposed to inclement weather conditions (heavy rain, freezing rain, ice or snow). Discuss how these components are protected from possible clogging to assure availability of the emergency diesel generators when needed (SRP 9.5.8, Part III, item 5).

RESPONSE:

See revised Subsection 9.5.8.3 for this information.

QUESTION 040.53

Provide a general discussion of the design criteria and bases of the various steam and condensate instrumentation systems in section 10.1 of the FSAR. The FSAR should differentiate between normal operation instrumentation and required safety instrumentation.

RESPONSE:

Section 10.1 has been revised to include this information.

QUESTION 040.54

For the turbine speed control system, provide with the aid of system schematics (including turbine control and extraction steam valves to the heaters), a detailed explanation of the turbine and generator electrical load following capability. Tabulate the individual overspeed protection devices (normal, emergency and backup), the design speed (or percent of rated speed) at which it performs its safeguards function and specify the valve or other component which is subsequently activated to complete the turbine trip. In order to evaluate the adequacy of the control and overspeed protection system include identifying numbers to valves and mechanisms (mechanical and electrical) on the schematics and provide a discussion to describe in detail with references to the identifying numbers, the sequence of events in a trip, including response times. Show that stable turbine operation will result after a trip. Provide the results of a failure mode and effects analysis for each of the overspeed protection systems. Show that a single valve failure cannot disable the turbine overspeed trip functions. (SRP 10.2, Part III, Items 1, 2, 3 and 4).

RESPONSE:

For the response to the question see revised FSAR Subsections 10.2.2.6 and 10.2.2.8.

QUESTION 040.55

In sections 10.2.1 and 10.2.2.2 you state that the generator is cooled by hydrogen at 75 psig pressure. Describe, with the aid of drawings, your design of the bulk hydrogen storage facility including controls, its location and distribution system. Include the protection measures and system design features considered to prevent fires and explosions during normal plant operations.

RESPONSE:

Refer to Subsection 10.2.2.2 for this information.

QUESTION 040.56

Discuss the measures taken to prevent galvanic corrosion of condenser tubes and components (SRP 10.4.1, Part III, Item 1).

RESPONSE:

Subsection 10.4.1.3.2 has been revised to include this information.

QUESTION 040.57

Indicate what design provisions have been made to preclude failures of condenser tubes or components from turbine by-pass blowdown. (SRP 10.4.1, Part III, item 1).

RESPONSE:

Subsection 10.4.1.3.2 has been revised to include this information.

QUESTION 040.58

Provide the following additional information (with the aid of drawings) for the turbine by-pass valves and associated instruments and controls: (1) number, size, principle of operations, construction, set points; (2) the capacity of each valve; (3) the malfunctions and/or modes of failure considered in the design; (4) the maximum reactor power step change the system is designed to accommodate without reactor or turbine trip and (5) the maximum electric load step change the reactor is designed to accommodate without reactor control rod motion or steam bypassing. (SRP 10.4.4, Part III, Items 1 and 2).

RESPONSE:

1) Number: There are 5 valves in one common valve chest. (refer to Subsection 10.4.4.2)

   Size: The valve chest is fed through two 18" headers from the main steam (refer to Subsection 10.4.4.2). The discharge of each valve is piped individually in 10" lines to the condenser (refer to Subsection 10.4.4.2 and Figure 10.4-1).

   Principle of Operation and Set Points:

   The bypass valve is biased from 5 to 15% above the difference of the desired control valve flow signal and the total steam flow (refer to Subsections 10.4.4.30, 7.7.1.5.3, 7.7.1.5.3.3 and Figure 7.7-15.

   Construction: All turbine-generator and associated auxiliaries supplied by GE are manufactured to GE standards (refer to Subsection 10.2.1).

2) The five bypass valves have the ability to bypass a total of 25% of the nuclear boiler rated steam flow. (refer to Subsections 10.2.1 & 10.4.4.2)

3) The malfunction or failure mode considered is discussed in Subsection 10.4.4.3. If the valves fail to operate (open), ultimately it would cause the main steam safety relief valves to open.

4) The turbine controls can follow a reactor power change of ±10% rated power per second which is discussed in Subsection 10.2.1. The bypass controls follow the control valve. (Refer to Subsections 10.4.4.1, 7.7.1.5.3.3 and the applicable failure analysis in Subsections 15.1 and 15.2).

5) The maximum electric load step change the reactor is designed to accommodate without reactor control rod motion or steam bypassing is discussed in Subsection 10.2.1.

QUESTION 040.59

Demonstrate that a high energy line failure of the turbine by-pass system (TBS) will not have an adverse effect or preclude operation of turbine speed controls or any safety related components or systems located close to the TBS. (SRP 10.4.4, Part III, Item 4).

RESPONSE:

See revised Subsections 10.4.4.2 and 10.4.4.3.

QUESTION 040.60

Provide the results of a failure mode and effects analysis to determine the effect of malfunctions of the turbine by-pass system on the operation of the reactor and main turbine generator unit. (SRP 10.4.4, Part III, Item 4).

RESPONSE:

See revised Subsections 10.4.4.2 and 10.4.4.3.

QUESTION 040.61

Discuss the affect of the maximum turbine by-pass flow on condenser back pressure and turbine exhaust temperature in reference to allowable values.

RESPONSE:

See revised Subsections 10.4.4.2 and 10.4.4.3.

QUESTION 040.62-X10

The RBCCW and TBCCW are sequenced in the D. G. buses after a loss of off-site power (LOOSP) (Table 8.3-1). In Section 9.2.2 in the FSAR these are both listed as non-ESF loads but in Tables 8.3-1 and 1a the RBCCW is listed as an ESF load, sequenced at 60 sec onto Unit 2 for safe shutdown. Explain the power supply rationale for these two systems, state whether they both can be isolated from their power supplies by a derivative of an accident signal in order to meet isolation requirements in accordance with Reg. Guide 1.75, and correct any inconsistences in the FSAR text.

RESPONSE:

Tables 8.3-1 through 8.3-5 have been revised to show RBCCW pumps as non-ESF loads. The RBCCW pumps are tripped by the opening of the motor starter contractors on LOCA conditions. The RBCCW system is not required to support post-LOCA recovery operations. The RBCCW pumps are powered from the emergency diesel generators on loss of off site power without occurrence of LOCA as described in FSAR section 9.22 in order to support non-essential loads.

The TBCCW pumps are not tripped by a LOCA signal. They are fed by a non-Class 1E 480 Vac motor control center connected too a Class 1E 480 V load center through an isolation system. Isolation Systems are described in Subsection 8.1.6.1-n. The TBCCW system is not required to support post-LOCA recovery operations. The BTCCW pumps are tripped on loss of off site power. The TBCCW pumps may be powered from the emergency diesel generators on loss of off site power as described in FSAR Section 9.2.3 in order to support non-essential loads.

QUESTION 040.63-X10

Provide a failure mode and effects analysis of the dc system of the plant. Describe the operation of the Unit 1 dc system and the "uninterruptable ac power supply" of Unit 1 during the period that Unit 1 is operating and Unit 2 is under construction.

During this phase of operation there is, apparently, some switching of loads (lighting and communication) from a Unit 1 vital ac bus to a Unit 2 vital ac bus under some conditions (Sec. 9.5). Provide further details of this aspect of your design.

The indicated load on the 125v dc system (Table 8.3-6) is 106A or greater over a four hour period, while the battery charger is rated at 100A. Discuss the time span and conditions or actions that will be necessary to establish charge equilibrium in the batteries.

In addition, with regard to the dc systems, provide note 5 for Figure 8.3-6 and for the 24v dc system shown in this figure. Review the battery capacity which should, by your own criteria, be 125% of four hour demand but seems to be actually only 100% of 4 hour demand by Table 8.3-8 and report your findings.

RESPONSE:

1) The failure-mode-and-effect analysis for the plant dc systems is presented in FSAR Tables 8.3-21, 8.3-22 and 8.3-23, corresponding to the 125 V dc, 250 V dc and + 24 V dc subsystems.

2) There are two uninterruptable ac power supplies (UPS) of each generating unit, the computer UPS and the vital ac UPS. The inverter of each UPS is fed from one of two 250 V dc load centers. The vital ac UPS bus supplies power to the intra-plant public address (PA) system and the emergency evacuation (EVAC) system. These systems require an alternate power supply which is the vital ac bus of Unit 2. During Unit 1 operation while Unit 2 is in construction stage, the alternate power to the PA and EVAC systems is taken from the Unit 1 computer UPS bus. Transfer from the normal supply to the alternate supply is done automatically. Subsections 9.5.2.2.1 and 9.5.2.2.4 of the FSAR have been revised to reflect the above arrangement.

   Another load which requires switching between Units 1 and 2 is the roof siren. The preferred source is a Unit 1 125 V dc lens and the alternate source is a Unit 2 125 V dc lens.

   During Unit 1 operation while Unit 2 is under construction, the alternate source is a separate 125 V dc bus of Unit 1.. Transfer from the normal supply to the alternate supply is done automatically. Subsection 9.5.2.2.4 of the FSAR has been revised to reflect the above arrangement.

3) During normal plant operation the batteries are maintained at fully charged state and the continuous current load of 44 Amperes is supplied by the charger which has ample capacity, if required, to recharge the battery.

The nominal rating of the 125 V dc battery charger is 100A. It has a 25% overload capacity. The charger is a constant voltage source until the overload limit (set point) is reached above which the unit shifts into a constant current source at a current equal to the set point value.

The current of 106A, as indicated in Table 8.3-6, can be supplied by the battery charger while the battery is fully charged.

4) Dwg. E-13, Sh. 1 of the FSAR has been revised to show Note 5 which will read: "Bechtel field shall disconnect fuses for transducer circuits unless otherwise noted."

5) The 18.74A dc load current shown in Table 8.3-8 is actually the arithmetic sum of the +24 V dc and -24V dc banks which are in series. At the distribution panel, + 9.37A and - 9.37A are distributed by the positive and the negative buses. The four-hour demand per bank is 9.37 x 4 or 37.48 AH. The 4 hour rating for the C&D type DCU-7 cells is 63 AH or 168% of the 4-hour demand.

QUESTION 040.64-X10

In the event of failure of preferred power, then the alternate power, please discuss the operational sequence for restoration of the Class 1E power channels.

a) from standby power to alternate power,

b) from standby power to preferred power.

RESPONSE:

See revised Subsection 8.3.1.3.6.

QUESTION 040.65-X10

Branch Technical Position ICSB (PSB) 2 Diesel Generator Reliability Qualification Testing (SRP Appendix 8A) requires a prototype qualification program to demonstrate the capability of new and/or unique designs for use in nuclear service. Provide the results of the prototype qualification for the Susquehanna SES units.

Cooper Bessemer has made recent changes in its design of cylinder heads and induction systems. State in light of these changes whether the Susquehanna SES diesel generators have these new design features and if so whether they have been qualified in accordance with BTP ICSB (PSB) 2, or offer an alternative on some other defined basis.

RESPONSE:

The prototype engine qualification testing was performed by the supplier in accordance with IEEE 387-1972 and IEEE 323-1971 editions as required by FSAR, Volume 7, Section 3.13.1, Regulatory Guide 1.9.

The results of the prototype qualification testing are available for NRC's review when required.

The following tests were performed:

1. High potential testing of control wiring
2. Measurement of engine vibration
3. Fast start capability
4. Transient performance evaluation
5. Steady state load capability
6. Load rejection
7. Number of starts from a single air receiver
8. Performance evaluation of power factor discrimination and standby voltage regulator.

The modifications made on the engines consisted of replacement of certain existing components with similar, improved components. The reason for replacing these components was to eliminate long term wear problems with the rocker arm assembly and cracking problems of the air intake valve spring. These changes have increased the engine's reliability.

Since major engine modifications were not made, retesting the engines for prototype qualifications is not required, and the original testing is still valid.

The engines, however, with the new components installed, will be subjected to site acceptance testing per Paragraph 6.3 of IEEE 387-1972 edition, which requires, that after startup testing "... each diesel generator unit shall be tested at the site to demonstrate that the capability of the unit to perform its intended function is acceptable."

QUESTION 040.66-X10

In FSAR Section 7.4.1.2.2 it is stated that both divisions of the SLCS are powered from Division I. Yet in Table 3.12-1 the SLCS is listed in two separate divisions, I and II. Provide a discussion which resolves these apparent inconsistencies.

RESPONSE:

Table 3.12-1 has been revised and is now consistent with Subsection 7.4.1.2.2.

QUESTION 040.67-X10

A "480v Swing Bus" is listed in Division I and another in Division II (table 3.12-1) and described in Section 8.3.1.3.5. Although these swings are not between redundant divisions they are between redundant separation channels as three channels out of four are required in your plant to successfully meet the on-site power requirements of a LOCA in one unit and safe shutdown of the other unit. This configuration requires independence and separation between Class 1E channels as well as ESF divisions in each of the two units of your plant. In order to facilitate our review of this aspect of your design, provide a common mode-common cause failure analysis for the Russell Electric Company transfer switches that you use to transfer from one power supply channel to the other in each division. Also describe the testing program for the entire isolation arrangement (motor-generator set) protective switchgear, and transfer scheme of the swing bus arrangement to satisfy the requirements of GDC 18.

RESPONSE:

See revised Subsection 8.3.1.3.5, Table 8.3-24 and Figures 8.3-13 and 8-3-14.

QUESTION 040.68-X10

Various metallic vapor lamps have "delayed" re-ignition time characteristics.

Postulate a condition such as a temporary loss of power, which would produce a delayed re-ignition condition. Are there any SSES plant areas in which this postulated condition could interfere with plant operations? If so, provide modified design to correct this situation.

RESPONSE:

High pressure sodium, mercury vapor, and LED lamps are provided at selected plant operating areas as described in Subsection 9.5.3.2. These lamps provide 80-90% of the total lighting. The remaining 10-20% is provided by the essential lighting system (fluorescent or LED) as described in Subsection 9.5.3.2.2. The essential lighting system provides minimum lighting level during the delayed re-ignition of the high pressure sodium and mercury vapor lamps, assuming a temporary loss of power. Therefore, plant operation is not affected.

QUESTION 040.69-X10

In Section 7.4 the statement "heat tracing of pump suction piping receives power from a bus that is connectable to the standby A-C power supply." Identify this "connectable bus" and describe the loads (by name and rating), method of connection, and isolation (if non-1E).

RESPONSE:

See revised Subsection 7.4.1.2.2.

QUESTION 040.70-X10

Reg. Guide 1.70 recommends "in particular, the circuits that supply power for the safety loads from the transmission network should be identified and shown to meet GDC 17 and 18," and "describe and provide layout drawings of the circuits that connect the onsite distribution system to the preferred power supply including transmission lines, switchyard arrangement, right of way, etc."

GDC 18 states "electric power systems important to safety shall be designed to permit appropriate periodic inspection and testing of important areas and features ---."

You state that for pre-Unit 2 operation the preferred power sources for the SSES are the Montour-Mountain and the Wescosville-Susquehanna tie lines. Discuss these two tie line systems and their associated switchyards with regard to the above stated references and reaffirm that PC protective relay testing, maintenance and calibration apply to these switchyards and can be performed during unit operation.

RESPONSE:

See revised Section 8.2

QUESTION 040.71-X10

In the event that the control room must be vacated, what means and methods of communication are available from the remote shutdown panel of Unit 2 to the various out-buildings such as diesel generator building, emergency service water pump house, make-up water pump house, circulating water pump house, and radwaste building.

RESPONSE:

See revised Subsection 9.5.2.2.1.

QUESTION 040.72-X10

General Design Criterion 18 requires the ability to periodically inspect and test important safety features of electric power systems. State whether periodic inspection of the penetration assemblies is possible and whether the requirement of GDC-18 have been satisfied in this regard.

Figure 3.13-4. Is there a program for testing and inspecting the 120V ac control circuit 6A fuses? Also, provide the type (e.g. molded case) and source of actuation power for the 20A Cutler mm Hammer Type CHB breakers, the HFB-TM 50A breakers at the 480V MCC, and the 225A supply breaker at each instrument ac panel.

Periodic testing of containment circuit protection schemes is a requirement. Provide the details of your periodic testing program.

RESPONSE:

See Section 3.13, revised response to Regulatory Guide 1.63.

QUESTION 040.73-X10

State whether the essential lighting system is sequenced onto the Class 1E 480 buses or remains connected to the bus throughout transfer to the diesels in the event of a LOOSP. Is the total of essential lighting 169kw as in Table 8.3-3, or 188kw and in 8.3-2 or 222kw as in 8.3-4, or 258kw in 8.3-5? Why these differences?

RESPONSE

See revised Subsection 9.5.3.2.2.

QUESTION 040.74-X10

On the topic of non-Class 1E instrument circuits: In paragraph 8.1.6.1.n-7 you state as an "analysis" that "non-Class 1E instrument circuits are considered low energy and the probability of these non-Class 1E circuits providing a mechanism of failure to the Class 1E circuit is extremely low."

This is not acceptable as an analysis of your design. Provide the necessary justification and supporting bases to demonstrate your conclusions.

In this same context review your use of Class 1E devices as information sources for digital/analog information, as described in paragraph 9 of Section 3.12.3.4.1 of the FSAR (Page 3.12-9 of FSAR) and report your findings. Verify that acceptable isolation is provided in accordance with IEEE Standard 279-1971 Sections 4.1 and 4.7.

RESPONSE

See revised Subsection 8.1.6.1.n.

QUESTION 040.75-X10

On the same topic as Item 040.82, above, but in its application to containment electrical penetrations, (your paragraph 8.1.6.1.n-13) you state that cable penetrations into the suppression pool contain Class 1E and non-Class 1E circuits.

These non-Class 1E circuits include instrumentation annunciation, circuits, and computer circuits. Provide further justification for the classification of these as non-Class 1E circuits in containment penetrations, or describe a testing program to demonstrate the acceptability of your design approach.

RESPONSE

See revised Subsection 8.1.6.1.n-13.

QUESTION 040.76-X10

Your placement of electrical separation descriptions in section 3.12.3.4 has made it difficult to follow the continuity of subject matter in the FSAR. In 3.12.3.4.1-fourth subsection, "Raceway sharing of Class 1E and non-Class 1E Circuits" it is stated that, "480v and 125/250v dc non-Class 1E load groups connected to Class 1E buses are supplied through two circuit breakers physically separated from each other and connected in series. The cables from the Class 1E bus up to the second breaker remain with and follow the same rules as the Class 1E circuits of the respective separation divisions and are uniquely identified. The second breaker and its circuits are not subject ---."

State whether the second breaker of such an arrangement is Class 1E, and list the circuits that use this double breaker isolation scheme. Further, provide the bases for acceptance for the use of this fault-actuated isolation scheme.

RESPONSE

See revised Subsection 8.1.6.

QUESTION 040.77-X10

Section 8.1.6.1.n, "Compliance with Regulatory Guide 1.75 (1/75)".

1) The statement at the end of the first paragraph of this section, referring to Section 7.1, is not understandable, nor is the next paragraph correct in its description of redundancy and independence.

   It is still not clear what forms of electrical isolation are used in the design of SSES.

   Therefore, provide a listing of all the associated and non-1E circuits that require isolation from the Class 1E systems and the method if isolation (method 1, 2, 3, or 4 as described in your paragraph 8.1.6.1.n-5) used for each circuit.

2) Your description of "isolation systems" in paragraph 8.1.6.1.n-5 defines something that is not in accordance with Regulatory Guide 1.75 for assuring independence of Class 1E power sources from an intermediate non-Class 1E bus (method 3 of the paragraph). Therefore, state whether there are indeed some non-Class 1E loads in the SSES design that are supplied from a Class 1E source through an intermediate bus, and describe that isolation system for that bus.

RESPONSE

See revised Subsection 8.1.6.1 and Table 8.1-2.

QUESTION 040.78-X10

Paragraph 8.3.1.3.14 of the FSAR indicates that some " ... electrical equipment associated with Class 1E loads identified in Chapter 16.0" is not testable during reactor operation. List or reference this equipment. Demonstrate that all of the above equipment so identified is in conformance with Regulatory Guide 1.22 Section D.4.

RESPONSE

See Section 8.3.1.3.15.

QUESTION 040.79-X10

Figure 8.3-5, "125v dc and 250v dc Systems" indicates that loads 1D666, 1D165, 1D656, and 1D155 and 1D615, 1D635, 1D625 and 1D645, are "Non-Q-Listed" Panels. Yet on drawings E11, Sheets 3 and 4, there are notes that all loads are "Q-listed". On drawing E11 Sheets 1 and 2 the note also says that all equipment is "Q listed". Provide further details to facilitate our understanding of this aspect of your design.

We do not have drawing E26-Sh. 3, and therefore, cannot tell just what loads are on the 125v dc distribution panels in question. Provide this drawing. In the 250v dc case (Fig. E-11 Sh. 3 and Sh. 4) the loads seem to be entirely emergency lube oil pumps that are not Class 1E by function. State how such load centers are handled and whether an accident signal derivative trips off the entire bus or individual loads.

We note that in Table 3.10c-13 panels 1D155, 1D165, as well as 2D155 and 2D165 (for Unit 2) are listed as seismically qualified while all the others are not. Explain the rationale for these differences.

Also, in Fig. 8.3-5 the 250v dc Class 1E battery supplies a 1600A distribution panel through a 2000A fuse. State the design bases for this aspect of your design.

RESPONSE

See revised Subsection 8.3.2.1.1.2, Table 1.7-1 (pages 2 and 3), and Table 3.10c-13.

QUESTION 040.80-X10

Provide a listing of all switchgear that is not self-activated (both safety and non-safety) and specifically identify the source of control power to each one. This is needed in order to assist our independent review of how your emergency power system design meets the single failure criterion.

RESPONSE:

See revised subsections 8.3.1.3 and 8.3.1.2, and Tables 8.3-17, 18, 19, and 20.

QUESTION 040.81

The availability on demand of an emergency diesel generator is dependent upon, among other things, the proper functioning of its controls and monitoring instrumentation. This equipment is generally panel-mounted and in some instances the panels are mounted directly on the diesel generator skid. Major diesel engine damage has occurred at some operating plants from vibration-induced wear on skid-mounted control and monitoring instrumentation. This sensitive instrumentation is not made to withstand and function accurately for prolonged periods under continuous vibrational stresses normally encountered with internal combustion engines. Operation of sensitive instrumentation under this environment rapidly deteriorates calibration, accuracy, and control signal output.

Therefore, except for sensor and other equipment that must be directly mounted on the engine or associated piping, the controls and monitoring instrumentation should be installed on a free-standing floor-mounted panel separate from the engine skids, and located on a vibration-free floor area or equipped with vibration mounts.

Confirm your compliance with the above requirement or provide justification for noncompliance.

RESPONSE:

See revised Subsection 8.3.1.4a.

QUESTION 040.82

Periodic testing and test loading of an emergency diesel generator in a nuclear power plant is a necessary function to demonstrate the operability, capability, and availability of the unit on demand. Periodic testing coupled with good preventive maintenance practices will assure optimum equipment readiness and availability on demand. This is the desired goal.

To achieve this optimum equipment readiness status, the following requirements should be met:

1. The equipment should be tested with a minimum loading of 25 percent of rated load. No load or light load operation will cause incomplete combustion of fuel resulting in the formation of gum and varnish deposits on the cylinder walls, intake and exhaust valves, pistons, and piston rings, etc., and accumulation of unburned fuel in the turbocharger and exhaust system. The consequences of no load or light load operation are potential equipment failure due to the gum and varnish deposits and fire in the engine exhaust system.

2. Periodic surveillance testing should be performed in accordance with the applicable NRC guidelines (Regulatory Guide 1.108), and with the recommendations of the engine manufacturer. Conflicts between any such recommendation and the NRC guidelines, particularly with respect to test frequency, loading, and duration, should be identified and justified.

3. Preventive maintenance should go beyond the normal routine adjustments, servicing and repair of components when a malfunction occurs. Preventive maintenance should encompass investigative testing of components which have a history of repeated malfunctioning and require constant attention and repair. In such cases, consideration should be given to replacement of those components with other products which have a record of demonstrated reliability, rather than repetitive repair and maintenance of the existing components. Testing of the unit after adjustments or repairs have been made only confirms that the equipment is operable and does not necessarily mean that the root cause of the problem has been eliminated or alleviated.

4. Upon completion of repairs or maintenance and prior to an actual start, run, and load test, a final equipment check should be made to assure that all electrical circuits are functional, i.e. fuses are in place,

switches and circuit breakers are in their proper position, no loose wires, all test leads have been removed, and all valves are in the proper position to permit a manual start of the equipment, after the unit to ready automatic standby service and under the control of the control room operator.

Provide a discussion of how the above requirements have been implemented in the emergency diesel generator system design and how they will be considered when the plant is in commercial operation, i.e., by what means will the above requirements be enforced.

RESPONSE:

1. Minimum Loading

The diesel generator surveillance test procedure provides for testing at 100% load on a monthly basis. The diesel generator operating procedure provides guidance on increasing the load prior to shutdown, if the diesel generator had been operating at less than 80% load. FSAR Subsection 8.3.1.4 shows the commitment to follow the manufacturers' recommendations for maintaining load at 50-100% for normal, continuous operation.

2. Periodic Surveillance Testing

Surveillance testing of the diesel generators will be in accordance with requirements contained in Technical Specifications to be issued for Susquehanna SES. The current draft of these Technical Specifications (being prepared for submittal one year prior to fuel load) closely follows the recommendations for diesel generator testing contained in NUREG-0123, Rev. 2, "Standard Technical Specifications for General Electric Boiling Water Reactors."

3. Investigative Testing

As Susquehanna SES, Technical Section engineers are assigned responsibility for various systems in the plant. The engineer assigned responsibility for the emergency diesel generators will provide the investigative testing and evaluation function described. System engineer responsibilities typically include review and revision of operating procedures, review of test results, evaluation of proposed modifications, evaluation of 1E bulletins, circulars, and information notices and other related duties. It

is a responsibility of the system engineer to suggest investigative testing when situations warrant. This technical support engineering function, combined with normal maintenance activities will enhance the reliability
of the diesel generators.

4. Post-Maintenance Testing

Specific maintenance procedures will specify steps necessary to return the system to operational status. Testing for operability is the responsibility of Shift Supervision and is controlled through the Work Authorization program.

QUESTION 040.83

Provide a detailed discussion (or plan) of the level of training proposed for your operators, maintenance crew, quality assurance, and supervisory personnel responsible for the operation and maintenance of the emergency generators. Identify the number and type of personnel that will be dedicated to the operations and maintenance of the emergency diesel generators and the number and type that will be assigned from your general plant operations and maintenance groups to assist when needed.

In your discussion, identify the amount of kind of training that will be received by each of the above categories and the type of ongoing training program planned to assure optimum availability of the emergency generators. Also discuss the level of education and minimum experience requirements for the various categories of operations and maintenance personnel associated with the emergency diesel generators.

RESPONSE:

At Susquehanna SES, no specific group of operators, maintenance personnel, supervisors, etc. will be assigned exclusive responsibility for the emergency diesel generators.

On each operation shift, one of the three Nuclear Plant Operators, (NPO) will handle diesel generator operations on a rotating basis. Control room operation of the diesel generators is assigned to one or more of the three Plant Control Operators (PCO) on shift. The PCO, who holds a reactor operator license, normally directs the activities of the NPO.

The initial training program for the Operations Section is described in Subsection 13.2.1.1.2. The program provides Susquehanna SES specific systems training for licensed and non-licensed operators, which encompasses emergency diesel generator training provided by the manufacturer or equivalent. The basic retraining program for operators is described in Subsection 13.2.2. To supplement this basic retraining, additional operations personnel may be selected to receive the detailed diesel generator training provided by the manufacturer or equivalent. The basic retraining program for operators is described in Subsection 13.2.2. To supplement this basic retraining, additional operations personnel may be selected to receive the detailed vendor training or a detailed retraining program.

The responsibility for maintenance of the diesel generators is shared by electrical maintenance, mechanical maintenance, instrumentation and control, and electrical test group for appropriate components and subsystems. As with the Operations

Section, no specific personnel will be dedicated to the diesel generators. However, selected personnel will receive detailed training offered by the manufacturer or equivalent as appropriate. Retraining/replacement training will be provided on an as-needed basis. This supplements the basic training program described in Subsections 13.2.1 and 13.2.2.

Qualifications of all plant personnel are discussed in Subsection 13.1.3.

QUESTION 040.84

Your response to request 040.36 is not complete. You state in Subsection 9.5.4.2 the available net positive suction head (NPSH), with the impeller flooded, is much greater than the 1 foot, 6 inch required NPSH for the pump. Therefore, the entire volume above the pump centerline, 10 3/4 inches from the bottom, is available for the diesel generator.

The fuel oil storage tank transfer pump selected requires a minimum NPSH of 1 foot, 6 inches to deliver its rated capacity of 25 gpm at 30 psi differential head. Operation of this pump with less than the required NPSH will affect pump performance and reliability. At some point, if the pump is permitted to operate with diminishing NPSH, the pump will cease to deliver fuel and severe cavitation will occur.

Your above statements need further clarification.

RESPONSE:

See revised Subsection 9.5.4.2.

QUESTION 040.85

Your answer to request 040.37 is not complete. The new Figures 9.5-28, 9.5-29, and 9.5-30 do not provide the needed information to evaluate the adequacy of the diesel generator fuel oil storage and transfer system.

Provide additional information and drawing (plans and sections).

1. The piping in the truck fill pit.

2. The location of the fuel oil storage tanks with respect to the diesel generator building including all fuel piping from the storage tank to its associated day tank and from the day tank to the storage tank.

3. The relation of the fuel oil storage tanks to buried yard piping that may be in the vicinity or cross under the fuel storage tank concrete support mat (see Figure 9.5-28). Identify the line size, carrying capacity in gpm, pressure and fluid. Provide assurance that a pipe line break under the fuel oil storage tanks support structure will not prevent the diesel generator fuel oil storage and transfer system from performing its safety function.

4. Plans of diesel generator building at elevations 660'-0", 710'-0", and 723'-0".

RESPONSE:

See revised Subsection 9.5.4.2. Dwgs. C-46, Sh. 1, C-5012, Sh. 1, C-904, Sh. 1, C-5013, Sh. 1, C-905, Sh. 1, C-5014, Sh. 1, C-5015, Sh. 1, C-1029, Sh. 1, C-1029, Sh. 2, E-412, Sh. 1, have been added.

QUESTION 040.86

Your answer to request 040.38 is not complete. Figures 9.5-19, 9.5-28, 9.5-29, and 9.5-30 show the tank fill connection and branch fill lines to each fuel oil storage tank as non-seismic, Class D construction. Also, the above figures do not identify the piping classification of the fuel oil storage tank vent line and other connections.

RESPONSE:

See revised Subsection 9.5.4.2

QUESTION 040.87

It is our position that the fuel oil storage tank fill line from the tank interface up to and including the truck fill interface and all other tank connections should be seismic Category I, Class C construction. Revise your design accordingly.

You state in Subsection 9.5.4.2 (Revision 9) that the fuel oil storage tank vents are goose-necked and provided with screens to keep out potential above-grade fuel contamination. This is not acceptable. It is our position that fuel tank vents should be provided with flame arrestors. Revise your design accordingly.

RESPONSE:

See revised Subsection 9.5.4.2

QUESTION 040.88

Section B on Figure 9.5-29 shows that the four diesel generator fuel oil storage tanks, concrete support mat and structures are located between and abutting existing crane foundations.

Provide the result of an analysis which demonstrates that in the event of a design basis earthquake seismic interaction between the existing crane foundations and diesel generator fuel oil system support structures will not prevent the diesel generator fuel oil storage and transfer system from performing its safety function.

RESPONSE:

The existing crane foundations were used to support cranes only during construction activity. A one-inch layer of rodofoam was placed between the crane foundation and the structure surrounding the diesel tanks, in order to dampen crane vibrations.

The crane foundations are continuous beyond both ends of the diesel structure and are supported directly on the bedrock in their entirety. Further, sand-cement-flyash backfill is placed between the east and west foundations from El. 646'-0" to El.670'-0", thus preventing movement in an inner direction. The foundations are abandoned in place since they do not support any permanent structure.

The presence of the foundations does not hinder the diesel tanks from performing safety functions. No special analysis is required.

QUESTION 040.89

You state in Subsection 9.5.4.3 (Revision 7) that excessive splashing and sediment turbulence is prevented by the fuel fill line discharging near the bottom of the storage tank. If minor sediment turbulence occurs, fuel filters will keep the overall quality of the fuel oil acceptable during replenishment.

Location of the fill line near the bottom of the storage tank does not necessarily mean that turbulence is minimized. to the contrary, the magnitude of turbulence generated with a vertical fuel fill line is dependent upon exit pipe velocity and the distance the end of the fuel fill pipe is from the bottom of the storage tank. The turbulence generated within the storage tank with your design is dependent upon the fill line location and exit velocity.

Provide a drawing showing the size and arrangement of the fuel fill line in the storage tank, expected maximum refueling rate (gpm), and maximum fill line exist velocity. Also provide assurance that the turbulence generated at the maximum existing velocity will not degrade the fuel and prevent availability of the diesel generator on demand.

A method of alleviating or minimizing excessive turbulence in storage tank would be by a perforated fuel fill distribution header. The perforations or orifices should be designed for low exist velocities.

RESPONSE:

See revised Subsection 9.5.4.3.

QUESTION 040.90

Operating experience has shown that accumulation of water in the starting air system has been one of the most frequent causes of diesel engine failure to start on demand. Condensation of entrained moisture in compressed air lines leading to control and starting air valves, air start motors, and condensation of moisture on the working surfaces of these components has caused rust, scale and water itself to build up and score and jam the internal working parts of these vital components thereby preventing starting of the diesel generators.

In the event of loss of offsite power the diesel generators must function since they are vital to the safe shutdown of the reactor(s). Failure of the diesel engines to start from the effects of moisture condensation in air starting systems and from other causes have lowered their operational reliability to substantially less than the desired reliability to substantially less than the desired reliability of 0.99 as specified in Branch Technical Position ICSB (PSB) 2" Diesel Generator Reliability Testing" and Regulatory Guide 1.108 "Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants."

In an effort toward improving diesel engine starting reliability we require that compressed air starting system designs include air dryers for the removal of entrained moisture. The two air dryers most commonly used are the desiccant and refrigerant types. Of these two types, the refrigerant type is the one most suited for this application and therefore is preferred. Starting air should be dried to a dew point of not more than 50°F when installed in a normally controlled 70°F environment, otherwise the starting air dew point should be controlled to at least 10°F less than the lowest expected ambient temperature.

Revise your design of the diesel engine air starting system accordingly, describe this feature of your design.

RESPONSE:

We concur that air dryers will minimize the potential for rust accumulation in the air start and pneumatic control systems of the diesel generators. Since all system low points are drained and the operating pressure is over 200 psig, there will be very little moisture in the air, even when saturated. Thus, we believe there is little risk of air start or control air blockage from moisture.

To prevent rust accumulation in the air start and control air systems, and thus improve the long-term reliability of the diesel generator sets, we will provide air dryers in the air start systems prior to plant startup following the first refueling outage. The air dryer units will be non-seismic components and will be standard commercial products of proven quality and reliability. These units are not available with ASME Section III components and will be provided with ASME Section VIII, ANSI B31.1 and commercial grade components. Each of the eight air dryer units will be independent and will be provided with power from the diesel generator they serve. The dryers will be located in the system between the air compressor and air receiver.

QUESTION 040.91

You state response to our request 040.49 is covered in section 9.5.7.2 revision 7. We have reviewed revision 7 and do not find that you have addressed our request. Provide your response to request 040.49.

Response:

See revised Subsection 9.5.7.2.

QUESTION 040.92

Several fires have occurred at some operating plants in the area of the diesel engine exhaust manifold and inside the turbocharger housing which have resulted in equipment unavailability. The fires were started from lube oil leaking and accumulating on the engine exhaust manifold and accumulating and igniting inside the turbocharger housing. Accumulation of lube oil in these areas, on some engines, is apparently caused from an excessively long prelube period, generally longer than five minutes, prior to manual starting of a diesel generator. This condition does not occur on an emergency start since the prelube period is minimal.

When manually starting the diesel generators for any reason, to minimize the potential fire hazard and to improve equipment availability, the prelube period should be limited to a maximum of three to five minutes unless otherwise recommended by the diesel engine manufacturer. Confirm your compliance with this requirement or provide your justification for requiring a longer prelube time interval period to manual starting of the diesel generators. Provide the prelube time interval your diesel engine will be exposed to prior to manual start.

RESPONSE:

See revised Subsection 9.5.7.1

QUESTION 040.93

An emergency diesel generator unit in a nuclear power plant is normally in the ready standby mode unless there is a loss of offsite power, an accident, or the diesel generator is under test. Long periods on standby have a tendency to drain or nearly empty the engine lube oil piping system. On an emergency start of the engine as much as 5 to 14 or more seconds may elapse from the start of cranking until full lube oil pressure is attained even though full engine speed is generally reached in about five seconds. With an essentially dry engine, the momentary lack of lubrication or the various moving parts may damage bearing surfaces producing incipient or actual component failure with resultant equipment unavailability.

The emergency condition of readiness requires this equipment to attain full rated speed and enable automatic sequencing of electric load within ten seconds. For this reason, and to improve upon the availability of this equipment on demand, it is necessary to establish as quickly as possible an oil film in the wearing parts of the diesel engine. Lubricating oil is normally delivered to the engine wearing parts by one or more engine driven pump(s). During the starting cycle the pump(s) accelerates slowly with the engine and may not supply the required quantity of lubricating oil where needed fast enough. To remedy this condition, as a minimum, an electrically driven lubricating oil pump, powered from a reliable DC power supply, should be installed in the lube oil system to operate in parallel with the engine driven main lube pump. The electric driven prelube pump should operate only during the engine cranking cycle or until satisfactory lube oil pressure is established in the engine main lube distribution header. The installation of this prelube pump should be coordinated with the respective engine manufacturer. Some diesel engines include a lube oil circulating pump as an integral part of the lube oil preheating system which is in use while the diesel engine is in the standby mode. In this case an additional prelube oil pump may not be needed.

Confirm your compliance with the above requirement or provide your justification for not installing an electric prelube oil pump.

RESPONSE:

See revised Subsection 9.5.7.1.

QUESTION 040.94

Experience at some operating plants has shown that diesel engines have failed to start due to accumulation of dust and other deleterious material on electrical equipment associated with starting of the diesel generators (e.g., auxiliary relay contacts, control switches - etc.). Describe the provisions that have been made in your diesel generator building design, electrical starting system, and combustion air and ventilation air intake design(s) to preclude this condition to assure availability of the diesel generator on demand.

Also describe under normal plant operation what procedure(s) will be used to minimize accumulation of dust in the diesel generator room. In your response also consider the condition when Unit 1 is in operation and Unit 2 is under construction (abnormal generation of dust).

RESPONSE:

See revised Subsection 9.4.7.2.

QUESTION 40.95

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TABLE 40.95-1

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TABLE 40.95-2

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QUESTION 40.96

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