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November 8, 2012

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Subject: Duke Energy Carolinas, LLC
Oconee Nuclear Station Units 1, 2, 3
Docket Nos. 50-269, -270, -287
Notification of Deviation from EPRI Steam Generator Management Program: Pressurized Water Reactor Steam Generator Examination Guidelines, Revision 7, Section 6.3.3.2

Duke Energy is providing notification that Oconee Units 1, 2, and 3 have processed a deviation from Nuclear Energy Institute (NEI) 03-08, "Guidelines for the Management of Material Issues," Revision 2, "needed" work product element contained in Electric Power Research Institute (EPRI) Steam Generator Management Program: Pressurized Water Reactor Steam Generator Examination Guidelines, Revision 7 Section 6.3.3.2. NEI 03-08 allows licensees to deviate from "needed" work product elements of an approved guideline, with appropriate justification and documentation.

The subject deviation documents Duke Energy's adoption of Zetec's RevospECT analysis application for eddy current testing (ECT) of steam generator tubing. This application is being used in the fully automated, stand-alone mode. Use of the application in this manner represents a deviation from Section 6.3.3.2 of the EPRI PWR Steam Generator Examination Guidelines, Revision 7, which states that "analysis for tube degradation data shall be completed by two independent analysis teams (designated as primary and secondary)."

In accordance with NEI 03-08, the enclosed information has been approved by the Industry Materials Issue Programs (IP) committee responsible for this issue and is being submitted for "information only." No NRC action is required. In addition Duke Energy acknowledges that the enclosed information is being submitted to the NRC late. This deviation has been in place since April 2011, thus the future tense wording in the deviation documents Duke Energy's review and approval of the deviation prior to usage.

No regulatory commitments are contained in this submittal.

If there are any questions regarding this submittal, please contact Corey Gray at (864) 873-6325.

Sincerely,

TPGillespie

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Vice President
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Enclosure: "Duke Energy Industry Guideline Deviation"

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Enclosure
Duke Energy Industry Guideline Deviation

Duke Energy
Industry Guideline Deviation

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Applicable Industry Guideline Document and Revision: EPRI Steam Generator Management Program: Pressurized Water Reactor Steam Generator Examination Guidelines, Revision 7, Section 6.3.3.2.

Primary Deviation: During the Oconee Unit 1 EOC26 outage (April, 2011), Duke Energy plans to use Zetec's RevospECT™ analysis application for eddy current testing (ECT) of the steam generator tubing. Duke plans to use this application in the fully automated, stand-alone mode. Use of RevospECT™ in this manner represents a deviation from Section 6.3.3.2 of the EPRI Guidelines, which states that "analysis for tube degradation data shall be completed by two independent analysis teams (designated as primary and secondary)."

The above requirement was introduced in 1987 for the purpose of preventing a significant missed indication (i.e., saturated signal across an oscilloscope or computer screen) due to human performance barriers. The entire analysis process has changed since that time, particularly in terms of analyst training and technique qualification. Training through Appendix G of the EPRI Guidelines and the Qualified Data Analyst (QDA) process have provided all certified analysts with a uniform knowledge base from which to perform steam generator tubing ECT analysis. Furthermore, ECT techniques have been qualified through Appendix H of the EPRI Guidelines. The intent of Appendix H was to develop standardized techniques to detect and size degradation. This has improved overall industry knowledge, but has also helped in avoiding human error, which can result when the process is left to the discretion of the individual analyst.

The current approach (traditional two party analysis) depends heavily on a large number of analysts to execute the process, all introducing their own thresholds for error and bias. Consequently, this approach introduces inconsistency in the results.

In the last decade, computers have become much more powerful and sophisticated signal processing techniques have been developed. The primary issue with using computerized eddy current analysis in the past has been the high overcall or discrepancy rate. Because of the high overcall rate, the computer results have had to be edited and resolved, a process which is also subject to human error. With the recent advancements in computerized signal processing, the capability now exist using RevospECT™ to perform a fully automated, stand-alone analysis without the need for human editing. This new approach eliminates human error during the data analysis phase and moves it to the configuration process where it can be readily checked and better controlled. Coupled with an appropriate validation process, this new application will minimize human performance errors and bring more consistency to the analysis results.

Oconee is an ideal place to implement a fully automated, stand-alone analysis process. The steam generators were replaced in 2003 and 2004. The new tube material is Alloy 690 with a very low noise level that is not subject to stress corrosion cracking. The steam generators have thousands of wear

indications at tube support plate (TSP) intersections, which have been demonstrated to be readily detectable by RevospECT™ during field trials. The inspection results from these field trials have shown a very low probability of missing a significant indication. Furthermore, a 100% full length inspection is being performed every outage for each unit at Oconee, eliminating any concern for a missed indication to be left in service that might be allowed to grow during skipped inspection cycles.

In a recent trial run at Oconee Unit 3, all indications greater than or equal to twenty percent through-wall reported by the resolution result were also reported by RevospECT™. Also, eighty indications greater than or equal to thirty percent through-wall were detected by the traditional analysis process and were also detected by RevospECT™ at 80% POD with a 100% confidence limit. Based on the results of trial runs performed at Oconee, the use of RevospECT™ will add hundreds of new low-level wear indications not reported by the traditional process. It will also result in several hundred non-degradation calls to further disposition. Figures 1 and 2 provide a compilation of these results.

In summary, the use of RevospECT™ at Oconee will reduce errors and improve consistency in results compared to the traditional two-party analysis approach. RevospECT™ has been successfully demonstrated in generic performance testing as well as field testing at Oconee. This testing has demonstrated that RevospECT™ will detect all flaws of structural significance with a high degree of confidence. Duke Energy has concluded that RevospECT™ is qualified for the purpose of steam generator examination at Oconee and will produce equivalent or better results than the traditional inspection approach.

Other Deviations:

As a result of implementing a fully automated analysis process, other "needed" or "shall" requirements of the EPRI Guidelines may not be met. The subsequent section attempts to delineate those requirements and provide an acceptable justification to deviate from those requirements.

Requirements in Section 6.3.3.3

a. Automated analysis of eddy current data is achieved by systems incorporating software that allows the processing of eddy current data and its presentation in the form of an analyzed output. These systems are typically applied in one of the following ways:

   1. Detection only mode: The software detects signals and the analyst applies manual analysis to provide results.

   2. Interactive mode: The software detects and analyzes the signals and the analyst reviews the results identified by the software and compares them with his/her own analysis of the signals before the results are accepted, modified, or rejected.

   3. Fully automated mode: The software detects and analyzes the signals and the analysis results are accepted with no human intervention.

b. Application of automated analysis systems shall be limited to the mode that was qualified.

c. Automated analysis systems used for degradation analysis are to be qualified through performance demonstration as follows:

1. The initial generic qualification shall be demonstrated on the applicable EPRI Automated Analysis Performance Demonstration Database (AAPDD) which validates detection and sizing / characterization algorithms for each applicable known damage mechanism found in Table G-1. Different algorithms may be required based on variations in AAPDD essential variables (for example, instrument types, drive voltages, tubing sizes, coil excitation frequencies).

2. It is recommended to use the initial generic performance algorithms as a source of information for help in establishing the site specific algorithms.

3. The site-specific performance capability of an automated analysis system shall be demonstrated and documented in accordance with the SSPD practical examination requirements in Appendix G.

4. Where appropriate, the SSPD qualified algorithms may be adjusted without requalification provided the adjustments are conservative or equivalent, and documented.

5. When non-conservative adjustments are made to the qualified algorithms, re-qualification of the adjusted algorithms on the SSPD shall be performed.

6. When adjustments are made to the qualified algorithms during an outage, an assessment of previously analyzed data from that outage shall be conducted to determine the need for reanalysis.

7. A process shall be established to maintain control of the qualified algorithm revision(s).

8. An analyst with experience in the automated system being utilized shall verify the following prior to each inspection:
   - Appropriate tube or region coverage exists for detection of degradation.
   - Equivalent or conservative algorithm rules exist when compared to the site specific guidelines.
   - Damage mechanisms, for which the automated data analysis system is being used, are properly screened.

d. SSPD qualifications of automated analysis systems shall be demonstrated independent of human intervention. Human intervention is defined as an analyst operating the automated analysis system deleting, adding, or changing a result.

e. Key points to be observed in the use of dual automated analysis systems for degradation analysis are the following:

1. Both teams may use automated analysis systems for detection provided they are independent systems. However, if the detection algorithms are the same, they are not considered independent; and at least one team shall analyze all data manually to ensure the detection algorithms are not missing degradation.

2. Both teams may use automated analysis systems for sizing/characterization provided they are independent systems. However, at least one of the two analysis teams or the resolution team shall review all the analysis results manually to verify the sizing/characterization algorithm.

Deviation

All of the requirements of this section will be met except for items e1 and e2. Two independent systems are being replaced by multiple, independent algorithms within a single system.

As the industry continues to assess the requirements for use of a fully automated analysis process, some believe that a single system should use multiple algorithms to detect and classify degradation. Current rules allow two party manual analyses utilizing the same detection technique (essentially a rise above threshold). Therefore, the success of two party analyses lies in the probability that two parties will not simultaneously miss a significant flaw rather than using two different detection methods.

RevospECT™ uses a variety of signal extraction and classification techniques ("analyzers") to optimize reporting of signals of interest. The analyzer is a specific chain of detection, discrimination, and classification elements that can be considered synonymous with the EPRI Guideline terminology of "detection algorithm", since the detection and discrimination elements together determine a particular signal's reportability. Similarly, RevospECT™ can be configured to provide independence in sizing/characterization of detected flaws through the application of different classification elements. The basis for the acceptance of this deviation is that the RevospECT™ configuration used during the Oconee inspections will be set up with multiple analyzers for flaw detection/characterization, essentially meeting the requirement for independent, dual analysis. In addition, reported wear indications greater than or equal to twenty percent through-wall will be reviewed manually to verify accurate characterization and or sizing.

Requirement in section 6.3.3.4

A discrepancy resolution team (representing primary and secondary) shall review and resolve discrepancies between the results of the two independent analysis teams. It is important that the site-specific data analysis guidelines contain an appropriate delineation of analyst responsibilities, clear definitions of discrepancy conditions, and a well-defined process for discrepancy resolution.

An extremely important consideration is the deletion of a reported indication of degradation made by either of the two analysis teams. If the primary or secondary analyst reports degradation including "I" codes, as defined in Appendix F, then at least two resolution analysts (not from the same team) shall concur and consider review of prior history and/or other techniques before the analysis result is overruled.

Deviation

A discrepancy resolution team will not be used at Oconee. The results will be reported in an unedited mode. RevospECT™ is a fully automated, stand-alone analysis process. The basis for the acceptance of this deviation is that the result of the automated process has not been subject to human interpretation (error/bias) and there are not two streams of results to resolve. Therefore a traditional resolution process is not needed and to do so would only introduce human error, which defeats the purpose of using a fully automated process.

Some aspects of the resolution process, such as comparison to historic indications, are incorporated into the automated process. In addition, indications of degradation (I codes), wear greater than or equal to twenty percent through-wall, and a sample of the raw data will be reviewed manually during the inspection to validate the analysis process.

The current plan for implementation of RevospECT™ at Oconee is to not edit the results. The results may be annotated to further explain the nature of a signal. Only under exceptional circumstances will editing be allowed. After careful review of an indication which is to be revised, editing will require the approval of two QDA's, one of which is the Independent QDA (IQDA), as well as Duke's Level III, thus essentially meeting the requirement of this section of the EPRI Guidelines. Any change to a reported indication will be documented and used to determine if future changes to the configuration are needed.

Other Discussion Points:

RevospECT™ has been qualified using the EPRI AAPDD. While the algorithms from this generic qualification may be useful in developing specific algorithms for detection of a specific mechanism, the configuration cannot be used as-is due to the different data sets in the AAPDD. RevospECT™ must be further qualified on a specific unit's data and site requirements to develop the site specific configuration. To fully qualify an automated system, the full spectrum of active and potential degradation is included in the qualification data set. Additional data may be provided through the use of signal injection software. Such a qualification set has not yet been developed for general use. Therefore, for Oconee, prior inspection data for a given unit will serve as the best method of qualification. Figures 1 and 2 show the unedited results for RevospECT™ compared to the traditional (two party) approach for inspections performed on Oconee Units 2 and 3.

Bridging of Technology:

RevospECT™ will be run on data from the Oconee Unit 1 EOC25 outage data prior to the EOC26 outage. This will validate the configuration setup by comparing it to known results from the traditional two party analysis (i.e., inspection of record) performed during EOC25. Also, it will ensure any differences in the two methods are well understood. The RevospECT™ results for EOC25 will be used for comparison during the EOC26 inspection.

Verification of the Configuration:

In addition to the above, the oversight provided by the IQDA, B&W Level III, and Zetec will assist in verifying the configuration. Noise measurement and monitoring will also be performed to verify the configuration by reviewing the noise output. Furthermore, a field proven automated analysis system (Zetec CDS) will be run in the background (tertiary) during the 1EOC26 outage to identify indications significant to tube integrity (i.e., indications ≥ 20% through-wall). The results from CDS will undergo an engineering review to detect any systematic problems occurring with the RevospECT™ analysis.

Looking for the Unknown:

Although wear at support locations is the only existing or potential degradation mechanism at Oconee, RevospECT™ will also be configured to detect unknown flaws that are not expected to occur. The raw result will be sampled by the IQDA to verify this condition.

ASME Code Considerations:

The steam generator inspection at Oconee is required to conform to ASME Section XI requirements (1998 edition, 2000 addenda). IWA-2233 requires the eddy current examination be conducted in accordance with Section V, Article 8, Appendix II. ASME Section V, Article 8, Appendix II, 840.4 allows the use of automated analysis systems and requires each system to be qualified in accordance with a written procedure. Qualification of RevospECT™ has been performed in accordance with a written procedure that addresses the preparation, validation, review, approval, and documentation elements needed to qualify the system.

Conclusion:

The use of Zetec's RevospECT™ as the steam generator eddy current data analysis method of record in a fully automated, stand-alone mode will be more conservative than the current two party analysis approach. This is based on the fact that the results will be more consistent and less subject to human error, as human interaction with the reported results will be minimized. The potential for error has been shifted from data analysis to the configuration phase. The configuration process can be readily controlled and validated against known results. The use of RevospECT™ offers an improved inspection versus more traditional inspection approaches that are very human process dependent.

Date Exception Effective: April 4, 2011
Station/Unit Affected: Oconee / All Units
Time Frame Exception is Effective: Permanent
Detailed Deviation Description: Included
Deviation Technical Justification: Included

Organizations Impacted: No other internal groups are effected

Approvals:

Initiated by:	O B Mayes	Date	3/29/2011
Reviewed by:	Eileen E. Hurd SGME Technical Support	Date	3/29/2011
Reviewed by	 Duke Energy ECT Level III	Date:	3/29/2011
Approved by:	P. W. Downing SGME Manager	Date	3/29/2011
Management Concurrence :	M R Robinson	Date	3/31/2011

References:

1. EPRI Pressurized Water Reactor Steam Generator Examination Guidelines, Revision 7, #1013706, October, 23007.

2. B&W document "Oconee Unit 1 EOC26 Steam Generator In-Service Inspection Automated Data Analysis Compliance with ASME Code Requirements".

3. Duke Energy Project Plan "Oconee Steam Generator Inspection using Zetec's RevospECT™ Automated Data Analysis System", Revision 2, March 16, 2011.

4. B&W document "Certification of Automated Analysis Systems"

Figure 1 - RevospECT™ Results (unedited) from Oconee Unit 2 EOC 25 (April, 2010)

	TSP Wear	Absolute Drift	Volumetric	Dent	Previous History	Non-Quantifiable	Axial Indication	Loose Part	Bad Data	Incomplete Test
Indication Code	WAR	ADI	VOL	DNT	HIS (no DNT)	NQI	SAI	PLP	RBD	RIC
SG A										
Resolution	4153	2	50	709	0	0	0	0	66	4
RevospECT	5165	33	69	599	224	18	0	0	1	0
SG B										
Resolution	3784	1	48	447	0	1	0	0	61	5
RevospECT	4082	41	74	442	149	17	0	0	0	2
Combined SG A & B										
Resolution	7937	3	98	1156	0	1	0	0	127	9
RevospECT	9247	74	143	1041	373	35	0	0	1	2
Delta between Resolution and RevospECT (Absolute Values)										
# of Indications	1310	72	45	115	373	34	0	0	126	7

Figure 2 - RevospECT™ Results (unedited) from Oconee Unit 3 EOC 25 (Nov. 2010)

	TSP Wear	Absolute Drift	Volumetric	Dent	Non-Quantifiable	Axial Indication	Loose Part
Indication Code	WAR	ADI	VOL	DNT	NQI	SAI	PLP
SG A							
Resolution	9500	5	18	276	1	0	2
RevospECT	10551	65	30	72	36	0	0
SG B							
Resolution	4227	9	14	41	0	0	1
RevospECT	4365	15	32	83	66	0	0
Combined SG A & B							
Resolution	13727	14	32	317	1	0	3
RevospECT	14916	80	62	155	102	0	0
Delta between Resolution and RevospECT (Absolute Values)							
# of Indications	1189	66	30	162	101	0	3