Duke Power
A Duke Energy Company

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May 3, 2000

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: Duke Energy Corporation
Catawba Nuclear Station, Unit 2
Docket Number 50-414
Proposed Technical Specifications Amendment
Technical Specification 3.6.9
Hydrogen Ignition System (HIS)

Pursuant to 10 CFR 50.90, Duke Energy Corporation is requesting an emergency amendment to the Catawba Nuclear Station Facility Operating License and Technical Specifications (TS) for Unit 2. This amendment applies to TS Section 3.6.9 (TS and Bases) for the HIS. Specifically, the proposed amendment modifies Surveillance Requirements (SRs) 3.6.9.1, 3.6.9.2, and 3.6.9.3 to exclude the two hydrogen ignitors located beneath the reactor vessel missile shield from the applicability of the SRs. These two ignitors are presently inoperable on Unit 2 and cannot be accessed for replacement with the unit in its current operating mode (Mode 1). This change is being requested for Unit 2 Cycle 11 only or until such time that the unit enters Mode 5 such that the inoperable ignitors can be accessed for replacement. The attached justification supports this proposed change.

Catawba is requesting that this proposed TS change be approved by the NRC on an emergency basis. Currently, Unit 2 is in TS 3.6.9, Condition B (one containment region with no operable hydrogen ignitor). Required Action B.1 for this condition requires the restoration of one hydrogen ignitor in the affected containment region to operable status within 7 days. As indicated previously, Catawba cannot access the inoperable ignitors in the present mode, and the 7-day Completion Time for TS 3.6.9, Condition B expires on May 6, 2000, at 0600 hours.

A001

In requesting this TS amendment on an emergency basis, Catawba informs the NRC that the emergency situation was not created by failure to take timely action. TS 3.6.9, Condition B was entered for Unit 2 on April 29, 2000, at 0600 hours, when the two ignitors beneath the reactor vessel missile shield were declared inoperable. At present, all ignitors with the exception of the two beneath the reactor vessel missile shield have been replaced and are operable.

The contents of this amendment request package are as follows:

Attachment 1 provides a marked copy of the affected TS and Bases pages for Catawba, showing the proposed changes. Attachment 2 contains reprinted pages of the affected TS and Bases pages. Attachment 3 provides a description of the proposed changes and technical justification. Pursuant to 10 CFR 50.92, Attachment 4 documents the determination that the amendment contains No Significant Hazards Considerations. Pursuant to 10 CFR 51.22(c)(9), Attachment 5 provides the basis for the categorical exclusion from performing an Environmental Assessment/Impact Statement.

Implementation of this amendment to the Catawba Facility Operating License and TS will not impact the Catawba Updated Final Safety Analysis Report (UFSAR).

Duke is requesting NRC review and approval of this proposed amendment by May 6, 2000, at 0600 hours (prior to the expiration of the 7-day Completion Time associated with TS 3.6.9, Condition B). Approval of this amendment will prevent having to shut down the affected unit to replace the inoperable ignitors.

In accordance with Duke administrative procedures and the Quality Assurance Program Topical Report, this proposed amendment has been previously reviewed and approved by the Catawba Plant Operations Review Committee and the Duke Corporate Nuclear Safety Review Board.

Pursuant to 10 CFR 50.91, a copy of this proposed amendment is being sent to the appropriate State of South Carolina official.

Inquiries on this matter should be directed to L.J. Rudy at (803) 831-3084.

Very truly yours,

Gary R. Peterson

LJR/s

Attachments

Gary R. Peterson, being duly sworn, states that he is Site Vice President of Duke Energy Corporation; that he is authorized on the part of said corporation to sign and file with the Nuclear Regulatory Commission this amendment to the Catawba Nuclear Station Facility Operating License Number NPF-52 and Technical Specifications; and that all statements and matters set forth herein are true and correct to the best of his knowledge.

Gary R. Peterson, Site Vice President

Subscribed and sworn to me: 5-3-00
Date

Notary Public

My commission expires: 6-26-2002
Date

SEAL

xc (with attachments):

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ATTACHMENT 1

MARKED-UP TECHNICAL SPECIFICATIONS PAGES FOR CATAWBA

3.6 CONTAINMENT SYSTEMS

3.6.9 Hydrogen Ignition System (HIS)

LCO 3.6.9 Two HIS trains shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One HIS train inoperable. *	A.1 Restore HIS train to OPERABLE status. OR A.2 Perform SR 3.6.9.1 on the OPERABLE train.	7 days Once per 7 days
B. One containment region with no OPERABLE hydrogen ignitor. *	B.1 Restore one hydrogen ignitor in the affected containment region to OPERABLE status.	7 days
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	6 hours

* For Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, each train's ignitor located beneath the reactor vessel missile shield may be inoperable without requiring entry into this Condition.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.9.1	Energize each HIS train power supply breaker and verify ≥ 34 (Unit 1) or 33* (Unit 2) ignitors are energized in each train.	92 days
SR 3.6.9.2	Verify at least one hydrogen ignitor is OPERABLE in each containment region. *	92 days
SR 3.6.9.3	Energize each hydrogen ignitor and verify temperature is ≥ 1700°F. *	18 months

* For Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, this SR is not applicable to each train's ignitor located beneath the reactor vessel missile shield.

B 3.6 CONTAINMENT SYSTEMS

B 3.6.9 Hydrogen Ignition System (HIS)

BASES

BACKGROUND

The HIS reduces the potential for breach of primary containment due to a hydrogen oxygen reaction in post accident environments. The HIS is required by 10 CFR 50.44, "Standards for Combustible Gas Control Systems in Light-Water-Cooled Reactors" (Ref. 1), and Appendix A, GDC 41, "Containment Atmosphere Cleanup" (Ref. 2), to reduce the hydrogen concentration in the primary containment following a degraded core accident. The HIS must be capable of handling an amount of hydrogen equivalent to that generated from a metal water reaction involving 75% of the fuel cladding surrounding the active fuel region (excluding the plenum volume).

10 CFR 50.44 (Ref. 1) requires units with ice condenser containments to install suitable hydrogen control systems that would accommodate an amount of hydrogen equivalent to that generated from the reaction of 75% of the fuel cladding with water. The HIS provides this required capability. This requirement was placed on ice condenser units because of their small containment volume and low design pressure (compared with pressurized water reactor dry containments). Calculations indicate that if hydrogen equivalent to that generated from the reaction of 75% of the fuel cladding with water were to collect in the primary containment, the resulting hydrogen concentration would be far above the lower flammability limit such that, if ignited from a random ignition source, the resulting hydrogen burn would seriously challenge the containment and safety systems in the containment.

The HIS is based on the concept of controlled ignition using thermal ignitors, designed to be capable of functioning in a post accident environment, seismically supported, and capable of actuation from the control room. A total of 70* ignitors are distributed throughout the various regions of containment in which hydrogen could be released or to which it could flow in significant quantities. The ignitors are arranged in two independent trains such that each containment region has at least two ignitors*, one from each train, controlled and powered redundantly so that ignition would occur in each region even if one train failed to energize.

* During Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, each train's ignitor located beneath the reactor vessel missile shield may be inoperable without impacting the OPERABILITY of its respective train.

BASES

BACKGROUND (continued)

(*)

When the HIS is initiated, the ignitor elements are energized and heat up to a surface temperature ≥ 1700°F. At this temperature, they ignite the hydrogen gas that is present in the airspace in the vicinity of the ignitor. The HIS depends on the dispersed location of the ignitors so that local pockets of hydrogen at increased concentrations would burn before reaching a hydrogen concentration significantly higher than the lower flammability limit. Hydrogen ignition in the vicinity of the ignitors is assumed to occur when the local hydrogen concentration reaches 8.5 volume percent (v/o) and results in 100% of the hydrogen present being consumed.

APPLICABLE SAFETY ANALYSES

The HIS causes hydrogen in containment to burn in a controlled manner as it accumulates following a degraded core accident (Ref. 3). Burning occurs at the lower flammability concentration, where the resulting temperatures and pressures are relatively benign. Without the system, hydrogen could build up to higher concentrations that could result in a violent reaction if ignited by a random ignition source after such a buildup.

The hydrogen ignitors are not included for mitigation of a Design Basis Accident (DBA) because an amount of hydrogen equivalent to that generated from the reaction of 75% of the fuel cladding with water is far in excess of the hydrogen calculated for the limiting DBA loss of coolant accident (LOCA). The hydrogen concentration resulting from a DBA can be maintained less than the flammability limit using the hydrogen recombiners. The hydrogen ignitors, however, have been shown by probabilistic risk analysis to be a significant contributor to limiting the severity of accident sequences that are commonly found to dominate risk for units with ice condenser containments. As such, the hydrogen ignitors satisfy Criterion 4 of 10 CFR 50.36 (Ref. 4).

LCO

Two HIS trains must be OPERABLE with power from two independent, safety related power supplies.

(Unit 1) or 33* (Unit 2)

For this unit, an OPERABLE HIS train consists of 34 of 35 ignitors energized on the train.

Operation with at least one HIS train ensures that the hydrogen in ~~containment can be burned in a controlled manner. Unavailability of both~~

* During Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, each train's ignitor located beneath the reactor vessel missile shield may be inoperable without impacting the OPERABILITY of its respective train.

BASES

LCO (continued)

HIS trains could lead to hydrogen buildup to higher concentrations, which could result in a violent reaction if ignited. The reaction could take place fast enough to lead to high temperatures and overpressurization of containment and, as a result, breach containment or cause containment leakage rates above those assumed in the safety analyses. Damage to safety related equipment located in containment could also occur.

APPLICABILITY

Requiring OPERABILITY in MODES 1 and 2 for the HIS ensures its immediate availability after safety injection and scram actuated on a LOCA initiation. In the post accident environment, the two HIS subsystems are required to control the hydrogen concentration within containment to near its flammability limit of 4.0 v/o assuming a worst case single failure. This prevents overpressurization of containment and damage to safety related equipment and instruments located within containment.

In MODES 3 and 4, both the hydrogen production rate and the total hydrogen production after a LOCA would be significantly less than that calculated for the DBA LOCA. Also, because of the limited time in these MODES, the probability of an accident requiring the HIS is low. Therefore, the HIS is not required in MODES 3 and 4.

In MODES 5 and 6, the probability and consequences of a LOCA are reduced due to the pressure and temperature limitations of these MODES. Therefore, the HIS is not required to be OPERABLE in MODES 5 and 6.

ACTIONS

A.1 and A.2 *

With one HIS train inoperable, the inoperable train must be restored to OPERABLE status within 7 days or the OPERABLE train must be verified OPERABLE frequently by performance of SR 3.6.9.1. The 7 day Completion Time is based on the low probability of the occurrence of a degraded core event that would generate hydrogen in amounts equivalent to a metal water reaction of 75% of the core cladding, the length of time after the event that operator action would be required to prevent hydrogen accumulation from exceeding this limit, and the low probability of failure of the OPERABLE HIS train. Alternative Required Action A.2, by frequent surveillances, provides assurance that the OPERABLE train continues to be OPERABLE.

* For Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, each train's ignitor located beneath the reactor vessel missile shield may be inoperable without requiring entry into this Condition.

BASES

ACTIONS (continued)

B.1 *

Condition B is one containment region with no OPERABLE hydrogen ignitor. Thus, while in Condition B, or in Conditions A and B simultaneously, there would always be ignition capability in the adjacent containment regions that would provide redundant capability by flame propagation to the region with no OPERABLE ignitors.

Required Action B.1 calls for the restoration of one hydrogen ignitor in each region to OPERABLE status within 7 days. The 7 day Completion Time is based on the same reasons given under Required Action A.1.

C.1

The unit must be placed in a MODE in which the LCO does not apply if the HIS subsystem(s) cannot be restored to OPERABLE status within the associated Completion Time. This is done by placing the unit in at least MODE 3 within 6 hours. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.6.9.1

This SR confirms that ≥ 34 (Unit 1) or 33** (Unit 2) of 35 hydrogen ignitors can be successfully energized in each train. The ignitors are simple resistance elements. Therefore, energizing provides assurance of OPERABILITY. The allowance of one inoperable hydrogen ignitor is acceptable because, although one inoperable hydrogen ignitor in a region would compromise redundancy in that region, the containment regions are interconnected so that ignition in one region would cause burning to progress to the others (i.e., there is overlap in each hydrogen ignitor's effectiveness between regions). The Frequency of 92 days has been shown to be acceptable through operating experience.

* For Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, each train's ignitor located beneath the reactor vessel missile shield may be inoperable without requiring entry into this Condition.

** For Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, this SR is not applicable to each train's ignitor located beneath the reactor vessel missile shield.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.9.2

This SR confirms that the two inoperable hydrogen ignitors allowed by SR 3.6.9.1 (i.e., one in each train) are not in the same containment region.* The Frequency of 92 days is acceptable based on the Frequency of SR 3.6.9.1, which provides the information for performing this SR.

SR 3.6.9.3

A more detailed functional test is performed every 18 months to verify system OPERABILITY. Each glow plug is visually examined to ensure that it is clean and that the electrical circuitry is energized. All ignitors (glow plugs), including normally inaccessible ignitors, are visually checked for a glow to verify that they are energized. Additionally, the surface temperature of each glow plug is measured to be ≥ 1700°F to demonstrate that a temperature sufficient for ignition is achieved.* The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components usually pass the SR when performed at the 18 month Frequency, which is based on the refueling cycle. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

REFERENCES

1. 10 CFR 50.44.
2. 10 CFR 50, Appendix A, GDC 41.
3. UFSAR, Section 6.2.
4. 10 CFR 50.36, Technical Specifications, (c)(2)(ii).

* For Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, this SR is not applicable to each train's ignitor located beneath the reactor vessel missile shield.

ATTACHMENT 2

REPRINTED TECHNICAL SPECIFICATIONS PAGES FOR CATAWBA

3.6 CONTAINMENT SYSTEMS

3.6.9 Hydrogen Ignition System (HIS)

LCO 3.6.9 Two HIS trains shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One HIS train inoperable.*	A.1 Restore HIS train to OPERABLE status.	7 days
	OR	
	A.2 Perform SR 3.6.9.1 on the OPERABLE train.	Once per 7 days
B. One containment region with no OPERABLE hydrogen ignitor.*	B.1 Restore one hydrogen ignitor in the affected containment region to OPERABLE status.	7 days
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	6 hours

* For Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, each train's ignitor located beneath the reactor vessel missile shield may be inoperable without requiring entry into this Condition.

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.6.9.1	Energize each HIS train power supply breaker and verify $\geq$ 34 (Unit 1) or 33* (Unit 2) ignitors are energized in each train.	92 days
SR 3.6.9.2	Verify at least one hydrogen ignitor is OPERABLE in each containment region.*	92 days
SR 3.6.9.3	Energize each hydrogen ignitor and verify temperature is $\geq$ 1700°F.*	18 months

* For Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, this SR is not applicable to each train's ignitor located beneath the reactor vessel missile shield.

B 3.6 CONTAINMENT SYSTEMS

B 3.6.9 Hydrogen Ignition System (HIS)

BASES

BACKGROUND

The HIS reduces the potential for breach of primary containment due to a hydrogen oxygen reaction in post accident environments. The HIS is required by 10 CFR 50.44, "Standards for Combustible Gas Control Systems in Light-Water-Cooled Reactors" (Ref. 1), and Appendix A, GDC 41, "Containment Atmosphere Cleanup" (Ref. 2), to reduce the hydrogen concentration in the primary containment following a degraded core accident. The HIS must be capable of handling an amount of hydrogen equivalent to that generated from a metal water reaction involving 75% of the fuel cladding surrounding the active fuel region (excluding the plenum volume).

10 CFR 50.44 (Ref. 1) requires units with ice condenser containments to install suitable hydrogen control systems that would accommodate an amount of hydrogen equivalent to that generated from the reaction of 75% of the fuel cladding with water. The HIS provides this required capability. This requirement was placed on ice condenser units because of their small containment volume and low design pressure (compared with pressurized water reactor dry containments). Calculations indicate that if hydrogen equivalent to that generated from the reaction of 75% of the fuel cladding with water were to collect in the primary containment, the resulting hydrogen concentration would be far above the lower flammability limit such that, if ignited from a random ignition source, the resulting hydrogen burn would seriously challenge the containment and safety systems in the containment.

The HIS is based on the concept of controlled ignition using thermal ignitors, designed to be capable of functioning in a post accident environment, seismically supported, and capable of actuation from the control room. A total of 70* ignitors are distributed throughout the various regions of containment in which hydrogen could be released or to which it could flow in significant quantities. The ignitors are arranged in two independent trains such that each containment region has at least two ignitors*, one from each train, controlled and powered redundantly so that ignition would occur in each region even if one train failed to energize.

* During Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, each train's ignitor located beneath the reactor vessel missile shield may be inoperable without impacting the OPERABILITY of its respective train.

BASES

BACKGROUND (continued)

When the HIS is initiated, the ignitor elements are energized and heat up to a surface temperature ≥ 1700°F*. At this temperature, they ignite the hydrogen gas that is present in the airspace in the vicinity of the ignitor. The HIS depends on the dispersed location of the ignitors so that local pockets of hydrogen at increased concentrations would burn before reaching a hydrogen concentration significantly higher than the lower flammability limit. Hydrogen ignition in the vicinity of the ignitors is assumed to occur when the local hydrogen concentration reaches 8.5 volume percent (v/o) and results in 100% of the hydrogen present being consumed.

APPLICABLE SAFETY ANALYSES

The HIS causes hydrogen in containment to burn in a controlled manner as it accumulates following a degraded core accident (Ref. 3). Burning occurs at the lower flammability concentration, where the resulting temperatures and pressures are relatively benign. Without the system, hydrogen could build up to higher concentrations that could result in a violent reaction if ignited by a random ignition source after such a buildup.

The hydrogen ignitors are not included for mitigation of a Design Basis Accident (DBA) because an amount of hydrogen equivalent to that generated from the reaction of 75% of the fuel cladding with water is far in excess of the hydrogen calculated for the limiting DBA loss of coolant accident (LOCA). The hydrogen concentration resulting from a DBA can be maintained less than the flammability limit using the hydrogen recombiners. The hydrogen ignitors, however, have been shown by probabilistic risk analysis to be a significant contributor to limiting the severity of accident sequences that are commonly found to dominate risk for units with ice condenser containments. As such, the hydrogen ignitors satisfy Criterion 4 of 10 CFR 50.36 (Ref. 4).

LCO

Two HIS trains must be OPERABLE with power from two independent, safety related power supplies.

For this unit, an OPERABLE HIS train consists of 34 (Unit 1) or 33* (Unit 2) of 35 ignitors energized on the train.

* During Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, each train's ignitor located beneath the reactor vessel missile shield may be inoperable without impacting the OPERABILITY of its respective train.

BASES

LCO (continued)

Operation with at least one HIS train ensures that the hydrogen in containment can be burned in a controlled manner. Unavailability of both HIS trains could lead to hydrogen buildup to higher concentrations, which could result in a violent reaction if ignited. The reaction could take place fast enough to lead to high temperatures and overpressurization of containment and, as a result, breach containment or cause containment leakage rates above those assumed in the safety analyses. Damage to safety related equipment located in containment could also occur.

APPLICABILITY

Requiring OPERABILITY in MODES 1 and 2 for the HIS ensures its immediate availability after safety injection and scram actuated on a LOCA initiation. In the post accident environment, the two HIS subsystems are required to control the hydrogen concentration within containment to near its flammability limit of 4.0 v/o assuming a worst case single failure. This prevents overpressurization of containment and damage to safety related equipment and instruments located within containment.

In MODES 3 and 4, both the hydrogen production rate and the total hydrogen production after a LOCA would be significantly less than that calculated for the DBA LOCA. Also, because of the limited time in these MODES, the probability of an accident requiring the HIS is low. Therefore, the HIS is not required in MODES 3 and 4.

In MODES 5 and 6, the probability and consequences of a LOCA are reduced due to the pressure and temperature limitations of these MODES. Therefore, the HIS is not required to be OPERABLE in MODES 5 and 6.

ACTIONS

<u>A.1 and A.2*</u>

With one HIS train inoperable, the inoperable train must be restored to OPERABLE status within 7 days or the OPERABLE train must be verified OPERABLE frequently by performance of SR 3.6.9.1. The 7 day Completion Time is based on the low probability of the occurrence of a degraded core event that would generate hydrogen in amounts equivalent to a metal water reaction of 75% of the core cladding, the

* For Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, each train's ignitor located beneath the reactor vessel missile shield may be inoperable without requiring entry into this Condition.

BASES

ACTIONS (continued)

length of time after the event that operator action would be required to prevent hydrogen accumulation from exceeding this limit, and the low probability of failure of the OPERABLE HIS train. Alternative Required Action A.2, by frequent surveillances, provides assurance that the OPERABLE train continues to be OPERABLE.

B.1*

Condition B is one containment region with no OPERABLE hydrogen ignitor. Thus, while in Condition B, or in Conditions A and B simultaneously, there would always be ignition capability in the adjacent containment regions that would provide redundant capability by flame propagation to the region with no OPERABLE ignitors.

Required Action B.1 calls for the restoration of one hydrogen ignitor in each region to OPERABLE status within 7 days. The 7 day Completion Time is based on the same reasons given under Required Action A.1.

C.1

The unit must be placed in a MODE in which the LCO does not apply if the HIS subsystem(s) cannot be restored to OPERABLE status within the associated Completion Time. This is done by placing the unit in at least MODE 3 within 6 hours. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.6.9.1

This SR confirms that $\geq$ 34 (Unit 1) or 33** (Unit 2) of 35 hydrogen ignitors can be successfully energized in each train. The ignitors are simple resistance elements. Therefore, energizing provides assurance of

* For Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, each train's ignitor located beneath the reactor vessel missile shield may be inoperable without requiring entry into this Condition.

** For Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, this SR is not applicable to each train's ignitor located beneath the reactor vessel missile shield.

BASES

SURVEILLANCE REQUIREMENTS (continued)

OPERABILITY. The allowance of one inoperable hydrogen ignitor is acceptable because, although one inoperable hydrogen ignitor in a region would compromise redundancy in that region, the containment regions are interconnected so that ignition in one region would cause burning to progress to the others (i.e., there is overlap in each hydrogen ignitor's effectiveness between regions). The Frequency of 92 days has been shown to be acceptable through operating experience.

SR 3.6.9.2

This SR confirms that the two inoperable hydrogen ignitors allowed by SR 3.6.9.1 (i.e., one in each train) are not in the same containment region*. The Frequency of 92 days is acceptable based on the Frequency of SR 3.6.9.1, which provides the information for performing this SR.

SR 3.6.9.3

A more detailed functional test is performed every 18 months to verify system OPERABILITY. Each glow plug is visually examined to ensure that it is clean and that the electrical circuitry is energized. All ignitors (glow plugs), including normally inaccessible ignitors, are visually checked for a glow to verify that they are energized. Additionally, the surface temperature of each glow plug is measured to be ≥ 1700°F to demonstrate that a temperature sufficient for ignition is achieved*. The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components usually pass the SR when performed at the 18 month Frequency, which is based on the refueling cycle. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

REFERENCES

1. 10 CFR 50.44.

2. 10 CFR 50, Appendix A, GDC 41.

* For Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, this SR is not applicable to each train's ignitor located beneath the reactor vessel missile shield.

BASES

REFERENCES (continued)

3. UFSAR, Section 6.2.
4. 10 CFR 50.36, Technical Specifications, (c)(2)(ii).

ATTACHMENT 3

DESCRIPTION OF PROPOSED CHANGES AND TECHNICAL JUSTIFICATION

Description of Proposed Changes

1) Modify TS 3.6.9 Conditions A and B with a footnote which reads as follows:

   "For Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, each train's ignitor located beneath the reactor vessel missile shield may be inoperable without requiring entry into this Condition."

2) Modify SRs 3.6.9.1, 3.6.9.2, and 3.6.9.3 with a footnote which reads as follows:

   "For Unit 2 Cycle 11 operation only, or until the next Unit 2 entry into MODE 5 which allows affected ignitor replacement, this SR is not applicable to each train's ignitor located beneath the reactor vessel missile shield."

3) Clarify SR 3.6.9.1 such that the SR requires $\geq$ 34 ignitors to be energized in each train for Unit 1 and $\geq$ 33 ignitors to be energized in each train for Unit 2.

4) Make corresponding Bases changes, consistent with the changes to the above TS.

Upon completion of Unit 2 Cycle 11 operation, or upon replacement of the affected ignitors during the next Unit 2 entry into Mode 5, the described changes will be immediately rendered obsolete and will be removed via a future license amendment.

Technical Justification

TS 3.6.9 governs the HIS and is applicable in the current mode of operation of Catawba Unit 2 (Mode 1). TS 3.6.9 requires that two HIS trains be operable in Modes 1 and 2. Operability of the HIS is demonstrated by:

1) SR 3.6.9.1, which requires that each HIS train power supply breaker be energized and that $\geq$ 34 ignitors be verified to be energized in each train,
2) SR 3.6.9.2, which requires that at least one hydrogen ignitor be verified operable in each containment region, and
3) SR 3.6.9.3, which requires that each hydrogen ignitor be energized and its temperature verified to be $\geq$ 1700°F.

With one HIS train inoperable per Condition A, Required Action A.1 requires that the HIS train be restored to operable status within 7 days, or alternatively, per Required Action A.2, SR 3.6.9.1 may be performed on the operable train once per 7 days. With one containment region with no operable hydrogen ignitor per Condition B, Required Action B.1 requires that one hydrogen ignitor in the affected containment region be restored to operable status within 7 days. With any Required Action and associated Completion Time not met, Required Action C.1 requires that the unit be in Mode 3 within 6 hours. With more than one containment region with no operable hydrogen ignitor, TS 3.0.3 would apply and the unit would have to be in Mode 3 within 6 hours.

The function of the HIS is to employ a method of controlled ignition, using thermal ignitors, to reduce the hydrogen concentration in an ice condenser containment following a degraded core accident. The HIS was installed as a post-TMI requirement according to 10 CFR 50.44. At Catawba, a total of 70 ignitors (35 per train) are distributed throughout the various regions of containment in which hydrogen could be released or to which it could flow in significant quantities. Each containment region has two ignitors, one per train, controlled and powered redundantly so that ignition would occur in each region even if one train failed to energize. Catawba utilizes diesel glow plugs as the hydrogen ignitors.

During the Unit 2 end-of-cycle 10 refueling outage (in March - April 2000), all glow plugs were replaced with ones of a different vendor sub-contractor. The replaced glow plugs were subjected to testing and all passed. Following the replacement and testing, all glow plugs were verified to be operable before Unit 2 entered Mode 2.

On April 25, 2000, at 1330 hours, testing was initiated on the Train B ignitors per TS 3.6.9 SRs. During the performance of the test, a total of 12 ignitors failed.

Catawba subsequently replaced 34 of the Train B glow plugs which are accessible with Unit 2 in Mode 1. A power reduction to 18% power was necessary to replace some of these glow plugs in order to minimize radiation exposure. The 34 glow plugs were replaced with glow plugs from the same vendor sub-contractor that had previously been utilized prior to the end-of-cycle 10 refueling outage (these were proven to be reliable). There is 1 remaining Train B glow plug located beneath the reactor vessel missile shield, which is inaccessible during power operation. Hence, this 1 glow plug was not replaced on Train B.

Following replacement of the 34 Train B glow plugs, Train B of the HIS was retested and was declared operable on April 29, 2000, at 0045 hours. Train A of the HIS was then tested and 2 ignitors failed in one group. All of the other Train A ignitors passed. Based on the Train B experience, 34 of the glow plugs were replaced with glow plugs from the same vendor sub-contractor that had previously been utilized. Again, the 1 Train A glow plug beneath the reactor vessel missile shield was not replaced due to it being inaccessible in Mode 1. Following replacement of the 34 Train A glow plugs, Train A of the HIS was retested and was declared operable on April 30, 2000, at 0322 hours. The glow plugs beneath the reactor vessel missile shield were considered to be inoperable from April 29, 2000, at 0600 hours. The decision to consider these 2 glow plugs inoperable was based on the fact that there is not a high confidence that they will function for the required duration in the event that the HIS was required.

Therefore, out of a total of 70 glow plugs, only 2 (the pair beneath the reactor vessel missile shield) were not replaced.

There is minimal safety consequence associated with this request. The remaining ignitors are fully operable and are capable of providing the required coverage for hydrogen ignition in the event of a severe accident causing fuel damage. If the 2 ignitors beneath the reactor vessel missile shield were to fail, operation of the ignitors in adjacent regions would compensate and burn off any accumulated hydrogen safely.

Direct ignition of the hydrogen within a region is not required in order to burn the hydrogen at low concentrations, which is the fundamental objective of the HIS. Burns ignited in one compartment can readily propagate into adjacent compartments when the hydrogen concentration in the adjacent compartment exceeds the propagation limit. Propagation limits are lower than the ignition limits.

The effectiveness of the propagation of burns can be seen in the analysis submitted by Duke Energy in 1993, Revision 15 to "An Analysis of Hydrogen Control Measures at McGuire Nuclear Station," to close out various open items related to the operating license for Catawba. This analysis clearly shows that propagation of burns between compartments is effective for initiating burns within compartments that have not yet reached the ignition limit. For the three LOCA sequences analyzed, the only compartment in which ignition occurred was the lower containment compartment. Combustion in all of the other compartments, dead-ended regions, ice condenser, and upper containment, resulted from the propagation of the burn from the lower compartment into those regions. In the fourth sequence analyzed, a high pressure sequence initiated by a loss of all feedwater, some burns were ignited in the dome region of the containment in addition to the lower containment. Combustion in all of the other compartments resulted from propagation. Propagation is also described in NUREG/CR-4993, "A Standard Problem for HECTR-MAAP Comparison: Incomplete Burning."

The significance of the propagation is that complete containment coverage with ignition sources is not a requirement for effective hydrogen control. The containment air return fans and the hydrogen skimmer fans provide for a well-mixed environment inside the containment. Ignition in any compartment is likely to result in combustion in every compartment that has accumulated hydrogen at the propagation limit. With lower containment as the region most likely to see the hydrogen source term, ignition occurs frequently in this compartment and spreads readily to the dead-ended compartments and up into and through the ice condenser into upper containment.

The initial design of the HIS at Catawba consisted of 72 ignitors with at least one pair of ignitors in all of the containment compartments. In 1995, a license amendment was submitted for each Catawba unit, which allowed the removal of the hydrogen ignitors from the incore instrument tunnel underneath the reactor vessel (License Amendment Numbers 136/130 for Units 1/2, respectively). The analysis provided in the amendment request described how the hydrogen concentration remained under control in this region in the absence of an ignition source. In the analysis, the combustion which occurred in the lower compartment prevented accumulation in the incore tunnel. Since the lower compartment is the source of air and hydrogen for the incore region, controlling the concentration in lower containment effectively provided control for the incore tunnel. No combustion occurred in the incore region in any of the analyses, indicating that the concentration remained below the propagation limit for the duration of the analysis. Similar results would be expected for any compartment where the gas concentrations are directly influenced by the conditions in lower containment.

As a result of the operation of the containment air return fans and the hydrogen skimmer system, the ice condenser containment is well mixed with flow assured through virtually every compartment in the containment. Among the dead-ended compartments, only the letdown heat exchanger room does not have a hydrogen skimmer system connection. Propagation of hydrogen deflagration flame fronts both within a compartment and between compartments assures that control of the hydrogen concentration in the containment would be effective with multiple ignitors unavailable.

The only region of the containment without direct coverage by redundant ignitors is the area above the reactor vessel head, which is beneath the missile shield. Flow out of this compartment is assured by the operation of the hydrogen skimmer system. Replacement air enters this compartment via the vent openings in the upper reactor cavity wall, which establishes a connection to the rest of the lower containment volume. The 6 vent openings are large, approximately 25 square feet each. Burns in lower containment in the vicinity of the reactor coolant system piping will propagate into the region through the vents if the hydrogen concentration in this region is above the propagation limit. In this manner, the hydrogen concentration in this region is controlled, even though no ignition source is available within the compartment. The HIS remains capable of controlling the hydrogen concentration to levels that are sufficiently low, such that containment integrity is not challenged.

In summary, NRC granting of this amendment request will not have any adverse consequences from the standpoint of public health and safety. Relief from the applicable requirements in order to allow Unit 2 to remain in the present mode until the affected ignitors can be replaced is preferable to the transient that would be incurred if the unit were forced to shut down. Duke Energy has evaluated the consequences of this request from a safety standpoint and the results were found to be acceptable. The remaining operable ignitors have been demonstrated to provide acceptable coverage for all containment regions that may be impacted as a result of hydrogen generation during a severe accident. Finally, the NRC has previously approved a license amendment request involving relief from applicable requirements for this system for another plant (reference License Amendment Number 10 for Watts Bar Nuclear Plant, Unit 1, dated June 9, 1998).

ATTACHMENT 4

NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

No Significant Hazards Consideration Determination

The following discussion is a summary of the evaluation of the changes contained in this proposed amendment against the 10 CFR 50.92(c) requirements to demonstrate that all three standards are satisfied. A no significant hazards consideration is indicated if operation of the facility in accordance with the proposed amendment would not:

1. Involve a significant increase in the probability or consequences of an accident previously evaluated, or

2. Create the possibility of a new or different kind of accident from any accident previously evaluated, or

3. Involve a significant reduction in a margin of safety.

First Standard

Implementation of this amendment would not involve a significant increase in the probability or consequences of an accident previously evaluated. Granting of this request will have no effect on accident probabilities, since no accidents not previously evaluated can be initiated as a result of the inoperable ignitors. No physical changes are being made to the plant which would impact accident probabilities. This request was evaluated and found to be acceptable from a safety standpoint. The remaining operable ignitors have been assessed to provide acceptable coverage for all containment regions that may be impacted as a result of hydrogen generation during a severe accident. Therefore, there will be no significant increase in any accident consequences.

Second Standard

Implementation of this amendment would not create the possibility of a new or different kind of accident from any accident previously evaluated. No new accident causal mechanisms are created as a result of NRC approval of this amendment request. No changes are being made to the plant which will introduce any new accident causal mechanisms. This amendment request does not impact any plant systems that are accident initiators and does not impact any safety analyses.

Third Standard

Implementation of this amendment would not involve a significant reduction in a margin of safety. Margin of safety is related to the confidence in the ability of the fission product barriers to perform their design functions during and following an accident situation. These barriers include the fuel cladding, the reactor coolant system, and the containment system. The performance of these fission product barriers will not be impacted by implementation of this proposed amendment. The HIS was demonstrated to perform its function in an acceptable manner in spite of the inoperable ignitors. No safety margins will be impacted. The safety implications of this request were evaluated and found to be acceptable.

Based upon the preceding discussion, Duke Energy has concluded that the proposed amendment does not involve a significant hazards consideration.

ATTACHMENT 5

ENVIRONMENTAL ANALYSIS

Environmental Analysis

Pursuant to 10 CFR 51.22(b), an evaluation of this license amendment request has been performed to determine whether or not it meets the criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9) of the regulations.

Implementation of this amendment will have no adverse impact upon Unit 2; neither will it contribute to any additional quantity or type of effluent being available for adverse environmental impact or personnel exposure.

It has been determined there is:

1. No significant hazards consideration,

2. No significant change in the types, or significant increase in the amounts, of any effluents that may be released offsite, and

3. No significant increase in individual or cumulative occupational radiation exposures involved.

Therefore, this amendment to the Catawba TS meets the criteria of 10 CFR 51.22(c)(9) for categorical exclusion from an environmental impact statement.