3.7 Auxiliary Electrical Systems

Applicability

Applies to the auxiliary electrical power systems.

Objectives

To specify conditions of operation for plant station power necessary to ensure safe reactor operation and combined availability of the engineered safety features.

Specifications

3.7.1 The reactor shall not be heated or maintained above 200°F unless the following conditions are met (except as permitted by Paragraph 3.7.2):

A. Any one of the following combinations of power sources operable:

1. Startup Transformer No. 1 and Startup Transformer No. 2.

2. Startup Transformer No. 2 and Unit Auxiliary Transformer provided that the latter one is connected to the 22KV line from the switchyard rather than to the generator bus.

B. All 4160 V switchgear, 480 V load centers, 480 V motor control centers and 120 V AC distribution panels in both of the ESAS distribution systems are operable and are being powered from either one of the two startup transformers or the unit auxiliary transformer.

C. Both diesel generator sets are operable each with:

1. a separate day tank containing a minimum of 160 gallons of fuel,

2. a separate emergency storage tank containing a minimum of 138 inches (20,000 gallons) of fuel,

3. a separate fuel transfer pump, and

4. a separate starting air compressor.

D. DELETED |

E. DELETED |

F. The off-site power undervoltage and protective relaying interlocks associated with required startup transformer power sources shall be operable per Table 3.5.1-1.

G. The selective load-shed features associated with Startup Transformer No. 2 shall be operable if selected for auto transfer.

3.7.2

A. The specifications in 3.7.1 may be modified to allow one of the following conditions to exist after the reactor has been heated above 200F. Except as indicated in the following conditions, if any of these conditions are not met, a hot shutdown shall be initiated within 12 hours. If the condition is not cleared within 24 hours, the reactor shall be brought to cold shutdown within an additional 24 hours.

B. In the event that one of the offsite power sources specified in 3.7.1.A (1 or 2) is inoperable, reactor operation may continue for up to 24 hours if the availability of the diesel generators is immediately verified.

C. Either one of the two diesel generators may be inoperable for up to 7 days in any month provided that during such 7 days the operability of the remaining diesel generator is demonstrated immediately and daily thereafter, there are no inoperable ESF components associated with the operable diesel generator, and provided that the two sources of off-site power specified in 3.7.1.A(1) or 3.7.1.A(2) are available.

D. Any 4160V, 480V, or 120V switchgear, load center, motor control center, or distribution panel in one of the two ESF distribution systems may be inoperable for up to 8 hours, provided that the operability of the diesel generator associated with the operable ESF distribution system is demonstrated immediately and all of the components of the operable distribution system are operable. If the ESF distribution system is not returned to service at the end of the 8 hour period, Specification 3.7.2.A shall apply.

E. DELETED

F. DELETED

G. DELETED

H. If the requirements of Specification 3.7.1.G cannot be met, either:

(1) place all Startup Transformer No. 2 feeder breakers in "pull-to-lock" within 1 hour, restore the inoperable interlocks to operable status within 30 days, or submit within 30 days a Special Report pursuant to Specification 6.12.5 outlining the cause of the failure, proposed corrective action and schedule for implementation; or

(2) apply the action requirements of Table 3.5.1-1, Note 14.

3.7.3 Both DC electrical power subsystems shall be operable when the unit is above the cold shutdown condition.

A. With one DC electrical power subsystem inoperable, restore the DC electrical subsystem to operable status within 8 hours, or be in hot shutdown within the next 6 hours, and cold shutdown within an additional 30 hours.

3.7.4 Battery parameters shall be within limits when the associated DC electrical power subsystems are required to be operable.

A. With one or more batteries with one or more battery parameters not within Battery Inspection Program limits but within limits of the associated Surveillance Requirement of TS 4.6.2:

1. Perform Surveillance Requirements 4.6.2.8 and 4.6.2.9 for the pilot cell within 1 hour,

2. Perform Surveillance Requirements 4.6.2.7, 4.6.2.8 and 4.6.2.9 for all connected cells within 24 hours and once per 7 days thereafter, and

3. Restore battery parameters to within limits of Battery Inspection Program within 31 days.

B. With one battery with float current ≥ 2 amps, but < 10 amps, restore battery float current to < 2 amps within 24 hours.

C. With one or more batteries with one or more battery parameters not within Battery Inspection Program limits but within limits of the associated Surveillance Requirement of TS 4.6.2 and unable to satisfy the requirements or allowable outage times of 3.7.4.A.1, 3.7.4.A.2, or 3.7.4.A.3, declare the associated battery inoperable immediately and perform the required actions of 3.7.3.A.

D. With one or more batteries with one or more battery parameters not within limits for reasons other than 3.7.4.A, 3.7.4.B, or 3.7.4.C, declare the associated battery inoperable immediately and perform the required actions of 3.7.3.A.

Bases

The electrical system is designed to be electrically self-sufficient and provide adequate, reliable power sources for all electrical equipment during startup, normal operation, safe shutdown and handling of all emergency situations. To prevent the concurrent loss of all auxiliary power, the various sources of power are independent of and isolated from each other.

In the event that the offsite power sources specified in 3.7.1.A (1 or 2) are inoperable, the required capacity of one emergency storage tank plus one day tank (20, 160 gallons) will be sufficient for not less than three and one-half days operation for one diesel generator loaded to full capacity. (ANO-1 FSAR 8.2.2.3) The underground emergency storage tanks are gravity fed from the bulk storage tank and are normally full, while the day tanks are fed from transfer pumps which are capable of being cross connected at their suction and discharges and automatically receive fuel oil when their inventory is less than 180 gallons. Thus, at least a seven day total diesel oil inventory is available onsite for emergency diesel generator operation during complete loss of electric power conditions.

Technical Specification 3.7.2 allows for the temporary modification of the specifications in 3.7.1 provided that backup system(s) are operable with safe reactor operation and combined availability of the engineered safety features ensured.

Technical Specifications 3.7.1.F and 3.7.1.G provide assurance that the Startup Transformer No. 2 loads will not contribute to a sustained degraded grid voltage situation. This will protect ESF equipment from damage caused by sustained undervoltage.

The 125 VDC electrical power system consists of two independent and redundant safety related class 1E DC electrical subsystems. Each subsystem consists of one 100% capacity 125 VDC battery, the associated battery charger for each battery, and all the associated control equipment and interconnecting cabling. Additionally, each subsystem is equipped with one spare battery charger.

Battery cell parameters must remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated DBA. Battery cell limits within the Battery Inspection Program are conservatively established, allowing continued DC electrical system function even with the Battery Inspection Program parameter limits not met. With one or more required parameters in one or more batteries not within limits of the Battery Inspection Program but within limits of the associated Surveillance Requirements of TS 4.6.2, the battery is degraded but there may still be sufficient capacity to perform its intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of Battery Inspection Program parameter limits not met, and continued operation is permitted for a limited time.

A float (charging) current ≥2 amps is indicative of a battery which has been at least partially discharged. However, if the float current remains <10 amps, this is indicative of a battery performing as expected when returning to a full state of charge. The 24 hour allowable outage time of TS 3.7.4.B is based on the period necessary for a normally recharging battery to reach a state of full charge from the point at which it is capable of performing at ≥80% of manufacturer's rating.

e. Diesel fuel from the emergency storage tank shall be sampled and found to be within acceptable limits specified in Table 1 of ASTM D975-68 when checked for viscosity, water, and sediment.

5. Once every 31 days the pressure in the required starting air receiver tanks shall be verified to be ≥ 175 psig.

   Once every 18 months, the capacity of each diesel oil transfer pump shall be verified to be at least 10 gpm.

4.6.2 DC Sources and Battery Parameters

1. Verify battery terminal voltage is ≥ 124.7 V on float charge once each 31 days.

2. Verify battery capacity is adequate to supply, and maintain in operable status, the required emergency loads for the design duty cycle when subjected to either a battery service test or a modified performance discharge test once every 18 months.

3. Verify battery capacity is ≥ 80% of the manufacturers rating when subjected to a performance discharge test or a modified performance discharge test once every 60 months, and once every 18 months when battery shows degradation or has reached 85% of the expected life.

4. Any battery charger which has not been loaded while connected to its 125V d-c distribution system for at least 30 minutes during every quarter shall be tested and loaded while connected to its bus for 30 minutes.

5. Verify battery parameters are within Battery Inspection Program limits as required by the Battery Inspection Program.

6. Verify average electrolyte temperature of representative cells is ≥ 60°F once every 92 days.

7. Verify battery float current < 2 amps on float charge once every 31 days.

8. Verify electrolyte level of connected battery cells is above the top of the plates, and not overflowing once every 31 days.

9. Verify float voltage of connected battery cells is > 2.07 V once every 92 days.

4.6.3 Emergency Lighting

The correct functioning of the emergency lighting system shall be verified once every 18 months.

Bases

The emergency power system provides power requirements for the engineered safety features in the event of a DBA. Each of the two diesel generators is capable of supplying minimum required engineered safety features from independent buses. This redundancy is a factor in establishing testing intervals. The monthly tests specified above will demonstrate operability and load capacity of the diesel generator. The fuel supply and diesel starter motor air pressure are continuously monitored and alarmed for abnormal conditions. Starting on complete loss of off-site power will be verified by simulated loss-of-power tests once every 18 months.

Considering system redundancy, the specified testing intervals for the station batteries should be adequate to detect and correct any malfunction before it can result in system malfunction. Batteries will deteriorate with time, but precipitous failure is extremely unlikely. The surveillance specified is that which has been demonstrated over the years to provide an indication of a cell becoming unserviceable long before it fails.

Verifying battery terminal voltage while on float charge helps to ensure the effectiveness of the charging system and the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the connected loads and the continuous charge required to overcome the internal losses of a battery and maintain the battery in a fully charged state.

A battery service test is a special test of the battery capability, as found, to satisfy the design requirements (battery duty cycle) of the DC electrical power system. The discharge rate and test length should correspond to the design duty cycle requirements. A modified performance discharge test may be used in lieu of the service test. A modified performance discharge test is a test of the battery capacity and its ability to provide a high rate, short duration load (usually the highest rate of the duty cycle). The test is a simulated duty cycle consisting of just two rates; the one minute rate published for the battery or the largest current load of the duty cycle, followed by the test rate employed for the performance test, both of which envelope the duty cycle of the service test. Initial conditions for the modified performance discharge test should be identical to those specified for a service test and the test discharge rate must envelope the duty cycle of the service test if the modified performance discharge test is performed in lieu of a service test.

A battery performance discharge test is a test of constant current capacity of a battery, normally done in the as found condition, after having been in service, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage. A battery modified performance discharge test may be used in lieu of the performance discharge test. Degradation is indicated, according to IEEE-450 when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is ≥10% below the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. IEEE-450 and IEEE-485 recommend that the battery be replaced if its capacity is below 80%.

TS 4.6.2.5 verifies required battery parameter testing is performed in accordance with the Battery Inspection program. The required parameters include the condition of the battery terminals and connectors, the condition of the battery cells, cell plates, and racks, the battery connection resistance, the electrolyte level, and float voltage. The term "connected battery cell" excludes any battery cell that may be jumpered out. The program also defines the normal maintenance parameter limits for each designated pilot cell in each battery and for each connected battery cell. The cells selected as pilot cells are those whose temperature and voltage approximate the state of charge of the entire battery. These maintenance parameter limits are typically more conservative than the acceptance criteria provided in the other requirements of TS 4.6.2, and are indicative of battery cell degradation which, if left unattended, will ultimately affect battery operability. Specific acceptance criteria and additional details are discussed in the Battery Inspection Program. This program implements the inspection guidance and corrective actions of IEEE-450 Section 4.3 and 4.4, respectively.

Testing of the emergency lighting is scheduled every 18 months and is subject to review and modification if experience demonstrates a more effective test schedule.

REFERENCE

FSAR, Section 8

6.8.2 Each procedure of 6.8.1 above, and changes in intent thereto, shall be reviewed and approved as required by the QAMO prior to implementation and reviewed periodically as set forth in administrative procedures.

6.8.3 Changes to procedures of 6.8.1 above may be made and implemented prior to obtaining the review and approval required in 6.8.2 above provided:

a. The intent of the original procedure is not altered.

b. The change is approved by two members of the plant management staff, at least one of whom holds a Senior Reactor Operator's license on Unit 1.

c. The change is documented, reviewed and approved as required by the QAMO, within 14 days of implementation.

6.8.4 Battery Inspection Program

A battery inspection program to monitor the battery condition and performance shall be established. The program shall include inspection and testing requirements and acceptance criteria, at the frequencies identified in Section 4.3 of IEEE-450 1995, for the following parameters:

1. Condition of battery terminals and connectors;

2. Condition of battery cells, cell plates, and racks;

3. Battery connection resistance;

4. Battery cell electrolyte level; and

5. Battery cell float voltage.

The provisions of Specification 4.0.2 and Specification 4.0.3 are applicable to the Battery Inspection Program.

MARKUP OF CURRENT ANO-1 TECHNICAL SPECIFICATIONS

(FOR INFO ONLY)

3.7 Auxiliary Electrical Systems

Applicability

Applies to the auxiliary electrical power systems.

Objectives

To specify conditions of operation for plant station power necessary to ensure safe reactor operation and combined availability of the engineered safety features.

Specifications

3.7.1 The reactor shall not be heated or maintained above 200°F unless the following conditions are met (except as permitted by Paragraph 3.7.2):

A. Any one of the following combinations of power sources operable:

1. Startup Transformer No. 1 and Startup Transformer No. 2.

2. Startup Transformer No. 2 and Unit Auxiliary Transformer provided that the latter one is connected to the 22KV line from the switchyard rather than to the generator bus.

B. All 4160 V switchgear, 480 V load centers, 480 V motor control centers and 120 V AC distribution panels in both of the ESAS distribution systems are operable and are being powered from either one of the two startup transformers or the unit auxiliary transformer.

C. Both diesel generator sets are operable each with:

1. a separate day tank containing a minimum of 160 gallons of fuel,

2. a separate emergency storage tank containing a minimum of 138 inches (20,000 gallons) of fuel,

3. a separate fuel transfer pump, and

4. a separate starting air compressor.

D. DELETED~~Both station batteries are operable and each is capable of supplying power to the 125V d-c distribution system. At least one battery charger associated with each station battery is operable.~~

E. DELETED~~At least 2 of 3 d-c control power sources to the 125V d-c switchyard distribution system are operable.~~

F. The off-site power undervoltage and protective relaying interlocks associated with required startup transformer power sources shall be operable per Table 3.5.1-1.

G. The selective load-shed features associated with Startup Transformer No. 2 shall be operable if selected for auto transfer.

3.7.2 A. The specifications in 3.7.1 may be modified to allow one of the following conditions to exist after the reactor has been heated above 200F. Except as indicated in the following conditions, if any of these conditions are not met, a hot shutdown shall be initiated within 12 hours. If the condition is not cleared within 24 hours, the reactor shall be brought to cold shutdown within an additional 24 hours.

B. In the event that one of the offsite power sources specified in 3.7.1.A (1 or 2) is inoperable, reactor operation may continue for up to 24 hours if the availability of the diesel generators is immediately verified.

C. Either one of the two diesel generators may be inoperable for up to 7 days in any month provided that during such 7 days the operability of the remaining diesel generator is demonstrated immediately and daily thereafter, there are no inoperable ESF components associated with the operable diesel generator, and provided that the two sources of off-site power specified in 3.7.1.A(1) or 3.7.1.A(2) are available.

D. Any 4160V, 480V, or 120V switchgear, load center, motor control center, or distribution panel in one of the two ESF distribution systems may be inoperable for up to 8 hours, provided that the operability of the diesel generator associated with the operable ESF distribution system is demonstrated immediately and all of the components of the operable distribution system are operable. If the ESF distribution system is not returned to service at the end of the 8 hour period, Specification 3.7.2.A shall apply.

E. DELETED~~With no operable battery charger associated with one station battery, operation is allowed to continue for a period of 8 hours provided at least one battery charger is operable on the opposite train, after which Specification 3.7.2.A shall apply.~~

F. DELETED~~One of the two station batteries and the associated distribution system may be inoperable for 8 hours provided that there are no inoperable safety related components associated with the remaining station battery which are redundant to the inoperable station battery and the operability of the diesel generator is verified immediately. If the battery is not returned to service at the end of the 8 hour period, Specification 3.7.2.A shall apply.~~

G. DELETED~~Two control power sources from the plant to the switchyard and the attendant distribution system may be inoperable for 8 hours, after which Specification 3.7.2.A shall apply.~~

H. If the requirements of Specification 3.7.1.G cannot be met, either:

(1) place all Startup Transformer No. 2 feeder breakers in "pull-to-lock" within 1 hour, restore the inoperable interlocks to operable status within 30 days, or submit within 30 days a Special Report pursuant to Specification 6.12.5 outlining the cause of the failure, proposed corrective action and schedule for implementation; or

(2) apply the action requirements of Table 3.5.1-1, Note 14.

3.7.3 ~~Deleted~~Both DC electrical power subsystems shall be operable when the unit is above the cold shutdown condition.

A. With one DC electrical power subsystem inoperable, restore the DC electrical subsystem to operable status within 8 hours, or be in hot shutdown within the next 6 hours, and cold shutdown within an additional 30 hours.

3.7.4 Battery parameters shall be within limits when the associated DC electrical power subsystems are required to be operable.

A. With one or more batteries with one or more battery parameters not within Battery Inspection Program limits but within limits of the associated Surveillance Requirement of TS 4.6.2:

1. Perform Surveillance Requirements 4.6.2.8 and 4.6.2.9 for the pilot cell within 1 hour,

2. Perform Surveillance Requirements 4.6.2.7, 4.6.2.8 and 4.6.2.9 for all connected cells within 24 hours and once per 7 days thereafter, and

3. Restore battery parameters to within limits of Battery Inspection Program within 31 days.

B. With one battery with float current ≥ 2 amps, but < 10 amps, restore battery float current to < 2 amps within 24 hours.

C. With one or more batteries with one or more battery parameters not within Battery Inspection Program limits but within limits of the associated Surveillance Requirement of TS 4.6.2 and unable to satisfy the requirements or allowable outage times of 3.7.4.A.1, 3.7.4.A.2, or 3.7.4.A.3, declare the associated battery inoperable immediately and perform the required actions of 3.7.3.A.

D. With one or more batteries with one or more battery parameters not within limits for reasons other than 3.7.4.A, 3.7.4.B, or 3.7.4.C, declare the associated battery inoperable immediately and perform the required actions of 3.7.3.A.

Bases

The electrical system is designed to be electrically self-sufficient and provide adequate, reliable power sources for all electrical equipment during startup, normal operation, safe shutdown and handling of all emergency situations. To prevent the concurrent loss of all auxiliary power, the various sources of power are independent of and isolated from each other.

In the event that the offsite power sources specified in 3.7.1.A (1 or 2) are inoperable, the required capacity of one emergency storage tank plus one day tank (20, 160 gallons) will be sufficient for not less than three and one-half days operation for one diesel generator loaded to full capacity. (ANO-1 FSAR 8.2.2.3) The underground emergency storage tanks are gravity fed from the bulk storage tank and are normally full, while the day tanks are fed from transfer pumps which are capable of being cross connected at their suction and discharges and automatically receive fuel oil when their inventory is less than 180 gallons. Thus, at least a seven day total diesel oil inventory is available onsite for emergency diesel generator operation during complete loss of electric power conditions.

Technical Specification 3.7.2 allows for the temporary modification of the specifications in 3.7.1 provided that backup system(s) are operable with

safe reactor operation and combined availability of the engineered safety features ensured.

Technical Specifications 3.7.1.F and 3.7.1.G provide assurance that the Startup Transformer No. 2 loads will not contribute to a sustained degraded grid voltage situation. This will protect ESF equipment from damage caused by sustained undervoltage.

The 125 VDC electrical power system consists of two independent and redundant safety related class 1E DC electrical subsystems. Each subsystem consists of one 100% capacity 125 VDC battery, the associated battery charger for each battery, and all the associated control equipment and interconnecting cabling. Additionally, there is one spare battery charger per subsystem, which provides backup service in the event that the preferred battery charger is out of service.

Battery cell parameters must remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated DBA. Battery cell limits within the Battery Inspection Program are conservatively established, allowing continued DC electrical system function even with the Battery Inspection Program parameter limits not met. With one or more required parameters in one or more batteries not within limits of the Battery Inspection Program but within limits of the associated Surveillance Requirements of TS 4.6.2, the battery is degraded but there may still be sufficient capacity to perform its intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of Battery Inspection Program parameter limits not met, and continued operation is permitted for a limited time.

A float (charging) current ≥2 amps is indicative of a battery which has been at least partially discharged. However, if the float current remains <10 amps, this is indicative of a battery performing as expected when returning to a full state of charge. The 24 hour allowable outage time of TS 3.7.4.B is based on the period necessary for a normally recharging battery to reach a state of full charge from the point at which it is capable of performing at ≥80% of manufacturer's rating.

e. Diesel fuel from the emergency storage tank shall be sampled and found to be within acceptable limits specified in Table 1 of ASTM D975-68 when checked for viscosity, water, and sediment.

5. Once every 31 days the pressure in the required starting air receiver tanks shall be verified to be ≥ 175 psig.

Once every 18 months, the capacity of each diesel oil transfer pump shall be verified to be at least 10 gpm.

4.6.2 ~~Station Batteries and Switchyard Batteries~~ DC Sources and Battery Parameters

1. ~~The voltage, temperature and specific gravity of a pilot cell in each bank and the overall battery voltage of each bank shall be measured and recorded daily~~Verify battery terminal voltage is ≥ 124.7 V on float charge once each 31 days.

2. ~~Measurements shall be made quarterly of voltage of each cell to the nearest 0.01 volt, of the specific gravity of each cell, and of the temperature of every fifth cell in each bank. The level of the electrolyte shall be checked and adjusted as required. All data, including the amount of water added to any cell, shall be recorded~~ Verify battery capacity is adequate to supply, and maintain in operable status, the required emergency loads for the design duty cycle when subjected to either a battery service test or a modified performance discharge test once every 18 months.

3. ~~Once every 18 months, a performance discharge test shall be conducted in accordance with the manufacturer's instructions, the purpose of determining battery capacity.~~ Verify battery capacity is ≥ 80% of the manufacturers rating when subjected to a performance discharge test or a modified performance discharge test once every 60 months, and once every 18 months when battery shows degradation or has reached 85% of the expected life.

4. Any battery charger which has not been loaded while connected to its 125V d-c distribution system for at least 30 minutes during every quarter shall be tested and loaded while connected to its bus for 30 minutes.

5. Verify battery parameters are within Battery Inspection Program limits as required by the Battery Inspection Program.

6. Verify average electrolyte temperature of representative cells is ≥ 60°F once every 92 days.

7. Verify battery float current < 2 amps on float charge once every 31 days.

8. Verify electrolyte level of connected battery cells is above the top of the plates, and not overflowing once every 31 days.

9. Verify float voltage of connected battery cells is > 2.07 V once every 92 days.

4.6.3 Emergency Lighting

The correct functioning of the emergency lighting system shall be verified once every 18 months.

Bases

The emergency power system provides power requirements for the engineered safety features in the event of a DBA. Each of the two diesel generators is capable of supplying minimum required engineered safety features from independent buses. This redundancy is a factor in establishing testing intervals. The monthly tests specified above will demonstrate operability and load capacity of the diesel generator. The fuel supply and diesel starter motor air pressure are continuously monitored and alarmed for abnormal conditions. Starting on complete loss of off-site power will be verified by simulated loss-of-power tests once every 18 months.

Considering system redundancy, the specified testing intervals for the station batteries should be adequate to detect and correct any malfunction before it can result in system malfunction. Batteries will deteriorate with time, but precipitous failure is extremely unlikely. The surveillance specified is that which has been demonstrated over the years to provide an indication of a cell becoming unserviceable long before it fails.

Verifying battery terminal voltage while on float charge helps to ensure the effectiveness of the charging system and the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the connected loads and the continuous charge required to overcome the internal losses of a battery and maintain the battery in a fully charged state.

A battery service test is a special test of the battery capability, as found, to satisfy the design requirements (battery duty cycle) of the DC electrical power system. The discharge rate and test length should correspond to the design duty cycle requirements. A modified performance discharge test may be used in lieu of the service test. A modified performance discharge test is a test of the battery capacity and its ability to provide a high rate, short duration load (usually the highest rate of the duty cycle). The test is a simulated duty cycle consisting of just two rates; the one minute rate published for the battery or the largest current load of the duty cycle, followed by the test rate employed for the performance test, both of which envelope the duty cycle of the service test. Initial conditions for the modified performance discharge test should be identical to those specified for a service test and the test discharge rate must envelope the duty cycle of the service test if the modified performance discharge test is performed in lieu of a service test.

A battery performance discharge test is a test of constant current capacity of a battery, normally done in the as found condition, after having been in service, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage. A battery modified performance discharge test may be used in lieu of the performance discharge test. Degradation is indicated, according to IEEE-450 when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is ≥10% below the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. IEEE-450 and IEEE-485 recommend that the battery be replaced if its capacity is below 80%.

TS 4.6.2.5 verifies required battery parameter testing is performed in accordance with the Battery Inspection program. The required parameters include the condition of the battery terminals and connectors, the condition of the battery cells, cell plates, and racks, the battery connection resistance, the electrolyte level, and float voltage. The term "connected battery cell" excludes any battery cell that may be jumpered out. The program also defines the normal maintenance parameter limits for each designated pilot cell in each battery and for each connected battery cell. The cells selected as pilot cells are those whose temperature and voltage approximate the state of charge of the entire battery. These maintenance parameter limits are typically more conservative than the acceptance criteria provided in the other requirements of TS 4.6.2, and are indicative of battery cell degradation which, if left unattended, will ultimately affect battery operability. Specific acceptance criteria and additional details

are discussed in the Battery Inspection Program. This program implements the inspection guidance and corrective actions of IEEE-450 Section 4.3 and 4.4, respectively.

~~Routine battery maintenance specified by the manufacturer includes regularly scheduled equalizing charges in order to retain the capacity of the battery. A test discharge should be conducted to ascertain the capability of the battery to perform its design function under postulated accident condition. An excessive drop of voltage with respect to time is indicative of required battery maintenance or replacement.~~

Testing of the emergency lighting is scheduled every 18 months and is subject to review and modification if experience demonstrates a more effective test schedule.

REFERENCE

FSAR, Section 8

6.8.2 Each procedure of 6.8.1 above, and changes in intent thereto, shall be reviewed and approved as required by the QAMO prior to implementation and reviewed periodically as set forth in administrative procedures.

6.8.3 Changes to procedures of 6.8.1 above may be made and implemented prior to obtaining the review and approval required in 6.8.2 above provided:

a. The intent of the original procedure is not altered.

b. The change is approved by two members of the plant management staff, at least one of whom holds a Senior Reactor Operator's license on Unit 1.

c. The change is documented, reviewed and approved as required by the QAMO, within 14 days of implementation.

6.8.4 Battery Inspection Program

A battery inspection program to monitor the battery condition and performance shall be established. The program shall include inspection and testing requirements and acceptance criteria, at the frequencies identified in Section 4.3 of IEEE-450 1995, for the following parameters:

1. Condition of battery terminals and connectors;

2. Condition of battery cells, cell plates, and racks;

3. Battery connection resistance;

4. Battery cell electrolyte level; and

5. Battery cell float voltage.

The provisions of Specification 4.0.2 and Specification 4.0.3 are applicable to the Battery Inspection Program.