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Mr. George W. Knighton, Chief
Licensing Branch No. 3
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U. S. Nuclear Regulatory Commission
Washington, DC 20555

South Texas Project
Units 1 & 2
Docket Nos. STN 50-498, STN 50-499
Revision to FSAR Questions
Diesel Generators and Lighting Systems

Dear Mr. Knighton:

As a result of discussions with the NRC Power Systems Branch Staff, Houston Lighting & Power Company (HL&P) has revised several Final Safety Analysis Report (FSAR) question responses regarding Diesel Generators and Lighting Systems. Attachment 1 is a list of the questions that have been revised. Attachment 2 contains the revised question responses. Attachment 3 contains proposed revisions to the FSAR which incorporate the question responses into the appropriate FSAR text.

Please note that questions 430.82N, 430.91N, 430.94N and the text for FSAR Section 9.5.3 was provided to you by letter ST-HL-AE-1235 dated April 24, 1985 and are not yet incorporated into the FSAR. That letter also provided responses to questions 430.74N through 430.105N, several of which are referenced in the attached revised question responses.

All these revisions will be formally incorporated into the FSAR in Amendment 49 of the FSAR.

If you have any questions, please contact Mr. M. E. Powell at (713) 993-1328.

Very truly yours,

M. R. Wisenburg
Manager, Nuclear Licensing

CAA:as
Attachments: (1) List of Revised Questions
(2) Revised Questions and Responses
(3) Revised FSAR text

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List of Revised Questions

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Attachment 2
ST-HL-AE-1268

Question 040.10

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

(1) Identify all working stations in the plant 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 that will be 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 page party communications systems, and

(b) any other additional communication system provided 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.

(6) 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

As stated in 9.5.2.2, maintenance jacks are provided throughout the plant for operating convenience including all areas required for safe shutdown. Also plant personnel have access to 2-way radio/walkie talkies to provide backup communications throughout the plant.

1. Table 040.10-1 identifies working stations in the plant where it may be necessary for plant personnel to communicate with the control room or the emergency shutdown panel during and/or following accidents (including fire) in order to mitigate the consequences of the event and to attain a safe cold shutdown.

2. The maximum sound levels that would exist at each of the above identified

Response (Continued)

working stations for all transients and accident conditions are also shown on Table 040.10-1.

3. The type of communication systems available at each of the above identified working stations is shown on Table 040.10-1.

4. The communications equipment at the locations specified in Table 040.10-1 is capable of performing at the maximum sound levels in those areas. The background sound levels are enveloped by the maximum sound levels.

   STP does not utilize a page party system. Refer to FSAR Section 9.5.2 for a description of the communications systems.

5. The performance requirements and tests that the above onsite working stations communication systems will be subjected to are identified in Section 9.5.2.2.3.

6. The protective measures taken to assure a functionally operable onsite communications systems are discussed in Section 9.5.2.2 and Question Response 430.77.

TABLE 040.10-1

	Max. Sound Level (dBSPL)		Available Com. System
	High noise areas are defined as greater than 90 dBSPL		
Auxiliary Shutdown Panel	55		A, B, C, D
Transfer Switch Panels	90		A, B, C, D
Standby Diesel Generator Control Panels	105	Noise cancelling headsets are provided for use with the maintenance jack system	A, B, C, D
Chiller Control Panels	90		A, B, C, D
Boric Acid Tank Room and Component Cooling Water Surge Tank	90		A, B, C, D
Essential Cooling Water Traveling Screen Rooms	95	Noise cancelling headsets are provided for use with the maintenance jack system	A, B, C, D
AFST (Aux. Feedwater Storage Tank)	85		A, B, C, D

Legend: A: Telephone EPBAX
B: Public Address
C: Maintenance Jacks (Sound Powered)
D: 2-Way Radio/Walkie Talkie

Question 040.11

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

The areas at which the unit may be brought to a safe shutdown and access/egress routes in safety-related equipment areas are as listed in Section 9.5.3.2.3. The lighting systems are as indicated in Section 9.5.3 and Table 9.5.3-1.

In addition, security lighting is discussed in the Security Plan.

Question 040.13

Section 9.5.4.1 emergency diesel engine fuel oil storage and transfer system (EDEFSS) does not 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

See the response to Q430.40N.

Question 040.14

Your design of the emergency diesel engine fuel oil storage and transfer system (EDEFSS) does not include a diesel fuel day tank. Provide you justification for omitting the day tank from the EDEFSS design. In your discussion compare the system availability and reliability of your present design to a system which would have included a day tank.

Response

See FSAR Section 9.5.4 in response to NRC Question 430.41N.

Question 040.15

In section 9.5.4.3 you state selection of suitable materials compatible with the type of fuel required to operate the diesel generators ensures that the system will not be subject to material corrosion. This statement is too general. Expand the FSAR to include a more explicit description of proposed materials and coatings which will be used in the design of the diesel engine fuel oil storage and transfer system. Where corrosion protective coatings are being considered include the industry standard(s) which will be used in their application. Also discuss what provisions will be made in the design of the fuel oil storage and transfer system in the use of an impressed current types cathodic protection system, in addition to water proof protective coatings, to minimize corrosion of buried piping or equipment. (SRP 9.5.4, Part II).

Response

See revised section 9.5.4.3.

Question 040.16

Figure 1.2-10 showing the diesel generator room general arrangement does not show the location and arrangement of the fuel oil storage tank truck fill piping and connecting fuel oil piping from the auxiliary fuel oil storage system. Provide plan and elevation drawings showing the arrangement of this piping. Indicate the height these lines are terminated above finished ground grade and maximum flood elevation.

Response

Diagrams that show the routing of all fuel oil lines associated with the diesel generators and storage tanks have been supplied to the NRC under separate cover. (J.H. Goldberg - HL&P to H.R. Denton ST-HL-AE-1139, October 2, 1984). The truck fill connection is terminated at elevation 32'-6". A discussion of flooding at the STP site can be found in Section 3.4.

Question 040.17

Figure 1.2-10 shows the location of the fuel oil storage tank vent line with flame arrestor. What provision has been made to protect the vent lines from tornado missiles? The arrangement indicates that the three fuel oil storage tank vent lines could be damaged by a single tornado missile.

Response

An impact by a tornado missile causing a complete loss of function of the flame arrestors is not considered to be credible. This is based on the amount of crimping that would be required (99.3%) to cause a vacuum to be formed in the tank. It is more likely that the pipe would shear. In addition, the physical location of the arrestors will reduce the probability of a missile impact.

Question 040.19

The diesel generator structures are designed to seismic and tornado criteria and are isolated from one another by a reinforced concrete wall barrier. Describe the barrier in more detail and its capability to withstand the effects of internally generated missiles resulting from a crankcase explosion, failure of one or all of the starting air receivers, or failure of any high or moderate energy line. In addition describe the effect of internal flooding from the cooling system on the ability of the barriers to resist flooding so that the assumed effects will not result in loss of an additional generator. (SRP 9.5.4, Part III, Item 2).

Response

The internal walls of the Diesel Generator Building (DGB) are designed to withstand the effects of internally generated missiles. (See Section 3.5.1.1.2, Item 4, and Table 3.5-1). Missiles created from a crankcase explosion are not considered to be credible due to adequately sized explosion doors which would relieve the pressure from the primary crankcase explosions and prevent the entry of air to eliminate the possibility of a secondary explosion. The walls, including doors and piping penetrations, of the building are also designed to contain flooding in one compartment. Additionally, there are no cross connections in floor drains or process flow lines which could result in propagation of flooding from one compartment to another.

There are no high energy lines in the DGB. The systems which contain moderate energy lines are discussed in Section 3.6.

Question 040.20

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 or its equivalent, clould point, entrained moisture, sulfur, particulates and other deleterious insoluble substances; procedure for testing newly delivered fuel, periodic sampling and testing of onsite 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 industry (or other) standards which will be followed to assure a reliable fuel oil supply to the emergency generators. (SRP 9.5.4, Part III, items 3 and 4).

Response

a) STP intends to use the McGuire Technical Specifications with the following exception:

   ASTM D4294-83, Sulfur in Petroleum Products by Non-Dispersive X-Ray Fluorescence Spectrometry, will be included in the STPEGS Technical Specifications in addition to ASTM D2622-82, Sulfur in Petroleum Products X-Ray Spectrographic Method. These two analytical procedures are similar in measurement methodology.

   Both methods utilize x-rays to excite the sample. The fundamental difference lies in the method of detection. ASTM D2622-82 describes a general purpose wavelength to dispersive X-ray spectrograph. It uses detector positioning to quantify the sulfur K-alpha radiation (a specific wavelength of radiation which is manifested due to the presence of sulfur). K-alpha radiation is dispersed from an analyzing crystal at a specific angle. ASTM D4294-83 describes a dedicated non-wavelength dispersive sulfur X-ray analyzer. It uses a filter to allow only a narrow band pass of X-rays, which includes the sulfur K-alpha radiation, to reach the detector.

   The wavelength dispersive spectrograph is designed to detect low levels in general, and can detect as low as 10 ppm sulfur. The non-wavelength dispersive analyzer's sensitivity is 100 ppm, but is well suited for the 1000 ppm or greater level of sulfur normally found in no. 2 diesel fuel oil.

   Dedicated sulfur analyzers employing the non-wavelength dispersive technique drastically reduce the cost of sulfur analyses, when compared to the general purpose wavelength dispersive spectrograph required by ASTM D2622-82.

b) The quality of the fuel oil supply will be verified in accordance with applicable industry standards as discussed in FSAR section 9.5.4.4.

Question 040.21

What provisions have been made in the 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 4).

Response

Strainers are provided in the lines which carry fuel oil from both sources of replenishment: the temporary truck fill connection and the Fuel Oil Storage System (See Figures 9.5.4-1 and 9.5.10-1). Sampling of the fuel oil as described in Section 9.5.4.4 will prevent entrance of deleterious material into the system during initial and subsequent fills. Section 9.5.4.3 also discusses how the entrance of deleterious materials into the system is precluded.

The emergency fill connection described in Section 9.5.4.3 will be provided with a means of removing deleterious material prior to filling of the tank.

Question 040.22

In the event of an accident or design basis earthquake it may be necessary to operate a diesel generator(s) continuously for a period of 30 days or more. Standard Review Plan 9.5.4, Part III, item 5b requires each diesel generator be provided with a seven day fuel oil storage supply. Under this condition discuss your plans how you will provide fuel oil replenishment to maintain the emergency diesel generator(s) in operation. In your discussion include sources where diesel quality fuel oil will be available and the distances required to be traveled from the sources to the plant. Also discuss how fuel oil will be delivered onsite under extremely unfavorable environmental conditions. (SRP 9.5.4, Part III, Item 5b).

Response

See the response to Q430.46N.

Question 040.23

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

Response

The diesel fuel oil will be analyzed as required by Technical Specifications and measurement of particulate contamination will serve as one method to detect undesirable algae or fungi growth in the tanks. Other detection methods will be used as required to monitor the types and amount of growth in the tanks in order to determine the effectiveness of additives (biocide) which may be employed for control. This type of control has been used successfully at other plants and should be an effective preventive measure for the DGFOST and the AFOST. The periodic removal of water from the tanks will serve as a prevention measure against such growth since the oil/water interface provides the most supportive conditions for the growth of the fungi.

Connections in the fill and drain piping of the fuel oil storage tanks are provided for the connection of temporary filtering and separation equipment to remove excessive deleterious materials or water. Should gross contamination occur, draining and physical cleaning of the DGFOST would be performed.

Question 040.24

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

There are no high energy lines in the DGB. Moderate energy systems in the diesel generator room have been identified in Section 3.6. A detailed discussion of the typical design measures to be taken to protect the safety-related systems from the effects of moderate energy line failure was presented in Ref. 3.6-5 (See response to Question 010.4).

It should be noted that the fuel oil guard pipe has been deleted. The deletion is as a result of the minimal amount of oil spillage expected and the addition of the leakage detection system described in Section 9.5.4.3.

Question 040.25

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

Fuel oil piping is routed so as not to be in the proximity of hot exhaust piping. The layout of fuel oil piping was transmitted under separate cover. (J.H. Goldberg - HL&P to H.R. Denton ST-HL-AE-1139, October 2, 1984).

Question 040.26

Figure 9.5.4-1 shows the Seismic Category I, class 3 boundary of the fuel oil storage tank fill line terminating at the inlet of the check valve nearest to the storage tank. This is not acceptable. It is our position that the fuel oil storage tank fill line should be Seismic Category I, class 3 up to the truck fill interface. It is also our position that connection to the truck fill line from a non-Seismic Category I supply such as the auxiliary fuel oil storage system should be provided with a Seismic Category I, class 3 isolation valve. Revise your system design accordingly.

Response

See Section 9.5.4.3.

Question 040.27

You state in Section 9.5.5.2.1 that the diesel generator cooling water system includes a standpipe with makeup water from a nonseismic source. The standpipe will provide a reserve to compensate for system changes in volume, any minor leaks at pump shaft seals, valve stems and other components during operation. The standpipe will also maintain required NPSH on the system circulating pump. Describe the standpipe and provide the size, volume and location. Demonstrate by analysis that the standpipe will be adequate to maintain required pump NPSH and makeup water for seven days continuous operation of the diesel generator at full rated load, or provide a Seismic Category I, quality group C makeup water supply to the standpipe.

Response

See Sections 9.5.5.2.1 and 9.5.5.3.

Question 040.30

The diesel generator sets should be capable of operation at less than full load for extended periods without degradation of performance or reliability. Expand your FSAR to include and explicitly define this requirement. (SRP 9.5.5, Part III, item 7).

Response

The diesel generator operating procedures will include instructions to intersperse 15-30 minute periods of operation at 75% to 100% load at approximately 6 hour intervals when operating the diesel for longer than 6 hours at light loads (less than 50%).

Also see response Section 9.5.5.6.

Question 040.31

Provide a discussion of the measures taken in the design of the standby diesel generator air starting system to preclude fouling of the starting air valve, filter or other components from oil carryover.

Response

See paragraph 5 under Section 9.5.6.2, System Description. The Diesel Generator Manufacturer does not consider any additional filters are necessary. Some oil carryover is considered advantageous as it provides lubrication for the cylinders. The manufacturer is not aware of any problems in the starting air system, due to oil carryover, on diesel generators they have supplied.

Question 040.32

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

a) The diesel lube oil system will be filled directly from the lube oil supply truck via the permanent truck fill connection, by gravity feed or by pressurizing the truck to assist lube oil flow.

b) An in line strainer on the fill line, and sampling of the lube oil prior to transfer from the supply truck to the lube oil sump will prevent contamination of lube oil by fill equipment.

Question 040.34

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

See Section 9.5.8.5. In Addition:

a) The calibration program for the instrumentation, controls, sensors, and alarms is under development and frequencies for these activities have not been determined. This information will be available for review prior to fuel load.

b) The operator action required following alarm actuation will be specified in the annunciator response procedure which is currently under development. These actions will be consistent with the manufacturer's guidelines. This procedure will be available for review prior to fuel load.

Question 040.35

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 response to Q430.59N.

Question 040.40

Assure that a high energy line failure of the turbine bypass 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

The failure of turbine bypass high energy line will not disable the turbine speed control system. Specifically, as described in Section 10.2.2.8, the following design features have been incorporated to ensure that any pipe rupture resulting in damage to an overspeed protection device would not prevent turbine trip.

1) Physical separation of "trip" devices

2) Fail-safe condition of relays

3) Effective redundancy of "trip" devices

4) Mechanical overspeed trip device

In addition, postulated ruptures of large high energy piping within non-Category I structures are checked to ensure that they are not capable of causing damage to safety-related equipment in the adjacent areas.

Question 430.24N

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 (R.G. 1.108), and with the recommendations of the engine manufacturer. Conflicts between any such recommendations and 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 has been satisfactorily started and load tested, return 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

See the response to Questions 040.30 and 430.50N for a description of the loading of the diesel generators for testing and troubleshooting.

STPEGS has procedural commitments to perform reviews of equipment failures. Based on these reviews, design changes are considered which would improve reliability.

Maintenance is performed in accordance with written procedures, which require verification or testing to ensure that equipment meets its design requirements prior to being declared operable. Refer to FSAR Section 13.5.1.3.

For STP's position on R.G. 1.108, see the response to Question 430.31N.

Question 430.25N

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 sensors, 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. If the floor is not vibration free, the panel shall be equipped with vibration mounts.

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

Response

The engine and generator control and instrumentation panels are physically located approximately 12 ft from the diesel generator (DG) at an elevation 10 ft above the bottom of the generator. The natural frequency of the DG and foundation system is lower than the machine speed. Also, the ratio of foundation weight to the diesel generator weight is approximately eight. Transmission of vibratory motion from the DG to the engine and generator panel is considered insignificant. Refer to Figure 1.2-10 of the STP FSAR for the physical location of the panel.

In addition the control panels were seismically tested and the Test Response Spectra curves envelope the Required Response Spectra curves by a margin of more than 10%. The panels were also vibration aged to the equivalent of 5 OBE's.

Question 430.28N

Provide a detail 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 diesel 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 and 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

The training program for supervisors, operators and maintenance personnel described in Chapter 13 of the FSAR includes training on the emergency diesel generators.

Specific personnel are not exclusively dedicated to the emergency diesel generators. The level of education, experience, numbers, and type of personnel assigned to supervision, operation and maintenance is described in Chapter 13. The criteria stated in Chapter 13 apply to diesel generators as well as other plant systems and components.

The training, education, experience and staffing of quality assurance personnel is described in Chapter 17.

Question 430.40N

Your response to Question 040.13 is unacceptable. ANSI Standard N195 "Fuel Oil Systems For Standby Diesel Generators" is applicable to your plant. Indicate how you comply with this standard in your design of the EDEFSS; otherwise provide justification for non-compliance. Also indicate how you comply with Regu'atory Guide 1.137 Position C.2.

Response

See FSAR section 9.5.4. See response to NRC Question 040.20 for the STP position on Reg. Guide 1.137, position C.2.

Question 430.42N

Describe the instruments, controls, sensors and alarms provided for monitoring the diesel engine fuel oil storage and transfer system and describe their function. Discuss the testing necessary to maintain and assure a highly reliable instrumentation, controls, sensors and alarm system and where the alarms are annunciated. Identify the temperature, pressure and level sensors which alert the operator when these parameters exceed the ranges recommended by the engine manufacturer, and describe what operator actions are required during alarm conditions to prevent harmful effects to the diesel engine. Discuss the system interlocks provided. (SRP 9.5.4, Part III, Item 1.)

Response

Refer to FSAR Sections 9.5.4.5 and Figure 9.5.4-1 and response to Q040.34.

Question 430.43N

Your response to Question 040.15 is incomplete. You did not discuss corrosion protection for the fuel oil storage tank internals. Provide a description of the proposed materials and coatings which will be used to protect the tank internals. Include the industry standards which will be used in their application.

Response

See section 9.5.4.3.

Question 430.44N

Your response to Question 040.16, 040.22, and 040.26 with regards to the fuel oil storage tank truck fill connection is unacceptable. The truck fill connection is located 13 feet below the maximum probable flood level and is non-seismic. The non-seismic yard storage tank is an unacceptable means of replenishing the D/G fuel oil storage tank under accident conditions, such as a seismic event, over an extended period time. It is our position that the truck fill connection be located above the PMF level, be designed seismic Category I, suitably protected from damage by tornado missiles and provided with a fill pipe cap and chain. Comply with this position.

Response

A description of the emergency fill connection can be found in section 9.5.4.3.

Question 430.46N

Your response to Question 040.22 with regards to the sources of quality diesel fuel oil is incomplete. Provide the sources where quality diesel fuel oil will be available and the distance required to be travelled from the sources to the plant, as well as discuss how fuel oil will be delivered onsite under extremely unfavorable environmental conditions such as during a flood.

Response

Each standby diesel generator (DG) is provided with a fuel oil storage tank to permit a minimum of 7 days continuous operations.

Fuel oil for continued operation beyond the 7-day time interval may be obtained for the onsite fuel oil storage tank. If this supply is unavailable, there are several major suppliers of acceptable quality fuel oil in the surrounding area of the STP, any one of which can be utilized to provide the additional supply of fuel oil. The following lists several suppliers, their location, and approximate distance required to travel to the plant:

Gulf Oil	Victoria	65 miles
Tesoro Oil	Port Lavaca	55 miles
Mobil Oil	Wadsworth	10 miles
Superior Oil	El Campo	50 miles
Mobil Oil	Houston	110 miles

It is highly unlikely that extremely unfavorable weather conditions will be of such duration as to exhaust all onsite supplies and require fuel delivery while the weather conditions persist. However, HL&P has extensive experience in handling and mitigating weather related problems (e.g, hurricanes, tornadoes, floods). This experience, coupled with the fact that numerous water transportation vehicles are available in the South Texas area, provide assurance that HL&P will be able to deliver any necessary fuel oil during unfavorable environmental conditions. Note that numerous roads to the general site area are available for the transportation of fuel oil to the site area.

See also the response to Q430.86N, item b.

Question 430.47N

The FSAR text, Figure 9.5.4-1 through 9.5.8-1, and Table 3.2-1 states that the components and piping systems for the diesel generator auxiliaries (fuel oil system, cooling water, lubrication, air starting, and intake and combustion system) that are mounted on the auxiliary skids are designed seismic Category I and are ASME Section III Class 3 quality. The engine mounted components and piping are designed and manufactured to DEMA standards, and are seismic Category I. This is not in accordance with Regulatory Guide 1.26 which requires the entire diesel generator auxiliary systems be designed to ASME Section III Class 3 or Quality Group C. Provide the industry standards that were used in the design, manufacture, and inspection of the engine mounted piping and components. Also show on the appropriate P & ID's where the Quality Group Classification changes from ASME Section III Class 3 (Quality Group C).

Response

Regulatory Guide (RG) 1.26, Revision 3, states:

> "Other systems not covered by this guide, such as instrument and service air, diesel engine and its generators and auxiliary support systems, diesel fuel, emergency and normal ventilation, fuel handling, and radioactive waste management systems, should be designed, fabricated erected, and tested to quality standards commensurate with the safety function to be performed."

The engine mounted components and piping for the diesel generator's auxiliaries are considered part of the engine; their design and function are integrated with the engine rather than the skid piping. Therefore, they are designed and manufactured to standards applicable to the engine (DEMA) and are seismic Category I. It is noted that the engine mounted piping is manufactured to ANSI B31.1 standards. The DEMA standards provide assurance that these auxiliaries are designed, fabricated, erected, and tested to quality standards commensurate with the safety function to be performed. In addition to DEMA tests, the engine is qualified by a reliability test.

Amended Figures 9.5.5-1, 9.5.7-1, and 9.5.4-1, 9.5.6-1, and 9.5.8-1 show quality group changes.

Question 430.49N

Describe the instrumentation, controls, sensors and alarms provided for monitoring of the diesel engine cooling water system and describe their function. Discuss the testing necessary to maintain and assure a highly reliable instrumentation, controls, sensors, and alarm system, and where the alarms are annunciated. Identify the temperature, pressure, level and flow (where applicable) sensors which alert the operator when these parameters exceed the ranges recommended by the engine manufacturer and describe what operator actions are required during alarm conditions to prevent harmful effects to the diesel engine. Discuss the systems interlocks provided. (SRP 9.5.6, Part III, item IC).

Response

Refer to FSAR Sections 9.5.5.4 and 9.5.5.5; Figure 9.5.5-1; Table 9.5.5-3; and response to Q040.34.

Question 430.50N

Your response to Question 040.30 is incomplete. The diesel generators are required to start automatically on loss of all offsite power and in the event of a LOCA. The diesel generator sets should be capable of operation at less than full load for extended periods without degradation of performance or reliability. Should a LOCA occur with availability of offsite power, discuss the design provisions and other parameters that have been considered in the selection of the diesel generators to enable them to run unloaded (on standby) for extended periods without degradation of engine performance or reliability. Expand your FSAR to explicitly define the capability of your design with regard to this requirement and provide the operating procedures used when operating unloaded. (SRP 9.5.5, Part III, item 7).

Response

See Sections 9.5.5.6.

Question 430.51N

Describe the instrumentation, controls, sensors and alarms provided for monitoring the diesel engine air starting system, and describe their function. Describe the testing necessary to maintain a highly reliable instrumentation, control, sensors and alarm system and where the alarms are annunciated. Identify the temperature, pressure and level sensors which alert the operator when these parameters exceed the ranges recommended by the engine manufacturer describe any operator actions required during alarm conditions to prevent harmful effects to the diesel engine. Discuss system interlocks provided. Revise your FSAR accordingly. (SRP 9.5.6, Part III, item 1).

Response

Refer to Sections 9.5.6.2 and 9.5.6.5; Table 9.5.6-2, Figure 9.5.6-1, and response to Q040.34.

Question 430.53N

For the diesel engine lubrication system in Section 9.5.7 provide the following information: 1) define the temperature differentials, flow rate, and heat removal rate of the interface cooling system external to the engine and verify that these are in accordance with recommendations of the engine manufacturer; 2) discuss the measures that will be taken to maintain the required quality of the oil, including the inspection and replacement when oil quality is degraded; and 3) describe the capability for detection and control of system leakage. (SRP 9.5.7, Part II, Items 8a, 8b, 8c, Part III, Item 1).

Response

See the response to Question 430.100N and FSAR Section 9.5.7.2.

Question 430.54N

Describe the instrumentation, controls, sensors and alarms provided for monitoring the diesel engine lubrication oil system and describe their function. Describe the testing necessary to maintain a highly reliable instrumentation, control, sensors and alarm system and where the alarms are annuniciated. Identify the temperature, pressure and level sensors which alert the operator when these parameters exceed the ranges recommended by the engine manufacturer and describe any operator action required during alarm conditions to prevent harmful effects to the diesel engine. Discuss systems interlocks provided. Revise your FSAR accordingly. (SRP 9.5.7, Part III, item 1C).

Response

Refer to Sections 9.5.7.2, 9.5.7.5, Table 9.5.7-2, Figure 9.5.7-1, and response to Q040.34.

Question 430.56N

Provide the results of an analysis that demonstrates that the function cf your diesel engine air intake and exhaust system design will not be degraded to an extent which prevents developing full engine rated power or cause engine shutdown as a consequence of any meteorological or accident condition. Include in your discussion the potential and effect of fire extinguishing (gaseous) medium, recirculation of diesel combustion products or other gases that may intentionally or accidentally be released on site, on the performance of the diesel generator. (SRP 9.5.8, Part III, item 3).

Response

Refer to revised Section 9.5.8.3.

Question 430.57N

Show by analysis that a potential fire in the diesel generator building together with a single failure of the fire protection system will not degrade the quality of the diesel combustion air so that the remaining diesel will be able to provide full rated power.

Response

Refer to revised Section 9.5.8.3 and Section 9.4.6.2.1.

Question 430.59N

Your response to Question 040.35 is incomplete. You did not discuss the protection provided to the diesel generator air intake and exhaust system from ice and freezing rain, nor did you discuss the protection or the exhaust system from all types of inclement weather conditions. Provide the requested information.

Response

See Section 9.5.8.2. Also see response to Q430.102 item c.

Question 430.60N

Figure 1.2-10 shows the diesel generator exhaust stack extending above the roof. The FSAR text does not specify whether this portion of the exhaust stack is protected from tornado missiles. Separation of the exhaust stacks does not constitute adequate protection. It is our position that the diesel generator exhaust stacks be tornado missile protected.

Response

Response will be provided upon finalization of design.

Question 430.82

You state in Sections 9.5.3.1 and 9.5.3.3 of the FSAR that illumination levels provided in the various areas of the plant either conform to or exceed that required in the Illumination Engineering Society (IES) Handbook. This statement is too general particularly for emergency lighting. Based on the guidelines in the IES Handbook (pages 2-11 and 2-45), the staff has determined that the plant emergency lighting for access and egress should be considered safety lighting for high hazards requiring visual detection and that a minimum of 10 foot-candles at the work station is required to adequately control, monitor and/or maintain safety-related equipment during accident and transient conditions and a minimum of 2 to 5 foot-candles in the corridors which provide access to and egress from these areas. For those safety-related areas listed in requests Q40.10 and Q40.11 and illuminated by the dc lighting systems only verify that the minimum of 10 foot-candles at the work station is being met. Also verify that the 10 foot-candle minimum at the work station is being met in those safety-related areas illuminated by the ac emergency system. Verify that that the access and egress corridors are illuminated by a minimum of 2 to 5 foot-candles. Confirm that the design provides the above or modify your design as necessary. (SRP 9.5.3, Parts I and II)

Response (Not in FSAR but previously transmitted via ST-HL-AE-1235 dated 4/24/85.)

A fixed dc emergency lighting system (Section 9.5.3.2.3) consisting of 8 hour battery packs is part of an integrated lighting system which meets applicable IES 1972 guidelines. The Essential AC Lighting System powered by diesel generators (two Class 1E, trains A and C, and one non-Class 1E TSC) backs up the 8 hour battery packs at a minimum of 10 foot-candles at the work stations and illuminates the access/egress routes by a minimum of 2 to 5 foot-candles as described in Section 9.5.3.2.2 except at the Essential Cooling Water (ECW) Traveling Screen Rooms. For these ECW rooms lighting (10 foot-candles and 2 to 5 foot-candles as noted above) is provided solely by 8 hour battery packs.

Question 430.91N

Recent licensee event reports have shown that tube leaks are being experienced in the heat exchangers of diesel engine jacket cooling water systems with resultant engine failure to start on demand. Provide a discussion of the means used to detect tube leakage and to corrective measures that will be taken. Include jacket water leakage into the lube oil system (standby mode), lube oil leakage into the jacket water (operating mode), jacket water leakage into the engine air intake and governor systems (operating or standby mode). Provide the permissible inleakage or outleakage in each of the above conditions which can be tolerated without degraded engine performance or causing engine failure. This discussion should also include the effects of jacket water/service water systems leakage. (SRP 9.5.5, Parts II and III)

Response (Not in FSAR but previously transmitted via ST-HL-AE-1235 dated 4/24/85.)

The jacket water system is completely separate from and does not interface (provide cooling) with the lube oil and governor systems. The ECW system provides cooling water to these system coolers.

It is noted that a major cause of the reported tube leaks (see IE information Notice 79-23) was attributed to inadequate tubesheet thicknesses and poor tube to tube sheet attachments. The STP lube oil and jacket water cooler tubesheets are greater than 1" in thickness (vs. 1/8" reported in IE 79-23) and the tubes are rolled (vs. soldered and epoxy reported in IE 79-23). Another potential cause of tube leaks is the quality of water used for cooling. The Essential Cooling Water quality has been evaluated in section 9.2.1.2.3. The STP diesel engine manufacturer is not aware of any tube leaks in these coolers on diesel engines they have supplied. They have supplied 36 diesel engines to the nuclear industry. Ten of these engines have been operated over ten years and there have been no reports of tube leaks. Based upon the construction of these coolers, tube leakage is considered improbable.

Question 430.94N

Diesel generators in many cases utilize air pressure or air flow devices to control diesel generator operation and/or emergency trip functions such as air operated overspeed trips. The air for these controls is normally supplied from the emergency diesel generator air starting system. Provide the following:

a) Expand your FSAR to discuss any diesel engine control functions supplied by the air starting system or any air system. The discussion should include the mode of operation for the control function (air pressure and/or flow), a failure modes and effects analysis, and the necessary P&ID's to evaluate the system.

b) Since air systems are not completely air tight, there is a potential for slight leakage from the system. The air starting system uses a nonseismic air compressor to maintain air pressure in the seismic Category I air receivers during the standby condition. In case of an accident, a seismic event, and/or loop, the air in the air receivers is used to start the diesel engine. After the engine is started, the air starting system becomes nonessential to diesel generator operation unless the air system supplies air to the engine controls. In this case the controls must rely on the air stored in the air receivers, since the air compressor may not be available to maintain system pressure and/or flow. If your air starting system is used to control engine operation, with the compressor not available, show that a sufficient quantity of air will remain in the air receivers, following a diesel engine start, to control engine operations for a minimum of seven days assuming a reasonable leakage rate. If the air starting system is not used for engine control describe the air control system provided and provide assurance that it can perform for a period of seven days or longer. (SRP 9.5.6, Part III)

Response (Not in FSAR but previously transmitted via ST-HL-AE-1235 dated 4/24/85.)

a) Air is needed to start the engine and once the engine is operating in the emergency mode, air pressure is no longer required for control functions including the maintenance barring device. It should be noted that only two (2) protection trips will stop the engine when operating in the emergency mode: 1) generator differential, 2) overspeeding. One of which, overspeed, uses air to isolate the fuel supply. In the event air is lost a manual operated control is provided.

b) N/A, See a) above.

Attachment 3
ST-HL-AE-1268

TABLE 3.12-1 (CONT'D)

REGULATORY GUIDE MATRIX

NO.	REGULATORY GUIDE TITLE	FSAR REFERENCE	REVISION STATUS	STATUS ON STP	
1.125	Physical Models for Design and Operation of Hydraulic Structures and Systems for Nuclear Power Plants		Rev 0 (3/77) FC	NA See Note 18	
1.126	An Acceptable Model and Related Statistical Methods for the Analysis of Fuel Densification		Rev 0 (3/77) FC	D See Note 25	23
1.127	Inspection of Water-Control Structures Associated with Nuclear Power Plants		Rev 0 (4/77) FC	A (Essential Cooling Pond only), See Note 22	32
1.128	Installation Design and Installation of Large Lead Storage Batteries for Nuclear Power Plants	8.3.2.2.5	Rev 0 (4/77) FC	A See Note 70	450.30.14N
1.129	Maintenance, Testing, and Replacement of large lead Storage Batteries for Nuclear Power Plants	8.3.2.1.4 8.3.2.2.5	Rev 0 (4/77) FC	A See Note 26	36
1.130	Design Limits and Loading Combinations for Class 1 Plate-and-Shell-Type Component Supports		Rev 0 (7/77) FC	NA See Note 31	
1.131	Qualification Tests of Electric Cables, Field Splices, and Connections for Light-Water-Cooled Nuclear Power Plants	9.5.1.2.2.	Rev 0 (8/77) FC	C See Note 3, Note 24	23
1.132	Site Investigations for Foundations of Nuclear Power Plants		Rev 0 (9/77) FC	NA See Note 2	
1.133	Loose-Part Detection Program for the Primary System of Light-Water-Cooled Reactors	4.4.6.4	Rev 1 (5/81)	A	360.492.02N
1.134	Medical Certification of Personnel Requiring Operating Licenses		Rev 0 (9/77) FC	B See Note 24	23
1.135	Normal Water Level and Discharge at Nuclear Power Plants		Rev 0 (9/77) FC	B See Note 3, Note 24	
1.136	Material for Concrete Containments		Rev 0 (11/77) FC	NA See Note 2, Note 13	45
1.137	Fuel-Oil Systems for Standby Diesel Generators		Rev 0 (1/78) FC	D ~~NA~~ See Note 2, Note 66	43
1.138	Laboratory Investigations of Soils for Engineering Analysis and Design of Nuclear Power Plants		Rev 0 (4/78)	NA See Note 2	
1.139	Guidance for Residual Heat Removal		Rev 0 (5/78)	B See Note 43	23
1.140	Design, Testing, and Maintenance Criteria for Normal Ventilation Exhaust System Air Filtration and Absorption Units of Light-Water-Cooled Nuclear Power Plants		Rev 0 (3/78)	See Note 61	

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Page 1

TABLE 3.12-1 (Cont'd.)
REGULATORY GUIDE MATRIX
NOTES

If a work activity and contract is for a two-month period or less, an audit is not necessary when a facility preaward audit has been conducted.

The QA program for operations will conform to the requirements of RG 1.94 Revision 1, with the same clarification:

55. Refer to Sections 3.7.4.1 and 3.7.4.2 for the discussion on seismic instrumentation.

56. Refer to Section 5.2.3.3.2 for Westinghouse alternate approach to RG 1.71. Also, refer to Section 10.3.6.2, for the BOP conformance to RG 1.71.

57. STP alternate approach to RG 1.99 is discussed in Section 5.3.2.1.

58. STP alternate approach to RG 1.121 is discussed in Section 3.12.1.

59. Revision 0 is utilized during the construction phase for RG 1.58, Positions C.5, C.6, C.7, C.8, and C.10 of Rev. 1 are also utilized.

60. With respect to Section 3.1.2 of ANSI N45.2.3-1973, HL&P interprets the lighting level of 100 footcandles to be guidance. It is HL&P's normal practice that the lighting level for determining "metal clean" of accessible surfaces of piping and components is determined by the inspector. Typically he uses a standard two-cell flashlight supplemented by other lighting as he deems necessary.

61. STP conforms to RG 1.140, with the exception that instrumentation is provided only to monitor and alarm pertinent pressure drops at critical points in the duct. Therefore, STP is in partial compliance with Position C.2.cc.

62. RG 1.1 as clarified by NUREG 75/087.

63. The basis for meeting the intent of RG 1.46 is the implementation of NRC Branch Technical Position (BTP) MEB 3-1, NRC BTP ASB 3-1, WCAP-8082-P-A, and WCAP-8172-A. Tables 3.6.1-2 and 3.6.1-3 provide a summary of the compliance with MEB 3-1 and ASB 3-1.

64. Exceptions to revision 2 are identified in FSAR reference sections.

65. The QA program during operations will conform to the requirements of Revision 2.

66. The quality of D.G. fuel oil will be checked as identified in Section 9.5.4.4.

9.5.3 Plant Lighting Systems

9.5.3.1 <u>Design Bases</u>.

1. The Lighting System is designed so that a single failure of any electrical component, assuming loss of offsite power (LOOP), will not terminate the system's ability to illuminate those areas where, during emergency conditions, reactor shutdown is carried out.

2. The lighting subsystems that serve the main control room, the remote shutdown areas and the access/egress routes thereto, and other areas in which the collapse of the Lighting System would physically impact on Class 1E equipment are seismically supported to prevent their collapse during and after a Safe Shutdown Earthquake (SSE). The Lighting System supports for equipment and raceway in close proximity to Category I equipment are designed for seismic concerns, and to prevent structural collapse during and after a SSE.

3. Lighting fixtures containing mercury lamps and mercury switches are not used inside the Reactor Containment Building (RCB), specific Mechanical Auxiliary Building (MAB) areas and Fuel Handling Building (FHB).

   Lighting fixtures with lamps containing mercury, if used in the turbine building over the turbine or portions of the secondary system which can be opened during maintenance operations, and over the condensate polishing demineralizer regeneration equipment area, are provided with solid translucent lamp guards to prevent falling lamps. All MAB lighting fixtures with lamps containing mercury are provided with solid translucent lamp guards.

   The above restrictions also apply to sodium vapor lamp fixtures.

   The design of the integrated Lighting System is based on the applicable portions of the following codes and standards:

   Illumination Engineering Society (IES) Lighting Handbook (1972)

   Occupational Safety and Health Standards (OSHA) 29CFR 1910

   National Electric Code (NEC) NFPA 70-1981

   Federal Aviation Administration (FAA) Obstruction Marking and Lighting - Advisory Circular No. 70/7460-IF, dated September 27, 1978

9.5.3.2 <u>System Description</u> The lighting system provides illumination for normal and emergency plant operations, and access/egress routes for fire fighting and safe building evacuation.

The lighting system is comprised of three separate systems as follows:

1. Normal AC Lighting
2. Essential AC Lighting
3. Emergency DC Lighting

9.5.3.2.1 Normal AC Lighting System The Normal AC Lighting System provides the major portion of the illumination requirements throughout the plant. This system also provides power for the 120V convenience receptacles.

Power for this system is supplied from the non-Class 1E system. If this power is not available, power for the yard area lighting is provided from a non-Class 1E diesel generator.

Under normal operating conditions, the Normal AC and Essential AC Lighting Systems operate together to provide lighting for the plant.

9.5.3.2.2 Essential AC Lighting System The Essential AC Lighting System provides the illumination requirements for the safe shutdown areas, other operating areas and access/egress routes. A minimum of ten footcandles are provided at the work stations in the safe shutdown areas which are:

a. Control Room
b. Auxiliary Shutdown Panel
c. Transfer Switch Panels as defined in Section 7.4.1.9.2
d. Standby Diesel Generator Control Panels
e. Chiller Control Panels
f. Boric Acid Tank Room
g. Component Cooling Water Surge Tank
h. Essential Cooling Water Traveling Screen Rooms

Two to five footcandles are provided in the access/egress routes between the above work stations.

Power for the Essential AC Lighting System is supplied from two Class 1E and one non-Class 1E systems. Upon loss of the normal power supply (i.e. loss of offsite power), the Essential AC Lighting System is automatically connected to the Class 1E (trains A and C) and non-Class 1E (TSC) diesel generators. The lighting power sources for the safe shutdown areas and access/egress routes are shown in Table 9.5.3.1.

9.5.3.2.3 Emergency DC Lighting System: The Emergency DC Lighting System consists of lighting supplied from batteries upon loss of the normal and Essential AC Lighting Systems.

The Emergency DC Lighting System provides illumination at safe shutdown areas including access/egress routes between them, and at the access/egress routes to and from fire areas during fire transients, and accident conditions including a safe shutdown earthquake (SSE) as follows:

1. The 8 hour sealed beam battery packs, Holophane M-19-2A-X-SEIS-PT, are supported to withstand a SSE. They are mounted in the safe shutdown areas as listed in Section 9.5.3.2.2, and in the access/egress routes between them.

2. The Technical Support Center (TSC) also uses 8 hour battery packs.

3. Lighting from sealed beam lights with at least 90 minute battery packs is provided in other access/egress routes upon loss of normal area lighting.

4. Emergency lighting in the Emergency Operations Facility (EOF), not within plant boundary, shall consist of 8 hour battery packs for ingress/egress.

TABLE 9.5.3-1

LIGHTING AT SAFE SHUTDOWN AND ACCESS/EGRESS AREAS

Areas	100% Essential AC Lighting Backed By Class 1E DG	10% Essential AC Lighting Backed By Non-Class 1E DG	8 Hr Emergency DC Lighting	Normal AC Lighting
1. Control Room	Yes	N/A	Yes	N/A
2. Auxiliary Shutdown	Yes	N/A	Yes	N/A
3. Transfer Switch Panels	Yes	N/A	Yes	N/A
4. Access/Egress Between 1, 2, 3 above	Yes	N/A	Yes	N/A
5. Standby Diesel Generator Control Panels	N/A	Yes	Yes	Yes
6. Chiller Control Panels	N/A	Yes	Yes	Yes
7. Boric Acid Tank Room and Component Cooling Water Surge Tank	N/A	Yes	Yes	Yes
8. Access/Egress between 5, 6 above operation	N/A	Yes	Yes	Yes
9. Essential Cooling Water Traveling Screen Rooms and Access/Egress to them	N/A	N/A	Yes	Yes

9.5.4.3 System Evaluation. The DGFOST System is designed to seismic Category I, Safety Class (SC) 3 requirements and will withstand a single failure and still perform its functional requirements. Failure of any one FOST System component results in the failure of only one standby DG. The safe shutdown of the reactor coincident with a LOOP is achieved using the remaining two DGs. A failure modes and effects analysis (FMEA) is provided in Table 9.5.5-2.

Provisions will be made for emergency refueling in case of a flood.

For the emergency fill connection, a Safety Class 3 pipe routed through the roof to the FOST fill line, will be equipped with an ASME III Class 3 locked closed valve filter and a quick disconnect coupling connected upstream of the valve (Figure 9.5.4-1). A hose could then be routed to the roof via an existing hose reel for tank filling when the flood level has receded.

A sampling point is also provided upstream of the isolation valve which allows checking and flushing of the line prior to filling operations from the truck fill. The end of the truck fill connection will be provided with a fill pipe cap and chain.

The FOST's are constructed of carbon steel and made to ASME III specifications. The tank is located indoors and is provided with exterior protection (painted). During operation the water content of the fuel oil will be monitored (section 9.5.4.4) to ensure both operability of the diesels as well as to minimize corrosion of the external fuel oil system. Internal coatings will not be added to the FOST's since a sufficient corrosion allowance (0.336") exists in the tank walls. This will aleviate any concern with peeling of internal coatings and the potential for clogging of the tank discharge.

Selection of suitable materials compatible with the type of fuel required to operate the DGs ensures that the system will not be subject to material corrosion. The basic material of construction for the piping and components in contact with fuel oil is carbon steel.

The AFOST (see section 9.5.10) will be protected by an exterior coating to reduce the possibility of corrosion. The periodic removal of water from the bottom of the tank will help minimize the possibility of internal, corrosion. Sampling and analysis for particulate matter will also be used to detect instability and oxidation of stored fuel oil which would contribute to corrosion. Appropriate actions will be taken if significant corrosion products are detected during the periodic testing.

Steel Structures Painting Council Surface Preparation Standard, this standard coupled with project specific requirements will be utilized for preparation of the tank surface and application of the coating respectively.

Buried piping from the yard auxiliary fuel oil storage tank (AFOST) and from the external truck fill connection is protected from corrosion by both cathodic protection and coating. Cathodic protection is by the impressed current method. Protective coating consists of coal tar epoxy spray applied per project specific requirements.

Means are provided for detecting and controlling a fuel spill. Each DG room is equipped with an instrumented drain sump. A high level alarm located in the main control room will indicate a leak (whether fuel oil, lube oil, cooling water, etc.) in the DG room. Once a leak has been detected it can be isolated external to the DG room by a shut off valve in the fuel oil storage tank room thus preventing further leakage.

The system is designed to withstand environmental design conditions, including earthquake, hurricane, and tornado loadings (see Chapter 3).

Each FOST is located within a flood- and missile-proof seismic Category I compartment. Each of the three compartments is physically separated so that a failure of one fuel oil train will not affect the remaining two trains. In addition, the compartments are designed so that in the event of a fire, it will be contained within the compartment. Refer to Figure 1.2-3 and 1.2-4 for the Plot Plans, and Figure 1.2-10 for the General Arrangement of the DGB.

9.5.4.4 Inspection and Testing Requirements. Components of the system have been inspected and tested by the manufacturer. After installation and before initial plant operation, the DGFOST System is inspected, tested, and operated. For the remainder of the plant life, the DG systems will be tested regularly to ensure performance under emergency conditions. Inservice inspection will be performed in accordance with ASME Boiler and Pressure Vessel (B&PV) Code, Section XI.

The quality of the fuel oil used for the operation of the Standby Diesel Generators (SBDGs) will be checked by the following methods:

1. When the fuel oil is transferred from the AFOST to the DGFOST, the quality of the fuel oil in the AFOST will be verified by one of two methods:

   a) Taking a composite multi-level sample of the fuel oil in the AFOST, prior to addition to the DGFOST, and testing the sample for the parameters identified in Technical Specification 4.8.1.1.2.c., or

   b) Sampling the contents of each supply truck prior to addition to the AFOST and testing for the parameters identified in Technical Specification 4.8.1.1.2.c.

2. When the fuel oil is added directly to the DGFOST from a supply truck a sample will be taken and tested for the parameters identified in Technical Specification 4.8.1.1.2.c.

3. The sample is tested for the following in accordance with ASTM D975-81:

   a) API Gravity or Specific Gravity

   b) Kinematic viscosity

   c) Flashpoint

   d) Clear and bright appearance

4. Within 30 days of obtaining the sample, the fuel oil will be tested for conformance with the other properties as specified in ASTM D975-81, Table 1.

5. The sulfur analysis will be in accordance with ASTM D1552-79, ASTM-D2622-82, ASTM D4294-83.

6. Once in storage, the DGFOST and the AFOST fuel oil is sampled periodically in accordance with ASTM D2276-78 and verified that particulate contamination is within limits.

9.5.4.5 Instrumentation Application. The three DGs are provided with independent fuel oil supply systems. Each fuel oil supply system is provided with its own instrumentation. Applicable portions of the fuel system instrumentation are designed to seismic Category I requirements, as defined in Section 3.2.

Each DG FOST is provided with level indication in the main control room at the local panel and locally at the tank. High-level, low-level and low-low-level alarms are provided for each tank. These alarms annunciate in the main control room (common trouble alarm) and at the local panel.

9.5.5 Diesel Generator Cooling Water System

9.5.5.1 Design Bases. The DG Cooling Water System (DGCWS) is designed to circulate sufficient quantities of cooling water to dissipate heat given off by the air coolers, lube oil coolers, and engine water jackets, under full load conditions.

The DGCWS is designed to seismic Category I and SC 3 requirements. In addition, each DG and its associated Closed-Loop Cooling Water System are located a physically separated tornado-, flood-, and missile-proof structure in the DGB, and are protected from the effects of moderate-energy line breaks.

9.5.5.2 System Description. The DGCWS consists of a Closed-Loop Cooling Water System: and an Open-Loop Cooling Water System. A schematic diagram for both systems is shown on Figure 9.5.5-1. Major components and design data are provided in Table 9.5.5-1.

9.5.5.2.1 Closed-Loop Cooling Water System: A forced-circulation Jacket Closed-Loop Cooling Water System is furnished for each DG to provide cooling of the engine by means of a water jacket and to supply heat to the combustion air, if necessary, via two air heaters/intercoolers.

This system consists of the following components:

1. Engine-driven jacket water pump

2. AC motor-driven jacket water standby pump

3. AC motor-driven circulation pump

4. Jacket water cooler

5. An automatic thermostatic valve

6. Jacket water standpipe

7. Combustion air heaters/intercoolers (one for each cylinder bank)

8. Electric water heater

9. Local control panel

10. Required instrumentation and piping

During normal operation, the engine-driven jacket water pump circulates water through the jacket water cooler, then through the engine water jackets and combustion air heaters/intercoolers back to the standpipe.

The standpipe provides a reserve to compensate for minor system leakages at pump shaft seals and valve stems. There is no normal consumption of jacket water. The standpipe also serves to maintain adequate NPSH on the jacket water pumps and to provide a holdup volume for jacket water to allow for deaeration. The standpipe is approximately 16 1/2 ft. tall and holds approximately 860 gallons. The standpipe is located on the auxiliary skid adjacent to the DG and is provided with a fill line that receives make-up water when the solenoid valve is opened by low level switch. A chemical make-up line, a drain, an overflow, and the engine discharge header complete the connections to the standpipe. A sight-glass and high/low level alarms are also furnished. The jacket water in the engine and system is initially filled with water and vented to remove the air from the system. During operation the holdup time and velocity of water in the standpipe serve to keep the jacket water deaerated and prevent formation of air pockets. Water temperature from the engine is controlled by a three-way thermostatic valve located downstream of the main pump. Water enters the valve at port "A" and at 175°F all water is directed out port "C" of the valve and through the jacket water cooler. Between 165°F and 175°F the valve modulates and the flow is through ports "B" and "C" to maintain the temperature at approximately 170°F. A temperature sensor in the Combustion Air System actuates a valve to regulate the flow of hot water through the combustion air heaters/intercoolers, thus controlling the combustion air temperature.

If the engine-driven water jacket pump should fail, the AC motor driven jacket water standby pump will automatically start and has the same capacity to provide jacket water to the engine. The standby jacket water pump is mounted on the auxiliary skid and is provided with a gauge on the skid gauge panel to indicate the discharge pressure. A check valve is installed downstream of this pump to prevent backflow when the pump is not operating. Automatic start of this pump occurs when the water pressure falls to 12 psig or the water temperature rises to 190°F.

When the engine is not in operation, a small AC motor-driven circulation pump, in combination with an electric water heater, maintains the Closed-Loop Cooling Water System at operating temperature. A temperature switch starts the pump and turns on the heater when jacket water-temperature is 120°F falling and turns them off at 130°F rising. A check valve on the outlet side of the heater prevents a reverse flow through the pump and heater when they are inoperative.

The circulaticn pump and electric water heater are both powered from a 480 V Class 1E Motor Control Center. Train A Motor Control Center E1A1 powers the pumps and water heater for the train A DG No. 11. Similarly, Train B and C Motor Control Centers E1B1 and E1C1 power the pumps and water heaters for Trains B and C DGs Nos. 12 and 13 respectively. Engine temperatures are 29 maintained at part load operation by thermostatic control of jacket water.

The heat load rejected to the Open-Loop Cooling Water System under normal, full-load operating conditions is 6,240,000 Btu/hr, based on a closed-loop flow of 1,350 gal/min entering the jacket water cooler at 170°F and an open-loop cooling water flow of 628 gal/min entering the Jacket Water HX at 115°F, the maximum design basis temperature of the Open-Loop Cooling Water System.

The circulation pump motor is rated 5hp, 460 vac, 3 phase, 60 Hz. The jacket water heater is rated 40 kW, 480 vac, 3 phase, 60 Hz. Table 9.5.5-4 identifies the power source for the pumps and heater.

Table 9.5.5-1 lists the capacity and discharge head of the pumps and rating of the jacket water heaters.

9.5.5.2.2 Open-Loop Cooling Water System: The Open-Loop Cooling Water System is a subsystem of the Essential Cooling Water System (ECWS) (see Section 9.2.1). It provides cooling water for the Closed Cooling Water System (CCWS), the lube oil cooler, the fuel oil cooler, the governor oil cooler, and 41 the combustion air intercoolers (one cooler per cylinder bank).

Each DG has its own separate Open-Loop Cooling Water System, which is supplied with cooling water by separate trains of the ECWS. There are no interconnections of individual trains of the Open-Loop Cooling Water System.

During operation , full cooling water flow is supplied to all of those components serviced by the Open-Loop Cooling Water System. The flows and heat loads for the various components are given in Table 9.5.5-1. The values are based on an ECSW supply temperature of 115°F. The total flow of the Open-Loop Cooling Water System is 1,500 gal/min with a full load total heat load of 13,244,400 Btu/hr.

9.5.5.3 System Evaluation. Each DG has an independent Cooling Water System with an independent source of water to the jacket water cooler. The DGCWS meets the single-failure criterion so that if a failure in one Cooling Water System prevents the associated DG from operating, the remaining DGs are not affected. The DG Closed Cooling Water System pumps are powered from a Class 1E source. A failure modes and effects analysis is provided in Table 9.5.5-2.

In the event of LOOP, the ECWS will begin operation within a specific time lapse (see Section 8.3) from initial startup of the DG. The time lapse will be within a safe margin of the point at which the DG would require the cooling capability of the coolers.

The DGCWS is capable of operating for a minimum of seven days without makeup from any source with the diesel generator operating at rated load. Beyond the seven-day period, makeup water if required can be provided. Sufficient instrumentation is provided to alert the oeprator to low water level, and adequate time is available for operator action. For these reasons, no seismic Category I system is required to provide assured makeup water for the DGCWS. Cooling water chemistry is maintained within the manufacturer's specifications to preclude corrosion and fouling.

9.5.5.4 Inspection and Testing Requirements. The DGCWS will be inspected and tested during the scheduled operational tests of the DGs. The cooling water in the closed-loop system will be periodically analyzed and treated as necessary to maintain the desired water quality. Inservice inspection will be performed in accordance with ASME B&PV Code, Section XI.

Instrumentation provided to monitor cooling water temperature, pressure, and standpipe level will be periodically calibrated and alarms verified operable as described in Section 13.5.2.

9.5.5.5 Instrumentation Application. The necessary controls are provided with each cooling system to maintain the engine jacket at the proper temperature for all modes of operation. Alarms are provided at the local control panel, with a common DG trouble alarm in the main control room, for low jacket water standpipe level, abnormal jacket water temperature, and low jacket water pressure at the inlet to the engine. The DGCWs indications and alarms are summarized in Table 9.5.5-3 and DG protective trips are discussed in Section 8.3.1.1.4.6. Alarm response procedures described in Section 13.5.2.1(5) will be prepared for alarms associated with this system.

9.5.5.6 No Load Operation. Actual shop tests performed on a prototype KSV-20-T diesel engine showed the engine capable of running at no-load for an extended period. Following six hours of no-load operation at rated speed, the engines were subjected to a 75 percent load test for one hour, followed by a 50 percent load test for one hour. Based on the prototype testing, no adjustments need to be made to the STP engines or controls. The operating procedures require interspersing 15-30 minute periods of operation at 75-100 percent load at approximately 6 hour intervals when operating the diesel for longer than 6 hours at light loads (less than 50%).

9.5.6 Diesel Generator Starting System

9.5.6.1 Design Bases. Each DG is provided with two compressed starting air systems, either of which is capable of starting the engine without power. The starting air system, including the interconnecting piping and the on-engine piping, is designed to seismic Category I, SC 3 requirements, except for the compressors and dryers, which are Non-Nuclear Safety. The on-engine piping is designed to Diesel Engine Manufacturers Association (DEMA) requirements and meets ANSI B31.1. The equipment is located within the DG compartments and is therefore protected from tornado winds, external missiles, flooding, and the effects of moderate-energy line breaks (see Chapter 3).

9.5.6.2 System Description. A schematic of the redundant DG Starting Air System for one diesel engine is shown on Figure 9.5.6-1. Each Starting Air System includes two ac motor-driven air compressors, two air dryers, two air receivers, two starting air valves, all necessary valves and fittings, instrumentation, and control systems. Table 9.5.6.-1 lists major components in the DGSS and their design data.

Each redundant air receiver is isolated from the nonsafety-related portions of the Starting Air System by one check valve and a manually operated isolation valve. Each receiver has a volume of 83 ft and a design pressure of 275 psig. This is sufficient for five start attempts per receiver without recharging. The receiver is constructed of stainless steel. The air compressors are sized to recharge each receiver from minimum pressure to maximum pressure in 17 minutes. Each receiver is provided with a pressure switch to stop and start the compressors as required. Low pressure is alarmed locally and as a common trouble alarm in the main control room. High pressure safety relief valves are provided.

From the receiver, the air flows to the engine-mounted components through stainless steel interconnecting piping. The on-engine components consist of two strainers, four pilot-solenoid, air-operated starting valves, two rotary air distributors, and the air headers for the left and right cylinder banks. The on-engine piping is also stainless steel.

The Starting Air System also supplies instrument air for essential and nonessential engine controls and air for the air motor on the maintenance barring device.

Carry-over of moisture, oil and corrosion products to the starting air valves is prevented by filters at the compressor inlet, desiccant driers at the compressor discharge, and traps in the air receiver drains. In addition, other inline filters are provided as indicated in Figure 9.5.6-1. Furthermore, stainless steel is used for all surfaces exposed to starting air.

Each air compressor serves one receiver tank. The compressors start when the air receiver pressure is 240 psig falling and stops when the pressure reaches 250 psig. The compressors are powered from a 480 v Non-Class IE Motor Control Center.

A check valve between the air dryer and air receiver ensures that a broken line will not result in a sudden loss of air. Pressure relief valves between the compressor and dryer and on the receiver are set at 265 psig. The relief valves in the air receivers can be manually tripped for test or for blowing down the receiver pressure.

Compressed air from the starting air receivers is applied to the starting air control valves, which are controlled by the starting air solenoid valves. When the starting air control valves open, starting air is supplied to both banks of air start valves and air distributors. One start valve is located in each cylinder head and all are controlled by the air distributors.

Alarm response procedures described in Sections 13.5.2.1 and 13.5.2.2 are prepared for alarms associated with this system. Information will be available to the operator to provide guidance in alarm response.

9.5.6.3 System Evaluation. The starting system for each DG is completely independent of the starting systems of the two other DGs. Consequently, failure of one starting system will result in failure of that DG only. The remaining DGs will be able to safely shut down the plant or mitigate the effects of a LOCA coincident with a LOOP. A failure modes and effects analysis (FMEA) is provided in Table 9.5.5-2.

9.5.6.4 Inspection and Testing Requirements. Periodic tests are performed to ensure system operability. Inspection and scheduled maintenance will be performed periodically using the manufacturer's recommendations and procedures. Inservice inspection will be performed in accordance with the requirements of ASME B&PV Code, Section XI.

The Starting Air System will be periodically tested as a minimum during the regularly scheduled tests of the DGs. Testing can be performed without affecting normal plant operation.

9.5.6.5 Instrumentation. Controls and alarms are provided at the local panel for

1. Independently starting and stopping the compressors.

2. Opening each starting air valve.

3. Alarming low starting air pressure with a common DG alarm in the main control room.

Indication of starting air pressure upstream of the starting air valves is provided in the control room and locally.

The DG starting air system indications and alarms are summarized in Table 9.5.6-2. Instruments are checked during periodic testing of the engine. Calibrations are routinely performed and alarms verified operable as described in section 13.5.2.

9.5.7 Diesel Generator Lubrication System

9.5.7.1 Design Bases. The DG Lubrication System is designed to provide a self-contained lube oil system for each DG engine. The system is safety-related and consequently is designed to seismic Category I, SC 3, and DEMA requirements.

The equipment is located within the DG compartments and therefore is protected from tornado winds, external missiles, flooding, and the effects of moderate-energy line breaks (see Chapter 3).

9.5.7.2 System Description. The lubrication system of each engine includes a direct engine-driven lube oil pump, an ac motor-driven lube oil standby pump, an ac motor-driven circulation pump, lube oil filters and strainers, a lube oil cooler, a thermostatic valve, an electric lube oil heater, and all necessary valves, fittings, piping, and instrumentation. The standby pump and circulation pump motors are powered from 480 v Class 1E motor control centers. A schematic of the DG Lubrication System is shown on Figure 9.5.7-1.

Table 9.5.7-1 lists the major components in the lubrication system and their design data.

The engine-driven lube oil pump has sufficient capacity to ensure adequate lubrication of all wearing parts as required. The ac motor-driven lube oil standby pump has sufficient capacity to replace the engine-driven pump should it fail. The lube oil pumps take oil from the lube oil sump through a strainer and deliver it to the thermostatic valve. This valve controls the lube oil temperature by bypassing a portion of the lube oil flow around the lube oil cooler. From the thermostatic valve and the lube oil cooler, the lube oil flows first through a full-flow oil filter and then through a duplex lube oil strainer. The lube oil then flows to the various engine components requiring lubrication and/or oil cooling and returns to the engine lube oil sump.

Pressure relief valves are provided on the discharge of the oil pumps and on the engine supply header. A pressure regulator regulates oil pressure to the turbocharger. Oil flow is not monitored.

Protective functions (including interlocks) for the DGs are discussed in Section 8.3.1. The low lube oil pressure protective function remains operational during periodic testing of the DGs. However, during operation of the DG this trip is automatically bypassed. The bypassed protective function is alarmed in the main control room.

The oil strainer may be manually bypassed for cleaning during operation. If necessary for plant protection, the filter can be manually bypassed for a short duration.

Alarm response procedures described in Sections 13.5.2.1 and 13.5.2.2 are prepared for alarms associated with this system. Information will be available to the operator to provide guidance in alarm response.

The system also includes a standby prelubricating and preheating system to keep the engine ready for quick starts. It consists of an ac motor-driven circulation pump, which takes suction from the engine lube oil sumps, and an electric heater which comes on when lube oil temperature is 120°F falling and turns off at 130°F rising, and an electric heater, which heats the lube oil to operating temperature. From the heater, the lube oil flows through the main oil filter and then to the various engine components requiring lubrication. This pump starts when the engine rpm falls below 280.

Essential cooling water at a flowrate of 300 gal/min is the source of cooling water for the lube oil coolers. Normal inlet temperature for this water is 95°F while the normal outlet temperature is 115°F. Maximum inlet temperature is 115°F while the maximum outlet temperature is 135°F. Heat removal rate is approximately 2,960,000 Btu/hr for the above conditions which is technically compatible with the engine manufacturer recommendations.

The engine is equipped with two low oil pressure shutdown switches to stop the engine in the test mode, in case oil pressure drops to 30 psig, which could result from insufficient oil inventory. One of these switches is located in the main header and the other one is located downstream of the turbocharger pressure regulator. System leakage is routed to floor drains which are piped to individual sumps which are then pumped to the oily waste system for processing.

All components are designed to seismic Category I requirements. In addition, each DG and its associated Combustion Air Intake and Exhaust System is located in a physically separated, tornado-, flood-, and missile-proof structure, and is protected from the effects of moderate line breaks (see Chapter 3).

9.5.8.2 System Description. A schematic of the DGCAIES is shown on Figure 9.5.8-1. The relative location of system equipment in the facility is shown on Figure 1.2-10.

Each DGCAIES consists of:

1. Combustion air intake filter and silencer (oil-bath type)

2. Exhaust silencer

3. Combustion air manifold

4. Exhaust manifold

5. Turbocharger

6. Air heaters/air coolers (one each per cylinder bank)

7. Connecting piping and expansion joints

8. Overspeed shutdown valve

Outside air for combustion is drawn into the building through a separate missile protected opening above the maximum flood level. Intake air velocity is limited to prevent the entry of rain or snow, thus eliminating the possibility of clogging the air intake or otherwise degrading performance. All portions of the DGCAIES, except for the air intake opening and the end of the exhaust pipe, are located within the DGB.

Air is drawn in through the combustion air intake filter and silencer and flows through the connecting piping and expansion joints to the overspeed shutdown valve and into the compressor stage of the turbocharger. From the turbocharger, the air flows through the air heaters/intercoolers and into the combustion air manifolds, where it becomes available to the power cylinders on demand.

The exhaust gases are released into the exhaust manifold and into the turbine of the turbocharger. The exhaust gases expand through the turbocharger turbine and flow through the interconnecting piping and expansion joints to the exhaust silencer. From the silencer, the exhaust gases are routed out of the DGB, via a beveled exhaust with a bird screen, (see Figure 1.2-10).

The overspeed shutdown valve located in the turbocharger is controlled by the engine overspeed protection device. Upon a signal from the overspeed protection device, the overspeed shutdown valve closes, shutting off the combustion air supply to the engine, thus providing a positive shutdown.

9.5.8.3 Safety Evaluation. The Combustion Air Intake and Exhaust System for each DG is completely independent of the Intake and Exhaust System of the other two DGs. Consequently, failure of one Intake and Exhaust System will result in the failure of only that DG. The remaining DGs will be able to safely shut down the plant or mitigate the effects of an LOCA in the event of a coincident LOOP.

Air from outside the DGB is drawn through fixed louvers and the intake air filter. These louvers are surrounded by a missile wall barrier such that an external missile cannot penetrate and cause damage to any of the DG components. The louvers are located above the design flood level.

Liquid nitrogen, is stored in an 11,000 gallon tank at the STP site in the Bulk Gas Storage Facility. An analysis has been performed which shows that in the unlikely event of an instantaneous rupture of the tank, the resulting dilution of the DG air intake would be only 17.0 percent. Under this condition, the engine is still capable of carrying its rated load. The following assumptions were used in the analysis:

1. Distance from the tank to the DG air intake, 486 ft
2. 11,000 gallons of liquified N2 stored in a low pressure tank
3. Puff release using the methodology of RG 1.78, Appendix B
4. Pasquill Type F meteorology
5. Air intake 65 ft above grade
6. No credit taken for building effects

The following is an assessment of the influence of diesel exhaust gases and smoke in the oxygen level of the combustion air:

1. As shown in Figure 1.2-10 the diesel exhaust is discharged to atmosphere through the north wall of the diesel generator building. Analysis results indicate an insignificant reduction in the oxygen level of the combustion air would occur as the result of predominant southerly or northerly winds directing a portion of the exhaust gases to the elevation of the air intake. This dilution would not affect engine operation. The only gaseous fire extinguishing medium for STP is halon used in the relay room, the computer room, the TSC computer room in the EAB, the Administration Building and the radwaste control room in the MAB. Release of halon from these buildings would be a controlled operation. No fire extinguishing gaseous medium is used for fire protection for the DGB.

2. From a geometrical standpoint, the combustion air intake louvers on the north side of the DGB are 90° with respect to the auxiliary ESF transformers which are approximately 20 ft east and 10 ft south of the building. The transformers are supplied with an automatic deluge system. A class B fire could result from an oil spill or internal shorts. Thirty minute response time and thirty minute fire brigade action would result in extinguishing the fire via existing fire hydrants or fire department connections with access to the deluge valve immediately adjacent to the DGB, in case of a single failure of the automatic deluge system.

3. A single failure of the fire protection system could result in the unavailability of the sprinkler system for a given engine compartment. The compartment ventilation system continues to be operational ensuring a purge of the smoke from the affected compartment. The smoke is exhausted approximately 30 ft south and 43 ft above the elevation of the combustion air intake louvers and, therefore, will tend to rise rather than be drawn down to the air intake louvers. Aspects of fire fighting are identical to those identified in 2 above. Until the closure of the thermal link dampers the smoke will be vented on the north side of the DGB via the oil room exhaust fan and duct. The exhaust gas will be hot and will rise, and as the gas rises, dilution will occur.

4. An analysis using the methods of James Halitsky in "Gas Diffusion Near Buildings" was performed (see reference 9.5.8-1). The results indicate that the following reductions would occur in the oxygen level of the combustion air intake:

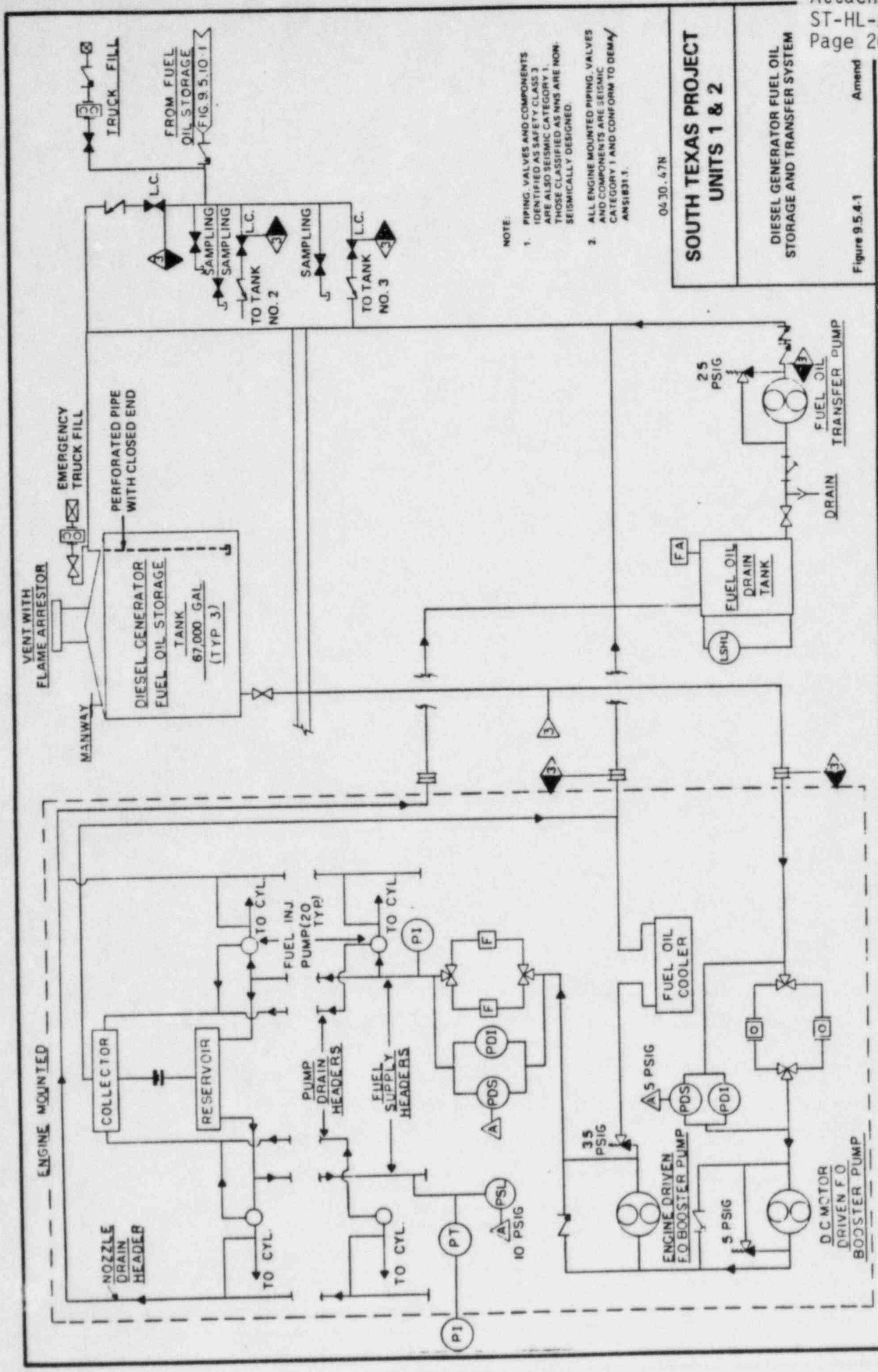
   a) ESF Transformer Fire - During the period from the start of the fire until the time it is extinguished, smoke could potentially be carried around to the north side of the DGB. The distance from the nearest ESF transformer to the closest air intake is about 30 feet. By the Halisky method the oxygen deficiency caused by a single ESF Transformer Fire is 16 percent. The engines will operate at oxygen deficiencies of up to 20 percent.

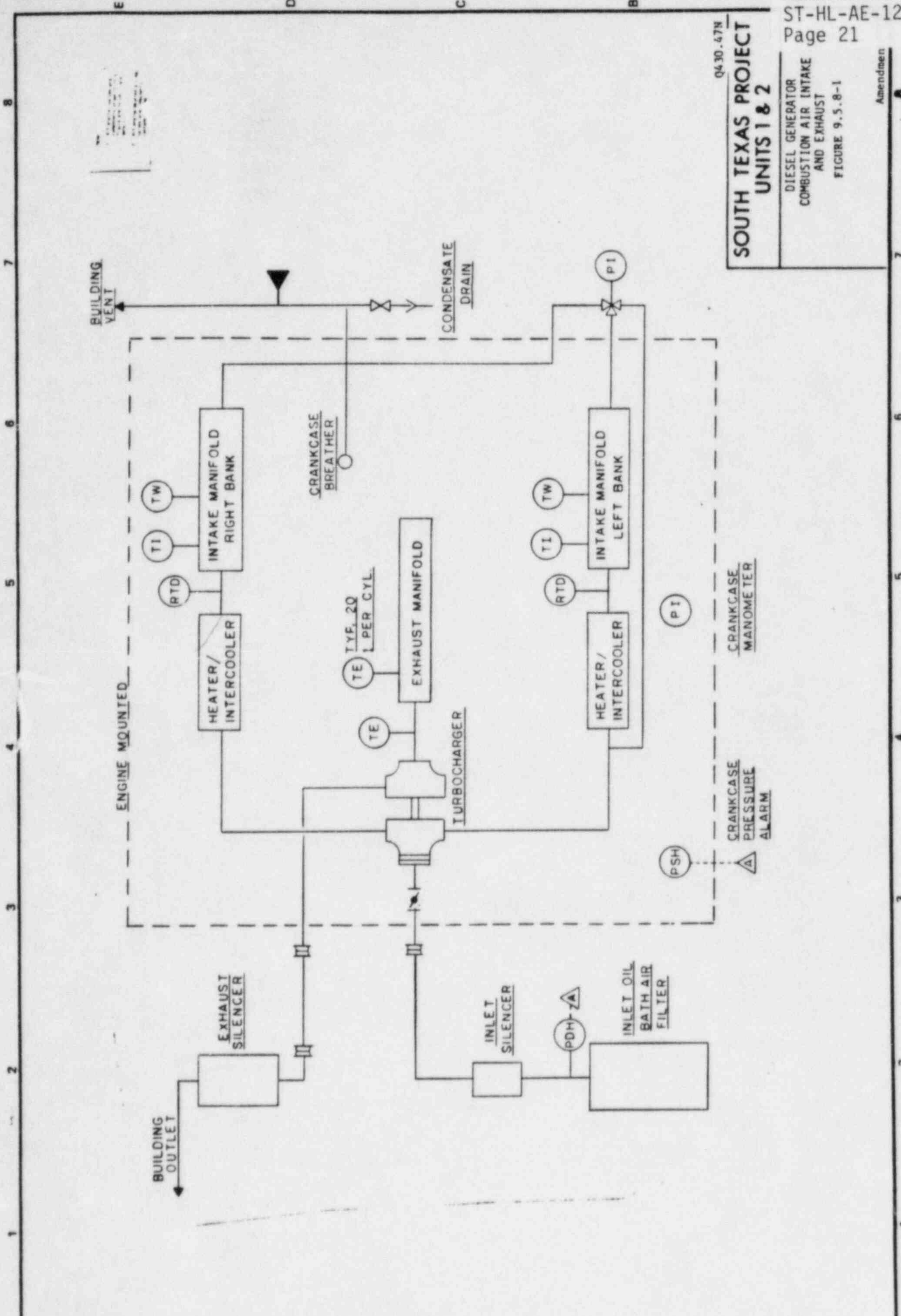
   b) Engine Room Compartment Fire - by the above method the oxygen deficiency for the remaining diesel generators would not exceed 11 percent during a fire in an adjacent engine compartment.

   c) Fuel Oil Storage Tank Room Fire - By the above method the oxygen deficiency for the diesel generators would not exceed 5.3 percent as the result of a fuel oil storage tank room fire.

REFERENCE

9.5.8-1 Halitsley, J., 1963, Gas Diffusion near Buildings, ASHRAE Trans., 69:464-484.


SOUTH TEXAS PROJECT
UNITS 1 & 2
DIESEL GENERATOR FUEL OIL
STORAGE AND TRANSFER SYSTEM
Figure 9.5.4-1
Amend
NOTE:
1. PIPING, VALVES AND COMPONENTS IDENTIFIED AS SAFETY CLASS 3 ARE ALSO SEISMIC CATEGORY 1. THOSE CLASSIFIED AS NNS ARE NON-SEISMICALLY DESIGNED.
2. ALL ENGINE MOUNTED PIPING, VALVES AND COMPONENTS ARE SEISMIC CATEGORY 1 AND CONFORM TO DEMA/ANSI B31.1.
0430.47N
TRUCK FILL
FROM FUEL OIL STORAGE FIG. 9.5.10-1
L.C.
SAMPLING
TO TANK NO. 2
TO TANK NO. 3
EMERGENCY TRUCK FILL
PERFORATED PIPE WITH CLOSED END
VENT WITH FLAME ARRESTOR
DIESEL GENERATOR FUEL OIL STORAGE TANK 67,000 GAL (TYP 3)
MANWAY
FA
FUEL OIL DRAIN TANK
LSHL
DRAIN
25 PSIG
FUEL OIL TRANSFER PUMP
ENGINE MOUNTED
COLLECTOR
RESERVOIR
TO CYL
FUEL INJ PUMP (20 TYP)
PI
F
PDI
PDS
FUEL OIL COOLER
PUMP DRAIN HEADERS
FUEL SUPPLY HEADERS
NOZZLE DRAIN HEADER
TO CYL.
PT
PSL
10 PSIG
35 PSIG
5 PSIG
ENGINE DRIVEN F.O BOOSTER PUMP
D C MOTOR DRIVEN F.O BOOSTER PUMP


SOUTH TEXAS PROJECT
UNITS 1 & 2
Q430.47N
DIESEL GENERATOR
COMBUSTION AIR INTAKE
AND EXHAUST
FIGURE 9.5.8-1
Amendment
BUILDING VENT
CONDENSATE DRAIN
PI
CRANKCASE BREATHER
ENGINE MOUNTED
TW
TI
INTAKE MANIFOLD RIGHT BANK
RTD
HEATER/ INTERCOOLER
TYP. 20 1 PER CYL
TE
EXHAUST MANIFOLD
TURBOCHARGER
INTAKE MANIFOLD LEFT BANK
CRANKCASE MANOMETER
CRANKCASE PRESSURE ALARM
PSH
A
EXHAUST SILENCER
BUILDING OUTLET
INLET SILENCER
PDH
INLET OIL BATH AIR FILTER