TEMPORARY INSTRUCTION 2515/174

HYDROGEN IGNITER BACKUP POWER VERIFICATION

CORNERSTONE: BARRIER INTEGRITY

APPLICABILITY: This temporary instruction (TI) applies to all holders of operating licenses for pressurized-water reactors (PWRs) with ice-condenser containments or boiling-water reactors (BWRs) with Mark III containments.

2515/174-01 OBJECTIVE

The objective of this TI is to verify that licensees have adequately implemented commitments related to provision of backup power to containment hydrogen igniters.

2515/174-02 APPLICABILITY

This TI will be performed at each affected site after completion of actions to make a backup power supply available to the hydrogen igniters. At dual-unit sites, the inspection of physical modifications should only be performed for one unit.

2515/174-03 BACKGROUND

The staff evaluated the potential for early failure of containment during very low probability events involving damage to the reactor core in NUREG/CR-6427, “Assessment of the Direct Containment Heat (DCH) Issue for Plants with Ice Condenser Containments." In that report, the investigators showed that the early containment failure probability of ice condenser containments is dominated by hydrogen combustion following core damage events. The staff extended the issue to include BWRs with Mark III containments because their relatively low free volume and strength are comparable to PWR ice condenser containments. To further investigate this issue, the staff opened a generic safety issue, GI-189, “Susceptibility of Ice Condenser and Mark III Containments to Early Failure from Hydrogen Combustion during a Severe Accident.”

Following a severe core damage event associated with station blackout (SBO) or other event affecting AC power distribution, the PWR ice condenser containment and BWR Mark III containment designs have the potential to fail as a result of large hydrogen detonations. These types of severe core damage events have a very low probability of occurrence, but they may produce large quantities of hydrogen through a reaction

between hot metal fuel cladding and steam. Plants with these containment designs use hydrogen igniters to control the buildup of hydrogen. The existing hydrogen igniters rely on the plant AC power distribution system for power, and AC power may not be available for certain events with the potential to result in severe core damage. A detonation of a large buildup of hydrogen has the potential to fail these containment types because of their low design pressure and low free internal volume. Therefore, for the hydrogen igniters to be effective in preserving containment integrity, the igniters must have power before a buildup of hydrogen has developed (i.e., before severe core damage has occurred).

To resolve GI-189, the staff recommended the addition of a backup power supply for the hydrogen igniters for the plants with ice condenser or Mark III containments. The staff completed a regulatory analysis (Reference 1) that indicated that the backup power modification may provide a substantial safety benefit at a justifiable cost for the PWRs with ice-condenser containments and voluntary measures proposed by the licensees for these facilities provided the majority of the benefit. For the BWRs, none of the options provided a substantial increase in the overall protection of public health and safety. However, external events and security insights were not fully evaluated in the regulatory analysis, and defense-in-depth considerations in improving the balance among accident prevention and mitigation provide an additional un-quantified benefit for both containment types. After further evaluation of security insights, the licensees for the affected plants committed to provide backup power to the hydrogen igniters that address the safety issues identified in GI-189 and provide benefit for some security scenarios. The affected plants are the four dual-unit PWR nuclear stations with ice condenser containments - McGuire, Catawba, DC Cook, and Sequoyah; a single-unit PWR nuclear station with an ice condenser containment - Watts Bar; and four single-unit BWR nuclear plants with Mark III containments - Grand Gulf, River Bend, Clinton, and Perry.

2515/174-04 INSPECTION REQUIREMENTS

04.01 General

Evaluate how the licensee has modified plant equipment and implemented training programs and procedures to provide backup power to at least one complete train of hydrogen igniters. Voluntary commitments to provide backup power involve permanent modifications to provide power from a fixed diesel generator to the igniters, development of procedures and training to provide power to the igniters through a temporary connection to a portable generator, or a combination of the two approaches. References 2 through 8 describe the specific commitments. Because planned modifications and the configurations of the two units at affected dual unit sites are similar, the inspection of physical modifications should only be performed for one unit.

The scope of the inspection differs based on the proposed plant changes. The capability to provide backup power to the igniters for events involving severe core damage coincident with a station blackout is beyond the current design basis of affected

facilities. Some proposed modifications involve permanent connections of alternate power supplies to power one train of hydrogen igniters. These modifications may require changes to the facility safety analysis report; less extensive modifications should not require changes to this document.

Consider the following in performance of the inspection:

a. Catawba, McGuire, and D.C. Cook PWRs

1. Proposed modifications to these facilities enhance the current capability to provide power to one or more igniter trains from fixed diesel generators through permanent connections. At Catawba and McGuire, the proposed modifications would permanently power one train of igniters from the safe shutdown facility and its diesel generator. At D.C. Cook, the proposed modification installs a method of activating at least one train of the hydrogen igniters in each unit from an area outside the control room complex.

2. The requirements of Title 10 of the Code of Federal Regulations (10 CFR) 50.44, "Combustible Gas Control for Nuclear Power Reactors," and Technical Specification requirements continue to apply to the modified hydrogen igniter system. Regulatory Guide 1.7, "Control of Combustible Gas Concentrations in Containment," Revision 3, provides guidance on acceptable means of complying with 10 CFR 50.44. In RG 1.7, the staff states that the combustible gas control systems installed at the affected facilities and approved by the NRC as of October 16, 2003, are acceptable without modification.

3. Inspection Procedure 71111, "Reactor Safety - Initiating Events, Mitigating Systems, Barrier Integrity," Attachment 71111.17, "Permanent Plant Modifications," (Reference 9) provides inspection guidance appropriate for review of these modifications and associated safety analysis report changes. Assess the continued compliance with the requirements of 10 CFR 50.44 and the ability to reliably provide power to the igniters consistent with commitments.

b. Sequoyah and Watts Bar PWRs

1. The changes at these units involve development of procedures and training to support connection of an existing large, mobile diesel generator to the electrical distribution system in a manner that provides power to at least one train of igniters through temporary connections.

2. Assess the identified location of the temporary connection to verify the ability to reliably provide power to the igniters consistent with commitments.

c. Clinton, Grand Gulf, Perry, and River Bend BWRs

1. The changes at these units involve procurement of a small, portable generator and development of procedures and training to support connection of this small, portable generator to the electrical distribution system in a manner that provides power to at least one train of igniters through temporary connections. In addition, these licensees have identified one or more additional fixed power sources that could be used to power one train of igniters through temporary electrical connections. The inspection focus is on the use of the portable generator as a backup power supply and associated equipment, procedures, and training.

2. Assess the identified location of the temporary connection to verify the ability to reliably provide power to the igniters consistent with commitments.

04.02 Equipment Modifications

Consistent with applicable commitments, determine whether the equipment necessary to provide backup power to the hydrogen igniters is available. Where portable power supplies and temporary connections were selected, determine the following:

a. The power supply can be transported from its storage location to the access location for providing power to the igniters using readily available equipment.

b. Fittings, cables, and power conditioning equipment necessary to provide power to the igniters are readily available and compatible with identified connection points on the power supply and in the internal power distribution system.

c. Unnecessary portions of the internal power distribution system can be separated from portions necessary to provide power to the igniters from the portable power supply.

d. The movement of the power supply and connection of necessary fittings and cables to provide backup power to the igniters can be completed within 3 hours.

e. The rating of the portable power supply is adequate to continuously power at least one train of igniters and the operating time is consistent with commitments.

04.03 Procedures

Determine that appropriate procedures have been established to govern the provision of backup power to the igniters. Procedures written at the level of severe accident management guidelines are acceptable for installation and operation of portable equipment. Section 5 of NEI 94-01, Rev. 1 (Reference 10) provides guidance on an acceptable level of detail for severe accident management procedures. Procedures should address the decision to provide backup power to the igniters and the steps

required to provide the backup power. Determine that the procedures include cautions against actuation of the igniters after indications of severe core damage are present (e.g., very high airborne radioactivity within containment that may be indicated by abnormally high radiation levels adjacent to containment).

04.04 Training

Determine that a suitable training program has been established to train selected staff in the actions necessary to provide backup power to the igniters. Determine that the training provides appropriate guidelines for initiation of backup power to the igniters.

04.05 Maintenance and Testing

Determine that maintenance and testing schedules that are consistent with vendor recommendations have been established for portable and permanently installed equipment. Determine that an initial operational test has been completed to demonstrate the capability of portable power supplies to provide power to the igniters.

2515/174-05 REPORTING REQUIREMENTS

The detailed responses to the inspection requirements specified in Section 04.01 should be submitted electronically and forwarded to NRR/DSS, to the attention of Steve Jones via e-mail to srj@nrc.gov within 45 days after the completion of the TI.

Document inspection results in a resident inspectors' routine inspection report. At a minimum, the inspectors should document the completion of the TI, the dates of the inspection, and any findings in Section 4OA5, "Other," of the integrated inspection report.

Any findings identified during this inspection should be processed and documented in accordance with NRC IMC 0612. Significance of inspection findings should be evaluated in accordance with applicable appendices of NRC IMC 0609, "Significance Determination Process." Any noncompliance resulting from this inspection should be evaluated and documented in accordance with NRC Enforcement Policy (NUREG - 1600) and Section 3.12 of the NRC Enforcement Manual.

2515/174-06 COMPLETION SCHEDULE

This TI will be completed within 6 months following the implementation date for the first unit at each site and no later than June 30, 2009.

The original scheduled implementation dates were: December 31, 2007, for the Clinton, D.C. Cook, Sequoyah, and Watts Bar sites; April 31, 2008, for the Grand Gulf, Perry, and River Bend sites; May 31, 2008, for the first unit at the McGuire site (Unit 2); and May 31, 2009, for the first unit at the Catawba site (Unit 2).

2515/174-07 EXPIRATION

This TI will expire August 31, 2009.

2515/174-08 CONTACT

Questions regarding the technical aspects of this TI should be addressed to Steve Jones at 301-415-2712 or Donnie Harrison at 301-415-3587.

2515/174-09 STATISTICAL DATA REPORTING

All direct inspection effort expended on this TI is to be charged to 2515/174 for reporting by the Regulatory Information Tracking System (RITS) with an IPE code of TI. All indirect inspection effort on this TI is to be charged to a specific inspection report number with an IPE code of TIP or TID for preparation and documentation, respectively.

2515/174-10 ORIGINATING ORGANIZATION INFORMATION

10.01 Organizational Responsibility

This TI was initiated by the Balance of Plant Branch (NRR/DSS/SBPB).

10.02 Resource Estimate

The estimated direct inspection effort to perform this TI is estimated to be 40 hours per site. The TI should be performed by qualified resident or regional inspectors.

10.03 Training

No specialized training is needed to perform inspection requirements in this TI beyond the basic training for inspectors (specified in IMC 1245, "Inspector Qualifications").

2515/174-11 REFERENCES

1. Regulatory Analysis: “Proposed Action to Address Generic Safety Issue 189: ‘Susceptibility of Ice Condenser and Mark III Containments to Early Failure from Hydrogen Combustion during a Severe Accident’,” May 24, 2005 (ADAMS Accession No.: ML051450060)

2. Duke Energy Corporation, letter to the U.S. NRC from James R. Morris, Vice President, Catawba Nuclear Station, March 8, 2007 (ADAMS Accession No.: ML070790255).

3. Indiana Michigan Power Company, letter to the U.S. NRC from Joseph N. Jensen, Site Vice President, Donald C. Cook Nuclear Plant, February 9, 2007 (ADAMS Accession No.: ML070520400).

4. Tennessee Valley Authority, letter to the U.S. NRC from Preston D. Swafford, Senior Vice President, Nuclear Support, March 6, 2007 (ADAMS Accession No.: ML070670149).

5. FirstEnergy Nuclear Operating Company, letter to the U.S. NRC from L. William Pearce, Vice President - Nuclear, February 26, 2007 (ADAMS Accession No.: ML070660457) (Non-Publicly Available).

6. Entergy Operations, Incorporated, letter to the U.S. NRC from Edward D. Harris, Acting Director, Nuclear Safety Assurance, Grand Gulf Nuclear Station, March 1, 2007 (ADAMS Accession No.: ML070720416) (Non-Publicly Available).

7. Entergy Operations, Incorporated, letter to the U.S. NRC from Rick J. King, Director, Nuclear Safety Assurance, River Bend Station, February 15, 2007 (ADAMS Accession No.: ML070520435).

8. AmerGen Energy Company, LLC, letter to the U.S. NRC from Bryan Hansen, Site Vice President, Clinton Power Station, February 28, 2007 (ADAMS Accession No.: ML072280266).

9. Inspection Procedure 71111, “Reactor Safety - Initiating Events, Mitigating Systems, Barrier Integrity,” Attachment 71111.17, “Permanent Plant Modifications,” dated July 7, 2005.

10. NEI 94-01, “Severe Accident Issue Closure Guidelines,” December 1994 (ADAMS Accession No.: ML072850981).

END

ATTACHMENT 1

Revision History for TI 2515/7174

Commitment Tracking Number	Issue Date	Description of Change	Training Required	Training Completion Date	Comment Resolution Accession Number
N/A	02/12/08 CN 08-007	This TI was developed to verify licensee implementation of voluntary commitments for provision of backup power to the containment hydrogen igniters.	None	N/A	ML080030467