CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT

DESIGN BASIS DOCUMENT

COMPONENT COOLING WATER SYSTEM

DBD-131

REVISION	DATE	PREPARED BY	INDEPENDENT REVIEW BY	APPROVED BY
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7	8/04/98			
Reason for Change	Changed description of ESW Pump start in paragraph 2.1.9 to reflect plant design. Added paragraph 2.1.21.4 to clarify description of system alignment during recirculation phase of operation.			

SIGNATURES ON ORIGINAL

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Note:

There are certain criteria which have been added to this DBD that were not originated, reviewed or verified by Ebasco. These criteria were provided by CP&L via comments to the DBD. Ebasco has agreed to incorporate these criteria; however, CP&L has responsibility for the origination, review and verification of these criteria. Criteria provided by CP&L has been identified by an asterisk (*).

1.0 FUNCTION

The Component Cooling Water System is an intermediate cooling loop which removes heat from safety related and non-safety related components during all plant operating conditions. The CCW System is utilized to prevent the direct leakage of radioactivity from nuclear support systems in the plant to the environment, and to prevent the ingress of chlorides and other corrosives into components to which these chemicals could be harmful. The CCW System is used as part of the Emergency Core Cooling System to remove heat from water being recirculated from the Containment Building sump to the reactor, and provide cooling water to safeguards pumps as part of the ESF supporting system.

2.0 DESIGN BASES AND ASSUMPTIONS

2.1 General System Requirements

2.1.1 The CCW System provides cooling for redundant essential loops and a nonessential loop.

2.1.1.1 Each of the two essential loops consist of the following:

a. One RHR heat exchanger

b. One RHR pump oil cooler

2.1.1.2 The nonessential loop consists of the following:

a. One letdown heat exchanger (CVCS)

b. One seal water heat exchanger (CVCS)

c. Two spent fuel pool heat exchangers (SFPCCS)

d. One boron recycle evaporator package consisting of one distillate cooler, one evaporator condenser, and one vent condenser (BRS)

e. Three reactor coolant pump packages, each consisting of one upper bearing lube oil cooler, one lower bearing oil cooler, and one thermal barrier cooler (RCS)

f. One gross failed fuel detector cooler (GFFDS)

g. One excess letdown heat exchanger (CVCS)

h. One reactor coolant drain tank heat exchanger (WPS)

i. Six sample coolers (PSS)

2.1 General System Requirements (continued)

2.1.2 The system is designed to operate during all phases of plant operation and shutdown.

2.1.3 Three CCW Pumps are provided to allow for maintenance on one pump. Each pump provides 100 percent of the flow required by the accident analyses. One pump is usually running during normal operation, two pumps during reactor cooldown, and one or two pumps are required during shutdown, depending on the reactor heat decay and auxiliary heat loads.

2.1.4 The design of the CCW System is based on a maximum service water supply temperature of 95°F. This temperature places no limitations on normal plant operation and affects only the time required for plant cooldown.

2.1.5 The CCW System is capable of cooling the Reactor Coolant System from 350°F to 140°F within 17 hours with both trains operating (see Reference 4.5.11).

2.1.6 The system is designed to supply cooling water at a maximum temperature of 120°F (for approximately 4 hours) to the components being cooled when the Residual Heat Removal System is first placed in operation during plant shutdown. This is the maximum permissible temperature of the cooling water supply to the reactor coolant pumps. During normal plant operation, the system is required to supply cooling water at 105°F (max), at a given flow rate to each component that will remove the rated heat load. The flow rates are adjusted manually during system balancing, or are automatically regulated by temperature control valves.

2.1.7 The size of the CCW System components is based on removing the decay and sensible heat from the reactor, plus miscellaneous auxiliary loads, using the temperatures that would exist 20 hours following reactor shutdown. Shutdown from an extended period of operation is assumed to determine the design decay heat. Operation of both CCW trains is assumed during normal shutdown, and each train is designed to remove one half the design heat load.

2.1.8 The heat load on the CCW System from auxiliary system components independent of the RCS is 20×10^6 Btu/Hr.

2.1.9 The Service Water System is required to provide the design flow of approximately 8250 gpm through each operating CCW Heat Exchanger. If one CCW Heat Exchanger is not in use, the Service Water flow through it may be isolated. However, except during maintenance outages which are governed by Plant Limiting Conditions for Operation, the Service Water Pump must be available to start automatically in response to activation of a safety injection 'S' signal.

2.1 <u>General System Requirements</u> (continued)

2.1.10 Instrument Air is provided to control valves that limit flow of CCW through the Letdown and Excess Letdown Heat Exchangers, the Gross Failed Fuel Detector System, the Boron Recycle System (BRS) evaporator condenser, the make-up water control valve from the Demineralized Water System, and the sample panel isolation valves.

2.1.11 The Demineralized Water System is required to provide initial fill and make-up water to the CCW System.

2.1.12 The Reactor Make-up Water System provides emergency make-up water to the CCW System through a normally closed manual valve.

2.1.13 The design objective of the surge tank overflow is to ensure the maximum CCW pump discharge pressure does not exceed 110% of the design pressure assuming a water solid surge tank coincident with the maximum anticipated inleakage through a ruptured tube in one of the CCW system heat exchangers. The CCW Surge Tank overflow is designed not to release any potentially contaminated gases within the Control Room habitability area. The overflow line is sized to minimize the back pressure on the tank.

2.1.14 Inservice testing of the CCW pumps is required in accordance with ASME Section XI to confirm that each pump is capable of operation at its design head and flow.

2.1.15 Containment isolation valves may be subject to leak rate verification for Integrated Leak Rate and/or Local Leak Rate Testing programs.

2.1.16 The Surge Tank is provided with a baffle, or divider, that provides separation between the redundant CCW trains during the recirculation phase of a LOCA, when the cross connect valves between the two trains are closed.

2.1.17 Relief Valve Sizing

2.1.17.1 Thermal expansion over pressure protection is provided on all components that may be isolated. This is accomplished two ways: Thermal relief valves are used on some components on the downstream side of the heat exchanger and can relieve to drains or back to the system. A bypass arrangement consisting of a restrictor orifice, locked open valve and check valve is installed across the downstream (outlet) isolation valve on other components in the system. The bypass flow is intended to provide thermal over pressure protection and prevent the fluid in the heat exchanger from stagnating if that exchanger is isolated.

2.1 General System Requirements (continued)

2.1.17.2 The relief valve downstream of the Excess Letdown Heat Exchanger is sized to pass the liquid/steam mixture flow that would result from a tube rupture.

2.1.18 A separate motor operated valve is provided on the return line from the Reactor Coolant Pump thermal barriers. This valve closes if high flow rates are detected. A separate valve is used to satisfy Standard Review Plan guidelines on use of containment isolation valves for additional process control. Piping isolated by this valve is designed for full RCS pressure.

2.1.19 No insulation is required for the CCW piping.

2.1.20 Equipment Qualification

2.1.20.1 All piping and components constructed to the requirements of ASME B&PV Code Section III are qualified for operation after a Design Basis Earthquake.

2.1.20.2 All components are qualified for operation in the temperature, pressure, humidity and radiation environment in which they are located (see References 4.3 and 4.5.9).

2.1.20.3 All piping has been reviewed for stresses due to thermal expansion and contraction, and for compliance with maximum allowable nozzle loads specified for plant components.

2.1.21 Operational Requirements

2.1.21.1 During a plant shutdown (refueling) one or both CCW trains may be in operation, depending on Service Water supply temperature, amount of heat decay being generated and the number of auxiliary systems in service.

2.1.21.2 During normal operation, only one CCW train is normally required, since only minimal letdown cooling and plant auxiliary loads are in service. The second CCW Pump and Heat Exchanger are available and will automatically start on low CCW supply pressure.

2.1.21.3 During normal operation at least one CCW pump is supplying cooling water to safeguard pumps. The activation of a safety injection 'S' signal will automatically start a second pump thereby ensuring the continued operation of at least one CCW pump operating during the injection phase of safety injection. Before the initiation of the SIS recirculation phase, the second CCW pump is started and the four motor operated valves that cross-connect the two trains are closed by operator action from the control room.

2.1 General System Requirements (continued)

2.1.21.4 All four motor operated valves are initially closed to establish the design ccw flowrate to the RHR heat exchangers. During the recirculation phase, two of the four motor operated valves must remain closed in order to ensure train separation. One pair of valves can be opened to re-establish ccw flow to the non-essential loop in order to provide cooling to the spent fuel pools.

2.1.22 The primary regulatory requirements applicable to the CCW System are 10CFR 50 Appendix A, Criteria 34, 35, 36, 37, 44, 45, 46, 54 and 57.

2.2 Instrumentation and Control

2.2.1 Instrumentation and Control devices have been provided to ascertain that functions defined in Section 1.0 of this DBD are adequately performed.

2.2.2 Although either of the CCW trains provides sufficient cooling for mitigation of any accident, the operation of the second train and closure of the cross-connecting valves is required to satisfy the single failure criteria for components in the CCW system.

2.2.3 Automatic CCW System controls are provided for the following functions:

2.2.3.1 Low CCW Pump discharge pressure starts the standby CCW pump and the associated Service Water Pump.

2.2.3.2 High CCW return flow from the Reactor Coolant Pump Thermal Barrier Cooling Coils closes an isolation valve on the CCW return line.

2.2.3.3 Low Surge Tank level isolates the Gross Failed Fuel Detector.

2.2.3.4 CCW flow through the Letdown Heat Exchanger is automatically regulated to maintain a preset letdown water temperature.

2.2.3.5 Gamma-radiation detectors on the discharge of the CCW Pumps alarm on high system radiation.

2.2.4 The following indication is available in the Main Control Room:

a - CCW Heat Exchanger outlet temperature
b - CCW Heat Exchanger outlet pressure
c - CCW Heat Exchanger outlet flow
d - CCW flow to the RHR Heat Exchanger
e - CCW Surge Tank level (1 on each side)
f - CCW Containment Isolation Valve Position

2.2 Instrumentation and Control (continued)

2.2.5 The following alarms are annunciated in the Main Control Room:

a - High temperatures in the CCW Pump suction

b - High (gamma) radiation in the CCW Pump discharge

c - High/Low levels in the CCW Surge Tank (both sides)

d - High temperatures in the CCW Heat Exchanger outlet

e - Low pressure in the CCW Heat Exchanger outlet

f - High flow in the CCW Heat Exchanger outlet

g - High temperatures in the Reactor Coolant Pump outlet headers

h - High/Low flow in the Reactor Coolant Pump bearing cooler outlet headers

i - Low flow in the Reactor Coolant Pump thermal barrier CCW outlet

j - High/Low flow in the Reactor Drain Tank Heat Exchanger CCW outlet

k - High/Low flow in the Letdown Heat Exchanger CCW outlet

l - High/Low flow in the Excess Letdown Heat Exchanger CCW outlet

m - High/Low flow in the Spent Fuel Pit Heat Exchanger CCW outlet

n - High/Low flow in the Seal Water Return Heat Exchanger CCW outlet

o - High differential flow (i.e. flow mismatch) between the CCW flow to and from the Recycle Evaporator package

p - Low flow from the RHR Pump cooler CCW outlet

q - High/Low flow from the RHR Heat Exchanger CCW outlet

2.2 <u>Instrumentation and Control</u> (continued)

2.2.6 Local indication is provided for:

a - CCW Surge Tank level (each side)

b - CCW Pumps suction and discharge pressure

c - CCW Heat Exchanger CCW inlet temperature

d - CCW Heat Exchanger CCW outlet flow

e - Reactor Coolant Pump CCW outlet headers temperature (2)

f - Reactor Coolant Pumps lower bearing cooler CCW outlet flow (3)

g - Reactor Coolant Pump upper and lower bearing cooler CCW outlet total flow (3)

h - Reactor Coolant Pumps thermal barrier cooler CCW outlet flow (3)

i - Reactor Coolant Pumps thermal barrier cooler CCW outlet header flow (1)

j - Reactor Coolant Drain Tank Heat Exchanger CCW outlet temperature

k - Reactor Coolant Drain Tank Heat Exchanger CCW outlet flow

l - Letdown Heat Exchanger CCW outlet temperature

m - Letdown Heat Exchanger CCW outlet flow

n - Excess Letdown Heat Exchanger CCW outlet temperature

o - Excess Letdown Heat Exchanger CCW outlet flow

p - Seal Water Heat Exchanger CCW outlet temperature

q - Seal Water Heat Exchanger CCW outlet flow

r - Spent Fuel Pit Heat Exchanger CCW outlet temperature

s - Spent Fuel Pit Heat Exchanger CCW outlet flow

t - RHR Heat Exchanger CCW outlet temperature

u - RHR Heat Exchanger CCW outlet flow

v - RHR Pump Oil Cooler CCW outlet flow

w - Boron Recycle Evaporator Package CCW return temperature

x - Boron Recycle Evaporator Vent Condenser CCW outlet flow

y - Gross Failed Fuel Detector CCW outlet flow

2.2 Instrumentation and Control (continued)

2.2.7 The containment isolation valves for the Excess Letdown Heat Exchanger and Reactor Coolant Drain Tank Heat Exchanger CCW headers close on a phase A isolation (i.e., a "T" signal). The containment isolation valves for the Reactor Coolant Pump CCW headers close on a phase B isolation (i.e., a "P" signal).

2.2.8 The CCW Surge Tank is located at the highest elevation of the CCW System to facilitate initial filling and prevent vapor binding of CCW piping segments.

2.2.9 The motor operated valve provided on the return line from the Reactor Coolant Pump thermal barriers will close on high flow rate.

2.2.10 Operating status of the equipment listed below are inputted to the plant computer for historical data and trend analysis.

a - Component Cooling Pumps

b - Isolation Valves

c - Cooling Water Outlet Valve

2.3 Electrical

2.3.1 Electrical power for the (3) 800 Hp CCW Pumps, motor operated valves and all essential controls are powered by ESF redundant off-site power supplies, standby on-site diesel generator power supplies and DC power supplies.

2.3.2 To assure reliability, the component cooling pumps and motor operated valves are connected to separate redundant electrical power supplies and separate redundant control circuits. Each train of CCW equipment performing similar functions are electrically independent.

2.3.3 An on-site emergency power source is required to supply essential electrical equipment if a total loss of normal power should occur.

2.3.4 Electric power for the motor operated valves is provided by the ESF 480V emergency MCC's 1A21-SA, 1A31-SA, 1B31-SB, 1A35-SA, and 1B35-SB. These loads are considered continuous. The component cooling water system is part of the Emergency Core Cooling System which is required for safe shutdown of the plant.

2.3.5 Portions of the system not essential for operation of the system, such as the transfer pump, drain tank pump and some instrumentation, are powered from non-ESF power supplies. These nonessential loads are considered intermittent.

2.3.6 DC power is supplied by safety related panels DP-1A-SA and DP-1B-SB. DC power is also supplied by non-safety related panel DC-1A.

2.3.7 Penetration heat loss calculation 22 shows that various conductor sizes within a single penetration are below the maximum allowable heat dissipation. This limits the nozzle concrete interface temperature to 120°F in accordance with IEEE standard 317-1983, drawings CAR 1364-4289, 4290 and 4291 and Electrical Penetration Schedule sheets S1223, S1227, S1230 and S1249.

2.3.8 Electrical penetration protection calculation 30 shows that without loss of mechanical integrity, the penetrations withstand the maximum short circuit current due to a fault. This is for a period of time sufficiently long enough to allow backup circuit protection to operate on failure of the primary protection device. Therefore primary and secondary (backup) fuses and/or breakers provide protection, interrupting a fault before the thermal capabilities of the penetration are exceeded.

2.3.9 Since two pumps may be required for reactor shutdown, three CCW pumps are provided to allow for maintenance on one pump. Pump 1A-SA is connected to 6.9 kV ESF Bus 1A-SA, Pump 1B-SB is connected to ESF Bus 1B-SB and Pump 1C-SAB is connectible to either Train "A" or Train "B".

2.3.10 In order for Pump 1C-SAB to replace either pump 1A-SA or 1B-SB and to maintain redundancy in electrical power supply and control, Pump 1C-SAB has a dual cubicle/single breaker arrangement. It can be powered and started from the same electrical division as the pump it replaces. Furthermore, provisions are made so that it cannot be connected to both redundant circuits at the same time, which would violate separation and single failure criteria. A mechanical interlock prevents placing the breaker for pump 1C-SAB in the connected position at the same time as either pump 1A-SA or 1B-SB. This assures that both are not started by an automatic starting signal which could overload the emergency power supply. An annunciator will alarm in the control room if this interlock is defeated and both the normal and Pump 1C-SAB breakers are racked in the same train. Before Pump 1C-SAB is started, the breaker designated for the dual cubicle arrangement must be moved to the corresponding cubicle in the emergency bus where the disabled pump is connected (see References 4.1.9 and the electrical calculations in Section 4.5.1).

2.3.11 Electrical power and control cables for the system are sized in accordance with SHNPP Unit 1 calculations and electrical design criteria 8, 9, 17, 18, 19, 20 and 21 (see Reference 4.5.10).

2.3 Electrical (continued)

2.3.12 Cable and raceway for the system is in accordance with SHNPP Unit 1 Electrical Design Criteria 3 and 4 (see Reference 4.5.10).

2.4 Structural

Not applicable to this DBD

2.5 Materials and Chemistry

2.5.1 All components for the CCW System are fabricated of carbon steel. Heat exchanger tube materials are stainless steel or 90-10 copper-nickel alloy, as dictated by the fluid on the tube side of the exchanger.

2.5.2 The CCW System is treated with a molybdate/nitrate/tolyltriazole (MNT) inhibitor for corrosion control.

2.5.3 Local sample points are provided downstream of the CCW Pumps and at the surge tank.

2.5.4 Water chemistry requirements are specified in the Westinghouse "Chemistry Criteria and Specifications for Westinghouse PWRs".

2.5.5 A Chemical Addition Tank is provided to allow pH and chromate adjustment. Chemicals added to the tank are swept into the surge tank standpipe by a line from the CCW Pump discharge.

2.5.6 Phosphoric acid and Sodium Hydroxide are used for pH adjustment.

2.5.7 Due to the chemical treatment of the CCW System, a CCW Drain Tank and CCW Hold-up Tank are provided to help limit the amount of water drained to the building sumps. If the CCW System becomes contaminated, these tanks also help retain the radiation within the plant. Transfer pumps are provided for each of these tanks.

2.6 Failure

2.6.1 The effect of a single active failure within the CCW System has been considered. The result of the analysis are tabulated on FSAR Table 9.2.2-4. In addition, the worst case leak scenario postulated is a leak in one train of the CCS that results in a loss of all component cooling water. For this scenario, no other single failures need to be postulated. This is acceptable since the CCWS is not essential in the short term following this event to establish safe reactor shutdown. In the longer term, system redundancy and isolation provisions will permit the operator to reestablish its operation so that long-term cold shutdown can be achieved. Therefore, SHNPP CCWS is designed to meet passive failure criteria and the Standard Review Plan Section 3.6.1 and 3.6.2 are applicable to its design and layout.

2.6 Failure (continued)

2.6.2 Failure of one CCW Heat Exchanger and/or one CCW train has no safety implications during reactor cooldown. The cooldown period will be extended due to the reduced capacity.

2.6.3 Failure of one CCW Heat Exchanger and/or one CCW train after shutdown has no safety implications. The RCS and operating CCW loop temperature will rise to a higher plateau, where the greater temperature differentials will compensate for the loss of the second train.

2.6.4 Failure of one CCW Heat Exchanger and/or one CCW train during normal operation reduces system redundancy and would require the shutdown of the reactor in accordance with Plant Limiting Conditions for Operation. However, only one train is required during normal operation, so the second train could be utilized while repairs are performed, and to cooldown the reactor, if required.

2.6.5 Failure of one CCW Heat Exchanger and/or one CCW train during the recirculation phase following a LOCA reduces system redundancy, however, the remaining CCW train provides 100% of the required capacity.

2.6.6 In the event of a failure of normal AC power, all ESF loads will be fed from both emergency diesel generators and Non-ESF loads can be aligned with emergency diesel generator 1A-SA or 1B-SB. During normal plant operation, operator discretion shall be utilized such that an overload condition will not occur.

2.6.7 Additional single failure effects analysis is provided in 1364-97525 (ESR 94-00057).

3.0 DESIGN MARGIN

Not applicable to systems within the Westinghouse NSSS scope of supply.

4.0 DOCUMENT REFERENCE LIST

4.1 Drawings

4.1.1 Flow Diagrams

CAR-2165-G-184	RAB Drainage Systems
CAR-2165-G-187	FHB Drainage Systems
CAR-2165-G-819	Component Cooling Water, Sheet 1
CAR-2165-G-820	Component Cooling Water, Sheet 2
CAR-2165-G-821	Component Cooling Water, Sheet 3
CAR-2165-G-822	Component Cooling Water, Sheet 4
CAR-2165-G-822S01	Component Cooling Water, Sheet 5

4.1.2 General Arrangements

CAR-2165-G-011	Containment Building Plan at El. 221' and 236'
CAR-2165-G-012	Containment Building Plan at El. 261' and 286'
CAR-2165-G-013	Containment Building Sections
CAR-2165-G-014	Containment Building Sections

4.1 Drawings (continued)

CAR-2165-G-015	RAB Plan at El. 190' and 216'
CAR-2165-G-016	RAB Plan at El. 236'
CAR-2165-G-017	RAB Plan at El. 261'
CAR-2165-G-018	RAB Plan at El. 286'
CAR-2165-G-019	RAB Plan at El. 305'
CAR-2165-G-020	RAB Sections Sheet 1
CAR-2165-G-021	RAB Sections Sheet 2

4.1.3 Piping Drawings

CAR-2165-G-120	Containment Building - Plan
CAR-2165-G-121	Containment Building - Partial Plans
CAR-2165-G-122	Containment Building - Sections & Details
CAR-2165-G-123	RAB Plan
CAR-2165-G-124	RAB Plan & Sections
CAR-2165-G-126	RAB Plan & Sections
CAR-2165-G-127	RAB Plan El. 236'
CAR-2165-G-255	FHB Plan El. 236' Sheet 2
CAR-2165-G-257	FHB Sections - Sheet 1
CAR-2165-G-260	FHB Sections - Sheet 4
CAR-2165-G-264	FHB Misc Plans & Sections

4.1.4 Power Distribution and Motor Data Sheets

CAR-2166-B-041 Sheets 45, 46, 172S03, 173S02, 175S01, 179S02, 181S02, 181S03, 194S03, 674, 678, 682.

4.1.5 One Lines

CAR-2165-G-030 480V Auxiliary One Line Wiring Diagram - Unit 1

CAR-2166-G-029 Main and 6900V One Line Diagram

4.1.6 Instrumentation Logic Diagrams

CAR-2166-B-430 Sheet 30.3

4.1.7 Control Wiring Diagrams

CAR-2166-B-401 Sheets 168, 292, 420, 421, 940 thru 944, 946 thru 963, 965 thru 975, 1471 and 1472.

4.1.8 Electrical Design Criteria

Criteria #	Title
3	Cable Tray Design and Installation
4	Conduit Design and Installation
8	Power Cable Ampacities
9	480V ACB, Starter and Cable Size for Major Load
17	480V Auxiliary System
18	Cable Data and Loop Length

4.1 Drawings (continued)

19	Special Cable Specification CAR-SH-E-15
20	Safety Related Bus Voltage Adequacy
21	208/120V Auxiliary System (1E)

4.1.9 Medium Voltage Relay Settings

CAR-2166-S-302	Sheets 19, 23 and 24

4.2 Specifications

CAR-SH-A-02	Nuclear Steam Supply System
CAR-SH-M-34R, 34Y	2" and Smaller, Carbon and Stainless Steel Valves
CAR-SH-M-36R, 36Y	2" and Smaller, Carbon and Stainless Steel Valves
CAR-SH-M-40	Miscellaneous Safety and Relief Valves
CAR-SH-M-41	Diaphragm Valves
CAR-SH-M-47	Temporary Strainers
CAR-SH-M-70	Water Check Valves
CAR-SH-M-73	Solenoid Valves (NS)
CAR-SH-M-12	Miscellaneous Pumps
CAR-SH-AS-12	Miscellaneous Shop-Fabricated Tanks
CAR-SH-E-06B	6.9kV Switchgear (Class 1E)
CAR-SH-E-10A	480V MCC (Non 1E)
CAR-SH-E-10B	480V MCC (Class 1E)
CAR-SH-E-12A	Motors for Station Auxiliary Service Furnished With Driven Equipment Up to 250 Hp
CAR-SH-E-13A	Motor for Station Auxiliary Service 6600 and 4000 V
CAR-SH-E-14A	15kV Power Cable (Non 1E)
CAR-SH-E-14B	Power and Control Cables
CAR-SH-E-14C	300V Instrumentation Cable (Class 1E)
CAR-SH-E-14D	Thermocouple Cable (Class 1E)
CAR-SH-E-15A	Special Cables (Anaconda) - Class 1E
CAR-SH-E-15B	Special Cables (Paige Electric) - Class 1E
CAR-SH-E-28	Containment Electrical Penetrations

4.2 Specifications (continued)

CAR-SH-IN-05	Auxiliary Control Panel
CAR-SH-IN-06	Local Panels and Racks
CAR-SH-IN-09	Temperature Switches
CAR-SH-IN-11	Rotameters and Flowswitches
CAR-SH-IN-12	Level Switches
CAR-SH-IN-13	Auxiliary Relay Panels
CAR-SH-IN-23	Isolation Panels
CAR-SH-IN-26	Transfer Panels
CAR-SH-IN-27	Sequencer Panels
CAR-SH-IN-38	Main Control Board (NS)

4.3 Final Safety Analysis Report (FSAR)

Section 3.11	"Environmental Design of Electrical and Mechanical Equipment"
Section 5.4.7	"Residual Heat Removal System"
Section 7.1.1.3	"ESF Supporting System"
Section 8.3.1.1.2.3	"On Site Power System Loads Supplied from Each Bus"
Section 8.3.1.1.2.4	"On Site Power System Manual and Automatic Interconnections Between Buses, Between Buses and Loads and Between Buses and Supplies"
Section 9.2.2	"Component Cooling Water"
Section 12.3	"Radiation Zone Maps"

4.4 Project Lists

CAR-1364-B-69	Valve List
CAR-1364-B-70	Piping Line List
CAR-3166-B-432	Instrument List
CAR-3166-B-508	Set Point Document
CAR-3166-B-043S01	Cable and Conduit List

4.5 Miscellaneous

4.5.1 Calculation List

Mechanical Calculations

Note: Ebasco Mechanical Calculations CC-1, CC-2, CC-3, CC-4, and CC-5 have been superseded by Westinghouse Proof-of-Design calculations.

CC-6	CCW Surge tank Room Maximum Flood Level
CC-7	CCW Heat Exchanger Torque Values
NSSS-038	RHR Heat Exchanger and Pump Cooler Cooling Water Outlet Temperature
SW-48	CCW Heat Exchanger Performance with Reduced Service Water Flow

Stress Analysis Calculations

Stress Calc No.	Corresponding Piping Iso. No.
SA-1147-1	1A-236-CC-39
SA-1230-1 thru 12	-1 thru -20
SA-1231	-28
SA-1232	-27
SA-1233	-30
SA-1234	-34 & -35
SA-1240	-25 & -26
SA-1241	-37
SA-1242	-22 & -23
SA-1243A thru C	-31 & -32
SA-1244	-36
SA-1245	-41
SA-1246	-38
SA-1247, 1248, & 1249	-40
SA-1250	-41
SA-1251 & 1252	-38
SA-1260	-23
SA-1261	-33
SA-1270	-29
SA-1271	-24

Electrical Calculations

E2-001.1	Overcurrent Protection for 6.9kV Motors: Component Cooling Water Pumps 1A-SA, 1B-SB and 1C-SAB
E2-006	Ground Overcurrent Relays, 6.9kV Feeders

4.5.2 Westinghouse Proof-of-Design calculations have been performed on the piping to each component to assure the proper flow rates are provided.

4.5 Miscellaneous (continued)

4.5.3 Vendor Manuals

a) CCW Pumps, VM-ISP

b) CCW Heat Exchanger, VM-MJB

c) CCW Drain Tank Pump, VM-IQW

d) CCW Hold-Up Tank Pump, VM-IQW

4.5.4 EMDRAC List

Primary system drawings are filed in:

S020507	CCW Pumps
S021000	CCW Heat Exchangers
S021500	CCW Surge Tank
S022000	Valves
S028500	Westinghouse Flow Diagrams
S032000	Process Instrument & Control Systems
S032500	Process Control System
S038600	Electrical Systems
435107	CCW Hold-Up and Drain Tanks
435181	Miscellaneous Centrifugal Pumps

b) EMDRAC Drawings

1364-002368	CCW Pumps
1364-002441	CCW Heat Exchanger
1364-002651	CCW Heat Exchanger Specs.
1364-002652	CCW Heat Exchanger Specs.
1364-002653	CCW Heat Exchanger Specs.
1364-011064	Drain Tank & Hold-Up Tank Pumps
1364-016352	Transfer Pump Performance Test Curve
1364-023814	Drain Tank Pump Performance Curve
1364-92105	CCW Pump Performance Curve
1364-96815	SD-CQL-291, Westinghouse SD

4.5.5 Letter CQL-6075, dated 11/19/80, which provides a list of Proof-of-Design calculations performed by Westinghouse

4.5.6 Westinghouse Reactor Fluid Systems Standard Design Manual

4.5.7 Westinghouse System Description, CQL-291, dated April, 1980 (Rev. 1)

4.5.8 Chemistry Criteria and Specifications for Westinghouse Pressurized Water Reactors

4.5.9 Mechanical Equipment Qualification Program Report

4.5.10 DBD #202 - Plant Electrical System, Off-site Power System, Generator, Exciter and Isophase Bus Duct, Generator and Exciter Mechanical Support Systems

4.5.11 Westinghouse letter FCQL-357, dated August 8, 1985 - FSAR Section 5.4 (RHR System)

4.5 Miscellaneous (continued)

4.5.12 Purchase Order 584756M-AA-Atlas Industrial Manufacturing Company Design Information for Reactor Coolant Drain Tank

4.5.13 Purchase Order 587731M-AA-Atlas Industrial Manufacturing Company Design Information for Excess Letdown Heat Exchangers

4.5.14 Westinghouse Letter CQL-90-563, dated October 2, 1990 - CCW System Post Accident Pressure Evaluation

4.5.15 Atlas Industrial Manufacturing Letter dated March 28, 1991 - Heat Exchanger Design Pressure Change Reactor Coolant Drain Tank

4.5.16 Letter from Ewell Morgan to Bill Slover dated July 20, 1993 - CCW System pH Control Practices, File # H-4080

5.0 APPENDIX

5.1 Design Input Documents

Not Applicable.