TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

							DISPLAY		
							MCR		
ITEM NUMBER	VARIABLE/SENSOR	R.G. 1.97 RECOMMENDED RANGE	R.G. 1.97 DESIGN CATEGORY	ACTUAL RANGE	REDUNDANCY	POWER SUPPLY	VARIABLE	TREND INDICATION	TSC, EOF COMPUTER
PLANT-SPECIFIC TYPE A VARIABLES									
A1	Degrees of Subcooling RC-PT-403 RC-PT-405 IC-TE-1 through 58	200°F subcooling to 35°F superheat (from B10)	1	+300°F subcooling to 50°F superheat	Yes	Vital UPS	RC-TI-9424A RC-TI-9424B	RC-XX-7315-1,2&3[4] RC-XX-7315-4[4]	Available Through Data Link
A2	Steam Generator Pressure FW-PT-514 SG-A FW-PT-515	From atmospheric pressure to 20% above the lowest safety valve setting (1425 psig) (from D18)	1	0-1300 psig*	Yes	Vital UPS	PI-514A PI-515A	XR-501	A0730 A0733
	FW-PT-524 SG-B FW-PT-525						PI-524A PI-525A	XR-502	A0740 A0743
	FW-PT-534 SG-C FW-PT-535						PI-534A PI-535A	XR-503	A0750 A0753
	FW-PT-544 SG-D FW-PT-545						PI-544A PI-545A	XR-504	A0720 A0723
A3	Core Exit Temperature IC-TE-1 through 58	200°F to 2300°F (from B8)	1	0-2300°F*	Yes	Vital UPS	RC-TI-9423A RC-TI-9423B RC-XX-7315-1,2&3[4] RC-XX-7315-4[4]	RC-XX-7315-1,2&3[4]** RC-XX-7315-4[4]	Available Through Data Link
A4	Steam Generator Level FW-LT-519 (NR) SG-A FW-LT-501 (WR)	From tube sheet to separators (from D17)	1	Taps 453.25" and 581" above bottom reference for narrow range Taps 22" and 581" above bottom reference for wide range.	Yes	Vital UPS	LI-519 (NR) LI-501 (WR)	LR-519[5] XR-501	A0734 A0737
	FW-LT-529 (NR) SG-B FW-LT-502 (WR)						LI-529 (NR) LI-502 (WR)	LR-529[5] XR-502	A0744 A0747
	FW-LT-537 (NR) SG-C FW-LT-503 (WR)						LI-537 (NR) LI-503 (WR)	LR-539[5][3] XR-503	A0756 A0757
	FW-LT-548 (NR) SG-D FW-LT-504 (WR)						LI-548 (NR) LI-504 (WR)	LR-549[5][3] XR-504	A0725 A0727
A5	Pressurizer Level RC-LT-459 RC-LT-460	Bottom to top (from D12)	1	Taps 6" from the top and bottom of the straight shell portion of the pressurizer*	Yes	Vital UPS	LI-459A LI-460A	LR-459**[2] LR-460	A0332 A0333

TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER		SB DESIGN CATEGORY	ENVIRONMENTAL QUALIFICATION	SEISMIC QUAL.	QA	TRENDING	REMARKS/NOTES
PLANT-SPECIFIC TYPE A VARIABLES							
A1	Degrees of Subcooling	1	Yes	Yes	Yes	N/A	
A2	Steam Generator Pressure	1	Yes	Yes	Yes	Yes**	* See Deviation No. 1 in Appendix 7A. ** Trending required based on use as a Type D variable.
A3	Core Exit Temperature	1	Yes	Yes	Yes	N/A	* Sensors are type K thermocouples that are calibrated to 1650°F. ** Individual sensor temperatures and spatial displays are provided on RC-XX-7315-1,2&3[(4)] and RC-XX-7315-4[(4)].
A4	Steam Generator Level	1	Yes	Yes	Yes	N/A	The WR steam generator level measurement taps cover the range from near the tube sheet to above the separators.
A5	Pressurizer Level	1	Yes	Yes	Yes	Yes	* See Deviation No. 2 in Appendix 7A. ** The input signal to LR-459 is selectable to any one of the pressurizer level channels.

TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE/SENSOR	R.G. 1.97 RECOMMENDED RANGE	R.G. 1.97 DESIGN CATEGORY	ACTUAL RANGE	REDUNDANCY	POWER SUPPLY	DISPLAY: MCR VARIABLE	DISPLAY: MCR TREND INDICATION	DISPLAY: TSC, EOF COMPUTER
A6	RWST Level Storage Tank Level CBS-LT-2380 CBS-LT-2383	Top to bottom (from D9)	1	22,000 to * 485,500 gal	Yes	Vital UPS	LI-2380 LI-2383	LR-2384 LR-2385	A0912 A0913
A7	RCS Pressure RC-PT-403 RC-PT-405	0 to 3000 psig (from B11 and B7)	1	0-3000 psig	Yes	Vital UPS	PI-403-1&2 PI-405-1&2	PR-403 PR-405(2) A0349	A0350
A8	Containment Hydrogen Concentration CGC-AIT-5828A CGC-AIT-5828B	0 to 10% volume (capable of operating from -5 psig to maximum design pressure 52 psig) (from C10)	1	0-10% H_2 -5 psig to 60 psig operating capability	Yes	Vital UPS & EMERG▵ MCC	AI-5828A* AI-5828B*	AR-5828A	A1445 A1446
A9	Control Room Temperature*								
REACTIVITY CONTROL									
B1	Neutron Flux NI-NE-6690 NI-NE-6691	10^{-6}% to 100% full power	1	10^{-8} -200% Full Power -1 to +7 DPM (Rate)	Yes	Vital UPS	NI-6690-2 NI-6691-2	NI-6690-1 NI-6691-1	A1019 A1022 A1018 A1021
B2	Control Rod Position CP-U-7338	Full in or not full in	3	0-228 Steps (Full in to fully withdrawn)	N/A	N/A	UI-7338		I0036 through I0092
B3	RCS Soluble Boron Concentration* (Grab Sample)	0 to 6000 ppm	3	0-6000 ppm	N/A	N/A			
B4	RCS Cold Leg Water Temperature	50°F to 400°F	3	See B6					

▵ Sample pumps and heaters powered from emergency MCCs.

TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE	SB DESIGN CATEGORY	ENVIRONMENTAL QUALIFICATION	SEISMIC QUAL.	QA	TRENDING		REMARKS/NOTES
A6	RWST Level Tank Level	1	Yes	Yes	Yes	N/A	*	See Deviation No. 3 in Appendix 7A.
A7	RCS Pressure	1	Yes	Yes	Yes	Yes		
A8	Containment Hydrogen Concentration	1	Yes	Yes	Yes	N/A	*	See Deviation No. 4 in Appendix 7A.
A9	Control Room Temperature						*	See Deviation No. 30 in Appendix 7A.
REACTIVITY CONTROL								
B1	Neutron Flux	1	Yes	Yes	Yes	Yes		
B2	Control Rod Position	3	N/A	N/A	Yes	N/A	*	Control rod position inputs to the computer are available but are not listed here.
B3	RCS Soluble Boron Concentration*	3	N/A	N/A	Yes	N/A	*	See Deviation No. 5 in Appendix 7A.
B4	RCS Cold Leg Water Temperature	See B6						

TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE/SENSOR	R.G. 1.97 RECOMMENDED RANGE	R.G. 1.97 DESIGN CATEGORY	ACTUAL RANGE	REDUNDANCY	POWER SUPPLY	DISPLAY: MCR VARIABLE	DISPLAY: MCR TREND INDICATION	DISPLAY: TSC, EOF COMPUTER
CORE COOLING									
B5	RCS Hot Leg Water Temperature RC-TE-413A RC-TE-423A RC-TE-433A RC-TE-443A	50°F to 700°F	1	32-700°F	NO*	Vital UPS	TI-413A TI-423A TI-433A[1] TI-443A[1]	TR-413A TR-413A TR-433A[2] TR-433A[2]	A0339 A0340 A0341 A0342
B6	RCS Cold Leg Water Temperature RC-TE-413B RC-TE-423B RC-TE-433B RC-TE-443B	50°F to 700°F	1	32-700°F	NO*	Vital UPS	TI-413B TI-423B TI-433B[1] TI-443B[1]	TR-413B TR-413B TR-433B[2]** TR-433B[2]**	A0343 A0344 A0345 A0346
B7	RCS Pressure	0-3000 psig	1	See A7					
B8	Core Exit Temperature	200°F to 2300°F	3	See A3					
B9	Reactor Coolant Inv. -Reactor Vessel Full Range Level (RCPs not running) RC-LT-1311 RC-LT-1321	Bottom of hot leg to top of vessel;	1	0-120%	Yes (Full range; bottom to top of vessel)	Vital UPS	RC-LI-1311 RC-LI-1321	RC-XX-7315-1,2&3[4] RC-XX-7315-4[4]	Available Through Data Link
	-Reactor Vessel Dynamic Head (RCPs running) RC-LT-1312 RC-LT-1322	Void trending		0-120% (dynamic head range; indicates normalized core dp)			RC-LI-1312 RC-LI-1322	RC-XX-7315-1,2&3[4] RC-XX-7315-4[4]	Available Through Data Link
B10	Degrees of Subcooling	200°F subcooling to 35°F superheat	2	See A1					
RCS INTEGRITY									
B11	RCS Pressure	0 to 3000 psig	1	See A7					
B12	Containment Drainage Sump Water Level, Narrow Range*	Top to Bottom (Sump)	2						

TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE	SB DESIGN CATEGORY	ENVIRONMENTAL QUALIFICATION	SEISMIC QUAL.	QA	TRENDING	REMARKS/NOTES
CORE COOLING							
B5	RCS Hot Leg Water Temperature	1	Yes	Yes	Yes	Yes	* All Channels powered from UPS-I-A. See Deviation No. 6 in Appendix 7A.
B6	RCS Cold Leg Water Temperature	1	Yes	Yes	Yes	Yes	* All channels powered from UPS-I-B See Deviation No. 7 in Appendix 7A.
B7	RCS Pressure	See A7					* RC-TR-433B procured to Class 1E requirements due to circuit interaction considerations
B8	Core Exit Temperature	See A3					
B9	Reactor Coolant	1	Yes	Yes	Yes	N/A	100% equals top of vessel or normal core dP Inventory with four reactor coolant pumps running.
B10	Degrees of Subcooling	See A1					
RCS INTEGRITY							
B11	RCS Pressure	See A7					
B12A	Containment Drainage Sump Water Level, Narrow Range*						* See Deviation No. 23 in Appendix 7A.

TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

							DISPLAY		
							MCR		
ITEM NUMBER	VARIABLE/SENSOR	R.G. 1.97 RECOMMENDED RANGE	R.G. 1.97 DESIGN CATEGORY	ACTUAL RANGE	REDUNDANCY	SUPPLY	POWER VARIABLE	TREND INDICATION	TSC, EOF COMPUTER
B12B	Containment Building Level, Wide Range CBS-LIT-2384 CBS-LIT-2385	(plant-specific)	1	4" to 8'4" above base elevation	Yes	Vital UPS & EMERG∆ MCC	LI-2384 LI-2385	LR-2384 LR-2385	A0930 A0931
CONTAINMENT INTEGRITY									
B13	Containment Pressure SI-PT-934, SI-PT-935	0 to design pressure (52 psig)	1	0-60 psig	Yes	Vital UPS	PI-934 PI-935	PR-934 PR-935	A0500 A0501
B14	Containment Isolation Valve Position	Closed-not closed	1	Closed-not closed	Yes*	Vital** DC			
	See Updated FSAR Subsection 6.2.4 and Table 6.2-83 for complete information on the design of the Containment Isolation System and the listing of individual containment isolation valves.								
B15	Containment Pressure SI-PT-2576 SI-PT-2577	-5 psig to design pressure (52 psig)	1	See C11					
B16	Containment Enclosure Negative Pressure EAH-PDT-5782 EAH-PDT-5789			0-0.5 in WCNEG		Yes UPS	Vital PDI-5782 PDI-5789		A3778

∆: LITs powered from emergency MCCs. Remainder of loops powered from vital UPS.

TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE	SB DESIGN CATEGORY	ENVIRONMENTAL QUALIFICATION	SEISMIC QUAL.	QA	TRENDING	REMARKS/NOTES
B12B	Containment Building Level, Wide Range	1	Yes	Yes	Yes	N/A	
CONTAINMENT INTEGRITY							
B13	Containment Pressure	1	Yes	Yes	Yes	Yes	
B14	Containment Isolation Valve Position	1	Yes	Yes	Yes	N/A	* The redundancy provision for containment isolation valves is met on a systems basis. ** The primary indications of containment isolation valve position are status lamp arrays arranged on a functional basis. A tile is provided for each valve closed on either a Phase A or Phase B containment isolation signal. Valve position indicating lights are also provided with each valve control switch.
B15	Containment Pressure	See C11					
B16	Containment Enclosure Negative Pressure	1	Yes	Yes	Yes	N/A	

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ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE/SENSOR	R.G. 1.97 RECOMMENDED RANGE	R.G. 1.97 DESIGN CATEGORY	ACTUAL RANGE	REDUNDANCY	POWER SUPPLY	DISPLAY: MCR VARIABLE	DISPLAY: MCR TREND INDICATION	DISPLAY: TSC, EOF COMPUTER
FUEL CLADDING									
C1	Core Exit Temperature	200°F to 2300°F	1	See A3					
C2	Radioactive Concentration or Radiation Level in Circulating Primary Coolant*	½ Tech Spec limit to 100 times Tech Spec limit (50 to 10^4 μCi/gm)	1						
C3	Analysis of Primary Coolant (Gamma Spectrum)	10 μCi/ml to 10 Ci/ml or TID-14844 source term in coolant volume	3	See E18					
RCS BOUNDARY									
C4	RCS Pressure	0 to 3000 psig	1	See A7					
C5	Containment Pressure	-5 psig to design pressure (52 psig)	1	See C11					
C6A	Containment Drainage Sump Water Level, Narrow-Range	Top to bottom of sump	2	See B12A					
C6B	Containment Recirculation Sump Water Level, Wide-Range	Wide-Range (plant-specific)	1	See B12B					
C7	Containment Area Radiation	1 R/hr to 10^4 R/hr	3	See E1					
C8	Effluent Radioactivity Noble Gas Effluent from Condenser Air Removal System Exhaust	10^{-6} μCi/cc to 10^{-2} μCi/cc	3	See E7					
CONTAINMENT									
C9	RCS Pressure	0-3000 psig	1	See A7					
C10	Containment Hydrogen Concentration	0 to 10% volume (capable of -5 psig to maximum design pressure (52 psig)	1	See A8					

TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE	SB DESIGN CATEGORY	ENVIRONMENTAL QUALIFICATION	SEISMIC QUAL.	QA	TRENDING	REMARKS/NOTES
FUEL CLADDING							
C1	Core Exit Temperature	See A3					
C2	Radioactive Concentration or Radiation Level in Circulating Primary Coolant*						* See Deviation No. 8 in Appendix 7A.
C3	Analysis of Primary Coolant (gamma spectrum)	See E18					
RCS BOUNDARY							
C4	RCS Pressure	See A7					
C5	Containment Pressure	See C11					
C6A	Containment Drainage Sump Water Level, Narrow-Range	See B12A					
C6B	Containment Recirculation Sump Water level, Wide Range	See B12B					
C7	Containment Area Radiation	See E1					
C8	Effluent Radioactivity Noble Gas Effluent from Condenser Air Removal System Exhaust	See E7					
CONTAINMENT							
C9	RCS Pressure	See B7					
C10	Containment Hydrogen Concentration	See A8					

TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE/SENSOR	R.G. 1.97 RECOMMENDED RANGE	R.G. 1.97 DESIGN CATEGORY	ACTUAL RANGE	REDUNDANCY	POWER SUPPLY	DISPLAY MCR VARIABLE	DISPLAY MCR TREND INDICATION	DISPLAY TSC, EOF COMPUTER
D25	Containment Atmosphere Temperature RC-TE-1313	40°F to 400°F	2	50-420°F*	N/A	Vital UPS	RC-XX-7315-1,2&3(4)		Available Through Data Link
D26	Containment Sump Water Temperature* CBS-TE-2378 & 2379	50°F to 250°F	2	32-1599°F	N/A	Non-Vital UPS			A0091 A0092
CHEMICAL AND VOLUME CONTROL									
D27	Makeup Flow-in CS-FT-121	0 to 110% design flow (150 gpm)	2	0-200 gpm	N/A	N/A	FI-121A		A0622
D28	Letdown Flow-out CS-FT-132	0 to 110% design flow (135 gpm)	2	0-200 gpm	N/A	N/A	FI-132		A0620
D29	Volume Control Tank Level CS-LT-185 CS-LT-112	Top to bottom (141")	2	0-80"*	N/A	N/A	LI-185 LI-112	LR-185	A0624
COOLING WATER									
D30	Component Cooling Water Temperature to ESF CC-TE-2171 CC-TE-2271	40°F to 200°F	2	0-175°F*	N/A	Vital UPS	TI-2171-1 TI-2271-1		A0271 A0269
D31	Component Cooling Water Flow to ESF System CC-FT-2103 CC-FT-2203	0 to 110% design flow (11,500 gpm)	2	0-13,000 gpm	N/A	Non-Vital UPS	FI-2103 FI-2203		A0273 A0272
D31a	RHR and CBS Heat Exchanger PCCW Outlet Valves CC-V266 CC-V272 CC-V137 CC-V145			Closed/Open	N/A	Emerg. MCC	CS-2245 CS-2244 CS-2145 CS-2144		D7823 D7824 D7821 D7822
D32	Cooling Tower Sump Level SW-LT-6129 SW-LT-6139			0-50 FT	N/A	Vital UPS	LI-6129 LI-6139	LR-6129	A1537

TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE	SB DESIGN CATEGORY	ENVIRONMENTAL QUALIFICATION	SEISMIC QUAL.	QA	TRENDING		REMARKS/NOTES
D25	Containment Atmosphere Temperature	2	Yes	N/A	Yes	N/A	*	See Deviation No. 14 in Appendix 7A.
D26	Containment Sump Water Temperature*	2	Yes	N/A	Yes	N/A	*	See Deviation No. 15 in Appendix 7A.
CHEMICAL AND VOLUME CONTROL								
D27	Makeup Flow-In	3*	N/A	N/A	Yes	N/A	*	See Deviation No. 16 in Appendix 7A.
D28	Letdown Flow-Out	3*	N/A	N/A	Yes	N/A	*	See Deviation No. 17 in Appendix 7A.
D29	Volume Control Tank Level	3*	N/A	N/A	Yes	N/A	*	See Deviation No. 18 in Appendix 7A.
COOLING WATER								
D30	Component Cooling Water Temperature to ESF	2	Yes	N/A	Yes	N/A	*	See Deviation No. 19 in Appendix 7A.
D31	Component Cooling Water Flow to ESF System	2	Yes	N/A	Yes	N/A		
D31a	RHR and CBS Heat Exchanger PCCW Outlet Valves	2	Yes	N/A	Yes	N/A		
D32	Cooling Tower Sump Level	2	Yes	N/A	Yes	N/A		

TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE/SENSOR	R.G. 1.97 RECOMMENDED RANGE	R.G. 1.97 DESIGN CATEGORY	ACTUAL RANGE	REDUNDANCY	POWER SUPPLY	DISPLAY MCR VARIABLE	DISPLAY MCR TREND INDICATION	DISPLAY TSC, EOF COMPUTER
D32a	Service Water Flow to DG Heat Exchanger			0-3500 gpm	N/A				
	SW-FT-6181					Non-Vital UPS	FI-6181		
	SW-FT-6191					Vital UPS	FI-6191		
D32b	Cooling Tower Pump Discharge Temperature			0-150°F	N/A	Non-Vital UPS			
	SW-TE-6184						TI-6184		A1503
	SW-TE-6194						TI-6194		A1505
RADWASTE									
D33	High-Level Radioactive Liquid (Floor Drain) Tank Level	Top to bottom (18 feet)	3	0-14 FT*	N/A	N/A			
	WL-LT-1462 (TK-59A)						LI-1462		A1285
	WL-LT-1466 (TK-59B)						LI-1466		
D34	Radioactive Gas Holdup Tank Pressure*	0 to 150% design pressure	3						
VENTILATION									
D35	Emergency Ventilation Damper Position	Open-closed status	2	Closed-not closed	N/A	Vital UPS			
	PAH-DP-35A						ZL-5370-3		
	PAH-DP-35B						ZL-5371-3		
	PAH-DP-36A						ZL-5370-4		
	PAH-DP-36B						ZL-5371-4		
	EAH-DP-30A						ZL-5780-2		
	EAH-DP-30B						ZL-5784-2		D5142
	CAH-DP-34A						ZL-5630-2		D5147
	CAH-DP-34B						ZL-5631-2		D5148
	CAH-DP-34C					Emerg. MCC	ZL-5634		D5149
	CAH-DP-34D						ZL-5635		
	CBA-DP-53A						CS-5331		
	CBA-DP-53B						CS-5329		
	CBA-DP-27A						CS-5318		
	CBA-DP-27B						CS-5320		
	CBA-DP-28						ZL-5332		
	CBA-DP-1058						ZL-1058		
D35a	Fan Status: Control Room Makeup Air Fans			Running/ not Running	N/A	Emerg. MCC			
	CBA-FN-27A						CS-5328		D7034
	CBA-FN-27B						CS-5330		D7035
	CBA-FN-16A						ZL-5365		D7017
	CBA-FN-16B						ZL-5320-2		D7006
	CBA-FN-15						ZL-5310		D7036

TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE	SB DESIGN CATEGORY	ENVIRONMENTAL QUALIFICATION	SEISMIC QUAL.	QA	TRENDING	REMARKS/NOTES
D32a	Service Water Flow to DG Heat Exchanger	2	Yes	N/A	Yes	N/A	
D32b	Cooling Tower Pump Discharge Temperature	2	Yes	N/A	Yes	N/A	
RADWASTE							
D33	High-Level Radioactive Liquid (floor drain) Tank Level	3	N/A	N/A	Yes	N/A	* See Deviation No. 20 in Appendix 7A.
D34	Radioactive Gas Holdup Tank Pressure*						* See Deviation No. 26 in Appendix 7A.
VENTILATION							
D35	Emergency Ventilation Damper Position	2	Yes	N/A	Yes	N/A	
D35a	Fan Status: Control Room Makeup Air Fans	2	Yes	N/A	Yes	N/A	

ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE/SENSOR	R.G. 1.97 RECOMMENDED RANGE	R.G. 1.97 DESIGN CATEGORY	ACTUAL RANGE	REDUNDANCY	POWER SUPPLY	DISPLAY – MCR – VARIABLE	DISPLAY – MCR – TREND INDICATION	DISPLAY – TSC, EOF COMPUTER
D35b	Containment Enclosure Temperature MM-TE-1002A MM-TE-1002B			30-220°F	N/A	Vital UPS	RC-XX-7315-1,2&3[4] RC-XX-7315-4[4]		Available Through Data Link
D35c	Primary Auxiliary Building Temperature MM-TE-1003A MM-TE-1003B			30-220°F	N/A	Vital UPS	RC-XX-7315-1,2&3[4] RC-XX-7315-4[4]		Available Through Data Link
D35d	Diesel Generator Building Temperature DAH-TE-5688 DAH-TE-5689			0-200°F	N/A	Non-Vital UPS	TI-5688 TI-5689		
D35e	Service Water Pumphouse Temperature SWA-TSHL 5612 SWA-TSHL 5608 SWA-TSHL 5609			0-140°F*	N/A	N/A			D6975 D6977 D6979
D35f	Cooling Tower Switchgear Area Temperature SWA-TSHL 5699 SWA-TSHL 5693 SWA-TSHL 5696			0-140°F*	N/A	N/A			D6993 D6989 D6991
D35g	Emergency Feedwater Pumphouse Temperature EPA-TSH-5434			0-140°F*	N/A	N/A			D7980
D35h	Control Building Temperature CBA-TSHL-5180 CBA-TSHL-5181 CBA-TSHL-5182 CBA-TSHL-5580 CBA-TSHL-5581			30°-110°F*	N/A	N/A			D7022 D7023 D7026 D7027 D7028
D35i	Containment Enclosure Emergency Exhaust Fan Discharge Flow EAH-FIT-5791			0-4000 ACFM	N/A	Non-Vital UPS	FR-5791	FR-5791	A3777

ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE/SENSOR	R.G. 1.97 RECOMMENDED RANGE	R.G. 1.97 DESIGN CATEGORY	ACTUAL RANGE	REDUNDANCY	POWER SUPPLY	DISPLAY: MCR VARIABLE	DISPLAY: MCR TREND INDICATION	DISPLAY: TSC, EOF COMPUTER
D35j	Control Building Temperature								
	CBA-TE-8630			30°-110°F	N/A	N/A			A0176 (B6543)
	CBA-TE-8631				N/A	N/A			A0177 (B6686)

TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE	SB DESIGN CATEGORY	ENVIRONMENTAL QUALIFICATION	SEISMIC QUAL.	QA	TRENDING	REMARKS/NOTES
D35b	Containment Enclosure Temperature	2	Yes	N/A	Yes	N/A	
D35c	Primary Auxiliary Building Temperature	2	Yes	N/A	Yes	N/A	
D35d	Diesel Generator Building Temperature	2	Yes	N/A	Yes	N/A	
D35e	Service Water Pumphouse Temperature	2	Yes	N/A	Yes	N/A	* High Temperature alarm provided
D35f	Cooling Tower Switchgear Area Temperature	2	Yes	N/A	Yes	N/A	* High Temperature alarm provided
D35g	Emergency Feedwater Pumphouse Temperature	2	Yes	N/A	Yes	N/A	* High Temperature alarm provided
D35h	Control Building Temperature	2	Yes	N/A	Yes	N/A	* High Temperature alarm provided
D35i	Containment Enclosure Emergency Exhaust Fan Discharge Flow	2	Yes	N/A	Yes	N/A	
D35j	Control Room Temperature	3	No	N/A	Yes	N/A	* High Temperature alarm provided

TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE/SENSOR	R.G. 1.97 RECOMMENDED RANGE	R.G. 1.97 DESIGN CATEGORY	ACTUAL RANGE	REDUNDANCY	POWER SUPPLY	DISPLAY: MCR VARIABLE	DISPLAY: MCR TREND INDICATION	DISPLAY: TSC, EOF COMPUTER
E5	Auxiliary Building (including any building containing primary system gases, e.g., waste gas decay tank)	10^{-6} μCi/cc 10^{5} μCi/cc (not needed if effluent discharges through common plant vent) 0 to 110% flow	2	See E7					
E6	Condenser Air Removal System Exhaust	10^{-6} μCi/cc to 10^{5} μCi/cc (not needed if effluent discharges through common plant vent) 0 to 110% flow	2	See E7					
E7	Common Plant Vent or Multipurpose Vent Discharging Any of Above Releases (if containment purge is included) RM-RE-6528-1, -2, -3 RM-FT-6577-1, -2	10^{-6} μCi/cc to 10^{4} μCi/cc 0 to 110% flow (0 to $2x10^{5}$ scfm)	2 2	10^{-7} to 10^{5} μCi/cc 0 to 3.5x 10^{5} scfm	N/A	Emerg. MCC	RK-6528 RM-XM-6599	RR-6528-1 RR-6528-2	Available Through Data Link
E8	Vent From Steam Generator Safety Relief Valves or Atmospheric Dump Valves RM-RE-6481-1,2; 6482-1, 2	10^{-1} μCi/cc to 10^{3} μCi/cc (Duration of releases in seconds and mass of steam per unit time)	2	1 to 10^{5} mr/hr*	N/A	Emerg. MCC	RM-XM-6599	RM-XM-6599	Available Through Data Link
	Safety/Relief Valve Position YE-6820 YE-6821 YE-6822 YE-6823	See D19							
E9	All Other Identified Plant Release Points*								

TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE	SB DESIGN CATEGORY	ENVIRONMENTAL QUALIFICATION	SEISMIC QUAL.	QA	TRENDING	REMARKS/NOTES
NOBLE GASES							
E5	Auxiliary Building (including any building containing primary system gases, e.g., waste gas decay tank)	See E7					Discharges through plant vent stack.
E6	Condenser Air Removal System Exhaust	See E7					Discharges through plant vent stack.
E7	Common Plant Vent or Multipurpose Vent Discharging Any of Above Releases (if containment purge is included)	2	Yes	N/A	Yes	Yes	Flow element provides a signal to the radiation monitors to permit the radiation monitors to calculate the microcuries per cubic centimeter flowing in the duct and microcuries per second released through the plant vent stack.
E8	Vent from Steam Generator Safety Relief Valves or Atmospheric Dump Valves	2	Yes	N/A	Yes	Yes	* Correlation from mr/hr to μCi/cc is included in the procedure for offsite dose assessment. Direct readout in μCi/cc is not required to support this procedure. The safety/relief valve position monitors can be used to determine the existence of flow through these valves.
E9	All Other Identified Plant Release Points*						* None Identified.

TABLE 7.5-1
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ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE/SENSOR	R.G. 1.97 RECOMMENDED RANGE	R.G. 1.97 DESIGN CATEGORY	ACTUAL RANGE	REDUNDANCY	POWER SUPPLY	DISPLAY: MCR VARIABLE	DISPLAY: MCR TREND INDICATION	DISPLAY: TSC, EOF COMPUTER
PARTICULATES AND HALOGENS									
E10	All Identified Plant Release Points (except steam generator safety relief valves or atmospheric steam dump valves and condenser air removal system exhaust).	10^{-3} µCi/cc to 10^{2} µCi/cc	3	10^{-3} µCi/cc to 10^{2} µCi/cc	N/A	N/A	N/A	N/A	N/A
	Sampling with Onsite Analysis Capability. RM-SKD-53-2	0 to 110% flow (o to $2x10^{5}$ scfm)		0 to 3.5x 10^{5} scfm	N/A	N/A	RM-XM-6599		Available Through Data Link
E12	Airborne Radiohalogens and Particulates (portable sampling with onsite analysis capability) Air Samplers: Low Volume High Volume Personnel Continuous air Monitor	10^{-9} µCi/cc to 10^{-3} µCi/cc	3	10^{-9} µCi/cc to 10^{-3} µCi/cc	N/A	N/A	N/A		
E13	Plant and Environs Radiation (portable instrumentation) Ion Chamber (Low Range) Ion Chamber (Mid Range) Ion Chamber (High Range) Geiger Mueller Detector Geiger Mueller Detector Alpha Scintillation Tele-detector Rate Detector	10^{-3} R/Hr to 10^{4} R/Hr photons 10^{-3} rads/hr to 10^{4} rads/hr, beta radiations and low-energy photons	3	0-1 R/Hr beta/gamma 0-1.000 R/Hr gamma Up to 10,000 R/Hr gamma 0-50,000 CPM beta/gamma 0-200 MR/Hr beta/gamma 0-500,000 CPM alpha 0.001-10 R/Hr neutron	N/A	N/A N/A N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A N/A N/A
E14	Plant and Environs Radioactivity (portable instrumentation)	(Isotopic analysis)	3	Multichannel gamma-ray spectrometer	N/A	N/A	N/A	N/A	N/A

TABLE 7.5-1
(Sheet 32 of 37)

ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE	SB DESIGN CATEGORY	ENVIRONMENTAL QUALIFICATION	SEISMIC QUAL.	QA	TRENDING	REMARKS/NOTES
PARTICULATES AND HALOGENS							
E10	All Identified Plant Release Points (except steam generator safety relief valves or ~~atmospheric steam dump~~ valves and condenser air removal system exhaust). Sampling with Onsite analysis Capability	3	N/A	N/A	Yes	N/A	
E12	Airborne Radiohalogens and Particulates (portable sampling with on-site analysis capability)	3	N/A	N/A	Yes	N/A	
E13	Plant and Environs Radiation (portable instrumentation)	3	N/A	N/A	Yes	N/A	
E14	Plant and Environs activity (portable instrumentation)	3	N/A	N/A	Yes	N/A	Function provided by gamma spectroscopy system located in the Counting Room. Portable air sampler used to obtain the air samples.

TABLE 7.5-1
(Sheet 33 of 37)

ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE/SENSOR	R.G. 1.97 RECOMMENDED RANGE	R.G. 1.97 DESIGN CATEGORY	ACTUAL RANGE	REDUNDANCY	POWER SUPPLY	DISPLAY MCR VARIABLE	DISPLAY MCR TREND INDICATION	DISPLAY TSC, EOF COMPUTER
METEOROLOGY									
E15	Wind Direction 43 feet above grade 209 feet above grade	0 to 360° (±5° accuracy with a deflection of 10°). Starting speed less than 0.4 mps (1.0 mph) Damping ratio greater than or equal to 0.4, delay distance less than or equal to 2 meters.	3	0-540°* Accuracy: ±5° Threshold: < 1 mph Damping Ratio: ≥ 0.4** Delay Distance: ≤ 2 meters**	N/A	N/A	Computer	Computer	A1630 A1627
E16	Wind Speed 43 feet above grade 209 feet above grade	0 to 22 mps (50 mph). ±0.2 mps (0.5 mph) accuracy for speeds less than 2 mps (5 mph), 10% for speeds in excess of 2 mps (5 mph), with a starting threshold of less than 0.4 mps (1.0 mph) and a distance constant not to exceed 2 meters.	3	0-100 mph Accuracy: ≤ ± 0.5 mph @ < 5 mph ≤ 10% @ > 5 mph Threshold: ≤ 1 mph Distance Constant: < 2 meters*	N/A	N/A	Computer	Computer	A1628 A1626
E17	Estimation of Atmospheric Stability 150-43 feet (delta-T) 209-43 feet (delta-T)	Based on vertical temperature difference from primary meteorological system, -5°C to 10°C (-9°F to 18°F) and ±0.15°C accuracy per 50-meter intervals (±0.3°F accuracy per 164-foot intervals) or analogous range for alternative stability estimate.	3	-10°F to 18°F Accuracy: ≤ ±0.2°F	N/A	N/A	Computer	Computer	A1632 A1631

TABLE 7.5-1
(Sheet 34 of 37)

ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE	SB DESIGN CATEGORY	ENVIRONMENTAL QUALIFICATION	SEISMIC QUAL.	QA	TRENDING	REMARKS/NOTES
METEOROLOGY							
E15	Wind Direction	3	N/A	N/A	Yes	Yes	Communication with the National Weather Service is available by telephone ** Range of 0-540° selected to minimize recorder pen travel for northerly wind directions. See Deviation No. 28 in Appendix 7A.
E16	Wind Speed	3	N/A	N/A	Yes	Yes	* Communication with the National Weather Service is available by telephone. See Deviation No. 29 in Appendix 7A.
E17	Estimation of Atmospheric Stability	3	N/A	N/A	Yes	Yes	Communication with the National Weather Service is available by telephone.

TABLE 7.5-1
(Sheet 35 of 37)

ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE/SENSOR	R.G. 1.97 RECOMMENDED RANGE	R.G. 1.97 DESIGN CATEGORY	ACTUAL RANGE	REDUNDANCY	POWER SUPPLY	DISPLAY: MCR VARIABLE	DISPLAY: MCR TREND INDICATION	DISPLAY: TSC, EOF COMPUTER
ACCIDENT SAMPLING CAPABILITY									
E18	Primary Coolant and Sump	Grab sample	3		N/A	N/A	N/A	N/A	N/A
	Gross Activity	1 μCi/ml to 10 Ci/ml		1 μCi/ml to 10 μCi/ml					
	Gamma Spectrum	(Isotopic Analysis)		Isotopic analysis					
	Boron Content	0 to 6000 ppm		0 to 6000 ppm					
	Chloride Content	0 to 20 ppm		0 to 20 ppm					
	Dissolved Hydrogen	0 to 2000cc (STP)/KG		0 to 2000cc (STP)/KG					
	Dissolved Oxygen	0 to 20 ppm		*					
	pH	1 to 13		1 to 13					
E19	Containment Air	Grab sample	3		N/A	N/A	N/A	N/A	N/A
	Hydrogen Content	0 to 10%		0 to 10%					
	Oxygen Content	0 to 30%		0 to 30%					
	Gamma Spectrum	(Isotopic analysis)		Isotopic analysis					

TABLE 7.5-1
(Sheet 36 of 37)

ACCIDENT MONITORING INSTRUMENTATION LIST

ITEM NUMBER	VARIABLE	SB DESIGN CATEGORY	ENVIRONMENTAL QUALIFICATION	SEISMIC QUAL.	QA	TRENDING	REMARKS/NOTES
ACCIDENT SAMPLING CAPABILITY							
E18	Primary Coolant and Sump	3	N/A	N/A	Yes	N/A	* See Deviation No. 21 in Appendix 7A.
E19	Containment Air	3	N/A	N/A	Yes	N/A	

TABLE 7.5-1
(Sheet 37 of 37)

ACCIDENT MONITORING INSTRUMENTATION LIST

DATA TABLE LEGEND AND NOTES

Abbreviations:

EOF	Emergency Operations Facility
MCC	Motor Control Center
MCR	Main Control Room
TSC	Technical Support Center
UPS	Uninterruptible Power Supply

Explanatory Notes:

A. Under the "Actual Range" column:

The calibrated range of the sensor is listed unless otherwise noted.

B. Under the "Redundancy" column:

"Yes" means redundant fully qualified displays are available in the MCR. For Design Category 2 and 3 instrumentation, this column is marked "N/A" since there are no redundancy requirements for this instrumentation.

C. Under the "Power Supply" column:

The type of power supply for the instrumentation channels is listed. Since there are no specific provisions for the power supply for Design Category 3 instrumentation, "N/A" is marked in this column.

D. Under the "Display" column:

The tag number of the available MCR display instrumentation is listed. For the TSC/EOF, display will be via CRTs driven by the Main Plant Computer System (MPCS). Where an analog input to the MPCS is provided, its corresponding analog input number is specified. Where a digital input is provided, its corresponding digital input number is specified.

E. Under the "SB Category" column:

The plant-specific design category for this instrumentation as determined from the review described in Subsection 7.5.4, is listed.

F. Under the "Environmental Qualification" column:

"Yes" means the instrumentation is included in the environmental qualification program. The appropriate requirements for each instrument are determined as part of this program. For Design Category 3 instrumentation, "N/A" is entered since there are no specific provisions for environmental qualifications.

G. Under the "Seismic Qualification" column:

"Yes" means that the instrumentation has been seismically qualified in accordance with the criteria stated in Subsection 7.5.6.

For Design Category 2 and 3 instruments, "N/A" is entered since there are no specific provisions for seismic qualification.

H. Under the "QA" column:

"Yes" means the instrumentation meets the QA requirements detailed in the Design Criteria section for the applicable design Category.

I. Under the "Trending" column:

"Yes" means that trend or transient information is required for operator information or action based on our review of the plant-specific emergency response procedures and is available. "N/A" means that trend or transient information is not required for operator information or action based on our review of the plant-specific emergency response procedures.

J. Under the "Remarks/Notes" column:

For each item number, any column entry with an asterisk is explained in the "Remarks/Notes" column.

TABLE 7.5-1
(Sheet 37a of 37)

ACCIDENT MONITORING INSTRUMENTATION LIST

DATA TABLE LEGEND AND NOTES

FOOTNOTES

(1) MCB indicator provides non redundant backup indication; MCB indicator is non Class 1E.

(2) MCB recorder provides second trend display channel. MCB recorder is non Class 1E.

(3) MCB recorders LR-539 and LR-549 receive signals from transmitters LT-539 and LT-549, respectively.

(4) Train A Plasma Display (RC-XX-7315-1,2&3) is installed fully qualified; Train B Plasma Display (RC-XX-7315-4) is essentially similar to seismically qualified display. Each ICCM cabinet (MM-CP-486A & 486B) has a local one-line display that is the fully qualified alternate display for ICCM variables.

(5) MCB recorder provides backup historical recording. (Immediate trend or transient information not required for these channels.) MCB recorder is non Class 1E.

TABLE 7.5-2
(Sheet 1 of 6)

CONTROL ROOM INDICATORS AND/OR RECORDERS AVAILABLE TO THE OPERATOR TO MONITOR SIGNIFICANT PLANT PARAMETERS DURING NORMAL OPERATION INCLUDING OPERATIONAL OCCURENCES

Parameter	No. of Channels Available	Range	Indicated Accuracy(1)	Indication	Location	Notes
NUCLEAR INSTRUMENTATION						
1. Source Range a. Count rate	2	1 to 10^6 counts/sec	±%7 of the linear full scale analog voltage	Both channels indicated and recorded.	Control Board	One eight-input recorder is provided for the two SR channels, two IR channels and four PR channels.
b. Startup rate	2	-1.5 to +5.0 decades/ min	±7% of the linear full scale analog voltage	Both channels indicated.	Control Board	
2. Intermediate Range a. Current	2	10^{-11} to 10^{-3}	±7% of the linear full scale analog voltage and ±3% of the linear full scale voltage in the range of 10^{-4} to 10^{-3} amps	Both channels indicated and recorded.	Control Board	
b. Startup rate	2	-1.5 to +5.0 decades/ min	±7% of the linear full scale analog voltage	Both channels indicated.	Control Board	
3. Power Range a. Uncalibrated ion chamber current (top and bottom uncompensated ion chambers)	4	0 to 120% of full power current	±1% of full power current	All 8 current signals indicated.	NIS racks in control room	

TABLE 7.5-2
(Sheet 2 of 6)

CONTROL ROOM INDICATORS AND/OR RECORDERS AVAILABLE TO THE OPERATOR TO MONITOR SIGNIFICANT PLANT PARAMETERS DURING NORMAL OPERATION INCLUDING OPERATIONAL OCCURENCES

Parameter	No. of Channels Available	Range	Indicated Accuracy[1]	Indication	Location	Notes
b. Average flux of the top and bottom ion chamber (% full power)	4	0 to 120% of full power	±3% of full power for indication ±2% for recording	All 4 channels indicated and recorded.	Control Board	
c. Flux difference of the top and bottom ion chambers	4	-30 to 30%	±4%	All 4 channels indicated.	Control Board	

TABLE 7.5-2
(Sheet 3 of 6)

CONTROL ROOM INDICATORS AND/OR RECORDERS AVAILABLE TO THE OPERATOR TO MONITOR SIGNIFICANT PLANT PARAMETERS DURING NORMAL OPERATION INCLUDING OPERATIONAL OCCURRENCES

Parameter	No. of Channels Available	Range	Indicated Accuracy(1)	Indication	Location	Notes
REACTOR COOLANT SYSTEM						
1. $T_{average}$ (measured)	1/loop	530°-630°F	±4.4°F	All channels indicated	Control Board	Accuracy for one channel indication. Higher accuracy (to 2.22°F) is obtained by averaging multiple T_{avg} indicators.
2. ΔT (measured)	1/loop	0 to 150% of full power ΔT	±4% of full power ΔT	All channels indicated. One channel is selected for recording.	Control Board	
a. T_{cold} or T_{hot} (measured, wide range)	1-T_{hot}, 1-T_{cold} per loop	0 to 700°F	±2.7%	4 T_{hot} channels are recorded on 2 - two pen recorders. 4 T_{cold} channels are recorded on 2 - two pen recorders.	Control Board	
3. Overpower ΔT Setpoint	1/loop	0 to 150% of full power ΔT	±4% of full power ΔT	All channels indicated. One channel is selected for recording.	Control Board	
4. Overtemperature ΔT Setpoint	1/loop	0 to 150% of full power ΔT	±4% of full power ΔT	All channels indicated. One channel is selected for recording.	Control Board	
5. Pressurizer Pressure	4	1600 to 2500 psig	±26 psi	All channels indicated. One channel is selected for recording/control.	Control Board	
6. Pressurizer Level	3	Entire distance between taps	±5.0 of span	All channels indicated. One channel dedicated recorder. One channel is selected for recording/control.	Control Board	Two pen recorder used, second pen records reference level signal
7. Primary Coolant Flow	3/loop	0 to 120% of nominal flow	2.1% (2)	All channels indicated.	Control Board	
8. Reactor Coolant Pump Motor Current	1/loop	0 to 400 AC amps	±1.6%	All channels indicated.	Control Board	One channel for each pump
9. System Pressure Wide Range	2	0 to 3000 psig	±2.8%	All channels indicated and recorded.	Control Board	

TABLE 7.5-2
(Sheet 4 of 6)

CONTROL ROOM INDICATORS AND/OR RECORDERS AVAILABLE TO THE OPERATOR TO MONITOR SIGNIFICANT PLANT PARAMETERS DURING NORMAL OPERATION INCLUDING OPERATIONAL OCCURENCES

Parameter	No. of Channels Available	Range	Indicated Accuracy(1)	Indication	Location	Notes
REACTOR CONTROL SYSTEM						
1. Rod Speed	1	5 to 75 steps/min.	±2%	The one channel is indicated	Control Board	
2. Auctioneered T_{avg}	1	530° to 630°F	±4°F	The one channel is recorded.	Control Board	Any one of the T_{avg} channels into the auctioneer may be bypassed
3. $T_{reference}$	1	530° to 630°F	±4°F	The one channel is recorded.	Control Board	
4. Control Rod Position						If system not available, borate and sample accordingly.
a. Number of steps of demanded rod withdrawal	1/group	0 to 230 steps	±1 step	Each group is indicated during rod motion.	Control Board	These signals are used in conjunction with the measured position signals (4b) to detect deviation of any individual rod from the demanded position. A deviation will actuate an alarm and annunciator.
b. Full length rod measured position	1 for each rod	0 to 228 steps	±4 steps	Each rod position indicated.	Control Board	
5. Control Rod Bank Demanded Position	4	0 to 230 steps	±2.5% of total bank travel	All 4 control rod bank positions are recorded along with the low-low limit alarm for each bank.	Control Board	1. One channel for each control bank. 2. An alarm and annunciator is actuated when the last rod control bank to be withdrawn reaches the withdrawal limit, when any rod control bank reaches the low insertion limit, and when any rod control bank reaches the low-low insertion limit.

TABLE 7.5-2
(Sheet 5 of 6)

CONTROL ROOM INDICATORS AND/OR RECORDERS AVAILABLE TO THE OPERATOR TO MONITOR SIGNIFICANT PLANT PARAMETERS DURING NORMAL OPERATION INCLUDING OPERATIONAL OCCURRENCES

Parameter	No. of Channels Available	Range	Indicated Accuracy(1)	Indication	Location	Notes
CONTAINMENT SYSTEM						
1. Containment Pressure	1 4 2	12 to 18 psia 0 to 60 psig -5 to 160 psig	±0.21 psia ±2.8% ±3.45%	All 7 channels indicated and 4 are recorded.	Control Board	Narrow range (12 to 18 psia) indication is used for compliance with Tech Spec limits.
FEEDWATER AND STEAM SYSTEMS						
1. Emergency Feedwater Flow	1/feed line	0 to 600 gpm	±22.5 gpm	All channels indicated and recorded.	Control Board	One channel to measure the flow to each steam generator.
2. Steam Generator Level (narrow range)	4/steam generator	0 to 100%	±3.5% of Δ P level (hot)	All channels indicated. One channel has dedicated recorder. The channels used for control are recorded.	Control Board	
3. Steam Generator Level (wide range)	1/steam generator	0 to 100%	±3.7% of level (hot)	All channels recorded.	Control Board	
4. Steam Generator Level Signal		+7 to -5 feet	±4%	The one channel is indicated.		
5. Main Feedwater Flow	2/steam generator	0 to $5x10^6$ lbs/hr	±5%	All channels indicated. The channels used for control are recorded.	Control Board	
6. Magnitude of Signal Controlling Main and Bypass Feedwater Control Valves	1/main 1/bypass	0 to 100% of valve opening	±1.5%	All channels indicated.	Control Board	1. One channel for each main and bypass feedwater control valve 2. OPEN/CLOSED indication is provided in the control room for each main and bypass feed water control valve
7. Steam Flow	2/steam generator	0 to $5x10^6$ lbs/hr	±5.5%	All channels indicated. The channels used for control are recorded.	Control Board	Accuracy is equipment capability; however, absolute accuracy depends on applicant calibration against feedwater flow.

7.6 ALL OTHER SYSTEMS REQUIRED FOR SAFETY

7.6.1 Instrumentation and Control System

For a description of the instrumentation and control power supply system, see Section 8.3. For a description of the remote safe shutdown control features, see Section 7.4.

7.6.2 Residual Heat Removal Isolation Valves

7.6.2.1 Description

The Residual Heat Removal System (RHRS) isolation valves are normally closed, and are only opened for residual heat removal after system pressure is reduced to approximately 362 psig and system temperature has been reduced to approximately 350°F (Subsection 5.4.7).

The residual heat removal valves are provided with red (open) and green (closed) position indication and power available lights located above the control switch for each valve at the MCB and the RSS panels.

There are two motor-operated valves in series in each of the two RHR pump suction lines from the RCS hot legs. The two valves nearest the RCS (RC-V22 and V87) are designated as the inner isolation valves, while the two valves nearest the RHR pumps (RC-V23 and V88) are designated as the outer isolation valves. Reactor Coolant System wide range pressure signals for the valve interlocks are derived from transmitters which are located outside of Containment. The transmitter associated with the interlocks for the inner isolation valves is diverse from the transmitter used for outer isolation valves' interlocks. Otherwise, the interlock features provided for the outer isolation valves, shown on Figure 7.6-1 are identical to those provided for the inner isolation valves, shown on Figure 7.6-2 and Figure 5.4-7 sheets 1 and 2.

Each valve is interlocked so that it cannot be opened unless the RCS pressure is below that which could result in the RHR system design pressure being exceeded. (This includes the effects of instrument uncertainty and bistable deadband.) Refer to the Station Technical Specifications. This interlock prevents the valve from being opened when the RCS pressure would be above the RHR system design pressure.

7.6.2.2 Analysis

Based on the scope definitions presented in References 1 and 2, these criteria do not apply to the residual heat removal isolation valve interlocks; however, in order to meet NRC requirements and because of the possible severity of the consequences of loss of function, the requirements of IEEE Standard 279-1971 will be applied with the following comments:

a. For the purpose of applying IEEE Standard 279-1971 to this circuit, the following definitions will be used:

   1. Protection System

      The two valves in series in each line and all components of their interlocking circuits.

   2. Protective Action

      The maintenance of Residual Heat Removal System isolation from the Reactor Coolant System when Reactor Coolant System pressures are above the preset value.

b. IEEE Standard 279-1971, paragraph 4.10: The above mentioned pressure interlock signals and logic will be tested on line to the maximum extent possible without adversely affecting safety. This test will include the analog signal through to the train signal which activates the slave relay (which provides the final output signal to the valve control circuit). This is done in the best interests of safety since an actual actuation to permit opening the valve could potentially leave only one remaining valve to isolate the low pressure Residual Heat Removal System from the Reactor Coolant System.

c. IEEE Standard 279-1971, paragraph 4.15: This requirement does not apply, as the setpoints are independent of mode of operation and are not changed.

Environmental qualification of the valves and wiring is discussed in Section 3.11.

7.6.3 Refueling Interlocks

Electrical interlocks (i.e., limit switches), as discussed in Subsection 9.1.4.3, are provided for minimizing the possibility of damage to the fuel during fuel handling operations.

7.6.4 Accumulator Motor-Operated Valves

The design of the signals to the accumulator isolation valves meets the following criteria established in previous NRC positions on this matter:

a. Automatic opening of the accumulator valves when (a) the primary coolant system pressure exceeds a preselected value (specified in the Technical Specifications) or (b) a safety injection signal has been initiated. Both signals shall be provided to the valves.

b. Use of a safety injection ("S") signal to automatically remove (override) any bypass features that are provided to allow an isolation valve to be closed for short periods of time when the Reactor Coolant System is at pressure (in accordance with the provisions of the Technical Specifications). As a result of the confirmatory "S" signal, isolation of an accumulator with the reactor at pressure is acceptable (see Drawing NHY-503907).

c. During plant operation, these valves are normally open, and the motor control center supplying power to the operators is de-energized.

The functional block diagram for these valves is shown on Figure 7.6-3. The valves and control logic are further discussed in Subsections 6.3.2.2 and 6.3.5.

The Safety Injection System accumulator discharge isolation valves are motor-operated, normally open valves which are controlled from the main control board.

These valves are interlocked so that:

a. They open automatically on receipt of an "S" signal with the main control board switch in either the "AUTO" or "CLOSE" position.

b. They open automatically whenever the Reactor Coolant System pressure is above the safety injection unblock pressure (P-11) specified in the Technical Specifications only when the main control board switch is in the "AUTO" position.

c. They cannot be closed as long as an "S" signal is present.

The four main control board switches for these valves provide a "spring return to AUTO" from the open position and a "maintain CLOSE" position.

The "maintain CLOSE" position is required to provide an administratively controlled manual block of the automatic opening of the valve at pressure above the safety injection unblock pressure (P-11). The manual block or "maintain CLOSE" position is required when performing a periodic check-valve leakage test when the reactor is at pressure. The maximum permissible time that an accumulator valve can be closed when the reactor is at pressure is specified in the Technical Specifications.

Administrative control is required to ensure that any accumulator valve, which has been closed at pressures above the safety injection unblock pressure, is returned to the "OPEN" position.

During plant shutdown, the accumulator valves are closed. To prevent an inadvertent opening of these valves during the shutdown period, whenever accumulator pressure is greater than 100 psig, power to the accumulator valve motor circuit is turned "OFF" by a separate control switch regulating power to the motor control center, which is administratively controlled. Administrative control is again required to ensure that these motor control centers are energized during the pre-startup procedures.

The four accumulator motor-operated isolation valves are provided with red (open) and green (closed) position-indicating lights located above the control switch on the MCB and at the remote shutdown panels. A monitor light that goes "on" for each isolation valve when the valve is full open, is provided in an array of monitor lights also located at the MCB. An alarm is actuated by the motor operator limit switch whenever the isolation valve is not fully opened, coincident with pressurizer pressure greater than a set value. This alarm remains a high priority on the VAS until the isolation valve is reopened. "Control switch in close position" alarm is also available. Control power availability to each of the valves is indicated by a monitoring light at the MCB. Thus, the design of this system meets the requirements of Branch Technical Position ICSB-4 (NUREG-0800, Appendix 7-A).

7.6.5 Switchover from Injection to Recirculation

The details of achieving cold leg recirculation following safety injection are given in Subsection 6.3.2.8 and on Table 6.3-7. Figures 7.6-4 and 7.6-5 show the logic which is used to automatically open the containment sump isolation valves.

Four narrow-range level sensors are provided for measurement of RWST level.

7.6.6 Interlocks for RCS Pressure Control during Low Temperature Operation

7.6.6.1 Design and Function

The basic function of the RCS pressure control during low temperature operation is discussed in Subsection 5.2.2. As noted in Subsection 5.2.2, this pressure control includes automatic actuation logic for two pressurizer power-operated relief valves (PORVs). The function of this actuation logic is to continuously monitor RCS temperature and pressure conditions, with the actuation logic only unblocked when plant operation is at a temperature below the Reference Nil Ductility Temperature (RNDT). The monitored RCS pressure signals are derived from wide-range pressure transmitters located outside of Containment. The monitored system temperature signals are processed to generate the reference pressure limit program, which is compared to the actual monitored RCS pressure. This comparison will provide an actuation signal to an actuation device which will cause the PORV to automatically open, if necessary, to prevent pressure conditions from exceeding allowable limits. See Figure 7.6-6 for the block diagram showing the interlocks for RCS pressure control during low temperature operation.

As shown on this figure, the generating station variables required for this interlock are channelized as follows:

a. <u>Protection Set I</u>

1. Wide range RCS temperature from hot legs
2. Wide range RCS pressure.

b. <u>Protection Set II</u>

Wide range RCS temperature from cold legs

c. <u>Protection Set IV</u>

Wide range RCS pressure

The wide-range temperature signals, as inputs to Protection Sets I and II, continuously monitor RCS temperature conditions whenever plant operation is at a temperature below the RNDT. In Protection Set I, the existing RCS hot leg wide-range temperature channels will continuously supply analog input through an isolator to two auctioneering devices, which are located in the Process Control Group No. 1.

The lowest reading as selected by one auctioneer is input to a function generator which calculates the reference pressure limit program, considering the plant's allowable pressure and temperature limits. Also available from Protection Set I, is the wide-range RCS pressure signal which is sent through an isolation device to Control Group 1. The reference pressure from the function generator is compared to the actual RCS pressure monitored by the wide-range pressure channel. The error signal derived from the difference between the reference pressure and the actual measured pressure will first annunciate a main control board alarm whenever the actual measured pressure approaches, within a predetermined amount, the reference pressure. On a further increase in measured pressure, the error signal will generate an actuation signal. The actuation signal available from the auxiliary relay rack will control PORV "A" whenever a temperature-dependent permissive signal from the lowest auctioneering temperature in Process Control Group 1 is present. The two auctioneering devices mentioned above select the lowest temperature. One low temperature is for use as a permissive, the other for use in the reference pressure limit program. The temperature-dependent permissive to the PORVs actuation device effectively disarms (blocks) the actuation signal at temperatures greater than the range of concern. This will prevent unnecessary system actuation when at normal RCS operating conditions as a result of a failure in the process sensors.

The monitored generating station variables that generate the actuation signal for the "B" PORV are processed in a similar manner. In the case of PORV "B", the reference temperature is generated in Process Control Group 4 from the lowest auctioneered wide-range cold leg temperature, which is a separate auctioneering circuit from the circuit used for the PORV "A" permissive. The auctioneering device derives its input from the RCS wide-range temperature in Protection Set II. The actual measured pressure signal is available from Protection Set IV. Therefore, the generating station variables used for PORV "B" are derived from a protection set that is independent of the sets from which generating station variables used for PORV "A" are derived. The error signal derivation itself used for the actuation signals is available from the control group.

Upon receipt of the actuation signal, the actuation device will automatically cause the PORV to open. Upon sufficient RCS inventory letdown, the operating RCS pressure will decrease, clearing the actuation signal. Removal of this signal causes the PORV to close.

7.6.6.2 Analysis of Interlock

Many criteria presented in IEEE 279-1971 and IEEE 388-1975 standards do not apply to the interlocks for RCS pressure control during low temperature operation, because the interlocks do not perform a protective function but rather provide automatic pressure control at low temperatures as a backup to the operator. However, although IEEE 279 criteria do not apply, some advantages of the dependability and benefits of an IEEE 279 design have accrued by including selected elements as noted above in the protection sets and by organizing the control of the two PORVs into dual channels, wherever practical, either of which can accomplish the RCS pressure control function.

The design of the low temperature interlocks for RCS pressure control is such that pertinent features include:

a. No credible failure at the output of the protection set racks, after the output leaves the racks to interface with the interlocks, will prevent the associated protection system channel from performing its protective function, because such outputs that leave the racks go through an isolation device as shown in Figure 7.6-6.

   No single random failure in either channel of the control system will defeat required actuation of both PORVs. It is noted that the lowest of four wide-range temperatures in each channel is derived twice by the two lowest auctioneering temperature circuits. One of these circuits is used to generate the reference pressure limit program for one PORV; the other of these auctioneering circuits is used as a permissive for the redundant PORV. A failure high of either auctioneering circuit in a given channel will not defeat operation of both PORVs.

b. Testing capability for elements of the interlocks within (not external to) the protection system is consistent with the testing principles and methods discussed in Subsection 7.2.2. An alarm is provided in the control room when there is low auctioneered RCS temperature (below RNDT) coincident with a closed position of the motor-operated (MOV) pressurizer relief isolation valve. This MOV is in the same fluid path as the PORV, with separate MOV and alarms used with the second PORV.

c. A loss of offsite power will not defeat the provisions for an electrical power source for the interlocks, because these provisions are through onsite power which is described in Section 8.3.

   In addition, associated with each motor-operated isolation valve for each PORV is a pressure interlock that opens the isolation valves on a high pressurizer pressure signal.

7.6.7 Fire Protection Instrumentation and Detection System

These systems are discussed in Subsection 9.5.1 and in the report, "Seabrook Station Fire Protection Program Evaluation and Comparison to Branch Technical Position APCSB 9.5.1, Appendix A."

7.6.8 Isolation of NNS Components in Primary Component Cooling Water System

A head tank is provided for each PCCW loop. The tank instrumentation is identical for both the loops. PCCW supply to nonessential (NNS) components is isolated on the head tank isolation signal. Isolation of the NNS portion of the PCCW system from its safety-related portion is accomplished in two phases. The first phase is the isolation of the waste processing building heat loads which are isolated either on a safeguard "T" signal (containment isolation phase-A) or upon a head tank low level isolation signal (see Drawing NHY-503273). The latter signal is indicative of a possible break in the NSS portion of the PCCW loop. The head tank isolation signal is generated using a two-out-of-three logic from the head tank level measurements in each tank (see Drawing NHY-503278). The second phase of PCCW isolation is the isolation of the loads in the Containment. These are isolated on either a safeguard "P" signal (containment isolation phase-B) or a low-low level in the PCCW head tank (see Drawing NHY-503268). The system is designed single failure-proof at the system level and meets the requirements of IEEE 279-1971. The sensors, activation logic components, and the solenoid valves are all classified as Class 1E equipment. The environmental qualification of the Class 1E components is discussed in Section 3.11.

7.6.9 Protection Against Spurious Valve Actuation

a. For the motor-operated valves listed below, protection against spurious actuation is provided by removal of motor and control power by de-energizing their Motor Control Centers (MCC 522 and MCC 622). Control of the breakers supplying power to these MCCs is provided in the main control room.

	Valve	Function
1.	RH-V14 and -V26	Residual Heat Removal Cold Leg Injection Valves
2.	RH-V32 and -V70	Residual Heat Removal Hot Leg Injection Valves
3.	SI-V3, -V17, -V32 and -V47	Safety Injection Accumulator Isolation Valves
4.	SI-V114	Safety Injection Cold Leg Isolation Valves
5.	SI-V102 and -V77	Safety Injection Pump to Hot Leg Isolation Valves

For all these valves, redundant valve position indication lights are provided at the Main Control Board (MCB), powered by different sources and actuated by different limit switches. "Control Power Available" indication is provided at the MCB for these valves.

b. SI-V93 (Safety injection pumps discharge to refueling water storage tank) is protected against spurious actuation by providing a nonreversing contactor in series with the normal reversing contactor. Control of this extra contactor is provided through a separate key-locked selector switch on the MCB. Position indication is from the normal valve control circuit (see Drawing NHY-503901). SI-V93 cannot be operated until the applicable interlocks are satisfied, the control switch for SI-V93 has been placed in "open" or "close," the key-locked selector switch has been unlocked and placed in "on."

c. Other safety-related motor-operated valves have power removed for reasons other than to prevent a single failure from preventing a safety function (BTP EICSB 18). These valves are provided with control room position indication that is independent of the motor-operator power supply. Position indication is available when power is removed from the motor operator.

7.6.10 High Energy Line Break Sensing System

On the basis of Standard Review Plan Subsections 3.6.1 and 3.6.2, types and locations of line breaks are postulated that would result in severe environmental conditions at the location of safety grade equipment. To mitigate the effects of such harsh environmental conditions, affected lines are isolated automatically by high energy line break (HELB) signals which are generated by redundant fast response thermocouples strategically located near postulated line breaks in PAB and containment enclosure areas. On a predetermined high temperature (on a per train basis) at any one of the locations described, a HELB signal is automatically generated which closes the following valves:

a) The steam generator blowdown containment isolation valves

b) The auxiliary steam isolation valves

c) The letdown line containment isolation valves.

Refer to Subsections 9.3.4.5.o, 10.4.8.6a, and 10.4.11.2 for further details.

7.6.11 Shutdown Monitor

The shutdown monitor measures the count rate from a neutron counting instrument. It performs a statistical time average of the neutron count rate and displays this average in the source range from 0.1 counts per second (cps) to 10^4 cps. It also provides an alarm output to indicate a decrease in reactor shutdown margin when the neutron count rate increases by an amount equal to the preset alarm ratio. The shutdown monitor alarm setpoint is continuously recalculated and automatically reduced as the reactor is shut down and the neutron flux is reduced. When the neutron count rate achieves steady value and then eventually increases, the alarm setpoint remains at its lowest value unless it is manually reset. An alarm will occur when the time averaged neutron count rate increases due to a reactivity addition to a value equal to the preset alarm setpoint. The response time for the alarm depends on the initial count rate and the rate of change of neutron flux. The preset alarm ratio is chosen to ensure an early alarm will occur during an inadvertent boron dilution event. Analysis of inadvertent boron dilution events is discussed in Subsection 15.4.6.

There are two redundant alarm channels. The alarm from one shutdown monitor channel is annunciated on the VAS and the alarm for the other channel is annunciated on a hardwired alarm on the main control board. Each shutdown monitor channel receives an input signal from an independent source range neutron flux monitoring channel.

7.6.12 ATWS Mitigation System

Generic analyses of Anticipated Transients Without Scram (ATWS) events for NSS designs that utilize a 12-foot core and Model 51 steam generators similar to Seabrook Station have determined that acceptable consequences would result provided the turbine trips and emergency feedwater is initiated in a timely fashion (References 3 and 4). The most severe ATWS scenarios were those in which there is complete loss of normal feedwater. These include loss of normal feedwater and loss of load caused by a loss of main condenser vacuum, which results in a loss of both feedwater pumps. The primary safety concern for these two transients is the potential for high pressures within the Reactor Coolant System (RCS). If a common mode failure in the protection system incapacitates Emergency Feedwater (EFW) flow initiation and/or turbine trip in addition to prohibiting a scram, then an alternate method of providing EFW flow and a turbine trip is required to maintain the RCS pressure below 3200 psig. This is the pressure corresponding to the ASME Boiler and Pressure Vessel Code Level C service limit stress criteria. The ATWS Mitigation System (AMS) provides an alternative means for automatically tripping the turbine and actuating Emergency Feedwater (EFW) flow apart from the protection system in the event of a loss of normal feedwater and/or a loss of load ATWS. The system design complies with the generic functional requirements established by References 5 and 6. Quality Assurance procedures for the AMS comply with the requirements of Reference 7.

The AMS actuation signal is initiated on low-low-low steam generator level, on three-out-of-four steam generators (one sensor for each steam generator). The setpoint is lower than the low-low steam generator level reactor trip/EFW actuation setpoint, and a time delay is added to the actuation signal in order to permit the protection system to actuate prior to AMS actuation. The maximum time delay is limited by the response time requirement from the ATWS analysis.

A permissive (C-20) is provided which will permit an AMS actuation when both turbine impulse pressure transmitters indicate more than the setpoint. The analyses (Reference 4) show that the AMS is not required to actuate at or below 70 percent reactor power to limit peak Reactor Coolant System pressure; however, in order to limit the amount of RCS voiding to that previously predicted in Reference 4, the C-20 setpoint is set to a nominal 20% reactor power to ensure that AMSAC is armed whenever reactor power is greater than or equal to 40 percent. The C-20 permissive is maintained following a turbine trip from above the C-20 setpoint long enough to allow the AMS to perform its function, if necessary.

The AMS actuation signal is maintained after an initiation, long enough so that the EFW turbine steam supply valve will go to its full open position and latch in. Once the AMS is initiated, separate deliberate manual actions are required to secure EFW flow and to reset the turbine. Figure 7.6-7 shows the logic for the system.

The AMS is not safety related or seismically qualified. The system shares narrow-range steam generator level and turbine impulse pressure sensors with the protection system; however, the AMS inputs are isolated from the protection system. The AMS bistables and logic network are of a different design and manufacturer than the protection system and are physically located in a separate cabinet. The logic cabinet is powered from a non-Class 1E 125V DC power source which is capable of providing uninterrupted power during a loss of offsite power. The outputs of the AMS are electrically isolated from the safety-related EFW pump circuit by relays in the isolation relay cabinet. The system has been designed so that a single failure will not result in an inadvertent actuation. The system may be bypassed to allow testing at power.

7.6.13 References

1. The Institute of Electrical and Electronic Engineers, Inc., "IEEE Standard: Criteria for Protection Systems for Nuclear Power Generating Stations," IEEE Standard 279-1971.

2. The Institute of Electrical and Electronic Engineers, Inc., "IEEE Criteria for the Periodic Testing of Nuclear Power Generating Station Protection Systems," IEEE Standard 338-1975.

3. "Westinghouse Anticipated Transients Without Trip Analysis," WCAP-8330, August 1974.

4. NS-TMA-2182, Anderson, T.M. "Anticipated Transients Without Scram for Westinghouse Plants," December 1979.

5. "AMSAC" Generic Design Package," WCAP-10858-P-A, Revision 1, July 1987.

6. ATWS Final Rule - Code of Federal Regulations 10 CFR 50.62 and Supplementary Information Package, "Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled-Nuclear Power Plants."

7. "Quality Assurance Guidance for ATWS Equipment That Is Not Safety-Related," Generic Letter 85-06; April 16, 1985.

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Functional Block Diagram of Accumulator Isolation Valve

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FIGURE 7.6-3

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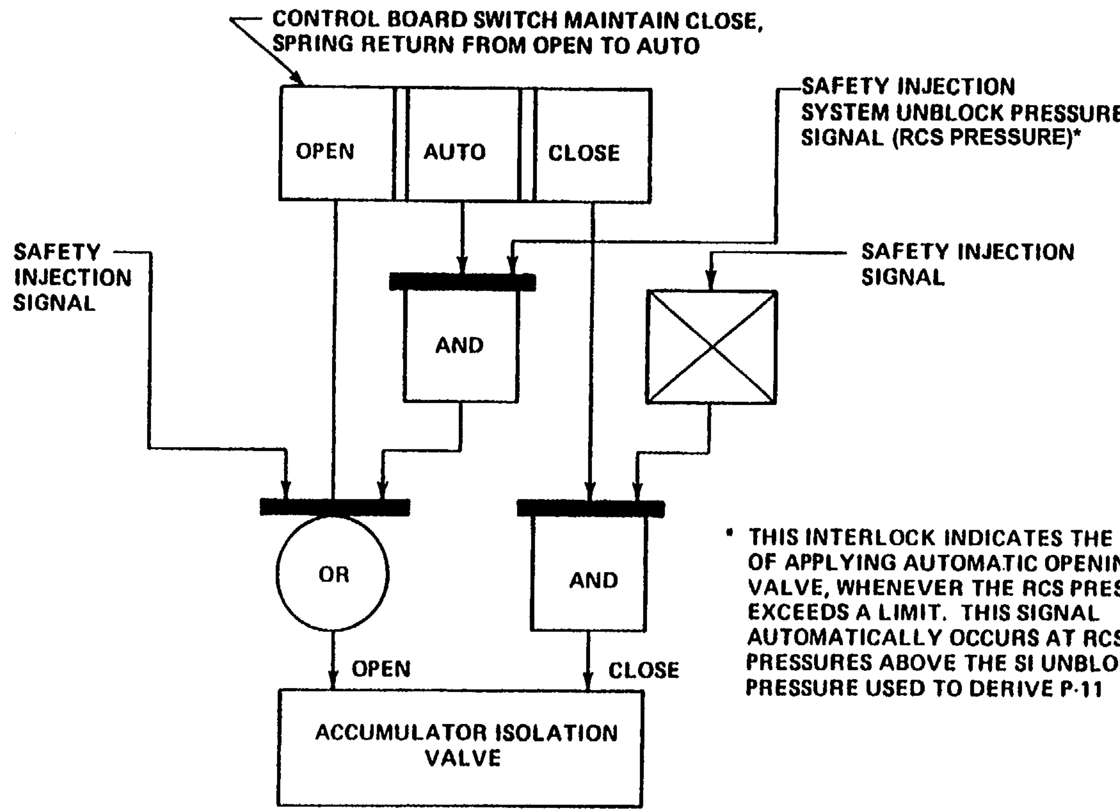
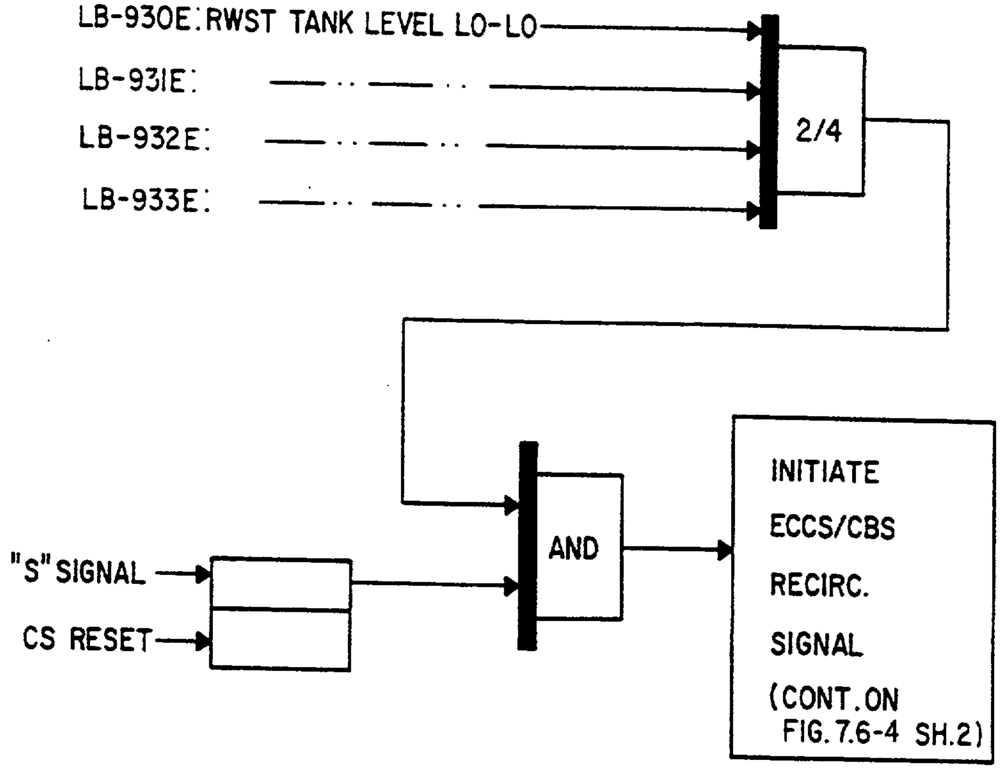


* THIS INTERLOCK INDICATES THE METHOD OF APPLYING AUTOMATIC OPENING OF THE VALVE, WHENEVER THE RCS PRESSURE EXCEEDS A LIMIT. THIS SIGNAL AUTOMATICALLY OCCURS AT RCS PRESSURES ABOVE THE SI UNBLOCK PRESSURE USED TO DERIVE P-11



RWST LEVEL CHANNEL BISTABLES

1) NORMALLY DE-ENERGIZED
2) DE-ENERGIZED ON LOSS OF POWER
3) TRIP SIGNAL PROVIDED WHEN ENERGIZED
4) ENERGIZED ON LO-LO LEVEL SET POINT

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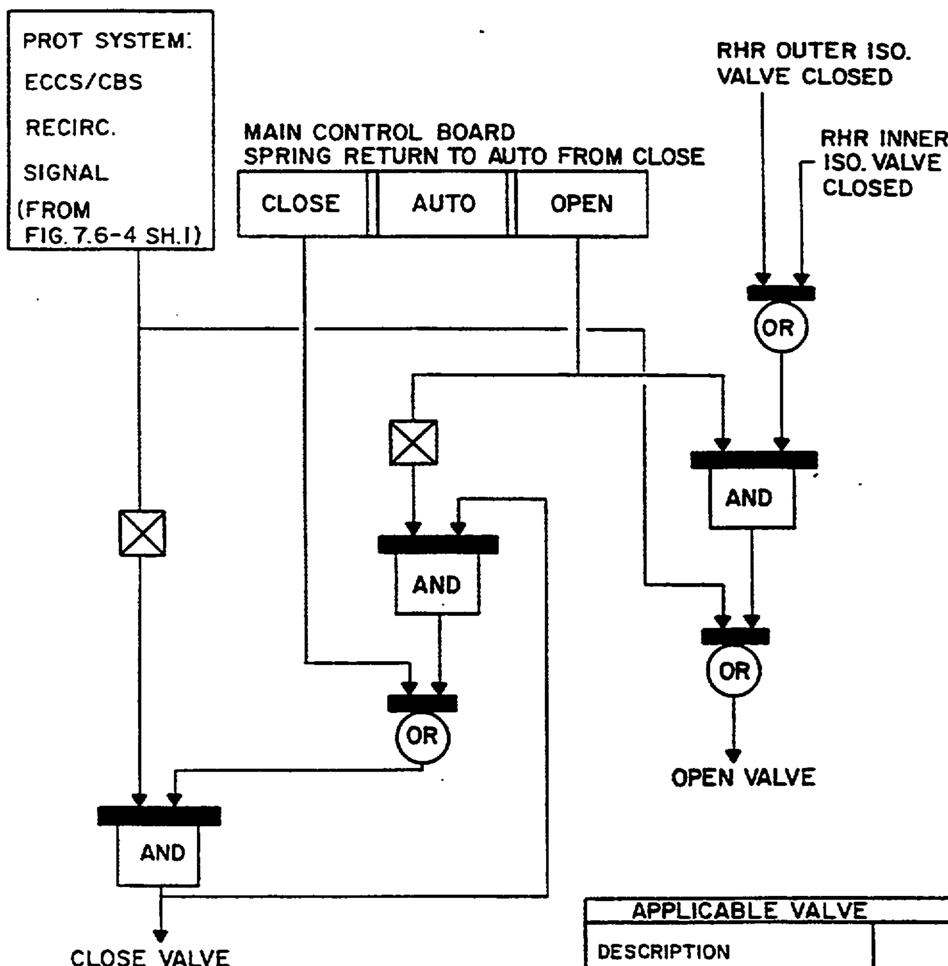

INTERLOCK TABLE

INTER LOCK WITH \ VALVE	CBS-V8	CBS-V14
RHR INNER ISO. VALVE	RC-V22	RC-V87
RHR OUTER ISO. VALVE	RC-V23	RC-V88
TRAIN	A	B

APPLICABLE VALVE

DESCRIPTION	
SUMP TO RHR PUMP P-8A	CBS-V8
SUMP TO RHR PUMP P-8B	CBS-V14

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SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	Safety Injection System Recirculation Sump and RHR Suction Isolation Valves	
	REV. 07	FIGURE 7.6-4 Sh. 2

7.7 CONTROL SYSTEMS NOT REQUIRED FOR SAFETY

The general design objectives of the plant control systems are:

- To establish and maintain power equilibrium between primary and secondary systems during steady-state unit operation;
- To constrain operational transients so as to preclude unit trip and re-establish steady-state unit operation;
- To provide the reactor operator with monitoring instrumentation that indicates all required input and output control parameters of the systems and ensures the capability for the operator to assume manual control of the system.

7.7.1 Description

The plant control systems described in this section perform the following functions:

Reactor Control System

a. Enables the nuclear plant to accept a step-load increase or decrease of 10 percent and a ramp increase or decrease of 5 percent per minute within the load range of 15 percent to 100 percent without reactor trip, steam dump, or pressurizer relief actuation, subject to possible xenon limitations.

b. Maintains reactor coolant average temperature (T_{avg}) within prescribed limits by creating the bank demand signals for moving groups of full-length road cluster control assemblies during normal operation and operational transients. The T_{avg} control also supplies a signal to pressurizer water level control, and steam dump control.

Rod Control System

Provides for reactor power modulation by manual or automatic control of full length control rod banks in a preselected sequence and for manual operation of individual banks.

Systems for Monitoring and Indicating

a. Provide alarms to alert the operator if the required core reactivity shutdown margin is not available due to excessive control rod insertion.

b. Display control rod position.

c. Provide alarms to alert the operator in the event of control rod deviation exceeding a preset limit.

Plant Control System Interlocks

a. Prevent further withdrawal of the control banks when signal limits are approached that predict the approach of a DNBR limit or kW/ft limit.

b. Inhibit automatic turbine load change as required by the Nuclear Steam Supply System.

Pressurizer Pressure Control

Maintains or restores the pressurizer pressure to the design pressure ±50 psi (which is well within reactor trip and relief and safety valve actuation setpoint limits) following normal operational transients that induce pressure changes by control (manual or automatic) of heaters and spray in the pressurizer. Provides steam relief by controlling the power-operated relief valves.

Pressurizer Water Level Control

Establishes, maintains, and restores pressurizer water level within specified limits as a function of the average coolant temperature. Changes in level are caused by coolant density changes induced by loading, operational, and unloading transients. Level changes are produced by means of charging flow control (manual or automatic) as well as by manual selection of modulate letdown valves. Maintaining coolant level in the pressurizer within prescribed limits by actuating the charging and letdown system thus provides control of the reactor coolant water inventory.

Steam Generator Water Level Control

a. Establishes and maintains the steam generator water level to within predetermined physical limits during normal operating transients.

b. Restores the steam generator water level to within predetermined limits at unit trip conditions. Regulates the feedwater flow rate so that under operational transients the heat sink for the Reactor Coolant System is maintained.

Steam Dump Control

a. Permits the nuclear plant to accept a sudden loss of load without incurring reactor trip. Steam is dumped to the condenser and/or the atmosphere as necessary to accommodate excess power generation in the reactor during turbine load reduction transients.

b. Insures that stored energy and residual heat are removed following a reactor trip to bring the plant to equilibrium no load conditions without actuation of the steam generator safety valves.

the power cabinet which could cause erroneous drive mechanism operation will remain undetected. Sufficient alarm monitoring (including "urgent" alarm) is provided in the design of the power cabinet for fault detection of those failures which could cause erroneous operation of a group of mechanisms. As noted in the foregoing, diverse monitoring systems are available for detection of failures that cause the erroneous operation of an individual control rod drive mechanism.

In summary, no single failure within the Rod Control System can cause either reactivity insertions or malpositioning of the control rods, resulting in core thermal conditions not bounded by analyses contained in Chapter 15.

7.7.1.3 Plant Control Signals for Monitoring and Indicating

a. Monitoring Functions Provided by the Nuclear Instrumentation System

The power range channels are important because of their use in monitoring power distribution in the core within specified safe limits. They are used to measure power level, axial flux imbalance and radial flux imbalance. These channels are capable of recording overpower excursions up to 200 percent of full power. Suitable alarms are derived from these signals as described below.

Basic power range signals are:

1. Total current from a power range detector (four such signals from separate detectors); these detectors are vertical and have a total active length of 10 feet.

2. Current from the upper half of each power range detector (four signals).

3. Current from the lower half of each power range detector (four signals).

Derived from these basic signals are the following (including standard signal processing for calibration):

1. Indicated nuclear power (four signals)

2. Indicated axial flux imbalance (ΔI), derived from upper half flux minus lower half flux (four signals)

Alarm functions derived are as follows:

1. Deviation (maximum minus minimum of four) in indicated nuclear power

2. Upper radial tilt (maximum to average of four) on upper-half currents

3. Lower radial tilt (maximum to average of four) on lower-half currents.

Nuclear power (SR, IR and PR) is continuously recorded on the control board. Indicators are provided on the control board for nuclear power and for axial flux imbalance.

The axial flux difference (AFD) monitor alarms are derived from the plant process computer which determines the one minute values of the excore detector outputs to monitor $\Delta\phi$ in the reactor core and alerts the operator where ΔI alarm conditions exist. An alarm message is output immediately upon determining a ΔI outside any of the acceptable spaces as defined in Technical Specification Bases.

Additional background information on the Nuclear Instrumentation System can be found in Reference 1.

b. Rod Position Monitoring of Full Length Rods

Two separate systems are provided to sense and display control rod position as described below:

1. Digital Rod Position Indication System

The digital rod position indication system measures the actual position of each full-length rod using a detector which consists of discrete coils mounted concentrically with the rod drive pressure housing. The coils are located axially along the pressure housing and magnetically sense the entry and presence of the rod drive shaft through its centerline. For each detector, the coils are interlaced into two data channels, and are connected to the containment electronics (Data A and B) by separate multi-conductor cables. By employing two separate channels of information, the digital rod position indication

"E" is chosen so that the low-low alarm would normally be actuated before the insertion limit is reached. The value for "D" is chosen to allow the operator to follow normal boration procedures. Figure 7.7-2 shows a block diagram representation of the control rod bank insertion monitor. The monitor is shown in more detail on the functional diagrams shown in Figure 7.2-9. In addition to the rod insertion monitor for the control banks, the plant computer, which monitors individual rod positions, provides an alarm that is associated with the rod deviation alarm discussed in Subsection 7.7.1.3d to warn the operator if any shutdown Rod Cluster Control Assembly leaves the fully withdrawn position.

Rod insertion limits are established by:

1. Establishing the allowed rod reactivity insertion at full power consistent with the purposes given above

2. Establishing the differential reactivity worth of the control rods when moved in normal sequence

3. Establishing the change in reactivity with power level by relating power level to rod position

4. Linearizing the resultant limit curve. All key nuclear parameters in this procedure are measured as part of the initial and periodic physics testing program.

Any unexpected change in the position of the control bank under automatic control, or a change in coolant temperature under manual control, provides a direct and immediate indication of a change in the reactivity status of the reactor. In addition, samples are taken periodically of coolant boron concentration. Variations in concentration during core life provide an additional check on the reactivity status of the reactor, including core depletion.

d. <u>Rod Deviation Alarm</u>

A rod deviation function is performed as part of the Digital Rod Position Indication System, where an alarm is generated if a preset limit is exceeded as a result of a comparison of any control rod against the other rods in a bank. The deviation alarm of a shutdown rod is based on a preset insertion limit being exceeded.

The demanded and measured rod position signals are also monitored by the plant computer which provides a visual printout and an audible alarm whenever an individual rod position signal deviates from the other rods in the bank by a preset limit. The alarm can be set with appropriate allowance for instrument error and within sufficiently narrow limits to preclude exceeding core design hot channel factors.

Figure 7.7-3 is a block diagram of the rod deviation comparator and alarm system implemented by the plant computer. Additionally, the DRPI system contains rod deviation circuitry that detects and alarms the following conditions:

1. When any 2 rods within the same control bank are misaligned by a preset distance (≥ 12 steps) and

2. When any shutdown rod is below the full-out position by a preset distance (18 steps).

e. Rod Bottom Alarm

A rod bottom signal for the control rods in the digital rod position system is used to operate a control relay, which generates a rod drop alarm.

7.7.1.4 Plant Control System Interlocks

The listing of the plant control system interlocks, along with the description of their derivations and functions, is presented in Table 7.7-1. It is noted that the designation numbers for these interlocks are preceded by "C." The development of these logic functions is shown in the functional diagrams (Figures 7.2-4, 7.2-5, 7.2-9, 7.2-10, and 7.2-15.

a. Rod Stops

Rod stops are provided to prevent abnormal power conditions which could result from excessive control rod withdrawal initiated by either a control system malfunction or operator violation of administrative procedures.

Rod stops are the C_1, C_2, and C_5 control interlocks identified in Table 7.7-1.

b. Turbine Loading Stop

An interlock (C-16) is provided to limit turbine loading during a rapid return to power transient when a reduction in reactor coolant temperature is used to increase reactor power (through the negative moderator coefficient). This interlock limits the drop in coolant temperature to exceed cooldown accident limits and preserves satisfactory steam generator operating conditions. Subsequent automatic turbine loading can begin after the interlock has been cleared by an increase in coolant temperature which is accomplished by reducing the boron concentration in the coolant.

7.7.1.5 Pressurizer Pressure Control

The reactor coolant system pressure is controlled by using either the heaters (in the water region) or the spray (in the steam region) of the pressurizer plus steam relief for large transients. The electrical immersion heaters are located near the bottom of the pressurizer. A portion of the heater group is proportionally controlled to correct small pressure variations. These variations are caused by heat losses, including heat losses due to a small continuous spray. The remaining (backup) heaters are turned on when the pressurizer pressure controlled signal demands approximately 100 percent proportional heater power.

The pressurizer heaters are controlled from nonredundant pressurizer pressure and level signals through contacts developed in the nonsafety-related auxiliary relay racks. Two groups of backup heaters are supplied from the redundant onsite power supplies.

Equipment associated with the pressurizer heater power circuits inside Containment have been qualified as Class 1E components up to the point of the pressurizer heater connection.

The spray nozzles are located on the top of the pressurizer. Spray is initiated when the pressure controller spray demand signal is above a given setpoint. The spray rate increases proportionally with increasing spray demand signal until it reaches a maximum value.

Steam condensed by the spray reduces the pressurizer pressure. A small continuous spray is normally maintained to reduce thermal stresses and thermal shock and to help maintain uniform water chemistry and temperature in the pressurizer.

Power-operated relief valves operation may prevent unnecessary challenges to the pressurizer safety valves during some positive pressure transients. See UFSAR Subsection 5.2.2 for a discussion of the overpressure protection provided by the safety valves.

Each pressurizer relief line consists of a motor-operated and a solenoid-operated valve in series. These valves are manually operable from either the main control board or the remote safe shutdown panel. Valve control point is switch selectable from the RSS panel.

A block diagram of the Pressurizer Pressure Control System is shown on Figure 7.7-4.

7.7.1.6 Pressurizer Water Level Control

The pressurizer operates by maintaining a steam cushion over the reactor coolant. As the density of the reactor coolant adjusts to the various temperatures, the steam water interface moves to absorb the variations with relatively small pressure disturbances.

The water inventory in the Reactor Coolant System is maintained by the Chemical and Volume Control System. During normal plant operation, the charging flow varies to produce the flow demanded by the pressurizer water level controller. The pressurizer water level is programmed as a function of coolant average temperature, with the highest average temperature (auctioneered) being used. The pressurizer water level decreases as the load is reduced from full load. This is a result of coolant contraction following programmed coolant temperature reduction from full power to low power. The programmed level is designed to match as nearly as possible the level changes resulting from the coolant temperature changes.

To control pressurizer water level during startup and shutdown operations, the charging flow is manually regulated from the main control room. The letdown line isolation valves are closed on low pressurizer level.

A block diagram of the Pressurizer Water Level Control System is shown on Figure 7.7-5.

7.7.1.7 Steam Generator Water Level Control

Each steam generator is equipped with a three element feedwater flow controller which is planned to operate with a constant level setpoint. The three-element feedwater controller regulates the feedwater valve by continuously comparing the feedwater flow signal, the water level signal, the constant setpoint and the pressure compensated steam flow signal. The feedwater pump speed is varied to maintain a programmed pressure differential between the steam header and the feed pump discharge header. The speed controller continuously compares the actual ΔP with a programmed ΔP_{ref} which is a linear function of steam flow. Continued delivery of feedwater to the steam generators is required as a sink for the heat stored and generated in the reactor following a reactor trip and turbine trip. An override signal closes all feedwater valves when the average coolant temperature is below a given temperature and the reactor has tripped, on steam generator high-high level or safety injection. Manual override of the Feedwater Control System is available at all times.

Block diagrams of the Steam Generator Water Level Control System and the Main Feedwater Pump Speed Control System are shown in Figures 7.7-6 and 7.7-7.

7.7.1.8 Steam Dump Control

The Steam Dump System is designed to accept a 50 percent loss of net load without tripping the reactor.

The automatic Steam Dump System is able to accommodate this abnormal load rejection and to reduce the effects of the transient imposed upon the Reactor Coolant System. By bypassing main steam directly to the condenser and/or the atmosphere, an artificial load is thereby maintained on the primary system. The Rod Control System can then reduce the reactor temperature to a new equilibrium value without causing overtemperature and/or overpressure conditions. The steam dump steam flow capacity is 40 percent of full load steam flow at full load steam pressure.

If the difference between the reference T_{avg} (T_{ref}) based on turbine impulse chamber pressure and the lead/lag compensated auctioneered T_{avg} exceeds a predetermined amount, and the interlock mentioned below is satisfied, a demand signal will actuate the steam dump to maintain the reactor coolant system temperature within control range until a new equilibrium condition is reached.

To prevent actuation of steam dump on small load perturbations, an independent load rejection sensing circuit is provided. This circuit senses the rate of decrease in the turbine load as detected by the turbine impulse chamber pressure. It is provided to unblock the dump valves when the rate of load rejection exceeds a preset value corresponding to a 10 percent step load decrease or a sustained ramp load decrease of 5 percent/minute.

A block diagram of the Steam Dump Control System is shown on Figure 7.7-8.

a. Load Rejection Steam Dump Controller

This circuit prevents large increases in reactor coolant temperature following a large, sudden load decrease. The error signal is a difference between the lead/lag compensated auctioneered T_{avg} and the reference T_{avg} as based on turbine impulse chamber pressure. The T_{avg} signal is the same as that used in the Reactor Coolant System. The lead/lag compensation for the T_{avg} signal is to compensate for lags in the plant thermal response and in valve positioning. Following a sudden load decrease, T_{ref} is immediately decreased and T_{avg} tends to increase, thus generating an immediate demand signal for steam dump. Since control rods are available, in this situation, steam dump terminates as the error comes within the maneuvering capability of the control rods.

b. Plant Trip Steam Dump Controller

Following a reactor trip, the load rejection steam dump controller is defeated and the plant trip steam dump controller becomes active. Since control rods are not available in this situation, the demand signal is the error signal between the lead/lag compensated auctioneered T_{avg}. When the error signal exceeds a predetermined setpoint the dump valves are tripped open in a prescribed sequence. As the error signal reduces in magnitude indicating that the reactor coolant system T_{avg} is being reduced toward the reference no-load value, the dump valves are modulated by the plant trip controller to regulate the rate of removal of decay heat and thus gradually establish the equilibrium hot shutdown condition.

c. Steam Header Pressure Controller

Residual heat removal is maintained by the steam generator pressure controller (manually selected) which controls the amount of steam flow to the condensers. This controller operates a portion of the same steam dump valves to the condensers which are used during the initial transient following turbine reactor trip on load rejection.

7.7.1.9 Incore Instrumentation

The Incore Instrumentation System consists of 58 thimble assemblies, each containing five fixed detectors, one chromel-alumel thermocouple and a calibration tube for the movable neutron detector, each thimble assembly being at a fixed core location. Per the original system design there are six movable miniature neutron detectors which can be positioned at the center of selected fuel assemblies, anywhere along the length of the fuel assembly vertical axis. The movable miniature neutron detector portion of this system may be in an installed layed-up condition and may not be immediately available for use. If the moveable miniature neutron detector portion of the system is layed up, manual actions will be taken to reactivate it. The basic system for insertion of these movable detectors, if used, is shown in Figure 7.7-9. Operation with less than the design number of incore detectors or incore thermocouples is permitted provided that the minimum operability requirements for each system are met.

a. Fixed/Movable Thimble Assembly

The combination fixed/movable detector flux thimble assembly consisting of a seamless inconel housing, or sheath tube; a seamless inconel calibration tube; five axially-spaced, fixed, self-powered platinum detectors plus a chromel-alumel thermocouple provides a dry path into the reactor core for a remotely driven miniature neutron flux detector. The self-powered fixed detectors are spirally wrapped around the calibration tube. Each fixed detector provides a signal proportional to the local power density within selected fuel assemblies. The assembly is enclosed by the sheath tube. During reactor operation, the retractable thimbles are stationary. They are extracted downward from the core during refueling to avoid interference within the core. A space above the seal table is provided for the retraction operation.

b. Movable Neutron Flux Detector Drive System

Miniature movable fission chamber detectors can be remotely positioned in retractable guide thimbles to provide flux mapping of the core. The stainless steel detector shell is welded to the leading end of helical wrap drive cable and to stainless steel sheathed coaxial cable. The retractable thimbles, into which the miniature detectors are driven, are pushed into the reactor core through conduits which extend from the bottom of the reactor core down through the concrete shield area and then up to a thimble seal table. Their distribution over the core is nearly uniform with about the same number of thimbles located in each quadrant.

The drive system for the insertion of the movable miniature detectors consists basically of drive assemblies, five path transfer assemblies, and ten path transfer assemblies, as shown in Figure 7.7-9. The drive system pushes hollow helical wrap drive cables into the core with the miniature detectors attached to the leading ends of the cables and small diameter sheathed coaxial cables threaded through the hollow centers back to the ends of the drive cables. Each drive assembly consists of a gear motor which pushes a helical wrap drive cable and a detector through a selected thimble path by means of a special drive box and includes a storage device that accommodates its radiated portion of the drive cable. Through a combination of movable detectors all 58 thimbles may be utilized for a flux map.

Manual isolation valves, or tube caps for the layed-up condition (one for each thimble) are provided for closing the thimbles. When closed, the valves or caps form a 2500-psig barrier. These isolation devices are not designed to isolate a thimble while a detector/drive cable is inserted into the thimble. The detector/drive cable must be retracted to a position above the isolation valve prior to closing the valve or installing the tube cap.

c. Control and Readout Description

The control and readout system provides means for inserting the movable miniature neutron detectors into the reactor core and withdrawing the detectors while plotting neutron flux versus detector position. The control system is located in the computer room. Limit switches in each transfer device provide feedback of path selection operation. Each gear box drives a resolver for position feedback. One five-path transfer is provided for each drive unit to insert the detector in one of five functional modes of operation. One ten-path transfer is also provided for each drive unit that is then used to route a detector into any one of up to ten electable paths. A common path is provided to permit cross calibration of the detectors.

The control room contains the necessary equipment for control, position indication, and flux recording for each detector.

A "flux-mapping" consists, briefly, of selecting flux thimbles in given fuel assemblies at various core quadrant locations. The detectors are driven to the top of the core and stopped automatically. An x-y plot (position versus flux level) is initiated with the slow withdrawal of the detectors through the core from top to a point below the bottom. In a similar manner, other core locations are selected and plotted. Each detector provides axial flux distribution data along the center of a fuel assembly.

Various radial positions of detectors are then compared to obtain a flux map for a region of the core.

The number and location of these thimbles have been chosen to permit measurement of local to average peaking factors to an accuracy of ±5 percent (95 percent confidence). Measured nuclear peaking factors will be increased by 5 percent to allow for this accuracy. If the measured power peaking is larger than acceptable, reduced power capability will be indicated.

Operating plant experience has demonstrated the adequacy of the movable incore instrumentation in meeting the design bases stated.

d. Fixed Incore Detectors

The Fixed Incore Detector System uses platinum self-powered detectors to provide information on the gamma and neutron flux levels in the same 58 instrumented assembly locations within the reactor core. From this information in conjunction with analytical predictions of the fluxes, the incore three-dimensional power distribution can be inferred. Once the power distribution has been inferred, the maximum local power peaking and hot channel factors can be derived and compared to established limits in a manner similar to the method used with the Movable Incore Detector System.

The Fixed Incore Detector Data Acquisition System (FIDDAS) collects and stores the 290 detector signals. The hardware used to generate the signal consists of two trains. Each train contains 145 detector and compensator lead inputs into a multiplexer. The multiplexer performs the compensation subtraction and voltage generation. Each multiplexer performs an analog-to-digital data conversion, and the resultant value (signal) is then sent to the main plant computer. The 290 incore instrumentation signals are saved once per minute as a data record on the main plant computer.

The FIDDAS data can be processed by off-line software to infer the measured three-dimensional power distribution and corresponding peaking factors.

Reference 2 demonstrated that the Fixed Incore Detector System is acceptable for performing power distribution surveillance compliance.

e. Thermocouples

Chromel-alumel thermocouples are part of the combination fixed/movable detector flux thimble assembly as described in Subsection 7.7.1.9a and thus enter the reactor vessel through the bottom head. During operation, the thermocouples are located at the exit-flow end of the instrumentation guide tube in the fuel assemblies. Each thermocouple measures the temperature of the fluid in the instrumentation guide tube that is heated by conduction from the bulk core fluid and by gamma heating of the components in the guide tube. The thermocouples are sealed at the seal table along with the electrical leads from the fixed neutron flux detectors. Thermocouple readings are displayed on the MCB and the Main Plant Computer System. The information is used as part of the inadequate core cooling monitor and for monitoring core temperature distribution. Further discussion of this monitor is provided in Subsection 4.4.6.5.

7.7.2 Analysis

The plant control systems are designed to assure high reliability in any anticipated operational occurrences. Equipment used in these systems is designed and constructed with a high level of reliability. Conformance to General Design Criterion 13 for instrumentation and control is as indicated in Table 7.1-1.

Instruments including sensing and sample lines are protected from freezing by being (1) located in an area with a heating system; (2) located in an enclosure with a heated tank; or (3) provided with heat tracing. The environmental monitoring and control system satisfy the requirements of Regulatory guide 1.151.

Proper positioning of the control rods is monitored in the control room by bank arrangements of the individual position columns for each Rod Cluster Control Assembly. A rod deviation alarm alerts the operator of a deviation of one Rod Cluster Control Assembly from the other rods in that bank position. There are also insertion limit monitors with visual and audible annunciation. A rod bottom alarm signal is provided to the control room for each full length Rod Cluster Control Assembly. Four excore long ion chambers also detect asymmetrical flux distribution indicative of rod misalignment.

Overall reactivity control is achieved by the combination of soluble boron and Rod Cluster Control Assemblies. Long-term regulation of core reactivity is accomplished by adjusting the concentration of boric acid in the reactor coolant. Short-term reactivity control for power changes is accomplished by the plant control system which automatically moves Rod Cluster Control Assemblies. This system uses input signals including neutron flux, coolant temperature, and turbine load.

The axial core power distribution is controlled by moving the control rods through changes in reactor coolant system boron concentration. Adding boron causes the rods to move out, thereby reducing the amount of power in the bottom of the core, allowing power to redistribute toward the top of the core. Reducing the boron concentration causes the rods to move into the core, thereby reducing the power in the top of the core; the result redistributes power towards the bottom of the core.

The plant control systems will prevent an undesirable condition in the operation of the plant that, if reached, will be protected by reactor trip. The description and analysis of this protection is covered in Section 7.2. Worst-case failure modes of the plant control systems are postulated in the analysis of off-design operational transients and accidents covered in Chapter 15, such as the following:

a. Uncontrolled rod cluster control assembly withdrawal from a subcritical condition

b. Uncontrolled rod cluster control assembly withdrawal at power

c. Rod cluster control assembly misalignment

d. Loss of external electrical load and/or turbine trip

e. Loss of all AC power to the station auxiliaries (Station Blackout)

f. Excessive heat removal due to feedwater system malfunctions

g. Excessive load increase incident

h. Accidental depressurization of the Reactor Coolant System.

These analyses show that a reactor trip setpoint is reached in time to protect the health and safety of the public under those postulated incidents and that the resulting coolant temperatures produce a DNBR well above the limiting value of 1.30. Thus, there will be no cladding damage and no release of fission products to the Reactor Coolant System under the assumption of these postulated worst-case failure modes of the plant control system.

7.7.2.1 <u>Separation of Protection and Control System</u>

In some cases, it is advantageous to employ control signals derived from individual protection channels through isolation amplifiers contained in the protection channel. As such, a failure in the control circuitry does not adversely affect the protection channel. Test results have shown that a short circuit or the application (credible fault voltage from within the cabinets) of 118V AC or 140V DC on the isolated output portion of the circuit (nonprotection side of the circuit) will not affect the input (protection) side of the circuit. Table 7.1-1 indicates the conformance to General Design Criterion 24.

Where a single random failure can cause a control system action that results in a generating station condition requiring protective action and can also prevent proper action of a protection system channel designed to protect against the condition, the remaining redundant protection channels are capable of providing the protective action even when degraded by a second random failure. This meets the applicable requirements of Section 4.7 of IEEE Standard 279-1971.

7.7.2.2 <u>Response Considerations of Reactivity</u>

Reactor shutdown with control rods is completely independent of the control functions since the trip breakers interrupt power to the full-length rod drive mechanisms regardless of existing control signals. The design is such that the system can withstand accidental withdrawal of control groups or unplanned dilution of soluble boron without exceeding acceptable fuel design limits. The design meets the requirements of the 1971 General Design Criteria 25.

No single electrical or mechanical failure in the Rod Control System could cause the accidental withdrawal of a single Rod Cluster Control Assembly from the partially inserted bank at full power operation. The operator could deliberately withdraw a single Rod Cluster Control Assembly in the control bank; this feature is necessary in order to retrieve a rod, should one be accidentally dropped. In the extremely unlikely event of simultaneous electrical failures which could result in single rod cluster control assembly withdrawal, rod deviation would be displayed on the plant annunciator, and the individual rod position readouts would indicate the relative positions of the rods in the bank. Withdrawal of a single Rod Cluster Control Assembly by operator action, whether deliberate or by a combination of errors, would result in activation of the same alarm and the same visual indications.

Each bank of control and shutdown rods in the system is divided into two groups (group 1 and group 2) of up to 4 to 5 mechanisms each. The rods comprising a group operate in parallel through multiplexing thyristors. The two groups in a bank move sequentially so that the first group is always within one step of the second group in the bank. The group 1 and group 2 power circuits are installed in different cabinets as shown in Figure 7.7-14, which also shows that one group is always within one step ($\frac{5}{8}$ inch) of the other group. A definite schedule of actuation or deactuation of the stationary gripper, movable gripper, and lift coils of a mechanism is required to withdraw the Rod Cluster Control Assembly attached to the mechanism. Since the four stationary gripper, movable gripper, and lift coils associated with the Rod Cluster Control Assemblies of a rod group are driven in parallel, any single failure which could cause rod withdrawal would affect a minimum of one group of Rod Cluster Control Assemblies. Mechanical failures are in the direction of insertion, or immobility.

Figure 7.7-15 is provided for a discussion of design features that ensure that no single electrical failure could cause the accidental withdrawal of a single Rod Cluster Control Assembly from the partially inserted bank at full power operation.

Figure 7.7-15 shows the typical parallel connections on the lift, movable and stationary coils for a group of rods. Since single failures in the stationary or movable circuits will result in dropping or preventing rod (or rods) motion, the discussion of single failure will be addressed to the lift coil circuits. (1) Due to the method of wiring the pulse transformers which fire the lift coil multiplex thyristors, three of the four thyristors in a rod group could remain turned off when required to fire, if for example, the gate signal lead failed open at point X_1. Upon "up" demand, one rod in group 1 and 4 rods in group 2 would withdraw. A second failure at point X_2 in the group 2 circuit is required to withdraw one Rod Cluster Control Assembly; (2) timing circuit failures will affect the four mechanisms of a group or the eight mechanisms of the bank and will not cause a single rod withdrawal; (3) more than two simultaneous component failures are required (other than the open wire failures) to allow withdrawal of a single rod.

The identified multiple failure involving the least number of components consists of open circuit failure of the proper two out of sixteen wires connected to the gate of the lift coil thyristors. The probability of open wire (or terminal) failure is 0.016×10^{-6} per hour by MIL-HDB-217A. These wire failures would have to be accompanied by failure, or disregard, of the indications mentioned above. The probability of this occurrence is therefore too low to have any significance.

Concerning the human element, to erroneously withdraw a single Rod Cluster Control Assembly, the operator would have to improperly set the bank selector switch, the lift coil disconnect switches, and the in-hold out switch. In addition, the three indications would have to be disregarded or ineffective. Such series of errors would require a complete lack of understanding and administrative control. A probability number cannot be assigned to a series of errors such as these.

The Rod Position Indication System provides direct visual displays of each control rod assembly position. The plant computer alarms for deviation of rods from their banks. In addition, a rod insertion limit monitor provides an audible and visual alarm to warn the operator of an approach to an abnormal condition due to dilution. The low-low insertion limit alarm alerts the operator to follow emergency boration procedures. The facility reactivity control systems are such that acceptable fuel damage limits will not be exceeded even in the event of a single malfunction of either system.

An important feature of the Control Rod System is that insertion is provided by gravity fall of the rods.

In all analyses involving reactor trip, the single, highest worth Rod Cluster Control Assembly is postulated to remain untripped in its full out position.

One means of detecting a stuck control rod assembly is available from the actual rod position information displayed on the control board. The control board position read-outs, one for each full length rod, give the plant operator the actual position of the rod in steps. The indications are grouped by banks (e.g., control bank A, control bank B, etc.) to indicate to the operator the deviation of one rod with respect to other rods in a bank. This serves as a means to identify rod deviation.

The plant computer monitors the actual position of all rods. Should a rod be misaligned from the other rods in that bank by more than 15 inches, the rod deviation alarm is actuated.

Misaligned Rod Cluster Control Assemblies are also detected and alarmed in the control room via the flux tilt monitoring system which is independent of the plant computer.

Isolated signals derived from the Nuclear Instrumentation System are compared with one another to determine if a preset amount of deviation of average power level has occurred. Should such a deviation occur, the comparator output will

7.7.2.6 Turbine-Generator Trip with Reactor Trip

Whenever the turbine-generator unit trips at an operating power level above the P-9 setpoint, the reactor also trips. The unit is operated with a programmed average temperature as a function of load, with the full load average temperature significantly greater than the equivalent saturation pressure of the steam generator safety valve setpoint. The thermal capacity of the Reactor Coolant System is greater than that of the secondary system, and because the full load average temperature is greater than the no load temperature, a heat sink is required to remove heat stored in the reactor coolant to prevent actuation of steam generator safety valves for a trip from full power. This heat sink is provided by the combination of controlled release of steam to the condenser and by makeup of feedwater to the steam generators.

The Steam Dump System is controlled from the reactor coolant average temperature signal whose setpoint values are programmed as a function of turbine load. Actuation of the steam dump is rapid to prevent actuation of the steam generator safety valves. With the dump valves open, the average coolant temperature starts to reduce quickly to the no load setpoint. A direct feedback of temperature acts to proportionally close the valves to minimize the total amount of steam which is bypassed.

The feedwater flow is cut off following reactor trip when the average coolant temperature decreases below a given temperature or when the steam generator water level reaches a given high level.

Additional feedwater makeup is then controlled manually to restore and maintain steam generator water level while assuring that the reactor coolant temperature is at the desired value. Residual heat removal is maintained by the steam header pressure controller (manually selected) which controls the amount of steam flow to the condensers. This controller operates a portion of the same steam dump valves to the condensers which are used during the initial transient following turbine and reactor trip.

The pressurizer pressure and level fall rapidly during the transient because of coolant contraction. The pressurizer water level is programmed so that the level following the turbine and reactor trip is above the heaters. However, if the heaters become uncovered following the trip, they are turned off and the Chemical and Volume Control System will provide full charging flow to restore water level in the pressurizer. Heaters are then turned on to restore pressurizer pressure to normal.

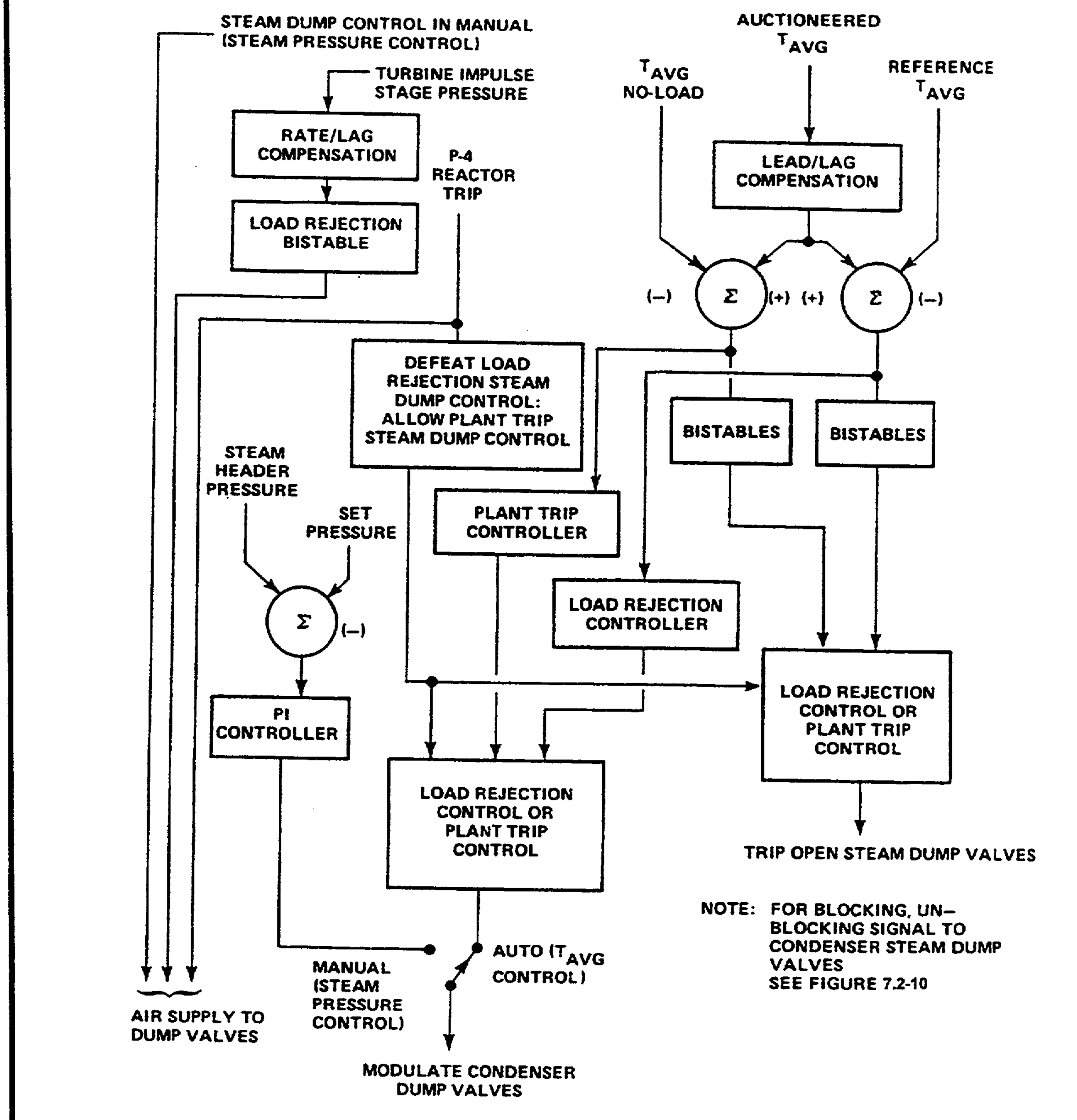
The Steam Dump and Feedwater Control Systems are designed to prevent the average coolant temperature from falling below the programmed no-load temperature following the trip to ensure adequate reactivity shutdown margin.

7.7.3 References

1. Lipchak, J.B. and Stokes, R.A., "Nuclear Instrumentation System," WCAP-8255, January 1974 (for background information only).

2. Gorski, Joseph P., "Seabrook Station Unit 1 Fixed Incore Detector System Analysis," YAEC-1855P, October 1992.

3. Shopsky, W.E., "Failure Mode and Effects Analysis (FMEA) of the Solid State Full Length Rod Control System," WCAP-8976.



SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	Block Diagram of Steam Dump Control System	
	REV. 07	FIGURE 7.7-8

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT

Simplified Block Diagram - Rod Control System

REV. 07

FIGURE 7.7-14

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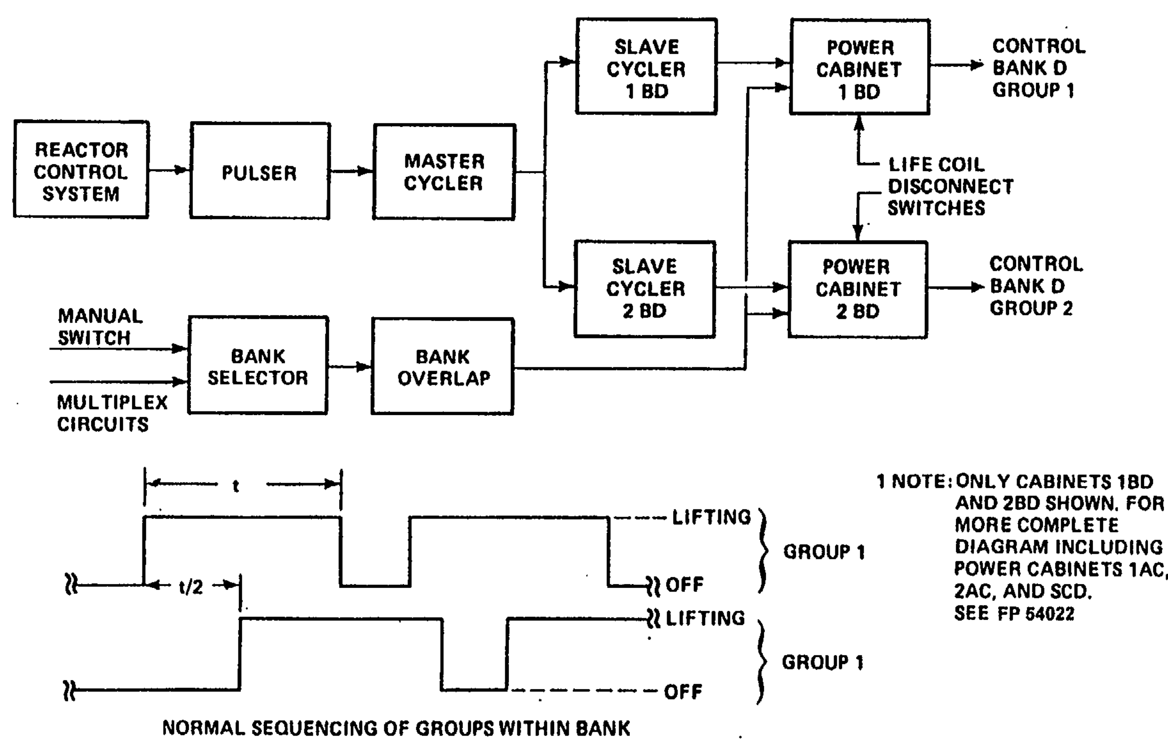


REGULATORY GUIDE 1.97, REVISION 3 REVIEW

Deviation No. 30

Variable	Data Table Item No.
Control Room Temperature	A9, D35j

Deviation From Regulatory Guide 1.97 Guidance

A deviation is taken to the requirement to provide Design Category 1, Type A AMI for this variable.

Justification

Pre-planned manual operator actions are assumed to maintain control room cooling capability on failure in the safety or non-safety related control room cooling subsystem. Since manual actions are required, control room temperature would be classified as Type A, Design Category 1 variable to comply with the requirements of Regulatory Position C.1.2 of Regulatory Guide 1.97.

The basis for this deviation credits the operating crew's awareness of the control room environment and indication of control room cooling system performance via Design Category 3, Type D indicator CBA-TI-8617. Since the control room is continuously manned, high temperature conditions will be detected by the operating crew as a change in control room comfort level. Control room temperature conditions would then be confirmed using indicator CBA-TI-8617 with the necessary manual actions initiated to start the redundant safety related cooling system if necessary.

Since credit can be taken for operator awareness of the environmental conditions in the control room, deviation from Regulatory Guide 1.97 guidance is acceptable for this variable.

GDC-4 Environmental and Missile Design Bases

GDC-5 Sharing of Structures Systems and Components

GDC-17 Electric Power Systems

GDC-18 Inspection and Testing of Electric Power Systems

GDC-50 Containment Design Bases

8.1.5.2 Institute of Electrical and Electronic Engineers (IEEE) Standards

a. The design of the electric power systems is in conformance with the following standards except as noted below:

IEEE Std. 1 - 1969	"General Principles for Temperature Limits in the Rating of Electrical Equipment"
IEEE Std. 80 - 1971	"Guide for Safety in AC Substation Grounding"
IEEE Std. 96 - 1969	"General Principles for Rating Electrical Apparatus for Short-Time, Intermittent, or Varying Duty"
IEEE Std. 142 - 1972	"Recommended Practice for Grounding of Industrial and Commercial Power Systems" (IEEE Green Book)
IEEE Std. 279 - 1971	"Criteria for Protection Systems for Nuclear Power Generating Stations"
IEEE Std. 288 - 1969	"Guide for Induction Motor Protection"
IEEE Std. 308 - 1971	"Standard Criteria for Class 1E Electric Systems for Nuclear Power Generating Stations" The standard provides a listing of Illustrative Periodic Tests in Table 2 for the electric power system. The surveillance activities required for Seabrook are given in the Technical Specifications (T/S). Where differences exist between the T/S and the Standard, the T/S are the governing document.
IEEE Std. 317 - 1972	"Electric Penetration Assemblies in Containment Structures for Nuclear Power Generating Stations"
IEEE Std. 323 - 1974	"Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations" (Refer to Subsection 3.11.2 for discussion of this standard.)

IEEE Std. 334 - 1971 "Trial-Use Guide for Type Tests of Continuous-Duty Class 1 Motors Installed Inside the Containment of Nuclear Power Generating Stations"

IEEE Std. 336 - 1971 "Installation, Inspection and Testing Requirements for Instrumentation and Electric Equipment During the Construction of Nuclear Power Generating Stations"

IEEE Std. 338 - 1975 "Criteria for the Periodic Testing of Nuclear Power Generating Station Protection Systems"

IEEE Std. 344 - 1975 "Guide for Seismic Qualification of Class I Electric Equipment for Nuclear Power Generating Stations" -- Refer to Section 3.10 for discussion of this standard.

IEEE Std. 379 - 1972 "Trial-Use Guide for the Application of the Single Failure Criterion to Nuclear Power Generating Station Protection Systems"

IEEE Std. 380 - 1972 "Definitions of Terms used in IEEE Nuclear Power Generating Station Standards"

IEEE Std. 382 - 1972 "Trial-Use Guide for Type Tests of Class I Electric Valve Operators for Nuclear Power Generating Stations"

IEEE Std. 383 - 1974 "Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations"

IEEE Std. 387 - 1972 "Trial-Use Standard Criteria for Diesel-Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations"

IEEE Std. 450 - 1975 "Recommended Practice for Maintenance, Testing and Replacement of Large Lead Storage Batteries for Generating Stations and Substations"

Regulatory Guide 1.129 endorses IEEE Std. 450-1975 whereas T/S Bases 3/4.8.2 states that the T/S battery surveillance requirements are based on IEEE Std. 450-1980. A comparison of the 1975 to the 1980 revision concluded that there are no differences of safety significance. UFSAR compliance to IEEE Std. 450 will use the 1980 revision (See Section 8.1.5.2.b).

Documents Applicable to Equipment Purchase Orders - The issue of the documents listed above in effect on the date of the purchase orders are applicable when supplying equipment/services against the purchase order.

b. An evaluation of the Seabrook design has been performed to the standards listed below some of which have more recent issue dates than those listed above. The purpose of the evaluation was to determine if there are any requirements of safety significance that the Seabrook design does not meet and which are included in the standards. The results of the evaluation are outlined below:

IEEE 308-1974: It is our engineering judgment that the Seabrook design meets the requirements of this standard. The standard provides a listing of Illustrative Periodic Tests in Table 2 for the electric power system. The surveillance activities required for Seabrook are given in the Technical Specifications (T/S). On test intervals for batteries and diesel generators, our design (T/S) exceeds the requirements of this standard because the intervals have been specified to meet even more recent industry standards such as IEEE 387 on diesel generators and IEEE 450 on batteries. Where differences exist between the T/S and the Standard, the T/S are the governing document.

IEEE 387-1977: The basic difference between the 1977 version of the standard and the 1972 version is the incorporation of type-testing requirements for diesel generators. Because the Updated FSAR commits to the type test program of IEEE 387-1977, it is our engineering judgment that the Seabrook design meets this standard.

IEEE 317-1976: All major electrical containment penetrations were manufactured to meet the 1976 version of the standard. Some minor electrical penetrations, ¾" to 1" size which are associated with the personnel air lock, the equipment hatch and the containment recirculation sump isolation valve encapsulation tank, were manufactured to meet the 1972 version. It is our engineering judgment that these minor penetrations meet all the important design requirements necessary to perform their safety function. Requirements that may be lacking are in the areas of QA documentation, Service Classification documentation, and definition of certain production tests.

IEEE 384-1974: The Seabrook design meets the requirements of this standard except as noted. For exception to Subsection 5.1.2 on conduit markings, see Updated FSAR Subsection 8.3.1.4k. For exception to Subsection 5.1.1.3(c) on cables above the cable tray side rails, see Updated FSAR Subsection 8.3.1.4e.

The Seabrook cable and raceway separation criteria (see Updated FSAR Subsection 8.3.1.4) is a combination of the standard criteria given in Attachment C of AEC Letter dated December 14, 1973 (see Updated FSAR Appendix 8A) and IEEE 384-1974 and criteria established by analysis and testing as permitted by Attachment C and IEEE 384-1974.

IEEE 338-1977: The Seabrook design meets the requirements of this standard.

IEEE 484-1975: The Seabrook design meets the requirements of this standard.

IEEE 450-1980: The Seabrook design meets the requirements of this standard except as follows:

1. The electrolyte level check of all cells (Section 4.3.1[3]) is performed at least once per quarter as outlined in the Technical Specifications.

2. The yearly inspections (Section 4.3.3) and the annual performance tests (Section 5.2[3]) are performed at least once per 18 months as outlined in the Technical Specifications.

3. The intercell resistance measurement acceptance criteria (Section 4.4.1[2]) will be as given in the Technical Specifications.

IEEE 741-1986: Use of standard limited to Subsection 5.4.3 for the protection of non-Class 1E circuits using containment penetration assemblies.

8.1.5.3 Regulatory Guides

a. The design of the electric power system is in conformance with the following Regulatory Guides:

RG 1.6 (3/10/71)	"Independence Between Redundant Standby (Onsite) Power Supplies and Between Their Distribution Systems" (Refer to Subsections 8.3.1.2 and 8.3.2.2.)
RG 1.29 (Rev 3)	"Seismic Design Classification" (Refer to Section 3.2.)
RG 1.30 (8/11/72)	"Quality Assurance Requirements for the Installation, Inspection and Testing of Instrumentation and Electric Equipment" (Refer to Section 1.8.)

RG 1.40 (3/16/73)	"Qualification Tests of Continuous Duty Motors Installed Inside the Containment of Water Cooled Nuclear Power Plants" (Refer to Section 3.11.)
RG 1.41 (3/16/73)	"Preoperational Testing of Redundant Onsite Electric Power Systems to Verify Proper Load Group Assignments"
RG 1.53 (6/73)	"Application of the Single-Failure Criterion to Nuclear Power Plant Protection Systems" (Refer to Subsection 7.1.2.)
RG 1.62 (10/73)	"Manual Initiation of Protection Actions" (Refer to Subsection 7.3.2.)
RG 1.73 (1/74)	"Qualification Tests of Electric Valve Operators Installed Inside the Containment of Nuclear Power Plants" (Refer to Section 3.11.)
RG 1.81 (Rev 1)	"Shared Emergency and Shutdown Electric Systems for Multi-Unit Nuclear Power Plants"
RG 1.89 (11/74)	"Qualification of Class IE Equipment for Nuclear Power Plants" (Refer to Section 3.11.)
RG 1.100 (Rev 1)	"Seismic Qualification of Electric Equipment for Nuclear Power Plants" (Refer to Section 3.10.)
RG 1.106 (Rev 1)	"Thermal Overload Protection for Electric Motors on Motor Operated Valves" (Refer to Subsection 8.3.1.1.)
RG 1.128 (Rev 1)	"Installation Design and Installation of Large Lead Storage Batteries for Nuclear Power Plants"
RG 1.131 (8/77)	"Qualification Tests of Electric Cables, Field Splices, and Connections for Light-Water Cooled Nuclear Power Plants" (Refer to Subsection 8.3.1.4.)
RG 1.155 (6/88)	"Station Blackout" (Refer to Section 8.4.)

b. The design of the electric power system is in accordance with the following regulatory guides, with clarifications as noted:

RG 1.9 (Rev 2)	"Selection of Diesel Generator Set Capacity for Standby Power Supplies"

Position C.14 requires that the engine run at full load for 22 hours following 2 hours at short time rated load. For Seabrook, a "Load Capability Qualification" test was performed per IEEE 387-1977. The engine was run at full load for 22 hours after reaching equilibrium temperature, but before 2 hours short time rated load test.

RG 1.22 (Rev 0) "Periodic Testing of Protection System Actuation Functions"

The design is in accordance with RG 1.22 as supplemented by Regulatory Guide 1.108, Rev. 1, entitled "Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants." Refer to Subsection 8.3.1

RG 1.32 (Rev 2) "Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants"

Physical Independence of electric systems is in accordance with Attachment C of AEC letter dated December 14, 1973, entitled "Physical Independence of Electric Systems" (Appendix 8A). Refer to Subsection 8.3.1

The Regulatory Guide states in Position C.1.c, "The battery service test described in IEEE Std 450-1975 should be performed in addition to the battery performance discharge test." The Technical Specifications require service tests at least once per 18 months and performance discharge tests at least once per 60 months. However, the Technical Specifications allow the performance discharge test to be performed in lieu of (not in addition to) the service test once per 60 month interval.

The Regulatory Guide also states in Position C.1.c, "The battery service test should be performed during refueling operations or at some other outage, with intervals between tests not to exceed 18 months." The Technical Specifications permit the battery service test to be performed during non-outage periods. The Seabrook Station design incorporates two 100% capacity battery banks per train. Removing one of these battery banks from service for surveillance testing does not reduce the system capabilities. The regulatory guide assumes only one 100% capacity battery bank per train.

RG 1.47 (5/73) "Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems"

With the exception of the Emergency Diesel Generator System, the Electric Power System is not required to have inoperable status indication because it is not expected to be bypassed or deliberately induced inoperable more frequently than once per year. Reference regulatory position C.3(b).

Inoperable status indication is provided for the Emergency Diesel Generator System as a result of data provided by the NRC indicating that diesel generator systems have been declared inoperable more frequently than once per year.

RG 1.63 (Rev 2) "Electric Penetration Assemblies in Containment Structures for Water-Cooled Nuclear Power Plants"

The electrical penetration assemblies are designed to withstand, without loss of mechanical integrity, the maximum fault current vs. time conditions that could occur as a result of single random failures of circuit overload devices. In addition to the 15 kV switchgear breakers, the medium voltage 15 kV penetrations are also protected by fuses inserted in the feeders outside containment. These fuses are qualified by experience and seismic testing. The 600 volt system x/R ratio used in specifying the electrical penetrations is 4. Calculations show that this value is conservatively applied because the actual ratio is considerably less than 4. Refer to Subsection 8.3.1.2

RG 1.68 (Rev 2) "Preoperational and Initial Startup Test Program for Water-Cooled Power Reactors" (Refer to Subsection 14.2.6 for exceptions.)

RG 1.75 (Rev 2) "Physical Independence of Electric Systems"

The design is consistent with the criteria for physical independence of electric systems established in Attachment C of AEC letter dated December 14, 1973, and is in general conformance with Regulatory Guide 1.75, except as follows:

<u>Battery Room Ventilation</u>. Although the four Class 1E batteries are housed in separate safety class structures, they represent only two redundant load groups (see Subsection 8.3.2). Each load group is served by a separate safety-related ventilation system. There is a cross-tie between the two ventilation systems to allow one system to serve both load groups in case the other system is inoperable. Fire dampers are provided to isolate each battery room.

For additional information on the four batteries and two redundant load groups, see Subsection 8.3.2.1a.

Refer to Subsection 8.3.1.2b.5 for a discussion of the onsite AC power system.

The requirements of position C4, as it relates to cables for the associated circuits, is clarified as follows:

> Instrumentation, control and power cables used for the associated circuits will not be covered by the Operational Quality Assurance Program (OQAP). However, programmatic controls will be applied to these items. The actual implementation of these controls will be defined by the program manuals used to control specific activities at Seabrook Station. Implementation of these programmatic controls will be verified by Quality Assurance personnel to the extent necessary to insure proper application. For further details on provisions and considerations for the associated circuits, see Updated FSAR Chapter 8, Subsection 8.3.1.4b.1(d).

The Seabrook cable and raceway separation criteria (see Updated FSAR Subsection 8.3.1.4) is a combination of the standard criteria given in Attachment C of AEC Letter dated December 14, 1973 (see Updated FSAR Appendix 8A) and IEEE 384-1974 and criteria established by analysis and testing as permitted by Attachment C and IEEE 384-1974.

RG 1.93 (12/74) "Availability of Electric Power Sources"

The Technical Specification (T/S) ac and dc power sources allowable out-of-service times (action statements) are based on RG 1.93. Where differences exist between the T/S and RG 1.93, the T/S are the governing document.

RG 1.93 does not allow out-of-service times to be used for preventative maintenance that incapacitates a power source. These activities are to be scheduled for refueling or shutdown periods. This is interpreted to also apply to surveillance activities. Preventative maintenance and surveillance activities are performed on-line when permitted by the T/S and with appropriate consideration of the effects on safety, reliability, and availability.

RG 1.108 (Rev 1) "Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants"

The diesel generator testing is in conformance with the recommendations of Regulatory Guide 1.108 except as noted below:

The requirements of position C.1.c are met with the following exception:

> Temporary jumpers are used on a limited basis during the performance of periodic tests for the emergency diesel generators.

The above exception to Regulatory Guide 1.108 is determined to be acceptable because the NRC has previously accepted the use of temporary jumpers for testing of protection system circuits addressed in UFSAR Section 7.1.2.11.d. This position is further supported by the discussion in SER Section 7.3.2.14. The NRC based its acceptance on the combination of explicit test procedures and administrative controls (independent second-person verification) which met the guidelines in NRC IE Information Notice No. 84-37, Use of Lifted Leads and Jumpers During Maintenance or Surveillance Testing. These guidelines provide reasonable assurance that the instrumentation will be restored to the correct configuration following testing. The use of jumpers is minimized and is performed only where permanent hardware changes are not practical or cannot be justified.

The requirements of position C.2.a(5) were met for preoperational testing as follows:

> The functional capability at full-load temperature was demonstrated during preoperational testing by performing the test outlined in position C.2.a(1) and (2) immediately following the full-load carrying capability test described in position C.2.a(3). The full-load carrying capability of position C.2.c(2) was demonstrated for greater than or equal to five minutes.

The above testing met the intent of position C.2.a(5) by demonstrating the capability of the diesel generator to start and accept load at full-load temperature.

The requirements of position C.2.a(3) will be met every 18 months as follows:

> Full-load carrying capability will be verified by operating the diesel generator at a load of greater than or equal to 5600 kW and less than or equal to

6100 kW. The 2-hour rating of the diesel generator will be verified by operating the diesel generator at a load of greater than or equal to 6363 kW and less than or equal to 6700 kW.

The above exceptions to Regulatory Guide 1.108 meet the intent of position (3) by demonstrating that the diesel generators are capable of carrying approximate full load for an interval of not less than 24 hours.

The requirements of position C.2.a(5) will be met every 18 months as follows:

The functional capability at full-load temperature will be demonstrated by verifying that the diesel generator will start from a manual or automatic start signal within five minutes of shutdown following the 24-hour surveillance run. The generator voltage and frequency shall be 4160 ± 420 volts and 60 ± 1.2 Hz within 10 seconds after the start signal, and the diesel generator shall be operated for at least five minutes.***

The above exception to Regulatory Guide 1.108 meets the intent of position (5) by demonstrating the capability of the diesel generator to start at normal operating temperature.

*** If the diesel generator fails to start during this test, then it is not necessary to repeat the preceding 24-hour test. Instead, the diesel generator may be operated at greater than or equal to 5600 kW and less than or equal to 6100 kW for 2 hours or until operating temperature has stabilized. The load range is provided to preclude routine overloading of the diesel generator. Momentary transients outside the load range, due to changing bus conditions, do not invalidate the test.

The periodic testing requirements of C.2.c(2) will be met as follows:

> Full-load carrying capability will be verified by periodically running the diesel generator at a load of greater than or equal to 5600 kW and less than or equal to 6100 kW for at least 60 minutes.

The above exception to Regulatory Guide 1.108 meets the intent of position (2) by demonstrating that the diesel generators are capable of carrying approximate full load for a period of not less than 60 minutes.

The periodic testing interval requirements of position C.2.d will be met as follows:

> The periodic testing interval will be no more than 31 days per T/S 4.8.1.1.2.a. The corrective actions for a test failure will be determined by the maintenance rule emergency diesel generator performance criteria.

The above exception to Regulatory Guide 1.108 meets the intent of position C.2.d by maintaining the periodic test interval and ensuring that adequate corrective actions are implemented if a test failure occurs.

The records and reporting requirements of position C.3.b will be met as follows:

> Significant emergency diesel generator failures will be reported in accordance with the provisions of 10CFR50.72 and 50.73. Footnote 3 in position C.3.b references Regulatory Guide 1.16. UFSAR Section 1.8 documents compliance with Regulatory Guide 1.16.

The above exception to Regulatory Guide 1.108 meets the intent of position C.3.b by providing NRC notification of diesel generator failures in accordance with the licensee's reporting requirements.

For further information refer to Subsections 8.3.1.1j and 8.3.1.1(e).

RG 1.118 (Rev. 2) "Periodic Testing of Electric Power and Protection Systems"

Position C.6 states that temporary jumpers may be used with portable test equipment where the safety system equipment to be tested is provided with facilities specifically designed for connection of this test equipment. The intention of this position is to ensure that test setups are of a quality that does not degrade the equipment and that makeshift test setups are not used.

Temporary jumpers are used on a limited basis during the performance of periodic tests for various electric power and protection systems. Regulatory Guide 1.118 does not provide details on what constitutes facilities specifically designed for connection of test equipment. When temporary jumpers are used during testing, they are connected via devices that are suitable for ensuring a reliable connection to the equipment under test. Certain points of connection may not have been specifically designed for the connection of test equipment, but the points are evaluated for acceptability for each application. This meets the intent of the regulatory position to ensure that makeshift test setups are not used. For additional information on the use of temporary jumpers, refer to the discussion under Regulatory Guide 1.108.

RG 1.129 (Rev. 1) "Maintenance, Testing and Replacement of Large Lead Acid Storage Batteries for Nuclear Power Plants" (Refer to Subsection 8.3.2)

The plant design conforms to Regulatory Guide 1.129 except for the following:

The Regulatory Guide states in Position C.1, "The battery service test should be performed in addition to the battery performance discharge test." The Technical Specifications require service tests at least once per 18 months and performance discharge tests at least once per 60 months. However, the Technical Specifications allow the performance discharge test to be performed in lieu of (not in addition to) the service test once per 60 month interval.

The Regulatory Guide states in Position C.1, "The battery service test should be performed during refueling operations or at some other outage, with intervals between tests not to exceed 18 months." The Technical Specifications permit the battery service test to be performed during non-outage periods. The Seabrook Station design incorporates two 100% capacity battery banks per train. Removing one of these battery banks from service for surveillance testing does not reduce the system capabilities. The regulatory guide assumes only one 100% capacity battery bank per train.

Although RG 1.129 endorses IEEE Std. 450-1975, its regulatory positions are worded such that they can also be applied to IEEE Std. 450-1980 revision which is referenced in the Technical Specification Bases.

8.1.5.4 Branch Technical Positions (BTPs)

The electrical power system is in conformance with the following BTPs with clarifications as noted:

BTP PSB 1 "Adequacy of Station Electric Distribution System Voltages"

See Subsection 8.3.1.2(c) for clarifications.

BTP EICSB 2 "Diesel-Generator Reliability Qualification Testing"

The number of allowable failures permitted during diesel generator reliability testing is in accordance with RG 1.9 (Rev. 1) and IEEE 387-1977.

BTP EICSB 6 "Capacity Test Requirements of Station Batteries-Technical Specifications"

The periodic testing of the batteries will comply with the requirements of RG 1.32, "Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants" as described in Section 8.1.5.3, IEEE 450 as described in Section 8.1.5.2 and the Technical Specifications.

BTP EICSB 7 "Shared Onsite Emergency Electrical Power Systems for Multi-Unit Generating Stations"

BTP EICSB 8 "Use of Diesel-Generator Sets for Peaking"

BTP EICSB 11 "Stability of Offsite Power Systems"

BTP EICSB 17 "Diesel-Generator Protective Trip Circuit Bypasses"

The design is in compliance with the recommendations of BTP 17. All protective trips except engine overspeed, generator differential, 4160-volt bus fault, and engine low lube oil pressure (which has been provided with the recommended independent measurements and coincident logic) are rendered inoperable by a bypass circuit during an accident condition. Refer to Subsection 8.3.1.1.

BTP EICSB 18	"Application of the Single Failure Criterion to Manually-Controlled Electrically-Operated Valves"
BTP EICSB 21	"Guidance for Application of RG 1.47"
BTP EICSB 27	"Design Criteria for Thermal Overload Protection for Motors of Motor-Operated Valves"

8.1.5.5 Other Standards and Documents

The electric power system is in conformance with the following documents except as noted:

ANSI C34.2 - 1968	"Practice and Requirements for Semi-Conductor Power Rectifiers"
ANSI C37.010 - 1972	"Application Guide for AC High Voltage Breakers"
ANSI C37.4 - 1953 and Suppl. of 1958 and 1970	"Definitions and Rating Structure, AC High Voltage Circuit Breakers Rated on a Total Current Basis"
ANSI C37.13 - 1973	"Low Voltage AC Power Circuit Breakers Used in Enclosure"
ANSI C37.20 - 1972	"Switchgear Assemblies Including Enclosed Bus"
ANSI C37.90 - 1971	"IEEE Standard for Relays and Relay System Associated with Electric Power Apparatus"
ANSI C37.91 - 1967	"Guide for Protective Relay Applications to Power Transformers"
ANSI C57.12.00 - 1973	"General Requirements for Distribution, Power and Regulating Transformers" Circuit protection for dry-type unit substation transformers is evaluated using the through-fault protection curves provided in IEEE Standard C57.12.59-1989, "IEEE Guide for Dry-Type Transformer Through-Fault Current Duration," versus using the ANSI withstand point methodology provided in ANSI C57.12.00-1973. The

through-fault protection curves contained in IEEE C57.12.59-1989 represent an improved methodology that is based on current industry information.

ICEA No. S-19-81 - 1969	"Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy"
ICEA No. P-46-426-1962	"Power Cable Ampacities"
ICEA No. P-54-440 - 1972	"Ampacities - Cable in Open-top Cable Trays"
ICEA No. S-66-525 - 1971	"Cross-Linked Thermosetting Polyethylene Insulation for Power Cable Rated 601-15,000 Volts"
NEMA MG-1 - 1972	"Motors and Generators"

Attachment C of AEC letter dated December 14, 1973, entitled "Physical Independence of Electric Systems" (see Updated FSAR Appendix 8A). For exception to Subsection 5.1.2 of Attachment C on conduit markings, see Updated FSAR Subsection 8.3.1.4k.

The Seabrook cable and raceway separation criteria (see Updated FSAR Subsection 8.3.1.4) is a combination of the standard criteria given in Attachment C of AEC Letter dated December 14, 1973 (see Updated FSAR Appendix 8A) and IEEE 384-1974 and criteria established by analysis and testing as permitted by Attachment C and IEEE 384-1974.

Documents Applicable to Equipment Purchase Orders - The issue of the documents listed above in effect on the date of the purchase orders are applicable when supplying equipment/services against the purchase order.

The RATs are located on the north side of the Turbine Building heater bay, as shown in Figure 8.2-6. The pair of transformers is connected to the 345-kV switching station by SF_6 gas-insulated bus.

The secondary winding of each reserve auxiliary transformer is connected to a 13.8-kV switchgear bus, and the tertiary winding is connected to one train of 4160-volt emergency switchgear and to one 4160-volt nonessential switchgear lineup. By this arrangement, a separate RAT feeds each emergency bus. Connections to both the 13.8-kV and the 4160-volt switchgear are made with three-phase nonsegregated phase bus ducts as shown in Figure 8.2-6. Subsection 8.3.1.1.b.9 describes a contingency alignment where emergency diesel generator EDG-1A may be aligned to provide power to the RAT-3A tertiary winding.

8.2.1.4 Switching Station - System Control and Protection

The protective relaying philosophy follows that generally employed for bulk power systems, and is designed in accordance with guidelines and requirements of the Northeast Power Coordinating Councils's "Bulk Power System Protection Criteria" (Reference 1). This design is based on the local backup philosophy of clearing all faults at the station which would normally clear that fault. In the design of local backup systems, consideration is included for failure of relays, current or potential transformers, DC-power supplies, wiring, and the circuit breaker itself.

a. Local Backup Protection

Local backup protection falls into two categories: relay backup and breaker backup.

1. Relay Backup Protection

Relay backup protection is provided for each transmission line and bus position by two independent protective relay systems, System No. 1 and System No. 2. Each relay system is connected to isolated current, potential and DC supplies with separate wiring and cable connections. The independence of System No. 1 and System No. 2 components and power supplies ensures that at least one system will function in the event of any single failure.

(a) Transmission Line Protection

The protection for each of the three 345-kV transmission lines is provided by two electrically independent, solid-state, high-speed relaying systems: System No. 1 and System No. 2. Each system uses an independent communication channel to provide high-speed clearing of all faults within the relay system zones of protection.

In the event of a failure of both communication channels, Relay System No. 2 is provided with facilities for local fault clearing.

(1) Transmission Line Relaying - System No. 1

This system is a solid-state directional comparison carrier-blocking system that uses the power line as a communication channel. Solid-state impedance relays are included to provide protection against all phase and ground faults.

(2) Transmission Line Relaying - System No. 2

This system is a solid-state directional comparison permissive-overreaching transfer trip assembly that uses a microwave system as a communication channel. Solid-state impedance relays provide complete phase and ground fault protection for the transmission line. In addition, two zones of backup protection are built into this system to provide backup protection in the event of failure of the System No. 1 and System No. 2 communication channels.

(b) Bus Protection

Each 345-kV bus section is protected by two high-speed voltage-type bus differential relaying systems (System 1 and System 2). Each of these relay systems is connected to its own dedicated current transformers, to an independent DC power supply, and to high-speed tripping and lockout relays. Each system is separated both physically and electrically in the same manner as the line relaying systems.

2. Breaker Backup Protection

Breaker backup protection is provided for each 345-kV circuit breaker. The function of this protection is to clear line sections adjacent to a 345-kV circuit breaker that has failed to trip when called upon to do so by the protective relays or by manual control devices.

Breaker backup protection is provided by the application of breaker failure relays. Two independent solid-state breaker failure systems (System No. 1 and System No. 2) are provided for each breaker. Each system is separated both physically and electrically in the same manner as the line relaying systems, and is initiated by the relay system or control system that operates the breaker. Each of these systems includes a current level detector, a timing device, and tripping outputs to clear all adjacent line positions.

g. Relay Room Locations and Equipment

The relay room is located at Elevation 21'-6" in the northern end of the heater bay which is located between the turbine room and the Administration and Service Building.

The following equipment is installed in the relay room:

1. 345-kV Switching Station Relay Panels
2. Protective Relay Panels
3. Digital Metering Panels
4. 345-kV Switching Station and Unit 1 Annunciator
5. Event Recorder - Switching Station
6. Digital Fault Recorder - Switching Station
7. 125V DC Switching Station Batteries and Chargers
8. 125V DC Distribution Panels and Throwover Switches
9. 480V AC Power Panel and Transfer Switches
10. 120/240V AC Power Panel and Transfer Switches
11. 48V DC Battery and Charger
12. 48V DC Distribution Panel
13. Inverter
14. Eye Wash Stations
15. Supervisory Control Equipment associated with the ESCC
16. Microwave Communication Racks

h. Out-of-Step Protection

Generator protection against system instability and loss of excitation is provided by an out-of-step relay in the relay room. The out-of-step relay trips 345 kV circuit breakers 11 and 163. Tripping of these circuit breakers will result in a turbine trip and then a sequential trip of the generator breakers on sudden loss of generator load (100% load rejection). The control system which

4. Protection of 13.8 kV Containment Electrical Penetrations

Fuses mounted in Class 1E metal-clad fuse enclosures are provided in the feeders to the reactor coolant pump motors. These fuses are located in a seismic Category I building and are part of the protection for the containment electrical penetrations as required by Regulatory Guide 1.63. In addition, a measure of backup protection is provided by the reactor coolant pump circuit breaker and the 13.8-kV bus incoming line circuit breaker. DC control power from separate battery sources is provided for these breakers to preclude the loss of a single DC source from preventing the tripping of both the RCP and the incoming line breaker. Although these breakers are not Class 1E, the construction of the 13.8-kV switchgear is similar to the construction of the Class 1E 4-kV switchgear. Periodic testing of these breakers according to the Technical Specifications further verifies their reliability.

A fault on one of the RCP motors assuming failure of its switchgear will be isolated by the fuses provided. Backup protection is provided by the incoming feeder to the switchgear; credit is taken for the 13.8-kV breakers mentioned above to provide backup protection because if it is assumed that the seismic event damages the nonseismic qualified 13.8-kV switchgear, then it will have to be assumed that the nonseismic qualified power sources will also be damaged by the same event; thus, the circuit will be de-energized. For the penetration protection coordination curve, see Figure 8.3-47.

5. Contingency Power Source

During an extended loss of off-site power (LOP) event, emergency diesel generator EDG-1A may be aligned to provide power to 13.8 kV Buses 1 & 2 (see Figure 8.3-1). This contingency alignment is described in Subsection 8.3.1.1.b.9.

b. 4160V Distribution System

1. Arrangement

The 4160V Distribution System is shown in Figures 8.3-1, 8.3-7, 8.3-8 and 8.3-9. The system consists of four buses, two of which are the redundant Class 1E emergency buses supplying the redundant engineered safety features loads. These safety loads are divided into two separate and independent Trains A and B, as shown on Figures 8.3-8 and 8.3-9. The preferred power supply to each 4160-volt bus is from a UAT. An alternate source is available to each bus through a RAT. A standby power supply, consisting of a diesel generator, is available to each emergency bus. Buses E5 and E6 are the equipment designations of the redundant Class 1E buses.

Redundant Class 1E Buses E5 and E6 are located in completely separate, but adjacent rooms in the seismic Category I Control Building, as shown on Figure 8.3-27. Buses E5 and E6 are connected to the auxiliary transformers via non-Class 1E nonsegregated phase bus duct.

The bus duct is supported by seismically qualified supports in the Control Building. Taps in the bus duct provide the power to nonsafety-related Buses 3 and 4 from the bus duct runs to Buses E5 and E6, respectively. The tie between the nonsafety-related bus ducts and the Class 1E switchgear is through Class 1E air circuit breakers.

2. Switchgear

All Class 1E switchgear has identical electrical ratings:

(a) Buses - 2000-ampere continuous rating, braced for 80,000 amperes momentary.

(b) Incoming line breakers - 2000-ampere continuous rating, 350-MVA nominal interrupting capacity.

(c) Feeder breakers - 1200-ampere continuous rating, 350-MVA nominal interrupting capacity.

The switchgear is selected in accordance with the criteria of ANSI C37.010 and C37.4.

3. Automatic and Manual Transfers

The automatic and manual transfers of power to each bus from one source to the other are as follows:

(a) An automatic transfer from the main generator supply to the offsite source through the GSUs is accomplished by the opening of the main generator breaker; no bus breaker action is required.

(b) A manually initiated live bus transfer is provided for transferring the 4.16-kV buses from the offsite source through the GSUs to the main generator source, and vice versa, by the operation of the main generator breaker. The transfer from offsite to main generator source is contingent upon the two sources being in synchronism.

(c) The opening of the UAT incoming line breaker, either manually or automatically, initiates an automatic transfer from UAT to RAT source, provided that the RAT transformer is energized, no fault exists on the bus, and the bus voltage is in synchronism with the RAT voltage at the time of transfer initiation or has decayed to approximately 25 percent of rated voltage.

This equipment will not be exposed to or rendered inoperative by degraded voltage and, therefore, would be available to place the plant in a safe shutdown status under nonaccident conditions.

5. <u>480-Volt Substation Feeders</u>

Feeders from the 4.16-kV emergency buses are taken to 480-volt unit substations to supply the engineered safety feature loads requiring 480 volt supply. The 4.16-kV breakers feeding load centers are normally closed during the plant operation, and control is provided at the 4.16-kV switchgear. Breaker position indication is provided on the main control board.

6. <u>Bus Ties</u>

No bus ties exist between the redundant 4.16-kV emergency buses.

7. <u>Grounding, Ground Detection and Protective Relaying</u>

The 4.16-kV system is a high resistance grounded system. In addition, the diesel generator neutral is grounded through a single-phase grounding transformer. In order to detect grounds, ground sensors have been provided on each motor circuit and load center feeder and each incoming line, including the diesel generator. Inputs from ground sensors and ground detection circuits are furnished to the station computer. The computer is programmed to recognize various combinations of inputs and to provide an alarm to alert the operator of the ground fault and its location. The grounding scheme used allows single ground faults to be alarmed only, and the equipment to continue operation.

The 4.16-kV motor and load center feeders are protected by overcurrent relays with long-time characteristics and instantaneous elements. The buses and incoming feeders are protected by inverse-time overcurrent relays.

8. <u>Control Power Supplies</u>

DC power supplies, as shown on Figures 8.3-3, are used to provide power for the operation of breakers and control circuitry associated with each of the redundant 4.16-kV emergency buses.

9. <u>Contingency Connections</u>

(a) Startup Feedpump

The startup feed pump (SUFP) P-113 is normally connected to 4-kV Bus 4. Under contingency conditions, an alternate (manually initiated) feed from 4-kV Bus E5 through a Class 1E breaker is possible. This connection is shown in Figures 8.3-7 and 8.3-8.

Paralleling of the Class 1E and non-Class 1E buses will be positively prevented by an interlocking system. A two-position (Bus E5 - Bus 4) key-locked switch must be operated to be able to close the breaker on Bus E5 or Bus 4. In addition to this interlock, when the switch is placed in position "Bus E5" it will send a trip signal to the circuitry of the SUFP on Bus 4 and vice versa. Furthermore, the 4-kV breaker in Bus E5 dedicated to the alternate feed of the SUFP will be kept racked out. Should an occasion arise where it is necessary to power the SUFP from Bus E5, the operator, following procedures, will have to rack out the 4-kV breaker from the SUFP compartment on Bus 4 and rack in the breaker on Bus E5. Kirk Key interlocks assure that only one breaker can be racked in at anytime.

(b) Extended Loss of Offsite Power

An extended loss of offsite power (LOP) in the winter months such as could occur during a severe winter storm or from a Y2K grid disturbance results in concern with equipment freezing in the non-safety related balance-of-plant (BOP) areas. Heating in these areas is not supplied by an emergency power supply. An LOP at 100% power would cause a plant trip with both safety related EDGs automatically starting to supply safe shutdown loads.

As a contingency action, emergency diesel generator EDG-1A can be aligned to supply the BOP loads (e.g., heating and lighting) on the non-safety related electrical buses (see Figure 8.3-1). This alignment is administered under procedural control and can be used only after EDG-1B is verified stable and supplying the loads required to maintain the plant in a safe shutdown condition. EDG-1A is still available to supply safety-related loads if problems are encountered with operation of EDG-1B.

EDG-1A can be connected to the non-safety related electrical buses using both reserve auxiliary transformers (RAT) or only using RAT-3A and the unit substation (US) cross tie circuit breakers to supply the Bus 2 US from the Bus 1 US. A study and analysis has been performed to demonstrate the capability of EDG-1A and RAT(s) to supply the BOP loads. EDG-1A loading will be maintained within its continuous rating while supplying the BOP loads.

Because this contingency connection is not a normal system lineup, various control circuit features, some of which are discussed in Subsection 8.3.1.1.b.3(c) & (d); 8.3.1.1.b.4(a) & 8.3.1.1.e.6, must be bypassed (jumper, lifted lead, etc.) to permit EDG-1A to supply the RAT(s). Installation of the circuit bypasses will be a controlled evolution according to an approved procedure. These circuit bypasses do not degrade the electrical protection (e.g., overcurrent, differential, etc.) for EDG-1A, the electrical buses and RAT(s). The same degree of electrical protection is provided for EDG-1A, the electrical buses and RAT(s) for this contingency lineup as is available when EDG-1A is paralleled with offsite for routine surveillance testing.

Control room bypass/inop status indication per Regulatory Guide 1.47 is not required for these circuit bypasses because the LOP condition is not expected to occur more frequently than once per year. Also, EDG-1A is not required to be operable since EDG-1B is operable/operating to supply the safety-related equipment required to cope with the LOP.

After offsite power is restored and verified stable and reliable, normal offsite power connections to the plant buses can be restored. EDG-1A would be synchronized with offsite power, its circuit breaker opened and EDG-1A shut down. Subsection 8.3.1.4.a indicates that protective devices for non-Class 1E loads connected to Class 1E buses are coordinated such that failure of all of the non-Class 1E loads will not result in tripping the incoming breaker to the Class 1E bus. The RAT, Buses 1 & 2 and their connected loads are non-safety related so the Bus E5 RAT circuit breaker potentially falls under this requirement. However, since EDG-1A and Bus E5 are considered inoperable for this contingency alignment, there is no need for coordination or testing of the protective device since trip of this circuit breaker to Bus E5 would not affect loads performing a safety related function.

c. <u>480V Distribution System</u>

1. <u>Arrangement</u>

The 480V Distribution System comprises unit substations, 460-volt motor control centers, and distribution panels. The unit substations consist of a transformer and adjacent 480-volt switchgear.

The 480V Engineered Safety Features Distribution System consists of two separate and independent Trains A and B, to supply redundant engineered safety features load groups, consistent with the separation of the 4160V Engineered Safety Features Distribution System. The system configuration, shown on Figures 8.3-1 and 8.3-11 through 8.3-15, shows the motor loads and motor control centers fed from the unit substations. The loads supplied from the safety-related motor control centers are shown on Figures 8.3-16 through 8.3-26 and Figures 8.3-52 through 8.3-54.

2. Unit Substation Transformers

Transformers for 480-volt emergency buses are supplied from the 4160 volt emergency buses. The transformers are rated 1000/1333 kVA (AA/FA) and are air insulated, dry type. The transformer impedance is selected to limit the maximum short-circuit current at the 480-volt load center bus to the motor control center (MCC) breaker rating of 25,000 amperes rms symmetrical, and to maintain voltage at the motors of 414 volts (90 percent of 460) under normal operating conditions and 368 volts (80 percent of 460) during starting of motors except for unit substation E64. A lower transformer impedance is selected panels which feed loads inside the containment are all qualified to meet Class 1E requirements and are located in seismic Category I structures. 460-volt loads inside the containment are fed from distribution equipment with special provisions to satisfy the requirements of Regulatory Guide 1.63 for containment electrical penetration protection. These provisions are outlined below.

460-volt loads inside containment which are fed from unit substations, motor control centers or distribution panels are provided with one of the following special arrangements to insure that the penetration integrity is maintained:

(1) Circuits of motors 5 hp and less are provided with two identical combination starters. Both units are located in the same compartment of the MCC. See Figure 8.3-50 for typical coordination curves. The thermal overload relays identified in the figure by numbers (2) and (4) are utilized to protect the penetration from a fault whose magnitude is insufficient to trip the magnetic part of the protective device.

(2) Circuits of motors greater than 5 hp are provided with a thermal magnetic breaker in series with a combination starter. Both the breaker and the combination starter are located in the same compartment of the MCC. See Figure 8.3-49 for typical coordination curves.

(3) Feeder circuits, except for the pressurizer heater circuits, are provided with two identical thermal magnetic breakers. Both breakers are located in the same compartment of the MCC or panel.

(4) Feeder circuits for the pressurizer heater Groups A and B circuits are provided with fuses in series with an air circuit breaker. Feeder circuits for the pressurizer heater Groups C, D, and E are provided with dual fuses. The fuses are located in panels and the air circuit breakers are located in unit substations.

The motor control centers and unit substations containing these special protective devices are located in the Control Building switchgear area, with one exception. The panels for the pressurizer heater circuits are located in the electrical penetration area outside the containment. Both the primary and the backup protective devices are qualified 1E devices.

There are no high or moderate energy lines in the above areas; therefore, only faults within the electrical devices could conceivably damage these protective devices. If a protective device fails catastrophically while clearing a short circuit, the second protective device may possibly be affected because of its proximity. However, in this instance, no penetration damage can occur because all short-circuit current flow will be diverted to the new fault located at the protective device. Therefore, there is no conceivable electrical failure that could prevent both the protective devices from operating and at the same time allow the fault current to flow through the penetration.

460-volt loads inside the containment, which are fed directly from the 480-volt unit substation, satisfy the requirements of Regulatory Guide 1.63 by utilizing the load breaker as primary protection and the unit substation incoming feeder breaker as backup protection. See Figure 8.3-48 for an example with the containment structure cooling units.

Feeders for 460-volt distribution panels (lighting panels), located inside containment are provided with two thermal magnetic molded-case breakers in series to satisfy the requirements of Regulatory Guide 1.63.

460-volt loads inside the containment which are normally used only during shutdown (e.g., cranes, refueling machines, welding receptacles, etc.) are not provided with redundant protection because their circuits are de-energized and padlocked at the unit substation or motor control center during normal plant operation. Verification of the circuits being de-energized is part of the Technical Specifications. Though some of these time ("definite start loads"; see Tables 8.3-1 and 8.3-2, Sheet 1 of 2). Maintained permissive contacts are provided for loads whose starting is also dependent upon the presence of a process signal ("indefinite start loads"; see Tables 8.3-1 and 8.3-2, Sheet 2 of 2).

The indefinite start loads assigned to the first load step at the 12-second time sequence point are not interlocked with a sequence timer contact and may, therefore, be loaded on the diesel generator at any time. By assigning these loads to the first load step in Tables 8.3-1 and 8.3-2, they are assumed to start at that time or anytime thereafter throughout the loading sequence. This first step is the most heavily loaded step and, therefore, is the limiting step. If these loads start randomly at any other time, other than at the first step, they will have less impact on the diesel generator loading capability. Indefinite start loads assigned to steps at the 17, 32, 52 and 120-second intervals are interlocked with sequencer timing contacts to prevent these loads from starting prior to their assigned sequence point. As in the first step, these loads may start at any time after their assigned step.

Indicating lights for the sequencing steps are provided on the main control board to assist operation. Loading is started when the diesel generator reaches rated speed and voltage and the generator circuit breaker closes (approximately 10 seconds after the diesel start signal).

Table 8.3-1 shows the order and time at which the loads are automatically and sequentially applied to the diesel generator during a combined loss of offsite power and accident condition.

During the diesel generator load sequence testing, which is performed at least every 18 months, the design accident load will be tested by simulating a loss of offsite power with a safety injection signal. In this way, the test will simulate the load of Table 8.3-1 as close as practical.

Table 8.3-2 shows the order and time at which loads are automatically and sequentially applied to the diesel generator during a loss of offsite power.

Whenever a tower actuation (TA) signal is received, the cooling tower pumps receive an automatic start signal and the service water pumps are automatically tripped and blocked from starting until the TA signal is reset.

As noted on Tables 8.3-1 and 8.3-2, either the cooling tower pump or the service water pump, but not both, will be loaded on the diesel generator. Upon loss of offsite power, all service water pumps and cooling tower pumps receive a trip signal. At sequence interval 52 seconds (step 8), both the cooling tower pump and the service water pump receive a start permissive from the EPS. If a TA signal is also present, the cooling tower pump will start; otherwise the service water pump will start.

The diesel generator has been tested and/or analyzed to demonstrate its ability to successfully start a load larger than the 800-hp cooling tower pump at the 52-second loading sequence interval.

During the diesel generator loading process, 4160 and 480-volt emergency bus undervoltage tripping circuits are disabled to prevent inadvertent tripping due to momentary voltage dips caused by application of large motor loads. If for any reason the diesel generator breaker trips open during or subsequent to the loading process, undervoltage tripping is restored and the bus is cleared, as in the original loss of offsite power. Upon reclosing of the diesel generator breaker, the loading process is re-initiated and proceeds as before.

The diesel generator is also capable of starting and powering the startup feed pump (SUFP) P-113 when carrying the maximum Train A load listed in Table 8.3-1. In addition, operating procedures for establishing the alternate supply to the SUFP (refer to Subsection 8.3.1.1b.9) will require that the operator verify diesel generator loading to ensure that adequate margin is available for running this pump. There is also an emergency power sequencer interlock to permit SUFP operation on the diesel generator only after load sequencing has been completed. Subsection 8.3.1.1.b.9 also describes a contingency alignment where emergency diesel generator EDG-1A may be aligned to provide power to the non-safety related electrical buses.

In the event of a safety injection signal, the diesel generators are automatically started and operated at idle. Should the offsite power supply subsequently fail, the diesel generators are automatically connected to the emergency buses and the loading sequence as described in Table 8.3-1 is initiated.

Upon receipt of an automatic diesel start signal (LOP or SI) during load testing, the diesel generator breaker is automatically tripped, and the diesel generator continues to run. The diesel generator controls, including voltage regulator control, is automatically returned to the Automatic Control System. Should this be accompanied by a loss of offsite power, relays sense the loss of voltage on the emergency bus and respond by initiating the loading sequence described in Table 8.3-1.

maximum voltage practically obtainable, and under plant heavy-load conditions to simulate the minimum voltage practically obtainable (reference Subsection 14.2.7, exceptions to Regulatory Guide 1.68).

j. <u>Provisions for Periodic Testing and Maintenance</u>

The onsite AC distribution system for engineered safety features loads is designed and installed to permit periodic inspection and testing in accordance with General Design Criterion 18, IEEE Standard 308-1971, Regulatory Guide 1.118, Rev. 2, and IEEE 338-1975 (except as noted in Subsections 8.1.5.2 and 8.1.5.3) to ensure:

1. The operability and functional performance of the components of the system, and

2. The operability of the system as a whole under design conditions.

Switchgear and accessories for the Auxiliary Power System are easily accessible for inspection and testing.

The 13.8-kV, 4160-volt and 480-volt switchgear circuit breakers may be tested when the individual equipment is de-energized. The breakers can be placed in the test position and tested functionally.

The first and second level undervoltage schemes (see Subsection 8.3.1.1b.4) are designed to permit periodic testing during normal plant operation.

Breakers for engineered safety features auxiliaries are exercised on a schedule similar to that for the auxiliaries controlled by the breakers. Transfer schemes can be exercised during normal operation, or by simulation of the necessary conditions. Timing checks can be performed on transfer schemes. Protective relays are provided with test plugs or test switches to permit testing and calibrating the devices.

Containment penetration conductors overcurrent-protective devices are periodically tested according to the requirements of the Technical Specifications.

The control circuits of the emergency diesel generators are designed to permit testing during operation of the plant as well as while the plant is shut down. Periodic tests are performed to demonstrate the availability and capability of the unit to perform its intended function. These tests are performed in accordance with Regulatory Guide 1.108, with clarification as explained in Subsection 8.1.5.3.

This periodic testing also provides input to the Maintenance Rule EDG performance criteria which support the target reliability levels required for the Station Blackout analysis (see Section 8.4.2).

Station procedures require fully loaded operation during routine diesel surveillance testing. This guards against the accumulation of incomplete combustion product buildup in the engine and exhaust systems.

During extended no-load or light-load operation (less than 20% load), the diesel will be loaded to a minimum of 50% load for one hour following each six hours of continuous no-load or light-load operation.

During troubleshooting, no-load operation will be minimized. If the troubleshooting operation takes place over an extended period of time (i.e., greater than four hours), the engine will be loaded to a minimum of 25% load for at least 30 minutes.

The Emergency Power Sequencer (EPS) is designed to permit periodic testing of the sequencer logic during operation of the plant. During the EPS test, combinations of EPS inputs are simulated and the corresponding EPS outputs are verified. During this testing, the continuity of the actual EPS output relay coils is verified and the accuracy of the interval between each sequence step is determined. If a bona fide EPS input is received during EPS testing, testing ceases and the EPS automatically performs its design function.

Every 18 months the actual input and output relays of the EPS are tested as part of the diesel generator load testing program.

k. Lightning Protection

Adequate lightning protection for all structures is provided by a system of air terminals, coursing and down conductors which are connected to the Plant Grounding System.

Lightning protection for the onsite AC distribution system is provided by a combination of metal-enclosed bus design and careful placement of lightning arrestors in the critical areas.

From the point where the 345-kV transmission lines drop down to make the transition to gas-insulated metal-enclosed bus, all outdoor power buses at 345 kV, 25 kV, 13.8 kV and 4.16 kV are of metal enclosed design. These metal enclosures are solidly connected to the plant ground system.

and the overspeed trip set point, which is set at 110.7 percent of nominal speed.

Diesel generator protective trips, other than engine overspeed, generator differential current, 4.16-kV bus fault and low lube oil pressure, are bypassed during accident conditions. For more information on design and testing of the bypass circuitry, refer to Subsection 8.3.1.1e. Generator overcurrent and reverse power have a common alarm in the main control room. Loss of field, high lube oil temperature, and high jacket coolant temperature each have a separate alarm in the control room. The station computer provides information as to which protective trip is activated first.

Periodic testing of the diesel generator is in accordance with Regulatory Guide 1.108, with clarification as explained in Subsection 8.1.5.3.

3. Regulatory Guide 1.32 - Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants

Two immediate access circuits are available from the transmission network to the Class 1E Emergency Distribution System.

4. Regulatory Guide 1.63 - Electric Penetration Assemblies in Containment Structures for Water-Cooled Nuclear Power Plants

The electric penetration assemblies are designed to withstand, without loss of mechanical integrity, the maximum fault current vs. time conditions that could occur as a result of single random failures of circuit overload devices. The 600-volt system X/R ratio used in specifying the electrical penetrations is 4. Calculations show that this value is conservatively applied because the actual ratio is considerably less than 4.

To preclude damage to electric penetrations due to single failures of circuit overload protection devices, each penetration circuit, with the exception of CRDM, 15-kV instrumentation and low energy circuits, is provided with dual Class 1E overload protective devices. Seismically qualified Class 1E fuses protect 15-kV penetrations. Additional protection is provided by two non-Class 1E breakers in series. These breakers are coordinated and derive their control power from different batteries. For more details refer to Subsections 8.3.1.1a and 8.3.1.1c.

5. Regulatory Guide 1.75 - Physical Independence of Electric Systems

The design is consistent with the criteria for physical independence of electric systems established in Attachment C of AEC (NRC) letter dated December 14, 1973. Attachment C which is incorporated as Appendix 8A, is in general conformance with Regulatory Guide 1.75.

For clarification of position C4 as it relates to associated circuits, refer to Updated FSAR Subsection 8.1.5.3b.

The Seabrook cable and raceway separation criteria (see Updated FSAR Subsection 8.3.1.4) is a combination of the standard criteria given in Attachment C of AEC Letter dated December 14, 1973 (see Updated FSAR Appendix 8A) and IEEE 384-1974 and criteria established by analysis and testing as permitted by Attachment C and IEEE 384-1974.

Physical separation and identification of circuits are described in detail in Subsections 8.3.1.3 and 8.3.1.4, respectively.

c. Compliance to Branch Technical Position PSB-1 - Adequacy of Station Electric Distribution System Voltages

1. Position B1

An acceptable alternative to the second level undervoltage protection system described in Position 1 is provided. This alternative system is described in Subsection 8.3.1.1b.4(b).

2. Position B2

The Seabrook Station design meets Position 2 of Branch Technical Position PSB-1 except as noted below. The bypass of the load shedding feature during sequencing, and its restoration in the event of a subsequent diesel generator breaker trip, is discussed in Updated FSAR Subsection 8.3.1.1e.6. In addition, the load shed feature is reinstated after load sequencer action when the operator resets the sequencer override pushbutton. This action permits the operator to reassume control of diesel generator loading.

Position 2 specifies that the Technical Specifications must include a test requirement to demonstrate the operability of the automatic bypass and reinstatement features at least once per 18 months during shutdown. During development of Seabrook Station's Technical Specifications, the NRC deleted this test requirement.

3. Position B3

The voltage regulation study was performed to meet the requirements of position 3. The voltage levels at the safety-and nonsafety-related buses are optimized for full load and minimum load conditions that are expected throughout the anticipated range of voltage variations of the offsite power source by appropriate adjustment of the voltage tap settings of the station transformers.

4. Position B4

The analytical techniques and assumptions used in the voltage analysis cited in item 3 (Position B3) above have been verified by actual measurement as part of the pre-operational test program. The guidelines of Position 4 of Branch Technical Position PSB-1 have been followed and good correlation between the analytical results and the test results have been demonstrated.

Seabrook Station's commitment to perform this testing is also described in Subsection 14.2.6, which describes Seabrook Station's interpretation of Regulatory Guide 1.68, Appendix A, Section 1.g.

d. Environmental Effects on Electric Equipment

All equipment that must operate in a hostile environment during and/or subsequent to a design-basis event are identified with their ambient environmental conditions, and their qualifications are discussed in Section 3.11.

e. Effects of Submergence on Electrical Equipment

Analysis has been performed to determine the effects of submergence as a result of a LOCA on electrical equipment. The results of this study indicate no detrimental effect upon the Class 1E electrical power sources as a result of submergence of electrical equipment following a LOCA.

8.3.1.3 Physical Identification of Safety-Related Equipment

All cables, raceways and safety-related equipment are assigned to a particular channel or train. There are two redundant trains of power and controls, and four redundant channels of instrumentation. Each channel or train is assigned a particular color, as shown below:

Separation Group		Equipment Nameplate	Raceway Tag	Cable Color
A.	Channel I and Train A Train A Associated	Red Black	Red	Red Black w/Red Tracer
B.	Channel II and Train B Train B Associated	White Black	White	White Black w/White Tracer
C.	Channel III	Blue	Blue	Blue
D.	Channel IV	Yellow	Yellow	Yellow

The equipment nameplate colors described above represent the color assigned to identify each separation group. In the original nameplate design, the nameplate background color was used to identify the separation group. As a result of labeling improvements, including the addition of bar codes, a redesign of the background color was required. Newer nameplates may use different methods, such as black letters on a white background with a border color that identifies the separation group. In this way, the same basic separation group color is maintained for different nameplate styles.

Each piece of electrical equipment is marked with the node number indicated on the design drawings, in the particular color corresponding to the channel or train to which that equipment is assigned. Similarly, trays and exposed conduits are marked with color-coded markers. The cable jacket color code serves as its identification. The operator or maintenance craftsman needs only to observe the color of the nameplate of any piece of equipment or the cable jacket color to determine which channel or train it serves. For exceptions to the above cable and raceway identification criteria, see Subsection 8.3.1.4k. For additional information on physical identification of safety-related equipment, see Subsection 7.1.2.3.

8.3.1.4 Independence of Redundant Systems

a. General

Seabrook Station complies with the requirements of Updated FSAR Appendix 8A, IEEE 384-1974 and Regulatory Guide 1.75, Rev. 2. These documents describe acceptable methods of complying with IEEE 279-1971 and Criteria 3, 17 and 21 of Appendix A to 10 CFR Part 50 with respect to the physical independence of the circuits and electrical equipment comprising or associated with the Class 1E power system, the protection system, systems actuated or controlled by the protection system, and auxiliary or supporting systems that must be operable for the protection system and the systems it actuates to perform their safety-related functions. Preservation of independence of redundant systems within the control boards and all other field-mounted racks is discussed in Subsection 7.1.2.2.

The design, construction, and installation of the penetration assemblies are in accordance with IEEE 317 and Regulatory Guide 1.63. (See Subsections 8.1.5.3, 8.3.1.1, and 8.3.1.2 for further details on compliance to Regulatory Guide 1.63.)

k. Cable and Raceway Identification

The computerized conduit and cable schedule provides a permanent record of the routing and termination of cables. Circuit level coding identifies the individual channel or train assigned to each raceway and cable. These data are entered into the conduit and cable program, which in turn produces reports designating the unique number with origin, destination, channel or train, and specific path for every cable. Every cable is identified by a tag affixed at each end, bearing the unique cable number.

Each channel or train is assigned a particular color, as described in Subsection 8.3.1.3.

All safety-related cables have jackets of the color assigned to the particular channel and train so there is no difficulty in distinguishing between cables of redundant channels. Nonsafety-related cables are associated with either Train A or B and have black jackets with a red trace for cables associated with Train A and a white trace for cables associated with Train B. It is immediately evident to the operator or maintenance man, by observing the color of the cable jacket, that a given cable is safety-related and that it is a particular channel or train. This system also prevents placing a cable of one channel or train with cables of another, by the obvious dissimilarity of jacket color. For SF-P10C, which can be powered from either the A or B train emergency bus, an exception has been taken to the general color code convention. The color code of the common cable is selected as Train A.

Per UFSAR Appendix 8A Section 5.1.2, cables were color coded to facilitate initial verification that the installation was in conformance with the separation criteria. Per cable specifications, cable color was only guaranteed for 10 years. In the event that certain cable colors change with age, example: white cables may yellow with age, the separation group can still be identified by the cable code that is printed on the jacket, or by the permanent identification tag at both ends of every cable.

Alternate methods of color coding cable have been made necessary by government regulations restricting the use of paints due to environmental concerns. New installations of safety-related cables may have black jackets stamped with their assigned color at intervals along their length. These cables will be further identified by the application of colored tape at both ends.

Each cable is further identified by a footage and cable code on the jacket of the cable at intervals of approximately five feet.

Reference to pulling records reveals the cable number, routing, separation, circuit type, and use of any cable at any accessible point in the raceway system where the footage marker and cable code can be identified.

Exceptions to the above cable identification criteria exist for vendor-supplied specialty cables for the Radiation Monitoring System continued independence and separation so that the loss of DC supply to either train does not prevent the minimum safety function of the other train from being performed.

One nonsafety-related inverter for the station computer is powered from the Train A DC system through a Class 1E breaker on Bus 11C. One nonsafety-related DC power panel is powered from the Train B DC system through a subfeed from safety-related DC power panel PP-111B. All remaining nonsafety-related loads (DC motors, other nonsafety-related inverters, nonvital control panels) are connected to the nonsafety-related batteries (Figure 8.3-38).

b. Station Battery Capacity

The safety-related station batteries are lead-calcium, power station type. Each battery consists of 59 cells, and has a nominal 8-hour rating of 2280-ampere hours.

Each safety-related battery is sized to supply its safety-related and nonsafety-related loads for the durations indicated in Table 8.3-5. Battery B-1C is capable of providing power to the nonvital computer inverter, I-2A, for 15 minutes while supplying its safety-related loads; the inverter load is automatically disconnected from the DC system after the 15-minute period. This disconnection is accomplished by a safety-related trip circuit on the Class 1E breaker feeding inverter I-2A. This circuit, which monitors the time the inverter draws power from the battery, is testable.

In addition, each safety-related battery is sized to have sufficient capacity to serve as the source, for the duration indicated in Table 8.3-5, for two load groups of the same train during the period when one battery is out of service (see Figure 8.3-37). Figure 8.3-51 shows the separate and combined load profiles for the safety-related batteries.

The safety-related station batteries also have sufficient capacity for the four-hour Station Blackout coping duration assuming that loads not needed to cope are shed from the DC buses. The loads to be shed are listed in plant procedures. The Station Blackout battery sizing evaluation includes the one battery/two bus configuration (see Section 8.4.4.2).

There are two nonsafety-related batteries (B-2A and B-2B) provided in the Turbine Building. The nonsafety-related station batteries are lead calcium, power station type, consisting of 59 cells. Battery B-2A supplies various DC motors for the turbine auxiliaries, various control panels and the Turbine Building DC lighting. Battery B-2B supplies the computer inverter I-2B, the nonvital instrument inverter I-4, Control Building DC lighting and various control panels.

Each Class 1E battery was sized in accordance with the recommended practices in IEEE Standard 485-1978. These practices were applied as follows:

1. The system maximum voltage (140 volts) and maximum equalizing cell voltage (2.33V per cell) were selected. This resulted in a selection of 59 cells which include margin between the equalizing voltage (137.5V), and the system's maximum voltage.

2. A duty cycle diagram was developed, based upon the combined known and anticipated loads for both DC buses of the same train (see Figure 8.3-51).

3. The battery capacity data were selected from the manufacturer's data, based upon the minimum cell voltage (1.78V per cell permitted by the system minimum voltage of 105V).

4. The calculated minimum required cell size was increased by 25 percent for end-of-life compensation.

5. Temperature correction factors were applied to the calculated minimum required cell size, to allow for operation at the minimum design temperature (65°F for batteries B-1A and B-1C, and 60°F for batteries B-1B and B-1D). These temperatures also apply to Station Blackout.

6. Sizing calculations were performed using methods similar to Figure 3 of IEEE 485-1978 to determine the minimum required cell size.

7. A minimum design margin of 15 percent was included in the original battery purchase specification calculated cell size to allow capacity for future loads.

c. <u>Battery Charging</u>

Power for each DC distribution bus is normally supplied through a battery charger dedicated to that bus. Each safety-related battery charger is rated for 150 amps and has been sized to charge its associated battery from the design discharged state (i.e. the state of a battery following a service discharge test) back to the charged state while carrying the largest combined demand of the steady-state loads under all plant operating conditions. If the battery has reached the design minimum charge state (i.e., the state of a battery following a performance discharge test), the charger will restore the battery back to the fully charged state while carrying the largest combined demand of the steady-state loads under all plant operating conditions. Transient emergency peak loads are adequately carried with assistance from the battery if these loads exceed the charger full load output capability.

Each cell is maintained on a float-charge of 2.23 volts. The battery manufacturer's data indicate that when this type cell is float-charged above 2.20 volts per cell it requires little or no equalizing charge. If equalizing is required, the cell voltage will be raised to 2.33 volts per cell (137.5 volts total). Equalized charging of each battery can be provided by the dedicated battery charger with the battery connected to the bus. All DC equipment has been specified and purchased with a maximum operating voltage of 140 volts DC.

Each charger is fed from a separate 460-volt emergency motor control center. On loss of the normal and preferred power supplies, the chargers are energized by standby power. See standby power supply loading sequence charts, Tables 8.3-1 and 8.3-2.

During the period when a charger requires maintenance, a portable spare charger can be used to replace the normal charger. The spare charger can be positioned adjacent to the charger it is replacing. 460V AC power is supplied to the portable battery charger by means of a plug and receptable connection. The portable charger is connected to the same power train as the fixed charger it is replacing. Alarms from this unit replace the alarms from the fixed charger.

In addition to being used as a one-for-one replacement for a normal charger that is taken out of service, the portable chargers can also be used during the performance of safety-related charger surveillance tests or to recharge the station safety-related batteries following on-line battery maintenance and testing. During this mode of operation, the portable chargers are operated coincident with the normal chargers. Maintenance and test activities on the nonsafety-related chargers and batteries do not require that the portable chargers be operated coincident with the normal chargers. When a portable charger is used for an application other than the replacement of a normal charger, only the local alarms on the portable charger are functional.

d. DC Power System Loading

The safety-related portions of the DC loads are divided into redundant load groups, as listed in Table 8.3-5 and detailed on Figure 8.3-37, Figures 8.3-39 through 8.3-42 and Figures 8.3-58 through 8.3-61. The batteries are sized to accommodate both the safety and nonsafety loads, as noted in Subsection 8.3.2.1b. The operator may manually load shed selected loads to extend the discharge time, if required. Load shedding is required to meet the four-hour Station Blackout duration (see Section 8.4.4.2). Two low voltage alarms, a battery ammeter and a DC bus voltmeter are available in the control room for each DC bus to aid the operator in this decision.

e. DC Power System Testing

The batteries and other equipment associated with the DC system are easily accessible for periodic testing and inspection. Surveillance and testing are performed in accordance with the plant Technical Specifications in compliance with the guidelines of IEEE Standard 338, 450, Regulatory Guides 1.118 and 1.129 except as described in Subsections 8.1.5.2 and 8.1.5.3.

The preoperational testing of the safety-related portion of the DC system has been performed in accordance with Regulatory Guides 1.68 and 1.41.

b. Compliance with Regulatory Guides

1. Regulatory Guide 1.6 - Independence Between Redundant Standby Power Sources and Between their Distribution Systems

The safety-related portion of the station DC system includes four batteries. The redundant safety-related load groups are each fed by a separate battery and battery charger. There is no provision for automatically connecting one battery-charger combination to any other redundant load group, nor is there any provision for interconnecting batteries either manually or automatically. To further enhance safety and reliability, two DC supply buses of the same train may be connected together manually, but circuit breaker interlocks prevent an operator error which would parallel two batteries. (See Figure 8.3-37).

2. Regulatory Guide 1.32 - Criteria for Safety Related Electric Power Systems for Nuclear Power Plants

The design is consistent with the requirements of this regulatory guide. For details, refer to Subsections 8.3.2.1c and 8.3.2.1e except as noted in Subsection 8.1.5.3.b.

3. Regulatory Guide 1.75 - Physical Independence of Electric Systems

The design is consistent with the criteria for physical independence of electric systems established in Attachment C of AEC letter dated December 14, 1973. Attachment C is incorporated as Updated FSAR Appendix 8A and is considered similar to Regulatory Guide 1.75.

For clarification of position C4 as it relates to associated circuits, refer to Updated FSAR Subsection 8.1.5.3b.

The Seabrook cable and raceway separation criteria (see Updated FSAR Subsection 8.3.1.4) is a combination of the standard criteria given in Attachment C of AEC Letter dated December 14, 1973 (see Updated FSAR Appendix 8A) and IEEE 384-1974 and criteria established by analysis and testing as permitted by Attachment C and IEEE 384-1974.

4. Regulatory Guide 1.129 - Maintenance, Testing and Replacement of Large Lead Acid Storage Batteries for Nuclear Power Plants

For compliance to this regulatory guide, refer to Subsection 8.3.2.1e.

5. Regulatory Guide 1.155 - Station Blackout

The design is consistent with the requirements of this Regulatory Guide. The safety-related station batteries have sufficient capacity for the four-hour Station Blackout coping duration assuming that loads not needed to cope are shed from the DC buses. The loads to be shed are listed in plant procedures (see Section 8.4.4.2).

c. Compliance with IEEE 308, Class 1E Electric Systems

The station DC system conforms to the requirements of IEEE 308 except as noted in Subsection 8.1.5.2. The power supplies, distribution system, and load groups (see Subsection 8.3.2.1) are arranged to provide direct current electric power to the Class 1E direct current electric loads, and for the control and operation of the Class 1E systems. Sufficient physical separation, electrical isolation, and redundancy are provided to prevent the occurrence of common failure modes in the Class 1E systems.

d. Conformance with Appropriate Quality Assurance Standards

The equipment of the DC system conforms to the controls for electrical equipment listed in Chapter 17.

e. Independence of Redundant Systems

The criteria and bases of minimum requirements to preserve the independence of redundant Class 1E electric systems are those outlined in the General Design Criteria and IEEE 308. Safety loads are divided into redundant groups and equipment is physically separated from its redundant counterpart to prevent the occurrence of a common failure mode.

Batteries are in individual rooms, and chargers and distribution equipment are separated by physical barriers, as indicated on Figure 8.3-27.

The criteria and bases for the installation of raceways and electrical cable for this system are the same as those listed for the AC power system in Subsection 8.3.1.4. Train separation throughout the safety-related portions of the plant is indicated on Figures 8.3-36, 8.3-43 and 8.3-44, which shows electrical arrangements at the three critical elevations.

f. Physical Identification of Safety-Related Equipment

The methods used to physically identify the DC safety-related equipment to assure its appropriate treatment is the same as that for the AC safety-related equipment listed in Subsection 8.3.1.3.

Identification systems distinguish between redundant separation groups; it is clearly evident to the operator or maintenance craftsman which equipment is safety-related and, if safety-related, which separation group is involved.

TABLE 8.3-1
(Sheet 1 of 5)

DIESEL GENERATOR LOADING SEQUENCE
SAFEGUARD SIGNAL WITH LOSS OF OFFSITE POWER

DEFINITE START LOADS

QTY	SEQUENCED LOAD	HP	BHP	kW	INRUSH kVA	kW AT VARIOUS TIMES 12 SEC	17 SEC	22 SEC	27 SEC	32 SEC	37 SEC	42 SEC	47 SEC	52 SEC	62 SEC	72 SEC	120 SEC	OPERATING TIME DURATION (Note 3)
1	Charging Pump	600	690	554	3552	554	554	554	554	554	554	554	554	554	554	554	554	1 Day
	*Lighting & Misc Dist Panels (A)	422.1 kVA(Total)		375		375	375	375	375	375	375	375	375	375	375	375	375	7 Days
	*Lighting & Misc Dist Panels (B)	200 kVA(Total)		180		180	180	180	180	180	180	180	180	180	180	180	180	7 Days
1	*Plant Vent WRGM Rad Monitoring (A)	7.5 kVA		8		8	8	8	8	8	8	8	8	8	8	8	8	7 Days
1	*DG Prelube/Filter Oil Pump	15		13	96	13	13	13	13	13	13	13	13	13	13	13	13	7 Days
1	Contm Encl Emerg Exh Fltr Fan	7.5		7	118	7	7	7	7	7	7	7	7	7	7	7	7	7 Days
1	Contm Struct Recirc Fltr Fan	30	24.9	20	237	20	20	20	20	20	20	20	20	20	20	20	20	7 Days
2	Inverters (NSSS)	7.5 kVA		17		17	17	17	17	17	17	17	17	17	17	17	17	7 Days
1	*DG Crankcase Exhauster Fan	3		3	30	3	3	3	3	3	3	3	3	3	3	3	3	7 Days
1	Inverter (BOP)	25 kVA		33		33	33	33	33	33	33	33	33	33	33	33	33	7 Days
3	Unit Sub Xfmr Losses (A)	15 kW		45		45	45	45	45	45	45	45	45	45	45	45	45	7 Days
4	Unit Sub Xfmr Losses (B)	15 kW		60		60	60	60	60	60	60	60	60	60	60	60	60	7 Days
1	*5 kV Swgr Aux Bus (A)	15 kVA		15		15	15	15	15	15	15	15	15	15	15	15	15	0 Days
	Cable Losses	60 kW		60		60	60	60	60	60	60	60	60	60	60	60	60	7 Days
1	Control Bldg Batt Rm Exh Fan	5	2.55	2	38	2	2	2	2	2	2	2	2	2	2	2	2	7 Days
1	*TG Main Seal Oil Pump (A)	20		18	116	18	18	18	18	18	18	18	18	18	18	18	18	7 Days
1	*TG Recirc Seal Oil Pump (A)	7.5		7	51	7	7	7	7	7	7	7	7	7	7	7	7	7 Days
1	Ctl Rm Emerg Clean-Up Fltr Fan (A)	15	5.1	5	84	5	5	5	5	5	5	5	5	5	5	5	5	7 Days
1	Ctl Rm Emerg Clean-Up Fltr Fan (B)	5	5	5	35	5	5	5	5	5	5	5	5	5	5	5	5	7 Days
10	Motor Operated Valves (A)	14.22 (Total)		20	146	20	20	20	20	20	20	20	20	20	20	20	20	1 Hour
9	Motor Operated Valves (B)	12.32 (Total)		17	125	17	17	17	17	17	17	17	17	17	17	17	17	1 Hour
1	Contm Encl Cooling Fan	125	109	88	682	-	88	88	88	88	88	88	88	88	88	88	88	7 Days
1	Contm Encl Return Air Fan	60	50.7	41	326	-	41	41	41	41	41	41	41	41	41	41	41	7 Days
1	DG Room Supply Air Fan	50	39.7	34	547	-	34	34	34	34	34	34	34	34	34	34	34	7 Days
1	DG Room Return Air Fan	40	34.1	28	274	-	28	28	28	28	28	28	28	28	28	28	28	7 Days
1	Safety Injection Pump	450	470	378	3050	-	378	378	378	378	378	378	378	378	378	378	378	1 Day
1	Residual Heat Removal Pump	400	435	347	2233	-	-	347	347	347	347	347	347	347	347	347	347	7 Days
1	Containment Spray Pump	600	500	396	3559	-	-	-	396	396	396	396	396	396	396	396	396	28 Hours
1	Pri Comp Cooling Water Pump	700	690	545	3949	-	-	-	-	545	545	545	545	545	545	545	545	7 Days
1	Fuel Storage Bldg Filter Fan	60		53	653	-	-	-	-	53	53	53	53	53	53	53	53	7 Days
1	Cooling Tower Pump (Note 1)	800	755	609	5096	-	-	-	-	-	-	-	-	609	609	609	609	7 Days
1	Service Water Pump (Note 1)	600	560	453	4017	-	-	-	-	-	-	-	-	-	-	-	-	0 Days
1	Emergency Feedwater Pump (B)	900	850	669	5051	-	-	-	-	-	-	669	669	669	669	669	669	1 Day
1	Control Room A/C Panel-Fans	82kVA		66	462	-	-	-	-	-	66	66	66	66	66	66	66	7 Days
1	Control Room A/C Pump	15		13	94	-	-	-	-	-	13	13	13	13	13	13	13	7 Days

TABLE 8.3-1
(Sheet 2 of 5)

DIESEL GENERATOR LOADING SEQUENCE
SAFEGUARD SIGNAL WITH LOSS OF OFFSITE POWER

DEFINITE START LOADS

QTY	SEQUENCED LOAD	HP	BHP	kW	INRUSH kVA	12 SEC	17 SEC	22 SEC	27 SEC	32 SEC	37 SEC	42 SEC	47 SEC	52 SEC	62 SEC	72 SEC	120 SEC	OPERATING TIME DURATION (Note 3)
						kW AT VARIOUS TIMES												
1	*Switchyard Station Service (A)	306 kVA		275		-	-	-	-	-	-	-	-	-	-	275	275	5 Days
2	*Turb Bldg Battery Chargers (A)	36 kVA		58		-	-	-	-	-	-	-	-	-	-	-	58	7 Days
2	Ctl Bldg Battery Chargers	36 kVA		58		-	-	-	-	-	-	-	-	-	-	-	58	7 Days
1	Portable Battery Charger	36 kVA		29		-	-	-	-	-	-	-	-	-	-	-	29	7 Days
1	*TB Computer Rm A/C Unit (A)	24.6 kVA		24	63	-	-	-	-	-	-	-	-	-	-	-	24	7 Days
2	*Inverters (A)	30 kVA		60		-	-	-	-	-	-	-	-	-	-	-	60	7 Days
1	*Inverter (A)	32 kVA		32		-	-	-	-	-	-	-	-	-	-	-	32	7 Days
1	*Radiation Mon Dist Pnl (A)	9.0 kVA		8		-	-	-	-	-	-	-	-	-	-	-	8	7 Days
1	*Ctl Bldg Cable Spread Rm Sup Fan (A)	10	9.2	8	65	-	-	-	-	-	-	-	-	-	-	-	8	7 Days
1	*Ctl Bldg Cable Spread Rm Ret Fan (A)	10	6.7	6	65	-	-	-	-	-	-	-	-	-	-	-	6	7 Days
1	Ctl Bldg Swgr Area Supply Fan (A)	60	38.8	34	653	-	-	-	-	-	-	-	-	-	-	-	34	7 Days
1	Ctl Bldg Swgr Area Return Fan (A)	40	29.4	24	231	-	-	-	-	-	-	-	-	-	-	-	24	7 Days
1	Ctl Bldg Swgr Area Supply Fan (B)	40	20.0	17	231	-	-	-	-	-	-	-	-	-	-	-	17	7 Days
1	Ctl Bldg Swgr Area Return Fan (B)	20	8.93	8	195	-	-	-	-	-	-	-	-	-	-	-	8	7 Days
1	*Cable Tunnel Exhaust Fan (A)	10	9.1	8	65	-	-	-	-	-	-	-	-	-	-	-	8	7 Days
	Definite Start Load Addition This Period - Train A					1202	569	347	396	598	79	0	0	609	0	275	347	
	Definite Start Load Addition This Period - Train B					971	569	347	396	598	79	669	0	609	0	0	112	

(A) - Train A Only
(B) - Train B Only

Notes

1. Cooling Tower Pump or Service Water Pump, not both, will be loaded on the DG. Cooling Tower Pump load is larger and is therefore listed.

2. Startup FW Pump may be manually connected to Train A diesel generator under contingency conditions.

3. Operating time duration is based on the expected cumulative run times of the various loads with consideration given to the 7 day diesel generator fuel oil system minimum volume.

* Non Class 1E Loads ("Lighting & Misc Dist Panels" includes both Class 1E and Non Class 1E loads.)

TABLE 8.3-1
(Sheet 3 of 5)

DIESEL GENERATOR LOADING SEQUENCE
SAFEGUARD SIGNAL WITH LOSS OF OFFSITE POWER

INDEFINITE START LOADS

QTY	SEQUENCED LOAD	HP	BHP	kW	INRUSH kVA	kW AT VARIOUS TIMES 12 SEC	17 SEC	22 SEC	27 SEC	32 SEC	37 SEC	42 SEC	47 SEC	52 SEC	62 SEC	72 SEC	120 SEC	OPERATING TIME MANUAL START	DURATION (Note 3)
1	SW PP House Exhaust Fan	15	14.1	12	92	12	12	12	12	12	12	12	12	12	12	12	12		1 Day
1	SW Swgr Rm Supply Fan	2	1.55	2	15	2	2	2	2	2	2	2	2	2	2	2	2		1 Day
1	Emerg FW PP Bldg Intake Fan	5	2.7	3	33	3	3	3	3	3	3	3	3	3	3	3	3		2 Days
1	PAB Aux Supply Air Fan	5	2.9	3	38	3	3	3	3	3	3	3	3	3	3	3	3		7 Days
1	Thermal Barrier PCCW Recirc Pump	30	21.7	18	187	18	18	18	18	18	18	18	18	18	18	18	18		7 Days
1	*SUFP Prelube Oil Pump (A)	1		1	7	1	1	1	1	1	1	1	1	1	1	1	1		1 Day
1	Clg Twr Swgr Rm Supply Fan	2	1.52	1	19	1	1	1	1	1	1	1	1	1	1	1	1		7 Days
1	Clg Twr PP Rm Exhaust Fan	5	2.8	3	38	3	3	3	3	3	3	3	3	3	3	3	3		7 Days
1	*DG Aux Lube Oil Pump	60		50	343	50	50	50	50	50	50	50	50	50	50	50	50		0 Days
1	*DG Aux Fuel Oil Pump	2		2	14	2	2	2	2	2	2	2	2	2	2	2	2		0 Days
1	DG Fuel Oil Transfer Pump	2	1.2	1	14	1	1	1	1	1	1	1	1	1	1	1	1		50 Hours
1	Hydrogen Analyzer Rm Supply Fan	2	1.37	1	15	1	1	1	1	1	1	1	1	1	1	1	1		7 Days
1	Boric Acid Transfer Pump	15.5 kW		16	69	16	16	16	16	16	16	16	16	16	16	16	16		5 Hours
1	Boric Acid Tank Area Heater	20 kW		20		20	20	20	20	20	20	20	20	20	20	20	20		7 Days
2	*DG Bldg Stairtower Heater (A)	10 & 15 kW		25		25	25	25	25	25	25	25	25	25	25	25	25		7 Days
1	*Fuel Oil Day Tank Room Heater	10 kW		10		10	10	10	10	10	10	10	10	10	10	10	10		7 Days
1	Fuel Storage Bldg Fltr Htr Coil	90 kW		90		-	-	-	-	90	90	90	90	90	90	90	90		2 Days
1	*SW Heat Tracing (A)	9 kVA		9		9	9	9	9	9	9	9	9	9	9	9	9		7 Days
1	*SW Heat Tracing (B)	9 kVA		9		-	-	-	-	-	-	-	-	-	-	-	-	9	7 Days
2	*SGFPT Turning Gear Motor (A)	1.5		3	28	3	3	3	3	3	3	3	3	3	3	3	3		1 Day
2	*SGFPT Main Oil Pumps (A)	40		70	468	70	70	70	70	70	70	70	70	70	70	70	70		1 Day
1	*TG Turning Gear Oil Pump (A)	50		44	289	44	44	44	44	44	44	44	44	44	44	44	44		3 Days
1	SF Pool Cooling Pump	20		17	98	-	-	-	-	-	-	-	-	-	-	-	-	17	7 Days
1	*Charging Pump Oil Pump	5		4	37	4	4	4	4	4	4	4	4	4	4	4	4		6 Days
1	*CW PP Lube Booster Pump (A)	10	6.3	6	65	6	6	6	6	6	6	6	6	6	6	6	6		1 Day
1	Hydrogen Analyzer Heat Tracing	3 kVA		3		3	3	3	3	3	3	3	3	3	3	3	3		7 Days
1	*Elec Tunnel Sump Pump	5	3	3	37	3	3	3	3	3	3	3	3	3	3	3	3		1 Day
15	Motor-Operated Valves (A)	18.09	(Total)	32	224	32	32	32	32	32	32	32	32	32	32	32	32		1 Hour
11	Motor-Operated Valves (B)	16.77	(Total)	29	207	29	29	29	29	29	29	29	29	29	29	29	29		1 Hour
8	*TG Bearing Lift Pumps (A)	5		35	293	35	35	35	35	35	35	35	35	35	35	35	35		3 Days
1	*DG Aux Coolant Pump	50		42	263	-	-	-	-	-	-	-	-	42	42	42	42		0 Days
1	DG Air Compressor	15		13	84	-	-	-	-	-	-	-	-	-	-	-	13		1 Day

TABLE 8.3-1
(Sheet 4 of 5)

DIESEL GENERATOR LOADING SEQUENCE
SAFEGUARD SIGNAL WITH LOSS OF OFFSITE POWER

INDEFINITE START LOADS

						kW AT VARIOUS TIMES													OPERATING TIME
QTY	SEQUENCED LOAD	HP	BHP	kW	INRUSH kVA	12 SEC	17 SEC	22 SEC	27 SEC	32 SEC	37 SEC	42 SEC	47 SEC	52 SEC	62 SEC	72 SEC	120 SEC	MANUAL START	DURATION (Note 3)
1	*DG Lube Oil Heater	35 kW		35	-	-	-	-	-	-	-	-	-	-	-	-	35		0 Days
1	Control Room A/C Panel Chiller	91 kVA		73	611	-	-	-	-	-	-	-	-	-	-	-	73		7 Days
1	*Computer Room A/C Panel (A)	55 kVA		55	103	55	55	55	55	55	55	55	55	55	55	55	55		7 Days
2	*Clg. Twr Swgr Rm Heaters	7.5 kW		15		15	15	15	15	15	15	15	15	15	15	15	15		7 Days
1	*TG Turning Gear Motor (A)	60		53	470	53	53	53	53	53	53	53	53	53	53	53	53		3 Days
1	Contm Encl Chg PP Rm Ret Fan (A)	15	14.1	12	92	-	-	-	-	-	-	-	-	-	-	-	12		7 Days
1	Contm Encl Chg PP Rm Ret Fan (B)	15	14.1	12	92	12	12	12	12	12	12	12	12	12	12	12	12		7 Days
1	*Computer Rm Dry Cooler (A)	7.5 kW		8	67	8	8	8	8	8	8	8	8	8	8	8	8		7 Days
1	*Contm Bldg Air Compressor	20		17	116	-	-	-	-	-	-	-	-	-	-	-	17		7 Days
1	*Instrument Air Dryer	7.6 kVA		6	52	6	6	6	6	6	6	6	6	6	6	6	6		7 Days
1	Hydrogen Recombiner	75 kW		75		-	-	-	-	-	-	-	-	-	-	-	75		7 Days
1	Hydrogen Analyzer Pump	1		1	9	-	-	-	-	-	-	-	-	-	-	-	-	1	7 Days
1	*Service Air Compressor Skid	178 kVA		157	1056	-	-	-	-	-	-	-	-	-	-	-	157		5 Days
1	*Admin Bldg Count Rm Dist Pnl (A)	5 kVA		5		5	5	5	5	5	5	5	5	5	5	5	5		7 Days
1	*Admin Bldg Fume Hood Exh Fan (A)	5	3.1	3	41	3	3	3	3	3	3	3	3	3	3	3	3		7 Days
1	*PAS System Vacuum Pump (A)	0.33		1	3	1	1	1	1	1	1	1	1	1	1	1	1		4 Hours
3	*PAB Liquid Sampling Pumps (A)	2.5 kW		8	55	8	8	8	8	8	8	8	8	8	8	8	8		3 Days
1	*Pressurizer Heaters	350 kW		350		-	-	-	-	-	-	-	-	-	-	-	-	350	0 Days
1	*Startup FW Pump (A) (Note 2)	1500	1390	1092	8580	-	-	-	-	-	-	-	-	-	-	-	-	1092	0 Days
1	Ctl Rm Emerg Cln-Up Filter Air Htr	3.6 kW		4		-	-	-	-	-	-	-	-	-	-	-	4		7 Days
1	*Clg Twr Fan Gear Red Imrs Htr (A)	3.75 kW		4		-	-	-	-	-	-	-	-	-	-	-	4		1 Day
2	*Clg Twr Fan Gear Red Imrs Htr (B)	3 kW		6		-	-	-	-	-	-	-	-	-	-	-	6		7 Days
1	*FP Booster Pump (A)	20		18	129	18	18	18	18	18	18	18	18	18	18	18	18		1 Day
2	*Elect Pen Area AC Unit Cndsr (A)	13 kW		26	201	-	-	-	-	-	-	-	-	-	-	-	-	26	3 Days
2	*Elect Pen Area AC Unit Cndsr (B)	17 kW		34	258	-	-	-	-	-	-	-	-	-	-	-	-	34	3 Days
2	*Elect Pen Area AC Unit Air Hndlg (A)	1		2	17	-	-	-	-	-	-	-	-	-	-	-	-	2	3 Days
2	*Elect Pen Area AC Unit Air Hndlg (B)	3		5	43	-	-	-	-	-	-	-	-	-	-	-	-	5	3 Days
1	Cooling Tower Fan (A)	400		317	2982	-	-	-	-	-	-	-	-	-	-	-	-	317	7 Days
2	Cooling Tower Fans (B)	250	195	308	2755	-	-	-	-	-	-	-	-	-	-	-	-	308	7 Days

TABLE 8.3-1
(Sheet 5 of 5)

DIESEL GENERATOR LOADING SEQUENCE
SAFEGUARD SIGNAL WITH LOSS OF OFFSITE POWER

	kW AT VARIOUS TIMES											
	12 SEC	17 SEC	22 SEC	27 SEC	32 SEC	37 SEC	42 SEC	47 SEC	52 SEC	62 SEC	72 SEC	120 SEC
Indefinite Start Load Addition This Period - Train A	549	0	0	0	90	0	0	0	42	0	0	373
Definite Start Load Addition This Period - Train A	1202	569	347	396	598	79	0	0	609	0	275	349
Cumulative Total Definite and Indefinite Loads This Period - Train A	1751	2320	2667	3063	3751	3830	3830	3830	4481	4481	4756	5478
Indefinite Start Load Addition This Period - Train B	214	0	0	0	90	0	0	0	42	0	0	454
Definite Start Load Addition This Period - Train B	971	569	347	396	598	79	669	0	609	0	0	112
Cumulative Total Definite and Indefinite Loads This Period - Train B	1185	1754	2101	2497	3185	3264	3933	3933	4584	4584	4584	5059

TABLE 8.3-2
(Sheet 1 of 6)

DIESEL GENERATOR LOADING SEQUENCE
LOSS OF OFFSITE POWER

DEFINITE START LOADS

QTY	SEQUENCED LOAD	HP	BHP	kW	INRUSH kVA	kW AT VARIOUS TIMES 12 SEC	17 SEC	22 SEC	27 SEC	32 SEC	37 SEC	42 SEC	47 SEC	52 SEC	62 SEC	72 SEC	120 SEC	OPERATING TIME DURATION (Note 3)
1	Charging Pump	600	690	554	3552	554	554	554	554	554	554	554	554	554	554	554	554	1 Day
	*Lighting & Misc Dist Panels (A)	422.1kVA	(Total)	375		375	375	375	375	375	375	375	375	375	375	375	375	7 Days
	*Lighting & Misc Dist Panels (B)	200 kVA	(Total)	180		180	180	180	180	180	180	180	180	180	180	180	180	7 Days
1	*Plant Vent WRGM Rad Monitoring (A)	7.5 kVA		8		8	8	8	8	8	8	8	8	8	8	8	8	7 Days
1	*DG Prelube/Filter Oil Pump	15		13	96	13	13	13	13	13	13	13	13	13	13	13	13	7 Days
2	Inverters (NSSS)	7.5 kVA		17		17	17	17	17	17	17	17	17	17	17	17	17	7 Days
1	*DG Crankcase Exhauster Fan	3		3	30	3	3	3	3	3	3	3	3	3	3	3	3	7 Days
1	Inverter (BOP)	25 kVA		33		33	33	33	33	33	33	33	33	33	33	33	33	7 Days
3	Unit Sub Xfmr Losses (A)	15 kW		45		45	45	45	45	45	45	45	45	45	45	45	45	7 Days
4	Unit Sub Xfmr Losses (B)	15 kW		60		60	60	60	60	60	60	60	60	60	60	60	60	7 Days
1	*5 kV Swgr Aux Bus (A)	15 kVA		15		15	15	15	15	15	15	15	15	15	15	15	15	0 Days
	Cable Losses	60 kW		60		60	60	60	60	60	60	60	60	60	60	60	60	7 Days
1	Control Bldg Batt Rm Exh Fan	5	2.55	2	38	2	2	2	2	2	2	2	2	2	2	2	2	7 Days
1	*TG Main Seal Oil Pump (A)	20		18	116	18	18	18	18	18	18	18	18	18	18	18	18	7 Days
1	*TG Recirc Seal Oil Pump (A)	7.5		7	51	7	7	7	7	7	7	7	7	7	7	7	7	7 Days
1	Ctl Rm Emerg Clean-Up Fltr Fan (A)	15	5.1	5	84	5	5	5	5	5	5	5	5	5	5	5	5	7 Days
1	Ctl Rm Emerg Clean-Up Fltr Fan (B)	5	5	5	35	5	5	5	5	5	5	5	5	5	5	5	5	7 Days
1	Motor Operated Valves (A)	0.33 (Total)		1	4	1	1	1	1	1	1	1	1	1	1	1	1	1 Hour
1	Motor Operated Valves (B)	0.33 (Total)		1	4	1	1	1	1	1	1	1	1	1	1	1	1	1 Hour
1	Contm Encl Cooling Fan	125	109	88	682	-	88	88	88	88	88	88	88	88	88	88	88	7 Days
1	Contm Encl Return Air Fan	60	50.7	41	326	-	41	41	41	41	41	41	41	41	41	41	41	7 Days
1	DG Room Supply Air Fan	50	39.7	34	547	-	34	34	34	34	34	34	34	34	34	34	34	7 Days
1	DG Room Return Air Fan	40	34.1	28	274	-	28	28	28	28	28	28	28	28	28	28	28	7 Days
1	Residual Heat Removal Pump	400	435	347	2233	-	-	347	347	347	347	347	347	347	347	347	347	6 Days
1	*Contm Struct Cooling Fan 1A (B)	200/100	136	109	1482	-	-	-	109	109	109	109	109	109	109	109	109	7 Days
1	*Contm Struct Cooling Fan 1B (B)	200	134	106	1052	-	-	-	106	106	106	106	106	106	106	106	106	7 Days
1	*Contm Struct Cooling Fan 1C (A)	200/100	136	109	1482	-	-	-	109	109	109	109	109	109	109	109	109	7 Days
1	*Contm Struct Cooling Fan 1D (B)	200	134	106	1052	-	-	-	-	-	-	-	106	106	106	106	106	7 Days
1	*Contm Struct Cooling Fan 1E (A)	200/100	136	109	1482	-	-	-	109	109	109	109	109	109	109	109	109	7 Days
1	*Contm Struct Cooling Fan 1F (A)	200	134	106	1052	-	-	-	-	-	-	-	106	106	106	106	106	7 Days

TABLE 8.3-2
(Sheet 2 of 6)

DIESEL GENERATOR LOADING SEQUENCE
LOSS OF OFFSITE POWER

DEFINITE START LOADS

QTY	SEQUENCED LOAD	HP	BHP	kW	INRUSH kVA	kW AT VARIOUS TIMES 12 SEC	17 SEC	22 SEC	27 SEC	32 SEC	37 SEC	42 SEC	47 SEC	52 SEC	62 SEC	72 SEC	120 SEC	OPERATING TIME DURATION (Note 3)
1	Pri Comp Cooling Water Pump	700	690	545	3949	-	-	-	-	545	545	545	545	545	545	545	545	7 Days
1	Fuel Storage Bldg Filter Fan	60		53	653	-	-	-	-	53	53	53	53	53	53	53	53	7 Days
1	Control Room A/C Panel-Fans	82kVA	66	462	-	-	-	-	-	66	66	66	66	66	66	66	66	7 Days
1	Control Room A/C Pump	15	13	94	-	-	-	-	-	13	13	13	13	13	13	13	13	7 Days
1	Cooling Tower Pump (Note 1)	800	755	609	5096	-	-	-	-	-	-	-	-	609	609	609	609	7 Days
1	Service Water Pump (Note 1)	600	560	453	4017	-	-	-	-	-	-	-	-	-	-	-	-	0 Days
1	Emergency Feedwater Pump (B)	900	850	669	5051	-	-	-	-	-	-	669	669	669	669	669	669	1 Day
1	*Switchyard Station Service (A)	306 kVA		275		-	-	-	-	-	-	-	-	-	-	275	275	5 Days
2	*Turb Bldg Battery Chargers (A)	36 kVA		58		-	-	-	-	-	-	-	-	-	-	-	58	7 Days
2	Ctl Bldg Battery Chargers	36 kVA		58		-	-	-	-	-	-	-	-	-	-	-	58	7 Days
1	Portable Battery Charger	36 kVA		29		-	-	-	-	-	-	-	-	-	-	-	29	7 Days
1	*TB Computer Rm A/C Unit (A)	24.6 kVA		24	63	-	-	-	-	-	-	-	-	-	-	-	24	7 Days
2	*Inverters (A)	30 kVA		60		-	-	-	-	-	-	-	-	-	-	-	60	7 Days
1	*Inverter (A)	32 kVA		32		-	-	-	-	-	-	-	-	-	-	-	32	7 Days
1	*Radiation Mon Dist Pnl (A)	9.0 kVA		8		-	-	-	-	-	-	-	-	-	-	-	8	7 Days
1	*Ctl Bldg Cable Spread Rm Sup Fan (A)	10	9.2	8	65	-	-	-	-	-	-	-	-	-	-	-	8	7 Days
1	*Ctl Bldg Cable Spread Rm Ret Fan (A)	10	6.7	6	65	-	-	-	-	-	-	-	-	-	-	-	6	7 Days
1	Ctl Bldg Swgr Area Supply Fan (A)	60	38.8	34	653	-	-	-	-	-	-	-	-	-	-	-	34	7 Days
1	Ctl Bldg Swgr Area Return Fan (A)	40	29.4	24	231	-	-	-	-	-	-	-	-	-	-	-	24	7 Days
1	Ctl Bldg Swgr Area Supply Fan (B)	40	20.0	17	231	-	-	-	-	-	-	-	-	-	-	-	17	7 Days
1	Ctl Bldg Swgr Area Return Fan (B)	20	8.93	8	195	-	-	-	-	-	-	-	-	-	-	-	8	7 Days
1	*Cable Tunnel Exhaust Fan (A)	10	9.1	8	65	-	-	-	-	-	-	-	-	-	-	-	8	7 Days
1	*Ctl Rod Drive Mech Cooling Fan (A)	30		24	187	-	-	-	-	-	-	-	-	-	-	-	24	7 Days
2	*Ctl Rod Drive Mech Cooling Fan (B)	30		48	374	-	-	-	-	-	-	-	-	-	-	-	48	7 Days
	Definite Start Load Addition This Period - Train A					1156	191	347	218	598	79	0	106	609	0	275	373	
	Definite Start Load Addition This Period - Train B					928	191	347	215	598	79	669	106	609	0	0	160	

(A) - Train A Only
(B) - Train B Only

TABLE 8.3-2
(Sheet 3 of 6)

DIESEL GENERATOR LOADING SEQUENCE
LOSS OF OFFSITE POWER

Notes

1. Cooling Tower Pump or Service Water Pump, not both, will be loaded on the DG. Cooling Tower Pump load is larger and is therefore listed.
2. Startup FW pump may be manually connected to Train A diesel generator under contingency conditions.
3. Operating time duration is based on the expected cumulative run times of the various loads with consideration given to the 7 day diesel generator fuel oil system minimum volume.

* Non Class 1E Loads ("Lighting & Misc Dist Panels" includes both Class 1E and Non Class 1E loads.)

TABLE 8.3-2
(Sheet 4 of 6)

DIESEL GENERATOR LOADING SEQUENCE
LOSS OF OFFSITE POWER

INDEFINITE START LOADS

QTY	SEQUENCED LOAD	HP	BHP	kW	INRUSH kVA	kW AT VARIOUS TIMES 12 SEC	17 SEC	22 SEC	27 SEC	32 SEC	37 SEC	42 SEC	47 SEC	52 SEC	62 SEC	72 SEC	120 SEC	MANUAL START	OPERATING TIME DURATION (Note 3)
1	SW PP House Exhaust Fan	15	14.1	12	92	12	12	12	12	12	12	12	12	12	12	12	12		1 Day
1	SW Swgr Rm Supply Fan	2	1.55	2	15	2	2	2	2	2	2	2	2	2	2	2	2		1 Day
1	Emerg FW PP Bldg Intake Fan	5	2.7	3	33	3	3	3	3	3	3	3	3	3	3	3	3		2 Days
1	PAB Aux Supply Air Fan	5	2.9	3	38	3	3	3	3	3	3	3	3	3	3	3	3		7 Days
1	Thermal Barrier PCCW Recirc Pump	30	21.7	18	187	18	18	18	18	18	18	18	18	18	18	18	18		7 Days
1	*SUFP Prelube Oil Pump (A)	1		1	7	1	1	1	1	1	1	1	1	1	1	1	1		1 Day
1	Clg Twr Swgr Rm Supply Fan	2	1.52	1	19	1	1	1	1	1	1	1	1	1	1	1	1		7 Days
1	Clg Twr PP Rm Exhaust Fan	5	2.8	3	38	3	3	3	3	3	3	3	3	3	3	3	3		7 Days
1	*DG Aux Lube Oil Pump	60		50	343	50	50	50	50	50	50	50	50	50	50	50	50		0 Days
1	*DG Aux Fuel Oil Pump	2		2	14	2	2	2	2	2	2	2	2	2	2	2	2		0 Days
1	DG Fuel Oil Transfer Pump	2	1.2	1	14	1	1	1	1	1	1	1	1	1	1	1	1		50 Hours
1	Hydrogen Analyzer Rm Supply Fan	2	1.37	1	15	1	1	1	1	1	1	1	1	1	1	1	1		7 Days
1	Boric Acid Transfer Pump	15.5 kW		16	69	16	16	16	16	16	16	16	16	16	16	16	16		5 Hours
1	*Boric Acid Tank Area Heater	20 kW		20		20	20	20	20	20	20	20	20	20	20	20	20		7 Days
2	*DG Bldg Stairtower Heater (A)	10 & 15 kW		25		25	25	25	25	25	25	25	25	25	25	25	25		7 Days
1	*Fuel Oil Day Tank Room Heater	10 kW		10		10	10	10	10	10	10	10	10	10	10	10	10		7 Days
1	Fuel Storage Bldg Fltr Htr Coil	90 kW		90		-	-	-	-	90	90	90	90	90	90	90	90		7 Days
1	*SW Heat Tracing (A)	9 kVA		9		9	9	9	9	9	9	9	9	9	9	9	9		7 Days
1	*SW Heat Tracing (B)	9 kVA		9		-	-	-	-	-	-	-	-	-	-	-	-	9	7 Days
2	*SGFPT Turning Gear Motor (A)	1.5		3	28	3	3	3	3	3	3	3	3	3	3	3	3		1 Day
2	*SGFPT Main Oil Pumps (A)	40		70	468	70	70	70	70	70	70	70	70	70	70	70	70		1 Day
1	*TG Turning Gear Oil Pump (A)	50		44	289	44	44	44	44	44	44	44	44	44	44	44	44		3 Days
1	SF Pool Cooling Pump	20		17	98	-	-	-	-	-	-	-	-	-	-	-	-	17	7 Days
1	*Charging Pump Oil Pump	5		4	37	4	4	4	4	4	4	4	4	4	4	4	4		6 Days
1	*CW PP Lube Booster Pump (A)	10	6.3	6	65	6	6	6	6	6	6	6	6	6	6	6	6		1 Day
1	Hydrogen Analyzer Heat Tracing	3 kVA		3		3	3	3	3	3	3	3	3	3	3	3	3		7 Days
1	*Elec Tunnel Sump Pump	5	3	3	37	3	3	3	3	3	3	3	3	3	3	3	3		1 Day
13	Motor Operated Valves (A)	15.39 (Total)		26	183	26	26	26	26	26	26	26	26	26	26	26	26		1 Hour
8	Motor Operated Valves (B)	12.17 (Total)		22	156	22	22	22	22	22	22	22	22	22	22	22	22		1 Hour
8	*TG Bearing Lift Pumps (A)	5		35	293	35	35	35	35	35	35	35	35	35	35	35	35		3 Days
1	*DG Aux Coolant Pump	50		42	263	-	-	-	-	-	-	-	-	42	42	42	42		0 Days
1	DG Air Compressor	15		13	84	-	-	-	-	-	-	-	-	-	-	-	13		1 Day

TABLE 8.3-2
(Sheet 5 of 6)

DIESEL GENERATOR LOADING SEQUENCE
LOSS OF OFFSITE POWER

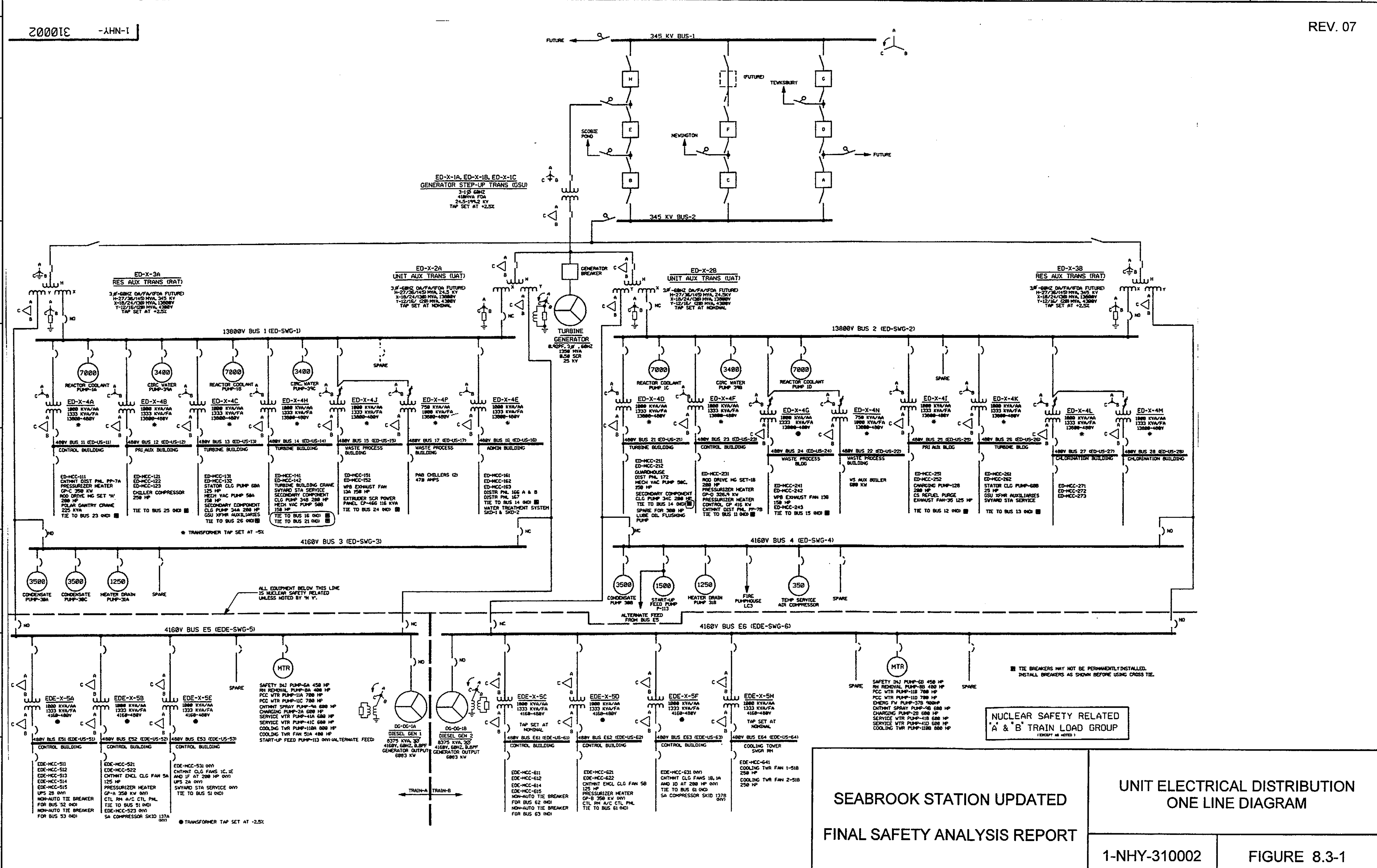
INDEFINITE START LOADS

QTY	SEQUENCED LOAD	HP	BHP	kW	INRUSH kVA	kW AT VARIOUS TIMES 12 SEC	17 SEC	22 SEC	27 SEC	32 SEC	37 SEC	42 SEC	47 SEC	52 SEC	62 SEC	72 SEC	120 SEC	MANUAL START	OPERATING TIME DURATION (Note 3)
1	*DG Lube Oil Heater	35 kW		35		-	-	-	-	-	-	-	-	-	-	-	35		0 Days
1	Control Room A/C Panel Chiller	91 kVA		164	611	-	-	-	-	-	-	-	-	-	-	-	73		7 Days
1	*Computer Room A/C Panel (A)	55 kVA		55	103	55	55	55	55	55	55	55	55	55	55	55	55		7 Days
2	*Clg Twr Swgr Rm Heaters	7.5 kW		15		15	15	15	15	15	15	15	15	15	15	15	15		7 Days
1	*TG Turning Gear Motor (A)	60		53	470	53	53	53	53	53	53	53	53	53	53	53	53		3 Days
1	Contm Encl Chg PP Rm Ret Fan (A)	15	14.1	12	92	-	-	-	-	-	-	-	-	-	-	-	12		7 Days
1	Contm Encl Chg PP Rm Ret Fan (B)	15	14.1	12	92	12	12	12	12	12	12	12	12	12	12	12	12		7 Days
1	*Computer Rm Dry Cooler (A)	7.5 kW		8	67	8	8	8	8	8	8	8	8	8	8	8	8		7 Days
1	*Contm Bldg Air Compressor	20		17	116	-	-	-	-	-	-	-	-	-	-	-	17		7 Days
1	*Instrument Air Dryer	7.6 kVA		6	52	6	6	6	6	6	6	6	6	6	6	6	6		7 Days
1	*Service Air Compressor Skid	178 kVA		157	1056	-	-	-	-	-	-	-	-	-	-	-	157		5 Days
1	*Pressurizer Heaters	350 kW		350		-	-	-	-	-	-	-	-	-	-	-	-	350	1 Day
1	*Startup FW Pump (A) (Note 2)	1500	1340	1092	8580	-	-	-	-	-	-	-	-	-	-	-	-	1092	0 Days
1	Ctl Rm Emerg Cln-Up Filter Air Htr	3.6 kW		4		-	-	-	-	-	-	-	-	-	-	-	4		7 Days
1	*Clg Twr Fan Gear Red Imrs Htr (A)	3.75 kW		4		-	-	-	-	-	-	-	-	-	-	-	4		1 Day
2	*Clg Twr Fan Gear Red Imrs Htr (B)	3 kW		6		-	-	-	-	-	-	-	-	-	-	-	6		1 Day
1	*FP Booster Pump (A)	20		18	129	18	18	18	18	18	18	18	18	18	18	18	18		1 Day
1	*Admin Bldg Count Rm Dist Pnl (A)	5 kVA		5		5	5	5	5	5	5	5	5	5	5	5	5		7 Days
1	*PAS System Vacuum Pump (A)	0.33		1	3	1	1	1	1	1	1	1	1	1	1	1	1		0 Days
1	*Admin Bldg Fume Hood Exh Fan (A)	5	3.1	3	41	3	3	3	3	3	3	3	3	3	3	3	3		7 Days
3	*PAB Liquid Sampling Pumps (A)	2.5 kW		8	55	8	8	8	8	8	8	8	8	8	8	8	8		0 Days
2	*Elect Pen Area AC Unit Cndsr (A)	13 kW		26	201	-	-	-	-	-	-	-	-	-	-	-	-	26	3 Days
2	*Elect Pen Area AC Unit Cndsr (B)	17 kW		34	258	-	-	-	-	-	-	-	-	-	-	-	-	34	3 Days
2	*Elect Pen Area AC Unit Air Hndlg (A)	1		2	17	-	-	-	-	-	-	-	-	-	-	-	-	2	3 Days
2	*Elect Pen Area AC Unit Air Hndlg (B)	3		5	43	-	-	-	-	-	-	-	-	-	-	-	-	5	3 Days
1	Cooling Tower Fan (A)	400		317	2782	-	-	-	-	-	-	-	-	-	-	-	-	317	7 Days
2	Cooling Tower Fans (B)	250	195	308	2755	-	-	-	-	-	-	-	-	-	-	-	-	308	7 Days

TABLE 8.3-2
(Sheet 6 of 6)

DIESEL GENERATOR LOADING SEQUENCE
LOSS OF OFFSITE POWER

	kW AT VARIOUS TIMES											
	12 SEC	17 SEC	22 SEC	27 SEC	32 SEC	37 SEC	42 SEC	47 SEC	52 SEC	62 SEC	72 SEC	120 SEC
Indefinite Start Load Addition This Period - Train A	543	0	0	0	90	0	0	0	42	0	0	298
Definite Start Load Addition This Period - Train A	1156	191	347	218	598	79	0	106	609	0	275	373
Cumulative Total Definite & Indefinite Loads This Period - Train A	1699	1890	2237	2455	3143	3222	3222	3328	3979	3979	4254	4925
Indefinite Start Load Addition This Period - Train B	207	0	0	0	90	0	0	0	42	0	0	288
Definite Start Load Addition This Period - Train B	928	191	347	215	598	79	669	106	609	0	0	160
Cumulative Total Definite & Indefinite Loads This Period - Train B	1135	1326	1673	1888	2576	2655	3324	3430	4081	4081	4081	4529



SEABROOK STATION UPDATED

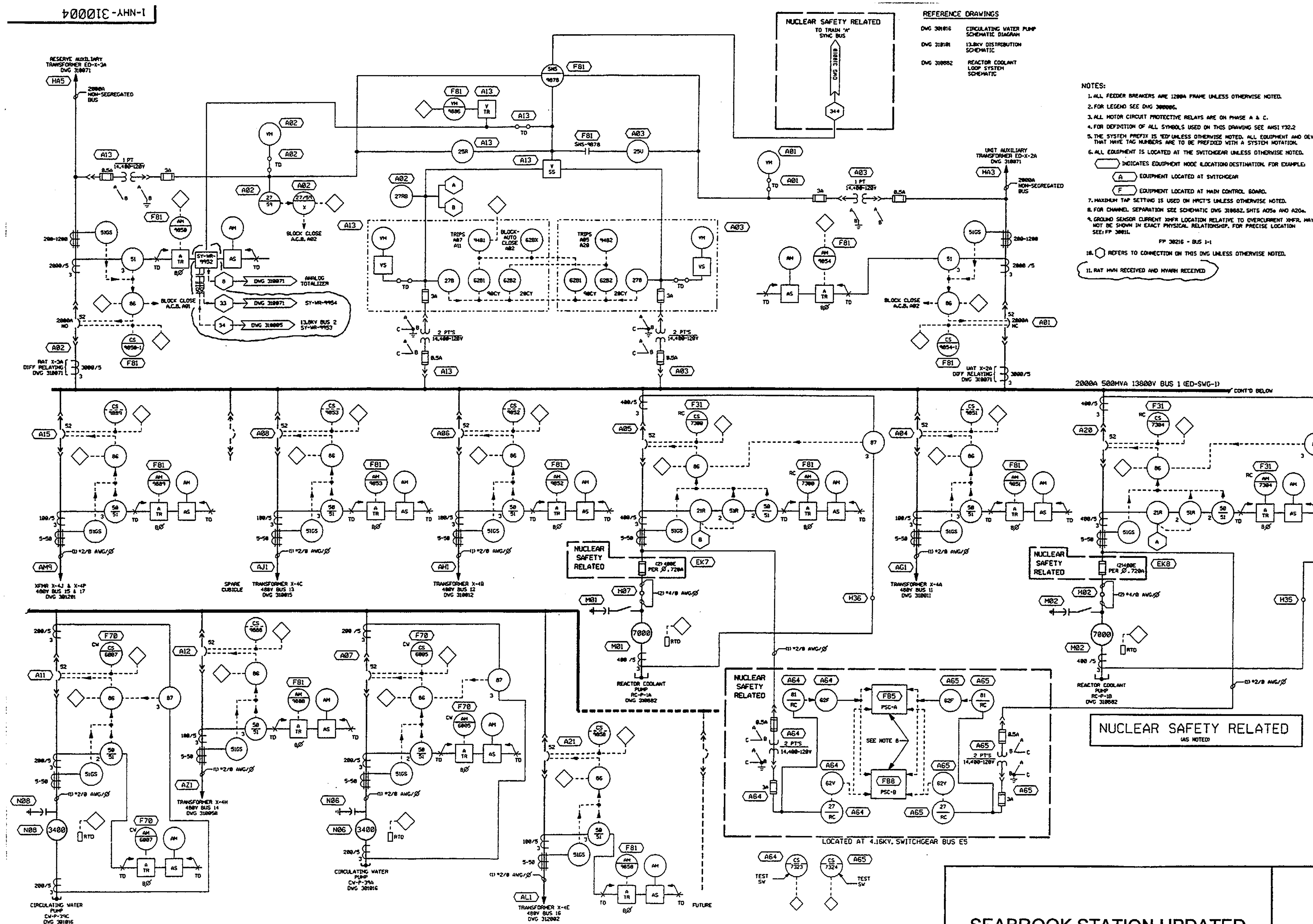
FINAL SAFETY ANALYSIS REPORT

UNIT ELECTRICAL DISTRIBUTION ONE LINE DIAGRAM

1-NHY-310002

FIGURE 8.3-1

REV. 07



REFERENCE DRAWINGS

DWG 301016	CIRCULATING WATER PUMP SCHEMATIC DIAGRAM
DWG 310101	13.8KV DISTRIBUTION SCHEMATIC
DWG 310082	REACTOR COOLANT LOOP SYSTEM SCHEMATIC

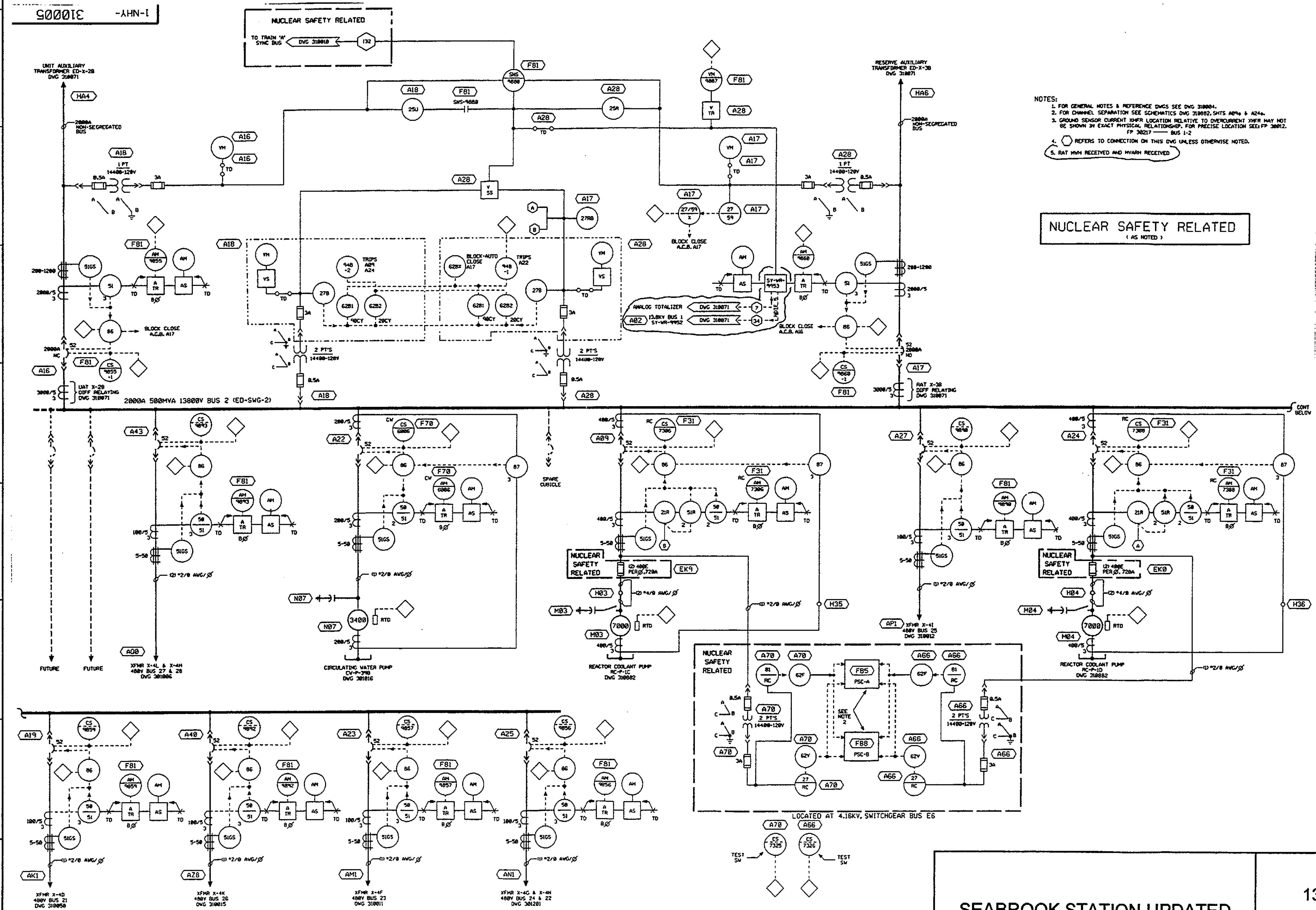
NOTES:

1. ALL FEEDER BREAKERS ARE 1200A FRAME UNLESS OTHERWISE NOTED.
2. FOR LEGEND SEE DWG 300006.
3. ALL MOTOR CIRCUIT PROTECTIVE RELAYS ARE ON PHASE A & C.
4. FOR DEFINITION OF ALL SYMBOLS USED ON THIS DRAWING SEE ANSI Y32.2
5. THE SYSTEM PREFIX IS "ED" UNLESS OTHERWISE NOTED. ALL EQUIPMENT AND DEVICES THAT HAVE TAG NUMBERS ARE TO BE PREFIXED WITH A SYSTEM NOTATION.
6. ALL EQUIPMENT IS LOCATED AT THE SWITCHGEAR UNLESS OTHERWISE NOTED.
   ( ) INDICATES EQUIPMENT NODE (LOCATION) DESTINATION. FOR EXAMPLE:
   (A) EQUIPMENT LOCATED AT SWITCHGEAR
   (F) EQUIPMENT LOCATED AT MAIN CONTROL BOARD.
7. MAXIMUM TAP SETTING IS USED ON MRCT'S UNLESS OTHERWISE NOTED.
8. FOR CHANNEL SEPARATION SEE SCHEMATIC DWG 310882. SHTS A05a AND A20a.
9. GROUND SENSOR CURRENT XMFR LOCATION RELATIVE TO OVERCURRENT XMFR. MAY NOT BE SHOWN IN EXACT PHYSICAL RELATIONSHIP. FOR PRECISE LOCATION SEE: FP 30011.

   FP 30216 - BUS 1-1
10. ⬡ REFERS TO CONNECTION ON THIS DWG UNLESS OTHERWISE NOTED.
11. RAT MWH RECEIVED AND MVARH RECEIVED

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	13800V SWITCHGEAR BUS 1-1 ONE LINE DIAGRAM
	1-NHY-310004 — FIGURE 8.3-5

REV. 07



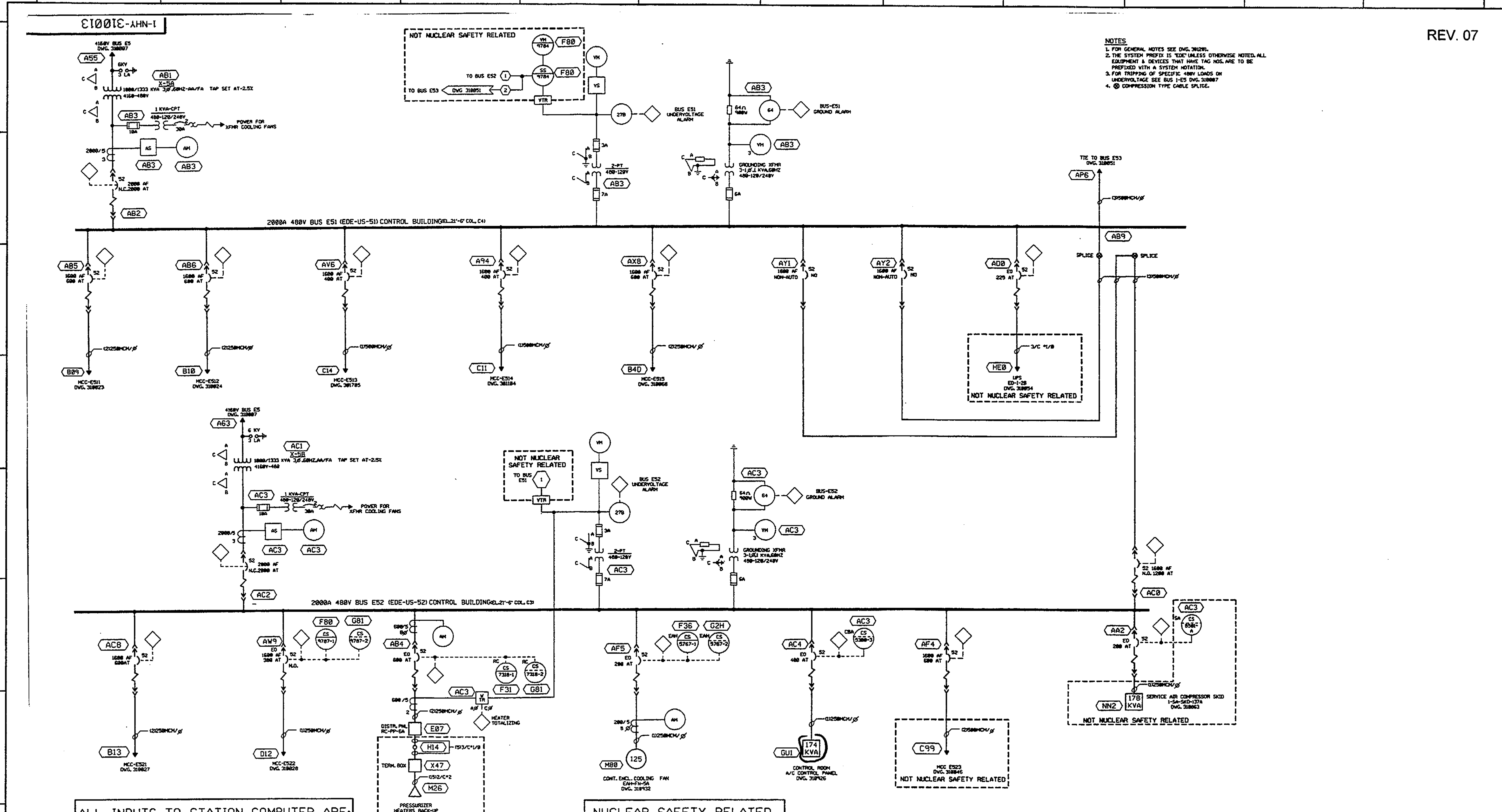
SEABROOK STATION UPDATED

FINAL SAFETY ANALYSIS REPORT

13800V SWITCHGEAR BUS 1-2
ONE LINE DIAGRAM

1-NHY-310005

FIGURE 8.3-6



SEABROOK STATION UPDATED

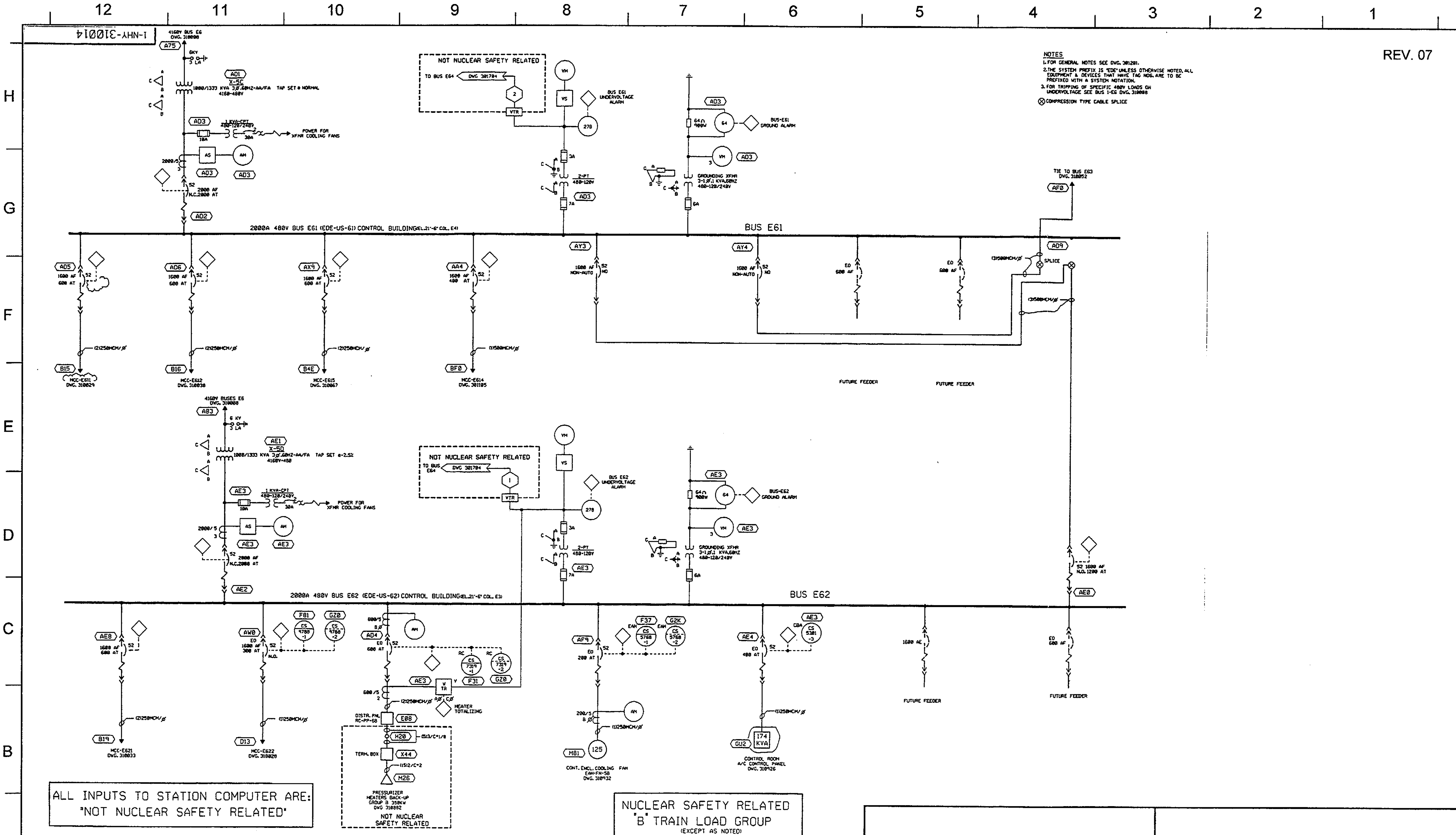
FINAL SAFETY ANALYSIS REPORT

480V UNIT SUBSTATION BUSES E-51 & E-52 ONE LINE DIAGRAM

1-NHY-310013

FIGURE 8.3-11

02/10/00 REV. 21



SEABROOK STATION UPDATED

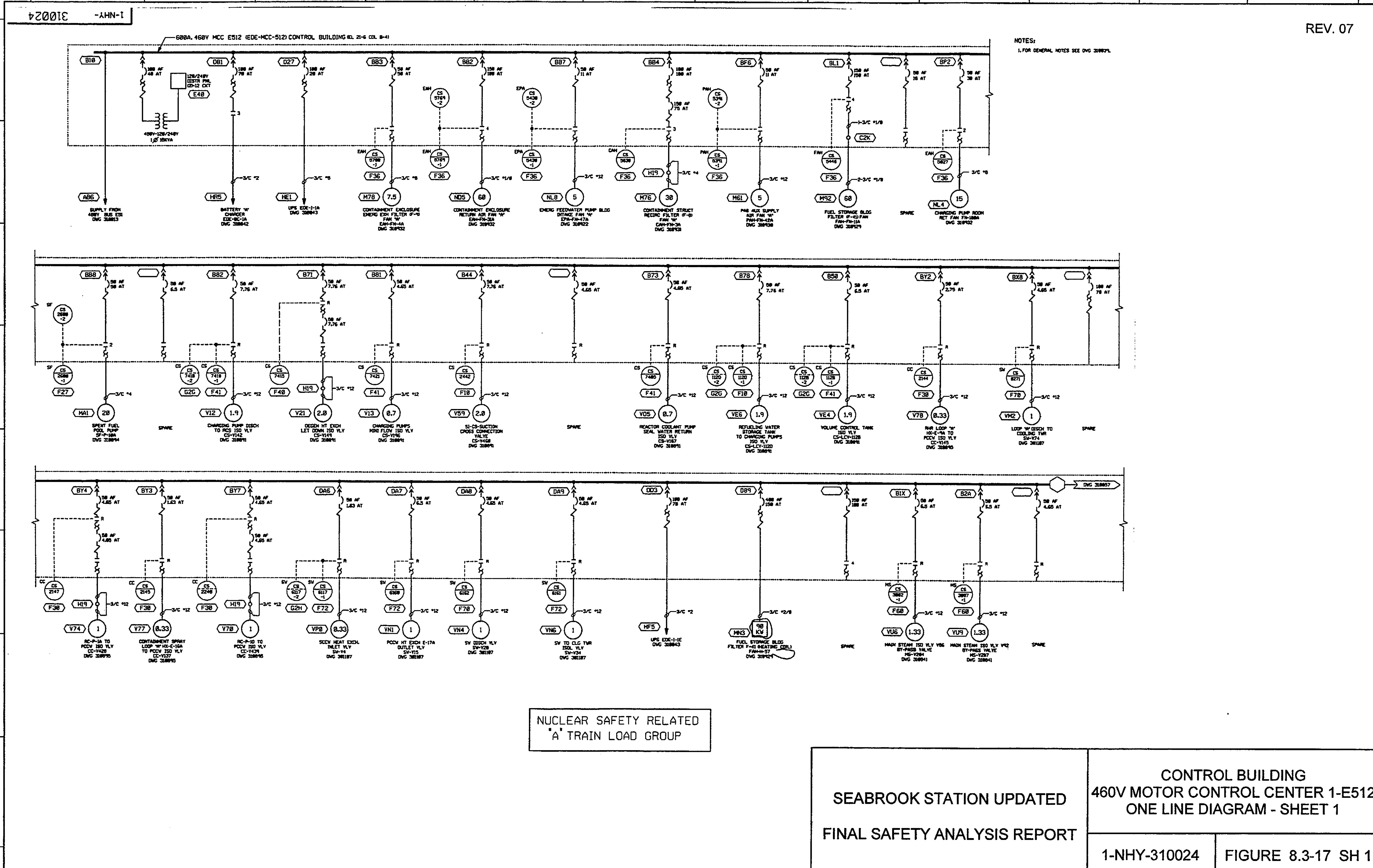
FINAL SAFETY ANALYSIS REPORT

480V UNIT SUBSTATION BUSES 1-E-61 & 1-E-62 ONE LINE DIAGRAM

1-NHY-310014

FIGURE 8.3-13

03/24/00 REV. 17



SEABROOK STATION UPDATED

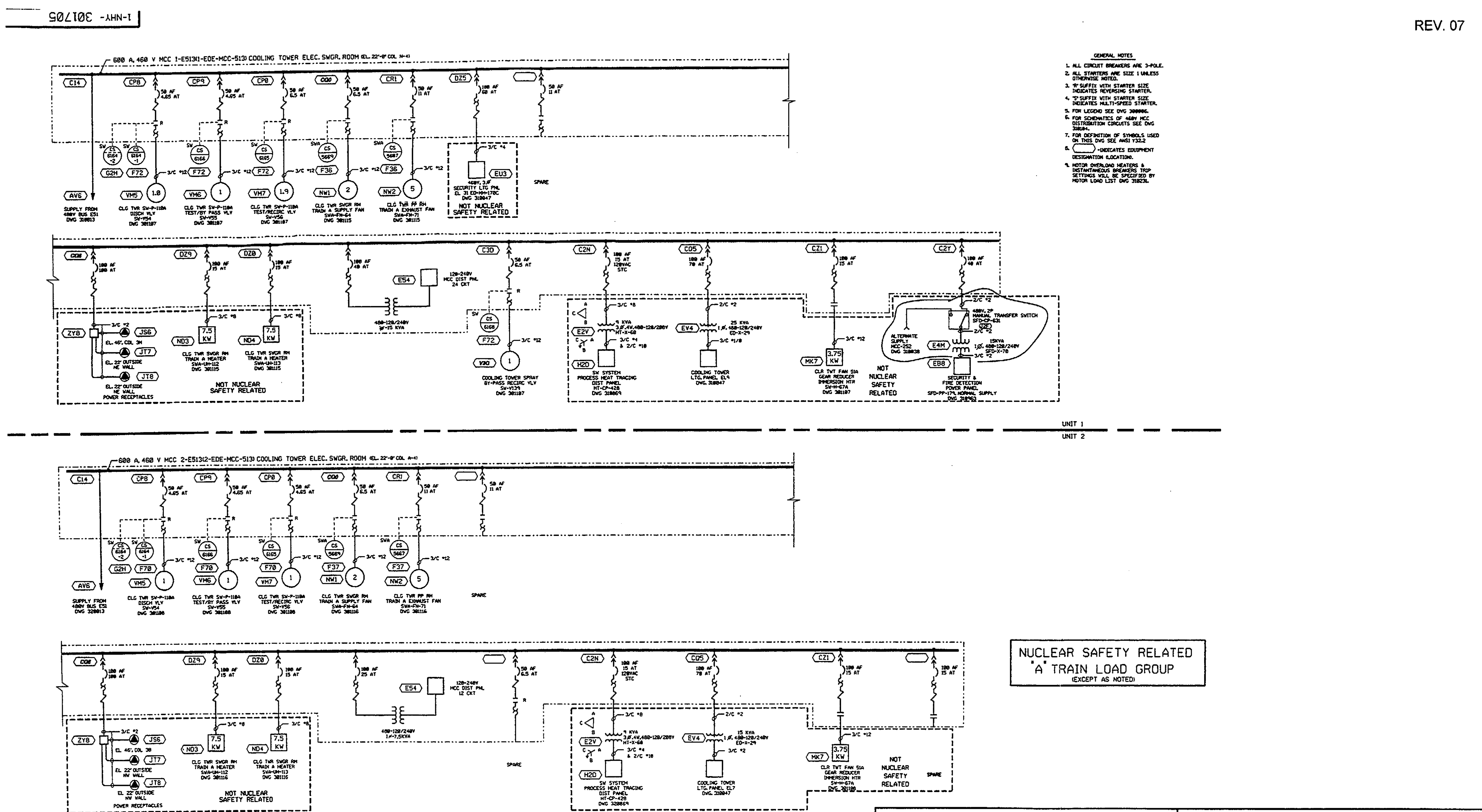
FINAL SAFETY ANALYSIS REPORT

CONTROL BUILDING
460V MOTOR CONTROL CENTER 1-E512
ONE LINE DIAGRAM - SHEET 1

1-NHY-310024

FIGURE 8.3-17 SH 1

02/04/00 REV. 22



SEABROOK STATION UPDATED

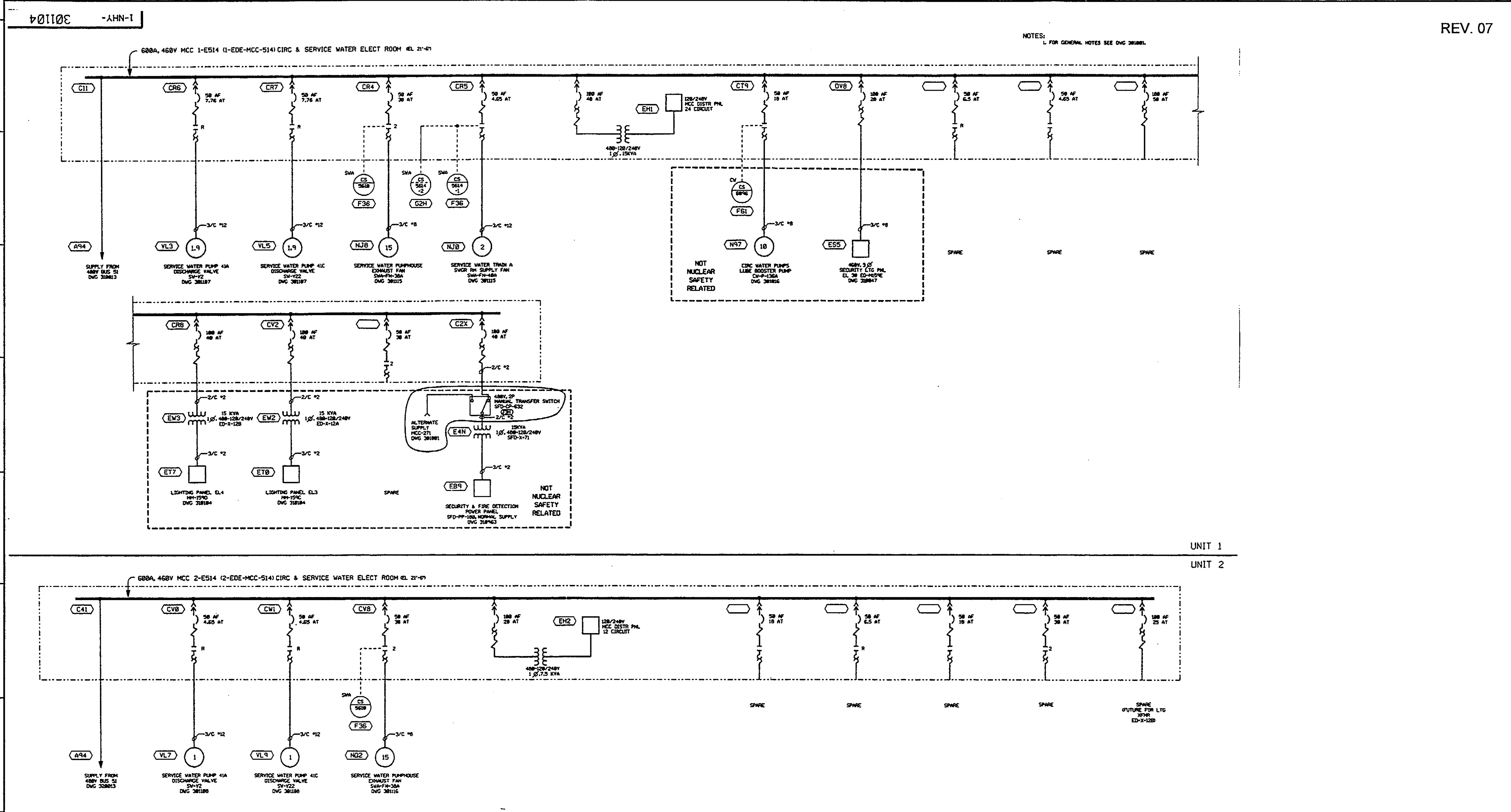
FINAL SAFETY ANALYSIS REPORT

COOLING TOWER ELEC. SWGR. ROOM
460V MOTOR CONTROL CENTER
1-E513 & 2-E513
ONE LINE DIAGRAM

1-NHY-301705

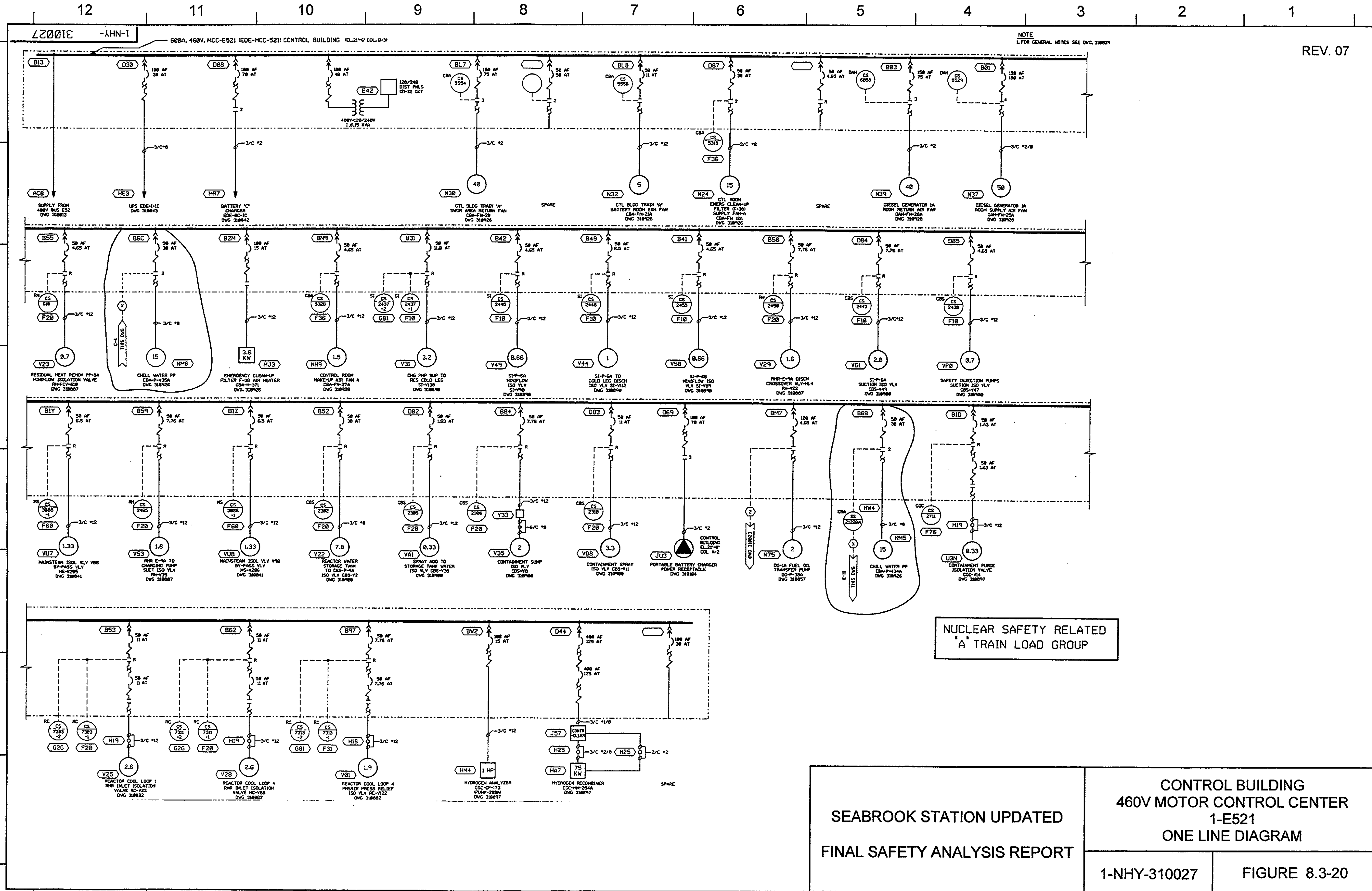
FIGURE 8.3-18

08/11/00 REV. 17



SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	SERVICE & CIRC WTR PMP HOUSE 460V MOTOR CONTROL CENTER 1-E514 & 2-E514 ONE LINE DIAGRAM	
	UNIT 1 & 2 1-NHY-301104	FIGURE 8.3-19

08/11/00 REV. 14



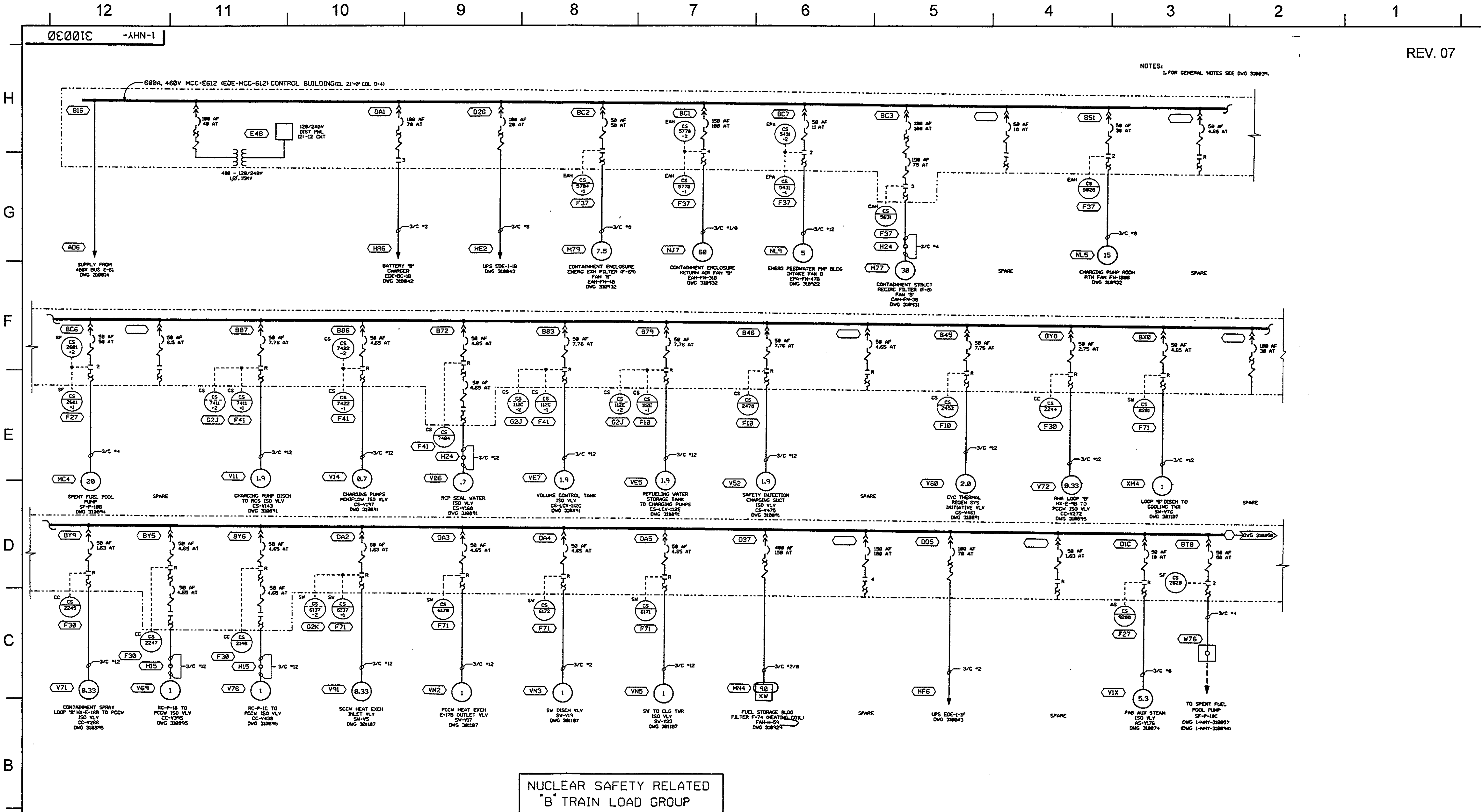
SEABROOK STATION UPDATED

FINAL SAFETY ANALYSIS REPORT

CONTROL BUILDING
460V MOTOR CONTROL CENTER
1-E521
ONE LINE DIAGRAM

1-NHY-310027

FIGURE 8.3-20



SEABROOK STATION UPDATED

FINAL SAFETY ANALYSIS REPORT

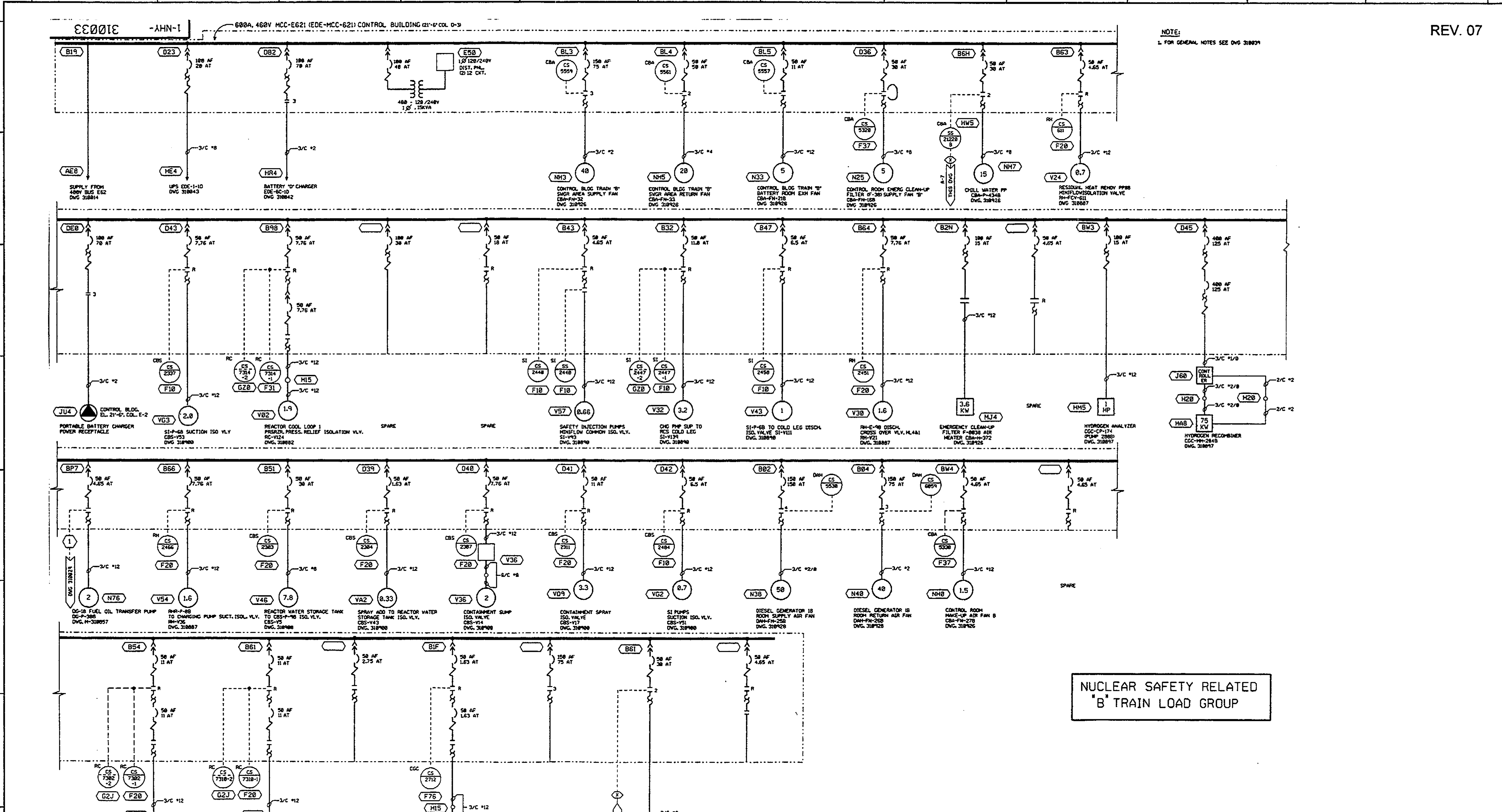
CONTROL BUILDING
460V MOTOR CONTROL CENTER
1-E612
ONE LINE DIAGRAM SHEET 1

1-NHY-310030

FIGURE 8.3-23 SH 1

12/23/99 REV. 23

REV. 07



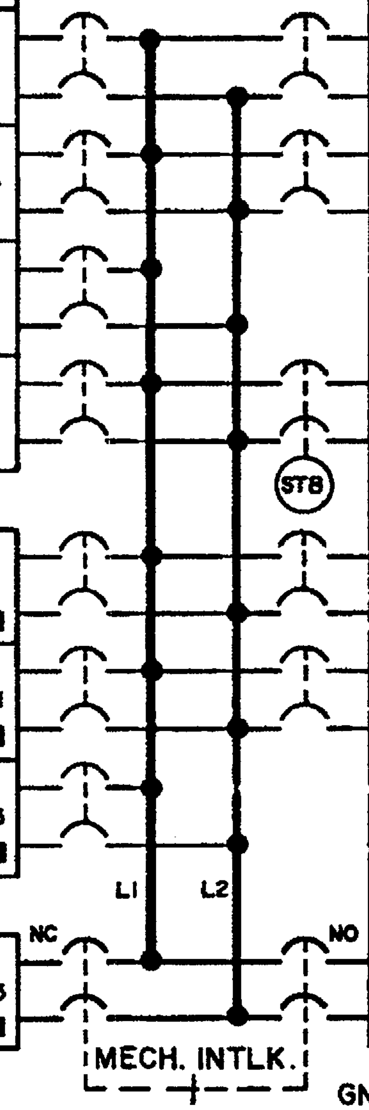
SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	CONTROL BUILDING 460V MOTOR CONTROL CENTER 1-E621 ONE LINE DIAGRAM SHEET 1
	1-NHY-310033 | FIGURE 8.3-25

11/21/00 REV. 24

1-NHY-310105 SH.E01a

REV. 07

REFERENCE DWG.	DESCRIPTION	LOAD	BKR TRIP (AMPS)	CKT NO.
310943 SH. FC6b	NI-CP-16 NIS CONTROL PANEL	—	15	1
310943 SH. FC6b	NI-CP-16 NIS INSTRUMENT POWER	—	15	3
———	SPARE	—	15	5
SH. E01b	MCB-GR PAM I INSTRUMENT BUS	—	15	7
	BLANK			
310942 SH. E01/9	MM-CP-1 PPC CAB. SET I	—	30	9 ■
310949 SH.E01/2a	MM-CP-12 SSPS OUTPUT CAB.#2 TRAIN A	—	15	11 ■
310949 SH.E01/13a	MM-CP-14 SAFEGUARD TEST CAB. TRAIN A	—	15	13 ■
	BLANK			
SH. D27a	I-1A NORMAL SUPPLY	—	SEE NOTE 1	15 ■



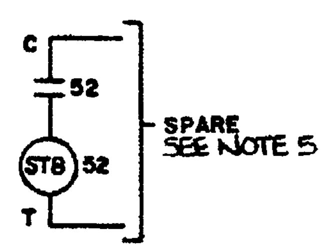
CKT NO.	BKR TRIP (AMPS)	LOAD	DESCRIPTION	REFERENCE DWG.
2	15	—	MM-CP-12 SSPS INPUT CAB. CHANNEL I	310949 SH.E01/2a
4	15	—	MM-CP-13 SSPS INPUT CAB. CHANNEL I	310949 SH.E02/4a
6		—	BLANK	
8	15	—	SPARE	———
10	15	—	ED-CP-231 GRD. DETECTION CAB.	SH.E01/10a
12	15	—	PP-1A LOSS OF POWER	SH.E01/12
14		—	SPACE	———
16 ■	100	—	MAINTENANCE SUPPLY ED-X-31A	SH. D27a

NOTES:

1- ALL BREAKERS ARE THERMAL MAGNETIC EXCEPT NORMAL SUPPLY BREAKER WHICH IS NON-AUTO.
2- FOR THREE LINE DIAGRAM SEE SH. D27a
3- FOR ARRG'T SEE F.P. 31874
4- ■ - SEE SH. 3
5- SHUNT TRIP OPTIONAL
6. SEE CALCULAION 9763-3-ED-00 34-F FOR CIRCUIT LOAD AMPS.

NUCLEAR SAFETY RELATED
'A' TRAIN LOAD GROUP
CHANNEL I

100A, 120VAC, 1Ø, 2W
DISTRIBUTION PANEL
E01
CONTROL BLDG. ELEV. 21'-6", COL. 1A

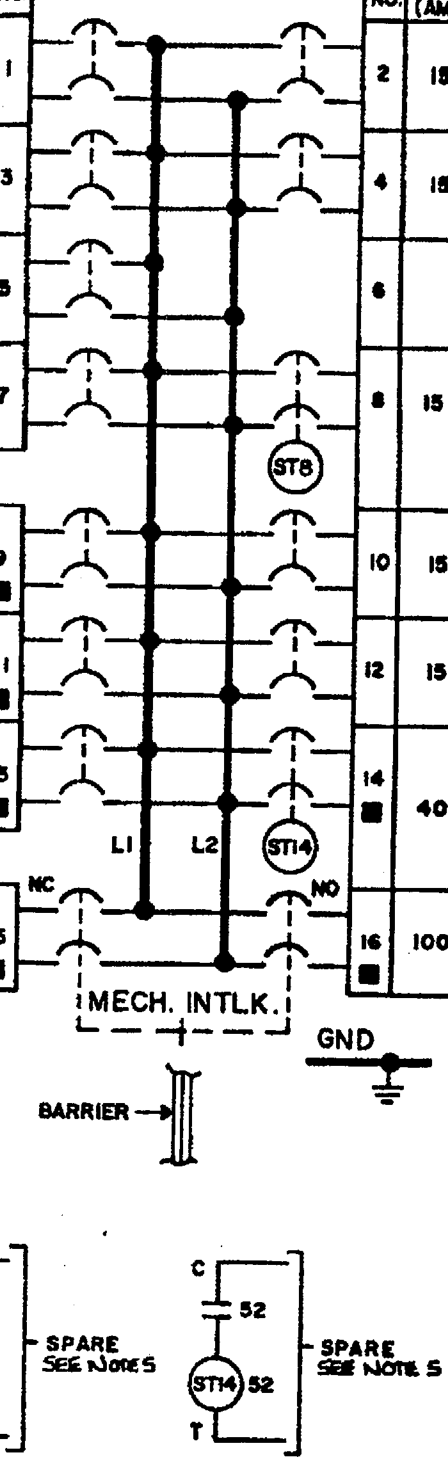


SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	UPS 1-I-1A VITAL INSTRUMENT DISTR. PANEL 1-PP-1A SCHEDULE
1-NHY-310105 SH E01a	FIGURE 8.3-28

09/15/99 REV. 12

REV. 07

1-NHY-310105 SH. E02a



REFERENCE DWG.	DESCRIPTION	LOAD	BKR TRIP (AMPS)	CKT NO.
310943 SH. FG1b	NI-CP-16 NIS CONTROL PANEL	—	15	1
310943 SH. FG1b	NI-CP-16 NIS INSTRUMENT POWER	—	15	3
———	SPARE	—	15	5
SH. E02b	MCB CR PAM 2 INSTRUMENT BUS	—	15	7
	BLANK			
310942 SH. E02/9	MM-CP-2 PPC CAB. SET II	—	30	9 ■
310949 SH. E02/4a	MM-CP-13 SSPS OUTPUT CAB #2 TRAIN B	—	15	11 ■
310949 SH. E01/13a	MM-CP-15 SAFEGUARD TEST CAB. TRAIN B	—	15	13 ■
	BLANK			
SH. D26a	I-1B NORMAL SUPPLY	—	SEE NOTE 1	15 ■

CKT NO.	BKR TRIP (AMPS)	LOAD	DESCRIPTION	REFERENCE DWG.
2	15	—	MM-CP-12 SSPS INPUT CAB. CHANNEL II	310949 SH. E01/2a
4	15	—	MM-CP-13 SSPS INPUT CAB. CHANNEL II	310949 SH. E02/4a
6		—	BLANK	BARRIER — B
8	15	—	SPARE	———
10	15	—	ED-CP-232 GRD. DETECTION CAB.	SH. E02/10a
12	15	—	PP-1B LOSS OF POWER	SH. E02/12
14 ■	40	—	SPARE	———
16 ■	100	—	MAINTENANCE SUPPLY ED-X-31B	SH. D26a

NUCLEAR SAFETY RELATED
'B' TRAIN LOAD GROUP
CHANNEL II

100A, 120VAC, 1Ø, 2W
DISTRIBUTION PANEL
E02
CONTROL BLDG. ELEV. 21'-6", COL. 1D

NOTES:

1- ALL BREAKERS ARE THERMAL MAGNETIC EXCEPT NORMAL SUPPLY BREAKER WHICH IS NON-AUTO.
2- FOR THREE LINE DIAGRAM SEE SH. D26a
3- FOR ARRG'T SEE F.P. 31878
4- ■ - SEE SH. 3
5- SHUNT TRIP OPTIONAL
6. SEE CALCULATION 9763-3-ED-00-34-F FOR CIRCUIT LOAD AMPS.

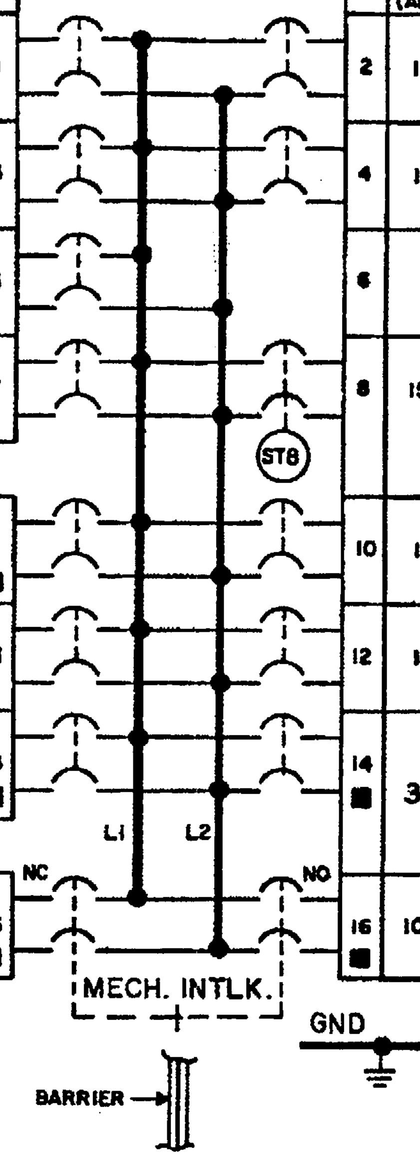
SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	UPS 1-I-1B VITAL INSTRUMENT DISTR. PANEL 1-PP-1B SCHEDULE	
	1-NHY-310105 SH E02a	FIGURE 8.3-29

09/15/99 REV. 12

1-NHY-310105 SH. E03a

REV. 07

REFERENCE DWG.	DESCRIPTION	LOAD	BKR TRIP (AMPS)	CKT NO.
310943 SH. FG3a	NI-CP-16 NIS CONTROL PANEL	—	15	1
310943 SH. FG3a	NI-CP-16 NIS INSTRUMENT POWER	—	15	3
—	SPARE	—	15	5
—	SPARE	—	15	7
	BLANK			
310942 SH. E03/9	MM-CP-3 PPC CAB. SET III	—	30	9 ■
—	SPARE	—	15	11
—	SPARE	—	15	13 ■
	BLANK			
SH. D30a	I-IC NORMAL SUPPLY	—	SEE NOTE 1	15 ■



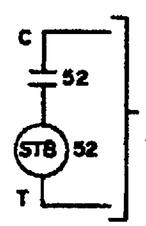
CKT NO.	BKR TRIP (AMPS)	LOAD	DESCRIPTION	REFERENCE DWG.
2	15	—	MM-CP-12 SSPS INPUT CAB. CHANNEL III	310949 SH. E01/2a
4	15	—	MM-CP-13 SSPS INPUT CAB. CHANNEL III	310949 SH. E02/4a
6		—	BLANK	BARRIER
8	15	—	SPARE	—
10	15	—	SPARE	—
12	15	—	PP-1C LOSS OF POWER	SH. E03/12
14 ■	30	—	ED-PP-3C NON-VITAL INSTR. DISTR. PANEL 3C	SH. D30a
16 ■	100	—	MAINTENANCE SUPPLY ED-X-31C	SH. D30a

NOTES:

1- ALL BREAKERS ARE THERMAL MAGNETIC EXCEPT NORMAL SUPPLY BREAKER WHICH IS NON-AUTO.
2- FOR THREE LINE DIAGRAM SEE SH. D30a
3- FOR ARRG'T SEE F.P. 31876
4- ■ - SEE SH. 3
5- SHUNT TRIP OPTIONAL
6. SEE CALCULATION 9763-3-ED-00-34-F FOR CIRCUIT LOAD AMPS.

NUCLEAR SAFETY RELATED
'A' TRAIN LOAD GROUP
CHANNEL III

100A, 120VAC, 1Ø, 2W
DISTRIBUTION PANEL
(E03)
CONTROL BLDG. ELEV. 21'-6", COL. 1A



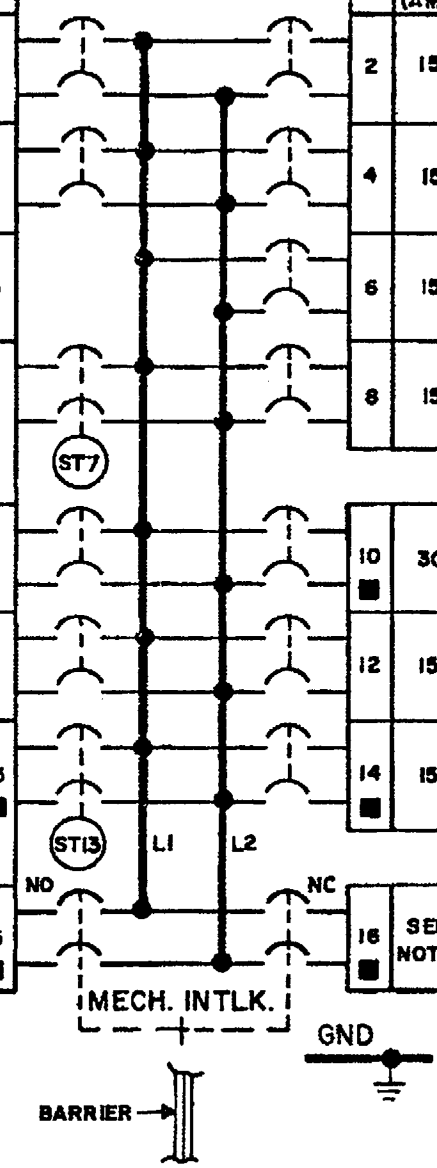
SPARE
SEE NOTE 5

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	UPS 1-I-1C VITAL INSTRUMENT DISTR. PANEL 1-PP-1C SCHEDULE
	1-NHY-310105 SH E03a
	FIGURE 8.3-30

1-NHY-310105 SH. E04a

REV. 07

REFERENCE DWG.	DESCRIPTION	LOAD	BKR TRIP (AMPS)	CKT NO.
310943 SH.FG5a	NI-CP-16 NIS CONTROL POWER	—	15	1
310943 SH.FG5a	NI-CP-16 NIS INSTRUMENT POWER	—	15	3
	BLANK	—		5
—	SPARE	—	15	7
SH.E04/9a	ED-CP-234 GRD. DETECTION CAB	—	15	9
SH.E04/11	PP-1D LOSS OF POWER	—	15	11
—	SPARE	—	40	13 ■
SH.D23a	MAINTENANCE SUPPLY ED-X-31D	—	100	15 ■



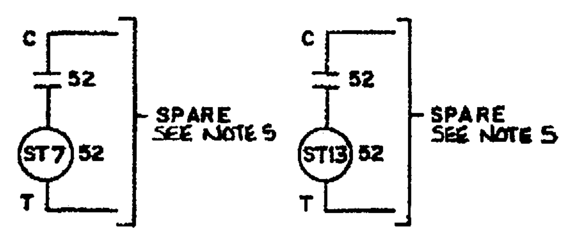
CKT NO.	BKR TRIP (AMPS)	LOAD	DESCRIPTION	REFERENCE DWG.
2	15	—	MM-CP-12 SSPS INPUT CAB CHANNEL IV	310949 SH.E01/2a
4	15	—	MM-CP-13 SSPS INPUT CAB. CHANNEL IV	310949 SH.E02/4a
6	15	—	SPARE	—
8	15	—	SPARE	—
			BLANK	
10 ■	30	—	MM-CP-4 PPC CAB. SECT IV	310942 SH.E04/10
12	15	—	SPARE	—
14 ■	15	—	SPARE	—
			BLANK	
16 ■	SEE NOTE 1	—	I-1D NORMAL SUPPLY	SH.D23a

NOTES:

1- ALL BREAKERS ARE THERMAL MAGNETIC EXCEPT NORMAL SUPPLY BREAKER WHICH IS NON-AUTO.
2- FOR THREE LINE DIAGRAM SEE SH. D23a
3- FOR ARRG'T SEE F.P. 31877
4- ■ - SEE SH. 3
5- SHUNT TRIP OPTIONAL
6. SEE CALCULATION 9763-3-ED-00-34-F FOR CIRCUIT LOAD AMPS.

NUCLEAR SAFETY RELATED
'B' TRAIN LOAD GROUP
CHANNEL IV

100A, 120VAC, 1Ø, 2W
DISTRIBUTION PANEL
E04
CONTROL BLDG. ELEV. 21'-6", COL. 2E

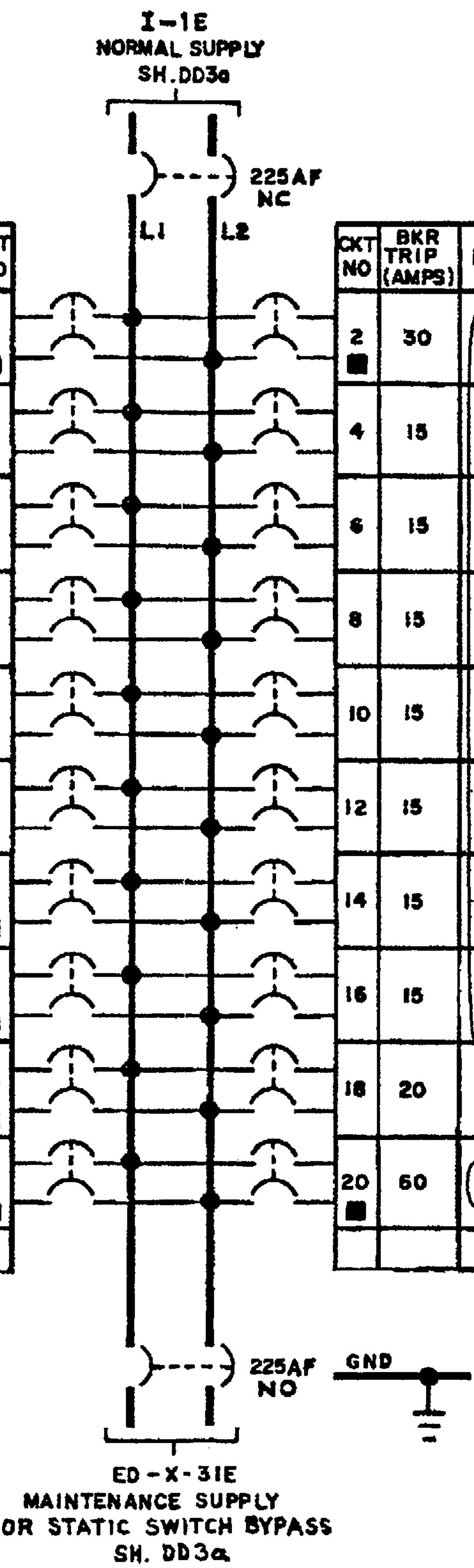


SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	UPS 1-I-1D VITAL INSTRUMENT DISTR. PANEL 1-PP-1D SCHEDULE
1-NHY-310105 SH E04a	FIGURE 8.3-31

09/15/99 REV. 11

1-NHY-310105 SH.EH9a

REV. 07



REFERENCE DWG.	DESCRIPTION	LOAD	BKR. TRIP (AMPS)	CKT NO
310952 SH. EH9/1a	CP-152A BOP INSTRUMENTS	—	30	1 ■
310951 SH. EH9/3a	PAM I & COOLING TOWER MONITOR LIGHTS - MCB BF	—	15	3
310107 SH. 5a	125 VDC BUS 11A 1-SWG-11A 120 VAC AUX. BUS	—	15	5
SH. EH9b	MCB SETPOINT STATION PWR SUPPLY MCB-SECT. BF	—	15	7
310890 SH.EH9/9a	SI ACCUM. TANK ISOL. VLV. POS. IND.	—	15	9
310890 SH.EH9/11a	SI & RH SYSTEMS A TRAIN VALVE POSITION INDICATING LIGHTS	—	15	11
SH.DD3a	PP-11E VITAL INSTR. DISTR. PANEL 11E	—	60	13 ■
M-310966 SH EH9/15a	ISOLATION SYS CONTROL POWER	—	15	15 ■
——	SPARE	—	20	17 ■
310952 SH.EH9/19	MM-CP-297A BOP INSTRUMENTS	—	30	19 ■
	SPACE			

CKT NO	BKR TRIP (AMPS)	LOAD	DESCRIPTION	REFERENCE DWG.
2 ■	30	—	CP-108A SHUTDOWN PANEL	310952 SH. EH9/2
4	15	—	CP-180A RADIATION MONITORING	310956 SH.EH9/4
6	15	—	125VDC BUS 11C 1-SWG-11C 120VAC AUX. BUS	310107 SH. 5c
8	15	—	CP-58 SEISMIC MONITORING	310957 SH. EH9/8
10	15	—	SW A TRAIN AUX. CONTROL	301107 SH.EH9/10a
12	15	—	PP-1E LOSS OF POWER	SH.EH9/12
14	15	—	ED-CP-235 GRD. DETECTION CAB.	SH.EH9/14a
16	15	—	RC VALVES (V-23 V-88) POSITION INDICATORS (FV-2894)	310882 SH.EH9/16
18	20	—	SPARE	——
20 ■	60	—	ED-PP-12E NON-VITAL INSTR. DISTR. PANEL 12E	SH.DD3a
			SPACE	

NUCLEAR SAFETY RELATED
A TRAIN LOAD GROUP

225A, 120VAC, 1Ø, 2W
DISTRIBUTION PANEL (EH9)
CONTROL BLDG., ELEV. 21'-6", COL. 1B

NOTES
1 - ALL BREAKERS ARE THERMAL MAGNETIC EXCEPT NORMAL SUPPLY BREAKER WHICH IS NON-AUTO.
2 - ALL BREAKER ARE 100AF UNLESS OTHERWISE NOTED.
3 - FOR ARRGT. SEE F.P. 33541.
4 - FOR THREE LINE DIAGRAM SEE SH. DD3a
5 - ■ SEE SHEET 3
6. SEE CALCULAITON 9763-3-ED-00-34-F FOR CIRCUIT LOAD AMPS.

SEABROOK STATION UPDATED
FINAL SAFETY ANALYSIS REPORT

UPS 1-I-1E
VITAL INSTRUMENT
DISTR. PANEL 1-PP-1E
SCHEDULE

1-NHY-310105
SH EH9a

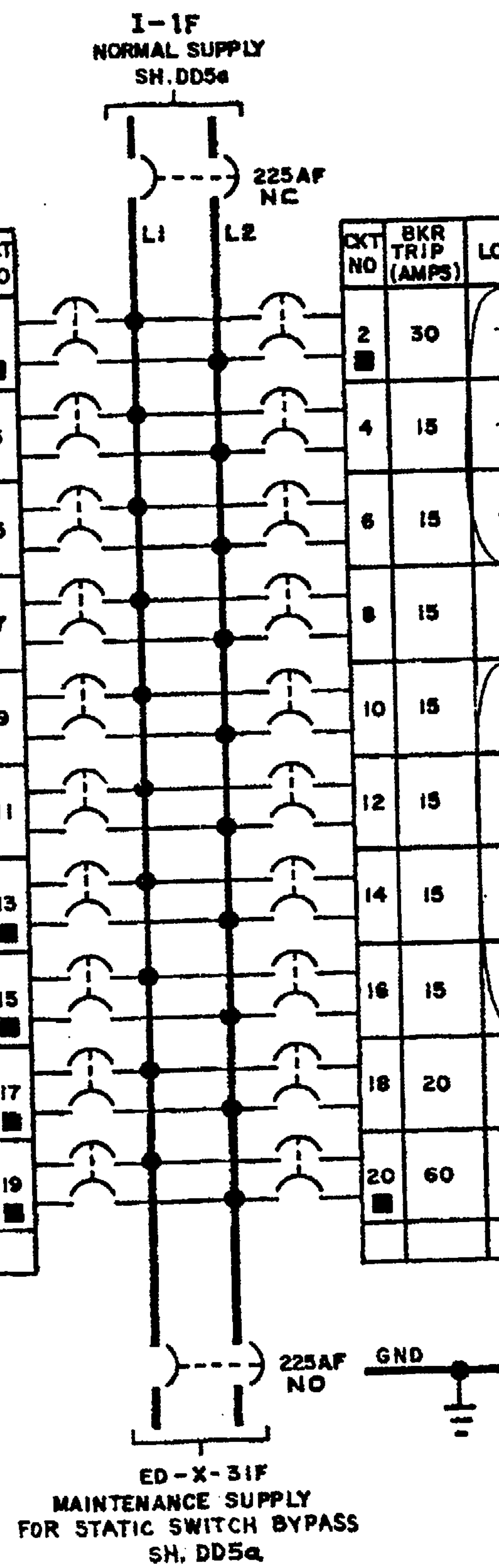
FIGURE 8.3-32

09/15/99 REV. 15

1-NHY-310105 SH.EH0a

REV. 07

REFERENCE DWG.	DESCRIPTION	LOAD	BKR. TRIP (AMPS)	CKT NO
310952 SH. EHO/1a	CP-152B BOP INSTRUMENTS	—	30	1 ■
310951 SH. EHO/3a	PAM 2 & COOLING TOWER MONITOR LIGHTS - MCB AR	—	15	3
310107 SH.5b	125 VDC BUS 11B 1-SWG-11B 120 VAC AUX. BUS	—	15	5
SH. EHOb	MCB SETPOINT STATION PWR SUPPLY MCB-SECT. DR	—	15	7
310890 SH.EHO/9a	SI ACCUM. TANK ISOL. VLV. POS. IND.	—	15	9
310890 SH.EHO/11a	SI & RH SYSTEMS B TRAIN VALVE POSITION INDICATING LIGHTS	—	15	11
SH. E1T/a	PP-11F VITAL INSTR. DISTR. PANEL 11F	—	60	13 ■
M-310966 SH. EHO/15a	ISOLATION SYS CONTROL POWER	—	15	15 ■
——	SPARE	—	20	17 ■
310952 SH.EHO/19	MM-CP-297B BOP INSTRUMENTS	—	30	19 ■
	SPACE			



CKT NO	BKR TRIP (AMPS)	LOAD	DESCRIPTION	REFERENCE DWG.
2 ■	30	—	CP-108B SHUTDOWN PANEL	310952 SH. EHO/2
4	15	—	CP-180B RADIATION MONITORING	310956 SH.EHO/4
6	15	—	125VDC BUS 11D 1-SWG-11D 120VAC AUX. BUS	310107 SH.5d
8	15	—	SPARE	——
10	15	—	SW B TRAIN AUX. CONTROL	301107 SH.EHO/10a
12	15	—	PP - 1F LOSS OF POWER	SH.EHO/12
14	15	—	ED - CP - 236 GRD. DETECTION CAB.	SH.EHO/14a
16	15	—	RC VALVES (V-22, V-87) POSITION INDICATORS (FV-2896)	310882 SH. EHO/16
18	20	—	SPARE	——
20 ■	60	—	SPARE	——
			SPACE	

NOTES
1- ALL BREAKERS ARE THERMAL MAGNETIC EXCEPT NORMAL SUPPLY BREAKER WHICH IS NON - AUTO.
2- ALL BREAKER ARE 100AF UNLESS OTHERWISE NOTED.
3- FOR ARRGT. SEE F.P. 33542.
4- FOR THREE LINE DIAGRAM SEE SH. DD5a
5- ■ SEE SHEET 3
6. SEE CALCULATION 9763-3-ED-00-34-F FOR CIRCUIT LOAD AMPS.

NUCLEAR SAFETY RELATED
B TRAIN LOAD GROUP

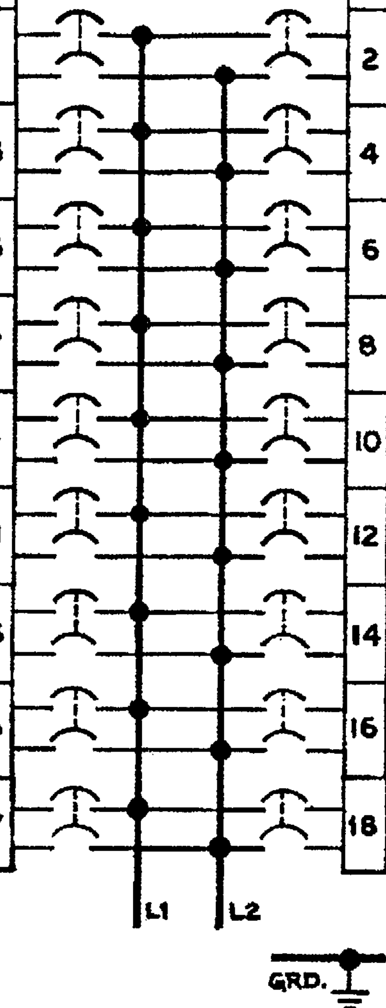
225A, 120VAC, 1Ø, 2W
DISTRIBUTION PANEL (EHO)
CONTROL BLDG., ELEV. 21'-6", COL. 2D

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	UPS 1-I-1F VITAL INSTRUMENT DISTR. PANEL 1-PP-1F SCHEDULE	
	1-NHY-310105 SH EH0a	FIGURE 8.3-33

1-NHY-310105 SH. E15a

REV. 07

REFERENCE DWG	DESCRIPTION	LOAD	BKR TRIP (AMPS)	CKT Nº
310956 SH. E15/1	RM-RM-6506A EAST AIR INTAKE RADIATION MONITOR	—	15	1
310956 SH. E15/3	RM-RM-6535A CNTMNT MANIPULATOR CRANE RADIATION MONITOR	—	15	3
310956 SH. E15/5	RM-RM-6576A CONTAINMENT POST LOCA RADIATION MONITOR	—	15	5
310841 SH-E15/7	MS ISOLATION VALVE V86 & V92	—	30A	7
310841 SH-E15/9	MS ISOLATION VALVE V88 & V90	—	30A	9
310965 SH. E15/11	RVLIS/HELB LOOP A PLASMA DISPLAY SYSTEM	—	15	11
310943 SH E15/13	NI-NT-6690 EX-CORE NEUTRON FLUX MONITORING SYSTEM	—	15	13
310943 SH E15/15	NI-NM-6690 J EX-CORE NEUTRON FLUX MONITORING SYSTEM	—	15	15
310965 SH E15/17	RVLIS/HELB CONTROL CABINET POWER SUPPLY	—	15	17



CKT Nº	BKR TRIP (AMPS)	LOAD	DESCRIPTION	REFERENCE DWG
2	15	—	RM-RM-6507A WEST AIR INTAKE RADIATION MONITOR	310956 SH. E15/2
4	15	—	MM-CP-108A REMOTE SHUTDOWN PNL. RECORDERS PWR. SUPPLY	310952 SH-E15/4
6	15	—	DAH SYSTEM DAMPER DP-16A CONTROL	310928 SH-E15/6a
8	15	—	CGC-CP-173 H_2 ANALYZER CONTROL PNL.	310897 SH-E15/8
10	15	—	RM-RM-6527A CNTMNT. ON-LINE PURGE RADIATION MONITOR	310956 SH-E15/10
12	15	—	LOSS OF POWER	SH-E15/12
14	15	—	NI-NM-6690 EX-CORE NEUTRON FLUX MONITORING SYSTEM	310943 SH E15/13
16	15	—	NI-NM-31G BORON DILUTION MONITOR TRAIN 'A'	310943 SH. FC6b
18	15	—	RVLIS/HELB LOOP A PLASMA DISPLAY SYSTEM	310965 SH. E15/11

100A, 120VAC, 1Ø, 2W
DISTRIBUTION PANEL
(E15)
CONTROL BLDG, ELEV. 21' 6", COL. B-1

NUCLEAR SAFETY RELATED
"A" TRAIN LOAD GROUP

NOTE:

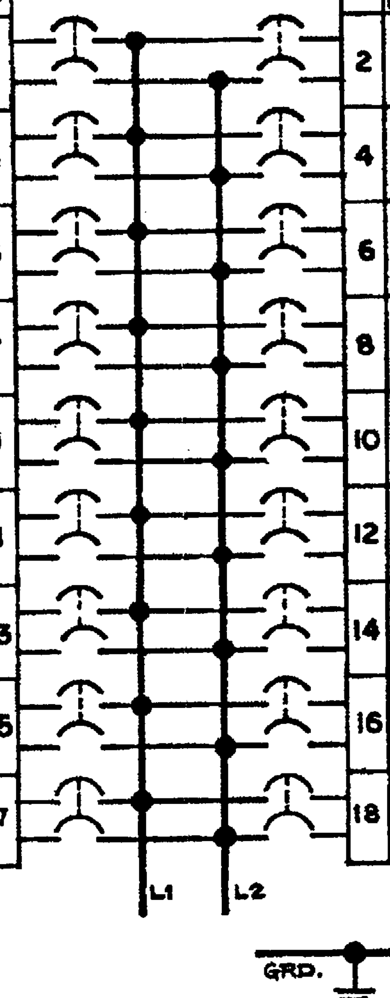
1. FOR THREE LINE DIAGRAM SEE SH. DD3a
2. FOR ARRG'T. SEE FP-32667
3. SEE CALCULATION 9763-3-ED-00-34-F FOR CIRCUIT LOAD AMPS.

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	UPS 1-I-1E VITAL INSTRUMENT DISTR. PANEL 1-PP-11E SCHEDULE
1-NHY-310105 SH EISa	FIGURE 8.3-34

1-NHY-310105 SH E1Ta

REV. 07

REFERENCE DWG	DESCRIPTION	LOAD	BKR TRIP (AMPS)	CKT Nº
310956 SH. EIT/1	RM-RM-6506B EAST AIR INTAKE RADIATION MONITOR	—	15	1
310956 SH.EIT/3	RM-RM-6535-B CNTMNT MANIPULATOR CRANE RADIATION MONITOR	—	15	3
310956 SH.EIT/5	RM-RM-6576-B CONTAINMENT POST LOCA RADIATION MONITOR	—	15	5
310841 SH-EIT/7	MS ISOLATION VALVES V86 & V92	—	30	7
310841 SH-EIT/9	MS ISOLATION VALVES V88 & V90	—	30	9
310182 SH-EIT/11a	ANNUNCIATORS MM-UA-51 & 55	—	15	11
310943 SH-EIT/13	NI-NT-6691 EX-CORE NEUTRON FLUX MONITORING SYS	—	15	13
310943 SH-EIT/13	NI-NM-6691 J EX-CORE NEUTRON FLUX MONITORING SYS	—	15	15
310965 SH EIT/17	RVLIS/HELB CONTROL CABINET POWER SUPPLY	—	15	17



CKT Nº	BKR TRIP (AMPS)	LOAD	DESCRIPTION	REFERENCE DWG
2	15	—	RM-RM-6507-B WEST AIR INTAKE RADIATION MONITOR	310956 SH EIT/2
4	15	—	MM-CP-108B SAFE SHUTDOWN PANEL RECORDERS PWR. SUPPLY	310952 SH-EIT/4
6	15	—	DAH SYSTEM DAMPER DP-16B CONTROL	310928 SH. EIT/6a
8	15	—	CGC-CP-174 H_2 ANALYZER CONTROL PNL.	310897 SH-EIT/8
10	15	—	RM-RM-6527B CNTMNT. ON-LINE PURGE RADIATION MONITOR	310956 SH-EIT/10
12	15	—	LOSS OF POWER	SH-EIT/12
14	15	—	NI-NM-6691 EX-CORE NEUTRON FLUX MONITORING SYS	310943 SH EIT/13
16	15	—	NI-NM-32G BORON DILUTION MONITOR TRAIN 'B'	310943 SH. FG1B
18	15	—	SPARE	—

100A, 120VAC, 1Ø, 2W
DISTRIBUTION PANEL
(EIT)
CONTROL BLDG, ELEV. 21' 6", COL. D-2

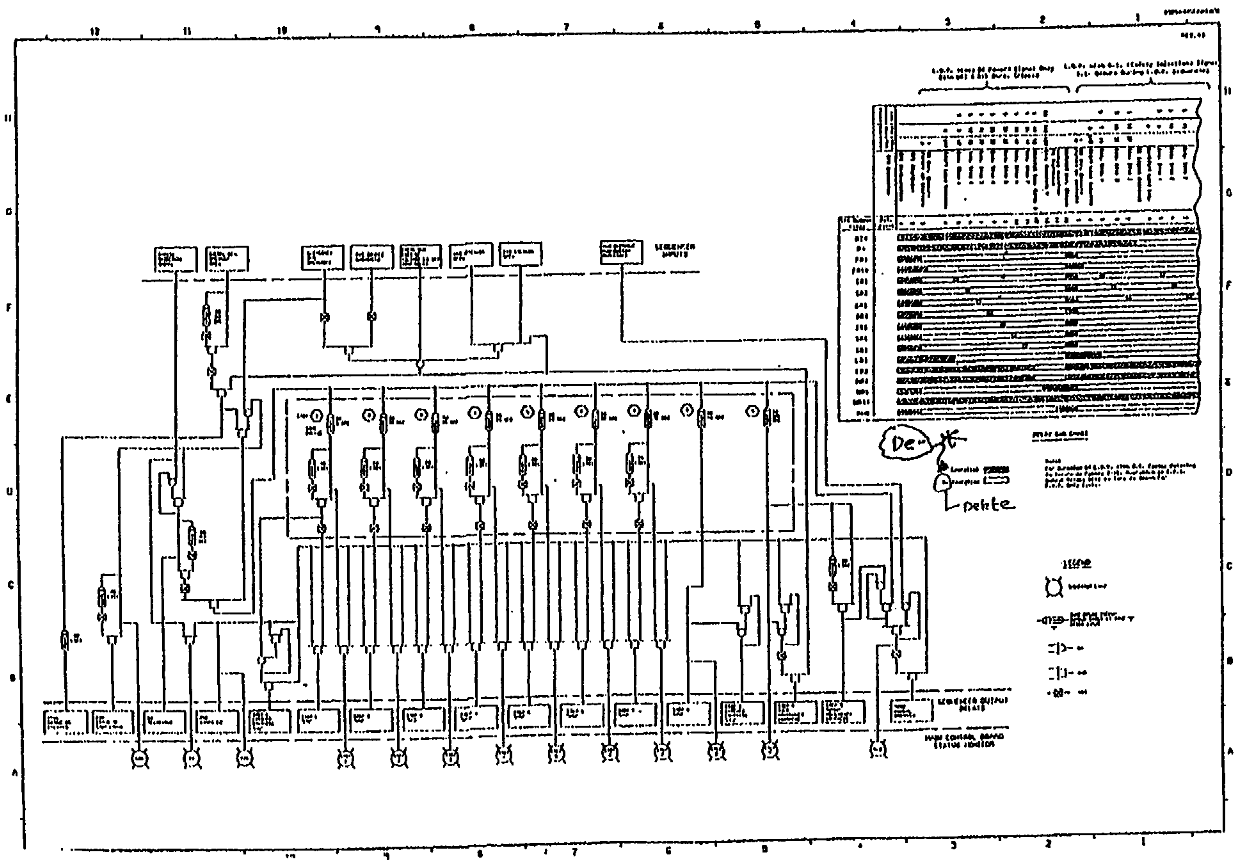
NOTES

1. FOR THREE LINE DIAGRAM SEE SH:D05a
2. FOR ARRG'T. SEE FP-32668
3. SEE CALCULATION 9763-3-ED-00-34-F FOR CIRCUIT LOAD AMPS

NUCLEAR SAFTY RELATED
"B" TRAIN LOAD GROUP

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	UPS 1-I-1F VITAL INSTRUMENT DISTR. PANEL 1-PP-11F SCHEDULE	
	1-NHY-310105 SH EITa	FIGURE 8.3-35

09/08/00 REV. 17



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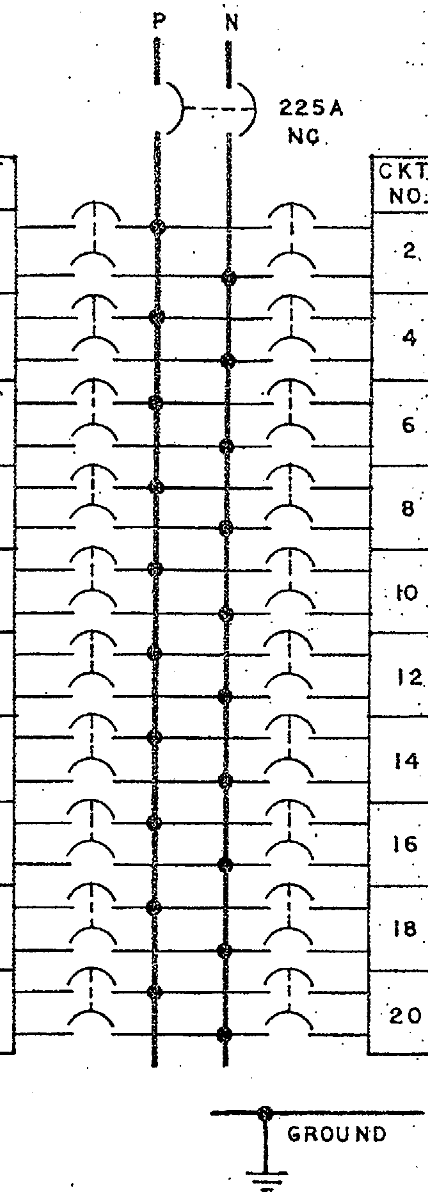
Seabrook Station Updated Final Safety Analysis Report	Emergency Power Sequencer Logic Diagram	
	Rev 07	Figure 8.3-46

1-NHY-310107 SH.E2Ta

REV. 07

REFERENCE DWG	DESCRIPTION	AMPS LOAD	BKR TRIP	CKT NO.	CKT NO.	BKR TRIP	AMPS LOAD	DESCRIPTION	REFERENCE DWG
M-301107 SH-E2T/1a	SW SYSTEM SW PUMP PERMISSIVE TRAIN-A (RV-54)	—	20	1	2	20	—	SW SYSTEM TRAIN -A SW VALVE (SW-V16)	M-301107 SH-E2T/2a
M-310895 SH-E2T/3a	CC SYSTEM HX-E17A TEMP. CTL. VLV'S. CC-TV-2171-1 & 2	—	20	3	4	20	—	CC SYSTEM LP-A INBD. RET. & SUPPLY ISO. VLV'S. CC-V121 & V57	M-310895 SH-E2T/4a
	SPARE	—	20	5	6	20	—	CC SYSTEM LP-B OUTBD. SUPPLY & RET. ISO. VLV'S. CC-V175 & V257	M-310895 SH-E2T/6a
M-310890 SH-E2T/7a	SI SYSTEM SI-FV-2482,83,95 & FV-2496	—	20	7	8	20	—	MS SYSTEM ATMOS. RELIEF VALVE MS-PV-3001	M-310841 SH-E2T/8a
M-310895 SH-E2T/9a	CC SYS.-PCCW LOOP A LIQUID RADIATION MONT'R. SAMPLE VALVE V-975	—	20	9	10	20	—	MS SYSTEM ATMOS. RELIEF VALVE MS-PV-3003	M-310841 SH-E2T/10a
M-310882 SH. A05 1	REACTOR COOLANT PUMP RC-P-1A UNDERVOLTAGE & UNDERFREQUENCY CKT	—	20	11	12	20	—	MS SYSTEM MAIN STM. ISO. VALVE MS-V-88	M-310841 SH-E2T/12a
——	SPARE	—	20	13	14	20	—	MS-SYSTEM MAIN STEAM ISO. VALVE MS-V-90	M-310841 SH. E2T/14a
M-310841, SH E2T/15	MS SYSTEM ATMOS. RELIEF VLV. MS-PV-3002	—	20	15	16	20	—	MS SYSTEM ATMOS. RELIEF VLV MS-PV-3004	M-310841 SH E2T/16
——	SPARE	—	20	17	18	20	—	SPARE	——
——	SPARE	—	20	19	20	15	—	LOSS OF POWER	SH-E2T/20



NOTES:

1. FOR THREE LINE DIAGRAM SEE SH. DB1b
2. FOR ARRG'MT. SEE FP-33307
3. ALL BREAKERS ARE THERMAL-MAGNETIC EXCEPT MAIN BREAKER WHICH IS NON-AUTO.
4. SEE CALCULATION 9763-3-ED-00-14-F FOR CIRCUIT LOAD AMPS.

225A, 125V DC, 2W
DISTRIBUTION PANEL
E2T
CONTROL BLDG. EL. 21'-6" COL. A-3

NUCLEAR SAFETY RELATED
'A' TRAIN LOAD GROUP

SEABROOK STATION UPDATED
FINAL SAFETY ANALYSIS REPORT

125V DC BUS 1-SWG-11A
DISTR. PNL. 1-PP-113A
SCHEDULE

1-NHY-310107
SH E2Ta

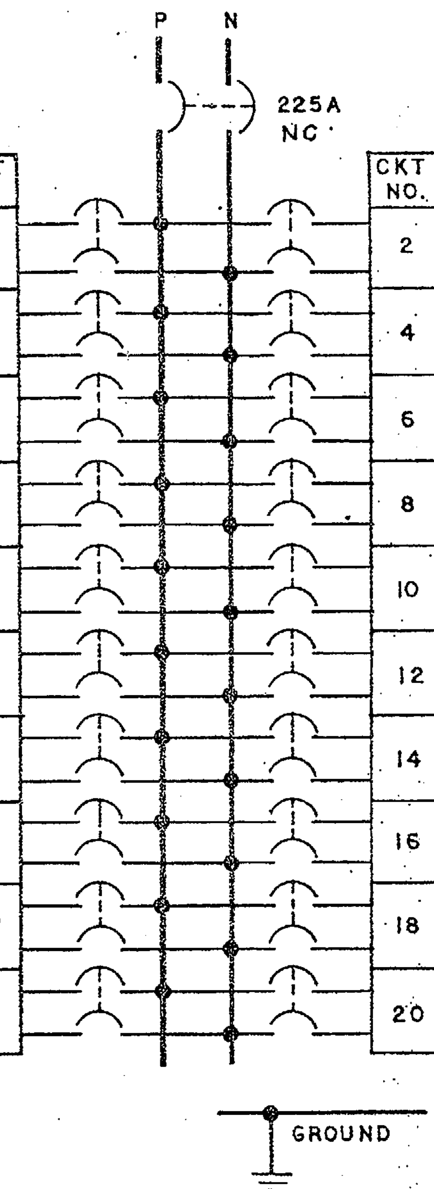
FIGURE 8.3-60

04/01/99 REV. 10

1-NHY-310107 SH. E2Ua

REV. 07

REFERENCE DWG	DESCRIPTION	AMPS LOAD	BKR TRIP	CKT NO.
M-301107 SH-E2U/1a	SW SYSTEM SW PUMP PERMISSIVE TRAIN-B (RV-25)	—	20	1
M-310895 SH-E2U/3a	CC SYSTEM HX E17B TEMP. CTL. VLV'S. CC-TV-2271-1 & 2	—	20	3
	SPARE	—	20	5
M-310890 SH-E2U/7a	SI SYSTEM SI-FV-2475,76,77 & FV-2486	—	20	7
M-310895 SH-E2U/9a	CC SYS.-PCCW LOOP-B LIQUID RADIATION MONT'R. SAMPLE VALVE V-986	—	20	9
M-310882 SH. A20i	REACTOR COOLANT PUMP RC-P-1B UNDERVOLTAGE & UNDERFREQUENCY CKT	—	20	11
M-310895 SH. E2U/3a	CC SYSTEM HX E17B TEMP. CTL. VLVS CC-TV-2271-1&2	—	20	13
M-310841 SHE2U/15a	MS SYSTEM ATMOS. RELIEF VLV. MS-PV-3001	—	20	15
——	SPARE	—	20	17
——	SPARE	—	20	19



CKT NO.	BKR TRIP	AMPS LOAD	DESCRIPTION	REFERENCE DWG
2	20	—	SW SYSTEM TRAIN-B SW VALVE (SW-V18)	M-301107 SH-E2U/2a
4	20	—	LOOP-B CNTMNT. STRUCT. RTN. & SUPPLY ISOL. VLV'S. CC-V256 & V176	M-310895 SH-E2U/4a
6	20	—	LOOP-A CNTMNT. STRUCT. RTN. & SUPPLY ISOL. VLV'S. CC-V122 & V168	M-310895 SH-E2U/6a
8	20	—	MS SYSTEM ATMOS. RELIEF VLV. MS-PV-3002	M-310841 SH-E2U/8a
10	20	—	MS SYSTEM ATMOS. RELIEF VLV. MS-PV-3004	M-310841 SH-E2U/10a
12	20	—	MS SYSTEM MAIN STM. ISO. VALVE MS-V-88	M-310841 SH-E2U/12a
14	20	—	MS SYSTEM MAIN STM ISO VLV MS-V-90	M-310841 SH E2U/14a
16	20	—	MS SYSTEM ATMOS RELIEF VLV. MS-PV-3003	M-310841 SH. E2U/16a
18	20	—	SPARE	——
20	15	—	LOSS OF POWER	SH.-E2U/20

NOTES:

1. FOR THREE LINE DIAGRAM SEE SH. DA1b
2. FOR ARRG'MT. SEE FP-33309
3. ALL BREAKERS ARE THERMAL-MAGNETIC EXCEPT MAIN BREAKER WHICH IS NON-AUTO.
4. SEE CALCULATION 9763-3-ED-00-14-F FOR CIRCUIT LOAD AMPS.

225A, 125V DC, 2W DISTRIBUTION PANEL

E2U

CONTROL BLDG. EL. 21'-6" COL. .

NUCLEAR SAFETY RELATED
'B' TRAIN LOAD GROUP

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	125V DC BUS 1-SWG-11B DISTR. PNL. 1-PP-113B SCHEDULE
	1-NHY-310107 SH E2Ua — FIGURE 8.3-61

04/01/99 REV. 10