Draft Design Criteria for the Backup Power to the Containment Hydrogen Igniters
GSI-189, "Susceptibility of Ice Condenser and Mark III Containments to Early Containment Failure Due to Hydrogen Combustion During a Severe Accident"

Revised September 16, 2004

Design Criteria	Draft NRC Staff View/Position	Rationale for Staff Position
Timing for H_2 Igniter Initiation/Operator Response Time	System shall be designed such that igniters can be loaded onto backup power source following accident initiation within 1 hour for BWRs, or 2 hours for PWRs, or as justified by frequency dominant station blackout (SBO).	The time at which igniters are needed is plant specific and varies based on plant type and which SBO accidents are most likely. Typical times to the onset of core damage are: BWR - fast SBO: ~ 1h; slow SBO: >3 h PWR - fast SBO: ~ 2h; slow SBO: >4 h
Portable versus Pre-Staged Generator	Not specified.	Provide flexibility while still meeting the functional requirements. Utility may determine that pre-staging is necessary to meet the functional requirement for backup power source availability.
Emergency Operator Procedures (EOPs) versus Severe Accident Management Guidelines (SAMG)	Guidance on igniter actuation should be entered sufficiently early in an event that necessary actions can be completed prior to the onset of core damage. In general, it should include guidance within EOPs or other plant procedures that would be entered following immediate actions that are taken to prevent core damage.	Actions to provide backup power to igniters are less critical than immediate actions to prevent core damage, and should be prioritized accordingly. SAMG would not be entered until core damage is imminent, and would not be expected to result in timely igniter actuation (unless system is designed to be actuated from the control room).
Remote Indication	Not required. Utility may determine that remote indication is desirable.	Remote indication may be necessary if the backup power system is designed to be actuated from the control room.

Draft Design Criteria for the Backup Power to the Containment Hydrogen Igniters
GSI-189, "Susceptibility of Ice Condenser and Mark III Containments to Early Containment Failure Due to Hydrogen Combustion During a Severe Accident"

Design Criteria	Draft NRC Staff View/Position	Rationale for Staff Position
Testing	Backup power source shall be started and brought to operating conditions that are consistent with its function as a power source at intervals not longer than three months. Once every refueling outage, a timed start (within the time period specified under SBO conditions) and rated load capacity test shall be performed. Testing should include (i) demonstration of startup operation within acceptable limits and time as well as full load carrying capability, and (ii) demonstration of the proper functionality of the cooling, lubrication, exhaust, fuel supply and control systems during fully loaded operation. Test data shall be maintained and made available to the inspectors as needed. The backup power source shall be demonstrated by initial test to be capable of powering required number of igniters within 1 hour for BWRs and 2 hours for PWRs of a SBO event. Test data shall be maintained at site for inspection.	Backup power source should be designed to be inspected, maintained and tested periodically to demonstrate its operability and reliability.

Draft Design Criteria for the Backup Power to the Containment Hydrogen Igniters
GSI-189, "Susceptibility of Ice Condenser and Mark III Containments to Early Containment Failure Due to Hydrogen Combustion During a Severe Accident"

Design Criteria	Draft NRC Staff View/Position	Rationale for Staff Position
Maintenance Rule	Utility shall evaluate the system against the scoping criteria of 10 CFR 50.65(b). Because the system is expected to be relied upon to mitigate accidents, or may be used in the plant emergency operating procedures, the NRC staff anticipates that the system would be within the scope of the Maintenance Rule.	Monitoring the performance of the system under the Maintenance Rule will provide additional assurance that the system is capable of performing its intended function. In accordance with the Maintenance Rule, the utility should either demonstrate that the preventative maintenance program effectively controls system performance or monitor the performance of the system against licensee-established goals in a manner sufficient to provide reasonable assurance that the system can perform its intended functions.
Seismic Qualifications	The backup power source and the fuel need not be seismically qualified. Protection against natural phenomena, such as earthquakes, shall be provided by enclosing the backup power source within the structures that conform with the applicable non-nuclear building codes and the burying exposed electrical cable runs between buildings.	Benefits of seismic qualification would be site-specific. An industrial grade backup power source, appropriately stored/secured for seismic events, would have a high likelihood of surviving seismic events and would provide risk reduction benefits in the moderate seismic events. Qualification of the backup power source for seismic events would substantially increase the cost of implementation without a commensurate increase in risk reduction benefits.
Tornado, Hurricanes and High Winds Protection	The backup power source and the fuel need not be tornado qualified. Protection against natural phenomena, such as hurricanes and high winds, shall be provided by enclosing the backup power source within the structures that conform with the applicable non-nuclear building codes and burying exposed electrical cable runs between buildings.	Even though tornados and high winds contribute only a small fraction of total plant risk, tornadoes have a high likelihood of causing loss of offsite power. The utility can increase the availability of the back-up power source in tornado and high wind events by considering these threats and their likely trajectories when determining the location(s) where the backup power source would be stored and/or staged.

Draft Design Criteria for the Backup Power to the Containment Hydrogen Igniters
GSI-189, "Susceptibility of Ice Condenser and Mark III Containments to Early Containment Failure Due to Hydrogen Combustion During a Severe Accident"

Design Criteria	Draft NRC Staff View/Position	Rationale for Staff Position
Igniter Coverage/ Number of Igniters	To provide backup power to sufficient igniters (number and location) will prevent accumulation of significant concentrations of hydrogen in any major compartment within a containment.	Each compartment within a containment is equipped with at least one igniter from each train. Powering one of two full trains of igniters would provide igniter coverage in every compartment. Powering less than one full train can be acceptable if it is justified by analysis.
Power Requirements	System shall be capable of generating sufficient electricity to supply AC backup power needed for the functioning of all hydrogen igniters determined necessary to prevent accumulation of hydrogen in any major compartments within a containment. Multi-unit sites can share a single power source. The power source must be capable of maintaining voltage and frequency within limits consistent with established industry standards.	The backup power source must have sufficient capacity to carry its required loads for the required coping duration.
Independence	Backup power source shall be independent from the onsite emergency power sources. Physical separation of backup power source and its cabling from safety related components or equipment shall conform with the separation criteria applicable for the unit's licensing basis. Electrical isolation of backup power source shall be provided through an appropriate isolation device. If the backup power source is connected to Class 1E buses, isolation shall be provided by two breakers in series.	No single point vulnerability should exist between the backup power source and the other safety systems.

Draft Design Criteria for the Backup Power to the Containment Hydrogen Igniters
GSI-189, "Susceptibility of Ice Condenser and Mark III Containments to Early Containment Failure Due to Hydrogen Combustion During a Severe Accident"

Design Criteria	Draft NRC Staff View/Position	Rationale for Staff Position
Backup Power to Air Return Fans or Hydrogen Analyzers	Not required.	Severe accident containment analyses performed for GSI-189 show that air return fans need not be supplied from backup power. Hydrogen analyzers need not be powered because sufficient hydrogen concentration information for decision-making can be inferred from plant parameters.
Fuel Type	Not specified.	Any type can be acceptable: propane, natural gas, gasoline or diesel.
Fire Protection	10 CFR 50, Appendix R does not apply. However, minimal fire protection design criteria are required for the additional igniter power supply. One would be the IEEE Standard 383 cabling which would be required to minimize additional combustible material. Another would be the installation, location, type, and storage of items related to the power supply that should not adversely affect the ability to achieve safe shutdown in the event of a fire. Additional information in the pre-fire plans and training may be appropriate.	GSI-189 involves a beyond design basis accident for which the fire protection requirements do not directly apply. .
Fuel Storage and Quality	Sufficient fuel to supply 24 hours of operation shall be stored on site.	Storage of fuel shall not adversely impact other systems required for safe shutdown. The installation, location, type, and storage of items related to the power supply (e.g., fuel supply) should not adversely affect the ability to achieve safe shutdown in the event of a fire. Fuel quality is expected to be covered by Maintenance Rule.
Security Requirements	No additional protection is required, provided that all associated modifications and operator actions are within the protected area.	System and components are expected to be located/stored within the protected area.

Draft Design Criteria for the Backup Power to the Containment Hydrogen Igniters
GSI-189, "Susceptibility of Ice Condenser and Mark III Containments to Early Containment Failure Due to Hydrogen Combustion During a Severe Accident"

Design Criteria	Draft NRC Staff View/Position	Rationale for Staff Position
50.59 Requirements	Changes can be implemented under 10 CFR 50.59.	Implementation will have minimal impact, if any, on safety-related systems and licensing basis events.
Operator Training/ Job Performance Measures	Inclusion of the use of the backup power source within the training provided to the control room and equipment operators. This should include system walk-downs and demonstration of the capability to position, start, and load the backup power supply in a timely manner.	Incorporation within the initial and recurring training is already provided to the control room and equipment operators.
Environmental Qualification	Not required. 10 CFR 50.49 does not apply.	Normal equipment quality envelops the environmental conditions associated with each plant.
Reliability and Availability	The backup power source should meet the target reliability and availability goals of 0.95 per demand and should be available at least 95% of the time the reactor is operating.	The backup power source should be reliable to perform its intended function.