7A. INTERFACE INFORMATION

This section provides necessary interface criteria (as well as interface criteria that will be met) among elements of the WAPWR Nuclear Power Block scope of supply and the remainder of the plant.

7A.1 CIRCUIT AND INSTRUMENT LINES SEPARATION INTERFACE CRITERIA

(Refer also to Section 7.1)

The conductors for power supply, instrumentation, and control circuits and the instrument impulse lines of a nuclear plant must have physical and electrical separation to preserve the redundancy and to ensure that no single credible event will prevent operation of any required safety system function. Credible events shall include, but not be limited to, the effects of short circuits, pipe rupture, missiles, etc. Circuit separation required for protection against plant events shall be included in the basic plant design in accordance with IEEE-384 (1974).*

7A.1.1 Separation Of Class 1E and Non-Class 1E Circuits

1. Separation of redundant circuits as described in this interface criteria document shall conform to the requirements of IEEE-384 (1974), "Criteria for Separation of Class 1E Equipment and Circuits".

2. Separation required in Subsection 7A.1.4 (separation by potential) is to minimize induced noise on low-level circuits from higher voltage circuits and switching transients. Separation can be accomplished by use of barriers in the same cable tray or separate cable trays (wireways).

---

* Basic plant design may also consider the supplementary requirements of Regulatory Guide 1.75, "Physical Independence of Electric Systems," including the Staff position concerning interrupting devices actuated by fault currents. For a discussion of conformance of the basic plant design to this Regulatory Guide, refer to Section 7.1

3. Non-Class 1E Circuits - Circuits not classified as reactor protection/ engineered safeguards channels, reactor trip signals, safeguards actuation signals or post-accident monitoring signals are considered non-Class 1E circuits and must be separated from redundant circuits as required by IEEE-384 (1974).

4. Associated circuits that are not physically separated from and/or share circuits with Class 1E circuits shall be identified and follow the separation criteria for Class 1E circuits. This separation need not be continued beyond an isolation device.

5. Sensors and sensor-to-process connections will be as required by Section 5.8 of IEEE-Std-384-1974, which is also applicable to R.G. 1.75 revisions 0 and 1. Specific locations will be a function of plant layout, which will be evaluated separately for the degree of protection required by Section 5.8 and the Westinghouse interface criteria for separation of instrument impulse lines presented in Subsection 7A.1.5 below.

   Safety related sensor electrical connections made to the integrated protection cabinets will be made with multi-conductor prefabricated cables, with separation among sensor-to-termination cabinets maintained in accordance with the Westinghouse interface criteria presented in this Section 7A.1.

7A.1.2 Separation of Channel Set and Protective Signals

1. Separate routing shall be maintained for the four redundant Class 1E integrated protection channel sets. These channel sets are designated as I, II, III and IV and include impulse lines, sensors, instrumentation, the Integrated Protection Cabinets, and the reactor trip signals.

2. Separate routing of the two safeguards actuation signals from the redundant ESFAC shall be maintained, consistent with the requirements of Subsection 7A.1.1.

3. Reactor shutdown systems - Separate routing of control and power circuits associated with the boric acid transfer pumps is required.

4. Pressurizer backup heaters - The two groups of pressurizer backup heaters used for maintaining the plant at hot shutdown obtain power from separate emergency diesel generators.

5. Nuclear instrumentation - All cables connecting the nuclear instrumentation sensors, including those associated with pre-amplifiers, shall be contained in four conduit groups; one for each redundant channel. Only nuclear instrumentation cables shall be contained in these conduits. The minimum separation from the conduits and containment penetrations to electrical noise sources such as power sources of 118VAC, 10A and higher voltages or circuits with switched loads such as relays, or SCR's shall be two feet. The minimum separation from 4160V and above power cables shall be six feet.

7A.1.3 Separation of Post Accident Monitoring (PAM) Signals

Post accident monitoring signals from sensors to integrated protection cabinets shall be routed with and separated in accordance with the requirements for reactor protection/engineered safeguards channel signals as described in Subsection 7A.1.2, Item 1.

At the integrated protection cabinets, these signals are isolated and can be routed to the control room for display, etc., by combining PAM output channels from integrated protection cabinets I & III into a channel called PAM 1. Combine the PAM output channels from integrated protection cabinets II & IV into a channel called PAM 2. Route PAM 1 with redundant channel I; and PAM 2 with redundant channel II.

7A.1.4 Separation By Potential

1. Power and control conductors operating at potentials of 600 volts or less shall not be placed in cable trays with conductors operating at potentials of more than 600 volts.

2. For Class 1E circuits, analog or other low level type signal conductors (potentials less than 100 volts) shall not be routed in cable trays containing power or control cables (potentials greater than 100 volts).

3. Analog or other low level type signal conductors for non-Class 1E circuits shall not be routed in cable trays with conductors at AC or DC potentials exceeding 120 VAC (RMS) and 140 VDC.

4. Class 1E and/or Non-Class 1E conductors used to transmit signal information by means of fiber optic techniques need not be "separated by potential", and may be installed in cable trays and/or conduits with electrical conductors operating at potentials of 600 volts or less. Separation shall be maintained on the electrical side of any electrical/optical interface device.

7A.1.5 Separation of Instrument Impulse Lines (Sensor Connections)

1. The minimum separation between redundant instrument impulse lines shall be at least eighteen inches (18" or 46 centimeters) in air in both horizontal and vertical directions in non-missile or jet stream areas and shall be maintained from its starting point at the root valves to the vicinity of the instrument. If this separation is not possible, then a suitable barrier shall be used and it shall extend at least one inch (25 millimeters) beyond the line of sight between the redundant impulse lines. Where potential missiles can be identified, additional separation, missile shields and/or barriers shall be used.

2. Where redundant, instrument impulse lines penetrate a wall or floor, the penetrations shall be separated by a minimum distance of eighteen inches in non-missile or jet stream areas. If separate penetrations are not possible for the multiple lines, then they may be run through one common penetration provided that the following conditions are met:

   a. Redundant instrument impulse lines shall be protected from postulated effects of failure of one another by a suitable barrier, such as a guard pipe.

   b. A missile shield shall be provided around the instrument impulse lines until the minimum separation distance of 18 inches (46 centimeters) is achieved between the different redundant impulse lines.

3. In those few places where it is impractical to provide redundant taps (i.e. the inside tap on an elbow flow element for example), the signal tap shall be protected from credible sources of common mode damage, and the "split" to redundant impulse lines shall be as close as possible to the process.

4. Instrument impulse line required in mitigating the effects of a postulated pipe rupture or bringing the reactor to a safe shutdown condition shall be protected from the effects of that postulated pipe rupture.

7A.2 REDUNDANT CIRCUIT AND EQUIPMENT IDENTIFICATION

The redundant equipment and circuits related to Class 1E systems must be marked to facilitate identification of redundant channels to ensure that channel separation is maintained during manufacture, construction and operation of the plant. All identification of equipment and circuits shall conform to the requirements of IEEE-384 (1974), "Criteria for Separation of Class 1E Equipment and Circuits."

7A.2.1 Redundant Channel Identification

1. Color coding - All equipment and interconnections may be identified according to the following color code:

   Channel I - Red
   Channel II - White
   Channel III - Blue
   Channel IV - Yellow

2. Color code and/or corresponding identification shall be applied to all equipment, cables, raceways and other devices to ensure that each redundant channel may be readily identified. Positive identification of cables and/or conductors should be made at all terminal parts.

3. Identification means may consist of, but is not limited to, nameplates, tags, paint and cable markers. The primary criteria governing the selection is the provision that the method selected shall provide permanent identification consistent with the life of the item to be identified.

4. Other Class 1E and Non-Class 1E circuits and equipment requiring identification, except associated circuits and/or equipment, shall be marked or designated in such a manner as to preclude its identification as part of any redundant channel circuit or equipment.

7A.3 PROTECTION OF NSSS I&C EQUIPMENT

(Refer also to Section 7.1 and Chapter 3 of RESAR-SP/90 PDA Module 7, "Structural/Equipment Design.")

7A.3.1 Operating Environments For Protection System Equipment

The temperature in the control and electronic equipment rooms is maintained for personnel comfort at 70°F $\pm$ 10°F. Design specifications for equipment

located in these rooms require no loss of function when operating in temperatures up to 120°F and humidity to 95 percent which are considered the maximums resulting from loss of air conditioning or the ventilation system.

The normal ambient for protection system electrical equipment within the containment is maintained below 120°F. Within this normal ambient environment, all equipment located inside the containment is designed for continuous operation within design tolerances. The neutron detectors are designed for continuous operation at 135°F and are capable of operation at 175°F for eight hours.

7A.3.2 Protection Against Hazards (sprays, missiles, pipe whip, etc)

All protection system electrical equipment is qualified for the environments in which the particular piece of equipment is required to function per IEEE-323-74 and WCAP-8587. In general, Westinghouse supplied electrical equipment is not designed to withstand the impact of postulated missiles (or pipe whip). Therefore the effects of postulated missiles (including pipe whip) must be considered so as to provide for the necessary protection of safety related electrical components as determined by the design basis.

7A.3.3 Protection Against Abnormal Events (fire, flood, etc.)

The protection system I&C equipment fulfills the requirements of IEEE-279-1971 to provide automatic protection and to provide initiating signals to mitigate the consequences of faulted conditions. The reactor trip system relies upon provisions made by the owner and operator of the plant to provide protection against destruction of the system from fires, explosions, floods, wind, and tornadoes.

All protection system I&C equipment is seismically qualified to withstand the safe shutdown earthquake floor accelerations for the particular floor elevation at which the equipment is located. Refer to the Chapter 3 of RESAR-SP/90 PDA Module 7, "Structural/Equipment Design" for a description of the seismic test methods and results for I&C equipment.

7A.4 POWER REQUIREMENTS FOR PROTECTION SYSTEM EQUIPMENT

(Refer also to Section 7.6 and Chapter 8)

The integrated protection system cabinets are designed to function satisfactorily under the following power source variations:

Voltage: 118 VAC ± 10% and 105 - 140 VDC
Frequency: 60 HZ ± 5% (or 50 HZ ± 5% where applicable)

7A.5 BYPASS INDICATION SYSTEM

For the description of the bypassed and inoperable status indication system (BISI) and compliance to R.G. 1.47, refer to RESAR-SP/90 PDA Module 15, "ACR/Human Factors".

7A.6 THERMAL OVERLOAD PROTECTION

Where thermal overload protection of safety related system motors including motor-operated valves (MOV) is provided the setpoints should be sufficiently desensitized so that overload protection will not cause the equipment to be bypassed under accident conditions.

7A.7 COMPLETION OF PROTECTIVE ACTION ONCE INITIATED

Safeguards components must be individually sealed in (latched), so that the loss of the actuation signal from the integrated protection system will not cause these components to return to the condition held prior to the advent of the actuation signal.

7A.8 SEQUENCING OF SAFEGUARDS LOADS ONTO THE DIESEL GENERATORS

(Refer to Chapter 8)

7A.9 TESTING OF ENGINEERED SAFETY FEATURES ACTUATION OF COMPONENTS ON-LINE AT POWER

The integrated protection system will provide the capability to test the actuation of components of the engineered safety features, on-line and at full power, if such testing will not damage equipment or upset plant operation. Where such equipment cannot be designed to be tested at power and it would upset the plant to do so, and the equipment is capable of being tested at shutdown, then the surveillance testing of this equipment will be performed at shutdown in conformance to Regulatory Guide 1.22.

7A.10 REGULATORY & INDUSTRY GENERIC CRITERIA

Table 7.1-1 lists certain applicable regulatory and industry generic criteria.

7A.11 FIRE PROTECTION CONSIDERATIONS IN THE CONTROL ROOM

1. Refer to RESAR-SP/90 PDA Module 13, "Auxiliary Systems".

2. The reactor trip switchgear is contained in two cabinets. Separation between the cabinets should be provided by a firewall.