

January 2, 2008

Mr. J. R. Morris  
Site Vice President  
Catawba Nuclear Station  
Duke Power Company LLC  
4800 Concord Road  
York, SC 29745

SUBJECT: CATAWBA NUCLEAR STATION, UNIT 1, ISSUANCE OF EMERGENCY  
AMENDMENT REGARDING ONE-TIME EXTENSION OF THE 1B CHARGING  
PUMP AND THE AUXILIARY BUILDING FILTERED VENTILATION EXHAUST  
SYSTEM ALLOWED OUTAGE TIME (TAC NO. MD7563)

Dear Mr. Morris:

The Nuclear Regulatory Commission has issued the enclosed Amendment No. 239 to Renewed Facility Operating License NPF-35 for the Catawba Nuclear Station, Unit 1. This amendment is in response to your application dated January 1, 2008, as supplemented January 2, 2008. This emergency amendment request was made under the provisions of Section 50.91(a)(5) to Title 10 of the *Code of Federal Regulations*.

This amendment approves a one-time extension of the allowed outage time (AOT) for the 1B centrifugal charging (NV) pump beyond the 72 hours allowed by the Technical Specifications (TSs) up to a total of 240 hours as part of the 1B NV pump repair.

In addition, the amendment approves a one-time extension for the auxiliary building filtered ventilation exhaust system (ABFVES), to have two ABFVES trains inoperable. The current TSs have an AOT of 24 hours. The amendment requests an AOT extension from 24 hours to 240 hours as part of the 1B NV pump repair.

J. Morris

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A copy of the related Safety Evaluation is also enclosed. A Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

/RA/

John Stang, Senior Project Manager  
Plant Licensing Branch II-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-413

Enclosures:

1. Amendment No. 239 to NPF-35
2. Safety Evaluation

cc w/encls: See next page

J. Morris

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Package No.: ML080010002  
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DUKE POWER COMPANY LLC  
NORTH CAROLINA ELECTRIC MEMBERSHIP CORPORATION  
SALUDA RIVER ELECTRIC COOPERATIVE, INC.  
DOCKET NO. 50-413  
CATAWBA NUCLEAR STATION, UNIT 1  
AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 239  
Renewed License No. NPF-35

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment to the Catawba Nuclear Station, Unit 1 (the facility) Renewed Facility Operating License No. NPF-35 filed by the Duke Power Company LLC, acting for itself, North Carolina Electric Membership Corporation and Saluda River Electric Cooperative, Inc. (licensees), dated January 1, 2008, as supplemented January 2, 2008, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as set forth in 10 CFR Chapter I;
  - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
  - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations set forth in 10 CFR Chapter I;
  - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
  - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is hereby amended by page changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-35 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 239, which are attached hereto, are hereby incorporated into this license. Duke Power Company LLC shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 30 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

***/RA by Timothy J. McGinty for/***

John F. Stang, Acting Chief  
Plant Licensing Branch II-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Attachment:  
Changes to License No. NPF-35  
and the Technical Specifications

Date of Issuance: January 2, 2008

ATTACHMENT TO LICENSE AMENDMENT NO. 239  
RENEWED FACILITY OPERATING LICENSE NO. NPF-35  
DOCKET NO. 50-413

Replace the following pages of the Renewed Facility Operating License and the Appendix A Technical Specifications (TSs) with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove

License Page  
Page 4

TSs  
3.5.2-1  
3.7.12-1

Insert

License Page  
Page 4

TSs  
3.5.2-1  
3.7.12-1

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO

AMENDMENT NO. 239 TO RENEWED FACILITY OPERATING LICENSE NPF-35

DUKE POWER COMPANY LLC

CATAWBA NUCLEAR STATION, UNIT 1

DOCKET NO. 50-413

1.0 INTRODUCTION

By application dated January 1, 2008, as supplemented January 2, 2008, Duke Power Company LLC (Duke, the licensee), requested changes to the Technical Specifications (TSs) for the Catawba Nuclear Station, Unit 1 (Catawba 1). The proposed amendment requests a one-time change to the allowed outage time (AOT) for the 1B centrifugal charging (NV) pump to extend the 72 hour AOT allowed by the TSs up to a total of 240 hours as part of the 1B NV pump repair.

In addition, the amendment approves a one-time extension for the auxiliary building filtered ventilation exhaust system (ABFVES), to have two ABFVES trains inoperable, due to inoperable ECCS pump rooms pressure boundary, from current TS AOT of 24 hours up to a total of 240 hours as part of the 1B NV pump repair.

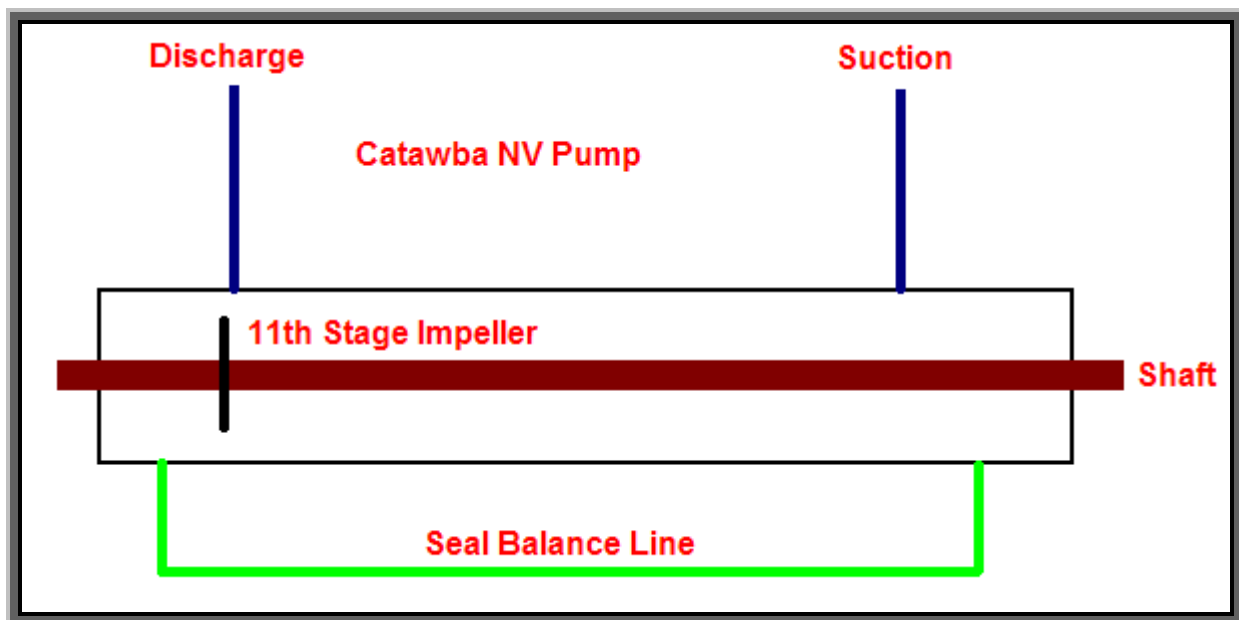
2.0 BACKGROUND

The Catawba 1 ECCS is composed, in part, of three separate subsystems: the high head centrifugal charging subsystem, the intermediate head safety injection subsystem, and the low head residual heat removal subsystem. Each subsystem consists of two redundant, 100 percent capacity trains that are interconnected such that either train is capable of supplying 100 percent of the flow required to mitigate accident consequences. The interconnecting and redundant subsystem design provides the operators with the ability to utilize components from opposite trains to achieve the required 100 percent flow to the core.

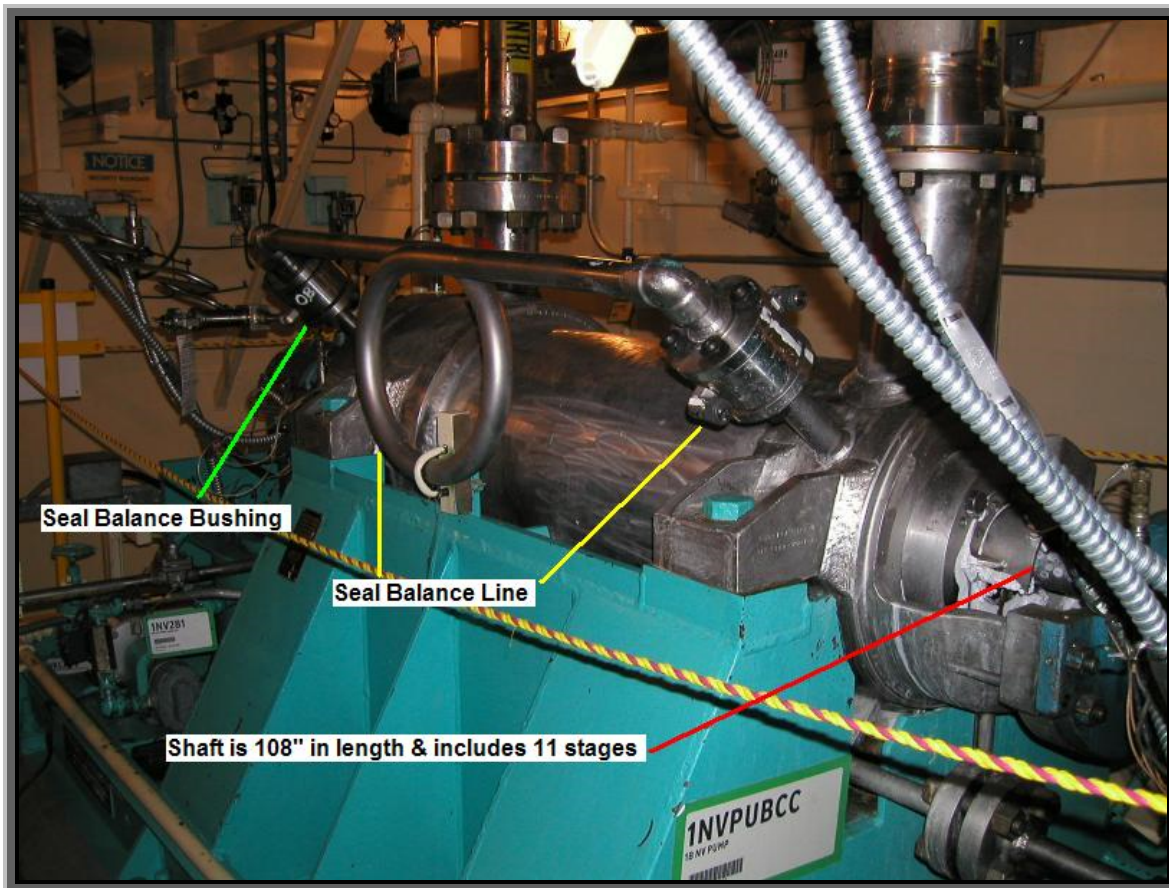
The ABFVES filters air exhausted from all potentially contaminated areas of the auxiliary building, which includes the ECCS area and nonsafety portions of the auxiliary building. The ABFVES, in conjunction with other normally operating systems, also provides ventilation for these areas of the auxiliary building. The ABFVES consists of two independent and redundant trains. Following receipt of a safety injection signal, the system isolates nonsafety portions of the ABFVES and exhausts air only from the ECCS pump rooms. Either ABFVES train is designed to be capable of maintaining a negative pressure in any of the ECCS pump rooms, regardless of train designation.

On December 30, 2007, the licensee noted, increased differential pressure (dP) readings on the seal balance line for the 1B NV pump. The seal balance line connects a bushing located after the 11<sup>th</sup> stage impeller (the last one) of the NV pump back to the suction side of the pump and is designed to reduce the loading on the outboard seal package and the thrust bearing. See the diagram below. In the event there is a problem internal to the pump, the flow back through the balance bushing will be adversely affected and the dP (pressure after the 11<sup>th</sup> stage impeller vs. the suction pressure) will show an increase. The licensee reviewed recent data recorded each shift, the dP has increased from a fairly consistent value of ~20 pounds per square differential (psid) to ~35 psid.

The drawing and photo below show the configuration of the 1B NV pump at Catawba 1.







Catawba 1 1B NV Pump

The motor stator temperatures of the 1B NV pump have also shown an increase. Any problems internal to the pump would require more motive force to get the same flow and hence the increased motor stator temperatures reflected in the measured values which tend to confirm the suspected impending failure of the NV pump shaft.

Late on December 30, 2007, local panel indications for high vibration were received and these were then confirmed by licensee maintenance personnel. The largest increase over data taken on December 19, 2007, during a routine surveillance test was on the outboard bearing in the vertical direction which went from a value of ~0.95 mils peak-to-peak to the measured value on December 31, 2007, of ~1.6 mils peak-to-peak.

The licensee entered vibration data into a computer code which graphed the shaft turning speed / displacement in vector format and this confirmed that the shaft is showing an increase in amplitude movement

Based on the above data the license declared the 1B NV pump inoperable at 0130 on December 31, 2007.

Completion times for the applicable TS required actions for the 1B ECCS will expire at 0130 on January 3, 2008. Although efforts are underway to replace the rotating element, the 1B NV pump will not be restored to operable status prior to expiration of the completion time.

In order to avoid the shutdown of Catawba Unit 1, the licensee proposes a one-time limited duration extension of the TSs Required Action Completion Time associated with the Unit 1B NV pump. The requested extension would allow continued operation of Unit 1 for an additional 168 hours while repairs and related testing of the 1B NV pump are completed.

A review of the environmental conditions necessary to complete the 1B NV pump repair has determined that the hatch in the 1B NV pump room should be opened in support of the maintenance work. In addition, in order to replace the rotating element, the equipment access hatch above the pump will have to be removed to allow the removal of equipment too large to be carried through the pump room door. Additionally, it may be necessary to allow the pump room door to be secured open for the placement and removal of equipment required to support disassembly and reassembly of the pump. Either the open hatch or the open door will create a breach in the pump room ventilation boundary of sufficient size such that neither ABFVES train will be capable of maintaining a negative pressure in the pump room relative to adjacent areas as required by TS 3.7.12.4. Therefore, the licensee also requested extending the AOT for the ABFVES, to have two ABFVES trains inoperable, due to inoperable ECCS pump room pressure boundary, from current TS AOT of 24 hours up to a total of 240 hours as part of the 1B NV pump repair.

In June 1999, the shaft on the same pump (1B) failed due to cracking. In this case the pump was allowed to run longer as the data was being analyzed. The parameter trends on the 1B pump as of December 31, 2007, are similar to the data that was taken in 1999; i.e., the same trends are being noticed. When the pump was disassembled and inspected in 1999, a crack in the shaft was identified under the 9<sup>th</sup> stage impeller. The crack was 360 degrees around the shaft and went approximately 50 percent of the way through the shaft itself.

### 3.0 REGULATORY EVALUATION

The following are applicable regulations and regulatory guidance used by the NRC staff in evaluating the proposed emergency license amendment:

The Commission's regulatory requirements related to the content of the TSs are set forth in Title 10 to the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.36. This regulation requires that the TSs include items in five specific categories. These categories include 1) safety limits, limiting safety system settings and limiting control settings, 2) limiting conditions for operation, 3) surveillance requirements, 4) design features, and 5) administrative controls.

Appendix A of 10 CFR Part 50, General Design Criterion (GDC) 27, "Combined Reactivity Control Systems Capability," requires that the reactivity control systems shall be designed to have a combined capability, in conjunction with poison addition by the emergency core cooling system, of reliably controlling reactivity changes to assure that under postulated accident conditions and with appropriate margin for stuck rods the capability to cool the core is maintained.

Appendix A of 10 CFR Part 50, General Design Criterion (GDC) 35, "Emergency Core Cooling," requires, in part, that the system safety function shall be to transfer heat from the reactor core following any loss of reactor coolant at a rate such that 1) fuel and clad damage that could interfere with continued effective core cooling is prevented and 2) clad metal-water reaction is limited to negligible amounts.

Section 50.46 of 10 CFR, "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors," requires that each light-water cooled nuclear power plant must be provided with an emergency core cooling system that must be designed so that its calculated cooling performance following postulated loss-of-coolant accidents conforms to the peak cladding temperature, maximum cladding oxidation, maximum hydrogen generation, coolable geometry, and long-term cooling criterion in 10 CFR 50.46(b).

Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," describes a risk-informed approach that is acceptable to the Nuclear Regulatory Commission (NRC) for assessing the nature and impact of proposed licensing-basis changes by considering engineering issues and applying risk insights. RG 1.177, "An Approach for Plant Specific, Risk-Informed Decision making: Technical Specifications," describes a risk-informed approach that is acceptable to the Nuclear Regulatory Commission (NRC) for assessing the nature and impact of proposed TS changes. RGs 1.174 and 1.177 are applicable to permanent changes, and are used as guidance by the staff to evaluate this temporary change.

RG 1.177, "An Approach for Plant-Specific, Risk-Informed Decision making: TS," describes an acceptable risk-informed approach specifically for assessing proposed permanent TS changes in allowed outage times. This regulatory guide also provides risk acceptance guidelines for evaluating the results of such assessments. RG 1.177 identifies a three-tiered approach for the licensee's evaluation of the risk associated with a proposed AOT TS change, as discussed below.

- § Tier 1 assesses the risk impact of the proposed change in accordance with acceptance guidelines consistent with the Commission's Safety Goal Policy Statement, as documented in RG 1.174 and RG 1.177. The first tier assesses the impact on operational plant risk based on the change in core damage frequency ( $\Delta$ CDF) and change in large early release frequency ( $\Delta$ LERF). It also evaluates plant risk while equipment covered by the proposed CT is out-of-service, as represented by incremental conditional core damage probability (ICCDP) and incremental conditional large early release probability (ICLERP). Tier 1 also addresses probabilistic risk assessment (PRA) quality, including the technical adequacy of the licensee's plant-specific PRA for the subject application. Cumulative risk of the present TS change in light of past related applications or additional applications under review are also considered along with uncertainty/sensitivity analysis with respect to the assumptions related to the proposed TS change.
- § Tier 2 identifies and evaluates any potential risk-significant plant equipment outage configurations that could result if equipment, in addition to that associated with the proposed license amendment, are taken out-of-service simultaneously, or if other risk-significant operational factors, such as concurrent system or equipment testing, are also involved. The purpose of this evaluation is to ensure that there are appropriate restrictions in place such that risk-significant plant equipment outage configurations will not occur when equipment associated with the proposed CT is implemented.

- § Tier 3 addresses the licensee=s overall configuration risk management program (CRMP) to ensure that adequate programs and procedures are in place for identifying risk-significant plant configurations resulting from maintenance or other operational activities and appropriate compensatory measures are taken to avoid risk significant configurations that may not have been considered when the Tier 2 evaluation was performed. Compared with Tier 2, Tier 3 provides additional coverage to ensure risk-significant plant equipment outage configurations are identified in a timely manner and that the risk impact of out of service equipment is appropriately evaluated prior to performing any maintenance activity over extended periods of plant operation. Tier 3 guidance can be satisfied by the Maintenance Rule (10 CFR 50.65(a)(4)), which requires a licensee to assess and manage the increase in risk that may result from activities such as surveillance testing and corrective and preventive maintenance, subject to the guidance provided in RG 1.177, Section 2.3.7.1, and the adequacy of the licensee=s program and PRA model for this application. The CRMP is to ensure that equipment removed from service prior to or during the proposed extended CT will be appropriately assessed from a risk perspective.

General guidance for evaluating the technical basis for proposed risk-informed changes is provided in Chapter 19.0, AUse of Probabilistic Risk Assessment in Plant-Specific, Risk-Informed Decisionmaking: General Guidance,@ of the NRC Standard Review Plan (SRP), NUREG-0800. Guidance on evaluating PRA technical adequacy is provided in Chapter 19.1, ADetermining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities.@ More specific guidance related to risk-informed TS changes is provided in SRP Section 16.1, ARisk-Informed Decisionmaking: Technical Specifications,@ (Ref. 7), which includes CT changes as part of risk-informed decisionmaking. Chapter 19.0 of the SRP states that a risk-informed application should be evaluated to ensure that the proposed changes meet the following key principles:

- § The proposed change meets the current regulations, unless it explicitly relates to a requested exemption or rule change.
- § The proposed change is consistent with the defense-in-depth philosophy.
- § The proposed change maintains sufficient safety margins.
- § When proposed changes increase core damage frequency (CDF) or risk, the increase(s) should be small and consistent with the intent of the Commission=s Safety Goal Policy Statement.
- § The impact of the proposed change should be monitored using performance measurement strategies.

In a D.C. Cook amendment, "Issuance of Emergency Amendment Regarding One Time Allowed Outage Time Extension for West Centrifugal Charging Pump," dated January 16, 2005 (ML050190367), requested a similar TS change regarding a revision to the Operating License to add a license condition to allow a one-time extension of the allowed outage time for the west centrifugal charging pump. Based on the staff's evaluation, we find the change acceptable.



## 4.0 TECHNICAL EVALUATION

### 4.1. Risk Assessment Evaluation

In evaluation of the risk information submitted by the licensee for proposed changes to TS 3.5.2, "Emergency Core Cooling Systems (ECCS)," and TS 3.7.12 "Auxiliary Building Filtered Ventilation Exhaust System," the NRC staff used the three-tiered approach and the five key principles outlined in RGs 1.174 and 1.177, as presented in the following sections.

#### 4.1.1 Implementation and Monitoring Program

RGs 1.174 and 1.177 establish the need for an implementation and monitoring program to ensure that extensions to TS AOTs do not degrade operational safety over time and that no adverse degradation occurs due to unanticipated degradation or common cause mechanisms. An implementation and monitoring program is intended to ensure that the impact of the proposed TS change continues to reflect the reliability and availability of systems, subsystems, and components (SSCs) impacted by the change. The potential impact to reliability and availability is limited by the one-time allowed extension to the AOT for this application, and no further performance measurement strategies are required.

#### 4.1.2 Tier 1: Probabilistic Risk Assessment (PRA) Capability and Insights

The first tier evaluates the impact of the proposed changes on plant operational risk. The Tier 1 NRC staff review involves two aspects: (1) evaluation of the adequacy of the Catawba PRA models and their application to the proposed changes, and (2) evaluation of the PRA results and insights based on the licensee's proposed application

#### PRA Quality

The objective of the PRA quality review is to determine whether the Catawba 1 PRA used in evaluating the proposed amendment is of sufficient scope, level of detail, and technical adequacy for this application. The NRC staff review evaluated the PRA quality information provided by the licensee in their application, including industry peer review results. The current PRA (Revision 3a) was used to perform the risk evaluation. This PRA is a full scope PRA including both internal and external events. The base case non-seismic core damage frequency (CDF) and large early release frequency (LERF) are  $1.9\text{E-}5/\text{Rx-yr}$  and  $1.2\text{E-}6/\text{Rx-yr}$ , respectively, using the average maintenance model. reactor coolant pump seal failure was modeled using the WOG 2000 seal model which the NRC has endorsed.

The original Catawba 1 PRA was a full scope Level 3 PRA with internal and external events. A peer review sponsored by the Electric Power Research Institute (EPRI) was conducted after completion of the draft report. In 1996, Catawba 1 initiated revision 2 of the 1992 PRA. In April 2001 the licensee notified the NRC that a voluntary initiative at Catawba 1 Nuclear Station to provide backup cooling to the 1A and 2A NV pump had been completed. In conjunction with the completion of the plant modifications, the Catawba PRA Level I analysis was also updated and was designated as Revision 2b. The impact of this modification was to lower the base case CDF. Revision 3 of the Catawba PRA was completed in December 2004. This update was a comprehensive revision to the PRA Models and associated documentation.

Between March 18-22, 2002, the licensee participated in the Westinghouse Owners Group (WOG) PRA Certification Program. In the application, the licensee stated that, based on the PRA peer review report, the Catawba PRA received no fact and observations (F&O) with the significance level of "A" and 32 F&O with the significance level of "B." "B" findings are important and necessary to address but may be deferred until the next update. The "B" findings have been reviewed and prioritized for incorporation into the PRA. Thirteen of the "B" F&O have already been incorporated into Revision 3 of the PRA. In the application submittal, the licensee stated that the remaining open "B" F&O's, were evaluated with respect to any impact on the proposed TS changes. It was determined that these have no significant impact on the proposed TS changes. It is expected that the remaining F&O will be resolved and incorporated into Revision 4 of the Catawba PRA.

The licensee identified its administrative process and procedures for updating the models and maintaining the Catawba PRA. Approved workplace procedures address the quality assurance of the PRA. Each system model is maintained in a set of notebooks and each system PRA analyst is responsible for updating a specific system model. This update consists of a comprehensive review of the system including drawings and plant modifications made since the last update as well as implementation of any PRA change notices that may exist on the system. The analyst's primary focal point is with the system engineer at the site. The system engineer provides information for the update as needed. The analyst will review the PRA model with the system engineer and as necessary, conduct a system walkdown with the system engineer. The system notebooks are reviewed and signed off by a second independent person and are approved by the manager of the group. When any change to the PRA is identified, the same three-signature process of identification, review, and approval is utilized to ensure that the change is valid and that it receives the proper priority.

The licensee reported that the PRA model was solved for the configuration of interest using the base case truncation limits (5E-10/year for CDF and 5E-11/year for LERF) with the event of interest set to 1.0. To ensure adequate representation of the configuration of interest in the resulting cut sets, cut sets containing the event of interest were separated from all other cut sets and retained. The licensee reviewed the cut sets and pertinent accident sequences for accuracy and completeness. Based on this evaluation, the licensee concluded that the calculations adequately modeled the effects of the 1B Charging Train unavailability.

Based on review of the above information, the NRC staff finds that the licensee has satisfied the intent of RG 1.177 (Sections 2.3.1, 2.3.2, and 2.3.3), RG 1.174 (Section 2.2.3 and 2.5), and SRP Chapter 19.1, and that the quality of the Catawba 1 PRA is sufficient to support the risk evaluation provided by the licensee in support of the proposed license amendment.

### PRA Results and Insights

The licensee provided baseline CDF and LERF, ICCDP and ICLERP, and  $\Delta$ CDF and  $\Delta$ LERF applicable for a one-time 10 day AOT for the 1B NV pump. The  $\Delta$ CDF and  $\Delta$ LERF estimates from the base case calculations are much small than the base-line results so the licensee performed additional calculations on the cut-sets obtained by generating the cut-sets after assigning the 1B pump a 1.0 failure probability. The  $\Delta$ CDF and  $\Delta$ LERF estimates can be conservatively estimated as the total CDF and LERF from the cut-sets containing the NV pump event assigned a probability of 1.0. The quantitative results excluded seismic risk contributions, which are discussed qualitatively.

The licensee stated that the PRA model credits the Standby Shutdown Facility (SSF). The SSF contains a reactor coolant makeup pump which can provide seal cooling to the reactor coolant pumps which is one of the functions of the charging pumps. This facility is independent of AC power. Additionally, Catawba has added drinking water as a backup cooling water source for the 1A charging train which also reduces the contribution of the unavailable 1B pump to risk.

The results of the licensee's assessment are as follows:

Baseline CDF:	1.9E-5/year
ICCDP:	3.6E-9
$\Delta$ CDF:	1.3E-7/year
Baseline LERF:	1.2E-6/year
ICLERP:	3.0E-11
$\Delta$ LERF:	1.1E-9/year

The risk impacts for the proposed one-time change to TS 3.5.2 CT from 72 hours to 10 days were found to be significantly below the RG 1.177 acceptance guideline of less than 5E-7 for ICCDP, and 5E-8 for ICLERP for permanent changes to TS and the RG 1.174 acceptance guidelines for very small changes for  $\Delta$ CDF and  $\Delta$ LERF. The analysis assesses  $\Delta$ CDF and the  $\Delta$ LERF for the current year only when the one-time change is implemented, and there is no permanent increase in these parameters.

Based on the results reported above, the staff finds that the licensee has satisfied the intent of RG 1.177 (Sections 2.4), RG 1.174 (Section 2.2.4 and 2.2.5), and SRP Chapter 19.1.

### External Events

The licensee described the evaluation performed to identify the seismic risk contribution to the AOT. In the seismic model, both NV pump trains were conservatively set to fail. The resulting computer analysis indicated no increase over the base line seismic CDF. These results were expected since the dominant seismic cut sets involve a loss of power with a loss of SSHR. The current seismic CDF has been determined to be 1.1E-05 / yr. The seismic PRA computer code truncates contributions to the seismic CDF less than 0.01%, so the increase in seismic CDF would be no higher than about 1E-09 / yr. Conservatively assigning this increase in CDF to the



increase in LERF, the increases in CDF and LERF are still well below RG 1.174's very small acceptance guideline when this contribution is summed to the estimates above. ICCDP and ICLERP can be very conservatively estimated by assuming the AOT last a full year so that these parameters take on the same quantitative value as the increase in CDF and LERF. Summing these values with the ICCDP and ICLERP values estimated above results in estimates well below the RG 1.177 guideline values.

Based on the above and the NRC staff's review, the NRC staff finds the licensee's Tier 1 evaluation of the risk impacts supports the implementation of a one-time change to TS 3.5.2 and TS 3.7.12 to extend the AOTs is acceptable.

#### 4.1.3 Tier 2 - Avoidance of Risk-Significant Plant Configurations

The second tier requires a licensee to provide reasonable assurance that risk-significant plant equipment outage configurations will not occur when specific plant equipment is taken out-of-service in accordance with the proposed TS change.

The licensee identified specific component and trains that are not to be taken out of service on the affect unit. These are:

1A Charging Train,  
1A Component Cooling,  
1A Nuclear Service Water  
The drinking water backup cooling to the 1A charging train,  
The 1A 4160 Volt bus and the  
Unit 1 standby shutdown facility (SSF).

Based on the above, the NRC staff finds that the licensee has searched for risk-significant plant specific equipment outage configuration and identified tier 2 restrictions that support the implementation of a one-time change to TS 3.5.2 to extend the AOT for the inoperable 1B NV pump, and therefore satisfied the Tier 2 assessment guidelines.

#### 4.1.4 Tier 3 - Risk-Informed Configuration Risk Management

The third tier requires a licensee to develop a program that ensures that the risk impact of out-of-service equipment is appropriately evaluated prior to performing any maintenance activity.

The licensee identified 10 CFR 50.65(a)(4), RG 1.182, and Nuclear Management And Resources Council (NUMARC), 93-01 require that prior to performing maintenance activities, risk assessments shall be performed to assess and manage the increase in risk that may result from proposed maintenance activities. The licensee stated that it has approved procedures and directives in place at Catawba 1 and 2 to ensure the requirements of the Maintenance Rule are implemented.

The NRC staff finds the licensee's Tier 3 program is acceptable and supports the proposed one-time changes for the AOTs for TS 3.5.2 and TS 3.7.12

#### 4.1.5 Comparison with Regulatory Guidance

The acceptance guidelines of RGs 1.177 and RG 1.174 for ICCDP, ICLERP,  $\Delta$ CDF and  $\Delta$ LERF are met for this temporary change.

#### 4.1.6 NRC Staff's Findings and Conditions

The risk impacts for  $\Delta$ CDF,  $\Delta$ LERF, ICCDP, and ICLERP, as estimated by the licensee, are within the acceptance guidelines for RG 1.77 and RG 1.174. Therefore, the risk increases for a one-time change are small and consistent with the intent of the NRC's Safety Goal Policy Statement. The licensee's Tier 2 analysis and commitments provide reasonable assurance that risk-significant plant equipment outage configurations will not occur when specific plant equipment is taken out of service in accordance with the proposed TS change. The licensee's Tier 3 CRMP is consistent with the RG 1.177 CRMP guidelines.

#### 4.2 Deterministic Evaluation

The proposed amendment requests a one-time change to the allowed outage time (AOT) for the 1B NV pump be extended beyond the 72 hours allowed by TSs up to a total of 240 hours as part of the 1B centrifugal charging pump repair

In addition the amendment approves a one-time extension for the ABFVES, allowed time two ABFVES trains can be inoperable due to inoperable ECCS pump rooms pressure boundary from 24 hours allowed by the current TSs Specifications up to a total of 240 hours as part of the 1B centrifugal charging pump repair.

#### Causal Analysis of the Failure of the Catawba 1 1B NV Pump Rotating Element.

The licensee states the possible failure modes of the rotating element include cracking or shear of the pump shaft. The apparent cause is supported by empirical data, internal and external operating experience and vendor information. The Catawba 1 1A NV pump rotating element includes a Nitronic-50 shaft manufactured with reduced stress risers (this is a different material than the failed shaft in the 1B NV pump). This shaft was installed in the 1A pump in the fall of 2000. Operating parameters of the 1A NV pump have been reviewed by the licensee. Based on this review, the 1A NV pump is considered in good running condition and is considered to be reliable. The 1A NV pump has been tested and verified to meet the minimum ECCS flow requirements. The 1A NV pump and its supports systems will be considered protected equipment and as such no scheduled maintenance will be performed on those systems during the extended AOTs. Therefore, a possible manufacturing defect of the Unit 1 1B NV pump failed shaft would not be common to the rotating element currently installed in the Catawba 1 1A NV pump.

Based on the above, the NRC staff finds that a common cause defect between the 1A and 1B rotating elements is highly unlikely. Further, the staff finds that based on testing and the compensatory measures taken by the licensee, the 1A NV pump will perform its intended function for all design basis accidents during the extended AOTs.

### Replacement Assemble

The replacement rotating assembly has a certified performance test report from the vendor as well as a letter from the vendor stating that no work has been done during the refurbishment of the rotating assembly that would affect its hydraulic performance. Comparison of the test report data to similar data from the rotating assembly that was removed from the 1B pump revealed that the replacement assembly has a slightly lower performance. The test data from the replacement element curve was entered into a approved RETRAN ECCS flow model. The results from this evaluation showed that adequate performance was achieved by the new element to meet all design basis accidents for which the 1B NV pump is required to be operable.

As confirmation of the replacement assembly's performance, a single flow point inservice test will be performed to validate the actual capacity of this pump against the certified test curve prior to declaring the pump OPERABLE. During the next refueling outage, currently scheduled to occur in late Spring 2008, when conditions will permit, a full flow test will be performed for the 1B NV pump to further confirm its performance.

After replacement of the NV 1B pump rotating element, monitoring of pump health will be accomplished by diverse means. First, vibration will be monitored continuously and checked once per shift by Operations. Second, pump stator temperature is monitored continuously and has a 205°F alarm set point on the Operator Aid Computer. This is in addition to other manufacturers recommended temperature readings. Third, capability to measure pump balance drum differential was added and will be monitored daily.

Based on the analysis performed by the licensee, post maintenance testing to be performed and the monitoring of the NV pumps the NRC staff finds that the replacement to the 1B NV pump rotation element is acceptable and the 1B NV is expect to perform its intended function for all design basis accidents.

### Auxiliary Building Filtered Ventilation Exhaust System

The ABFVES filters air exhausted from all potentially contaminated areas of the auxiliary building, which includes the ECCS area and nonsafety portions of the auxiliary building. The ABFVES, in conjunction with other normally operating systems, also provides ventilation for these areas of the auxiliary building. The ABFVES consists of two independent and redundant trains. Following receipt of a safety injection signal, the system isolates nonsafety portions of the

ABFVES and exhausts air only from the ECCS pump rooms. Either ABFVES train is designed to be capable of maintaining a negative pressure in any of the ECCS pump rooms, regardless of train designation.

The licensee performed a full-scope implementation of an alternative source term (AST) for evaluating the consequences of design basis accidents at Catawba Nuclear Station, Units 1 and 2. The AST for Catawba was approved in Amendment No. 227 on September 30, 2005 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML052730312). In the amendment the licensee evaluated the dose due to leakage from ECCS components outside containment. The analysis considered release from ECCS components

inside the auxiliary building and the potential release through back leakage to the refueling water storage tank (RWST). The duration of the ECCS leakage for both cases is assumed to start

when ECCS recirculation initiates and continues at a constant rate until the end of the accident period at 30 days. The ECCS is assumed to leak 0.5 gallons per minute (gpm) into rooms where the ABFVES is initially aligned, and 0.5 gpm into rooms where the ABFVES is manually aligned after 3 days. Therefore, only half of the ECCS leakage in the auxiliary building is filtered before release for the first 3 days, but all is filtered thereafter. The leakage into the RWST is assumed to be 20 gpm. The source term for the ECCS leakage is the radioactivity in the containment sump water and is assumed to consist of only the iodine isotopes and their precursors. The iodine species in the ECCS leakage release are assumed to be 97 percent elemental iodine and 3 percent organic iodine compounds. These assumptions are in accordance with guidance in RG 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors".

During the maintenance activities, while the 1B NV room pressure boundary is breached and the ABFVES is incapable of maintaining a negative pressure in that room relative to adjacent areas, the 1B NV pump will be isolated. Therefore, the potential for significant leakage of containment sump fluids in the room through the pump is diminished. The licensee has committed that if minor leakage is present in the ECCS pump room areas it will be compared to limits established in the dose analysis for containment sump fluid leakage outside of the ECCS pump room areas. If leakage values exceed the limits established by the licensee's regulatory commitments, then corrective action will be initiated to bring the leakage to within allowable values or the ventilation boundary integrity will be reestablished. The licensee has committed to implement enhanced ECCS pump room area leakage checks for the duration of the extended AOT.

The alteration of the 1B NV pump room boundary will not adversely affect the performance of the ABFVES filters. System flow rates will remain below the required TS limits and HEPA and carbon bed iodine removal efficiencies will not be affected. Additionally, even with the ventilation boundary of the 1B NV pump breached, the ABFVES will still be capable of maintaining a negative pressure in the other ECCS pump rooms. Therefore, the Catawba 1 dose analysis results will not be adversely affected and dose rates will remain within the values established by NRC regulations.

## 5.0 SUMMARY

The NRC staff has concluded that the proposed one-time extension of the AOTs for the Catawba 1B NV pump and the ABFVES is acceptable. This conclusion is based, in part, on the availability and reliability of the 1A NV pump and the low likelihood of the loss of the 1A NV pump during the extended AOT. In addition, the licensee has taken compensatory measures limiting activities that have the potential to result in a plant transient. Therefore, the NRC staff finds that there is no undue risk to public health and safety associated with granting the AOT extensions for the 1B NV pump and the ABFVES trains.

## 6.0 EMERGENCY CIRCUMSTANCES

The NRC's regulations 10 CFR 50.91 contain provisions for issuance of an amendment where the Commission finds that emergency circumstances exist, in that a licensee and the Commission must act quickly and that time does not permit the Commission to publish a *Federal Register* notice allowing 30 days for prior public comment.

In the January 1, 2008, application, the licensee requested that this amendment be treated as an emergency amendment. In accordance with 10 CFR 50.91(a)(5), the licensee provided information regarding why this emergency situation occurred and how it could not be avoided.

The licensee provided the following explanation.

1 Reason Emergency Situation Has Occurred:

On December 30, 2007 at approximately 2100, during Auxiliary Building rounds, a Non-Licensed Operator noticed an increase in 1B NV pump seal balance differential pressure. The licensee's engineering department was contacted to review data and take local readings on the 1B NV pump parameters and collect data. After review of this data, engineering and operations determined that the 1B NV pump was inoperable and was declared out of service at 0130 on December 31, 2007. This required Catawba 1 to enter TS Required Action B.1 with a completion time of 72 hours. The licensee determined that the 1B NV pump rotating element will have to be replaced. This replacement will require approximately 10 days to complete. This includes removal, replacement, centering rotating element, rebuilding seals, pump alignment, post maintenance testing and final evaluation of test data. This repair plan will be beyond the completion time of TS 3.5.2 and thus require relief to avoid a unit shutdown.

2 Reason the Situation Could Not Have Been Avoided:

Since the failure of the rotating element in the 1B NV pump in 1999, the following actions have been taken to monitor charging pump performance to minimize unanticipated failures:

Vibration

Overall vibration measurements are taken on a quarterly basis during the In-Service Pump Test. More detailed vibration data is recorded every two weeks. This data is screened by the Predictive Maintenance technicians for obvious changes and by both the pump engineer and the vibration engineer for more subtle differences. In 2000 Catawba installed a continuous vibration monitoring system that measures vibration and will alarm if setpoints are exceeded. This system is checked once per shift by Operational Rounds. During the biannual Comprehensive Pump Test vibration is monitored at all flows. No abnormal data has been identified.

The local vibration alarm actuated on December 31, 2007, while the pump was being secured. Vibration monitoring is designed to provide indication to allow actions to be taken to prevent catastrophic pump failure. This vibration monitoring functioned as designed to allow the 1B NV pump to be secured prior to catastrophic failure. Prior to this event, no actionable changes in vibration levels were noted.

Balance Drum Differential Pressure

A modification was performed in 2002 to allow monitoring of the Balance Drum differential

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pressure, which is used to detect shaft and pump degradation. It is monitored daily by Operations Rounds. This is the parameter that alerted operations personnel to the potential equipment degradation and resulted in securing the 1B NV pump without a loss of charging flow.

## Motor Stator Temperature

In addition to the manufacturer recommended temperature alarms, in 2000, Catawba set up a lower level alarm of 205 °F in order to provide an early indication of potential pump degradation. While the temperature was noted to be increasing the lower level alarm setpoint was not exceeded prior to proactively securing the 1B NV pump.

## Additional Actions

The 1A charging pump rotating assembly was removed after 17 years of service in the fall of 2000. A visual inspection as well as Dye Penetrant Testing was performed. The shaft showed no signs of cracks or other degradation and all clearances were within specification. As a proactive response, this rotating assembly was replaced with a Nitronic-50 material assembly.

In the fall of 2007 the 2B NV pump rotating assembly was replaced while having good performance during service life. This rotating assembly was also replaced with a Nitronic-50 material assembly which is manufactured with reduced stress risers.

Based on the above discussion, the licensee has been actively monitoring pump data and this failure could not have been predicted. Neither a routine nor an exigent TS amendment request could have been processed within the 72 hour period. Therefore, an emergency TS amendment is required to preclude a shutdown.

Based on the above, the Commission finds that an emergency situation exists, in that failure to act in a timely way would result in shutdown of the plant. The licensee has explained why the emergency situation occurred and why it could not be avoided. Accordingly, the Commission has determined that emergency circumstances exist pursuant to 10 CFR 50.91(a)(5) and could not have been avoided, that the submittal of information by the licensee was timely, and the licensee did not create the emergency condition. Therefore, this request was handled under the provisions of 10 CFR 50.91(a)(5).

## 7.0 REGULATORY COMMITMENTS

In the January 1, 2008, submittal the licensee made the following regulatory commitments;

1. Specific components and trains have been identified that are not to be taken out of service on the affected unit. These are: 1A Charging Train, 1A Component Cooling, 1A Nuclear Service Water, the drinking water backup cooling to the 1A Charging Train, the 1A 4160 volt bus and the Unit 1 standby shutdown facility.
2. In addition to the list above, the following equipment is not to be taken out of service on the affected unit: 1B safety injection pump, 1B residual heat removal pump and the 1B 4160 volt bus.
3. Any minor leakage present in the room will be compared to new revised limits of 0.25 GPM established to ensure that the dose analysis for containment sump fluid leakage outside of the ECCS pump room areas is maintained well below Regulatory and Licensing limits. If leakage values exceed the new limit, the ventilation boundary integrity will be reestablished in accordance with the Hazard Barrier Manual requirements. During this period, if a reactor

trip or safety injection were to occur on Unit 1, the ventilation boundary will be reestablished as required by the Hazard Barrier Manual.

4. Catawba will implement enhanced ECCS pump room area leakage checks for the duration of the 1B NV pump repair activities.
5. Since Unit 1 is in Mode 1, testing of the replacement 1B NV pump rotating element over the range of the entire pump curve cannot be performed at this time, and must be delayed until the first outage opportunity which facilitates full flow testing.
6. In addition to the above actions, as a prudent measure, Catawba will not allow any discretionary maintenance on switchyard components, the 1A & 1B emergency diesel generators, and the transformers that feed the 1A & 1B 4160 volt busses.
7. Catawba will perform a detailed cause evaluation of this failure of the 1B NV pump. This cause evaluation will include a review of pertinent information from previous failures of this pump; system configuration and operating history associated with this pump; shaft material; and pertinent industry operating experience. Catawba will present the cause evaluation and proposed corrective actions to the NRC staff.

The above regulatory commitments have been entered in the licensee's commitment management system which complies with Nuclear Energy Institute Document 99-04, Revision 0, "Guidelines for Managing NRC Commitment Changes." The NRC staff has reviewed the regulatory commitments and how they will be controlled and finds that the licensee's commitments provide adequate assurance that safe plant operation will not be affected by the extended AOT.

#### 8.0 FINAL NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

The Commission's regulations in 10 CFR 50.92(c) state that the Commission may make a final determination that a license amendment involves no significant hazards consideration if operation of the facility in accordance with the 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 previously evaluated; or,
- (3) Involve a significant reduction in a margin of safety.

The following analysis was provided by the licensee in their letter of January 1, 2008

- i. Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

The 1B NV pump safety related function is as an accident mitigator and is not required unless an accident occurs. The 1B NV pump does not affect a[n] accident initiators or



precursors. The proposed extension of the Required Action Completion Time does not affect the 1B NV pump's interaction with any system whose failure or malfunction could initiate an accident. Therefore the probability of an accident previously evaluated is not significantly increased.

The 1B NV pump safety related function is to mitigate a loss of coolant accident. The risk evaluation performed in support of this amendment request demonstrates that the consequences of an accident are not significantly increased. As such, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

- ii. Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No.

This change does 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 the NRC granting of this proposed change. No changes are being made to the plant which will introduce any new accident causal mechanisms.

- iii. Does the proposed amendment involve a significant reduction in the margin of safety?

Response: No.

Based on the availability of redundant systems, the mitigating actions that will be taken and the low probability of an accident, Catawba concludes that the reduction of availability of the 1B NV pump does not result in a significant reduction in the margin of safety.

The 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 significantly impacted by the proposed change. The risk implications of this request were evaluated and found to be acceptable.

The NRC staff agrees with the licensee's analysis and, based on this review has concluded that the three standards of 10 CFR 50.92(c) are satisfied. Therefore, the NRC staff makes a final determination that the amendment does not involve a significant hazards consideration.

## 9.0 STATE CONSULTATION

In accordance with the Commission's regulations, the South Carolina State official was notified of the proposed issuance of the amendments. The State official had no comments.

## 10.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to the installation or use of facility components located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts and no significant change in the types of any effluents that may be released offsite and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has made a final no significant hazards finding with respect to this amendment. Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

## 11.0 CONCLUSION

The NRC staff has concluded, based on the considerations discussed above, that (1) the amendment does not (a) involve a significant increase in the probability or consequences of an accident previously evaluated, or, (b) create the possibility of a new or different kind of accident from any previously evaluated or, (c) involve a significant reduction in a margin of safety and therefore, the amendment does not involve a significant hazards consideration; (2) there is a reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (3) such activities will be conducted in compliance with the Commission's regulations, and (4) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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