



UFSAR Revision 30.0

 <p>An AEP Company</p>	<p>INDIANA MICHIGAN POWER D. C. COOK NUCLEAR PLANT UPDATED FINAL SAFETY ANALYSIS REPORT</p>	<p>Revision: 21.2 Table: 7.2-1 Page: 1 of 5</p>
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LIST OF REACTOR TRIPS AND ACTUATION MEANS OF: ENGINEERED SAFETY FEATURES, CONTAINMENT AND STEAM LINE ISOLATION & AUXILIARY FEEDWATER

Initiator	Coincidence Circuitry and Interlocks	Comments
Reactor Trip		
1.	Manual	1/2, no interlocks
2.	Neutron flux (Power Range):	
2A.	High neutron flux	2/4, low setpoint interlocked with P-10 High and low settings; manual block and automatic reset of low setting by P-10, Table 7.2-2
2B.	High positive neutron flux rate	2/4, no interlocks
3.	Overtemperature ΔT	2/4, no interlocks
4.	Overpower ΔT	2/4, no interlocks
5.	Low pressurizer pressure	2/4, interlocked with P-7
6.	High pressurizer pressure	2/4, no interlocks
7.	High pressurizer water level	2/3, interlocked with P-7
8.	Low reactor coolant flow	2/3 signals per loop, interlocked with P-7 and P-8 Blocked below P-7. Low flow in 1 loop permitted below P-8.
9.	Monitored electrical supply to reactor coolant pumps:	
9A.	Undervoltage	2/4 bus undervoltage signals will actuate a reactor trip (interlocked with P-7) and will also actuate the autostart of the turbine driven auxiliary feedwater pump (not interlocked with P-7).
9B.	Underfrequency	2/4, interlocked with P-7 2/4 underfrequency signals will actuate a reactor trip: (interlocked with P-7).


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Initiator		Coincidence Circuitry and Interlocks	Comments
9C.	Reactor coolant pump breaker position	2/4, interlocked with P-7	2/4 breakers open will cause a reactor trip above P-7. Blocked below P-7.
10.	Safety injection signal	Manual 1/2 panel switches (per train). 2/3 low pressurizer pressure. 2/3 high containment pressure. 2/3 differential steam line pressure signals of one line compared with the other three lines. 2/4 Low steam line pressure.	Trips main feedwater pumps. Closes feedwater control valves. Closes feedwater isolation valves. Initiates Phase A isolation. Actuation by pressurizer pressure may be manually blocked below P11 and is automatically unblocked above P-11. 2/3 high containment pressure actuates the Containment Air Recirculation Hydrogen Skimmer System Fans.
11.	Turbine-generator trip	Interlocked with P-8 OR 4/4 stop valves closed signal interlocked P-8.	31 percent power (P-8)
12.	Low Feedwater Flow	1/2 steam/feedwater flow mismatch in coincidence with 1/2 low steam generator water level, per loop.	
13.	Low-low steam generator water level	2/3, per loop	
14.	Intermediate range neutron flux	1/2, manual block permitted by P-10	Manual block and automatic reset
15.	Source range neutron flux	1/2, manual block permitted by P-6, interlocked with P-10	Manual block and automatic reset
Containment Isolation Actuation			
16.	Containment pressure	Same as Item 10 or 1/2 manual	Actuates all non-essential process lines containment isolation trip valves. (Isolation Phase A)
		Coincidence of 2/4 containment Hi-Hi pressure or 1/2 manual	Actuates all remaining trip valves (except those required for operation of engineered safeguard system). (Isolation Phase B)


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	Initiator	Coincidence Circuitry and Interlocks	Comments
17.	High containment activity	1/3 high activity signal, from containment area, air particulate, or noble gas monitors or manual initiation of Phase A or Phase B isolation	Closes containment purge supply, exhaust ducts and all other necessary to isolate containment atmosphere. (Containment Ventilation Isolation)
Engineering Safeguards Systems Actuation			
18.	Safety injection signal	See Item 10	
19.	Containment spray signal	Hi-Hi-containment pressure (2/4) or manual 1/1 (per train)	
20.	NaOH addition	Containment Spray Actuation Signal	
Steam Lines Isolation Actuation			
21.	Steam flow	High Steam flow (any 2 steam lines out of 4) coincident with low-low T_{avg} .	
22.	Steamline Pressure	2/4 Low Steamline Pressure	
23.	Containment pressure	2/4 Hi-Hi containment pressure signal	
24.	Manual (per steam line)	1/1 per steam line (per train)	


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Initiator	Coincidence Circuitry and Interlocks	Comments
Auxiliary Feedwater Actuation		
24.	Turbine driven pump	Coincidence of 2/3 low-low level in two steam generators or undervoltage on 2/4 RCP busses or 3/4 low feedwater flow coincident with power above 40% (AMSAC) or manual (local and remote) 2/3 high level in steam generator trips main feedwater pumps
25.	Motor driven pumps	2/3 low-low level in any steam generator: or trip of both main feedwater pumps, or safety injection signal, manual (local and remote); 3/4 low feedwaterflow coincident with power 40% (AMSAC); or 2/3 per bus (T11A, T11D) to start pump; valve actuation or 2/3 per bus on 2 busses (T11A and T11B or T11C and T11D)
Main Feedwater Isolation		
26.	Safety Injection	See No. 10 Feedwater isolation signal closes main feedwater control valves (fast closure) and feedwater isolation valves. SI signal also trips main feedwater pumps which causes subsequent feedwater pump discharge valve closure.
27	Hi-Hi Steam Generator level.	2/3 high-high in 1/4 steam generators. Feedwater isolation signal closes main feedwater control valves (fast closure) and feedwater isolation valves. Hi-Hi steam generator level signal also trips main feedwater pumps which causes subsequent feedwater pump discharge valve closure.

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Initiator		Coincidence Circuitry and Interlocks	Comments
28	Reactor Trip	Reactor Trip coincident with low Tavg. (Interlock P-4, see Table 7.2-2)	Feedwater isolation signal closes main feedwater control valves (fast closure) and feedwater isolation valves. Interlock P-4 signal also trips main feedwater pumps which causes subsequent feedwater pump discharge valve closure

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INTERLOCK CIRCUITS

Note: Where applicable setpoints can be found in the Technical Specifications for each unit, or in appropriate engineering documents.

Designation	Derivation	Function
P-4	1/2 Reactor trip breakers and its corresponding bypass breaker open	Actuates main turbine trip.
		Initiates feedwater isolation on T _{avg} below setpoint.
		Actuates main feedwater pump trip.
		Blocks re-actuation of safety injection after manual reset of safety injection actuation signal.
P-6	1/2 Intermediate range neutron flux above setpoint	Allows manual block of source range reactor trip.
P-6 Reset	2/2 Intermediate range neutron flux below reset point	Prevents or defeats the manual block of source range reactor trip.
P-7	Enabled by P-10 or P-13 - 2/4 Power range neutron flux channels above setpoint (P-10) or 1/2 turbine first stage pressure above setpoint (P-13)	Permits reactor trip when any of the following conditions are sensed:
		<ul style="list-style-type: none"> Greater than one loop reactor coolant flow low
		<ul style="list-style-type: none"> Greater than one reactor coolant pump breaker open
		<ul style="list-style-type: none"> Reactor coolant pump bus undervoltage or underfrequency
		<ul style="list-style-type: none"> Pressurizer low pressure
		<ul style="list-style-type: none"> Pressurizer high level
P-7 Reset	P-10 reset and P-13 reset	Prevents or defeats the reactor trip when any of the following conditions are sensed:
		<ul style="list-style-type: none"> Greater than one loop reactor coolant flow low
		<ul style="list-style-type: none"> Greater than one reactor coolant pump breaker open
		<ul style="list-style-type: none"> Reactor coolant pump bus undervoltage or underfrequency
		<ul style="list-style-type: none"> Pressurizer low pressure
		<ul style="list-style-type: none"> Pressurizer high level

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INTERLOCK CIRCUITS

Note: Where applicable setpoints can be found in the Technical Specifications for each unit, or in appropriate engineering documents.

Designation	Derivation	Function
P-8	2/4 power range channels above setpoint	Prevents or defeats the automatic block of reactor trip on low coolant flow condition in a single loop.
		Permits reactor trip when the Turbine Trip condition is sensed.
P-8 Reset	3/4 NIS power range channels below reset point	Permits the automatic block of reactor trip on low flow in a single loop.
		Prevents or defeats the reactor trip when the Turbine Trip condition is sensed.
P-10	2/4 power range neutron flux channels above setpoint	Inputs to P-7 permissive.
		Permits the manual block of reactor trip on:
		<ul style="list-style-type: none"> Intermediate range high neutron flux level.
		<ul style="list-style-type: none"> Power range channel low setpoint high neutron flux level.
		Permits manual block of intermediate range channel rod stop.
		Permits automatic block of source range channel trip.
P-10 Reset	3/4 power range channels below reset point	Prevents or defeats the manual block of reactor trip on:
		<ul style="list-style-type: none"> Intermediate range channel high neutron flux level.
		<ul style="list-style-type: none"> Power range channel low setpoint high neutron flux level.
		Prevents or defeats the manual block of intermediate range channel rod stop.
P-11	2/3 pressurizer pressure below setpoint	Permits manual block of safety injection actuation on low pressurizer pressure.
P-11 Reset	2/3 pressurizer pressure above reset point	Prevents or defeats manual block of safety injection actuation on low pressurizer pressure.
P-12	2/4 T _{avg} channels below setpoint	Permits manual block of safety injection on low steam line pressure.
		Permits or causes steam line isolation on high steam line flow.
		Blocks condenser steam dump.

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INTERLOCK CIRCUITS

Note: Where applicable setpoints can be found in the Technical Specifications for each unit, or in appropriate engineering documents.

Designation	Derivation	Function
P-12 Reset	3/4 T _{avg} channels above reset point	Prevents or defeats manual block of safety injection on low steam line pressure.
		Prevents or defeats steam line isolation on high steam flow.
		Permits condenser steam dump.
P-13	1/2 turbine first stage pressure channel above setpoint	Inputs to P-7.
P-13 Reset	2/2 turbine first stage pressure below reset point	Inputs to P-7.
P-14	2/3 hi-hi steam generator level (any steam generator) greater than or equal to setpoint	Permits the initiation of:
		<ul style="list-style-type: none"> Feedwater isolation
		<ul style="list-style-type: none"> Main feedwater pump trip.
		<ul style="list-style-type: none"> Main turbine trip.
P-14 Reset	2/3 hi-hi steam generator level (any steam generator) less than or equal to reset point	Prevents or defeats initiation of:
		<ul style="list-style-type: none"> Feedwater isolation.
		<ul style="list-style-type: none"> Main feedwater pump trip.
		<ul style="list-style-type: none"> Min turbine trip.
C-1	1/2 Intermediate range neutron flux above setpoint	Blocks automatic and manual control rod withdrawal.
		May be manually blocked above P-10.
		Automatically unblocked below P-10.
C-2	1/4 Power range neutron flux above setpoint	Blocks automatic and manual control rod withdrawal.
C-3	2/4 Overtemperature Delta T above setpoint	Blocks automatic and manual control rod withdrawal.
		Actuates turbine runback via load reference.
C-4	2/4 overpower Delta T channels above setpoint	Blocks automatic and manual rod withdrawal and initiates turbine runback
C-5	Turbine impulse pressure equivalent below setpoint	Blocks automatic rod withdrawal

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INTERLOCK CIRCUITS

Note: Where applicable setpoints can be found in the Technical Specifications for each unit, or in appropriate engineering documents.

Designation	Derivation	Function
C-7A, C-B	1/1 Time Derivative (absolute value) of turbine First Stage pressure (decrease only) above setpoint	Makes steam dump valves available for either tripping or modulation.
C-8	2/3 Turbine Emergency Trip Fluid pressure below setpoint or 4/4 stop valves closed	Blocks steam dump control via load rejection T _{avg} controller.
	2/3 Turbine emergency trip fluid pressure above setpoint or 4/4 stop valves not closed	Blocks steam dump control via turbine trip T _{avg} controller.
C-9	Any condenser vacuum above setpoint <i>or</i> All circulation water pump breakers open <i>or</i> Loss of CRID II Power	Blocks steam dump to condenser.
C-11	Control Bank D demand signal above withdrawal limit setpoint	Blocks automatic control rod withdrawal.
C-20	2/2 Turbine first stage pressure high	Defeats the block of AMSAC.

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ROD STOPS

Rod Stop	Designation*	Rod Motion Blocked
Nuclear Overpower		
a. Intermediate Range	C-1	Automatic and manual withdrawal**
b. Power Range	C-2	Automatic and manual withdrawal
<u>High ΔT:</u>		
a. Over-temperature	C-3	Automatic and manual withdrawal
b. Over-power	C-4	Automatic and manual withdrawal
<u>Turbine Power:</u>		
a. Low Demand	C-5	Automatic withdrawal
b. High Demand	C-11	Automatic withdrawal














* See Table 7.2-2 for more detail.

** May be manually overridden above interlock P-10.
Automatically re-instated below interlock P-10.

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SYMBOLS AND ABBREVIATIONS

	Transmitter
	Test Switch
	Test Point
	Computer Input
	Power Supply
	Signal Isolator
	Lead/Lag Unit
	Indicator
	Test Lamp
	Channel in Test Warning Lamp
	Signal Monitor (Bistable) De-energize (trip) on signal < set point
	Signal Monitor (Bistable) De-energize (trip) on signal > set point
	Signal Monitor (Bistable) Energize (trip) on signal > set point

ABBREVIATIONS

DNBR	Departure from nucleate boiling ratio
TH	Reactor Coolant Hot Leg temperature
TC	Reactor Coolant Cold Leg temperature
Tavg	(TH+TC (per loop))
ΔT	TH - TC (per loop)
AUCT	Auctioneered (highest)
LVDT	Linear Variable Differential Transformer (position sensor)
Ch.	Protection channel
S. I.	Safety Injection
MDAFP	Motor Driven Auxiliary Feedwater Pump
TDAFP	Turbine Driven Auxiliary Feedwater Pump
CIA	Containment Isolation Phase "A"
CIB	Containment Isolation Phase "B"
CVI	Containment Ventilation Isolation
FWI	Feedwater Isolation
SLI	Steam Line Isolation
CTS	Containment Spray
WR Rec.	Wide Range Recorder
NR Rec.	Narrow Range Recorder

*=P=Pressure Channel
*=L=Level Channel

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PROCESS CONTROL BLOCK DIAGRAM DRAWING INDEX

Item #	Function		Drawing #	Drawing Title
1	Index			
2	Reactor Coolant Flow	Protection Set I	99010	Reactor Coolant Flow Loops 1,2,3,4
3	Reactor Coolant Flow	Protection Set II	99010	Reactor Coolant Flow Loops 1,2,3,4
4	Reactor Coolant Flow	Protection Set III	99010	Reactor Coolant Flow Loops 1,2,3,4
5	Wide-Range Reactor Coolant Temp. (Hot Leg)	Control	99029	Wide Range Reactor Coolant Temp & Press
6	Wide-Range Reactor Coolant Temp. (Cold Leg)	Control	99029	Wide Range Reactor Coolant Temp & Press
7	Loop 1 ΔT /AVG	Protection Set I	99001	Reactor Coolant Delta T Protection Channel 1
8	Loop 2 ΔT /AVG	Protection Set II	99002	Reactor Coolant Delta T Protection Channel 2
9	Loop 3 ΔT /AVG	Protection Set III	99003	Reactor Coolant Delta T Protection Channel 3
10	Loop 4 ΔT /AVG	Protection Set IV	99004	Reactor Coolant Delta T Protection Channel 4
11	Pressurizer Levels	Protection Set I, II, III	99031	Pressurizer, RWST, & Condensate Storage Tank Levels
12	Pressurizer Pressure	Protection Set I Thru IV	99022	Pressurizer Pressure CH 1,2, & 3
13	Pressurizer Pressure	Protection Set I Thru IV	99034	Stm Gen Hdr Press Ch 3,4 Pressurizer Pressure Ch 4& Lower Containment Press Channel 4
14	Steam Generators 1 & 2 Mismatch	Protection Set I	99012	Steam Generator 1 & 2 Mismatch Channel 1
15	Steam Generators 3 & 4 Mismatch	Protection Set I	99014	Steam Generators 3 & 4 Mismatch Channel 1
16	Steam Generators 1 & 3 Mismatch	Protection Set II	99015	Steam Generators 1 & 3 Mismatch Channel 2
17	Steam Generators 2 & 4 Mismatch	Protection Set II	99013	Steam Generator 2 & 4 Mismatch Channel 2
18	Steam Generator Levels	Protection Set I, II	99032	Steam Generator Level Channel 1 & 2
19	Turbine Impulse Chamber Pressure	Protection Set I, II	99033	Upper & Lower Containment Ch. 1,2,3 & Turbine Impulse Ch. 1, 2 Pressure
20	Steam Generator Levels	Protection Set III	99018	Steam Generator level Channel 3
21	Steam Generator Levels	Protection Set IV	99019	Steam Generator level Channel 4

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PROCESS CONTROL BLOCK DIAGRAM DRAWING INDEX

Item #	Function		Drawing #	Drawing Title
22	Steam Pressures	Protection Set III, IV	99034	Stm Gen Hdr Press Ch. 3,4 Pressurizer Pressure Ch. 4 & Lower Containment Press Channel 4
23	None			
24	Rod Control	Control	99007	Rod Control
25	Rod Control	Control	99007	Rod Control
26	Steam Dump Feed Pump Speed Control	Control	99008	Steam Dump, Turbine & Feed Pump Control
27	Pressurizer Pressure Control	Control	99023	Prz pressure Control
28	Pressurizer Level Control	Control	99024	Pressurizer Level Control System
29	Volume Control Tank Level Control	Control	99027	RWST, CST and VCT Level
30	Boric Acid Blend Control	Control	99061	Boric Acid and Primary Water
31	Rod Insertion Limit	Control	99006	Rod Insertion Limits
32	ΔT /Auctioneered ΔT Deviation Alarms	Control	99005	Tavg & ΔT /Auctioneered Tavg & ΔT Deviation Alarms
33	TAVG/Auctioneered TAVG Deviation Alarms	Control	99005	Tavg & ΔT /Auctioneered Tavg & ΔT Deviation Alarms
34	Steam Generator Level Control	Control	99016	Steam Generators 1,2 & 3 Level Control System
35	Steam Generator Level Control	Control	99017	S. G. #4 Level Control
36	Steam Generator Level (Wide Range)	Control	99020	Steam Pressure & Wide Range S.G. Level
37	ΔT & ΔT - S.P. Recording	Control	99001	Reactor Coolant Delta T Protection Channel 1

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REACTOR TRIP SYSTEM INSTRUMENTATION RESPONSE TIMES¹

	Functional Unit	Response Time
1	Power Range, Neutron Flux (High and Low setpoint)	Less than or equal to 0.5 seconds ²
2	Overtemperature ΔT	For Unit 1, see Table 14.1-2 ⁽²⁾ ----- For Unit 2, see Table 14.1.0-4 ⁽²⁾
3	Overpower ΔT	For Unit 1, see Table 14.1-2 ----- For Unit 2, see Table 14.1.0-4
4	Pressurizer Pressure - Low	Less than or equal to 2.0 seconds
5	Pressurizer Pressure - High	Less than or equal to 2.0 seconds
6	Pressurizer Water Level - High	Less than or equal to 2.0 seconds
7	Loss of Flow - Single Loop (Above P-8)	Less than or equal to 1.0 seconds
8	Loss of Flow - Two Loops (Above P-7 and below P-8)	Less than or equal to 1.0 seconds
9.	Steam Generator Water Level -Low-Low	Less than or equal to 2.0 seconds
10	Undervoltage - Reactor Coolant Pumps	Less than or equal to 1.5 seconds
11	Underfrequency - Reactor Coolant Pumps	Less than or equal to 0.6 seconds

¹ Response times previously in Technical Specifications 4.3.1.1.3 as documented in Reference 19.

² Neutron detectors are exempt from response time testing. Response time of the neutron flux signal portion of the channel shall be measured from detector output or input of first electronic component in the channel.

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Engineered Safety Feature Actuation System Response Times¹

	Initiating Signal and Function	Response Time In Seconds
1.	<u>Containment Pressure - High</u>	
	a. Safety Injection (ECCS)	Less than or equal to 27.0 ² / 27.0 ³
	b. Reactor Trip (from SI)	Less than or equal to 3.0
	c. Essential Service Water System	Less than or equal to 47.0 ⁴
	d. Containment Air Recirculation Fan	Greater than or equal to 270.0 and less than or equal to 300.0 [Unit 1]; Greater than or equal to 108.0 and less than or equal to 132.0 [Unit 2]
	e. Feedline Isolation	Less than or equal to 44
2.	<u>Pressurizer Pressure - Low</u>	
	a. Safety Injection (ECCS)	Less than or equal to 27.0 ² / 27.0 ³
	b. Reactor Trip (from SI)	Less than or equal to 3.0
	c. Feedwater Isolation	Less than or equal to 8.0
	d. Essential Service Water	Less than or equal to 47.0 ⁴


¹ Response times previously in Technical Specifications 4.3.2.1.3 as documented in Reference 19.

² Diesel generator starting and sequence loading delays NOT included. Offsite power available. Response time limit includes opening of valves to establish SI path and attainment of discharge pressure for centrifugal charging pumps. Sequential transfer of charging pump suction from the VCT to the RWST (RWST valves open, then VCT valves close) is included.

³ Diesel generator starting and sequence loading delays included. Response time limit includes opening of valves to establish SI path and attainment of discharge pressure for centrifugal charging, SI and RHR pumps. Sequential transfer of charging pump suction from the VCT to the RWST (RWST valves open, then VCT valves close) is NOT included. For Unit 1 only, an additional allowance of 20 sec. is provided from the LOCA analysis (47.0 seconds total).

⁴ Essential Service Water System is implicitly assumed available for safety injection and containment spray pump operability in addition to heat exchangers ultimate heat sink.

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Engineered Safety Feature Actuation System Response Times¹

	Initiating Signal and Function	Response Time In Seconds
3.	<u>Steam Line Pressure - Low</u>	
	a. Safety Injection (ECCS)	Less than or equal to 27.0 ² / 37.0 ⁵
	b. Reactor Trip (from SI)	Less than or equal to 3.0
	c. Feedwater Isolation	Less than or equal to 8.0
	d. Steam Line Isolation	Less than or equal to 11.0
4.	<u>Containment Pressure - High-High</u>	
	a. Containment Spray	Greater than or equal to 244.0 and less than or equal to 300.0 [Unit 1]; Less than or equal to 45.0 [Unit 2]
	b. Steam Line Isolation	Less than or equal to 11.0
5.	<u>Steam Generator Water Level -High - High</u>	
	a. Turbine Trip	Less than or equal to 2.5
	b. Feedwater Isolation	Less than or equal to 11.0
6.	<u>Steam Generator Water Level-Low - Low</u>	
	a. Motor Driven Auxiliary Feedwater Pumps	Less than or equal to 60.0
	b. Turbine Driven Auxiliary Feedwater Pumps	Less than or equal to 60.0

⁵ Diesel generator starting and sequence loading delays included. Response time limit includes opening of valves to establish SI path and attainment of discharge pressure for centrifugal charging pumps. Sequential transfer of charging pump suction from the VCT to the RWST (RWST valves open, then VCT valves close) is included.


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Engineered Safety Feature Actuation System Response Times¹

	Initiating Signal and Function	Response Time In Seconds
7.	<u>4160 volt Emergency Bus Loss of Voltage</u>	
	a. Motor Driven Auxiliary Feedwater Pumps	Less than or equal to 60.0
8.	<u>Loss of Main Feedwater Pumps</u>	
	a. Motor Driven Auxiliary Feedwater Pumps	Less than or equal to 60.0
9.	<u>Reactor Coolant Bus Undervoltage</u>	
	a. Turbine Driven Auxiliary Feedwater Pumps	Less than or equal to 60.0


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PROCESS INSTRUMENTATION FOR RPS & ESF ACTUATION

Parameter	Quantity	Sensor Type	Protect./Safeguards Use	Taps
Reactor Coolant Temperature	16	RTD	ΔT trips, T_{avg} permissives	Installed in thermowells
Pressurizer Pressure	4	Transmitter	Hi/Lo pressure trips, Safety Injection	3 (top level), one shared
Pressurizer Level	3	ΔP Transmitter	Reactor Trip	3 (top level), 3 (bottom level)
Steam Flow	8	ΔP Transmitter	Mismatch Trip, Safety Injection	1 pair each
Feedwater Flow	8	ΔP Transmitter	Mismatch Trip	1 pair each
Steam Pressure	12	Transmitter	Safety Injection	1 each
Steam Generator Level	12	ΔP Transmitter	Mismatch Trip, Low Level Trip	1 pair each
Reactor Coolant Flow	12	ΔP Transmitter	Low Flow Trip	1 High press shared/loop, 1 Low press each
Containment Pressure	4	Transmitter	Safety Injection (3), Containment Spray (4)	4
Turbine 1st Stage Pressure	2	Transmitter	Set Point Programs, Turbine Power permissives	1 each


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ENGINEERED SAFETY FEATURES EQUIPMENT EXPOSED TO HARSH ENVIRONMENT

Equipment	Quantity	Inside Containment	Outside Containment	Operating Mode LOCA or MSLB	Design Operating Duration
Miscellaneous					
Containment Air Recirculation/ Hydrogen Skimmer Fan	2	X		Approximately 2 minutes after 2/3 hi containment pressure.	1 Year
Safeguards Equipment Power, Control and Instrument Cable		X	X	As required by equipment serviced	As required by equipment serviced
Valves					
Containment Isolation	34	14	20	2 open, 8 remain as is, 2 switch & 22 close	Various
ECCS Process	40	8	32	14 remain as is, 6 close & 20 switch	Various
Other ESF Process	38	8	30	16 open, 9 remain as is, 4 close & 9 switch	Various

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ENGINEERED SAFETY FEATURES EQUIPMENT EXPOSED TO HARSH ENVIRONMENT

Equipment	Quantity	Inside Containment	Outside Containment	Initiate LOCA or MSLB		Monitor	Design Operating Duration
Instrumentation							
Auxillary Feedwater Flow	4		X			X	4 Months
Containment Pressure	4		X	X	X	X	4 Months
Main Feedwater Flow	2/Stm. Gen.		X		X		1 Minute
Main Steam Flow	2/Stm. Gen.	X			X		1 Minute
Main Steam Pressure	3/Stm. Gen.		X		X	X	4 Months
Pressurizer Level	3	X				X	4 Months
Pressurizer Pressure	3	X		X	X	X	4 Months
	1	X		X	X		1 Minute
Wide Range Reactor Coolant Pressure	2	X				X	4 Months
Narrow Range Reactor Coolant Temperature	2/Loop	X		X	X		1 Minute
Wide Range Reactor Coolant Temperature	2/Loop	X				X	4 Months
Steam Generator Narrow Range Level	3/Stm. Gen.	X			X	X	4 Months
Containment Water Level	8*	X				X	4 Months

* Includes a redundant pair of overlapping level monitors and a redundant pair of level switches.

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
A-1	Verify ECCS Flow Prior to Manual Stop of Reactor Coolant Pumps	Flow in HPI System (Centrifugal Charging Pump Flow)	<div>IFI-51 IFI-52</div> <div>IFI-53 IFI-54</div>	<div>0 to 110% design flow</div> <div>-----</div> <div>0-200 GPM</div>	Control Room Panel SIS
A-2	Manual Trip of RC pumps based on RCS pressure	RCS Pressure (wide range)	<div>NPS-110 NPS 111</div> <div>MR-13</div>	<div>0-3000 psig</div> <div>-----</div> <div>0-3000 psig</div>	<div>Control Room Panel SIS</div> <div>Control Room Panel RHR for MR-13</div>
A-3	Not used				
A-4	Not used				
A-5	Not used				
A-6	Not used				

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Item No.	Purpose	Variable	Tag No.	Range Reg Guide 1.97 Value ----- Installed Value	Display Location
A-7	Determination of required core exit temperature by SG pressure	S/G Pressure	MPP-210 MPP-211 MPP-212 MPP-220 MPP-221 MPP-222 MPP-230 MPP-231 MPP-232 MPP-240 MPP-241 MPP-242	From atmospheric pressure to 20% above the lowest safety valve setting ----- 0-1200 psig	Control Room Panel SG
A-8	Determination of Adverse Containment	Containment Water Level	NLI-320 NLI-321 NLI-330 NLI-331 NLI-340 NLI-341	----- 599'-3" to 614' elevation (Containment floor to max flood level) 602'-2 3/4" to 613'-0"	Control Room Panel RHR

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
A-9	Manual reduction of ECCS Flow (secondary heat sink capability)	S/G Level Narrow Range	BLP-110 BLP-111 BLP-112 BLP-120 BLP-121 BLP-122 BLP-130 BLP-131 BLP-132 BLP-140 BLP-141 BLP-142	From below 1 st stage separator to 2 nd stage separator ----- From below 1 st stage separator to 2 nd stage separator	Control Room Panel SG
A-10	Manual Reduction of ECCS Flow	Pressurizer Level	NLP-151 NLP-152 NLP-153	Top to Bottom ----- 0-100% (96% of indicated volume)	Control Room Panel PRZ
A-11	Not used				

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
A-12	Determination of adverse containment	Containment Area Radiation Monitor High Range	VRA-1310 VRA-1410 for U1 VRA-2310 VRA-2410 for U2	<div>1 R/Hr to 1 x 10⁷ R/Hr</div> <hr/> <div>1 R/Hr to 1 x 10⁷ R/Hr</div>	Control Room Panel RMS-CT
A-13	Manually establish or trip containment spray	Containment Pressure (narrow range)	PPP-300 PPP-301 PPP-302 PPP-303	<div>-5 to design pressure</div> <hr/> <div>-5 to +12 psig</div>	Control Room Panel SPY
A-14	Not used				

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
A-15	Manual reduction of ECCS Flow (Secondary heat sink capability)	Auxiliary Feedwater Flow	FFI-210 FFI-220 FFI-230 FFI-240	0-110 % design flow <hr/> 0 to 250 x 10 ³ PPH	Control Room Panel SG
A-16	Manual transfer to cold leg recirculation in low level in RWST	RWST Level	ILS-950 ILS-951 MR-36 for ILS-950	Essentially Top (bottom of overflow) to Bottom (bottom of safety injection pipe) (100% of total volume) <hr/> Essentially Top (bottom of overflow) to Bottom (bottom of safety injection pipe) (100% of total volume)	Control Room Panel Spy for MR-36 Control Room Panel BA for ILS-951

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
A-17	Manual trip or reduction of Pressurizer Spray and ECCS flow	Degrees subcooling	Inputs are received from variables A-2, A-25, A-38, and A-39 for Hot and Cold Leg Variables	200°F subcooling to 35°F superheat ----- 425°F subcooling to 75°F superheat	Control Room Panel BA
A-18	Not used				
A-19	Not used				
A-20	Not used				
A-21	Not used				
A-22	Not used				
A-23	Not used				
A-24	Not used				

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
A-25	Manual reduction of ECCS Flow	Core Exit Temp	SG-30 and SG-31 for TC 1-65 ¹	<div>200 - 2300°F</div> <div>-----</div> <div>200 - 2300°F</div>	Control Room Panel FI TC Readings Monitored By PPC and Recorders
A-26	Not used				
A-27	Not used				
A-28	Manual Trip of RCPs	CCP Breaker status	Unit 1 & 2 101-TD7 (Pump PP-50E) by BKR T11D7 101-TA8 (Pump PP-50W) by BKR T11A8	<div>Open/Close</div> <div>-----</div> <div>Open/Close</div>	Control Room Panel BA

¹ Technical Specifications (Unit 1-3.3.3.8 and Unit 2-3.3.3.6) require two TCs per channel per quadrant minimum.

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
A-29	Manual Trip of RCPs	SI pump breaker status	Unit 1 & 2 101-TD5 (Pump PP-26N) by BKR T11D5 101-TA1 (Pump PP-26S) by BKR T11A1	<div>Open/Close</div> <div>-----</div> <div>Open/Close</div>	Control Room Panel SIS
A-30	Not used				
A-31	Not used				
A-32	Not used				
A-33	Not used				
A-34	Manual trip of RCPs	Safety Injection Pump Flow	IFI-260 IFI-266	<div>0-500 gpm</div> <div>-----</div> <div>0-500 gpm</div>	Control Room Panel SIS
A-35	Not used				
A-36	Not used				

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
A-37	Not used				
A-38	RCS Cold Leg water temperature	RCS Cold Leg water temperature	MR-9 and MR-11 for NTR-210 NTR-230	<div>50-400°F</div> <div>-----</div> <div>0-700°F</div>	Control Room Panel DTU
A-39	Core Cooling	RCS Hot Leg water temperature	MR-9 and MR-11 for NTR-110 NTR-130	<div>50-700°F</div> <div>-----</div> <div>0-700°F</div>	Control Room Panel DTU

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
A-40	Post-Accident Sampling Containment	Containment Hydrogen concentration	PAS-H2-A-CRI and PAS-H2-B-CRI for ESR-1, ESR-2, ESR-3, ESR-4, ESR-5, ESR-6, ESR-7, ESR-8, ESR-9	0 to 30 volume % for ice-condenser type containment <hr/> 0-30 volume %	Control Room Panel IV
A-41	CCW flow to ESF system	CCW Pump Breaker Status	(101-TD3) PP-10E by BKR T11D3 (101-TA7) PP-10W by BKR T11A7	Open/Close <hr/> Open/Close	Control Room Panel CCW

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
A-42	Determination of excessive fouling or blockage of recirculation sump strainers	Containment Recirculation Sump Water Level	NLI-300 NLI-301	<div>-----</div> <div>Above/Below Vortex Limit</div>	Control Room Panel RHR

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TYPE "B" VARIABLES PROVIDED THE OPERATOR FOR MANUAL FUNCTIONS DURING AND FOLLOWING AN ACCIDENT

Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
B-1	Reactivity Control	Neutron Flux	NRI-21 NRI-23	10^{-6} to 100% power ----- 10^{-8} to 200% power	Control Room Panel NIS
B-2	Reactivity Control (continued)	Control Rod Position	CA1-8 (U1), CB1-4 (U1) CA1-4 (U2), CB1-8 (U2) CC1-8 CD1-9 SA1-8 SB1-8 SC1-4 SD1-4	Full In or Not Full In ----- Full In or Not Full In	Control Room Panel RC

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TYPE "B" VARIABLES PROVIDED THE OPERATOR FOR MANUAL FUNCTIONS DURING AND FOLLOWING AN ACCIDENT

Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
B-3	Reactivity Control (continued)	RCS soluble Boron concentration	NSX-101 NSX-103	<div>0-6000 ppm</div> <hr/> <div>Diluted = 375-10000 ppm</div> <div>Undiluted = 0.375-10000 ppm</div>	NA
B-4	Reactivity Control (continued) See Item A-38	RCS Cold Leg water temperature		<div>50-400°F</div> <hr/> <div>0-700°F</div>	
B-5	Core Cooling See Item A-39	RCS Hot Leg water temperature		<div>50-700°F</div> <hr/> <div>0-700°F</div>	

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TYPE "B" VARIABLES PROVIDED THE OPERATOR FOR MANUAL FUNCTIONS DURING AND FOLLOWING AN ACCIDENT

Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
B-6	Core Cooling (continued) See Items A-38 and B-4	RCS Cold Leg water temperature		<div>50-700°F</div> <hr/> <div>0-700°F</div>	
B-7	Core Cooling (continued) See Item A-2	RCS Pressure		<div>0-3000 psig</div> <hr/> <div>0-3000 psig</div>	
B-8	Core Cooling (continued) See Item A-25	Core exit temperature	SG-30 and SG-31 for TC 1-65	<div>200-2300°F</div> <hr/> <div>200-2300°F</div>	

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TYPE "B" VARIABLES PROVIDED THE OPERATOR FOR MANUAL FUNCTIONS DURING AND FOLLOWING AN ACCIDENT

Item No.	Purpose	Variable	Tag No.		Range Reg Guide 1.97 Value ----- Installed Value	Display Location
B-9	Core Cooling (continued)	Coolant Inventory RVLIS	NLI-110	NLI-111	Bottom of hot leg to top of vessel	Control Room Panel SIS
			NLI-120	NLI-121	Bottom of hot leg to top of vessel	
			NLI-130	NLI-131	Top of head vent piping to bottom of vessel (100% of volume)	
B-10	Core Cooling (continued) See item A-17	Degrees Subcooling				

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
B-11	Maintaining RCS Integrity See Item A-2	RCS Pressure		0-3000 psig ----- 0-3000 psig	
B-12	Maintaining RCS Integrity (continued) See Item A-8	Containment sump water level	NLA-310 NLI-311	----- 589'5" to 599'8" (bottom of sump to containment floor)	Control Room Panel RHR
B-13	Maintaining RCS Integrity (continued)	Containment pressure (wide range)	PPA-310 PPA-312	0 to design pressure (psig) ----- -5 to +36 psig	Control Room Panel SPY

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
B-14	Maintaining Containment Integrity	Containment Isolation valve position (excluding check valves)	See Table 5.4-1	<div>Closed-not closed</div> <hr/> <div>Closed-not closed</div>	Control Room Panel IV, Panel BA, Panel SIS, Panel SPY
B-15	Maintaining Containment Integrity (continued) See Items A-13 & B-13	Containment pressure		<div>-5 psig to design pressure</div> <hr/> <div>-5 to +12 psig (A-13) or -5 to +36 psig (B-13)</div>	

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TYPE "C" VARIABLES PROVIDED THE OPERATOR FOR MANUAL FUNCTIONS DURING AND FOLLOWING AN ACCIDENT

Item No.	Purpose	Variable	Tag No.	<div>Range Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
C-1	Fuel Cladding See Item A-25	Core Exit Temperature	SG-30 and SG-31 for TC 1-65	<div>200-2300°F</div> <hr/> <div>200-2300°F</div>	
C-2	Fuel Cladding (continued)	Radioactive Concentration or Radiation Level in Circulating Primary Coolant	NSX-101 NSX-103	<div>½ Tech Spec limit to 100 times Tech Spec limit</div> <hr/> <div>Equipment capable of measuring 1 µCi/ml to 10 Ci/ml</div>	NA

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
C-3	Fuel Cladding (continued) See Item C-2	Analysis of Primary Coolant (gamma spectrum)		<div>10 μCi/ml to 10Ci/ml or TID-14844 source term in coolant volume</div> <hr/> <div>Equipment capable of measuring 1 μCi/ml to 10 Ci/ml</div>	
C-4	Reactor Coolant pressure boundary See Item A-2	RCS Pressure		<div>0-3000 psig</div> <hr/> <div>0-3000 psig</div>	

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
C-5	Reactor Coolant pressure boundary (continued) See items A-13 & B-13	Containment Pressure		-5 psig to design pressure <hr/> -5 to +12 psig (A-13) or -5 to +36 psig (B-13)	
C-6	Reactor Coolant pressure boundary (continued) See Items A-8 & B-12	Containment Sump Water Level		See Items A-8 & B-12 <hr/> See Items A-8 & B-12	

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Item No.	Purpose	Variable	Tag No.	<div>Range Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
C-7	Reactor Coolant pressure boundary (continued) See Item A-12	Containment Area Radiation		<div>1 R/Hr to 1 x 10⁴ R/Hr</div> <hr/> <div>1 R/Hr to 1 x 10⁷ R/Hr</div>	
C-8	Reactor Coolant pressure boundary (continued)	Effluent Radioactivity- Noble Gas effluent from condenser air removal system exhaust	SRA-1900 for Unit 1 SRA-2900 for Unit 2	<div>1 x 10⁻⁶ to 1 x 10⁻² μCi/cc</div> <hr/> <div>9x10⁻⁷ to 9x10⁴ μCi/cc (Minimum Range)</div>	Control Room FFC Panel
C-9	Containment See Item A-2	RCS Pressure		<div>0-3000 psig</div> <hr/> <div>0-3000 psig</div>	

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
C-10	Containment (continued) See Item A-40	Containment Hydrogen Concentration	PAS-H2-A-CRI and PAS-H2-B-CRI for ESR 1 through 9	0 to 30 volume % for ice-condenser type containment <hr/> 0-30 volume %	
C-11	Containment (continued) See Items A-13 & B-13	Containment Pressure		-5 psig pressure to 3 times design pressure for concrete containment <hr/> -5 to +12 psig (A-13) or -5 to +36 psig (B-13)	

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Item No.	Purpose	Variable	Tag No.	<div>Range Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
C-12	Containment (continued)	Containment Effluent Radioactivity Noble Gases from identified release points	VRS-1500 for Unit 1 VRS-2500 for Unit 2	<div>1×10^{-6} to 1×10^{-2} $\mu\text{Ci/cc}$</div> <hr/> <div>9×10^{-7} to 9×10^4 $\mu\text{Ci/cc}$ (Minimum Range)</div>	Control Room FFC Panel
C-13	Containment (continued) See Item C-12	Effluent Radioactivity Noble Gases (from buildings or areas where penetrations and hatches are located, eg,) secondary containment and AUX buildings that are in direct contact with primary containment			

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
D-1	RHR System	RHR System Flow	<div>IFI-310 IFI-320</div> <div>(0-1500 GPM)</div> <div>IFI- 311 IFI-321</div> <div>(1500-5000 GPM)</div>	<div>0 to 110% design flow</div> <div>-----</div> <div>0-1500 GPM</div> <div>1500-5000 GPM</div>	Control Room Panel RHR
D-2	RHR System (continued)	RHR Heat Exchanger Outlet Temperature	<div>ITI-310</div> <div>ITI-320</div>	<div>40-350°F</div> <div>-----</div> <div>0-400°F</div>	Control Room Plant Process Computer (PPC)

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Item No.	Purpose	Variable	Tag No.	<div>Range Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
D-3a	SI System	Accumulator Tank Level	<div>ILA-110 ILA-120 ILA-130 ILA-140 (Wide Range)</div> <div>ILA-111 ILA-121 ILA-131 ILA-141 (Narrow Range)</div>	<div>10 to 90% volume</div> <div>-----</div> <div>Wide Range 4.148 to 120.8" or 300 to 1000 cubic ft (52% of total volume)</div> <div>Narrow Range 104.15 to 129.15" or 900 to 1050 cubic ft (7.5% of total volume)</div>	Control Room Panel SIS
D-3b	SI System (continued)	Accumulator Tank Pressure	<div>IPA-110 IPA-111 IPA-120 IPA-121 IPA-130 IPA-131 IPA-140 IPA-141</div>	<div>0 to 750 psig</div> <div>-----</div> <div>0-700 psig</div>	Control Room Panel SIS

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
D-4	SI System (continued)	Accumulator Tank Isolation Valve Position	<div>IMO-110 IMO-120</div> <div>IMO-130 IMO-140</div>	<div>Closed or Open</div> <hr/> <div>Closed or Open</div>	Control Room Panel SIS
D-5	SI System (continued) See Item D-24	Boric Acid Charging Flow	QFI-200	<div>0 to 110% design flow</div> <hr/> <div>0-200 GPM</div>	
D-6	SI System (continued) See Item A-1	Flow in HPI System	<div>IFI-51 IFI-52</div> <div>IFI-53 IFI-54</div>	<div>0 to 110% design flow</div> <hr/> <div>0-200 GPM</div>	

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
D-7	SI System (continued) See Item D-1	Flow in LPI System		0 to 110% design flow <hr/> 0-1500 GPM 1500-5000 GPM	
D-8	SI System (continued) See Item A-16	RWST Level		Top to Bottom <hr/> Essentially Top (bottom of overflow) to Bottom (bottom of safety injection pipe) (100% of total volume)	

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
D-9	Primary Coolant System	RCP Status	RCP-1 for PP-45-1 RCP-2 for PP-45-2 RCP-3 for PP-45-3 RCP-4 for PP-45-4	<div>Motor Current</div> <hr/> <div>0-1200 A</div>	Control Room Panel RCP
D-10	Primary Coolant System (continued)	Primary System Safety Relief Valve Flow	QR-107A QR-107B QR-107 C QR-107D	<div>NA</div> <hr/> <div>NA</div>	Control Room Panel RC
D-11	Primary Coolant System (continued) See Item A-10	Pressurizer Level		<div>Top to Bottom</div> <hr/> <div>0-100% (96% of indicated volume)</div>	

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Item No.	Purpose	Variable	Tag No.	Range Reg Guide 1.97 Value <hr/> Installed Value	Display Location
D-12	Primary Coolant System (continued)	Pressurizer Heater Status	Group A1, A2, A3 C1, C2, C3	On/Off <hr/> On/Off	Control Room Panel PRZ
D-13	Primary Coolant System (continued)	Quench Tank Level	NLA-351	Top to Bottom <hr/> 7" above tank bottom to 7" below tank top	Control Room Panel PRZ
D-14	Primary Coolant System (continued)	Quench Tank Temperature	NTA-351	50-750°F <hr/> 50-750°F	Control Room Panel PRZ

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
D-14a	Primary Coolant System (continued)	Quench Tank Pressure	NPA-351	<div>0 to design pressure</div> <hr/> <div>-10 to 100 psig</div>	Control Room Panel PRZ
D-15a	Secondary System (Steam Generator)	S/G Level (wide range)	<div>BLI-110 BLI-120</div> <div>BLI-130 BLI-140</div>	<div>From tube sheet to separators</div> <hr/> <div>From 12" above tube sheet to separators</div>	Control Room Panel SG

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TYPE "D" VARIABLES PROVIDED THE OPERATOR FOR MANUAL FUNCTIONS DURING AND FOLLOWING AN ACCIDENT

Item No.	Purpose	Variable	Tag No.	Range Reg Guide 1.97 Value <hr/> Installed Value	Display Location
D-15b	Secondary System (Steam Generator) (continued) See Item A-7	S/G Pressure		From atmospheric pressure to 20% above the lowest safety valve setting <hr/> 0-1200 psig	
D-16a	Secondary System (Steam Generator) (continued) See Item D-16b	Safety/Relief Valve Positions			

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
D-16b	Secondary System (Steam Generator) (continued)	Main Steam Flow	MFC-110 MFC-111 MFC-120 MFC-121 MFC-130 MFC-131 MFC-140 MFC-141	<div>NA</div> <hr/> <div>0-4 x 10⁶ PPH</div>	Control Room Panel SG
D-17	Secondary System (Steam Generator) (continued)	Main Feedwater Flow	FFC-210 FFC-211 FFC-220 FFC-221 FFC-230 FFC-231 FFC-240 FFC-241	<div>0 to 110% design flow</div> <hr/> <div>0-4 x 10⁶ PPH</div>	Control Room Panel SG
D-18	Auxiliary Feedwater System See Item A-15	Aux Feedwater Flow		<div>0 to 110% design flow</div> <hr/> <div>0 to 250 x 10³ PPH</div>	

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
D-19	Auxiliary Feedwater System (continued)	Condensate Storage Tank Level	<div>CLI-113 CLI-114</div> <div>CLR-110 CLR-111</div> <div>MR-49 for</div> <div>CLR-110 CLR-111</div>	<div>Plant specific</div> <hr/> <div>Essentially top to bottom (95% total volume)</div>	Control Room Panel CP
D-20	Containment Cooling System	Containment Spray Flow	<div>IFI-330 IFI-331</div> <div>(upper containment)</div> <div>(0-2500 GPM)</div> <div>PP-9E PP-9W</div> <div>(On/Off)</div>	<div>0 to 110% design flow</div> <hr/> <div>0-2500 GPM</div> <div>On/Off</div>	Control Room Panel SPY
D-21	Containment Cooling System (continued)	Heat Removal by Containment Heat Removal System	D.C. Cook does not have this type of system and therefore it does not apply		

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Item No.	Purpose	Variable	Tag No.	Range Reg Guide 1.97 Value ----- Installed Value	Display Location
D-22	Containment Cooling System (continued)	Containment Atmosphere Temperature	SG-18 for ETR-11 ETR-12 ETR-13 ETR-14 ETR-15 ETR-16 ETR-17 ETR-18 ETR-19 ETR-20 ETR-21 ETR-22 ETR-23 ETR-24 ETR-25 ETR-26 and ETR-27	40-400°F ----- 0-400°F	Control Room Aux Relay Panel A-15
D-23	Containment Cooling System (continued)	Containment Sump Water Temperature	MR-14 and MR-15 for ITR-311 and ITR-321	50 to 250°F ----- 50 to 400°F	Control Room Panel RHR

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
D-24	Chemical and Volume Control System	Makeup Flow – In	QFI-200	<div>0 to 110% design flow</div> <hr/> <div>0-200 GPM</div>	Control Room Panel BA
D-25	Chemical and Volume Control System (continued)	Letdown Flow – Out	QFI-301	<div>0 to 110% design flow</div> <hr/> <div>0-200 GPM</div>	Control Room Panel BA and Panel HSD
D-26	Chemical and Volume Control System (continued)	Volume Control Tank Level	<div>QLC-451</div> <div>QLC-452</div>	<div>Top to Bottom</div> <hr/> <div>Essentially top to bottom (65% of total volume)</div>	Control Room Panel BA

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
D-27	Cooling Water System	CCW Water Temperature to ESF System	SG-10 for CTR-410 CTR-415 CTR-420 CTR-425	<div>40-200°F</div> <hr/> <div>0-200°F</div>	Control Room Panel ESW
D-28	Cooling Water System (continued)	CCW Flow to ESF System	CFI-410 CFI-420 (0-10000 GPM) CFI-419 CFI-429 (0-6000 GPM)	<div>0 to 110% design flow</div> <hr/> <div>0-10000 GPM 0-6000 GPM</div>	Control Room Panel CCW
D-29	Rad Waste System	High Level Radioactive Liquid Tank Level	12-RLS-255 12-RLS-256	<div>Top to Bottom</div> <hr/> <div>Essentially top to bottom (84% of total volume)</div>	Panel WDS

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
D-30	Rad Waste System (continued)	Radioactive Gas Holdup Tank Pressure	12-MR-58 and 12-MR-59 for 12-RPC-310 12-RPC-320 12-RPC-330 12-RPC-340 12-RPC-350 12-RPC-360 12-RPC-370 12-RPC-380	0 to 150% design pressure <hr/> 0-250 psig	Panel WDS
D-31	Ventilation System	Emergency Ventilation Damper Position	VCR-201 VCR-202 VCR-203 VCR-204 VCR-205 VCR-206 VCR-207	Open/Closed <hr/> Open/Closed	Control Room Panel IV VCR-207 on Control Room Panel SPY

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
D-32a	Status of Standby Power and Other Energy Sources Important to Safety	Diesel Generator Status	DGAB-AM-1-REM DGCD-AM-1-REM DGAB-AM-2-REM DGCD-AM-2-REM DGAB-AM-3-REM DGCD-AM-3-REM	<div>Plant Specific</div> <hr/> <div>0-800 A</div>	Control Room Panel SA
D-32b	Status of Standby Power and Other Energy Sources Important to Safety (continued)	4Kv Safety Related Power Systems Status	Bus T11A, T11B, T11C, T11D for Unit 1 Bus T21A, T21B, T21C, T21D for Unit 2	<div>Plant Specific</div> <hr/> <div>0-150 V</div>	Control Room Panel SA

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
D-32c	Status of Standby Power and Other Energy Sources Important to Safety (continued)	250 Vdc Battery Power System Status	BATT-AB-REM-VM BATT-CD-REM-VM	<div>Plant Specific</div> <hr/> <div>0-300 V</div>	Control Room Panel SA
D-32d	Status of Standby Power and Other Energy Sources Important to Safety (continued)	120 Vac Safety Related Power System Status	Channel I, II, III, IV CRID-1-VM CRID-2-VM CRID-3-VM CRID-4-VM	<div>Plant Specific</div> <hr/> <div>0-150 V</div>	Control Room Panel SA

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
D-32e	Status of Standby Power and Other Energy Sources Important to Safety (continued)	Instrument Air Status	XPI-100 (0-150 psig) XPI-50 (0-100 psig) XPI-20 (0-60 psig) XPI-85 (0-160 psig)	<div>Plant Specific</div> <div>-----</div>	Control Room Panel SV

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
E-1	Containment Radiation See Item A-12	Containment Area Radiation Monitor High Range		<div>1 R/Hr to 1 x 10⁷ R/Hr</div> <div>-----</div> <div>1 R/Hr to 1 x 10⁷ R/Hr</div>	

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
E-2	Area Radiation	Radiation Exposure Rate (inside buildings or where areas of access are required to service equipment important to safety)	<div>ERA-7303 ERA-7304</div> <div>ERA-7305 ERA-7306</div> <div>ERA-7307 ERA-7308</div> <div> </div> <div>ERA-7403 ERA-7404</div> <div> </div> <div>ERA-7504 ERA-7507</div> <div> ERA-7508</div> <div> </div> <div>ERA-7601 ERA-7602</div> <div>ERA-7603 ERA-7604</div> <div> ERA-7605</div> <div> </div> <div>ERA-8303 ERA-8304</div> <div>ERA-8305 ERA-8306</div> <div>ERA-8307 ERA-8308</div> <div> </div> <div>ERA-8403</div> <div> </div> <div>ERS-7401</div> <div> </div> <div>ERS-8401</div>	<div>1 x 10⁻¹ R/Hr</div> <div> </div> <div>to</div> <div> </div> <div>1 x 10⁴ R/Hr</div> <div> </div> <div>-----</div> <div> </div> <div>Equipment installed is capable of monitoring within the range</div>	Control Room FFC Panel

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
E-3a	Noble Gases and Vent Flow Rate See Item E-3e	Containment or Purge Effluent			
E-3b	Noble Gases and Vent Flow Rate (continued) See Item E-3e	Reactor Shield Building Annulus			
E-3c	Noble Gases and Vent Flow Rate (continued) See Item E-3e	Aux Building			

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
E-3d	Noble Gases and Vent Flow Rate (continued)	Condenser Air Removal System Exhaust	SRA-1900 for Unit 1 SRA-2900 for Unit 2 SFR-401 (0-250 scfm only)	1×10^{-6} to $1 \times 10^5 \mu\text{Ci/cc}$ 0 to 110% vent design flow ----- 9×10^{-7} to $9 \times 10^4 \mu\text{Ci/cc}$ (Minimum Range) 0-250 scfm	Control Room FFC Panel

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TYPE "E" VARIABLES PROVIDED THE OPERATOR FOR MANUAL FUNCTIONS DURING AND FOLLOWING AN ACCIDENT

Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
E-3e	Noble Gases and Vent Flow Rate (continued)	Common Plant Vent	VRS-1500 for Unit 1 VRS-2500 for Unit 2 VFR-315 (0-200k scfm only)	1×10^{-6} to $1 \times 10^3 \mu\text{Ci/cc}$ 0 to 110% vent design flow ----- 9×10^{-7} to $9 \times 10^4 \mu\text{Ci/cc}$ (Minimum Range) 0-200k scfm	Control Room FFC Panel

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TYPE "E" VARIABLES PROVIDED THE OPERATOR FOR MANUAL FUNCTIONS DURING AND FOLLOWING AN ACCIDENT

Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
E-3f	Noble Gases and Vent Flow Rate (continued)	Vent from S/G Safety Relief Valves	MRA-1600, MRA-1700 (Unit 1) MRA-2600, MRA-2700 (Unit 2)	<div> 1×10^{-1} to $1 \times 10^3 \mu\text{Ci/cc}$ </div> <div>-----</div> <div> 0.1 to $100 \mu\text{Ci/cc}^2$ </div>	Control Room FFC Panel

² This is the minimum sensitivity of the instrument for normal operation, to follow the course of an accident, and/or take protective actions. Values of the instrument above or below this minimum sensitivity range are acceptable.

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TYPE "E" VARIABLES PROVIDED THE OPERATOR FOR MANUAL FUNCTIONS DURING AND FOLLOWING AN ACCIDENT

Item No.	Purpose	Variable	Tag No.	<div>Range Reg Guide 1.97 Value</div> <hr/> <div>Installed Value</div>	Display Location
E-3g	Noble Gases and Vent Flow Rate (continued)	Other Identified Release Points	<p>SRA-1800 (Unit 1)</p> <p>SRA-2800 (Unit 2)</p> <p>SFR-201 (0-4500 scfm only)</p>	<p>1×10^{-6} to $1 \times 10^2 \mu\text{Ci/cc}$</p> <p>0 to 110% vent design flow</p> <hr/> <p>1×10^{-7} to $1 \times 10^5 \mu\text{Ci/cc}$ (SRA-1800) 1×10^{-7} to $1 \times 10^5 \mu\text{Ci/cc}$ (SRA-2800) (Minimum Range)</p> <p>Unit 1 = 0-1500 scfm</p> <p>Unit 2 = 0-4500 scfm</p>	Control Room FFC Panel

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Item No.	Purpose	Variable	Tag No.	<div style="text-align: center;"> Range Reg Guide 1.97 Value ----- Installed Value </div>	Display Location
E-4	Particulates and Halogens See Item E-3e	All Identified Release Points (except S/G safety relief valves and condenser air removal system exhaust) sampling and onsite analysis		<div style="text-align: center;"> 1×10^{-3} to $1 \times 10^2 \mu\text{Ci/cc}$ 0 to 110% vent design flow ----- </div>	
E-5a	Environmental Radiation and Radioactivity	Airborne Radioactivity and Particulates Sampling and Analysis (portable)	NA	<div style="text-align: center;"> 1×10^{-9} to $1 \times 10^3 \mu\text{Ci/cc}$ ----- 1×10^{-9} to $1 \times 10^{-3} \mu\text{Ci/cc}$ (minimum) </div>	

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TYPE "E" VARIABLES PROVIDED THE OPERATOR FOR MANUAL FUNCTIONS DURING AND FOLLOWING AN ACCIDENT

Item No.	Purpose	Variable	Tag No.	<div>Range Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
E-5b	Environmental Radiation and Radioactivity (continued)	Plant and Environmental Radiation (portable)	NA	<div> 1×10^{-3} to 1×10^4 R/hr photons </div> <div> 1×10^{-3} to 1×10^4 Rads/hr Beta radiations and low-energy photons </div> <div> <div>-----</div> Gamma 1×10^{-3} to 1×10^4 R/hr </div> <div> Beta / low energy gamma 1×10^{-3} to 1×10^4 Rad/hr </div>	

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
E-5c	Environmental Radiation and Radioactivity (continued)	Plant and Environmental Radioactivity (portable)	NA	<div>Isotopic analysis</div> <div>-----</div> <div>Isotopic analysis</div>	
E-6	Meteorology	Wind Direction	<div>EFR-410 EFR-412</div> <div>EFR-413 EFR-414</div>	<div>0-360 degrees</div> <div>-----</div> <div>0-360 degrees</div>	Control Room Plant Process Computer (PPC)
E-7	Meteorology (continued)	Wind Speed	<div>EFR-400 EFR-404</div> <div>EFR-402 EFR-403</div>	<div>0-100 MPH</div> <div>-----</div> <div>0-125 MPH</div>	Control Room Plant Process Computer (PPC)

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Item No.	Purpose	Variable	Tag No.	<div>Range</div> <div>Reg Guide 1.97 Value</div> <div>-----</div> <div>Installed Value</div>	Display Location
E-8	Meteorology (continued)	Estimation of Atmospheric Stability	<div>ETR-400 ETR-402</div> <div>ETR-403</div> <div>ETQ-401</div>	<div>-5°C to +10°C</div> <div>per 50 meter intervals</div> <div>-----</div> <div>-30 to 50 °C</div>	Control Room Plant Process Computer (PPC)
E-9a	Line Item Deleted				
E-9b	Line Item Deleted				
E-9c	Line Item Deleted				
E-9d	Line Item Deleted				
E-9f	Line Item Deleted				
E-9g	Line Item Deleted				
E-9h	Line Item Deleted				
E-10a	Line Item Deleted				
E-10b	Line Item Deleted				
E-10c	Line Item Deleted				