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Docket Nos.: 50-387/388

Mr. Norman W. Curtis
Vice President
Engineering and Construction
Pennsylvania Power and Light Company
2 North Ninth Street
Allentown, Pennsylvania 18101

Dear Mr. Curtis:

SUBJECT: SUSQUEHANNA STEAM ELECTRIC STATION, UNIT NOS. 1 AND 2 - REQUEST FOR ADDITIONAL INFORMATION

As a result of our review of your application for operating licenses for the Susquehanna Steam Electric Plant, we find that we need additional information in the area of Power Systems. The specific information required is listed in the Enclosure.

Some of this review has been performed by the Oak Ridge National Laboratory (ORNL). Questions originated by ORNL are identified by an X10 to the question number.

Please contact us if you desire any discussion or clarification of the information requested.

Sincerely,

Original Signed by
Olan Parr

Olan D. Parr, Chief
Light Water Reactors, Branch No. 3
Division of Project Management

Enclosure:
As Stated

cc: See Next Page

App
3

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DATE	11/23/79	11/23/79				

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Mr. Norman W. Curtis

cc: Mr. Earle M. Mead
Project Engineering Manager
Pennsylvania Power & Light Company
2 North Ninth Street
Allentown, Pennsylvania 18101

Jay Silberg, Esq.
Shaw, Pittman, Potts &
Trowbridge
1800 M Street, N. W.
Washington, D. C. 20036

Mr. William E. Barberich,
Nuclear Licensing Group Supervisor
Pennsylvania Power & Light Company
2 North Ninth Street
Allentown, Pennsylvania 18101

Edward M. Nagel, Esquire
General Counsel and Secretary
Pennsylvania Power & Light Company
2 North Ninth Street
Allentown, Pennsylvania 18101

Bryan Snapp, Esq.
Pennsylvania Power & Light Company
901 Hamilton Street
Allentown, Pennsylvania 18101

Robert M. Gallo
Resident Inspector
P. O. Box 52
Shickshinny, Pennsylvania 18655

Susquehanna Environmental Advocates
c/o Gerald Schultz, Esq.
500 South River Street
Wilkes-Barre, PA 18702

John L. Anderson
Oak Ridge National Laboratory
Union Carbide Corporation
Bldg. 3500, P. O. Box X
Oak Ridge, Tennessee 37830

Mr. Robert J. Shovlin
Project Manager
Pennsylvania Power and Light Co.
2 North Ninth Street
Allentown, Pennsylvania 18101

Matias F. Travieso-Diaz, Esq.
Shaw, Pittman, Potts &
Trowbridge
1800 M Street, N. W.
Washington, D. C. 20036

Dr. Judith H. Johnsrud
Co-Director
Environmental Coalition on
Nuclear Power
433 Orlando Avenue
State College, PA 16801

Mr. Thomas M. Gerusky, Director
Bureau of Radiation Protection
Department of Environmental
Resources
Commonwealth of Pennsylvania
P. O. Box 2063
Harrisburg, PA 17120

Ms. Colleen Marsh
Box 538A, RD#4
Mountain Top, PA 18707

Mrs. Irene Lemanowicz, Chairperson
The Citizens Against Nuclear
Dangers
P. O. Box 377
RD#1
Berwick, PA 18603

SECOND ROUND REQUESTS

SUSQUEHANNA STEAM ELECTRIC STATION

DOCKET NO. 50-387

POWER SYSTEMS BRANCH

by 125% of four hour demand but seems to be actually only 100% of 4 hour demand by Table 8.3-8 and report your findings.

040.64-X10 In the event of failure of preferred power, then the alternate power; please discuss the operational sequence for restoration of the Class IE power channels,

a) from standby power to alternate power,

b) from standby power to preferred power.

040.65-X10 Branch Technical Position ICSB (PSB) 2 Diesel Generator Reliability Qualification Testing (SRP Appendix 8A) requires a prototype qualification program to demonstrate the capability of new and/or unique designs for use in nuclear service. Provide the results of the prototype qualification for the SSES units.

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

040.66-X10 In FSAR Section 7.4.1.2.2 it is stated that both divisions of the SLCS are powered from Division I. Yet in Table 3.12-1 the SLCS is listed in two separate divisions, I and II. Provide a discussion which resolves these apparent inconsistencies.

040.67-X10 A "480v Swing Bus" is listed in Division I and another in Division II (Table 3.12-1) and described in Section 8.3.1.3.5 Although these swings are not between redundant divisions they are between redundant separation channels as three channels out of four are required in your plant to successfully meet the on-site power requirements of a LOCA in one unit and safe shutdown of the other unit. This configuration requires independence and separation

040.62-X10 The RBCCW and TBCCW are sequenced on the D. G. buses after a loss of off-site power (LOOSP) (Table 8.3-1). In Section 9.2.2 in the FSAR these are both listed as non-ESF loads but in Tables 8.3-1 and 1a the RBCCW is listed as an ESF load, sequenced at 60 sec onto Unit 2 for safe shutdown. Explain the power supply rationale for these two systems, state whether they both can be isolated from their power supplies by a derivative of an accident signal in order to meet isolation requirements in accordance with Reg. Guide 1.75, and correct any inconsistences in the FSAR text.

040.63-X10 Provide a failure mode and effects analysis of the dc system of the plant. Describe the operation of the Unit 1 dc system and the "uninterruptable ac power supply" of Unit 1 during the period that Unit 1 is operating and Unit 2 is still under construction.

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

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

In addition, with regard to the dc systems, provide note 5 for Figure 8.3-6 and for the 24v dc system shown in this figure.

Review the battery capacity which should, by your own criteria, between Class IE channels as well as ESF divisions in each of the two units of your plant. In order to facilitate our review of this aspect of your design, provide a common mode-common cause failure analysis for the Russell Electric Company transfer switches that you use to transfer from one power supply channel to the other in each division. Also describe the testing program for the entire isolation arrangement (motor-generator set) protective switchgear, and transfer scheme of the swing bus arrangement to satisfy the requirements of GDC 18.

040.68-X10 Various metallic vapor lamps have "delayed" reignition time characteristics. Postulate a condition such as a temporary loss of power, which would produce a delayed reignition condition. Are there any SSES plant areas in which this postulated condition could interfere with plant operations? If so, provide modified design to correct this situation.

040.69-X10 In Section 7.4 the statement "heat tracing of pump suction piping receives power from a bus that is connectable to the standby A-C power supply." Identify this "connectable bus" and describe the loads (by name and rating), method of connection, and isolation (if non-IE).

040.70-X10 8.2 Reg. Guide 1.70 recommends "in particular, the circuits that supply power for the safety loads from the transmission network should be identified and shown to meet GDC 17 and 18," and describe and provide layout drawings of the circuits that connect the onsite distribution system to the preferred power supply including transmission lines, switchyard arrangement, right of way, etc."

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

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

040.71-X10 In the event that the control room must be vacated, what means and methods of communication are available from the remote shutdown panel of Unit 2 to the various out-buildings such as diesel generator building, emergency service water pump house, make-up water pump hose, circulating water pump house, and radwaste building.

040.72-X10 General Design Criterion 18 requires the ability to periodically inspect and test important safety features of electric power systems. State whether periodic inspection of the penetration assemblies is possible and whether the requirement of GDC-18 have been satisfied in this regard.

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

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

040.73-X10 State whether the essential lighting system is sequenced onto the Class IE 480 buses or remains connected to the bus throughout transfer to the diesels in the event of a LOOSP. Is the total of essential lighting 169kw as in Table 8.3-3, or 188kw as in 8.3-2 or 222kw as in 8.3-4, or 258kw in 8.3-5? Why these differences?

040.74-X10 On the topic of non-Class IE instrument circuits: In paragraph 8.1.6.1.n-7 you state as an "analysis" that "non-Class IE instrument circuits are considered low energy and the probability of these non-Class IE circuits providing a mechanism of failure to the Class IE circuit is extremely low."

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

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

040.75-X10 On the same topic as Item 040.82, above, but in its application to containment electrical penetrations, (your paragraph 8.1.6.1.n-13) you state that cable penetrations into the suppression pool contain Class IE and non-Class IE circuits.

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

040.76-X10 Your placement of electrical separation descriptions in section 3.12.3.4 has made it difficult to follow the continuity of subject matter in the FSAR. In 3.12.3.4.1-fourth subsection, "Raceway sharing of Class IE and non-Class IE Circuits" it is stated that, "480v ac and 125/250v dc non-Class IE load groups connected to Class IE buses are supplied through two circuit breakers physically separated from each other and connected in series. The cables from the Class IE bus up to the second breaker remain with and follow the same rules as the Class IE circuits of the respective separation divisions and are uniquely identified. The second breaker and its circuits are not subject---."

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

040.77-X10 Section 8.1.6.1.n, "Compliance with Regulatory Guide 1.75 (1/75)."

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

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

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

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

040.78-X10 Paragraph 8.3.1.3.14 of the FSAR indicates that some "---electrical equipment associated with Class IE loads identified in Chapter 16.0" is not testable during reactor operation. List or reference this equipment. Demonstrate that all of the above equipment so identified is in conformance with Regulatory Guide 1.22 Section D.4.

040.79-X10 Figure 8.3-5, "125v dc and 250v dc Systems" indicates that loads 1D666, 1D165, 1D656, and 1D155 and 1D615, 1D635, 1D625 and 1D645, are "Non-Q-Listed" Panels. Yet on drawings E11, Sheets 3 and 4, there are notes that all loads are "Q-listed." On drawing E11 Sheets 1 & 2 the note also says that all equipment is "Q listed." Provide further details to facilitate our understanding of this aspect of your design.

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

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

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

040.80-X10 Provide a listing of all switchgear that is not self-activated (both safety and non-safety) and specifically identify the source of control power to each one. This is needed in order to assist our independent review of how your emergency power system design meets the single failure criterion.

040.81
(8.3)
RSP

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 senstive 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 or equipped with vibration mounts.

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

040.82
(8.3)
RSP

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 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 the NRC guidelines, particularly with respect to test frequency, loading and duration, should be identified and justified.

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

4. Upon completion of repairs or maintenance and prior to an actual start, run, and load test a final equipment check should be made to assure that all electrical circuits are functional, i.e., fuses are in place, switches and circuit breakers are in their proper position, no loose wires, all test leads have been removed, and all valves are in the proper position to permit a manual start of the equipment. After the unit 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.

040.83 (8.3) 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.

040.84 (9.5.4) Your response to request 040.36 is not complete. You state in section 9.5.4.2 the available net positive suction head (NPSH), with the impeller flooded, is much greater than the 1 ft. 6 inch required NPSH for the pump. Therefore the entire volume above the pump centerline, 10 3/4 inch from the bottom, is available for the diesel gnerators.

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

Your above statements need further clarification.

040.85 (9.5.4) Your answer to request 040.37 is not complete. The new Figures 9.5-28, 9.5-29 and 9.5-30 do not provide the needed information to evaluate the adequacy of the diesel generator fuel oil storage and transfer system.

Provide additional information and drawing (plans and sections)

1. The piping in the truck fill pit.
2. The location of the fuel oil storage tanks with respect to the diesel generator building including all fuel piping from the storage tank to its associated day tank and from the day tank to the storage tank.
3. The relation of the fuel oil storage tanks to buried yard piping that may be in the vacinity or cross under the fuel storage tank concrete support mat. (see Fig. 9.5-28). Identify the line size, carrying capacity in gpm, pressure and fluid. Provide assurance that a pipe line break under the fuel oil storage tanks support structure will not prevent the diesel generator fuel oil storage and transfer system from performing its safety function.
4. Plans of diesel generator building at elevations 660'-0", 710'-0" and 723'-0"

040.86
(9.5.4)
RSP

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

040.87
(9.5.4)
RSP

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

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

040.88 (9.5.4) Section B on figure 9.5-29 shows the four diesel generator fuel oil storage tanks, concrete support mat and structures are located between and abutting existing crane foundations.

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

040.89 (9.5.4) You state in section 9.5.4.3 (Rev. 7) excessive splashing and sediment turbulance is prevented by the fuel fill line discharging near the bottom of the storage tank. If minor sediment turbulence occur, fuel filters will keep the overall quality of the fuel oil acceptable during replenishment.

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

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

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

040.90
(9.5.6)
RSP

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

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

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

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

040.91 (9.5.7) You state response to our request 040.49 is covered in section 9.5.7.2 revision 7. We have reviewed revision 7 and do not find that you have addressed our request. Provide your response to request 040.49.

040.92 (9.5.7) RSP Several fires have occurred at some operating plants in the area of the diesel engine exhaust manifold and inside the turbocharger housing which have resulted in equipment unavailability. The fires were started from lube oil leaking and accumulating on the engine exhaust manifold and accumulating and igniting inside the turbocharger housing. Accumulation of lube oil in these areas, on some engines, is apparently caused from an excessively long prelube period, generally longer than five minutes, prior to manual starting of a diesel generator. This condition does not occur on an emergency start since the prelube period is minimal.

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

040.93
(9.5.7)
RSP

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

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

respective engine manufacturer. Some diesel engines include a lube oil circulating pump as an intregal part of the lube oil preheating system which is in use while the diesel engine is in the standby mode. In this case an additional prelube oil pump may not be needed.

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

040.94 (9.5.8) Experience at some operating plants has shown that diesel engines have failed to start due to accumulation of dust and other deliterious material on electrical equipment associated with starting of the diesel generators (e.g., auxiliary relay contacts, control switches - etc). Describe the provisions that have been made in your diesel generator building design, electrical starting system, and combustion air and ventilation air intake design(s) to preclude this condition to assure availability of the diesel generator on demand.

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

Docket File

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOV 2 3 1979

Docket Nos.: 50-387/388

Mr. Norman W. Curtis
Vice President
Engineering and Construction
Pennsylvania Power and Light Company
2 North Ninth Street
Allentown, Pennsylvania 18101

Dear Mr. Curtis:

SUBJECT: SUSQUEHANNA STEAM ELECTRIC STATION, UNIT NOS. 1 AND 2 - REQUEST FOR ADDITIONAL INFORMATION

As a result of our review of your application for operating licenses for the Susquehanna Steam Electric Plant, we find that we need additional information in the area of Power Systems. The specific information required is listed in the Enclosure.

Some of this review has been performed by the Oak Ridge National Laboratory (ORNL). Questions originated by ORNL are identified by an X10 to the question number.

Please contact us if you desire any discussion or clarification of the information requested.

Sincerely,

Olan D. Parr

Olan D. Parr, Chief
Light Water Reactors, Branch No. 3
Division of Project Management

Enclosure:
As Stated

cc: See Next Page

App 3

A 7912050 520

Mr. Norman W. Curtis

cc: Mr. Earle M. Mead
Project Engineering Manager
Pennsylvania Power & Light Company
2 North Ninth Street
Allentown, Pennsylvania 18101

Jay Silberg, Esq.
Shaw, Pittman, Potts &
Trowbridge
1800 M Street, N. W.
Washington, D. C. 20036

Mr. William E. Barberich,
Nuclear Licensing Group Supervisor
Pennsylvania Power & Light Company
2 North Ninth Street
Allentown, Pennsylvania 18101

Edward M. Nagel, Esquire
General Counsel and Secretary
Pennsylvania Power & Light Company
2 North Ninth Street
Allentown, Pennsylvania 18101

Bryan Snapp, Esq.
Pennsylvania Power & Light Company
901 Hamilton Street
Allentown, Pennsylvania 18101

Robert M. Gallo
Resident Inspector
P. O. Box 52
Shickshinny, Pennsylvania 18655

Susquehanna Environmental Advocates
c/o Gerald Schultz, Esq.
500 South River Street
Wilkes-Barre, PA 18702

John L. Anderson
Oak Ridge National Laboratory
Union Carbide Corporation
Bldg. 3500, P. O. Box X
Oak Ridge, Tennessee 37830

Mr. Robert J. Shovlin
Project Manager
Pennsylvania Power and Light Co.
2 North Ninth Street
Allentown, Pennsylvania 18101

Matias F. Travieso-Diaz, Esq.
Shaw, Pittman, Potts &
Trowbridge
1800 M Street, N. W.
Washington, D. C. 20036

Dr. Judith H. Johnsrud
Co-Director
Environmental Coalition on
Nuclear Power
433 Orlando Avenue
State College, PA 16801

Mr. Thomas M. Gerusky, Director
Bureau of Radiation Protection
Department of Environmental
Resources
Commonwealth of Pennsylvania
P. O. Box 2063
Harrisburg, PA 17120

Ms. Colleen Marsh
Box 538A, RD#4
Mountain Top, PA 18707

Mrs. Irene Lemanowicz, Chairperson
The Citizens Against Nuclear
Dangers
P. O. Box 377
RD#1
Berwick, PA 18503

SECOND ROUND REQUESTS

SUSQUEHANNA STEAM ELECTRIC STATION

DOCKET NO. 50-387

POWER SYSTEMS BRANCH

by 125% of four hour demand but seems to be actually only 100% of 4 hour demand by Table 8.3-8 and report your findings.

040.64-X10 In the event of failure of preferred power, then the alternate power, please discuss the operational sequence for restoration of the Class IE power channels,

a) from standby power to alternate power,

b) from standby power to preferred power.

040.65-X10 Branch Technical Position ICSB (PSB) 2 Diesel Generator Reliability Qualification Testing (SRP Appendix 8A) requires a prototype qualification program to demonstrate the capability of new and/or unique designs for use in nuclear service. Provide the results of the prototype qualification for the SSES units.

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

040.66-X10 In FSAR Section 7.4.1.2.2 it is stated that both divisions of the SLCS are powered from Division I. Yet in Table 3.12-1 the SLCS is listed in two separate divisions, I and II. Provide a discussion which resolves these apparent inconsistencies.

040.67-X10 A "480v Swing Bus" is listed in Division I and another in Division II (Table 3.12-1) and described in Section 8.3.1.3.5 Although these swings are not between redundant divisions they are between redundant separation channels as three channels out of four are required in your plant to successfully meet the on-site power requirements of a LOCA in one unit and safe shutdown of the other unit. This configuration requires independence and separation between Class IE channels as well as ESF divisions in each of the two units of your plant. In order to facilitate our review of this aspect of your design, provide a common mode-common cause failure analysis for the Russell Electric Company transfer switches that you use to transfer from one power supply channel to the other in each division. Also describe the testing program for the entire isolation arrangement (motor-generator set) protective switchgear, and transfer scheme of the swing bus arrangement to satisfy the requirements of GDC 18.

040.68-X10 Various metallic vapor lamps have "delayed" reignition time characteristics. Postulate a condition such as a temporary loss of power, which would produce a delayed reignition condition. Are there any SSES plant areas in which this postulated condition could interfere with plant operations? If so, provide modified design to correct this situation.

040.69-X10 In Section 7.4 the statement "heat tracing of pump suction piping receives power from a bus that is connectable to the standby A-C power supply." Identify this "connectable bus" and describe the loads (by name and rating), method of connection, and isolation (if non-IE).

040.70-X10
8.2
Reg. Guide 1.70 recommends "in particular, the circuits that supply power for the safety loads from the transmission network should be identified and shown to meet GDC 17 and 18," and describe and provide layout drawings of the circuits that connect the onsite distribution system to the preferred power supply including transmission lines, switchyard arrangement, right of way, etc."

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

You state that for pre-Unit 2 operation the preferred power sources for the SSES are the Montour-Mountain and the Wescosville-Susquehanna tie lines. Discuss these two tie line systems and their associated switchyards with regard to the above stated references and reaffirm that PC3 protective relay testing, maintenance and calibration apply to these switchyards and can be performed during unit operation.

040.71-X10 In the event that the control room must be vacated, what means and methods of communication are available from the remote shutdown panel of Unit 2 to the various out-buildings such as diesel generator building, emergency service water pump house, make-up water pump hose, circulating water pump house, and radwaste building.

040.72-X10 General Design Criterion 18 requires the ability to periodically inspect and test important safety features of electric power systems. State whether periodic inspection of the penetration assemblies is possible and whether the requirement of GDC-18 have been satisfied in this regard.

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

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

040.73-X10 State whether the essential lighting system is sequenced onto the Class IE 480 buses or remains connected to the bus throughout transfer to the diesels in the event of a LOOSP. Is the total of essential lighting 169kw as in Table 8.3-3, or 188kw as in 8.3-2 or 222kw as in 8.3-4, or 258kw in 8.3-5? Why these differences?

040.74-X10 On the topic of non-Class IE instrument circuits: In paragraph 8.1.6.1.n-7 you state as an "analysis" that "non-Class IE instrument circuits are considered low energy and the probability of these non-Class IE circuits providing a mechanism of failure to the Class IE circuit is extremely low."

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

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

040.75-X10 On the same topic as Item 040.82, above, but in its application to containment electrical penetrations, (your paragraph 8.1.6.1.n-13) you state that cable penetrations into the suppression pool contain Class IE and non-Class IE circuits.

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

040.76-X10 Your placement of electrical separation descriptions in section 3.12.3.4 has made it difficult to follow the continuity of subject matter in the FSAR. In 3.12.3.4.1-fourth subsection, "Raceway sharing of Class IE and non-Class IE Circuits" it is stated that, "480v ac and 125/250v dc non-Class IE load groups connected to Class IE buses are supplied through two circuit breakers physically separated from each other and connected in series. The cables from the Class IE bus up to the second breaker remain with and follow the same rules as the Class IE circuits of the respective separation divisions and are uniquely identified. The second breaker and its circuits are not subject---."

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

040.77-X10 Section 8.1.6.1.n, "Compliance with Regulatory Guide 1.75 (1/75)."

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

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

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

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

040.78-X10 Paragraph 8.3.1.3.14 of the FSAR indicates that some "---electrical equipment associated with Class IE loads identified in Chapter 16.0" is not testable during reactor operation. List or reference this equipment. Demonstrate that all of the above equipment so identified is in conformance with Regulatory Guide 1.22 Section D.4.

040.79-X10 Figure 8.3-5, "125v dc and 250v dc Systems" indicates that loads 1D666, 1D165, 1D656, and 1D155 and 1D615, 1D635, 1D625 and 1D645, are "Non-Q-Listed" Panels. Yet on drawings E11, Sheets 3 and 4, there are notes that all loads are "Q-listed." On drawing E11 Sheets 1 & 2 the note also says that all equipment is "Q listed." Provide further details to facilitate our understanding of this aspect of your design.

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

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

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

040.80-X10 Provide a listing of all switchgear that is not self-activated (both safety and non-safety) and specifically identify the source of control power to each one. This is needed in order to assist our independent review of how your emergency power system design meets the single failure criterion.

040.81
(8.3)
RSP

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 senstive 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 or equipped with vibration mounts.

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

040.82
(8.3)
RSP

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 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 the NRC guidelines, particularly with respect to test frequency, loading and duration, should be identified and justified.

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

4. Upon completion of repairs or maintenance and prior to an actual start, run, and load test a final equipment check should be made to assure that all electrical circuits are functional, i.e., fuses are in place, switches and circuit breakers are in their proper position, no loose wires, all test leads have been removed, and all valves are in the proper position to permit a manual start of the equipment. After the unit 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.

040.83
(8.3)

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.

040.84 (9.5.4) Your response to request 040.36 is not complete. You state in section 9.5.4.2 the available net positive suction head (NPSH), with the impeller flooded, is much greater than the 1 ft. 6 inch required NPSH for the pump. Therefore the entire volume above the pump centerline, 10 3/4 inch from the bottom, is available for the diesel gnerators.

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

Your above statements need further clarification.

040.85 (9.5.4) Your answer to request 040.37 is not complete. The new Figures 9.5-28, 9.5-29 and 9.5-30 do not provide the needed information to evaluate the adequacy of the diesel generator fuel oil storage and transfer system.

Provide additional information and drawing (plans and sections)

1. The piping in the truck fill pit.
2. The location of the fuel oil storage tanks with respect to the diesel generator building including all fuel piping from the storage tank to its associated day tank and from the day tank to the storage tank.
3. The relation of the fuel oil storage tanks to buried yard piping that may be in the vacinity or cross under the fuel storage tank concrete support mat. (see Fig. 9.5-28). Identify the line size, carrying capacity in gpm, pressure and fluid. Provide assurance that a pipe line break under the fuel oil storage tanks support structure will not prevent the diesel generator fuel oil storage and transfer system from performing its safety function.
4. Plans of diesel generator building at elevations 660'-0", 710'-0" and 723'-0"

040.86
(9.5.4)
RSP

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

040.87
(9.5.4)
RSP

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

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

040.88 (9.5.4) Section B on figure 9.5-29 shows the four diesel generator fuel oil storage tanks, concrete support mat and structures are located between and abutting existing crane foundations.

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

040.89 (9.5.4) You state in section 9.5.4.3 (Rev. 7) excessive splashing and sediment turbulance is prevented by the fuel fill line discharging near the bottom of the storage tank. If minor sediment turbulence occur, fuel filters will keep the overall quality of the fuel oil acceptable during replenishment.

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

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

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

040.90
(9.5.6)
RSP

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

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

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

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

040.91 (9.5.7) You state response to our request 040.49 is covered in section 9.5.7.2 revision 7. We have reviewed revision 7 and do not find that you have addressed our request. Provide your response to request 040.49.

040.92 (9.5.7) RSP Several fires have occurred at some operating plants in the area of the diesel engine exhaust manifold and inside the turbocharger housing which have resulted in equipment unavailability. The fires were started from lube oil leaking and accumulating on the engine exhaust manifold and accumulating and igniting inside the turbocharger housing. Accumulation of lube oil in these areas, on some engines, is apparently caused from an excessively long prelube period, generally longer than five minutes, prior to manual starting of a diesel generator. This condition does not occur on an emergency start since the prelube period is minimal.

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

040.93 (9.5.7) RSP An emergency diesel generator unit in a nuclear power plant is normally in the ready standby mode unless there is a loss of offsite power, an accident, or the diesel generator is under test. Long periods on standby have a tendency to drain or nearly empty the engine lube oil piping system. On an emergency start of the engine as much as 5 to 14 or more seconds may elapse from the start of cranking until full lube oil pressure is attained even though full engine speed is generally reached in about five seconds. With an essentially dry engine, the momentary lack of lubrication at the various moving parts may damage bearing surfaces producing incipient or actual component failure with resultant equipment unavailability.

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

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

040.94 (9.5.8) Experience at some operating plants has shown that diesel engines have failed to start due to accumulation of dust and other deliterious material on electrical equipment associated with starting of the diesel generators (e.g., auxiliary relay contacts, control switches - etc). Describe the provisions that have been made in your diesel generator building design, electrical starting system, and combustion air and ventilation air intake design(s) to preclude this condition to assure availability of the diesel generator on demand.

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