

TABLE 1.4-1

**BWR SAFETY ENGINEERING CONCEPT FOR CLASSIFICATION OF BWR SYSTEMS,  
CRITERIA AND REQUIREMENTS FOR SAFETY EVALUATION**

**ACTUAL PLANT DESIGN AND OPERATION**

<u>Type of Operation or Event</u>	<u>Safety Considerations</u>	<u>Power Generation Considerations</u>
1. Planned Operation	In this category are classified the unacceptable safety results, criteria, plant actions, systems, and operational requirements pertinent to safety during planned operation. This space represents the aspects of the BWR which must be considered to assure that the BWR operator can operate the plant within specified safety limitations. Certain process indicators, process variable limits and limits on the release of radioactive material would be classified here.	In this category are classified the unacceptable results for power generation, criteria, plant actions, systems and operational requirements pertinent to the production of electrical power during planned operation. Process systems and normal operational procedures would be classified here.
2. Abnormal Operational Transients	In this category are classified the unacceptable safety results, criteria, plant actions, systems and operational requirements pertinent to safety in regard to abnormal operational transients. Certain protection systems, safety limits, and limiting safety system settings would be classified here.	In this category are classified the unacceptable results for power generation, criteria, plant actions, systems and operational requirements pertinent to the ability to produce electrical power as that ability is affected by abnormal operational transients. Certain systems not used for planned operation would be classified here.
3. Accidents	In this category are classified the unacceptable safety results, criteria, plant actions, systems and operational requirements pertinent to safety in regard to accidents. Engineered safeguards would be classified here.	In this category are classified the unacceptable results for power generation, criteria, plant actions, systems and operational requirements pertinent to the ability to produce electrical power as that ability is affected by accidents. Design considerations and post-accident procedures provided to enable the plant to be used for power generation after an accident would be classified here.
4. Special Event	In this category are classified the unacceptable safety results, criteria, plant actions, systems and operational requirements pertinent to safety in regard to the stated special event. Safety systems provided especially for the special event would be classified here.	In this category are classified the unacceptable results for power generation, criteria, plant actions, systems and operational requirements pertinent to the ability to produce electrical power as that ability is affected by the stated special event. Systems and procedures provided to enable the plant to be returned to power operation following the special event would be classified here.

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Table 1.4-2A

(Sheet 1)

BROWNS FERRY NUCLEAR PLANT  
CLASSIFICATION OF BWR SYSTEMS, CRITERIA,  
AND REQUIREMENTS FOR SAFETY EVALUATION

ACTUAL PLANT DESIGN AND OPERATION  
SAFETY CONSIDERATIONS

Type of Operation or event	Unacceptable Safety Results		Types of Applicable Criteria	Types of Actions Required to Avoid Unacceptable Results	Types of Systems Required to Carry Out Action	Types of Requirements to be Observed in Operation of Plant to Avoid Unacceptable Results
1. Planned Operation	1-1	The release of radioactive material to the environs to such an extent that the limits of 10CFR20 are exceeded.	Nuclear Safety Design Criteria-Type S-1	Safety Action- Type S-1	Safety Systems- Type S-1	Operational Nuclear Safety Requirements-Type S-1
			Nuclear Safety Operational Criteria- Type S-1	Process Safety Action (A Category of Safety Action)	Process Safety Systems (A Category of Safety Systems)	Operational Nuclear Safety Limits-Type S-1
	1-2	Fuel failure to such an extent that were the fired fission products to the environs via the normal discharge paths for radioactive material, limits of 10CFR20 would be exceeded.	Process Safety Design Criteria	Indication of Process Variables	Indicators	Technical Specifications- Type S-1
			Process Safety Operational Criteria	Rod Worth Monitoring	Rod Worth Minimizer Program of Process Computer	Process Safety Limits
			Various Industry Codes	Rod Pattern Control	Radwaste Systems	Limiting Conditions for Operation for Indicators
			Radwaste Criteria	Control of Process Variables	Process Radiation Monitors	Radioactive Material Release Limits
	1-3	Nuclear System stress in excess of that allowed for planned operation by applicable industry codes.	Loading Criteria (Normal Conditions)	Control Rod Control Refueling Block	Control Rod Drive System	Rod Pattern Limits
				Control Rod Control	Reactor Manual Control System	
				Refueling Block	Refueling Interlocks	Limiting Conditions for Operation for Radwaste Systems
				Core Shutdown Control	Reactor Protection System (Manual Scram)	Nuclear System Leakage Limits
	1-4	The existence of a plant condition not considered by plant safety analysis.		Radwaste		
				Isolation	Condensate Storage System  Neutron Monitoring System	

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Table 1.4-2A (Sheet 2)  
BROWNS FERRY NUCLEAR PLANT  
CLASSIFICATION OF BWR SYSTEMS, CRITERIA,  
AND REQUIREMENTS FOR SAFETY EVALUATION

ACTUAL PLANT DESIGN AND OPERATION  
SAFETY CONSIDERATIONS

<u>Type of Operation or Event</u>	<u>Unacceptable Safety Results</u>	<u>Types of Applicable Criteria</u>	<u>Types of Actions Required to Avoid Unacceptable Results</u>	<u>Types of Systems Required to Carry Out Action</u>	<u>Types of Requirements to be Observed in Operation of Plant to Avoid Unacceptable Results</u>
2. Abnormal Operational Transients	2.1 The release of radioactive material to the environs to such an extent that the limits of 10CFR20 are exceeded.	Nuclear Safety Design Criteria-Type S-2	Safety Action-Type S-2	Safety Systems-Type S-2	Operational Nuclear Safety Requirements-Type S-2
		Nuclear Safety Operational Criteria-Type S-2	Scram	Protection System (Generic Term)	
			Pressure Relief	Nuclear Safety Systems (A Category of Protection Systems)	Operational Nuclear Safety Limits-Type S-2
	2.2 Any fuel failure calculated as a result of the transient.	Various Industry Codes	Core Cooling		
			Containment Cooling (RHRS)	Reactor Protection System (Scram)	Technical Specifications-Type S-2
		IEEE-279	Primary Containment	Control Rod Drive System (Scram)	Safety Limits
		Availability Goals	Secondary Containment	Neutron Monitoring System (IRM, APRM)	Limiting Safety System Settings
		Loading Criteria (Upset Conditions)		Pressure Relief System	
	2.3 Nuclear system stress in excess of that allowed for transients by applicable industry codes.	Single Failure Criterion		Reactor Vessel Isolation Control System	Limiting Conditions for Operation for Protection Systems
		Testability Criteria		High Pressure Coolant Injection System	Surveillance Requirements for Protection Systems
				D-C Power System	
				Standby A-C Power	

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Table 1.4-2A (Sheet 3)  
BROWNS FERRY NUCLEAR PLANT  
CLASSIFICATION OF BWR SYSTEMS, CRITERIA,  
AND REQUIREMENTS FOR SAFETY EVALUATION

ACTUAL PLANT DESIGN AND OPERATION  
SAFETY CONSIDERATIONS

<u>Type of Operation or Event</u>	<u>Unacceptable Safety Results</u>	<u>Types of Applicable Criteria</u>	<u>Types of Actions Required to Avoid Unacceptable Results</u>	<u>Types of Systems Required to Carry Out Action</u>	<u>Types of Requirements to be Observed in Operation of Plant to Avoid Unacceptable Results</u>
3. Accidents	3-1 Radioactive material release to such an extent that the guideline values of 10CFR50.67 would be exceeded.	Nuclear Safety Design Criteria-Type S-3	Safety Action-Type S-3	Safety Systems-Type S-3	Operational Nuclear Safety Requirement-Type S-3
		Nuclear Safety Operational Criteria - Type S-3	Scram Core Cooling	Protection Systems (Generic Term) Engineered Safeguards	Operational Nuclear Safety Limits-Type S-3
	3-2 Fuel cladding temperatures in excess of 2200°F for Pipe Breaks		Containment	Reactor Protection System Control Rod Drive System Neutron Monitoring System	Technical Specifications-Type S-3
	3-3 Nuclear system pressure in excess of that allowed for accidents by applicable industry codes.	Various Industry Codes	Containment Cooling	Pressure Relief System (Main Steam Relief Valves) Reactor Vessel Isolation Control System Primary Containment Isolation Control System Primary Containment Secondary Containment Main Steam Line Isolation Valves Main Steam Line Flow Restrictor High Pressure Coolant Injection System Automatic Depressurization System Low Pressure Coolant Injection Core Spray System RHRS (Containment Cooling) Control Rod Velocity Limiter	Limiting Safety System Settings
		IEEE-279 Availability Goals	Stop Control Rod Ejection		Limiting Conditions for Operation for Protection Systems
	3-4 Containment stresses sufficient to produce containment failure when containment is required.	Loading Criteria (Emergency and Faulted Conditions)	Limit Reactivity Insertion Rate Pressure Relief		Surveillance Requirements for Nuclear System
	3-5 Overexposure to radiation of operating personnel in the control room.	Single Failure Criteria	Reactor Vessel Isolation		
		Testability Criteria	Primary Containment Isolation		

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Table 1.4-2A (Sheet 4)  
BROWNS FERRY NUCLEAR PLANT  
CLASSIFICATION OF BWR SYSTEMS, CRITERIA,  
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ACTUAL PLANT DESIGN AND OPERATION  
SAFETY CONSIDERATIONS

<u>Type of Operation or Event</u>	<u>Unacceptable Safety Results</u>	<u>Types of Applicable Criteria</u>	<u>Types of Actions Required to Avoid Unacceptable Results</u>	<u>Types of Systems Required to Carry Out Action</u>	<u>Types of Requirements to be Observed in Operation of Plant to Avoid Unacceptable Results</u>
3. Accidents (Cont.)	3-5 Overexposure to radiation of operating personnel in the control room.	Testability Criteria	Secondary Containment Isolation	Control Rod Drive Housing Supports Standby Gas Treatment System Standby A-C Power System D-C Power System Main Steam Line Radiation Monitoring System Reactor Building Ventilator Radiation Monitoring System RHR Service Water System	Surveillance requirements for nuclear systems
			Treatment of Fission Products		
			Restriction of Coolant Loss Rate		
			Control Room Isolation		
	3-6 Peak enthalpy of fuel in excess of 280 cal/gm for the control rod drop accident.				

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Table 1.4-2A (Sheet 5)  
BROWNS FERRY NUCLEAR PLANT  
CLASSIFICATION OF BWR SYSTEMS, CRITERIA,  
AND REQUIREMENTS FOR SAFETY EVALUATION

ACTUAL PLANT DESIGN AND OPERATION  
SAFETY CONSIDERATIONS

<u>Type of Operation or Event</u>	<u>Unacceptable Safety Results</u>	<u>Types of Applicable Criteria</u>	<u>Types of Actions Required to Avoid Unacceptable Results</u>	<u>Types of Systems Required to Carry Out Action</u>	<u>Types of Requirements to be Observed in Operation of Plant to Avoid Unacceptable Results</u>
4. Special Event Loss of Habitability of the Control Room	4-1 The inability to bring the reactor to the shutdown condition by manip- ulation of the local controls and equipment which  side the control room.	Nuclear Safety Design Criteria-Type S-4	Safety Action - Type S-4  Special Safety Action	Safety Systems-Type S-4  Special Safety Systems	Operational Nuclear Safety Requirements-Type S-4
		Nuclear Safety Operational Criteria- are available out-	Shutdown From Outside Type S-4	Local Controls Outside Control Room	Operational Nuclear Safety Limits-Type S-4 Control Room
		Special Safety Design Criteria	Cooldown from Outside Control Room	Local Indicators Outside Control Room	Technical Specifications- Type S-4
	4-2 The inability to bring the reactor to the cold shut- down condition from outside the control room.	Special Safety Operational Criteria		Condensate Storage System	Limiting Conditions for Operation for Special Safety Systems
				Reactor Core Isolation Cooling System	Surveillance Requirements for Special Safety Systems
				Pressure Relief System	
				Reactor Protection System	
				Control Rod Drive System	
				RHR (containment Cooling)	

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Table 1.4-2A (Sheet 6)  
BROWNS FERRY NUCLEAR PLANT  
CLASSIFICATION OF BWR SYSTEMS, CRITERIA,  
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ACTUAL PLANT DESIGN AND OPERATION  
SAFETY CONSIDERATIONS

<u>Type of Operation or Event</u>		<u>Unacceptable Safety Results</u>	<u>Types of Applicable Criteria</u>	<u>Types of Actions Required to Avoid Unacceptable Results</u>	<u>Types of Systems Required to Carry Out Action</u>	<u>Types of Requirements to be Observed in Operation of Plant to Avoid Unacceptable Results</u>	
5.	Special Event-Inability to Shut Down Reactor With Control Rods	5-1	The inability to shut down the reactor independent of control rods	Nuclear Safety Design Criteria-Type S-5	Safety Action-Type S-5  Special Safety Action	Safety Systems-Type S-5  Special Safety Systems	Operational Nuclear Safety Requirements-Type S-5  Operational Nuclear Safety Limits-Type S-5
		5-2	The inability to maintain the reactor in the shutdown condition independent of control rods	Nuclear Safety Operational Criteria Type S-5	Shutdown Without Control Rods	Standby Liquid Control System	Technical Specifications-Type S-5
				Special Safety Design Criteria	Maintain Shutdown During Reactor Cooldown	RWCU Isolation	Limiting Conditions for Operation for Special Safety Systems
				Special Safety Operational Criteria			Surveillance Requirements for Special Safety Systems

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Table 1.4-2B (Sheet 1)  
BROWNS FERRY NUCLEAR PLANT  
CLASSIFICATION OF BWR SYSTEMS, CRITERIA,  
AND REQUIREMENTS FOR SAFETY EVALUATION

ACTUAL PLANT DESIGN AND OPERATION  
POWER GENERATION CONSIDERATIONS

<u>Type of Operation or Event</u>	<u>Unacceptable Results for Power Generation (Where More Restrictive Than Unacceptable Safety Results)</u>	<u>Types of Applicable Criteria</u>	<u>Types of Actions Required to Avoid Unacceptable Results (Where Not Required as a Safety Action)</u>	<u>Types of Systems Required to Avoid Unacceptable Results (Where Not Required as a Safety Action)</u>	<u>Types of Requirements to be Observed in Operation of Plant to Avoid Unacceptable Results</u>
1. Planned Operation	1-1 Inability to generate electrical power	Power Generator Design Criteria-Type PG-1	Power Generation Action-Type PG-1	Power Generator Systems-Type PG-1	Operational Power Generator Requirements-Type PG-1
	1-2 Fuel Failure	Power Generator Operational Criteria - Type PG-1			Operational Power Generator Limits-Type PG-1
	1-3 Inability to Perform Routine Maintenance with Plant at Power	Process Design Criteria	Process Action (A Category of Power Generation Action)	Process Systems (A Category of Power Generator Systems)	Normal Operating Procedures
	1-4 Inability to Optimize Fuel Performance	Process Operational Criteria	Indications of Process Variables	Indicators	Maintenance Procedures
	1-5 Inability to Respond to Changes in Power Demand		Process Operations  Fuel Performance Calculations	Process Computer System  Recirculation Flow Control System	Calibration Procedures  Refueling Procedures
	1-6 Inability to Shut Down Reactor with Control Rods in the Normal Manner		Power Level Control  Consideration of Exhaust Steam	Reactor Manual Control System  Control Rod Drive System  Feedwater System  Turbine-Generator  Main Condenser	



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Table 1.4-2B (Sheet 2)  
BROWNS FERRY NUCLEAR PLANT  
CLASSIFICATION OF BWR SYSTEMS, CRITERIA,  
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ACTUAL PLANT DESIGN AND OPERATION  
POWER GENERATION CONSIDERATIONS

<u>Type of Operation or Event</u>	<u>Unacceptable Results for Power Generation (Where More Restrictive Than Unacceptable Safety Results)</u>	<u>Types of Applicable Criteria</u>	<u>Types of Actions Required to Avoid Unacceptable Results (Where Not Required as a Safety Action)</u>	<u>Types of Systems Required to Avoid Unacceptable Results (Where Not Required as a Safety Action)</u>	<u>Types of Requirements to be Observed in Operation of Plant to Avoid Unacceptable Results</u>
2. Abnormal Operational Transients	2-1 Fuel Failure	Power Generation Design Criteria-Type PG-2	Power Generation Action Type PG-2	Power Generation Systems Type PG-2	Operational Power Generation Requirements-Type PG-2
	2-2 The Lifting of Main Steam Relief Valves	Power Generation Operational Criteria Type PG-2			Operational Power Generation Limits-Type PG-2
	2-3 Conditions Requiring the Opening of the Reactor Vessel for Inspection or Repair		Rod Block	Reactor Manual Control System (Rod Block)	
			Pressure Relief	Pressure Relief System	Normal Operating Procedures
			Refueling Block		
	2-4 Inability to Return to Power Operation		Scram	Refueling Interlocks	Post Transient Recovery Procedures
	2-5 Inadvertent Criticality During Refueling		Core Cooling	Reactor Protection System (RPS)	Refueling Restrictions
				Electro Hydraulic Control (EHC) System	
				Reactor Core Isolation Cooling (RCIC)	

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Table 1.4-2B (Sheet 3)  
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POWER GENERATION CONSIDERATIONS

<u>Type of Operation or Event</u>	<u>Unacceptable Results for Power Generation (Where More Restrictive Than Unacceptable Safety Results)</u>	<u>Types of Applicable Criteria</u>	<u>Types of Actions Required to Avoid Unacceptable Results (Where Not Required as a Safety Action)</u>	<u>Types of Systems Required to Avoid Unacceptable Results (Where Not Required as a Safety Action)</u>	<u>Types of Requirements to be Observed in Operation of Plant to Avoid Unacceptable Results</u>
3. Accidents	3-1 Inability to Return to Power Operation	Power Generation Design Criteria-Type PG-3  Power Generation Operational Criteria - Type PG-3	Power Generation Action - Type PG-3	Power Generation Systems - Type PG-3	Operational Power Generation Requirements-Type PG-3  Operational Power Generation Limits-Type PG-3  Post Accident Recovery Procedures
4. Special Event Loss of Habitability of the Control Room	4-1 Inability to Return to Power Operation	Power Generation Design Criteria-Type PG-4  Power Generation Operational Criteria - Type PG-4	Power Generation Action- Type PG-4	Power Generation Systems- Type PG-4	Operational Power Generation Requirements-Type PG-4  Operational Power Generation Limits-Type PG-4  Post Event Recovery Procedures
5. Special Event Inability to Shut Down Reactor With Control Rods	5-1 Inability to Return to Power Operation	Power Generation Design Criteria-Type PG-5  Power Generation Operational Criteria - Type PG-5	Power Generation Action - Type PG-5	Power Generation Systems- Type PG-5	Operational Power Generation Requirements-Type PG-5  Operational Power Generation Limits-Type PG-5  Post Event Recovery Procedures