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Both 4.16-kV Class 1E busses have a circuit breaker installed in the normal and alternate preferred offsite power source cubicles. Either breaker is capable of connecting the bus to an offsite power source. Both Class 1E 4.16-kV busses may be manually connected and paralleled to the same offsite power source as discussed in paragraph 8.3.1.1.2.D. The connection would be accomplished under administrative control by performing a manual, hot-bus transfer between the normal and alternate offsite sources. Although the preferred offsite power sources are momentarily paralleled during a hot-bus transfer, electrical interlocks are provided to prevent the preferred offsite power sources from remaining paralleled.

E. Permissives

A single switch in the diesel generator room is provided for each diesel generator to block automatic start signals when the diesel is out for maintenance.

When in the local-manual position, an annunciator is initiated in the control room.

A pushbutton in the control room and a local pushbutton in the diesel generator room are provided to allow manual start capability.

An emergency start is provided in the diesel generator room which bypasses the automatic start signals to allow a manual start of the diesel. During periodic diesel generator tests, subsequent to diesel start and synchronization to the preferred system, a switch in the control room allows parallel operation with the preferred power source.

F. Load Shedding Circuits

Upon recognition of a loss of or degraded voltage on a 4.16-kV Class 1E bus, a logic signal is initiated to effect the following on each load group through the safety feature sequencer:

- Shed all loads; load center transformers remain connected.
- Send signal to start diesel generator.
- Trip 4.16-kV preferred power supply breaker.

Two voltage sensing schemes for each Class 1E 4.16-kV bus are employed to initiate the logic signal. One scheme will recognize a loss of voltage, and the other will recognize degraded voltage conditions. Each scheme is provided voltage signals through four potential transformers located on each bus.

To sense a loss of voltage, four solid state type undervoltage devices are provided. Logic is provided to allow load shedding and tripping of the incoming breaker on two-out-of-four undervoltage logic signals. These devices are set to operate with a time delay of 0.8 s at a minimum of 70 percent of nominal voltage which is below the minimum expected voltage during diesel generator sequencing. The undervoltage relay design meets the applicable requirements of IEEE 279.

Four additional undervoltage logic circuits are provided for each bus to recognize degraded voltage conditions. These circuits are set to operate at a minimum of 88.5 percent of nominal voltage with a maximum time delay of 20 s. This setpoint is above the minimum motor starting voltage during normal operation; however, the time delay has been selected to prevent unwanted tripping and undervoltage-induced damage to the safety-related loads. Load shedding and tripping of the incoming breaker is provided by two-out-of-four undervoltage logic.

A two-out-of-four undervoltage logic set at 93.1 percent of nominal voltage with a time delay of 10 s is also provided to initiate an alarm in the control room to warn the operators of a degraded voltage condition. An SIS subsequent to the initiating of this alarm does not separate the auxiliary power system from the offsite power system. Studies have been performed which indicate that at the degraded voltage trip setpoint indicated above, based on the worst case motor thermal damage curve, the permanently connected Class 1E loads will not be damaged. These studies also indicate that adequate voltage is provided to allow starting of the loads.

After a diesel generator has been started and reaches rated voltage and frequency, the generator circuit breaker connecting it to the corresponding 4.16-kV bus closes, energizing that bus and the associated load center transformers. Each diesel generator is designed to accept loads within 9.5 s after receipt of a start signal, and all automatically sequenced loads are connected to the Class 1E bus within 30.5 s thereafter.

H. Testing

Because the diesel generators are of the type and size that have been previously used as a standby emergency power source in other nuclear power plants, the following site tests are given during the plant preoperational test program and during the plant operation. The test procedures shall include a final equipment check prior to starting these tests.

1. During the plant preoperational test programs only, 35 consecutive start tests for each diesel generator with no failures are to be run to demonstrate the required reliability.

2. During the plant operation, a single start test on 31-day test intervals will be performed. The periodic testing of diesel generator units during the plant operation is to:

   a. Demonstrate that the diesel starts and gradually accelerates to at least 440 rpm, and verify that the required voltage and frequency are attained.

   b. Demonstrate maximum expected load-carrying capability for an interval of not less than 1 h. The maximum expected loading for VEGP is based on a loss of offsite power without a LOCA.

      This test may be accomplished by synchronizing the generator with the offsite system, by connecting through either a RAT or the SAT, and assuming a load at the maximum practical rate.

   c. Demonstrate that the capability of the diesel generator unit to supply emergency power is not impaired.

3. Diesel generator failures will be addressed in accordance with plant procedures that implement the provisions of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants."

4. The Technical Specifications will include requirements such that during the preoperational period and at least once every 18 months after the plant is in operation, tests are run during shutdown (except for tests described by items f, g, h, and k) to verify the following. The test procedures shall include a final equipment check prior to starting these tests. Tests described by items f, g, h, and k may be performed during any mode of plant operation as required.

   a. Demonstrate that on loss of offsite power the emergency busses have been deenergized and that the loads have been shed from the emergency busses in accordance with design requirements.

   b. Demonstrate that on loss of offsite power the diesel generators start on the autostart signal, load shed occurs, the emergency busses are energized along with load center transformers, the autoconnected shutdown loads are energized through the load sequencer, and the system operates for 5 min while the generators are loaded with the shutdown loads.

   c. Demonstrate that on a safety features actuation signal (without loss of offsite power) the diesel generators start on the autostart signal and operate on standby for 5 min.

   d. Demonstrate that on loss of offsite power, in conjunction with a safety features actuation signal, the diesel generators start on the autostart signal, load shed occurs, the emergency busses are energized along with load center transformers, the autoconnected emergency (accident) loads are energized through the load sequencer, and the system operates for 5 min while the generators are loaded with the emergency loads.

   e. Deleted

   f. Demonstrate maximum expected load-carrying capability for 24 h, of which 22 h are at a load equivalent to the maximum expected loading of the diesel generator and 2 h at a load equivalent to or greater than 105 percent of the maximum expected loading of the diesel generator.

g. Demonstrate functional capability at full load temperature conditions by verifying the diesel starts upon receipt of a manual or auto-start signal, and generator voltage and frequency are attained within the required time limits. This test will be performed within 5 min of shutting down the DG after the DG has operated a minimum of 2 hours loaded at a minimum of 6800 kW and a maximum of 7000 kW.

h. Demonstrate proper operation during diesel generator load shedding, including a test of the loss of the largest single load and of complete loss of load. Verify that the overspeed limit is not exceeded.

i. Demonstrate the ability to:

- Synchronize the diesel generator unit with the offsite system while the unit is connected to the emergency load.
- Transfer the emergency load to the offsite system.
- Restore the diesel generator unit to standby status.

j. Deleted

k. Demonstrate that the fuel transfer pumps transfer fuel from each fuel storage tank to the day tank of each diesel generator via installed cross-connection lines.

l. Demonstrate that, with the diesel generator operating in a test mode, connected to its bus, a simulated safety injection signal overrides the test mode by: (1) returning the diesel generator to standby operation, and (2) automatically energizing the emergency loads with offsite power.

5. The test procedures will specifically state that the diesel generator unit is to be reset at the conclusion of the test to allow an automatic start when required.

I. Fuel Oil Storage and Transfer Systems

The diesel generator fuel oil system is described in subsection 9.5.4.

The diesel generator cooling water system is described in subsection 9.5.5.

J. Diesel Generator Cooling and Heating Systems

K. Instrumentation and Control Systems for Standby Power Supply

Equipment is provided in the control room for each diesel generator for the following operations:

- Manual starting and stopping.
- Manual and automatic synchronization.
- Manual frequency and voltage setting.
- Emergency stop.
- Voltage regulator manually actuated droop and reset.

A transfer switch is provided in each diesel room for local remote control selection. The switch is normally in the remote position, whereby the engineered safety features system senses an accident or loss of preferred power and starts the diesel. The transfer switch is placed in the local position to allow manual operation of the diesel locally when it is out for maintenance. Equipment is provided locally at each diesel generator for manual starting in case of a control room evacuation. The local emergency start functions to start the diesel generator, regardless of the position of the transfer switch.

Equipment is provided at each local control panel for the following operations (when the transfer switch is in the local position):

- Manual starting.
- Manual stopping.
- Manual frequency and voltage setting.

High voltage power circuit breaker interrupting capacity ratings are selected in accordance with ANSI C37.06-1971.

2. Load Centers, Motor Control Centers, and Distribution Panels

Load centers, motor control centers, and distribution panel circuit breakers have a symmetrical rated interrupting current as great as the determined total available symmetrical current at the point of assumed fault. Symmetrical short-circuit current is determined in accordance with the procedures of ANSI C37.13-1973 for low voltage circuit breakers other than molded case breakers and of National Electrical Manufacturers Association (NEMA) Standards Publication AB 1 for molded case circuit breakers.

H. Electric Circuit Protection

Refer to paragraph 8.3.1.1.2K for criteria regarding the electric circuit protection.

I. Grounding Requirements

Equipment and system grounding has been designed using IEEE 80-1971, Guide for Safety in ac Substation Grounding, and IEEE 142-1972, Recommended Practice for Grounding of Industrial and Commercial Power Systems, as a guide.

J. Safety-Related Cable

The 5-kV safety-related power cable insulation and the 600-V power and control cable insulation utilized in balance-of-plant applications are type EPR/HYP with hypalon in the jacket. The balance of plant safety-related instrument and specialty cable insulation consists of moisture, radiation, and ozone-resistant thermosetting compounds. The jackets used on these cables consist of flame retardant, moisture, radiation, and ozone-resistant thermosetting compounds. Safety-related cables are qualified for the design life of the plant as described in IEEE 323-1974 and 383-1974. The cable supplied under the NSSS scope is qualified in accordance with the methodology outlined in WCAP-8587 for the applicable system or component in which the cable is installed.

8.3.1.1.9 Heat Tracing Systems

There are no Class 1E heat tracing systems required to ensure the safe operation of the plant. The chemical and volume control system, safety injection system, and the waste processing system liquid are provided with temperature monitoring and alarms for annunciation to help ensure the boric acid is maintained at or above 65°F. The alarms are powered from non-Class 1E busses which are backed by the onsite emergency diesel generators. The heat traced portions of the auxiliary feedwater, vacuum degasifier systems for RMWST and CST, demineralizer water system, and nuclear service cooling water systems are provided with nonredundant heat tracing systems for freeze protection. The containment hydrogen monitoring system, the radiation monitoring system, and the post accident sampling system are provided with non-redundant heat tracing systems powered from non-class 1E busses which are backed by the onsite emergency diesel generators.

8.3.1.1.10 Electrical Equipment Subject to Submergence Due to Containment Flooding

Electrical equipment located in the containment building that would be subject to submergence under a LOCA condition includes miscellaneous nonsafety-related and safety-related equipment.

Equipment faults due to submergence would not cause damage to containment building electrical penetrations because the associated power circuits are either disconnected, are protected by redundant overcurrent protective devices, or have fault currents at the penetration below the penetration damage level (see paragraph 8.3.1.1.12).

The nonsafety-related devices are not designed for operation under water; however, there would be no effect on the safety-related power systems, since this equipment is powered from nonsafety-related busses.

The safety-related equipment includes the nuclear instrumentation detectors (source, intermediate, and power range), and extended range excore neutron detectors, reactor vessel level instrumentation system (RVLIS) temperature compensation RTDs, containment reactor cavity sump level transmitter, accumulator isolation valves, one reactor coolant system hot leg wide range pressure transmitter, and the steam generator blowdown flow

Certain applications use Class 1E circuit breakers, fuses, or other devices for isolation. Specific cases are described below:

1. The cables feeding the non-Class 1E pressurizer heaters use two non-Class 1E circuit breakers in series as protection for each Class 1E containment penetration. Cables from the nonsafety load centers (two of which are connected to the emergency busses) follow separate routes to the splice box under the pressurizer. The two circuit breakers in series for each circuit are qualified to seismic requirements and are coordinated with the load center supply and feeder breakers. Where the Class 1E distribution systems electrify certain pressurizer heaters, the Class 1E to non-Class 1E isolation is provided by the Class 1E 4.16-kV switchgear by a 4.16-kV qualified isolation device (as noted in paragraph 8.3.1.4.3.E.2.).

2. Class 1E 4.16-kV Circuit Breaker Trips on Safety Injection Actuation Signal.

   The Class 1E 4.16-kV circuit breakers are tripped on receipt of an accident signal which will isolate the downstream non-Class 1E circuits and loads from their respective Class 1E power sources under accident conditions and therefore pose no threat to the Class 1E sources. The Class 1E 4.16-kV circuit breakers are therefore acceptable for use as isolation devices.

3. Circuit Breakers - Redundant, Molded Case Class 1E

   Two molded case circuit breakers are used in series (120-V-ac distribution panel branch breaker and the distribution panel main breaker) to provide isolation between Class 1E 480-V busses and non-Class 1E motor space heaters mounted in Class 1E motors.

   The two breakers are coordinated such that protection is provided to the circuit in the event of failure of the primary protection device (branch circuit breaker).

4. Class 1E 13.8-kV Circuit Breaker and Current Transformers

   The RCP motor Class 1E current transformers installed in the RCP motor non-Class 1E circuit, are not to provide isolation, but together with the Class 1E protective relaying, are used to ensure the tripping of the Class 1E circuit breaker when an abnormal overcurrent condition occurs. In any event, the assured tripping of Class 1E circuit breaker will prevent the current transformers and the protective relays from being damaged.

5. Class 1E Battery Charger

   Battery chargers are used as isolation devices between separation groups as shown in drawing 2X3D-AA-G01A.

   A fault on the primary side of the battery charger (fault on 480-V-ac bus) will not affect the secondary side of the battery charger (125-V-dc side) because the fault current on the primary side of the battery charger will be cleared by the battery charger feeder breaker, which is upstream of the battery charger.

   Postulated failures on the secondary side of a battery charger will not result in unacceptable effects on the primary side.

6. Fuses

   Fuses are used in control circuits to provide isolation as follows:

   a. Between Class 1E voltage transformer secondary circuits and non-Class 1E plant fault recorder and between Class 1E voltage transformer secondary circuits and non-Class 1E diesel generator auto synchronizer.

   b. Between the two Class 1E contacts in series (synchronizing switch contact and diesel generator break auxiliary contact) and non-Class 1E diesel generator auto synchronizer. The series contacts are used to give permissive signal to the auto synchronizer.

   c. Between Class 1E control power circuit in the electric hydrogen recombiner control panel and the non-Class 1E temperature controller (used for indication only).

   d. Between Class 1E control power circuits in the nuclear instrumentation system and non-Class 1E circuits used for high flux at shutdown, indication, and annunciation.

7. Isolation Relays

   Auxiliary relays are used in control circuits to provide isolation as follows:

   a. Potter and Brumfield Type MDR Rotary Relay

      The majority of the auxiliary relays used as isolating relays are barrier-mounted Potter and Brumfield type MDR rotary relays. The barrier effectively isolates the coil and the contact wiring.

   b. Allen Bradley 700 Type N

      Allen Bradley 700 Type N auxiliary relays are used for interfacing diesel generator Class 1E circuit with the nonsafety-related diesel generator autosynchronizer for paralleling the diesel generator with offsite power during testing.

   c. Consolidated Controls Corporation, Model KJR431A

      Consolidated Controls Corporation relays, Model KJR431A, are used for interfacing the safety features sequencer boards with nonsafety-related 480-V load centers to shed the nonsafety-related load centers from 4.16-kV emergency bus on a safety feature actuation signal.

8. Optical Isolator

   Optical isolators are furnished in the isolation device panels and diesel engine control panel.

   a. Optical isolators in the isolation device panels are the Reliance Electric Company IsoMate digital isolation system. Barrier panels built into the panels provide front-to-rear separation between Class 1E and non-Class 1E wiring compartments. A 5-in. air gap formed by the barriers separates the two compartments.

b. Optical isolators in the diesel engine control panel are used solely to isolate the Class 1E diesel generator circuitry from a non-Class 1E annunciator mounted in the same panel.

The non-Class 1E wiring emanating from isolation devices and extending beyond the equipment panels is separated from high energy power cables by routing these cables through control level trays as described in paragraph 8.3.1.4.3.G.

9. Transformer Modulation Isolator

Validyne Engineering Corporation transformer-modulated isolators are used to provide Class 1E to non-Class 1E isolation for low energy analog instrumentation signals. The analog input signals are modulated, transformed, and demodulated to provide the required isolation. This isolator is used for interfacing Class 1E circuit with nonsafety-related auxiliary feedwater turbine-driven pump speed indicator.

10. Ferro Resonant Transformers

IEEE Standard 449-1990 covers the ferro resonant transformer voltage regulator of the type that is used as an isolation device. The overload characteristic with unsaturated series inductance, Figure 10 of this standard, describes the performance of the Solidstate Controls, Inc., regulating transformers, which are used at VEGP. This output voltage vs. output current characteristic indicates the constant output over the regulating range to full-rated current and then an overload current with reduced output voltage which proceeds to a limiting short-circuit current. Tests performed by Solidstate Controls, Inc., on a single unit of each transformer model verify this characteristic.

These transformers limit the input current for an output fault to a range within the limits set forth in IEEE 449 (1990). These transformers also meet the requirement for current limiting isolation devices as specified in Regulatory Guide 1.75 (IEEE 384, 1981).

For additional information on isolation device application, see responses to NRC questions of April 30, 1984.

TABLE 8.3.1-4 (SHEET 1 OF 9)

CIRCUITS ANALYZED FOR SEPARATION REQUIREMENTS

A.[a]

1. 7300 Process Control System
2. Nuclear Instrumentation System
3. Solid State Protection System

B. An analysis was performed for selected Unit 1 cables larger than 8 AWG and terminating in multitrain panels. The analysis determined which cables could not ignite under fault conditions (i.e. where there is insufficient available energy or where the backup protection was fast enough to open the faulted circuit before the cables could ignite). Those cables which could not ignite under fault conditions were exempted from separation verification.

C. VEGP generally complies with the separation requirements of IEEE 384-1981. A series of tests and analyses has been performed for circuits of 480-V or lower voltage to establish alternate reduced minimum separation distances where separation distances specified in IEEE 384 are not met. Analyses have also been performed to justify separation of Class 1E 4160-V cables from non-1E 480 V and lower cables. These tests and analyses have been performed as allowed by Sections 6.1.1.3 and 6.6.2 of IEEE 384-1981 and Regulatory Guide 1.75. The test results are documented in Wyle Laboratories Test Report No. 48141-02 and Wyle Laboratories Test Report No. 17959-02, which have been submitted for review by the NRC under separate cover.

Based on the Wyle Laboratories test results,[b] the following minimum separation distances were established:

a. The analyses/tests performed for the above equipment are further described in paragraph 7.1.2.2.1.

b. The test configuration of target cables above the fault cable represents the worst case, since heat/flame has tendency to flare vertically upwards.

TABLE 8.3.1-4 (SHEET 2 OF 9)

The separation distances are applied between raceways and cables of any separation group for both vertical (above and below) and horizontal (side by side) physical configurations or as noted.

	Configuration/Service Level	Minimum Spatial Separation Distance
1.	Between trays carrying cables of 480 V or lower voltage of sizes 2/0 AWG or smaller.	12 in.
2.	Cables in tray with cover on the bottom from non-class 1E cables in tray or free air (the non-Class 1E cables are limited to 480 V or lower voltage and size 2/0 AWG or smaller and located below or along side Class-1E tray).	3/4 in.
3.	Cables in tray or free air running either vertically, or horizontally (side-by-side) from horizontal non-Class 1E cable in tray (the non-Class 1E cables are limited to 480 V or lower voltage and size 2/0 AWG or smaller).	1 in.
3a.	Cables in tray or free air running either vertically, or horizontally (side-by-side) from horizontal non-Class 1E cable in free-air (the non-Class 1E cables are limited to 480 V or lower voltage and size 2/0 AWG or smaller).	1-3/4 in.

TABLE 8.3.1-4 (SHEET 3 OF 9)

	Configuration/Service Level	Minimum Spatial Separation Distance
4.	Tray[a] or free-air cables to a non-Class 1E rigid steel conduit carrying cables of 480 V or lower voltage and sizes 2/0 AWG or smaller.	Contact
4a.	Tray or free-air cables to a non-Class 1E rigid steel conduit carrying cables of 480 V or lower voltage and sizes 3/0 AWG through 500MCM.	3/4 in.
5.	Tray or free-air cables to a rigid steel conduit (the free-air cables, cables in the tray, and in the conduit are limited to 480 V or lower voltage and size 2/0 AWG or smaller).	1/2 in.
5a.	Cables in tray to a rigid steel conduit routed below or beside the tray (the cables in the tray, and in the conduit are limited to 480 V or lower voltage and size 2/0 AWG or smaller).	Contact
6.	Tray or free-air cables to a non-Class 1E flexible conduit (the non-Class 1E cables are limited to 480 V or lower voltage and size 2/0 AWG or smaller).	1 in.
6a.	Tray or free-air cables to a non-Class 1E stripped flexible conduit (the non-Class 1E cables are limited to 480 V or lower voltage and size 2/0 AWG or smaller).	Contact
7.	Tray or free-air cables to a flexible conduit (the free-air cables, cables in the tray and in the conduit are limited to 480 V or lower voltage and size 2/0 AWG or smaller).	1 in.

c. For the purpose of testing, the cables in the punched bottom tray are considered the same as cables in free air since the cables in the tray are directly exposed to the heat generated by the faulted cable in the areas of the tray that have been punched.

TABLE 8.3.1-4 (SHEET 4 OF 9)

	Configuration/Service Level	Minimum Spatial Separation Distance
8.	Tray or free-air cables to a non-Class 1E aluminum sheathed cable of size 8 AWG or smaller or non-Class 1E electrical metallic tubing (EMT) carrying cables of sizes 8 AWG or smaller. (Limited to lighting, communications, and fire detection cables)	1 in.
9.	Tray or free-air cables to a non-Class 1E metal-clad cable (type MC) of size 8 AWG or smaller.	3/4 in.
10.	Tray or free-air cables to a non-Class 1E steel-armored 480-V cable (500 MCM or smaller).	3/4 in.
10a.	Tray or free-air cables (480V or lower voltage and size 2/0 AWG or smaller) to steel-armored 480-V cable (500 MCM or smaller).	3/4 in.
11.	Cables in flexible conduit to cables in flexible conduit (the cables are limited to 480 V or lower voltage and size 500 MCM or smaller).	1 in.
11a.	Cables in stripped flexible conduit to non-Class 1E cables in stripped flexible conduit (the non-Class 1E cables are limited to 480 V or lower voltage and size 2/0 AWG or smaller).	Contact
11b.	Cables in stripped flexible conduit to cables in stripped flexible conduit (the cables are limited to 480 V or lower voltage and size 2/0 AWG or smaller).	Contact

TABLE 8.3.1-4 (SHEET 5 OF 9)

	Configuration/Service Level	Minimum Spatial Separation Distance
12.	Cables in flexible conduit to non-Class 1E cables in rigid steel conduit (the non-Class 1E cables are limited to 480 V or lower voltage and size 2/0 AWG or smaller).	Contact
13.	Between two rigid steel conduits (the cables in the conduits are limited to 480 V or lower voltage and size 2/0 AWG or smaller).	Contact
13a.	Cables in rigid steel conduit to non-Class 1E cables in rigid steel conduit (the non-Class 1E cables are limited to 480 V or lower voltage and size 2/0 AWG or smaller).	Contact
14.	Between perpendicular rigid steel conduits carrying cables of 480 V or lower voltage and sizes 3/0 AWG through 500 MCM.	1/8 in.
15.	Cables in rigid steel conduit crossing non-Class 1E cables in tray or free air (the non-Class 1E cables are limited to 480 V or lower voltage and size 2/0 AWG or smaller). The angle of crossing shall be 30° or greater.	Contact
16.	Free-air cables to free-air cables, where one of the groups is wrapped in three layers (200 percent overlap) of silicon dioxide cloth (Siltemp 188 CH). Service voltage is limited to 480 V or lower voltage and sizes of 500 MCM or smaller.	6 in.
16a.	From non-Class 1E free air cables 480 V or lower voltage and size of 500 MCM or smaller, wrapped with three layers (200 percent overlap) of silicon dioxide cloth (Siltemp 188 CH) to Class 1E free-air cables.	6 in.

TABLE 8.3.1-4 (SHEET 6 OF 9)

	Configuration/Service Level	Minimum Spatial Separation Distance
17.	Free-air cables 480 V or lower voltage and size of 500 MCM or smaller, to free air control or instrumentation cables (8 AWG or smaller). The control or instrumentation cables are wrapped in two layers (100 percent overlap) of silicon dioxide cloth (Siltemp 188 CH).	1 in.
18.	Between free air instrumentation or control cables of 125 V-dc or 120 V-ac or lower, sizes number 8 AWG or smaller.	1 in.
19.	Between free air instrumentation or control cables (125 V-dc or 120 V-ac or lower sizes number 8 AWG or smaller). with either group of cables wrapped in two layers (100 percent overlap) of silicon dioxide cloth (siltemp 188 CH).	Contact
20.	Free-air, class 1E cable(s) to free-air non-class 1E cables with the class 1E cables wrapped in two layers (100 percent overlap) of silicon dioxide cloth. The non-class 1E cables are limited to 480 V or lower voltage of sizes 500 MCM or smaller.	1 in.

TABLE 8.3.1-4 (SHEET 7 OF 9)

Configuration/Service Level	Minimum Spatial Separation Distance
21. Within panels and control boards:	
a. Between instrumentation or control cables of 125 V-dc or 120 V-ac of sizes number 8 AWG or smaller.	1 in.
b. Between instrumentation or control cables with either group of cables wrapped in two layers (100 percent overlap) of silicon dioxide cloth (siltemp 188 CH). The cables are limited to 120 V-ac, 125 V-dc, or lower voltage of sizes number 8 AWG or smaller.	Contact
c. Separation distances shown for general plant areas in items 4, 5, 6, 10, 13, and 14 have been applied to separation requirements within panels.	
d. Separation distances for cable installed in rigid steel or flexible conduit inside panels are the same as those tested in items 11, 11a, 11b, 12, 13, 13a, and 14.	

Where:

Tray - Ventilated (punched bottom) tray or tray fittings, solid bottom tray, or tray fittings

Conduit - Hot dipped galvanized rigid steel conduit

Flexible Conduit - Flexible steel conduit, sealtite, type UA

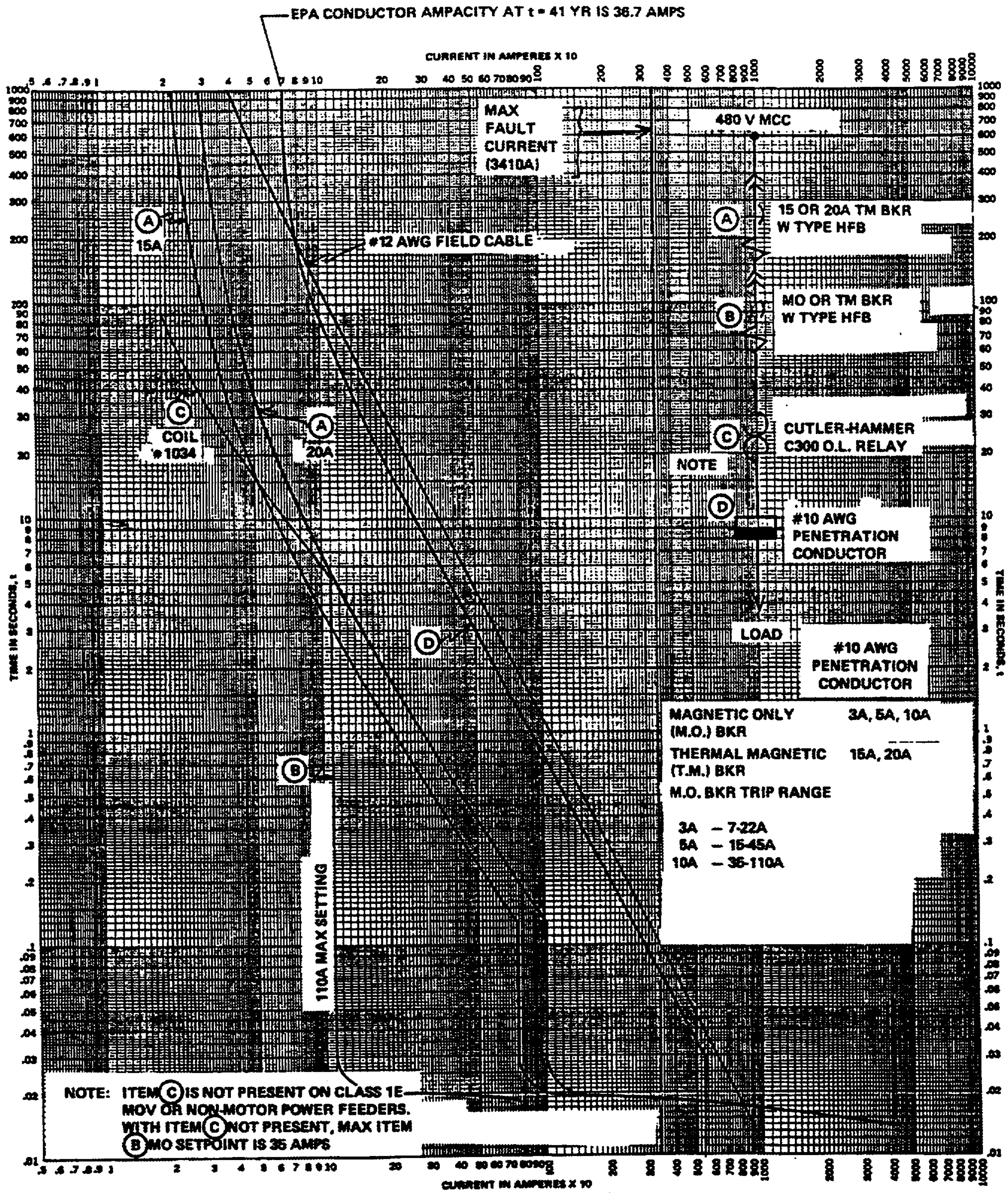
TABLE 8.3.1-4 (SHEET 8 OF 9)

Steel-Armored - Cable	EPR insulation/hypalon jacket with galvanized steel armor. Used for 480-V switchgear loads in tray only.
Aluminum Sheathed - Cable (ALS)	A factory assembly of insulated conductors enclosed in a smooth continuous aluminum sheath. Used for lighting system application.
Metal-Clad Cable - (MC)	A factory assembly of one or more conductors each individually insulated, covered with an overall insulating jacket, and all enclosed in a metallic sheath of interlocking galvanized steel. Used in non-1E circuit only.
Electrical - Metallic Tubing (EMT)	Thinwall, steel conduit which conforms to ANSI standard C80.3-1977. This material provides a barrier equal to, or better than, the aluminum sheathing on ALS because it is manufactured from steel which has higher strength and a higher melting temperature than aluminum.

Free-air cables may consist of steel armored or nonarmored cables, ALS, or type MC cables of any size or voltage level unless otherwise limited in the specific configuration description.

TABLE 8.3.1-4 (SHEET 9 OF 9)

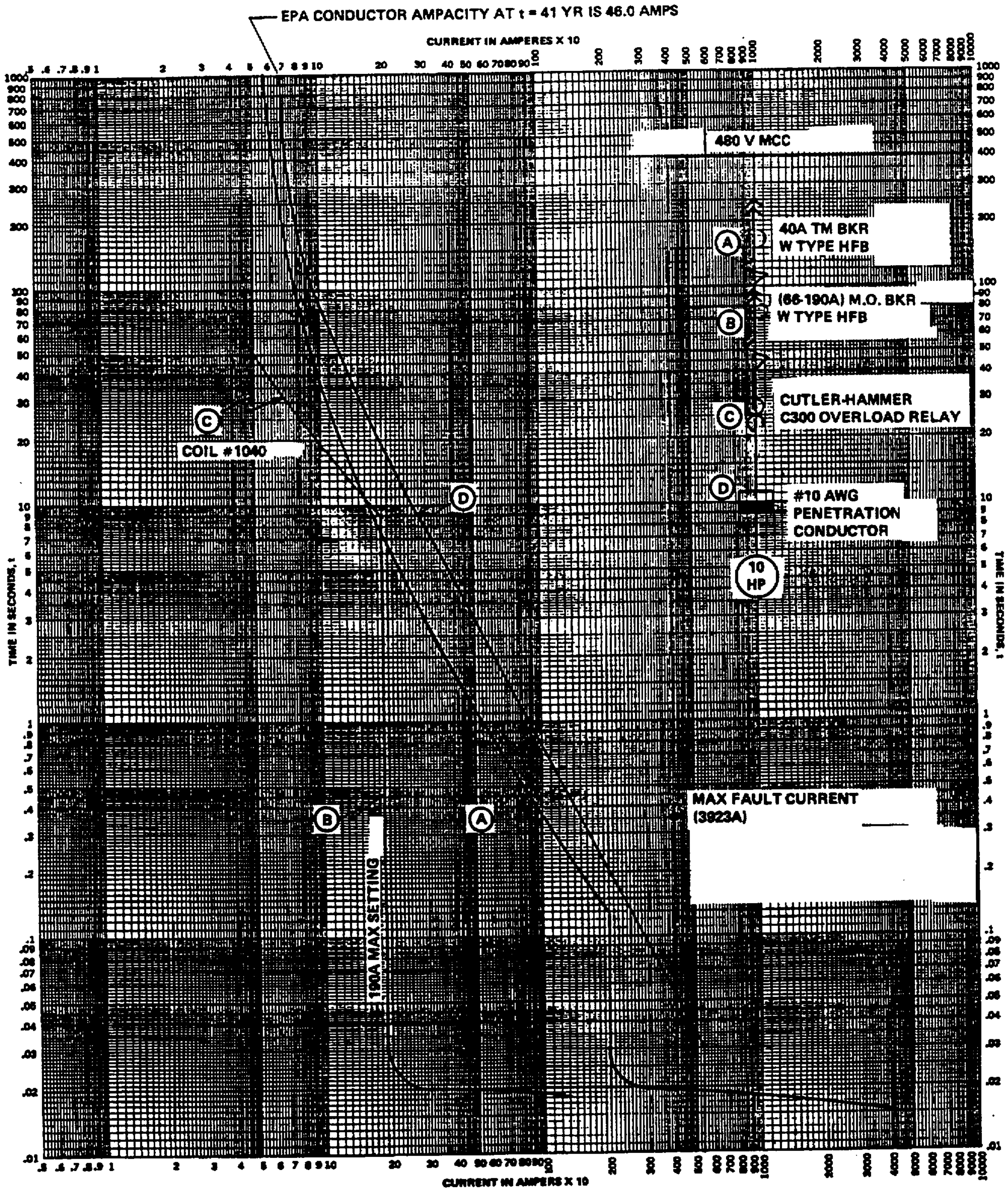
D. Non-class 1E fire detection Protectowire has been used in safety related cable tray within containment to detect cable tray fires. This wiring is installed in a zig-zig fashion along the length of the tray in close proximity to the cables. It consists of two conductors individually encased in heat sensitive material. The encased conductors are twisted together to impose a spring pressure between them. When heated to the critical for operating temperature the heat sensitive material yields to the pressure on it, permitting the conductors to move into contact with each other. A supervisory current of 2.5 mA at a maximum of 26.4 V dc normally flows through the Protectowire. During an alarm condition this current rises to a maximum of 20 mA. Therefore, Protectowire is considered a low energy circuit, which is designed to short during an alarm condition, and cannot cause degradation of any Class 1E cables in the vicinity. A separate Protectowire panel is provided for each train thereby providing electrically independent monitoring of the cable tray temperatures in each train. Based on the discussion above, no separation is required between the non-class 1E fire protection Protectowires and any class 1E cables.



REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

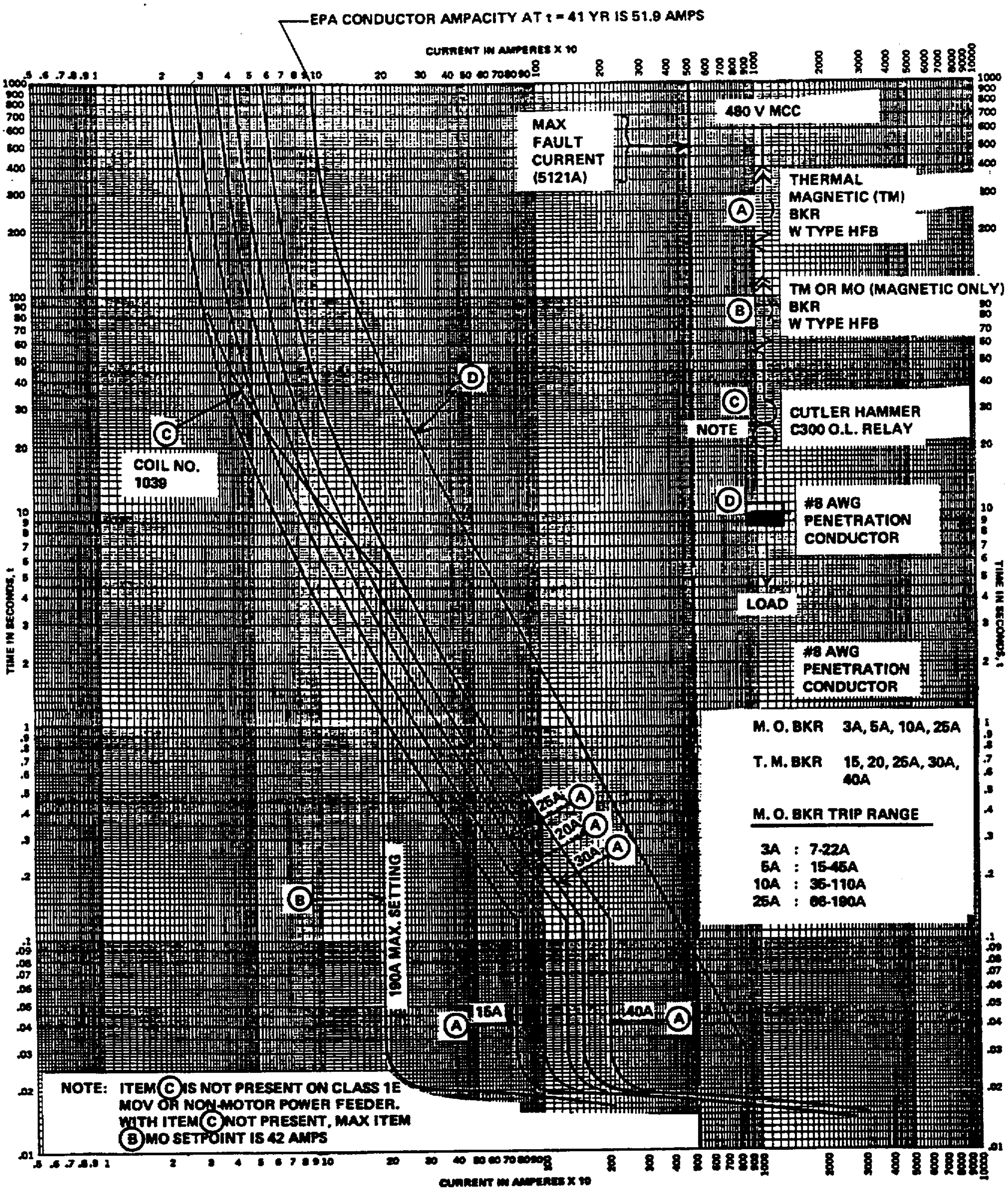
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 1 OF 30)



FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

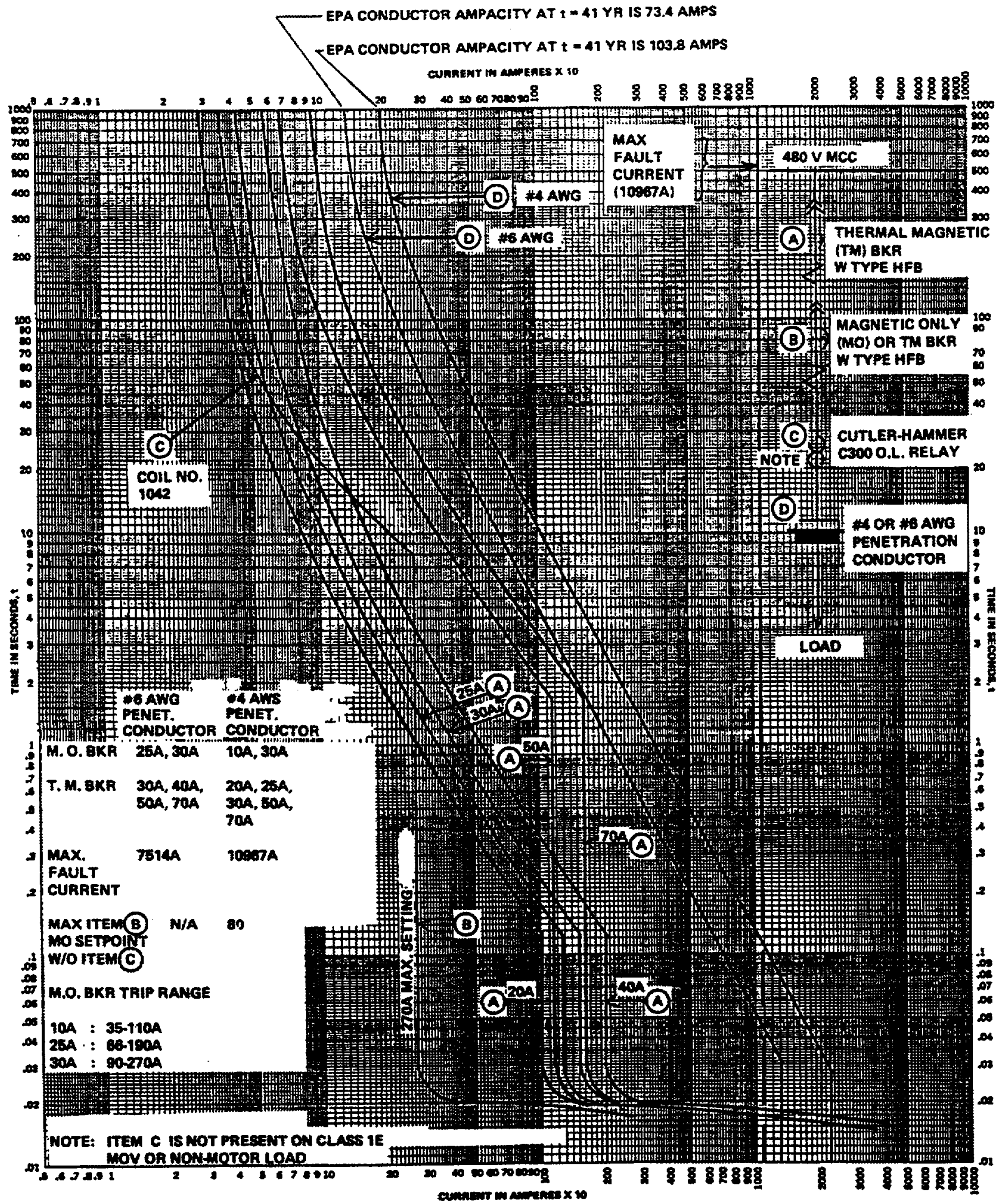
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 2 OF 30)



FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

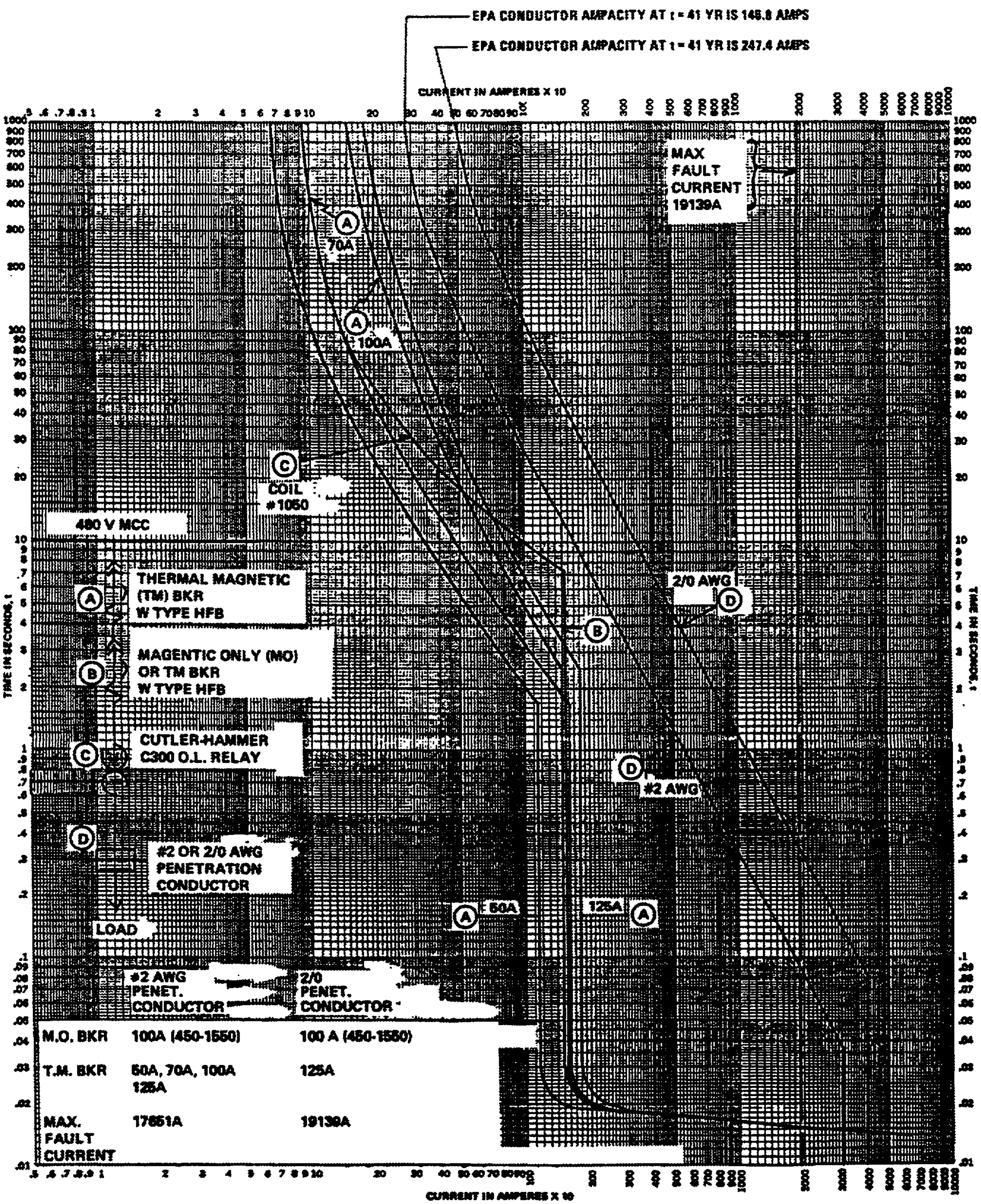
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 3 OF 30)



REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES FIGURE 8.3.1-1 (SHEET 4 OF 30)



	#2 AWG PENET. CONDUCTOR	2/0 PENET. CONDUCTOR
M.O. BKR	100A (450-1550)	100 A (450-1550)
T.M. BKR	50A, 70A, 100A 125A	125A
MAX. FAULT CURRENT	17851A	19139A

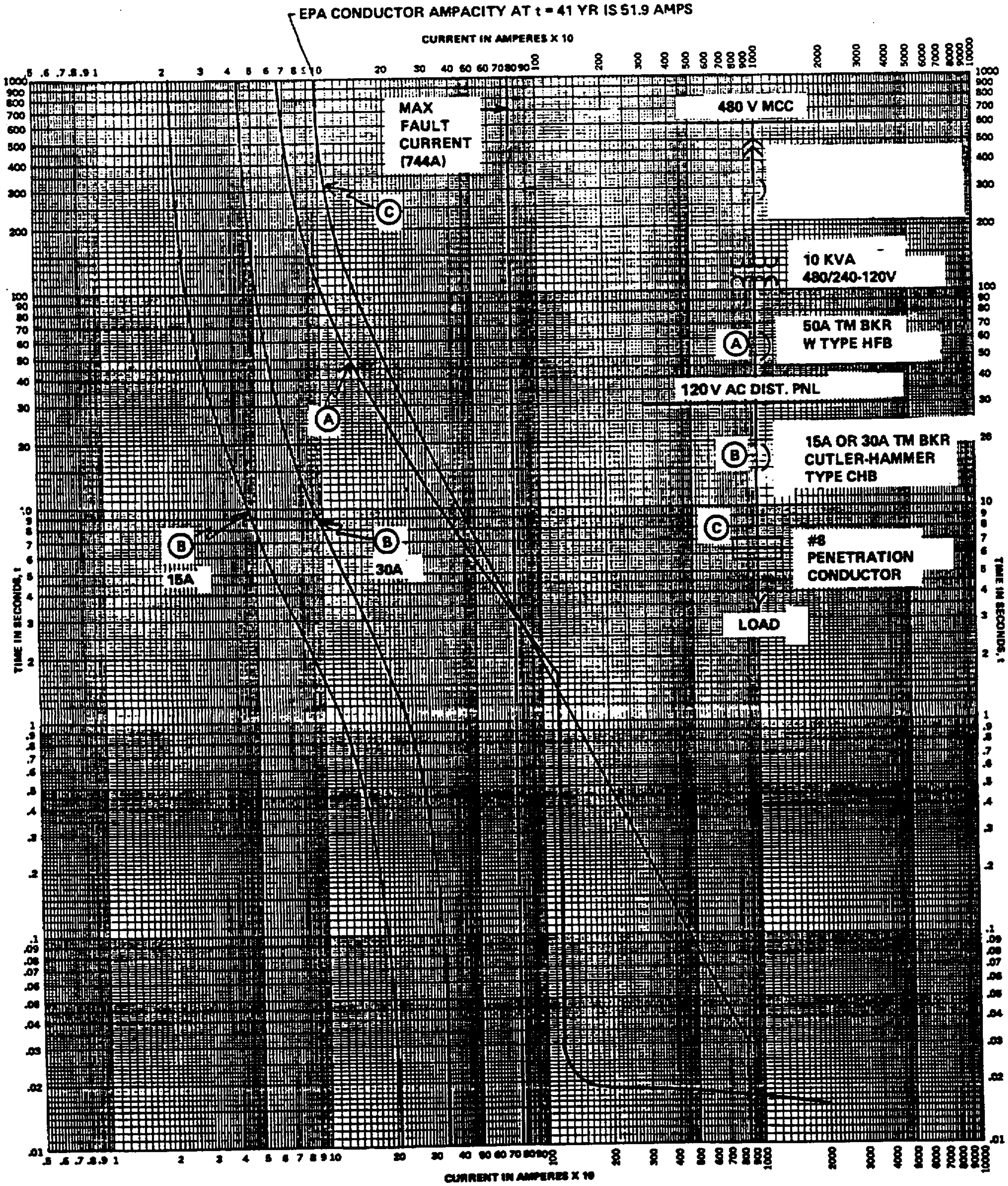
REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

VOGTLE
ELECTRIC GENERATING PLANT
UNIT 1 AND UNIT 2

PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES

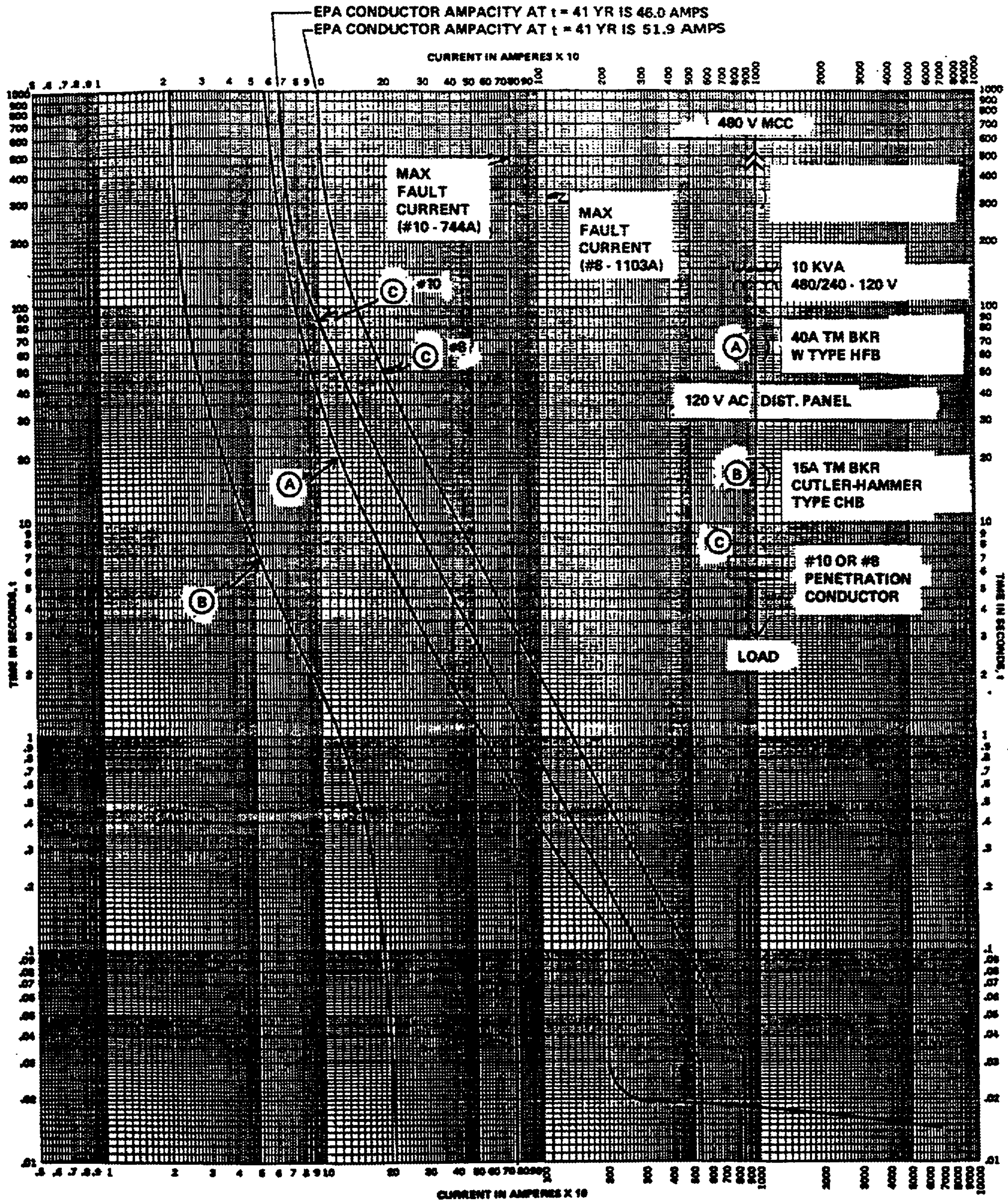
FIGURE 8.3.1-1 (SHEET 5 OF 30)



REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

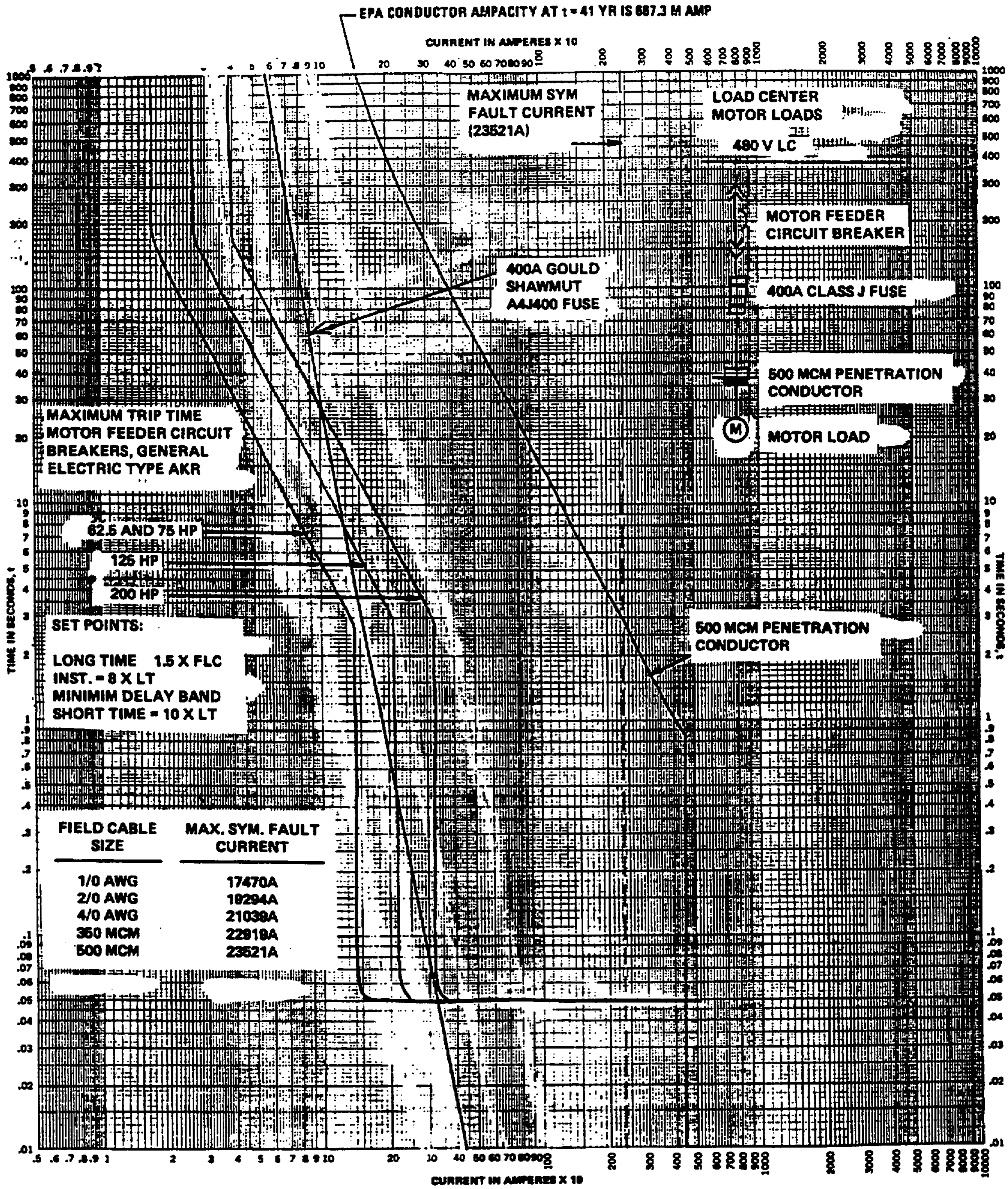
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 6 OF 30)



REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

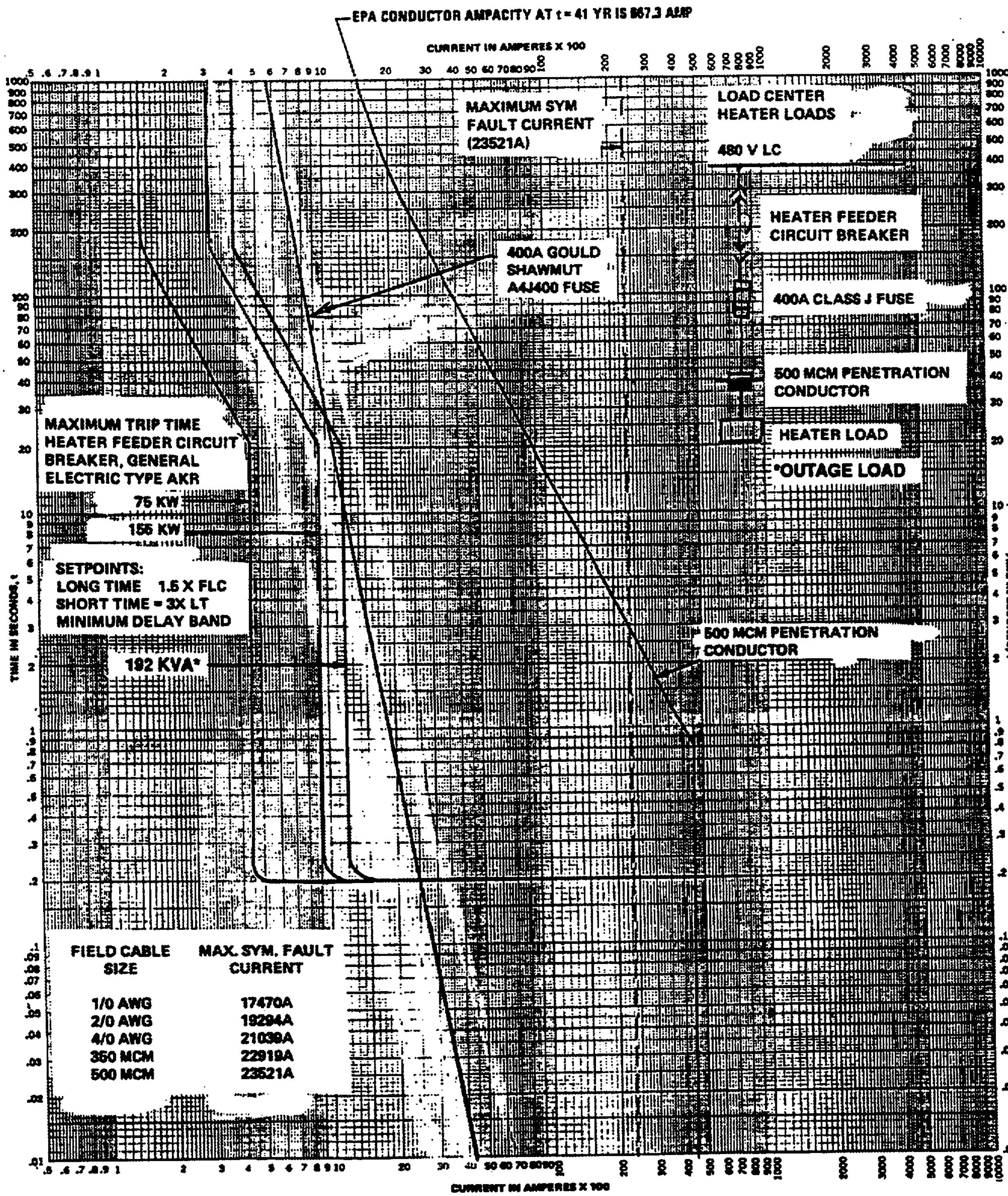
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES FIGURE 8.3.1-1 (SHEET 7 OF 30)



REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

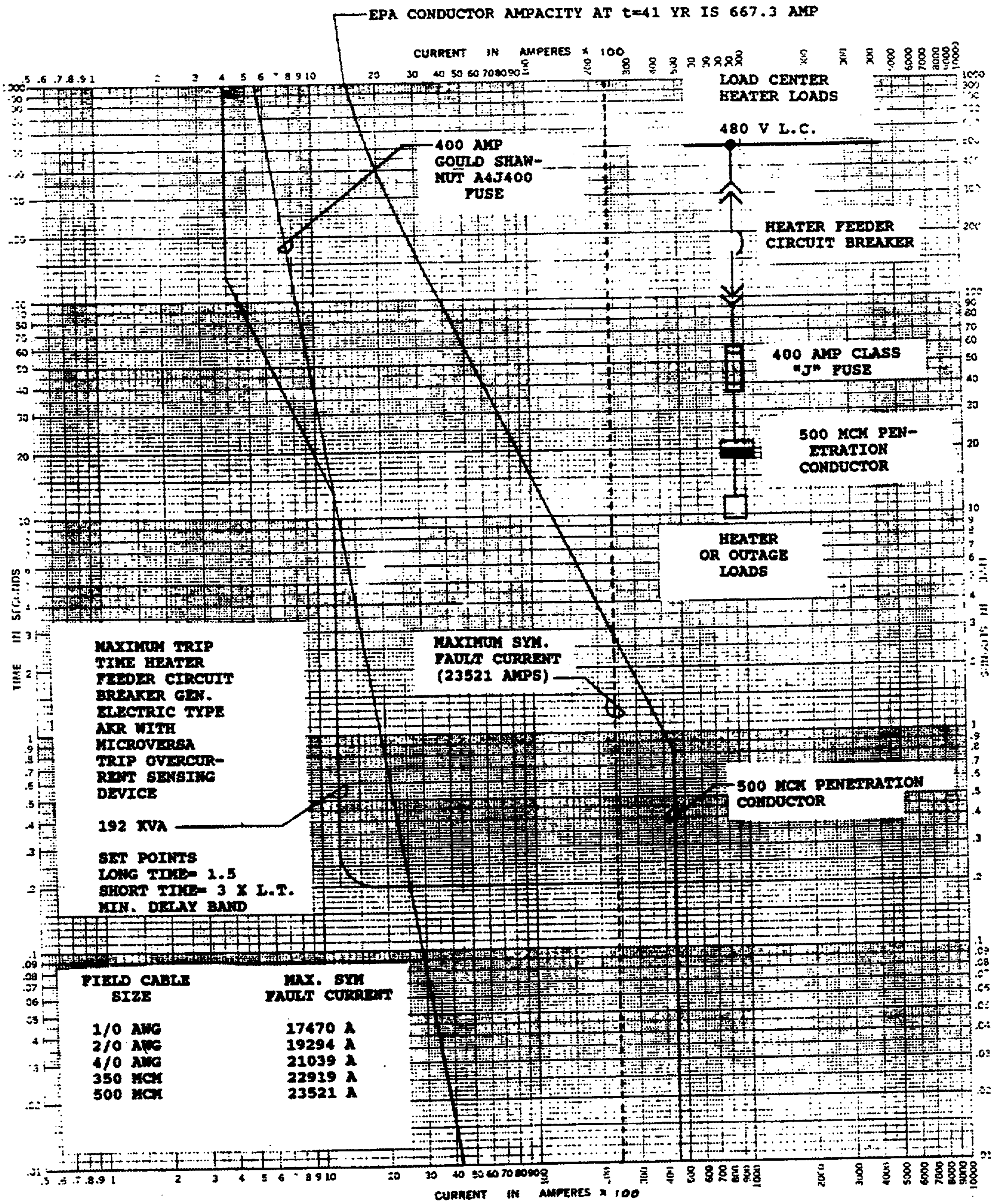
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 8 OF 30)



REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92
REV 1 3/91

FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

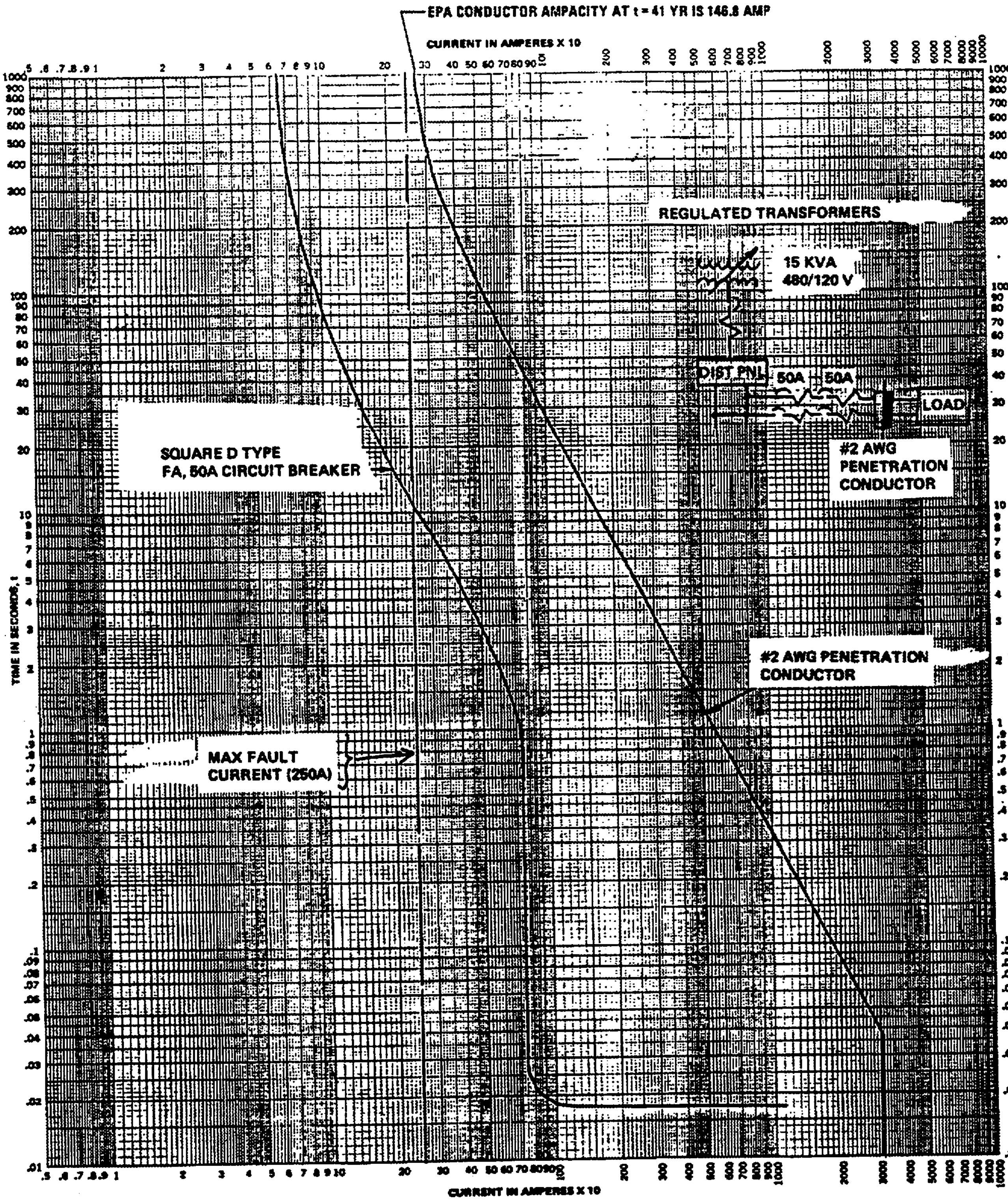
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 9 OF 30)



REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

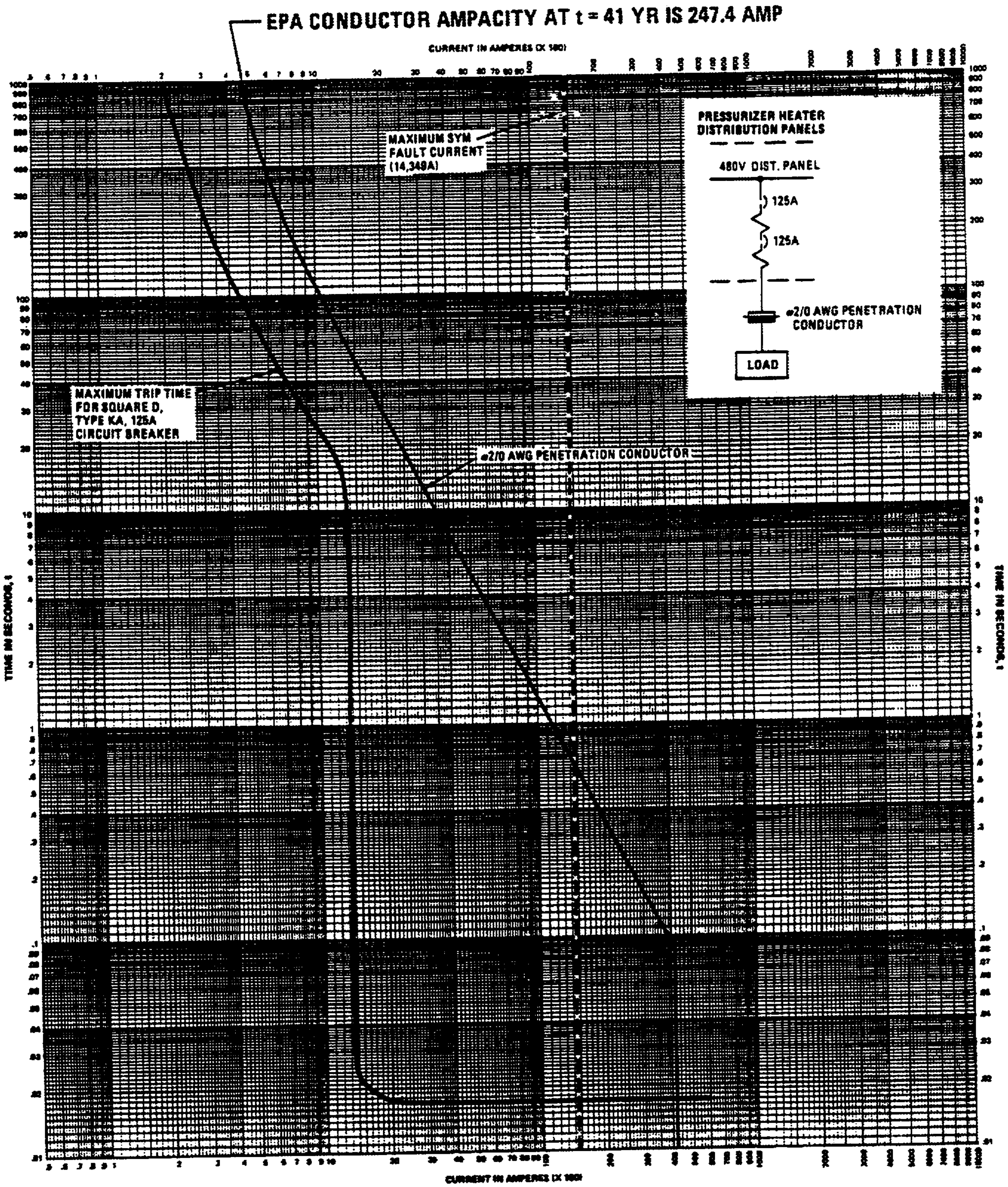
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES FIGURE 8.3.1-1 (SHEET 10 OF 30)



FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

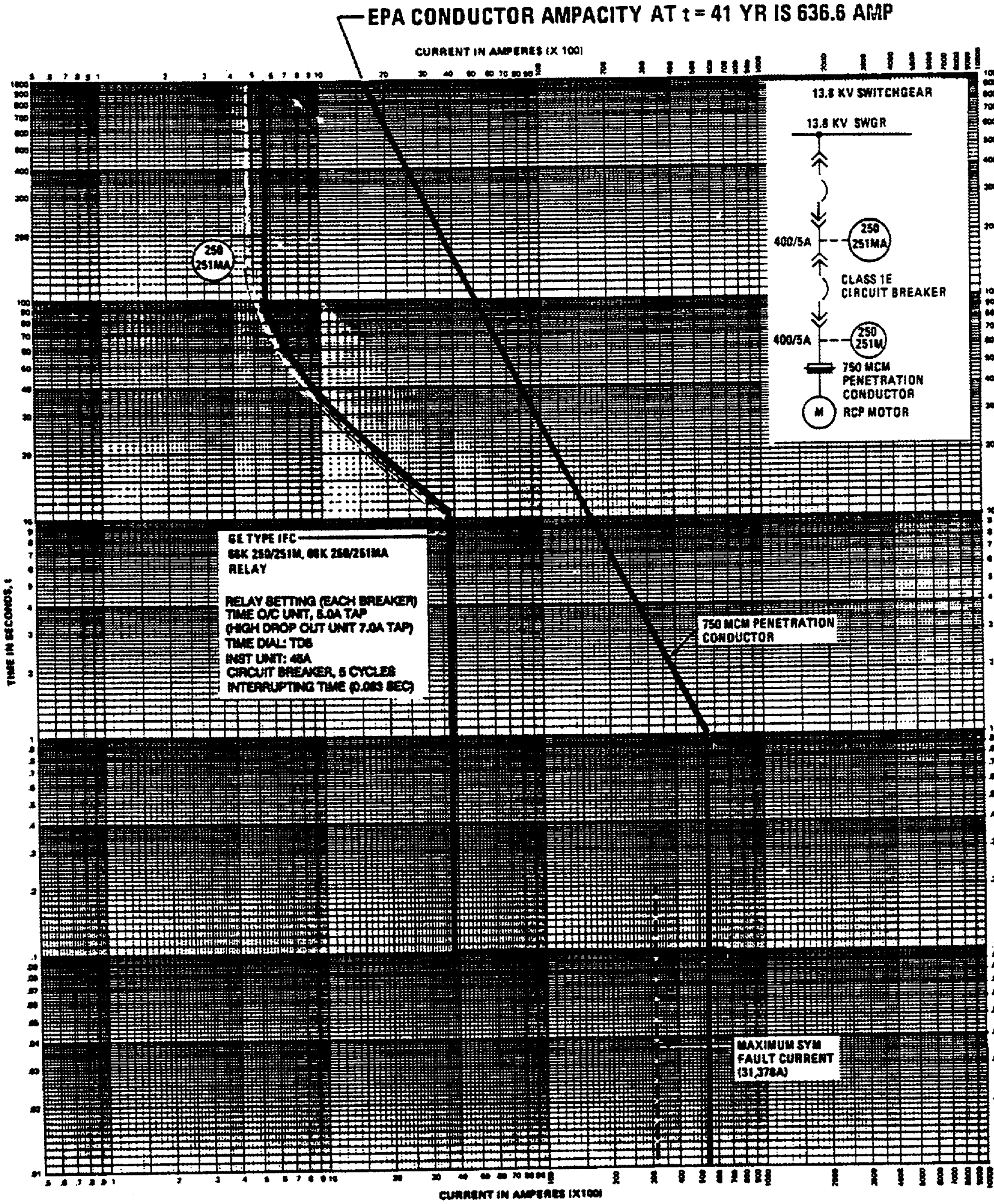
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 11 OF 30)



REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 12 OF 30)

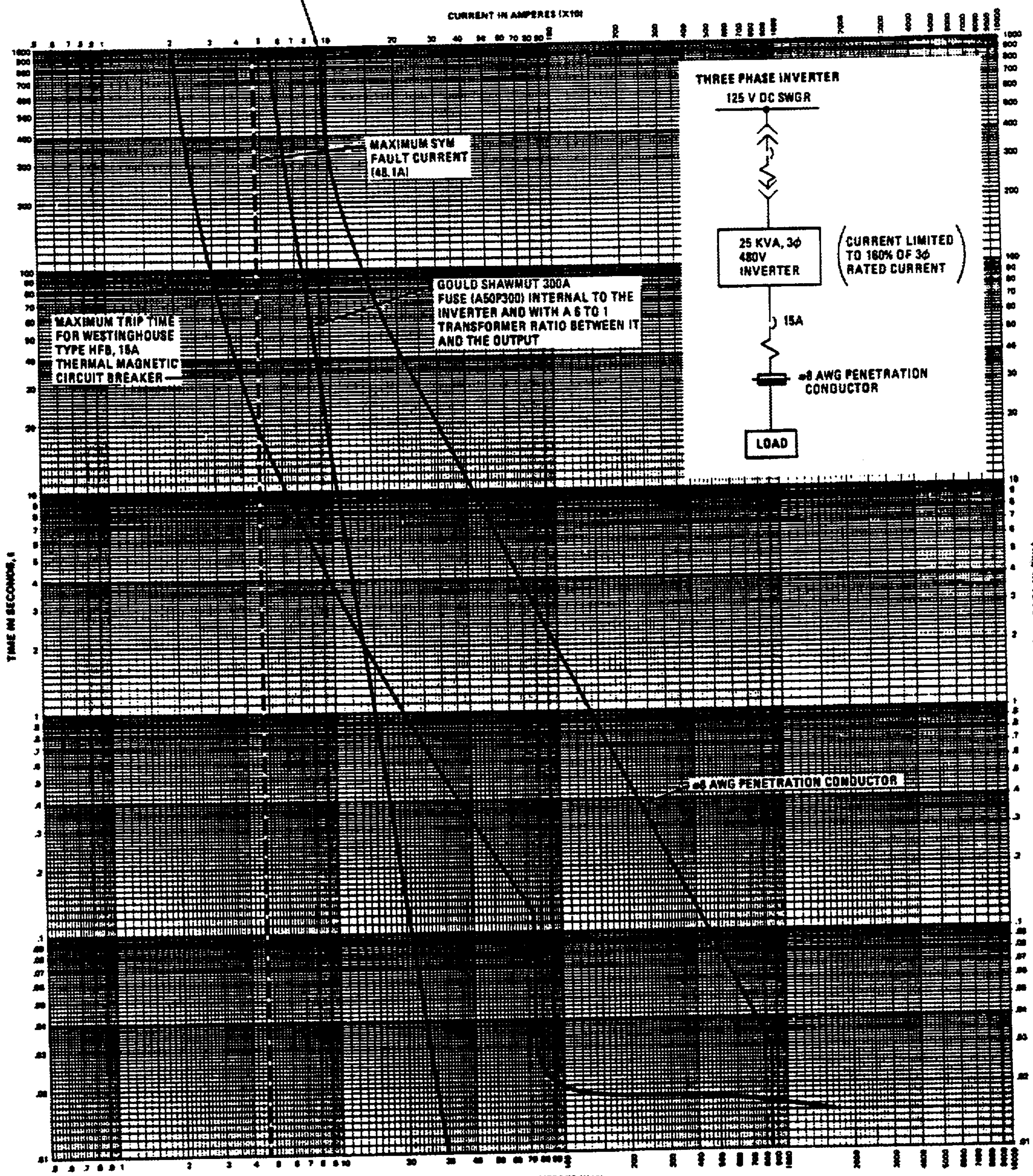


REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 13 OF 30)

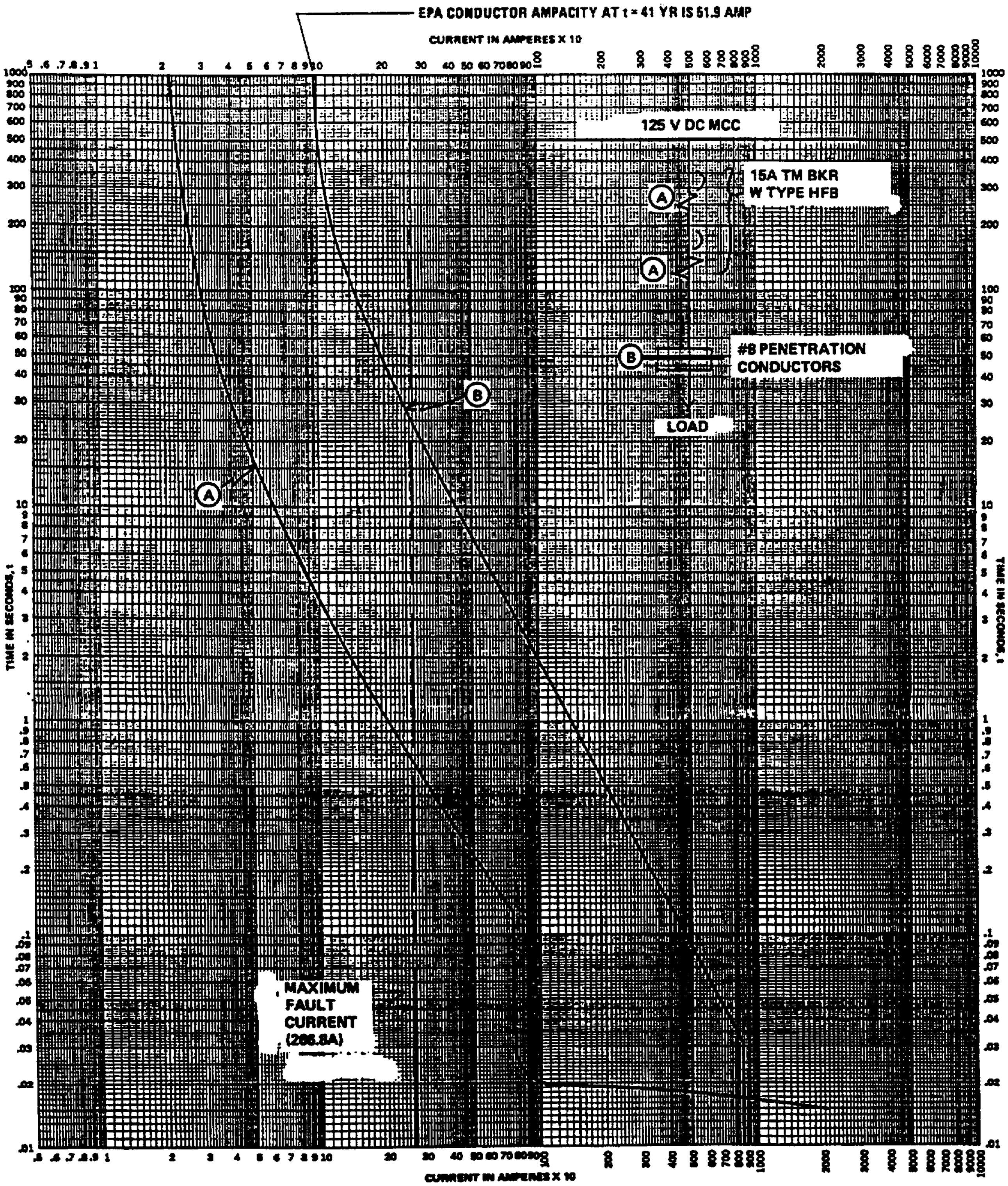
EPA CONDUCTOR AMPACITY AT t = 41 YR IS 51.9 AMP



REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

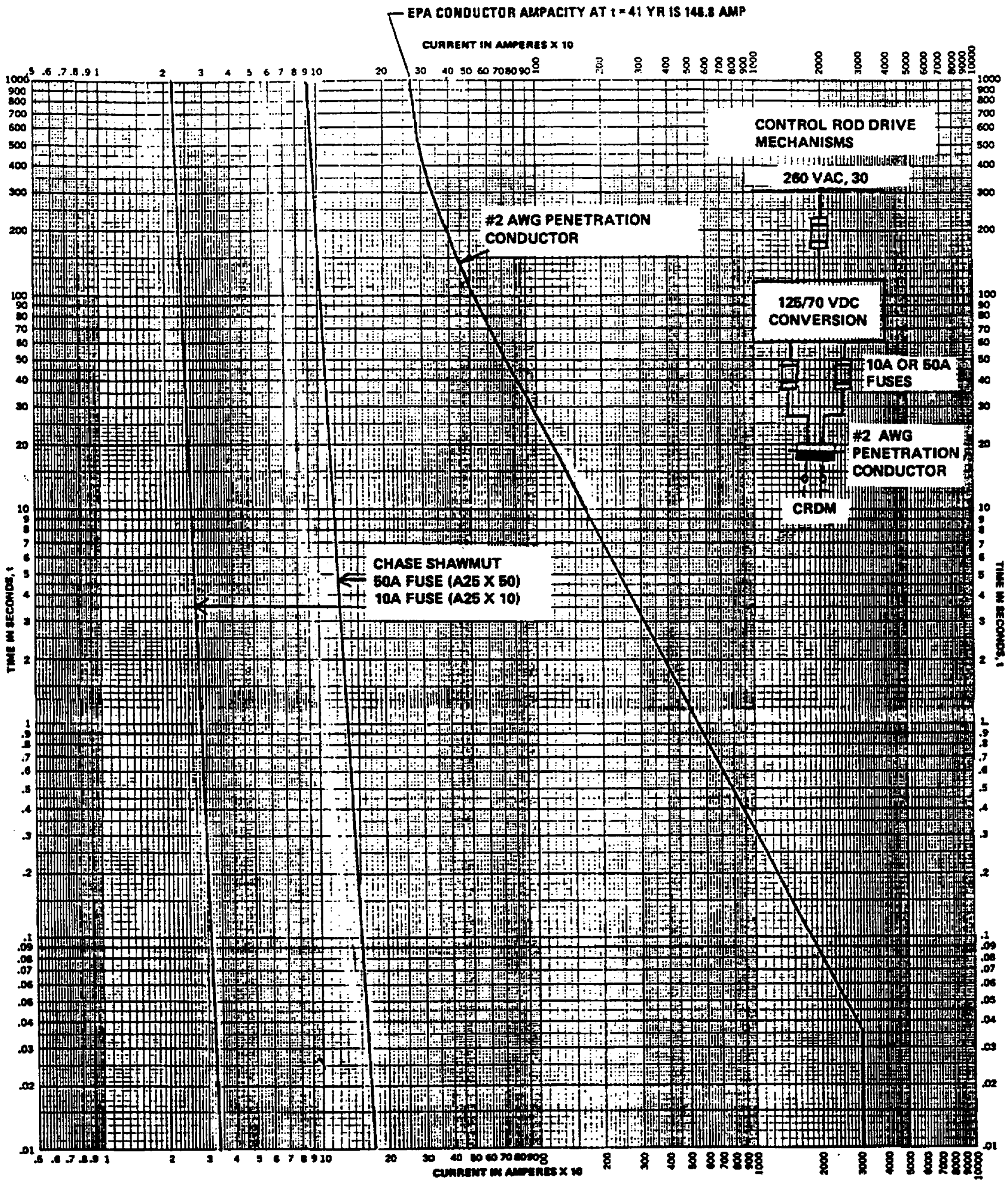
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 14 OF 30)



REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

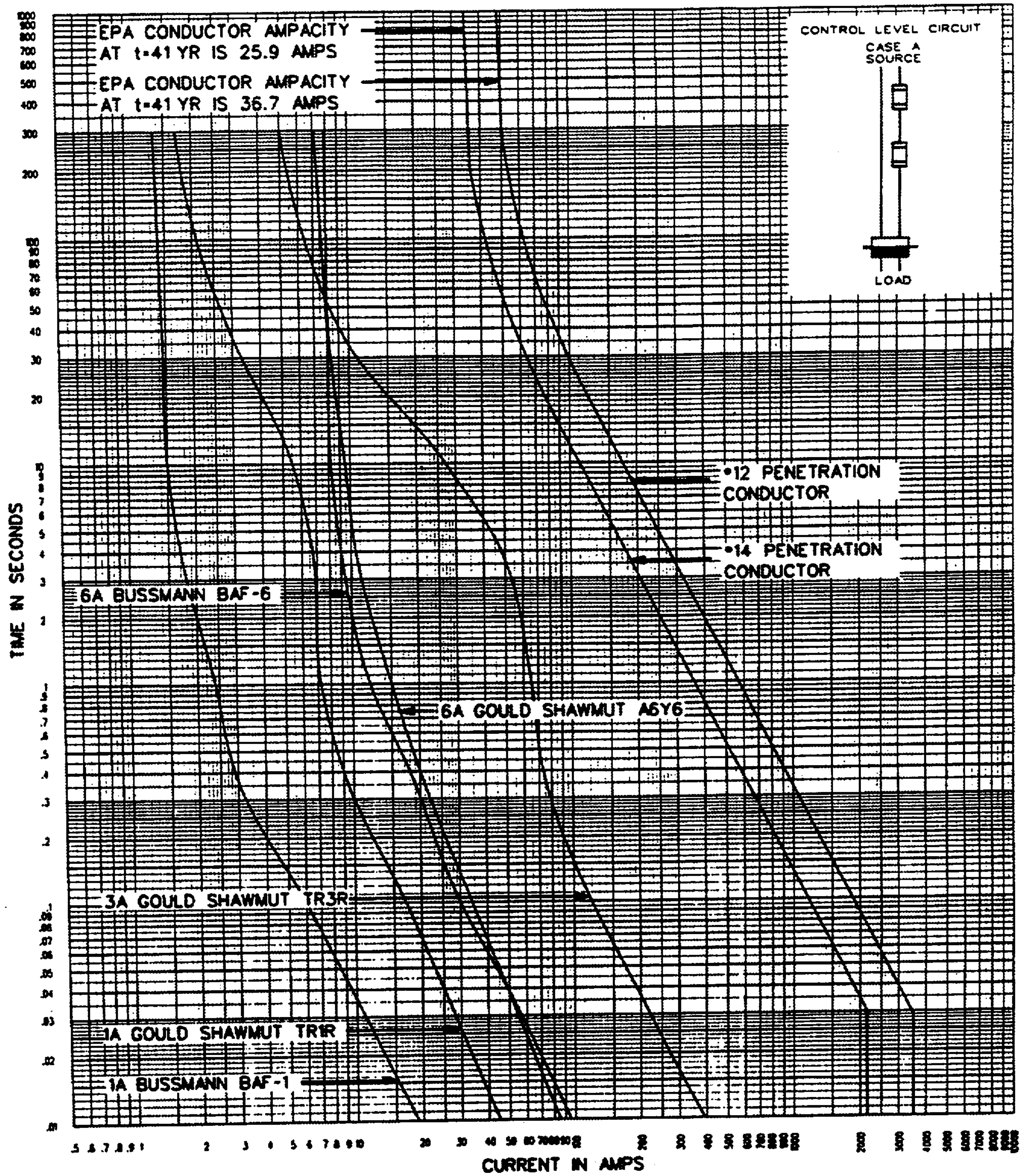
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 15 OF 30)



REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

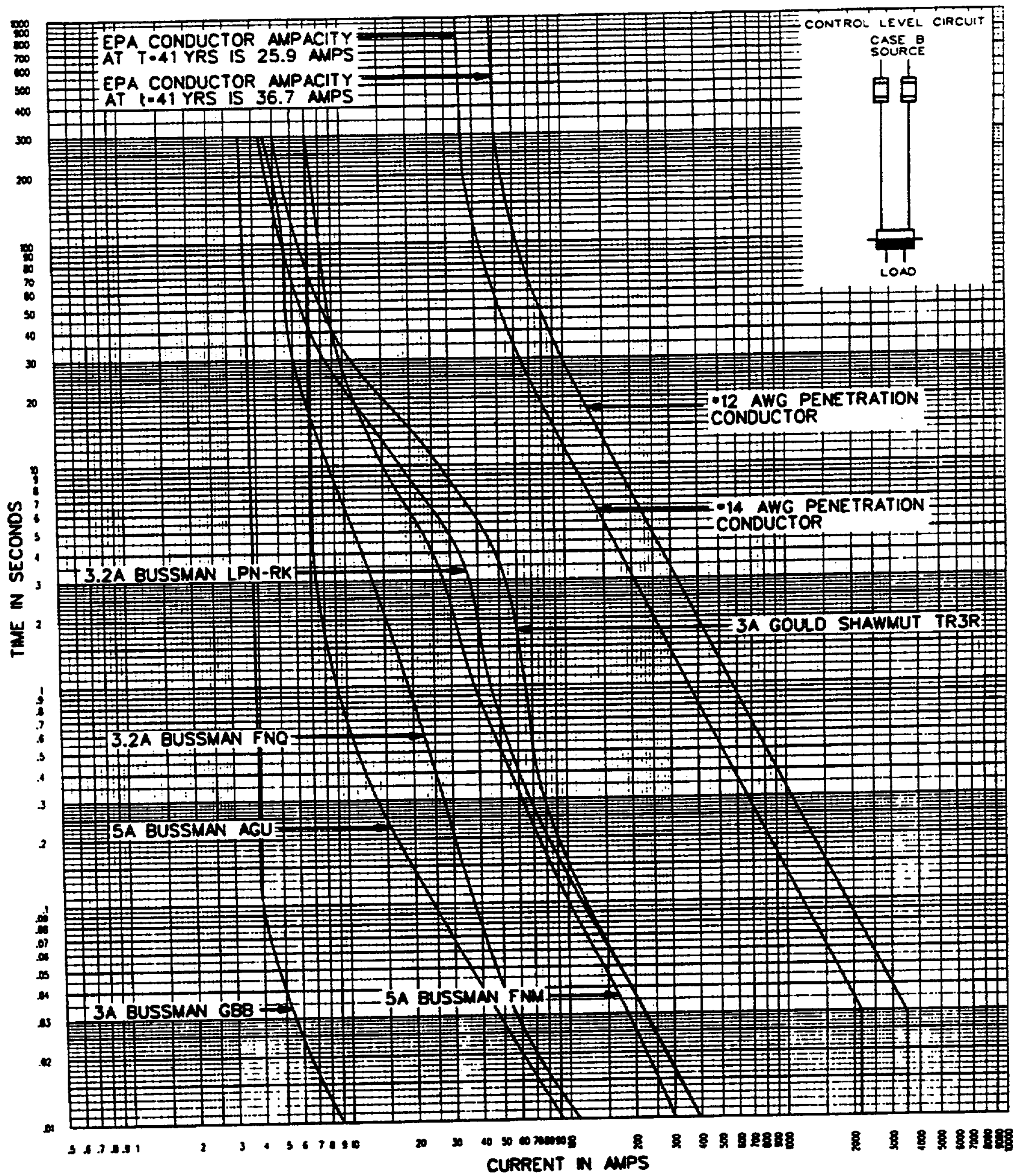
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 16 OF 30)



REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

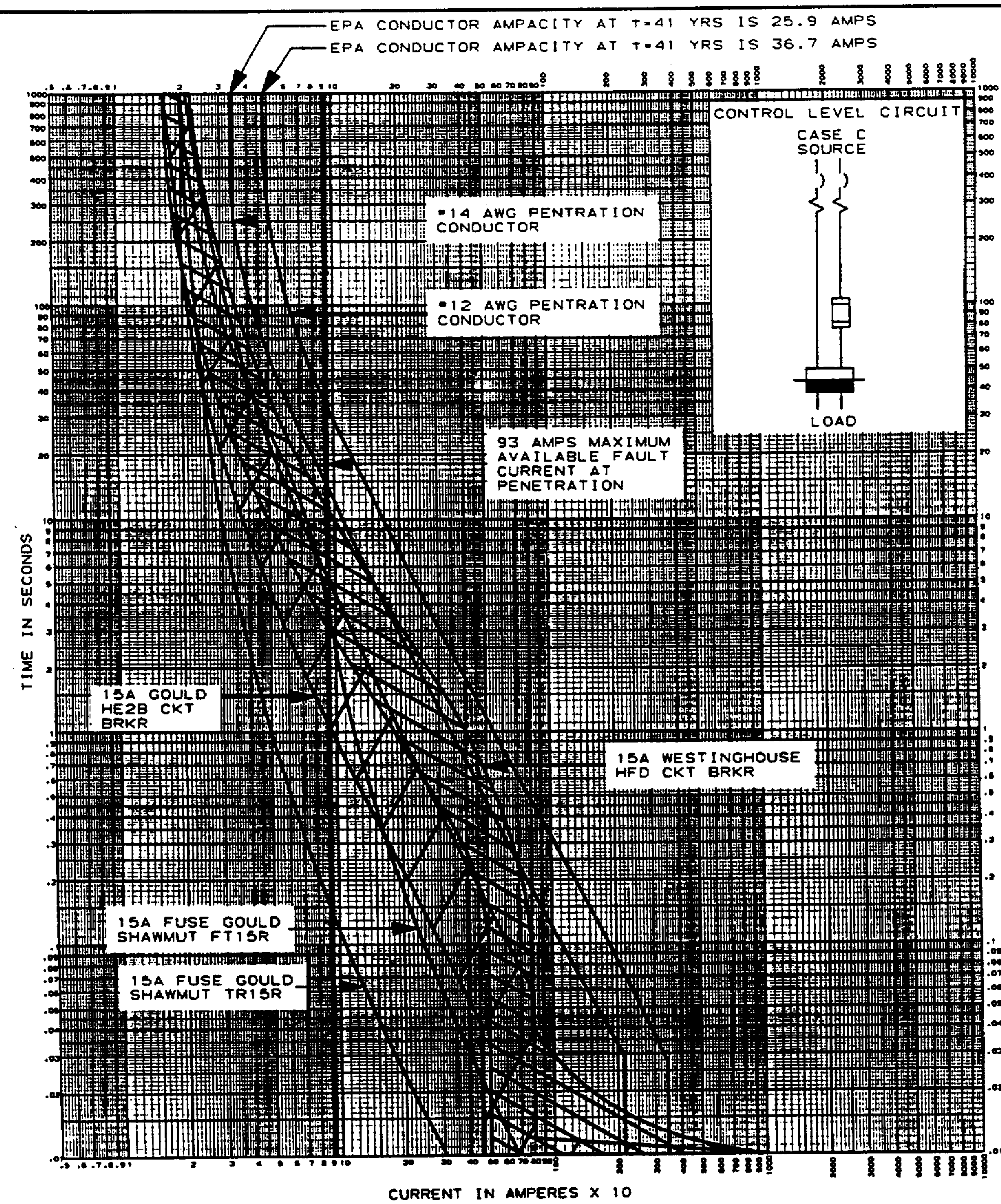
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES FIGURE 8.3.1-1 (SHEET 17 OF 30)



FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 18 OF 30)

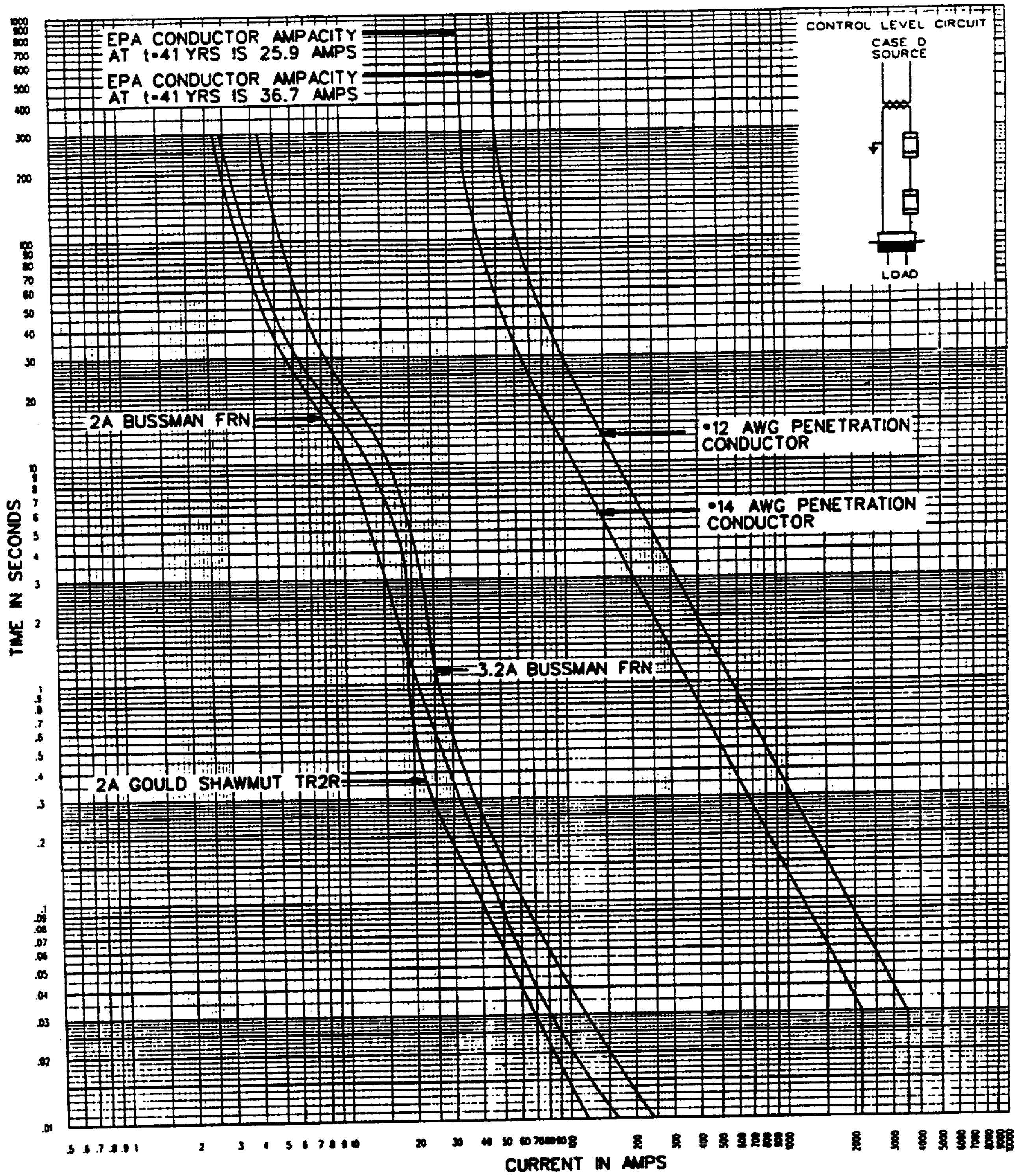


FOR EPA CONDUCTOR PROTECTION AT TIME, T=41 YRS
SEE FIGURE 8.3.1-1 (SHEET 27 OF 27)

FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

REV 9 5/00
REV 8 10/98
REV 6 4/97
REV 5 9/95
REV 2 3/92

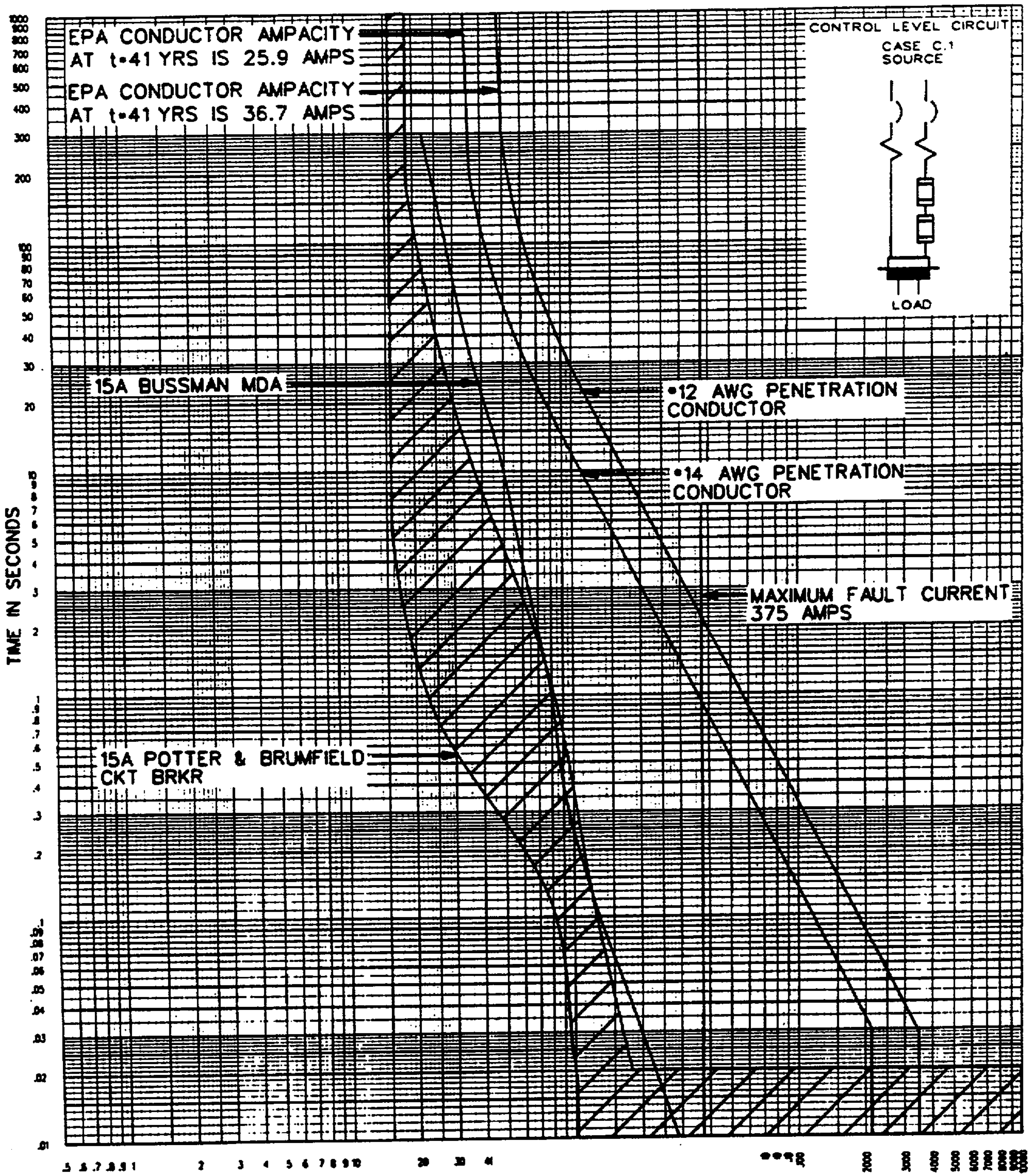
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 19 OF 30)



FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

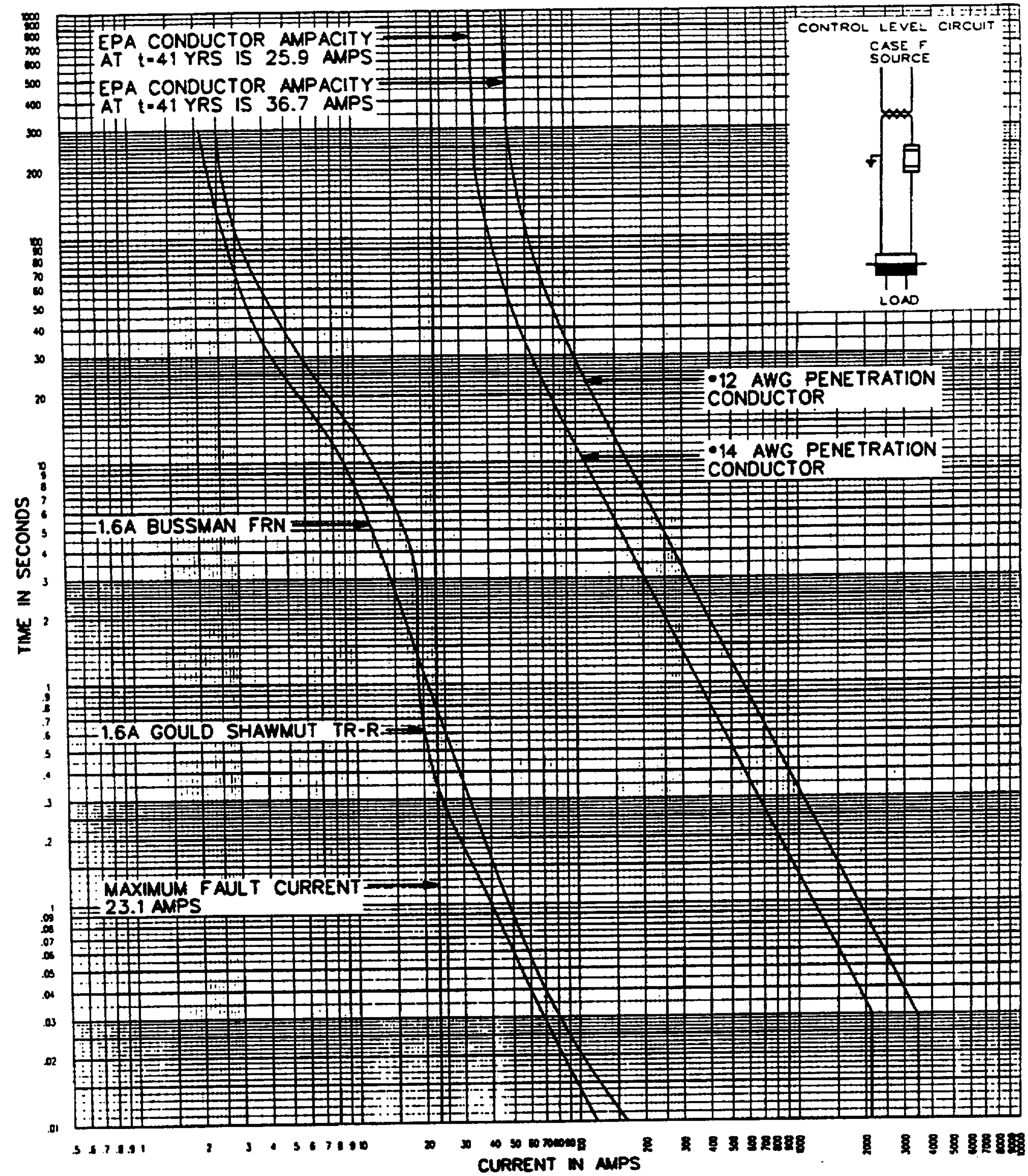
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 20 OF 30)



FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

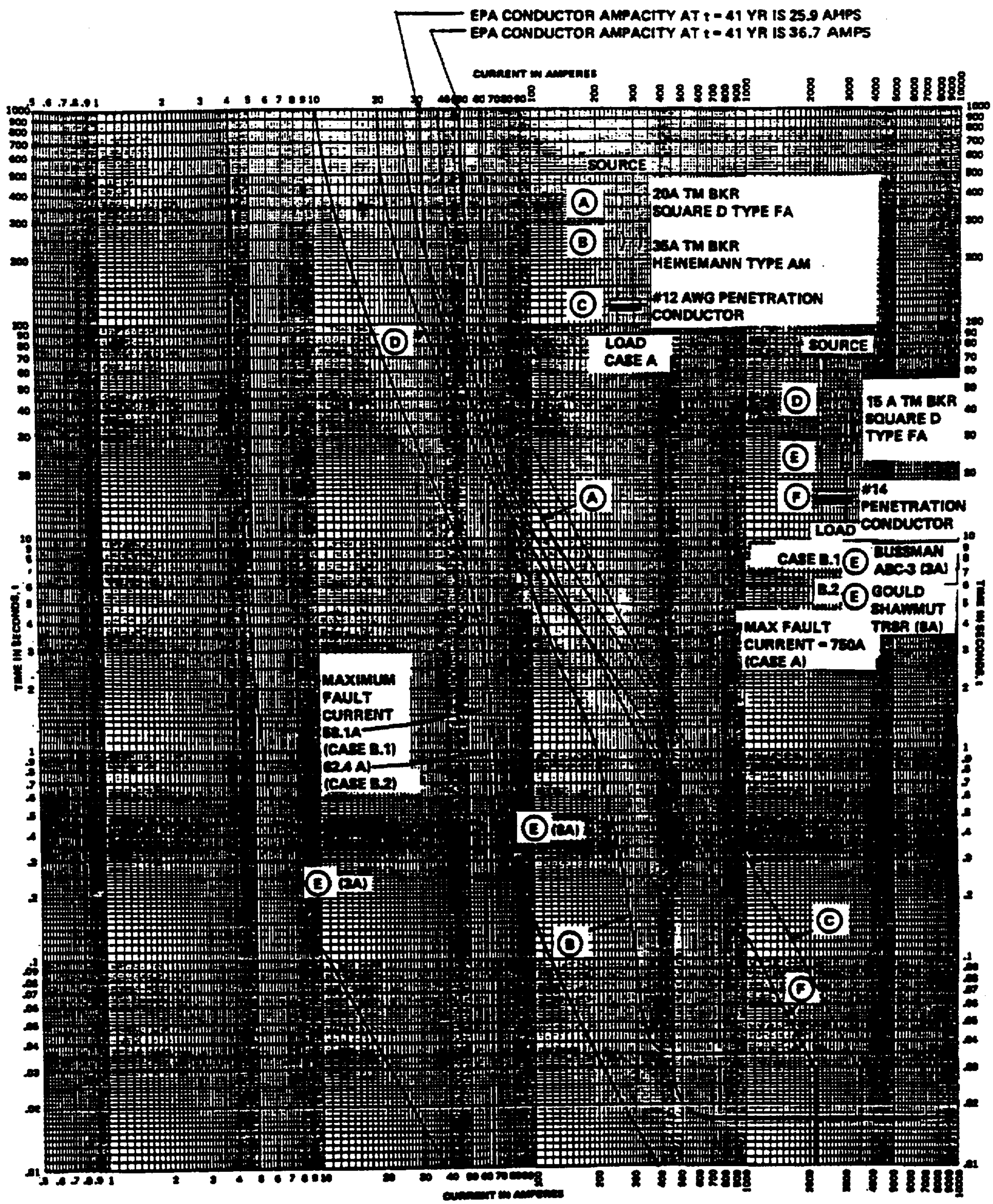
VOGTLE **ELECTRIC GENERATING PLANT** **UNIT 1 AND UNIT 2**	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES FIGURE 8.3.1-1 (SHEET 21 OF 30)



FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 22 OF 30)

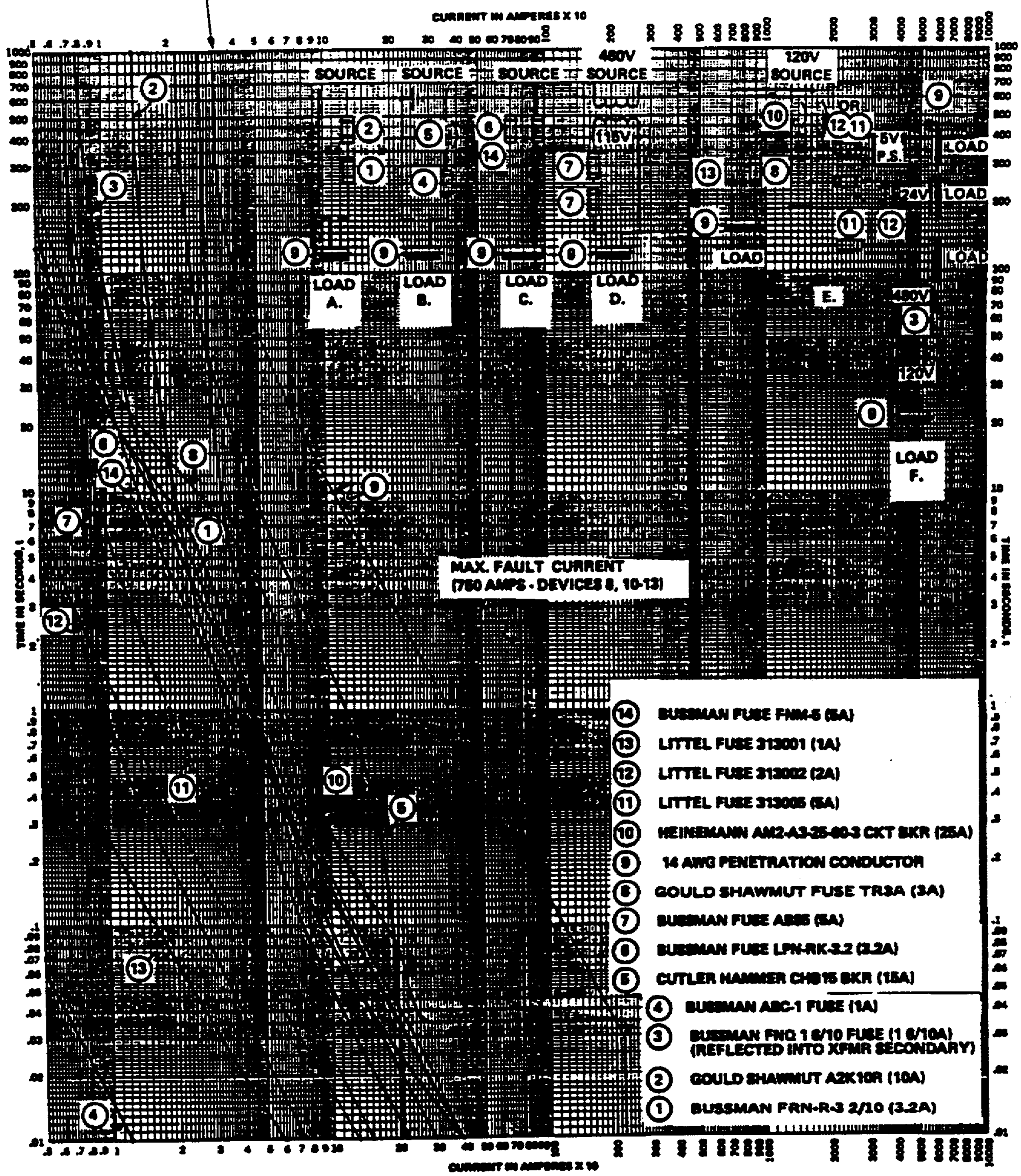


FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 23 OF 30)

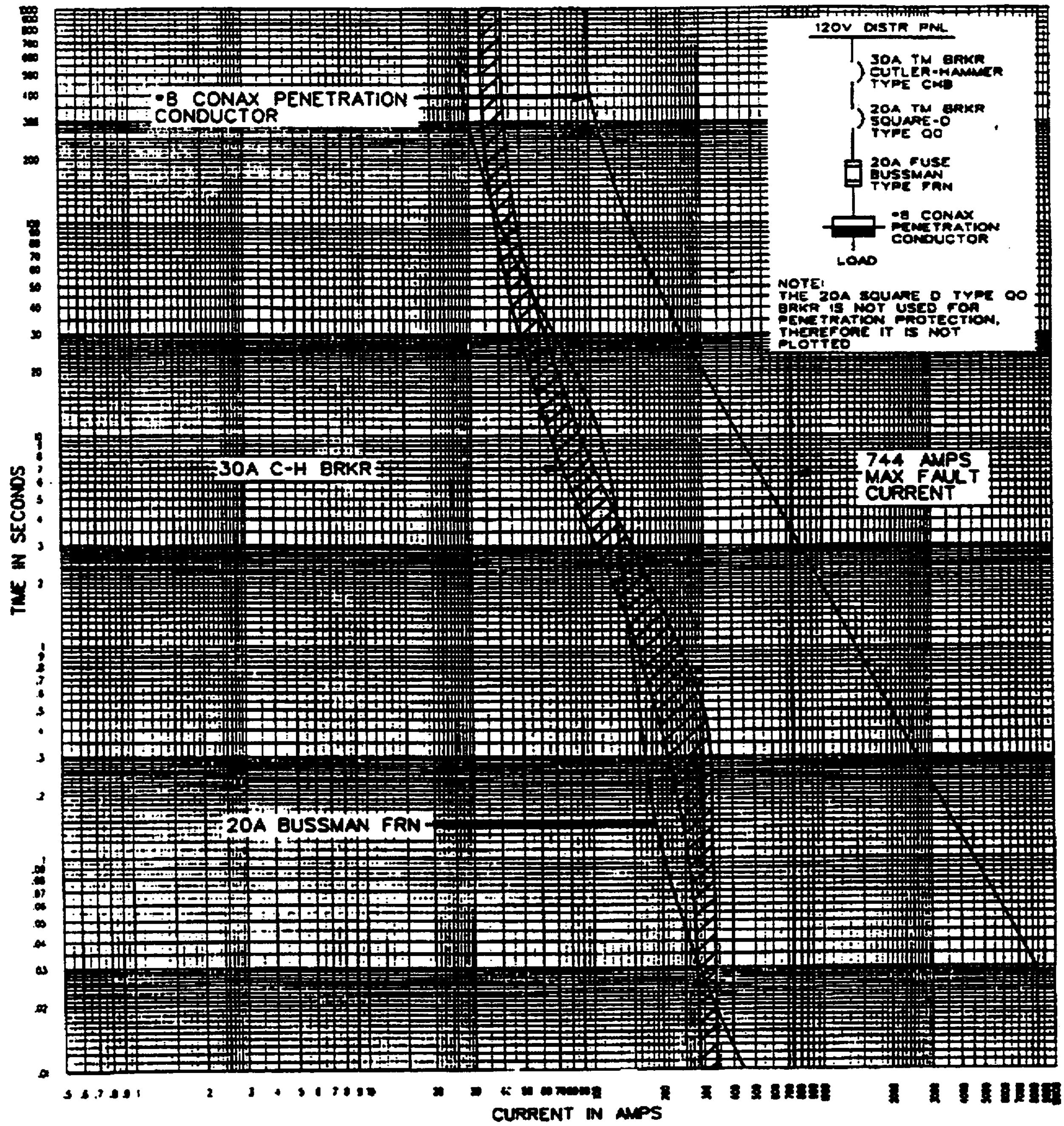
EPA CONDUCTOR AMPACITY AT t = 41 YR IS 25.9 AMPS



REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

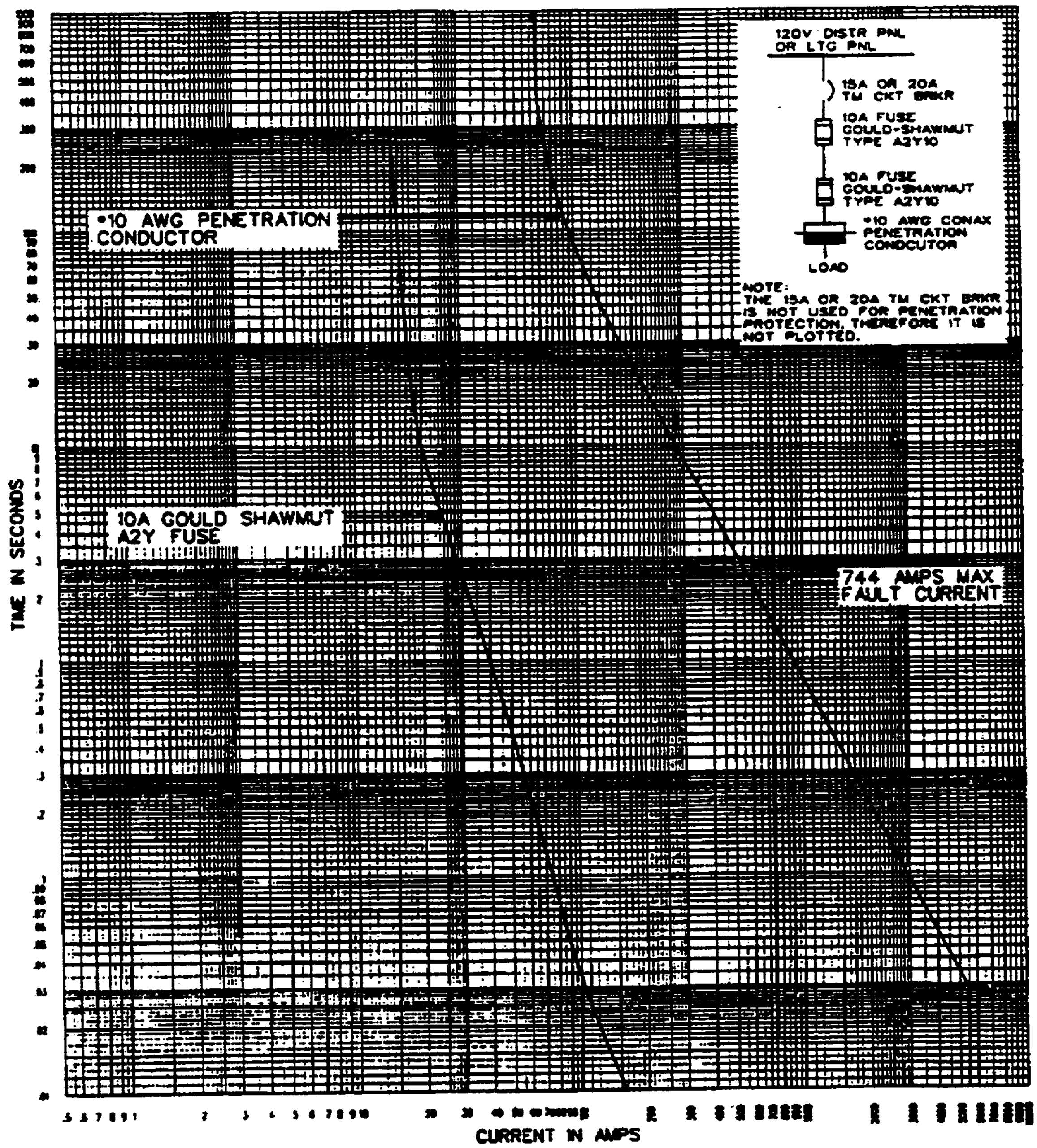
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 24 OF 30)



FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

REV 9 5/00
REV 6 4/97

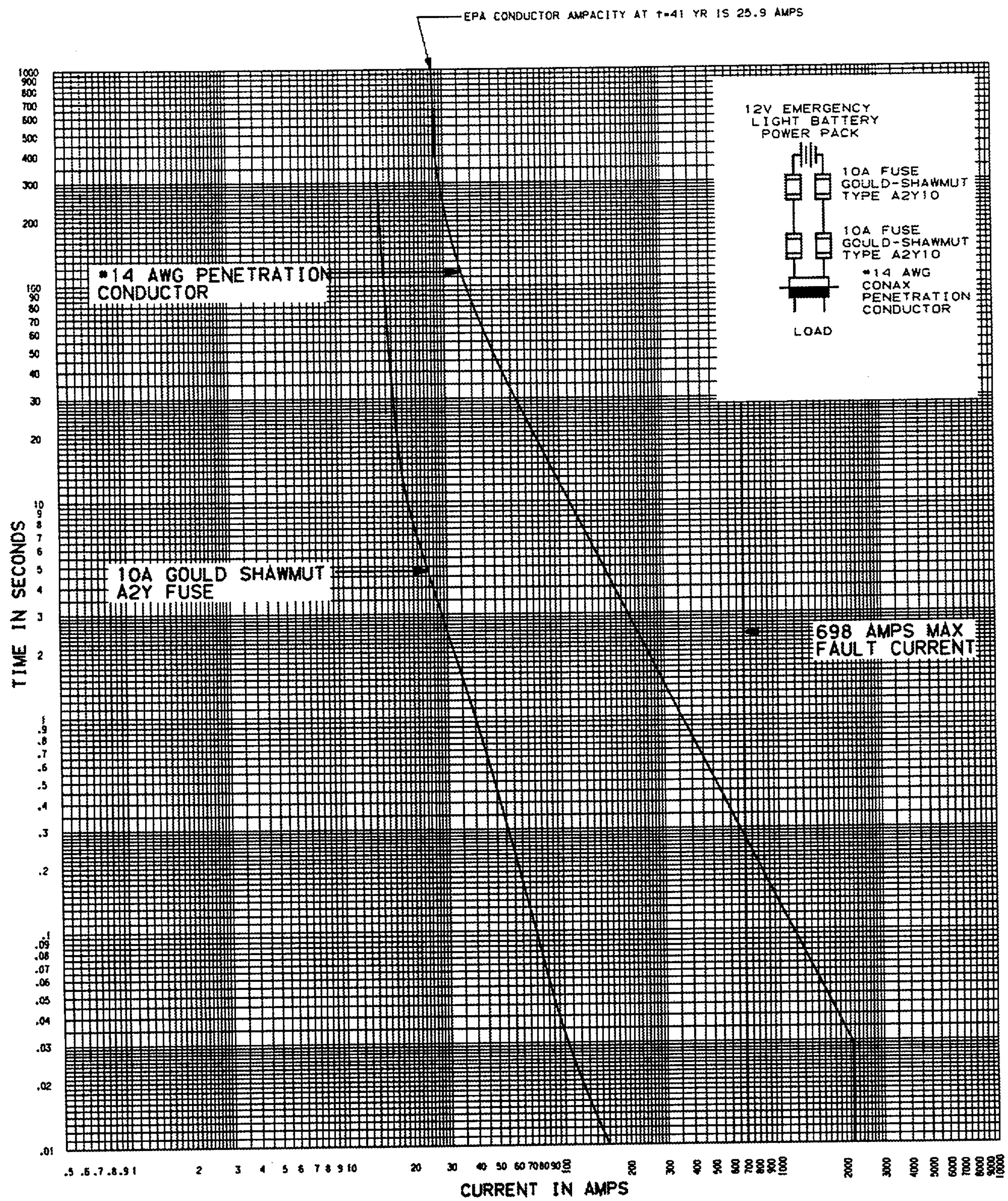
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 25 OF 30)



FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30).

REV 9 5/00
REV 6 4/97

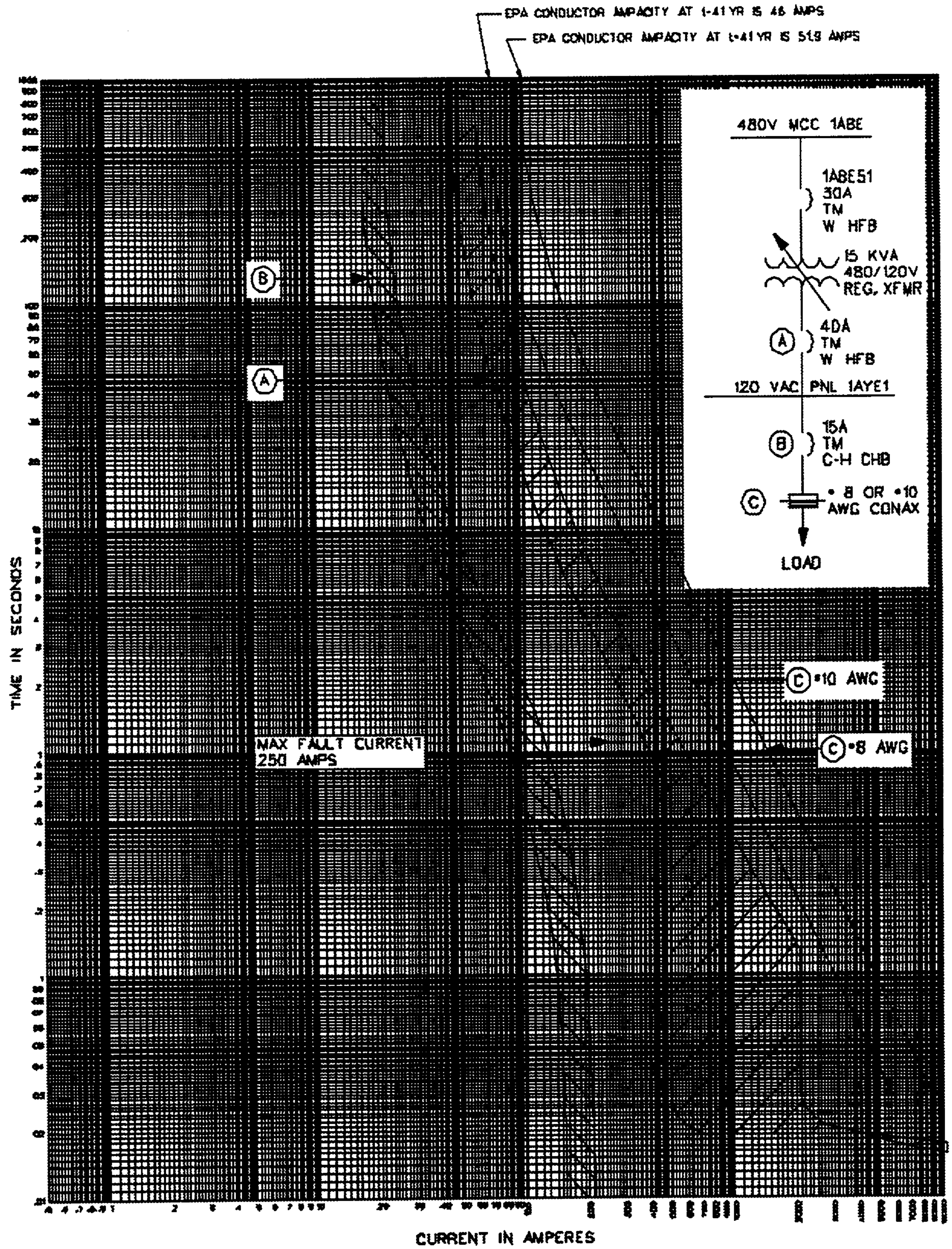
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES FIGURE 8.3.1-1 (SHEET 26 OF 30)



FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 2 3/92

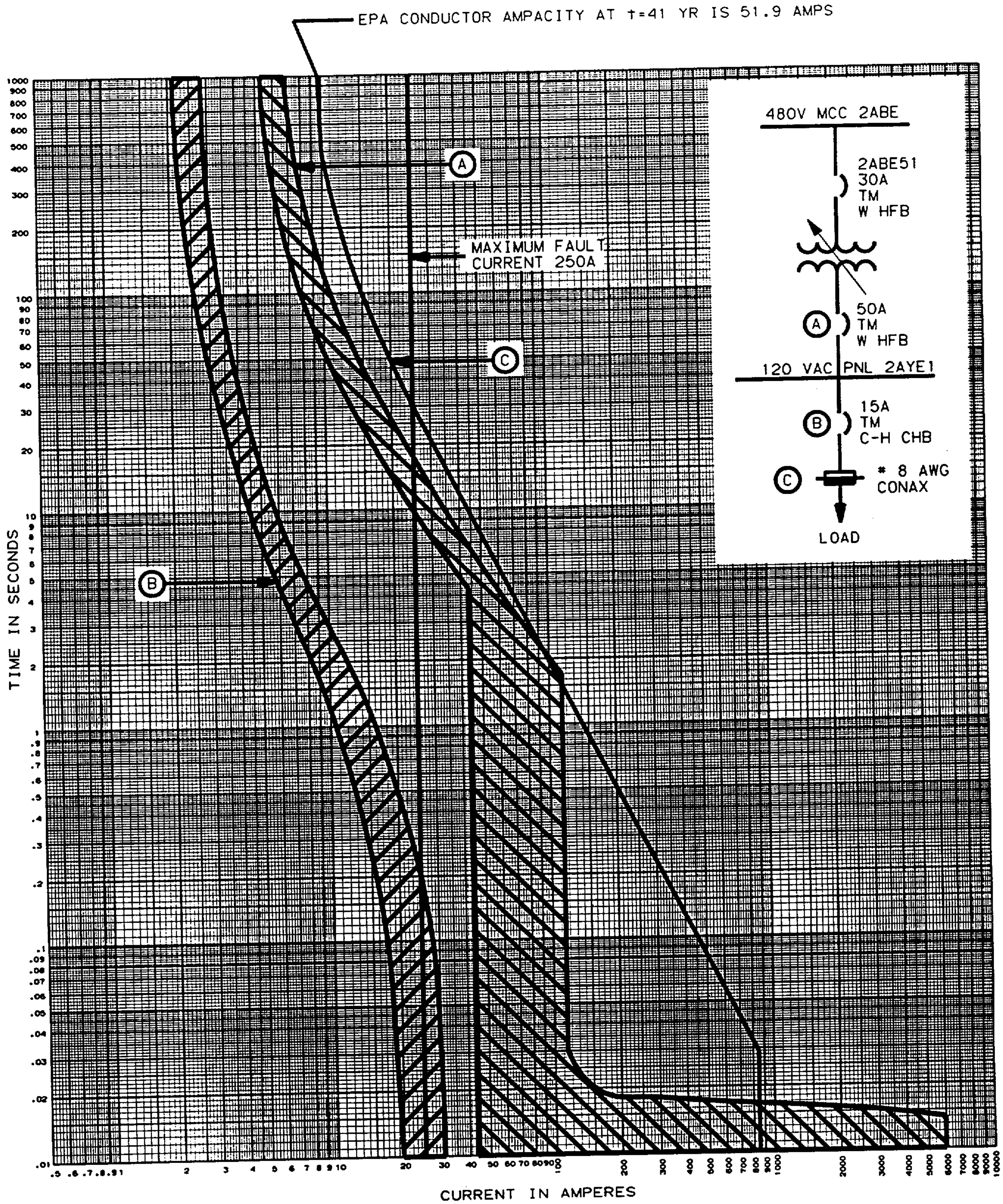
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 27 OF 30)



FOR EPA CONDUCTOR PROTECTION AT TIME, t = 41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

REV 9 5/00

VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 28 OF 30)



FOR EPA CONDUCTOR PROTECTION AT TIME t=41 YR
SEE FIGURE 8.3.1-1 (SHEET 30 OF 30)

REV 9 5/00

VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	PENETRATION OVERCURRENT PROTECTION COORDINATION CURVES
	FIGURE 8.3.1-1 (SHEET 29 OF 30)

THERMAL MAGNETIC CIRCUIT BREAKER RATINGS WHICH PROTECT THE EPA CONDUCTOR AT TIME t = 41 YEARS UNDER LOW LEVEL LONG TERM FAULT (OVERCURRENT) CONDITION:

EPA CONDUCTOR SIZE AWG	EPA CONDUCTOR AMP AT TIME t = 41 YR.; EPA MAX. TEMPERATURE OF 120°C AT EPA CONDUCTOR SEAL	MAX. THERMAL MAGNETIC BREAKER TRIP RATING IN AMPERES TO PROTECT EPA CONDUCTOR PER REG. 1.63
16	18.4	Not Applicable
14	25.9	25
12	36.7	35
10	36.7 (46.0) (NOTE 6)	20 (40)
8	51.9	50
6	73.4	70
4	103.8	70
2	146.8	125
2/0	247.4	125
500	667.3	Note 2
750	636.6 (NOTE 5)	Note 2

NOTES:

1. EPA CONDUCTOR SIZES 16, 14 AND 12 AWG ARE NOT USED FOR POWER SERVICE LEVEL CIRCUITS. THESE SIZES HAVE BEEN ANALYZED ON AN INITIAL CONDUCTOR TEMPERATURE (NORMAL OPERATING TEMPERATURE) OF 60°C. CONDUCTOR SIZES 10 AWG OR LARGER ARE USED FOR POWER SERVICE LEVEL CIRCUITS AND HAVE BEEN ANALYZED ON THE BASIS OF 90°C INITIAL CONDUCTOR TEMPERATURE.
2. EPA CONDUCTOR SIZES 500 AND 750 MCM ARE USED FOR CIRCUITS WHICH ARE PROTECTED BY OVERCURRENT RELAY PROTECTIVE DEVICES.
3. THE THERMAL OVERLOAD RELAY (TOR) CHARACTERISTICS SHOWN ON THE GRAPHS ADDRESS MORE CONSERVATIVE (HIGHER RATED) HEATER ELEMENTS THAN ARE TYPICALLY USED FOR THESE CIRCUITS. THESE TORs ARE USED IN CONJUNCTION WITH MAGNETIC ONLY (MO) BREAKERS WHOSE CHARACTERISTICS ARE DRAWN AT THEIR MAXIMUM SETPOINT. ACTUAL MO BREAKER SETPOINTS ARE TYPICALLY LOWER.
4. BREAKERS USED TO PROTECT THE EPA CONDUCTORS SHALL HAVE TRIP RATINGS IN ACCORDANCE WITH THE RATINGS SHOWN ABOVE.
5. CONDUCTOR SIZE 750 MCM HAS BEEN ANALYZED FOR A MAXIMUM TEMPERATURE OF 90°C IN LIEU OF 120°C DUE TO A DIFFERENT EPA DESIGN.
6. IN SOME CASES, 10 AWG EPA CONDUCTORS HAVE BEEN PROTECTED WITH 40 AMPERE THERMAL MAGNETIC BREAKERS. THESE CONDUCTORS HAVE BEEN ANALYZED AND DEMONSTRATED TO BE CAPABLE OF CONTINUOUSLY CARRYING 46 AMPERES BASED ON LOWER INITIAL OPERATING TEMPERATURES.
7. AMPACITIES SHOWN ARE FOR A SINGLE TWO OR THREE CONDUCTOR CIRCUIT UNDER OVERCURRENT CONDITIONS FOR THE 41 YEAR LIFETIME OF THE PLANT WITH THE REMAINING CONDUCTORS IN THE EPA OPERATING AT RATED CURRENT.

REV 9 5/00

TABLE 8.3.2-3

125-V-dc BATTERY C LOAD REQUIREMENTS
(LOCA/LOSP)

Load Description	Unit[b]	Current Required per Time Interval after ac Power Loss (A) 0-1 min	1-165 min	Random Load
Inverters	1	60.2	60.2	
	2	59.9	59.9	
Turbine-driven auxiliary feedwater pump MOVs	1	145.1		82.0
	2	145.1		82.0
DC distribution panel[c]	1	18.0	18.0	0.3
	2	10.2	10.2	0.3
DC switchgear and MCC indication and relaying	1	3.7	3.4	
	2	3.8	3.5	
RHR isolation valve inverter[a]				
Total	1	227.0	81.6	82.3
	2	219.0	73.6	82.3

a. The RHR isolation valve is not required to operate when ac power is not available to the RHR system.

b. Differences between switchgear and control load design configurations cause amperages to vary between Units 1 and 2.

c. The dc distribution panel includes the following loads: turbine-driven auxiliary feedwater pump control panel, safety features status indication relays and lights, miscellaneous control, and dc switchgear space heaters.

TABLE 8.3.2-5 (SHEET 6 OF 10)

Item No.	Description of Component	Safety Function	Plant Operating Mode	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	General Remarks
12.	Inverter; train A 1AD1I1, 1AD1I11 train B 1BD1I2, 1BD1I12 train C 1CD1I3, train D 1DD1I4	Convert 125-V dc to 120-V ac and provide voltage to vital instrument panels 1AY1A, 1BY1B, 1CY1A, 1DY1B, 1AY2A, 1BY2B	A, B, C	No output	Annunciator in main control room for inverter trouble.	None; system safety function can be met with loss of one channel	
13.	Regulated transformer;[c] train A 1ABB40RX and 1ABC09RX train B 1BBB40RX and 1BBA07RX train C 1ABA07RX train D 1BBC09RX	Backup to inverter (item 12) when it is isolated for maintenance or malfunction (requires local manual switching at item 14 panel)	A, B	No output	None	None; train B available	For single failure analysis: since these components are redundant to item 1, failure of item 1 and 2 components would require two single failures; thus this should not be considered; however, these components are redundant to item 12
			C	No input	None	None; train B available	This component cannot function during blackout
14.	120-V ac vital instrument panel; train A 1AY1A, 1AY2A, train B 1BY1B, 1BY2B, train C 1CY1A, train D 1DY1B	Distribute power via breakers to loads	A, B, C	Ground and bus fault	Panel trouble alarm in main control room for ground detection and bus undervoltage	None; system safety function can be met with loss of one channel	Power still available with a single ground.

REV 9 5/00
REV 6 4/97
REV 5 9/95
REV 3 12/92

TABLE 8.3.2-5 (SHEET 7 OF 10)

Item No.	Description of Component	Safety Function	Plant Operating Mode	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	General Remarks
15.	Interlock breaker[(b)] one per train (located at item 14 panel)	Provide local manual switching between inverter (item 12) and regulated transformer (item 13) and preclude both being connected together; also provide incoming overload protection	A, B,	Inadvertent transfer	Panel trouble alarm in main control room for ground detection and bus undervoltage	None; momentary loss of power to item 14 panels; train B available	
			A, B	Inadvertent opening	Panel trouble alarm in main control room for ground detection and bus undervoltage	None; train B available	
			C	Inadvertent opening	Panel trouble alarm in main control room for ground detection and bus undervoltage	None; panels are normally fed from inverters which are backed by batteries that are available for 4 h	
16.	125-V dc panel; train A 1AD12, train B 1BD12	Distribute power via breakers to loads	A, B, C	Ground, bus fault	One panel trouble alarm per panel in main control room for branch breaker overload. Bus fault will provide an annunciator isolation device panel trouble alarm. Ground detection provided by control room alarm for the panel supply switchgear.	None; train B available	Power still available with a single ground Power not available with bus fault.
17.	125-V dc panel; train A 1AD11 train B 1BD11	Distribute power via breakers to loads	A, B, C	Ground, bus fault	One panel trouble alarm per panel in main control room for bus undervoltage and branch breaker overload. Ground detection provided by control room alarm for the panel supply switchgear.	Same as 16	Power still available with a single ground

TABLE 8.3.2-5 (SHEET 8 OF 10)

Item No.	Description of Component	Safety Function	Plant Operating Mode	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	General Remarks
18.	125-V dc MCC; train A 1AD1M, train B 1BD1M	Distribute power via breakers to loads	A, B, C	Ground, bus fault	MCC trouble alarm in main control room for bus undervoltage, and branch breaker overload. Ground will provide a control room alarm for the MCC supply switchgear.	None; train B available	Power still available with a single ground
19.	125-V dc panel; train C 1CD11, train D 1DD11	Distribute power via breakers to loads	A, B, C	Ground, bus fault	One panel trouble alarm per panel in main control room for branch breaker overload. Bus fault will provide control room annunciator isolation device panel trouble alarm. Ground detection provided by control room alarm for the panel supply switchgear.	None; train D available	Power still available with a single ground Power not available for bus fault.
			C	Ground, bus fault	One panel trouble alarm per panel in main control room for branch breaker overload. Bus fault will provide control room annunciator isolation device panel trouble alarm. Ground detection provided by control room alarm for the panel supply switchgear.	Single failure; single failure on auxiliary feedwater turbine-driven pump space heater and control panel functions; blackout does not require single failure criteria	For 1CD104 breaker auxiliary feedwater function only; for other function train D available

TABLE 8.3.2-5 (SHEET 10 OF 10)

Item No.	Description of Component	Safety Function	Plant Operating Mode	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	General Remarks
23.	Individual Cell Equalizer	None	A, B, C	Open	A. Cell voltage reading B. Measure ICE current.	None; the battery cell will be effectively returned to its original configuration	A short in the ICE device will fail to an open state.

a. Plant operating modes are represented as follows:

A - normal (offsite power available).
B - loss of offsite power.
C - blackout (loss of all ac systems, except 120-V ac vital system).

System success criteria are as follows:

125-V dc system - one of two (train A or B and train C or D) channels required.
120-V ac vital system - three of four channels required.

b. It is to be understood that the failure of any one circuit breaker to open when required to under fault conditions will result in the loss of the associated train with redundant train still available.

c. Unit 2 transformer numbers are suffixed by "RX" in lieu of "X."

TABLE 8.3.2-8

125-V-dc BATTERY C LOAD REQUIREMENTS
(SBO)

Load Description	Unit[b]	Current Required per Time Interval after ac Power Loss (A) 0-1 min	1-240 min	Random Load
Inverter	1	60.2	60.2	
	2	59.9	59.9	
Turbine-driven auxiliary feedwater pump MOVs	1	145.1		82.0
	2	145.1		82.0
DC distribution panel[c]	1	18.0	18.0	
	2	10.2	10.2	0.3
DC switchgear and MCC indication and relaying	1	3.7	3.4	
	2	3.8	3.5	
RHR isolation valve inverter[a]				
Total	1	227.0	81.6	82.3
	2	219.0	73.6	82.3

a. The RHR isolation valve is not required to operate when ac power is not available to the RHR system.

b. Differences between switchgear and control load design configurations cause amperages to vary between Units 1 and 2.

c. The dc distribution panel includes the following loads: turbine-driven auxiliary feedwater pump control panel, safety features status indication relays and lights, miscellaneous control, and dc switchgear space heaters.

LIST OF TABLES (Continued)

LIST OF FIGURES

9.1.2 SPENT FUEL STORAGE

9.1.2.1 Design Bases

Spent fuel is stored in high density racks. Each rack in the Unit 1 spent fuel pool consists of several cells welded together to form the rack top grid. The cells are welded at the bottom to a supporting grid structure. The Unit 2 spent fuel pool consists of an assemblage of cells interconnected to each other along their contiguous corners to produce a honeycomb cellular structure. All of these modules are free-standing, neither anchored to the floor nor braced to the wall. The rack arrays in the Unit 1 pool(figure 9.1.2-1, sheet 1), have a center-to-center spacing of 10.25 in., as shown in figure 9.1.2-2, sheet 1. The spent fuel storage racks include storage locations for 1476 fuel assemblies in the Unit 1 pool(figure 9.1.2-3). In the Unit 2 pool(figure 9.1.2-1, sheet 2) rack arrays have a center-to-center spacing of 10.40 inches in the east-west direction and 10.58 in. in the north-south direction (figure 9.1.2-2, sheets 2 and 3). There are a total of 2098 storage locations in the Unit 2 pool. Spent fuel pool cooling is discussed in subsection 9.2.2, fuel handling building ventilation in subsection 9.4.2, and fuel handling building fire protection in appendix 9A, fire area 1-AB-LD-B.

9.1.2.2 Facilities Description

The spent fuel storage facility is designed to the guidelines of ANS 57.2. The spent fuel storage facility is located within the Seismic Category 1 fuel handling building. The facility is protected from the effects of natural phenomena such as earthquakes, winds, tornadoes, floods, and external missiles. The facility is designed to maintain its structural integrity following a safe shutdown earthquake and to perform its intended function following a postulated hazard such as fire, internal missiles, or pipe break. Each unit is provided with its own spent fuel pool. The units share a common cask loading and washdown area.

The spent fuel pool provides storage space for irradiated spent fuel. New fuel may be moved from the new fuel racks to the spent fuel racks in preparation for a refueling outage. Each nuclear unit has a separate pool. The pool is approximately 41 ft deep, constructed of reinforced concrete, and lined with 1/4-in. thick stainless steel plate. The normal water volume of the pool is about 447,030 gal of borated water with a nominal boron concentration of 2000 ppm. Drawings 1X4DE317, 1X4DE320, and 1X4DE322 show the spent fuel pools and the cask loading area.

The spent fuel racks are vertical modules designed to hold Westinghouse 17-by-17 fuel assemblies in various arrays. A total of 3574 storage locations will be provided. The Unit 2 pool will initially contain at least two racks with storage space for 198 fuel assemblies. The design allows the addition, during or before plant operation, of any number of racks up to a total of 20 racks in the Unit 2 pool as shown in figure 9.1.2-5.

Contiguous to each spent fuel pool is a short canal leading to the fuel transfer canal. The fuel transfer canal is connected to the refueling canal inside the containment by the fuel transfer tube. All portions of the spent fuel transfer operation are completed underwater, and the waterways are of sufficient depth to maintain a nominal 10 ft of shielding water above the active fuel. A metal gate with gasket assembly separates the short spent fuel pool canal from the fuel transfer canal. This allows the transfer canal to be drained without interfering with the water level in the fuel pool. Subsection 9.1.3 further addresses the minimum water level in the spent fuel pool. In the event that fuel is damaged and fuel fragments or pellets are collected on filters or other devices, the shielding requirements for the movement of the filters govern rather than the requirements on the submergence of spent fuel.

Common to the spent fuel pools and accessible by small canals is an approximately 47-ft-deep cask loading pit. The canals are separated from the spent fuel pools by metal gates with gasket assemblies. The cask washdown enclosure is an epoxy-coated internal structure of the fuel handling building provided for decontamination of the shipping cask before it leaves the VEGP.

The spent fuel bridge crane traverses the spent fuel pools and the new fuel storage facility. It is used in the movement of both new and spent fuel assemblies. This crane also has access to the adjoining canals.

The cask handling bridge crane traverses the auxiliary building and a portion of the fuel handling building. The cask handling crane's path is perpendicular to the path of the spent fuel bridge crane and is designed such that the cask crane cannot pass over the spent fuel pools. This precludes the movement of heavy loads (other than those associated with the spent fuel bridge crane) over the spent fuel pools, in accordance with Regulatory Guide 1.13. The cask handling crane is used for operations involving the spent fuel shipping cask.

During fuel handling operations, a controlled and monitored ventilation system removes gaseous radioactivity from the atmosphere above the spent fuel pools and processes it before discharge through the plant vent. Refer to subsection 9.4.2 for a detailed discussion of the fuel handling building heating, ventilation, and air-conditioning system and section 11.5 for process radiation monitoring.

The spent fuel pool is provided with a Seismic Category 1 backup water supply. Water can be either pumped or gravity-fed to the pool from the reactor makeup water storage tank. The reactor makeup water pumps are nonsafety-related Seismic Category 1 pumps which can be aligned to the emergency non-1E buses. In the event that the pumps fail to function, water can flow through the nonfunctioning pumps to provide makeup to the pool. All intervening piping is designed to Seismic Category 1 requirements.

9.1.2.2.1 Spent Fuel Rack Design

A. Applicable Codes, Standards, and Specifications

The racks are designed and fabricated to applicable portions of the following Nuclear Regulatory Commission (NRC) Regulatory Guides, Standard Review Plan Sections, and published standards.

1. April 14, 1978, NRC Position for Review and Acceptance of Spent Fuel Storage and Handling Applications, as amended by the NRC letter dated January 18, 1979.

2. NRC Regulatory Guides

1.13, Rev. 1, Dec. 1975	Spent Fuel Storage Facility Design Basis
1.25, March 1972	Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors
1.26, Rev. 3, Feb. 1976	Quality Group Classifications and Standards for Water Steam and Radioactive Waste Containing Components of Nuclear Power Plants
1.29, Rev. 3, Sept. 1978	Seismic Design Classification
1.92, Rev. 1, Feb. 1976	Combining Modal Responses and Spatial Components in Seismic Response Analysis

1.124, Rev. 1, Jan. 1978	Service Limits and Load Combinations for Class 1 Linear-Type Component Supports

3. Standard Review Plan - NUREG-0800

Rev. 2, August 1989	Section 3.7, Seismic Design (Unit 1)
Rev. 1, July 1981	Section 3.7, Seismic Design (Unit 2)
Rev. 1, July 1981	Section 3.8.4, Other Seismic Category I Structures
Rev. 3, July 1981	Section 9.1.2, Spent Fuel Storage
Rev. 1, July 1981	Section 9.1.3, Spent Fuel Pool Cooling System
NRC Branch Technical Position Rev. 2, July 1981	ASB 9-2, Residual Decay Energy for Light Water Rectors for Long Term Cooling

4. Industry Codes and Standards

ANSI N16.1-75	Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors
ANSI N16.9-75	Validation of Calculational Methods for Nuclear Criticality Safety
ANSI N210-76	Design Objectives for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Stations
ASME Section III-95	Nuclear Power Plant Components (Unit 1)
ASME Section III-83	Nuclear Power Plant Components (through Summer 1984 Addendum) (Unit 2)
ACI 318-63	Building Code Requirements for Reinforced Concrete (Unit 1 & 2)
ACI 318-71	Building Code Requirements for Reinforced Concrete (Unit 1)

B. Seismic and Impact Loads

The spent fuel racks are designed using the seismic loading described in this section.

Seismic analysis of the fuel storage racks is performed by the time-history method. The time histories and response spectrum utilized in these analyses represent the responses of the pool structure to the specified ground motion. The seismic analysis of the racks is performed with a damping value of 4 percent for safe shutdown earthquake (SSE) and 2 percent for operating basis earthquake (OBE).

Maximum dynamic forces and stresses are calculated for the worst condition as determined by combination with forces and stresses computed in accordance with paragraph C.

Deflections or movements of racks under earthquake loading are limited by design such that, in the active fuel region, the racks do not touch each other or the spent fuel pool walls, the racks are not damaged to the extent that nuclear parameters provided in paragraph 9.1.2.3 are exceeded, and the fuel assemblies are not damaged.

The interaction between the fuel elements and the rack is considered, particularly gap effects. The resulting impact loads are of such magnitude that there is no structural damage to the fuel assemblies.

C. Loads and Load Combinations

Table 9.1.2-1 shows loads and load combinations that are considered in the analyses of the spent fuel racks include those given in the NRC, OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications, dated April 14, 1978, as amended by the NRC letter dated January 18, 1979.

It is noted from the seismic analysis that the magnitude of stresses varies considerably from one geometrical location to the other in the model. Consequently, the maximum loaded major rack components are analyzed. Such an analysis envelops the other areas of the rack assembly.

For both the Unit 1 and Unit 2 pool racks, the margins of safety for the multi-directional seismic event were evaluated by applying statistically independent acceleration time histories in three orthogonal directions concurrently. Simultaneous application of the seismic slab motion dispenses with the need to perform statistical summations (square-root-of-the-sum-of-squares).

D. Design and Analysis Procedures for Spent Fuel Storage Racks

The seismic and stress analyses of the spent fuel rack modules considers the various conditions of full, partially filled, and empty fuel assembly loadings for the wet pool case. The Unit 2 analysis includes conditions of partially filled and empty fuel assembly loadings for the dry case. In addition, an analysis of a Unit 2 pool rack in the dry condition and fully loaded with new fuel was performed. The racks are evaluated for both operating basis earthquake (OBE) and safe shutdown earthquake (SSE) conditions and meet Seismic Category I requirements. A detailed stress analysis is performed to verify the acceptability of the critical load components and paths under normal and faulted conditions. The racks rest freely on the pool floor and are evaluated under all loading conditions to determine if rack-to-rack or rack-to-wall impact occurs.

The dynamic response of the fuel rack assembly during a seismic event is the condition which produces the governing loads and stresses on the structure. The seismic analysis of a free-standing fuel rack is a time-analysis performed on a nonlinear model.

1. Unit 1 Spent Fuel Pool Rack Analysis

The details of the structural models and the structural analyses of the Unit 1 spent fuel racks are described in the following paragraphs:

The analyses performed to confirm the structural integrity of the racks to demonstrate compliance with the USNRC Standard Review Plan[1] and the OT Position Paper[2] are as follows:

- 3-D transient analyses of the spent fuel racks individually and as an assemblage acting as free-standing submerged bodies subjected to seismic excitations applied as synthetic acceleration time-histories.

- Evaluation of the primary stresses in the rack structure to establish compliance with the stress limits for ASME Section III Subsection NF[3].

- Evaluation of the secondary and peak stresses amplitudes in the most severely loaded rack sections to ensure that failure from cyclic fatigue will not occur.

The spent fuel racks are designed as Seismic Category I as required by USNRC Standard Review Plan[4]. The response of a free-standing rack module to seismic inputs is highly nonlinear involving a complex combination of motions (sliding, rocking, twisting, and turning), resulting in impacts and friction effects. An accurate simulation of the structural response is obtained by direct integration of the nonlinear equations of motion using pool slab acceleration time-histories as the forcing function.

Particulars of modeling details and assumptions for the 3-D single rack analysis for the fuel racks are given in the following:

a. The fuel rack structure motion is captured by modeling the rack as a 12 degrees-of-freedom structure. Movement of the rack cross-section at any height is described by 6 degrees of freedom of the rack base and 6 degrees of freedom at the rack top. In this manner, the beam-like response of the module, relative to the baseplate, is captured in the dynamic analyses once suitable springs are introduced to couple the rack degrees of freedom. Rattling fuel assemblies within the rack are modeled by five lumped masses located at H, .75H, .5H, .25H, and at the rack base (H is the rack height measured above the base). Each lumped fuel mass has 2 horizontal displacement degrees of freedom. Vertical motion of the fuel assembly mass is assumed equal to rack vertical motion at the base.

b. Seismic motion of a fuel rack is characterized by random rattling of fuel assemblies in their individual storage locations. All fuel assemblies are assumed to move in-phase within a rack. This exaggerates computed dynamic loading on the rack structure and, therefore, yields conservative results.

c. Fluid coupling between the rack and the fuel assemblies, and between the rack and the wall, is simulated by appropriate inertial coupling in the system kinetic energy. Fluid coupling terms for rack-to-rack coupling are based on either in-phase or opposed-phase motion of adjacent modules.

d. Fluid damping and form drag are conservatively neglected.

e. Sloshing is negligible at the top of the rack and is therefore neglected in the analysis of the rack.

f. Potential impacts between the cell walls of the racks and the contained fuel assemblies are accounted for by appropriate compression-only gap elements between masses involved. The possible incidence of rack-to-wall or rack-to-rack impact is simulated by gap elements at the top and bottom of the rack in two horizontal directions. Bottom gap elements are located at the rack base.

g. Pedestals are modeled by gap elements in the vertical direction and as "rigid links" for transferring horizontal stress. Each pedestal support is linked to the pool liner by two friction springs. The spring rate for the friction springs includes any lateral elasticity of the stub pedestals. Local pedestal vertical spring stiffness accounts for the floor elasticity and the local rack elasticity just above the pedestal.

h. Rattling of fuel assemblies inside the storage locations causes the gap between fuel assemblies and cell wall to change from a maximum of twice the nominal gap to a theoretical zero gap. Fluid coupling coefficients are based on the nominal gap dimension.

Figure 9.1.2-4, sheet 1, shows a schematic of the dynamic model where p_i (i = 1,2,3,7,8,...,19) represents the translational degrees of freedom, and q_i (i = 4,5,6,20,21,22) represents the rotational degrees of freedom. Translational and rotational degrees of freedom 1 through 6 and 17 through 22 describe the rack motion; the rattling fuel masses, which are located at nodes 1*, 2*, 3*, 4*, and 5* in figure 9.1.2-4, sheet 1, are described by translational degrees of freedom 7 to 16.

The single rack 3-D model handles the array of variables as follows:

- Interface Coefficient of Friction

  Parametric runs are made with upper bound and lower bound values of the coefficient of friction. The limiting values are based on experimental data which have been found to be bounded by the values 0.2 and 0.8.

- Impact Phenomena

  Compression-only gap elements are used to provide for opening and closing of interfaces such as the pedestal-to-bearing pad interface, and the fuel assembly-to-cell wall interface.

- Fuel Loading Scenarios

  The fuel assemblies are conservatively assumed to rattle in unison which obviously exaggerates the contribution of impact against the cell wall. The different patterns of possible fuel assembly loadings in the rack are simulated by orienting the center of gravity column of the assemblage of fuel assemblies with respect to the module geometric center of gravity in an appropriate manner.

- Fluid Coupling

  The contribution of fluid coupling forces is ascertained by prescribing the motion of the racks (adjacent to the one being analyzed).

The whole pool multi-rack (WPMR) analysis methodology is the vehicle available to establish the presence or absence of specific rack-to-rack impacts during the seismic event.

In WPMR analysis, a 16 degrees of freedom discretization is used to model each rack plus contained fuel. The rack structure is modeled by 12 degrees of freedom, and the contained fuel is modeled by 4 horizontal degrees of freedom. The only difference between the single rack model, which is described in paragraph 9.1.2.2.1.D.2, and the WPMR model is the number of rattling fuel masses. The WPMR model has two fuel masses which are located at nodes 3* and 5* in figure 9.1.2-4, sheet 1. Thus, the WPMR model involves all racks in the spent fuel pool with each individual rack and its fuel modeled as a 16 degrees of freedom structure.

The WPMR model includes gap elements that represent compression-only pedestals, impact potential at fuel assembly-fuel rack interfaces, and impact potential at rack-to-rack and rack-to-wall locations. The rack-to-rack and rack-to-wall impact springs are located at the top and bottom corners of the rack. Each pedestal has two friction elements associated with the force in the vertical compression element.

The spring constants are equal to the corresponding values from the 22 degrees of freedom single-rack model.

The WPMR dynamic model is of all rack modules in the pool, and includes all fluid coupling interactions among them, as well as fluid coupling interactions between racks and pool walls.

The 3-D WPMR analyses demonstrate that all kinematic criteria for the spent fuel rack modules are satisfied, and that resultant structure loads confirm the validity of the single rack structural qualification. The results of the analyses indicate that (1) there is no rack-to-pool wall impact, and (2) no rack-to-rack impact in the cellular region of the racks containing active fuel.

2. Unit 2 Spent Fuel Pool Rack Analysis

The details of the structural model and the structural analysis are described in the following paragraphs:

The seismic analysis is performed in three steps:

a. Development of a nonlinear dynamic model consisting of inertial mass elements and gap and friction elements.

b. Generation of the equations of motion and inertial coupling and solution of the equations using the "component element time integration scheme" to determine nodal forces and displacements.

c. Computation of the detailed stress field in the rack (at the critical location) and in the support legs using the nodal forces calculated in the previous step. These stresses are checked against the design limits given in Table 9.1.2-1.

Since the racks are not anchored to the pool floor or attached to the pool walls or to each other, they can execute a wide variety of rigid body motions. For example, the rack may slide on the pool floor (so-called "sliding condition"); one or more legs may momentarily lose contact with the liner ("tipping condition"); or the rack may experience a combination of sliding and tipping conditions. The structural model permits simulation of these kinematic events with inherent built-in conservatisms. Since these rack modules are designed to preclude the incidence of interrack impact, it is also necessary to include the potential interrack impact phenomena in the analysis to demonstrate that such impacts do not occur. Lift-off of the support legs and subsequent liner impacts must be modeled using appropriate impact elements, and Coulomb friction between the rack and the pool liner must be simulated by appropriate piecewise linear springs. These special attributes of the rack dynamics require a strong emphasis on the modeling of the linear and nonlinear springs, dampers, and stop elements.

These considerations lead to the following attributes of the analysis model:

a. The fuel rack structure is a folded metal plate assemblage welded to a baseplate and supported on a minimum of four legs. The rack structure itself is a very rigid structure. Dynamic analysis of typical multicell racks has shown that the motion of the structure is captured almost completely by the behavior of a six degrees-of-freedom structure. Therefore, the movement of the rack cross-section at any height is described in terms of the six degrees-of-freedom of the rack base. The rattling fuel is modeled by five lumped masses located at H, .75H, .5H, .25H, and at the rack base. (Figure 9.1.2-4, sheet 2 and Figure 9.1.2-4, sheet 3).

b. The seismic motion of a fuel rack is characterized by random rattling of fuel assemblies in their individual storage locations. Substituting the assemblage of rattling masses by an effective dynamic mass group greatly reduces the required degrees-of-freedom needed to model the fuel assemblies which are represented by five lumped masses located at different levels of the rack. The centroid of each fuel assembly mass can be located relative to the rack structure centroid at that level, so as to simulate a partially loaded rack (Figure 9.1.2-4, sheet 3).

c. The local flexibility of the rack-support interface is modeled conservatively in the analysis (spring K_R in Figure 9.1.2-4, sheet 2).

d. The rack base support may slide or lift off the pool floor.

e. Fluid coupling between rack and assemblies, and between rack and adjacent racks, is simulated by introducing appropriate inertial coupling into the system kinetic energy.

f. Potential impacts between rack and assemblies are accounted for by appropriate "compression only" gap elements between masses involved.

g. Fluid damping between rack and assemblies, and between rack and adjacent rack, is conservatively neglected.

h. The supports are modeled as "compression only" elements for the vertical direction and as "rigid links" for horizontal displacement. The bottom of a support leg is attached to a frictional spring as shown in figure 9.1.2-4, sheet 2. The cross-section inertial properties of the support legs are computed and used in the final computations to determine support leg stresses.

i. The possible incidence of interrack impact is simulated by a series of gap elements at the top and bottom of the rack in the two horizontal directions. The most conservative case of adjacent racks movement is assumed; each adjacent rack is assumed to move completely out of phase with the rack being analyzed.

j. The form drag opposing the motion of the fuel assemblies in the storage locations is conservatively neglected in the results reported herein.

k. The form drag opposing the motion of the fuel rack in the water is also conservatively neglected in the results reported herein.

l. The rattling of the fuel assemblies inside the storage locations causes the "gap" between the fuel assemblies and the cell wall to change from a maximum of twice the nominal gap to a theoretical zero gap. Therefore, the fluid coupling coefficients utilized are based on nonlinear vibration theory. Studies in the literature show that inclusion of the nonlinear effect (viz. vibration amplitude of the same order of magnitude as the gap) provides a more accurate characterization of the equipment response.

m. The cross coupling effects due to the movement of fluid from one interstitial (interrack) space to the adjacent one is modeled using potential flow and Kelvin's circulation theorem.

Figure 9.1.2-4, sheet 4 shows a schematic of the model. Six degrees-of-freedom are used to track the motion of the rack structure. Figure 9.1.2-4, sheet 3 shows the fuel assembly/storage cell impact springs at a particular level.

An important feature of the rack analysis is incorporation of the fluid coupling effects. The fluid coupling forces are a strong function of the interbody gap, reaching large values for very small gaps. The lateral motion of a fuel assembly inside the storage location encounters the fluid coupling effect. So does the motion of a rack adjacent to another rack. These effects are included in the equations of motion. Furthermore, the rack equations contain coupling terms which model the effect of fluid in the gaps between adjacent racks. The coupling terms modeling the effects of fluid flowing between adjacent racks are computed assuming that all adjacent racks are vibrating 180° out of phase from the rack being analyzed. Therefore, only one rack is considered surrounded by a hydrodynamic mass computed as if there were a plane of symmetry located in the middle of the gap region.

The fluid virtual mass is included in the vertical direction vibration equations of the rack; virtual inertia is also added to the governing equation corresponding to the rotational degree-of-freedom (See figure 9.1.2-4, sheet 4).

Damping of the rack motion arises from material hysteresis (material damping, relative intercomponent motion in structures structural damping), and fluid drag effects (fluid damping). In the analysis, a maximum of 4 percent structural damping is imposed on elements of the rack structure during SSE seismic simulations, and 2 percent for OBE simulations. Material and fluid damping are conservatively neglected. The dynamic model constructed in this manner is employed to evaluate the rack module structural response for limiting values of the interface coefficient of friction ($\mu = 0.2$ and 0.8), and a number of conditions of rack loading.

E. Structural Acceptance Criteria for Spent Fuel Storage Racks

The fuel racks are analyzed for the normal and faulted load combinations of paragraph C in accordance with the NRC, OT Positions for Review and Acceptance of Spent Fuel Storage and Handling Applications.

The major normal and upset condition loads are produced by the operating basis earthquakes. The thermal stresses due to rack relative expansion are calculated and combined with the appropriate seismic loads in accordance with the NRC, OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications[2].

The faulted condition loads are produced by the safe shutdown earthquakes and a postulated fuel assembly drop accident.

The computed stresses are within the acceptance limits identified in the NRC, OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications[2].

In summary, the results of the seismic and structural analysis show that the VEGP spent fuel storage racks meet all the structural acceptance criteria adequately.

F. Fuel Handling Crane Uplift Analysis

An analysis is performed to demonstrate that the rack can withstand a maximum uplift load of 5000 lb. This load can be applied to a postulated stuck fuel assembly without violating the criticality acceptance criterion. Resulting stresses are within acceptable stress limits, and there is no change in rack geometry of a magnitude which causes the criticality acceptance criterion to be violated.

G. Fuel Assembly Drop Accident Analysis

In the unlikely event of dropping a fuel assembly, accidental deformation of the rack does not cause the criticality acceptance criterion to be violated.

Analysis of radiological consequences considers the case of a dropped spent, irradiated fuel assembly in a flooded pool. The criticality analysis takes credit for dissolved boron in the water but takes no credit for burnup.

For the analysis of a dropped fuel assembly, two accident conditions are postulated. The first accident condition conservatively assumes that the weight of a fuel assembly, control rod assembly, and handling tool (2300 lb total) impacts the top of the fuel rack from a drop height of 3 ft. Calculations show that the impact energy is absorbed by the dropped fuel assembly, the cells, and rack base plate assembly. Under these faulted conditions, credit is taken for dissolved boron in the water, and the criticality acceptance criterion is not violated.

The second accident condition assumes that the dropped assembly and tool (2300 lb) falls straight through an empty cell and impacts the rack base plate from a drop height of 3 ft above the top of the rack. The results of this analysis show that the impact energy is absorbed by the fuel assembly and the rack base plate.

The accident condition of an inclined drop of a fuel assembly on top of the rack is bounded by the above two accidents. No additional analysis was performed for this condition.

Criticality calculations show that $k_{eff} \leq 0.95$ and the acceptance criterion is not violated.

H. Fuel Rack Sliding and Overturning Analysis

Consistent with the criteria of the NRC, OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications[2], the racks are evaluated for overturning and sliding displacement due to earthquake conditions.

The nonlinear models described in paragraph D are used in this evaluation to account for fuel-to-rack impact loading, hydrodynamic forces, and the nonlinearity of sliding friction interfaces.

The fuel rack nonlinear time-history analyses show that the fuel rack slides a minimal distance. The factor of safety against overturning is well within the values permitted by Section 3.8.5.II.5 of the Standard Review Plan.

9.1.2.3 Safety Evaluation

The design and safety evaluation of the spent fuel racks is in accordance with the Nuclear Regulatory Commission position paper, Review and Acceptance of Spent Fuel Storage and Handling Applications.[2]

The racks, being Nuclear Safety Class 0 and Seismic Category 1 structures, are designed to withstand normal and postulated dead loads, live loads, loads resulting from thermal effects, and loads caused by the operating basis earthquakes and safe shutdown earthquake events.

The design of the racks is such that k_{eff} remains less than or equal to 0.95 under all conditions, including fuel handling accidents. Because of the close spacing of the cells, it is impossible to insert a fuel assembly in other than design locations. Inadvertent insertion of a fuel assembly between the rack periphery and the pool wall or placement of a fuel assembly across the top of a fuel rack is considered a postulated accident, and as such, realistic initial conditions such as boron in the water can be taken into account. This condition has an acceptable k_{eff} of less than 0.95. Should the spent fuel storage be used for new fuel storage in the dry condition, k_{eff} will be less than or equal to 0.98.

The racks are also designed with adequate energy absorption capabilities to withstand the impact of a dropped fuel assembly from the maximum lift height of the fuel handling machine. Handling equipment (fuel building crane) capable of carrying loads heavier than a fuel assembly is prevented by interlocks or administrative controls, or both, from traveling over the fuel storage area. The fuel storage racks can withstand an uplift force greater than or equal to the uplift capability of the fuel handling machine (4000 lb).

All materials used in construction are compatible with the storage pool environment, and all surfaces that come into contact with the fuel assemblies are made of annealed austentic stainless steel. All the materials are corrosion resistant and will not contaminate the fuel assemblies or pool environment. Venting of the boraflex and boral can be accomplished through the holes in the corners of the wrapper.

Design of the facility in accordance with Regulatory Guide 1.13 ensures adequate safety under normal and postulated accident conditions.

A discussion of the methodology used in the criticality analyses is provided in paragraph 4.3.2.6.

REFERENCES

1. USNRC Standard Review Plan, NUREG-0800 (SRP 3.7.1, Rev. 2, 1989).

2. Nuclear Regulatory Commission, letter to All Power Reactor Licensees, from B. K. Grimes, "OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications", April 14, 1978.

3. ASME Boiler & Pressure Vessel Code Section III, Subsection NF (1980).

4. USNRC Standard Review Plan, NUREG-0800 (SRP 3.8.4, Rev. 1, July 1981).

TABLE 9.1.2-1

LOADS AND LOAD COMBINATIONS

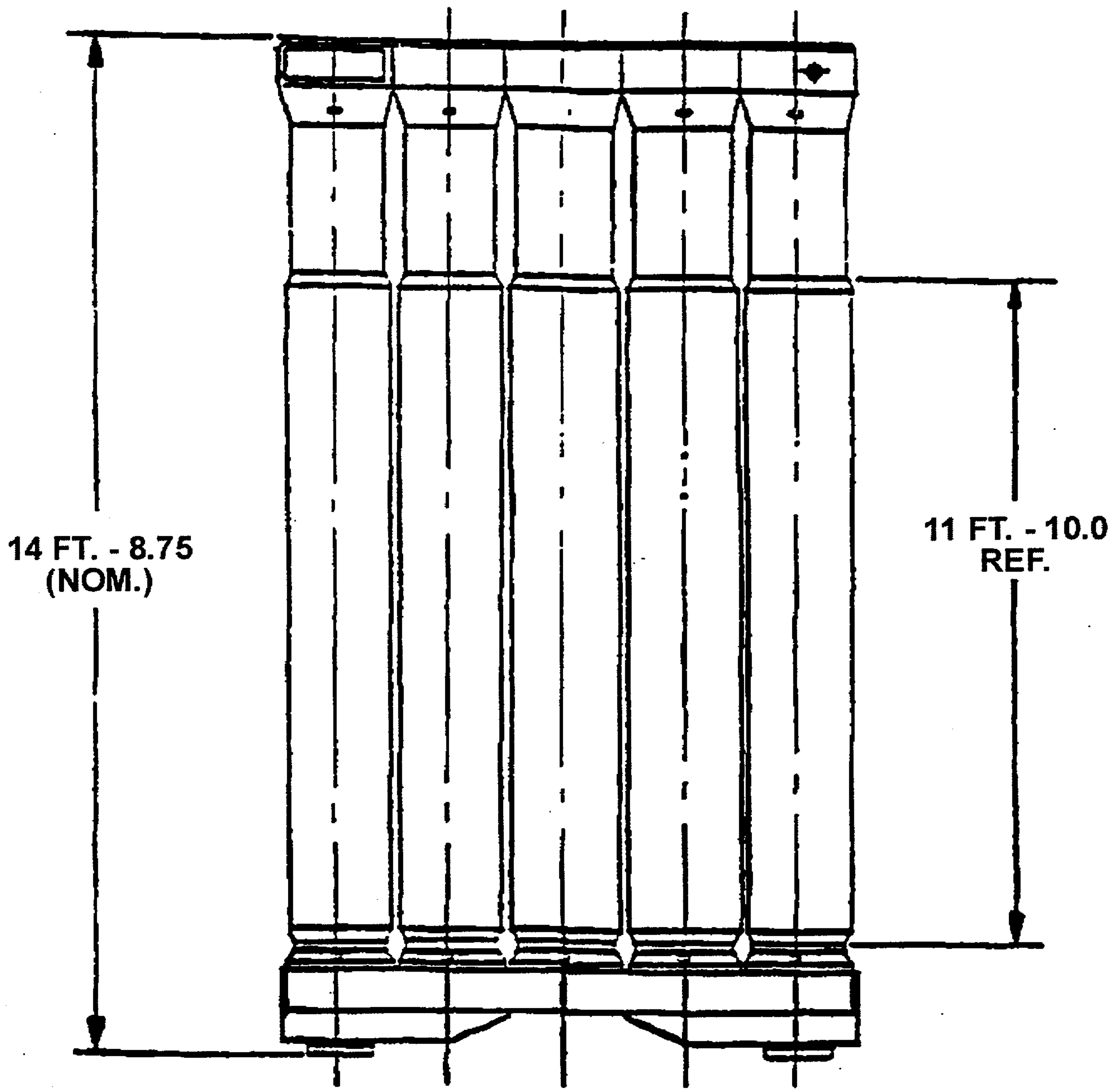
Loading Combination	Stress Limit
D + L	Level A service limits
D + L + T_o	
D + L + T_o + E	
D + L + T_a + E	Level B service limits
D + L + T_o + P_f	
D + L + T_a + E′	Level D service limits
D + L + F_d	The functional capability of the fuel racks should be demonstrated.

where:

D	=	Dead weight-induced stresses (including fuel assembly weight)
L	=	Live load (0 for the structure, since there are no moving objects in the rack load path)
F_d	=	Force caused by the accidental drop of the heaviest load from the maximum possible height
P_f	=	Upward force on the racks caused by postulated stuck fuel assembly
E	=	Operating Basis Earthquake
E′	=	Safe Shutdown Earthquake
T_o	=	Differential temperature induced loads (normal or upset condition)
T_a	=	Differential temperature induced loads (abnormal design conditions)

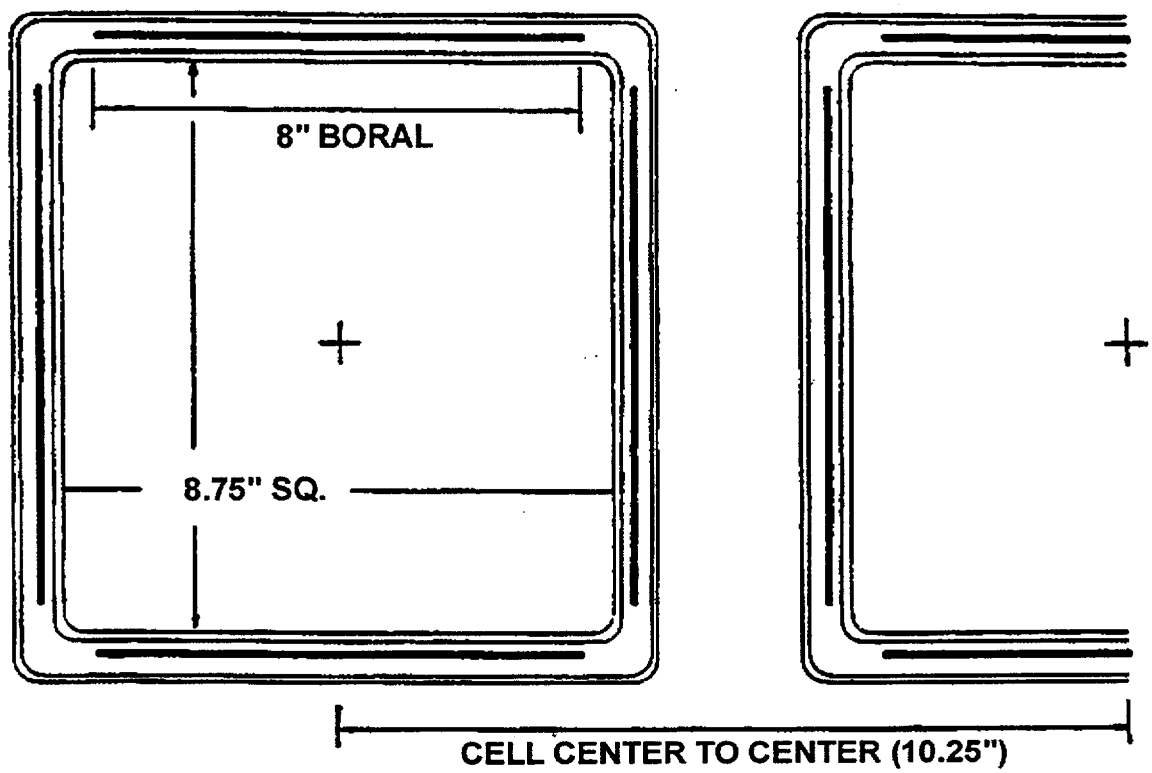
NOTES:

1. The abbreviations in the table above are those used in the Standard Review Plan, subsection 3.8.4.



REV 9 5/00

VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	SPENT FUEL POOL STORAGE RACK ARRAY, SIDE VIEW (UNIT 1)
	FIGURE 9.1.2-1 (SHEET 1 OF 2)



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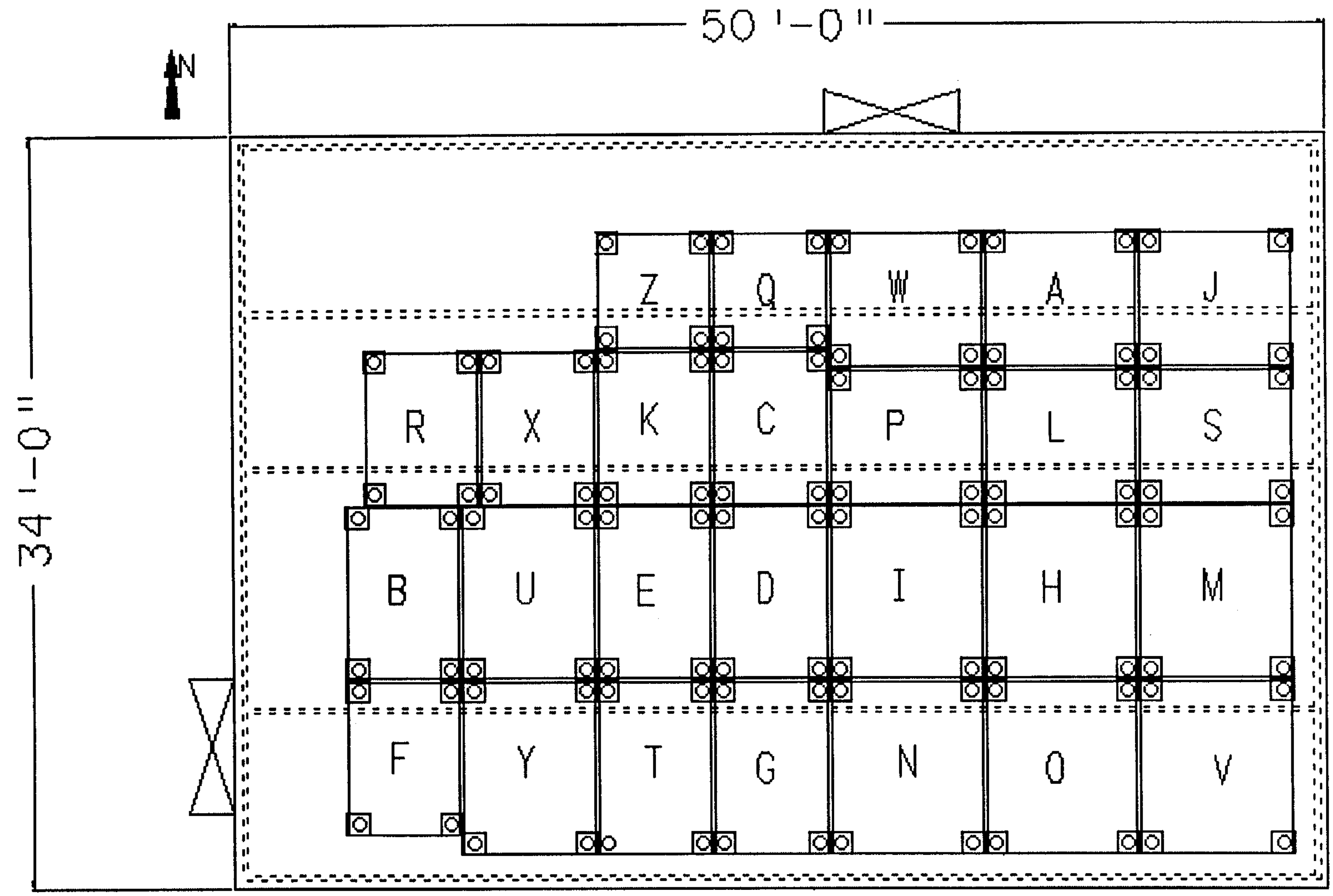
VOGTLE
ELECTRIC GENERATING PLANT
UNIT 1 AND UNIT 2

SPENT FUEL POOL STORAGE
CELL NOMINAL DIMENSIONS (UNIT 1)

FIGURE 9.1.2-2 (SHEET 1 OF 3)



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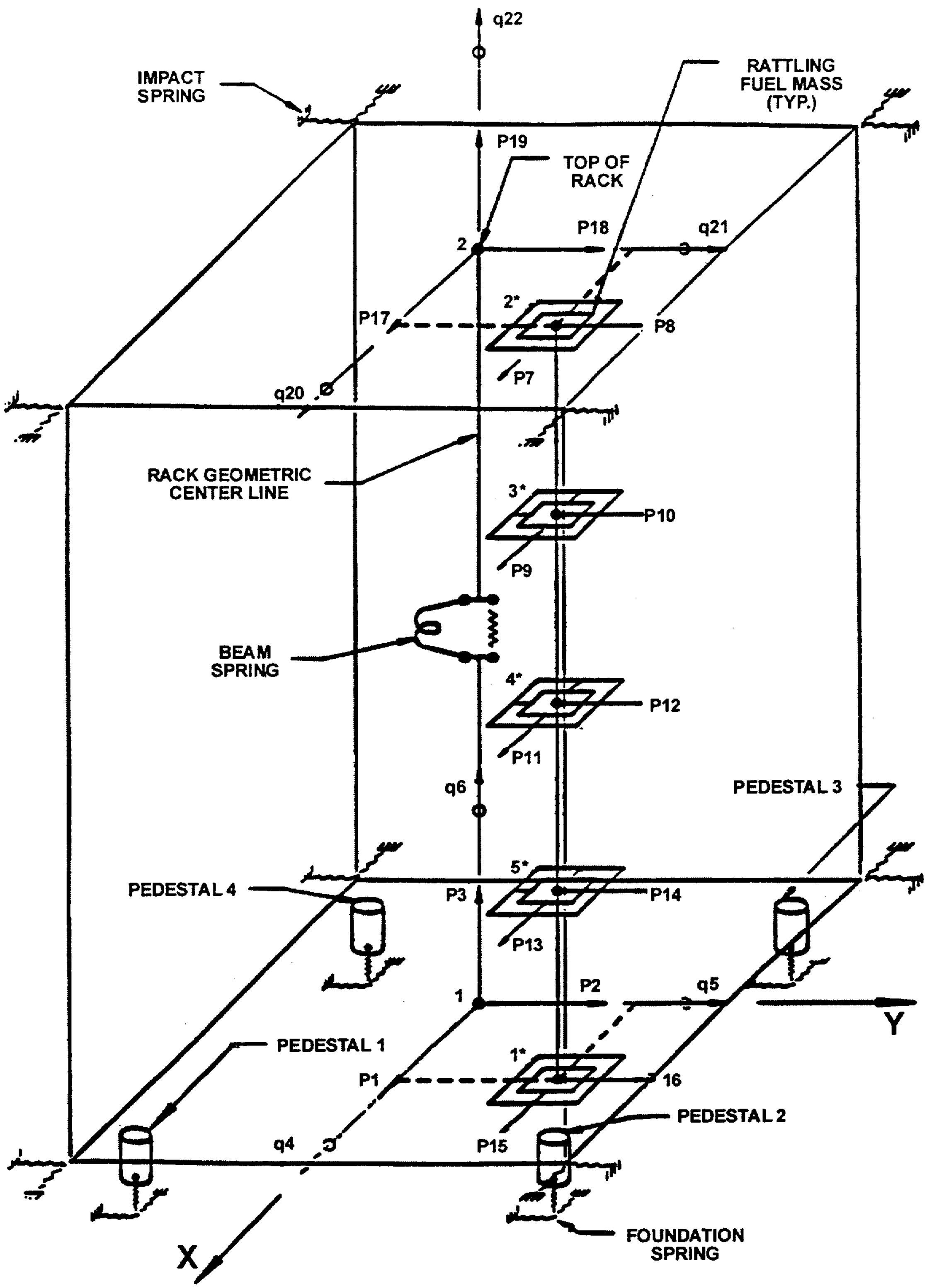
VOGTLE
ELECTRIC GENERATING PLANT
UNIT 1 AND UNIT 2

SPENT FUEL POOL STORAGE
LAYOUT (UNIT 1)

FIGURE 9.1.2-3



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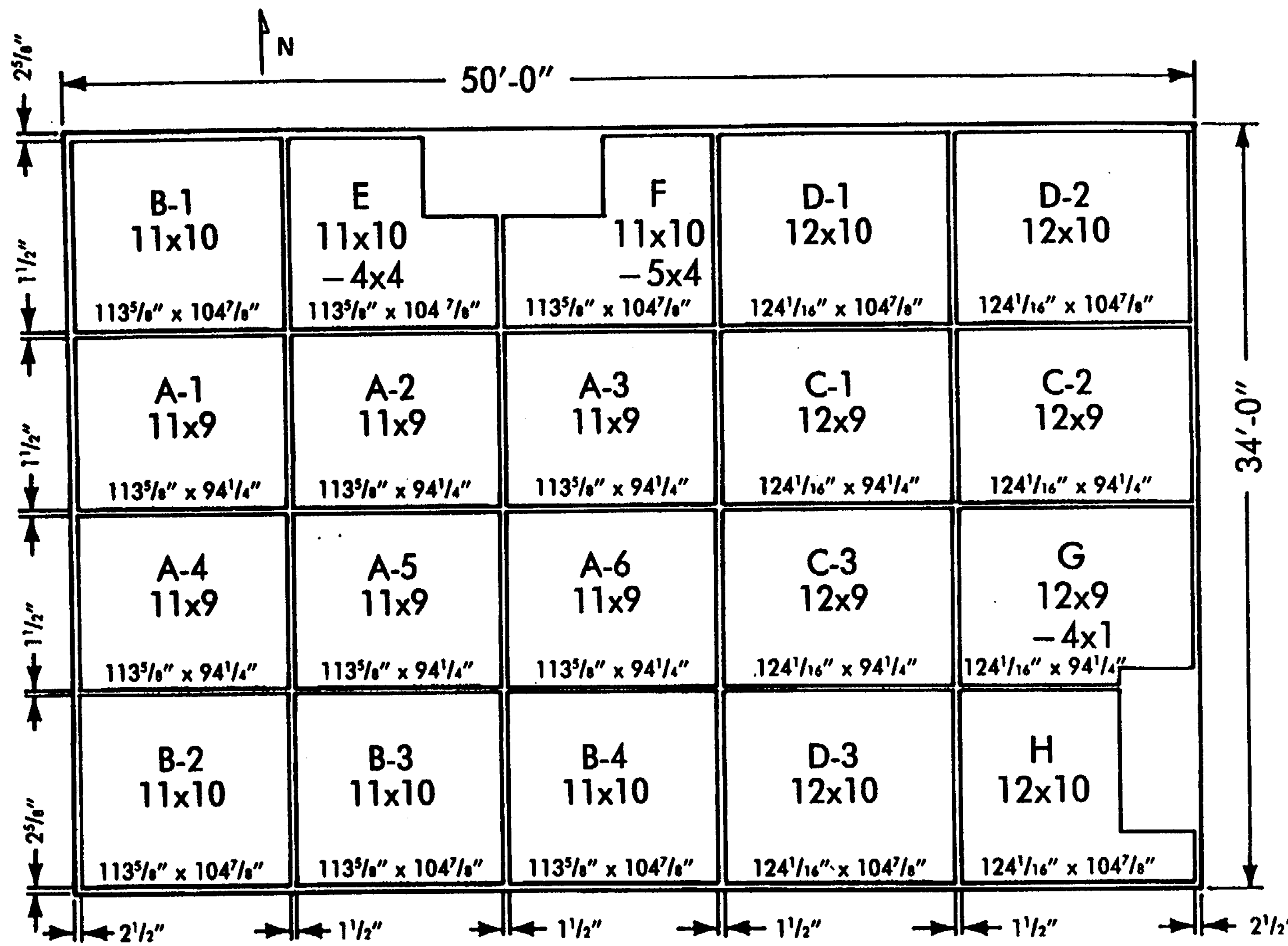
VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	SPENT FUEL POOL RACK'S SCHEMATIC MODEL FOR DYNRACK (UNIT 1)
	FIGURE 9.1.2-4 (SHEET 1 OF 4)



REV 9 5/00

VOGTLE
ELECTRIC GENERATING PLANT
UNIT 1 AND UNIT 2

SPENT POOL STORAGE LAYOUT (UNIT 2)

FIGURE 9.1.2-5

An alternative method that may be used in lieu of the above is to maintain the vessel head just above the water as the water level is raised while the refueling cavity is being filled. When the water reaches the safe shielding depth for spent fuel transfer (paragraph 9.1.4.3.4), the head is taken to the storage pedestal (cavity fill/slow lift method). The remaining sequence of the vessel disassembly after the head lift is as discussed above.

9.1.4.2.2.3 Phase III - Fuel Handling. All fuel assemblies are offloaded and transferred to the spent fuel pool. While in the spent fuel pool, the fuel inserts are shuffled. After the inserts are shuffled, the fuel assemblies are to be reused, and the new fuel assemblies are transferred to the core.

The general fuel handling sequence is as follows:

A. The refueling machine is positioned over a fuel assembly in the core.

B. The refueling machine withdraws a fuel assembly from the core and raises it to a predetermined height sufficient to clear the vessel flange and still leave sufficient water covering the fuel assembly. For Unit 2, an in-mast sipping test may be performed at this time that will determine if the fuel assembly contains leaking fuel rods.

C. The FTS car is moved into the refueling canal from the fuel storage area.

D. The fuel assembly container is pivoted to the vertical position by the lifting arm.

E. The refueling machine is moved to line up the fuel assembly with the FTS.

F. The refueling machine loads a fuel assembly into the fuel assembly container of the transfer car.

G. The FTS container is pivoted to the horizontal position by the lifting arm.

H. The FTS container is moved through the fuel transfer tube to the fuel building by the transfer car.

I. The FTS container is pivoted to the vertical position. The fuel assembly is unloaded by the spent fuel handling tool attached to the fuel handling machine.

J. The fuel assembly is placed in the spent fuel storage rack. This process is continued until the core is offloaded.

K. The fuel inserts are shuffled inside the spent fuel pool. The RCCA change tool and the thimble plug change tool are capable of removing and reinstalling individual RCCAs or thimble plugs utilizing the fuel handling machine. Burnable poison rod assemblies (BPRAs) can also be relocated within the pool using the BPRA handling tool. All three tools are long handled to ensure that sufficient radiation shielding is maintained during movement of the inserts.

L. A fuel assembly is taken from a spent fuel storage rack and loaded into the fuel assembly container by the spent fuel tool suspended from the fuel handling machine.

M. The FTS container is pivoted to the horizontal position and moved back into the containment building.

N. The FTS container is pivoted to the vertical position.

O. The fuel assembly is withdrawn from the fuel container by the refueling machine and placed in the location prepared for it in the reactor core.

P. This process is continued until the core is loaded.

9.1.4.2.2.4 Phase IV - Reactor Assembly. Reactor assembly, following refueling, is achieved essentially by reversing the operations given in Phase II - Reactor Disassembly. The water is lowered to just below the flange and then the vessel head is lowered onto the flange.

An alternative method that may be used in lieu of the above is to lower the vessel head and water simultaneously until the vessel head engages the guide studs. Then the water is lowered to the top of the reactor vessel flange, and the placement of the head on the vessel is resumed.

9.1.4.2.2.5 Fuel Assembly Reconstitution. The fuel assemblies have mechanical features that permit the replacement of damaged fuel rods with filler rods which contain stainless steel or natural uranium instead of enriched uranium. Fuel reconstitution is performed in the northeast end of the Unit 1 fuel transfer canal using the new fuel elevator fitted with a reconstitution basket.

During fuel assembly reconstitution, the affected assembly will be located in the new fuel elevator reconstitution basket, which replaced the new fuel elevator basket. The fuel assembly in the reconstitution basket will have a minimum water depth of 10 feet above the top of the assembly. The gate between the Unit 1 enough so that the upper end is still contained in the mast when the gripper end contacts the fuel. Mounted on the trolley, a winch raises the gripper tube and fuel assembly up into the mast tube. While inside the mast tube the fuel is transported to its new position.

In Unit 2, fuel may be checked for leaking rods by the in-mast sipping system. After the fuel assembly is raised into the mast, a small amount of air is introduced through a manifold at the bottom of the mast and will rise to the top, where it is captured and analyzed for radiological content.

All controls for the refueling machine are mounted on a console in the trolley. The bridge is positioned on a coordinate system laid out on one rail. A television monitor on the console indicates the position of the bridge and trolley. The drives for the bridge, trolley, and winch are variable speed and include inching controls for the bridge and trolley. The approximate maximum speeds for the bridge and trolley are 60 ft/min and 20 ft/min, respectively. The hoist travels at an approximate maximum speed of 40 ft/min. The auxiliary monorail hoist on the refueling machine has hoisting speeds of approximately 7 and 20 ft/min.

Electrical interlocks and limit switches on the bridge and trolley drives prevent damage to the fuel assemblies. The winch is also provided with limit switches to prevent a fuel assembly from being raised above a safe shielding depth should the limit switch fail. In an emergency the bridge, the trolley, and the winch can be operated manually using a handwheel.

The refueling machine is also provided with a bypass interlock switch. This switch will bypass all electrical interlocks associated with the bridge and trolley boundaries, the hoist overload and underload, and the upper and lower limits associated with the encoders. The switch will not override the mechanically geared interlocks that prevent lifting the fuel above a safe shielding depth. The bypass interlock switch is a key operated switch, which must be turned and held for operation. Control of this key is maintained in accordance with the key control program.

B. Fuel Handling Machine

The fuel handling machine (figure 9.1.4-2) is a wheel-mounted walkway spanning the spent fuel pools; it carries a trolley-mounted electric hoist on an overhead structure. This machine is used for handling fuel assemblies within the fuel storage area by means of a long-handled tool suspended from the hoist. A load monitoring device, an integral part of the hoist, is used to monitor all loads. The hoist travel and tool length are designed to limit the maximum lift of a fuel assembly to a safe shielding depth.

The bridge trolley and hoist speeds are variable. The approximate maximum speed for the bridge and trolley is 30 ft/min and for the hoist is 20 ft/min.

C. New Fuel Elevator and Reconstitution Basket

The new fuel elevator (NFE) (figure 9.1.4-3) consists of a box-shaped elevator assembly with its top end open and sized to house one fuel assembly. It is used to transfer new fuel assemblies between the new fuel storage area and the spent fuel pool. It is also used in the process of placing ancillary equipment in spent fuel storage rack locations (e.g., failed fuel rod storage basket, debris basket, etc.). The elevator winch has a load sensing device which prevents a fuel assembly from being raised in the elevator. The NFE is located at the northwest end of the Unit 2 transfer canal.

The new fuel elevator reconstitution basket (NFERB) is located at the northeast end of the Unit 1 transfer canal. The NFERB interchanges with the site spent fuel pool new fuel elevator basket. The NFERB is designed to rigidly support the repair fuel assembly and accept all removable top nozzle (RTN) tooling required. This basket is designed to sit and ride on the spent fuel pool new fuel elevator tracks. The basket is made with a bottom section specifically designed to provide fuel assembly holddown during RTN reconstitution. The track has a mechanical hard stop installed as a safety precaution to ensure a safe shielding depth in the case of a limit switch failure. The NFERB is installed in a manner that allows for conversion back to the NFE if needed.

D. Fuel Transfer System

The FTS (figures 9.1.4-4 and 9.1.4-5) includes an underwater, electric motor-driven transfer car that runs on tracks extending from the refueling canal, through the transfer tube, and into the fuel storage area; a hydraulically actuated lifting arm is at each end of the transfer tube. The fuel container in the refueling canal receives a fuel assembly in the vertical position from the refueling machine. The fuel assembly is then lowered to a horizontal position for passage through the transfer tube. After passing through the tube, the fuel assembly is raised to a vertical position for removal by a tool suspended from a hoist mounted on a fuel handling machine in the fuel storage area. The fuel handling machine then moves to a storage loading position and places the spent fuel assembly in the spent fuel storage racks.

During reactor operation, the transfer car is stored in the fuel storage area. A blind flange is bolted on the containment end of the transfer tube to seal the reactor containment. The terminus of the tube outside the containment is closed by a valve.

E. Spent Fuel Assembly Handling Tool

The spent fuel assembly handling tool (figure 9.1.4-6) is used to handle new and spent fuel assemblies in the fuel storage area. It is a manually actuated tool, suspended from the fuel handling machine, which uses four cam-actuated latching fingers to grip the underside of the fuel assembly top nozzle. The operating handle for actuating the fingers is located at the top of the tool. When the fingers are latched, a pin is inserted into the operating handle, which prevents the fingers from being accidentally unlatched during fuel handling operations.

F. New Fuel Assembly Handling Tool

The new fuel assembly handling tool (figure 9.1.4-7) is used to lift and transfer fuel assemblies from the new fuel shipping containers to the new fuel storage racks or new fuel elevator. A manually actuated tool, suspended from the cask crane or fuel handling machine, it uses four cam-actuated latching fingers to grip the underside of the fuel assembly top nozzle. The operating handle which actuates the fingers is located at the side of the tool. When the fingers are latched, the safety screw is turned in to prevent the accidental unlatching of the fingers.

G. Integrated Head Package

The integrated head package is a system which combines the head lifting rig, seismic platform, lift columns, reactor vessel missile shield, control rod drive mechanism (CRDM) forced air-cooling system, and electrical and instrumentation cable routing into an efficient, one-package reactor vessel head design. A permanent reactor vessel head radiation shield (PHS) is installed on the integrated head package. The PHS protects refueling and maintenance personnel from the major sources of radiation emanating from the reactor vessel head area and the CRDM coil stacks and is designed to allow access for maintenance and inspection activities.

1. Cooling Shroud Structure

   The cooling shroud structure provides support for the CRDM cooling system fans and the stud tensioner hoists. Cooling air is directed through openings in the shroud, down along the mechanisms, back up the shroud through the CRDM cooling fans; it is finally exhausted upward into the containment atmosphere. Four fans are provided: two provide the design flowrate, while the other two are held in reserve. The shroud structure is bolted to a support ring on the reactor vessel head and is also attached to the three lift columns. The shroud also provides support for the CRDM power and instrumentation (reactor protection instrumentation and thermocouple) cables. Cables are routed from the mechanisms to the connector plate which is attached to the shroud. Connectors are provided on the connector plate so that the cable tray bridge with the cables may be easily removable. Access is also provided through the shroud for use of a thermocouple (T/C) column loading tool.

2. Missile Shield

   The reactor vessel missile shield is used to prevent any postulated missiles from the reactor vessel head appendages from penetrating other reactor coolant system pressure boundaries and/or containment structures. In addition to this function, the missile shield also transfers the reactor vessel head load to the lifting rig. The missile shield also provides seismic support for the CRDMs. Attached to the three lift rods during plant operation, the missile shield can be properly leveled for the lift operation and can be easily detached from the lift rods to provide access to the CRDMs.

3. Cable Tray Bridge

The cable tray bridge is a structure which is attached to the cooling shroud and pivots on the steam generator wall or another appropriate support structure. The cable tray bridge serves to support the power and instrumentation cables from the shroud to the terminal boxes. It also provides a method of easily disassembling and storing the cables in preparation for head removal.

4. Stud Handling System

By providing the capability of handling studs independently of the main polar crane, the stud handling system permits more efficient and smoother stud handling. Studs and stud tensioners are handled by the hoists supported from a monorail on the shroud structure. Radial travel of studs and stud tensioners is also provided through transfer beam assemblies to improve the flexibility of stud movement. The Unit 2 stud handling hoists are only installed for stud handling activities.

H. Reactor Vessel Head Assembly Lifting Device

The reactor vessel head assembly lifting device consists of a welded and bolted structural steel frame with suitable rigging to enable the crane operator to lift the head and store it during refueling operations. The lifting device is permanently attached to the reactor vessel head.

I. Reactor Internals Lifting Device

The reactor internals lifting device (figure 9.1.4-8) is a structural frame suspended from the overhead crane. The frame is lowered onto the guide tube support plate of the internals and is mechanically connected to the support plate by three breech-lock-type connectors. Bushings on the frame engage guide studs in the vessel flange to provide guidance during removal and replacement of the internals package.

J. Reactor Vessel Stud Tensioner

The quick-acting stud tensioners (figure 9.1.4-9) are employed to secure the head closure joint at every refueling. The stud tensioner is a hydraulically operated device that uses oil as the working fluid. The device permits preloading and unloading of the reactor vessel closure studs at cold shutdown conditions. Stud tensioners minimize the time required for the tensioning or unloading operation. Six tensioners are provided and are applied simultaneously to studs located 60° apart. A single hydraulic pumping unit operates the tensioners, which are hydraulically connected in series. The studs are tensioned to their operational load in two steps to prevent high stresses in the flange region and unequal loadings in the studs. Relief valves on each tensioner prevent overtensioning of the studs due to excessive pressure.

K. Rod Control Cluster Assembly (RCCA) Change Tool

The rod control cluster assembly (RCCA) change tool is a device used to remove an RCCA from one assembly and transfer it to another assembly in the spent fuel pit or to an insert fixture in the spent fuel racks. The RCCA change tool is portable and is lowered by the fuel handling machine bridge hoist until it rests on the nozzle of the desired fuel assembly. The gripper actuator is then lowered and latched onto the RCCA spider which allows the entire RCCA to be drawn up inside the guide tube of the tool. Once this operation is completed, the tool may be repositioned over another fuel assembly. The above process is then reversed for reinsertion of the RCCA.

L. Thimble Plug Change Tool

The thimble plug change tool is a device used to remove a thimble plug from a fuel assembly, and transfer it to another assembly in the spent fuel pit or to an insert fixture in the spent fuel racks. The thimble plug change tool is portable and is lowered by the fuel handling machine bridge hoist until it rests on top of the desired fuel assembly. The gripper actuator is then lowered and latched onto a thimble plug. The thimble plug is then drawn up into the tool, and the tool may be repositioned over another fuel assembly.

The above process is then reversed for reinsertion of the thimble plug.

M. Burnable Poison Rod Assembly (BPRA) Handling Tool

The BPRA handling tool is used to transfer BPRAs between fuel assemblies or to or from a fuel assembly, and a rack insert fixture in the spent fuel pit. The BPRA handling tool is portable and is lowered by the fuel handling machine bridge hoist until it rests on the top of the desired fuel assembly. The gripper actuator is then lowered and latched onto a BPRA, and the BPRA is drawn up inside the tool. The tool may then be repositioned over the location to which it is to be transferred and the process is reversed to reinsert the BPRA.

9.1.4.2.5 Applicable Design Codes

The design codes and standards used for the LLHS are given in table 3.2.2-1 and paragraph 9.1.4.3.

9.1.4.3 Safety Evaluation

9.1.4.3.1 Safe Handling

Design criteria for the LLHS are as follows:

A. The primary design requirement of the equipment is reliability. A conservative design approach is used for all load bearing parts. Where possible, components are used that have a proven record of reliable service. Throughout the design, consideration has been given to the fact that the equipment spends long idle periods stored in an atmosphere of 120°F and high humidity.

B. Except as otherwise specified, the refueling machine and fuel handling machine are designed and constructed in accordance with Crane Manufacturers Association of America, Inc. (CMAA), Specification 70 for Class A-1 service.

C. The static design loads for the crane structures and all lifting components are normal dead and live loads plus three times the fuel assembly weight with an RCCA.

D. The allowable stresses for the refueling machine and fuel handling machine structures supporting the weight of a fuel assembly are as specified in the American Society of Mechanical Engineers Boiler and Pressure Vessel (ASME B&PV) Code Section III, Appendix XVII, Subarticle 2200.

E. The design load on the wire rope hoisting cables does not exceed 0.20 times the average breaking strength. Two independent cables are used, and each is assumed to carry one half the load.

F. All components critical to the operation of the equipment or located so that parts can fall into the reactor are assembled with the fasteners restrained from loosening under vibration.

Industrial codes and standards used in the design of the fuel handling equipment are as follows:

A. The refueling machine and fuel handling machine: Applicable sections of CMAA Specification 70.

B. Structural equipment: ASME B&PV Code, Section III, Appendix XVII, Subarticle 2200.

C. Fuel transfer tube: ASME Code, Section III, Class MC.

D. Electrical equipment: Applicable standards and requirements of the National Electric Code, and National Fire Protection Association (NFPA) 70 for design, installation, and manufacturing.

E. Materials: Main load bearing materials conform to the specifications of the American Society of Testing Materials (ASTM) standards.

F. Safety: Occupational Safety and Health Administration (OSHA) standards, 29 CFR 1910 and 1926, including load testing requirements, the requirements of American National Standards Institute (ANSI) N18.2, Nuclear Regulatory Commission (NRC) Regulatory Guide 1.29, and General Design Criteria 61 and 62.

9.1.4.3.1.1 Refueling Machine. The refueling machine design includes the following provisions to ensure safe handling of fuel assemblies:

A. Safety Interlocks

Operations which could endanger the operator or damage the fuel or RCCA, designated below by an asterisk (*), are prohibited by mechanical or fail-safe electrical interlocks or by redundant electrical interlocks. All other interlocks are intended to provide equipment protection and may be implemented either mechanically or by electrical interlock, not necessarily fail-safe. Fail-safe electrical design of a control system interlock is applied according to the following rules:

- Fail-safe operation of an electrically operated brake is such that the brake engages on loss of power.
- Fail-safe operation of an electrically operated clutch is such that the clutch engages on loss of power.

- Fail-safe operation of a relay is such that the de-energized state of the relay inhibits unsafe operation.

- Fail-safe operation of a switch, termination, or wire is such that breakage or high resistance of the circuit inhibits unsafe operation. The dominant failure mode of the mechanical operation of a cam-operated limit switch is sticking of the plunger in its depressed position. Therefore, use of the plunger-extended position (on the lower part of the operating cam) to energize a relay is consistent with fail-safe operation.

- Fail-safe operation of an electrical comparator or impedance bridge is not defined.

Those parts of a control system interlock required to be fail-safe which are not or cannot be operated in a fail-safe mode as defined in these rules are supplemented by a redundant component or components to provide the requisite protection.

* 1. The refueling machine can only place a fuel assembly in the core or FTS.

* 2. When the refueling machine gripper is supporting a fuel assembly, the machine can traverse in the run mode after the fuel assembly is withdrawn into the stationary mast.

* 3. When the refueling machine gripper is not supporting a fuel assembly, the machine can traverse in the run mode after the gripper is withdrawn to a safe height above the fuel assembly.

* 4. Simultaneous traversing and hoisting operations are prevented.

* 5. The refueling machine is restricted to raising a fuel assembly or core component to a height at which the water provides a safe radiation shield.

* 6. When a fuel assembly is raised or lowered, interlocks ensure that the refueling machine can only apply loads which are within safe operating limits.

* 7. The fuel gripper is monitored by limit switches to confirm operation to the fully engaged or fully disengaged position. An audible and visual alarm is actuated if both engage and disengage switches are actuated at the same time or if neither is actuated.

8. Lowering of the guide tube is not permitted if slack cable exists in the hoist.

9. The guide tube is prevented from lowering completely out of the mast.

10. Before the fuel gripper can release a fuel assembly, the fuel gripper must be in its down position in the core or in the FTS.

* 11. The weight of the fuel assembly must be off the gripper before the fuel gripper can release a fuel assembly.

12. The FTS container is prevented from moving unless the engaged gripper is in the full up position or the disengaged gripper is withdrawn into the mast or unless the refueling machine is out of the fuel transfer zone. An interlock is provided from the refueling machine to the FTS to accomplish this.

B. Bridge and Trolley Hold-Down Devices

Both refueling machine bridge and trolley are horizontally restrained on the rails by two pairs of guide rollers, one pair at each wheel location on one truck only. The rollers are attached to the bridge truck and contact the vertical faces on either side of the rail to prevent horizontal movement. Vertical restraint is accomplished by antirotation bars located at each of the four wheels for both the bridge and trolley. The antirotation bars are bolted to the trucks and extend under the rail head. Both horizontal and vertical restraints are adequately designed to withstand the forces and overturning moments resulting from the SSE.

C. Main Hoist Braking System

The main hoists are equipped with two independent braking systems. A solenoid release, spring-set electric brake is mounted on the motor shaft. This brake operates in the normal manner to release upon application of current to the motor and to set when current is interrupted. The second brake is a mechanically actuated load brake internal to the hoist gear box that sets if the load starts to overhaul the hoist. It is necessary to apply torque from the motor to raise or lower the load. In raising, this motor cams the brake open; in lowering, the motor slips the brake allowing the load to lower. This brake actuates upon loss of torque from the motor for any reason and is not dependent on any electrical circuits. Both brakes are rated at 125 percent of the hoist design load.

D. Fuel Assembly Support System

The main hoist system is supplied with redundant paths of load support such that failure of any one component will not result in free fall of the fuel assembly. Two wire ropes are anchored to the winch drum and carried to a load equalizing mechanism on the top of the gripper tube.

The working load capacity of fuel assembly gripper is approximately 3000 lb. The gripper itself has four fingers gripping the fuel, any two of which will support the fuel assembly weight.

During each refueling outage and prior to removing fuel, the gripper and hoist system are routinely load tested to 125 percent of the maximum setting on the hoist load limit switch.

9.1.4.3.1.2 Fuel Transfer System. The following safety features are provided for in the FTS:

A. Transfer Car Permissive Switch

The transfer car controls are located in the fuel building, and conditions in the containment are therefore not visible to the operator. The transfer car permissive switch allows a second operator in the containment to exercise some control over car movement if conditions visible to him warrant such control.

Transfer car operation is possible only when both lifting arms are in the down position as indicated by the limit switches. The permissive switch is a backup for the transfer car lifting arm interlock. Assuming the fuel container is in the upright position in the containment and the lifting arm interlock circuit fails in the permissive condition, the operator in the fuel storage area still cannot operate the car because of the permissive switch interlock. The interlock therefore can withstand a single failure.

B. Lifting Arm - Transfer Car Position

Two redundant interlocks allow lifting arm operation only when the transfer car is at the end of its travel and therefore can withstand a single failure.

Of the two redundant interlocks which allow lifting arm operation only when the transfer car is at the end of its travel, one interlock is a position limit switch in the control circuit. The backup interlock is a mechanical latch device on the lifting arm that is opened by the car moving into position.

C. Transfer Car - Valve Open

An interlock on the transfer tube valve permits transfer car operation only when the transfer tube valve position switch indicates the valve is fully open and therefore can withstand single failure.

D. Transfer Car - Lifting Arm

The transfer car lifting arm is primarily designed to protect the equipment from overload and possible damage if an attempt is made to move the car while the fuel container is in the vertical position. This interlock is redundant and can withstand a single failure. The basic interlock is a position limit switch in the control circuit. The backup interlock is a mechanical latch device that is opened by the weight of the fuel container when in the horizontal position.

E. Lifting Arm - Refueling Machine

The containment side lifting arm is interlocked with the refueling machine. Whenever the transfer car is located in the refueling canal, the lifting arm cannot be operated unless the refueling machine mast is inside the stationary mast, the refueling machine is over the core, or the gripper is released and inside the stationary mast.

F. Lifting Arm - Fuel Handling Machine

On the spent fuel pool side, the lifting arm is interlocked with the fuel handling machine. The lifting arm cannot be operated unless the fuel handling machine is not over the lifting arm area.

9.1.4.3.1.3 <u>Fuel Handling Machine</u>. The fuel handling machine includes the following safety features:

A. The fuel handling machine controls are interlocked to prevent simultaneous operation of bridge drive and hoist.

requirements of ANSI N14.6 as supplemented by NUREG 0612. The reactor coolant pump motor lifting device, the refueling machine maintenance lifting device, and heat exchanger lift rigs will meet the intent of NUREG 0612 and ANSI N14.6-1978. The refueling machine gripper mast is an integral part of the refueling machine which is discussed in paragraph 9.1.4.2.4A. The lifting devices associated with the stud turnout tool and stud tensioner are integral to the turnout tool and tensioner. A failure of these lifting devices would lead to the same acceptable consequences as a hoist failure.

9.1.5.2.3.4.1 Integrated Head Package Lifting Rig. The integrated head package lifting rig is a three-legged carbon steel structure, approximately 42-ft high and 15 ft in diameter, weighing approximately 12,000 lb. It is used to handle the assembled reactor vessel head. The lift assembly consists of a tripod-shaped steel structure that attaches to the missile shields and lift rods which attach to the reactor vessel head.

9.1.5.2.3.4.2 Internals Lifting Rig. The internals lift rig is a three-legged carbon and stainless steel structure, approximately 30 ft high and 14 ft in diameter, weighing approximately 17,850 lb. It is used to handle the upper and lower reactor vessel internals packages. It is attached to the main crane hook for all internals lifting, lowering, and traversing operations. A load cell linkage is connected between the main crane hook and the rig to monitor loads during all operations. When not in use, the rig is stored on the upper internals storage stand. The rig may be temporarily stored on the operating deck or the structural steel at el 261 ft during maintenance activities.

The internals lift rig attaches to the internals package by means of three rotolock studs which engage three rotolock inserts located in the internals flange. These rotolocks studs are manually operated from the internals lift rig platform using a handling tool which is an integral part of the rig. The studs are normally spring retracted upward and are depressed to engage the inserts. Rotating the mechanism locks it in both positions.

9.1.5.2.3.4.3 Load Cell and Load Cell Linkage. The load cell is used to monitor the load during lifting and lowering of the integrated head package or internals to ensure that no excessive loadings are occurring. The unit is a load-sensing clevis type, rated at 500,000 lb.

This load cell is a part of the load cell linkage, which is an assembly of pins, plates, and bolts that connect the polar crane main hook to the lifting blocks of both the reactor vessel head and the internals lift rigs.

9.1.5.2.3.4.4 Other Cranes Inside Containment. Table 9.1.5-3 lists the OHLHS housed inside containment. The system description and safety evaluation of the refueling machine is discussed as a part of the light load handling system in paragraphs 9.1.4.2.4 and 9.1.4.3.1.1. The radial arm stud tensioner hoist assemblies are provided as a part of the integrated head package and are discussed in paragraph 9.1.4.2.4.G. The Unit 2 hoists are not permanently installed plant equipment. A 2-ton monorail with hoist is provided to remove the steel hatch plugs which provide access to the fuel transfer blind flange. A 3-ton, wall-mounted, cantilever jib crane is provided above the operating deck in the vicinity of each reactor coolant pump to remove the grating and perform any miscellaneous maintenance activities associated with the reactor coolant pumps. Two 3-ton, wall-mounted, cable bridge winches are provided for each of the integrated head cable bridges. Paragraph 9.1.4.2.4.G.3 provides a discussion of the cable bridge. A 1-ton "6" shaped monorail is provided in the pressurizer compartment to remove the pressurizer relief valves. A 20-ton hoist is provided for opening and closing the equipment hatch cover.

9.1.5.2.4 Miscellaneous Cranes and Hoists

Miscellaneous cranes and hoists are provided to service and maintain mechanical equipment. Hoists and cranes have adequate capacity to perform lifting of components necessary for maintenance and are designed to industry standards as listed in table 9.1.5-2. The associated monorails are designed per the applicable AISC specifications.

Table 9.1.5-2 lists equipment that may be lifted and includes hoist/crane capacity, load weight, maximum lift height, and reference to figures showing the load paths.

9.1.5.2.5 Lifting Devices Not Specifically Designed

The slings associated with the OHLHS will be selected based on the criteria established by NUREG 0612 and ANSI B30.9 with the clarification that the dynamic loadings associated with the acceleration and deceleration of the load (based on maximum hoisting speeds) are a small fraction of the static load and that revising the selection criteria stated in ANSI B30.9 to accommodate them would not have a substantial effect on the load handling reliability. The slings will be marked in accordance with ANSI B30.9 requirements. Load handling procedures will specify the slings and other devices used with the slings to make a complete lifting device, that are required for handling the load.

9.1.5.3 Safety Evaluation

A. The spent fuel cask bridge crane and the polar crane are designed as Seismic Category 1 to ensure they withstand the effect of an SSE.

B. The spent fuel cask bridge crane is designed to be single failure proof to prevent a load from being dropped in the event of a single failure.

C. The spent fuel cask bridge crane is shared between Units 1 and 2 to the extent that spent fuel cask handling is performed in a common area of the fuel handling building. The sharing of the spent fuel cask bridge crane does not impair the safety of the plant.

D. The safety-related Seismic Category 1 spent fuel cask bridge crane and fuel handling building ensures that fuel handling and storage systems, structures, and components are designed for adequate safety during normal and accident conditions.

E. The design and operation of the OHLHS is such that the design features of the OHLHS; i.e, single failure proof, or the consequences of a failure are acceptable to ensure the capability to safely shut down the plant, remove decay heat, and maintain doses within prescribed limits.

F. The OHLHS conforms with the applicable portions of codes and standards invoked for the OHLHS design, operation, inspection, testing, and maintenance.

G. For the purposes of operator qualification, a heavy load is a load whose weight is greater than the combined weight of a single spent fuel assembly and its handling tool.

   Heavy load crane operators shall be trained and qualified and conduct themselves in accordance with Chapter 2 and 3 of ANSI B30.2 1976 "Overhead and Gantry Cranes."

H. Spent fuel, safe shutdown equipment, and decay heat removal equipment are separated and evaluated to ensure that potential load drops from OHLHS will not jeopardize the safety of the plant. Sufficient redundancy has been designed into safety-related systems to ensure that potential load drops will not preclude safe shutdown or decay heat removal.

A review of OHLHS was performed in accordance with NUREG-0612 and following the guidelines of enclosure 3 to the Nuclear Regulatory Commission generic letter dated December 22, 1980, as amended on February 3, 1981. The OHLHS in the following buildings were reviewed:

- Auxiliary building.
- Fuel handling building.
- Containment building.
- Control building.
- Diesel generator building.
- Auxiliary feedwater pumphouse.
- Nuclear service cooling water pumphouse.
- Alternate radwaste building.

The turbine and radwaste transfer buildings do not house spent fuel, safe shutdown equipment, or decay heat removal equipment and therefore was not reviewed.

A review of plant arrangements was performed to evaluate load drops from OHLHS. The results of the review are shown in tables 9.1.5-2 through 9.1.5-4. Table 9.1.5-2 provides an evaluation of OHLHS with the exception of those used in the containment and fuel handling systems. Table 9.1.5-3 provides a listing of containment building overhead load handling systems. The fuel handling building spent fuel cask bridge crane and fuel handling systems are listed in table 9.1.5-4. The location and envelope of load handling devices are shown on drawings 1X4DE502, 1X4DE503, 1X4DE504, 1X4DE505, 1X4DE506, 1X4DE507, 1X4DE508, 1X4DE509, 1X4DE510, 1X4DE511, 1X4DE512, 1X4DE513, 1X4DE514, 1X4DE515, 1X4DE516, 1X4DE517, 1X4DE518, 1X4DE519, 1X4DE520, 1X4DE521, 1X4DE522, 2X4DE502, 2X4DE503, 2X4DE504, 2X4DE505, 2X4DE506, 2X4DE507, 2X4DE508, 2X4DE509, 2X4DE510, 2X4DE511, 2X4DE512, 2X4DE514, 2X4DE515, 2X4DE516, 2X4DE517, 2X4DE518, 2X4DE519, 2X4DE520, 2X4DE521, 2X4DE522, AX4DE500, and AX4DE503.

The OHLHS were evaluated to identify interactions which could damage safety-related equipment. For those loads that do not pass over safety-related equipment, no further evaluation is performed. Other loads are excluded based on separation of center line of the reactor over an inoperable RHR train as long as the alternate RHR train is operable and in operation, or over an operating RHR train as long as the other train is operable and in standby.

B. Mode 5 (cold shutdown with loops not filled), requires that two RHR trains shall be operable and at least one RHR train shall be in operation. Under these conditions, there are no additional restrictions on the movement of the RCP motor load within the designated RCP safe load path.

C. Mode 6 (refueling mode when the water level above the reactor vessel flange is greater than or equal to 23 ft) requires that one RHR train shall be operable and in operation. The RCP motor load could travel within the RCP safe load path to the north-south center line of the reactor over an inoperable RHR train (or other project class 111 large bore pipe) as long as the alternate RHR train is operable and in operation, or over an operating RHR train as long as the other train is operable and in standby. During the lift, there shall not be any fuel movement in progress.

D. Mode 6 (refueling mode when the water level above the reactor vessel flange is less than 23 ft) requires that two RHR trains shall be operable and one RHR train in operation. The RCP motor load may be moved anywhere within the designated RCP safe load path as long as no fuel movement is in progress.

The specific load path is defined on drawing 1X4DE602.

During refueling operations a postulated load drop in the vicinity of the reactor coolant pump hatches could result in water leakage from the RCS that could uncover in-transit fuel in the refueling canal or spent fuel pool (via the transfer tube). To preclude this occurrence, the restrictions described below shall be placed on using the reactor coolant pump jib cranes and/or the polar crane above the reactor coolant pump hatches while irradiated fuel is being moved inside containment, or while the transfer tube isolation valve is open and irradiated fuel is being moved in the fuel handling building:

A. Maximum lift weights and heights shall be limited to the values given in figure 9.1.5-3 for lifted loads traveling over the reactor coolant pump hatches with the grating for the platform at el 220 ft 0 in. in place.

B. The reactor coolant pump jib crane and the polar crane shall not be used directly above or inside the reactor coolant pump hatches when the grating at el 220 ft 0 in. is removed.

9.1.5.3.1.1.5 Internals Lifting Rig. Anticipated heavy load movements have been analyzed and safe load paths defined, as discussed in paragraph 9.1.5.3.1.1.1. When not in use, the rig is normally stored on the upper internals storage stand. However, movement of the rig to the operating deck or el 261 ft structural steel floor is required for temporary storage during maintenance activities. For these temporary storage cases, safe load path considerations are based on administrative controls and comparison with analyzed cases, previously defined safe movement areas, and previously defined restricted areas.

The specific load path for the temporary storage location is defined on drawing 1X4DE604.

9.1.5.3.1.1.6 Carbon Bed Containers. It is expected that the carbon in the containment building pre-access filtration units will need to be replaced several times over the life of the plant. As part of this activity, two special temporary containers will be brought into containment, lifted and placed on the floor at el 261 ft-0 in. with the polar crane. Each container weighs approximately 18,000 pounds when filled with carbon. When the carbon bed replacement is completed, the containers will be removed from containment. For the temporary placement of these containers, safe load considerations are based on administrative controls and comparison with analyzed cases, previously defined safe load movement areas, and previously defined restricted areas.

The specific load path for these temporary containers is defined on drawing 1X4DE608.

9.1.5.3.1.2 Other Cranes Inside Containment. The safety evaluation of the refueling machine is discussed in paragraph 9.1.4.3.1.1. The effect of dropping a load from the reactor coolant pump maintenance jib crane onto the pump motor stand was evaluated. A drop from 37 ft will not cause buckling of the pump support columns nor yielding of the primary coolant piping. A load drop from the radial arm stud tensioner hoist assemblies could occur only when the integrated head is in place. When in its fully extended position on the radial arm, a postulated drop would land on the seal ring and would not damage the reactor vessel or decay heat removal capability. As shown in table

REV 9 5/00
REV 8 10/98
REV 6 4/97
REV 5 9/95
REV 4 4/94
REV 2 3/92
REV 1 3/91

9.1.5-3, the postulated load drops from the remaining monorails will not preclude decay heat removal capability or damage fuel. See paragraph 9.1.5.3.1.1.4 for discussion of concurrent refueling operations and use of the reactor coolant pump maintenance jib crane.

9.1.5.3.2 Postulated Loads Inside Fuel Handling Building

There are three OHLHS associated with the fuel handling building: the cask lifting device jib crane, the spent fuel cask bridge crane (SFCBC), and the fuel handling machine. A drop from the cask lifting device jib crane from its maximum possible height was analyzed and determined not to impact safety-related equipment or compromise the integrity of the spent fuel pool. Because of the 8-ft proximity of the jib crane to the spent fuel pool, minimum lift heights will be utilized for the use of the jib crane to preclude the potential for a load to tip or roll into the spent fuel pool.

The spent fuel cask bridge crane operates in the fuel handling and railroad car bay of the auxiliary building. It is anticipated that the lifts made by the spent fuel cask bridge crane associated with the spent fuel cask, new fuel shipping containers, and new fuel assemblies will be small compared to the miscellaneous equipment and maintenance lifts that will occur in the auxiliary building. For those SFCBC loads which are handled in the fuel handling building, specific procedures will be utilized. The SFCBC main hoist conformance with NUREG 0554 is shown in table 9.1.5-5.

A postulated load drop of 5 tons from the auxiliary hoist of the SFCBC has been analyzed and determined not to compromise the integrity of the spent fuel pool. The movement of the new fuel containers is governed by a specific procedure that defines the safe load path in the fuel handling building (drawing 1X4DE603) to maximize the distance between the load and the spent fuel pool. The analysis of a postulated load drop from the monorail hoist of the SFCBC is enveloped by the auxiliary hoist analysis discussed above. The movement of the new fuel assemblies from the new fuel containers does not qualify as a heavy load. If heavy loads other than those specified in table 9.1.5-4 are to be moved within the fuel handling building, the safe load paths to maintain maximum distance between the load path and the spent fuel pools will be reviewed and approved by the plant review board. In addition, if the safe load path is within 15 ft of the spent fuel pool, the review board will review any special equipment (safety cables, etc.) or geometric arguments that would preclude the load from rolling or tipping into the spent fuel pool. The safety evaluation of the fuel handling machine is discussed in paragraph 9.1.4.3.1.3. Periodically, it will be necessary to replace the seals associated with the spent fuel pool gates between the pool and the cask loading pit and the pool and the fuel transfer canal. The gate seal removal for both the transfer canal and cask loading pit seal will utilize the fuel handling machine to remove the seal and transport it to the cask loading pit. The seal will then be transferred to the monorail hoist of the SFCBC and placed in an acceptable work area. The seal frame weighs approximately 1500 lb, which classifies it as a light load. Administrative controls and safety cables will ensure that minimum lift heights will be followed and minimum drop heights would occur. Movement of the seal over fuel assemblies will be minimized whenever possible.

9.1.5.3.3 Postulated Loads Inside Other Buildings

The effects of postulated load drops in the auxiliary building, lower levels of the fuel handling building, diesel generator building, auxiliary feedwater pumphouse, and nuclear service cooling water pumphouse have been evaluated. Table 9.1.5-2 lists each of the loads and the bases for satisfying the NUREG 0612 criteria.

All loads, except five, postulated in table 9.1.5-2 can be excluded from the NUREG 0612 requirements based on not compromising the ability of safety-related equipment to perform its safety function or preclude decay heat removal.

A postulated drop of 6000 lb and 18 ft from the backflushable filter/hatch covers/resin charging tank hoist on level B of the auxiliary building was analyzed. It was determined that a drop from this height could cause sufficient secondary missiles on level D that the ability to safely shut down could be compromised. The only safe shutdown equipment/components that would be affected are located under the mezzanine area. By analysis, a safe load height was determined such that a postulated drop would not compromise components on level D. The safe load height of 3 ft is incorporated into the safe load path shown on drawing 1X4DE605. This safe load path will be administratively controlled and will be a part of the load handling procedures described in paragraph 9.1.5.6.

The analysis of a postulated drop of 8000 lb and 9 ft 8 in. from the cartridge filter hatch cover and filter cask hoist on level D of the auxiliary building determined that a drop in the area of the boric acid filter on level D from a height greater than 1 ft would compromise the ability of the boric acid filter to function. The safe load path for the OHLHS is shown on drawings 1X4DE606 and 2X4DE601.

A postulated load drop of the residual heat removal (RHR) heat exchanger would compromise the redundant train of residual heat removal and the redundant train of the nuclear service cooling water system. In addition to crane operator qualification load handling procedures and conformance of lifting devices (sling and associated devices) with ANSI B30.9-1971, an inspection of the monorail, hoist, lifting device (sling and associated devices), and lifting lug attached to the heat exchanger will be performed prior to the lift.

The analysis of a postulated drop of the equipment hatch cover (4000 lbs) on the 6-inch slab at the roof of Unit 2 control building, level 3, determined that a drop from a height greater than 6 feet could cause the roof to collapse and compromise the ability to shut down Unit 2. The safe load path for the OHLHS is shown on drawing 2X4DE600.

The analysis of a postulated drop of the auxiliary feedwater pumphouse sump pump hatch cover (approximately 25,000 lbs), on the auxiliary feedwater pumphouse roof, determined that a drop in this area from a height greater than 2 feet might cause the roof to collapse and compromise the ability to safely shut down. The safe load path for the OHLHS is shown on drawing 1X4DE607.

9.1.5.4 Tests and Inspections

Selected load carrying mechanical components subject to repeated stress undergo nondestructive examination in the shop.

Preoperational testing is performed in the field to demonstrate acceptable performance of mechanical and electrical components. The cask crane and polar crane main hook and auxiliary hook are load tested to 125 percent of hoist rating in accordance with ANSI B30.2. The ability of these cranes to handle loads smoothly within the design speed range is demonstrated by testing in accordance with Occupational Safety and Health Administration (OSHA) P 1910.

Prior to use, components and interfacing portions of the components are checked to ensure proper matchup and verify they are free of foreign or loose parts.

Test, inspection, and maintenance of OHLHS are performed in accordance with the manufacturer recommendations and will be consistent with ANSI B30.2 or with appropriate ANSI standards with the clarification that when the crane use frequency is less than the specified test or inspection frequency, the test or inspection will be done prior to crane use.

9.1.5.5 Instrumentation Applications

Mechanical and electrical interlocks are provided when required to ensure the proper and safe operations of OHLHS.

The OHLHS are equipped with limit switches as appropriate to prevent improper travel and ensure safe operation of OHLHS. Specific details and descriptions of OHLHS are provided in paragraph 9.1.5.2.

9.1.5.6 Load Handling Procedures

Load handling operations for heavy loads that are or could be handled over or in proximity to irradiated fuel or safe shutdown equipment are controlled by written procedures. As a minimum, procedures will be used for handling loads with spent fuel cask bridge crane and polar crane, and for those loads listed in table 3-1 of NUREG 0612. Each procedure will address:

- The specific equipment required to handle load (e.g., special lifting device, slings, shackles, turnbuckles, clevises, load cell, etc.).
- The requirements for crane operator and riggers qualification.
- The requirements for inspection prior to load movement and acceptance criteria for inspection.
- The defined safe load path and provisions to provide visual reference to the crane operator and/or signal person of the safe load path envelope.
- Specific steps and proper sequence to be followed for handling load.
- Precautions, limitations, prerequisites, and/or initial conditions associated with movement of the load.

Slings and other devices used with the sling to make a complete lifting device that are specified in the load handling procedures will conform to NUREG 0612 and ANSI B30.9 as described in paragraph 9.1.5.2.5.

Equipment layout drawings showing the safe load path will be used to define safe load paths in load handling procedures. Deviation from defined safe load paths will require a written alternative procedure approved by the Plant Review Board.

TABLE 9.1.5-2 (SHEET 1 OF 12)

EVALUATION OF OVERHEAD HEAVY LOAD HANDLING SYSTEMS

Equipment[(a)]	Hoist/Crane[(b)] Capacity (lb)	Design[(i)] Standard	Load Weight (lb)	Maximum[(c)] Vertical Lift (ft)	Safety-[(d)] Related Item in Load Path	Safety-[(e)] Related Item on Lower Elevation	Basis[(f)] for Con-formance/ Exclusion	Reference[(g)] Drawings	Remarks
				Auxiliary Building - Level D					
RHR pump A	6,000	3	5,000	14	Yes	No	2	1X4DE521 2X4DE521	
RHR pump B	6,000	3	5,000	14	Yes	No	2	1X4DE521 2X4DE521	
Cartridge filter hatch covers and filter cask	8,000	3,4	6,000	14	Yes	No	6	1X4DE521 2X4DE521	
Containment spray pumps A and B (2)	6,000	3	4,280	8	Yes	No	2	1X4DE521 2X4DE521	
				Auxiliary Building - Level C					
Centrifugal charging pump A	12,000	3	7,500	12	Yes	Yes	3	1X4DE522 2X4DE522	
Centrifugal charging pump B	12,000	3	7,500	12	Yes	No	2	1X4DE522 2X4DE522	
Positive displacement charging pump	12,000	3	12,000	12	Yes	No	2	1X4DE522 2X4DE522	
RHR and containment spray valve encapsulation vessels and concrete hatch covers (2)	12,000	3	10,600, 6,670	8	Yes	Yes	3	1X4DE522 2X4DE522	
Steam generator blowdown heat exchangers (2)	3,000	3	2,200	8	No	Yes	3	1X4DE522 2X4DE522	

TABLE 9.1.5-2 (SHEET 2 OF 12)

Equipment	Hoist/Crane Capacity (lb)	Design Standard	Load Weight (lb)	Maximum Vertical Lift (ft)	Safety-Related Item in Load Path	Safety-Related Item on Lower Elevation	Basis for Conformance/ Exclusion	Reference Drawings	Remarks
Boron recycle (6) holdup tank diaphragm	2,000	3	1,320	12	No	No	1	1X4DE522 2X4DE522	
Boric acid[h] batching tank	2,000	2,3,4	150	8	No	No	1	1X4DE522	
Boron recycle[h,j] evaporator package components	3,000	2,3	2,200	19	No	No	1	1X4DE522 2X4DE522	
Waste evaporator package components[j]	3,000	2,3	2,200	19	No	No	1	1X4DE522 2X4DE522	
Auxiliary Building - Level B									
Auxiliary component cooling water (ACCW) pumps (2)	6,000	3	5,730	8	Yes	Yes	3	1X4DE502 2X4DE502	
Safety injection pump A	8,000	3	6,100	8	Yes	Yes	3	1X4DE502 2X4DE502	
Safety injection pump B	8,000	3	6,100	8	Yes	Yes	3	1X4DE502 2X4DE502	
Backflushable filters/hatch covers/resin charging tank/ cartridge filter cask	6,000	3,4	5,600	18	Yes	Yes	6	1X4DE502 2X4DE502	
Filter valve gallery (2)	6,000	3,4	5,400	8	Yes	No	2	1X4DE502 2X4DE502	
Seal water heat exchanger	2,000	3	1,315	6	Yes	Yes	3	1X4DE502 2X4DE502	
Access hatch cover	6,000	3	4,650	12	No	No	1	1X4DE502 2X4DE502	

TABLE 9.1.5-2 (SHEET 3 OF 12)

Equipment	Hoist/Crane Capacity (lb)	Design Standard	Load Weight (lb)	Maximum Vertical Lift (ft)	Safety-Related Item in Load Path	Safety-Related Item on Lower Elevation	Basis for Conformance/ Exclusion	Reference Drawings	Remarks
				Auxiliary Building - Level A					
Spent fuel pit pump	4,000	7	2,150	8	Yes	No	2	1X4DE503 2X4DE503	
Letdown heat exchanger tube bundle	4,000	3	2,350	8	Yes	No	2	1X4DE503 2X4DE503 also shows the letdown reheat heat exchanger tube bundle crane pathway. This crane capacity is < 1 ton.	
Spent fuel pit heat exchanger tube bundle (2)	16,000	3	13,220	8	Yes	No	2	1X4DE503 2X4DE503	
Component cooling water pumps (2)	4,000	3	2,800	8	Yes	Yes	3	1X4DE503 2X4DE503	
Feedwater regulating valves (2)	4,000	3	4,000	8	Yes	Yes	5	1X4DE503 2X4DE503	
Steam generator[h] blowdown filters hatch covers and filter cask	6,000	2,3,4	6,000	14	No	No	1	1X4DE503 2X4DE503	
Sample transport[h] cask from post accident sampling	2,000	2,3	560	8	No	No	1	1X4DE503	
Hot machine[h] shop equipment	4,000	2,4,6	4,000	15	No	Yes	3	2X4DE504	
ACCW heat exchangers		(Heat exchangers are not lifted until they have been rolled outside of the auxiliary building, where they are lifted by a truck crane.)					1X4DE504 2X4DE504		

TABLE 9.1.5-2 (SHEET 4 OF 12)

Equipment	Hoist/Crane Capacity (lb)	Design Standard	Load Weight (lb)	Maximum Vertical Lift (ft)	Safety-Related Item in Load Path	Safety-Related Item on Lower Elevation	Basis for Con-formance/ Exclusion	Reference Drawings	Remarks
Demineralizer hatch/resin charging tank	8,000	2,4	3,830	15	Yes	Yes	3	1X4DE504 2X4DE504	
RHR heat exchanger	30,000	3,4	29,500	55	Yes	Yes	7	1X4DE504 2X4DE504	Vertical lift.
RHR hot leg injection valve HV-8840	4,000	7	4,000	5	No	Yes	2,5	1X4DE503 2X4DE503	Vertical lift.
				Auxiliary Building - Level 1					
RHR heat exchanger	30,000	3,4	29,500	44	Yes	Yes	7	1X4DE504 2X4DE504	Removal lift in hori-zontal position
Equipment hatches/misc equipment from lower levels (2)	12,000	3,4	12,000	150	Yes	No	2	1X4DE504 2X4DE504	
RHR heat exchanger room hatch covers	30,000	3,4	12,700	40	Yes	Yes	3	1X4DE504 2X4DE504	Hatches are on level A and are lifted by RHR heat ex-changer hoist on level 1.
Drum storage(h) area equipment spent filter cartridge	20,000	3,4	14,000	8	No	Yes	3	1X4DE504	
				Auxiliary Building - Level 2					
Main steam safety and isolation valves (3)	8,000	3	6,850	15	Yes	Yes	5	1X4DE505 2X4DE505	
Atmospheric relief valves (2)	4,000	3	3,500	20	Yes	Yes	5	1X4DE505 2X4DE505	

TABLE 9.1.5-2 (SHEET 5 OF 12)

Equipment	Hoist/Crane Capacity (lb)	Design Standard	Load Weight (lb)	Maximum Vertical Lift (ft)	Safety-Related Item in Load Path	Safety-Related Item on Lower Elevation	Basis for Conformance/ Exclusion	Reference Drawings	Remarks
Equipment hatches/ misc equipment from lower levels	10,000	3,4	10,000	35	No	No	2	1X4DE505 2X4DE505	
Equipment hatches/ misc equipment from lower levels	6,000	3,4	6,000	35	No	No	2	1X4DE505 2X4DE505	
Component cooling water heat exchangers		(Heat exchangers are not lifted until they have been rolled outside of the auxiliary building, where they are lifted by a truck crane)					1X4DE505	2X4DE505	
Equipment hatch cover	4,000	3,4	4,000	12	No	No	1	1X4DE505 2X4DE505	
Auxiliary building/stairwell jib crane	4,000	2,3	4,000	127	No	No	1	2X4DE505	
				Auxiliary Building - Roof					
Tendon surveillance equipment (test weights, ram, etc.)	>4,000	3	4,000	8	No	Yes	1	AX4DE503 1X4DE505 2X4DE505	
				Fuel Handling Building - Level C					
RHR encapsulation vessel	12,000	3	10,600	8	Yes	No	2	1X4DE522 2X4DE522	
Containment spray encapsulation vessel	12,000	3	6,670	8	Yes	No	2	1X4DE522 2X4DE522	
Drain sump pumps (2)	4,000	3	1,135	11	No	No	1	1X4DE522 2X4DE522	
				Fuel Handling Building - Level A					
Spent fuel pit heat exchanger tube bundle	16,000	3	13,220	8	Yes	No	2	1X4DE506 2X4DE506	
Spent fuel pit pump	4,000	7	2,220	8	Yes	No	2	1X4DE506 2X4DE506	

TABLE 9.1.5-2 (SHEET 6 OF 12)

Equipment	Hoist/Crane Capacity (lb)	Design Standard	Load Weight (lb)	Maximum Vertical Lift (ft)	Safety-Related Item in Load Path	Safety-Related Item on Lower Elevation	Basis for Con-formance/ Exclusion	Reference Drawings	Remarks
Fuel transfer tube hatch	8,000	3	6,500	18	Yes	No	2	1X4DE506 2X4DE506	
				Fuel Handling Building - Level 1					
Cask lifting device jib crane				(Refer to table 9.1.5-4.)					
Fuel handling[h] machine				(Refer to table 9.1.5-4.)					
				Fuel Handling Building - Level 2					
Sample chase concrete hatch cover	8,000	2,3	5,000	8	Yes	Yes	2	1X4DE509 2X4DE509	
				Fuel Handling Building - Level 3					
Equipment hatch cover	4,000	3,4	4,000	12	No	Yes	1	1X4DE510 2X4DE510	
				Fuel Handling Building - Level 3					
Spent fuel cask bridge crane				(Refer to table 9.1.5-4.)					
				Diesel Generator Building					
Diesel generator A components	10,000	2,4,6	10,000	27	Yes	No	2	1X4DE511 2X4DE511	
Diesel generator B components	10,000	2,4,6	10,000	27	Yes	No	2	1X4DE511 2X4DE511	
Diesel generator A components	6,000	2,4	6,000	27	Yes	No	2	1X4DE511 2X4DE511	Load path enveloped by 10,000-lb hoist/ crane

TABLE 9.1.5-2 (SHEET 7 OF 12)

Equipment	Hoist/Crane Capacity (lb)	Design Standard	Load Weight (lb)	Maximum Vertical Lift (ft)	Safety-Related Item in Load Path	Safety-Related Item on Lower Elevation	Basis for Con-formance/ Exclusion	Reference Drawings	Remarks
Diesel generator B components	6,000	2,4	6,000	27	Yes	No	2	1X4DE511 2X4DE511	Load path enve-loped by 10,000-lb hoist/crane
				Auxiliary Feedwater Pumphouse					
Motor-driven pump A motor	6,000	3	5,000	18	Yes	No	2	1X4DE512 2X4DE512	
Motor-driven pump B motor	6,000	3	5,000	18	Yes	No	2	1X4DE512 2X4DE512	
Turbine-driven pump turbine	6,000	3	4,000	18	Yes	No	2	1X4DE512 2X4DE512	
Auxiliary feedwater pumphouse sump pumps	3,000	7	1,446	12	Yes	No	2	1X4DE512 2X4DE512	
Auxiliary feedwater pumphouse sump pump hatch	-	-	-	-	Yes	No	9	1X4DE512 2X4DE512	Installed lifting equipment is not provided. Truck crane required to move this hatch. The weight of the hatch is approx. 25,000 lb.

TABLE 9.1.5-2 (SHEET 8 OF 12)

Equipment	Hoist/Crane Capacity (lb)	Design Standard	Load Weight (lb)	Maximum Vertical Lift (ft)	Safety-Related Item in Load Path	Safety-Related Item on Lower Elevation	Basis for Con-formance/ Exclusion	Reference Drawings	Remarks
Nuclear Service Cooling Water Pumphouse									
Nuclear service cooling water pumps/hatches	-	-	-	120	Yes	No	2	1X4DE518, 1X4DE519, 2X4DE518, 2X4DE519	Installed-lifting equipment is not provided. A truck crane would be required to move these pumps/ hatches. The actual weight of the pump, driver, and motor is 27,600 lb. The lift height identified is the lift necessary to remove the pump. The weight of the hatch is 6,200 lb.
Control Building - Level B									
Control building sump pumps	3,000	7	220	34 (Unit 1) 5 (Unit 2)	No	No	1	1X4DE520 2X4DE520	
Control Building - Level A									
Feedwater (2) regulating valves	6,000	3	4,000	8	Yes	Yes	5	1X4DE517 2X4DE517	

TABLE 9.1.5-2 (SHEET 9 OF 12)

Equipment	Hoist/Crane Capacity (lb)	Design Standard	Load Weight (lb)	Maximum Vertical Lift (ft)	Safety-Related Item in Load Path	Safety-Related Item on Lower Elevation	Basis for Con-formance/ Exclusion	Reference Drawings	Remarks
				Control Building - Level 1					
Feedwater regulating valves	6,000	3	4,000	36	Yes	Yes	5	1X4DE515 1X4DE516, 2X4DE515, 2X4DE516,	This hoist is used to lift the valves from level A to level 1.
Main steam safety & isolation valves (2)	8,000	3	6,850	15	Yes	Yes	5	1X4DE515, 1X4DE516, 2X4DE515, 2X4DE516	Monorail is located-on level 2.
Atmospheric relief valves	8,000	3	3,500	20	Yes	Yes	5	1X4DE515, 1X4DE516, 2X4DE515, 2X4DE516	
Feedwater isolation valves	3,000	2,3	3,000	16	Yes	Yes	5	1X4DE517 2X4DE517	
				Control Building - Level 2					
Equipment hatch cover (Unit 1 only)	4,000	3,4	4,000	12	No	No	1	1X4DE509	
				Control Building - Level 3					
ESF chilled water chillers	4,000	7	3,500	8	Yes	Yes	2	1X4DE514 2X4DE514	
Equipment hatch cover (Unit 2 only)	4,000	3,4	4,000	12	No	Yes	8	2X4DE510	
				Control Building - Level 4					
Normal chilled[(h)] water chillers	8,000	3	7,000	8	No	Yes	4	1X4DE513	
Normal chilled[(h)] water pumps	8,000	3	6,900	8	No	Yes	4	1X4DE513	

TABLE 9.1.5-2 (SHEET 10 OF 12)

Equipment	Hoist/Crane Capacity (lb)	Design Standard	Load Weight (lb)	Maximum Vertical Lift (ft)	Safety-Related Item in Load Path	Safety-Related Item on Lower Elevation	Basis for Con-formance/ Exclusion	Reference Drawings	Remarks
				Control/Fuel Handling-Building - Roof					
Tendon surveillance equipment (test weights, ram, etc.)	>4,000	3	4,000	8	No	Yes	1	AX4DE503 1X4DE509 1X4DE510 2X4DE510	
				Alternate Radwaste Building					
Alternate radwaste building bridge crane	80,000	1	79,000	25	No	Yes	3	AX4DE500	
				Ground Surface Area Above NSCW Tunnels (1T2A and 1T5A)					
Tendon surveillance equipment (test weights, ram, etc.)	>4,000	3	4,000	44 or 2 above parapet	No	Yes	4	AX4DE503	
				Ground Surface Area Above AFW Tunnels (1T6A and 2T6A)					
Tendon surveillance equipment (test weights, ram, etc.)	>8,500	3	8,500	6	No	Yes	4	AX4DE503	
				Tendon Buttress 1 Area - With Lifted Load Below VSL Platform					
Tendon surveillance equipment (test weights, ram, etc.)	>8,500	3	8,500	100	No	No	1	AX4DE503	
				Tendon Buttress 1 Area - With Lifted Load Above VSL Platform					
Tendon surveillance equipment (test weights, ram, etc.)	>8,500	3	8,500	6	No	No	1	AX4DE503	
				Tendon Surveillance (VSL) Platform - Davit Load Path					
Tendon surveillance equipment (test weights, ram, etc.)	5,500	3	4,000	1	No	No	1	AX4DE503	

TABLE 9.1.5-2 (SHEET 11 OF 12)

a. The equipment being serviced by the hoist/crane is identified. Number of cranes associated with the load shown in parenthesis.

b. The load lifting capacity of the hoist/crane (in pounds) is provided. The load lifting capacity is provided rather than the load weight for conservatism, unless noted otherwise. Administrative controls ensure that hoist/cranes are not modified to lift loads greater than the weight specified.

c. The maximum vertical lift travel (in feet) of the hoist/crane is provided. The maximum vertical lift travel is provided for conservatism. In actuality, most loads would only be lifted a few feet to allow placement on a dolly. Administrative controls ensure that hoists/cranes are not modified to lift loads higher than the distance specified.

d. Yes - A safety-related item is located in the load path of the hoist/crane.

   No - A safety-related item is not located in the load path of the hoist/crane.

e. Yes - A safety-related item is located on level(s) below which a load is handled by a hoist/crane.

   No - A safety-related item is not located on level(s) below which a load is handled by a hoist/crane.

f. The basis for conformance/exclusion of an overhead handling system from which a load drop may result in damage to safety-related equipment is as follows. Bases 1 through 5 are exclusions, while bases 6 through 9 provide bases for conformance.

   1. The equipment lifted by this hoist/crane is nonsafety related. Load paths are designed unique to the associated load handling equipment. A load drop will not result in damage to safety-related equipment.

   2. The equipment lifted by this hoist/crane is safety related or passes over safety-related equipment. The equipment is physically separated from redundant safety-related equipment or is located in its own reinforced concrete room. Load paths are designed unique to the associated load handling equipment. A load drop will not result in damage to a separate train of safety-related equipment required for safe shutdown.

   3. The equipment lifted by this hoist/crane is located on a floor above safety-related equipment. If this load was dropped and fell through the floor, only equipment from a single train would be damaged. The redundant train would be available. Alternately, if equipment from the redundant train is damaged, the system function is maintained using portions of both trains.

   4. The equipment lifted by this hoist/crane is located on a floor above safety-related equipment. Analysis has demonstrated that a failure of the OHLHS and subsequent load drop will not prevent safe shutdown or decay heat removal or cause unacceptable radiation releases.

   5. The equipment lifted by this device is lifted only during plant shutdown. Damage to safety-related equipment will not preclude decay heat removal.

   6. Analysis has demonstrated that a failure of the OHLHS and subsequent load drop from the maximum height could prevent safe shutdown or decay heat removal capability. The safe load path and load height is defined on drawings 1X4DE605, 1X4DE606, and 2X4DE601.

   7. See paragraph 9.1.5.3.3 for discussion of the administrative controls associated with the RHR heat exchanger.

   8. The equipment lifted by this crane is nonsafety related. Analysis has demonstrated that the height is designed unique to the associated handling equipment for this level. The safe load path and load height is defined on drawing 2X4DE600.

TABLE 9.1.5-2 (SHEET 12 OF 12)

9. Analysis has demonstrated that a failure of the OHLHS and subsequent load drop from the maximum height could prevent safe shutdown or decay heat removal capability. The safe load path and load height are defined on drawing 1X4DE607.

g. The identified load is shown on these drawings.

h. This OHLHS is common to both units.

i. Design Standards

(1) ANSI B 30.2.0 Overhead and Gantry Cranes (Multiple Girder)

(2) ANSI B 30.11 Monorail Systems and Underhung Cranes

(3) ANSI B 30.16 Overhead Hoists

(4) HMI 100 Electric Wire Rope Hoists

(5) CMAA 70 Electric Overhead Traveling Cranes

(6) CMAA 74 Top Running and Under Running Single Girder Electric Overhead Traveling Cranes

(7) The hand hoists utilized will be designed to industry standards (e.g., HMI 100 and ANSI B 30.16).

j. The evaporator has been abandoned in place, but the equipment remains physically located in the plant.

TABLE 9.1.5-3 (SHEET 1 OF 3)

CONTAINMENT BUILDING OVERHEAD LOAD HANDLING SYSTEMS

Heavy Load Handling System	Equipment Designator No.	Design[a] Standard	Load Identification	Load Weight (lb)	Lifting Device	Basis[b] for Conformance/ Exclusion	References Drawings
Polar crane (225/25 ton)	1 and 2 - 2101R4001	1,5	Integrated head package	450,000[c] 440,000[d]	Head lifting ring (4800 lb)	7	1X4DE507, 1X4DE508 2X4DE507, 2X4DE508
			Reactor coolant pump	94,400	Sling	11	
			Reactor coolant pump motor	97,600	Reactor coolant pump motor lifting device	11	
			Refueling machine component (maintenance)	36,950	Refueling machine maintenance lifting device	12	
			Reactor coolant drain tank pump	360		1	
			Reactor cavity filtration system				
			- Filter unit	375		1	
			- Pump and motor	250		1	
			Upper internals	132,000	Internals lifting rig (17,850 lb)	8	
			Lower internals	260,000	Internals lifting rig (17,850 lb)	4	
			Regenerative heat exchanger	4,200	Regenerative heat exchanger lift rig	10	
			Excess letdown heat exchanger	1,350	Excess letdown lift rig	1	
			Miscellaneous equipment from level B (e.g., small pumps, heat exchanger bundles, etc.)	2,000		1	
			Crane load block	18,000		7	
			Internals lifting rig	17,850		14	
			Containment building pre-access filtration unit carbon bed containers	18,000		1	
Refueling machine (1.5 ton)	1 and 2 - 2101R6003	5	Fuel assembly	1,600	Refueling machine gripper mast (900 lb)	13	1X4DE507 2X4DE507

TABLE 9.1.5-3 (SHEET 2 OF 3)

CONTAINMENT BUILDING OVERHEAD LOAD HANDLING SYSTEMS

Heavy Load Handling System	Equipment Designator No.	Design[(a)] Standard	Load Identification	Load Weight (lb)	Lifting Device	Basis[(b)] for Con-formance/ Exclusion	References Drawings
Radial arm stud tensioner hoist assembly	1 and A - 2148R2001 through 006	4(U1) 3,7(U1&U2)	Reactor stud turnout tool	(Hoist capacity is 4000 lb)	Weight compensation device	9	1X4DE507 2X4DE507
			Quick grip stud tensioner		Tensioner lifting arm	9	
Monorail with hoist (2-ton capacity)	1 and 2 - 2101R4011	3,4	Steel hatch plugs	1,500	Hoist and trolley	2	1X4DE506 2X4DE506 at node E; also see 1X4DE508 2X4DE508
Wall-mounted cantilever jib cranes (3-ton capacity)	1 and 2 - 2101R4003 1 and 2 - 2101R4004 1 and 2 - 2101R4005 1 and 2 - 2101R4006	2,3,4	Misc. maintenance activities	(Crane capacity is 6000 lb)	Hoist and trolley	3	1X4DE507 2X4DE507
Wall-mounted cable bridge winch (3-ton capacity)	1 and 2 - 2101R4007 1 and 2 - 2101R4008 1 and 2 - 2101R4009 1 and 2 - 2101R4010	4	Cable bridge	7,320	Winch (2 per cable bridge)	6	1X4DE507 2X4DE507
Monorail with hoist (1-ton capacity)	1 and 2 - 2101R4012	3,4	Pressurizer relief valves	900	Hoist and trolley	5	1X4DE510 2X4DE510
Underhung hoist (20-ton capacity)	1 and 2-2101R4017	3,4	Equipment hatch cover	32,000	Hoist	5	1X4DE507 2X4DE507

a. Design Standards

1. ANSI B 30.2.0 Overhead and Gantry Cranes (Multiple Girder)
2. ANSI B 30.11 Monorail System and Underhung Cranes
3. ANSI B 30.16 Overhead Hoists
4. HMI 100 Electric Wire Rope Hoists
5. CMAA 70 Electric Overhead Traveling Cranes
6. CMAA 74 Top Running and Underrunning Single Girder Electric Overhead Traveling Cranes
7. HMI 400

system discharges, voiding may occur in an idle train or upon loss of offsite power and subsequent pump trip. In order to preclude waterhammer on pump restart, the NSCW system incorporates the following design features (these features are shown on drawings 1X4DB133-1, 1X4DB133-2, 1X4DB134, 1X4DB135-1, 1X4DB135-2, 2X4DB133-2, and 2X4DB134):

A. Interlocks and pressure switches to close both tower valves (spray header HV-1668A and HV-1669A and cold weather bypass HV-1668B and HV-1669B) whenever the NSCW pumps in the same train are not operating and to allow normal process controlled valve operation when the pumps are in service.

B. Motor operators on the NSCW pump discharge valves, with interlocks to close the valve if the respective pump is not running and to prevent pump start unless the valve is closed. The valve starts to open after a delay of approximately 45 s when the respective pump starts, thus, limiting the rate of system repressurization.

C. Check valves in the NSCW supply line to all components located above grade to limit the extent of system voiding resulting from draining back to the basins.

D. Keep-full system, consisting of interties between the two trains, with control room alarm on high flow and manual isolation capability. The locations of the branch takeoff and injection points have been chosen such that above atmospheric pressures will be maintained in all portions of the idle train without overpressurizing the components located 100 ft below grade. The manual isolation valve can be closed within 30 min after receipt of high flow alarm to prevent unacceptable loss of basin inventory.

E. Interlocks to close the NSCW tower blowdown valves, if in auto, unless at least one NSCW pump in the respective train is operating.

F. For Unit 2 only, the inlet and outlet isolation valves for the containment auxiliary air cooling coils and reactor cavity cooling coils are interlocked so that the outlet valve partially opens for 3 seconds, delays 60 seconds, then fully opens. The inlet valve then opens. This design serves to limit the hydraulic transients in these coolers to prevent water hammer.

G. For Unit 2 only, there are vacuum breakers installed at the high points of the system, (e.g., the control building essential chiller and the component cooling water heat exchanger). These vacuum breakers serve to mitigate the pressure reduction in these portions of the system when the train is shut down for maintenance or during post accident response.

The tower temperature controls are designed to provide automatic start of the tower fans on increasing water temperature in the return header. The first fan to start in each NSCW tower is interlocked to start when the tower's spray valve opens and will stop when the spray valve closes. The spray valve begins to open when the NSCW return temperature is above 75°F and begins to close when the temperature falls below 65°F. The other three fans in each NSCW tower are controlled by independent temperature switches set to start sequentially through a range of 79°F to 87°F. Automatic trip of these tower fans will occur on decreasing temperature with each fan set to trip sequentially through a range of 77° to 71°F. To protect against tower icing in the event of low ambient temperature, two interlocked valves function to bypass the cooling tower spray headers and return the water directly to the cooling tower basin whenever the return water temperature is below 65°F. When necessary due to low ambient temperatures, freezing of an idle NSCW train or tower basin will be prevented by operating both NSCW trains and/or both NSCW transfer pumps, and by periodically operating all three NSCW pumps in each train. Idle piping, stagnant lines, and instrument sensing lines will be protected from freezing by either insulation, electric heat tracing, space heaters, or other means. The heat tracing is controlled by ambient sensors located outdoors in a location not exposed to sun or other heat sources so as to accurately measure the ambient temperature. The sensors are NEMA 4 rated for outdoor locations and are set to actuate at 38+5°F. A drain hole is provided in each of the four 12-in. supply headers to the tower spray nozzles to promote self-draining. Those portions of the spray header supply piping which will not self-drain are protected from freezing.

During freezing rain, enough heat is present from the basin water to prevent a heavy ice buildup.

Makeup for each NSCW tower is normally provided by a connection with the plant makeup water wells. The backup source of makeup water is the Savannah River. NSCW tower basin water is the source of supply to the NSCW system and does not perform any other function. The makeup supply to the tower basins and provisions to ensure adequate net positive suction head (NPSH) for the NSCW pumps are discussed in paragraph 2.4.11.5.

The impact of long-term corrosion on the NSCW piping is compensated for by appropriate corrosion allowances and addition of a corrosion inhibitor.

Each NSCW cooling tower is provided with chemical treatment that employs biocide to prevent biological fouling, and a corrosion inhibitor. Chemical treatment is added to each tower basin as required. A portion of the system coolant is blown down, when makeup water is available, to prevent the accumulation of fouling agents. The blowdown rate may be controlled by conductivity or manually. Upon a safety injection signal or loss of external makeup, the tower blowdown is terminated and the concentration of total dissolved solids is allowed to increase. However, during the postulated 30-day design accident case (subsection 9.2.5), the solids buildup will not prevent acceptable operation of the cooling tower or associated NSCW equipment.

Air-operated valves CV-9446 and CV-9447 modulate NSCW tower blowdown to limit the buildup of total dissolved solids in the NSCW system. The valves close automatically upon receipt of a safety injection signal and are designed to fail closed upon a loss of offsite power. Thus, the valves will close automatically whenever required to conserve NSCW tower basin inventory. The valves also close whenever the respective NSCW train is not in service as part of the keep-full system.

Failure of a tower blowdown valve to close when required will be indicated by valve position lights on the main control board and by a high flow alarm in the keep-full intertie. Additionally, this condition will be identified by basin level verification required by the Technical Specifications or, in a post-accident situation, by the valve status verification required by the emergency instructions. Isolation of the blowdown line can be effected by closing manual valves 047 and 048 (CV-9446) or 049 and 050 (CV-9447). See drawings 1X4DB133-1, 1X4DB133-2, 1X4DB134, 1X4DB135-1, and 1X4DB135-2.

Failure of the valve to close will have negligible effect on NSCW system operability. The most limiting case is for the valve to stay open coincident with a loss of offsite power (and resultant loss of basin makeup) with or without a simultaneous accident. Assuming 30-min operator response time, the loss of basin inventory is less than 1 hour in capacity.

The tower blowdown sample line class break is at the flow orifice with the nonsafety-related isolation valve downstream of the orifice. The orifices will limit basin inventory loss in the event of a seismic failure of the downstream piping. Over the postulated 30-day period without offsite power and tower makeup, the combined loss from the two sample lines (one on each NSCW train) is equivalent to approximately 0.3 days or 1 percent of the total available capacity. This can be reduced to approximately 0.2 days by closing the keep-full intertie isolation valves (492 and 497) during such conditions as only one NSCW train need be operable.

The NSCW system is protected from overpressure conditions resulting from pump shutoff pressures by using relief valves on individual component flowpaths and a large relief valve on the

NSCW system return header to the cooling tower. Specifically, the following component flowpaths are protected with individual pressure relief valves: centrifugal charging pump motor and lube oil coolers, safety injection pump motor and lube oil coolers, containment spray pump motor coolers, and residual heat removal pump motor coolers. Also, a pressure relief valve in the NSCW tower area protects the diesel generator, control building essential chiller, and reactor cavity cooling coil from overpressure conditions. All other components in the NSCW system have a design pressure greater than their respective pressures at pump shutoff conditions. Thermal relief valves protect other components cooled by NSCW, should NSCW flow be terminated for any reason.

The NSCW corrosion coupon racks allow for continuous monitoring of corrosion rates in the NSCW system. These racks are located in the NSCW chemical addition room.

The chlorine sample lines from the NSCW cooling tower supply headers supply flow to the NSCW corrosion racks. The class break for these lines is downstream of a manual isolation valve. Operator action to close these valves within 8 hours will be taken to limit potential flow loss due to a failure of the downstream piping.

9.2.1.3 Safety Evaluation

A. The volume of NSCW maintained in the tower basins is sufficient to perform required cooling. The normal source of makeup water is the makeup wells. In the event of failure of these wells, a backup source is available from the river. Required flows are shown in table 9.2.1-1. Refer to subsection 9.2.5 for a discussion of conformance with Nuclear Regulatory Commission Regulatory Guide 1.27, Revision 2.

B. Paragraphs 9.2.1.2 and 9.2.1.5 describe provisions for identifying and isolating leakage from the system.

C. The system is designed and constructed as Seismic Category 1, as indicated in table 3.2.2-1. All NSCW system piping is contained within Seismic Category 1 structure.

D. Section 3.5 provides the basis for missile protection. The NSCW pumps are protected by a series of concrete barrier walls and slabs in a pumphouse.

E. Section 3.6 provides the basis for protection from high- and moderate-energy line breaks. Sections 3.3 and 3.4 provide the basis for protection from natural phenomena.

TABLE 9.2.1-2 (SHEET 12 OF 46)

Item No.	Description of Component	Safety Function	Plant Operating Mode	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	General Remarks
				A2. Fails open or fails to close upon command	A2. Position lights on HS-9446 (QMCB) show valve open with conductivity indicator CITS-9446 (PNSS) within limits; low level alarm LSLL 1606 will alert operator	A2. None; effect of 30-minute uncontrolled blowdown on basin inventory insignificant; blowdown can be isolated by closing manual valves 047 and 048; also, redundant NSCW train B available	
			B. Modes 2, 3, and 4	B. Fails open or fails to close upon command	B. Position lights on HS-9446 (QMCB)	B. None; same as item A2.	
18	NSCW tower W4-002 blowdown control valve CV-9447 (normally open, fail closed air-operated globe valve) (train B)	Same as item 17 except for train B tower and controlled by CIC-9447 on PNSS	A. Mode 1	A1. Fails closed or fails to open upon command	A1. Same as item 17A1 except switch is HS-9447 (QMCB) and with FR-1653 and CITS-9447 on PNSS	A1. None; same as item 17A1 except manual valve is 050 and redundant NSCW train is train A	
				A2. Fails open or fails to close upon command	A2. Same as item 17A2 except for HS-9447 on QMCB and CITS-9447 on PNSS	A2. None; same as item 17A2 except blowdown isolated by valves 049 and 050 and redundant NSCW train is train A	
			B. Modes 2, 3 and 4	B. Fails open or fails to close upon command	B. Position light on HS-9447 (QMCB)	B. None; same as item A2	

9.2.6 CONDENSATE STORAGE FACILITY

The condensate storage facility consists of two condensate storage tanks (CSTs), a vacuum degasifier, degasifier feed and transfer pumps, degasifier vacuum pumps, and associated valves, piping, and instrumentation. The condensate storage facility provides the following:

- Degasified and demineralized makeup and surge capacity to compensate for changes in the turbine plant water inventory.
- Reserve supply for emergency shutdown decay heat removal in the event of failure of the normal feedwater system.
- Secondary system fill water for plant startups.

9.2.6.1 Design Bases

Protection of the condensate storage from wind and tornado effects is discussed in section 3.3. Flood protection is discussed in section 3.4. Missile protection is discussed in section 3.5. Protection against the dynamic effects associated with postulated rupture in piping is addressed in section 3.6. Environmental design is discussed in section 3.11.

9.2.6.1.1 Safety Design Bases

A. The condensate storage facility provides water to the suctions of the auxiliary feedwater pumps during emergency conditions, including loss of offsite power, with a coincident single failure.

B. Each CST capacity is based on satisfying the safety-grade cold shutdown capability which is sufficient to allow plant operation in the hot standby mode for 4 h, followed by a 5-h orderly plant cooldown, at an average rate of 50°F/h but not to exceed a rate of 100°F/h, to a temperature of 350°F when the residual heat removal (RHR) system may be placed in operation.

C. The CSTs are designed to remain functional during and after a safe shutdown earthquake (SSE). Provision is made so that failure of any non-Seismic Category 1 lines attached to the CSTs cannot cause a loss of the reserve capacity required for safe plant shutdown.

D. The piping layout from the CSTs to the auxiliary feedwater pumps ensures adequate net positive suction head (NPSH) at the maximum CST water temperature.

9.2.6.1.2 Power Generation Design Bases

A. The CSTs provide:

1. Sufficient water storage for simultaneous filling of all three condenser shells upon completion of condenser field erection for the purpose of hydrostatic testing of the condenser.

2. Sufficient water volume for filling of the condensate feedwater system condenser hotwells and steam generators to their normal water levels just prior to initial plant operation.

3. Sufficient water capacity to simultaneously fill all three condensers for leak testing of condensers during scheduled shutdown periods.

B. The CSTs serve as a reservoir to supply or receive condensate as required by the condenser hotwell level control system.

C. The condensate storage facility permits periodic testing of the auxiliary feedwater pumps and valves.

9.2.6.1.3 Codes and Standards

Codes and standards applicable to the condensate storage facility are listed in table 3.2.2-1. The storage tanks and safety-related piping are designed and constructed as Seismic Category 1. The vacuum degasifier and appurtenances are designed and constructed as Seismic Category 2.

9.2.6.2 System Description

9.2.6.2.1 General System Description

The condensate storage facility is shown in drawing 1X4DB161-1. The layout of the condensate storage facility is shown in section 1.2. The system consists of two CSTs, a vacuum degasifier, degasifier feed pump, degasifier transfer pump, a degasifier feed/transfer pump, two degasifier vacuum pumps, and

TABLE 9.2.8-1

AUXILIARY COMPONENT COOLING WATER SYSTEM
HEAT LOADS AND FLOWS

Component	No. of Units	Flow (gal/min) Each	Flow (gal/min) Total	Heat Load (10^6 Btu/h) Startup	Power Gen.	Cooldown(b)	Refueling
Reactor coolant pump	4	514	2056	11.49	11.49	2.88	(c)
Excess letdown heat exchanger	1	260	260	5.2	(c)	(c)	(c)
Letdown heat exchanger	1	1003(e)	1003	15.9	6.53	4.8	0.93
Seal water heat exchanger	1	252	252	1.98	1.98	1.98	1.98
Positive displacement charging pump	1	100	100	0.42	0.42	0.42	0.42
Reactor coolant sample cooler	1	15	15	0.19	0.19	0.19	(c)
Pressurizer liquid sample cooler	1	15	15	0.21	0.21	0.21	(c)
Pressurizer steam sample cooler	1	15	15	0.26	0.26	0.26	(c)
Post-accident sample cooler	1	10	10	0.0	(d)	0.0	0.0
ACCW pump motor cooler	2	30	60	0.21	0.21	0.21	0.21
Waste evaporator (abandoned in place)	1	727	727	(f)	(f)	(f)	(f)
Reactor coolant drain tank heat exchanger	1	226	226	0.64	2.23	(c)	(c)
Waste gas compressor package	2	49	97	0.14	0.14	0.14	(c)
Catalytic hydrogen recombiner	(a)	10	10	0.07	0.07	0.07	(c)
Pumping system loss	-	-	-	1.05	1.05	1.05	1.05
			4846	37.76	24.78	12.21	4.59

a. There is one catalytic hydrogen recombiner per unit, plus a common one served by either Unit 1 or Unit 2 ACCW systems.

b. With offsite power available and one reactor coolant pump in service.

c. Flow maintained without heat load.

d. The post-accident sample cooler functions during post-accident conditions and is operated periodically during power generation, resulting in a negligible heat load.

e. The flow rate corresponds to the temperature control valve at full open.

f. Flow is bypassed around evaporator.

C. Turbine Plant Closed Cooling Water Pumps

The closed cooling water pumps are constant speed, electric motor-driven, horizontal, centrifugal pumps. The two pumps are connected in parallel with common suction and discharge lines. The pumps operate at approximately 900 gal/min.

D. Turbine Plant Closed Cooling Water Heat Exchangers

The closed cooling water heat exchangers are of horizontal shell and straight tube design. The tube side is supplied with turbine plant cooling water, and the shell side is supplied with closed cooling water.

9.2.10.2.3 System Operation

During normal power operation, one of the two 100-percent capacity, closed cooling water pumps circulates demineralized water through the shell of one of the two 100-percent capacity, closed cooling water heat exchangers. The heat from the closed cooling water heat exchanger is rejected to the turbine plant cooling water passing through the tubes.

Cooling water flowrate to the electrohydraulic control coolers, steam generator feedwater pump turbine lube oil coolers, rotary air compressors, and reciprocating air compressors is regulated by automatic control valves. These control valves are throttled in response to temperature signals from the fluid being cooled.

The flowrate of cooling water to all of the other coolers or equipment is manually regulated by individual throttling valves located on the cooling water side of each cooler.

The closed cooling water makeup surge tank is located at an elevation above the highest component in the system and is connected to the pumps' suction. The surge tank provides a reservoir for small amounts of leakage from the system and for the expansion and contraction of the cooling fluid with changes in the system temperature.

Demineralized water makeup to the turbine plant closed cooling water system is controlled automatically by a level control valve which is actuated by sensing surge tank level. A corrosion inhibitor is manually added to the system.

9.2.10.3 Safety Evaluation

The turbine plant closed cooling water system does not serve a safety-related system.

9.2.10.4 Tests and Inspections

The performance, structural, and leaktight integrity of all system components is demonstrated by continuous operation.

9.2.10.5 Instrument Applications

Local indication of closed cooling water surge tank level is provided. Surge tank low- and high-level alarms are provided in the control room. Each pump discharge contains a pressure gauge.

Pressure indicator connections are provided where required for testing and balancing the system. Flow indicator taps are provided at strategic points in the system for initial balancing of the flows and for verifying flows during plant operation.

TABLE 9.2.10-1

TURBINE PLANT CLOSED
COOLING WATER SYSTEM FLOW REQUIREMENTS
NORMAL POWER GENERATION OPERATION

Component	Flow Each (gal/min)	Total Flow (gal/min)	Duty Each ($x 10^6$ Btu/h)	Total Duty ($x 10^6$ Btu/h)
Rotary air compressor	68	136	0.55	1.10
Reciprocating air compressor	32	64	0.98	1.96
Condensate pump motor oil coolers	27	81	0.14	0.42
Heat drain pumps	20	40	0.10	0.20
Turbine plant sampling system	432	432	1.53	1.53
Electrohydraulic control coolers	30	30	0.04	0.04
Air ejector gas radiation monitor air cooler	15	15	0.016	0.0166
Steam generator feedwater pump turbine lube oil coolers	100	200	0.50	1.00
		998		6.266

TABLE 9.2.11-1

TURBINE PLANT COOLING WATER SYSTEM
FLOW REQUIREMENTS - NORMAL POWER GENERATION OPERATION

Component	Flow Each (gal/min)	Total Flow (gal/min)	Duty Each ($\times 10^6$ Btu/h)	Total Duty ($\times 10^6$ Btu/h)
Turbine plant closed loop cooling water heat exchangers	800	800	6.26	6.26
Main turbine lube oil coolers	2,900	2,900	11.28	11.28
Normal central water chillers	10,000 [(a)]	10,000 [(a)]	44.09	44.09
Steam generator blowdown trim heat exchanger	540	540	5.40	5.40
Chemical and volume control system chillers	414	414	2.07	2.07
Generator hydrogen coolers	1,706	3,411	11.76	23.52
Isophase bus cooling unit	154	154	1.52	1.52
Vacuum pump seal water coolers	700	1,400	0.91	1.82
Generator stator coolers	1,000	2,000	8.70	17.40
		21,619		113.36

a. Series flow rate requirement when both units are in operation.

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TABLE 9.3.1-2 (SHEET 3 OF 3)

System	Quantity	Location	Design Function	Safe Position	Failure Mode on Loss of Air Supply	Comments
Electric steam boiler system	2 AHV19722 AHV19723			Closed	Closed	Electric steam boilers and components located in the electric steam boiler building have been removed. All other equipment has been abandoned in place.
Boron recycle system	2 HV12596 HV12597	Recycle holdup tank ventilation inlet	Serve as negative pressure boundary for piping penetration ventilation for containment isolation	Closed	Closed	

Note: Valves serve as pressure boundary devices.

quality analyses are performed on these samples to determine the following:

1. pH and conductivity levels.

2. Dissolved oxygen.

3. Residual hydrazine.

4. Sodium.

5. Silica.

The above measurements are used to control water chemistry and to permit appropriate corrective action by the laboratory staff. In addition, grab sample capabilities are provided at each of these monitoring points to monitor other chemical species.

C. Local grab sampling stations, as listed in table 9.3.2-4, are provided as needed for various process points.

D. The PASS remotely obtains fluid samples from the RCS, the containment sumps, and the containment atmosphere and performs various chemical analyses and radiological measurements.

E. The WWRBESS is provided to continuously take effluent samples and flow data (total flow) from waste water retention basins. The collected flow data and composite samples are used to determine the total doses of released radioactive material from WWRB to unrestricted areas. With this sampling system, the WWRB effluents are monitored to assure that the concentrations of released radioactive material are within the limits specified in the Offsite Dose Calculation Manual.

F. The NSSL, NSSG, TPSS, PASS, and WWRBESS are designed and built to the codes listed in table 3.2.2-1.

9.3.2.2 System Description

9.3.2.2.1 Nuclear Sampling System - Liquids

The NSSL collects samples from the RCS and the auxiliary systems and transports them to a common location in a sample room in the control building. The NSSL consists of sample conditioning equipment and a sampling panel. To minimize the source volume exposed at the sampling panel, some sampling components that retain potentially radioactive fluids, such as sample coolers, isolation valves, and associated piping, are located in shielded compartments away from the sample panel. The rack is located behind a concrete wall which provides radiation shielding. The sampling panel also contains grab sampling facilities. The NSSL is shown in drawings 1X4DB140 and 2X4DB140. The sample coolers, which reduce the temperature of the samples to below 115°F (to permit the safe handling of samples), are cooled by the auxiliary component cooling water system (ACCW). The sample line instrumentation is designed for inlet stream conditions.

After temperature and pressure reduction, the NSSL samples are routed to the sample panel within an exhaust-ventilated, hooded enclosure to confine any leakage or spillage of radioactive fluids. Temperature and pressure indicators are provided to verify the sample conditions. Within the vented sampling hood are grab sample points for each stream and the sample pressure vessels. Any liquid leakage is collected in the sink and drained to the waste holdup tank for processing through the liquid radwaste system.

Most NSSL sample points are manually operated on an intermittent basis to provide samples for laboratory analysis. The exception to this manual method is the CVCS letdown sample lines that may be collected manually or use in-line instrumentation for conductivity and hydrogen samples from the RCS stream. Sample lines are purged before each sample is drawn to ensure that representative samples are obtained. The purged liquid is returned to the low-pressure end of its own system.

The high-pressure RCS samples are collected at full process pressure and reduced temperature in one of two methods. A removable sample pressure vessel may be used. These sample vessels are designed for 3000 psig at 600°F and are equipped with quick-disconnect couplings to facilitate removal to the radiochemical laboratory for analysis.

A second method uses a multiport valve assembly connected to the nuclear sampling system panel via the same quick-disconnect couplings. Reactor coolant sample at full system pressure is captured in a sample loop. By operating the valve, the sample can be transferred to a container for laboratory analysis.

The RCS hot leg sample lines include a delay coil (tubing of sufficient length) to permit the decay of N-16 before the sample leaves the containment. The RCS, chemical and volume control system (CVCS), and accumulator samples require sufficient purge to ensure representative samples. System pressure provides the motive force for the purging flows. Purge time is determined for each sample by the flowrate and the individual sample line volume. Primary coolant purge flows are discharged to the CVCS mixed bed demineralizer or the volume control tank or sample sink drain. Other purge flows are returned to the recycle holdup tank, as shown in drawings 1X4DB140 and 2X4DB140. The sample sink drain, which may be contaminated with particulates or cleaning solutions, is routed to the auxiliary building chemical drain tank.

9.3.2.2.2 Nuclear Sampling System - Gaseous

The NSSG collects gaseous samples from auxiliary systems. The sample points are indicated in table 9.3.2-2, and a schematic drawing is provided in drawing 1X4DB141. The NSSG is located in the same control building complex as the NSSL. The gaseous sample vessels are positioned inside a filtered vent hood. Residual liquids collected in the sample sink are routed to the waste holdup tank. The lines are purged before sampling to ensure that samples are representative. The purged gas returns to the waste gas compressors as shown in drawing 1X4DB141.

9.3.2.2.3 Turbine Plant Sampling System

The purpose of the TPSS is to provide the data necessary to implement procedures for controlling the water quality of the secondary plant systems listed in table 9.3.2-3. The TPSS, most of which is located in the turbine building (the steam generator blowdown local conductivity sample panel is in the auxiliary building), is shown in drawings 1X4DB171-1, 1X4DB171-2, 1X4DB171-3, 1X4DB171-4, 1X4DB171-5, 1X4DB171-6, 1X4DB171-7, 1X4DB171-8, and 1X4DB171-9.

The steam generator blowdown lines are continuously monitored for radioactivity by one process radiation monitor on the common blowdown header. Blowdown is automatically terminated when radioactivity in the blowdown stream approaches the radiation monitor setpoint. Continuous monitoring of the water quality of the steam generator blowdown is provided by the TPSS. All steam generator blowdown lines and steam generator blowdown sample lines are automatically isolated from the containment on any signal which automatically starts the auxiliary feedwater pumps. However, the steam generator sample isolation valves may be opened 30 seconds after closure due to an auxiliary feedwater auto-start signal to allow operators to obtain a sample.

The TPSS samples are given in table 9.3.2-3. Roughing coolers are provided for the samples whose temperatures exceed 125°F. All samples are conditioned to approximately 77°F by a chilled water, constant temperature bath and to approximately 40 psig by pressure regulators.

Samples are analyzed, and the results are used for automatic or manual control of the process fluids. All analyzers continuously monitor representative samples. The sample line and sample sink drains in the TPSS are collected in the secondary liquid waste system where they go to the turbine building floor sump. Each sample line has a grab sampling capability for laboratory analysis.

9.3.2.2.4 Manual Grab Sample Stations

Manual grab sample stations are provided for the liquid and gaseous sample points which require sampling at a frequency of less than once a week or on a nonscheduled basis. All gas sampling stations are of the inline type which returns purge gases to the process lines. Quick-disconnect type couplings are used for sample bottle connections to provide a convenient and expeditious way of sampling for the nuclear sampling system.

Grab sample points for secondary system liquids and gases are identified in table 9.3.2-4. No sample point is provided on the chemical mixing tank of the CVCS since chemical additives are preanalyzed before they are added to the mixing tank. The grab sample points are indicated on the appropriate system diagrams.

Additional local sampling points and sampling vessels are provided to collect samples of fluids and gases from the radwaste systems for laboratory analysis by the operating staff. The characteristics of these sampling points are listed in table 9.3.2-5. The individual sampling points are also shown on the appropriate system diagrams.

9.3.2.2.5 Post-Accident Sampling System

The VEGP PASS consists of an inline monitoring and grab sample system which meets the requirements of NUREG-0737, Task II.B.3 (including clarification (9)), and Regulatory Guide 1.97. The PASS has the capability to remotely obtain liquid samples from the RCS and the containment sumps and gaseous samples from the containment atmosphere. Radioisotopic identification, concentration, and gross activity of grab samples are provided by a computer-based analyzing system. Onsite liquid sample analysis capability permits measurement of nuclide concentration in the range from approximately 1 μci/g to 10 ci/g.

TABLE 9.3.2-3 (SHEET 3 OF 5)

Line No.	Sample Point Name	Analysis
058	Feedwater to steam generator	Na
		O_2
		SC
		pH
		N_2H_4
		CC
		SC
084	Steam generator blowdown system discharge	SC
		CC
		S_iO_2
019	SG001 blowdown	Na
		SC
		pH
		CC
		S_iO_2
020	SG002 blowdown	Na
		SC
		pH
		CC
		S_iO_2
021	SG003 blowdown	Na
		SC
		pH
		CC
		S_iO_2

TABLE 9.3.2-3 (SHEET 4 OF 5)

Line No.	Sample Point Name	Analysis
022	SG004 blowdown	Na
		SC
		pH
		CC
		SiO_2
066	Main steam from SG001	Na
		CC
067	Main steam from SG002	Na
		CC
068	Main steam from SG003	Na
		CC
069	Main steam from SG004	Na
		CC
059	Reheat steam to C1V3	Na
		CC
060	Reheat steam to C1V4	Na
		CC
061	Reheat steam to C1V2	Na
		CC

TABLE 9.3.2-4 (SHEET 6 OF 8)

Sample Point No.	Sample Point Name	Pressure[b] (psig)	Temperature[b] (°F)
87	CCW pump room, train B	Atmospheric	Ambient
88	Spent fuel pool heat exchanger room, train A	Atmospheric	Ambient
89	Spent fuel pool heat exchanger room, train B	Atmospheric	Ambient
90	Turbine building drain system oil separator outlet	100	Ambient
91	Turbine building drain system demineralizer feed filter outlet	110	Ambient
92	Turbine building drain system demineralizer 001 outlet	100	Ambient
93	Turbine building drain system demineralizer 002 outlet	100	Ambient
94	Turbine building drain discharge filter outlet	100	Ambient
95	Electric steam boiler 001BD (Abandoned in place)	-	-
96	Electric steam boiler 002BD (Abandoned in place)	-	-
Control Building			
97	Control building drains sump pumps discharge	25	100
Fuel Handling Building			
98	Spent fuel pit filter outlet	65	120
99	Demineralizer inlet	160	120
100	Demineralizer outlet	150	120

9.3.3.2.2.9 Turbine Building Drains. The wastes generated in the turbine building, including drains, leakages, and sampling wastes, are collected in the sumps in the turbine building.

The sump discharge, combining with other miscellaneous drains from other buildings, is normally sampled by a radiation monitor before entering into an oil separator prior to discharge. If the radioactivity level of this combined waste stream exceeds the setpoint of the radiation monitor, the waste stream is then sent to the turbine building drain tank for holdup before pumping to the auxiliary building for oil and radioactive material removal.

9.3.3.2.3 System Operation

The various subsystems drain directly to the appropriate collection point by gravity. Sump pumps have both automatic and manual operating capabilities. Sump pumps are started in automatic when a predetermined high level in the sump is reached. The subsystems and their operation are described in subsequent paragraphs according to their classification as nonradioactive or potentially radioactive.

Some sumps are provided with duplex pumps while others are provided with simplex pumps. A portable pump is used to pump waste water from the alternate radwaste building sump to the auxiliary building. Portable pumps are also used to pump accumulated rainwater from the containment building tendon gallery sumps to the storm drainage system.

The duplex sump pumps are controlled by a main level control and a backup level control per sump. When the sump level rises to a preset level, the pump is started by the displacement action of the level switch. In all but the turbine building sumps, if the level continues to rise, a second level switch starts the second pump and provides a high high level alarm. Sumps that are equipped with only one sump pump are also provided with two level control switches, one controls the operation of the sump pump, the other provides a high high level alarm. The tendon gallery sump pumps are equipped with a single level switch to control pump operation; a high-high level alarm is not provided.

Failure of one pump to start will not prevent the second pump from starting. If the level continues to rise, a separate high-high level switch is incorporated in the design to activate an annunciator in the control room advising the operators that a flooding condition is imminent. After the pumps lower the level to a point just above the pump suction, a third displacer on the control level switch stops both pumps.

REV 9 5/00
REV 5 9/95
REV 2 3/92
REV 1 3/91

9.3.3.2.3.1 Potentially Radioactive Drainage. Fluids conveyed by potentially radioactive drainage systems flow by gravity to sumps in the respective buildings and are then pumped to the waste holdup tanks drawings 1X4DB143, 1X4DB144-1, and 1X4DB144-2).

9.3.3.2.3.2 Storm Drainage. The storm drainage system collects water resulting from precipitation on all building roofs and areaways and paved and unpaved surfaces outside the buildings and conveys it to a natural body of water.

9.3.3.2.3.3 Oily Waste. The oily waste system collects liquid waste which enters floor drains located in areas which are normally not sources of potentially radioactive waste, and where possibility for oil spillage exists, and conveys it to an oil interceptor. The clarified effluent from the interceptor is conveyed to a waste water retention basin before being discharged (drawings 1X4DB180-1, 1X4DB180-2, 1X4DB180-3, and 1X4DB180-4).

9.3.3.2.3.4 Acid Waste. The acid wastes, which are liquid wastes containing chemicals and corrosive substances discharged by fixtures or equipment, enter floor drains located in areas which are not sources of potentially radioactive waste and are conveyed to an acid neutralizing sump. The effluent from the acid neutralizing sump is conveyed to the floor drainage system (drawings 1X4DB142-1, 1X4DB142-2, 1X4DB145-1, 1X4DB145-2, 1X4DB145-3, 1X4DB145-4, 1X4DB145-5, 1X4DB145-6, 1X4DB145-7, 1X4DB146-1, 1X4DB146-2, 1X4DB146-3, and AX4DB105-4).

9.3.3.2.3.5 Liner Plate Leakage Detection.

A. Fuel Transfer Canal

   A 3/4-in. valved line connected behind the fuel transfer canal liner plate discharges to a leak detection pit located in the fuel handling building. The leak detection pit drains to the fuel handling building drain sump.

B. Spent Fuel Pool

   Two 3/4-in. valved lines connected behind the spent fuel pool liner plate also discharge to the leak detection pit in the fuel handling building. A dripping 3/4-in. line indicates the existence of a leak.

G. Clean Water Sump

Located in the auxiliary building, the clean water sump principally collects drains from the tube side of component cooling water (CCW) and auxiliary component cooling water (ACCW) heat exchangers, auxiliary building normal A/C unit condensates. Duplex pumps discharge to the turbine building drain system, the floor drain tank, and RD-101.

H. Sumps in Electrical Tunnels

Two sumps are provided in the electrical tunnels between the control building and the diesel generator building. Each sump has a single pump that discharges to the storm drains.

I. Main Steam Feedwater Tunnel Sump

This sump has two pumps that discharge into the storm drains.

J. Control Building Sumps

Both sumps collect normally nonradioactive drainage in the control building. The control building sumps have crosstie capability and can discharge to either the Unit 1 or Unit 2 turbine building oil separators Both control building sumps can be routed to their respective unit's waste monitor tanks if necessary. The discharge to the turbine building oil separator via the turbine building drain system is monitored for radiation. A high radiation alarm will shut off the flow (drawings 1X4DB142-1, 1X4DB180-1, 1X4DB180-2, 1X4DB180-3, and 1X4DB180-4).

K. NSCW Pumphouse Sumps

One sump is provided for each train of the NSCW system. Each sump has a single pump that discharges to the NSCW tower basin (drawing 1X4DB146-2).

L. Auxiliary Feedwater System Sump

Two joint sumps are provided. One collects drainage from the auxiliary feedwater pumphouse, and the other collects drainage from the condensate storage facility. Each sump has a single pump that normally discharges through a common header to the turbine building drain system but may be routed to the storm drain catch basin.

M. Transformer Area Sumps

Normal rainfall onto the switchyard runs off to the yard drain ditch surrounding the area. Each transformer is independently diked, and the diked areas drain to a sump. The sumps are sized to contain one main transformer oil volume in addition to 30 min of fire protection deluge, including outside fire protection hose streams.

In the event of an oil spill, the contents of the sump will be pumped out and disposed by a suitable means such as tank trucks. Normal rainfall collected in the sump containing no oil is typically automatically pumped to the waste water retention basin during normal operation.

N. Lube Oil and Fuel Oil Storage Area Sump

A diked area is provided for the clean lube oil tank, the dirty lube oil tank, and the fuel oil storage tank. The truck station is curbed and surfaced; discharge from this area is drained to the dike for the oil storage area. The dike design provides capacity for single complete drainage from the largest tank plus the rainwater associated with a 100-year rainfall (11 in. in 24 h). The diked areas drain to a sump with a single pump. Discharge from this area is routed to the turbine building drain system oily waste separator.

O. Water Treatment Building Sump

This sump collects drainage from the water treatment building drains. The sump has two sump pumps which discharge to the waste water retention basin.

P. Electric Steam Boiler Building Sump

This is another normally nonradioactive drain collection point.

Q. Alternate Radwaste Building Floor Sump

This sump is located in the alternate radwaste building and collects floor drainage from the alternate radwaste building. A portable pump is utilized to pump out the sump contents. Piping is provided so that the sump discharge may be directed to the auxiliary building floor drain tank, or if contaminated, to the auxiliary building waste holdup tank. A separate leak detecting

TABLE 9.3.3-1 (SHEET 1 OF 3)

EQUIPMENT AND FLOOR DRAINAGE SYSTEM
COMPONENT DATA

Component	No. of Pumps	Flow (gal/min)	Pressure (ft)
Reactor cavity sump pumps	2	50	130
Containment sump pumps	4	50	90
Penetration room sump pumps	2	50	95
Auxiliary building sump pumps	2	50	85
Radioactive drain sump pumps	2	50	70
Clean water sump pumps	2	50	125
NSCW pumphouse sump pumps	2	50	45
Diesel generator electrical tunnel sump pumps	2	50	100
Main steam and feedwater tunnel sump pumps	2	50	80
Control building sump pumps	2	150	120
Diesel generator building oily waste sump pumps	2	50	100
North firewater pumphouse oily waste separator pumps	2	75	47
Turbine building sump pumps	4	300	100
Turbine building drain transfer pumps	2	50	390
Maintenance building sump pumps	2	130	85
CCW drain tank pump	1	200	160
Fuel handling building sump pumps	2	50	100
Alternate radwaste building submersible sump pump	1	40	100

TABLE 9.3.3-2 (SHEET 1 OF 2)

SUMP PARAMETERS

Sump	Project Classification (Entering Lines)[a]	Top Elevation of Sump (ft)	(in.)	Dimensions (ft) Long x Wide x Deep
Normally Nonradioactive:				
Auxiliary building	414	119	3	5.0 x 8.0 x 6.0
Clean water	414	119	3	4.0 x 6.5 x 6.0
Main steam and feedwater tunnel	N/A	198	0	5.0 x 8.0 x 6.0
Turbine building	424	195	0	6.5 x 8.0 x 15.0
Control building	414	160	0	4.0 x 6.5 x 14.75[b]
NSCW pumphouse	414	205	0	2.5 x 5.0 x 5.5
Diesel generator electric tunnel	N/A	175	0	2.5 x 5.0 x 5.5
Diesel generator building oily waste	414	220	0	2.5 x 5.0 x 4.0
Penetration room[d]	414[c]	119	3	4.0 x 6.5 x 4.0
Auxiliary feedwater	414	215	0	2.5 x 5.0 x 10.0
Alternate radwaste building floor drain	424	220	5	4.0 x 4.0 x 3.0
Maintenance building	424	219	6	5.5 x 5.5 x 6.0
North firewater pumphouse oily waste separator	626	208	0	32.0 x 6.0 x 6.0
Water treatment building	626	220	0	5.5 x 11.0 x 8.0

materials and water chemistry of borated water/stainless steel/zirconium/Inconel systems. In addition, lithium-7 is produced in the core region due to irradiation of the dissolved boron in the coolant.

The concentration of lithium-7 in the RCS is coordinated with the boron concentration per the fuel warranty contract for pH control. (See table 5.2.3-3.) If the concentration exceeds this range, as it may during the early stages of a core cycle, the CVCS demineralizers are employed to remove excess lithium. Since the amount of lithium to be removed is small and its buildup can be readily calculated, the flow through the demineralizers is not required to be full letdown flow. If the concentration of lithium-7 is below the specified limits, lithium hydroxide can be introduced into the RCS via the charging flow. The solution is prepared in the laboratory and poured into the chemical mixing tank. Reactor makeup water is then used to flush the solution to the suction manifold of the charging pumps.

B. Oxygen Control

During plant startup from the cold condition, hydrazine is employed to scavenge oxygen. The hydrazine solution is introduced into the RCS in the manner described above for the pH control agent. Hydrazine is not normally employed except during refueling and startup from the cold shutdown state.

During normal plant operation, hydrogen dissolved in the reactor coolant is used to control and scavenge oxygen produced by radiolysis of water in the core region. A sufficient partial pressure of hydrogen is maintained in the volume control tank such that the specification is maintained. A pressure control valve maintains a minimum pressure of 15 to 20 psig in the vapor space of the volume control tank. This valve can be adjusted to provide the correct equilibrium hydrogen concentration. Hydrogen is supplied from the hydrogen manifold in the auxiliary gas system.

C. Reactor Coolant Purification

Mixed bed demineralizers are provided in the letdown line to provide cleanup of the letdown flow. The demineralizers remove ionic corrosion products and certain fission products and act as filters. One demineralizer is in continuous service and can be supplemented intermittently by the cation bed demineralizer, if necessary, for additional purification. The cation resin removes principally cesium and lithium isotopes from the purification flow. The second mixed bed demineralizer serves as a standby unit for use if the operating demineralizer becomes exhausted during operation.

A further cleanup feature is provided for use during cold shutdown and residual heat removal. A remote-operated valve admits a bypass flow from the residual heat removal system (RHRS) into the letdown line upstream of the letdown heat exchanger. The flow passes through the heat exchanger, through a mixed bed demineralizer and the reactor coolant filter to the volume control tank. The fluid is then returned to the RCS via the normal charging route.

Filters are provided at various locations to ensure filtration of particulate and resin fines and to protect the seals on the reactor coolant pumps.

Fission gases are removed from the reactor coolant by continuous purging of the volume control tank to the gaseous waste processing system.

9.3.4.1.2.3 Reactor Makeup Control System. The soluble neutron absorber (boric acid) concentration is controlled by the boron thermal regeneration system and by the RMCS. The RMCS is also used to maintain proper reactor coolant inventory. In addition, for emergency boration and makeup, the capability exists to provide refueling water or 4 weight percent boric acid directly to the suction of the charging pump.

The RMCS provides a manually preselected makeup composition to the charging pump suction header or to the volume control tank. The makeup control functions are those of maintaining desired operating fluid inventory in the volume control tank and adjusting reactor coolant boron concentration for reactivity control. Reactor makeup water and boric acid solution (4 weight percent) can be blended together at the reactor coolant boron concentration for use as makeup to maintain volume control tank inventory, or they can be used separately to change the reactor coolant boron concentration.

A boron concentration measurement system (section 7.7) is provided to monitor the boron content of the reactor coolant in the letdown line. The boron concentration is indicated in the main control room.

The boric acid is stored in one boric acid storage tank for each unit. There are two boric acid transfer pumps for each unit. The capability exists to direct the contents of the Unit 1 tank to the Unit 2 tank and vice versa. A pump can be periodically run to recirculate the tank contents with or without the boric acid filter and back to the tank. On a demand signal by the RMCS, one pump starts and delivers boric acid for makeup.

All portions of the CVCS which normally contain 4 weight percent boric acid solution are required to be located in compartments that are maintained at a temperature of ≥65°F. If a portion of the system which normally contains concentrated boric acid solution is not located in a heated area, it is provided with some other means, e.g., heat tracing or low temperature alarming capability, to ensure that the solution is maintained at a temperature ≥65°F.

The reactor makeup water pumps, taking suction from the reactor makeup water storage tank (RMWST), are employed for various makeup and flushing operations throughout the systems. One of these pumps starts on demand from the reactor makeup controller and provides flow to the suction header of the charging pumps or the volume control tank through the letdown line and spray nozzle.

During reactor operation, changes are made in the reactor coolant boron concentration for the following conditions:

A. Reactor startup: boron concentration must be decreased from shutdown concentration to achieve criticality.

B. Load follow: boron concentration must be either increased or decreased to compensate for the xenon transient following a change in load.

C. Fuel burnup: boron concentration must be decreased to compensate for fuel burnup and for buildup of fission products in the fuel.

D. Cold shutdown: boron concentration must be increased to the cold shutdown concentrations.

The boron thermal regeneration system is normally used to control boron concentration to compensate for xenon transients during load follow operations. Boron thermal regeneration can also be used in conjunction with dilution operations of the RMCS to reduce the amount of effluent to be processed by the boron recycle system.

The RMCS can be set up for the following modes of operation:

A. Automatic Makeup

The automatic makeup mode of operation of the RMCS provides blended boric acid solution preset to match the boron concentration in the RCS. Automatic makeup compensates for minor leakage of reactor coolant without causing significant changes in the reactor coolant boron concentration.

Under normal plant operating conditions, the mode selector switch is set in the "automatic makeup" position. This switch position establishes a preset control signal to the total makeup flow controller and establishes positions for the makeup stop valves for automatic makeup. The boric acid flow controller is set to blend to the same concentration of borated water as contained in the RCS. A preset low-level signal from the volume control tank level controller causes the automatic makeup control action to:

1. Start a reactor makeup water pump.
2. Start a boric acid transfer pump.
3. Open the makeup gate valve to the charging pump suction.
4. Position the boric acid flow control valve and the reactor makeup waterflow control valve.

The flow controllers then blend the makeup stream according to the preset concentration. Makeup addition to the charging pump suction header causes the water level in the volume control tank to rise. At a preset high-level point, the makeup is stopped. This operation may be terminated manually at any time.

If the automatic makeup fails or is not aligned for operation and the tank level continues to decrease, a low-level alarm is actuated. Manual action may correct the situation, or, if the level continues to decrease, a low-low signal opens the stop valves in the refueling water supply line to the charging pumps and closes the stop valves in the volume control tank outlet line.

A local sampling point is provided for verifying the solution concentration before transferring it out of the tank. The tank is provided with an agitator to improve mixing during batching operations.

9.3.4.1.2.5.14 Chemical Mixing Tank. The chemical mixing tank is used primarily in the preparation of caustic solutions for pH control, hydrazine solution for oxygen scavenging, and chemicals for corrosion product oxidation during a refueling shutdown.

9.3.4.1.2.5.15 Chiller Surge Tank. The chiller surge tank handles the thermal expansion and contraction of the water in the chiller loop. The surge volume in the tank also acts as a thermal buffer for the chiller. In addition, this tank can provide a holdup should there be a leak in the chiller heat exchanger. The fluid level in the tank is monitored with level indication and high- and low-level alarms provided on the main control board.

9.3.4.1.2.5.16 Mixed Bed Demineralizers. Two flushable mixed bed demineralizers assist in maintaining reactor coolant purity. A lithium-form cation resin and hydroxyl-form anion resin are charged into the demineralizers. The anion resin is converted to the borate form in operation. Both types of resin remove fission and corrosion products. The resin bed is designed to reduce the concentration of ionic isotopes in the purification stream, except for cesium, yttrium, and molybdenum, by a minimum factor of 10.

Each demineralizer has more than sufficient capacity for one core cycle with 1 percent of the rated core thermal power being generated by defective fuel rods. One demineralizer is normally in service with the other in standby.

A temperature sensor monitors the temperature of the letdown flow downstream of the letdown heat exchanger. If the letdown temperature exceeds the maximum allowable resin operating temperature (approximately 140°F), a three-way valve is automatically actuated so that the flow bypasses the demineralizers. Temperature indication and high alarm are provided on the main control board. The air-operated three-way valve failure mode directs flow to the volume control tank.

9.3.4.1.2.5.17 Cation Bed Demineralizers. A flushable demineralizer with cation resin in the hydrogen form is located downstream of the mixed bed demineralizers and is used intermittently to control the concentration of lithium-7 which builds up in the coolant from the $B^{10} \rightarrow (n,\alpha) \rightarrow Li^{7}$ reaction. The demineralizer also has sufficient capacity to maintain the cesium-137 concentration in the coolant below 1.0 $\mu Ci/cm^3$ with 1-percent defective fuel. The resin bed is designed to reduce the concentration of ionic isotopes, particularly cesium, yttrium, and molybdenum, by a minimum factor of 10.

The demineralizer has more than sufficient capacity for one core cycle with 1 percent of the rated core thermal power being generated by defective fuel rods.

9.3.4.1.2.5.18 Thermal Regeneration Demineralizers. The function of the thermal regeneration demineralizers is to store the total amount of boron that must be removed from the RCS to accomplish the required dilution during a load cycle to compensate for xenon buildup resulting from a decreased power level. Furthermore, the demineralizers must be able to release the previously stored boron to accomplish the required boration of the reactor coolant during the load cycle to compensate for a decrease in xenon concentration resulting from an increased power level.

The thermally reversible ion storage capacity of the resin applies only to borate ions. The capacity of the resin to store other ions is not thermally reversible. Thus, during boration, when borate ions are released by the resin, there is no corresponding release of the ionic fission and corrosion products stored on the resin.

The thermal regeneration demineralizer resin capacity is directly proportional to the solution boron concentration and inversely proportional to the temperature. Further, the differences in capacity as a function of both concentration and temperature are reversible. For the 50°F to 140°F temperature cycle, this reversible capacity varies from the beginning of a core cycle to the end of core life by a factor of about 2.

The demineralizers can accept flow in either direction. The flow direction during boron storage is therefore always opposite to that during release. When the beds are switched from storage to release and vice versa, this provides much faster response than would be the case if the demineralizers could accept flow in only one direction.

A. One charging pump is started, which provides blended flow at the cold shutdown boron concentration. The standby RHR train may be used to aid in the filling process. Acceptable sources of borated water are the RMCS, VCT, RWST, and the RHUT.

B. The vents on the head of the reactor vessel and pressurizer are opened.

C. The RCS is filled and the vents closed.

The system pressure is raised by using the charging pump and is controlled by the low-pressure letdown valve. When the system pressure is adequate for operation of the reactor coolant pumps, seal waterflow to the pumps is established and the pumps are operated and vented sequentially until all gases are cleared from the system. Final venting takes place at the pressurizer.

After the filling and venting operations are completed, charging and letdown flows are established. All pressurizer heaters are energized, and the reactor coolant pumps are employed to heat up the system. After the reactor coolant pumps are started, the residual heat removal pumps are stopped, but pressure control via the RHRS and the low-pressure letdown line is continued as the pressurizer steam bubble is formed. At this point, steam formation in the pressurizer is accomplished by manual control of the charging flow and automatic pressure control of the letdown flow. When the pressurizer water level reaches the no-load programmed setpoint, the pressurizer level control is shifted to control the charging flow to maintain the programmed level. The RHRS is then isolated from the RCS, and the normal letdown path is established. The pressurizer heaters are now used to increase RCS pressure.

The reactor coolant boron concentration is now reduced either by operating the RMCS in the dilute mode or by operating the boron thermal regeneration system in the boron storage mode and, when the resin beds are saturated, washing off the beds to the boron recycle system. The reactor coolant boron concentration is corrected to the point where the control rods may be withdrawn and criticality achieved. Nuclear heatup may then proceed with corresponding manual adjustment of the reactor coolant boron concentration to balance the temperature coefficient effects and maintain the control rods within their operating range. During heatup, the appropriate combination of letdown orifices is used to provide necessary letdown flow.

Prior to or during the heating process, the CVCS is employed to obtain the correct chemical properties in the RCS. The RMCS is operated on a continuing basis to ensure correct control rod position. Chemicals are added through the chemical mixing tank as required to control reactor coolant chemistry such as pH and dissolved oxygen content. Hydrogen overpressure is established in the volume control tank to ensure the appropriate hydrogen concentration in the reactor coolant.

9.3.4.1.2.6.2 Power Generation and Hot Standby Operation.

A. Base Load

At a constant power level, the rates of charging and letdown are dictated by the requirements for seal water to the reactor coolant pumps and the normal purification of the RCS. One charging pump is employed, and charging flow is controlled automatically from pressurizer level. The only adjustments in boron concentration necessary are those to compensate for core burnup. These adjustments are made at infrequent intervals to maintain the control groups within their allowable limits. Rapid variations in power demand are accommodated automatically by control rod movement. If variations in power level occur and the new power level is sustained for long periods, some adjustment in boron concentration may be necessary to maintain the control groups within their maneuvering band.

During normal operation, normal letdown flow is maintained, and one mixed bed demineralizer is in service. Reactor coolant samples are taken periodically to check boron concentration, water quality, pH, and activity level. The charging flow to the RCS is controlled automatically by the pressurizer level control signal through the discharge header flow control valve or the positive displacement pump speed controller.

B. Load Follow

A power reduction will initially cause a xenon buildup followed by xenon decay to a new, lower equilibrium value. The reverse occurs if the power level increases: initially, the xenon level decreases and then it increases to a new and higher equilibrium value associated with the amount of the power level change.

The boron thermal regeneration system is normally used to vary the reactor coolant boron concentration to compensate for xenon transients occurring when reactor power level is changed. The CVCS chiller is shared between the operating units; therefore, the boron thermal regeneration system has the capacity to serve only one unit at a time. The RMCS may also be used to vary the boron concentration in the reactor coolant.

After the RHRS is placed in service and the reactor coolant pumps are shut down, further cooling of the pressurizer liquid is accomplished by charging through the auxiliary spray line. Coincident with plant cooldown, a portion of the reactor coolant flow is diverted from the RHRS to the CVCS for cleanup. Demineralization of ionic radioactive impurities and stripping of fission gases reduce the reactor coolant activity level sufficiently to permit personnel access for refueling or maintenance operations.

9.3.4.1.3 Safety Evaluation

The classification of structures, components, and systems is presented is section 3.2. A further discussion on seismic design categories is given in section 3.7. Conformance with Nuclear Regulatory Commission general design criteria for the plant systems, components, and structures important to safety is discussed in section 3.1. Section 1.9 provides a discussion on applicable regulatory guides.

9.3.4.1.3.1 Reactivity Control. Anytime the plant is at power, the quantity of boric acid retained and ready for injection always exceeds that quantity required for normal cold shutdown, assuming that the control assembly of greatest worth is in its fully withdrawn position. This quantity always exceeds the quantity of boric acid required to bring the reactor to hot shutdown and to compensate for subsequent xenon decay. An adequate quantity of boric acid is also available in the refueling water storage tank to achieve cold shutdown.

When the reactor is subcritical, i.e., during cold or hot shutdown, refueling, and approach to criticality, the neutron source multiplication is continuously monitored and indicated. Any appreciable increase in the neutron source multiplication, including that caused by the maximum physical boron dilution rate, is slow enough to give ample time to start a corrective action to prevent the core from becoming critical. (The boron dilution accident is discussed in subsection 15.4.6.) The rate of boration, with a single boric acid transfer pump operating, is sufficient to take the reactor from full-power operation to 1-percent shutdown in the hot condition, with no rods inserted, in a few hours. In a few additional hours enough boric acid can be injected to compensate for xenon decay, although xenon decay below the equilibrium operating level will not begin until approximately 25 h after shutdown. Additional boric acid is employed if it is desired to bring the reactor to cold shutdown conditions.

Two separate and independent flow paths are available for reactor coolant boration, i.e., the charging line and the reactor coolant pump seal injection line. A single failure does not result in the inability to borate the RCS.

If the normal charging line is not available, charging to the RCS is continued via reactor coolant pump seal injection at the rate of approximately 5 gal/min per pump. At the charging rate of 20 gal/min (5 gal/min per reactor coolant pump), the time required to add enough boric acid to solution to counteract xenon decay is greater than the time with normal charging available, but still within a few hours. Xenon decay below the full-power equilibrium operating level will not begin until approximately 25 h after the reactor is shut down.

As backup to the normal boric acid supply, the operator can align the refueling water storage tank outlet to the suction of the charging pumps. Other systems can be applied in mode 6 to comply with Technical Requirements Manual requirements. RHR can be available for boration in mode 6 under certain conditions as described in paragraph 5.4.7.2.3.6. The safety injection system can be available for boration in mode 6 when the reactor vessel head is removed. Additional details are provided in the Technical Requirements Manual.

Since inoperability of a single component does not impair ability to meet boron injection requirements, the Technical Specifications and Technical Requirements Manual, as applicable, allow components to be temporarily out of service for repairs. However, with an inoperable component, the ability to tolerate additional component failure is limited. Therefore, the Technical Specifications and Technical Requirements Manual, as applicable, require action to effect repairs of an inoperable component, restrict permissible repair time, and require demonstration of the operability of the redundant component.

9.3.4.1.3.2 Reactor Coolant Purification. The CVCS is capable of reducing the concentration of ionic isotopes in the purification stream as required in the design basis. This is accomplished by passing the letdown flow through one of the mixed bed demineralizers which removes ionic isotopes, except those of cesium, molybdenum, and yttrium, with a minimum decontamination factor of 10. Through occasional use of the cation bed demineralizer, the concentration of cesium can be maintained below 1.0 μcm^3, assuming 1 percent of the rated core thermal power is being produced by fuel with defective cladding. The cation bed demineralizer is capable of passing the maximum purification letdown flow, though only a portion of this capacity is normally utilized. Each mixed bed demineralizer is capable of processing the maximum purification letdown flowrate. If the normally operating mixed bed demineralizer's resin has become exhausted, the second demineralizer can be placed in service. Each demineralizer is designed, however, to operate for one core cycle with 1-percent defective fuel.

A further cleanup feature is provided for use during residual heat removal operations. A remotely operated valve admits a bypass flow from the RHRS into the letdown line at a point

9.3.4.1.3.6 Ability to Meet the Safeguards Function. A failure analysis of the portion of the CVCS that is safety related (used as part of the ECCS) is included as part of the ECCS failure analysis presented in tables 6.3.2-5 and 6.3.2-6.

Those portions of the CVCS utilized in the safety-grade cold shutdown operation are included as part of the RHRS failure analysis presented in table 5.4.7-4.

The use of the CVCS in conjunction with the emergency core cooling system in providing reactor coolant makeup and boration is in conformance with General Design Criteria 5, 29, 33, and 35.

9.3.4.1.3.7 Heat Tracing. Heat tracing requirements for boric acid solutions depend mainly on the solution concentration. The concentration of boric acid in the CVCS ranges from 10 ppm to 4 weight percent boric acid. Electrical heat tracing low temperature alarming capability is provided as required on CVCS components which contain 4 weight percent boric acid to ensure the temperature is maintained at a temperature of 65°F or higher. Refer to paragraph 9.3.4.1.2 for more information.

9.3.4.1.3.8 Abnormal Operation. The CVCS is capable of making up for a small RCS leakoff up to approximately 130 gal/min (except for Unit 1 Train A centrifugal charging pump which is only capable of making up to approximately 105 gal/min) using one centrifugal charging pump and still maintaining seal injection flow to the reactor coolant pumps. This also allows for a minimum RCS cooldown contraction. This is accomplished with the letdown isolated.

9.3.4.1.4 Tests and Inspections

As part of plant operation, periodic tests, surveillance inspections, and instrument calibrations are made to monitor equipment condition and performance. Most components are in use regularly; therefore, assurance of the availability and performance of the systems and equipment is provided by control room and/or local indication.

Inservice inspection of piping, pumps, and valves is performed in accordance with the requirements of ASME Section XI as discussed in section 6.6 and subsection 3.9.6, respectively.

Technical Specifications and requirements in the Technical Requirements Manual have been established concerning calibration, checking, and sampling of the CVCS.

Refer to section 14.2 for information for the initial test program.

9.3.4.1.5 Instrumentation Application

Process control instrumentation is provided to acquire data concerning key parameters about the CVCS. The location of the instrumentation is shown on drawings 1X4DB114, 1X4DB115, 1X4DB116-1, 1X4DB116-2, 2X4DB116-2, 1X4DB117, and 1X4DB118).

The instrumentation furnishes input signals for monitoring and/or alarming purposes. Indications and/or alarms are provided for the following parameters:

- Temperature.
- Pressure.
- Flow.
- Water level.

The instrumentation also supplies input signals for control purposes. Some specific control functions are listed below:

A. Letdown flow is diverted to the volume control tank upon high-temperature indication upstream of the mixed bed demineralizers.

B. Pressure upstream of the letdown heat exchanger is controlled to prevent flashing of the letdown liquid.

C. Charging flowrate is controlled during charging pump operation.

D. Water level is controlled in the volume control tank.

E. Temperature of the boric acid solution in the batching tank is maintained.

F. Reactor makeup is controlled.

G. Temperature of letdown flow to the boron thermal regeneration system is controlled.

H. Temperature of the chilled waterflow to the letdown chiller heat exchanger is controlled.

I. Temperature of letdown flow return from the boron thermal regeneration demineralizers is controlled.

9.3.4.2 Boron Recycle System

The boron recycle system (BRS), which is shared between the two units, processes reactor coolant effluent that can be readily reused as makeup. The system decontaminates the effluent by means of demineralization.

9.3.4.2.1 Design Bases

9.3.4.2.1.1 Collection Requirements. The BRS collects and processes RCS effluent, most of which is the deaerated, tritiated, borated, and radioactive water from the letdown and process drains.

The BRS is designed to collect, via the letdown line in the CVCS, the excess reactor coolant that results from the following plant operations during one core cycle:

A. Dilution for core burnup from approximately 1200 ppm boron at the beginning of an annual core cycle to approximately 10 ppm near the end of the core cycle.

B. Hot shutdowns and startups. Four hot shutdowns are assumed to take place during an annual core cycle.

C. Cold shutdowns and startups. Three cold shutdowns are assumed to take place during an annual core cycle.

D. Refueling shutdown and startup.

The BRS also collects water from the following sources:

A. Reactor coolant drain tank (liquid waste processing system), which collects leakoff type drains from equipment inside the containment.

B. Volume control tank and charging pump suction pressure reliefs (CVCS) and safety injection, residual heat removal pressure reliefs.

C. Boric acid blending tee (CVCS), which provides storage of boric acid if a boric acid tank must be emptied for maintenance. The boric acid solution is stored in a recycle holdup tank after first being diluted with reactor makeup water by the blending tee to ensure against precipitation of the boric acid in the unheated recycle holdup tank.

D. Accumulators (safety injection system), which collect effluent resulting from leak testing of accumulator check valves.

E. Liquid waste processing system.

F. Spent fuel pool pumps (spent fuel pool cooling and cleanup system), which provide a means of storing the fuel transfer canal water in case maintenance is required on the transfer equipment.

G. Valve leakoffs and equipment drains.

H. Safety injection system, which accepts flush water when boron injection tank valves are being tested or flushed.

9.3.4.2.1.2 Capacity Requirement. The BRS is designed to process the total volume of water collected during a core cycle as well as short-term surges. The design surge is that produced by a cold shutdown and subsequent startup during the latter part of a core cycle or by a refueling shutdown and startup.

9.3.4.2.2 System Description

The BRS is shown in drawings AX4DB123-1 and AX4DB123-2. The codes and standards to which the individual components of the BRS are designed are listed in section 3.2. When water is directed to the recycle holdup tank, the recycle evaporator feed demineralizers and filters will normally be bypassed. The recycle evaporator feed pumps can be used to transfer liquid from one recycle holdup tank to the other if desired.

Piping connections have been provided to permit the use of both a portable demineralizer system and a portable backflushable filter system, which are located in the alternate radwaste building.

9.3.4.2.2.1 Component Descriptions. A summary of principal component data is given in table 9.3.4-3; the code requirements are given in section 3.2.

REV 9 5/00
REV 5 9/95
REV 4 4/94

9.3.4.2.2.1.1 Recycle Evaporator Feed Pumps. Two centrifugal, canned motor pumps were installed to recirculate water from the recycle holdup tanks through the recycle evaporator feed demineralizers for cleanup and to feed the ARB demineralizer system. An auxiliary discharge connection is provided to return water to the fuel transfer canal from the recycle holdup tanks, if those tanks were used for storage of transfer canal water during refueling equipment maintenance. Another auxiliary discharge connection is provided to supply water to the suction of the charging pumps (CVCS) for refilling the RCS after loop or system drain.

9.3.4.2.2.1.2 Recycle Holdup Tanks. Two recycle holdup tanks provide storage of radioactive fluid which is discharged from the RCS during startup, shutdown, load changes, and boron dilution. The sizing criteria are based on the design surge produced by a cold shutdown and subsequent startup during the latter part of core cycle or by refueling shutdown and startup.

Each tank has a diaphragm which prevents air from dissolving in the water and prevents the hydrogen and fission gases in the water from mixing with the air. The volume in the tank above the diaphragm is continuously ventilated with building supply air, and any gas which accumulates below the diaphragm is intermittently vented to the gaseous waste processing system.

In addition to the collection of effluents, the recycle holdup tanks perform the following functions:

A. Serve as a head tank for the recycle evaporator feed pumps.

B. Provide holdup for an RCS drain to the centerline of the reactor vessel nozzles, including the pressurizer and steam generators.

C. Provide storage for refueling transfer canal water during refueling equipment maintenance.

D. Collect discharges from the various relief valves.

9.3.4.2.2.1.3 Recycle Evaporator Feed Demineralizers. Two flushable, mixed bed demineralizers remove fission products from the fluid directed to the recycle holdup tanks. The demineralizers also provide a means of cleaning the recycle holdup tank contents via recirculation.

9.3.4.2.2.1.4 Recycle Evaporator Condensate Demineralizer. A flushable, anion demineralizer is provided as a polishing demineralizer for cleanup of the RMWST contents. Although the bed may become saturated with boron at the normally low concentration (at 10 ppm), it will still remove boron if the concentration increases.

9.3.4.2.2.1.5 Recycle Evaporator Feed Filters. These backflushable filters collect resin fines and particulates from the fluid entering the recycle holdup tanks.

9.3.4.2.2.1.6 Recycle Evaporator Condensate Filter. This filter collects resin fines and particulates from the boric acid evaporator condensate stream.

9.3.4.2.2.1.7 Recycle Holdup Tank Vent Ejector. The ejector is designed to pull gases from under the diaphragm in a recycle holdup tank and deliver them to the gaseous waste processing system. Nitrogen, provided by the standby waste gas compressor, provides the motive force.

9.3.4.2.2.2 <u>System Operation</u>. The BRS is manually operated with the exception of a few automatic protection functions, which:

A. Protect the recycle evaporator feed demineralizers from a high inlet temperature and a high differential pressure.

B. Prevent a high vacuum from being drawn on the recycle holdup tank diaphragm.

C. Protect the recycle evaporator feed pumps from low net positive suction head.

The BRS has sufficient instrumentation readouts and alarms to provide the operator information to ensure proper system operation.

TABLE 9.3.4-1

CHEMICAL AND VOLUME CONTROL SYSTEM DESIGN PARAMETERS

General	
Seal water supply flowrate, for four reactor coolant pumps, nominal (gal/min)	32
Seal water return flowrate, for four reactor coolant pumps, nominal (gal/min)	12
Letdown flow	
Normal (gal/min)	75
Maximum (gal/min)	120[(1)]
Charging flow (excludes seal water)	
Normal (gal/min)	55
Maximum (gal/min)	100[(1)]
Temperature of letdown reactor coolant entering system (°F)	<560
Temperature of charging flow directed to RCS (°F)	517
Temperature of effluent directed to BRS (°F)	115
Centrifugal charging pump miniflow, each (gal/min)	60
Amount of 4 weight percent boric acid solution required to meet cold shutdown requirements shortly after full-power operation (gal)	31,740
Maximum pressurization required for hydrostatic testing of RCS (psig)	3107

(1) Following replacement of Unit 1 Train A centrifugal charging pump rotating element and installation of a flow orifice in the discharge line during refueling outage 1R07. This pump can provide a maximum charging flowrate of 105 gal/min (including seal water injection). The maximum letdown flowrate the Unit 1 Train A centrifugal charging pump can support is therefore 75 gal/min (one 75 gal/min orifice inservice).

TABLE 9.4.2-2 (SHEET 1 OF 4)

FUEL HANDLING BUILDING VENTILATION
FAILURE MODES AND EFFECTS ANALYSIS

Item No.	Description of Component	Safety Function	Plant Operating Mode[(a)]	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	Go to Item No.
1	No. 8 breaker on 1ABA 480-V; IE bus; train A; NC (normally closed)	Provides continuity and protection to fan motor, item 3	A	Inadvertent opening	MCC alarm Motor indicating light Flow alarm low	None; loss of train A; train B available	2
2	No. 8 motor starter on 1ABA; 480-V; IE bus; train A; NO (normally open)	Provides continuity to fan motor, item 3	A	Fails to close	Motor indicating light Flow alarm low	None; loss of train A; train B available	3
3	A-1542-N7-001-M01 fan and motor ND (normally deenergized); train A	Provides motive power to circulate air	A	Fails to start and operate	Motor indicating light Flow alarm low	None; loss of train A; train B available	4
4	No. 35 breaker on 1AYE1 120-V; IE bus; train A; NC	Provides continuity and protection to HV 12512, item 5	A	Inadvertent opening	Flow alarm low None; Position indicating light	loss of train A; train B available	5
5	HV 12512 open-close louver; NC; train A	Enables discharge air from post-accident filter unit to stack	A	Fails to open	Position indicating light Flow alarm low	None; loss of train A; train B available	6
6	No. 35 breaker on 1AYE1 120-V; IE bus; train A; NC	Provides continuity and protection to HV 12510, item 7	A	Inadvertent opening	Position indicating light Flow alarm low	None; loss of train A; train B available	7
7	HV 12510, open-close louver; NC; train A	Enables air from FHB corridor to post-accident filter unit	A	Fails to open	Position indicating light Flow alarm low	None; loss of train A; train B available	8

TABLE 9.4.2-2 (SHEET 2 OF 4)

Item No.	Description of Component	Safety Function	Plant Operating Mode[(a)]	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	Go to Item No.
8	No. 10 breaker on 1ABA 480-V; IE bus; train A; NC	Provides continuity and protection to heater, item 9	A	Inadvertent opening	MCC alarm Moisture alarm (high) Temperature indicator	None; loss of train A; train B available	9
9	A-1542-N7-001-H01 heater	Reduces relative humidity	A	No heating	Moisture alarm high Temperature indicator	None; no credit is taken for the heaters; loss of train A; train B available	10
10	No. 8 breaker on 1BBA 480-V; IE bus; NC; train B	Provides continuity and protection to fan motor, item 12	A	Inadvertent opening	MCC alarm Motor indicating light Flow alarm low	None; loss of train B; train A available	11
11	No. 8 starter on 1BBA 480-V; 1E bus; NO; train B	Provides continuity to fan motor, item 12	A	Fails to close	Motor indicating light Flow alarm low	None; loss of train B; train A available	12
12	A-1542-N7-002-M01, fan and motor; ND; train B	Provides motive power to circulate air	A	Fails to start and operate	Motor indicating light Flow alarm low	None; loss of train B; train A available	13
13	No. 32 breaker on 1BYC1 120-V; IE bus; NC; train B	Provides continuity and protection to HV 12513, item 14	A	Inadvertent opening	Flow alarm low Position indicating light	None; loss of train B; train A available	14
14	HV 12513, open-close louver; NC; train B	Enables discharge air from post-accident filter unit to stack	A	Fails to open	Position indicating light Flow alarm low	None; loss of train B; train A available	15

TABLE 9.4.2-2 (SHEET 3 OF 4)

Item No.	Description of Component	Safety Function	Plant Operating Mode[(a)]	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	Go to Item No.
15	No. 32 breaker on 1BYC1; 120-V; 1E bus; train B; NC	Provides continuity and protection to HV 12511, item 16	A	Inadvertent opening	Flow alarm low Position indicating light	None; loss of train B; train A available	16
16	HV 12511, open-close louver; NC; train B	Enables air from FHB corridor to post-accident filter unit	A	Fails to open	Position indicating light Flow alarm low	None; loss of train B; train A available	17
17	No. 10 breaker on 1BBA bus; 480-V; IE bus; NC; train B	Provides continuity and protection to heater, item 18	A	Inadvertent opening	MCC alarm Moisture alarm (high) Temperature indicator	None; loss of train B; train A available	18
18	A-1542-N7-002-H01, heater	Reduces relative humidity	A	No heating	Moisture alarm (high) Temperature indicator	None; no credit is taken for the heater; loss of train B; train A is available	19
19	HV 2535, on-off, air-operated damper; NO/FC (fail close)	Isolates safety system from nonsafety normal ac system Enables FHB to maintain negative pressure	A	Fails to close	Position indicating light	None; redundant damper available; item 20	20
20	HV 2534, on-off, air-operated damper; NO/FC	Isolates safety system from nonsafety normal ac system Enables FHB to maintain negative pressure	A	Fails to close	Position indicating light	None; redundant damper available; item 19	21
21	HV 2529, on-off, air-operated damper; NO/FC	Isolates safety system from nonsafety normal ac system Enables FHB to maintain negative pressure	A	Fails to close	Position indicating light	None; redundant damper available; item 22	22

TABLE 9.4.3-5 (SHEET 2 OF 6)

Item No.	Description of Component	Safety Function	Plant Operating Mode	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	Go to Item No.
7	Electric contact to energize item 8; NO	Provide continuity for item 8	A	Fail to close	Pressure differential alarm low Position indicating light	None; loss of train A; train B available. Item 8 is an NC/FC damper; thus it will block air passage discharge to maintain negative pressure.	8
8	PV2550B, electric/ hydraulic ON-OFF damper; NC/FC, train A; NO; remain open	Open to maintain negative pressure inside AB	A	Fail to open	Pressure differential alarm low Position indicating light	None; loss of train A; train B available. Item 8 is an NC/FC damper; thus it will block air passage discharge to maintain negative pressure	9
9	002; tornado damper; NC, train A	Open to allow negative pressure inside AB and prevent backflow into building	A	Fail to open	Pressure differential alarm low	None; loss of train A; train B available	10
10	No. 10 breaker on 1AYE1; panel (120/240-V); 1ABE MCC 480-V; train A; NC	Provide continuity and protect motor, item 12	A	Inadvertent open	Position indicating light	None; loss of train A; train B available	11
11	Electric contact to energize item 12; NO	Provide continuity for item 12; NO; remain open	A	Fail to close	Flow alarm low Position indicating lights	None; loss of train A; train B available	12
12	HV12614, on-off damper; train A; NC/FC	Allow return air to item 2	A	Fail to open	Flow alarm low Position indicating lights	None; loss of train A; train B available	13
13	No. 04 breaker on 1AB15 480-V switchgear; 1E bus; train A; NO	Provide continuity and protect heater, item 14	A	Fail to close	Switchgear alarm Moisture alarm Temperature indicator	None; loss of train A; train B available	14

A. The record storage facility is located in the service building, separate from main plant structures, and does not present a fire exposure to any safety-related equipment. Fire protection for the record storage facility consists of an automatic Halon 1301 system, providing a 5-percent minimum concentration. An automatic ionization detection system is installed for early warning of a smoke condition, automatic closure of dampers and fire doors, and automatic release of the agent.

B. The administrative building fire protection consists of a sprinkler system, portable extinguishers, and standpipe hoselines.

C. The auxiliary fuel oil tank is located above ground, away from safe shutdown buildings, and is surrounded by dikes. The auxiliary fuel oil tank will be utilized as described in paragraph 9.5.4.2.2.

D. When necessary, storage of ion exchange resins in areas containing safety-related systems will be in accordance with CMEB 9.5-1 requirements of paragraph C.2.b (Administrative Controls). Portable extinguishers and standpipe hoselines are provided for these areas, in addition to the preaction system. Selected storage areas are adequately drained and curbed as necessary.

E. Materials that collect and contain radioactivity such as spent ion exchange resins, charcoal filters, etc., are stored in metal containers located in areas which do not expose safety-related systems or equipment.

F. Bulk hazardous chemical storage is maintained in an area that does not house or expose areas containing safety-related systems. Portable fire extinguishers are provided. Hoselines are provided for those chemicals which will not react with water.

Precautions are taken in the use and storage of flammable construction items such as paint and solvents. Special precautions are utilized in conjunction with cutting and welding operations. Housekeeping is applied to prevent accumulation of trash or other combustible materials in accordance with Regulatory Guide 1.39. (See section 1.9 for exceptions.) The nuclear plant general manager will implement a periodic inspection program to promote fire prevention.

9.5.1.3 Safety Evaluation

A. Noncombustible construction is employed throughout all buildings to minimize fire potential. Interior wall and structural components, thermal insulation materials, radiation shielding, and soundproofing materials are fire resistant. Interior finishes are fire resistant and are listed by UL or FM for flame spread, smoke, and fuel contribution of 25 or less in their use configuration in accordance with ASTM E-84, Surface Burning Characteristics of Building Materials. The use of plastic materials is minimized. Halongenated plastics such as polyvinyl chloride and neoprene are used only when substitute noncombustible materials are not available.

Employment of heat and flame resistant construction materials throughout all buildings reduces the potential for fire, particularly in areas that contain or may expose safety equipment or that rely on manual fire protection.

B. Electrical cables are installed with permanently colored exteriors for channel identification and separation. Insulation for electrical conductors is designed to be resistant to moisture, radiation, continuous conductor operating temperatures of 90°C and 130°C emergency overload temperatures, and a short circuit temperature of 250°C.

Power, control, instrumentation, and communications cable is flame-retardant in accordance with IEEE 383-1974. Exceptions are detailed in appendix 9B. Fire protection for cable systems is further described in subsection 8.3.3.

C. Thermal antisweat insulation, with ASTM E-84 ratings of 25 for flame spread, 50 for fuel contributed, and 50 for smoke generated, is provided for service and cooling water piping. The auxiliary feedwater pump turbine is covered with an insulated, removable galvanized steel shell.

Insulation with UL ratings of 25 or less for flame spread, fuel contributed and smoke generated, is provided for ductwork above the ceiling of the control room.

9.5.1.5.4 Responsibilities

The following are the responsibilities of the VEGP fire protection organization as related to the fire protection program.

A. Vice President-Project (Vogtle)

The vice president-project (Vogtle) has ultimate responsibility for the overall fire protection program at VEGP, including periodic assessment of the effectiveness of the VEGP fire protection program.

B. Nuclear Plant General Manager

The nuclear plant general manager has overall management responsibility for the VEGP fire protection program. He is also responsible for developing and maintaining agreements with offsite fire departments.

C. Maintenance Manager

The maintenance manager is responsible for surveillance tests and inspections assigned to maintenance. The maintenance manager is also responsible for overall material condition of the fire protection systems, features, and facilities.

D. Nuclear Specialist (Fire Protection)

The nuclear specialist (fire protection) is responsible for ensuring the effective implementation of the fire protection program. Areas of responsibility include administration, implementation, and documentation of the fire protection program.

E. Operations Manager

The operations manager has overall responsibility for administration of the VEGP fire protection program. The operations manager shall ensure that the required procedures for implementation of the fire protection program are current and in effect. The operations manager is also responsible for surveillance tests and inspections assigned to Operations.

F. Plant Training and Emergency Preparedness Manager

The training and emergency preparedness manager is responsible for implementing the fire training program. He shall ensure that all training is properly scheduled, conducted, and documented.

G. Security Manager

The security manager is responsible for development and implementation of security procedures which describe the methods for gaining emergency access to security controlled areas by fire brigade members, admission of offsite firefighters, traffic and spectator control, and post-fire security.

H. Health Physics and Chemistry Manager

The health physics and chemistry manager is responsible for development and implementation of health physics procedures which describe the actions of health physics personnel during a fire emergency which may involve radiologically controlled areas or materials.

I. Shift Superintendent (SS)

The SS has overall responsibility for plant safety in the event of a fire emergency. He will coordinate with and provide assistance to the fire team captain, as needed.

J. Fire Team Captain

Responsibilities of the fire team captain include:

1. Ensuring that the onshift fire brigade members respond to a fire emergency with the appropriate equipment.

2. Ensuring communications with the control room to keep the shift supervisor informed of the status of the fire and firefighting efforts.

3. Identifying the need for additional assistance.

4. Ensuring that plant safety-related features are considered in the firefighting efforts.

TABLE 9.5.1-1 (SHEET 2 of 81)

Unit 1 Tag Number	Description	SSD TRN	Power TRN/CHL	Hot/Cold Shutdown	C.R. Fire Isolation (39)	Location Fire Area	Fire Zone
HY-0442B	HV-0442B I/Power converter	B	B	Both	Yes	1CBLBD	60
HV-8000A	Pressurizer PORV block valve (29)	A	A	Both	Yes	1CTB	140E
HV-8000B	Pressurizer PORV block valve (29)	B	B	Both	Yes	1CTB	140E
HV-8145	CVCS auxiliary spray valve	N/A	N/A (2)	Both	Yes	1CTB	140B
HY-8145	Auxiliary spray valve solenoid	N/A	N (2)	Both	Yes	1CTB	140B
LT-0459	Pressurizer level	A	1	Both	No	1CTB	140A
LT-0460	Pressurizer level	B	2	Both	Yes	1CTB	140B
PT-0403	RCS wide range pressure	B	B	Both	Yes	1CTB	140A
PT-0405	RCS wide range pressure	A	A	Both	No	1CTB	140B
PT-0408	RHR valve pressure interlock	A	3	Cold	No (3)	1ABLDG	26A
PT-0418	RHR valve pressure interlock	B	4	Cold	No (3)	1ABLDB	27
PT-0428	RHR valve pressure interlock	B	2	Cold	No (3)	1ABLDB	27
PT-0438	RHR valve pressure interlock	A	1	Cold	No (3)	1ABLDG	26A
PV-0455A	Pressurizer PORV (29)	A	A	Both	Yes	1CTB	140E
PV-0456A	Pressurizer PORV (29)	B	B	Both	Yes	1CTB	140E
RE-13135A	R.G. 1.97 neutron flux chamber	A	A	Both	No	1CTB	140A
RE-13135B	RG 1.97 Neutron flux chamber	B	B	Both	Yes	1CTB	140B
1-1602-P5-NFA	RG 1.97 neutron flux amplifier panel	A	A	Both	No	1CBLBT	61
1-1602-P5-NFB	RG 1.97 neutron flux amplifier panel	B	B	Both	Yes	1CBLBD	62
1-1602-P5-OIB	RG 1.97 neutron flux isolator panel	B	B	Both	Yes[40]	1CBLBD	62
TE-0413A	RCS T-hot wide range loop 1	A	1	Both	No	1CTB	140C

TABLE 9.5.1-1 (SHEET 39 of 81)

Unit 1 Tag Number	Description	SSD TRN	Power TRN/CHL	Hot/Cold Shutdown	C.R. Fire Isolation (39)	Location Fire Area	Fire Zone
1-1806-S3-DSD	125-V-dc switchgear 1DD1	B	D	Both	N/A	1CBLBO	56A
1-1807-Q3-VI1	Vital bus distribution panel 1AY1A	A	A	Both	N/A	1CBLBN	78A
1-1807-Q3-VI2	Vital bus distribution panel 1BY1B	B	B	Both	N/A	1CBLBC	79A
1-1807-Q3-VI3	Vital bus distribution panel 1CY1A	A	C	Both	N/A	1CBLBL	77A
1-1807-Q3-VI4	Vital bus distribution panel 1DY1B	B	D	Both	N/A	1CBLBO	56A
1-1807-Q3-VI5	Vital bus distribution panel 1AY2A	A	A	Both	N/A	1ABL1C	44
1-1807-Q3-VI6	Vital bus distribution panel 1BY2B	B	B	Both	N/A	1ABL1B	43
1-1807-Y3-IA1	120-V-ac vital bus inverter 1AD1I1	A	A	Both	N/A	1CBLBN	78A
1-1807-Y3-IA11	120-V-ac vital bus inverter 1AD1I11	A	A	Both	N/A	1ABL1C	44
1-1807-Y3-IB12	120-V-ac vital bus inverter 1BD1I12	B	B	Both	N/A	1ABL1B	43
1-1807-Y3-IB2	120-V-ac vital bus inverter 1BD1I2	B	B	Both	N/A	1CBLBC	79A
1-1807-Y3-IC3	120-V-ac vital bus inverter 1CD1I3	A	C	Both	N/A	1CBLBL	77A
1-1807-Y3-ID4	120-V-ac vital bus inverter 1DD1I4	B	D	Both	N/A	1CBLBO	56A
1-1807-Y3-14	480/120-V transformer IBBC42RX	B	B	Both	N/A	1CBLBH	71
1-1816-U3-001	Auxiliary relay panel 1ACPAR1	A	A	Both	N/A	1CBLAN	94

TABLE 9.5.1-1 (SHEET 42 of 81)

Unit 2 Tag Number	Description	SSD TRN	Power TRN/CHL	Hot/Cold Shutdown	C.R. Fire Isolation (39)	Location Fire Area	Location Fire Zone
LT-0459	Pressurizer level	A	1	Both	No	2CTB	140A
LT-0460	Pressurizer level	B	2	Both	Yes	2CTB	140B
PT-0403	RCS wide range pressure	B	2	Both	Yes	2CTB	140A
PT-0405	RCS wide range pressure	A	1	Both	No	2CTB	140B
PT-0408	RHR valve pressure interlock	A	3	Cold	No (3)	2ABLDG	26A
PT-0418	RHR valve pressure interlock	B	4	Cold	No (3)	1ABLDB	27
PT-0428	RHR valve pressure interlock	B	2	Cold	No (3)	1ABLDB	27
PT-0438	RHR valve pressure interlock	A	1	Cold	No (3)	2ABLDG	26A
PV-0455A	Pressurizer PORV (29)	A	A	Both	Yes	2CTB	140E
PV-0456A	Pressurizer PORV (29)	B	B	Both	Yes	2CTB	140E
RE-13135A	RG 1.97 neutron flux chamber	A	A	Both	No	2CTB	140A
2-1602-P5-NFA	RG 1.97 neutron flux amplifier panel	A	A	Both	No	2CBLBT	61
RE-13135B	RG 1.97 Neutron flux chamber	B	B	Both	Yes	2CTB	140B
2-1602-P5-NFB	RG 1.97 Neutron flux amplifier panel	B	B	Both	Yes	2CBLBD	62
2-1602-P5-OIB	RG 1.97 Neutron flux OPT isolator panel	B	B	Both	Yes (40)	2CBLBD	62
TE-0413A	RCS T-hot wide range loop 1	A	1	Both	No	2CTB	140C
TE-0413B	RCS T-cold wide range loop 1	A (4)	2	Both	No	2CTB	140C

TABLE 9.5.1-1 (SHEET 78 of 81)

Unit 2 Tag Number	Description	SSD TRN	Power TRN/CHL	Hot/Cold Shutdown	C.R. Fire Isolation (39)	Location Fire Area	Location Fire Zone
2-1806-S3-DSD	125-V-dc switchgear 2DD1	B	D	Both	N/A	2CBLBO	56A
2-1807-Q3-VI1	Vital bus distribution panel 2AY1A	A	A	Both	N/A	2CBLBN	78A
2-1807-Q3-VI2	Vital bus distribution panel 2BY1B	B	B	Both	N/A	2CBLBC	79A
2-1807-Q3-VI3	Vital bus distribution panel 2CY1A	A	C	Both	N/A	2CBLBL	77A
2-1807-Q3-VI4	Vital bus distribution panel 2DY1B	B	D	Both	N/A	2CBLBO	56A
2-1807-Q3-VI5	Vital bus distribution panel 2AY2A	A	A	Both	N/A	2ABL1C	44
2-1807-Q3-VI6	Vital bus distribution panel 2BY2B	B	B	Both	N/A	2ABL1B	43
2-1807-Y3-14	Regulated transformer 2BBC42RX	B	B	Both	N/A	2CBLBH	71
2-1807-Y3-IA1	120-V-ac vital bus inverter 2AD1I1	A	A	Both	N/A	2CBLBN	78A
2-1807-Y3-IA11	120-V-ac vital bus inverter 2AD1I11	A	A	Both	N/A	2ABL1C	44
2-1807-Y3-IB12	120-V-ac vital bus inverter 2BD1I12	B	B	Both	N/A	2ABL1B	43
2-1807-Y3-IB2	120-V-ac vital bus inverter 2BD1I2	B	B	Both	N/A	2CBLBC	79A
2-1807-Y3-IC3	120-V-ac vital bus inverter 2CD1I3	A	C	Both	N/A	2CBLBL	77A
2-1807-Y3-ID4	120-V-ac vital bus inverter 2DD1I4	B	D	Both	N/A	2CBLBO	56A

TABLE 9.5.1-1 (SHEET 81 of 81)

22. For a control room fire, use local tank level indicators LI-5100 and LI-5115.
23. (Deleted)
24. For a control room fire event, valve deenergization at its power supply panel may be required.
25. For a control room fire event, valve deenergization and local manual alignment may be required.
26. Device and its electrical circuitry are totally independent of the control room.
27. Local starting of device by performing a repair at the power supply breaker may be required.
28. Not required for a control room fire.
29. Operability of the pressurizer PORVs is not required for a fire inside the containment. The pressurizer code safety valves and the reactor vessel head vent letdown paths are additional overpressurization protection features for the reactor coolant system. In the event spurious opening of a pressurizer PORV occurs, closure of the pressurizer PORV block valve will terminate the loss of reactor coolant system pressure and inventory. Where fire damage can preclude PORV block valve operability, operator actions to deenergize the PORV (fails closed upon loss of power) may be necessary.
30. Power is not required for this device to function. Power association for this device is the interlocked device control circuitry.
31. Power for operation of this component is supplied from the damper control power circuit.
32. For a control room fire event, local manual alignment may be required.
33. Valve travel is mechanically limited to always ensure minimum cooling water flow.
34. Valve to be deenergized prior to establishing RHR shutdown cooling operation.
35. For a control room fire event, local room ventilating may be required.
36. Breaker for valve locked locally in the open position.
37. Train A diesel generator bus duct passes through fire areas 2DBL1A, 2CBLBA, 2CBLAN, 2CBLAG/Fire Zones 161, 143, 73, 85, 91.
38. Train B diesel generator bus duct passes through fire areas 2DBL1B, 2CBLBD, 2CBLAI, 2CBLAH/Fire Zones 162, 144, 65, 66, 67, 93, 92.
39. The entry for this column, a N/A, Yes, or No, follows a logic tree described in calculation X4C2301S035.
40. For a control room fire, the optical isolator "TEST/STATUS" control switch should be in the "REMOTE" position.

TABLE 9.5.1-7 (SHEET 1 OF 2)

COMPONENTS DESIGNED TO RETAIN AND COLLECT RADIOACTIVITY

Backflushable filters as follows:

Seal water injection

Seal water return

Spent resin sluice

Recycle evaporator feed

Recycle evaporator concentrates (Abandoned in place)

Waste evaporator feed (Filter is removed, housing used for piping only.)

Waste monitor tank

Floor drain tank

Steam generator blowdown

Cartridge filters as follows:

Boric acid filter

Waste gas drain filter

Turbine building drain demineralizer feed filter

Turbine building drain discharge filter

Laundry and hot shower filter

Steam generator blowdown filter

Spent fuel pit skimmer filter

Waste evaporator condensate filter

Reactor coolant

Spent fuel pit

TABLE 9.5.1-8

MAJOR PROCESS COLLECTION POINTS IN
RADIOACTIVE WASTE SYSTEMS

Waste gas decay tanks

Waste gas shutdown tanks

Reactor coolant drain tank

Waste holdup tank

Waste process evaporator (Abandoned in place)

Boron recycle evaporator (Abandoned in place)

Spent resin tanks

Chemical waste tank

Waste monitor tank

Waste evaporator concentrate tank (Abandoned in place)

Refueling water storage tank

Backflushable filter and tank

Volume control tank

Laundry hot shower drain tank

Boron concentration measuring tank

Boron recycle holdup tank

Building sumps

TABLE 9.5.1-9 (SHEET 13 OF 15)

The following information is not relative to the operability and maintenance of the VEGP smoke detection system and will not be provided on procedure checklists as required by the listed sections:

Subsection 8-6.1(d): Installer/maintenance company name, address, and representative.

Subsection 8-6.1(e): Approving agency name, address, and representative.

Subsection 8-6.1(k): Signature of approval authority representative. This information is not relative to the operability and maintenance of the VEGP smoke detection system.

Subsection 8-6.2(e): Installer/maintenance company name, address, and representative.

Subsection 8-6.2(f): Approving agency name, address, and representative.

Subsection 8-6.2(l): Signature of approval authority representative.

NFPA 80-1983 FIRE DOORS AND WINDOWS

Section 1-6.1: VEGP fire doors may undergo minor modifications that void or otherwise compromise the Underwriters Laboratories label that was originally affixed to the door. Therefore, each door may not be labeled as required by this section. In all cases the modifications have been individually evaluated and determined not to adversely affect the door's fire rating as allowed by the guidelines of NRC Generic Letter 86-10 section 3.2.3.

Section 2-5.4: Clearances between the door and the door frame may exceed the 1/8-in. gap required by this section. The gap may extend to a maximum of 3/8 in. on single swinging metal fire doors to a maximum of 1/4 in. on double swinging metal fire doors. The gap between meeting edges of double swinging metal fire doors may also extend to a maximum of 1/4 in. The gap at the strikeplate area will not exceed 1/8 in. in any case. VEGP swinging hollow metal fire doors have been tested by an independent laboratory to the above-referenced dimensions. Pressure and bulletproof swinging doors have been evaluated to be comparable to or exceed the qualifications of the hollow metal doors that were tested by the independent laboratory.

Section 2-8.7.1: Fire doors to control building electrical equipment rooms are equipped with hold-open devices for use during station blackout conditions. Due to air balance conditions, some doors at VEGP may require deliberate manual

TABLE 9.5.1-9 (SHEET 14 OF 15)

action to close. Personnel are trained on the proper use of doors to ensure they are fully closed and latched following use.

Chapter 13 - This chapter is not applicable.

NFPA 90A-1981, INSTALLATION OF AIR CONDITIONING AND VENTILATION SYSTEMS

Subsection 2-1.2.2: This subsection is not applicable, since flexible duct connection penetrating floors are not used.

Chapter 4: Automatic shutdown of fan or isolation of return airflow upon receipt of a fire alarm is not provided in the control room. The control room is a continuously occupied area and the operator is relied upon to evaluate the fire location and take appropriate action to isolate necessary dampers, shutdown normal fans, if necessary, and start the smoke removal fan manually.

NFPA 92M-1972, WATERPROOFING AND DRAINING OF FLOORS

NFPA 92M is not utilized in the VEGP design for the following reasons:

- Floor drains have been provided in the various fire areas to drain any water accumulation resulting from fire fighting activities.
- Potential flooding damage to safe-shutdown equipment resulting from fire suppression system operation will be evaluated in the plant flooding analysis and appropriate corrective action to preclude any damage from occurring will be implemented.
- In areas where decontamination chemicals are expected to be utilized, the floor surfaces have been applied with an epoxy coating.

NFPA 1201-1984 (FORMALLY NFPA-4) ORGANIZATION FOR FIRE SERVICES

This standard is written specifically for a public fire department and does not apply to the fire protection program of a nuclear power plant. However, the standard does provide some guidance that VEGP feels will enhance the loss prevention program and will comply with the following sections/subsections only: 1-1.1.2, 1-2.1, 1-2.2.1, 1-6.1,

TABLE 9.5.1-9 (SHEET 15 OF 15)

3-3.1.2.1, 5-2.1.5, 5-2.1.6, 6-2.1, 6-3.2, 6-4.1.1, 15-1.3.1, 15-1.3.2, 15-1.3.3, 15-2.1.3, 15-2.2, 15-3.1.1, 16-1.2.3, and 16-2.5.

NFPA 1962-1979, CARE, USE, AND MAINTENANCE OF FIRE HOSE INCLUDING CONNECTIONS AND NOZZLES

Subsection 2-3.4 - This subsection is not applicable.

Subsection 2-4.2 - This subsection is not applicable.

Subsection 2-4.3 - This subsection is not applicable.

Chapter 3 - This chapter is not applicable.

Chapter 4 - This chapter is not applicable.

Chapter 6 - Individual records for each section of fire hose are not kept. Acceptance information on the hose can be found from the warehouse stock description. Each section of hose is labeled with the latest hydrostatic test date.

Subsection 8-3.2 - This subsection is not applicable.

Subsection 7-3 - This subsection is not applicable.

Subsection 8-5 - This subsection is not applicable.

Subsection 8-6 - This subsection is not applicable.

TABLE 9.5.1-10 (SHEET 9 OF 13)

6.3 ACTION

With one or more of the yard hydrants given in table 9.5.1-10d inoperable, within 1 hour have one hydrant hose and equipment card inside the plant protected area to provide the equipment necessary to cover the area for which the inoperable hydrant provided service. The hydrant hose and equipment cart should be positioned at the closest operable hydrant(s) shown in table 9.5.1-10d if the failed hydrant is a primary hydrant. For a backup hydrant, perform the same action within 24 hours. The hydrant hose and equipment cart used for compensatory action should be in addition to the hydrant hose and equipment cart used for fire brigade response. Each hydrant hose and equipment cart carries, as a minimum, the equipment that was provided by three hydrant hose houses. When there are more than three inoperable hydrants given in table 9.5.1-10d, or should a hydrant hose and equipment cart become inoperable, obtain a third hydrant hose and equipment cart. Should all hydrant hose and equipment carts become inoperable, remove the equipment and restock the primary hydrant houses listed in table 9.5.1-10d within 1 hour and backup hydrant houses within 24 hours for the operable hydrants only.

6.4 SURVEILLANCE REQUIREMENTS

6.4.1 Each of the yard fire hydrants and associated hydrant hose houses given in table 9.5.1-10d shall be demonstrated operable:

A. Perform periodic visual inspections of the hydrant hose and equipment cart for gas and oil levels, and general condition of the equipment and the cart.

B. At least once every 31 days, by visual inspection of the hydrant hose house or hydrant hose and equipment cart, whichever is in service, to assure all required equipment is in place and operable.

C. At least once per 6 months, by visually inspecting each yard fire hydrant and verifying that the hydrant barrel is dry and that the hydrant is not damaged.

TABLE 9.5.1-10 (SHEET 11 OF 13)

C. At least 10 percent of each type of sealed penetration (mechanical and electrical).[f] If apparent changes in appearance or abnormal degradations are found, a visual inspection of an additional 10 percent of each type of sealed penetration shall be made. This inspection process shall continue until a 10-percent sample with no apparent changes in appearance or abnormal degradation is found.

7.4.2 Each of the above required fire doors shall be verified operable by:

A. Verifying that each normally closed, unlocked fire door is closed at least once per 24 h.

B. Verifying that doors with automatic hold-open and release mechanisms are free of obstructions at least once per 24 h.

C. Verifying that each locked closed fire door is closed at least once per 7 days.

D. Performing a visual inspection of the automatic hold-open and release mechanisms at least once per 6 months.

E. Performing a functional test of doors with automatic hold-open and release mechanisms at least once per 18 months.

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a. The use of remote monitoring with CCTV is an acceptable alternative to a fire watch or fire patrol as used in the action statements of this table for normally inaccessible areas or designated high radiation areas when monitored at the required frequencies stated in the table.

b. With the affected preaction systems tripped, the Function B detection instruments revert to Function A detection instruments.

c. For preaction sprinkler systems, in the event of a detector failure, operability will be maintained by manually tripping the preaction sprinkler system control valve.

d. A hose station is considered "primary" only if there is no automatic suppression system providing protection for safe shutdown equipment within effective reach of the hose station.

TABLE 9.5.1-10 (SHEET 12 OF 13)

e. The hatch plugs in the ceilings of auxiliary building rooms RA123, RA124, RA125, RA126, RA127, RA128, RA129, RA130, RA131, RA132, RA133, and RA134 do not need to be removed to verify a portion of the boundary between fire areas 1-AB-L1-H and 2-AB-LD-B. The verification of this portion is accomplished by inspecting the floor of R142 with the hatch plugs over these rooms installed.

f. The ceiling and west wall of auxiliary building room RD37 need not be inspected to verify a portion of the boundary between fire areas 1-AB-LD-B and 2-AB-LD-B. The verification of this portion is accomplished by inspecting the floors of RC51, RC54, RC55, and RC56 along with the east wall of RD33.

g. The south wall and floor of tunnel 1T6B need not be inspected to respectively verify the fire area boundary between 1-AFB-C and 1-EB-B and the fire area boundary between 1-AFB-C and 1-CB-LA-A. This verification is accomplished by inspecting the north walls of Unit 1 equipment building rooms R116 and R114 and the ceilings of control building rooms RA61 and RA62.

h. The south wall and floor of tunnel 2T6B need not be inspected to respectively verify the fire area boundary between 2-AFB-C and 2-EB-B and the fire area boundary between 2-AFB-C and 2-CB-LA-A. This verification is accomplished by inspecting the north walls of Unit 2 equipment building rooms R116 and R114 and the ceilings of control building rooms RA03 and RA04.

i. The north wall, partial south wall, and partial floor of fuel handling building room RB10 need not be inspected to respectively verify the fire area boundary between 1-AB-LD-B and 1-CB-LC-B, the fire area boundary between 1-AB-LD-B and 1-CB-LB-D, the fire area boundary between 1-AB-LD-B and 1-FB-LC-A, and the fire area boundary between 1-AB-LD-B and 1-CB-LC-A. This verification is accomplished by respectively inspecting the south walls of control building rooms RB39 and RB43, the north walls of fuel handling building rooms RB12 and RB11, and the ceiling of fuel handling building room RC08.

j. The north wall, partial south wall, and partial floor of fuel handling building room RB04 need not be inspected to respectively verify the fire area boundary between 1-AB-LD-B and 1-CB-LC-B, the fire area boundary between 1-AB-LD-B and 2-CB-LB-D, the fire area boundary between 1-AB-LD-B and 2-FB-LC-A, and the fire area boundary between 1-AB-LD-B and 2-CB-LC-A. This verification is accomplished by respectively inspecting the south walls of control building rooms RB39, RB38, and RB19; the north walls of fuel handling building rooms RB02 and RB01; and the ceiling of fuel handling building room RC04.

TABLE 9.5.1-10 (SHEET 13 OF 13)

k. The west wall and partial floor of fuel handling building room RB05 need not be inspected to respectively verify the fire area boundary between fire areas 1-AB-LD-B and 2-FB-LC-A and the fire area boundary between fire areas 1-AB-LD-B and 2-CB-LC-A. This verification is accomplished by respectively inspecting the east walls of fuel handling building rooms RB01 and RB02 and the ceiling of fuel handling building room RC04.

l. The east wall and partial floor of fuel handling building room RB09 need not be inspected to respectively verify the fire area boundary between fire areas 1-AB-LD-B and 1-FB-LC-A and the fire area boundary between fire areas 1-AB-LD-B and 1-CB-LC-A. This verification is accomplished by respectively inspecting the west walls of fuel handling building rooms RB11 and RB12 and the ceiling of fuel handling building room RC08.

Table 9.5.1-10A (SHEET 11 OF 12)

Fire-Zone	Elevation	Instrument Location	Total Number of Instruments(a) Heat (A/B)	Flame (A/B)	Smoke (A/B)	IR (A/B)	Line X/Y
Diesel Generator Building (Unit 1)							
143	180	Electrical tunnel train A			0/9		
144	180	Electrical tunnel train B			0/9		
161	220	Standby diesel generator room train A	0/37			0/4	
162	220	Standby diesel generator room train B	16/16			0/4	
163	220	Diesel fuel oil day tank room Train A				0/2	
164	220	Diesel fuel oil day tank room train B				0/2	
165	211	Diesel fuel oil storage tank pumps room train A		2/0			2/0
166	211	Diesel fuel oil storage tank pumps room train B		5/0			2/0
Diesel Generator Building (Unit 2)							
143	180	Electrical tunnel train A			0/9		
144	180	Electrical tunnel train B			0/9		
161	220	Standby diesel generator room train A	0/37			0/4	
162	220	Standby diesel generator room train B	0/37			0/4	
163	220	Diesel fuel oil day tank room train A				0/2	
164	220	Diesel fuel oil day tank room train B				0/2	
165	211	Diesel fuel oil storage tank pumps room train A	2/0			2/0	
166	211	Diesel fuel oil storage tank pumps room train B	5/0			2/0	
NSCW Pumphouse (Unit 1)							
145	N/A	Electrical chase train A			0/7		
146	N/A	Electrical chase train B			0/8		
160 A	N/A	NSCW pumps train A			7/0		
160 B	N/A	NSCW pumps train B			7/0		
NSCW Pumphouse (Unit 2)							
145	N/A	Electrical chase train A			0/7		
146	N/A	Electrical chase train B			0/8		
160 A	N/A	NSCW pumps train A			7/0	4/0	
160 B	N/A	NSCW pumps train B			7/0	4/0	

9.5.2 COMMUNICATION SYSTEMS

9.5.2.1 Design Bases

The communication system is designed to provide effective intraplant communications and effective plant-to-offsite communications during normal, transient, fire, and accident conditions, including loss of offsite power. The communication system consists of the following subsystems:

A. Telephone/page system.

B. Private automatic branch exchange (PABX) system.

C. Sound-powered system.

These communication systems are independent of one another; therefore, a failure in one system does not degrade performance of the other systems. Communication systems are nonsafety related and serve no safety function.

9.5.2.2 System Description

9.5.2.2.1 Telephone/Page System

The telephone/page system consists of handsets, amplifiers, loudspeakers, siren tone generators, tone receiver assemblies, flashing beacons, volume control devices, page extensions, a centralized test and distribution cabinet, and associated equipment designed to provide convenient, effective operational service to the plant. The system consists of one paging line (with four zones: Unit 1, Unit 2, outside areas, and the administration building) and five party lines. All lines are independent of one another with no crosstalk or interference. One party line is designed for communication between all zones at all times. Communication is established by selecting the same clear party line at each desired station using the party line selector switch provided with each unit and then talking into the handset. Intrazone announcements are made by pushing the paging button and speaking into the handset microphone at the handset station. Interzone announcements are made by first merging the required zones and then pushing the paging button and speaking into the handset microphone at the handset station. Remote zone merging control units are provided at the Unit 1 control room, the Unit 2 control room, the central alarm security station, the secondary security alarm station, and the captain's office in the PESB.

The following is a description of the power supply to the telephone/page system:

A. The primary source of power is from a 25-kVA, 120-V-ac inverter.

B. The normal supply to the inverter is from a common normal 480-V-ac motor control center that is backed by a non-Class 1E (security) diesel generator.

C. The backup supply to the inverter is from the 125-V-dc technical support center battery. This battery is sized for 1 h of operation after loss of power to the battery chargers. One of the battery chargers for this battery receives backup power from a non-Class 1E security diesel generator should normal power be lost.

D. During testing or maintenance, the telephone/page system will receive power from a normal 120-V-ac source.

A multi-tone siren tone generator is provided to annunciate alarms using the telephone page system amplifiers and speakers. Alarm initiation and tone selection capability are provided in the Unit 1 control room.

Volume control adjustment knobs are provided with each amplifier. For high ambient noise areas, a volume control bypass relay is provided with each amplifier that will bypass the volume controls upon initiation of an alarm by the siren tone generator. This will ensure full volume for all alarms. Additionally, tone receiver assemblies may be used to activate a flashing beacon which will visually signal the initiation of alarms by the siren tone generator. In the control room and technical support center, volume control devices will be used to control the volume level of the page speakers in these areas. This will ensure clear, intelligible signals that are adjustable to meet the variable ambient noise levels experienced in these two areas. All zones are automatically merged during an alarm condition.

Within Unit 1, Unit 2, and outside area zones, subcircuits are provided which break the zone into several sections. Each subcircuit can be disconnected from the rest of the system at a central location should a disabling failure occur.

TABLE 9.5.2-1

COMMUNICATION EQUIPMENT AND LOCATIONS
AVAILABLE FOR SAFE SHUTDOWN

Location	Available Equipment				
Control room	T/P,	PABX,	RSP,	CSP,	MSP
Shutdown panel A	T/P,	PABX,		CSP,	MSP
Shutdown panel B	T/P,	PABX,		CSP,	MSP
Auxiliary feedwater turbine-driven pump panel	T/P,	PABX,		CSP,	MSP
Diesel generator local panel	T/P,	PABX,		CSP,	MSP
Safety-related 4.16-kV switchgear rooms	T/P[a]	PABX,		CSP,	MSP
Safety-related 480-V switchgear rooms	T/P[b]	PABX,[c]		CSP,	MSP
RHR Hx Inlet Valves[d]				CSP	

T/P - Telephone/page
PABX - Private automatic branch exchange system
RSP - Refueling sound-powered system
CSP - Cold shutdown sound-powered system
MSP - Maintenance sound-powered system

(a) Paging output only.
(b) Paging output only, except the rooms containing switchgear AB15 (Auxiliary Building R-D105 Unit 1; and R-D104, Unit 2) which do not have T/P equipment. T/P equipment is available for rooms containing switchgear 2BB06 and 2BB07 (control building R-B18, Unit 2).
(c) Except the rooms containing switchgear BB16 (R-207, Unit 1; R-223, Unit 2) which do not have PABX equipment.
(d) RHR Hx inlet valves to control RCS temperature, rooms R-C89 and R-C38.

9.5.3 LIGHTING SYSTEMS

The plant lighting systems include normal, essential, and emergency lighting designed to provide adequate lighting during normal operation and accident conditions, including the effects of a loss of offsite power.

9.5.3.1 Design Bases

9.5.3.1.1 Safety Design Bases

The lighting system (with the exception of isolating transformers) is nonsafety related and therefore serves no safety function.

9.5.3.1.2 Power Generation Design Bases

Adequate lighting systems are provided in areas used during normal, shutdown, and emergency operations, including the appropriate access or exit routes. Lighting intensities are designed to the levels recommended by the Illuminating Engineering Society. The use of high-pressure sodium, fluorescent, and mercury vapor lamps is restricted; these lamps are not used in the following major areas:

- Containment. Temporary use of fluorescent and high-pressure sodium lamps is permitted during refueling outages/plant shutdowns during Modes 5 and 6 only. Usage during these times is administratively controlled.
- Above the fuel transfer canal.
- Above the new and spent fuel storage areas.
- The alternate radwaste building (only mercury vapor is restricted).

Incandescent lighting is used in these areas except as noted in the radwaste building.

9.5.3.2 System Description

The plant lighting systems are illustrated schematically in drawings 1X3DG020, 2X3DG030, and 1X3DG021.

REV 9 5/00
REV 5 9/95
REV 2 3/92

9.5.3.2.1 Normal Lighting System

The normal lighting system is supplied power from two sources:

A. Two double-ended 480/277-V-ac lighting load centers furnished for each unit.

B. Lighting panels fed from non-Class 1E motor control centers through 480-208Y/120-V dry-type transformers.

9.5.3.2.2 Essential Lighting System

The essential lighting system is used in conjunction with the normal lighting system, especially in main walkways and stairs, Class 1E equipment, and switchgear rooms. The essential lighting system is supplied power from non-Class 1E motor control centers backed by the emergency diesel generators. Power to these motor control centers is provided as indicated in paragraph 8.3.1.1.3.F.

9.5.3.2.3 Emergency Lighting System

The emergency lighting system is defined as the system that is provided power from either Class 1E 480-V buses or from self-contained battery pack units, as indicated below. The emergency lighting system has adequate lighting to achieve safe shutdown upon loss of offsite power and loss of one emergency diesel generator (DG) as indicated below (See table 9.5.3-2.) The emergency lighting system is divided as follows:

A. Main Control Board Emergency Lighting

The main control board shall be illuminated by 120-V-ac fluorescent fixtures with 90-min rated, self-contained battery and charger units, supplied through qualified 480/120-V-ac isolation devices, constant voltage regulating transformers (one per train). The transformer primary side is connected to the 480-V-ac Class 1E bus. The transformer secondary side is connected to a 120-V-ac non-Class 1E Seismic Category 1 distribution panel. The Class 1E busses feeding these transformers are backed by their respective emergency DGs. The transformers are automatically connected to the output of the DGs under loss-of-offsite power and accident conditions. In the event that one DG is lost, a minimum lighting level of 25 foot-candles (fc) can[a] be maintained by the ceiling

a. The above lighting levels are approximate and may vary. Lighting levels lower than those shown were verified as being acceptable for the task at hand by operating personnel.

fixtures that are powered from the other DG. The cables and components required to power the ceiling fixtures are located such that at least one set of lights (channel A or B oriented power supply) will be available except during a fire which would require a main control room evacuation. Additionally, in the event of station blackout (SBO), SBO transfer switches exist so operators can power control room lighting from the opposite unit's DG backed lighting distribution panels. Associated cable, raceway, SBO transfer switches, and fixtures are supported using Seismic Category 1 mounting. The routing of the cables that provide power to the control room ceiling light fixtures, has been determined to meet the separation requirements of Branch Technical Position CMEB 9.5-1. On this basis, VEGP utilizes this power supply design in lieu of the requirement of CMEB 9.5-1 to provide self-contained 8-h battery-backed lighting fixtures. See section 9B for additional details and justification.

B. Safe Shutdown Panels Emergency Lighting

Emergency lighting for the remote shutdown panels, diesel generator panels, and auxiliary feedwater pumphouse panels are powered from 480-V-ac Class 1E motor control centers through qualified 480/120-V-ac isolation devices (regulating transformers). The transformer secondary side is connected to a 120-V-ac non-Class 1E Seismic Category 1 bus. Associated cable, raceway, and fixtures are supported using Seismic Category 1 mounting. In addition, sealed beam fixtures are provided to illuminate the panels and the access route between the main control room and the shutdown panel rooms and all areas required for safe shutdown operations. Sealed beam fixtures are 8-h rated with integral battery and charger units. The sealed beam fixtures are powered from the normal and/or essential lighting system except for the fixtures in the diesel generator panel room, remote shutdown panel rooms, and the auxiliary feedwater pumphouse panel room, which are powered from the ac emergency lighting system.

In areas other than the main control board area, emergency lighting is provided by 8-h sealed beam lighting fixtures which provide the following minimum[a] illumination levels:

a. The above lighting levels are approximate and may vary. Lighting levels lower than those shown were verified as being acceptable for the task at hand by operating personnel.

Min. fc	Location
10	Remote shutdown panels Diesel generator panels Auxiliary feedwater panels
0.5 to 3	Access routes from the main control room to the remote shutdown panels and routes within the control building from the main control room to the auxiliary feedwater pumphouse and to the diesel generator building.

No credit is taken for the outdoor lighting system. Portable dc units will be used.

Power to the sealed beam modular units used for access to the shutdown rooms from the control room will be from their self-contained battery and charger unit (power pack unit) which is rated for 8-h minimum operation upon loss of power to the essential lighting system. Power to the sealed beam modular units in the auxiliary feedwater pumphouse and in the diesel generator building will be from their self-contained battery and charger unit (power pack unit) which is rated for 8-h minimum operation upon loss of power to the associated emergency lighting system. The power pack unit is identical to the unit which was seismically tested by the supplier, and is, therefore equivalent to Seismic Category 1.

The emergency lighting system components, including raceways and lighting fixtures, have been mounted to Seismic Category 1 requirements; the distribution panel boards are seismically qualified.

C. Fire Protection Lighting

Sealed beam fixtures are provided in all plant areas to supply sufficient illumination for safe ingress and egress of personnel following a loss of normal and/or essential lighting. The fixtures have self-contained battery and charger units powered from the normal lighting system. The fixtures are 8-h rated, with the exception of the fixtures in the turbine building and outside areas, where they are minimum 1 1/2-h rated.

TABLE 9.5.3-1 (SHEET 1 OF 7)

EMERGENCY[a] AND ESSENTIAL[b] LIGHTING SYSTEM FAILURE MODES AND EFFECTS ANALYSIS

Item No.	Description of Component	Safety Function	Plant Operating Mode [d]	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	General Remarks
1.	No. 23 breaker[c] on MCC 1ABC-NC, train A, 1E	Provide continuity and protection between MCC and lighting panel for MCR and cold shutdown panel areas	A	Inadvertent open	A. Operator observation B. Control room alarm	None. 50% loss of lighting in MCR and cold shutdown panel areas. 90-min battery-powered lighting available in MCR; 8-h battery-powered lighting available in both areas. Train B available.	
2.	1ABC23RX-XFMR, [e] train A	Reduce 480 V to 120 V	A	No output	No alarm or indicator	None. Same as 1.	
3.	1NLP29, emergency lighting panel	Distribute emergency lights in MCR and cold shutdown panel areas	A	No output	Same as 2	None. Same as 1. Also, power from Unit 2 available to MCR via SBO transfer switches (item 50).	Seismic Category 1 Panel
4.	No. 23 breaker[c] - same as 1 except MCC 1BBC, train B, 1E	Same as 1	A	Same as 1	Same as 1A and 1B	None. Same as 1 except train A available.	
5.	1BBC23RX-XFMR, [e] train B	Same as 2	A	No output	Same as 2	None. Same as 4.	
6.	1NLP32, emergency lighting panel	Same as 3	A	No output	Same as 2	None. Same as 4. Also, power from Unit 2 available to MCR via SBO transfer switches (item 50).	Seismic Category 1 Panel
7.	No. 13 breaker[c] - same as 1 except MCC 1ABF	Same as 1 except for diesel generator and auxiliary feedwater pump local control areas	A	Same as 1	Same as 1A and 1B	None. 50% loss of lighting in these areas. Train B available.	

TABLE 9.5.3-1 (SHEET 2 OF 7)

Item No.	Description of Component	Safety Function	Plant Operating Mode[d]	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	General Remarks
8.	1ABF13RX - [e] same as 2	Same as 2	A	No output	Same as 2	None. Same as 7.	
9.	1NLP50 - same as 3	Same as 3 except for diesel generator and auxiliary feedwater pump local control areas	A	No output	Same as 2	None. Same as 7.	Seismic Category 1 Panel
10.	No. 13 breaker[c] - same as 4 except MCC 1BBF	Same as 7	A	Same as 1	Same as 1A	None. Same as 7 except train A available.	
11.	1BBF13RX - [e] same as 5	Same as 2	A	No output	Same as 2	None. Same as 10.	
12.	1NLP47 - same as 6	Same as 9	A	No output	Same as 2	None. Same as 10.	Seismic Category 1 Panel
13.	No. 15 breaker[c] - same as 1 except MCC 1NBS, non-1E	Same as 1 except for control and fuel handling building and tunnel areas.	B	Inadvertent open	Operator observation	Partial loss of essential lighting in the control and fuel handling building and tunnel areas. 8-h battery-backed emergency lighting available.	
14.	1NBS15X-XFMR, non-1E	Reduce 480 V to 208/120 V	B	No output	Same as 2	Same as 13	
15.	1NLP35, essential lighting panel, non-1E	Distribute essential lights in control and fuel handling building and tunnel areas	B	No output	Same as 2	Same as 13	

TABLE 9.5.3-1 (SHEET 7 OF 7)

Item No.	Description of Component	Safety Function	Plant Operating Mode (d)	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	General Remarks
55.	SBO transfer switches	Provide power from alternate unit, in the event of SBO, to main control room lighting	A	No output	No alarm or indicator	None. 90-min battery-powered lighting available in MCR. 8-h battery-backed emergency lighting available.	

a. Emergency - provide sufficient illumination in areas manned for a safe shutdown and for access and egress routes to and from all areas upon loss of normal lighting.

b. Essential - provide required illumination levels throughout the plant upon loss of offsite power.

c. Circuit breaker with thermal magnetic overload trip coil. The failure of any one circuit breaker to open when required under fault conditions will result in the loss or partial loss of only the associated train with the redundant train still available.

d. Plant operating modes:

A - all plant operating modes, including loss of offsite power, with or without a safety injection signal.
B - all plant operating modes, including loss of offsite power, without a safety injection signal.

e. Unit 2 transformer numbers are suffixed by "RX" in lieu of "X."

TABLE 9.5.4-2 (SHEET 1 OF 7)

FAILURE MODES AND EFFECTS ANALYSIS

Item No.	Description of Component	Safety Function	Plant Operating Mode	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	General Remarks
1.	Diesel fuel oil (DFO) storage tank, train A, tag No. 1-2403T4001 and 2-2403T4001	Stores DFO supply	All	Leaks	• Low level DFO storage tank light and alarm on engine control panel PDG2 and on QEAB in in control room • Periodic inspection	None; low level in DFO storage tank will not degrade engine operation	DFO can be transferred from train B storage tank to train A DFO day tank. Also, day tank can be filled at truck fill inlet.
2.	DFO transfer pump 1a, train A, normally deenergized, tag No. 1-2403P4001 and 2-2403P4001	Pumps DFO to day tank to maintain required day tank level	All	Fails to operate (pump or motor)	• 480-V MCC 1/2ABF alarm • High/low level day tank light and alarm on PDG2 and QEAB • Visual level gauge on day tank	None; DFO transfer pump 2a will be automatically energized by pressure transmitter (PT-9014) and by day tank level switch (LS-9020) at low-low level	DFO transfer pumps 1a and 2a are set to operate at different levels in the day tank and start alternately
3.	DFO transfer pump 2a, train A, normally deenergized, tag No. 1-2403P4002 and 2-2403P4002	Pumps DFO to day tank if the transfer pump 1a fails to operate	All	Same as item 2	Same as item 2	None; low-low level in day tank will not degrade engine operation. Approximately 1 h fuel left in tank at engine full load.	Same as item 1
4.	DFO day tank, train A, tag No. 1-2403T4003 and 2-2403T4003	Stores 2.3 h of DFO supply and provides positive suction head to the engine driven fuel oil pump	All	Same as item 1	• Same as item 2 except 480-V MCC 1/2ABF alarms • Periodic inspection	Same as item 3	

TABLE 9.5.4-2 (SHEET 6 OF 7)

Item No.	Description of Component	Safety Function	Plant Operating Mode	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	General Remarks
20.	Same as item 1 except train B, tag No. 1-2403T4002 and 2-2403T4002	Same as item 1	All	Same as item 1	Same as item 1 except PDG4	Same as item 1	Same as item 1 except fuel oil transfers from train A to train B
21.	Same as item 2 except train B, tag No. 1-2403P4004 and 2-2403P4004	Same as item 2	All	Same as item 2	Same as item 2 except 480-V MCC 1/2BBF alarm	Same as item 2 except PT-9015 and LS-9021	Same as item 2
22.	Same as item 3 except train B, tag No. 1-2403P4003 and 2-2403P4003	Same as item 3	All	Same as item 2	Same as item 21	Same as item 3	Same as item 20
23.	Same as item 4 except train B, tag No. 1-2403T4004 and 2-2403T4004	Same as item 4	All	Same as item 1	Same as item 4 except PDG4	Same as item 3	
24.	Same as item 5 except train B	Same as item 5	All	Same as item 5	Same as item 5 except PDG4 available	None; loss of train B, train A	Same as item 5
25.	Same as item 6 except train B and check valve (050)	Same as item 6	All	a. Same as item 6a b. Same as item 6b	a. Same as item 21 except no 480-V MCC 1/2BBF alarm b. Same as item 25a	a. Same as item 21 b. Same as item 21	b. Same as item 6b
26.	Same as item 7 except train B and check valve (053)	Same as item 7	All	a. Same as item 6a b. Same as item 6b	a. Same as item 25a b. Same as item 25a	a. Same as item 3 b. Same as item 21	a. Same as item 1 b. Same as item 7b
27.	Same as item 8 except train B	Same as item 8	All	Same as item 8	Same as item 8 except PDG4	Same as item 24	Same as item 8
28.	Same as item 9 except train B	Same as item 9	All	Same as item 9	Same as item 9 except PDG4	Same as item 24	Same as item 9

jacket water cooler. For temperatures above approximately 152°F, a portion of the jacket water flow passes through the jacket water cooler.

9.5.5.2.1.4 Aftercoolers. The aftercooler is an air-to-water heat exchanger. After the jacket water exits the jacket water cooler, a portion of the water is diverted to the aftercoolers. There are two aftercoolers per engine. The jacket water flows through the finned tubes of the aftercooler, and the combustion air passes over the finned tubes. The aftercooler cools the combustion air after it has passed through the turbocharger.

9.5.5.2.1.5 Lube Oil Cooler. The diesel generator lube oil cooler is a shell and tube heat exchanger that provides the means of removing heat from the engine lube oil. The lube oil flows through the shell side and the jacket water passes through the tube side.

9.5.5.2.1.6 Jacket Water Standpipe. The jacket water standpipe (surge tank) is connected to the diesel generator coolant loop to allow for coolant volumetric changes due to temperature variations, to provide makeup water, and to absorb pump pressure variations. The standpipe has a working capacity of approximately 600 gal and is fitted with level instrumentation, vent, and makeup and drain connections. Makeup to the standpipe can be manually initiated from the non-Seismic Category 1 demineralized water system.

9.5.5.2.1.7 Jacket Water Keep Warm System. The jacket water keep-warm system consists of a 3-hp, motor-driven, centrifugal, keep-warm circulating pump and a 75-kW immersion heater. The immersion heater is thermostatically controlled to maintain the jacket water between 145°F and 165°F. The circulation pump runs continuously when the engine is idle and automatically stops when the engine is started.

9.5.5.2.2 System Operation

When the diesel generator is not in operation, the unit is maintained at a temperature to ensure quick starting and fast loading. The keep-warm circulating pump operates continuously to maintain the engine at this temperature by circulating warmed water through the engine water jackets. A thermostat on the heater maintains the temperature of the circulating water between

145°F and 165°F. The keep-warm circulating pump and heater are automatically deenergized when the diesel engine is started.

The diesel generator cooling water system provides a sufficient heat sink to permit the diesel engine to start and operate for 3 min without flow from the nuclear service cooling water system through the diesel generator jacket water cooler. This margin is provided since the electric-driven nuclear service cooling water system pumps do not activate until after the diesel generator is in operation.

The diesel generator cooling water is treated in accordance with plant chemistry procedures as appropriate to maintain the compatibility of the water chemistry and the system materials and to preclude long-term corrosion and organic fouling. The diesel generator cooling water system can be vented to ensure that all spaces are filled with cooling water.

During operation of the diesel engine, temperature regulation of the jacket water is accomplished through action of the automatic three-way thermostatic valve that modulates coolant flow between the diesel generator jacket water cooler and its associated bypass line. In this manner, the engine jacket water is maintained at the proper temperature for maximum engine efficiency.

Active components in the diesel generator cooling water system include the jacket water pump, the keep-warm circulating pump, the engine jacket water pump discharge check valve, and the three-way thermostatic valve. Failure of the engine-driven jacket water pump, indicated by a low jacket water pressure alarm, requires shutdown of its diesel generator; the other redundant train of engineered safety features equipment continues to be powered by its associated diesel generator. Failure of the keep-warm pump or the heater while the diesel engine is in standby status would be indicated by the water jacket low-temperature alarm at 140°F; this annunciation would prompt operators to replace the failed unit or start the engine to prevent low temperatures in the diesel generator cooling water system. The pump or the heater may be replaced readily, and the large mass of the diesel engine retains heat for lengthy periods. Moreover, reduction to room temperature does not seriously lengthen the time required to start the engine. The diesel generator room heating and ventilating system maintains the room air temperature at a minimum of 50°F. The three-way thermostatic valve is designed to fail in the position directing maximum shell-side coolant flow to the diesel generator heat exchanger to provide maximum cooling. Should the three-way valve become stuck

TABLE 9.5.5-2 (SHEET 3 OF 4)

Item No.	Description of Component	Safety Function	Plant Operating Mode	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	General Remarks	Go to Item No.
6	JW standpipe, train A.	Expansion chamber air and vapor eliminator and keeps constant suction head on engine-driven JW pump and JWKW pump.	All	Leaks water.	• Low-level JW light and alarm on PDG2 and QEAB panels. • Level Instrumentation	None; low level in JW standpipe will not degrade engine operation.	Demineralized water system (1418) can supply makeup water.	
7	JW heater, train A, normally energized (non-IE power).	Warms the JW during engine standby.	All	Fails to operate.	Same as item 4.	Same as item 4.	Same as item 4.	
8	JW heat exchanger, train A.	Cools JW to desired temperature level.	All	Leaks water.	Same as item 6.	Same as item 6.	Same as item 6.	
9	Lube oil heat heat exchanger, train A.	Cools lube oil to desired temperature level during engine operation.	All	Heat exchanger tube leaks water.	None.	None.	Can be detected by periodic inspection. 1. Water present in lube oil sump tank drain. 2. Oil scum in JW standpipe.	See note b.
10	Cooling water system piping, train A.	Conveys JW to engine and associated equipment in a closed loop and maintains pressure boundary.	All	Pipe break.	Same as item 1.	Same as item 1.		
11	Same as item 1, except train B.	Same as item 1.	All	Same as item 1.	Same as item 1, except engine control panel PDG4.	None; loss of train B, train A available.		
12	Same as item 2, except train B.	Same as item 2.	All	Same as item 2.	Same as item 11.	Same as item 11.		

9.5.6 DIESEL GENERATOR STARTING SYSTEM

This subsection discusses the mechanical features of the diesel generator starting system. Control and instrumentation for starting the diesel generator system are discussed in section 7.3. The standby power supply is discussed in detail in section 8.3.

9.5.6.1 Design Bases

Protection of the diesel generator starting system from wind and tornado effects is discussed in section 3.3. Flood design is discussed in section 3.4. Missile protection is discussed in section 3.5. Protection against dynamic effects associated with postulated rupture of piping is discussed in section 3.6. Environmental design is discussed in section 3.11.

9.5.6.1.1 Safety Design Bases

A. The diesel generator starting system initiates an engine start such that within 9.5 s after receipt of the start signal, the diesel generator is operating at load speed and is ready to begin load sequencing. This time frame is less than that assumed in the accident analyses presented in chapter 15.

B. The diesel generator starting system is designed so that no single active failure, assuming a loss of off-site power, can result in a complete loss of the standby power source function.

C. Portions of the diesel generator starting system which are required to start the diesel upon receipt of an engineered safety features actuation signal are designed to remain functional after a safe shutdown earthquake.

D. Active components of the system can be tested during plant operation in accordance with 10 CFR 50, General Design Criterion 18.

9.5.6.1.2 Power Generation Design Bases

The diesel generator starting system has no power generation design basis.

9.5.6.1.3 Codes and Standards

Codes and standards applicable to the diesel generator starting system are listed in table 3.2.2-1.

9.5.6.2 System Description

The diesel generator starting system is shown schematically in drawings 1X4DB170-1, 1X4DB170-2, 2X4DB170-1 and 2X4DB170-2. Each diesel generator is equipped with two independent and redundant starting air systems. Each starting air system consists of one air compressor, aftercooler, air dryer, air receiver, compressor air intake filter, scale trap, piping, valves, and associated instrumentation. Design parameters for the major system components are summarized in table 9.5.6-1.

9.5.6.2.1 Component Description

9.5.6.2.1.1 Air Compressors. One motor-driven compressor is provided for each starting air system (two starting air systems per diesel generator set).

9.5.6.2.1.2 Air Dryers. Each starting air system is equipped with an air dryer to ensure that dry air is available for all starts. A bleedoff orifice is installed downstream of the dryer and is sized to regulate the air compressor run time to approximately 20 minutes. This run time will decrease moisture accumulation in the air compressor discharge piping and in the compressor crankcase oil.

9.5.6.2.1.3 Air Receivers. Each starting air system is equipped with one air receiver. Each air receiver is capable of providing starting air for five consecutive engine starts without compressor assistance. Provisions are made for blowdown of air receivers to eliminate any moisture that might accumulate.

9.5.6.2.1.4 Aftercoolers. Each starting air system is equipped with an aftercooler to cool the air after compression and to condense any moisture in the air to aid the air dryers in removing moisture. The aftercooler is installed between the compressor and the dryer.

9.5.6.2.1.5 Air Start Distributors. Each engine is equipped with two air start distributors, one per air start system. The air distributors time, or distribute, the starting air to each cylinder in relation to the power stroke of each piston.

9.5.6.2.1.6 Air Start Solenoid Valves. Each starting air system is equipped with two air start solenoid valves, connected in parallel, so that failure of one solenoid valve does not compromise the operability of the system.

The piping downstream of the receiver is provided with a drainline to remove any moisture which may accumulate. A Y-strainer is installed upstream of the parallel air start valves to prevent oil and particulate from fouling these valves. Periodic testing of the diesel confirms operability of these valves.

9.5.6.2.2 System Operation

The air receivers for each diesel engine are maintained at operating pressure by compressors. The compressors start when air receiver pressure drops to 225 psig and stop when pressure is increased to 250 psig. Two compressors are provided. Each compressor keeps one receiver pressurized. A check valve in the air receiver charging line ensures that a broken line from the compressor will not affect the receiver. The air dryers and aftercoolers ensure that the starting air is dry.

A cross-connect line, located upstream from each air receiver's inlet check valve, connects the two air receivers with a normally closed valve. The valves on the cross-connect and discharge piping can be aligned manually so that either air receiver can be recharged from either air compressor. The air dryers and aftercoolers ensure that the starting air is dry.

When the diesel generator set receives a start signal, all four solenoid valves are energized simultaneously, allowing starting air to flow to each cylinder, using air from both air start systems independently. Thus, if one air start system fails to operate, the second will start the diesel generator set without waiting for a second start attempt and without switching from the first air start system to the second. When a start signal is initiated, either manual or automatic, the starting air valves (HV-9068 A/B and HV-9070 A/B for train A and HV-9069 A/B and HV-9071 A/B for train B) will all open, admitting air to both banks of cylinders on the engine. The starting air valves will open for 5 seconds and automatically close after the 5 seconds have elapsed. However, the 5-second time limit is bypassed on an emergency start signal. The air distributor for each bank will properly time the opening of the air valve in each cylinder head to admit air to the cylinder whose piston is in proper position for the starting effort. As soon as the engine has fired and is running on its own power, a speed switch cuts the electrical circuit to the starting air valves and causes the valves to close. The speed switch is set to cut off the electrical circuit to the starting air valves at an engine speed of approximately 200 rpm. Also, the air valve in each cylinder head cannot admit starting air to the cylinder if the cylinder has fired. This is due to the differential pressure between the starting air pressure and the pressure of combustion inside the cylinder. Normally, after two to three engine revolutions the engine will fire and no starting air will be used to rotate the engine, even though the engine has not reached a speed of 200 rpm. When receiver pressure drops to 150 psig, the automatic starting sequence is stopped, but manual start attempts may be made as long as both receivers are connected to their respective cylinder banks and until pressure drops to approximately 90 psig. Starting air pressure below 90 psig is not sufficient to turn the engine, and the receivers must be recharged at this point.

An in-line membrane-type dryer is provided upstream of the starting air receiver tank to remove water vapor from the compressed air before it reaches the receiver tank. Compressed air passes through a bundle of hollow membrane fibers. The water vapor is swept through the membrane walls and out of the dryer through the sweep ports. The dried air continues down the dryer tube and into the downstream piping. A bleedoff orifice is installed downstream of the dryer and sized to allow enough air to bleed off to regulate the air compressor run time to approximately 20 minutes. This run time for the air compressors will minimize moisture accumulation in the compressor discharge piping and in the compressor crankcase oil.

TABLE 9.5.6-1 (SHEET 1 OF 2)

STANDBY DIESEL GENERATOR STARTING SYSTEM
COMPONENT DATA

Compressors	
Quantity (per engine)	2
Type	Reciprocating, air cooled
Capacity (sf^3/min)	76
Discharge pressure (psig)	250
Air temperature leaving cooler (°F)	120-135
Number of stages/cylinders	2/3 (2 low pressure, 1 high pressure)
Revolutions per minute	790
Regulation	Dual control
Design code	Manufacturer's standard
Driver	
Type	Electric motor TEFC
Horsepower	30
Revolutions per minute	1800
Power supply	460-V, 60-Hz, 3-phase
Source of power	MCC 1NBI/2NBI, 1NBO/2NBO
Seismic design	Category 2
Dryers	
Quantity (per engine)	2
Type	Membrane
Flow capacity (sf^3/min)	88
Design pressure (psig)	250
Air inlet temperature (°F)	max. 150°F
Dew point of air leaving dryer (°F)	-20°F
Design code	Manufacturer's standard
Maximum working pressure (psig)	300
Maximum Dp at rated flow (psi)	5
Seismic design	Category 2

9.5.8.2.3 System Operation

There are no active components within the diesel generator combustion air intake and exhaust system.

Upon initiation of a diesel generator start signal, combustion air is drawn into the air intake filter and passes through the intake piping and silencer to the turbocharger then through the aftercooler to the engine intake manifolds. The combustion air intake filter, silencer, and the combustion air piping are sized to supply an adequate supply of air to the engine while operating at 110 percent of nameplate rating. After the exhaust gases pass through the turbocharger, the exhaust gas enters the exhaust pipe, passes through the exhaust silencer, and is then piped out of the building. The exhaust piping and silencer are sized to prevent excessive backpressure on the engine when operating at 110-percent nameplate rating.

9.5.8.3 Safety Evaluation

A. The diesel generator combustion air intake and exhaust system is capable of supplying an adequate quantity and quality of filtered combustion air to the engine and of disposing of the resultant exhaust gases without creating an excessive backpressure on the engine when the engine is operating at 110-percent nameplate rating.

The diesel generator buildings are not equipped with gaseous fire suppression systems nor are they located near the gas storage facilities. The carbon dioxide storage tank is located 260 ft away, the hydrogen storage facility is 600 ft away, and the nitrogen storage system is 600 ft away. Figure 6.4.2-2 shows the physical relationship of the diesel generator building to those plant features which could affect the system. These distances are adequate to ensure that an accidental release of these gases does not degrade diesel performance. Drawings 1X4DE327, 1X4DE330, 2X4DE327, and 2X4DE330 show the protection provided against precipitation and tornado missiles.

The combustion air intake filter for each diesel is located in a separate enclosure on the second floor of the diesel generator building and is protected against tornado missiles. The intake is located on the sidewall of the second floor of the diesel generator building, below the roof level. The engine exhaust discharges above the roof of the diesel generator building, and the portion of the exhaust pipe above the roof is protected by a guard structure against precipitation and tornado missiles as shown in drawing 1X4DE330 and 2X4DE330. The engine exhaust is located about 50 ft from the engine air intake, thereby minimizing the chances of the engine exhaust being drawn into the combustion air intake. Drawings 1X4DB327, 1X4DB330, 2X4DE327, and 2X4DE330 show the equipment layout within the diesel generator building.

B. The diesel generator combustion air intake and exhaust system is designed to Seismic Category 1 requirements as specified in section 3.2. Systems, equipment, and components which are not Seismic Category 1 and whose failure might impair the functioning of the combustion air intake and exhaust system are designed so that failure cannot impair the functioning of safety-related equipment.

C. The diesel generator combustion air intake and exhaust system contains no active components. A single failure is assessed as a failure of the diesel generator with which the component is associated. In such a circumstance, safe shutdown is attained and maintained by the appropriate redundant diesel generator installation. Table 9.5.8-2 provides the failure modes and effects analysis for this system.

9.5.8.4 Tests and Inspections

Visual inspections, pressure and leak testing, and operational checks of the combustion air intake and exhaust system are performed as the system is installed. The diesel generator combustion air intake and exhaust system is operationally checked during the periodic testing of the diesel generator system.

9.5.8.5 Instrumentation Applications

The diesel generator combustion air intake and exhaust system is provided with instrumentation consisting of a combustion air pressure indicator and exhaust gas temperature indicators.

- LV0112A - Letdown to volume control tank.
- Train A safety-related cables.
- Train B safety-related cables.
- Boron recycle holdup tank.
- Waste gas compressors.
- Waste gas decay tanks.
- 1-1206-V4-002 - Encapsulation vessel.

J. Nonsafety-Related Equipment

- CVCS chillers.
- Electric steam boiler (abandoned).
- Electric steam boiler condensate receiver tank (abandoned).
- Chemical drain tank and pump.
- Spent fuel pit skimmer pump.
- Clean and radioactive sumps and pumps.
- Resin charging tank.
- Waste monitor tank and pumps.
- Spent resin sluice pump and storage tank.
- CVCS chiller surge tank.
- Waste evaporator pumps.
- Floor drain tank and pump.
- CVCS chiller pumps.
- Recycle evaporator feed pumps.
- Fuel pool area recirculation fan.
- Radioactive and nonradioactive filters.
- Recycle evaporator package. (Abandoned in place)

- Refueling water purification pump.
- Waste evaporator package. (Abandoned in place)
- Absorption tower.
- Crud tank pumps.
- Chemical mixing tank.
- Waste evaporator concentrates holdup tank and pump. (Abandoned in place)
- Waste evaporator condensate tank and pump.
- SGB spent resin storage tank and sluice pump.
- Liquid nitrogen receiving tank.
- Boron meter tank.
- Waste evaporator feed pump.
- Catalytic hydrogen recombiners.
- Recycle evaporator feed pump.
- Waste gas decay tank drain pump.
- Gas traps.
- Demineralizers.
- Waste holdup tank.
- Steam generator blowdown to condenser valves.
- Crud tank pump inlet valves.
- Crud tank pump outlet valves.
- Crud tank pump recirculation valve.
- Waste process control panels.
- Heat tracing cabinets.

9A.1.27 FIRE AREA 1-AB-L1-B

A. Location: Auxiliary Building, Central Area, Levels 1, 2

B. Drawings: AX4DJ8017 and AX4DJ8019

C. Description: Includes fire zones 43, 149.

Train B MCC and SWGR rooms

D. Description of Boundaries

1. Level 1

- Floor - 3-h-rated barrier separates area from 1-AB-LD-A.
- North - 3-h-rated barrier separates area from 1-AB-LD-B.
- East - 3-h-rated barrier separates area from 1-AB-LD-A, 1-AB-LD-G.
- South - 3-h-rated barrier separates area from 1-AB-LD-B.
- West - 3-h-rated barrier separates area from 1-AB-LD-B.

2. Level 2

- North - 3-h-rated barrier separates area from 1-AB-L2-C.
- East - 3-h-rated barrier separates area from 1-AB-LA-B, 1-AB-LD-G, 1-AB-LD-A.
- South - 2-h-rated barrier separates area from stairwell No. 3.
  - 3-h-rated barrier separates area from 1-AB-LD-F.
- West - 3-h-rated barrier separates area from 1-AB-L2-A.
- Ceiling - Unrated exterior area boundary.

E. Area Access

1. Level 1

- East - Class A door from 1-AB-LD-A.
- West - Class A door from 1-AB-LD-B.

2. Level 2

- East - Class A door from 1-AB-LD-A.
- West - Class A door from 1-AB-L2-A.

F. Sealed Penetrations

Seals meet or exceed fire barrier ratings.

G. Fire Dampers

Dampers meet or exceed fire barrier ratings.

H. Safe Shutdown Components

- TISH12201 - Fan 1-1555-A7-002 interlock.
- TISH12205 - Fan 1-1555-A7-006 interlock.
- 1-1555-A7-006 - Train B MCC room cooler.
- 1-1805-S3-BBB - Class 1E 480-V MCC 1BBB.
- 1-1805-S3-B16 - Class 1E 480-V switchgear 1BB16.
- 1-1807-Y3-IB12 - 120-V-ac vital bus inverter 1BD1I12.
- 1-1807-Q3-V16 - Vital bus distribution panel 1BDY2B.
- Train B safe shutdown cables.

I. Safety-Related Equipment

- 1-1807-Y3-RX21 - Train B regulating transformer 1BBB40RX.

J. Nonsafety-Related Equipment

No major equipment.

K. Combustibles Loading

1. Zone No. 43

   - Fixed combustible material

     - Cable insulation
     - Oil

   - Heat Release

     - Fixed combustibles ≤11,760,000 Btu
     - Transient combustibles 800,000 Btu

   - Combustible loading ≤40,000 Btu/ft^2

   - Fire severity (wood equivalent) ≤30 min

2. Zone No. 149

   - Fixed combustible material

     - Cable insulation

   - Heat release

     - Fixed combustibles ≤49,440,000 Btu
     - Transient combustibles 800,000 Btu

   - Combustible loading ≤80,000 Btu/ft^2

   - Fire severity (wood equivalent) ≤60 min

L. Evaluation of Safe Shutdown Capability

1. For a fire in this area, use safe shutdown train A.

2. Special operational and design considerations:

   None.

3. Spurious actuation concerns:

   a. CVCS volume control tank outlet valve, LV-0112C, may close due to a fire in this fire area.

   b. The train A charging path containment isolation valve, HV-8105, may close due to a fire in this fire area.

   c. RHR to safety injection pumps valve HV-8804B may open due to a fire in this fire area.

M. Fire Detection

Early warning fire detectors are installed within the following zones:

- Zone 43
- Zone 149

N. Fire Suppression

1. Automatic

   - Zone 43 preaction sprinkler system - Partial zone coverage.
   - Zone 149 preaction sprinkler system - Total zone coverage.

2. Manual

   Hose stations (with portable extinguishers) are conveniently located to each area. Any location can be reached with at least one effective water stream. Independent Seismic Category 1 dry standpipe system provides alternate source of water for post-SSE firefighting.

9A.1.28 FIRE AREA 1-AB-L1-C

A. Location: Auxiliary Building, Central Area, Level 1

B. Drawing: AX4DJ8017

C. Description: Includes fire zone 44.

Train A MCC room

D. Description of Boundaries

- Floor - 3-h-rated barrier separates area from 1-AB-LD-A, 1-AB-LA-A.
- North - 3-h-rated barrier separates area from 1-AB-L2-A.
- East - 3-h-rated barrier separates area from 1-AB-LD-G.
- South - 3-h-rated barrier separates area from 1-AB-LD-B, 1-AB-LD-A (HVAC chase).
- West - 3-h-rated barrier separates area from 1-AB-LD-B.
- Ceiling - 3-h-rated barrier separates area from 1-AB-L2-A, 1-AB-L2-C.

E. Area Access

- South - Class A door from 1-AB-LD-B.
- East - Class A door from 1-AB-LD-G.

F. Sealed Penetrations

Seals meet or exceed fire barrier ratings.

G. Fire Dampers

Dampers meet or exceed fire barrier ratings.

H. Safe Shutdown Components

- TISH12204 - Fan 1-1555-A7-005 interlock.
- 1-1555-A7-005 - Train "A" MCC room cooler.

- 1-1805-S3-ABB - Class 1E 480-V MCC 1ABB.
- 1-1807-Y3-IA11 - 120-V-ac vital bus inverter 1AD1I11.
- 1-1807-Q3-V15 - Vital bus distribution panel 1AY2A.
- Train A safe shutdown cables.

I. Safety-Related Equipment

- 1-1807-Y3-RX22 - Train A regulating transformer 1ABB40RX.
- Train A safety-related cables.

J. Nonsafety-Related Equipment

No major equipment.

K. Combustible Loading

1. Zone No. 44

- Fixed combustible material
  - Cable insulation
  - Oil
- Heat release
  - Fixed combustibles ≤20,800,000 Btu
  - Transient combustibles 800,000 Btu
- Combustible loading ≤40,000 Btu/ft^2
- Fire severity (wood equivalent) ≤30 min

L. Evaluation of Safe Shutdown Capability

1. For a fire in this area, use safe shutdown train B.
2. Special operational and design considerations:

   None.

3. Zone No. 138

- Fixed combustible material
  - Cable insulation
- Heat release
  - Fixed combustibles ≤56,360,000 Btu
  - Transient combustibles 800,000 Btu
- Combustible loading ≤40,000 Btu/ft^2
- Fire severity (wood equivalent) ≤30 min

L. Evaluation of Safe Shutdown Capability

1a. For a fire in this area, shutdown Unit 1 using safe shutdown train B.

1b. For a fire in this area, shutdown Unit 2 using safe shutdown train A or B.

2a. Special operational and design considerations (Unit 1):

a. Fire damage to the train B CBSF battery room exhaust fans 1-1532-B7-002 and 1-1532-B7-004 and their associated discharge dampers HV-12727 and HV-12749 may require use of portable ventilation (not required for at least 48-h) to preclude hydrogen buildup in the train B battery rooms (B49 and B44).

b. Deleted.

c. The following raceways are covered with a 3-hour-rated fire barrier to protect essential train B safe shutdown cables from a fire in this fire area:

- 1BE311TLAM
- 1BE311RM156
- 1BE331RM161
- 1BE311RS123
- 1DE311RS112
- 1BE31DRX221

- 1BE311RS124
- 1DE31CRS075
- 1DE311RS105
- 1BE311RX146
- 1BE311RT316
- 1DE311RS222
- 1BE311TSAM

For a fire in this fire area, PORV block valve 1-HV-8000A may be required to be closed. If the block valve will not close, opening the feeder breaker to PORV 1-PV-0455A to remove all power to the fail close PORV may be required. Opening the feeder breaker allows the PORV to close.

2b. Special operational and design considerations (Unit 2):

None.

3a. Spurious actuation considerations (Unit 1):

a. Pressurizer PORV PV-0455A may open due to a fire in this fire area.

b. Pressurizer auxiliary spray valve HV-8145 may open due to a fire in this fire area.

c. Safety injection actuation may occur due to fire damage to solid state protection cabinet 1-1605-Q5-SPA 125-V dc power feeder circuits in this fire area.

d. Safety injection actuation may occur due to fire damage to solid state protection cabinet 1-1605-Q5-SPB 125-V dc power feeder circuits in this fire area.

3b. Spurious actuation considerations (Unit 2):

None.

9A.1.43 FIRE AREA 1-CB-LB-B

A. Location: Control Building Level B

B. Drawing: AX4DJ8022

C. Description: Includes fire zone 75
Train A switchgear room

D. Description of Boundaries

- Floor - Unrated concrete basemat.
- North - 3-h-rated barrier separates area from 1-CB-LB-A.
- East - 3-h-rated barrier separates area from 1-CB-LB-A.
- South - 3-h-rated barrier separates area from 1-CB-LB-A, 1-CB-LB-D.
- West - 3-h-rated barrier separates area from 1-CB-LB-A.
- Ceiling - 3-h-rated barrier separates area from 1-CB-LA-S. 1-CB-LA-A.

E. Area Access

- East - Class A doors from 1-CB-LB-A.
- South - Class A door from 1-CB-LB-D.
- West - Class A doors from 1-CB-LB-A.

F. Sealed Penetrations

Seals meet or exceed fire barrier rating.

G. Fire Dampers

Dampers meet or exceed fire barrier rating.

H. Safe Shutdown Components

- 1-1805-S3-B04 - Class 1E 480 V switchgear 1AB04.
- 1-1805-S3-B05 - Class 1E 480 V switchgear 1AB05.

- 1-1805-S3-ABC - Class 1E 480 V MCC 1ABC.
- Train A safe shutdown cables.

I. Safety-Related Equipment

- 1-1513-H7-001-H01 - Train A hydrogen recombiner power panel
- 1-1513-P5-ERA - Train A hydrogen recombiner control panel.
- 1-1807-Y3-RX25 - Regulating transformer 1ABC20RX

J. Nonsafety-Related Equipment

No major equipment.

K. Combustible Loading

1. Zone No. 75

   - Fixed combustible material
     - Cable insulation
     - Oil
   - Heat release
     - Fixed combustibles ≤117,520,000 Btu
     - Transient combustibles 800,000 Btu
   - Combustible loading ≤120,000 Btu/ft^2
   - Fire severity (wood equivalent) ≤90 min

L. Evaluation of Safe Shutdown Capability

1. For a fire in this area, use safe shutdown train B.
2. Special operational and design considerations:

   None.

- 1-1602-P5-OIB - Regulatory Guide 1.97 neutron flux optical isolator panel.
- 1-1602-P5-NFB - Regulatory Guide 1.97 neutron flux amplifier panel.
- 1-1807-Y3-11 - Regulating transformer 1BBA07RX.
- 1-1807-Y3-13 - Regulating transformer 1BBC09RX.
- 1-1808-T3-115 - Lighting isolation transformer 1BBF13RX.
- TY12725A - TV12725 signal converter.
- 1-1532-A7-002 - CBSF electrical equipment room HVAC.
- Train A safe shutdown cables.
- Train B safe shutdown cables.

I. Safety-Related Equipment

- HV12721 - CBSF electrical equipment smoke removal damper.
- Train A safety-related cables.
- Train B safety-related cables.

J. Nonsafety-Related Equipment

- HV28180 - Fire protection manual actuation valve.
- Nonsafety-related cables.

K. Combustible Loading

1. Zone No. 60
   - Fixed combustible material
     - Cable insulation
   - Heat release
     - Fixed combustibles ≤40,480,000 Btu
     - Transient combustibles 800,000 Btu

- Combustible loading ≤80,000 Btu/ft^2
- Fire severity (wood equivalent) ≤60 min

2. Zone No. 62

   - Fixed combustible material
     - Cable insulation
     - Oil
   - Heat release
     - Fixed combustibles ≤317,440,000 Btu
     - Transient combustibles 800,000 Btu
   - Combustible loading ≤160,000 Btu/ft^2
   - Fire severity (wood equivalent) ≤120 min

3. Zone No. 65

   - Fixed combustible material
     - Cable insulation
   - Heat release
     - Fixed combustibles ≤70,000,000 Btu
     - Transient combustibles 800,000 Btu
   - Combustible loading ≤80,000 Btu/ft^2
   - Fire severity (wood equivalent) ≤60 min

4. Zone No. 66

- Fixed combustible material
  - Cable insulation

- Heat release
  - Fixed combustibles ≤63,200,000 Btu
  - Transient combustibles 800,000 Btu
- Combustible loading ≤160,000 Btu/ft^2
- Fire severity (wood equivalent) ≤120 min

5. Zone No. 67
   - Fixed combustible material
     - Cable insulation

   - Heat release
     - Fixed combustibles ≤126,560,000 Btu
     - Transient combustibles 800,000 Btu
   - Combustible loading ≤80,000 Btu/ft^2
   - Fire severity (wood equivalent) ≤60 min

6. Zone No. 68
   - Fixed combustible material
     - Cable insulation

- Heat release

  - Fixed combustibles ≤11,600,000 Btu
  - Transient combustibles 800,000 Btu

- Combustible loading ≤40,000 Btu/ft^2

- Fire severity (wood equivalent) ≤30 min

7. Zone No. 70

   - Fixed combustible material

     - Cable insulation

   - Heat release

     - Fixed combustibles ≤38,440,000 Btu
     - Transient combustibles 800,000 Btu

   - Combustible loading ≤40,000 Btu/ft^2

   - Fire severity (wood equivalent) ≤30 min

8. Zone No. 144

   - Fixed combustible material

     - Cable insulation
     - Oil

   - Heat release

     - Fixed combustibles ≤221,800,000 Btu
     - Transient combustibles 800,000 Btu

   - Combustible loading ≤120,000 Btu/ft^2

   - Fire severity (wood equivalent) ≤90 min

L. Evaluation of Safe Shutdown Capability

1. For a fire in this area, use safe shutdown train A.

2. Special operational and design considerations:

   The following raceways are covered with a 3-hour-rated fire barrier to protect essential train A safe shutdown cables from a fire in this fire area:

   - 1CE321KPH01
   - 1CE321KXH01
   - 1CE301KPH02
   - 1CE301KXH02

3. Spurious actuation considerations:

   a. Pressurizer PORV, PV-0456A, may open and it may not be possible to close block valve, HV-8000B, due to a fire in this fire area.

   b. Pressurizer PORVs, PV-0455A and PV-0456A, may open (PT-0456 circuit damage) and it may not be possible to close block valve, HV-8000B, due to a fire in this fire area.

   c. Pressurizer spray valve, PV-0455C, may open due to a fire in this fire area.

   d. Pressurizer auxiliary spray valve, HV-8145, may open due to a fire in this fire area.

   e. Main steam atmospheric dump valve, PV-3010, may open due to a fire in this fire area.

   f. Main steam atmospheric dump valve, PV-3020, may open due to a fire in this fire area.

   g. Train B RHR system vent valve, HV-10466, may open due to a fire in this fire area.

   h. Automatic starting of the train A motor-driven auxiliary feedwater pump, 1-1302-P4-003, may occur due to fire damage to steam generator 1 and 4 level transmitter circuits in this fire area.

i. Automatic starting of the turbine-driven auxiliary feedwater pump, 1-1302-P4-001, may occur due to fire damage to HV-5106 circuits in this fire area.

j. Automatic starting of the turbine-driven auxiliary feedwater pump, 1-1302-P5-001, may occur due to a fire damage to steam generator level transmitter circuits in this fire area.

k. Safety injection actuation may occur due to fire damage to pressurizer pressure circuits in this fire area.

l. Reactor vessel head letdown path valves HV-8095B, HV-8096B, and HV-0442B may all open due to a fire in this fire area.

M. Fire Detection

Early warning fire detectors are installed within the following zones:

- Zone 60
- Zone 62
- Zone 65
- Zone 66
- Zone 67
- Zone 68
- Zone 70
- Zone 144

N. Fire Suppression

1. Automatic

- Zone 60 preaction sprinkler system - Total zone coverage.
- Zone 62 preaction sprinkler system - Total zone coverage.

9A.1.49 FIRE AREA 1-CB-LB-H

A. Location: Control Building, Level B

B. Drawing: AX4DJ8022

C. Description: Includes fire zone 71

Train B switchgear room

D. Description of Boundaries

- Floor - Unrated concrete base mat.
- North - 3-h-rated barrier separates area from 1-CB-LB-A.
- East - 3-h-rated barrier separates area from 1-CB-LB-D.
- South - 3-h-rated barrier separates area from 1-CB-LB-D.
- West - 3-h-rated barrier separates area from 1-CB-LB-K, 1-CB-LB-L, 1-CB-LB-E.
- Ceiling - 3-h-rated barrier separates area from 1-CB-LA-G, 1-CB-LA-H.

E. Area Access

- South - Class A door from 1-CB-LB-D.

F. Sealed Penetrations

Seals meet or exceed fire barrier rating.

G. Fire Dampers

Dampers meet or exceed barrier rating.

H. Safe Shutdown Components

- 1-1805-53-806 - Class 1E 480-V switchgear 1BB06.
- 1-1805-S3-B07- Class 1E 480-V switchgear 18807.
- 1-1805-S3-BBC - Class 1E 480-V MCC 1BBC.

- 1-1807-Y3-14 - Class 1E 480/120-V regulating transformer 1BBC42RX.
- Train B safe shutdown cables.

I. Safety-Related Equipment

- 1-1513-H7-002-H01 - Train B hydrogen recombiner power panel.
- 1-1513-P5-ERB - Train B hydrogen recombiner control panel.
- 1-1807-Y3-RX26 - Regulating transformer 1BBC20RX

J. Nonsafety-Related Equipment

No major equipment.

K. Combustible Loading

1. Zone No. 71

   - Fixed combustible material
     - Cable insulation
     - Oil
   - Heat release
     - Fixed combustibles ≤68,000,000 Btu
     - Transient combustibles 800,000 Btu
   - Combustible loading ≤80,000 Btu/ft^2
   - Fire severity (wood equivalent) ≤60 min

L. Evaluation of Safe Shutdown Capability

1. For a fire in this area, use safe shutdown train A.
2. Special operational and design considerations:

   None.
3. Spurious actuation considerations:

   None.

9A.1.55 FIRE AREA 1-CB-LB-N

A. Location: Control Building, Level B

B. Drawing: AX4DJ8022

C. Description: Includes fire zone 78A

Train A channel 1 switchgear battery room

D. Description of Boundaries

- Floor - Unrated concrete base mat.
  - 3-h-rated barrier separates area from 1-CB-LC-A.
- North - 3-h-rated barrier separates area from 1-CB-LB-M.
- East - 3-h-rated barrier separates area from 1-CB-LB-E.
- South - 3-h-rated barrier separates area from 1-CB-LB-D, 1-CB-LC-B.
- West - 3-h-rated barrier separates area from 1-CB-LC-B.
- Ceiling - 3-h-rated barrier separates area from 1-CB-LC-B.

E. Area Access

- West - Class A door from 1-CB-LC-B.

F. Sealed Penetrations

Seals meet or exceed fire barrier rating.

G. Fire Dampers

Dampers meet or exceed barrier rating.

H. Safe Shutdown Components

- 1-1806-B3-CAA - Battery charger 1AD1CA.
- 1-1806-B3-CAB - Battery charge 1AD1CB.

- 1-1806-S3-DCA - 125-V-dc MCC 1AD1M.
- 1-1806-53-D5A - 125-V-dc switchgear 1AD1.
- 1-1806-Q3-DA1 - 125-V-dc distribution panel 1AD11.
- 1-1806-Q3-DA2 - 125-V-dc distribution panel 1AD12.
- 1-1807-Q3-V11 - Vital bus distribution panel 1AY1A.
- 1-1807-Y3-IA1 - 120-V-ac vital bus inverter 1AD1I1.
- Train A safe shutdown cables.

I. Safety-Related Equipment

- 1-1807-Y3-10 - Regulating transformer 1ABC09RX
- 1-1807-Y3-12 - Regulating transformer 1ABA07RX

J. Nonsafety-Related Equipment

No major equipment.

K. Combustibles Loading

1. Zone No. 78A

   - Fixed combustible material
     - Cable insulation
     - Oil
   - Heat release
     - Fixed combustibles ≤14,960,000 Btu
     - Transient combustibles 800,000 Btu
   - Combustible loading ≤40,000 Btu/ft^2
   - Fire severity (wood equivalent) ≤30 min

L. Evaluation of Safe Shutdown Capability

1. For a fire in this area, use safe shutdown train B.

9A.1.60A FIRE AREA 1-CB-LB-T

A. Location: Control Building, Level B

B. Drawing: AX4DJ8022

C. Description: Includes fire zones 61, 64 Train A penetration room, motor control center room.

D. Description of Boundaries:

- Floor - Unrated concrete basemat.
- North - 3-h-rated barrier separates area from 1-CB-LB-A, 1-CB-LB-D.
- East - Unrated below grade exterior area boundary.
- South - Unrated barrier separates area from containment building 1-CTB.
- West - 3-h-rated barrier separates area from 1-CB-LB-D.
- Ceiling - 3-h-rated barrier separates area from 1-CB-LA-B, 1-CB-LA-C.

E. Area Access

- North - Class A door from 1-CB-LB-D.
  - Class A door from 1-CB-LB-A (el 192 ft 6 in.)

F. Sealed Penetrations

Seals meet or exceed fire barrier rating.

G. Fire Dampers

Dampers meet or exceed fire barrier ratings.

H. Safe Shutdown Components

- HYO442A - HVO442A I/power converter.
- HYO943A - HVO943A I/power converter.
- 1-1602-PS-NFA - Regulatory Guide 1.97 neutron flux amplifier panel

- 1-1805-S3-ABE - Class 1E 480-V MCC 1ABE.
- Train A safe shutdown cables.

I. Safety Related Equipment

- 1-1807-Y3-15 - Regulating transformer 1ABE51RX.
- Train A safety-related cables.

J. Nonsafety-Related Equipment

- Nonsafety-related cables.

K. Combustible Loading

1. Zone No. 61

   - Fixed combustible material
     - Cable insulation
   - Heat release
     - Fixed combustibles ≤170,320,000 Btu
     - Transient combustibles 800,000 Btu
   - Combustible loading ≤80,000 Btu/ft^2
   - Fire severity (wood equivalent) ≤60 min

2. Zone No. 64

   - Fixed combustible material
     - Cable insulation
     - Oil

- Zone 103 Halon suppression system - Total zone coverage.

2. Manual

Hose stations (with portable extinguishers) are conveniently located to each area. Any location can be reached with at least one effective water stream. Independent Seismic Category 1 dry standpipe system provides alternate source of water for post-SSE firefighting.

O. Radioactive Materials

None.

P. Ventilation

Smoke can be removed using the normal ventilation system in a once-through-only mode of operation. For areas isolated by fire dampers, smoke may be removed by portable fans using flexible tubes to direct the smoke to an area capable of being ventilated or directly to outside.

Q. Drainage

A flooding analysis has determined that drainage from the fire areas is adequate.

R. Emergency Lighting

8-h-rated battery fixture(s) provide safe ingress/egress of personnel.

8-h-rated battery fixture(s) provide the capability to operate breakers in 4.16-kV switchgear 1AA02 and control the plant shutdown from remote shutdown panel "A".

S. Deviations and Justifications

See section 9A.2.54, paragraph S, for the justification for having safety-related cable trays without automatic fire suppression in this fire area.

- 1/2-1604-Q5-PP4 - BOP protection channel IV.
- 1/2UI13134A - Liquid plasma display.
- 1/2UI13134B - Liquid plasma display.
- 1/2-1605-Q5-SPA - Solid state protection panel-A.
- 1/2-1605-Q5-SPB - Solid state protection panel-B.
- 1/2-1605-Q5-SPC - Solid state protection panel-C.
- 1/2-1605-Q5-SPD - Solid state protection panel-D..
- 1/2-1816-U3-007 - Electrical auxiliary board QEAB.
- 1/2-1626-Q5-AMS - AMSAC cabinet.
- Train A safe shutdown cables.
- Train B safe shutdown cables.

Unit 2

- 2-1626-Q5-AMS - AMSAC cabinet.
- 2-1500-Q5-HVC - HVAC panel 2ACQHVC.
- 2-1500-V7-001 - HVAC instrument panel.
- 2-1500-V7-002 - HVAC instrument panel.
- 2-1601-Q5-MCB - Main control board QMCB.
- 2-1604-Q5-PCP - Miscellaneous equipment panel.
- 2-1604-Q5-PS1 - Process protection set I.
- 2-1604-Q5-PS2 - Process protection set II.
- 2-1604-Q5-PS3 - Process protection set III.
- 2-1604-Q5-PS4 - Process protection set IV.
- 2-1604-Q5-PP1 - BOP protection channel I.
- 2-1604-Q5-PP2 - BOP protection channel II.
- 2-1604-Q5-PP3 - BOP protection channel III.
- 2-1604-Q5-PP4 - BOP protection channel IV.

- 2UI13134A - Liquid plasma display.
- 2UI13134B - Liquid plasma display.
- 2-1605-Q5-SPA - Solid-state protection panel A.
- 2-1605-Q5-SPB - Solid-state protection panel B.
- 2-1605-Q5-SPC - Solid-state protection panel C.
- 2-1605-Q5-SPD - Solid-state protection panel D.
- 2-1816-U3-007 - Electrical auxiliary board QEAB.
- 1-1626-Q5-AMS - AMSAC cabinet.
- Train A safe shutdown cables.[a]
- Train B safe shutdown cables.[a]

I. Safety-Related Equipment

- 1-1513-Q5-HMA - Train A containment H_2 monitoring panel.
- 1-1513-Q5-HMB - Train B containment H_2 monitoring panel.
- 1-1602-Q5-NIR - Nuclear instrument rack.
- 1-1605-Q5-STA - Train A safeguard test cabinet.
- 1-1605-Q5-STB - Train B safeguard test cabinet.
- 1-1609-Q5-RM2 - Rad S.R. display console.
- 1-1620-Q5-ESF - BOP ESF panel.
- 1-1816-U3-005 - Isolation device panel A.

a. Alternate shutdown capability ensures that safe shutdown can be achieved in the event of a fire in this fire area (see paragraph L).

G. Fire Dampers

Dampers meet or exceed fire barrier ratings.

H. Safe Shutdown Components

1. Unit 1

- HV12128 - Control room fan discharge damper.
- HV12129 - Control room fan discharge damper.
- HV12130 - Control room fan return damper.
- HV12131 - Control room fan return damper.
- Train A safe shutdown cables.[a]
- Train B safe shutdown cables.[a]

Unit 2

- 2HV12128 - Control room fan discharge damper.
- 2HV12129 - Control room fan discharge damper.
- 2HV12130 - Control room fan return damper.
- 2HV12131 - Control room fan return damper.
- Train A safe shutdown cables.
- Train B safe shutdown cables.

I. Safety-Related Equipment

- 1-1808-T3-116 - Lighting isolation transformer 1ABC23RX.
- HV3520 - Residual heat removal train A sampling.
- HV3521 - Residual heat removal train B sampling.
- HV3526 - CVCS downstream of letdown heat exchanger.
- 1-1808-T3-113 - Lighting isolation transformer 1BBC23RX.

a. Separation concerns eliminated by the operational considerations of paragraph L.

- HV3530 - CVCS downstream of mix bed demineralizer.
- Train A safety-related cables.
- Train B safety-related cables.
- 2-1808-T3-116 – Regulated Transformer 2ABC23RX.
- 2-1808-T3-113 – Regulated Transformer 2BBC23RX.

J. Nonsafety-Related Equipment

- Repair and test equipment.
- Instruments.
- Health, physics equipment.
- Laboratory equipment.
- 1-1609-E5-001 - Radiation monitor minicomp cooler CRT.
- A-1535-B7-001 - CB fume hood supply fan unit.
- A-1535-H7-001-HCP - CB service area heater control panel.
- Nonsafety-related cables.

K. Combustible Loading

1. Zone No. 109.

   - Fixed combustible material.
     - Cellulosic materials.
     - Plastics.
   - Heat release.
     - Fixed combustibles ≤4,187,500 Btu
     - Transient combustibles 1,012,500 Btu
   - Combustible loading ≤40,000 Btu/ft^2
   - Fire severity (wood equivalent) ≤30 min

- Combustible loading ≤40,000 Btu/ft^2
- Fire severity (wood equivalent) ≤30 min

7. Zone No. 116

- Fixed combustible material

  - Cellulosic materials
  - Plastics

- Heat release

  - Fixed combustibles ≤29,040,000 Btu
  - Transient combustibles 4,400,000 Btu

- Combustible loading ≤40,000 Btu/ft^2
- Fire severity (wood equivalent) ≤30 min

8. Zone No. 117

- Fixed combustible material

  - Cellulosic materials
  - Oil/grease
  - Plastics

- Heat release

  - Fixed combustibles ≤11,240,000 Btu
  - Transient combustibles 8,400,000 Btu

- Combustible loading ≤40,000 Btu/ft^2
- Fire severity (wood equivalent) ≤30 min

9. Zone No. 118

- Fixed combustible material

  - Cable insulation
  - Plastics
  - Oil

- Heat release

  - Fixed combustibles ≤79,506,000 Btu
  - Transient combustibles 8,534,000 Btu

- Combustible loading ≤40,000 Btu/ft^2

- Fire severity (wood equivalent) ≤30 min

10. Zone No. 119

- Fixed combustible material

  - Cable insulation
  - Cellulosic materials
  - Plastics

- Heat release

  - Fixed combustibles ≤30,994,000 Btu
  - Transient combustibles 3,046,000 Btu

- Combustible loading ≤40,000 Btu/ft^2

- Fire severity (wood equivalent) ≤30 min

11. Zone No. 124

- Fixed combustible material

- Cellulosic materials
- Oil/grease
- Plastics

- Heat release

  - Fixed combustibles ≤190,000,000 Btu
  - Transient combustibles 800,000 Btu

- Combustible loading ≤240,000 Btu/ft^2

- Fire severity (wood equivalent) ≤180 min

7. Zone No. 130

- Fixed combustible material

  - Oil

- Heat release

  - Fixed combustibles ≤22,000,000 Btu
  - Transient combustibles 400,000 Btu

- Combustible loading ≤40,000 Btu/ft^2

- Fire severity (wood equivalent) ≤30 min

8. Zone No. 131

- Fixed combustible material

  - Cable insulation

  - Cellulosic materials
  - Oil/grease
  - Plastics

- Heat release
  - Fixed combustibles ≤107,120,000 Btu
  - Transient combustibles 8,400,000 Btu
- Combustible loading ≤160,000 Btu/ft^2
- Fire severity (wood equivalent) ≤120 min

9. Zone No. 133A
   - Fixed combustible material
     - Cable insulation
     - Plastics
   - Heat release
     - Fixed combustibles ≤20,423,750 Btu
     - Transient combustibles 11,976,250 Btu
   - Combustible loading ≤120,000 Btu/ft^2
   - Fire severity (wood equivalent) ≤90 min

10. Zone No. 133B
    - Fixed combustible material
      - Cable insulation
      - Cellulosic materials
      - Oil/grease
      - Plastics
    - Heat release
      - Fixed combustibles ≤289,920,000 Btu
      - Transient combustibles 1,920,000 Btu
    - Combustible loading ≤120,000 Btu/ft^2
    - Fire severity (wood equivalent) ≤90 min

9A.1.114 FIRE AREA 1-DB-L1-A

A. Location: Diesel Generator Building, Levels 1 and 2

B. Drawing: AX4DJ8037

C. Description: Includes fire zone 161

Train A diesel generator, intake filter, fan room, air plenum room, exhaust silencer room, duct penetration room

D. Description of Boundaries

1. Level 1

- Floor - Unrated concrete base mat.
- North - Unrated exterior area boundary.
  - 3-h-rated barrier separates area from 1-CB-LB-A.
- South - Unrated exterior area boundary.
- East - Unrated exterior area boundary.
  - 3-h-rated barrier separates area from 1-DB-L1-C.
- West - 3-h-rated barrier separates area from 1-DB-L1-B, 1-DB-L1-D.

2. Level 2

- Floor - Unrated barrier separates area from 1-DB-L1-C.
- North - Unrated exterior area boundary.
- South - Unrated exterior area boundary.
- East - Unrated exterior area boundary.
- West - 3-h-rated barrier separates area from 1-DB-L1-B.

- 2-h-rated barrier separates area from stairwell.

- Ceiling - Unrated exterior area boundary.

E. Area Access

1. Level 1

- North - Unlabeled door from 1-CB-LB-A.
- North - Class A door from outside.
- South - Class A door from 1-DB-L1-C.
- South - Class A door from outside.

2. Level 2

- North - Class B door from stairwell.

F. Sealed Penetration

Seals meet or exceed fire barrier ratings.

G. Fire Dampers

Dampers meet or exceed fire barrier ratings.

H. Safe Shutdown Components

- TV12086 - Diesel generator building outside air damper.
- TY12086 - Diesel generator building outside air damper solenoid.
- TV12094A - Diesel generator building outside air damper.
- TY12094C - Diesel generator building outside air damper solenoid.
- TY12094D - Diesel generator building outside air damper solenoid.

- TV12094B - Diesel generator building outside air damper.
- TY12094E - Diesel generator building outside air damper solenoid.
- TY12094F - Diesel generator building outside air damper solenoid.
- TV12096 - Diesel generator building outside air damper.
- TY12096 - Diesel generator building outside air damper solenoid.
- TV12097 - Diesel generator building outside air damper.
- TV12100A - Diesel generator building outside air damper.
- TY12100C - Diesel generator building outside air damper solenoid.
- TV12100 - Deisel generator building outside air damper.
- TY12100B - Diesel generator building outside air damper solenoid.
- TISH12051 - Diesel generator building temperature interlock.
- TISH12100 - Diesel generator ventilation temperature interlock.
- HV12050 - Diesel generator building fan damper.
- HV12051 - Diesel generator building fan damper.
- FE12087 - Diesel generator building ventilation flow interlock.
- FS12087 - Diesel genertor building ventilation flow interlock.
- 1-1566-B7-001 - Diesel generator building fan.
- 1-1566-B7-003 - Diesel generator building fan.

- 1-2403-G4-001 - Diesel generator package.
- 1-2403-G4-001-V01 - Diesel generator air start receiver.
- 1-2403-G4-001-V02 - Diesel generator air start receiver.
- 1-2403-P5-DG1 - Diesel generator panel DG1A.
- 1-2403-P5-DG2 - Diesel generator panel DG1A.
- 1-1805-S3-ABF - Class 1E 480-V MCC 1ABF.
- TV-12086A - Diesel generator building outside air damper.
- TV-12094C - Diesel generator building outside air damper.
- TV-12094D - Diesel generator building outside air damper.
- TV-12096A - Diesel generator building outside air damper.
- TV-12097A - Diesel generator building outside air damper.
- Train A safe shutdown cables.

I. Safety-Related Equipment

- 1-2403-64-001-F02 - Diesel generator exhaust silencers.
- HV-12052 - DGB fan damper.
- Train A safety-related cables.
- 1-1808-T3-114 - LTG isolation XFMR 1ABF13RX

J. Nonsafety-Related Equipment

- 1-1566-B7-005 - DGB non-ESF exhaust fan.
- 1-1566-U7-005 - DGB unit heater.
- 1-1566-U7-007 - DGB unit heater.
- 1-1566-U7-009 - DGB unit heater.

P. Ventilation

Smoke can be removed using the normal ventilation system in a once-through-only mode of operation. For areas isolated by fire dampers, smoke may be removed by portable fans using flexible tubes to direct the smoke to an area capable of being ventilated or directly to outside.

Q. Drainage

A flooding analysis has determined that drainage from the fire areas is adequate.

R. Emergency Lighting

8-h-rated battery fixture(s) provide safe ingress/ egress of personnel.

8-h-rated battery fixture(s) provide for operation of the diesel generator at the control panels.

S. Deviations and Justifications

1. Unrated exterior fire area boundary:

   See Appendix 9B, section C.5.a(1).

2. Unlabeled doors:

   The unlabeled door at the north boundary (door number 12107L1101) between this area and 1CB-LB-A level 1 is fabricated of the same material of construction as that of a 3-h labeled door.

   See Appendix 9B, section C.5.a(5).

3. Unrated hatch:

   See section 9A.1.116.S.

9A.1.115 FIRE AREA 1-DB-L1-B

A. Location: Diesel Generator Building, Levels 1 and 2

B. Drawing: AX4DJ8037

C. Description: Includes fire zone 162

Train B diesel generator, intake filter, fan room, air plenum room, exhaust silencer room, duct penetration room

D. Description of Boundaries

1. Level 1

- Floor - Unrated concrete base mat.
- North - Unrated exterior area boundary.
  - 3-h-rated barrier separates area from 1-CB-LB-D.
- South - Unrated exterior area boundary.
- East - 3-h-rated barrier separates area from 1-DB-L1-A, 1-DB-L1-D.
- West - Unrated exterior area boundary.

2. Level 2

- North - Unrated exterior area boundary.
- South - Unrated exterior area boundary.
- East - 3-h-rated barrier separates area from 1-DB-L1-A.
- West - Unrated exterior area boundary.
  - 2-h-rated barrier separates area from stairwell.
- Ceiling - Unrated exterior area boundary.
- Floor - 3-h-rated barrier separates area from 1-DB-L1-C.

E. Area Access

1. Level 1

- North - Unlabeled door from 1-CB-LB-D.
  - Certified class A door from outside.
- South - Class A door from 1-DB-L1-D.
  - Certified class A door from outside.

2. Level 2

- North - Class B door from stairwell.

F. Sealed Penetrations

Seals meet or exceed fire barrier ratings.

G. Fire Dampers

Dampers meet or exceed fire barrier ratings.

H. Safe Shutdown Components

- HV12053 - Diesel generator building fan damper.
- HV12054 - Diesel generator building fan damper.
- TV12085 - Diesel generator building outside air damper.
- TV12095A - Diesel generator building outside air damper.
- TY12095C - Diesel generator building outside air damper solenoid.
- TY12095D - Diesel generator building outside air damper solenoid.
- TV12095B - Diesel generator building outside air damper.
- TY12095E - Diesel generator building outside air damper solenoid.

- TY12095F - Diesel generator building fan damper solenoid.
- TV12098 - Diesel generator building outside air damper.
- TY12098 - Diesel generator building outside air damper solenoid.
- TV12099 - Diesel generator building outside air damper.
- TY12099 - Diesel generator building outside air damper solenoid.
- TV12101A - Diesel generator building outside air damper.
- TY12101C - Diesel generator building outside air damper solenoid.
- TV12101 - Diesel generator building outside air damper.
- TY12101B - Diesel generator building outside air damper solenoid.
- TISH12054 - Diesel generator building temperature interlock.
- TISH12101 - Diesel generator ventilation temperature interlock.
- 1-1566-B7-002 - Diesel generator building fan.
- 1-1566-B7-004 - Diesel generator building fan.
- 1-2403-G4-002 - Diesel generator package.
- 1-2403-G4-002-V01 - Diesel generator air start receiver.
- FE12088 - Diesel generator building ventilation flow interlock.
- FS12088 - Diesel generator building ventilation flow interlock.
- 1-2403-G4-002-V02 - Diesel generator air start receiver.
- 1-2403-P5-DG3 - Diesel generator panel DG1B.

- 1-2403-P5-DG4 - Diesel generator panel DG1B.
- 1-1805-S3-BBF - Class 1E 480-V MCC 1BBF.
- TV-12085A - Diesel generator building outside air damper.
- TV-12095C - Diesel generator building outside air damper.
- TV-12095D - Diesel generator building outside air damper.
- TV-12098A - Diesel generator building outside air damper.
- TV-12099A - Diesel generator building outside air damper.
- Train B safe shutdown cables.

I. Safety-Related Equipment

- 1-2403-G4-002-F01 - Diesel generator intake air filter.
- 1-2403-G4-002-F02 - Diesel generator exhaust silencers.
- HV-12055 - Diesel generator building fan damper.
- 1-2403-G4-001-F01 - Diesel generator intake air filter.
- Train B safety-related cables.
- 1-1808-T3-115 - Lighting isolation transformer 1BBF13RX

J. Nonsafety-Related Equipment

- 1-1215-P4-017 - Diesel generator building oily waste sump pump.
- 1-1566-B7-006 - Diesel generator building non-ESF exhaust fan.
- 1-1566-U7-002 - Diesel generator building unit heater.
- 1-1566-U7-004 - Diesel generator building unit heater.

- 1-1566-U7-006 - Diesel generator building unit heater.
- 1-1566-U7-008 - Diesel generator building unit heater.
- 1-1566-U7-010 - Diesel generator building unit heater.
- 1-1566-U7-012 - Diesel generator building unit heater.
- 1-1566-U7-014 - Diesel generator building unit heater.
- 1-1566-U7-016 - Diesel generator building unit heater.
- 1-1566-U7-018 - Diesel generator building unit heater.
- 1-1566-U7-020 - Diesel generator building unit heater.
- 1-1805-S3-NBQ - 480-V MCC.
- 1-2403-G4-002-C02 - Diesel generator air start compressor air cooler.
- 1-2403-G4-002-K01 - Diesel generator air start air dryer.
- 1-2403-G4-002-K02 - Diesel generator air start air dryer.
- 1-2403-G4-002-E02 - Diesel generator air start compressor aftercooler.
- 1-2403-S3-002 - Diesel generator 480-V MCC.
- 1-1566-B7-007 - Diesel generator building fuel oil day tank room exhaust fan.
- HV-28182 - Fire protection system manual actuation valve.
- PV-9081 - DG1B start air compressor to aftercooler valve.
- Nonsafety-related cables.

K. Combustible Loading

1. Zone No. 162

- Fixed combustible material
  - Cable insulation
  - Oil/grease
  - Plastics

- Heat release
  - Fixed combustibles ≤629,269,000 Btu
  - Transient combustibles 106,331,000 Btu

- Combustible loading ≤80,000 Btu/ft^2

- Fire severity (wood equivalent) ≤60 min

L. Evaluation of Safe Shutdown Capability

1. For a fire in this area, use safe shutdown train A.

2. Special operational and design considerations:

   None.

3. Spurious actuation consideration:

   None.

M. Fire Detection

Early warning fire detectors are installed within the following zone:

- Zone 162

N. Fire Suppression

1. Automatic

   - Zone 162 preaction sprinkler system - Partial zone coverage.

2. Manual

   Hose stations (with portable extinguishers) are conveniently located to each area. Any location can be reached with at least one effective water stream. Independent Seismic Category 1 dry standpipe system provides alternate source of water for post-SSE firefighting.

O. Radioactive Materials

None.

P. Ventilation

Smoke can be removed using the normal ventilation system in a once-through-only mode of operation. For areas isolated by fire dampers, smoke may be removed by portable fans using flexible tubes to direct the smoke to an area capable of being ventilated or directly to outside.

Q. Drainage

A flooding analysis has determined that drainage from the fire areas is adequate.

R. Emergency Lighting

8-h-rated battery fixture(s) provide safe ingress/ egress of personnel.

8-h-rated battery fixture(s) provide for operation of the diesel generator at the control panels.

S. Deviations and Justifications

1. Unrated exterior fire area boundary:

   See Appendix 9B, section C.5.a(1).

2. Unlabeled doors:

   The unlabeled door at the north boundary (door number 12107L1104) between this area and 1CB-LB-D level 1 is fabricated of the same material of construction as that of a 3-h labeled door.

   See Appendix 9B, section C.5.a(5).

3. Unrated penetration seal configuration in north wall separating this area from 1-CB-LB-D.

   This configuration involves the Calvert bus duct, several cable trays, conduits, and pipe passing through the diesel generator building wall, the control building wall, and the seismic gap between the two buildings. The Calvert bus duct cannot be rigidly held in place as is done with normal foam penetration seals, and a seismic gap seal cannot be installed with the existing field configuration.

With these special restrictions, an alternative method was developed and evaluated that involves installing a three-hour-rated penetration seal in the north side of the control building tunnel south wall and a 1-in. noncombustible damming board in the south side of the diesel generator building north wall and then filling the entire space in between (approximately 5.5 ft) with loose penetration seal damming material. A 1-in. gap, filled with damming material, is left between the Calvert bus duct and the damming board in the diesel generator building wall only to allow for the required seismic movement of the Calvert bus duct. This deviation is justified because of the total lack of combustible material in the seismic gap and because the void between the control building penetration seal and the diesel generator building damming board (including the seismic gap) is stuffed with a significant amount of noncombustible damming material, thereby creating an effective barrier to the passage of smoke and hot gases through the seismic gap or through the 1-in. gap around the Calvert bus duct.

M. Fire Detection

Early warning fire detectors are installed within the following zone:

- Zone 163

N. Fire Suppression

1. Automatic

   - Zone 163 preaction sprinkler system - Total zone coverage.

2. Manual

   Hose stations (with portable extinguishers) are conveniently located to each area. Any location can be reached with at least one effective water stream. Independent Seismic Category 1 dry standpipe system provides alternate source of water for post-SSE firefighting.

O. Radioactive Materials

None.

P. Ventilation

Smoke can be removed using the normal ventilation system in a once-through-only mode of operation. For areas isolated by fire dampers, smoke may be removed by portable fans using flexible tubes to direct the smoke to an area capable of being ventilated or directly to outside.

Q. Drainage

A flooding analysis has determined that drainage from the fire areas is adequate.

R. Emergency Lighting

8-h-rated battery fixture(s) provide safe ingress/ egress of personnel.

S. Deviations and Justifications

1. Unrated exterior fire area boundary:

   See Appendix 9B, section C.5.a(1).

2. Unrated hatch:

   A hatch cover is located in the ceiling of the train A fuel oil day tank room separating the tank room from the rest of the train A diesel generator building (fire area 1-DB-L1-A). The hatch opening is 3 ft x 7 ft and is used to facilitate access to various manual valve operators. The opening is closed by an access hatch that is fabricated of the same material and methods of constuction as that of a 3-h-labeled fire door.

   An "A" label is maintained on the hatch to ensure surveillance per 3-h rating criteria.

   The fire area boundary containing the unrated hatch cover does not separate redundant safe shutdown components.

9A.2.23 FIRE AREA 2-AB-L1-B

A. Location: Auxiliary Building, Central Area, Levels 1, 2

B. Drawings: AX4DJ8017, AX4DJ8019

C. Description: Includes fire zones 43, 149

Train B MCC and SWGR rooms

D. Description of Boundaries

1. Level 1

- Floor - 3-h-rated barrier separates area from 2-AB-LD-A.
- North - 3-h-rated barrier separates area from 2-AB-LD-B.
- West - 3-h-rated barrier separates area from 2-AB-LD-A, 2-AB-LD-G.
- South - 3-h-rated barrier separates area from 2-AB-LD-B.
- East - 3-h-rated barrier separates area from 2-AB-LD-B.

2. Level 2

- North - 3-h-rated barrier separates area from 2-AB-L2-C.
- West - 3-h-rated barrier separates area from 2-AB-LA-B, 2-AB-LD-G, 2-AB-LD-A.
- South - 2-h-rated barrier separates area from stairwell No. 2.
  - 3-h-rated barrier separates area from 2-AB-LD-F.
- East - 3-h-rated barrier separates area from 2-AB-L2-A.
- Ceiling - Unrated exterior area boundary.
- Floor - 3-h-rated barrier separates area from 2-AB-LD-B.

E. Area Access

1. Level 1

- West - Class A door from 2-AB-LD-A.
- East - Class A door from 2-AB-LD-B.

2. Level 2

- West - Class A door from 2-AB-LD-A.
- East - Class A door from 2-AB-L2-A.

F. Sealed Penetrations

Seals meet or exceed fire barrier ratings.

G. Fire Dampers

Dampers meet or exceed fire barrier ratings.

H. Safe Shutdown Components

- TISH12201 - Fan 2-1555-A7-002 interlock.
- TISH12205 - Fan 2-1555-A7-006 interlock.
- 2-1555-A7-006 - Train B MCC room cooler.
- 2-1805-S3-BBB - Class 1E 480-V MCC 2BBB.
- 2-1805-S3-B16 - Class 1E 480-V switchgear 2BB16.
- 2-1807-Y3-IB12 - 120-V-ac vital bus inverter 2BD1I12.
- 2-1807-Q3-V16 - Vital bus distribution panel 2BDY2B.
- Train B safe shutdown cables.

I. Safety-Related Equipment

2-1807-Y3-RX21 - Train B regulated transformer/2BBB40RX.

J. Nonsafety-Related Equipment

No major equipment.

9A.2.24 FIRE AREA 2-AB-L1-C

A. Location: Auxiliary Building, Central Area, Level 1

B. Drawing: AX4DJ8017

C. Description: Includes fire zone 44

Train A MCC room

D. Description of Boundaries

- Floor - 3-h-rated barrier separates area from 2-AB-LD-A.
- North - 3-h-rated barrier separates area from 2-AB-L2-A.
- West - 3-h-rated barrier separates area from 2-AB-LD-G, 2-AB-L2-A.
- South - 3-h-rated barrier separates area from 2-AB-LD-B, 2-AB-LD-A (HVAC chase).
- East - 3-h-rated barrier separates area from 2-AB-LD-B.
- Ceiling - 3-h-rated barrier separates area from 2-AB-L2-A, 2-AB-L2-C.

E. Area Access

- South - Class A door from 2-AB-LD-B.
- West - Class A door from 2-AB-LD-G.

F. Sealed Penetrations

Seals meet or exceed fire barrier ratings.

G. Fire Dampers

Dampers meet or exceed fire barrier ratings.

H. Safe Shutdown Components

- TISH12204 - Fan 2-1555-A7-005 interlock.
- 2-1555-A7-005 - Train A MCC room cooler.

- 2-1805-S3-ABB - Class 1E 480-V MCC 2ABB.
- 2-1807-Y3-IA11 - 120-V-ac vital bus inverter 2AD1I11.
- 2-1807-Q3-VI5 - Vital bus distribution panel 2AY2A.
- Train A safe shutdown cables.

I. Safety-Related Equipment

- 2-1807-Y3-RX22 - Train A regulated transformer/2ABB40RX.
- Train A safety-related cables.

J. Nonsafety-Related Equipment

No major equipment.

K. Combustible Loading

Zone No. 44

- Fixed combustible material.
  - Cable insulation.
- Heat release.
  - Fixed combustibles. ≤42,400,000 Btu
  - Transient combustibles. 800,000 Btu
- Combustible loading. ≤80,000 Btu/ft^2
- Fire severity (wood equivalent). ≤60 min

L. Evaluation of Safe Shutdown Capability

1. For a fire in this area, use safe shutdown train B.
2. Special operational and design considerations:

   None.

E. Area Access

1. Level B

- North - Class A door from 2-CB-LB-A.
  - Four class A doors from 2-CB-LC-A.
- West - Class A door from 2-CB-LB-M, 2-CB-LB-N, 2-CB-LB-Q, 2-CB-LB-C, 2-CB-LB-J, 2-CB-LB-K, 2-CB-LB-L, 2-CB-LB-P, 2-CB-LB-I.
- South - Class A door from 1-CB-LC-B.

F. Sealed Penetrations

Seals meet or exceed fire barrier ratings.

G. Fire Dampers

Dampers meet or exceed fire barrier rating.

H. Safe Shutdown Components

- 2-1532-B7-001 - CBSF battery room fan.
- 2-1532-B7-002 - CBSF battery room fan.
- 2-1532-B7-003 - CBSF battery room fan.
- 2-1532-B7-004 - CBSF battery room fan.
- HV12727 - CBSF battery room fan damper.
- HV12742 - CBSF battery room fan damper.
- HV12748 - CBSF battery room fan damper.
- HV12749 - CBSF battery room fan damper.
- Train A safe shutdown cables.
- Train B safe shutdown cables. (Spurious actuation concerns and separation concerns eliminated by the design and operational considerations of paragraph L.)

I. Safety-Related Equipment

- Train A safety-related cables.
- Train B safety-related cables.

- 2-1807-Y3-12 – Regulated transformer 2ABA07RX.
- 2-1807-Y3-10 – Regulated transformer 2ABC09RX.

J. Nonsafety-Related Equipment

- 2-1805-S3-B08 - 480-V switchgear 2NB08.
- 2-1805-S3-B09 - 480-V switchgear 2NB09.
- 2-1805-S3-BL1 - 480-V switchgear 2NBL1.
- 2-1805-S3-B17 - 480-V switchgear 2NB17.
- 2-1805-S3-B10 - 480-V switchgear 2NB10.
- 2-1805-S3-NBR - 480-V MCC 2NBR.
- Nonsafety-related cables.

K. Combustible Loading

Zone No. 80.

- Fixed combustible material.
  - Cable insulation.
  - Plastics.
- Heat release.
  - Fixed combustibles ≤504,000,000 Btu
  - Transient combustibles 800,000 Btu
- Combustible loading ≤80,000 Btu/ft^2
- Fire severity (wood equivalent) ≤60 min

REV 9 5/00
REV 4 4/94
REV 2 3/92

L. Evaluation of Safe Shutdown Capability

1. For a fire in this area, use safe shutdown train B.

2. Special operational and design considerations:

   a. Fire damage to the train B CBSF battery room exhaust fans, 2-1532-B7-002 and 2-1532-B7-004, and their associated discharge dampers, HV-12727 and HV-12749, may require use of portable ventilation (not required for at least 48-h) to

      preclude hydrogen buildup in the train B battery rooms (B32 and B37).

   b. The following raceways are covered with a 3-h-rated fire barrier to protect essential train B safe shutdown cables from a fire in this fire area:

      - 2BE350TLAM
      - 2BE350TSAM
      - 2DE350TXAH
      - 2DE350TQAG
      - 2DE350RQ210
      - 2DE350RX142
      - 2DE350RX145
      - 2DE350RQ127

   For a fire in this fire area, PORV block valve 2-HV-8000A may be required to be closed. If the block valve will not close, opening the feeder breaker to PORV 2-PV-0455A to remove all power to the fail close PORV may be required. Opening the feeder breaker allows the PORV to close.

3. Spurious actuation considerations:

   a. Pressurizer PORV, PV-0455A, may open due to a fire in this fire area.

   b. Pressurizer auxiliary spray valve, HV-8145, may open due to a fire in this fire area.

   c. It may not be possible to close either letdown isolation valve, LV-0459 or LV-0460, due to a fire in this fire area.

   d. The turbine-driven auxiliary feedwater pump, 2-1302-P4-001, may start due to fire damage to HV-5106 circuits in this fire area.

M. Fire Detection

Early warning fire detectors are installed within Zone 80.

N. Fire Suppression

1. Automatic

Zone 80 preaction sprinkler system - partial zone coverage.

2. Manual

Hose stations (with portable extinguishers) are conveniently located to each area. Any location can be reached with at least one effective water stream. Independent Seismic Category 1 dry standpipe system provides alternate source of water for post-SSE firefighting.

O. Radioactive Materials

None.

P. Ventilation

Smoke can be removed using the normal ventilation system in a once-through only mode of operation. For areas isolated by fire dampers, smoke may be removed by portable fans using flexible tubes to direct the smoke to an area capable of being ventilated or directly to outside.

The mechanical ventilation system which could be used to remove smoke from this area may not be operational because electrical cables and/or equipment associated with its operation are located in the fire area.

Q. Drainage

A flooding analysis has determined that drainage from the fire areas is adequate.

R. Emergency Lighting

8-h-rated battery fixture(s) provide safe ingress/ egress of personnel.

8-h-rated battery fixture(s) provide the capability to operated breakers in 480-V switchgear 2NB08, 2NB09, 2NB10.

9A.2.31 FIRE AREA 2-CB-LB-B

A. Location: Control Building Level B

B. Figures 9A-18

C. Description: Includes fire zone 75

Train A switchgear room

D. Description of Boundaries

- Floor - Unrated concrete basemat.
- North - 3-h-rated barrier separates area from 2-CB-LB-A.
- East - 3-h-rated barrier separates area from 2-CB-LB-A.
- South - 3-h-rated barrier separates area from 2-CB-LB-A, 2-CB-LB-D.
- West - 3-h-rated barrier separates area from 2-CB-LB-A.
- Ceiling - 3-h-rated barrier separates area from 2-CB-LA-S.

E. Area Access

- East - Class A doors from 2-CB-LB-A.
- South - Class A door from 2-CB-LB-D.
- West - Class A doors from 2-CB-LB-A.

F. Sealed Penetrations

Seals meet or exceed fire barrier rating.

G. Fire Dampers

Dampers meet or exceed fire barrier rating.

H. Safe Shutdown Components

- 2-1805-S3-B04 - Class 1E 480-V switchgear 2AB04.
- 2-1805-S3-B05 - Class 1E 480-V switchgear 2AB05.

- 2-1805-S3-ABC - Class 1E 480-V MCC 2ABC.
- Train A safe shutdown cables.

I. Safety-Related Equipment

- 2-1513-H7-001-H01 - Train A hydrogen recombiner power panel.
- 2-1513-P5-ERA - Train A hydrogen recombiner control panel.
- 2-1807-Y3-RX25 - Regulated transformer 2ABC20RX

J. Nonsafety-Related Equipment

No major equipment.

K. Combustible Loading

1. Zone No. 75

- Fixed combustible material
  - Cable insulation
- Heat release
  - Fixed combustibles ≤153,600,000 Btu
  - Transient combustibles 800,000 Btu
- Combustible loading ≤160,000 Btu/ft^2
- Fire severity (wood equivalent) ≤120 min

L. Evaluation of Safe Shutdown Capability

1. For a fire in this area, use safe shutdown train B.
2. Special operational and design considerations:

None.

F. Sealed Penetrations

Seals meet or exceed fire barrier rating.

G. Fire Dampers

Dampers meet or exceed fire barrier rating.

H. Safe Shutdown Components

- HY0442B - HV0442B I/power converter.
- HY0943B - HV0943B I/power converter.
- TV12725 - Control building electrical equipment cooler valve.
- TY12725A - TV12725 signal converter.
- 2-1602-P5-NFB - Regulatory Guide 1.97 neutron flux amplifier panel.
- 2-1602-P5-OIB-R.G. - spout (Regulatory Guide) 1.97 neutron flux optical Isolator panel.
- 2-1532-A7-002 - CBSF electrical equipment room HVAC.
- 2-1804-W3-CB800- Diesel generator B cable bus.
- Train A safe shutdown cables. (Spurious actuation concerns and separation concerns eliminated by the design considerations of paragraph L.)
- Train B safe shutdown cables.

I. Safety-Related Equipment

- HV12719 - CBSF electrical equipment air conditioning unit A7002 damper.
- HV12734 - CBSF electrical equipment air conditioning unit A7001 damper
- HV12721 - CBSF electrical equipment smoke removal damper.
- Train A safety-related cables.
- Train B safety-related cables.
- 2-1807-Y3-11 - Regulated Transformer 2BBA07RX
- 2-1807-Y3-13 - Regulated Transformer 2BBC09RX

J. Nonsafety-Related Equipment

- 2-1606-M6-001 - Train A rod drive M-G set.
- 2-1807-Y3-RX9 - Regulated transformer 2NBR32X.
- 2-1807-Y3-RX10 - Regulated transformer 2NBS32X.
- Nonsafety-related cables.

K. Combustible Loading

1. Zone No. 60

   - Fixed combustible material
     - Cable insulation

   - Heat release
     - Fixed combustibles ≤42,000,000 Btu
     - Transient combustibles 800,000 Btu

   - Combustible loading ≤80,000 Btu/ft^2

   - Fire severity (wood equivalent) ≤60 min

2. Zone No. 62

   - Fixed combustible material
     - Cable insulation

   - Heat release
     - Fixed combustibles ≤361,600,000 Btu
     - Transient combustibles 800,000 Btu

9A.2.37 FIRE AREA 2-CB-LB-H

A. Location: Control Building, Level B.

B. Figure: 9A-18.

C. Description: Includes fire zone 71.

Train B switchgear room.

D. Description of Boundaries

- Floor - Unrated concrete basemat.
- North - 3-h-rated barrier separates area from 2-CB-LB-A.
- West - 3-h-rated barrier separates area from 2-CB-LB-D, 2-CB-LB-A.
- South - 3-h-rated barrier separates area from 2-CB-LB-D.
- East - 3-h-rated barrier separates area from 2-CB-LB-X, 2-CB-LB-L, 2-CB-LB-E, 2-CB-LC-B.
- Ceiling - 3-h-rated barrier separates area from 2-CB-LA-G, 2-CB-LA-H.

E. Area Access

- South - Class A door from 2-CB-LB-D.

F. Sealed Penetrations

Seals meet or exceed fire barrier rating.

G. Fire Dampers

Dampers meet or exceed barrier rating.

H. Safe Shutdown Components

- 2-1805-S3-BO6 - Class 1E 480-V switchgear 2BB06.
- 2-1805-S3-BO7 - Class 1E 480-V switchgear 2BB07.
- 2-1805-S3-BBC - Class 1E 480-V MCC 2BBC.
- 2-1807-Y3-14 - Regulated transformer 2BBC42RX.

- Train B safe shutdown cables.

I. Safety-Related Equipment

- 2-1513-H7-002-H01 - Train B hydrogen recombiner power panel.
- 2-1513-P5-ERB - Train B hydrogen recombiner control panel.
- 2-1807-Y3-RX26 - Regulated transformer 2BBC20RX.

J. Nonsafety-Related Equipment

No major equipment.

K. Combustible Loading

Zone No. 71

- Fixed combustible material
  - Cable insulation
- Heat release
  - Fixed combustibles ≤66,800,000 Btu
  - Transient combustibles 800,000 Btu
- Combustible loading ≤80,000 Btu/ft^2
- Fire severity (wood equivalent) ≤60 min

L. Evaluation of Safe Shutdown Capability

1. For a fire in this area, use safe shutdown train A.
2. Special operational and design considerations:

   None.
3. Spurious actuation considerations:

   a. Main steam atmospheric dump valve, PV-3010, may open due to a fire in this fire area.

9A.2.43 FIRE AREA 2-CB-LB-N

A. Location: Control Building, Level B.

B. Figure: 9A-18.

C. Description: Includes fire zone 78A.

Train A channel 1 switchgear room.

D. Description of Boundaries

- Floor - Unrated concrete basemat.
  - 3-h-rated barrier separates area from 2-CB-LC-A, 1-AB-LD-B.
- North - 3-h-rated barrier separates area from 2-CB-LB-M.
- West - 3-h-rated barrier separates area from 2-CB-LB-E.
- South - 3-h-rated barrier separates area from 2-CB-LB-D, 2-CB-LC-B.
- East - 3-h-rated barrier separates area from 2-CB-LC-B.
- Ceiling - 3-h-rated barrier separates area from 2-CB-LC-B.

E. Area Access

- East - Class A door from 2-CB-LC-B.

F. Sealed Penetrations

Seals meet or exceed fire barrier rating.

G. Fire Dampers

Dampers meet or exceed barrier rating.

H. Safe Shutdown Components

- 2-1806-B3-CAA - Battery charger 2AD1CA.
- 2-1806-B3-CAB - Battery charger 2AD1CB.

- 2-1806-S3-DCA - 125-V-dc MCC 2AD1M.
- 2-1806-S3-DSA - 125-V-dc switchgear 2AD1.
- 2-1806-Q3-DA1 - 125-V-dc distribution panel 2AD11.
- 2-1806-Q3-DA2 - 125-V-dc distribution panel 2AD12.
- 2-1807-Q3-VI1 - Vital bus distribution panel 2AY1A.
- 2-1807-Y3-IA1 - 120-V-ac vital bus inverter 2AD1I1.
- Train A safe shutdown cables.

I. Safety-Related Equipment

- No major equipment.

J. Nonsafety-Related Equipment

No major equipment.

K. Combustibles Loading

Zone No. 78A

- Fixed combustible material
  - Cable insulation

- Heat release
  - Fixed combustibles ≤30,400,000 Btu
  - Transient combustibles 800,000 Btu
- Combustible loading ≤80,000 Btu/ft^2
- Fire severity (wood equivalent) ≤60 min

L. Evaluation of Safe Shutdown Capability

1. For a fire in this area, use safe shutdown train B.

9A.2.47 FIRE AREA 2-CB-LB-T

A. Location: Control Building, Level B

B. Figure: 9A-18

C. Description: Includes fire zones 61, 64 train A penetration room, MCC room.

D. Description of Boundaries:

- Floor - Unrated concrete basemat.
- North - 3-h-rated barrier separates area from 2-CB-LB-A, 2-CB-LB-D.
- West - Unrated below grade exterior area boundary.
- South - Unrated barrier separates area from 2-CTB.
  - 3-h-rated barrier separates area from 2-AB-L2-A.
- East - 3-h-rated barrier separates area from 2-CB-LB-D.
- Ceiling - 3-h-rated barrier separates area from 2-CB-LA-B, 2-CB-LA-C.

E. Area Access

- North - Class A door from 2-CB-LB-D.
  - Class A door from 2-CB-LB-A (el 192 ft-6 in.)

F. Sealed Penetrations

Seals meet or exceed fire barrier rating.

G. Fire Dampers

Dampers meet or exceed fire barrier ratings.

H. Safe Shutdown Components

- HY0442A - HV0442A I/power converter.
- HY0943A - HV0943A I/power converter.

- 2-1602-P5-NFA - R.G. 1.97 neutron flux amplifier panel.
- 2-1805-S3-ABE - Class 1E 480-V MCC 2ABE.
- Train A safe shutdown cables.

I. Safety Related Equipment

- 2-1807-Y3-15 - Regulated transformer 2ABE51RX.
- Train A safety-related cables.

J. Nonsafety-Related Equipment

- Nonsafety-related cables.

K. Combustible Loading

1. Zone No. 61
   - Fixed combustible material
     - Cable insulation
   - Heat release
     - Fixed combustibles ≤158,400,000 Btu
     - Transient combustibles 800,000 Btu
   - Combustible loading ≤80,000 Btu/ft^2
   - Fire severity (wood equivalent) ≤60 min
2. Zone No. 64
   - Fixed combustible material
     - Cable insulation

9A.2.78 FIRE AREA 2-DB-L1-A

A. Location: Diesel Generator Building, Levels 1 and 2

B. Drawing: AX4DJ8046

C. Description: Includes fire zone 161.

Train A diesel generator, intake filter, fan room, air plenum room, exhaust silencer room, duct penetration room.

D. Description of Boundaries

1. Level 1

- Floor - Unrated concrete basemat.
- North - Unrated exterior area boundary.
  - 3-h-rated barrier separates area from 2-CB-LB-A.
- South - Unrated exterior area boundary.
  - 3-h-rated barrier separates area from 2-NSP-LA-A.
- West - Unrated exterior area boundary.
- East - 3-h-rated barrier separates area from 2-DB-L1-B.
  - 3-h-rated barrier separates area from 2-DB-L1-C.

2. Level 2

- Floor - Unrated barrier separates area from 2-DB-L1-C.
- North - Unrated exterior area boundary.
- South - Unrated exterior area boundary.
- West - Unrated exterior area boundary.
- East - 3-h-rated barrier separates area from 2-DB-L1-B.

- Interior - 2-h-rated barrier separates area from stairwell.
- Ceiling - Unrated exterior area boundary.

E. Area Access

1. Level 1

   - North - Unlabeled door from 2-CB-LB-A.
     - Exterior door.
   - South - Class A door from 2-DB-L1-C.
     - Exterior door.

2. Level 2

   - North - Class B door from stairwell.

F. Sealed Penetration

Seals meet or exceed fire barrier ratings.

G. Fire Dampers

Dampers meet or exceed fire barrier ratings.

H. Safe Shutdown Components

- TV12086 - Diesel generator building outside air damper.
- TY12086 - Diesel generator building outside air damper solenoid.
- TV12094A - Diesel generator building outside air damper.
- TY12094C - Diesel generator building outside air damper solenoid.
- TY12094D - Diesel generator building outside air damper solenoid.

- TV12094B - Diesel generator building outside air damper.
- TY12094E - Diesel generator building outside air damper solenoid.
- TY12094F - Diesel generator building outside air damper solenoid.
- TV12096 - Diesel generator building outside air damper.
- TY12096 - Diesel generator building outside air damper solenoid.
- TV12097 - Diesel generator building outside air damper.
- TV12100A - Diesel generator building outside air damper.
- TY12100C - Diesel generator building outside air damper solenoid.
- TV12100 - Diesel generator building outside air damper.
- TY12100B - Diesel generator building outside air damper solenoid.
- TISH12051 - Diesel generator building temperature interlock.
- TISH12100 - Diesel generator ventilation temperature interlock.
- HV12050 - Diesel generator building fan damper.
- HV12051 - Diesel generator building fan damper.
- FE12087 - Diesel generator building ventilation flow interlock.
- FS12087 - Diesel generator building ventilation flow interlock.
- 2-1566-B7-001 - Diesel generator building fan.
- 2-1566-B7-003 - Diesel generator building fan.

- 2-2403-G4-001 - Diesel generator package.
- 2-2403-G4-001-V01 - Diesel generator air start receiver.
- 2-2403-G4-001-V02 - Diesel generator air start receiver.
- 2-2403-P5-DG1 - Diesel generator panel DG2A.
- 2-2403-P5-DG2 - Diesel generator panel DG2A.
- 2-1804-W3-CB700 - Diesel generator A cable bus.
- 2-1805-S3-ABF - Class 1E 480-V MCC 2ABF.
- TV-12086A - Diesel generator building outside air damper.
- TV-12094C - Diesel generator building outside air damper.
- TV-12094D - Diesel generator building outside air damper.
- TV-12096A - Diesel generator building outside air damper.
- TV-12097A - Diesel generator building outside air damper.
- Train A safe shutdown cables.
- 2-1808-T3-114 - Regulated transformer 2ABF13RX

I. Safety-Related Equipment

- 2-2403-G4-001-F01 - Diesel Generator intake air filter.
- 2-2403-G4-001-F02 - Diesel generator exhaust silencer.
- Train A safety related cables.

J. Nonsafety-Related Equipment

- 2-1566-B7-005 - DGB non ESF exhaust fan.
- 2-1566-U7-005 - DGB unit heater.
- 2-1566-U7-007 - DGB unit heater.
- 2-1566-U7-009 - DGB unit heater.

Independent Seismic Category 1 dry standpipe system provides alternate source of water for post-SSE firefighting.

O. Radioactive Material

None.

P. Ventilation

Smoke can be removed using the normal ventilation system in a once-through-only mode of operation. For areas isolated by fire dampers, smoke may be removed by portable fans using flexible tubes to direct the smoke to an area capable of being ventilated or directly to outside. The mechanical ventilation system which could be used to remove smoke from this area may not be operational because electrical cables and/or equipment associated with its operation are located in the fire area.

Q. Drainage

A flooding analysis has determined that drainage from the fire areas is adequate.

R. Emergency Lighting

Security lighting and 8-h-rated battery fixture(s) provide safe ingress/egress of personnel.

8-h-rated battery fixture(s) provide for operation of the diesel generator at the control panels.

S. Deviations and Justifications

1. Unrated exterior fire area boundary:

   See Appendix 9B, section C.5.a(1).

2. Unlabeled doors:

   The unlabeled door at the north boundary (door number 22107L1104) between this area and 2CB-LB-D level 1 is fabricated of the same material of construction as that of a 3-h labeled door.

   See Appendix 9B, section C.5.a(5).

3. Unrated hatch:

   See section 9A.2.80.S.2.

9A.2.79 FIRE AREA 2-DB-L1-B

A. Location: Diesel Generator Building, Levels 1 and 2 and Tunnel 2T3B

B. Drawings: AX4DJ8046 and AX4DJ8041

C. Description: Includes fire zones 162 and 146A.

Train B diesel generator, intake filter, fan room, air plenum room, exhaust silencer room, duct penetration room, and Tunnel 2T3B

D. Description of Boundaries

1. Level 1

- Floor - Unrated concrete basemat.
- North - Unrated exterior area boundary.
  - 3-h-rated barrier separates area from 2-CB-LB-D.
- South - Unrated exterior area boundary.
- West - 3-h-rated barrier separates area from 2-DB-L1-A and 2-DB-L1-C.
- East - Unrated exterior area boundary.
  - 3-h-rated barrier separates area from 2-DB-L1-D.

2. Level 2

- North - Unrated exterior area boundary.
- South - Unrated exterior area boundary.
- West - 3-h-rated barrier separates area from 2-DB-L1-A.
- East - Unrated exterior area boundary.
- Interior - 2-h-rated barrier separates area from stairwell.
- Ceiling - Unrated exterior area boundary.
- Floor - 3-h-rated barrier separates area from 2-DB-L1-D.

3. Below Grade (Tunnel 2T3B)

- Floor - Unrated concrete basemat.
  - 3-h-rated barrier separates area from 2-NSP-LA-A.
- North - Unrated exterior area boundary
- South - Unrated exterior area boundary.
- East - 3-h-rated barrier separates area from 2-AB-LA-B.
- West - Unrated exterior boundary.
- Ceiling - Unrated exterior boundary.
  - 3-h-rated boundary separates area from 2-NSP-LA-A.

E. Area Access

1. Level 1

- North - Unlabeled door from 2-CB-LB-D.
  - Exterior door.
- South - Class A door from 2-DB-L1-D.
  - Exterior door.

2. Level 2

- West - Class B door from stairwell.

F. Sealed Penetrations

Seals meet or exceed fire barrier ratings.

G. Fire Dampers

Dampers meet or exceed fire barrier ratings.

H. Safe Shutdown Components

- HV12053 - Diesel generator building fan damper.

- 2-2403-G4-002-F02 - Diesel generator exhaust silencer.
- Train B safety-related cables.
- 2-1808-T3-115 - Regulated transformer 2BBF13RX

J. Nonsafety-Related Equipment

- 2-1566-B7-006 - DGB non ESF exhaust fan.
- 2-1566-U7-002 - DGB unit heater.
- 2-1566-U7-004 - DGB unit heater.
- 2-1566-U7-006 - DGB unit heater.
- 2-1566-U7-008 - DGB unit heater.
- 2-1566-U7-010 - DGB unit heater.
- 2-1566-U7-012 - DGB unit heater.
- 2-1566-U7-014 - DGB unit heater.
- 2-1566-U7-016 - DGB unit heater.
- 2-1566-U7-018 - DGB unit heater.
- 2-1566-U7-020 - DGB unit heater.
- 2-2403-G4-002-K01 - DG air start air dryer.
- 2-2403-T3-NGB - Neutral grounding cabinet.
- 2-2403-G4-002-CO2 - DG air start compressor air cooler.
- 2-2403-G4-002-E02 - DG air start compressor after cooler.
- 2-2403-G4-002-K02 - DG air start air dryer.
- 2-2403-S3-002 - DG 480-V MCC.
- 2-1215-P4-017 - DGB oily waste sump pump.
- 2-1805-S3-NBQ - 480-V MCC.
- PV-9081 - DG1B start air compressor to after cooler valve.

- HV-28180 - Fire protection system actuation valve.
- HV-28182 - Fire protection system actuation valve.
- HV-12055 - Nonsafety-related cables
- Nonsafety-related cables.

K. Combustible Loading

1. Zone No. 162

   - Fixed combustible material
     - Cable insulation
     - Oil/grease
     - Plastics
   - Heat release
     - Fixed combustibles ≤629,200,000 Btu
     - Transient combustibles 106,400,000 Btu
   - Combustible loading ≤80,000 Btu/ft^2
   - Fire severity (wood equivalent) ≤60 min

2. Zone No. 146A

   - Fixed combustible material

     None.

   - Heat release
     - Fixed combustibles ≤39,200,000 Btu
     - Transient combustibles 0 Btu

- Combustible loading ≤40,000 Btu/ft^2
- Fire severity (wood equivalent) ≤30 min

L. Evaluation of Safe Shutdown Capability

1. For a fire in this area, use safe shutdown train A.
2. Special operational and design considerations:

   None.

3. Spurious actuation consideration:

   None.

M. Fire Detection

Early warning fire detectors are installed within the following zone:

- Zone 162

N. Fire Suppression

1. Automatic

   - Zone 162 preaction sprinkler system - Partial zone coverage.
   - Zone 146A - No zone coverage.

2. Manual

   Hose stations (with portable extinguishers) and hydrant and equipment house are conveniently located to this area. Any location can be reached with at least one effective water stream. Independent Seismic Category 1 dry standpipe system provides alternate source of water for post-SSE firefighting.

O. Radioactive Materials

None.

P. Ventilation

Smoke can be removed using the normal ventilation system in a once-through-only mode of operation (except fire zone 146A). For areas isolated by fire dampers, smoke may be removed by portable fans using flexible tubes to direct the smoke to an area capable of being ventilated or directly to outside. The mechanical ventilation system which could be used to remove smoke from this area may not be operational because electrical cables and/or equipment associated with its operation are located in the fire area.

Q. Drainage

A flooding analysis has determined that drainage from the fire areas is adequate.

R. Emergency Lighting

Security lighting and 8-h-rated battery fixture(s) provide safe ingress/ egress of personnel.

8-h-rated battery fixture(s) provide for operation of the diesel generator at the control panels.

S. Deviations and Justifications

1. Unrated exterior fire area boundary:

   See Appendix 9B, section C.5.a(1).

2. Unlabeled doors:

   The unlabeled door at the north boundary (door number 22107L1101) between this area and 2CB-LB-A level 1 is fabricated of the same material of construction as that of a 3-h labeled door.

   See Appendix 9B, section C.5.a(5).

3. Unrated hatch:

   See section 9A.2.81.S.2.

M. Fire Detection

Early warning fire detectors are installed within the following zone:

- Zone 163

N. Fire Suppression

1. Automatic

   - Zone 163 preaction sprinkler system - Total zone coverage.

2. Manual

   Hose stations (with portable extinguishers) and hydrant and equipment house are conveniently located to this area. Any location can be reached with at least one effective water stream. Independent Seismic Category 1 dry standpipe system provides alternate source of water for post-SSE firefighting.

O. Radioactive Materials

None.

P. Ventilation

Smoke can be removed using the normal ventilation system in a once-through-only mode of operation. For areas isolated by fire dampers, smoke may be removed by portable fans using flexible tubes to direct the smoke to an area capable of being ventilated or directly to outside. The mechanical ventilation system which could be used to remove smoke from this area may not be operational because electrical cables and/or equipment associated with its operation are located in the fire area.

Q. Drainage

A flooding analysis has determined that drainage from the fire areas is adequate.

R. Emergency Lighting

8-h-rated battery fixture(s) provide safe ingress/ egress of personnel.

S. Deviations and Justifications

1. Unrated exterior fire area boundary:

   See Appendix 9B, section C.5.a(1).

2. Unrated hatch:

   A hatch cover is located in the ceiling of the Train A fuel oil day tank room separating the tank room from the rest of the Train A diesel generator building (fire area 2-DB-L1-A). The hatch opening is 3 ft x 7 ft and is used to facilitate access to various manual valve operators. The opening is closed by an access hatch that is fabricated of the same material and methods of constuction as that of a 3-h-labeled fire door.

   An "A" label is maintained on the hatch to ensure surveillance per 3-h rating criteria.

   The fire area boundary containing the unrated hatch cover does not separate redundant safe shutdown components.

CMEB 9.5-1 Requirements	VEGP Position	Clarification of Conformance or Justification of Deviation
		facturer. The manufacturer cannot affix a label to these doors and frames because they are a special design for the Vogtle project and have not been subjected to an actual physical UL fire test. In each case the thickness of the metal used to construct the door frame, door skin, stiffeners, and strike and butt reinforcements exceeds the thickness of metal used in standard fire rated doors and frames. Clearances between the door and the door frame may exceed the 1/8-in. gap required by section 2-5.4 of NFPA 80. The gap may extend to a maximum of 3/8-in. on single swinging metal fire doors and to a maximum of 1/4-in. on double swinging metal doors. The gap between meeting edges of double swinging metal doors may also extend to a maximum of 1/4-in. The gap at the strikeplate area will not exceed 1/8-in. in any case. VEGP swinging hollow metal fire doors have been tested by an independent laboratory to the above referenced dimensions. Pressure and bullet proof swinging doors have been evaluated to be comparable to or exceed the qualifications of the hollow metal doors that were tested by the independent laboratory. The following fire doors to control building electrical equipment rooms are equipped with hold-open devices for use during station blackout conditions: V12111L1B54 V22111L1B07 V12111L1B57 V22111L1B25 V12111L1B59 V22111L1B28 V12111L1B61 V22111L1B34 V12111L1B70 V22111L1B36 V12111L1B88 V22111L1B39 V12111L1B102 V22111L1B103

CMEB 9.5-1 Requirements	VEGP Position	Clarification of Conformance or Justification of Deviation
		Security doors in 3-h rated fire area boundaries that do not fall into the categories mentioned above are labeled Class A fire doors.

VEGP
Normally Open Fire Doors in Rated Fire Area Boundaries

Door No.	Fire Area	Separation Fire Zone
Auxiliary Building		
D65	1-AB-LD-A/ 1-AB-LD-B	11B/12
C47	1-AB-LD-A/ 1-AB-LD-B	11B/24
B18	1-AB-LD-A/ 1-AB-LD-B	11B/40
A17	1-AB-LD-A/ 1-AB-LD-B	11B/38
D66	2-AB-LD-A/ 2-AB-LD-B	11B/13
C21	2-AB-LD-A/ 2-AB-LD-B	11B/24
B50	2-AB-LD-A/ 2-AB-LD-B	11B/40
A84	2-AB-LD-A/ 2-AB-LD-B	11B/38

Doors equipped with automatic hold-open and release mechanisms will be inspected at least semiannually to verify their operability.

CMEB 9.5-1 Requirements	VEGP Position	Clarification of Conformance or Justification of Deviation
One of the following measures should be provided to ensure they will protect the opening as required in case of fire:	Conforms	One of the specified measures will be used to protect door openings.
(a) Fire doors should be kept closed and electrically supervised at a continuously manned location.		Due to air balance conditions, some doors at VEGP may require deliberate manual action to close. Personnel receive training on the proper use of doors to ensure they are fully closed and latched following use.
(b) Fire doors should be locked closed and inspected weekly to verify that the doors are in the closed position.		

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REV 1 3/91

CMEB 9.5-1 Requirements	VEGP Position	Clarification of Conformance or Justification of Deviation
to a single hose station serving that area. Provisions should be made to supply water, at least to standpipes and hose connections, for manual firefighting in areas containing equipment required for safe plant shutdown in the event of an SSE. The piping system serving such hose stations should be analyzed for SSE loading and should be provided with supports to ensure system pressure integrity. The piping and valves for the portion of hose standpipe system affected by this functional requirement should, as a minimum, satisfy ANSI B31.1, Power Piping. The water supply for this condition may be obtained by manual operator actuation of valves in a connection to the hose standpipe header from a normal Seismic Category 1 water system such as the essential service water system. The cross connection should be (a) capable of providing flow to at least two hose stations (approximately 75 gal/min per hose station), and (b) designed to the same standards as the Seismic Category 1 water system; it should not degrade the performance of the Seismic Category 1 water system.		control room entrances but not inside the control room. Water from the Seismic Category 1 nuclear service cooling water system will be available for manual fire fighting in the event of a fire after an SSE. This water source is connected to a Seismic Category 1 dry standpipe system within the control, containment, auxiliary, and diesel generator buildings. The dry standpipe system is not provided in the auxiliary feedwater pumphouse because the building can be reached by hoses from the diesel generator building. It is not provided in the nuclear service cooling water towers because the combustibles loading is minimal. It is not provided in the fuel handling building because this building can be reached by hoses from the auxiliary building. This arrangement will be entirely independent of the normal fire protection water system, thus protecting the integrity of the Seismic Category 1 nuclear service cooling water system. This water supply is obtained by manual operator actuation of valves. All piping will be designed and installed to ASME Boiler and Pressure Vessel Code, Section III - Class 3 (no N-stamping required). The Seismic Category 1 standpipe system does not conform with the guidelines of NFPA 14. Although the Seismic Category 1 standpipe system is not designed to conform to NFPA 14, it will be tested in accordance with Section 8-1.2 and Section 8-2.1 of NFPA 14-1983. The standard provides the suitable requirements for testing and inspections of the system to maintain the defense-in-depth concept.
(5) The proper type of hose nozzle to be supplied to each area should be based on the fire hazards analysis. The usual combination spray/ straight-stream nozzle should not be used in areas where the straight stream can cause unacceptable mechanical damage. Fixed fog nozzles should be provided at locations where high-voltage shock hazards exist. All hose nozzles should have shutoff	Conforms	(5) Electrically safe hose nozzles are used in all internal building areas.

CMEB 9.5-1 Requirements	VEGP Position	Clarification of Conformance or Justification of Deviation
capability. (Guidance on safe distances for water application to live electrical equipment may be found in the NFPA Fire Protection Handbook.)		
(6) Fire hose should be hydrostatically tested in accordance with the recommendations of NFPA 1962, Fire Hose Care, Use, Maintenance. Hose stored in outside hose houses should be tested annually. Interior standpipe hose should be tested every 3 years.	Conforms	(6) All VEGP fire hoses are hydrostatically tested annually for outside hoses and every 3 years for interior hoses. Reference FSAR table 9.5.1.9 for specific conformance to NFPA 1962.
	Not applicable	(7) VEGP does not use AFFF foam systems.
C.6.d. Halon Suppression Systems		C.6.d Halon Suppression Systems
Halon fire extinguishing systems should comply with the requirements of NFPA 12A and NFPA 12B, Halogenated Fire Extinguishing Agent Systems - Halon 1301 and Halon 1211. Only UL-listed or FM-approved agents should be used. Provisions for locally disarming automatic Halon systems should be key-locked and under strict administrative control. Automatic Halon extinguishing systems should not be disarmed unless controls as described in Position C.2.c. are provided.	Conforms	The use of Halon fire extinguishing agents and systems is guided by the requirements of NFPA 12A. Only UL- or FM-approved agents and systems are used. Provisions for locally disarming automatic Halon systems are key locked and under administrative control. Deviations from the code are described in table 9.5.1-9.
In addition to the guidelines of NFPA 12A and 12B, preventive maintenance and testing of the systems, including check weighing of the Halon cylinders, should be done at least quarterly.	Partial conformance	In addition to the guidelines of NFPA No. 12A, preventative maintenance and testing of the systems are done in accordance with the FSAR. Halon cylinders will be either weighed or level checked for halon quantity. NFPA 12B is not applicable to VEGP. Deviations from the codes are discussed in table 9.5.1-9.