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Docket Nos. 50-348
50-364

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Joseph M. Farley Nuclear Plant
Response to Generic Letter 91-06, Resolution of Generic
Issue A-30, "Adequacy of Safety-Related DC Power Supplies"

Gentlemen:

The information requested by Generic Letter 91-06, Resolution of Generic Issue A-30, "Adequacy of Safety-Related DC Power Supplies," Pursuant to 10 CFR 50.54(f), for the Farley Nuclear Plant Units 1 and 2 is provided in the enclosure to this letter. The responses are based on the current Farley Nuclear Plant configuration and are subject to change in the future under 10 CFR 50.59 and/or licensing amendments as necessary.

Submission of the enclosed information completes the requirements of Generic Letter 91-06. If there are any questions please advise.

Respectfully submitted,

W. G. Hairston, III

WGH, III/KWW:map 1132

Enclosure

cc: Mr. S. D. Ebneter
Mr. S. T. Hoffman
Mr. G. F. Maxwell

SWORN TO AND SUBSCRIBED BEFORE ME

THIS 25th DAY OF October, 1991

Notary Public

My Commission Expires: 12/15/92

A001

ENCLOSURE

JOSEPH M. FARLEY NUCLEAR PLANT
INFORMATION REQUESTED IN GENERIC LETTER 91-06

QUESTION 1:

Unit

RESPONSE:

Farley Nuclear Plant, Unit 1 and Unit 2

QUESTION 2:

A. The number of independent redundant divisions of Class 1E or safety-related DC power for this plant is (include any separate Class 1E or safety-related DC, such as any DC dedicated to the diesel generators).

B. The number of functional safety-related divisions of DC power necessary to attain safe shutdown for this unit is.

RESPONSE:

A. There are two separate, safety-related DC power systems for each unit. One 125V-DC system is located in the auxiliary building (and also supplies the diesel building). The other 125V-DC system is located in the service water building and consists of 2 DC distribution systems shared between Units 1 and 2. Both the auxiliary building and the service water systems have two independent and redundant divisions. Figures 1 and 2 illustrate the auxiliary building and service water DC distribution systems.

B. One; one train of the auxiliary building DC system and its associated train of service water DC.

QUESTION 3:

Does the control room at this unit have the following separate independently annunciated alarms and indications for each division of DC power?

A. Alarms

1. Battery disconnect or circuit breaker open?

2. Battery charger disconnect or circuit breaker open (both input AC and output DC)?

3. DC system ground?

4. DC bus undervoltage?

5. DC bus overvoltage?

6. Battery charger failure?

7. Battery discharge?

B. Indications

1. Battery float charge current?

2. Battery circuit output current?

3. Battery discharge?

4. Bus voltage?

C. Does the unit have written procedures for response to the above alarms and indications?

RESPONSE:

A. Alarms

Explanation and Justifications Relative to Question 3

A "yes" response for an alarm indicates that there is a separate, independently annunciated alarm for the specific function in question. It does not mean that the specific function has a dedicated annunciator window. Several alarm signals may be transmitted to a single annunciator window. As an example, Annunciator Window VC4, "1B BATT CHG FAULT OR DISC" would illuminate and an alarm would sound for any of the following causes:

1. Loss of AC input to Battery Charger 1B.
2. Battery Charger 1B internal fault.
3. Battery Charger 1B in manual control.
4. Battery Charger 1B DC output breaker or bus 1B incoming breaker open.

This annunciator would inform the operator that there was a problem associated with Battery Charger 1B. The specific problem would then be ascertained and corrected in accordance with the appropriate annunciator response procedure.

JOSEPH M. FARLEY NUCLEAR PLANT
INFORMATION REQUESTED IN GENERIC LETTER 91-06

Auxiliary Building DC System	Service Water DC System
1. Yes	1. No
2. Yes	2. Yes
3. Yes	3. Yes
4. Yes	4. No
5. No	5. No
6. Yes	6. Yes
7. No	7. No

B. Indications

Auxiliary Building DC System	Service Water DC System
1. No	1. No
2. Yes	2. Yes
3. No	3. No
4. Yes	4. Yes

C. Yes

QUESTION 4:

Does this unit have indication of bypassed and inoperable status of circuit breakers or other devices that can be used to disconnect the battery and battery charger from its DC bus and the battery charger from its AC power source during maintenance or testing?

RESPONSE:

Auxiliary Building DC System	Service Water DC System
No	No

QUESTION 5:

If the answer to any part of question 3 or 4 is no, then provide information justifying the existing design features of the facility's safety-related DC systems.

JOSEPH M. FARLEY NUCLEAR PLANT
INFORMATION REQUESTED IN GENERIC LETTER 91-06

RESPONSE:

Question 3.A.1 - The service water DC system consists of four batteries, each with its own battery charger. There are two battery/battery chargers dedicated to each train. One battery and its associated battery charger supplies the service water A train DC distribution system. One battery and its associated battery charger supplies the service water B train DC distribution system. Two batteries and their associated battery chargers are on standby. Therefore, each train of the service water distribution system has a redundant battery and battery charger on standby. The battery and battery charger combination may be switched by changing the position of a transfer switch. The battery and battery charger output are supplied to the service water DC distribution cabinets by fuses. If the supply fuses are pulled or blow, there is no "fuse blown" annunciator in the control room. However, power available lights for several breakers in the control room would be extinguished due to the loss of service water DC. Other non-related annunciators, e.g., service water intake structure annunciator, would alarm in the control room due to the loss of service water DC. In addition, the total current ammeter for the service water battery and battery charger would read lower than normal due to the loss of loads. Based on these indications, the operator has sufficient information to identify the service water distribution cabinets supply fuses have blown.

Question 3.A.4 - Control Room annunciators exist for service water battery undervoltage or battery charger alarm. This annunciator monitors low DC output voltage on the battery charger side of the service water DC distribution cabinet supply fuses. Providing the fuses supplying the distribution cabinets have not blown, this voltage would also be that on the the service water DC bus. Indication of blown service water supply fuses was discussed under 3.A.1 above.

Question 3.A.5 - There is no control room alarm for DC bus overvoltage. However, the auxiliary building and service water DC systems battery charger output voltage is monitored by auxiliary high voltage relays which will initiate a "battery charger fault or disconnect" alarm in the control room on high voltage. The DC bus voltage is also indicated in the control room. Therefore, upon receiving the battery charger alarm, the operators could readily ascertain that the voltage was high and that the high voltage was a likely cause of the battery charger fault alarm. In addition, the annunciator response procedures require the alarm to be investigated to determine the cause. Any conditions that would cause a high voltage on the DC bus would have to pass through the battery charger and result in the battery charger fault alarm in the control room.

JOSEPH M. FARLEY NUCLEAR PLANT
INFORMATION REQUESTED IN GENERIC LETTER 91-06

Question 3.A.7 - There is no control room alarm that specifically indicates that a battery is discharged. Control room indication is provided for auxiliary building battery current and auxiliary building and service water bus voltage. A discharged battery would be detected by reduced bus voltage indication. A bus undervoltage alarm set at 127 volts would be received in the control room before the batteries could discharge to an unacceptable level. Surveillance testing of the batteries which would detect a discharged condition is performed on a seven day interval. It would be very unusual for the batteries utilized at the Farley Nuclear Plant to discharge in a rapid manner while a float charge is being maintained. A gradual discharge would be detected by the surveillance testing before a significant reduction in battery capability could occur.

Question 3.B.1 - There is no indicator in the control room that is capable of indicating the small battery float currents for the auxiliary building or service water batteries. Control room indication is provided for auxiliary building battery output current and bus voltage and for service water total DC current and battery charger output current. The battery output current would normally indicate zero on the indicator. The currents and voltages are also indicated locally at the chargers. If the battery charger should malfunction requiring the battery to feed the DC bus, the indicators would indicate the current flow. If for some reason the battery became discharged requiring a significant current flow from the charger to the battery, the indicators would indicate the magnitude of the current. In the unlikely event that the battery float current was not maintained and the condition was not detected by the available monitoring instrumentation, the problem would be identified during the scheduled surveillance testing and/or by the operators during routine equipment inspections.

Question 3.B.3 - There is no control room indicator that specifically displays a battery discharge condition for the auxiliary building or service water batteries, but the battery/battery charger output current indicators would alert the operators if a battery was carrying a significant load or if a large current was required to maintain a battery in the charged condition. It is very unlikely that a battery could discharge without being detected by existing instrumentation. A battery could not discharge to the DC bus unless there was a problem with a battery charger. Any battery charger trouble that would cause a battery to discharge to the bus would be detected and alarmed by the battery charger protection instrumentation. If a battery should become partially discharged and not be detected by existing indicators and alarms, the discharged condition would be identified within seven days by surveillance testing. It is highly unlikely that the batteries would discharge in that time period.

Question 4, Auxiliary Building DC System - In the control room, there are battery circuit breaker open alarms and battery charger DC output circuit breaker trip alarms for the auxiliary building DC power system. The circuit breaker alarms would be initiated for open circuits regardless of whether they were caused from a manual opening for maintenance and testing or an automatic

opening due to unstable AC or DC power conditions. If the circuit breakers in either DC power system are racked out for maintenance, the alarm will clear. However, the racking out of the breaker would be covered by procedure and approved by the Operations Department. In addition, an LCO would be placed in effect in accordance with the plant Technical Specifications.

If a circuit breaker in the AC power supply to the auxiliary building battery charger should open, a battery charger trouble alarm would be initiated in the control room due to the loss of AC input to the battery charger. The annunciator response procedure requires that plant personnel determine and correct the cause of the alarm. Therefore, the control room would have adequate indication via the annunciators and administrative controls to alert them to the removal of any battery charger from its normal service.

Question 4, Service Water DC - The service water DC system consists of four batteries, each with its own battery charger. There are two battery/battery chargers dedicated to each train. One battery and its associated battery charger supplies the service water A train DC distribution system. A second battery and its associated battery charger supplies the service water B train DC distribution system. Two batteries and their associated battery chargers are on standby. Therefore, each train of the service water distribution system has a redundant battery and battery charger on standby. The battery and battery charger combination may be switched by changing the position of a transfer switch. The battery and battery charger output are supplied to the service water DC distribution cabinets by fuses. If the supply fuses are pulled or blow, there is no "fuse blown" annunciator in the control room. However, power available lights for several breakers in the control room would be extinguished due to the loss of service water DC. Other non-related annunciators, e.g. service water intake structure annunciator, would alarm in the control room due to the loss of service water DC. In addition, the total current ammeter for the service water battery and battery charger would read lower than normal due to the loss of load. Based on these indications, the operator has sufficient information to identify the service water distribution cabinets supply fuses have blown.

Maintenance would only be performed on the battery or charger that was in the standby position. If maintenance was performed on the on service battery charger, the AC input breaker to the battery charger would be opened which would initiate an annunciator for battery undervoltage or charger alarm. Removing the DC fuses for the service water DC distribution system would result in a battery no charge alarm, assuming the battery is fully charged and charger current drops significantly. Therefore, the control room has sufficient indication via the annunciator system and administrative controls to provide adequate control of the service water DC system.

QUESTION 6:

(1) Have you conducted a review of maintenance and testing activities to minimize the potential for human error causing more than one DC division to be unavailable? and (2) Do plant procedures prohibit maintenance or testing on redundant DC divisions at the same time?

RESPONSE:

(1) No.
(2) No.

QUESTION 7:

Are maintenance, surveillance and test procedures regarding station batteries conducted routinely at this plant? Specifically:

A. At least once per 7 days are the following verified to be within acceptable limits:

   1. Pilot cell electrolyte level?

   2. Specific gravity or charging current?

   3. Float voltage?

   4. Total bus voltage on float charge?

   5. Physical condition of all cells?

B. At least once per 92 days, or within 7 days after a battery discharge, overcharge, or if the pilot cell readings are outside the 7-day surveillance requirements are the following verified to be within acceptable limits:

   1. Electrolyte level of each cell?

   2. The average specific gravity of all cells?

   3. The specific gravity of each cell?

   4. The average electrolyte temperature of a representative number of cells?

   5. The float voltage of each cell?

   6. Visually inspect or measure resistance of terminals and connectors (including the connectors at the DC bus)?

C. At least every 18 months are the following verified:

   1. Low resistance of each connection (by test)?

2. Physical condition of the battery?

3. Battery charger capability to deliver rated ampere output to the DC bus?

4. The capability of the battery to deliver its design duty cycle to the DC bus?

5. Each individual cell voltage is within acceptable limits during the service test?

D. At least every 60 months, is capacity of each battery verified by performance of a discharge test?

E. At least annually, is battery capacity verified by performance discharge test, if the battery shows signs of degradation or has reached 85% of the expected service life?

NRC statement regarding Question 7:

If the facility Technical Specifications have provisions equivalent to those found in the Westinghouse and Combustion Engineering Standard Technical Specifications for maintenance and surveillance, then question 7 may be skipped and a statement to that effect may be inserted here.

RESPONSE:

The facility Technical Specifications for Farley Nuclear Plant have provisions for maintenance and surveillance of the DC power supplies that are equivalent to the Westinghouse Standard Technical Specifications (NUREG-0452, Revision 4). In some cases, Farley specific values have been used for the battery parameters that are more appropriate for the batteries in service (e.g. different limits and allowable values for float voltage and specific gravities.)

Note: Revision 4 of NUREG-0452 specifies that an annual discharge test of battery capacity be performed on any battery that shows signs of degradation or has reached 80% of the service life expected for the application. The Technical Specifications for the Farley Nuclear Plant require this test to be performed at least once per each 18 months. The discharge test is normally performed during plant shutdown, and an 18 month refueling cycle is utilized at the Farley Nuclear Plant. Therefore, the 18 month frequency for the battery discharge test is appropriate. Performance of the test once per each 18 months is also in agreement with draft Revision 5 of NUREG-0452.

JOSEPH M. FARLEY NUCLEAR PLANT
INFORMATION REQUESTED IN GENERIC LETTER 91-06

QUESTION 8:

Does this plant have operational features such that following loss of one safety-related DC power supply or bus:

A. Capability is maintained for ensuring continued and adequate reactor cooling?

B. Reactor coolant system integrity and isolation capability are maintained?

C. Operating procedures, instrumentation (including indicators and annunciators), and control functions are adequate to initiate systems as required to maintain adequate core cooling?

RESPONSE:

A. Yes; the size of each auxiliary building battery and service water battery is based on anticipated breaker operations required during a loss-of-offsite power in conjunction with a loss-of-coolant accident. Each battery has adequate storage capacity to carry required vital loads without charger support for a period of 2 hours.

B. Yes; reactor coolant system integrity and isolation capability are maintained on loss of one safety-related DC power supply or bus.

C. Yes; specific annunciator response procedures have been developed to respond to off-normal conditions that develop relative to the DC power system. Abnormal operating procedures (AOPs) ensure that the plant can be stabilized in hot standby and cooled down to cold shutdown conditions with one train of AC or DC power inoperable. Two separate AOPs have been provided - one for stabilization with Train A inoperable and one for use with Train B inoperable. Those procedures provide instructions for placing the the plant in a safe, stable condition using the available instrumentation and controls with one power train (AC or DC) inoperable.

QUESTION 9:

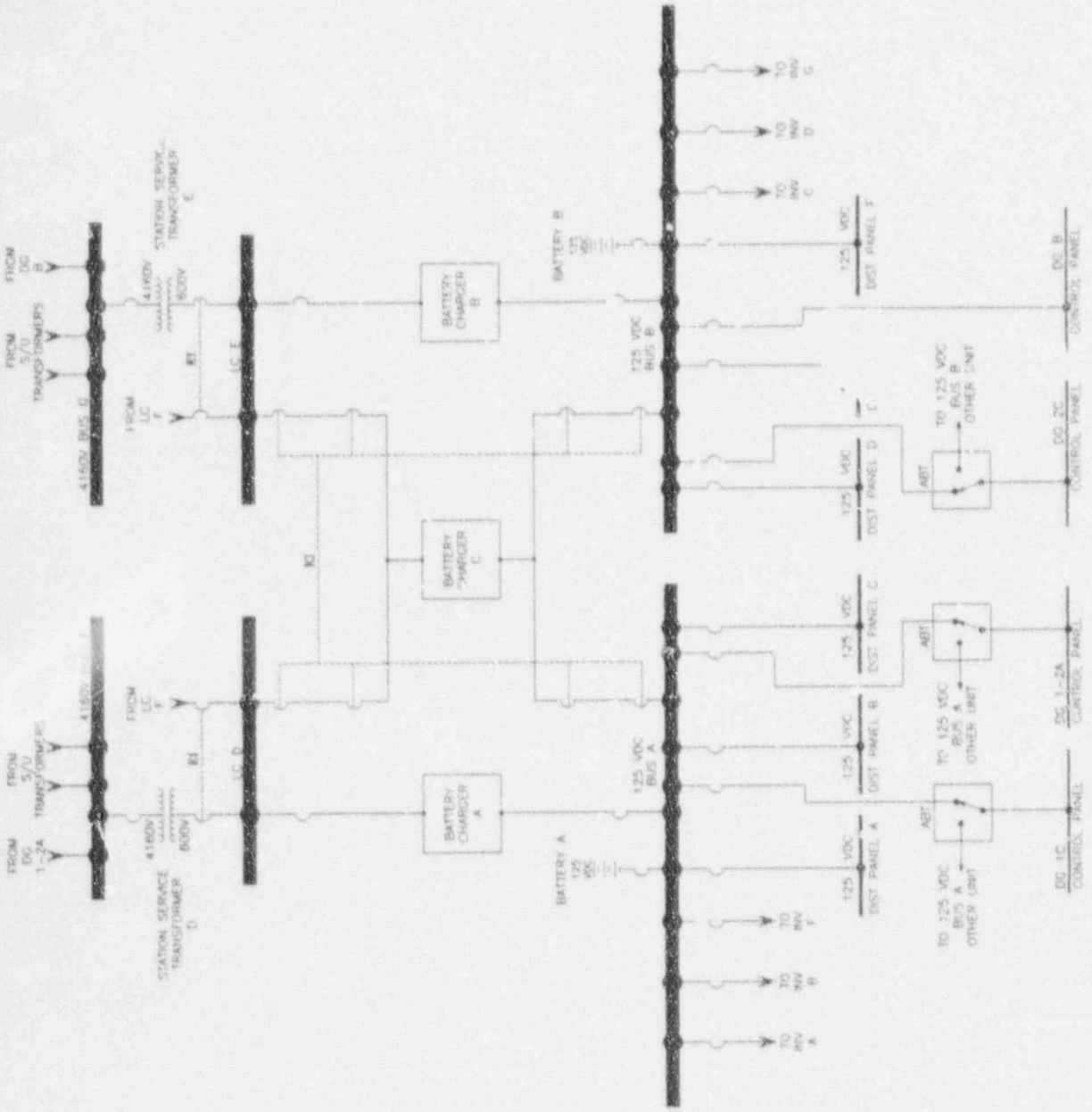
If the answer to any part of question 6, 7, or 8 is no, then provide your basis for not performing the maintenance, surveillance and test procedures described and/or the bases for not including the operational features cited.

JOSEPH M. FARLEY NUCLEAR PLANT
INFORMATION REQUESTED IN GENERIC LETTER 91-06

RESPONSE:

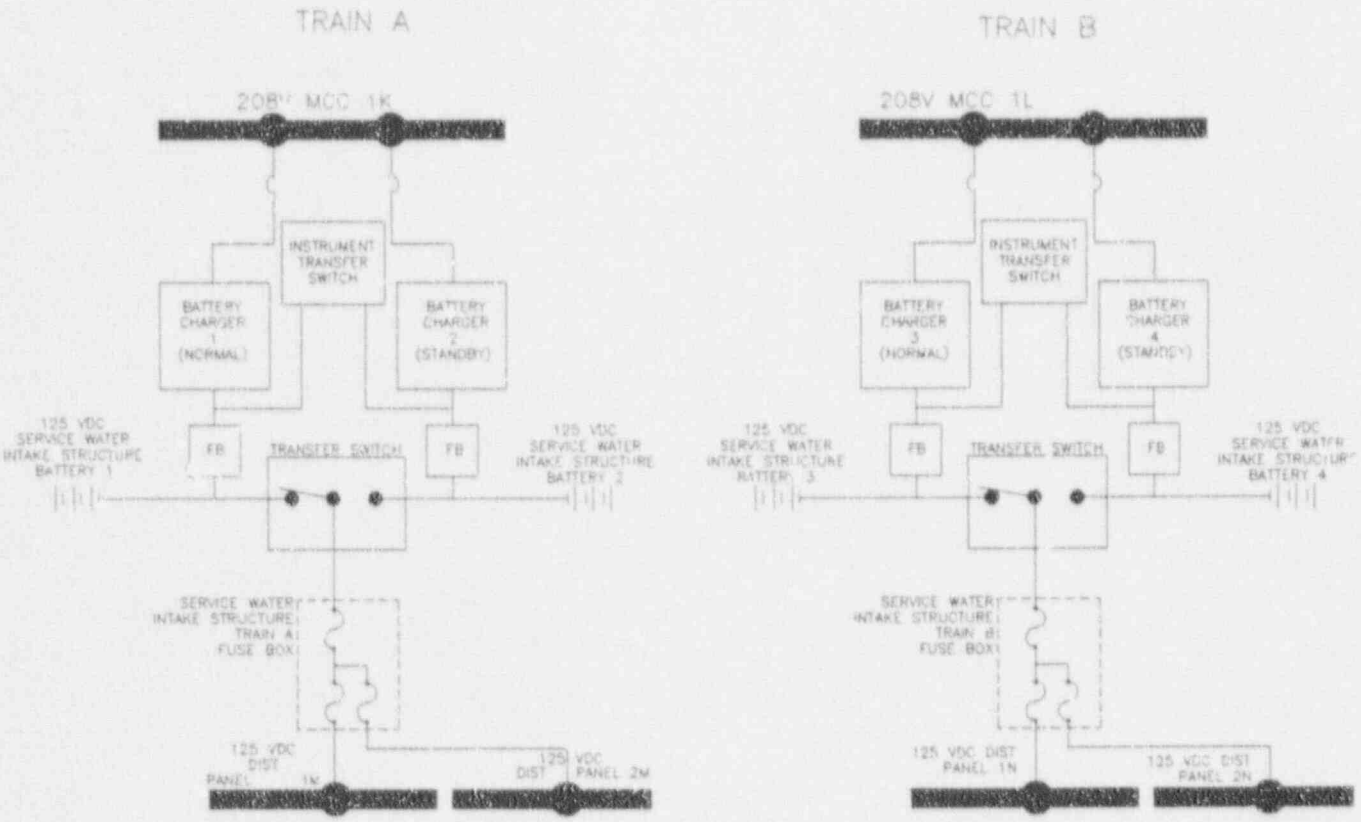
Question 6.1 - Although no formal study specifically for the 125 volt DC distribution systems has been performed, Farley Nuclear Plant has conducted several evaluations of events (both at Farley Nuclear Plant and at other facilities) in which the wrong unit or wrong train (division) of electrical equipment was isolated because of human error. These evaluations are applicable to the 125V-DC Distribution System. Redundant trains of the 125V-DC Distribution System (including the battery room door signs) are color coded to minimize the potential for human error during the execution phase of maintenance or testing. Plant design features (including Appendix R modifications) ensure that no single active failure can render inoperable both trains of 125V-DC Distribution. This design also minimizes the possibility that a maintenance or testing error in one train could render inoperable both trains of 125V-DC Distribution.

Question 6.2 - Administrative procedures provide controls for the planning phase of maintenance or testing to ensure that only one redundant train of the 125V-DC Distribution System is removed from service for maintenance or testing. However, some maintenance practices, e.g., battery visual inspections or taking battery cell gravities, are not controlled to prohibit performance on redundant trains at the same time; nor should they be.



AUXILIARY BUILDING
DC DISTRIBUTION
(TYPICAL FOR UNIT 1 OR 2)

FIGURE 1



SERVICE WATER INTAKE STRUCTURE 125 VDC DISTRIBUTION (SHARED FOR UNITS 1 & 2)

FIGURE 2