

**Duke Power Company
Oconee Nuclear Station
Units 1**

**License Renewal
Integrated Plant Assessment
Engineering Report**

Report No. ONLR-0005

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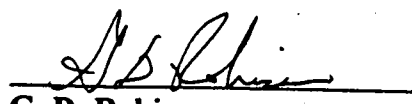
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Revision A


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Revision B

Table Of Contents

1.0	Integrated Plant Assessment Demonstration Introduction	
2.0	Integrated Plant Assessment Process Description	
3.0	Integrated Assessment System Evaluation Results	
3.1	Diverse Scram System (DSS) Portion of the ATWS System	
3.1.1	DSS ITLR Requirements	
3.1.2	DSS ITLR Functions	
3.1.3	DSS Boundary	
3.1.4	Component Screening Results	
3.1.5	Selected Component Evaluations	
3.1.6	References and Data Sources	
3.2	Low Pressure Injection System	
3.2.1	LPI System ITLR Requirements	
3.2.2	LPI System ITLR Functions	
3.2.3	LPI System Boundary	
3.2.4	Component Screening Results	
3.2.5	Selected Component Evaluations	
3.2.6	References and Data Sources	
4.0	Structures Investigation Results	
5.0	Conclusions and Lessons Learned	
6.0	Master Component Functions Listing	B
7.0	IPA Methodology and Logic Diagram	

6.0 MASTER COMPONENT FUNCTION LISTING

GENERIC COMPONENT SUMMARY FOR GLR PROGRAM

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Attached is the Generic Component Summary For GLR Program (Table 4). This table lists components, their GLRP component code (if applicable, this is based on NPRDS convention), component type(s), component function(s), function type (active or passive), detectable symptoms of functional failure, and comments. These fields are defined in Table 1. For each component function, a function type and one or more detectable symptoms are presented.

This list of generic components and functions was compiled from the following source documents:

- [1] NPRDS Reportable System and Component Scope Manual, Babcock & Wilcox Pressurized Water Reactors, The Institute of Nuclear Power Operations (INPO), INPO 83-020B, Revision 4, April 1990.
- [2] TMI-1 Database (See Memo from Darel Alvarez to Mark Rinckel, TMI-1 Component Tally, May 24, 1993).
- [3] Davis-Besse Administrative Procedure, Structure, System, and Component Quality Classification, Attachment 6: Component Function Table, Procedure Number EN-DP-01130, C-1, Revision 02, as included in Memo from M. A. Rinckel to W. R. Gray, Trip Report-Davis Besse 6/21/93-6/22/93, July 15, 1993.
- [4] Safety List Classification and Configuration Data, Sorted by Category - Major; Tag - Minor, NE600005, Florida Power Corporation, May 2, 1993
- [5] Prioritization of TIRGALEX - Recommended Components for Further Aging Research, Pacific Northwest Laboratory, prepared for the U.S. Nuclear Regulatory Commission, NUREG/CR-5248, PNL-6701, Nov. 1988.
- [6] Guidelines for the Safety Classification of Systems, Components, and Parts Used in Nuclear Power Plant Applications, EPRI NP-6895, February 1991.

To aid in GLR analysts' task to classify plant equipment/components into the generic component bins, Table 2 has been prepared. Table 2 is a cross-reference of various components names to the GLRP Component Code field of Table 4. For example, "hand switches" are included in the generic component category "circuit closer/interrupter (CKTBKR)," based on NPRDS coding convention.

At present, Table 4 should be considered preliminary. It is intended for trial use in the vertical slice activity. Further refinement or changes as a result of lessons learned and technical discussion are expected. The following items are a partial list of areas that may require further attention:

1. Components whose primary function is structural have not been developed. These components, have been partially listed in Table 3. Data source [4] is not reflected in this list because the level

of detail was considerably greater than the other sources. Some of the issues that have a bearing on the development of the structural component evaluation process are:

- a) what is the preferred (consensus) level of detail in component screening, and
 - b) would it be more productive to perform severity-based discrimination into the condition-based and ARDM-based paths or rely directly on ARDM-based commodity grouping?
2. The level of detail to which the electrical systems should be subjected may be different than reflected in the table. Experience may show that channel or train level of detail may be more appropriate for identification of functions and performance-based programs.
 3. In some cases, especially electrical components, there is some ambiguity in the definition of passive vs. active component function. In the evaluation methodology, designation as "active" is a short cut for dispositioning to the condition (performance)-based path. That is, the component automatically meets the "Block 4" criteria relative to its loss of function being revealed and not resulting in loss of system ITLR function. Any doubt of "passive" versus "active" should cause the analyst to address the criteria explicitly (i.e., the default is "passive").
 4. Consensus is needed, as well as experience gained from the vertical slices, in finalizing generic components and functions.

The plan for resolution of comments is:

- Forward all comments, suggested changes, and lessons learned to BWNT.
- Comments on each generic component will be collected and collated by component.
- After the vertical slice is completed, all comments/suggested changes will be discussed and resolved in the open forum of a GLRP team meeting.

TABLE 1

GENERIC COMPONENT SUMMARY INFORMATION

FIELD	DESCRIPTION
Component	Generic component name.
GLRP Code	Generic component code. Codes with an asterisk (*) are not currently used in NPRDS.
Type	Component types or subcategories, (based on NPRDS).
Component Functions	Typical functions that the generic component performs. Some, all, or none of these functions may be ITLR for the specific component being evaluated.
Function Type	Type of component function (active or passive). An active function is a function that requires mechanical motion or a change of state (e.g., closure of a valve or relay, or the change in state of a transistor). For electrical devices, an active function is one that supplies energy to a system (e.g., battery or power supply) or converts energy from one form to another ¹ . A passive function is a function that is not active (e.g., the pressure retaining function of a valve that is not required to change position).
Detectable Symptoms of Functional Failure	Typical symptoms of component functional failure (i.e., loss of stated component function) that provide the means to detect failures once they have occurred. Symptoms will be used to assure the appropriateness of functional performance tests (e.g., Technical Specification Surveillance Testing); therefore, symptoms that reveal incipient failure (e.g., cracking, wall thinning) are not listed. When failure symptoms are specified, the symptoms should address both the functionality of the ITLR system/structure and the potential impact on the environment. Both symptoms are appropriate because they reveal functional failure of the component. For instance, the symptoms of a pipe failing to maintain pressure boundary integrity are insufficient flow rate and/or excessive leakage of process fluid, and localized flooding in the adjacent area.
Comments	Explanatory comments that may include, but are not limited to, clarifications of other information in the table and additional subcategory information.

¹ William D. Stanley. Electronic Devices, Circuits and Applications. Prentice Hall, 1989.

TABLE 2

CROSS-REFERENCE OF PLANT EQUIPMENT TO COMPONENT CATEGORY

Plant Equipment	GLRP Component Code
AC or DC Motor Operator	VALVOP
Accumulator	ACCUMU
Air Dryer	AIRDRY
Alarm	INDREC
Amplifier	INTCPM
Analyzer	INTCPM/IXMITR
Angle Valve	VALVE
Angle Stop Check Valve	VALVE
Annunciator Module	INDREC
Ball Valve	VALVE
Battery	BATTRY
Bistable	IBISSW
Blower	BLOWER
Bus	CABLE ¹
Butterfly Valve	VALVE
Charger	BATTRY
Check Valve	VALVE
Circuit Closer/Interrupter	CKTBRK
Coils (Heating/Cooling)	HTEXCH
Comparator	IBISSW
Compressor	BLOWER
Computer Signal Conditioner	INTCPM
Condensate/Steam/Water Trap	TRAP ¹
Condenser	HTEXCH

Plant Equipment	GLRP Component Code
Control Rods	CONROD
Controller	ICNTRL
Converter	INTCPM
Current to Pneumatic Converter	INTCPM
Damper	VALVE
Damper Operator	VALVOP
Demineralizer	DEMIN
Detector	IXMITR
Diaphragm Operator	VALVOP
Diaphragm Valve	VALVE
Eductor/Ejector	PUMP
Electric Heater	HEATER
Electrical Penetration	PENETR
Element	IXMITR
Engine	ENGINE
Evaporator	HTEXCH
Expansion Joint	PIPE
Fan	BLOWER
Filter	FILTER
Fuse	CKTBRK
Gas Stripper	AIRDRY
Gate Valve	VALVE
Generator	GENERA
Globe Valve	VALVE
Hand Indicator Switch	CTRBRK
Hand Selector Switch	CTRBRK
Handswitch	CTRBRK

Plant Equipment	GLRP Component Code
Heat Exchanger/Cooler	HTEXCH
Hydraulic or Air Motor Operator	VALVOP
Indicator/Recorder	INDREC
Input/Output Module	INTCPM
Integrator/Computation Module	ICNTRL
Inverter	IPWSUP
Isolation Device	ISODEV
Level Glass	INDREC
Logic Module	INTCPM
Lubricator	MIXER ¹
Manual/Auto Station	ICNTRL or INTCPM
Mechanical Function Unit	MECFUN
Mixer	MIXER ¹
Moisture/Oil Separator	AIRDRY
Motor	MOTOR
Motor Control Center	CKTBRK
Multiplier/Divider	INTCPM
Needle Valve	VALVE
Neutron Detector	IXMITR
Orifice	PIPE
Penetration, Containment	PENETR
Pinch Valve	VALVE
Pipe	PIPE
Plug or Cock Valve	VALVE
Potentiometer	INDREC or [application-specific]
Power Supply	IPWSUP
Process Switch	IBISSW

Plant Equipment	GLRP Component Code
Pressurizer	VESSEL
Pump	PUMP
Radiation Monitor	IXMITR or INDREC
Reactor Vessel	VESSEL
Recombiner	RECOMB
Recorder	INDREC
Regulator	ICNTRL
Relay	RELAY
Resistive Temperature Detector	IXMITR
Sample Station	Varies by Application
Sensor	IXMITR
Signal Summer	INTCPM
Solenoid Operator	VALVOP
Steam Generator	HTEXCH
Strainer, Screen	FILTER
Switch	CKTBRK
Switchgear	CKTBRK
Tank	ACCUMU
Thermal Sleeve	PIPE
Three-Way or Four-Way Valve	VALVE
Transformer	TRANSF
Transmitter/Primary Detector	IXMITR
Turbine	TURBIN
Vacuum Breaker	VALVE/VALVOP
Vessels, Pressure	VESSEL

¹ Not a NPRDS code.

TABLE 3

STRUCTURAL PLANT EQUIPMENT (INCOMPLETE)

Plant Equipment
Building
Cabinet
Control Panel
Distribution Panel
Electrical or Instrument Rack
Pipe Hanger
Relay Panel
Shock Suppressor/Support
Wall

TABLE 4. GENERIC COMPONENT SUMMARY FOR GLR PROGRAM

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Air/Gas Dryer	AIRDRY	A - Heat (adsorption) D - Heatless (static separator) G - Refrigerated (absorption) M - Moisture separator	A - Remove water/oil (from process fluid). B - Allow flow (limit blockage of process fluid). C - Pressure boundary (for process fluid).	Active or Passive Passive Passive	A.1 - Excessive carryover of water or oil in process fluid. B.1 - Insufficient flow rate of process fluid (plugged). C.1 - Insufficient flow rate of process fluid. C.2 - Process fluid loss to the environment (leak).	Depending upon air/gas dryer type, (1) the water/oil removal function may be passive (e.g., moisture separator), and (2) other failure modes (e.g., process fluid contamination with refrigerant) may require consideration.
Battery and Charger	BATTRY	A - Battery charging unit C - Wet cell battery	A - Provide DC power.	Active	A.1 - DC power (voltage and current) not within specified limits (e.g., high, low, erratic, or no output).	

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Blower	BLOWER	Subcategories: A - Compressor C - Fan E - Vacuum pump	A - Provide flow (of process vapor). B - Pressure boundary (for process vapor).	Active Passive	A.1 - Insufficient process vapor flow rate or pressure. B.1 - Insufficient process vapor flow rate or pressure.	
Cable and Connectors	CABLE*	Includes: Cables Buses Connectors/jacks Terminations etc.	A - Electrical continuity.	Passive	A.1 - End device does not operate	* - Not an NPRDS category.

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Circuit Closer/ Interrupter (e.g.: Switch, Circuit Breaker)	CKTBRK	Subcategories: A - Circuit Breaker (including fuse) B - Contactor C - Controller (e.g. motor controller) D - Starter E - Switch F - Hand Switch G - Hand Indicator Switch X - Other	A - Circuit Protection/ Coordination. B - Circuit Control.	Active or Passive Active or Passive	A.1 - Circuit closer/interrupter does not open or opens late. A.2 - Inadvertent continued operation of end device. A.3 - Propagation of fault through system. A.4 - Circuit closer/interrupter opens spuriously or prematurely. A.5 - End device does not operate. B.1 - Circuit closer/interrupter does not open/close. B.2 - End device does not operate. B.3 - Circuit closer/interrupter opens/closes spuriously. B.4 - Inadvertent operation of end device. NOTE: See next page for additional symptoms.	Active or Passive designation depends on whether component has to change state (versus remain as is) to perform its ITR function.

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Circuit Closer/ Interrupter (Continued)	CKTBRK		<p>C - Electrical Continuity.</p> <p>D- Maintain electrical system integrity.</p>	<p>Passive</p> <p>Passive</p>	<p>C.1 - Circuit closer/interrupter opens spuriously.</p> <p>C.2 - End device does not operate.</p> <p>D.1 - Protective devices (fuses, circuit breakers) trip.</p> <p>D.2 - Malfunction of associated devices.</p>	The maintain electrical system integrity function only applies if the component is part of interfaces with a class 1E circuit, is not required to perform a safety function, and cannot be isolated from the class 1E circuit.
Control Rod	CONROD	<p>A - Cylindrical</p> <p>E - Cruciform</p> <p>F - Clustered</p>	<p>A - Absorb neutrons.</p> <p>B - Trip and/or move (to desired position within prescribed time limits).</p>	<p>Passive</p> <p>Active</p>	<p>A.1 - Insufficient rod worth/shutdown margin.</p> <p>B.1 - Control rod does not insert/move within prescribed time limits.</p>	

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Control Rod Drive Mechanism	CRDRVE	A - Hydraulic piston	A - Unlatch control rod (within prescribed time limits to allow control rod to trip into core).	Active	A.1 - Control rod does not insert within prescribed time limits.	
		B - Rack and pinion	B - Move control rod (to desired position within prescribed time limits).	Active	B.1 - Control rod does not move within prescribed time limits.	
		C - Magnetic jack latch			B.2 - Anomalous core power distribution.	
		D - Lead screw/roller nut	C - Hold control rod (in desired position).	Active	B.3 - Incorrect control rod position.	
		F - Motor, drum and cable.			C.1 - Anomalous core power distribution.	
		G - Hydraulic control unit	D - Pressure boundary (RCS).	Passive	C.2 - Incorrect control rod position.	
					D.1 - Loss of reactor coolant inventory/pressure.	
					D.2 - Loss of coolant to the reactor building (leak).	

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Demineralizer	DEMIN	<p>A - Anion</p> <p>B - Mixed-bed</p> <p>C - Cation</p> <p>D - Powered resin</p>	<p>A - Remove contaminants.</p> <p>B - Allow flow (limit blockage of process fluid).</p> <p>C - Contain resins (prevent contamination of process fluid with demineralizer resins).</p> <p>D - Pressure boundary (for process fluid).</p>	<p>Active</p> <p>Passive</p> <p>Active or Passive</p> <p>Passive</p>	<p>A.1 - Unacceptable process fluid chemistry.</p> <p>B.1 - Insufficient flow rate of process fluid (plugged).</p> <p>C.1 - Unacceptable process fluid chemistry.</p> <p>D.1 - Insufficient flow rate of process fluid or loss of process fluid system inventory.</p> <p>D.2 - Loss of process fluid to the environment (leak).</p>	Depending upon demineralizer type, the resin retention function may be passive.

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Engine, Internal Combustion	ENGINE	<p>A - Two-stroke, reciprocating, in-line block</p> <p>B - Two-stroke, reciprocating, V-block</p> <p>C - Four-stroke, reciprocating, in-line block</p> <p>D - Four-stroke, reciprocating, V-block</p> <p>G - Opposed piston</p> <p>X - Other</p>	<p>A - Provide motive power.</p> <p>B - Start on demand.</p> <p>C - Stop on demand.</p>	<p>Active</p> <p>Active</p> <p>Active</p>	<p>A.1 - Engine and/or end device (e.g., electrical generator, pump) does not operate or does not operate within prescribed limits (e.g., rated speed).</p> <p>B.1 - Start time greater than maximum allowable, or does not start.</p> <p>C.1 - Inadvertent continued operation of engine/end device.</p>	

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Filter	FILTER	<p>A - Mechanical restriction mesh/screen</p> <p>B - Membrane</p> <p>C - Porous solid/loose material</p> <p>D - Chemical/fluid</p> <p>E - Gravity/settling</p> <p>F - Centrifugal</p> <p>G - Electrostatic/magnetic</p> <p>H - Wound cartridge</p> <p>X - Other</p>	<p>A - Remove particulates.</p> <p>B - Allow flow (limit blockage of process fluid).</p> <p>C - Pressure boundary (for process fluid).</p>	<p>Active or Passive</p> <p>Passive</p> <p>Passive</p>	<p>A.1 - Unacceptable process fluid chemistry.</p> <p>B.1 - Insufficient flow rate of process fluid (plugged).</p> <p>C.1 - Insufficient flow rate of process fluid or loss of process fluid system inventory.</p> <p>C.2 - Loss of process fluid to the environment (leak).</p>	Depending upon filter type, the particulate removal function may be passive.
Generator	GENERA	<p>A - Alternator</p> <p>B - Converter</p> <p>D - Generator</p> <p>F - Inverter</p> <p>G - Exciter (main generator)</p>	A - Provide AC power.	Active	<p>A.1 - AC power (voltage, current and frequency) not maintained within specified limits (e.g., high, low, erratic, or no output).</p> <p>A.2 - Inoperability/degraded operability of the powered device(s).</p>	

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Heater, Electric	HEATER	Application: C - Engine oil heater E - Tank heater F - Desaturating heater G - Engine jacket water heater	A - Heat process fluid.	Active	A.1 - Insufficient/excessive heating of process fluid. A.2 - Heater will not energize. A.3 - Degraded operability of associated system or component (e.g., BWST, emergency diesel generator).	

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Heat Exchanger	HTEXCH	A - Horizontal shell & tube	A - Transfer heat (from hotter fluid to colder fluid).	Passive	A.1 - Temperatures, flow rates and/or pressure drops for either process fluid not maintained within acceptable limits.	Subcategory: A - Heater/superheater C - Cooler D - Condenser E - Evaporator F - Steam generator G - Heater/cooler
		B - Vertical shell & tube				
		C - Shell & concentric tube	B - Pressure boundary (for hotter process fluid).	Passive	B.1 - Insufficient flow rate of hotter process fluid or loss of hotter process fluid system inventory.	
		D - Shell & multisection tube			B.2 - Loss of hotter process fluid to the environment (external leak) or colder process fluid system (internal leak), as appropriate.	
		E - Shell & tube plus steam drum				
		G - Direct contact			C.1 - Insufficient flow rate of colder process fluid or loss of colder process fluid system inventory.	
		H - Radiator type	C - Pressure boundary (for colder process fluid).	Passive	C.2 - Loss of colder process fluid to the environment (external leak) or hotter process fluid system (internal leak), as appropriate.	

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Instrumentation, Bistable/ Process Switch	IBISSW	B - Bistable S - Process Switch (e.g., pressure switch)	A - Change state (when and only when measured parameter exceeds setpoint).	Active	<p>A.1 - Failure to change state within allowable time limits when setpoint is exceeded (e.g., delayed or no trip).</p> <p>A.2 - Degraded operability of instrument string/end device (e.g., loss of end device for a given input signal).</p> <p>A.3 - Spurious or erratic changes of state regardless of input.</p> <p>A.4 - Change of state above or below expected point (e.g., premature operation).</p> <p>A.5 - Inadvertent trip of safety channel/end device.</p>	
			<p>B - Reset (when appropriate conditions exist).</p> <p>NOTE: See next page for additional functions.</p>	Active	<p>B.1 - Failure to reset when appropriate conditions exist.</p> <p>B.2 - Degraded operability of instrument string/end device (e.g., inadvertent operation of end device).</p> <p>NOTE: See next page for additional symptoms.</p>	

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Instrumentation, Bistable/ Process Switch (Continued)	IBISSW		C - Pressure boundary (if appropriate, e.g., pressure switch).	Passive	<p>C.1 - Insufficient process fluid system inventory, flow rate, or pressure.</p> <p>C.2 - Loss of process fluid to the environment (leak).</p>	
Instrumentation, Controller	ICNTRL		<p>A - Provide control.</p> <p>B - Maintain electrical system integrity.</p>	<p>Active</p> <p>Passive</p>	<p>A.1 - Failure to provide an output signal within allowable limits that is a function of the input signal (e.g., high, low, erratic, unresponsive, or no output).</p> <p>A.2 - Failure to maintain the applicable process parameter at or near the given setpoint.</p> <p>A.3 - Degraded operability of instrument string/end device (e.g., inadvertent operation/loss of end device for a given input signal).</p> <p>B.1 - Protective devices (fuses, circuit breakers) trip.</p> <p>B.2 - Malfunction of associated devices.</p>	<p>This category includes the type of device that uses an error signal (measured vs. desired) to control a process parameter.</p> <p>The maintain electrical system integrity function only applies if the component is part of interfaces with a class 1E circuit, is not required to perform a safety function, and cannot be isolated from the class 1E circuit.</p>

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Instrumentation, Indicator/Recorder	INDREC	I - Indicator R - Recorder A - Annunciator, alarm	A - Provide indication. B - Maintain electrical system integrity.	Active Passive	A.1 - Visual display not accurate and/or responsive to input, within allowable limits (e.g., high, low, or erratic output). A.2 - Visual display not operating. B.1 - Protective devices (fuses, circuit breakers) trip. B.2 - Malfunction of associated devices.	The maintain electrical system integrity function only applies if the component is part of interfaces with a class 1E circuit, is not required to perform a safety function, and cannot be isolated from the class 1E circuit.

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Instrumentation, Integrator/ Computation Module	INTCPM	Q - Integrator Y - Computational module	A - Provide converted signal.	Active	<p>A.1 - Failure to provide an output signal within allowable limits that is a function of the input signal (e.g., output is high or low, does not respond to input, fluctuates erratically).</p> <p>A.2 - Inoperability of computation string/end device (e.g., inadvertent operation/loss of end device for a given input signal).</p>	<p>Includes devices that convert one variable to another, e.g.: Converters (I/P, E/P, I/I, E/E, P/P), Square root extractor, summer, averager, multiplier/divider, amplifier, integrator, auctioneer, function generator.</p> <p>The maintain electrical system integrity function only applies if the component is part of interfaces with a class 1E circuit, is not required to perform a safety function, and cannot be isolated from the class 1E circuit.</p>
			B - Maintain electrical system integrity.	Passive	<p>B.1 - Protective devices (fuses, circuit breakers) trip.</p> <p>B.2 - Malfunction of associated devices.</p>	

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Instrumentation, Electronic Power Supply	IPWSUP	A - AC input, AC output B - AC input, DC output C - AC input, both AC & DC outputs D - DC input, AC output E - DC input, DC output F - DC input, both AC & DC outputs X - Other	A - Provide Power.	Active	A.1 - AC/DC power (voltage, current and frequency) not maintained within specified limits (e.g., high, low, erratic, or no output). A.2 - Inoperability/degraded operability of the powered instrumentation/devices.	

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Instrumentation, Isolation Device	ISODEV		A - Electrical isolation.	Active	<p>A.1 - Failure to provide an output signal within allowable limits that is equal to the input signal.</p> <p>A.2 - Inoperability of instrument string/end device (e.g., inadvertent operation/loss of end device for a given input signal).</p> <p>A.3 - Propagation of fault to devices connected to output signal.</p>	

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Instrumentation, Transmitter/Sensor	IXMITR	E - Sensor/detector/element T - Transmitter	A - Sense/transmit signal.	Active	<p>A.1 - Failure to provide an output signal within allowable limits that is a function of the process variable (e.g., output is high or low, does not respond to process changes, or changes erratically.</p> <p>A.2 - Inoperability of instrument string/end device (e.g., inadvertent operation/loss of devices that utilize output signal from transmitter, primary detector, or element).</p>	The maintain electrical system integrity function only applies if the component is part of interfaces with a class 1E circuit, is not required to perform a safety function, and cannot be isolated from the class 1E circuit.
			B - Pressure boundary (of measured process, if applicable).	Passive	<p>B.1 - Insufficient process fluid pressure or flow rate.</p> <p>B.2 - Loss of process fluid to the environment (leak).</p>	
			C - Maintain electrical system integrity.	Passive	<p>C.1 - Protective devices (fuses, circuit breakers) trip.</p> <p>C.2 - Malfunction of associated devices.</p>	

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Mechanical Function Unit	MECFUN	A - Centrifugal B - Flexible C - Geared D - Mechanical-hydraulic X - Other	A - Control speed/transfer energy (e.g., engine, turbine). B - Start prime mover. C - Stop prime mover.	Active Active Active	A.1 - Inoperability/degraded operability of prime mover and/or end device (e.g., pump, generator). A.2 - Speed of prime mover not within prescribed limits. B.1 - Inoperability of prime mover and/or end device. C.1 - Inadvertent operation of prime mover and/or end device.	Subcategory: A - Controller or Governor B - Coupling C - Power transmission device D - EHC hydraulic power unit
Mixer	MIXER*	Includes: - Lubricator	A - Combine process ingredients. B - Allow flow (provide unobstructed pathway of process fluid(s)). C - Pressure boundary (for process fluid(s)).	Active Passive Passive	A.1 - Unacceptable process fluid chemistry. B.1 - Insufficient flow rate of process fluid(s). C.1 - Insufficient flow rate or inventory of process fluid(s). C.2 - Loss of process fluid(s) to the environment (leak).	* - Not an NPRDS category.

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Motor	MOTOR	<p>A - Synchronous</p> <p>B - Hysteresis-synchronous</p> <p>C - Induction, squirrel cage</p> <p>D - Induction, slip ring</p> <p>E - Induction, repulsion start</p> <p>F - Capacitor start</p> <p>G - Split phase</p> <p>H - DC commutator, single speed</p> <p>J - DC commutator, variable speed</p> <p>K - Hydraulic</p> <p>L - Pneumatic</p>	<p>A - Provide motive power.</p> <p>B- Start on demand.</p> <p>C - Stop on demand.</p> <p>D - Pressure boundary (for process fluid).</p>	<p>Active</p> <p>Active</p> <p>Active</p> <p>Passive</p>	<p>A.1 - Motor and/or end device not operable (e.g., does not run) or not operating within prescribed limits.</p> <p>B.1 - Start time greater than maximum allowable, or does not start.</p> <p>C.1 - Inadvertent operation of motor and/or end device.</p> <p>C.2 - Motor does not stop within prescribed limits (e.g., coast down time).</p> <p>D.1 - Insufficient process fluid flow rate or pressure, or loss of process fluid system inventory.</p> <p>D.2 - Loss of process fluid to the environment (leak).</p>	

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Penetration, Primary Containment	PENETR	Subcategory: A - Personnel access B - Fuel handling C - Equipment access * - Electrical * - Mechanical (pipe)	A - Pressure boundary (containment). NOTE: see other component types (e.g., cable, pipe) for additional component functions associated with penetrating item.	Passive	A.1 - Excessive leakage of containment atmosphere to the environment or containment annulus (as appropriate). A.2 - Inert gas leakage from penetration (if applicable).	* - Electrical and mechanical penetrations are not NPRDS reportable.

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Pipe, fitting	PIPE	Subcategory: A - Straight section B - Elbow C - Tee D - Reducer/orifice E - Nozzle/safe end F - Thermowell G - Connecting weld H - Rupture diaphragm I - Flange J - Ductwork X - Other	A - Pressure boundary. B - For orifice: restrict flow. C - For rupture diaphragm: must burst when design pressure is exceeded.	Passive Passive Passive	A.1 - Insufficient flow rate, pressure, and/or inventory of process fluid. A.2 - Loss of system inventory to the environment (leak). B.1 - Excessive pressure/flow rate of process fluid. C.1 - Failure of vessel/pipe under extreme load.	Depending upon type of fitting, other component functions may be performed. For most component subcategories, the process fluid will be lost from the system to the environment. For ductwork (Subcategory J), the external environment may enter the process flow stream depending upon pressure differential.

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Pump	PUMP	A - Centrifugal - axial B - Centrifugal - other D - Rotary - gear E - Reciprocating - piston/plunger/diaphragm G - Rotary - screw H - Rotary - vane K - Eductor	A - Provide flow. B - Pressure boundary.	Active or Passive Passive	A.1 - Insufficient process fluid flow rate or pressure. A.2 - Pump does not run. B.1 - Insufficient process fluid flow rate or pressure, or loss of process fluid system inventory. B.2 - Loss of process fluid to the environment (leak).	Depending upon pump type, the process fluid transport function may be passive (e.g., eductor).
Recombiner	RECOMB	B - Catalytic C - Thermal	A - Recombine hydrogen (in process gas stream). B - Allow flow (provide limited flow blockage for process gas). C - Pressure boundary (for process gas).	Active or Passive Passive Passive	A.1 - Excessive hydrogen concentration in process gas stream. B.1 - Insufficient process gas flow rate. C.1 - Insufficient process gas flow rate.	Depending upon recombiner type, the hydrogen recombination function may be active or passive.

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Relay	RELAY	<p>A - Control, general purpose</p> <p>B - Control, sealed</p> <p>C - Miniature</p> <p>D - Switchgear, protective</p> <p>E - Switchgear, protective, slow-acting</p> <p>F - Switchgear, auxiliary</p> <p>G - Mercury-wetted</p> <p>H - Time delay, pneumatic</p> <p>J - Time delay, solid state</p> <p>K - Reed</p> <p>L - Telephone</p> <p>NOTE: See next page for additional component types.</p>	<p>A - De-energize to open/close contacts.</p> <p>B - Energize to open/close contacts.</p>	<p>Active</p> <p>Active</p>	<p>A.1 - Relay does not de-energize and/or contacts do not open/close on demand.</p> <p>A.2 - Delayed operation of relay.</p> <p>A.3 - Inadvertent actuation/loss of end devices that utilize relay output signal.</p> <p>A.4 - Spurious or premature operation of relay (e.g., fails to remain energized).</p> <p>A.5 - Inadvertent actuation/loss of end devices that utilize relay output signal.</p> <p>B.1 - Relay does not energize (pickup) and/or contacts do not open/close on demand.</p> <p>B.2 - Delayed operation of relay.</p> <p>NOTE: See next page for additional symptoms.</p>	

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Relay (Continued)	RELAY	M - Event sequencer, timer, or time-sequence controller S - Solid state U - Circuit card, relay			B.3 - Inadvertent actuation/loss of end devices that utilize relay output signal. B.4 - Spurious or premature operation of relay (e.g., fails to remain energized). B.5 - Inadvertent actuation/loss of end devices that utilize relay output signal.	
Tank	TANK	A - Liquid, pressurized B - Liquid, unpressurized C - Gas Note: includes Accumulators.	A - Pressure boundary. B - Maintain volume (within required limits).	Passive Passive	A.1 - Low level and/or pressure in tank/accumulator. A.2 - Loss of contained fluid to the environment (leak). B.1 - Low level and/or pressure in tank/accumulator. B.2 - Loss of contained fluid to the environment (leak).	For vibration dampers, loss of pressure boundary results in failure to dampen vibrations of device requiring vibration suppression.

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Transformer	TRANSF	A - Power step-up B - Power step-down C - Voltage D - Current E - Tripping/holding F - Differential/regulating G - Transducer/coupling H - Variable J - Isolation	A - Provide power.	Active	A.1 - Power (voltage, current and frequency) not maintained within specified limits (e.g., high, low, or no output, fault to ground or line). A.2 - Inoperability/degraded operability of the powered device(s).	
Trap	TRAP*	A - Steam trap B - Condensate trap C - Water trap	A - Remove water/condensate. B - Pressure boundary.	Active or Passive Passive	A.1 - Excessive carryover of water, or condensate in process fluid. B.1 - Insufficient flow rate of process fluid. B.2 - Process fluid loss to the environment (leak).	* - Not an NPRDS category.

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Turbine	TURBIN	G - Combustion	A - Provide motive power.	Active	A.1 - Turbine and/or end device (e.g., generator, pump) not operable or not operating within prescribed limits (e.g., rated speed).	
		H - Hydro				
		J - Steam				
			B - Start on demand.	Active	B.1 - Failure to start within maximum allowable starting time, or does not start.	
			C - Stop on demand.	Active	C.1 - Inadvertent operation of end device.	
			D - Pressure boundary (for working fluid expanded through turbine).	Passive	D.1 - Inoperability/degraded operability of end device (e.g., generator, pump).	
					D.2 - Loss of working fluid to the environment (leak).	

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Valve and Damper	VALVE	A - Ball B - Butterfly C - Check D - Diaphragm E - Gate F - Globe G - Needle H - Plug K - Single blade damper L - Parallel blade damper M - Opposed blade damper N - Relief O - 3-way & 4-way	A - Open and/or remain open. B - Close and/or remain closed. C - Allow flow (throttle). D - Provide pressure relief. E - Pressure boundary. F - Maintain leak tightness.	Active or Passive Active or Passive Active or Passive Active Passive Passive	A.1 - Valve does not open, is delayed in opening, or does not stay open. A.2 - Insufficient system flow rate. B.1 - Valve does not close, is delayed in closing, or does not stay closed. B.2 - Cannot isolate system. C.1 - Does not properly control system flow rate. D.1 - System overpressure. D.2 - Process fluid leakage through other paths. E.1 - Insufficient system flow rate or loss of system inventory. E.2 - Loss of process fluid to the environment (leak). F.1 - Intrasytem leakage which affects parameters (e.g., inventory) in both systems.	Failures of the pressure boundary function for most component types will result in loss of process fluid to the environment. For dampers, the external environment may enter the process flow stream depending upon pressure differential. Active or Passive designation depends on whether component has to change state (versus remain as is) to perform its ITLR function.

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Valve and Damper Operator	VALVOP	<p>A - Electric motor - AC</p> <p>B - Electric motor - DC</p> <p>C - Hydraulic</p> <p>D - Pneumatic</p> <p>E - Solenoid - AC</p> <p>F - Solenoid - DC</p> <p>J - Mechanical (differential pressure to open/spring force to close)</p> <p>K - Mechanical (spring force to open/differential pressure to close)</p> <p>* - Manual (see comments)</p>	<p>A - Move valve/damper (open, close and/or throttle).</p> <p>B- Pressure boundary (process fluid).</p> <p>C- Pressure boundary (operator pneumatic/ hydraulic fluid).</p> <p>D - Maintain electrical system integrity.</p>	<p>Active</p> <p>Passive</p> <p>Passive</p> <p>Passive</p>	<p>A.1 - Valve does not open, is delayed in opening, or does not stay open.</p> <p>A.2 - Valve does not close, is delayed in closing, or does not stay closed.</p> <p>A.3 - Insufficient or excessive system flow rate.</p> <p>B.1 - Insufficient system flow rate or loss of system inventory.</p> <p>B.2 - Loss of process fluid to the environment (leak).</p> <p>C.1 - Insufficient pressure in pneumatic/hydraulic system.</p> <p>C.2 - Pneumatic/hydraulic fluid loss to environment (leak).</p> <p>C.3 - Valve operator (or other device) malfunction.</p> <p>D.1 - Protective devices (fuses, circuit breakers) trip.</p> <p>D.2 - Malfunction of associated devices.</p>	<p>* Valve/damper is manually positioned (e.g., handwheel). Note that this component type is <u>not</u> included in NPRDS.</p> <p>The maintain electrical system integrity function only applies if the component is part of interfaces with a class 1E circuit, is not required to perform a safety function, and cannot be isolated from the class 1E circuit.</p>

Component	GLRP Code	Type	Component Functions	Function Type	Detectable Symptoms of Functional Failure	Comments
Vessel, Pressure	VESSEL	A - Reactor vessel B - Pressurizer vessel	A - Pressure boundary (RCS).	Passive	A.1 - Loss of subcooling margin in reactor coolant system.	Other reactor vessel and pressurizer subcomponents (e.g., relief valves, heaters) should be evaluated separately.
			B - Provide Radiation Barrier.	Passive	A.2 - Loss of reactor coolant to the containment. B.1 - Excessive ex-vessel radiation.	