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B 3.3 INSTRUMENTATION

B 3.3.3.1 Post Accident Monitoring (PAM) Instrumentation

BASES

BACKGROUND

The primary purpose of the PAM instrumentation is to display plant variables that provide information required by the control room operators during accident situations. This information provides the necessary support for the operator to take the manual actions for which no automatic control is provided and that are required for safety systems to accomplish their safety functions for Design Basis Events. The instruments that monitor these variables are designated as Type A, Category I, and non-Type A, Category I, in accordance with Regulatory Guide 1.97 (Ref. 1).

The OPERABILITY of the accident monitoring instrumentation ensures that there is sufficient information available on selected plant parameters to monitor and assess plant status and behavior following an accident. This capability is consistent with the recommendations of Reference 1.

APPLICABLE SAFETY ANALYSES

The PAM instrumentation LCO ensures the OPERABILITY of Regulatory Guide 1.97, Type A variables so that the control room operating staff can:

- Perform the diagnosis specified in the Emergency Operating Procedures (EOPs). These variables are restricted to preplanned actions for the primary success path of Design Basis Accidents (DBAs), (e.g., loss of coolant accident (LOCA)), and

- Take the specified, preplanned, manually controlled actions for which no automatic control is provided, which are required for safety systems to accomplish their safety function.

The PAM instrumentation LCO also ensures OPERABILITY of Category I, non-Type A, variables so that the control room operating staff can:

- Determine whether systems important to safety are performing their intended functions;

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

- Determine the potential for causing a gross breach of the barriers to radioactivity release;
- Determine whether a gross breach of a barrier has occurred; and
- Initiate action necessary to protect the public and for an estimate of the magnitude of any impending threat.

The plant specific Regulatory Guide 1.97 Analysis (Ref. 2 and 3) documents the process that identified Type A and Category I, non-Type A, variables.

Accident monitoring instrumentation that satisfies the definition of Type A in Regulatory Guide 1.97 meets Criterion 3 of the NRC Policy Statement. (Ref. 4) Category I, non-Type A, instrumentation is retained in Technical Specifications (TS) because they are intended to assist operators in minimizing the consequences of accidents. Therefore, these Category I variables are important for reducing public risk.

LCO

LCO 3.3.3.1 requires two OPERABLE channels for all but one Function to ensure that no single failure prevents the operators from being presented with the information necessary to determine the status of the plant and to bring the plant to, and maintain it in, a safe condition following that accident.

Furthermore, provision of two channels allows a CHANNEL CHECK during the post accident phase to confirm the validity of displayed information.

The exception to the two channel requirement is primary containment isolation valve (PCIV) position. In this case, the important information is the status of the primary containment penetrations. The LCO requires one position indicator for each active PCIV. This is sufficient to redundantly verify the isolation status of each isolable penetration either via indicated status of the active valve and prior knowledge of passive valve or via system boundary

(continued)

BASES

LCO (continued)

status. If a normally active PCIV is known to be closed and deactivated, position indication is not needed to determine status. Therefore, the position indication for valves in this state is not required to be OPERABLE.

The following list is a discussion of the specified instrument Functions listed in Table 3.3.3.1-1 in the accompanying LCO. Table B 3.3.3.1-1 provides a listing of the instruments that are used to meet the operability requirements for the specific functions.

1. Reactor Steam Dome Pressure

Reactor steam dome pressure is a Type A, Category 1, variable provided to support monitoring of Reactor Coolant System (RCS) integrity and to verify operation of the Emergency Core Cooling Systems (ECCS). Two independent pressure channels, consisting of three wide range control room indicators and one wide range control room recorder per channel with a range of 0 psig to 1500 psig, monitor pressure. The wide range recorders are the primary method of indication available for use by the operators during an accident, therefore, the PAM Specification deals specifically with this portion of the instrument channel.

2. Reactor Vessel Water Level

Reactor vessel water level is a Type A, Category 1, variable provided to support monitoring of core cooling and to verify operation of the ECCS. A combination of three different level instrument ranges, with two independent channels each, monitor Reactor Vessel Water Level. The extended range instrumentation measures from -150 inches to 180 inches and outputs to three control room level indicators per channel. The wide range instrumentation measures from -150 inches to 60 inches and outputs to one control room recorder and three control room indicators per channel. The fuel zone range instrumentation measures from -310 inches to -110 inches and outputs to a control room recorder (one channel) and a control room indicator (one channel). These three ranges of instruments combine to provide level indication from the bottom of the Core to above the main steam line. The wide range level recorders, the fuel zone level indicator and level recorder, and one inner ring extended range level indicator per channel are the primary method of indication available for use by the operator during an accident, therefore the PAM

(continued)

BASES

LCO

2. Reactor Vessel Water Level (continued)

Specification deals specifically with this portion of the instrument channel.

3. Suppression Chamber Water Level

Suppression chamber water level is a Type A, Category 1, variable provided to detect a breach in the reactor coolant pressure boundary (RCPB). This variable is also used to verify and provide long term surveillance of ECCS function. A combination of two different level instrument ranges, with two independent channels each, monitor Suppression chamber water level. The wide range instrumentation measures from the ECCS suction lines to approximately the top of the chamber and outputs to one control room recorder per channel. The wide range recorders are the primary method of indication available for use by the operator during an accident, therefore the PAM Specification deals specifically with this portion of the instrument channel.

4. Primary Containment Pressure

Primary Containment pressure is a Type A, Category 1, variable provided to detect a breach of the RCPB and to verify ECCS functions that operate to maintain RCS integrity. A combination of two different pressure instrument ranges, with two independent channels each, monitor primary containment pressure. The LOCA range measures from -15 psig to 65 psig and outputs to one control room recorder per channel. The accident range measures from 0 psig to 250 psig and outputs to one control room recorder per channel (same recorders as the LOCA range). The recorders (both ranges) are the primary method of indication available for use by the operator during an accident, therefore the PAM Specification deals specifically with this portion of the instrument channel.

5. Primary Containment High Radiation

Primary containment area radiation (high range) is provided to monitor the potential of significant radiation releases

(continued)

BASES

LCO

5. Primary Containment High Radiation (continued)

and to provide release assessment for use by operators in determining the need to invoke site emergency plans. Two independent channels, which output to one control room recorder per channel with a range of 10^0 to $1X10^8$ R/hr, monitor radiation. The PAM Specification deals specifically with this portion of the instrument channel.

6. Primary Containment Isolation Valve (PCIV) Position

PCIV position is provided for verification of containment integrity. In the case of PCIV position, the important information is the isolation status of the containment penetration. The LCO requires a channel of valve position indication in the control room to be OPERABLE for an active PCIV in a containment penetration flow path, i.e., two total channels of PCIV position indication for a penetration flow path with two active valves. For containment penetrations with only one active PCIV having control room indication, Note (b) requires a single channel of valve position indication to be OPERABLE. This is sufficient to redundantly verify the isolation status of each isolable penetration via indicated status of the active valve, as applicable, and prior knowledge of passive valve or system boundary status. If a penetration flow path is isolated, position indication for the PCIV(s) in the associated penetration flow path is not needed to determine status. Therefore, the position indication for valves in an isolated penetration flow path is not required to be OPERABLE. These valves which require position indication are specified in Table B 3.6.1.3-1. Furthermore, the loss of position indication does not necessarily result in the PCIV being inoperable.

The PCIV position PAM instrumentation consists of position switches unique to PCIVs, associated wiring and control room indicating lamps (not necessarily unique to a PCIV) for active PCIVs (check valves and manual valves are not required to have position indication). Therefore, the PAM Specification deals specifically with these instrument channels.

(continued)

BASES

LCO (continued)

7. Neutron Flux

Wide range neutron flux is a Category I variable provided to verify reactor shutdown. The Neutron Monitoring System Average Power Range Monitors (APRM) provides reliable neutron flux measurement from 0% to 125% of full power. The APRM consists of four channels each with their own chassis powered with redundant power supplies. The APRM sends signals to the analog isolator module which in turn sends individual APRM signals to the recorders used for post accident monitoring. The PAM function for neutron flux is satisfied by having any 2 channels of APRM provided for post accident monitoring. The PAM Specification deals specifically with this portion of the instrument channel.

The Neutron Monitoring System (NMS) was evaluated against the criteria established in General Electric NEDO-31558A to ensure its acceptability for post-accident monitoring. NEDO-31558A provides alternate criteria for the NMS to meet the post-accident monitoring guidance of Regulatory Guide 1.97. Based on the evaluation, the NMS was found to meet the criteria established in NEDO-31558A. The APRM sub-function of the NMS is used to provide the Neutron Flux monitoring identified in TS 3.3.3.1 (Ref. 5 and 6).

8. Not Used

(continued)

BASES

LCO (continued)

9. Drywell Atmosphere Temperature

Drywell atmosphere temperature is a Category I variable provided to verify RCS and containment integrity and to verify the effectiveness of ECCS actions taken to prevent containment breach. Two independent temperature channels, consisting of two control room recorders per channel with a range of 40 to 440 degrees F, monitor temperature. The PAM Specification deals specifically with the inner ring temperature recorder portion of the instrument channel.

10. Suppression Chamber Water Temperature

Suppression Chamber water temperature is a Type A, Category 1, variable provided to detect a condition that could potentially lead to containment breach and to verify the effectiveness of ECCS actions taken to prevent containment breach. The suppression chamber water temperature instrumentation allows operators to detect trends in suppression chamber water temperature in sufficient time to take action to prevent steam quenching vibrations in the suppression pool. Two channels are required to be OPERABLE. Each channel consists of eight sensors of which a minimum of four sensors (one sensor in each quadrant) must be OPERABLE to consider a channel OPERABLE. The outputs for the temperature sensors are displayed on two independent indicators in the control room and recorded on the monitoring units located in the control room on a back panel. The temperature indicators are the primary method of indication available for use by the operator during an accident, therefore the PAM Specification deals specifically with this portion of the instrument channel.

APPLICABILITY

The PAM instrumentation LCO is applicable in MODES 1 and 2. These variables are related to the diagnosis and preplanned actions required to mitigate DBAs. The applicable DBAs are assumed to occur in MODES 1 and 2. In MODES 3, 4, and 5, plant conditions are such that the likelihood of an event that would require PAM instrumentation is extremely low; therefore, PAM instrumentation is not required to be OPERABLE in these MODES.

(continued)

BASES (continued)

ACTIONS

A note has been provided to modify the ACTIONS related to PAM instrumentation channels. Section 1.3, Completion Times, specifies that once a Condition has been entered, subsequent divisions, subsystems, components, or variables expressed in the Condition discovered to be inoperable or not within limits, will not result in separate entry into the Condition. Section 1.3 also specifies that Required Actions of the Condition continue to apply for each additional failure, with Completion Times based on initial entry into the Condition. However, the Required Actions for inoperable PAM instrumentation channels provide appropriate compensatory measures for separate Functions. As such, a Note has been provided that allows separate Condition entry for each inoperable PAM Function.

A.1

When one or more Functions have one required channel that is inoperable, the required inoperable channel must be restored to OPERABLE status within 30 days. The 30 day Completion Time is based on operating experience and takes into account the remaining OPERABLE channels, the passive nature of the instrument (no critical automatic action is assumed to occur from these instruments), and the low probability of an event requiring PAM instrumentation during this interval.

B.1

If a channel has not been restored to OPERABLE status in 30 days, this Required Action specifies initiation of action in accordance with Specification 5.6.7, which requires a written report to be submitted to the NRC. This report discusses the results of the root cause evaluation of the inoperability and identifies proposed restorative actions.

(continued)

BASES

ACTIONS

B.1 (continued)

This action is appropriate in lieu of a shutdown requirement because alternative actions are identified before the written report is submitted to the NRC, and given the likelihood of plant conditions that would require information provided by this instrumentation.

C.1

When one or more Functions have two required channels that are inoperable (i.e., two channels inoperable in the same Function), one channel in the Function should be restored to OPERABLE status within 7 days. The Completion Time of 7 days is based on the relatively low probability of an event requiring PAM instrument operation and the availability of alternate means to obtain the required information. Continuous operation with two required channels inoperable in a Function is not acceptable because the alternate indications may not fully meet all performance qualification requirements applied to the PAM instrumentation. Therefore, requiring restoration of one inoperable channel of the Function limits the risk that the PAM Function will be in a degraded condition should an accident occur.

D.1

This Required Action directs entry into the appropriate Condition referenced in Table 3.3.3.1-1. The applicable Condition referenced in the Table is Function dependent. Each time an inoperable channel has not met any Required Action of Condition C, as applicable, and the associated Completion Time has expired, Condition D is entered for that channel and provides for transfer to the appropriate subsequent Condition.

E.1

For the majority of Functions in Table 3.3.3.1-1, if any Required Action and associated Completion Time of Condition C are not met, the plant must be brought to a MODE in which the LCO not apply. To achieve this status, the plant must be brought to at least MODE 3 within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions

(continued)

BASES

ACTIONS

E.1 (continued)

from full power conditions in an orderly manner and without challenging plant systems.

F.1

Since alternate means of monitoring primary containment area radiation have been developed and tested, the Required Action is not to shut down the plant, but rather to follow the directions of Specification 5.6.7. These alternate means will be temporarily installed if the normal PAM channel cannot be restored to OPERABLE status within the allotted time. The report provided to the NRC should discuss the alternate means used, describe the degree to which the alternate means are equivalent to the installed PAM channels, justify the areas in which they are not equivalent, and provide a schedule for restoring the normal PAM channels.

SURVEILLANCE REQUIREMENTS

The following SRs apply to each PAM instrumentation Function in Table 3.3.3.1-1.

SR 3.3.3.1.1

Performance of the CHANNEL CHECK once every 31 days ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel against a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria which are determined by the plant staff based on an investigation of a combination of the channel instrument uncertainties, may be used to support this

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.3.1.1 (continued)

parameter comparison and include indication and readability. If a channel is outside the criteria, it may be an indication that the instrument has drifted outside its limit and does necessarily indicate the channel is Inoperable.

The Frequency of 31 days is based upon plant operating experience, with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel of a given Function in any 31 day interval is rare. The CHANNEL CHECK supplements less formal checks of channels during normal operational use of those displays associated with the required channels of this LCO.

SR 3.3.3.1.2 and SR 3.3.3.1.3

A CHANNEL CALIBRATION is performed every 24 months except for the PCIV Position Function. The PCIV Position Function is adequately demonstrated by the Remote Position Indication performed in accordance with 5.5.6, "Inservice Testing Program". CHANNEL CALIBRATION verifies that the channel responds to measured parameter with the necessary range and accuracy, and does not include alarms.

The CHANNEL CALIBRATION for the Containment High Radiation instruments shall consist of an electronic calibration of the channel, not including the detector, for range decades above 10 R/hr and a one point calibration check of the detector below 10 R/hr with an installed or portable gamma source.

The Frequency is based on operating experience and for the 24 month Frequency consistency with the industry refueling cycles.

(continued)

BASES

REFERENCES

1. Regulatory Guide 1.97 Rev. 2, "Instrumentation for Light Water Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident," February 6, 1985

2. Nuclear Regulatory Commission Letter A. Schwencer to N. Curtis, Emergency Response Capability, Conformance to R.G. 1.97, Rev. 2, dated February 6, 1985.

3. PP&L Letter (PLA-2222), N. Curtis to A. Schwencer, dated May 31, 1984.

4. Final Policy Statement on Technical Specifications Improvements, July 22, 1993 (58 FR 32193)

5. NEDO-31558A, BWROG Topical Report, Position on NRC Reg. Guide 1.97, Revision 3 Requirements for Post Accident Neutron Monitoring System (NMS).

6. Nuclear Regulatory Commission Letter from C. Poslusny to R.G. Byram dated July 3, 1996.

TABLE B 3.3.3.1-1

Post Accident Instruments
(Page 1 of 3)

Instrument/Variable	Element	Transmitter	Recorder	Indicator
1. Reactor Steam Dome Pressure	N/A	PT-14201A	UR-14201A (red)*	PI-14202A PI-14202A1 PI-14204A
	N/A	PT-14201B	UR-14201B (red)*	PI-14202B (left side) PI-14202B1 (left side) PI-14204B (left side)
2. Reactor Vessel Water Level	N/A	LT-14201A (Wide Range)	UR-14201A (blue)*	LI-14201A (left side) LI-14201A1 (left side) LI-14203A (left side)
	N/A	LT-14201B (Wide Range)	UR-14201B (blue)*	LI-14201B (left side) LI-14201B1 (left side) LI-14203B (left side)
	N/A	LT-14203A (Extended Range)	N/A	LI-14201A (right side)*(1) LI-14201A1 (right side) LI-14203A (right side)
	N/A	LT-14203B (Extended Range)	N/A	LI-14201B (right side)*(1) LI-14201B1 (right side) LI-14203B (right side)
	N/A	LT-14202A (Fuel Zone Range)	UR-14201A (orange)*	N/A
	N/A	LT-14202B (Fuel Zone Range)	UR-14201B (orange)*	N/A
3. Suppression Chamber Water Level	N/A	LT-15776A (Wide Range)	UR-15776A (red)*	N/A
	N/A	LT-15776B (Wide Range)	UR-15776B (red)*	N/A
	N/A	LT-15775A (Narrow Range)	UR-15776A (blue)	LI-15775A
	N/A	LT-15775B (Narrow Range)	UR-15776B (blue)	LI-15775B

TS-Prop/3.3/SA33031A.B1B

TABLE B 3.3.3.1-1

Post Accident Instruments
(Page 2 of 3)

Instrument/Variable	Element	Transmitter	Recorder	Indicator
4. Primary Containment Pressure	N/A	PT-15709A (0 to 250 psig)	UR-15701A (Dark Blue)*	N/A
	N/A	PT-15709B (0 to 250 psig)	UR-15701B (Dark Blue)*	N/A
	N/A	PT-15710A (-15 to 65 psig)	UR-15701A (Red)*	N/A
	N/A	PT-15710B (-15 to 65 psig)	UR-15701B (Red)*	N/A
5. Primary Containment High Radiation	RE-15720A	RITS-15720A	UR-15776A (Green)*	N/A
	RE-15720B	RITS-15720B	UR-15776B (Green)*	N/A
6. PCIV Position	See Technical Specification Bases Table B 3.6.1.3-1 for PCIV that require position indication to be OPERABLE			
7. Neutron Flux	N/A	APRM-1	NR-C51-1R603A (red pen)*	N/A
	N/A	APRM-2	NR-C51-1R603B (red pen)*	N/A
	N/A	APRM-3	NR-C51-1R603C (red pen)*	N/A
	N/A	APRM-4	NR-C51-1R603D (red pen)*	N/A
8. Containment Oxygen and Hydrogen Analyzer	AE-15745A (Hydrogen)	AIT-15745A	UR-15701A (Blue Violet)* UR-15701A (Violet)*	N/A
	AE-15745B (Hydrogen)	AIT-15745B	UR-15701B (Blue Violet)* UR-15701B (Violet)*	N/A
	AE-15746A (Oxygen)	AIT-15746A	UR-15701A (Orange)*	N/A
	AE-15746B (Oxygen)	AIT-15746B	UR-15701B (Orange)*	N/A

TABLE B 3.3.3.1-1

Post Accident Instruments
(Page 3 of 3)

Instrument/Variable	Element	Transmitter	Recorder	Indicator
9. Drywell Atmosphere Temperature	TE-15790A	TT-15790A	UR-15701A (Brown)* TR-15790A (point # 1)	N/A
	TE-15790B	TT-15790B	UR-15701B (Brown)* TR-15790B (point # 1)	N/A
10. Suppression Chamber Water Temperature	TE-15753 TE-15755 TE-15757 TE-15759 TE-15763 TE-15765 TE-15767 TE-15769	TX-15751	N/A	TIAH-15751* TI-15751
	TE-15752 TE-15754 TE-15758 TE-15760 TE-15762 TE-15766 TE-15768 TE-15770	TX-15752	N/A	TIAH-15752* TI-15752

* Indicates that the instrument (and associated components in the instrument channel) is considered as instrument channel surveillance acceptance criteria.

(1) In the case of the inner ring indicators for extended range level, it is recommended that LI-14201A and LI-14201B be used as acceptance criteria, however LI-14201A1, LI-14201B1, LI-14203A, or LI-14203B may be used in their place provided that surveillance requirements are satisfied. Only one set of these instruments needs to be OPERABLE.

B 3.6 CONTAINMENT SYSTEMS

B 3.6.3.1 Not Used

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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources-Operating

BASES

BACKGROUND

The DC electrical power system provides the AC emergency power system with control power. It also provides both motive and control power to selected safety related equipment. As required by 10 CFR 50, Appendix A, GDC 17 (Ref. 1), the DC electrical power system is designed to have sufficient independence, redundancy, and testability to perform its safety functions, assuming a single failure. The DC electrical power system also conforms to the recommendations of Regulatory Guide 1.6 (Ref. 2) and IEEE-308 (Ref. 3).

The Unit DC power sources provide both motive and control power to selected safety related equipment, as well as circuit breaker control power for the nonsafety related 13.8 kV, 4.16 kV, and 480 V and lower AC distribution systems. Each DC subsystem is energized by one 125/250 V battery and at least 1 Class 1E battery charger. The 250 V DC batteries for division I are supported by two half-capacity chargers; the 250 V DC batteries for division II are supported by a full capacity charger; and, the 125 V DC batteries are each supported by a single full capacity charger. Each battery is exclusively associated with a single 125/250 VDC bus and cannot be interconnected with any other 125/250 VDC subsystem. The chargers are supplied from the same AC load groups for which the associated DC subsystem supplies the control power. Transfer switches provide the capability to power Unit 1 and common DC loads from Unit 2 DC sources.

Diesel Generator (DG) E DC power sources provide control and instrumentation power for DG E.

During normal operation, the DC loads are powered from the battery chargers with the batteries floating on the system. In case of loss of normal power to the battery charger, the DC loads are automatically powered from the station batteries.

(continued)

BASES

BACKGROUND (continued)

The DC power distribution system is described in more detail in Bases for LCO 3.8.7, "Distribution System—Operating," and LCO 3.8.8, "Distribution System—Shutdown."

Each battery has adequate storage capacity to carry the required load continuously for approximately 4 hours.

Each subsystem, including the battery bank, chargers and DC switchgear, is located in an area separated physically and electrically from the other subsystems to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing between redundant Class 1E subsystems such as batteries, or battery chargers.

The batteries for the electrical power subsystems are sized to produce required capacity at 80% of nameplate rating, corresponding to warranted capacity at end of life cycles and the 100% design demand. The minimum design voltage limit is 105/210 V.

Each battery charger of DC electrical power subsystem has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged. Each battery charger has sufficient capacity to restore the battery from the design minimum charge to its fully charged state within design basis requirements while supplying normal steady state loads (Ref. 3).

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6 (Ref. 4) and Chapter 15 (Ref. 5), assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the DGs, emergency auxiliaries, and control and switching during all MODES of operation. The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining DC sources OPERABLE during accident conditions in the event of:

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

a. An assumed loss of all offsite AC power or all onsite AC power; and

b. A worst case single failure.

The DC sources satisfy Criterion 3 of the NRC Policy Statement (Ref. 6).

LCO

The DC electrical power subsystems are required to be OPERABLE to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA. Loss of any DC electrical power subsystem does not prevent the minimum safety function from being performed (Ref. 3).

The DC electrical power subsystems include:

a) each Unit 1 DC electrical power subsystem identified in Table 3.8.41 including a 125 volt or 250 volt DC battery bank in parallel with a battery charger and the corresponding control equipment and interconnecting cabling supplying power to the associated bus; and,

b) the Diesel Generator E DC electrical power subsystem identified in Table 3.8.4-1 including a 125 volt DC battery bank in parallel with a battery charger and the corresponding control equipment and interconnecting cabling supplying power to the associated bus.

APPLICABILITY

The DC electrical power sources are required to be OPERABLE in MODES 1, 2, and 3 to ensure safe unit operation and to ensure that:

a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients; and

(continued)

BASES

APPLICABILITY (continued)

b. Adequate core cooling is provided, and containment integrity and other vital functions are maintained in the event of a postulated DBA.

The DC electrical power requirements for MODES 4 and 5 are addressed in the Bases for LCO 3.8.5, "DC Sources—Shutdown."

ACTIONS

A.1

Condition A represents one subsystem with a loss of ability to completely respond to an event, and a potential loss of ability to remain energized during normal operation. It is therefore imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for
complete loss of DC power to the affected division. The 2 hour limit is consistent with the allowed time for an inoperable DC Distribution System division.

If one of the required DC electrical power subsystems is inoperable (e.g., inoperable battery, inoperable battery charger(s), or inoperable battery charger and associated inoperable battery), the remaining DC electrical power subsystems have the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure could, however, result in the loss of minimum necessary DC electrical subsystems to mitigate a worst case accident, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide 1.93 (Ref. 7) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

Condition A is modified by a Note that states that Condition A is not applicable to the DG E DC electrical power subsystem. Condition C or D is applicable to an inoperable DG E DC electrical power subsystem.

(continued)

BASES

ACTIONS (continued)

B.1 and B.2

If the Unit 1 DC electrical power subsystem cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 12 hours and to MODE 4 within 36 hours. The allowed Completion Times are
reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the unit to MODE 4 is consistent with the time required in Regulatory Guide 1.93 (Ref. 7).

C.1

If Diesel Generator E is not aligned to the class 1E distribution system, the only supported safety function is for the ESW system. Therefore, under this condition, if Diesel Generator E DC power subsystem is not OPERABLE actions are taken to either restore the battery to OPERABLE status or shutdown Diesel Generator E and close the associated ESW valves in order to ensure the OPERABILITY of the ESW system. The 2 hour limit is consistent with the allowed time for other inoperable DC sources and provides sufficient time to evaluate the condition of the battery and take the corrective actions.

D.1

If the Diesel Generator is aligned to the class 1E distribution system, the loss of Diesel Generator E DC power subsystem will result in the loss of a on-site Class 1E power source. Therefore, under this condition, if Diesel Generator E DC power subsystem is not OPERABLE actions are taken to either restore the battery to OPERABLE status or declare Diesel Generator E inoperable and take Actions of LCO 3.8.1. The 2 hour limit is consistent with the allowed time for other DC sources and provides sufficient time to evaluate the condition of the battery and take the necessary corrective actions.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge for the batteries 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 continuous charge required to overcome the internal losses of a battery (or battery cell) and maintain the battery (or a battery cell) in a fully charged state. The voltage requirements are consistent with the initial voltages assumed in the battery sizing calculations. The SR must be performed every 7 days consistent with manufacturer recommendations and IEEE-450 (Ref. 8). However, this Frequency is modified by a Note that allows the Frequency to be extended for up to 14 days when the battery is on equalize charge or has been on equalize charge any time during the previous 24 hours.
This change recognizes the routine 7 day Frequency must be extended until 24 hours after an equalize charge is completed so that meaningful results are obtained for this SR. The 14 day Frequency is not modified by the Note, therefore, the SR must be performed every 14 days regardless of how often the battery is placed on equalize charge.

SR 3.8.4.2

Visual inspection to detect corrosion of the battery cells and connections; or, measurement of the resistance of each inter-cell, inter-rack, inter-tier, and terminal connection with visible corrosion, provides an indication that there is no physical damage or abnormal deterioration that could potentially degrade battery performance.

The connection resistance limits established for this SR provide two acceptance limits for any connection where there is visible signs of corrosion. The first limit, if met, requires no additional actions and ensures the design capability of the battery is maintained. If the second limit is used, the calculated average resistance for the associated battery determined is SR 3.8.4.5 shall be recalculated using the new resistance value. Resistance values shall be measured for only those connections where there is visible signs of corrosion. To determine the average connection resistance, data from the performance of SR 3.8.4.5 can be used for unaffected connections.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.2 (continued)

The Frequency for these inspections, which can detect conditions that can cause power losses due to resistance heating, is 92 days. This Frequency is considered acceptable based on operating experience related to detecting corrosion trends.

SR 3.8.4.3

Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance. The presence of physical damage or deterioration does not represent a failure of this SR, provided an evaluation determines that the physical damage or deterioration does not affect the OPERABILITY of the battery (its ability to perform its design function).

The Frequency of this SR is acceptable because other administrative controls ensure adequate battery performance during the 18 month interval. Furthermore, operating experience has shown these components usually pass the Surveillance when performed at the 18 month Frequency; therefore, the Frequency is acceptable from a reliability standpoint.

SR 3.8.4.4 and SR 3.8.4.5

Visual inspection and resistance measurements of inter-cell, inter-rack, inter-tier, and terminal connections provides an indication of physical damage or abnormal deterioration that could indicate degraded battery condition. The anti-corrosion material is used to help ensure good electrical connections and to reduce terminal deterioration. The visual inspection for corrosion is not intended to require removal of and inspection under each terminal connection.

The removal of visible corrosion is a preventive maintenance SR. The presence of visible corrosion does not necessarily represent a failure of this SR, provided visible corrosion is removed during performance of this Surveillance. The

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.4 and SR 3.8.4.5 (continued)

connection resistance limits for this SR must be below the limits specified in the SR. The calculated average resistance limit ensure that the total voltage drop across the battery connections is consistent to those assumed in the battery calculations, while the upper limit for battery resistance prevents the possibility of battery damage due to overheating of the connections.

The Frequency of this SR is acceptable because other administrative controls ensure adequate battery performance during the 18 month interval. Furthermore, operating experience has shown these components usually pass the Surveillance when performed at the 18 month Frequency; therefore, the Frequency is acceptable from a reliability standpoint.

SR 3.8.4.6

Battery charger capability requirements are based on the design capacity of the chargers (Ref. 3). According to Regulatory Guide 1.32 (Ref. 9), the battery charger supply is required to be based on the largest combined demands of the various steady state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensures that these requirements can be satisfied.

The Frequency is acceptable, given the unit conditions required to perform the test and the other administrative controls existing to ensure adequate charger performance during these 24 month intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.7

A battery service test is a special test of the battery's capability, as found, to satisfy the design requirements (battery duty cycle) of the DC electrical power system. The test can be conducted using actual or simulated loads. The discharge rate and test length corresponds to the design duty cycle requirements as specified in Reference 12.

The Frequency of 24 months is consistent with the recommendations of Regulatory Guide 1.32 (Ref. 9) and Regulatory Guide 1.129 (Ref. 10), which state that the battery service test should be performed during refueling operations or at some other outage, with intervals between tests not to exceed 24 months.

This SR is modified by a Note which allows the performance of a modified performance discharge test in lieu of a service test once per 60 months.

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). This will confirm the battery's ability to meet the critical period of the load duty cycle, in addition to determining its percentage of rated capacity. Initial conditions for the modified performance discharge test should be identical to those specified for a service test.

The modified performance discharge test is a test of simulated duty cycle consisting of two different discharge rates. The first discharge rate consists of the one minute published rate for the battery or the largest current loads of the duty cycle followed by a second discharge rate which employs the test rate for the performance discharge test. These discharge rates envelope the duty cycle of the service test. Since the ampere-hours removed by a published one minute discharge rate represent a very small portion of the battery capacity, the test rate can be changed to that for the performance discharge test without compromising the results of the performance discharge test. The battery terminal voltage for the modified performance discharge test should remain above the minimum battery terminal voltage specified in the service test.

When the battery loads after the first minute exceeds the performance test discharge rate, the modified performance discharge test is

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.7 (continued)

performed by first conducting the service test, than adjusting the discharge rate to the constant current value normally used for the performance discharge test. This test is terminated when the specified minimum battery terminal voltage is reached.

When the battery loads after the first minute exceeds the performance discharge test rate, the battery capacity is calculated as follows:

% of rated capacity at 25°C (77°F) =

$$K\left[\frac{\sum (I_n)(t_n)}{Rated\ Ampere\ Hours}\right] x\,100$$

Where:

K = Temperature Correction Factor from IEEE 450-1995

I_n = Discharge Current in amps for n-th section

T_n = Duration of n-th section discharge in hour

n = Section number for each portion of the discharge, including both service test and performance test portions

This % of rated capacity equation uses the temperature corrected Ampere-Hours instead of the temperature corrected discharge rates as specified in IEEE 450-1995. It is not possible to temperature correct the discharge rate without impacting the service test.

The SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the Electrical Distribution System, and challenge safety systems.

Since the Diesel Generator E DC electrical power subsystem does not support loads other than the Diesel Generator E required loads, the mode restriction note need not be applied to the Diesel Generator E subsystem unless it is aligned to the class 1E distribution subsystem. The note does have applicability to the Diesel Generator E subsystem when the Diesel Generator E is substituted for one of the other Diesel Generators.

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.7 (continued)

When the Diesel Generator E is aligned to the class 1E distribution subsystem, the Diesel Generator E subsystem is required to support operability of the Diesel Generator E. Thus when in this configuration, the note does need to be applicable since performing the Surveillance would remove a required DC electrical power subsystem from service.

SR 3.8.4.8

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 is described in the Bases for SR 3.8.4.7. Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.4.8; however, only the modified performance discharge test may be used to satisfy SR 3.8.4.8 while satisfying the requirements of SR 3.8.4.7 at the same time.

The acceptance criteria for this Surveillance is consistent with IEEE-450 (Ref. 8) and IEEE-485 (Ref. 11). These references recommend that the battery be replaced if its capacity is below 80% of 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.

The Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected service life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected service life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity ≥ 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 8), 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. All these Frequencies are consistent with the recommendations in IEEE-450 (Ref. 8).

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.8 (continued)

The SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the Electrical Distribution System, and challenge safety systems.

Since the Diesel Generator E DC electrical power subsystem does not support loads other than the Diesel Generator E required loads, the mode restriction note need not be applied to the Diesel Generator E subsystem unless it is aligned to the class 1E distribution subsystem. The note does have applicability to the Diesel Generator E subsystem when the Diesel Generator E is substituted for one of the other Diesel Generators. When the Diesel Generator E is aligned to the class 1E distribution subsystem, the Diesel Generator E subsystem is required to support operability of the Diesel Generator E. Thus when in this configuration, the note does need to be applicable since performing the Surveillance would remove a required DC electrical power subsystem from service.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. Regulatory Guide 1.6.
3. IEEE Standard 308.
4. FSAR, Chapter 6.
5. FSAR, Chapter 15.
6. Final Policy Statement on Technical Specifications Improvements, July 22, 1993 (58 FR 39132).
7. Regulatory Guide 1.93.
8. IEEE Standard 450.
9. Regulatory Guide 1.32, February 1977.
10. Regulatory Guide 1.129, April 1977, February 1978.
11. IEEE Standard 485, 1983.
12. FSAR, Chapter 8, Section 8.3.2.1.1.6