UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
245 PEACHTREE CENTER AVENUE NE, SUITE 1200
ATLANTA, GEORGIA 30303-1257

September 17, 2012

Mr. Kelvin Henderson
Site Vice President
Duke Energy Corporation
Catawba Nuclear Station
4800 Concord Road
York, SC 29745-9635

SUBJECT: PUBLIC MEETING SUMMARY – CATAWBA NUCLEAR STATION – DOCKET NOS. 50-413, 50-414

Dear Mr. Henderson:

This refers to the Category 1 public meeting which was held on September 11, 2012, in Atlanta, GA. The purpose of this meeting was to discuss the preliminary Yellow and Greater than Green finding documented in the Catawba SIT report/choice letter (ML12207A614). A listing of meeting attendees and information presented during the meeting are enclosed.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room (PDR) or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Should you have any questions concerning this meeting, please contact me at (404) 997-4607.

Sincerely,

/RA/

Jonathan H. Bartley, Chief
Reactor Projects Branch 1
Division of Reactor Projects

Docket Nos.: 50-413, 50-414
License Nos.: NPF-35, NPF-52

Enclosures:
1. List of Attendees
2. NRC PowerPoint Presentation
3. Licensee PowerPoint Presentation

cc w/encls: (See page 2)

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X PUBLICLY AVAILABLE ☐ NON-PUBLICLY AVAILABLE ☐ SENSITIVE X NON-SENSITIVE

ADAMS: ☐ Yes ACCESSION NUMBER:_____ ☐ SUNSI REVIEW COMPLETE ☐ FORM 665 ATTACHED

OFFICE	RII:DRP						
SIGNATURE	JHB /RA/						
NAME	JBartley						
DATE	09/17/2012						
E-MAIL COPY?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO

OFFICIAL RECORD COPY DOCUMENT NAME: DOCUMENT4

cc w/encl:

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Letter to Kelvin Henderson from Jonathan H. Bartley dated September 17, 2012

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Distribution w/encls:
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L. Douglas, RII
OE Mail
RIDSNRRDIRS
PUBLIC
RidsNrrPMCatawba Resource

CATAWBA PUBLIC MEETING ATTENDEES
SEPTEMBER 11, 2012

Licensee:

Bob Duncan, Senior Vice President, Duke Energy
Kelvin Henderson, Site Vice President, Catawba
Tom Simril, Acting Station Manager, Catawba
Bill Suslick, Design Engineering Manager, Catawba
Chris Nolan, Regulatory Affairs Director, Nuclear General Office (NGO)
Bob Rishel, PRA Manager, NGO
Lee Kanipe, PRA Plant Support Senior Engineer, NGO
Ken Caldwell, Principal Engineer, Catawba

NRC:

Victor McCree, Regional Administrator, Region II (RII)
Rick Croteau, Director, Division of Reactor Projects (DRP), RII
Bill Jones, Deputy Director, RII, DRP
Jonathan Bartley, Chief, Reactor Projects Branch 1, DRP, RII
John Hanna, Senior Reactor Analyst, DRP, RII
Terry Reis, Director, Division of Reactor Safety, RII
Scott Sparks, Senior Enforcement Specialist, Office of Enforcement and Investigation Coordination, RII

Public:
Bob Beadle, North Carolina Electric Membership Corporation (EMC)
Terry Ryan, North Carolina EMC
Joe Troutman, North Carolina Municipal Power Agency

Via Telecon:
Sunil Weerakkody, Chief, PRA Operational Branch Support
Gerry Waig, Senior Reactor Systems Engineer, Office of Nuclear Reactor Regulation (NRR)
Khadijah Hemphill, General Engineer, NRR
Jeff Mitman, Senior Reliability and Risk Analyst, NRR
Fernando Ferrante, Reliability and Risk Analyst, NRR
Stephen Vaughn, Reactor Operations Engineer, NRR
Lauren Casey, Enforcement Specialist, Office of Enforcement

CATAWBA REGULATORY CONFERENCE

September 12, 2012

Enclosure 2

Agenda

- OPENING REMARKS AND INTRODUCTION
- NRC REGULATORY AND ENFORCEMENT POLICY
- STATEMENT OF ISSUES AND APPARENT VIOLATIONS
- DUKE ENERGY CAROLINAS
- BREAK/NRC CAUCUS
- NRC FOLLOW UP QUESTIONS
- CLOSING REMARKS
- PUBLIC QUESTIONS

CATAWBA REGULATORY CONFERENCE

September 11, 2012

Enclosure 2

Catawba Nuclear Station
Regulatory Conference

Zone G Modification
NRC Region II Headquarters
Atlanta, GA
September 11, 2012

Enclosure 3

Duke Participants

▪ Bob Duncan	Senior Vice President, Duke Energy
▪ Kelvin Henderson	Site Vice President
▪ Tom Simril	Acting Plant Manager
▪ Bill Suslick	Design Engineering Manager
▪ Chris Nolan	Director of Regulatory Affairs
▪ Bob Rishel	PRA Manager
▪ Lee Kanipe	Senior PRA Engineer
▪ Ken Caldwell	Principal Engineer

Agenda

▪ Opening Remarks	Kelvin Henderson
▪ Overview/Plant Response	Tom Simril
▪ Zone G Modification	Ken Caldwell
▪ Risk Significance	Lee Kanipe
▪ Regulatory Perspectives	Chris Nolan
▪ Cause Analysis & Corrective Actions	Bill Suslick
▪ Closing Remarks	Kelvin Henderson

Opening Remarks

Kelvin Henderson
Vice President, Catawba Nuclear Station

Opening Remarks

- NRC proposed one finding related to compliance with Technical Specifications for offsite power sources:
  - Related to failure to follow procedure for procurement specifications for services for a plant modification designed by a vendor
- Catawba agrees with NRC's characterization of the violation:
  - Apparent violation of TS 3.8.1 for Unit 1
  - Apparent violation of TS 3.8.1 & 3.8.2 for Unit 2

Opening Remarks

- Errors by Catawba personnel set up the conditions that led to this Loss of Offsite Power (LOOP). The plant and Operations personnel responded well. We will address in our presentation:
  - Plant response and restoration efforts
  - Zone G modification issue
  - Risk Insights
  - Restoration of compliance
  - Lessons learned and comprehensive corrective actions
- Key drivers contained in the probabilistic risk assessment:
  - Multiple Unit LOOP Factor
  - Recovery of Offsite power
  - Recovery Credit with Standby Shutdown Facility (SSF) success

Opening Remarks

- Catawba's determination of risk significance related to the finding is:
  - Unit 1 - low to moderate safety significance
  - Unit 2 - very low safety significance

Overview/Plant Response

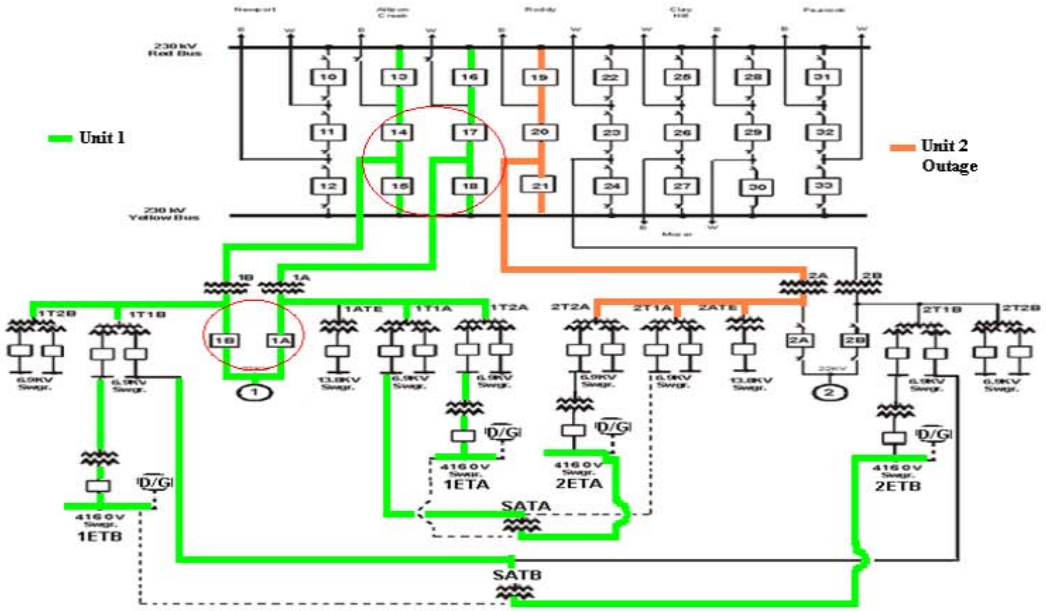
Tom Simril
Acting Plant Manager

Enclosure 3

Overview/Plant Response

- Initial Conditions:
  - Unit 1 Status – 100% Power, Tavg 584.7 deg F
  - Unit 2 Status –Entered Mode 5 from Mode 6 on 4/4/12 19:43 hrs; Reactor Coolant temperature 88.1 deg F, Reactor Coolant at vessel flange level (22.5%), 2A RHR train in service
  - Initiating Event
    - 4/4/12; 20:03:08 hrs; 1D reactor coolant pump trip due to electrical fault

Overview - Power Alignment
Pre Event



Enclosure 3

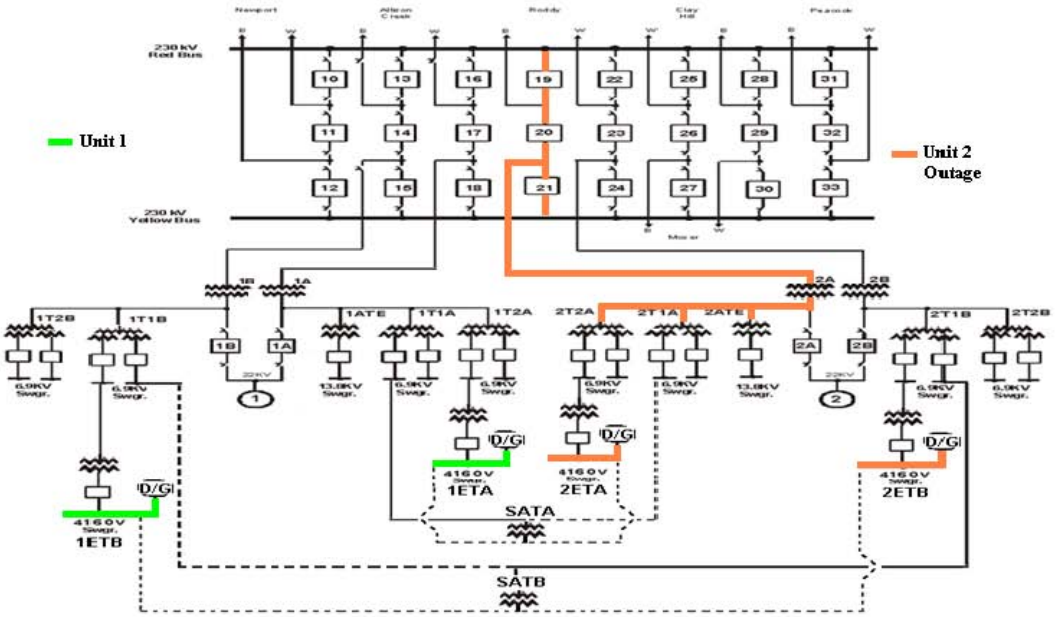
Plant Response – Unit 1

- Unit 1 – 100% Power
  - 4/4/12
    - 20:03:08 hrs; 1D reactor coolant pump trip due to ground fault
    - 20:03:08 hrs; 1B essential 4160 volt buss 1ETB loses power due to 1ATD feeder breaker opening
    - 20:03:08 hrs; 1B Emergency Diesel Generator (EDG) starts
    - 20:03:09 hrs; Unit 1 reactor trip due to low flow in 1D reactor coolant loop
    - 20:03:15 hrs; Unit 1 generator PCB's open, resulting in Unit 1 switchyard PCB's opening
    - 20:03:25 hrs; Loss of Offsite Power (LOOP) to Unit 1
    - 20:03:25 hrs; 1A EDG starts due to LOOP
    - ~20:55; Unexpected Zone G relay actuation identified as source of switchyard separation.
    - 23:35 hrs; Unit 1 in Mode 3, Natural Circulation Cooldown procedure entered
    - EDG's supplying essential busses, deliberate approach to apply Industry OE related to restoring power to a faulted buss was made to verify power system and relaying conditions prior to restoring power from offsite.

Plant Response – Unit 1

- 4/5/12
  - 01:29 hrs; Offsite power restored to Unit 1 A train essential 4160 volt buss 1ETA
  - 05:37 hrs; Offsite power restored to Unit 1 B train essential 4160 volt buss
- 4/6/12
  - 09:16 hrs; Independent offsite power source restored to Unit1 B train essential 4160 volt buss (this restored compliance with TS 3.8.1)

Overview - Power Alignment Post Event



Enclosure 3

Plant Response – Unit 2

- Unit 2 – Mode 5
  - 4/4/12
    - 20:03:25 hrs; LOOP due to power alignment from Unit 1
    - 20:03:25 hrs; Loss of Residual Heat Removal (RHR) and spent fuel pool cooling
    - 20:03:29 hrs; 2A EDG starts due to LOOP
    - 20:03:29 hrs; 2B EDG starts due to LOOP
    - 20:06 hrs; Started 2A RHR pump to restore core cooling
    - 20:31 hrs; Started 2B spent fuel cooling pump
    - ~2045 hrs; Started raising Unit 2 reactor coolant system level. Level increased to approximately 43%
  - 4/5/12
    - 01:37 hrs; Offsite power restored to Unit 2 B train essential 4160 volt buss 2ETB (this restored compliance with TS 3.8.2)
    - 02:36 hrs; Offsite power restored to Unit 2 A train essential 4160 volt buss 2ETA

Zone G Modification

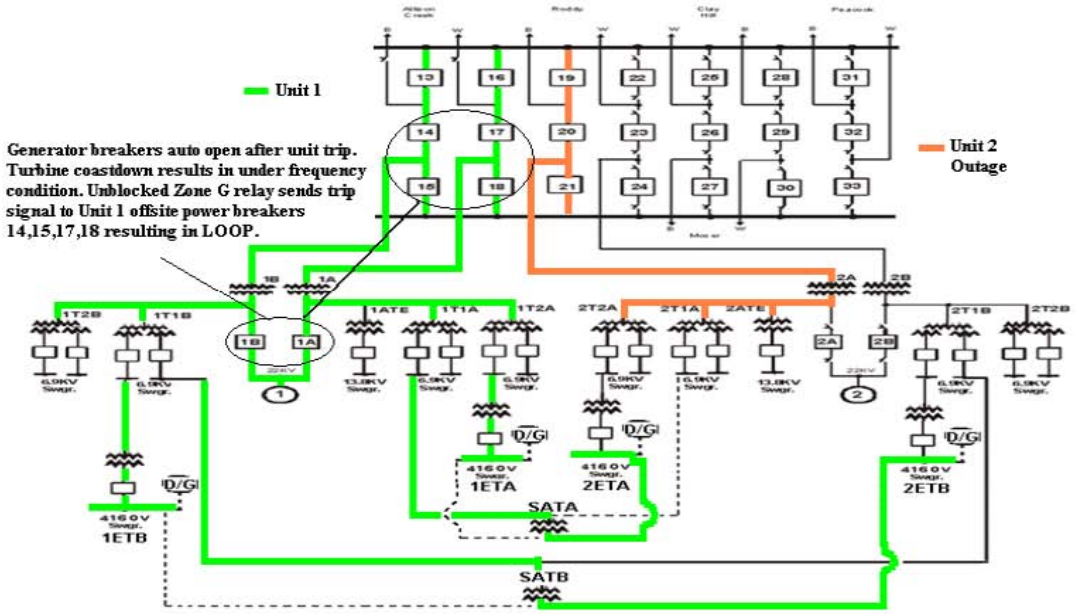
Ken Caldwell
Principal Engineer

Enclosure 3

Zone G Modification

- Zone G
  - Enhanced Catawba design for generator relay protective scheme
  - Relay protection scheme isolates main generator from offsite circuits. Includes a trip of offsite circuit feeder breakers in switchyard to allow unit to runback and provide in house loads from main generator on under frequency on the grid.
  - Original design included a block of this trip function when the main generator breakers were open.
  - Modification to replace relays missed the block of the trip function, allowing it to occur when the main generator breakers were open.

Zone G Modification



Enclosure 3

Risk Significance

Lee Kanipe
Senior PRA Engineer

Enclosure 3

Risk Significance: Overview

- Catawba Risk Assessment Results
- Phase III Modeling Changes
- Areas of Difference
- Risk Characterization

Risk Significance
Catawba Risk Assessment Results

- Catawba Unit 1 – At Power Risk
  - ICCDP = ~2E-06
  - ICLERP = ~5E-07
- Catawba Unit 2 – At Power and Shutdown Risk
  - ICCDP = ~3E-07
  - ICLERP = ~8E-08

Risk Significance
Phase III Modeling Changes

- Catawba provided additional information regarding changes needed to the SPAR analysis model.
  - Component Cooling Water System Unavailability
  - Offsite Power Recovery Modeling
    - Missing Recovery Actions
    - Exclusion of Weather/Grid Event Data
    - Treatment of Run Failures
  - LERF Modeling Assumptions
- The combined impact of these changes represents a reduction in the estimated risk from the initial Phase III results.

Risk Significance
Areas of Difference

- Important Differences
  1. Multi-Unit LOOP Factor
  2. Power Recovery From Opposite Unit
  3. Recovery Credit With Standby Shutdown Facility (SSF) Success

Risk Significance Difference #1
Multi-Unit LOOP Factor

- The Multi-Unit LOOP factor represents the conditional probability that Unit 2 would lose power from the switchyard given that a LOOP occurred on Unit 1.
- The Zone G design problem that causes a very specific plant-centered LOOP event.
  - It does not cause a failure or malfunction of any switchyard equipment.
  - It only opens the Unit 1 Tie Breakers causing a Unit 1 LOOP.
  - The effect on Unit 2 of opening of the Unit 1 tie-breakers is similar to a reactor trip at most other plants in the industry.
  - The impact of the Zone G modification on Unit 1 has no impact on the availability or reliability of the opposite unit.

Risk Significance Difference #1
Multi-Unit LOOP Factor

- The likelihood of Unit 2 losing offsite power should be represented by the generic consequential LOOP probability.
  - The opening of switchyard power circuit breakers is the normal means of isolating the main generator at most plants. This occurs for every reactor trip at these plants.
  - NUREG/CR-6890 estimates a value of 5E-03 (compared to initial Phase III value of 0.579)

Risk Significance Difference #2 Power Recovery From Opposite Unit

- Following a Unit 1 LOOP, power can be restored from either the Unit 1 offsite power sources or from the Shared Transformers supplied by Unit 2.
- NRC Operator failure probability is 2.5 times the Duke estimate due to extreme stress levels assumed.
  - Duke assumed high stress.
- The extreme stress category is generally reserved for actions performed under life threatening conditions.
- The dominant NRC scenarios involve run failures of EDGs and the Turbine-Driven Auxiliary Feedwater Pump which provides more time for operator response.

Risk Significance Difference #3
SSF Mitigation Success

- A functional and available Standby Shutdown Facility can achieve and maintain stable hot shutdown conditions for at least 72 hours.
- The SSF provides time in this case for near certainty in recovery of offsite power.
- Thus, additional recovery credit should be applied to the analysis.

Risk Significance
Risk Characterization

- Catawba Unit 1
  - ICCDP = ~2E-06
  - ICLERP = ~5E-07
- Catawba Unit 2
  - ICCDP = ~3E-07
  - ICLERP = ~8E-08

Regulatory Perspectives

Chris Nolan
Director, Regulatory Affairs

Enclosure 3

Regulatory Perspectives

- For Unit 1 - Apparent Violation of TS 3.8.1, AC Sources – Operating
  - Catawba agrees with the apparent violation
  - Corrective actions completed 4/6/12 to restore compliance
  - Comprehensive actions taken or planned for extent-of-condition

Regulatory Perspectives

- For Unit 2 - Apparent Violation of TS 3.8.1, AC Sources – Operating & TS 3.8.2, AC Sources - Shutdown
  - Catawba agrees with the apparent violation
  - Corrective actions completed 4/5/12 to restore compliance
  - Comprehensive actions taken or planned for extent-of-condition

Cause Analysis & Corrective Actions

Bill Suslick
Catawba Design Engineering Manager

Enclosure 3

Initiating Event

- Unit 1 Reactor Trip was caused by trip of reactor coolant pump 1D
- 1D reactor coolant pump tripped on an AC-fault in the Y-phase cable at the motor bushing connection
- A prior failure at the bushing connection in November 2000 degraded the cable insulation which led to premature insulation failure
- April 4, 2012 - an instantaneous under-frequency relay was not properly blocked when the generator circuit breakers were opened resulting in the loss of offsite power

Initial Actions

- Established a Prompt Investigation Review Team (PIRT) to independently assess event
- Performed post trip review to verify plant response
- Corrected logic for Zone G Relays on both Units and replaced damaged cable to 1D reactor coolant pump
- Implemented design change on over-current relay for switch-gear feeder increasing time delay setting from 6 to 12 cycles for normal and alternate 6.9 kV breakers

Initial Actions

- Performed Extent of Condition and Extent of Cause review
- Established a root cause team to fully evaluate causes and propose corrective actions
- Nuclear Network entry made to share preliminary information with industry

Cause Analysis

- Root Causes
  - Catawba failed to define a critical design input, leading to design elements not being incorporated into the Zone G Relaying Modification.
  - Catawba inadequately specified services required from vendor resulting in the omission of a critical design function for the Zone G Relaying Modification.
- Contributing Causal Factors
  - Catawba had inadequate vendor control and oversight, resulting in errors in vendor design products
  - Multiple barriers were ineffective including post modification testing
  - Vendor failed to include blocking function due to inadequate self check

Extent of Condition/Cause

- Initial Actions Taken:
  - Extent of condition review on all of the relay logic in each of the Zone G relays - No issues outside the original error
  - Independent reviewed of Post Modification Tests (PMTs) for pending Catawba design changes that presented nuclear risk were performed - No issues identified
  - Catawba Design Engineering performed a review of design changes over the last five years that involved vendor design products - One issue identified with software controls on fuel handling crane

Corrective Actions

- Corrective Actions to Prevent Recurrence
  - Revise Engineering Change Procedure to require additional detail in critical design function identification and testing
  - Revise Procurement Specification for Services Procedure to require explicit documentation of critical design function identification and testing, vendor check responsibilities, and vendor oversight
  - Revise Engineering Calculations/Analyses Procedure to improve guidance on documentation of design inputs, checker responsibilities, and minimum requirements for non-QA calculations

Corrective Actions

- Other Corrective Actions
  - Create Design Review Board
    - Validate initial modification scope and design inputs
    - Challenge modification risk assessment and risk mitigation tools
    - Validate post modification test will verify design
  - Modification Quality Review Team Changes
    - Challenge post modification tests
    - Challenge design inputs

Corrective Actions

- Other Corrective Actions
  - Shared Operating Experience - INPO Design Engineering Manager's Conference
  - Performed a Catawba Design Engineering stand down to discuss the lessons learned from this event
  - Benchmark industry for insights leading to more effective vendor oversight
  - Post Modification Testing workplace procedure being developed
  - Case study being developed for Engineering continuing training

Closing Remarks

Kelvin Henderson
Vice President, Catawba Nuclear Station

Enclosure 3

Closing Remarks

- Catawba's performance did not meet our expectations
- Requirements regarding design input verification and post modification testing were not met
  - Immediate actions were taken and compliance was restored
  - Prompt and comprehensive corrective actions have been taken or planned
- Mitigating factors and defense-in-depth features should inform the significance determination
- Catawba has offered its perspectives regarding significance
  - low to moderate significance for Unit 1 and very low safety significance for Unit 2