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NTTF 2.3 SEISMIC PEER REVIEW SUPPLEMENTARY REPORT CATAWBA NUCLEAR STATION UNIT 1

Prepared for:

Duke Energy Carolinas, LLC

Prepared by: Stone & Webster, Inc. and ARES Corporation

March 14, 2013

QA CATEGORY III

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Peer Reviewer: George Bushnell, P.E. Stone and Webster, Inc. (A CB&I Company)	3/14/2013 Date	ARES Approval: C.M. Conselman Project Manager	3/14/2013 Date
Peer Reviewer: Robert Keiser, P.E. Duke Energy	3/14/2013 Date	CB&I Approval: Anthony F. Fazio Project Manager	3/14/2013 Date

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Acronyms

ARES	ARES Corporation
AWC	Area Walk-By Checklist
CAP	Corrective Action Program
CB&I	CB&I Company
CNS	Catawba Nuclear Station
Duke Energy	Duke Energy Carolinas, LLC
EPRI	Electric Power Research Institute
IPEEE	Individual Plant Examination of External Events
NRC	U.S. Nuclear Regulatory Commission
NTTF	Near-Term Task Force
PIP	Problem Investigation Process
SQUG	Seismic Qualification Utility Group
SSC	Structure, System and Component
SWC	Seismic Walkdown Checklist
SWE	Seismic Walkdown Engineer
SWEL	Seismic Walkdown Equipment List

1.0 INTRODUCTION

Electric Power Research Institute (EPRI) Report 1025286, *Seismic Walkdown Guidance for Resolution of Fukushima Near-Term Task Force Recommendation 2.3: Seismic*, was issued in June 2012. This document provides guidance and procedures to perform seismic walkdowns as required by the U.S. Nuclear Regulatory Commission's (NRC's) 50.54(f) letter regarding Near-Term Task Force (NTTF) Recommendation 2.3: Seismic. The EPRI guidance covers selection of personnel; selection of a sample of structures, systems, and components (SSCs) that represent diversity of component types and ensures inclusion of components from critical systems/functions; conduct of the walkdowns; evaluation of potentially adverse conditions against the plant seismic licensing basis; peer review; Individual Plant Examination of External Events (IPEEE) vulnerabilities; and reporting requirements. It was intended that all U.S. nuclear power plants utilize this guidance document in meeting the requirements of the NRC 50.54(f) letter.

Duke Energy Carolinas, LLC (Duke Energy) contracted with Stone and Webster, Inc., a CB&I Company (CB&I) / ARES Corporation (ARES) Team to perform the NTTF 2.3 peer review at the Catawba Nuclear Station (CNS). This report documents that peer review. A peer review of the NTTF 2.3 seismic walkdowns of Units 1 and 2 was conducted in September 2012 and documented in CB&I /ARES Technical Report 1457690303-R-M-00003, *NTTF 2.3 Seismic Peer Review Report, Catawba Nuclear Station Units 1 and 2*. At that time, some items had not been walked down due to being inaccessible during plant operation. Walkdown of the Unit 1 inaccessible items were deferred to the Unit 1 1EOC20 refueling outage scheduled for November 2012. This report documents the supplementary peer review performed at Unit 1 in March 2013. The supplementary peer review covered the walkdown of inaccessible items at Unit 1 performed by Duke Energy during the Unit 1 refueling outage.

2.0 SCOPE

The scope of this supplementary effort was to perform the NTTF 2.3 Seismic Peer Review of the walkdown of the inaccessible items at CNS Unit 1, in accordance with the guidelines in Section 6, *Peer Review*, of EPRI 1025286. It is intended that the information contained herein will be utilized by Duke Energy as part of its overall NTTF 2.3 final submittal report for Unit 1 to be delivered to the NRC in March 2013.

3.0 METHODOLOGY

The CB&I/ARES methodology conforms to the guidance in Section 6 of EPRI 1025286. The Peer Review Team consisted of three individuals, all of whom have seismic engineering experience as it applies to nuclear power plants. These individuals participated in the peer review of each of the applicable activities. The Peer Review Team for the supplementary peer review consisted of the same individuals that performed the September 2012 peer review.

The peer review process for the Seismic Walkdown Equipment List (SWEL) development and seismic walkdowns was documented in CB&I / ARES Technical Report 1457690303-R-M-00003. Since the

SWEL did not change from the time of the September 2012 peer review, it was not part of the supplementary peer review.

The peer review process for the seismic walkdowns and walk-bys of the inaccessible items consisted of conducting a final review of the completed documentation. The other, in-process, steps in the review methodology described in CB&I / ARES Technical Report 1457690303-R-M-00003 were not considered necessary since the Duke Energy seismic walkdown engineers (SWEs) were included in the September 2012 peer review of in-process activities.

The peer review process for the licensing basis evaluations and the decisions for entering potentially adverse conditions into the Corrective Action Program (CAP) consisted of reviewing all of the licensing basis reviews resulting from the walkdown of the inaccessible items. The peer review process for the submittal report consisted of reviewing the draft submittal revision prepared by Catawba Design Engineering for licensing review.

4.0 PERSONNEL

The CNS Peer Review Team for the supplemental peer review consisted of the following individuals. As noted above, these are the same individuals who performed the September 2012 peer review.

- **Paul Baughman**, P.E., ARES Corporation, Team Leader. Mr. Baughman is a licensed structural engineer with over 40 years of experience in seismic engineering for nuclear power stations. Mr. Baughman is a subject matter expert and trainer for the Seismic Qualification Utility Group (SQUG). Mr. Baughman has performed seismic assessment activities for CNS and is familiar with the CNS seismic licensing basis. Mr. Baughman has performed many seismic margin assessments and seismic probabilistic risk assessments, and is familiar with systems modeling and development of safe shutdown equipment lists.

- **George Bushnell**, P.E., CB&I Power Group. Mr. Bushnell is a licensed mechanical engineer with over 40 years of experience in engineering qualification of electrical and mechanical equipment for nuclear power stations. Mr. Bushnell is a qualified SQUG Seismic Capability Engineer and company specialist for design and qualification of ASME III components.

- **Robert Keiser**, P.E., Duke Energy. Mr. Keiser is a licensed professional engineer in North and South Carolina with over 20 years of experience in the seismic qualification of electrical equipment for Duke Energy's McGuire, Catawba, and Oconee Nuclear Stations. Mr. Keiser received training as a SQUG Seismic Capability Engineer and was involved with the SQUG effort at Oconee and the IPEEE efforts at all three stations.

5.0 SELECTION OF THE SSCs INCLUDED ON THE SWEL

Peer review of the SWEL is described in CB&I / ARES Technical Report 1457690303-R-M-00003. Since the SWEL did not change from September 2012 no further peer review was required.

6.0 SEISMIC WALKDOWNS AND AREA WALK-BYS

The inaccessible equipment items and areas to be walked down were listed in Appendix C of CB&I / ARES Technical Report 1457690303-R-M-00001. The walkdowns consist of two parts: equipment-specific seismic walkdowns and area walk-bys. The specific instructions for each part are delineated in EPRI 1025286. The walkdowns were performed by Duke Energy.

Seismic walkdowns of specific items focused on identifying adverse anchorage conditions, adverse seismic interactions, and other adverse seismic conditions that could challenge the seismic adequacy of a SWEL item.

Anchorage was examined for degraded, nonconforming or unanalyzed conditions. This included visual inspection of the anchorage and verification of anchorage condition. The visual inspections looked for bent, broken, missing or loose hardware; corrosion that is more than mild surface oxidation; visible cracks in the concrete near anchors; and other potentially adverse seismic conditions. This did not apply to line-mounted items.

Anchorage configuration was verified to be consistent with the existing plant documentation for a portion of the equipment with anchorage. The anchorage configuration verification must be done for at least 50% of the non-line-mounted SWEL items. As noted in CB&I / ARES Technical Report 1457690303-R-M-00001, the percentage for CNS Unit 1 exceeds the EPRI 1025286 requirement.

The area adjacent to and surrounding the SWEL item was inspected for nearby SSCs that could be seismic interaction hazards due to proximity, failure, and falling, or insufficient flexibility of attached lines and cables. Detailed guidance on seismic spatial interactions is given in Appendix D of EPRI 1025286.

The item was also examined to see if there were any other potentially adverse seismic conditions besides anchorage and seismic interaction. These could include other degraded conditions, loose or missing subcomponent fasteners, unusual large or heavy subcomponents, doors or panels not latched or fastened, or any other condition which might be seismically adverse. Where possible, cabinets and enclosures were opened for examination of internals.

Area walk-bys consisted of examining the general area surrounding the specific SWEL items for potentially adverse seismic conditions. The area examined included either the entire room enclosing the SWEL item or at least 35 feet in any direction. The examination looked for degraded anchorage conditions of equipment in the area; significantly degraded equipment; poorly supported cable/conduit raceways, HVAC ducting, or piping; and unsecured temporary equipment that could cause seismic interactions (seismic housekeeping concerns). The area walk-by included looking for potential seismic interactions from flooding, spray, or fire. These potential seismic interactions are described in Section 4 of EPRI 1025286.

The Peer Review Team reviewed the qualifications of the Duke Energy engineers performing the walkdowns and verified that they meet the requirements for a SWE in EPRI 1025286. The Peer Review Team also conducted interviews with the engineers to confirm that they had a good understanding of the guidance in EPRI 1025286.

The individuals interviewed were:

- T. R. Leitch – Duke Energy, Senior Walkdown Team Member
- R. C. Fung – Duke Energy, Walkdown Team Member
- J. D. Kennedy – Duke Energy, Walkdown Team Member

Interviews of walkdown personnel were jointly performed by the Duke Energy, ARES, and CB&I members of the Peer Review Team. Personnel were interviewed to assess their working synergy as well as individual capabilities/knowledge. All were verified to have attended the EPRI NTTF 2.3 Seismic Walkdown Training Course. Discussion provided positive indication that the walkdown personnel had adequate experience and training to perform walkdown and walk-by activities in compliance with the EPRI Seismic Walkdown Guidance. They displayed knowledge of the primary objectives of the walkdowns, appropriate levels of dialog between themselves to reach common agreement without excessive discussion, and adequate objectivity in identification of significant discrepancies between as-designed and as-found conditions. Team member qualifications are included in the Duke Energy walkdown report.

The September 2012 peer review included review of in-process Area Walkdown Checklists (AWCs) and Seismic Walkdown Checklists (SWCs). Group meetings were held with the SWEs to address the peer review comments. The Duke Energy personnel who performed walkdowns of the inaccessible items attended these meetings.

The Peer Review Team reviewed 100% of the final SWCs and AWCs for the inaccessible items. This is more than the 10% sample that the EPRI guidance requires. The review is summarized in Appendix A of this report. The table in Appendix A lists the 16 SWCs and 11 AWCs reviewed.

The Peer Review Team concluded that the walkdowns were conducted in accordance with the EPRI guidance.

The Peer Review Team has reviewed the Duke Energy walkdown report (Duke Energy Calculation CNC-1206.03-00-0203, *Fukushima Near-Term Task Force (NTTF) Recommendation 2.3: NRC Submittal Report for Seismic Walk-downs*, Attachment 7A, "Duke Portion of Walkdown.") The report describes the walkdown and summarizes the results. The report contains all of the information required by the EPRI guidance.

7.0 LICENSING BASIS REVIEWS

All potentially adverse conditions require a licensing basis review in accordance with the EPRI guidance. For CNS, the licensing basis reviews were performed by Duke Energy Design Engineering personnel. Mr. Thomas Leitch performed most of the licensing basis reviews. He was assisted by Messrs. Raymond Fung, Robert Pryce, and David Kennedy. These individuals meet the personnel requirements in EPRI 1025286.

The walkdown of the inaccessible items identified four potentially adverse seismic conditions. As with the accessible items, each potentially adverse condition identified by the walkdown team was entered

into the CAP via the Problem Investigation Process (PIP) to enable tracking to closure. All of the items were entered into a single PIP, but they are listed separately. The Duke Energy Licensing Basis Reviewer stated that the licensing basis reviews were documented in the PIP associated with the potentially adverse conditions and no conditions were found to violate the CNS seismic licensing basis.

The potentially adverse seismic conditions identified by the walkdown of the inaccessible items are listed in Appendix B of the Duke Energy walkdown report. The peer reviewers verified that all of the potentially adverse seismic conditions listed in Appendix B of the walkdown report had licensing basis reviews documented in the referenced PIP. The Peer Review Team reviewed the licensing basis evaluations for all of the potentially adverse seismic conditions and concluded that they were conducted in accordance with the EPRI guidance

The peer reviewers also reviewed the licensing basis reviews for the items with comments provided to Duke Energy during the September peer review. The Peer Review Team concluded that the comments were acceptably resolved.

8.0 DECISIONS ON ENTERING POTENTIALLY ADVERSE SEISMIC CONDITIONS INTO THE CAP PROCESS

All of the potentially adverse seismic conditions identified by the seismic walkdown of the inaccessible items were entered in the CAP for further evaluation. The Peer Review Team review of the seismic walkdowns determined that the identifications of potentially adverse seismic conditions were conservatively made. Thus, the decision to enter all of them into the CAP was likewise conservative.

The licensing basis reviews determined none of the potentially adverse seismic conditions violated the CNS licensing basis. Therefore, it was not necessary to perform any extent of condition evaluations.

The licensing basis evaluations of the potentially adverse seismic conditions identified enhancements, which were determined to improve the seismic condition of the plant. Work orders were assigned for implementation of the enhancements.

The Peer Review Team concludes that the decisions on entering potentially adverse conditions in the CAP process were in accordance with the EPRI guidance.

9.0 SUBMITTAL REPORT

The Peer Review Team reviewed a draft of the revised submittal report for CNS Unit 1 provided by Mr. Thomas Leitch on March 12, 2013. The report contained the required sections and discussions. Comments on the submittal were provided to Mr. Leitch on March 13, 2013.

The Peer Review Team concludes that the submittal report is in accordance with the EPRI guidance.

10.0 CONCLUSIONS

The conclusion of the peer review is that the CNS NTTF 2.3 seismic walkdown for the inaccessible items has been conducted in accordance with the guidance in EPRI 1025286. Comments made during the September 2012 peer review have been addressed satisfactorily.

11.0 REFERENCES

CB&I / ARES Technical Report 1457690303-R-M-00001, *Seismic Walkdown Report for Duke Energy's Catawba Nuclear Station Unit 1*, Revision 2, November 14, 2012.

CB&I / ARES Technical Report 1457690303-R-M-00003, *NTTF 2.3 Seismic Peer Review Report, Catawba Nuclear Station Units 1 and 2*, Revision 0, November 18, 2012.

Duke Energy Calculation CNC-1206.03-00-0203, *Fukushima Near-Term Task Force (NTTF) Recommendation 2.3: NRC Submittal Report for Seismic Walk-downs*, Revision 1, DRAFT, March 2013.

EPRI 1025286, *Seismic Walkdown Guidance for Resolution of Fukushima Near-Term Task Force Recommendation 2.3: Seismic*, June 2012, Electric Power Research Institute, Palo Alto, CA.

Letter, E. Leeds and M. Johnson (NRC) to All Power Reactor Licensees et al., "Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Tern Task Force Review of Insights from the Fukushima Dai-ichi Accident," Enclosure 2.3, "Recommendation 2.3: Seismic," dated March 12, 2012.

APPENDIX A

SUMMARY OF PEER REVIEW OF FINAL SWCs AND AWCs FOR INACCESSIBLE ITEMS

Walkdown Team Members:

T. R. Leitch, Duke Energy R. C. Fung, Duke Energy J. D. Kennedy, Duke Energy

Summary of Peer Review of Final SWCS and AWCS For Inaccessible Items

EDB ID	Equipment Class	50% Anchorage	Non 50% Anchorage	Line Mounted	Overall Status	Team	Comments
CV1 El 557 Reactor Bldg	-	-	-	-	Y	Leitch/ Fung	Area Walkdown (Deg 58 Rad 40): 1. WD centered around AOV 1NV52A 2. No adverse conditions noted 3. Apparently abandoned segment of electray noted 4. Photos included
1NV52A	7	-	-	X	Y	Leitch/ Fung	No adverse condition noted Minor interaction with air line; deemed insignificant Photos provided
CV1 El 560 Reactor Bldg	-	-	-	-	Y	Leitch/ Fung	Area Walkdown (Deg 46 Rad 47) 1. WD centered around1NI54A 2. No adverse condition noted 3. Loose locknut noted; Work Request generated (PIP-12-10589) 4. Photos included
1NI0054A	8	-	-	X	Y	Leitch/ Fung	No adverse condition noted Documents referenced Photos provided
CV1 El 562 Reactor Bldg	-	-	-	-	Y	Leitch/ Fung	Area Walkdown (Deg 40 Rad 55) 1. WD centered around 1NI438A 2. No seismically adverse condition noted 3. Housekeeping: boron deposits noted on adjacent tubing: work request initiated
1NI438A	8	-	-	X	Y	Leitch/ Fung	No adverse condition noted Documents referenced Photos provided

Summary of Peer Review of Final SWCS and AWCS For Inaccessible Items

EDB ID	Equipment Class	50% Anchorage	Non 50% Anchorage	Line Mounted	Overall Status	Team	Comments
CV1 El 567 Reactor Bldg	-	-	-	-	Y	Leitch/ Kennedy	Area Walkdown (Deg 176 Rad 50) 1. WD centered around pump 1ND2A 2. Unattached cable runs noted in area; work request initiated 3. No seismically adverse conditions noted 4. Photo provided
1ND2A	8	-	-	X	Y	Leitch/ Kennedy	No seismically adverse condition noted Safety related cable fasteners and supports in degraded condition noted; work request initiated (work order 02070468)
CV1 El 568 Reactor Bldg	-	-	-	-	Y	Leitch/ Fung	Area Walkdown (Deg 176 Rad 25) 1. WD centered around pump 1ND1B 2. No seismically adverse conditions noted 3. Temporary shielding judged adequately supported; tubing as-found condition judged insignificant 4. Photos provided
1ND1B	8	-	-	X	Y	Leitch/ Fung	No adverse condition noted Documents referenced Photos provided
CV1 El 635 Reactor Bldg	-	-	-	-	Y	Leitch/ Fung	Area Walkdown (Deg105 Rad 37) 1. WD centered around 3 inline components 2. No seismically adverse conditions noted 3. Photos provided to illustrate congested but adequate clearance conditions
1NC34A	7	-	-	X	Y	Leitch/ Fung	No adverse condition noted Documents referenced Comment provided wrt maintenance schedule for component
1NC32B	7	-	-	X	Y	Leitch/ Fung	No adverse condition noted Photos provided
1NC36B	7	-	-	X	Y	Leitch/ Fung	No adverse condition noted Comment provided wrt maintenance schedule for component Photos provided to illustrate congested but adequate clearance conditions

Summary of Peer Review of Final SWCS and AWCS For Inaccessible Items

EDB ID	Equipment Class	50% Anchorage	Non 50% Anchorage	Line Mounted	Overall Status	Team	Comments
CV1 El568 Reactor Bldg	-	-	-	-	Y	Leitch/ Kennedy	Area Walkdown (Deg 244 Rad 47) 1. WD centered around drain 2. No seismically adverse conditions noted 3. Comments/photos included describing/justifying minor conditions
1FW8	00	-	X	-	Y	Leitch/ Kennedy	SWEL 2 component No seismically adverse condition noted Documents referenced; photo provided
CV1 El 563 Reactor Bldg	-	-	-	-	Y	Leitch/ Fung	Area Walkdown (Deg 300 Rad 33) 1. WD centered around drain 2. No seismically adverse conditions noted 3. Comments describing/justifying minor conditions
1FW46	00	-	-	X	Y	Leitch/ Fung	SWEL 2 component No seismically adverse condition noted Documents referenced; photo provided
RX1 El 557 RB Annulus	-	-	-	-	Y	Leitch/ Fung	Area Walkdown (Deg 280 Rad 58-63) 1. WD centered on 3 SWEL 2 components 2. No seismically adverse conditions noted 3. Comments/photos included describing/justifying minor conditions, apparent good practice issue re: clearances
1NVPD0042	00	-	X	-	Y	Leitch/ Fung	SWEL 2 component No seismically adverse condition noted Documents referenced; photos provided Comments justify adequacy of close clearance/potential interaction condition
1NV865A	8	-	-	X	Y	Leitch/ Fung	SWEL 2 component No seismically adverse condition noted Documents referenced; photos provided
1NVPUSB	5	X	-	-	Y	Leitch/ Fung	Anchorage verified SWEL 2 component; anchorage verified No seismically adverse condition noted Documents referenced; photos provided Background comments provided

Summary of Peer Review of Final SWCS and AWCS For Inaccessible Items

EDB ID	Equipment Class	50% Anchorage	Non 50% Anchorage	Line Mounted	Overall Status	Team	Comments
Aux Bldg El 594 Control Room	-	-	-	-	Y	Leitch/ Fung	Area Walkdown (CC-55) 1. WD centered on SSPS Train A cabinets 2. Required removal of some ceiling panels; opening of cabinets to complete 3. No seismically adverse conditions noted
1SSPSA	18	X	-	-	Y	Leitch/ Fung	Anchorage verified No seismically adverse conditions noted Documents referenced; photos provided Background discussion included in form of comments
Aux Bldg El 560	-	-	-	-	Y	Leitch/ Fung	Area Walkdown (Room 372 AA-51) 1. WD centered on 2 transformers 2. No seismically adverse condition noted 3. Documents referenced; photos provided 4. Discussion provided on resolution of apparent close clearance conditions
1ETXB	4	X	-	-	Y	Leitch/ Fung	Anchorage verified No seismically adverse conditions noted Documents referenced; photos provided Background discussion included in form of comments
1ETXD	4	X	-	-	Y	Leitch/ Fung	Anchorage verified No seismically adverse conditions noted Background discussion included in form of comments to resolve apparent close clearance condition