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April 10, 2014

10CFR52.3

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Subject: Duke Energy Carolinas, LLC
William States Lee III Nuclear Station - Docket Nos. 52-018 and 52-019
AP1000 Combined License Application for the William States Lee III Nuclear Station Units 1 and 2
Update Roadmap
Ltr#: WLG2014.04-02

Reference: Letter from Christopher Fallon (Duke Energy) to NRC Document Control Desk, *Update for William States Lee III Nuclear Station Units 1 and 2 Combined License Application,* dated March 27, 2014 (ML14091A868)

This letter provides information supporting the recent Duke Energy update of the application for a combined license for William States Lee III Nuclear Station Units 1 and 2. Enclosed is a "roadmap" of the changes included in the recent update provided as an enclosure to the referenced letter, along with an explanation of the information contained in the roadmap.

If you have any questions or need any additional information, please contact Robert H. Kitchen, Nuclear Development Licensing Director, at (704) 382-4046.

Sincerely,

Christopher M Fallon

Christopher M. Fallon
Vice President
Nuclear Development

D093
NRO

Enclosure:

Lee Nuclear COLA Submittal 11 Update Roadmap

xc (w/out enclosure):
Frederick Brown, Deputy Regional Administrator, Region II

xc (w/ enclosure):
Brian Hughes, Senior Project Manager, DNRL

Lee Nuclear COLA Submittal 11 Update Roadmap

Format Explanation (by column)

QB Change ID# - unique identifier for tracking purposes

COLA Rep – identifies the change as plant specific (WLS)

COLA Part A - affected COLA Part (Part 01 through Part 11)

Chapter A - affected FSAR chapter (FSAR 01 to 19)

Section/Page A - section and page number (if identified) specific to the document to be revised

Complete Change Description - description of the change

Basis for Change - source or reason for the change

Attachment:

Duke Energy WLS COLA Roadmap of Submittal 11 Update

Attachment 1

Duke Energy WLS COLA Roadmap of Submittal 11 Update

APOG Tracking System : COLA Changes | WLS COLA Roadmap of Submittal 11

APR-08-2014 11:07 AM

WLS COLA Roadmap of Submittal 11

QB Change ID#	COLA REP	COLA Part A	Chapter A	Section / Page A	Complete Change Description	Basis for Change
Pt 01 (8 COLA Changes)						
11612	WLS	Pt 01		01.01.01	COLA Part 1, General and Financial Information, Section 1.1.1, third paragraph is revised to read: On July 2, 2012, a merger occurred between Duke Energy Corporation and Progress Energy, Inc. Duke Energy Corporation, as the holding company of Duke Energy Carolinas, LLC, is now the largest electric power holding company in the United States with more than $100 billion in total assets. Duke Energy Corporation is duly organized and existing under the laws of the State of Delaware. The company's general office, and principal place of business, is located in Charlotte, North Carolina, and through its subsidiaries, also transacts business on a regular basis in South Carolina, Kentucky, Ohio, Florida, and Indiana. It is an investor-owned corporation focused on electric power and gas distribution operations, and other energy services in both North and South America. Through its regulated electric and gas utility operating companies, Duke Energy Carolinas, Duke Energy Ohio, Duke Energy Indiana, Duke Energy Kentucky, Duke Energy Florida and Duke Energy Progress, Duke Energy Corporation operates more than 58,000 MW of regulated electric generation and 8, 100 MW of unregulated electric generation in the United States. A diverse fuel mix of nuclear, coal-fired, hydro-electric and combustion-turbine generation allows Duke Energy Corporation to provide this generating capacity to more than 7 million electric and 0.5 million gas customers located in the combined service territories of these operating companies. Duke Energy Corporation is a Fortune 250 company, and its shares are publicly held and listed for trading on the New York Stock Exchange under the symbol DUK.	Duke Energy 2013 Organizational Update
11613	WLS	Pt 01		01.01.01.F / F1.1-1	COLA Part 1, General and Financial Information, Figure 1.1-1 is revised to reflect Organizational Structure.	Duke Energy 2013 Organizational Update
11614	WLS	Pt 01		01.01.03.01	COLA Part 1, General and Financial Information, Subsection 1.1.3.1, listing of the business address, names, current titles and citizensip of the current executive officers and senior nuclear leadership of Duke Energy Carolinas, LLC is revised as follows: Good, Lynn J., title change to Chief Executive Officer Rogers, James E. is removed. Savoy, Brian D., Vice President, Chief Accounting Officer and Controller, US Young, Steven K., title change to Executive Vice President and Chief Financial Officer.	Duke Energy 2013 Organizational Update
11615	WLS	Pt 01		01.01.03.02	COLA Part 1, General and Financial Information, Subsection 1.1.3.2, listing of the business address, names, current titles and citizensip of the Duke Energy Corporation Board of Directors is revised to add the following entry: Good, Lynn J., US	Duke Energy 2013 Organizational Update
11616	WLS	Pt 01		01.01.03.02	COLA Part 1, General and Financial Information, Subsection 1.1.3.2, listing of the business address, names, current titles and citizensip of the current executive officers of Duke Energy Corporationis revised as follows: Good, Lynn J., title change to Vice Chairman, President and Chief Executive Officer Rogers, James E., title change to Chairman of the Board of Directors Savoy, Brian D., Vice President, Controller and Chief Accounting Officer, US Young, Steven K., title change to Executive Vice President and Chief Financial Officer, US	Duke Energy 2013 Organizational Update
11599	WLS	Pt 01		01.01.06	COLA Part 1, General and Financial Information, Section 1.1.6, second paragraph is revised to read: Duke Energy Carolina, LLC's 2013 Integrated Resource Plan as submitted to both the North Carolina Utility	Duke Energy 2013 Integrated Resource Plan

Commission and the South Carolina Public Service Commission reflects a commercial operation date of 2024 is being used for the first unit of the Lee Nuclear Station. The Integrated Resource Plan is sensitive to assumptions made for various factors such as market conditions, commodity costs, environmental compliance costs, customer growth, and customer usage patterns. The precision with which these factors can be predicted diminishes as the forecast period increases. This plan is updated annually, increasing the precision of this forecast as the licensing process progresses. The project timeline assumes that the NRC licensing and adjudicatory process will result in the issuance of a license by May 2016. The construction schedule in FSAR Table 1.1-203 provides for completion of the plant in a timeframe supporting commercial operation dates of 2024 and 2025 for Unit 1 and 2 respectively. The actual schedule will be influenced by many of the same factors discussed above.

11618 WLS Pt 01 01.06.01

COLA Part 1, General and Financial Information, Section 1.6.1, is revised to read:

Duke Energy 2013 Financial Update

1.6.1 FINANCIAL STRENGTH

The financial position and creditworthiness of Duke Energy Carolinas, LLC and its holding company, Duke Energy Corporation, provide them with reliable access to the capital markets. As of September 30, 2013, Duke Energy Corporation's market capitalization was approximately $47 billion and its total assets were $115 billion. Duke Energy Carolinas. LLC, on that same date, had book equity of approximately $10.1 billion and total assets of $32 billion. The audited financial statements of Duke Energy Carolinas, LLC and Duke Energy Corporation for the three most recent fiscal years and the unaudited quarterly interim financial statements for the current fiscal year are available as part of the investor information provided at www.duke-energy.com/ investors/publications.asp. The financial statements most recently filed prior to the submission of this application are also provided in Appendices A-1 through A-5 to this part.

The current credit ratings of Duke Energy Corporation are:

	S&P	Moody's	Fitch
Corporate Credit Rating	BBB+	–	BBB+
Issuer Rating	–	Baa1	–
Senior Unsecured	BBB	Baa1	BBB+
Commercial Paper	A-2	P-2	F-2

Duke Energy Carolinas, LLC's total outstanding long-term debt (as of September 30, 2013) was approximately $8.7 billion, including current maturities. As of September 30, 2013, the company had approximately $870 million of short term borrowing capacity under the Duke Energy Corporation $6.0 billion Master Credit Facility. Duke Energy Carolinas, LLC's standalone ratings at the time of this application are as follows:

	S&P	Moody's	Fitch
Senior Secured	A	Aa3	A+
Senior Unsecured	BBB+	A2	A

Duke Energy Corporation intends to maintain a capital structure for Duke Energy Carolinas, LLC, as required to meet regulatory requirements and to maintain its current credit ratings.

11619 WLS Pt 01 01.06.05

COLA Part 1, General and Financial Information, Section 1.6.5, second sentence is revised to read:

Editorial

This funding flexibility, along with Duke Energy Carolinas LLC's, and its parent, Duke Energy Corporation's strong credit ratings and established access to the capital markets, provides reasonable assurance that the Duke Energy Carolinas, LLC, will fully and successfully fund the construction and operaton of the Lee Nuclear Station.

Pt 02 (219 COLA Changes)

11601 WLS Pt 02 FSAR 01 01.01.05

COLA Part 2, FSAR Chapter 1, Subsection 1.1.5, second and third paragraphs are revised to read:

Duke Energy 2013 Integrated Resource Plan

Duke Energy Carolina, LLC's 2013 Integrated Resource Plan as submitted to both the North Carolina Utility Commission and the South Carolina Public Service Commission reflects a commercial operation date of 2024 for the first unit of the Lee Nuclear Station. The Integrated Resource Plan is sensitive to assumptions made for various factors such as market conditions, commodity costs, environmental compliance costs, customer growth, and customer usage patterns. The precision with which these factors can be predicted diminishes as the forecast period increases. This plan is updated annually, increasing the precision of this forecast as the licensing process progresses. The project timeline assures that the NRC licensing and adjudicatory process will result in the issuance

					of a license by May 2016. The construction schedule in FSAR Table 1.1-203 provides for completion of the plant in a timeframe that would support commercial operation dates of 2024 and 2025 for Unit 1 and 2 respectively. The actual schedule will be influenced by many of the same factors discussed above. Some population-sensitive impacts projected in the Final Safety Analysis Report Revision 0 were based on a projected operation date of 2016. Duke Energy has concluded that the change in operation date from 2016 to 2024 does not affect the validity of the data or conclusions in the Final Safety Analysis Report.	
11570	WLS	Pt 02	FSAR 01	01.01.F / F1.1-202	COLA Part 2, FSAR Figure 1.1-202 is revised as reflected on Duke Energy Supplemental Respose to RAI Letter 110, RAI 2.3.5-6(b), Enclosure 1, Attachment 4.	Duke Energy Supplemental Response to RAI Letter 110, RAI 2.3.5-6(b), Enclosure 1, Attachment 4, WLG2013.09-01 (ML13283A227)
11620	WLS	Pt 02	FSAR 01	01.01.T / T1.1-201	COLA Part 2, FSAR Chapter 1, Table 1.1-201 is revised to add the following acronyms: CEUS SSC - Central and Eastern United States Seismic Source Characterization CVSZ - Central Virginia Seismic Zone DNAG - Decade of North American Geology ECC-AM - Extended Continental Crust-Atlantic Margin ECMA - East Coast Magnetic Anomaly GCVSZ - Giles County, Virginia Seismic Zone GHSHSZ - Gold Hill-Silver Hill Shear Zone MESE - Mesozoic-and-Younger Extended Crust MMI - Modified Mercalli Intensity NYAL - New York-Alabama Lineament PEZ - Paleozoic Extended Crust RLME - Repeated Large Magnitude Earthquakes ZRA - Zone of Riven Anomalies	Editorial
11634	WLS	Pt 02	FSAR 01	01.01.T / T1.1-201	COLA Part 2, FSAR Chapter 1, Table 1.1-201 is revised to add the following acronyms: AHEX - Atlantic Highly Extended Crust BPT - Brownian Passage Time ECC-GC - Extended Continental Crust-Gulf Coast EERI - Earthquake Engineering Research Institute GEER - Geotechnical Extreme Events Reconnaissance IBEB - Illinois Basin Extended Basement IRM - Iapetus Rifted Margin MidC - Midcontinent-Craton NAP - Northern Appalachian NI FIRS - Nuclear Island Foundation Input Response Spectrum NMESE - Non-Mesozoic-and-Younger Extended Crust NMFS - New Madrid Fault System NSHMP - National Seismic Hazard Mapping Project PPRP - Participatory Peer Review Panel RGC - Rough Creek Graben RR - Reelfoot Rift SCR - Stable Continental Regions	Editorial
11602	WLS	Pt 02	FSAR 01	01.01.T / T1.1-203	COLA Part 2, FSAR Table 1.1-203 is revised to reflect revisions to the project timeline.	Duke Energy 2013 Integrated Resource Plan
11546	WLS	Pt 02	FSAR 01	01.06.T / T1.6-201	COLA Part 2, FSAR Chapter 1, Table 1.6-201 is revised at the entry QAPD as follows: Under the column heading, Revision, the QAPD is updated to 9. Under the column heading, Document Transmittal Date, the QAPD is updated to June 2013.	Conforming change to Revision 9 of the QAPD

11745	WLS	Pt 02	FSAR 01	01.08.T / T1.8-201	COLA Part 2, FSAR Chapter 1, Table 1.8-201 is revised as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 1.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 1, WLG2014.01-02 (ML14064A435)
11767	WLS	Pt 02	FSAR 01	01.08.T / T1.8-201	COLA Part 2, FSAR Chapter 1; Table 1.8-201 is revised as reflected on Duke Energy Supplemental Response 4 to RAI 01.05-1, Enclosure 2, Attachment 1.	Duke Energy Supplemental Response 4 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 1, WLG2014.02-02
11589	WLS	Pt 02	FSAR 01	01.08.T / T1.8-201	COLA Part 2, FSAR Table 1.8-201 is revised with the addition of WLS DEP 3.11-1, following the entry for WLS DEP 1.8-1 to read: WLS DEP 3.11-1 DCD Table 3.11-1 (Sheet 14 of 51) "Envir. Zone" numbers for Spent Fuel Pool Level instruments SFS-JE-LT019A, SFS-JE-LT019B, and SFS-JE-LT019C are revised to be consistent with the location of the insturments. 3.11	Duke Energy endorsement of Levy response to LNP RAI LTR 108, Supplement 6, RAI 01.05-1, NPD-NRC-2013-008 (ML13100A002), dated April 5, 2013 for the Lee COL Application
11792	WLS	Pt 02	FSAR 01	01.08.T / T1.8-202	COLA Part 2, FSAR Chapter 1, Table 1.8-202, Sheet 4 of 19 is revised at the entry for COL Item 2.5-3 to remove 3.7.2.1.5 from the FSAR Section listing.	Editorial
10628	WLS	Pt 02	FSAR 01	01.08.T / T1.8-202 SH08	COLA Part 2, FSAR Table 1.8-202 Sheet 8 of 19 is revised at the entry for COL Item 3.9-7, under the column heading 'COL APPLICANT (A), HOLDER (H) or BOTH (B) from 'H' to 'B'	Editorial, DCD 19 conformance
11807	WLS	Pt 02	FSAR 01	01.09.T / T1.9-201	COLA Part 2, FSAR Chapter 1, Table 1.9-201, Sheet 10 of 17, at the entry for Regulatory Guide 1.165 to replace the FSAR Chapter, Section or Subsection with 2.5.2.1.	Conforming change to Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A435)
11746	WLS	Pt 02	FSAR 01	01.09.T / T1.9-202	COLA Part 2, FSAR Chapter 1, Table 1.9-202 is revised as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 1.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 1, WLG2014.01-02 (ML14064A435)
11747	WLS	Pt 02	FSAR 01	APP.01.AA	COLA Part 2, FSAR Chapter 1, Appendix 1AA is revised at the entry for Regulatory Guide 1.208 as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 1.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 1,

						WLG2014.01-02 (ML14064A435)
11742	WLS	Pt 02	FSAR 02	02.00.T / T2.0-201	COLA Part 2. FSAR Chapter 2, Table 2.0-201 is revised as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2. Attachment 2.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 2, WLG2014.01-02 (ML14064A435)
11768	WLS	Pt 02	FSAR 02	02.00.T / T2.0-201	COLA Part 2, FSAR Chapter 2, Table 2.0-201 is revised as reflected on Duke Energy Supplemental Response 4 to RAI 01.05-1, Enclosure 2, Attachment 2.	Duke Energy Supplemental Response 4 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 2, WLG2014.02-02
11574	WLS	Pt 02	FSAR 02	02.00.T / T2.0-201	COLA Part 2, FSAR Table 2.0-201 is revised as reflected on Duke Energy Supplemental Respose to RAI Letter 110, RAI 2.3.5-6 b), Enclosure 1, Attachment 5.	Duke Energy Supplemental Response to RAI Letter 110, RAI 2.3.5-6 b), Enclosure 1, Attachment 5, WLG2013.09-01 (ML13283A227)
11544	WLS	Pt 02	FSAR 02	02.01.01.02	COLA Part 2, FSAR Chapter 2, Subsection 2.1.1.2 is revised to add a new third sentence read: Table 2.1-201 lists the counties that are entirely or partially located within the 50-mi. region.	Editorial
11571	WLS	Pt 02	FSAR 02	02.01.01.02.01	COLA Part 2, FSAR Chapter 2, Subsection 2.1.1.2.1, second sentence is revised to read: No areas within the site boundary are used for residential quarters or industrial, commercial, institutional, or recreational facilities not controlled by Duke Energy.	Duke Energy Respose to RAI 02.03.05-6, Letter 110, Enclosure 1, Item a), Attachment 3, WLG2013.08-01 (ML13248A105)
11603	WLS	Pt 02	FSAR 02	02.01.01.02.01	COLA Part 2, FSAR Chapter 2, Subsection 2.1.1.2.1 is revised to read: There are no residents in the Exclusion Area. No areas within the site boundary are used for residential quarters or industrial, commercial, institutional, or recreational facilities not controlled by Duke Energy. Access within the site boundary is controlled as described in FSAR Section 2.1.2. FSAR Section 2.3 provides details on gaseous release points and their relation to the site boundary. The discussion of normal releases (gaseous and aqueous) are in FSAR Sections 11.2 and 11.3, and accidental releases are discussed in FSAR Chapter 15. All areas outside the exclusion area are unrestricted areas in the context of 10 CFR Part 20. For the Lee Nuclear Station, the Restricted Area is the same as the Protected Area. Figure 2.1-201 shows the Protected Area Boundary. For Lee Nuclear Station, the Protected Area is the fenced area surrounding the reactor buildings. It contains all of the buildings required for the operation of the reactor with the exception of the cooling towers (See Figure 2.1-201 for the site plot plan).	Editorial
11572	WLS	Pt 02	FSAR 02	02.01.02	COLA Part 2, FSAR Chapter 2. Subsection 2.1.2, second sentence is revised to read: The site boundary is clearly posted with no trespassing signs, with the exception of a publicly accessible boat launch area located upstream of Ninety-Nine Islands Hydroelectric Dam. The no trespassing signs also include actions to be taken in the event of emergency conditions at the plant.	Duke Energy Respose to RAI 02.03.05-6, Letter 110, Enclosure 1. Item a), Attachment 4,

						WLG2013.08-01 (ML13248A105)
11573	WLS	Pt 02	FSAR 02	02.01.02.02	COLA Part 2. FSAR Chapter 2, Subsection 2.1.2.2 is revised to read: There are no residential quarters, and only limited recreational and commercial activities within the Exclusion Area. Commercial activities are limited to a sand dredging operation on the Broad River to the NNW of the site, and the Ninety-Nine Islands Hydroelectric Dam located on the Broad River east of the site. The recreational activities are limited to the Broad River, which crosses the EAB on the northern and eastern sides of the site. No public highways or active railroads traverse the exclusion area. There are four historical cemeteries within the site boundary. Access to these cemetaries is controlled by security personnel.	Duke Energy Respose to RAI 02.03.05-6, Letter 110, Enclosure 1, Item a). Attachment 5. WLG2013.08-01 (ML13248A105)
11610	WLS	Pt 02	FSAR 02	02.01.03	COLA Part 2, FSAR Chapter 2, Subsection 2.1.3, last paragraph, first sentence is revised to read: The commercial operation date was initially estimated to be 2016, but has been revised to approximately 2024.	Duke Energy 2013 Integrated Resource Plan
11604	WLS	Pt 02	FSAR 02	02.03.04	COLA Part 2, FSAR Chapter 2, Subsection 2.3.4, last sentence is revised to read: This section describes the development of the short-term diffusion estimates for the EAB, low population zone (LPZ), and the control room.	Conforming change to RAI LTR 110, WLG2013.09-01
11605	WLS	Pt 02	FSAR 02	02.03.04.01	COLA Part 2, FSAR Chapter 2, Subsection 2.3.4.1, second paragraph, first sentence is revised to read: Relative concentrations of released gases, X/Q values, as a function of direction for various time periods at the EAB and outer boundary of the LPZ, were determined by the use of the computer code PAVAN, NUREG/CR-2858 (Reference 233).	Editorial
11575	WLS	Pt 02	FSAR 02	02.03.05.01	COLA Part 2, FSAR Chapter 2, Subsection 2.3.5.1, fourth paragraph is revised to read: For receptors located at the site boundary, the analysis assumed a ground level point source located at the Effluent Release Boundary closest to the receptor.	Duke Energy Supplemental Respose to RAI Letter 110, RAI 2.3.5-6 b), Enclosure 1, Attachment 6, WLG2013.09-01 (ML13283A227)
11576	WLS	Pt 02	FSAR 02	02.03.05.02	COLA Part 2, FSAR Chapter 2, Subsection 2.3.5.2, second paragraph is revised to read: The results of the analysis, based on two years of data collected on site, are presented in Tables 2.3-287 through 2.3-292. The limiting atmospheric dispersion factor (X/Q) at the site boundary, 1.5 x 10-5 sec/m3, is in the NW direction from Unit 1 at 427 meters (approximately 0.27 mi.) from the effluent release boundary. The limiting atmospheric dispersion at the nearest residence, 4.60 x 10-6 sec/m3, is in the SE direction at 1588 meters. Atmospheric dispersion factors for other receptors are given in Table 2.3-289. Long term atmospheric dispersion factors are not given in the AP1000 DCD except at the EAB. The DCD site boundary annual average X/Q is 2.0 x 10-5 sec/m3. This bounds the Lee Nuclear Station annual average routine release site boundary X/Q value of 1.5 x 10-5 sec/m3. Table 2.0-201 provided a comparison of the Lee Nuclear Station site characteristics with the DCD design parameters.	Duke Energy Supplemental Response to RAI Letter 110, RAI 2.3.5-6 b), Enclosure 1, Attachment 6, WLG2013.09-01 (ML13283A227)
11577	WLS	Pt 02	FSAR 02	02.03.T / T2.3-282	COLA Part 2, FSAR Table 2.3-282 is revised as reflected on Duke Energy response to RAI 2.3.5-6(b), Enclosure 1, Attachment 7.	Duke Energy Supplemental Response to RAI Letter 110, RAI 2.3.5-6 b), Enclosure 1, Attachment 7. WLG2013.09-01 (ML13283A227)
11547	WLS	Pt 02	FSAR 02	02.03.T / T2.3-287	COLA Part 2, FSAR Chapter 2, Table 2.3-287, Sheets 1 and 2, under the column heading 'Sector', each entry following SW is revised to read WSW.	Editorial

11578	WLS	Pt 02	FSAR 02	02.03.T / T2.3-289	COLA Part 2, FSAR Table 2.3-289 is revised as reflected on Duke Energy response to RAI 2.3.5-6(b), Enclosure 1, Attachment 7.	Duke Energy Supplemental Response to RAI Letter 110, RAI 2.3.5-6 b), Enclosure 1, Attachment 7, WLG2013.09-01 (ML13283A227)
11743	WLS	Pt 02	FSAR 02	02.04.01.02.02.02	COLA Part 2, FSAR Chapter 2, Subsection 2.4.1.2.2.2, under the sub-heading 'Sediment Transport,' fourth paragraph is revised to read: The values used for the design basis are an average TSS concentration of 20 mg/L and a maximum TSS concentration of 300 mg/L, based on current Broad River data from Duke's surrounding power plants.	Conforming change Duke Energy Revised Response to RAI LTR 075, RAI 01-008, Enclosure 1, Attachment 4, WLG2014.03-02
10619	WLS	Pt 02	FSAR 02	02.04.12.02.03.01	COLA Part 2, FSAR Chapter 2, Subsection 2.4.12.2.3.1 is revised at the second bullet to add the following last sentence: Figure 2.4.12.-211 provides a hydrograph of groundwater elevations at each observation point over the duration of the modeled storm event.	Editorial
10632	WLS	Pt 02	FSAR 02	02.04.12.T / T2.4.12-204	COLA Part 2, FSAR Chapter 2, Table 2.4.12-204 is revised at the entry 'Undifferentiated Material' under the column heading 'Median' to read: 4.0 x 10-4	Editorial
11621	WLS	Pt 02	FSAR 02	02.04.13.02	COLA Part 2, FSAR Chapter 2, Subsection 2.4.13.2, sixth paragraph is revised to read: The remaining four tank applications were considered - the effluent holdup tanks, waste holdup tanks, monitor tanks (located in the auxiliary building), and chemical waste tank. Of these tanks, the effluent holdup tanks have both the highest potential radioactive isotope concentrations and the largest volume. The effluent holdup tanks are also located on the lowest level of the auxiliary building, which is a limiting location relative to an uncontrolled release from the auxiliary building via the groundwater pathway. Therefore, an effluent holdup tank is limiting for the purpose of calculating the effects of the failure of a radioactive liquid-containing tank.	Editorial
11652	WLS	Pt 02	FSAR 02	02.05.01	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1, second paragraph is revised as follows: Subsection 2.5.2 describes the methodology used to develop the ground motion GMRS and FIRS for the Lee Nuclear Site. This section provides a description of the geological, seismological, and geophysical database for the Lee Nuclear Site, in the context of the 2012 Central and Eastern United States Seismic Source Characterization for Nuclear Facilities (CEUS SSC) project (Reference 441).	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11653	WLS	Pt 02	FSAR 02	02.05.01.01.01.04	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.1.4, third paragraph is revised with the addition of a new last sentence as follows: Recent detrital zircon work has shown that portions of the Kings Mountain terrane are as young as late Middle Cambrian, younger than previously thought (Reference 438).	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11624	WLS	Pt 02	FSAR 02	02.05.01.01.01.04	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.1.4, twelfth paragraph, first sentence is revised to remove extraneous parenthesis: The Carolina Zone is part of a late Precambrian–Cambrian composite arc terrane, exotic to North America (References 231 and 238), and accreted either during the Ordovician to Silurian (Hibbard et al. (2002) (Reference 204)) or during the Middle Devonian to Early Mississippian (Hatcher et al. (2007) (Reference 404)) sometime during the Ordovician to Devonian Period (Reference 239); (Reference 240).	Editorial

11625	WLS	Pt 02	FSAR 02	02.05.01.01.01.04	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.1.4, thirteenth paragraph, first sentence is revised to correct the parenthesis: Hibbard et al. (2002) (Reference 204) propose updated nomenclature for the Carolina Zone ("Carolinia" in Hibbard et al. (2006)) (Reference 260) based on the tectonothermal overprint of units.	Editorial
11654	WLS	Pt 02	FSAR 02	02.05.01.01.02.01	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.2.1, eleventh paragraph is revised with the addition of a new last sentence as follows: More recent geomorphic analyses of fluvial systems in the southern Appalachians of western Tennessee suggest that topographic relief associated with the Blue Ridge escarpment may be responding to mantle forcing (Reference 439).	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11655	WLS	Pt 02	FSAR 02	02.05.01.01.02.01	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.2.1, thirteenth paragraph is revised as follows: Wheeler (1995) (Reference 267) suggests that many earthquakes in the eastern part of the Piedmont province and beneath the Coastal Plain province may be associated spatially with buried normal faults related to rifting that occurred during the Mesozoic Era. Normal faults in this region that bound Triassic basins may be listric into the Paleozoic detachment faults (Reference 268) or may penetrate through the crust as high-angle faults. No definitive correlation of seismicity with Mesozoic normal faults has been conclusively demonstrated. However, the CEUS SSC model (Reference 441) characterized these areas as two seismotectonic zones as discussed in Subsection 2.5.1.1.3.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11656	WLS	Pt 02	FSAR 02	02.05.01.01.02.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.2.2 is revised as follows: Since the 1980's, researchers have assessed and compiled available stress data for the central and eastern United States, including well-bore breakouts, results of hydraulic fracturing studies, in situ stress measurements and earthquake focal mechanisms (References 270, 271, 272, 440). The most recent compilations as part of the CEUS SSC project confirm previous work that indicates the prevailing stress field in the midcontinent is east-northeast to northeast maximum horizontal stress direction, with no strong evidence for stress subprovinces (Reference 441). This is consistent with the theoretical trend of compressive forces acting on the North American plate from the mid-Atlantic Ridge (Reference 272). As shown in Figure 2.5.1-245, data are ranked in terms of quality (A being the highest quality and C the being the lowest quality) and tectonic regime is characterized as normal, thrust, strike-slip or unknown (Reference 441). In addition to better documenting the orientation of stress, research addresses quantitatively the relative contributions of various forces that may be acting on the North American plate to the total stress within the plate. Richardson and Reding (1991) (Reference 273) describe the results of numerical modeling of stress in the continental U.S. interior and consider the contribution to total tectonic stress to be from three classes of forces: • Horizontal stresses that arise from gravitational body forces acting on lateral variations in lithospheric density. These forces commonly are called buoyancy forces. Richardson and Reding (1991) (Reference 273) emphasize that what is commonly called ridge-push force is an example of this class of force. Rather than a line-force that acts outwardly from the axis of a spreading ridge, ridge-push arises from the pressure exerted by positively buoyant, young oceanic lithosphere near the ridge against older, cooler, denser, less buoyant lithosphere in the deeper ocean basins (Reference 274). The force is an integrated effect over oceanic lithosphere ranging in age from about 0 to 100 Ma (Reference 275). The ridge-push force transmits as stress to the interior of continents by the elastic strength of the lithosphere. • Shear and compressive stresses transmit across major plate boundaries (strike-slip faults and subduction zones). • Shear tractions acting on the base of the lithosphere from relative flow of the underlying asthenospheric mantle. Richardson and Reding (1991) (Reference 273) concludes that the observed northeast-southwest trend of principal stress in the CEUS dominantly reflects ridge-push forces. They estimate the magnitude of these forces to be about 2 to 3 x 1012 Newtons per meter (i.e., the total vertically integrated force acting on a column of lithosphere 3.28 ft [1 m]	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)

					wide), which corresponds to average equivalent stresses of about 40 to 60 megapascals (MPa) distributed across a 30 mi.-thick elastic plate. Richardson and Reding (1991) (Reference 273) find that the fit of the model stress trajectories to data is improved by adding compressive stress (about 5 to 10 MPa) acting on the San Andreas fault and Caribbean plate boundary structures. The fit of the model stresses to data further indicates that shear stresses acting on these plate boundary structures must also be in the range of 5 to 10 MPa. Richardson and Reding (1991) (Reference 273) note that numerical models that assume horizontal shear tractions acting on the base of the North American plate reproduce the general northeast-southwest orientation of principal stress in the CEUS. Richardson and Reding (1991) (Reference 273) do not favor this as a significant contributor to total stress in the mid-continent region because their model would require an order-of-magnitude increase in the horizontal compressive stress from the eastern seaboard to the Great Plains.	
11657	WLS	Pt 02	FSAR 02	02.05.01.01.02.03	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.2.3 is revised as follows: In 1987, the Geological Society of America published regional maps of the gravity and magnetic fields in North America as part of the Society's Decade of North American Geology (DNAG) project. These maps include the Committee for the Gravity Anomaly Map of North America (Reference 276) and the Committee for the Magnetic Anomaly Map of North America (Reference 277). The maps present the potential field data at 1:5,000,000-scale and are useful for identifying and assessing regional gravity and magnetic anomalies with wavelengths on the order of about 6 mi. or greater. Published maps of the gravity and aeromagnetic fields for the state of South Carolina (Reference 278) and the digital data from these maps are the basis of the gravity and magnetic maps in Figures 2.5.1-205 and 2.5.1-206, respectively as these data provide higher resolution than the regional datasets Gravity and magnetic data were incorporated in the DNAG E-4 crustal transect, which traverses the Appalachian orogen to the northeast of the Lee Nuclear Site (Figure 2.5.1-207). The DNAG E-4 transect extends from central Kentucky to the Carolina trough in the offshore Atlantic basin, just north of the South Carolina-North Carolina state line (Reference 282) and passes a few miles to the northeast of the Lee Nuclear Site. Figure 2.5.1-207 presents geologic and potential field data from the DNAG E-4 transect. As part of the CEUS SSC database development, regional gravity and magnetic data were reprocessed and published as part of the CEUS SSC database (Reference 441). Because the 1987 data were incorporated in the DNAG E-4 transect and provide a useful reference to regional crustal structures and lithology, the CEUS SSC gravity and magnetic field data were overlain on the DNAG E-4 transect as shown on Figure 2.5.1-207.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11658	WLS	Pt 02	FSAR 02	02.05.01.01.02.03.01	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.2.3.1, first paragraph is revised as follows: The gravity profile along the DNAG E-4 (Reference 276) crustal transect (Figure 2.5.1-207), documents a long-wavelength anomaly east of the Brevard fault zone. The Brevard fault zone marks the tectonic boundary between the Blue Ridge province to the west and the Piedmont province to the east (Figure 2.5.1-201). Bouguer gravity values increase by about 80 to 120 milliGals (mGal) across an approximately 125 to 155 mi. reach of the Piedmont east of the Blue Ridge (Figure 2.5.1-207). As shown on Figure 2.5.1-207, this gradient is present across the Piedmont physiographic province along much of the length of the Appalachian belt.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11659	WLS	Pt 02	FSAR 02	02.05.01.01.02.03.01	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.2.3.1, sixth paragraph is revised as follows: To summarize, gravity data published since the mid-1980s including the data reprocessed as part of the CEUS SSC database development, document that long-wavelength anomalies in the vicinity of the Lee Nuclear Site are characteristic of large parts of the Appalachian belt (References 276 and 441). Furthermore, these data reflect first-order features of the various provinces and accreted Paleozoic terranes, as well as west-to-east thinning of the ancestral North American continental crust. The dominant short-wavelength characteristics of the gravity field in the vicinity of the Lee Nuclear Site are gravity highs and lows associated with mafic and granitic intrusions, respectively.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11660	WLS	Pt 02	FSAR 02	02.05.01.01.02.03.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.2.3.2, first paragraph is revised as follows: In contrast to the gravity data, the magnetic field does not exhibit a long-wavelength anomaly east of the Brevard fault zone coincident with the accreted Taconic terranes of the Piedmont. As shown on the magnetic profile for the DNAG E-4 transect (Figure 2.5.1-207), the magnetic field across the Piedmont generally is characterized by high and low anomalies with wavelengths on the order of about 3 to 6 mi. Key features of the regional magnetic field include the following:	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11661	WLS	Pt 02	FSAR 02	02.05.01.01.02.03.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.2.3.2, ninth paragraph, first sentence is revised as follows:	Duke Energy Supplemental

					To summarize, magnetic data published since the mid-1980s, including reprocessed data for the CEUS SSC database (Reference 441), provide additional characterization of the magnetic field in the Lee Nuclear Site region (Reference 277).	Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11626	WLS	Pt 02	FSAR 02	02.05.01.01.02.04.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.2.4.2, third paragraph, third sentence is revised to read: For example, seismicity in the Giles County, Virginia seismic zone (GCVSZ), located in the Valley and Ridge province, is occurring at depths ranging from 3 to 16 mi.....	Editorial
11545	WLS	Pt 02	FSAR 02	02.05.01.01.02.04.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.2.4.2, under the sub-heading Hyco Shear Zone, first sentence is revised to read: Hyco Shear Zone. In northern North Carolina and southern Virginia, the Hyco shear zone dips shallow to steeply to the southeast and juxtaposes the Carolina terrane rocks over the Milton terrane, rocks correlated with the Inner Piedmont or Piedmont zone (Hibbard et al. (1998) (Reference 417)) (FSAR Figure 2.5.1-209).	Editorial
11662	WLS	Pt 02	FSAR 02	02.05.01.01.02.04.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.2.4.2, under the subheading "Brindle Creek Thrust Fault," second paragraph is revised with the addition of a new last sentence as follows: Recent mapping has extended the Brindle Creek fault, and thus the Cat Square terrane, into central Georgia (Reference 442).	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11627	WLS	Pt 02	FSAR 02	02.05.01.01.02.04.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.2.4.2, the paragraph under the subheading Gold Hill-Silver Hill Shear Zone is revised as follows: Gold Hill-Silver Hill Shear Zone. The Gold Hill-Silver Hill shear zone (GHSHSZ) is a dextral strike-slip shear zone located approximately 30 mi. south of the Lee Nuclear Site (Figure 2.5.1-210). Based upon cross-cutting relationships with intrusive igneous bodies and the Cross Anchor fault, West (1998) (Reference 297) constrains motion on this shear zone to between approximately 400 and 325 Ma. Work along the GHSHSZ to the northeast has variably indicated deformation events of earliest Cambrian dextral-reverse faulting (Allen et al. (2007) (Reference 427)). Late Ordovician sinistral deformation (Hibbard et al. (2007) (Reference 425)), and Devonian to Mississippian remobilization (Hibbard et al (2007) (Reference 425); Hibbard et al. (2008) (Reference 426)). The best evidence for the latest movement on the GHSHSZ, however, is based on its cross-cutting relationship with the Cross Anchor fault that indicates latest motion was sometime prior to 325 Ma (West (1998) (Reference 297)).	Editorial
11663	WLS	Pt 02	FSAR 02	02.05.01.01.02.04.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.2.4.2, under the subheading "Other Paleozioic Faults," second paragraph is revised as follows: Furthermore, no seismicity is attributed to the Paleozoic faults in the site region, and published literature does not indicate that any of these faults offset late Cenozoic deposits or exhibit a geomorphic expression indicative of Quaternary deformation. In addition, Crone and Wheeler (2000) (Reference 310) and Wheeler (2005) (Reference 311) do not show any of these faults to be potentially active Quaternary faults. Therefore, these Paleozoic structures in the site region are not considered to be capable tectonic sources.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11664	WLS	Pt 02	FSAR 02	02.05.01.01.02.04.03	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.2.4.3, under the subheading "Mesozoic Rift Basins," is revised as follows: Mesozoic Rift Basins. A broad zone of fault-bounded, elongate, depositional basins associated with crustal extension and rifting formed during the opening of the Atlantic Ocean in early Mesozoic time. These rift basins are common features along the eastern coast of North America from Florida to Newfoundland (Figures 2.5.1-201 and 210). Wheeler (1995) (Reference 267) suggests that many earthquakes in the eastern part of the Piedmont province and beneath the Coastal Plain province may be associated spatially with buried normal faults related to rifting that occurred during the Mesozoic Era. However, definitive correlation of seismicity with Mesozoic normal faults is not conclusively demonstrated. Figure 2.5.1 210 shows the lack of spatial correlation between Mesozoic basins and seismicity within 50 miles of the site. As of March 2009, there was no positive correlation between earthquakes in the	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)

					site region and Mesozoic basins. Normal faults in this region that bound Triassic basins may be listric into the Paleozoic detachment faults (Reference 268) or may penetrate through the crust as high-angle faults. Within regions of stable continental cratons, areas of extended crust potentially contain the largest earthquakes (Reference 317) (Figure 2.5.1-212). Mesozoic basins have long been considered potential sources for earthquakes along the eastern seaboard (Reference 318). No seismicity is attributed to these Mesozoic features, and published literature does not indicate that any of these faults offset late Cenozoic deposits or exhibit a geomorphic expression indicative of Quaternary deformation. In addition, Crone and Wheeler (2000) (Reference 310) and Wheeler (2005) (Reference 311) do not show any of these faults to be potentially active Quaternary faults. Therefore, these Mesozoic structures in the site region are not considered to be capable tectonic sources; however, they are considered within the seismotectonic zone of Mesozoic extended crust (Extended Continental Crust-Atlantic Margin (ECC-AM)) in the CEUS SSC (Reference 441).	
11665	WLS	Pt 02	FSAR 02	02.05.01.01.03	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.3 is revised as follows: Subsection 2.5.1.1.3 includes descriptions of instrumental and historic earthquake activity in the Lee Nuclear Site region and beyond. Special emphasis is placed on the Charleston seismic zone because it one of the largest earthquakes in eastern U.S. history and it is located within 200 mi of the Lee Nuclear Site.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11666	WLS	Pt 02	FSAR 02	02.05.01.01.03.01	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.3.1 is revised as follows: Seismicity in the CEUS is in general broadly distributed, but areas of concentrated earthquake activity are shown in Figure 2.5.1-214. Areas of concentrated seismicity are described in this section. Although these areas have elevated seismicity rates, they do not all have well-defined evidence for being a source of Repeated Large Magnitude Earthquakes (RLMEs) as defined by the CEUS SSC project, that is having 2 or more earthquakes with M> 6.5 (Reference 441). Only Charleston and the New Madrid Fault System are RLMEs discussed as part of this application. The CEUS SSC project used smoothing of seismicity rates within larger sesimotectonic zones to account for the higher earthquake rates in areas that lack evidence for being a source of RLMEs, such as the Eastern Tennessee seismic zone (ETSZ), the Central Virginia seismic zone, and the Giles County, Virginia seismic zone (GCVSZ). A discussion of the above seismic sources or areas of concentrated seismicity respective to the CEUS SSC model and application to the Probabilistic Seismic Hazard Analysis (PSHA) is provided in Subsection 2.5.2.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11628	WLS	Pt 02	FSAR 02	02.05.01.01.03.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.3.2 is revised to utilize acronyms and correct the call-out of Fault/Seismic Zones in the last three sentences as follows: The ETSZ and GCVSZ are discussed in Subsections 2.5.1.1.3.2.2 and 2.5.1.1.3.2.3, respectively. Two additional areas of concentrated seismicity beyond the site region (i.e., the New Madrid Fault Zone and Central Virginia seismic zone) are discussed in Subsection 2.5.1.1.3.2.4.	Editorial
11667	WLS	Pt 02	FSAR 02	02.05.01.01.03.02.01	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.3.2.1 is revised as follows: The August 31, 1886, E[M] 6.90 Charleston, South Carolina, earthquake is the largest historical earthquake in the eastern United States (Reference 441). The event produced Modified Mercalli Intensity (MMI) X shaking in the epicentral area and was felt strongly as far away as Chicago (Reference 330). Strong ground shaking during the 1886 Charleston earthquake resulted in extensive liquefaction, primarily expressed as sand-blow craters at the ground surface (Reference 355). Because no primary tectonic surface rupture has been identified as the causative structure for the 1886 earthquake and the relatively high risk in the Charleston area, government agencies funded numerous investigations to identify the source of the earthquake and recurrence history of large magnitude events in the region. In spite of this effort, the source of the 1886 earthquake is not definitively attributed to any particular fault shown in Figure 2.5.1-215. A combination of geologic, geophysical, geomorphic, and instrumental seismicity data have been used by multiple investigators to suggest several different faults as the potential source for Charleston-area seismicity (e.g., References 342, 331, 343, 345, 338, 346, 443, 444, 445, 446, 448, 454) (see discussion below). Work has revealed that pre-1886 paleoliquefaction features occur throughout coastal South Carolina, indicating prior strong ground motions during prehistoric large earthquakes in the region (e.g., References 447, 448, 335, 336, 357, 449). The paleoliquefaction studies conducted in coastal South Carolina since the 1980s provide evidence that the	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)

Charleston seismic source exhibits RLME and that these earthquakes appear to be located only in the Charleston area. Because of this field evidence for liquefaction and paleoliquefaction features, the Charleston seismic zone was characterized as an RLME source by the EPRI CEUS project (Reference 441). Again, neither the 1886 nor the prehistoric (i.e. pre-1886) earthquakes preserved in the liquefaction record in the Charleston area can be definitively attributed to any specific fault or fault zone at the present time. Hence, the CEUS SSC project developed three alternative geometries for the Charleston source, Charleston Local, Charleston Narrow, and Charleston Regional (Figure 2.5.1-246).

The 1886 Charleston earthquake produced no identifiable primary tectonic surface deformation; therefore, the source of the earthquake is inferred based on the geology, geomorphology, and instrumental seismicity of the region (Figures 2.5.1-215, 2.5.1-216, and 2.5.1-217). Talwani (1982) (Reference 331) suggests that the inferred north-northeast-striking Woodstock fault produced the 1886 earthquake near its intersection with the northwest-striking Ashley River fault. Both the postulated Woodstock and Ashley River faults are inferred on the basis of seismicity (Reference 331). More recently, Marple and Talwani (1993, 2000) (References 337 and 338) suggest that a northeast-trending zone of river anomalies, referred to as the ECFS, represents the causative fault for the 1886 Charleston event. The southern segment of the ECFS coincides with a linear zone of micro-seismicity that defines the northeast-trending Woodstock fault of Talwani (1982) (Reference 331) and the isoseismal zone from the 1886 earthquake.

Potential Charleston Source Faults. Over the last several decades, a number of faults have been identified or described in the literature as possible sources related to the 1886 Charleston earthquake. These include paleoliquefaction features and numerous faults localized in the Charleston meizoseismal area.

There is evidence, in the form of paleoliquefaction features in the South Carolina Coastal Plain, that the source of the 1886 Charleston earthquake has repeatedly generated vibratory ground motion. Paleoliquefaction evidence is lacking for prehistoric earthquakes elsewhere along much of the eastern seaboard (e.g., References 334, 335, and 336). While the 1886 Charleston earthquake was likely produced by a capable tectonic source, the causative tectonic structure has yet to be identified. Various studies propose potential candidate faults for the 1886 event; however, a positive linkage between a discrete structure and the Charleston earthquake has yet to be determined.

These potential causative features are shown in Figures 2.5.1-215, 2.5.1-216, and 2.5.1-217 and are described below:

- East Coast Fault System. The inferred ECFS, the southern section of which is also known as the "zone of river anomalies" (ZRA) based on the alignment of river bends, is a northeast-trending, approximately 370-mi-long fault system extending from west of Charleston, South Carolina, to southeastern Virginia (Reference 338). The ECFS comprises three approximately 125-mi.-long, right-stepping sections (southern, central, and northern). Evidence for the southern section is strongest, with evidence becoming successively weaker northward (Reference 311). Even within the southern segment of the ECFS, Dura-Gomez and Talwani indicate that evidence for the existence and activity of the ECFS is greatest in the south and decreases northeastward (References 443 and 444). Marple and Talwani (1993) (Reference 337) identify a series of geomorphic anomalies (i.e., ZRA) located along and northeast of the Woodstock fault and attribute these to a buried fault much longer than the Woodstock fault. Marple and Talwani (References 337 and 338) suggest that this structure, the ECFS, may have been the source of the 1886 Charleston earthquake. Marple and Talwani (2000) (Reference 338) provide additional evidence for the existence of the southern section of the ECFS, including seismic reflection data, linear aeromagnetic anomalies, exposed Plio-Pleistocene faults, local breccias, and upwarped strata. Because most of the geomorphic anomalies associated with the southern section of the ECFS are in late Pleistocene sediments, Marple and Talwani (2000) speculate that the fault has been active in the past 130 to 10 ka, and perhaps remains active. Wildermuth and Talwani (2001) (Reference 339) use gravity and topographic data to postulate the existence of a pull-apart basin between the southern and central sections of the ECFS, implying a component of right-lateral slip on the fault. Wheeler (2005) (Reference 311) classifies the ECFS as a Class C feature based on the lack of demonstrable evidence that the ECFS has or can generate strong ground motion and the lack of any demonstrable evidence for any sudden uplift anywhere along the proposed fault.

- Adams Run Fault. Weems and Lewis (2002) (Reference 340) postulate the existence of the Adams Run fault on the basis of microseismicity and borehole data. Their interpretation of borehole data suggests the presence of areas of uplift and subsidence separated by the inferred fault. However, review of these data shows that the pattern of uplift and subsidence does not appear to persist through time (i.e., successive stratigraphic layers) in the same locations and that the intervening structural lows between the proposed uplifts are highly suggestive of erosion along ancient river channels. In addition, there is no geomorphic evidence for the existence of the Adams Run fault, and analysis of

microseismicity in the vicinity of the proposed Adams Run fault does not clearly define a discrete structure (Figure 2.5.1-217). Marple and Miller (Reference 450) call into question the existence of the Adams Run fault.

• Ashley River Fault. Talwani (1982) (Reference 331) identifies the Ashley River fault on the basis of a northwest-oriented, linear zone of seismicity located about 6 mi. west of Woodstock, South Carolina, in the meizoseismal area of the 1886 Charleston earthquake. The postulated Ashley River fault, a southwest-side-up reverse fault, is thought to offset the north-northeast-striking Woodstock fault about 3 to 4 mi. to the northwest near Summerville (References 331, 332, and 340), although revised depictions indicate that it is an aseismic structure extending only southeastward from the northern end of the southern segment of the Woodstock fault (References 443 and 444) (Figure 2.5.1-217).

• Charleston Fault. Lennon (1986) (Reference 341) proposes the Charleston fault on the basis of geologic map relations and subsurface borehole data. Weems and Lewis (2002) (Reference 340) suggest that the Charleston fault is a major, high-angle reverse fault that has been active at least intermittently in Holocene to modern times. The Charleston fault has no clear geomorphic expression, nor is it clearly defined by microseismicity (Figure 2.5.1-217). Note that Dura-Gomez and Talwani (References 443 and 444) also give the name "Charleston fault" to a different structure located in a stepover zone between segments of the Woodstock Fault (Figure 2.5.1-217).

• Cooke Fault. Behrendt et al. (1981) (Reference 342) and Hamilton et al. (1983) (Reference 343) identify the Cooke fault based on seismic reflection profiles in the meizoseismal area of the 1886 Charleston earthquake. This east-northeast-striking, steeply northwest-dipping fault has a total length of about 6 mi. (References 342 and 343). Marple and Talwani (References 337and 338) reinterpret these data to suggest that the Cooke fault may be part of a longer, more northerly striking fault (i.e., the ZRA of Marple and Talwani [1993] [Reference 337] and the ECFS of Marple and Talwani [2000] [Reference 338]). Crone and Wheeler (2000) (Reference 310) classify the Cooke fault as a Class C feature based on lack of evidence for faulting younger than Eocene.

• Helena Banks Fault Zone. Seismic reflection lines offshore of South Carolina clearly image the Helena Banks fault zone (References 344 and 345). Relevant sources of information regarding the Helena Banks fault zone include:

- In 2002, two magnitude mb3.5 earthquakes (mb 3.5 and 4.4) occurred offshore of South Carolina in the vicinity of the Helena Banks fault zone in an area previously devoid of seismicity.

- Bakun and Hopper (2004) (Reference 333) reinterpret intensity data from the 1886 Charleston earthquake and show that the calculated intensity center is located about 100 mi. offshore from Charleston (although they ultimately conclude that the epicentral location most likely lies onshore in the cluster of seismicity in the Middleton Place –Summerville area).

- Crone and Wheeler (2000) (Reference 310) describe the Helena Banks fault zone as a potential Quaternary tectonic feature (although it is classified as a Class C feature that lacks sufficient evidence to demonstrate Quaternary activity). The occurrence of the 2002 earthquakes and the location of the Bakun and Hopper (2004) (Reference 333) intensity center offshore suggest, at a low probability, that the fault zone could be considered a potentially active fault. If the Helena Banks fault zone is an active source, its length and orientation may explain the distribution of paleoliquefaction features along the South Carolina coast.

• The Helena Banks fault zone is included in the Charleston Regional seismic source configuration. Sawmill Branch Fault. Talwani and Katuna (2004) (Reference 346) postulate the existence of the Sawmill Branch fault on the basis of microseismicity and further speculate that this feature experienced surface rupture in the 1886 earthquake. According to Talwani and Katuna (2004) (Reference 346), this approximately 3-mi.-long, northwest-trending fault, a segment of the larger Ashley River fault, offsets the Woodstock fault in a left-lateral sense. Talwani and Katuna (2004) (Reference 346) use earthquake damage to infer that surface rupture occurred in 1886. Field review of these localities, however, indicates that they are unlikely the direct result of earthquake surface rupture. Features along the banks of the Ashley River (small, discontinuous cracks in a tomb that dates to 1671 AD and displacements [less than 4 in] in the walls of colonial Fort Dorchester) are almost certainly the product of shaking effects as opposed to fault rupture. Moreover, assessment of microseismicity in the vicinity of the proposed Sawmill Branch fault does not clearly define a discrete structure distinct or separate from the larger Ashley River fault (Figure 2.5.1-217). Dura-Gomez and Talwani (References 443 and 444) refine the mapping of the Sawmill Brach fault.

• Dorchester Fault. Bartholomew and Rich (2007) (Reference 451) hypothesized the existence of this northwest-striking fault based upon cracking the walls of colonial Fort Dorchester and seismicity. As stated above, the cracking

at Fort Dorchester is most likely due to shaking rather than fault rupture.

• Summerville Fault. Weems et al. (1997) (Reference 347) postulate the existence of the Summerville fault near Summerville, South Carolina, on the basis of previously located microseismicity. However, there is no geomorphic or borehole evidence for the existence of the Summerville fault. Analysis of microseismicity in the vicinity of the proposed Summerville fault does not clearly define a discrete structure (Figure 2.5.1 217).

• Woodstock Fault. Talwani (1982) (Reference 331) identifies the Woodstock fault, a postulated north-northeast-trending, dextral strike-slip fault, on the basis of a linear zone of seismicity located approximately 6 mi. west of Woodstock, South Carolina, in the meizoseismal area of the 1886 Charleston earthquake. Madabhushi and Talwani (References 348 and 349) use a revised velocity model to relocate Middleton Place–Summerville seismic zone earthquakes. The results of this analysis are used to further refine the location of the postulated Woodstock fault. Talwani (References 332 and 350) subdivides the Woodstock fault into two segments that are offset in a left-lateral sense across the northwest-trending Ashley River fault, and later maps the Charleston, Lincolnville, and Sawmill Branch faults in this contractional stepover (References 443 and 444) (Figure 2.5.1-217). However, others feel a bend in the Woodstock fault is a more likely geometry than an offset (Reference 443). Marple and Talwani include the Woodstock fault as part of their larger ZRA (Reference 337) and ECFS (Reference 338).

Charleston Area Seismic Zones. Three zones of increased seismic activity have been identified in the greater Charleston area. These include the Middleton Place Summerville, Bowman, and Adams Run seismic zones. Each of these features is described in detail below, and the specifics of the seismicity catalog are discussed in Subsections 2 5.2.2.4.1 and 2.5.2.3.

• Middleton Place–Summerville Seismic Zone. The Middleton Place–Summerville seismic zone is an area of elevated microseismic activity located about 12 mi. northwest of Charleston (References 346, 349, 351, and 352) (Figure 2.5.1-216). Between 1980 and 1991, 58 events with Md 0.8 to 3.3 were recorded in a 7- by 9-mi. area, with hypocentral depths ranging from about 1 to 7 mi. (Reference 349). The elevated seismic activity of the Middleton Place–Summerville seismic zone has been attributed to stress concentrations associated with the intersection of the Ashley River and Woodstock faults (References 331, 346, 349, and 353). Persistent foreshock activity was reported in the Middleton Place–Summerville seismic zone area (Reference 355), and it is speculated that the 1886 Charleston earthquake occurred within this zone (e.g., References 331, 333, and 351).

• Bowman Seismic Zone. The Bowman seismic zone is located about 50 mi. northwest of Charleston, South Carolina, outside of the meizoseismal area of the 1886 Charleston earthquake (Figure 2.5.1-216). The Bowman seismic zone is identified on the basis of a series of local Magnitude (ML) $3<ML<4$ earthquakes that occurred between 1971 and 1974 (References 352 and 354).

• Adams Run Seismic Zone. The Adams Run seismic zone, located within the meizoseismal area of the 1886 Charleston earthquake, is identified on the basis of four $M < 2.5$ earthquakes, three of which occurred in a 2-day period in December 1977 (Reference 351). Bollinger et al. (1991) (Reference 352) downplay the significance of the Adams Run seismic zone, noting that, in spite of increased instrumentation, no additional events were detected after October 1979. Magnitudes of the earthquakes in the Adams Run seismic zone (coda magnitudes [Mc] < 2.3) are too small to appear in the CEUS SSC earthquake catalog.

Charleston Area Seismically Induced Liquefaction Features. The presence of liquefaction features in the geologic record may be indicative of past earthquake activity in a region. Liquefaction features are recognized throughout coastal South Carolina and are attributed to both the 1886 Charleston and earlier moderate to large earthquakes in the region.

• 1886 Charleston Earthquake Liquefaction Features. Liquefaction features produced by the 1886 Charleston earthquake are most heavily concentrated in the meizoseismal area (References 334, 355, and 356), but are reported as far away as Columbia, Allendale, Georgetown (Reference 356) and Bluffton, South Carolina (Reference 357) (Figures 2.5.1-215 and 2.5.1-216).

• Paleoliquefaction Features in Coastal South Carolina. Liquefaction features predating the 1886 Charleston earthquake are found throughout coastal South Carolina (Figures 2.5.1-215 and 2.5.1-216). The spatial distribution and ages of paleoliquefaction features in coastal South Carolina constrain possible locations and recurrence rates for large earthquakes (References 334, 335, 336, 358, and 359). The CEUS SSC project developed a list of 3 to 5 possible prehistoric events, going back up to 5500 years BP identified by various authors (Reference 441).

					Geotechnical studies in the Charleston, South Carolina area suggest that magnitudes of prehistorical large earthquakes were in the high-5 to high-7 range (e.g., References 452, 453, 454, and 455).	
11811	WLS	Pt 02	FSAR 02	02.05.01.01.03.02.01	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.3.2.1, Sawmill Branch Fault bullet, last sentence is revised to replace Sawmill Brach fault with Sawmill Branch fault.	Editorial correction to Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A435)
11668	WLS	Pt 02	FSAR 02	02.05.01.01.03.02.02	COLA Part 2, FSAR Chapter 2. Subsection 2.5.1.1.3.2.2 is revised as follows: The Eastern Tennessee Seismic Zone (ETSZ) is one of the most active seismic zones in eastern North America in terms of the rate of small (i.e., M<5) earthquakes. The ETSZ is located in the Valley and Ridge province of eastern Tennessee, approximately 150 mi. west-northwest of the Lee Nuclear Site (Figure 2.5.1-214). The ETSZ is about 185 mi. long and 60 mi. wide and has not produced a damaging earthquake in historical time (Reference 362). Earthquakes in the ETSZ are occurring at depths from 3 to 16 mi. within Precambrian crystalline basement rocks buried beneath the exposed thrust sheets of Paleozoic rocks. The mean focal depth within the seismic zone is 9 mi., well below the Appalachian basal decollement's maximum depth of 3 mi. (Reference 362). The lack of seismicity in the shallow Appalachian thrust sheets implies that the seismogenic structures in the ETSZ are unrelated to the surface geology of the Appalachian orogen (Reference 292). The majority of earthquake focal mechanisms show right-lateral slip on northerly-striking planes or left-lateral slip on easterly-striking planes (Reference 364). A smaller number of focal plane solutions show right-lateral motion on northeasterly trending planes that parallel the overall trend of seismicity (Reference 363). Statistical analyses of focal mechanisms and epicenter locations suggest that seismicity is occurring on a series of northeast-striking en-echelon basement faults intersected by several east-west-striking faults (Reference 364). Potential structures most likely responsible for the seismicity in Eastern Tennessee are reactivated Cambrian or Precambrian normal faults formed during the rifting that formed the Iapetan Ocean and presently located beneath the Appalachian thrust sheets (Reference 267). Earthquakes within the ETSZ cannot be attributed to known surface faults (Reference 362), and no capable tectonic sources are identified within the seismic zone. However, the seismicity is spatially associated with major geophysical lineaments or anomalies (References 290, 362, 352, 363). The western margin of the ETSZ is sharply defined and is coincident with the prominent gradient in the magnetic field defined by the New York-Alabama magnetic lineament (Reference 363). Powell et al. (Reference 362) proposed that the ETSZ is an evolving seismic zone in which slip on north- and east-striking surfaces coalesces into a larger strike-slip zone located near the northwestern boundary of the relatively weak Ocoee block in eastern Tennessee. Powell et al (Reference 362) also noted that the densest seismicity and the largest of the instrumentally located epicenters in the ETSZ generally lie close to and east of the New York-Alabama lineament between latitudes 34.3 °N and 36.5°N. In spite of the observations of small to moderate earthquakes in the ETSZ, recent studies had found no geological evidence, such as paleoliquefaction, that demonstrated the occurrence of prehistoric earthquakes larger than any historical shocks within the seismic zone (References 311, 363 and 456). As a result, Wheeler (2005) (Reference 311) classifies the ETSZ as a Class C feature for lack of geological evidence of large earthquakes. The CEUS SSC project did not delineate the ETSZ as a RLME source and relied upon the spatial smoothing of a- and b-values to account for elevated seismicity (Reference 441). The ETSZ is located within the Paleozoic Extended Crust (PEZ) seismotectonic zone, which was separated on the basis of Mmax and future earthquake characteristics. However, very recent work has suggested that there may be a pre-historical record of larger earthquakes on the ETSZ. Hatcher et al. (2012) investigated the ETSZ and possible paleoliquefaction features (Reference 457). In this study, French Broad River terraces were inspected along Douglas Reservoir near Dandridge Tennessee. The soils and terraces exposed range from more than 200 ka (T4) to as young as 10 ka (T1) and bear a variety of small-displacement faults, fractures, and possible seismogenic features such as clastic dikes, fluidized alluvium and sand boils. Cross-cutting relationships indicate that at least two sesimogenic events may have been responsible for the deformation observed along the shores of Douglas Reservoir. However, because of poor age limits on soils cut by fractures, the ages of the structures observed remain poorly defined and no recurrence intervals could be estimated (Reference 457). Nonetheless, Hatcher et al (Reference 457) conclude that one or more M 6.5 earthquakes could be associated with the ETSZ within the last 73 to approximately 200 ka.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)

					While these recent studies strengthen the argument that the ETSZ has experienced at least one moderate-sized earthquake in the late Quaternary, they do not quantify parameters (e.g., recurrence interval, magnitude) necessary to demonstrate that the ETSZ produces repeating large-magnitude events. As such, the ETSZ is modeled within the Mesozoic-and-younger extended crust (MESE) Mmax zone and the PEZ seismotectonic zone using smooth seismicity. No RLME source is defined for the eastern Tennessee seismic zone in the CEUS SSC.	
11629	WLS	Pt 02	FSAR 02	02.05.01.01.03.02.03	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.3.2.3, paragraphs 1 – 6 are revised to replace "Giles County seismic zone" with the acronym "GCVSZ" (9 instances)	Editorial
11669	WLS	Pt 02	FSAR 02	02.05.01.01.03.02.03	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.3.2.3, last paragraph is revised as follows: Because the seismicity associated with the GCVSZ is located at depth beneath the Appalachian detachment surface, it, like the ETZS, is located in the Paleozoic Extended Crust sesimotectonic zone in the CEUS SSC model (Reference 441).	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11670	WLS	Pt 02	FSAR 02	02.05.01.01.03.02.04	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.3.2.4, second paragraph under the subheading "New Madrid Seismic Zone" is revised as follows: The New Madrid seismic zone is approximately 125 mi. long and 25 mi. wide. Research conducted since 1986 identifies three distinct fault segments embedded within the seismic zone. These three fault segments include a southern northeast-trending dextral slip fault, a middle northwest-trending reverse fault, and a northern northeast-trending dextral strike-slip fault (Reference 373) referred to as the New Madrid fault system in the CEUS SSC. In the current east-northeast to west-southwest directed CEUS regional stress field, Precambrian and Late Cretaceous age extensional structures of the Reelfoot rift appear to be reactivated as right-lateral strike-slip and reverse faults.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11671	WLS	Pt 02	FSAR 02	02.05.01.01.03.02.04	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.1.3.2.4, beginning with the fifth paragraph under the subheading "New Madrid Seismic Zone" through the end of the subsection, is revised as follows: Because there is very little surface expression of faults within the New Madrid seismic zone, earthquake recurrence estimates are based largely on dates of paleoliquefaction and offset geological features. The most recent summaries of paleoseismologic data (References 379, 380, 381 and 458) suggest a mean recurrence time of 500 years, which was used in the 2002 USGS model (Reference 360). Paleoseismic studies have suggested the seismic activity of the New Madrid Fault System source since the Holocene may not be indicative of the long-term recurrence rate (CEUS SSC) (Reference 441) and (Holbrook et al 2006) (Reference 458). Models of temporal clustering used to account for this uncertainty and other uncertainties associated with the paleoliquefaction record and recurrence are also accounted for in the New Madrid source characterization presented in Subsection 2.5.2Central Virginia Seismic Zone. CVSZ is an area of persistent, low-level seismicity in the Piedmont province, located more than 250 mi. from the Lee Nuclear Site (Figure 2.5.1-214). The zone extends about 75 mi. in a north-south direction and about 90 mi. in an east-west direction from Richmond to Lynchburg, Virginia (Reference 382). The largest historical earthquake that has occurred in the CVSZ is the magnitude (Mw) 5.8 event on August 23, 2011 near the town of Mineral, in Louisa County, Virginia (Reference 462). The Mineral earthquake may prove to be illuminating about the seismicity in this area, but current research on this earthquake is somewhat preliminary and only now beginning to be published in peer-reviewed journals (e.g., References 459, 460, 461). The most recent information indicates that the Mineral event occurred on a plane striking N28-30°E and dipping 45-51°SE, but not associated with a previously mapped fault (Reference 459). Seismicity in the CVSZ ranges in depth from about 2 to 8 mi. (Reference 383) with a mean depth at 5 mi. (Reference 352). Coruh et al. (1988) (Reference 384) suggest that seismicity in the central and western parts of the zone may be associated with west-dipping reflectors that form the roof of a detached antiform, while seismicity in the eastern part of the zone near Richmond may be related to a near-vertical diabase dike swarm of Mesozoic age. However, given the depth distribution of 2 to 8 mi. (Reference 383) and broad spatial distribution, it is difficult to uniquely attribute the seismicity to any known geologic structure. The relatively shallow depth of seismicity compared to the basal Appalachian detachment (References 384 and 352), indicates that the CVSZ seismicity occurs on the Paleozoic and Mesozoic faults that lie above the Precambrian basement (Reference 441). No capable faults or structures are identified within the CVSZ. Two paleoliquefaction sites are identified within the	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)

					seismic zone (References 310 and 385), but the relative paucity of paleoliquefaction features along the coastlines and riverways of Virginia make it unlikely that the CVSZ has produced a M>7 earthquake in the last 5,000 years (Reference 385). The seismicity of the CVSZ in encompassed in the ECC-AM sesimotectonic zone (Reference 441).	
11630	WLS	Pt 02	FSAR 02	02.05.01.02.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.2.2, ninth paragraph, second to last sentence is revised to read: In any case, in addition to the Concord suite plutons, the record for Devonian tectonothermal activity in the Charlotte terrane is confined to the GHSHSZ.	Editorial
10634	WLS	Pt 02	FSAR 02	02.05.01.02.03	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.2.3 is revised to correct the citation of figures with the 'a' designation in the second sentence as follows: 'There is disagreement, however as to whether the rock mass mapped at the site (map unit "Zto" on Figures 2.5.1-218a through 2.5.1-220) belongs to the Battleground Formation.	Editorial
10635	WLS	Pt 02	FSAR 02	02.05.01.02.03.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.2.3.2 is revised to correct the citation of figures with the 'a' designation in the second sentence as follows: 'The site is underlain by a metamorphosed plutonic rock mass, shown on Figures 2.5.1-218a through 2.5.1-220, 2.5.1-224, and 2.5.1-229 as rock mass Zto.	Editorial
11672	WLS	Pt 02	FSAR 02	02.05.01.02.05.04	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.2.5.4, first paragraph, first sentence, is revised as follows: As in the site vicinity, the major control on geologic trends in the country rock and map patterns are foliations and folding due to the D2 deformation. However, the intrusive metagranodiorite-diorite pluton is massive in nature and locally contains discrete zones expressed as joints, fractures and shear/breccia zones. These features are discussed in detail below.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11673	WLS	Pt 02	FSAR 02	02.05.01.02.07	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.2.7, first, second and third paragraphs are revised as follows: The largest earthquake within 25 mi. of the Lee Nuclear Site included in the updated CEUS SSC seismicity catalog is an E[M] 4.13 event that occurred in 1886. The highest recorded shaking intensities estimated for the Lee Nuclear Site resulted from earthquakes located outside of the site area. The August 31, 1886, Charleston, South Carolina, earthquake is one of the largest historical earthquakes in the eastern United States. The event produced Modified Mercalli Intensity (MMI) X shaking in the epicentral area (Reference 395). Maximum MMI shaking intensity at the Lee Nuclear Site is estimated at approximately VI (Figure 2.5.1-215). The Charleston earthquake is discussed in greater detail in Subsections 2.5.1.1.3.2.1 and 2.5.2.3. The January 1, 1913 E[M] 4.54 Union County, South Carolina earthquake (Reference 441) was felt over an area of approximately 43,000 square mi., with an estimated Rossi-Forel shaking intensity VIII (Reference 396, as reported in Reference 397). Rossi-Forel shaking intensity at the Lee Nuclear Site is estimated at approximately VI (Reference 396, as reported in Reference 397) (Figure 2.5.1 232). The epicenter of the Union County earthquake is poorly located and the fault on which this earthquake occurred has not been identified.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11674	WLS	Pt 02	FSAR 02	02.05.01.03	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.3, References are removed as follows: References 269. Removed 361. Removed 365. Removed 366. Removed 367. Removed 368. Removed 369. Removed	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11675	WLS	Pt 02	FSAR 02	02.05.01.03	COLA Part 2, FSAR Chapter 2, Subsection 2.5.1.3, References are added as follows: 438) Dennis, Allen J., Shervais, John W., LaPoint, Dennis, "Geology of the Ediacaran-Middle Cambrian Rocks of Western Carolina in South Carolina," The Geological Society of America Field Guide 29, p. 303-325, 2012.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure

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11676	WLS	Pt 02	FSAR 02	02.05.01.F / F2.5.1-207	COLA Part 2, FSAR Chapter 2, FSAR Figure 2.5.1-207 is revised as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 3.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11677	WLS	Pt 02	FSAR 02	02.05.01.F / F2.5.1-210	COLA Part 2, FSAR Chapter 2, FSAR Figure 2.5.1-210 is revised as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 3.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11678	WLS	Pt 02	FSAR 02	02.05.01.F / F2.5.1-211	COLA Part 2, FSAR Chapter 2, FSAR Figure 2.5.1-211 is revised as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 3.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11679	WLS	Pt 02	FSAR 02	02.05.01.F / F2.5.1-214	COLA Part 2, FSAR Chapter 2, FSAR Figure 2.5.1-214 is revised as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 3.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)

11680	WLS	Pt 02	FSAR 02	02.05.01.F / F2.5.1-215	COLA Part 2. FSAR Chapter 2, FSAR Figure 2.5.1-215 is revised as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2. Attachment 3.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1. Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11681	WLS	Pt 02	FSAR 02	02.05.01.F / F2.5.1-216	COLA Part 2. FSAR Chapter 2. FSAR Figure 2.5.1-216 is revised as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 3.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2. Attachment 3. WLG2014.01-02 (ML14064A435)
11682	WLS	Pt 02	FSAR 02	02.05.01.F / F2.5.1-217	COLA Part 2, FSAR Chapter 2. FSAR Figure 2.5.1-217 is revised as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1. Enclosure 2, Attachment 3.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11635	WLS	Pt 02	FSAR 02	02.05.01.F / F2.5.1-231 F2.5.1-236 F2.5.1-237 F2.5.1-238 F2.5.1-239 F2.5.1-240 F2.5.1-241 F2.5.1-242 F2.5.1-243 F2.5.1-244	COLA Part 2. FSAR Chapter 2. Figures are revised to correct numbering from "2.5-1-XXX" to "2.5.1-XXX" for the following figures: Figure 2.5.1-231 Figure 2.5.1-236 Figure 2.5.1-237 Figure 2.5.1-238 Figure 2.5.1-239 Figure 2.5.1-240 Figure 2.5.1-241 Figure 2.5.1-242 Figure 2.5.1-243 Figure 2.5.1-244	Editorial
11683	WLS	Pt 02	FSAR 02	02.05.01.F / F2.5.1-232	COLA Part 2, FSAR Chapter 2, FSAR Figure 2.5.1-232 is revised as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 3.	Duke Energy Supplemental Response 3 to RAI LTR 105. RAI 01.05-1. Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11684	WLS	Pt 02	FSAR 02	02.05.01.F / F2.5.1-245	COLA Part 2. FSAR Chapter 2, FSAR Figure 2.5.1-245 is added as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2. Attachment 3.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11685	WLS	Pt 02	FSAR 02	02.05.01.F / F2.5.1-246	COLA Part 2. FSAR Chapter 2, FSAR Figure 2.5.1-246 is added as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 3.	Duke Energy Supplemental

						Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.01-02 (ML14064A435)
11706	WLS	Pt 02	FSAR 02	02.05.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2, third paragraph is revised as follows: RG 1.208 provides guidance on methods acceptable to the NRC to satisfy the requirements of the seismic and geologic regulation, 10 CFR 100.23, for assessing the appropriate Safe Shutdown Earthquake (SSE) ground motion levels for new nuclear power plants. RG 1.208 states that an acceptable starting point for this assessment at sites in the Central and Eastern United States (CEUS) is the PSHA conducted by the EPRI-SOG in the 1980s (References 201, 203, and 207). However, that has now been supplanted by the recent EPRI CEUS SSC model, detailed in NUREG 2115, which was created to provide a regionally consistent model of seismic hazard for nuclear facilities throughout the central and eastern United States (Reference 326). Subsection 2.5.2 takes this most recent CEUS SSC as the starting point for the Lee Nuclear site PSHA, but adding detail and updated data as necessary.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A435)
11707	WLS	Pt 02	FSAR 02	02.05.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2, fourth paragraph is revised with a new first sentence as follows: Subsection 2.5.2.4 describes the PSHA calculation for a base case rock seismic hazard.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A435)
11708	WLS	Pt 02	FSAR 02	02.05.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2, sixth paragraph, first sentence is revised as follows: Subsections 2.5.2.1 through 2.5.2.4 document the review and update of the available EPRI CEUS seismicity, seismic source, and ground motion models.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A435)
11709	WLS	Pt 02	FSAR 02	02.05.02.01	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.1, first paragraph is revised and the second paragraph is removed as follows: The Lee Nuclear site region (Figure 2.5.2-248) is located within the CEUS SSC project study region (Figure 2.5.2-249). The CEUS SSC relied upon a complete, declustered earthquake catalog with uniform magnitude measures for each event to analyze historical seismicity in the CEUS and determine appropriate recurrence models for seismic source zones. The historical earthquake catalog used in the EPRI CEUS SSC analysis is complete through 2008 (Reference 326).	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A435)
11710	WLS	Pt 02	FSAR 02	02.05.02.01.01	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.1.1 is revised as follows: 2.5.2.1.1 Seismicity Catalog Used for 2012 CEUS SSC Project The seismicity catalog used in the CEUS SSC (NUREG 2115) extends from the longitude of the Rocky Mountain foothills (105°W) in the west to 200 mi offshore of the Atlantic coastline to the east (Reference 326). The northern and southern boundaries extend a minimum of 200 mi into Canada or into the Gulf of Mexico (Figure 2.5.2-249). The CEUS catalog is assumed to be complete throughout the historical record to the time of the catalog compilation (December 31, 2008) in that all instrumental earthquakes and significant historical earthquakes are included. In addition, the catalog applies uniform size measure to each earthquake, moment magnitude M (see Section 3.3.2 of NUREG 2115 for conversion procedures) and only includes main events of earthquake clusters (i.e., the catalog is declustered). RG 1.206 states that a COL applicant shall "provide a complete list of all historically reported earthquakes that could have reasonably affected the region surrounding the site, including all earthquakes of Modified Mercalli intensity greater than or equal to IV or of magnitude greater than or equal to 3.0 that have been reported within 200 miles of	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A435)

					the site." The CEUS SSC catalog provides this information through 2008 for the Lee Nuclear site region (Figure 2.5.2-248).	
11711	WLS	Pt 02	FSAR 02	02.05.02.01.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.1.2 is revised as follows: 2.5.2.1.2 Recent and Historical Seismicity The CEUS SSC seismicity catalog described in Subsection 2.5.2.1.1 is shown in Figures 2.5.2-248, 2.5.2-249, and 2.5.1-210. Since the compilation of this catalog, the August 23, 2011 earthquake that occurred near Mineral, VA is arguably the most (or only) significant earthquake in the CEUS region since the completion of the CEUS SSC catalog. The epicenter was located approximately 280 mi. from the Lee Nuclear site. Although located outside the Lee Nuclear site region, this earthquake is discussed as part of the discussion of the Central Virginia seismic zone (Subsection 2.5.1.1.3.2.4) and in the source characterization below (Subsection 2.5.2.2.5.2). The largest historical earthquake in the eastern U.S. occurred in Charleston, South Carolina on August 31,1886. The earthquake produced modified Mercalli intensity (MMI) X shaking in the epicentral area near Charleston and was felt as far away as Chicago (Reference 231). Maximum MMI shaking intensity at the Lee Nuclear site from this event is estimated at approximately VI (Figure 2.5.1-215). Estimates of the magnitude of this earthquake are based on liquefaction data and isoseismal area regressions, and vary from the high-6 to mid-7 range, and the CEUS SSC catalog assigns it an E[M] of 6.90 (Reference 326). Another significant historical earthquake located near the site was the January 1, 1913 E[M] 4.54 Union County, South Carolina earthquake, located just outside the site vicinity (Figure 2.5.1-210). This event was felt over an area of approximately 43,000 square mi, with an estimated Rossi-Forel shaking intensity VIII (Reference 327). Rossi Forel shaking from this event for the Lee Nuclear site is estimated at approximately VI (Figure 2.5.1-232). The epicenter of the Union County earthquake is poorly located and the fault on which this earthquake occurred has not been identified. The largest earthquake within 25 mi. of the Lee Nuclear Site included in the updated CEUS SSC earthquake catalog is the 1886 E[M] 4.13 Event.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A435)
11712	WLS	Pt 02	FSAR 02	02.05.02.01.03	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.1.3, eighth paragraph is revised as follows: Consequently, available information indicates that any RIS that might be associated with Make-Up Pond C operating parameters would likely have a maximum RIS magnitude of M < 4 and is unlikely to have a maximum magnitude of M greater than or equal to 5. The current short-period design is controlled by a local M 6.0-6.2 as described in Subsection 2.5.2.4.2. There is no observed precedent for M > 5 RIS associated with reservoirs located in low seismicity rate metamorphic terranes.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A435)
11713	WLS	Pt 02	FSAR 02	02.05.02.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.2 is revised in its entirety as follows: 2.5.2.2 Geologic and Tectonic Characterizations of the Site and Region This subsection describes the new SSC for the CEUS, and the sources within the CEUS-SSC model that are used in the PSHA for the Lee Nuclear Site. As described in Subsection 2.5.1, a comprehensive review of available geological, seismological, and geophysical data has been performed for the Lee Nuclear Site region and adjoining areas. Subsection 2.5.1.1.1 describes regional physiography, geomorphology, and stratigraphy. Subsection 2.5.1.1.2 describes regional tectonic setting, including stress regimes and tectonic structures. As discussed in RG 1.208, the seismic sources used in a PSHA study may be identified based on existing databases and models, with the provision that new information relevant to a seismic source must be evaluated and incorporated as appropriate (Subsection 2.5.2.4). The starting point for the Lee Nuclear Site PSHA is the regional seismic source model developed by the Central and Eastern United States CEUS SSC Project, which was published in 2012 (Reference 326). The CEUS SSC model is the most recent seismic source characterization specifically designed for PSHAs for nuclear facilities, replacing the EPRI SOG model (Reference 201) and the Lawrence Livermore National Laboratory model (Reference 328). The CEUS SSC model (Reference 326) also incorporates new data gathered during the most recent iteration of the National Seismic Hazard Mapping Project (NSHMP) (Reference 329). The CEUS SSC model (Reference 326) was developed using SSHAC Study Level 3 methodology (References 330, 331, and 332), ensuring that uncertainty is represented in a manner consistent with NRC regulatory guidance. Toward this end, scientists involved in the development of the NSHMP, the most recent regional seismic source characterization at the time, were included in the evaluation process of the CEUS SSC model (Reference 326).	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A435) (ML14064A436)

2.5.2.2.1 Overview of CEUS SSC

The CEUS SSC model was created to provide a regionally consistent model of seismic hazard for nuclear facilities throughout the central and eastern United States. The CEUS SSC model focuses on regionally significant elements, with the understanding that site-specific PSHAs would need to refine the CEUS SSC model with site-specific and updated data as necessary.

In the CEUS SSC model, the spatial and temporal distribution of future earthquakes is modeled by two types of seismic sources. The first type is a distributed seismicity source, which is based on observed seismicity. These sources cover the entire CEUS region. The second type is a RLME source, which is based on the paleo- and historical earthquake record, and requires evidence of previous earthquakes with M greater than or equal to 6.5. By definition, RLME sources are the locations of repeated (more than one) large-magnitude (M greater than or equal to 6.5) earthquakes in the historical or paleoearthquake record.The RLME sources cover the much more localized phenomenon of repeated large magnitude earthquakes at specific locations. While notably considering distinct tectonic characteristics, the CEUS SSC model places less importance on specific discrete or localized tectonic features, which were emphasized in the older EPRI-SOG model.

Distributed seismicity sources are defined in the CEUS SSC model according to two conceptual approaches (Figure 2.5.2-250). The first approach smoothly varies seismicity rates throughout the entire CEUS; distributed seismicity sources are only differentiated by maximum magnitude (Mmax) potential. These sources are modeled as "Mmax Zones" (Subsection 2.5.2.2.2). Figure 2.5.2-249 shows the locations and extents of the Mmax zones and Figure 2.5.2-251 shows the logic tree for the Mmax zones. The second approach to distributed seismicity sources considers a wider array of seismotectonic properties in order to define distributed seismicity sources. These sources are modeled as "Seismotectonic Zones" (Subsection 2.5.2.2.3). Figures 2.5.2-252 and 2.5.2-253 show the location and extent of the seismotectonic zones and Figures 2.5.2-254a and 2.5.2-254b show the logic tree for the seismotectonic zones. In each model alternative, RLME sources are independently assessed and added to the hazard of the distributed seismicity sources (Subsections 2.5.2.2.2 and 2.5.2.2.3). Subsection 2.5.2.2.4 provides additional discussion of the RLME sources.

Table 2.5.2-227 lists all distributed seismic sources defined in the CEUS SSC model (Reference 326) (Figures 2.5.2-249, 2.5.2-252, and 2.5.2-253) and Table 2.5.2-228 provides a list of seismotectonic zones as they correspond (spatially) to the larger Mmax zones. Figure 2.5.2-255 shows the locations of all RLME sources in the CEUS SSC model (Reference 326).

2.5.2.2.1.1 CEUS SSC Methodology.

The CEUS SSC model was created following SSHAC Level 3 guidelines (References 330, 331, and 332), ensuring that uncertainty is represented in a manner consistent with NRC regulatory guidance (RG 1.208). The SSHAC process calls for a Technical Integration (TI) Team, headed by a TI Lead, to evaluate and integrate all available data, models, and methods into the hazard model. These evaluation and integration steps are performed with the aid of the informed technical community, members of which serve as resource and proponent experts for the TI Team. Technical assessment and regulatory adherence is reviewed throughout the course of the project by the Participatory Peer Review Panel (PPRP). The intended result of the SSHAC process is to create a hazard model that represents the center, body, and range of technically defensible interpretations of the informed technical community.

As stated above, the CEUS SSC model accounts for the likely spatial and temporal distribution of future earthquakes using observed seismicity and the paleoearthquake record. Specifically, the model depends on the theory that the spatial pattern of small- to moderate-magnitude earthquakes is indicative of the future locations of moderate- to large-magnitude earthquakes. This idea is generally accepted by the scientific community, and thus forms the basis for the spatial model of distributed seismicity sources in the CEUS SSC model. Similarly, the average rate and aperiodicity of future earthquakes is also governed by the temporal distribution of earthquakes in the instrumental and historical catalog.

2.5.2.2.1.2 CEUS SSC Earthquake Recurrence Rate

The earthquake recurrence rate within each distributed seismicity source is assessed by dividing each source into a number of ¼° to ½° cells. The rate and b-value (recurrence parameter) in each cell is calculated using the likelihood function of the data in that cell (which addresses catalog completeness), along with penalty functions that smooth out large variations in rate and b-value between cells. Earthquakes associated with RLME sources are excluded from

these calculations. The full earthquake recurrence calculation in each zone produces the following results:

- The recurrence rate of earthquakes of moment magnitude (M)>m0 (where m0=2.9 is the lowest magnitude considered in the recurrence analysis) per equatorial degree

- The b-value, expressed in log base-10 units

- The area of each cell in equatorial degrees

This is a simplified overview of the method for calculating and smoothing earthquake recurrence rates in distributed seismicity sources. A complete discussion of the smoothing approach is provided in the CEUS SSC report, Section 5.3.2 (Reference 326).

The calculation of earthquake recurrence rates in RLME sources is more straightforward, since RLME sources tend to have a more narrowly defined Mmax distribution and geographical extent. Earthquake occurrence rates for RLME sources are based on data in the paleo and historical earthquake record, and modeled using either a Poisson model or a renewal model. In the Poisson model, the time between RLME earthquakes is modeled by an exponential distribution with a standard deviation that equals the mean earthquake recurrence interval. This model is favored for RLME sources that exhibit a higher degree of aperiodic RLME occurrence. The renewal model is better suited to RLME sources in which RLME earthquakes appear to be more periodic. The time between RLME earthquakes in this model is based on the Brownian Passage Time (BPT) model, which represents the physical process of strain buildup and release (References 238 and 239). Full details related to the estimation of earthquake recurrence in RLME sources is provided in Section 5.3.3 of the CEUS SSC report (Reference 326).

2.5.2.2.1.3 CEUS SSC Maximum Magnitude

The maximum magnitude (Mmax) potential in the CEUS SSC distributed seismicity sources is assessed through two alternative approaches, a Bayesian approach and one from Kijko (2004) (Reference 333). In the Bayesian approach, a prior Mmax distribution (or, in some cases, two prior Mmax distributions) is determined by comparison of each respective seismic source with analogous world-wide stable continental regions (SCR) (Reference 269). This prior distribution is then updated based on site-specific observations; the updated prior distribution is called a likelihood function. The prior distribution and the likelihood function are convolved to create a posterior Mmax distribution for use in the hazard analysis, truncated at M5.5 and M8.25.

In the Kijko (Reference 333) approach, Mmax is based solely on the observed seismicity. The CEUS SSC model utilizes two weighted alternatives from Kijko (2004): the K-S estimator, which is a truncated exponential distribution, and the K-S-B estimator, which includes uncertainty in the b-value. Kijko (Reference 333) also includes a third estimator for Mmax. This third estimator, however, is not included in the CEUS SSC as a weighted alternative for the distributed seismicity sources since it is based on characteristic earthquake behavior. Earthquakes of this type are modeled by RLME sources in the CEUS SSC, as described below. Mmax distributions computed according to the Kijko (Reference 333) approach are truncated at M5.5 and M8.25. A complete description of the process for assessing Mmax is provided in the CEUS SSC report, Section 5.2 (Reference 326).

Whereas the instrumental and historical record of small-to-moderate earthquakes is used to determine hazard in the distributed seismicity sources, historical and prehistorical data in some places point to the repeated occurrence of large-magnitude (M greater than or equal to 6.5) earthquakes Where data are sufficient, these zones are modeled as RLME sources, and earthquakes associated with these zones are excluded from the calculation of Mmax in the host distributed seismicity source. The distribution of magnitudes used to model the characteristic earthquake size in RLME sources is narrower than that in the distributed seismicity sources, and is based on the amount and quality of data available for each RLME.

2.5.2.2.2 CEUS SSC Mmax Zones Included in the Lee Nuclear Site PSHA

In the CEUS SSC model, Mmax zones are sources of distributed seismicity defined solely by differences in potential maximum earthquake magnitude. Based on a statistical analysis of the global stable continental regions (SCR) database (References 269 and 334), alternative sets of Mmax zones are considered in the CEUS SSC. In the first alternative, which is given a slightly stronger weight, the eastern U.S. is divided into two zones of unique prior Mmax distributions, based upon areas that exhibit Mesozoic-and-younger extension (detailed in Subsection 2.5.2.2.2.1). In the second alternative, the seismic hazard of the entire CEUS region is modeled as a single Mmax zone with a single prior distribution, called Study Region (described in Subsection 2.5.2.2.2.3). In both alternatives, Mmax and

recurrence are determined according to the methods described in Subsection 2.5.2.2.1.1. The full logic tree for the Mmax zones model alternative is shown in Figure 2.5.2-251.

All Mmax zones defined in the CEUS SSC model (Reference 326) are included in the hazard calculation for the Lee Nuclear site, truncated at a distance from the site of approximately 520 km (Figure 2.5.2-249, Figure 2.5.2-256). The maximum magnitude distributions for the Mmax zones are described in Table 2.5.2-229 and the default characteristics for future earthquakes in the CEUS are described in Table 2.5.2-230.

2.5.2.2.2.1 Mesozoic and Younger Extended Crust (MESE)

As discussed in Section 2.5.1, rifting of the African and North American plates created a series of Mesozoic basins trending parallel to the Appalachian orogenic belt. Those portions of the CEUS exhibiting such Mesozoic-and-younger extension are included in the MESE Mmax zone (Figures 2.5.2-249 and 2.5.2-256).

Although Mesozoic basins are known to exist in the modern-day Piedmont, Blue Ridge, Coastal Plain, and Continental Shelf physiographic provinces, the western termination of Mesozoic extension is poorly constrained. To account for this uncertainty, two alternatives for the MESE Mmax zone are modeled: a "narrow" MESE (MESE-N), which only includes the portion of the CEUS that exhibits clear Mesozoic-and-younger extension, and a "wide" MESE (MESE-W) that extends further west to capture areas of more questionable Mesozoic-and-younger extension (Figure 2.5.2-249). The MESE-N zone is the more heavily weighted alternative due to the fact that evidence supporting this alternative is more technically defensible.

The largest historical earthquake in both the MESE-N and MESE-W zones that is not associated with an RLME source is the 1732 E[M] 6.25 St. Lawrence region earthquake (Reference 326). In the CEUS SSC, the term E[M] is defined as the uniform moment magnitude estimate for a given earthquake, as discussed in Subsection 2.5.2.1.1. Modeled Mmax values and weights for the MESE-N and MESE-W zones are listed in Table 2.5.2-229. A full description of the MESE-N and MESE–W zones is provided in the CEUS SSC report (Reference 326), Sections 6.2, 6.3, and 6.4.

2.5.2.2.2.2 Non-Mesozoic and Younger Extended Crust (NMESE)

The portion of the CEUS that is interpreted to have not experienced Mesozoic-and-younger extension (NMESE) is modeled by the NMESE Mmax zone. As is the case for the MESE, the NMESE is modeled by "narrow" and "wide" alternatives (Figure 2.5.2-251). These alternatives, however, are labeled according to their corresponding MESE zone. The result is that the NMESE-N zone is actually wider than the NMESE-W zone, since the "-N" and "-W" designators for the NMESE refer to the width of the MESE zone (Figures 2.5.2-249 and 2.5.2-256).

The largest historical earthquakes in the NMESE-N and NMESE-W zones that are not associated with an RLME source are, respectively, the 1897 E[M] 5.91 Giles County, Virginia earthquake and the 1909 E[M] 5.72 earthquake of eastern Montana (Reference 326). Modeled Mmax values and weights for the NMESE-N and NMESE-W zones are listed in Table 2.5.2-229. A full description of the NMESE-N and NMESE–W zones is provided in the CEUS SSC report (Reference 326), Sections 6.2, 6.3, and 6.4.

2.5.2.2.2.3 Study Region

The statistical analysis conducted for the CEUS SSC model (Reference 326) concluded that there is only a marginally significant probability the MESE and NMESE could be characterized by unique prior distributions. As such, an alternative model in which the entire study region is treated as a single Mmax zone is labeled as the Study Region zone (Figure 2.5.2-249). This is indicated on the Mmax Zones logic tree as the "No" branch of the "Separation of Mesozoic Extended and Non-extended" node, which is assigned a weight of 0.4 (Figure 2.5.2-251).

The largest historical earthquake attributed to the Study Region Mmax zone that is not associated with an RLME source is the 1732 E[M] 6.25 St. Lawrence region earthquake (Reference 326). Modeled Mmax values and weights for the Study Region zone are listed in Table 2.5.2-229.

2.5.2.2.3 CEUS SSC Seismotectonic Zones Included in the Lee Nuclear Site PSHA

In contrast to the Mmax zones, seismotectonic zones in the CEUS SSC model consider a number of factors, including regional differences in recurrence rates, Mmax, and probability of activity. Each seismotectonic zone is drawn to roughly follow the outline of a major tectonic domain in the CEUS and is characterized by a uniform and

distinct value for one of the above-mentioned factors (with the exception of recurrence rates, which are smoothed as described in Subsection 2.5.2.2.1.2) (Figures 2.5.2-252 and 2.5.2-253). The uncertainty related to the location of zone boundaries is only considered for a few of the seismotectonic zones, with the assumption that site-specific studies will examine zone boundaries in more detail as necessary. In all seismotectonic zones, recurrence rate and Mmax are calculated according to the procedures detailed in Subsections 2.5.2.2.1.2 and 2.5.2.2.1.3. The full logic tree for the seismotectonic zones model alternative is shown in Figures 2.5.2-254a and 2.5.2-254b.

The seismotectonic zones included in the hazard calculation for the Lee Nuclear site are the Atlantic Highly Extended Crust (AHEX), Extended Continental Crust-Atlantic Margin (ECC-AM), Extended Continental Crust-Gulf Coast (ECC-GC), Illinois Basin Extended Basement (IBEB), Paleozoic Extended Crust (PEZ), Midcontinent-Craton (MidC) seismotectonic zones (MidC-A through MidC-D), and Reelfoot Rift zone-Rough Creek graben (RR-RCG) zones. Each zone is truncated at a distance of 520 km from the site.

2.5.2.2.3.1 Atlantic Highly Extended Crust (AHEX)

Mesozoic extension associated with the breakup of Pangea and development of the Atlantic Ocean had a great impact on the mafic oceanic crust adjacent to the eastern edge of the North American continent; this thinned oceanic crust is represented as the AHEX seismotectonic zone. The greater degree of extension in this zone has produced crust that is 15-30 km thick, thinner than the 35-40 km thickness of the adjacent thinned continental crust, represented by the ECC-AM zone (discussed below). Although seismological data within the AHEX are too sparse to directly assess seismogenic thickness, the observation of thinner crust is taken to indicate that seismogenic thickness is correspondingly thinner. This is expected to result in a significant difference in future earthquake rupture characteristics between the ECC-AM and AHEX zones (Table 2.5.2-231). In addition, the AHEX zone can be compositionally distinguished from the ECC-AM due to the introduction of large amounts of basalt during extension of the AHEX zone.

The AHEX zone lies entirely offshore (Figure 2.5.2-257), roughly paralleling the continental shelf. The boundary between the ECC-AM zone and the AHEX zone is the ECMA (Figure 2.5.2-258), which has been shown to be spatially correlated with the easternmost extent of continental crust using seismic reflection data (e.g., References 335 and 336).

The largest historical earthquake in the AHEX zone is the September 24, 1996 E[M] 2.89 earthquake (Reference 326). Due to the sparse seismicity of the AHEX zone, the Kijko (Reference 333) methods of Mmax calculation (which depend on observed seismicity) are not used in the calculation of Mmax. Modeled Mmax values and weights for the AHEX zone are listed in Table 2.5.2-232.

2.5.2.2.3.2 Extended Continental Crust-Atlantic Margin (ECC-AM)

The ECC-AM seismotectonic zone encompasses the portions of the Piedmont, Coastal Plain, and Continental Shelf physiographic provinces that have experienced Mesozoic-and-younger extension (Figure 2.5.2-257). The rationale for defining this zone is primarily based on the observation that all M>7 earthquakes in SCR crust occur within Mesozoic-and-younger extended crust (Reference 269). In addition, the continental crust outside the ECC-AM is characterized by a different structural grain and reactivation history, suggesting a difference in future earthquake rupture characteristics. In the vicinity of the Lee Nuclear site, the boundaries of the ECC-AM zone are established with the Piedmont gravity anomaly to the west, the ECMA to the east, and the Brunswick magnetic anomaly to the south (Figure 2.5.2-258).

The primary structural feature of the ECC-AM zone is an east-dipping Paleozoic basal thrust that juxtaposes sheared Appalachian terranes against the underlying North American craton (Figure 2.5.1-207). No faults within the ECC-AM show direct evidence for Quaternary activity. Expected future earthquake characteristics within the ECC-AM zone are summarized in Table 2.5.2-231.

Seismicity within the ECC-AM zone is spatially variable. For example, near the Lee Nuclear site, notable clusters of earthquakes occur in Charleston, South Carolina (see Subsection 2.5.1.1.3.2.1) and central Virginia (Central Virginia seismic zone, see Subsection 2.5.1.1.3.2.4) (Figure 2.5.2-259). The largest non-RLME historical earthquake to have occurred within the ECC-AM zone is the 1755 E[M] 6.10 Cape Ann, Massachusetts earthquake. Given location uncertainty for this event; however the CEUS SSC report assigned a 60% probability of having occurred within the ECC-AM, leaving a 40% probability that the largest earthquake within the ECC-AM is instead the June 11, 1638 E[M] 5.32 earthquake (Reference 326). The recent 2011 E[M] 5.71 Mineral, Virginia earthquake occurred after the development of the CEUS SSC earthquake catalog. This 2011 earthquake now represents the second largest

earthquake in the ECC-AM that is not associated with an RLME source. Further discussion of this earthquake is included in Subsection 2.5.2.1. Mmax values and weights for the ECC-AM zone as originally modeled by CEUS SSC (Reference 326) and used here are listed in Table 2.5.2-232. The E[M] 5.71 earthquake is below the lower magnitude range defined for the ECC-AM in NUREG 2115 (Reference 326).

2.5.2.2.3.3 Extended Continental Crust-Gulf Coast zone (ECC-GC)

Like the ECC-AM, the ECC-GC represents continental crust that was thinned during the Mesozoic as Pangea broke up. Adjacent to the ECC-GC zone, both the Atlantic Ocean and the Gulf of Mexico were formed during this rifting. The crust here varied between 20 and 40 km thick, with the thickest crust being places of relatively high basement, and thin crust corresponding to basement lows. The northern boundary of this zone is the Brunswick magnetic anomaly (Figure 2.5.2-258). This zone is distinguished from the ECC-AM zone based on differences in expected future earthquake characteristics. In particular, the ECC-GC does not display a well-defined structural grain and the orientation of the structures that accommodated the opening of the Gulf of Mexico is both variable and uncertain (Reference 326). Expected future earthquake characteristics within the ECC-GC zone are summarized in Table 2.5.2-231.

The largest historical earthquake in the ECC-GC zone is the October 22, 1882 E[M] 5.58 event, although the largest instrumentally recorded earthquake in the zone is the October 24, 1997 E[M] 4.88 earthquake. Due to the sparse seismicity of the ECC-GC zone, the Kijko (Reference 333) methods of Mmax calculation (which depend on observed seismicity) are not used in the calculation of Mmax. Modeled Mmax values and weights for the ECC-GC zone are listed in Table 2.5.2-232.

2.5.2.2.3.4 Illinois Basin Extended Basement (IBEB)

The IBEB seismotectonic zone models seismicity associated with the Illinois basin, which is an area of structural complexity within the midcontinent (Reference 337). The primary rationale for defining this zone is the observation of an elevated rate of instrumental seismicity compared to the neighboring craton, as well as evidence for moderate-magnitude earthquakes in the paleoearthquake record. Additionally, the structural complexity of the IBEB zone suggests that its crust is distinct from the crust in neighboring zones.

The boundaries of the IBEB zone are based on the oval shape of the Illinois basin and the spatial distribution of underlying Precambrian basement structures. The extent of these basement structures, however, is poorly constrained. At its closest approach, the IBEB zone barely extends to within the 520 km limit of the Lee Nuclear site study area (Figure 2.5.2-252). This distant source only contributes 3 cells to the Lee Nuclear site gridded seismicity and does not make a significant contribution to the hazard (<1%), but was included for completeness.

Seismicity within the IBEB zone is concentrated at its southern end, adjacent to the Reelfoot Rift. Although McBride et al. (Reference 337) note that seismicity tends not to be clearly associated with mapped structures in the IBEB zone, the location of some moderate-magnitude earthquakes suggests that Precambrian basement faults and Paleozoic faults are being reactivated. The largest historical non-RLME event in the IBEB seismotectonic zone is the September 27, 1891 E[M]5.52 earthquake. Paleoliquefaction studies, however, suggest that the IBEB zone has experienced one approximately M6.3 event and three approximately M6.2 events (Reference 326). Modeled Mmax values for this seismotectonic zone are provided in Table 2.5.2-232.

2.5.2.2.3.5 Paleozoic Extended Crust (PEZ)

As described in Section 2.5.1, the African and North American plates experienced several phases of rifting and collision. The Mesozoic phase of rifting and associated continental extension discussed above partially overprinted structures formed during a more extensive phase of late Proterozoic to early Paleozoic rifting (during the opening of the Iapetus Ocean). The portion of the craton containing all known and inferred normal faulting associated with the opening of the Iapetus Ocean is the Iapetan rifted margin (IRM) (Reference 338). The western boundary of the IRM is poorly defined, since Paleozoic rift structures irregularly decrease in size and abundance to the west.

In the CEUS SSC model, the IRM is divided into three seismotectonic zones: the Northern Appalachian (NAP), St. Lawrence Rift (SLR), and PEZ zones (Figures 2.5.2-252 and 2.5.2-253). The PEZ zone is the portion of the IRM abutting against the ECC-AM zone. The boundary between the PEZ and ECC-AM zones is marked by the Piedmont gravity gradient (Figure 2.5.2-258). Due to the uncertainty associated with the western boundary of the IRM, two alternative geometries of the PEZ zone are modeled in the CEUS SSC. In the PEZ Narrow (PEZ-N) geometry, the western boundary of the zone is formed by the Birmingham basement fault system of Alabama and the New York-

Alabama lineament. This zone geometry encompasses the most well-defined set of Iapetan faults and rift sediments in the North American craton, and is heavily favored in the CEUS SSC model. The PEZ Wide (PEZ-W) geometry includes more tentative evidence of Iapetan rifting, and extends to the Rome trough of Kentucky and West Virginia. Expected future earthquake characteristics for both zones are summarized in Table 2.5.2-231.

In the region of the Lee Nuclear site, concentrated zones of seismicity of the PEZ zones occur in the Eastern Tennessee seismic zone (Subsection 2.5.1.1.3.2.2) and in the Giles County, Virginia seismic zone (Subsection 2.5.1.1.3.2.3) (Figure 2.5.2-259). The Giles County seismic zone produced the 1897 Giles County earthquake (MMI = VIII, mb = 5.7, E[M] 5.91), the largest observed earthquake in the PEZ seismotectonic zones (Reference 326). Modeled Mmax values and weights for the PEZ-N and PEZ-W zones are listed in Table 2.5.2-232.

2.5.2.2.3.6 Midcontinent Craton (MidC) Sesimotectonic Zones

The portion of the CEUS SSC model that did not experience Mesozoic-and-younger extension is represented by the MidC seismotectonic zone (Figure 2.5.2-257). The seismotectonic character of this zone is instead shaped by Paleoproterozoic plate collisions that formed the core of the North American continent. These collisions resulted in deeply buried Precambrian crustal structures that overlie a thick, strong, and compositionally depleted lithosphere (i.e., lithosphere from which certain dense minerals have been extracted via partial melting, resulting in a relatively buoyant, thick, and anhydrous composition). The absence of Mesozoic-and-younger extension, as described by Johnston et al. (Reference 269) and in Subsection 2.5.2.2.2.2. is expected to lower the Mmax potential of the MidC seismotectonic zone. In addition, Mooney and Ritsema (Reference 339) show that high lithospheric S-wave velocities (which serve as a proxy for high lithospheric strength) are correlated with lower Mmax potential. The MidC is further differentiated from other midcontinental sources based on the expectation that neighboring zones will have different future earthquake rupture characteristics, in part due to differences in structural grain (Table 2.5.2-230 and Table 2.5.2-231).

The northern and western boundaries of the MidC zone terminate at the CEUS study region boundary (Figures 2.5.2-252 and 2.5.2-253). The location of the southern and eastern boundaries of the MidC zone, however, vary based on the alternative geometries of neighboring seismotectonic zones, which results in four alternative MidC zone geometries. These model alternatives are labeled MidC-A, MidC-B, MidC-C, and MidC-D (Figures 2.5.2-252 and 2.5.2-253). All four model alternatives are included in the baseline hazard calculation (Figure 2.5.2-257).

As is the case throughout the CEUS region, seismicity in the MidC seismotectonic zone is spatially variable. Although several concentrated areas of seismicity occur in the MidC zone (e.g., the Anna, Ohio seismic zone (Figure 2.5.2-259) and the Northeast Ohio seismic zone), there is not enough evidence to suggest that any of these areas produce RLMEs. The largest earthquake in this zone that is not associated with an RLME source is the 1909 E[M] 5.72 earthquake of eastern Montana (Reference 326). Modeled Mmax values and weights for all MidC seismotectonic zones are listed in Table 2.5.2-232.

2.5.2.2.3.7 Reelfoot Rift (RR)-Rough Creek Graben (RCG)

The RCG represents the eastward extension of extensional deformation related to formation of the intracontinental rift system during Precambrian to earliest Cambrian rifting of North America (References 340, 341, and 342) (Figures 2.5.2-252 and 2.5.2-253). Some suggest that this graben should be considered part of the Reelfoot Rift, which is characterized by Mesozoic reactivation of faults, higher rates of seismicity, the occurrence of multiple Quaternary active faults and identified RLME sources (Reference 326). Although there is some evidence for Mesozoic activity on faults in the Rough Creek graben, the lack of clearly associated alkaline igneous rocks of Mesozoic age in the RCG suggests that Mesozoic reactivation of deep-penetrating faults was limited, and seismicity rates are lower than the Reelfoot Rift. Hence, a lower weight of 0.33 is applied to the inclusion of the Rough Creek graben in the Reelfoot Rift zone. At the extreme edge of the Lee Nuclear site study area, the Rough Creek graben (rather than the Reelfoot Rift proper), contributes 8 cells to the gridded seismicity for the Lee Nuclear site study region. The RR-RCG zone does not make a significant contribution to the hazard (<1%), but was included for completeness. Expected future earthquake characteristics within the RR-RCG zone are summarized in Table 2.5.2-231.

The two largest historical earthquakes in the RR-RCG zone are the January 5, 1843 and October 31, 1895 events, both interpreted as E[M] 6.0 earthquakes. Modeled Mmax values and weights for the RR-RCG zone are listed in Table 2.5.2-232.

2.5.2.2.4 CEUS SSC RLME Sources Included in the Lee Nuclear Site PSHA

In several places throughout the CEUS, historical and paleoearthquake records point to the repeated occurrence of large-magnitude (greater than or equal to 6.5) earthquakes in specific locations (Figure 2.5.2-255). Due to the amount of strain accumulation needed to generate a large magnitude earthquake, these events are most often interpreted from the paleoearthquake record. This inherently results in a bias in the location of RLMEs throughout the model, as the spatial coverage of the paleoearthquake record is more limited than that of the historical record. This limitation is recognized in the CEUS SSC model, and is accounted for by allowing significant earthquake potential in the distributed seismicity sources.

The only RLME sources that contribute significantly to hazard at the Lee Nuclear site are Charleston and New Madrid RLME sources. The largest earthquake within 25 mi. of the Lee Nuclear Site included in the updated CEUS SSC earthquake catalog is the 1886 E[M] 4.13 Event.

2.5.2.2.4.1 Charleston

The largest historical earthquake in the eastern U.S. occurred in Charleston, South Carolina in 1886. Estimates of the magnitude of this earthquake are based on liquefaction data and isoseismal area regressions, and vary from the high-6 to mid-7 range (Reference 326). In addition, a number of geologic investigations have documented evidence for large pre-1886 earthquakes in the Charleston, South Carolina area based on sand blows and paleoliquefaction features (e.g., References 220, 221, 222, 224, 343, and 344). Based on the quality and quantity of the available data, Charleston is modeled as an RLME source in the CEUS SSC model. The Charleston RLME source is located within the Lee Nuclear Site region as near as 187 km away (Figures 2.5.2-255, 2.5.2-259 and 2.5.2-260).

No tectonic features have been conclusively correlated with the 1886 earthquake. In addition, although a number of faults have been postulated in the Charleston area, none have been shown to be tectonically active. In order to account for the spatial uncertainty associated with Charleston RLME source, three alternative geometries are modeled (Figures 2.5.2-260 and 2.5.2-261a through 2.5.2-261d). The Charleston Local geometry encompasses the area with the densest concentration of liquefaction associated with the 1886 earthquake and prehistoric earthquakes, the meizoseismal area of the 1886 earthquake, and the majority of local tectonic features. This alternative is the most heavily weighted of the three. The Charleston Narrow geometry is based on the location and orientation of postulated faults and tectonic features in the Charleston area, resulting in a relatively narrow, north-northeast oriented source geometry. The Charleston Regional geometry encompasses the Local and Narrow zones, along with outlying paleoliquefaction sites and other tectonic features. In all cases, future earthquakes are modeled as occurring on pseudofaults with the properties listed in Table 2.5.2-231.

Geologic and geomorphic studies have suggested that the seismic activity of the Charleston RLME source since the mid-Holocene may not be indicative of the long-term recurrence rate (e.g., References 345 and 346). Models of temporal clustering used to account for this uncertainty are discussed in detail in Section 5.1.2 of the CEUS SSC report and further uncertainties associated with the earthquake recurrence rate are discussed in the CEUS SSC report (Reference 326), Section 6.1.2.5.

The CEUS SSC model assigns E[M] 6.90 to the 1886 Charleston earthquake. Geotechnical studies in the Charleston, South Carolina area suggest that prehistorical large earthquakes were in the high-5 to high-7 range (e.g., References 347, 348, 349, and 350). Based on the assumption that future earthquakes in the Charleston RLME source will be similar to previous large earthquakes in the Charleston area, the CEUS SSC model assigns Mmax values of between M6.7 and M7.5 (Table 2.5.2-233).

2.5.2.2.4.2 New Madrid Fault System

The three largest historical earthquakes in the CEUS region all occurred in the New Madrid area. These earthquakes occurred on December 16, 1811, January 23, 1812, and February 7, 1812, and a great deal of uncertainty exists regarding their exact magnitudes. In addition, a number of paleoliquefaction studies document multiple major prehistorical earthquakes in the New Madrid area (e.g., References 248, 351, 352, and 353). Based on these observations, the CEUS SSC model defines the New Madrid fault system (NMFS) as an RLME to account for large prehistoric earthquakes and the three large events that occurred in 1811-1812. At its closest approach, this RLME is approximately 720 km from the Lee Nuclear site (Figure 2.5.2-255).

Modern seismic activity within the New Madrid area closely aligns with the three fault segments that constitute the NMFS (also referred to as "Reelfoot Rift Central Fault System" in CEUS SSC report (Reference 326) (Figure 2.5.2-260). These individual fault segments (New Madrid North, New Madrid South, Reelfoot Thrust) have been associated with the earthquakes of the 1811-1812 sequence (see discussion in the CEUS SSC report, Section 6.1.5

(Reference 326), and sources therein). Consequently, the geometry of the NMFS RLME source is narrowly defined, with alternative geometries for long and short interpretations of the New Madrid North fault and the Reelfoot thrust (Figure 2.5.2-262). Alternative geometries for the New Madrid South fault either combine the Blytheville arch with the Bootheel lineament or the Blytheville fault zone (Figures 2.5.2-263a and 2.5.2-263b).

Seismic reflection data (e.g., References 354 and 355) and geomorphic observations (e.g., Reference 356) suggest that the Holocene Epoch represents a period of temporally clustered earthquake activity along the NMFS that is not representative of the long-term rate of activity. Additionally, geodetic studies suggest that the present rate of strain accumulation is much too small to account for the Holocene rate of paleoseismicity (References 357 and 358). To account for uncertainty in the future rate of earthquakes in the NMFS RLME, the CEUS SSC model allows for alternatives (at very low weights) in which some or all of the fault segments of the NMFS are inactive. A detailed discussion of the recurrence of large earthquakes in the NMFS RLME source is presented in Section 6.1.5.4 of NUREG 2115 (Reference 326).

The Mmax distribution for the NMFS RLME source is based on the estimated magnitudes of the earthquakes in the 1811-1812 sequence. The CEUS SSC model equally weights the estimates from Bakun and Hopper (Reference 232), Johnston (2004, personal communication, as cited in Reference 326), and Hough and Page (Reference 359), which are M7.2 to M7.8, M7.5 to M7.9, and M6.5 to M6.9, respectively. The resulting Mmax distribution for the NMFS RLME source in the CEUS SSC model ranges from M6.7 to M7.9 (Table2.5.2-234).

All other uncertainties identified in the NMFS logic tree (Figures 2.5.2-263a and 2.5.2-263b) are included in the Lee Nuclear site hazard calculation exactly as detailed in the CEUS SSC report, with the exception of seismogenic depth, which is simplified from the distribution listed in Table 2.5.2-231 to a single value of 15 km. Given the distance of the NMFS RLME source to the Lee Nuclear site, this simplification is judged to be appropriate for the Lee Nuclear site PSHA.

2.5.2.2.5 Post-CEUS SSC Studies

This subsection describes geologic and seismic investigations of the site region and beyond that provide information that can be used to evaluate and potentially update the CEUS SSC model relevant to the Lee Nuclear site PSHA. Specifically, these studies include ongoing investigations of: (1) geologic investigations of the Eastern Tennessee seismic zone; and (2) the 2011 Mineral, Virginia earthquake that occurred in or near the Central Virginia seismic zone.

2.5.2.2.5.1 Geologic Investigations of the Eastern Tennessee Seismic Zone

Seismicity associated with the ETSZ is located within the Lee Nuclear site region (Figure 2.5.2-259) (Subsection 2.5.1.1.3.2.2). The ETSZ can be identified as a narrow trend of concentrated seismicity east of the New York-Alabama magnetic lineament (Reference 244). However, in spite of the high rate of seismic activity, the largest historical earthquake in the region is magnitude 4.6 (magnitude scale unspecified) (References 244 and 360).

The most recent geologic studies of the ETSZ either post-date the CEUS SSC model or were published during development of the CEUS SSC model. These studies suggest that the ETSZ may have produced large prehistoric earthquakes. Vaughn et al. (Reference 361) find evidence of minor surface faulting, fracturing, and disrupted features in terrace alluvium, along with minor paleoliquefaction, northeast of Knoxville, Tennessee. Similarly, Obermeier et al.'s (2010) study (Reference 360) of Douglas Reservoir documents fracture systems and sandy intrusions in terrace deposits that they interpret as paleoseismic in origin, although the significance of these features is unclear. Howard et al. (Reference 362) and Warrell et al. (Reference 363) document fractures, small faults, and displacements in Quaternary alluvium along Douglas Reservoir that they suggest resulted from earthquakes with magnitudes greater than 6.0 and 6.5 (magnitude scale unspecified).

These Douglas reservoir studies were continued by Hatcher et al (2012) (Reference 364), which coupled the geologic observations with preliminary optically stimulated luminescence age dating of Quaternary deposits. Hatcher et al (Reference 364) conclude that one or more "probable minimum" M 6.5 earthquakes could be associated with the ETSZ within the last 73 to approximately 200 ka. However, because of poor age limits on soils cut by fractures, the ages of the structures observed remain poorly defined and no recurrence intervals could be estimated (Reference 364).

While these recent studies strengthen the argument that the ETSZ has experienced at least one moderate-sized

earthquake in the late Quaternary, they do not quantify parameters (e.g., recurrence interval, magnitude) necessary to demonstrate that the ETSZ produces repeating large-magnitude events as defined in NUREG 2115. As such, the ETSZ is modeled within the MESE Mmax zone and the PEZ seismotectonic zone using smooth seismicity. No RLME source is defined for the ETSZ.

2.5.2.2.5.2 Investigations of the 2011 Mineral, Virginia Earthquake

The Mineral earthquake occurred on August 23, 2011 at 17:51 UTC near Mineral, Louisa County, Virginia (Reference 365) (Figure 2.5.2-259) (Subsection 2.5.1.1.3.2.4). The epicentral region lies within the Appalachian Piedmont, about 130 km southwest of Washington, D.C., and within or near the Central Virginia seismic zone (Reference 365). The M5.8 main shock hypocenter originated at 6.0 ± 3.1 km depth (Reference 365), with an epicentral uncertainty of 2.3 km stemming from the sparse P-wave recordings (References 365 and 366). Chapman (Reference 366) notes that only four stations within 150 km recorded mainshock arrival times. The earthquake has been given various names and assigned magnitudes in the M5.7 to 5.8 range. Following the CEUS SSC methodology (Reference 326), this earthquake is assigned an expected moment magnitude of E[M]5.71 in the updated project catalog (Subsection 2.5.2.1). The Mineral earthquake was the largest historical event in the region and the largest instrumentally recorded earthquake in eastern North America since the 1988 M5.84 Saguenay earthquake (Reference 367).

A series of aftershocks highlighted the rupture plane of the Mineral earthquake, which was previously unrecognized at the surface or in the subsurface (Figure 2.5.2-264). Aftershocks ranged in depth from 1 to 7.5 km and included events up to M3.9 (References 368 and 369). Walsh et al. (Reference 370) suggest that aftershocks of the Mineral earthquake, as well as other intraplate earthquakes, could last up to 100 years, as opposed to only a few years in more tectonically active margins (e.g., Southern California). The majority of 2011 Mineral, Virginia earthquake aftershock hypocenters defined surface suggesting a plane oriented approximately north-northeast with a moderate dip of about 45°-51° to the southeast (References 366, 368, 371, 372, 373 and 374). Propagation of the rupture was complex, exhibiting three distinct slip events: a smaller and deeper initiation event, followed by two larger and shallower events (Reference 366). Focal mechanisms of the mainshock indicate a primarily reverse sense of slip (Reference 365).

The earthquake caused moderate damage in the epicentral region, although felt intensity at close distances (less than 100 km) was less than predicted by Atkinson and Wald relations (Reference 375) as noted by Assatourians and Atkinson (Reference 376). Ground motions at larger distances were in relatively close agreement with the Atkinson and Wald (2007) relations, and the earthquake was felt by more people than any other earthquake in U.S. history (Reference 377). At short periods (0.2 s), ground motions agreed well with eastern ground motion prediction equations, but were less than expected at longer periods (1.0 s) (Reference 367).

Geologic evidence of the 2011 Mineral, Virginia earthquake was sparse, although some coseismic features were observed. Rock falls were identified over a wide region covering most of mountainous Virginia and parts of Maryland and West Virginia (References 377, 378, and 379). Four sand boils (two definite, one likely, and one questionable) were observed in two locations that lie within the approximate vertical surface projection of the rupture plane (References 378, 379, and 380).

Despite targeted searches in the field, the Earthquake Engineering Research Institute (EERI) (Reference 378) and Geotechnical Extreme Events Reconnaissance (GEER) association (Reference 379), did not identify surface rupture associated with the 2011 Mineral, Virginia earthquake (Subsection 2.5.1.1.3.2.4). The consensus results of these investigations suggest that the Mineral earthquake occurred on a previously unrecognized structure, the dimensions of which are unknown and not observable at the ground surface.

The 2011 Mineral earthquake is not included as a new fault or RLME source in the Lee Nuclear site PSHA. Without slip-rate, recurrence, or Mmax constraints for the structure defined by the distribution of aftershock hypocenters that likely produced the Mineral earthquake, it is most appropriate to consider this earthquake as an event captured by the host zones (ECC-AM, MESE-N, MESE-W, and Study Region) in the CEUS SSC model framework. Because of the distance to the Lee Nuclear site (450 km), and the buffer between the Mineral earthquake magnitude and lower end of the Mmax magnitude distribution, no changes to the EPRI CEUS model were required due to this event.

11714	WLS	Pt 02	FSAR 02	02.05.02.03	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.3 is revised in its entirety as follows: 2.5.2.3 Correlation of Earthquake Activity with Seismic Sources The CEUS SSC earthquake catalog (Reference 326) includes earthquakes in the CEUS from 1568 through the end	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure

of 2008, and its development is discussed in Subsection 2.5.2.1 (Figure 2.5.2-248). The complete CEUS SSC catalog comprises 10,984 earthquakes, including 3,298 events added during the update of the earthquake catalog (Subsection 2.5.2.1). The complete catalog and the updated events include dependent events and earthquakes with E[M] greater than or equal to 2.2. For rate calculations, the dependent and small events are removed, but patterns of seismicity are better illustrated when these events are included (e.g., as shown in Figures 2.5.2-249, 2.5.2-256, 2.5.2-257, 2.5.2-259, and 2.5.2-260). Over 80% of the independent earthquakes in the CEUS SSC catalog with E[M] greater than or equal to 2.9 are contained in the 2008 NSHMP earthquake catalog (Reference 329), with remaining events gathered from special studies, and local and regional catalogs (Reference 326).

2. Attachment 4, WLG2014.01-02 (ML14064A436)

The uncertainty in the horizontal location of earthquakes included in the CEUS SSC catalog is the result of a combination of standard errors for instrumentally recorded earthquakes from the various catalog sources and estimates based on accounts of shaking intensity (Reference 326). In general, location uncertainties have improved through time, with horizontal uncertainties up to 50 km for less well-documented events in the earliest part of the catalog, to as little as 1-2 km for well-recorded events in the most recent part of the catalog (Appendix B of Reference 326).

Earthquake depths are reported in the updated CEUS SSC catalog based on data from source catalogs, or depths documented in a variety of published sources (Reference 326). Many of the earthquake depths represent fixed crustal depths for either shallow or deep events. For example, the NEIC catalog uses fixed depths of 10 km for shallow events and 33 km for deep events (Reference 326). Additionally, many earthquakes in the CEUS SSC catalog are assigned a depth of 0 km when no data are available to provide a basis for an estimate. This is most common in earlier parts of the catalog. Alternative depth estimates are presented if more than one value was reported in source catalogs or published literature; however, depth uncertainties are not provided in the CEUS SSC catalog (Reference 326). Despite these horizontal and depth location uncertainties, gross regional patterns of seismicity are preserved and partially form the basis for defining some CEUS SSC seismic sources.

As described in Subsection 2.5.2.2, the CEUS SSC source model defines three types of seismic sources: Mmax zones, zones of repeated large-magnitude earthquakes (RLMEs), and seismotectonic zones (Reference 326). Mmax zones are defined on expected differences in Mmax potential and are broad zones that are not defined on the basis of geologic structures or the spatial distribution of seismicity. The discussion of correlation of seismicity with seismic sources presented in this subsection is limited to seismotectonic zones and RLME sources significant to the Lee Nuclear site (Subsections 2.5.2.2.3 and 2.5.2.2.4).

The Charleston, South Carolina RLME source is within the 200-mile radius site region (Figure 2.5.2-255) and, as described in Subsection 2.5.2.2, the more distant New Madrid fault system (NMFS) RLME is also included in the site PSHA. At its nearest point, the Charleston RLME is located approximately 190 km southeast of the site. The NMFS RLME is located approximately 720 km west of the site. The correlation of seismicity with these two RLMEs is described in the following text:

Charleston. The Charleston RLME, as described in Subsection 2.5.2.2.4.1, represents the Charleston seismic zone, the source for the largest recorded earthquake in the eastern U.S., the 1886 Charleston E[M] 6.90 earthquake (Figure 2.5.2-260). The Charleston seismic zone is characterized by sparse seismicity (in comparison to the Eastern Tennessee or New Madrid seismic zones) that is tightly concentrated, but lacking prominent linear trends. There is no evidence that indicates a correlation of well-documented prehistoric large earthquakes or historical earthquakes with a discrete structure. Therefore, three alternative zones are hypothesized for the Charleston RLME that are based on locations of posited fault sources, damage, felt intensity, and/or density of liquefaction features. Theorized fault sources, spaced about 10 km apart, are modeled throughout the zones. This approach accounts for uncertainty in the location, extent, and existence of faulting, reflecting the poor understanding of the correlation of earthquakes with structures in the Charleston seismic zone.

New Madrid Fault System (NMFS). The NMFS RLME lies within the broader New Madrid seismic zone and represents the source of the three largest historical earthquakes in the CEUS region, and several prehistoric large earthquakes in 1811 and 1812 (E[M] 7.60, 7.50, and 7.80) (Figure 2.5.2-262). A number of faults have been identified in the New Madrid seismic zone. The NMFS RLME comprises three main fault sources, each with two alternative geometries to reflect uncertainty in their extent and/or location. The spatial distribution of seismicity defines clear, highly concentrated trends of earthquakes along these faults as seen on Figure 2.5.2-262. Seismicity also occurs away from these faults, defining a roughly 250 x 400 km concentration of earthquakes from the Marianna zone near the southern end, extending northeast along the Mississippi River to just south of northwest-trending basement structures in Illinois (Figure 2.5.2-260). Earthquakes within this broader concentration of seismicity are commonly associated with faults comprising the Reelfoot Rift system.

Atlantic Highly Extended Crust (AHEX). The AHEX seismotectonic zone represents the highly extended transition between extended and thick continental crust and thin oceanic crust. The zone is defined primarily on the basis of its shallow seismogenic thickness. Only five earthquakes from the updated CEUS SSC catalog lie within the AHEX, and seismicity is sparse throughout the zone (Figure 2.5.2-257). Therefore, trends in seismicity are not readily apparent, despite the presence of large faults inferred from geophysical data. The largest earthquake observed within the AHEX is the 1996 E[M] 2.89 earthquake located approximately 310 km off the coast of New Jersey.

Extended Continental Crust – Atlantic Margin (ECC-AM). As discussed in Subsection 2.5.2.2, the ECC-AM seismotectonic zone is defined primarily on the basis of Mesozoic rift-related extension. Seismicity within the ECC-AM is spatially variable, ranging from very diffuse to spatially concentrated. As seen in Figure 2.5.2-257, higher concentrations of seismicity are observed near the southern end of the ECC-AM in South Carolina, as well as along the Atlantic Coast from New Jersey northward. Additionally, the ECC-AM encompasses the CVSZ, an area with an elevated rate of generally small-magnitude seismicity (Figure 2.5.2-259). Seismicity is generally shallow within the CVSZ, and interpreted to occur on Paleozoic and Mesozoic faults that lie above the Appalachian detachment (References 381 and 382). An area of elevated concentration of seismicity with similar characteristics occurs in the New York-Philadelphia region. These areas lack evidence for repeated, large-magnitude earthquakes and discrete faults associated with seismicity are not mapped at the surface. Thus, these seismic zones do not meet the CEUS SSC criteria for inclusion as RLMEs. Outside of these more prominent zones of seismicity, earthquakes in the ECC-AM do not appear to correlate with known geologic structures or define linear trends.

The largest observed earthquake possibly within the ECC-AM seismotectonic zone is the 1755 Cape Ann, Massachusetts E[M] 6.10 earthquake. Due to the uncertainty associated with the horizontal location of the Cape Ann earthquake, it is assigned a 60% probability of having occurred within the ECC-AM and 40% probability of having occurred within the Northern Appalachian seismotectonic zone (NAP) (Reference 326). When the Cape Ann earthquake is considered to have occurred in the NAP, the 2011 Mineral, Virginia E[M] 5.71 earthquake is the largest event in the ECC-AM.

The 2011 Mineral, Virginia earthquake and associated aftershocks occurred within the ECC-AM on a previously unknown structure, oriented similar to many of the thrust faults in the region. As discussed in Subsections 2.5.2.1.1.3.2.4 and 2.5.2.2, the aftershocks defined a southeast-dipping, northeast-striking rupture plane that extends from about 7.5 to 1.0 km depth (References 366 and 368) (Figure 2.5.2-264). However, too little is known regarding the fault that produced the Mineral earthquake to justify the addition of an additional RLME or discrete fault source to the CEUS SSC model.

Extended Continental Crust – Gulf Coast Zone (ECC-GC). As discussed in Subsection 2.5.2.2, the ECC-GC seismotectonic zone is defined primarily on the basis of Mesozoic rift-related extension. Like AHEX, ECC-GC has very sparse seismicity and trends in seismicity are not readily apparent. As described in NUREG 2115 (Reference 326), the largest earthquake in the ECC-GC is either the October 22, 1882 E[M] 5.58 earthquake, the October 24, 1997 E[M] 4.88 earthquake, or the potential paleoearthquake identified from the studies of Cox and others (see discussion in Section 7.3.9.5 of NUREG 2115) (Reference 326). The uncertainty in the location of the October 22, 1882 E[M] 5.58 earthquake allows for the possibility that this event occurred within the neighboring OKA seismotectonic zone (Reference 326).

Illinois Basin Extended Basement Zone (IBEB). The IBEB zone encompasses faults within Precambrian basement and the Paleozoic Illinois Basin as well as a zone of liquefaction features thought to be associated with four moderate events (approximately M 6.20 to 6.30). The largest historical event to have occurred in the IBEB zone was the 1891 E[M] 5.52 event in southern Illinois. Larger earthquakes have occurred in the zone (E[M] greater than or equal to 6.5), but they are characterized by the Wabash Valley RLME. Seismicity is sparse in the northern part of the IBEB zone, increasing regularly to the south (Figure 2.5.2-248). Hypocentral depths range from shallow (less than 5 km) to deep (up to 27 km), with shallower earthquakes slightly more common. Earthquakes do not define linear trends or areas of concentrated seismicity. Seismicity is relatively evenly distributed and dense compared with surrounding regions not characterized as RLME sources. Several structures and processes have been posited as sources of earthquakes in the IBEB zone, but they remain poorly understood.

Midcontinent-Craton Zone (MidC). The MidC seismotectonic zone comprises crust that has not been significantly deformed by Phanerozoic orogens. Seismicity of the MidC zone is generally diffuse with a few areas of spatially concentrated seismicity including the Anna (Ohio), northeast Ohio, and Nemaha Ridge-Humboldt fault (Oklahoma, Kansas, and Nebraska) seismic zones (Figure 2.5.2-248). Seismicity within the Anna seismic zone is spatially concentrated and tenuously associated with basement faults that comprise the Fort Wayne rift. A paleoseismic

					investigation by Obermeier (Reference 383) indicates a lack of large-magnitude, repeated earthquakes for several thousand years in the Anna seismic zone. Seismicity within the northeast Ohio seismic zone is defined by a northeast-trending zone of earthquakes. A 1986 E[M] 4.65 earthquake and aftershock sequence within the zone has been associated with northeast-trending geophysical anomalies (References 384 and 385). In a paleoseismic investigation, however, Obermeier (Reference 383) found a lack of evidence for large, repeated earthquakes in the zone. Seismicity within the Nemaha Ridge-Humboldt fault seismic zone is questionably associated with basement structures that are sub-parallel and west of the Proterozoic Midcontinent rift system (References 386 and 387). Outside of the seismic zones described above, spatially concentrated areas of seismicity within the MidC zone are observed in central Oklahoma and northern Alabama, and along the Nebraska-South Dakota border (Figure 2.5.2-248). Paleozoic Extended Crust (PEZ). The PEZ seismotectonic zone represents the western portion of the IRM and includes narrow (PEZ-N) and wide (PEZ-W) alternative geometries as discussed in Subsection 2.5.2.2. Seismicity within the zone is spatially variable, ranging from diffuse to concentrated, occasionally defining trends. Relatively high concentrations of seismicity are observed between Lake Ontario and Lake Erie (PEZ-W only) and at the southern end of the PEZ zone in Alabama. Additionally, the PEZ encompasses several well-studied areas of elevated seismicity including the eastern Tennessee and Giles County, Virginia seismic zones (Figure 2.5.2-248). Earthquakes within the ETSZ are generally deep, spatially associated with or limited in extent by geophysical anomalies including the Alabama-New York lineament, and define several northeast-oriented linear trends. Several studies have posited a variety of possible structures and processes associated with earthquakes in the ETSZ, including reactivated basement faults (Reference 244), depositional anisotropies (Reference 388), and heterogeneity in crustal strength (Reference 389). The GCVSZ (Figure 2.5.2-259) is similarly characterized by deep seismicity that defines a northeast-oriented, steeply southeast-dipping tabular zone. This zone of seismicity lies beneath the Appalachian detachment in Precambrian basement (References 390 and 391) and, therefore, the deep seismicity is not reflected in the geology of overlying thrust sheets. Several small-displacement faults and folds have been identified at the ground surface in terrace sands within the GCVSZ (Reference 392). Whether this surface deformation is related to deep seismicity, or other processes such as karst development and collapse in underlying carbonate rocks, is unclear (References 393, 394, and 395). The GCVSZ hosted the largest earthquake observed in the PEZ, the 1897 Giles County, Virginia E[M] 5.91 earthquake. Reelfoot Rift-Rough Creek Graben Zone (RR-RCG). The RR-RCG seismotectonic zone includes faults that developed during late Proterozoic-Cambrian Iapetan-phase rifting and were later reactivated in the late Paleozoic, and then the Mesozoic. Seismicity rates are lower in the portions of the RR-RCG that are within the Lee Nuclear site study region (radius of 520 km), relative to the rest of the RR or RR-RCG zones (Figure 2.5.2-265). Seismicity ranges from 13 to 17 km deep (Reference 326). The two largest earthquakes in the RR-RCG zone are the historical January 5, 1843 and October 31, 1895 events, both interpreted as E[M] 6.0 earthquakes. The 1811-1812 large magnitude earthquakes located within this zone are considered part of the NMFS RLME source.	
11812	WLS	Pt 02	FSAR 02	02.05.02.03	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.3, eleventh paragraph, second sentence is revised to read: As discussed in Subsections 2.5.1.1.3.2.4 and 2.5.2.2, the aftershocks defined a southeast-dipping, northeast-striking rupture plane that extends from about 7.5 to 1.0 km depth (References 366 and 368) (Figure 2.5.2-264).	Editorial correction to Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A436)
11715	WLS	Pt 02	FSAR 02	02.05.02.04	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.4 is revised in its entirety as follows: 2.5.2.4 Probabilistic Seismic Hazard Analysis and Controlling Earthquake A PSHA on rock requires a set of seismic sources and their characteristics, and a set of earthquake ground motion models. For the PSHA for the Lee site, the seismic sources published in NUREG 2115 (Reference 326) were used. These seismic sources were derived for the central and eastern CEUS-SSC by considering a wide range of alternative interpretations, and the characteristics of earthquake occurrences in each source (activity rates, magnitude distributions, and maximum magnitudes) were derived by developing an updated earthquake catalog for the CEUS. Alternative models of earthquake sources and characteristics of earthquake occurrences were determined, with weights representing the relative credibility of each model. This model of earthquake sources has	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A436)

been accepted by the USNRC (Reference 326) as a valid model for use in PSHA for nuclear licensing applications in the CEUS.

Earthquake ground motion models were adopted from an EPRI 2013 study (Reference 396), which updated earlier models of earthquake ground motions (References 202 and 249). These ground motion models represent alternative methods of estimating earthquake shaking and include estimates of variability in ground motion amplitudes. Weights on alternatives represent the relative credibility of each model. This representation of earthquake ground motion has been accepted by the USNRC (Reference 397) as a valid model for use in PSHA for nuclear licensing applications in the CEUS.

Table 2.5.2-235 compares the results of a PSHA hazard analysis at the Chattanooga test site (Chattanooga) using LCI seismic hazard software compared to published results from the 2012 CEUS SSC Report (Reference 326). The total mean rock hazard at 0.2 g and 0.6 g is obtained using each methodology (LCI software and digitized CEUS data) for three spectral frequencies (1 Hz, 10 Hz, and PGA) with % differences computed. A cumulative absolute velocity (CAV) filter was not applied in this calculation and no site amplification factors are used. All results are for hard rock conditions. The "% difference" row shows the percent difference of hazard calculated for the CEUS Chattanooga test site compared to LCI Chattanooga site. For this comparison the LCI hazard result is higher than those published from the 2012 CEUS EPRI study, except for the 10 Hz value at 0.2g which is 0.2% below the CEUS result.

The comparisons shown in Table 2.5.2-235 are considered acceptable agreement, given that the comparison is made with the EPRI 2012 Chattanooga test site using independent software. Comparisons were made using mean annual frequencies of exceedance because these are the most important results used to derive seismic design spectra. The similarity of these results, verifies that the LCI software suite is calculating hazard correctly.

2.5.2.4.1 New Ground Motion Models

As indicated in Section 2.5.2.4, updated ground motion models were published in 2013 by EPRI (Reference 396). These updated equations estimate median spectral acceleration and its uncertainty as a function of earthquake magnitude and distance. Epistemic uncertainty is modeled using multiple ground motion equations with weights, and multiple estimates of aleatory uncertainty, also with weights. Different sets of sources are recommended for seismic sources that represent rifted versus non-rifted regions of the earth's crust. Difference equations are also recommended for the mid-continent region of the CEUS and for the Gulf region. Equations are available for spectral frequencies at hard rock sites of 100 Hz (which is equivalent to peak ground acceleration, PGA), 25 Hz, 10 Hz, 5 Hz, 2.5 Hz, 1 Hz, and 0.5 Hz.

As part of the EPRI 2013 (Reference 396) project, aleatory variabilities were estimated for the ground motion models of the CEUS. To create a complete model, epistemic uncertainties in the aleatory variabilities were represented with alternative models, with weights.

In summary, the ground motion model used in the seismic hazard calculations consists of the median equations and uncertainties from NRC, EPRI, and DOE (Reference 396). The cumulative absolute velocity (CAV) filter which accounts for the damageability of small magnitude earthquake ground motions, was not used, and a minimum magnitude of E[M] 5.0 was used for all earthquake sources.

2.5.2.4.2 Updated Probabilistic Seismic Hazard Analysis and Deaggregation

The seismic hazard at the Lee site is recalculated with the CEUS SSC model for the CEUS. This calculation is for hard rock conditions, which is consistent with the updated ground motion model.

A PSHA consists of calculating annual frequencies of exceeding various ground motion amplitudes for all possible earthquakes that are hypothesized in a region. The seismic sources specify the rates of occurrence of earthquakes as a function of magnitude and location, and the ground motion prediction model estimates the distribution of ground motions at the site for each event. Multiple weighted hypotheses on seismic sources, earthquake rates of occurrence, and ground motions (characterized by the median ground motion amplitude and its uncertainty) result in multiple, weighted seismic hazard curves, and from these the mean and fractile seismic hazard can be determined.

Figures 2.5.2-223, 224, 225, 226, 227, 228, and 229 show mean and fractile (15th, median, and 85th) seismic hazard curves from this calculation for the 7 spectral frequencies that are available from the EPRI ground motion model. Figure 2.5.2-266a shows high and low frequency mean spectra for 10-4, 10-5, and 10-6 annual frequencies

					of exceedance. The mean UHRS values are also documented in Table 2.5.2-217 for annual frequencies of exceedance of 10-4, 10-5, and 10-6. The seismic hazard is deaggregated following the guidelines of RG 1.208. Specifically, the mean contributions to seismic hazard for 1 Hz and 2.5 Hz are deaggregated by magnitude and distance for the mean 10-4 ground motions at 1 Hz and 2.5 Hz, and these deaggregations are combined. Figure 2.5.2-231 shows this combined deaggregation. Similar deaggregations of the mean hazard are performed for 5 and 10 Hz spectral accelerations (Figure 2.5.2-232). Figures 2.5.2-233 and 234 show deaggregations of the mean hazard for 10-5 ground motions, and Figures 2.5.2-235 and 236 show deaggregations of the mean hazard for 10-6 ground motions. RG 1.206 recommends deaggregation of the mean seismic hazard. Table 2.5.2-218 summarizes the mean magnitude and distance resulting from these deaggregations, for the mean 10-4, 10-5, and 10-6 ground motion amplitudes for all contributions to hazard and for contributions with distances exceeding 62 miles (100 km). The deaggregation plots in Figures 2.5.2-231, 232, 233, 234, 235, and 236 indicate that the local background, Charleston and New Madrid seismic sources contribute to seismic hazard at the Lee site. Note that the 160 - 360 km bins represent hazard contribution from the Charleston RLME, and the 730 km bin represents hazard contribution from the New Madrid RLME. For 10-4 annual frequency of exceedance, the background and Charleston sources are the largest contributor to seismic hazard for both 1 and 2.5 Hz (Figure 2.5.2-231) and 5 and 10 Hz (Figure 2.5.2-232). For 10-5 annual frequency of exceedance, the background and Charleston sources are the largest contributor to seismic hazard for both 1 and 2.5 Hz (Figure 2.5.2-233) with the background source being the largest contributor to seismic hazard at 5 and 10 Hz (Figure 2.5.2-234). For 10-6 annual frequency of exceedance, the Charleston contribution is smaller at 1 and 2.5 Hz and is absent for 5 and 10 Hz (Figures 2.5.2-235 and 2.5.2-236). The local background sources representing seismicity out to a distance of 520 km dominate for all annual frequencies for 5 and 10 Hz. As an update to Reference 326 in June, 2012 (Reference 398), the logic tree structures for the Charleston and New Madrid RLMEs were revised. For the Lee site, these changes affect the seismogenic crustal thickness branch of the Charleston RLME source logic tree (Figures 2.5.2-261a through 2.5.2-261d). Seismogenic crustal thickness branch weights of the New Madrid RLME logic tree are also revised (Figures 2.5.2-263a and 2.5.2-263b); however, this branch is collapsed to its central value for expedience, and the central value is not affected. A sensitivity study was conducted to determine the effect of these changes on the total mean rock hazard at the Lee site. The observed effect of including changes to the logic trees is a slight decrease in mean hazard between 0% and -1% for each analyzed combination of spectral frequency and amplitude. Thus, the results of the sensitivity study demonstrate that the revised Charleston RLME logic tree have no impact on the seismic hazard calculated at Lee. Smooth UHRS are developed from the UHRS amplitudes in Table 2.5.2-217, using the hard rock spectral shapes for CEUS earthquake ground motions recommended in NUREG/CR-6728 (Reference 251). The UHRS for the 7 spectral frequencies at which hazard calculations were made (Table 2.5.2-217), were obtained by interpolation of hazard curves. In between the 7 spectral frequencies, interpolation is used adopting spectral shapes published in Reference 251. To apply these spectral shapes, the high-frequency magnitude and distance were used for 5 Hz and higher spectral frequencies, and the low-frequency magnitude and distance were used for 2.5 Hz and lower spectral frequencies. For spectral frequencies below 0.5 Hz but above 0.125 Hz, 1/T scaling is assumed (where T is spectral period). Below 0.125 Hz 1/T squared scaling is applied. This is the low frequency spectral shape recommended by Building Seismic Safety Council for seismic design (Reference 294). Figure 2.5.2-266a shows the horizontal HF and LF spectra calculated in this way for 10-4, 10-5, and 10-6 annual frequencies of exceedance. Figure 2.5.2-266b shows the resultant mean rock UHRS for 10-4, 10-5, and 10-6 annual frequencies of exceedance. As mentioned previously, these spectra accurately reflect the UHRS amplitudes in Table 2.5.2-217 that are calculated for the seven spectral frequencies at which PSHA calculations are performed.	
11716	WLS	Pt 02	FSAR 02	02.05.02.05	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.5, second paragraph is revised as follows: In summary, the Lee Nuclear Site is a hard rock site with a shear-wave velocity exceeding 9,200 ft/sec. Therefore the EPRI 2004, 2006 GMM Review Project (Reference 396) ground motion equations are used directly, without calculation of site response. The recommended uniform hazard response spectrum reflects this hard rock condition.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A436)

11717	WLS	Pt 02	FSAR 02	02.05.02.06	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.6, first and second paragraphs are revised as follows: This subsection presents the performance goal-based approach used to develop the ground motion response spectrum GMRS for the Lee Nuclear Site, based on the PSHA methodology and results described in Subsection 2.5.2.4. Specifically, the envelope of the 10-4 and 10-5 horizontal HF and LF spectra shown in Figure 2.5.2-266a is used to represent the 10-4 and 10-5 UHRS, and the horizontal GMRS is determined from the following equations: AR = SA(10-5)/SA(10-4) Equation 2.5.2-1 DF = 0.6 AR0.8 Equation 2.5.2-2 GMRS = max([SA(10-4) x max(1, DF)], 0.45 SA(10-5)) Equation 2.5 2-3 where AR is the ground motion slope ratio, DF is the design factor, and SA(10-4) and SA(10-5) are the horizontal envelope spectral amplitudes corresponding to UHRS annual frequencies of 10-4 and 10-5, respectively. Figure 2.5.2-239 shows the horizontal Lee Nuclear Station GMRS calculated at the top of hard rock Table 2.5.2-219 documents the horizontal 10-4, 10-5, and 10-6 UHRS and the horizontal GMRS (Equation 2.5.2 3).	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A436)
11718	WLS	Pt 02	FSAR 02	02.05.02.06	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.6, third paragraph, last sentence is revised as follows: Table 2.5.2 220 lists the resulting vertical 10-4, 10-5, and 10-6 UHRS and GMRS, and Figure 2.5.2-239 shows the horizontal and vertical GMRS.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A436)
11719	WLS	Pt 02	FSAR 02	02.05.02.07	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.7, third paragraph, last sentence is revised as follows: Unit 1 FIRS as described in this subsection is calculated using the mean and fractiles hazard curves described in Subsection 2.5.2.4.2.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A436)
11720	WLS	Pt 02	FSAR 02	02.05.02.07.01	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.7.1, equation following the fifth paragraph is re-numbered to Equation 2.5.2-4.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A436)
11721	WLS	Pt 02	FSAR 02	02.05.02.07.01.01	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.7.1.1, first paragraph, third bullet is revised as follows: • Based on the deaggregation (Subsection 2.5.2.4.2 describes deaggregation procedure), transfer functions are computed for M 5.1 using the omega-square source model and CEUS parameters (Table 2.5.2-221). Because the site-specific condition is quite stiff (concrete), linear site response analyses are used requiring a single (large or small M) earthquake.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A436)
11722	WLS	Pt 02	FSAR 02	02.05.02.07.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.7.2, fifth paragraph, last sentence is revised as follows: The M 5.1 distance ranges more than adequately accommodate the hazard deaggregation (Subsection 2.5.2.4.2).	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4,

						WLG2014.01-02 (ML14064A436)
11723	WLS	Pt 02	FSAR 02	02.05.02.07.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.7.3, first paragraph, beginning with the sen-tence preceding the equation, and the equation numbering are revised as follows: Since the source corner frequency, or transition from approximately constant spectral velocity to spectral displacement, depends on magnitude, an average representative magnitude of M 7.2, based on the deaggregations, is assumed to apply for frequencies below 0.5 Hz, based on the low-frequency deaggregation (Subsection 2.5.2.4.2). Application of the empirical relation Log T = -1.25 + 0.3M Equation 2.5.2-5	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A436)
11808	WLS	Pt 02	FSAR 02	02.05.02.07.02	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.7.2, ninth paragraph is revised to replace the call-out of Subsection 2.5.2.4.3.2 with Subsection 2.5.2.2.4 (two instances).	Conforming change to Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A436)
11724	WLS	Pt 02	FSAR 02	02.05.02.08	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.8 is revised to remove references as follows: 204. Deleted 205. Deleted 206. Deleted 208. Deleted 209. Deleted 210. Deleted 211. Deleted 212. Deleted 213. Deleted 214. Deleted 215. Deleted 216. Deleted 217. Deleted 218. Deleted 219. Deleted 223. Deleted 225. Deleted 226. Deleted 227. Deleted 228. Deleted 229. Deleted 230. Deleted 233. Deleted 234. Deleted 235. Deleted 236. Deleted 237. Deleted 240. Deleted 241. Deleted 242. Deleted 243. Deleted 245. Deleted 246. Deleted 247. Deleted 250. Deleted 252. Deleted	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A436)

					253. Deleted 254. Deleted 255. Deleted 256. Deleted 257. Deleted 258. Deleted 259. Deleted 260. Deleted 261. Deleted 262. Deleted 263. Deleted 264. Deleted 265. Deleted 266. Deleted 267. Deleted 268. Deleted 269. Deleted 270. Deleted 271. Deleted 272. Deleted 276. Deleted 283. Deleted 284. Deleted 285. Deleted 287. Deleted 293. Deleted	
11725	WLS	Pt 02	FSAR 02	02.05.02.08	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.8 is revised to add new references as follows: 326. NUREG 2115, Central and Eastern United States Seismic Source Characterization for Nuclear Facilities, U.S. Nuclear Regulatory Commission NUREG-2115, Department of Energy DOE/NE-0140, and Electric Power Research Institute Report 1021097, 2012. 327. Visvanathan, T.R., "Earthquakes in South Carolina, 1698-1975," South Carolina Geological Survey Bulletin 40, 1980. 328. Bernreuter, D.L., Savy, J.B., Mensing, R.W., Chen, J.C., and Davis, B.C., Seismic Hazard Characterization of 69 Nuclear Plant Sites East of the Rocky Mountains: U.S. Nuclear Regulatory Commission, NUREG/CR-5250, Volumes 1–8, 1989. 329. Petersen, M.D., Frankel, A.D., Harmsen, S.C., Mueller, C.S., Haller, K.M., Wheeler, R.L., Wesson, R.L., Oliver, Y.Z, Boyd, S., Perkins, D.M., Luco, N., Field, E.H., Wills, C.J., and Rukstales, K.S., Documentation for the 2008 Update of the United States National Seismic Hazard Maps: USGS Open-File Report 2008-1128, 128 p., 2008. 330. Senior Seismic Hazard Analysis Committee (SSHAC), Recommendations for Probabilistic Seismic Hazard Analysis — Guidance on Uncertainty and Use of Experts: Prepared by SSHAC, NUREG/CR-6372, 256 p., 1997. 331. Hanks, T.C., Abrahamson, N.A., Boore, D.M., Coppersmith, K.J, and Knepprath, N.E., Implementation of the SSHAC Guidelines for Level 3 and 4 PSHAs—Experience Gained from Actual Applications: U.S. Geological Survey Open-File Report 2009-1093, 66 p., 2009. 332. Kammerer, A.M. and Ake, J.P., Practical Implementation Guidelines for SSHAC Level 3 and 4 Hazard Studies: U.S. Nuclear Regulatory Commission NUREG-2117, Rev 1, 235 p., 2012. 333. Kijko, A., Estimation of the Maximum Earthquake Magnitude, Mmax: Pure and Applied Geophysics, v. 161, pp. 1-27, 2004. 334. Schulte, S.M., and Mooney, W.D., An Updated Global Earthquake Catalog for Stable Continental Regions: Reassessing the Correlation with Ancient Rifts, Geophysical Journal International, v. 161, pp. 707-721, 2005. 335. LASE Study Group, Deep structure of the US East Coast passive margin from large aperture seismic	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A436) (ML14064A438)

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11809	WLS	Pt 02	FSAR 02	02.05.02.08	COLA Part 2, FSAR Chapter 2, Subsection 2.5.2.8, Reference 269 is restored as follows: 269. Johnston, A.C., Coppersmith, K.J., Kanter, L.R., and Cornell, C.A., The Earthquakes of Stable Continental Regions, Volume I: Assessment of Large Earthquake Potential, EPRI Final Report TR-102261-V1, 1994.	Correction to Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A438)
11730	WLS	Pt 02				

			FSAR 02	02.05.02.F / F2.5.2-201 F2.5.2-202 F2.5.2-203 F2.5.2-204 F2.5.2-205 F2.5.2-206 F2.5.2-207 F2.5.2-208 F2.5.2-209 F2.5.2.210 F2.5.2-211 F2.5.2-212 F2.5.2-213 F2.5.2-214 F2.5.2-215 F2.5.2-216 F2.5.2-217 F2.5.2-218 F2.5.2-219 F2.5.2-220 F2.5.2-221 F2.5.2-222	COLA Part 2, FSAR Figures 2.5.2-201 through 2.5.2-222 are deleted as reflected on Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A438)
11731	WLS	Pt 02	FSAR 02	02.05.02.F / F2.5.2-223 F2.5.2-224 F2.5.2-225 F2.5.2-226 F2.5.2-227 F2.5.2-228 F2.5.2-229	COLA Part 2, FSAR Figures 2.5.2-223 through 2.5.2-229 are revised as reflected on Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A438)
11732	WLS	Pt 02	FSAR 02	02.05.02.F / F2.5.2-230	COLA Part 2, FSAR Figure 2.5.2-230 is deleted as reflected on Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A438)
11733	WLS	Pt 02	FSAR 02	02.05.02.F / F2.5.2-231 F2.5.2-232 F2.5.2-233 F2.5.2-234 F2.5.2-235 F2.5.2-236	COLA Part 2, FSAR Figures 2 5.2-231 through 2.5.2-236 are revised as reflected on Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A438)
11734	WLS	Pt 02	FSAR 02	02.05.02.F / F2.5.2-237 F2.5.2-238	COLA Part 2, FSAR Figures 2.5.2-237 and 2.5.2-238 are deleted as reflected on Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A438)
11735	WLS	Pt 02				

			FSAR 02	02.05.02.F / F2.5.2-239	COLA Part 2, FSAR Figure 2.5.2-239 is revised as reflected on Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A438)
11736	WLS	Pt 02	FSAR 02	02.05.02.F / F2.5.2-244a F2.5.2-244b F2.5.2-244c	COLA Part 2, FSAR Figures 2.5.2-244a through 2.5.2-244c are revised as reflected on Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A438)
11737	WLS	Pt 02	FSAR 02	02.05.02.F / F2.5.2-245a F2.5.2-245b F2.5.2-245c	COLA Part 2, FSAR Figures 2.5.2-245a through 2.5.2-245c are revised as reflected on Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A438)
11738	WLS	Pt 02	FSAR 02	02.05.02.F / F2.5.2-246a F2.5.2-246b F2.5.2-246c	COLA Part 2, FSAR Figures 2.5.2-246a through 2.5.2-246c are revised as reflected on Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A438)
11739	WLS	Pt 02	FSAR 02	02.05.02.F / F2.5.2-247a F2.5.2-247b F2.5.2-247c	COLA Part 2, FSAR Figures 2.5.2-247a through 2.5.2-247c are revised as reflected on Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4.	Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A438)
11740	WLS	Pt 02	FSAR 02	02.05.02.F / F2.5.2-248 F2.5.2-249 F2.5.2-250 F2.5.2-251 F2.5.2-252 F2.5.2-253 F2.5.2-254a F2.5.2-254b F2.5.2-255 F2.5.2-256 F2.5.2-257 F2.5.2-258 F2.5.2-259 F2.5.2-260 F2.5.2-261a F2.5.2-261b	COLA Part 2, FSAR Figures 2.5.2-248 through 2.5.2-266b are added as reflected on Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A438) (ML14064A433)

				F2.5.2-261c F2.5.2-261d F2.5.2-262 F2.5.2-263a F2.5.2-263b F2.5.2-264 F2.5.2-265 F2.5.2-266a F2.5.2-266b		
11726	WLS	Pt 02	FSAR 02	02.05.02.T / T2.5.2-201 T2.5.2-202 T2.5.2-203 T2.5.2-204 T2.5.2-205 T2.5.2-206 T2.5.2-207 T2.5.2-208 T2.5.2-209 T2.5.2.210 T2.5.2-211 T2.5.2-212 T2.5.2-213 T2.5.2-214 T2.5.2-215 T2.5.2-216	COLA Part 2, FSAR Tables 2.5.2-201 through 2.5.2-216 are deleted as reflected on Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A438)
11727	WLS	Pt 02	FSAR 02	02.05.02.T / T2.5.2-217 T2.5.2-218 T2.5.2-219 T2.5.2-220	COLA Part 2, FSAR Tables 2.5.2-217 through 2.5.2-220 are revised as reflected on Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A438)
11728	WLS	Pt 02	FSAR 02	02.05.02.T / T2.5.2-224 T2.5.2-225 T2.5.2-226	COLA Part 2, FSAR Tables 2.5.2-224 through 2.5.2-226 are revised as reflected on Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A438)
11729	WLS	Pt 02	FSAR 02	02.05.02.T / T2.5.2-227 T2.5.2-228 T2.5.2-229 T2.5.2-230 T2.5.2-231 T2.5.2-232 T2.5.2-233 T2.5.2-234 T2.5.2-235	COLA Part 2, FSAR Tables 2.5.2-227 through 2.5.2-235 are added as reflected on Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A438)
11754	WLS	Pt 02				Editorial

			FSAR 02	02.05.02.T / T2.5.2-231	COLA Part 2, FSAR Table 2.5.2-231 is revised at the Note as follows: Note: Default characteristics (i.e., those listed on Table 5.4-2 of NUREG/CR-2115 for the entire CEUS region) are indicated in italics.	
11755	WLS	Pt 02	FSAR 02	02.05.02.T / T2.5.2-233	COLA Part 2, FSAR Table 2.5.2-233 is revised at the first column header to replace "(M)" with "[M]".	Editorial
11686	WLS	Pt 02	FSAR 02	02.05.03.01	COLA Part 2, FSAR Chapter 2, Subsection 2.5.3.1, second paragraph, fourth bullet is revised as follows: • Seismicity data compiled and analyzed in published journal articles and the CEUS SSC (Reference 244).	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 5, WLG2014.01-02 (ML14064A433)
11687	WLS	Pt 02	FSAR 02	02.05.03.01.04	COLA Part 2, FSAR Chapter 2, Subsection 2.5.3.1.4, first paragraph is revised as follows: The highest recorded ground shaking intensities at the Lee Nuclear Site are the result of earthquakes located beyond the site vicinity The largest earthquake within 25 mi. of the Lee Nuclear Site included in the updated CEUS SSC earthquake catalog is the 1886 E[M] 4.13 event. Located just outside the 25 mi site radius was the 1913 E[M] 4.54 Union County, South Carolina earthquake, located approximately 25 mi. southwest of the Lee Nuclear Station (Figure 2.5.1-210) (Reference 244).	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 5, WLG2014.01-02 (ML14064A433)
11688	WLS	Pt 02	FSAR 02	02.05.03.01.05	COLA Part 2, FSAR Chapter 2, Subsection 2.5.3.1.5, first and second paragraphs are revised as follows: As described in Subsection 2.5.2.1, the CEUS SSC earthquake catalog of the central and eastern United States is updated to incorporate earthquakes that occurred between 1568 and 2008. In 2006, four minor earthquakes occurred in northeast South Carolina. Two of these events that occurred in January were less than mb 3.0, and two events that occurred in September were larger than mb 3.0. None of these four events are included in the CEUS SSC earthquake catalog. In an unpublished online report, Talwani (2006a, Reference 218) describes the two January earthquakes located near Jonesville, South Carolina, approximately 20 mi. southwest of the Lee Nuclear Site. Talwani (2006a, Reference 218) suggests that the January 24, 2006 magnitude 2.5 and January 25, 2006 magnitude 1.5 (magnitude scale unspecified) earthquakes are associated with the western margin of the Baldrock granitic pluton. Talwani (2006a, Reference 218) does not provide estimates of location uncertainty for these two micro-earthquakes, but the epicentral locations are likely inaccurate due to the small magnitudes of these events.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 5, WLG2014.01-02 (ML14064A433)
11689	WLS	Pt 02	FSAR 02	02.05.03.01.05	COLA Part 2, FSAR Chapter 2, Subsection 2.5.3.1.5, third paragraph is revised as follows: The additional, minor earthquakes occurred in September 2006, in northeast South Carolina near the town of Bennettsville. In unpublished online reports, the USGS National Earthquake Information Center describes the September 22, 2006 mb 3.5 and the September 25, 2006 mb 3.7 earthquakes (References 219 and 220). The epicenters of these two earthquakes are not precisely located, but are more than 75 mi. east-southeast of the Lee Nuclear Site. Estimates of location uncertainty for the September 22, 2006 event are: +/-4.5 mi. horizontal, +/-7.9 mi. depth (+/-7.3 km horizontal, +/-12.8 km depth) (Reference 219). Estimates of location uncertainty for the September 25, 2006 event are: +/-6.8 mi. horizontal, with depth fixed at 3.1 mi. by the location program (+/-10.9 km horizontal, depth fixed at 5 km) (Reference 220). Due to the lack of nearby seismograph stations, focal mechanisms are not determined for these events. The September 2006 earthquakes are spatially associated with a small Mesozoic extensional basin mapped beneath the Coastal Plain by Benson (1992, Reference 221) (Figure 2.5.1-210). In an unpublished online report, Talwani (2006b, Reference 222) suggests that these two earthquakes may be spatially related to the Eastern Piedmont fault system, a broad zone of faults interpreted by Hatcher et al. (1977, Reference 223) as a regional fault zone (Figure 2.5.1-209). At the latitude of the two September 2006 earthquakes, the Eastern Piedmont fault system is up to 40 mi. wide. Given the uncertainty associated with the locations of the two September 2006 earthquakes and the broad regional extent of the Eastern Piedmont fault system, these two minor events cannot be positively correlated with this fault system.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 5, WLG2014.01-02 (ML14064A433)

11690	WLS	Pt 02	FSAR 02	02.05.03.01.06	COLA Part 2, FSAR Chapter 2, Subsection 2.5.3.1.6, first paragraph is revised as follows: Aerial photography, satellite imagery, and topographic maps of varying scales and vintages reveal no evidence of geomorphic features indicative of the potential for surface deformation (e.g., faulting or warping) within the site area. Imagery reviewed as part of this license application includes:	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 5, WLG2014.01-02 (ML14064A433)
11691	WLS	Pt 02	FSAR 02	02.05.03.03	COLA Part 2, FSAR Chapter 2, Subsection 2.5.3.3 is revised as follows: Seismicity with the Lee Nuclear Site vicinity is shown in Figure 2.5.1-210. As shown on this figure, there is no spatial correlation of earthquake epicenters with known or postulated faults or other tectonic features. No faults or geomorphic features within the site vicinity can be correlated with earthquakes. Based on review of existing literature, no reported historical earthquake epicenters have been associated with bedrock faults within the Lee Nuclear Site vicinity (Figure 2.5.1-210). None of these faults within the Lee Nuclear Site vicinity are classified as capable tectonic sources. The CEUS SSC earthquake catalog does not include any earthquakes of E[M] > 3.0 within the site area. However, several small events have occurred within or just beyond the site vicinity (Figure 2.5.1-210) and are discussed above in Subsections 2.5.3.1.4 and 2.5.3.1.5. The largest of these is the January 1, 1913 (E[M] 4.54, (Reference 244) Union County, South Carolina earthquake, located approximately 25 mi. southwest of the Lee Nuclear Station (Reference 216). The fault on which this earthquake occurred has not been identified.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 5, WLG2014.01-02 (ML14064A433)
11692	WLS	Pt 02	FSAR 02	02.05.03.09	COLA Part 2, FSAR Chapter 2, Subsection 2.5.3.9, is revised to remove Reference 204 as follows: 204. Removed	Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 5, WLG2014.01-02 (ML14064A433)
11693	WLS	Pt 02	FSAR 02	02.05.03.09	COLA Part 2, FSAR Chapter 2, Subsection 2.5.3.9, is revised to add the following reference: 244. NUREG-2115, Central and Eastern United States Seismic Source Characterization for Nuclear Facilities, U.S. Nuclear Regulatory Commission NUREG-2115, Department of Energy DOE/NE-0140, and Electric Power Research Institute Report 1021097, 2012.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 5, WLG2014.01-02 (ML14064A433)
11694	WLS	Pt 02	FSAR 02	02.05.04.01.01	COLA Part 2, FSAR Chapter 2, Subsection 2.5.4.1.1, fourth paragraph is revised as follows: Since the 1980's, researchers have assessed and compiled available stress data for the central and eastern United States, including well-bore breakouts, results of hydraulic fracturing studies, in situ stress measurements and earthquake focal mechanisms (References 241, 242, 243, 244). The most recent compilations as part of the CEUS SSC project confirm previous work that indicates the prevailing stress field in the midcontinent is east-northeast to northeast maximum horizontal stress direction, with no strong evidence for stress subprovinces (Reference 245). This is consistent with the theoretical trend of compressive forces acting on the North American plate from the mid-Atlantic Ridge as shown in Figure 2.5.1-245.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 6, WLG2014.01-02 (ML14064A433)
11695	WLS	Pt 02	FSAR 02	02.05.04.03.06	COLA Part 2, FSAR Chapter 2, Subsection 2.5.4.3.6, third paragraph is revised to read: These profiles depict the original and existing ground surface, extent of granular fill, plant and yard grade representations, nuclear island foundation and other important power block foundation features, and the location of borings and geophysical tests in the vicinity of each profile. The granular fill depicted on these cross sections will extend horizontally outward from the walls of the nuclear island a distance of 100 feet or as necessary to form the foundation support zone of the seismic category II portion of the annex building and the turbine building (including the seismic category II first bay), whichever is the greater distance.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 6, WLG2014.01-02 (ML14064A433)
11696	WLS	Pt 02		02.05.04.08		

			FSAR 02		COLA Part 2, FSAR Chapter 2, Subsection 2.5.4.8, third and fourth paragraphs are revised to read: Outside the nuclear islands, compacted engineered granular fill is placed adjacent to seismic Category I structures over the exposed rock/fill concrete surfaces to the extent of 100 ft from the nuclear island walls or as necessary to form the foundation support zone of the seismic category II portion of the annex building and the turbine building (including the seismic category II first bay), whichever is the greater distance, as shown on Figures 2.5.4 245 and 2.5.4 260 through 2.5.4 265. This granular backfill forms the supporting materials for the power block structures outside but adjacent to the nuclear islands. The typical thickness of granular fill is about 40 feet with a maximum thickness of about 55 feet under the radwaste building where fill concrete is not used to build up to the bottom of the nuclear island foundation. Beyond the perimeter of the granular fill as described above, Group I engineered fill is placed as necessary to completely backfill the Cherokee Nuclear Station excavation, encompassing the granular backfill around the Lee Nuclear Station nuclear island structures up to yard grade. As discussed in Subsection 2.5.4.6, groundwater will rise above the bedrock surface within the engineered granular fill to elevations between about 574 feet to 584 feet msl. Shallow foundations for non-Category I plant facilities adjacent to the nuclear island (i.e., seismic Category II part of the annex building, non-seismic radwaste building, and seismic Category II part of the turbine building) are completely founded on or over compacted engineered granular fill over partially weathered rock/continuous rock, or compacted engineered granular fill over concrete and partially weathered rock/continuous rock. The non-seismic part of the annex building and non-seismic part of the turbine building are underlain at depth by partially weathered rock/continuous rock, concrete and partially weathered rock/ continuous rock, or saprolite soils overlying partially weathered rock/continuous rock.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 6, WLG2014.01-02 (ML14064A433)
11697	WLS	Pt 02	FSAR 02	02.05.04.08	COLA Part 2, FSAR Chapter 2, Subsection 2.5.4.8, ninth paragraph, first sentence is revised to read: The southern ends of the non-seismic portions of the annex buildings for Unit 1 and Unit 2 and the southern end of the non-seismic portion of the turbine building for Unit 2 may be underlain at depth by saprolite.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 6, WLG2014.01-02 (ML14064A433)
11698	WLS	Pt 02	FSAR 02	02.05.04.09	COLA Part 2, FSAR Chapter 2, Subsection 2.5.4.9, second paragraph, first and second bullets are revised as follows: • Review the 2012 CEUS seismic source characterization (CEUS SSC) model, detailed in NUREG-2115, which was created to provide a regionally consistent model of seismic hazard for facilities throughout the central and eastern United States (Reference 245). Subsection 2.5.2 uses this most recent CEUS SSC as the starting point for the Lee Nuclear site PSHA for the site region (200-mile radius). • Review the 2013 EPRI (2004, 2006) Ground-Motion Model (GMM) Review Project ground motion prediction equations (Reference 246).	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 6, WLG2014.01-02 (ML14064A433)
11699	WLS	Pt 02	FSAR 02	02.05.04.10.01.01	COLA Part 2, FSAR Chapter 2, Subsection 2.5.4.10.1.1, is revised with a new last paragraph as follows: The applied seismic loading may exceed, by a relatively small amount, the DCD value as a result of the site-specific seismic loading. The results described above show that a large margin of bearing capacity is available above the DCD requirement, and therefore the factor of safety under the site-specific seismic loading requirement will remain high and the available bearing pressure will exceed the site specific requirement by a significant amount. The bearing pressure demand from the site-specific seismic loading will not alter the condition that the ultimate bearing capacity provides factors of safety that exceed the AP1000 minimum criterion factors of safety (3.0 for static loading and 1.5 for seismic loading).	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 6, WLG2014.01-02 (ML14064A433)
11700	WLS	Pt 02	FSAR 02	02.05.04.10.03	COLA Part 2, FSAR Chapter 2, Subsection 2.5.4.10.3, second paragraph, sixth sentence is revised to replace Reference 240 with 247 as follows: The compaction-induced earth pressures in Table 2.5.4-226A do not result in excessive lateral pressures on the nuclear island walls (Reference 247).	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 6, WLG2014.01-02 (ML14064A433)

11701	WLS	Pt 02	FSAR 02	02.05.04.10.03	COLA Part 2, FSAR Chapter 2, Subsection 2.5.4.10.3, seventh paragraph is revised and new eighth paragraph is added as follows: The seismic acceleration used, (a) = 0.352g, is applied as a uniform seismic acceleration to the granular backfill along the height of the nuclear island wall. Westinghouse has evaluated the Lee Nuclear Station site-specific lateral earth pressures and has determined that they are bounded by the standard AP1000 design pressures (Reference 247).	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 6, WLG2014.01-02 (ML14064A433)
11702	WLS	Pt 02	FSAR 02	02.05.04.13	COLA Part 2, FSAR Chapter 2, Subsection 2.5.4.13, References are removed as follows: 204. Removed. 212. Removed. 219. Removed. 240. Removed.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 6, WLG2014.01-02 (ML14064A433)
11703	WLS	Pt 02	FSAR 02	02.05.04.13	COLA Part 2, FSAR Chapter 2, Subsection 2.5.4.13, References are added as follows: 241. Zoback, M.L. and Zoback, M.D., "Tectonic Stress Field of the Continental United States," in Geophysical Framework of the Continental United States, Geological Society of America Memoir 172:523-539, 1989. 242. Zoback, M.L., Zoback, M.D., Adams, J., Assumpcao, M., Bell, S., Bergman, E.A., Bluemling, P., Brereton, N.R., Denham, D., Ding, J., Fuchs, K., Gay, N., Gregersen, S., Gupta, H.K., Gvishiani, A., Jacob, K., Klein, R., Knoll, P., Magee, M., Mercier, J.L., Mueller, B.C., Paquin, C., Rajendran, K., Stephansson, O., Suarez, G., Suter, M., Udias, A., Xu, Z.H., and Zhizin, M., "Global Patterns of Tectonic Stress," Nature 341 (6240):291-298, 1989. 243. Zoback, M.L., "Stress Field Constraints on Intraplate Seismicity in Eastern North America," Journal of Geophysical Research 97 (B8):11,761-11,782, 1992. 244. Heidbach, O., Tingay, M., Barth, A., Reinecker, J., Kurfess, D., and Muller, B., The World Stress Map database release 2008, doi:10.1594/GFZ.WSM.Rel2008. 245. U.S. NRC, 2012, NUREG-2115, Technical Report: Central and Eastern United States Seismic Source Characterization for Nuclear Facilities. EPRI, Palo Alto, CA, U.S. DOE, and U.S. NRC: January, 2012. 246. EPRI (2013). EPRI (2004, 2006) Ground-Motion Model (GMM) Review Project, Elec. Power Res. Inst, Palo Alto, CA, Rept. 3002000717, June 2013. 247. Westinghouse Electric Company LLC, 2013. "William S. Lee Site-Specific Assessment of Lateral Earth Pressure Loads Due to 2012/2013 CEUS Ground Motion Seismic Input." Document No.WLG-1000-S2R-806, Rev. 2, November, 2013.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 6, WLG2014.01-02 (ML14064A433)
11636	WLS	Pt 02	FSAR 02	02.05.04.F / F2.5.4-256a	COLA Part 2, FSAR Chapter 2, Figure 2.5.4-256a is revised to correct the COL item from WLS COL 2.5-13 to WLS COL 2.5-11.	Editorial
11549	WLS	Pt 02	FSAR 02	02.05.04.F / F2.5.4-246	COLA Part 2, FSAR Chapter 2, Figure 2.5.4-246 is deleted as reflected on Duke Energy Supplemental Response to Lee Units 1 and 2 Physical Locations, Enclosure 2, Attachment 3.	Correction to remove this figure in FSAR Rev. 7, as reflected in Duke Energy Supplemental Response to Lee Units 1 and 2 Physical Locations, Enclosure 2, Attachment 3, WLG2013.05-02 (ML13127A227).

						previously recorded with QB 11381
11550	WLS	Pt 02	FSAR 02	02.05.04.F / F2.5.4-249	COLA Part 2, FSAR Chapter 2, Figure 2.5.4-249 is deleted as reflected on Duke Energy Supplemental Response to Lee Units 1 and 2 Physical Locations, Enclosure 2, Attachment 3.	Correction to remove this figure in FSAR Rev. 7, as reflected in Duke Energy Supplemental Response to Lee Units 1 and 2 Physical Locations, Enclosure 2, Attachment 3, WLG2013.05-02 (ML13127A227), previously recorded with QB 11384
11705	WLS	Pt 02	FSAR 02	02.05.04.F / F2.5.4-256b	COLA Part 2, FSAR Chapter 2, Figure 2.5.4-256b is revised as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 6.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 6, WLG2014.01-02 (ML14064A433)
11810	WLS	Pt 02	FSAR 02	02.05.04.T / T2.5.4-230	COLA Part 2, FSAR Table 2.5.4-230, Footnote a is revised to read: a) See Reference 237, raised 3 ft per Reference 247.	Conforming change to Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 4, WLG2014.01-02 (ML14064A433)
11631	WLS	Pt 02	FSAR 02	02.05.04.T / T2.5.4-222	COLA Part 2, FSAR Table 2.5.4-222, Sheet 1 of 4 is revised at the entry "Granular Backfill", Test, "Field Density," under the column heading "Minimum Sampling and Testing Frequency", first paragraph is revised to read: Minimum 1 sample per lift per 10,000 square feet or per 250 cubic yards, whichever is smallest volume in cubic yards. One test for every 2,500 square feet per lift or per 250 cubic yards whichever is smallest volume in cubic yards when manually operated compactors are used.	Editorial - clarification
11704	WLS	Pt 02	FSAR 02	02.05.04.T / T2.5.4-227	COLA Part 2, FSAR Chapter 2, Table 2.5.4-227 is revised as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 6.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 6, WLG2014.01-02 (ML14064A433)
11637	WLS	Pt 02	FSAR 03	03.07.01.01.01	COLA Part 2, FSAR Chapter 3, Subsection 3.7.1.1.1 is revised as follows: 3.7.1.1.1 Design Foundation Response Spectra	Duke Energy Supplemental Response 3 to RAI

					Design foundation response spectra for Lee Nuclear Station Unit 1 and Unit 2 nuclear islands are presented in this subsection. The foundation conditions at Lee Nuclear Station are unique in that the Unit 1 nuclear island foundation is supported on new and previously placed concrete materials placed directly over continuous rock. In contrast, the Unit 2 nuclear island foundation is configured more conventionally with the nuclear island founded directly over continuous rock, except for the eastern edge of the Unit 2 nuclear island, which will require approximately 20 ft. of fill concrete to build up the support zone to the base of the nuclear island. The Lee Nuclear Station site provides uniform hard-rock support for the nuclear island; foundation conditions and uniformity are described in Subsection 2.5.4.7.4 (Figure 2.5.4-241). Measured shear wave velocities for continuous rock underlying the Units 1 and 2 nuclear islands range from between 9000 to 10,000 fps, as described in Subsection 2.5.4.7. The stability of subsurface materials including foundation conditions are described in Subsection 2.5.4. Based on these foundation conditions, individual foundation response spectra are provided for the certified design portion of the plant at Units 1 and 2. The site-specific dynamic velocity profiles developed for the Lee Nuclear Station are described in Subsection 2.5.4.7.5. As described in Subsection 2.5.2.7.4, the site ground motion response spectra (GMRS) defines the input motion (FIRS) at Unit 2, while the FIRS associated with dynamic profile A1 defines the Unit 1 FIRS. For Unit 1, the Foundation Input Response Spectrum (FIRS) defines the site response foundation input motion for the nuclear island foundation placed on concrete over continuous rock. Unit 1 FIRS, associated with Unit 1 FIRS A1 dynamic velocity profile (Figure 2.5.4-252a), represents the nuclear island centerline foundation input motion and is based on the GMRS developed at the top of a hypothetical outcrop (e.g. continuous rock) fixed at 530 feet North American Vertical Datum (NAVD) transferred up through previously placed and new concrete materials to the basemat foundation level at 553.5 feet (NAVD). For Unit 2, the GMRS defines the site response foundation input motion developed at the top of a hypothetical outcrop of competent material (e.g. continuous rock) fixed at the basemat foundation level at 553.5 feet (NAVD). The GMRS (Unit 2 FIRS) is associated with dynamic velocity Profile C (Figure 2.5.4-250). Detailed discussions of the methods used to calculate the horizontal and vertical GMRS and FIRS are described in Subsections 2.5.2.6, Ground Motion Response Spectra GMRS, and 2.5.2.7, Development of FIRS for Units 1 and 2. Both the GMRS and the Unit 1 FIRS exceed the AP1000 CSDRS at higher frequencies. As a conservative simplification, the site-specific foundation input motion for both Units 1 and 2 is represented as the horizontal and vertical envelope of the GMRS (Unit 2) and Unit 1 FIRS. These envelope spectra, considered to be applicable to both units, are illustrated in Figures 3.7-201 and 3.7-202, and are referred to as the nuclear island FIRS (NI FIRS). As shown on Figure 3.7-201, the horizontal NI FIRS exceeds the horizontal AP1000 CSDRS at frequencies above approximately 14 hertz. PGA at 100 hertz of the NI FIRS is 0.352 g. As shown on Figure 3.7-202, the vertical NI FIRS exceeds the vertical AP1000 CSDRS at frequencies above approximately 16 hertz. As shown on Figure 3.7-201, the horizontal NI FIRS is above the horizontal AP1000 HRHF spectrum for all frequencies above about 3 hertz. As shown on Figure 3.7-202, the vertical NI FIRS is above the vertical AP1000 HRHF for frequencies between about 3 to 55 hertz and 80 to 100 hertz. As described in AP1000 DCD Appendix 3I, generic hard rock spectrum high frequency exceedances are within the seismic design margin of the AP1000 and will not adversely affect the structures, systems, or components of the plant. The Lee Nuclear Station site provides uniform hard-rock support for the nuclear island, but the site characteristic NI FIRS exceed the horizontal and vertical AP1000 HRHF. As described in AP1000 DCD Section 2.5.2.1, Paragraph 4b, if the site-specific spectra are not enveloped by the AP1000 HRHF envelope response spectra or the AP1000 CSDRS, the COL applicant may perform site-specific studies to demonstrate high frequency is not damaging. Therefore, a site-specific analysis of the AP1000 has been performed, similar to the analysis described in AP1000 DCD Appendix 3I, to demonstrate that these high frequency spectra exceedances are within the seismic design margin of the AP1000 certified design and will not adversely affect the structures, systems, or components of the plant (Reference 206). Subsection 3.7.2.15 describes confirmatory site-specific analyses of the nuclear island that demonstrate compliance with the AP1000 DCD.	LTR 105, RAI 01.05-1, Enclosure 2, Attachment 7, WLG2014.01-02 (ML14064A433)
11757	WLS	Pt 02	FSAR 03	03.07.01.01.01	COLA Part 2, FSAR Chapter 3, Subsection 3.7.1.1.1, fifth paragraph is further revised to apply parenthesis to GMRS in the title of Subsection 2.5.2.6 as follows:	Editorial

					Detailed discussions of the methods used to calculate the horizontal and vertical GMRS and FIRS are described in Subsections 2.5.2.6, Ground Motion Response Spectra (GMRS), and 2.5.2.7, Development of FIRS for Units 1 and 2.	
11781	WLS	Pt 02	FSAR 03	03.07.01.01.01	COLA Part 2, FSAR Chapter 3, Subsection 3.7.1.1.1, eighth paragraph is revised to add WLS SUP 3.7-3.	Editorial
11638	WLS	Pt 02	FSAR 03	03.07.02.01.02	COLA Part 2, FSAR Chapter 3, Subsection 3.7.2.1.2 is revised as follows: 3.7.2.1.2 Time-History Analysis and Complex Frequency Response Analysis Add the following information to the end of DCD Subsection 3.7.2.1.2: For cases when site-specific analyses of the nuclear island structures may be required, artificial time histories (two horizontal and one vertical) were developed to be compatible with the Lee Nuclear Station foundation input motions, and to satisfy the requirements of Standard Review Plan (SRP) 3.7.1. As a conservative simplification, the foundation input motion for both units was represented as the envelope of the GMRS (Unit 2 FIRS) and the Unit 1 FIRS, referred to as the Lee Nuclear Station NI FIRS, (Figures 3.7-201 and 3.7-202). The methodology used in the development of these time histories is summarized in the following four steps: 1. Select a real 3-component ground-motion record to use as a starting point. All components should be broad-banded and should have reasonable durations consistent with the magnitude and distance of the earthquake. The ILA031 record from the 1999 Chi-Chi earthquake in Taiwan (magnitude (M) 7.6, closest distance (Rclosest) = 94.7 km) is selected. This record is part of the NRC time history library (Reference 207) and belongs to the WUS ROCK, M>7, D=50-100 km bin. 2. Modify the time history for each component using spectral-matching software until it is compatible with the target response spectrum. 3. Use visual examination of the results to confirm that the resulting time histories are realistic and independent calculations to confirm that they meet the requirements of SRP 3.7.1 as well as the requirements defined in Item 4 below. A scaling factor may be used in this step to make minor adjustments. 4. Calculate the cross-correlation coefficients between the three components of acceleration and check that they do not exceed the criterion of |cross-correlation| <0.16. Additionally, the following criteria are also applied: a. Time step interval shall be no more than 0.005 seconds. b. Total duration of the motion shall be no less than 30 seconds. c. The strong motion duration (5%-75% Arias intensity) shall be consistent with the magnitude and distance of interest. d. The time histories of the three components shall be statistically independent. The cross-correlation shall not exceed 0.16. Attributes of the resulting time histories representing the NI FIRS are shown in Table 3.7-201. Figures 3.7-203a through 203c illustrate the three component time histories.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 7, WLG2014.01-02 (ML14064A433)
11782	WLS	Pt 02	FSAR 03	03.07.02.01.02	COLA Part 2, FSAR Chapter 3, Subsection 3.7.2.1.2, first paragraph is revised to add WLS SUP 3.7-6.	Editorial
11769	WLS	Pt 02	FSAR 03	03.07.02.08.04	COLA Part 2, FSAR Chapter 3, Subsection 3.7.2.8.4 third paragraph is revised as follows: The properties of the granular fill material that will be placed above continuous rock, presented in FSAR Table 2.5.4-211 and FSAR Tables 2.5.4-224A through 2.5.4-224F, are consistent with those used by Westinghouse in developing design criteria for adjacent Seismic Category II structures and include having a shear wave velocity greater than 500 fps.	Duke Energy Supplemental Response 4 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.02-02

11770	WLS	Pt 02	FSAR 03	03.07.02.08.04	COLA Part 2, FSAR Chapter 3, Subsection 3.7.2.8.4, sixth paragraph is revised as follows: The information above demonstrates that the Lee site provides uniform support for the Seismic Category II buildings, site-specific fill material is consistent with that considered in establishing generic AP1000 design criteria for these buildings; the configuration of the granular fill supporting the Seismic Category II buildings is consistent with that described in the AP1000 DCD; and the bearing capacity of the supporting granular fill is greater than the bearing demand. Therefore, the Lee Nuclear Station site complies explicitly with the requirements of DCD Subsection 3.7.2.8.4 for a hard rock site, with the exception that the NI FIRS is not bounded by the AP1000 HRHF spectra.	Duke Energy Supplemental Response 4 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.02-02
11771	WLS	Pt 02	FSAR 03	03.07.02.08.04	COLA Part 2, FSAR Chapter 3, Subsection 3.7.2.8.4, seventh paragraph is replaced and new eighth through twelfth paragraphs are added as follows: As permitted by DCD Section 3.7.2.8.4, site-specific analyses of the Lee Nuclear Station Seismic Category II adjacent buildings were performed. Site-specific performance-based surface response spectra (PBSRS) at plant grade were developed for each Seismic Category II building, using the same analytical methods used in calculating the Unit 1 FIRS. Hazard-consistent, strain-compatible properties were also developed for the granular fill material supporting the Seismic Category II adjacent buildings. These site-specific characteristics are used as inputs to the site-specific soil-structure interaction analyses described in Reference 205, which are performed using analyses consistent with those supporting the AP1000 DCD. The analyses presented in Reference 205 confirm that the calculated site-specific relative displacements of the Seismic Category II adjacent buildings are much less than the building separation provided, so there is no contact between the nuclear island and the Seismic Category II adjacent buildings. The maximum site-specific bearing demand (approximately 24.5 ksf for the Annex Building and 5.3 ksf for the Turbine Building) is significantly less than the site-specific allowable bearing pressure shown in FSAR Table 2.5.4-228 (approximately 33.55 ksf for the Annex Building and 45.03 ksf for the Turbine Building), demonstrating that the granular fill material selected is adequate for supporting those structures. As required by AP1000 DCD Subsection 3.7.2.8.4, the Lee site-specific Seismic Category II foundation seismic response spectra are compared to the corresponding AP1000 annex building and turbine building first bay generic design envelope response spectra. This comparison is shown in Figures 3.7-213a and 3.7-213b for the annex building and Figures 3.7-214a and 3.7-214b for the first bay of the turbine building. These foundation response spectra are computed in 2-D analyses, and have been adjusted for 3-D effects, as required by the AP1000 DCD. Figure 3.7-213a demonstrates that the site-specific annex building horizontal foundation response spectrum falls beneath the generic design envelope that is used in designing the AP1000 standard annex building. Figure 3.7-214a illustrates the comparable horizontal foundation response spectrum for the turbine building first bay, which is generally less than the generic design envelope, but exhibits a minor exceedance between 3 Hz and 5 Hz for one soil case. These horizontal foundation response spectra are of primary importance in assessing the potential interactions of Seismic Category II adjacent buildings with the nuclear island. The comparison provides high confidence that the lateral force resisting system for the AP1000 standard Seismic Category II adjacent structures is also adequate for the Lee site-specific seismic requirements. Figure 3.7-213b and Figure 3.7-214b compare the site-specific vertical foundation response spectra to the comparable generic design envelope for the AP1000 standard annex building and turbine building first bay, respectively. For both the annex building and the turbine building first bay, vertical spectra exceedances are noted between about 6 Hz and 25 Hz. These exceedances are likely associated with vertical resonance of the granular fill column in this frequency range. These vertical foundation response spectra are of less importance in assessing potential interactions with the nuclear island, but are important for design of individual building elements such as floor slabs and roofs within the Seismic Category II adjacent structures. As required by DCD Section 3.7.2.8, Seismic Category II adjacent structures must be designed to prevent their collapse when subjected to their design earthquake. Therefore, the detailed design of the building elements making up the AP1000 standard Seismic Category II adjacent structures will be reviewed to confirm that they satisfy the acceptance criteria specified in AP1000 DCD Section 3.7.2 when subjected to the forces resulting from the site-specific foundation response spectra. Should any building element not meet those criteria, appropriate design changes will be implemented to increase its capacity. In this manner, Duke Energy will confirm that the Seismic Category II adjacent buildings are designed not only for the site-specific seismic requirements, but also for the AP1000 Seismic Category II adjacent buildings generic design envelope. This review will be conducted when the source of the actual granular fill material supporting the Seismic Category II adjacent buildings is selected, as part of verifying the compatibility of that material with the facility seismic design. This approach to the non-safety related	Duke Energy Supplemental Response 4 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.02-02

					Seismic Category II adjacent buildings is similar to that used for an item of equipment for which detailed fabrication design has not been completed, but for which all safety-related performance requirements have been identified. The review and any required design changes will be completed prior to start of construction of the Seismic Category II adjacent buildings at Lee Nuclear Station.	
11639	WLS	Pt 02	FSAR 03	03.07.02.15	COLA Part 2, FSAR Chapter 3, Subsection 3.7.2.15 is revised as follows: 3.7.2.15 Site-Specific Analyses of Nuclear Island Seismic Category I Structures Add the following information to the end of DCD Subsection 3.7.2: As described in FSAR Subsection 3.7.1.1.1, the Lee Nuclear Station site provides uniform hard-rock support but the updated site characteristic GMRS and Unit 1 FIRS are not bounded by the HRHF spectra. To address the exceedances of the design basis AP1000 CSDRS and alternate AP1000 HRHF spectra described above, confirmatory site-specific analyses of the nuclear island Seismic Category I structures were performed using an envelope of the updated GMRS (Unit 2 FIRS) and Unit 1 FIRS, referred to as NI FIRS, to confirm that site-specific seismic demands will not adversely affect the structures, systems, or components of the Lee Nuclear Station (Reference 206). This site-specific evaluation uses the same methodology described in AP1000 DCD Appendix 3I to evaluate and qualify the AP1000 HRHF spectra. These site-specific analyses described in Reference 206 include three-dimensional incoherent SSI analysis based on the NI FIRS. The nuclear island analytical model used in these analyses is an updated version of the NI20 model referred to as NI20u. The updated NI20u model includes detailed design changes identified since AP1000 DCD Revision 19. The model also includes refinements to provide a better match to the more detailed NI10 model used in the AP1000 DCD analyses, while continuing to be a conservative representation of the NI10 model. All AP1000 DCD descriptions of the NI20 model remain applicable to the NI20u model, and the changes incorporated do not impact or require an update to the licensing basis as defined in the AP1000 DCD Revision 19. A screening criteria to identify a representative sample of AP1000 structures, systems, and components (SSCs) to be evaluated to demonstrate acceptability of the AP1000 certified design for the Lee Nuclear Station NI FIRS (Reference 206). To better understand the significance of the evaluations required, the in-structure response spectra for the AP1000 CSDRS, HRHF spectra and NI FIRS were compared at the six key location identified in AP1000 DCD Table 3G.4-1 as listed below. • Containment internal structures (CISs) at elevation of reactor vessel support – Node 1761 • Auxiliary building northeast corner at elevation 116'-6" – Node 2078 • Containment operating floor – Node 2199 • Shield building at fuel building roof – Node 2675 • Steel containment vessel (SCV) at polar crane support – Node 2788 • Shield building roof – Node 3329 The resulting site-specific in-structure FRS are shown in Figures 3.7-209a through 3.7-211c for these six (6) key locations. These figures compare the in-structure spectra resulting from the envelope of the AP1000 CSDRS cases (bold black curve) to that resulting from the AP1000 HRHF analyses (solid red curve) to that resulting from the site-specific NI FIRS (dashed blue curve). It should be noted that these spectra are at the same locations, though the node numbers in the site-specific NI20u model are different than in the NI20 model used for AP1000 DCD Revision 19. It is important to note that the AP1000 HRHF broad curve (envelope) is based on SASSI 3D analyses and includes seismic motion incoherency effects. The 3D analyses compare the Lee Nuclear Station 3D FRS results with incoherency to the AP1000 HRHF envelope, also including incoherency. At these six key locations, minor exceedances of the comparable AP1000 DCD in-structure spectra resulting from the AP1000 CSDRS or HRHF spectra were noted. More detailed evaluations are therefore presented in Reference 206 to justify those exceedances and to demonstrate that they are acceptable. In-structure floor response spectra were investigated in additional locations, consistent with the evaluations supporting Appendix 3I of the DCD. These locations are shown below.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 7, WLG2014.01-02 (ML14064A433)

- Auxiliary and Shield Building at Grade
- Auxiliary and Shield Building at Main Control Room Floor
- Auxiliary and Shield Building at Elevation 135'
- Auxiliary and Shield Building at Elevations 160', 180' and 230'
- Auxiliary and Shield Building at Elevations 267', 289' and 327'
- Containment Internal Structures at Grade Elevation 99'
- Containment Internal Structures at Elevation 135'
- Containment Internal Structures at Elevations 153' East, 153' West, and 160'
- Hot Legs and Pressurizer Bottom

Consistent with the criteria established in DCD Section 3.7.5.4, in-structure spectra are determined to be acceptable if they are within ten percent of the corresponding CSDRS and HRHF spectra. Using this criterion, three instances of exceedances were noted. The first instance is above 60 Hz in the vertical direction for the Auxiliary and Shield Building at Main Control Room Floor. The second instance is above 60 Hz in the vertical direction for the Containment Internal Structures at Elevation 153'. Figure 3.7-212 shows the in-structure vertical spectra for these two locations. The only equipment potentially affected by such high frequency exceedance is tested to levels higher than those imposed by these in-structure spectra, as described below. The third instance of exceedance was at lower horizontal frequencies at the reactor coolant loop hot legs and pressurizer bottom. This exceedance was justified by detailed comparative analyses of representative piping attached at these locations, as described below.

Evaluations of representative portions of the building structures (three locations in the Auxiliary Building, eight locations in the Shield Building and three areas in the CIS) confirmed that the seismic loads associated with the design basis AP1000 CSDRS envelope those from the Lee site-specific spectra in all cases (Reference 206).

The reactor vessel and internals were selected for evaluation as representative of major equipment. The analyses described in Reference 206 demonstrate that the AP1000 CSDRS results in higher loads and stresses than those from the Lee site-specific spectra. Likewise, the design of the primary component supports and the reactor coolant loop primary equipment nozzles were found to be controlled by the CSDRS rather than the Lee site-specific spectra.

As described in DCD Appendix 3I, ASME Class 1, Class 2, and Class 3 piping is designed for both CSDRS and HRHF spectra. As described in Reference 206, forty piping packages and the associated floor response spectra were reviewed for susceptibility to high frequency input motion. Three piping packages were selected for detailed review as the most susceptible to the effects of high frequency inputs, and to any differences between the site-specific spectra and CSDRS or HRHF spectra. Two of those packages, a portion of the Automatic Depressurization System and the Pressurizer Surge Line, attach to the reactor coolant loop hot legs and to the pressurizer bottom, where in-structure spectra exceedances of the Lee site-specific spectra compared to CSDRS or HRHF spectra were noted. The third package, a portion of the Spent Fuel System in the Auxiliary Building, was selected based on its potential susceptibility to high-frequency input motion.

The stress analysis results for these three piping systems (Reference 206) indicate that the piping stresses resulting from the site-specific spectra are less than those resulting from HRHF spectra except for the Pressurizer Surge Line, where the site-specific stresses are slightly higher. Nevertheless, it was demonstrated that the stresses resulting from the CSDRS control the design over both the site-specific spectra and HRHF spectra, except for one point where the site-specific stresses are only approximately 3% higher than those due to CSDRS. Based on the selection of these piping packages, these results are representative of all safety class piping for the plant. It is therefore concluded that stresses resulting from site-specific high frequency input are bounded by AP1000 design basis analysis results, and the effect of site-specific high frequency input on piping is non-damaging.

Reference 206 describes a review of current AP1000 equipment qualification test methods and requirements, and a comparison of those requirements to the Lee site-specific requirements. Some of the site-specific in-structure spectra exhibit minor exceedances of the comparable standard AP1000 qualification required response spectra (RRS)

					envelopes. Nevertheless, in all cases the actual test response spectra (TRS) used in completed testing exceed the site-specific demands by a significant margin. It is therefore concluded that those qualification tests are also applicable for the Lee site-specific requirements, and that there is high confidence that future tests will also be applicable to Lee site-specific requirements. Duke Energy will ensure that all seismic qualification testing for safety-related equipment required per DCD Appendix 3I appropriately envelopes the Lee site-specific requirements, in addition to the CSDRS and HRHF RRS. As described above, a site-specific analysis of the AP1000 using the Lee site-specific criteria has been performed, comparing the resulting in-structure spectra at six key locations to the spectra resulting from the design basis AP1000 CSDRS envelope. Exceedances of those in-structure standard plant spectra have been evaluated and justified (Reference 206) by detailed site-specific analyses of representative portions of building structures, primary equipment and piping systems, and by a review of standard AP1000 seismic qualification testing practices.	
11783	WLS	Pt 02	FSAR 03	03.07.02.15	COLA Part 2, FSAR Chapter 3, Subsection 3.7.2.15, first paragraph is revised to replace WLS COL 2.5-3 with WLS SUP 3.7-5.	Editorial
11784	WLS	Pt 02	FSAR 03	03.07.02.15	COLA Part 2, FSAR Chapter 3, Subsection 3.7.2.15, second paragraph is revised to add WLS SUP 3.7-5.	Editorial
11758	WLS	Pt 02	FSAR 03	03.07.02.15	COLA Part 2, FSAR Chapter 3, Subsection 3.7.2.15, third paragraph is further revised to pluralize 'location' as follows: To better understand the significance of the evaluations required, the in-structure response spectra for the AP1000 CSDRS, HRHF spectra and NI FIRS were compared at the six key locations identified in AP1000 DCD Table 3G.4-1 as listed below.	Editorial
11640	WLS	Pt 02	FSAR 03	03.07.06	COLA Part 2, FSAR Chapter 3, Subsection 3.7.6, is revised to add new references as follows: 206. Westinghouse Electric Company, LLC, "Effect of William S. Lee Site Specific Seismic Requirements on AP1000 SSCs," WLG-GW-GLR-815, Revision 0, January 17, 2014. 207. McGuire, R.K., Silva, W.J., and Constantino, C.J. (2001). Technical basis for revision of regulatory guidance on design ground motions: hazard- and risk-consistent ground motion spectra guidelines, U.S. Nuclear Regulatory Commission Report, NUREG/CR-6728, October, 2001.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 7, WLG2014.01-02 (ML14064A433)
11759	WLS	Pt 02	FSAR 03	03.07.06	COLA Part 2, FSAR Chapter 3, Subsection 3.7.6, is revised to remove Reference 201 as follows: 201. Removed	Editorial
11772	WLS	Pt 02	FSAR 03	03.07.06	COLA Part 2, FSAR Chapter 3, Subsection 3.7.6, Reference 205 is revised as follows: 205. Westinghouse Electric Company Report WLG 1000 S2R 804, Revision 3, William S. Lee Site Specific Adjacent Buildings Seismic Evaluation Report, February 2014.	Duke Energy Supplemental Response 4 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.02-02
11642	WLS	Pt 02	FSAR 03	03.07.F / F3.7-201	COLA Part 2, FSAR Chapter 3, Figure 3.7-201 is revised as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 7.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 7, WLG2014.01-02 (ML14064A433)
11786	WLS	Pt 02	FSAR 03	03.07.F / F3.7-201 F3.7-202	COLA Part 2, FSAR Chapter 3, Figures 3.7-201 and 3.7-202 are revised to replace WLS COL 2.5-2 with WLS SUP 3.7-3.	Editorial
11643	WLS	Pt 02	FSAR 03	03.07.F / F3.7-202	COLA Part 2, FSAR Chapter 3, Figure 3.7-202 is revised as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 7.	Duke Energy Supplemental

						Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 7. WLG2014.01-02 (ML14064A433)
11644	WLS	Pt 02	FSAR 03	03.07.F / F3.7-203	COLA Part 2, FSAR Chapter 3, Figure 3.7-203 is removed and replaced with Figures 3.7-203a, 3.7-203b, and 3.7-203c as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 7.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 7, WLG2014.01-02 (ML14064A433)
11645	WLS	Pt 02	FSAR 03	03.07.F / F3.7-203a F3.7-203b F3.7-203c	COLA Part 2, FSAR Chapter 3, Figures 3.7-203a, 3.7-203b, and 3.7-203c added as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 7.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 7, WLG2014.01-02 (ML14064A433)
11787	WLS	Pt 02	FSAR 03	03.07.F / F3.7-203a F3.7-203b F3.7-203c	COLA Part 2, FSAR Chapter 3, Figures 3.7-203a through 3.7-203c are revised to replace WLS COL 2.5-2 with WLS SUP 3.7-6	Editorial
11646	WLS	Pt 02	FSAR 03	03.07.F / F3.7-209a F3.7-209b F3.7-209c	COLA Part 2, FSAR Chapter 3, Figures 3.7-209a, 3.7-209b, and 3.7-209c added as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 7.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 7, WLG2014.01-02 (ML14064A433)
11788	WLS	Pt 02	FSAR 03	03.07.F / F3.7-209a F3.7-209b F3.7-209c	COLA Part 2, FSAR Chapter 3, Figures 3.7-209a through 3.7-209c are revised to replace WLS COL 2.5-2 with WLS SUP 3.7-5.	Editorial
11647	WLS	Pt 02	FSAR 03	03.07.F / F3.7-210a F3.7-210b F3.7-210c	COLA Part 2, FSAR Chapter 3, Figures 3.7-210a, 3.7-210b, and 3.7-210c added as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 7.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 7, WLG2014.01-02 (ML14064A433)
11789	WLS	Pt 02	FSAR 03	03.07.F / F3.7-210a F3.7-210b F3.7-210c	COLA Part 2, FSAR Chapter 3, Figures 3.7-210a through 3.7-210c are revised to replace WLS COL 2.5-2 with WLS SUP 3.7-5.	Editorial
11648	WLS	Pt 02	FSAR 03	03.07.F / F3.7-211a F3.7-211b F3.7-211c	COLA Part 2, FSAR Chapter 3, Figures 3.7-211a, 3.7-211b, and 3.7-211c added as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 7.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI

						01.05-1, Enclosure 2, Attachment 7, WLG2014.01-02 (ML14064A433)
11790	WLS	Pt 02	FSAR 03	03.07.F / F3.7-211a F3.7-211b F3.7-211c	COLA Part 2, FSAR Chapter 3, Figures 3.7-211a through 3 7-211c are revised to replace WLS COL 2.5-2 with WLS SUP 3.7-5.	Editorial
11649	WLS	Pt 02	FSAR 03	03.07.F / F3.7-212	COLA Part 2, FSAR Chapter 3, Figure 3.7-212 is added as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 7.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 7, WLG2014.01-02 (ML14064A433)
11791	WLS	Pt 02	FSAR 03	03.07.F / F3.7-212	COLA Part 2, FSAR Chapter 3, Figure 3.7-212 is revised to replace WLS COL 2.5-2 with WLS SUP 3.7-5.	Editorial
11773	WLS	Pt 02	FSAR 03	03.07.F / F3.7-213a F3.7-213b	COLA Part 2, FSAR Chapter 3, Figures 3.7-213a and 3.7-213b are added as reflected on Duke Energy's Supplemental Response 4 to RAI 01.05-1, Enclosure 2, Attachment 3.	Duke Energy Supplemental Response 4 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.02-02
11774	WLS	Pt 02	FSAR 03	03.07.F / F3.7-214a F3.7-214b	COLA Part 2, FSAR Chapter 3, Figures 3.7-214a and 3.7-214b are added as reflected on Duke Energy's Supplemental Response 4 to RAI 01.05-1, Enclosure 2, Attachment 3.	Duke Energy Supplemental Response 4 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 3, WLG2014.02-02
11641	WLS	Pt 02	FSAR 03	03.07.T / T3.7-201	COLA Part 2, FSAR Chapter 3, Table 3.7-201 is revised as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 7.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 7, WLG2014.01-02 (ML14064A433)
11756	WLS	Pt 02	FSAR 03	03.07.T / T3.7-201	COLA Part 2, FSAR Table 3.7-201 is revised at the Notes section to replace "IAL" with ILA" for Horizontal 2 and Vertical.	Editorial
11785	WLS	Pt 02	FSAR 03	03.07.T / T3.7-201	COLA Part 2, FSAR Chapter 3, Table 3.7-201 is revised to add WLS SUP 3.7-6.	Editorial
11590	WLS	Pt 02	FSAR 03	03.11.T / T3.11-201	COLA Part 2, FSAR Table 3.11-201, "Environmentally Qualified Electrical and Mechanical Equipment", is added with LMA, WLS DEP 3.11-1.	Duke Energy endorsement of Levy response to RAI Letter 108, Supplement 6, RAI 01.05-1, NPD-NRC-2013-008 (ML13100A002), dated April 5, 2013

						for the Lee COL Application.
11608	WLS	Pt 02	FSAR 03	03.11.T / T3.11-201	COLA Part 2, FSAR Table 3.11-201 is revised to add "(Sheet 14 of 51)".	Editorial
11609	WLS	Pt 02	FSAR 03	03.11.T / T3.11-201	COLA Part 2, FSAR Table 3.11-201 is revised to move "WLS DEP 3.11-1" to the following entries: Spent Fuel Pool Level SFS-JE-LT019A Spent Fuel Pool Level SFS-JE-LT019B Spent Fuel Pool Level SFS-JE-LT019C	Editorial
11650	WLS	Pt 02	FSAR 03	APP.03.I	COLA Part 2, FSAR Chapter 3, Appendix 3I is revised as follows: APPENDIX 3I EVALUATION FOR HIGH FREQUENCY SEISMIC INPUT This section of the referenced DCD is incorporated by reference with the following departures and/or supplements. 3I.1 Introduction Add the following information to the end of DCD Subsection 3I.1 The nuclear island foundation input response spectra (NI FIRS) for Lee Nuclear Station, the envelope of the GMRS (Unit 2 FIRS) and the Unit 1 FIRS (Subsection 3.7.1.1.1), are slightly above the AP1000 HRHF spectra, but the spectra are very similar. Figures 3I.1-201 and 3I.1 202 compare the NI FIRS to the AP1000 CSDRS and the AP1000 HRHF spectra for the horizontal and vertical directions for 5% damping. The NI FIRS exceeds the AP1000 CSDRS for frequencies above approximately 14 Hz and the AP1000 HRHF spectra above approximately 3 Hz. Because the NI FIRS are not enveloped by the AP1000 HRHF spectra, a site-specific analysis is performed to evaluate and justify exceedances. Technical report WLG-GW-GLR-815 (Reference 201) provides a summary of those evaluations and results. This report presents in-structure response spectra throughout the Nuclear Island resulting from the site-specific input. These in-structure response spectra are less than or within ten percent of those for the AP1000 CSDRS and the AP1000 HRHF spectra at most locations/elevations and several minor exceedances are justified by further evaluations. 3I.2 High Frequency Seismic Input Add the following information to the end of DCD Subsection 3I.2 Figures 3I.1-201 and 3I.1-202 present a comparison of the horizontal and vertical (respectively) Lee Nuclear Station NI FIRS to the AP1000 CSDRS and the AP1000 HRHF. The NI FIRS are calculated at foundation level (39.5' below grade), at the upper most competent material and treated as an outcrop for calculation purposes. For each direction, the NI FIRS exceeds the CSDRS in higher frequencies (greater than 14 Hz horizontal and 16 Hz vertical) and the AP1000 HRHF spectra at frequencies greater than 3 Hz in both the horizontal and vertical directions. 3I.3 NI Models Used To Develop High Frequency Response Add the following information to the end of DCD Subsection 3I.3 The NI20u nuclear island model (Reference 201) is analyzed in ACS SASSI using the Lee Nuclear Station NI FIRS time histories (Subsection 3.7.2.1.2) applied at foundation level to obtain the motion at the base. The NI20u model used in the Lee Nuclear Station site-specific analysis was updated to incorporate design changes from detailed design finalization of the AP1000 standard plant (no impact from design changes to licensing basis as defined in AP1000 DCD Rev 19) and to improve the match between the NI20u model and the more realistic NI10 model used to design and qualify the AP1000 standard plant for the CSDRS. Evaluation of incoherent NI FIRS has been performed. In-structure response spectra for the AP1000 CSDRS,	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 8. WLG2014.01-02 (ML14064A433)

incoherent HRHF spectra and the incoherent NI FIRS were compared at a number of locations/elevations in the Nuclear Island. Several minor exceedances were noted that are addressed as part of the sampling evaluation outlined in DCD Subsection 3I.6.

3I.6 Evaluation

Add the following information to the end of DCD Subsection 3I.6

As described in Lee Nuclear Station site-specific Technical Report WLG-GW-GLR-815 (Reference 201), the in-structure response spectra resulting from the Lee Nuclear Station NI FIRS input are less than or within ten percent of those generated for the AP1000 CSDRS and the AP1000 HRHF spectra at most locations/elevations and several minor exceedances are justified by further evaluation. Therefore, the sample of structures, systems and components selected for evaluation remains unchanged.

3I.6.1 Building Structures

Add the following information to the end of DCD Subsection 3I.6.1
Load comparisons for the building structures evaluated show that the seismic loads resulting from the CSDRS input motion are greater than the seismic loads generated from the NI FIRS (Reference 201).

3I.6.2 Primary Coolant Loop

Add the following information to the end of DCD Subsection 3I.6.2

Load comparisons for the primary component supports and nozzles evaluated show that the seismic loads resulting from the CSDRS input motion are greater than the seismic loads generated from the NI FIRS (Reference 201).

3I.6.3 Piping Systems

Add the following information to the end of DCD Subsection 3I.6.3

ASME Class 1, 2, and 3 piping packages were reviewed along with local input seismic response spectra for susceptibility to excitation from high frequency seismic input motion. Since the in-structure floor response spectra (FRS) generated from the Lee Nuclear Station NI FIRS are enveloped completely by either by the FRS generated from the CSDRS or HRHF spectra in most locations, all of the piping analyses do not need to be redone for the NI FIRS.

Three piping packages, ADS 4th Stage East Compartment and Passive RHR Supply, Pressurizer Surge Line, and SFS from Auxiliary Building Area 4 SCV to Auxiliary Building Area 6 SFS Pumps were chosen for evaluation (Reference 201). These packages are representative of all safety class piping in Lee Nuclear Station because they are the most susceptible to excitation from high frequency seismic input motion.

The stress results of the sample piping analysis packages show that the AP1000 HRHF stresses were greater than the NI FIRS stresses for all nodes in the ADS 4th Stage and SFS from Auxiliary Building from 4 to 6 piping packages and only slightly less in the Pressurizer Surge Line piping package. Stress comparison results show that AP1000 CSDRS stresses are greater than the NI FIRS stresses at all nodes in all three piping packages except for one node in the SFS from Auxiliary Building 4 to 6 piping package where there was a slight NI FIRS exceedance of less than three percent.
The stresses due to the Lee Nuclear Station NI FIRS input are bounded by design basis analysis results. The same applies to all of the analyzed piping supports. As a result, the effect of the NI FIRS input on safety class piping is found to be non-damaging (Reference 201).

3I.6.4 Electrical and Electro-Mechanical Equipment

Add the following information to the end of DCD Subsection 3I.6.4

To demonstrate acceptability, the test response spectra (TRS) for high frequency sensitive equipment procured for Lee Nuclear Station will have to bound the required response spectra (RRS) of the AP1000 CSDRS, AP1000 HRHF spectra , and the NI FIRS generated in-structure response spectra. As shown in the Lee Nuclear Station site-specific Technical Report WLG-GW-GLR-815 (Reference 201), very little if any of the AP1000 equipment will need to be re-

					qualified for the Lee Nuclear Station high frequency seismic motion considering margins in the TRS currently being used to qualify AP1000 high frequency sensitive equipment. However, per the licensing commitment in Subsection 3.7.2.15, Duke Energy will ensure that all seismic qualification testing for safety-related equipment required per this Appendix appropriately envelopes the Lee Nuclear Station site-specific seismic requirements, in addition to the CSDRS and HRHF RRS. 3I.7 References Add the following information to the end of DCD Subsection 3I.7 201. Westinghouse Electric Company, LLC, "Effect of William S. Lee Site Specific Seismic Requirements on AP1000 SSCs," WLG-GW-GLR-815, Revision 0, January 17, 2014.	
11651	WLS	Pt 02	FSAR 03	APP.03.I.F / F3I.1-201 F3I.1-202	COLA Part 2, FSAR Chapter 3, Appendix 3I is revised with the addition of Figures 3I.1-201 and 3I.1-202 as reflected on Duke Energy Supplemental Response 3 to RAI 01.05-1, Enclosure 2, Attachment 8.	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 8, WLG2014.01-02 (ML14064A433)
11591	WLS	Pt 02	FSAR 09	09.01.03.07	COLA Part 2, FSAR Chapter 9, Subsection 9.1.3.7 is added, with LMA WLS SUP 9.1-1 as follows: 9.1.3.7 Instrumentation Requirements Add the following paragraph after the first paragraph of DCD Subsection 9.1.3.7.D. All three safety-related spent fuel pool level instruments and associated instrument tubing lines are located below the fuel handling area operating deck and the cask washdown pit. This location provides protection from missiles that may result from damage to the structure over the spent fuel pool. The SFP level instruments associated with PMS divisions A and C are physically separated from the SFP level instrument associated with PMS division B. The safety-related spent fuel pool level instruments measure the water level from the top of the spent fuel pool to the top of the fuel racks. These instruments are conservatively calibrated at a reference temperature suitable for normal spent fuel pool operation on a regular basis and accuracy is not affected by power interruptions.	Duke Energy endorsement of Levy response to RAI Letter 108, Supplement 6, RAI 01.05-1, NPD-NRC-2013-008 (ML13100A002), dated April 5, 2013 for the Lee COL Application.
11761	WLS	Pt 02	FSAR 09	09.02.05.02.01	The source of water for the potable water system is the Draytonville Water District. The potable water system meets or exceeds the pressure, capacity, and quality requirements in DCD Subsection 9.2.5.	Updated Conceptual Design Information
11762	WLS	Pt 02	FSAR 09	09.02.05.03	COLA Part 2, FSAR Chapter 9, Subsection 9.2.5.3 is revised to read: The municipal water supply system provides filtered and disinfected water to the potable water distribution system. The potable water system maintains the required pressure throughout the water distribution system.	Updated Conceptual Design Information
11751	WLS	Pt 02	FSAR 09	09.02.09.02.02	COLA Part 2, FSAR Chapter 9, Subsection 9.2.9.2.2 under the sub-heading 'Plant Outfall,' sixth sentence is revised to read: The outfall pipe is attached to the upstream face of the Ninety-Nine Islands Dam below the normal level of the impoundment, runs along the dam approximately 750 ft. and ends with an approximately 88 ft. long multi-port diffuser located in the zone where the impoundment water flows to the intake of the Ninety-Nine Islands Hydroelectric station.	Duke Energy Revised Response to RAI LTR 064, RAI 09.02.01-6, Enclosure 1, Attachment 1, WLG2014.03-01
11752	WLS	Pt 02	FSAR 09	09.02.11.02.01	COLA Part 2, FSAR Chapter 9, Subsection 9.2.11.2.1, second paragraph is revised to read: The RWS is designed based on an average total suspended solids (TSS) of 20 mg/l and a maximum TSS of 300 mg/l.	Duke Energy Revised Response to RAI LTR 075, RAI 01-008, Enclosure 1, Attachment 4, WLG 2014.03-02
11763	WLS	Pt 02		09.02.11.02.02		

			FSAR 09		COLA Part 2, FSAR Chapter 9, Subsection 9.2.11.2.2, under the sub-heading "Make-Up Pond B Subsystem," last paragraph is revised to read: An intake on Make-Up Pond B contains five make-up pond pumps. Four pumps are used to transfer water to Make-Up Pond A. When Make-Up Pond B is aligned to maintain level in Make-Up Pond A, up to three pumps are in operation and one is in standby to support plant operation.	Duke Energy Revised Response to RAI LTR 064, RAI 019.02.01-6, Enclosure 1, Attachment 1, WLG2014.03-04
11764	WLS	Pt 02	FSAR 09	09.02.11.03.02	COLA Part 2, FSAR Chapter 9, Subsection 9.2.11.3.2, under the sub-heading "Make-Up Pond B pumps," first and second paragraphs are revised to read: Five pumps are mounted on the Make-Up Pond B intake. Four pumps are used to transfer water to Make-Up Pond A. Each of these pumps is sized to supply one third of the normal raw water demand for two units. When Make-Up Pond B is aligned to maintain level in Make-Up Pond A, three pumps are in operation and one is in standby. The pumps are of vertical turbine, wet pit design. The fifth pump is dedicated to transferring water to Make-Up Pond C when permit conditions on the Broad River allow for supplemental withdrawals that are below the minimum capacity of the refill subsystem pumps.	Duke Energy Revised Response to RAI LTR 064, RAI 019.02.01-6, Enclosure 1, Attachment 1, WLG2014.03-04
11753	WLS	Pt 02	FSAR 09	09.05.01.02.01.03	COLA Part 2, FSAR Chapter 9, Subsection 9.5.1.2.1.3, second paragraph is revised to replace WLS SUP 9.2-2 with WLS SUP 9.2-4.	Editorial
11760	WLS	Pt 02	FSAR 10	10.04.12.03	COLA Part 2, FSAR Chapter 10, Subsection 10.4.12.3 is revised to read: The potable water is being supplied by the municipal water system of Draytonville Water District for domestic and human consumption, as specified in FSAR Section 9.2.5.2.1. No additional onsite treatment is required for this supply of water.	Editorial
11564	WLS	Pt 02	FSAR 11	11.02.01.02.05.02	COLA Part 2, FSAR Chapter 11, Subsection 11.2.1.2.5.2, first paragraph is revised, with LMA WLS COL 11.2-1, to read: When mobile or temporary equipment is selected to process liquid effluents, the equipment design and testing meets the applicable requirements of Regulatory Guide 1.143. When confirmed through sampling that the radioactive waste contents result in an inventory on a mobile system that is below the A2 quantity limit for radionuclides specified in Appendix A to 10 CFR Part 71, the liquid effluent may be processed with the mobile liquid waste processing system in the Radwaste Building. When pre-process sampling and controls indicate that A2 quantity limits may be exceeded by processing liquid effluent in the Radwaste Building, liquid waste is processed in the seismic Category I Auxiliary Building. Procedural controls also ensure that the total cumulative source term of unpackaged wastes including liquid waste, wet waste, solid waste, gaseous waste, activated or contaminated metals and components, and contaminated waste present at any time in the Radwaste Building is limited consistent with RG 1.143, Revision 2, unmitigated radiological release criteria, so that an unmitigated release, occurring over a two hour time period, would not result in a dose of greater than 500 millirem at the protected area boundary, or an unmitigated exposure, occurring over a two hour time period, would not result in a dose of greater than 5 rem to site personnel located 10 feet from the total cumulative radioactive inventory. The unmitigated, unshielded worker dose is calculated at 10 feet from the source. Unlimited worker occupancy workstations and low dose rate waiting areas are located no closer than 10 feet from a mobile radwaste processing system or a Waste Monitor Tank.	Duke Energy endorsement of Levy revised response to LNP RAI LTR 112, RAI 11.02-4 S1, (24734-6), NPD-NRC-2013-039 (ML13259A147), dated September 12, 2013 for the Lee COL Application
11565	WLS	Pt 02	FSAR 11	11.02.01.02.05.02	COLA Part 2, FSAR Chapter 11, Subsection 11.2.1.2.5.2, second paragraph is revised to add STD COL 11.2-1.	Duke Energy endorsement of Levy revised response to LNP RAI LTR 112, RAI 11.02-4 S1, (24734-6), NPD-NRC-2013-039 (ML13259A147), dated September 12, 2013 for the Lee COL Application

11597	WLS	Pt 02	FSAR 11	11.02.03.05.01	COLA Part 2, FSAR Chapter 11, Subsection 11.2.3.5.1, third paragraph is revised to read: The maximum doses to individuals resulting from routine liquid effluents per unit are presented and compared to the regulatory criteria set forth in 10 CFR Part 50, Appendix I, and 10 CFR 20.1301 in Table 11.2-207 and Table 11.2-208, respectively.	Editorial
11633	WLS	Pt 02	FSAR 11	11.02.05.01	COLA Part 2, FSAR Chapter 11, Subsection 11.2.5.1 is revised to add left margin annotation WLS COL 11.2-1.	Conforming change to Duke Energy endorsement of Levy revised response to LNP RAI LTR 112, RAI 11.02-4 S1, (24734-6), NPD-NRC-2013-039 (ML13259A147), dated September 12, 2013 for the Lee COL Application
11765	WLS	Pt 02	FSAR 11	11.02.T / T11.2-201	COLA Part 2, FSAR Table 11.2-201 is revised at the Parameter entry "Plant Discharge Rate (cfs)" under the Averege Annual Condition column to read 18.3.	Duke Energy Revised Response to RAI LTR 013, RAI 11.02-002, Enclosure 2, Attachment 2, WLG2014.03-05
11766	WLS	Pt 02	FSAR 11	11.02.T / T11.2-202	COLA Part 2, FSAR Table 11.2-202 is revised at the Input Parameter entry "Discharge Flowrate (cfs)" under the Value column to read 18.3.	Duke Energy Revised Response to RAI LTR 013, RAI 11.02-002, Enclosure 2, Attachment 2, WLG2014.03-05
11581	WLS	Pt 02	FSAR 11	11.02.T / T11.2-206	COLA Part 2, FSAR Table 11.2-206 is revised as reflected on Duke Energy response to RAI Letter 110, RAI 2.3.5-6 (b), Enclosure 1, Attachment 9.	Duke Energy Supplemental Response to RAI Letter 110, RAI 2.3.5-6 b), Enclosure 1, Attachment 9, WLG2013.09-01 (ML13283A227)
11596	WLS	Pt 02	FSAR 11	11.03.03.04	COLA Part 2, FSAR Chapter 11, Subsection 11.3.3.4, first paragraph is revised to read: The calculated gaseous doses for the maximum exposed individual are compared to the regulatory criteria in Appendix I of 10 CFR Part 50 and 10 CFR Part 20.1301 for acceptance. Table 11.3-205 and Table 11.3-206 display this comparison and demonstrate that the calculated gaseous doses for the maximally exposed individual are less than the regulatory criteria. The Lee Nuclear Station site-specific values are bounded by the DCD identified acceptable releases. With the annual airborne releases listed in DCD Table 11.3-3, the site-specific air doses at ground level at the site boundary are 0.773 mrad for gamma radiation and 3.25 mrad for beta radiation. These doses are based on the annual average atmospheric dispersion factor from Section 2.3. These doses are below the 10 CFR Part 50, Appendix I design objectives of 10 mrad per year for gamma radiation or 20 mrad per year for beta radiation.	Editorial
11579	WLS	Pt 02		11.03.03.04		

			FSAR 11		COLA Part 2. FSAR Chapter 11. Subsection 11.3.3.4, paragraphs 1 through 4 are revised to read: The calculated gaseous doses for the maximum exposed individual are compared to the regulatory limits from Appendix I of 10 CFR Part 50 and 10 CFR Part 20.1301 for acceptance. Table 11.3-205 and Table 11.3-206 display this comparison and demonstrate that the calculated gaseous doses for the maximally exposed individual are less than the regulatory limits. The Lee Nuclear Station site-specific values are bounded by the DCD identified acceptable releases. With the annual airborne releases listed in DCD Table 11.3-3, the site-specific air doses at ground level at the site boundary are 1.25 mrad per year for gamma radiation and 7.32 mrad per year for beta radiation. These doses are based on the annual average atmospheric dispersion factor from Section 2.3. These doses are below the 10 CFR Part 50, Appendix I design objectives of 10 mrad per year for gamma radiation or 20 mrad per year for beta radiation. Dose and dose rate to man were calculated using the GASPAR II computer code. This code is based on the methodology presented in Regulatory Guide 1.109. Factors common to both estimated individual dose rates and estimated population dose are addressed in this subsection. Unique data are discussed in the respective subsections. Activity pathways considered are plume, ground deposition. inhalation, and ingestion of vegetables, meat, and milk (cow or goat). Based on site meteorological conditions, the highest combined dose rate of from plume exposure and ground deposition occurs at the site boundary 0.27 mi. (427 m) NW of the Effluent Release Boundary.	Duke Energy Supplemental Response to RAI Letter 110, RAI 2.3.5-6 b), Enclosure 1, Attachment 8, WLG2013.09-01 (ML13283A227)
11580	WLS	Pt 02	FSAR 11	11.03.03.04.01	COLA Part 2. FSAR Chapter 11, Subsection 11.3.3.4.1 is revised as follows: Dose rates to individuals are calculated for airborne decay and deposition. inhalation, and ingestion of milk (goat or cow), meat and vegetables. Dose from plume and ground deposition are calculated as affecting all age groups equally. Plume exposure approximately 0.27 mi. NW of the Effluent Release Boundary produced a maximum dose rate to a single organ of 4.90 mrem/yr to skin. The maximum total body dose rate was calculated to be 7.32E-1 mrem/yr. Ground deposition approximately 0.27 mi. NW of the Effluent Release Boundary produced a maximum dose rate to a single organ of 2.98E-1 mrem/yr to skin. The maximum total body dose rate was calculated to be 2.53E-1 mrem/yr. Inhalation Dose at the site boundary. 0.27 mi. NW of the Effluent Release Boundary, results in a maximum dose rate to a single organ of 1.54 mrem/yr to a child's thyroid. The maximum total body dose rate is calculated to be 1.24E-1 mrem/yr to a teenager. Vegetable consumption assumes that the dose is received from the garden special location. approximately 1.0 mi. SSE of the plant. GASPAR II default vegetable consumption values are used in lieu of site-specific vegetable consumption data as permitted by Regulatory Guide 1.109. The estimated maximum dose rate to a single organ is 2.42 mrem/yr to a child's thyroid. The maximum total body dose rate is calculated to be 4.59E-1 mrem/yr to a child. Meat consumption assumes that the dose is received from the cow special location, approximately 1.65 mi. SE of the plant. GASPAR II default meat consumption values are used in lieu of site-specific meat consumption data as permitted by Regulatory Guide 1.109. The estimated maximum dose rate to a single organ is 2.74E-1 mrem/yr to a child's bone The maximum total body dose rate is calculated to be 5.81E-2 mrem/yr to a child. Cow milk consumption assumes that the dose is received from the cow special location, approximately 1.65 mi. SE of the plant. GASPAR II default cow milk consumption values are used in lieu of site-specific cow milk consumption data as permitted by Regulatory Guide 1.109. The estimated maximum dose rate to a single organ is 6.23 mrem/yr to an infant's thyroid. The maximum total body dose rate is calculated to be 3.99E-1 mrem/yr to an infant. Goat milk consumption assumes that the dose is received from the nearest milk goat special location, approximately 1.05 mi. SSW of the plant. GASPAR II default goat milk consumption values are used in lieu of site-specific goat milk consumption data as permitted by Regulatory Guide 1.109. The estimated maximum dose rate to a single organ is 7.58 mrem/yr to an infant's thyroid. The maximum total body dose rate is calculated to be 3.26E-1 mrem/yr to an infant. The maximum dose rate to any organ considering every pathway is calculated to be 9.95 mrem/yr to an infant's	Duke Energy Supplemental Response to RAI Letter 110, RAI 2.3.5-6 b), Enclosure 1, Attachment 8, WLG2013.09-01 (ML13283A227)

thyroid. The maximum total body dose rate is calculated to be 1.81 mrem/yr to a child. These are below the 10 CFR 50, Appendix I design objectives of 5 mrem/yr to total body, and 15 mrem/yr to any organ, including skin.

Table 11.3-201 contains GASPAR II input data for dose rate calculations. Information regarding the special locations for cow, goat, garden, site boundary and the EAB is located in Section 2.3. Table 11.3-202 contains total organ dose rates based on age group and pathway. Table 11.3-203 contains total air dose at each special location.

11548	WLS	Pt 02	FSAR 11	11.03.03.04.02	COLA Part 2, FSAR Chapter 11, Subsection 11.03.03.04.02, is revised to read. The population dose analysis performed to determine off-site dose from gaseous effluents is based upon the AP1000 generic site parameters included in DCD Chapter 1 and DCD Tables 11.3-1, 11.3-2 and 11.3-4, and the year 2056 population data in FSAR Tables 2.1-203 and 2.1-204. The population doses are shown in Table 11.3-204.	Editorial, correct citation of DCD Chapter
11582	WLS	Pt 02	FSAR 11	11.03.T / T11.3-202	COLA Part 2, FSAR Table 11.3-202 is revised as reflected on Duke Energy response to RAI Letter 110, RAI 2.3.5-6 (b), Enclosure 1, Attachment 9.	Duke Energy Supplemental Response to RAI Letter 110, RAI 2.3.5-6 b), Enclosure 1, Attachment 9, WLG2013.09-01 (ML13283A227)
11583	WLS	Pt 02	FSAR 11	11.03.T / T11.3-203	COLA Part 2, FSAR Table 11.3-203 is revised as reflected on Duke Energy response to RAI Letter 110, RAI 2.3.5-6 (b), Enclosure 1, Attachment 9.	Duke Energy Supplemental Response to RAI Letter 110, RAI 2.3.5-6 b), Enclosure 1, Attachment 9, WLG2013.09-01 (ML13283A227)
11598	WLS	Pt 02	FSAR 11	11.03.T / T11.3-205	COLA Part 2, FSAR Table 11.3-205 is revised as follows: Title is revised to read: "CALCULATED MAXIMUM INDIVIDUAL DOSES COMPARED TO 10 CFR PART 50 APPENDIX I DESIGN OBJECTIVES." Center column header, 'Limit' is revised to read "Design Objective."	Editorial
11554	WLS	Pt 02	FSAR 11	11.03.T / T11.3-205	COLA Part 2, FSAR Table 11.3-205 is revised as reflected on Duke Energy response to RAI Letter 109.	Duke Energy Response to RAI LTR 109, RAI 11.3-004, Attachment 1, WLG2013.08-02 (ML13239A054) This change is included in Duke Energy Response to RAI LTR 110, S1, RAI 2.3.5-6 b), Enclosure 1, Attachment 9 (ML13283A227)
11584	WLS	Pt 02	FSAR 11	11.03.T / T11.3-205	COLA Part 2, FSAR Table 11.3-205 is revised as reflected on Duke Energy response to RAI Letter 110, RAI 2.3.5-6 (b), Enclosure 1, Attachment 9. Note, the revisions to this table include the revision previously identified and submitted in Duke Energy's response to RAI Ltr. 109.	Duke Energy Supplemental Response to RAI

						Letter 110, RAI 2.3 5-6 b), Enclosure 1, Attachment 9, WLG2013.09-01 (ML13283A227)
11555	WLS	Pt 02	FSAR 11	11.03.T / T11.3-206	COLA Part 2, FSAR Table 11.3-206 is revised as reflected on Duke Energy response to RAI Letter 109.	Duke Energy Response to RAI LTR 109, RAI 11.3-004, Attachment 2, WLG2013.08-02 (ML13239A054) This change is included in Duke Energy Response to RAI LTR 110, S1, RAI 2.3.5-6 b), Enclosure 1, Attachment 9 (ML13283A227)
11585	WLS	Pt 02	FSAR 11	11.03.T / T11.3-206	COLA Part 2, FSAR Table 11.3-206 is revised as reflected on Duke Energy response to RAI Letter 110, RAI 2.3.5-6 (b), Enclosure 1, Attachment 9. Note, the revisions to this table include the revision previously identified and submitted in Duke Energy's response to RAI Ltr. 109.	Duke Energy Supplemental Response to RAI Letter 110, RAI 2.3.5-6 b), Enclosure 1, Attachment 9, WLG2013.09-01 (ML13283A227)
11556	WLS	Pt 02	FSAR 11	11.03.T / T11.3-207	COLA Part 2, FSAR Table 11.3-207 is revised as reflected on Duke Energy response to RAI Letter 109.	Duke Energy Response to RAI LTR 109, RAI 11.3-004, Attachment 3, WLG2013.08-02 (ML13239A054)
11586	WLS	Pt 02	FSAR 11	11.03.T / T11.3-207	COLA Part 2, FSAR Table 11.3-207 is revised as reflected on Duke Energy response to RAI Letter 110, RAI 2.3.5-6 (b), Enclosure 1, Attachment 9. Note, the revisions to this table include the revision previously identified and submitted in Duke Energy's response to RAI Ltr. 109.	Duke Energy Supplemental Response to RAI Letter 110, RAI 2.3.5-6 b), Enclosure 1, Attachment 9, WLG2013.09-01 (ML13283A227)
11566	WLS	Pt 02	FSAR 11	11.04.06	COLA Part 2, FSAR Chapter 11, Subsection 11.4.6, a new second paragraph is added, with LMA WLS COL 11.4-1, to read: When the disposable media is removed from mobile radwaste processing system, the process control program is utilized to move the media from the system and place the media into a package suitable for shipping. The mobile radwaste processing system is not placed back into service until the media that has been removed is packaged and ready for shipment.	Duke Energy endorsement of Levy revised response to LNP RAI LTR 112, RAI 11.02-4 S1, (24734-7), NPD-NRC-2013-039 (ML13259A147), dated September

						12, 2013 for the Lee COL Application
11567	WLS	Pt 02	FSAR 11	11.04.06	COLA Part 2, FSAR Chapter 11, Subsection 11.4.6, third paragraph is revised to add STD COL 11.4-1.	Duke Energy endorsement of Levy revised response to LNP RAI LTR 112, RAI 11.02-4 S1, (24734-7), NPD-NRC-2013-039 (ML13259A147), dated September 12, 2013 for the Lee COL Application
11562	WLS	Pt 02	FSAR 13	13.5.2.2.5	COLA Part 2, FSAR Chapter 13, Subsection 13.5.2.2.5 is revised with the addition of the following new last paragraph, with LMA WLS COL 13.5-1: As required by License Condition, operating procedures that include provisions to assure that A2 quantities for radionuclides specified in Appendix A to 10 CFR Part 71 are not exceeded will be developed, implemented and maintained prior to initial fuel load. Procedural controls limit the radionuclide inventory to less than the A2 limit in each of the three (3) monitor tanks, and in each of up to three (3) mobile radwaste processing systems. Procedures also ensure that any additional equipment to be located in the Radwaste Building is limited to A2 quantities. Spent media transfer from a mobile radwaste processing system located in the Radwaste Building is procedurally controlled such that spent media transfer and packaging for offsite shipment must be complete prior to placing the mobile radwaste processing system back into service. The procedures also ensure that the total cumulative source term of unpackaged wastes, including liquid waste, wet waste, solid waste, gaseous waste, activated or contaminated metals and components, and contaminated waste present at any time in the Radwaste Building is limited consistent with RG 1.143, Revision 2, unmitigated radiological release criteria, so that an unmitigated release, occurring over a two hour time period, would not result in a dose of greater than 500 millirem at the protected area boundary, or an unmitigated exposure, occurring over a two hour time period, would not result in a dose of greater than 5 rem to site personnel located 10 feet from the total cumulative radioactive inventory. The unmitigated, unshielded worker dose is calculated at 10 feet from the source. Unlimited worker occupancy workstations and low dose rate waiting areas are located no closer than 10 feet from a mobile radwaste processing system or a Waste Monitor Tank. The liquid radwaste system is discussed in Section 11.2.	Duke Energy endorsement of Levy revised response to LNP RAI LTR 112, RAI 11.02-4, (24734-4), NPD-NRC-2013-039 (ML13259A147), dated September 12, 2013 for the Lee COL Application
11563	WLS	Pt 02	FSAR 13	13.5.2.2.6	COLA Part 2, FSAR Chapter 13, Subsection 13.5.2.2.6 to add STD COL 13.5-1.	Duke Energy endorsement of Levy revised response to LNP RAI LTR 112, RAI 11.02-4 (24734-4), NPD-NPD-NRC-2013-039 (ML13259A147), dated September 12, 2013 for the Lee COL Application
11744	WLS	Pt 02	FSAR 19	19.55.06.03	COLA Part 2, FSAR Chapter 19, Subsection 19.55.6.3, first paragraph is revised as follows: Discussions regarding design ground motionfoundation response spectra are presented in Subsection 3.7.1.1.1. The Lee site-specific seismic demand, characterized by the ground motion response spectrum (GMRS) (applicable to Unit 2) and foundation input response spectra (FIRS) A1 (applicable to Unit 1) are not enveloped by the WEC AP1000 Tier 1 criteria for SSE, which combines both the CSDRS and Hard Rock High Frequency (HRHF) spectra. A site-specific analysis of the AP1000 was performed, similar to the analysis described in AP1000 DCD Appendix 3I, to demonstrate that these exceedances are within the seismic design margin of the AP1000 certified design and will not	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 2, Attachment 9, WLG2014.01-02 (ML14064A433)

				adversely affect the structures, systems, or components of the plant. Subsection 3.7.2.15 describes the confirmatory site-specific analyses of the nuclear island that demonstrates compliance with the AP1000 DCD. As part of this site-specific analysis, it has been confirmed that the high confidence of low probability of failure (HCLPF) values presented in Chapter 19 of the AP1000 DCD do not have to be adjusted for the Lee Nuclear Station, since the plant design is controlled by the CSDRS. It is therefore concluded that the Seismic Margin Assessment described in DCD Section 19.55 is applicable to the nuclear island of the Lee Nuclear Station.	

Pt 04 (2 COLA Changes)

11587	WLS	Pt 04	04.01.F / F4.1-1	COLA Part 4, Figure 4.1-1 is revised as reflected on Duke Energy response to RAI Letter 110, RAI 2.3.5-6(b), Enclosure 1, Attachment 10.	Duke Energy Supplemental Respose to RAI Letter 110, RAI 2.3.5-6(b), Enclosure 1, Attachment 10, WLG2013.09-01 (ML13283A227)
11588	WLS	Pt 04	04.01.F / F4.1-2	COLA Part 4, Figure 4.1-2 is revised as reflected on Duke Energy response to RAI Letter 110, RAI 2.3.5-6(b), Enclosure 1, Attachment 10.	Duke Energy Supplemental Response to RAI Letter 110, RAI 2.3.5-6(b), Enclosure 1, Attachment 10, WLG2013.09-01 (ML13283A227)

Pt 05 (13 COLA Changes)

11797	WLS	Pt 05	APP.3	COLA Part 5, Appendix 3, Section 3 is revised to read: The design objective of the primary Alert and Notification System for the Lee Nuclear Station is to essentially complete initial alerting and initiate notification of the population (via the EAS) on an area-wide basis throughout the Plume Exposure Pathway EPZ within about 15 minutes from the time the cognizant offsite agencies have determined the need for such alerting exists. The emergency plans of each State include evidence of EAS preparation for emergency situations and the means for activating the system. The backup alert and notification capability is not subject to the 15-minute criterion. The objective for the backup alert and notification capability is to be capable of alerting and notifying populations at the highest risk of potential adverse health effects, such as those nearest the site and in downwind sectors, so that offsite protective action options remain viable. Additional time may be necessary and is acceptable for warning other populations at less risk. The acceptability of both the primary and backup alert and notification capabilities is documented by FEMA's acceptance of the final ANS Design Report.	Duke Energy Response to RAI LTR 111, Enclosure 1, Attachment 1, WLG2014.02-01
11795	WLS	Pt 05	APP.5	COLA Part 5, Appendix 5, first table, is revised on Duke Energy's response to RAI Letter 111, Attachment 1.	Duke Energy Response to RAI LTR 111, Enclosure 1, Attachment 1, WLG2014.02-01
11793	WLS	Pt 05	II.A.1.b	COLA Part 5, Subsection II.A.1.b, subheading "Local Agency Support Services" is revised to read: State, local and county agencies responsible for public health and safety work through the Emergency Management Agency's Emergency Operations Center in the affected counties. During the initial stages of an emergency, the Operations Shift Manager coordinates onsite emergency response activities, including requests for required offsite support. During an event involving hostile action, the Operations Shift Manager coordinates the response of offsite agencies to the site with on-shift Security personnel. Following staffing of the EOF, the EOF coordinates with the	Duke Energy Response to RAI LTR 111, Enclosure 1, Attachment 1, WLG2014.02-01

				agencies necessary to support the emergency condition, including provision of on-site support during hostile action events, consistent with the affected agencies' plans, procedures, and Letters of Agreement with Duke Energy. Agencies and private sector organizations that have agreed to provide support, as necessary to the Lee Nuclear Station and surrounding areas are listed below.	
11794	WLS	Pt 05	II.B.9	COLA Part 5, Subsection II.B.9 is revised to read: 9. Local Emergency Response Support Duke Energy has established and maintains agreements for local emergency response support services, including firefighting, rescue squad, medical and hospital services. An EPIP entitled, "Site Response to Security Events," as listed in Appendix 5, provides information regarding measures to integrate offsite response resources and capabilities into onsite emergency response activities. Appendix 7 of this Plan provides certification letters for organizations providing the required services.	Duke Energy Response to RAI LTR 111, Enclosure 1, Attachment 1, WLG2014.02-01
11796	WLS	Pt 05	II.E.6	COLA Part 5, Subsection II.E.6 is revised to read: 6. Instructions to the Public in the Plume Exposure EPZ Duke Energy coordinates with responsible State and local agencies to establish the physical and administrative means for alerting members of the public within the plume exposure pathway EPZ of emergency conditions requiring protective actions and for providing prompt emergency instructions to these individuals. The primary method of alerting the public is by activating the Alert and Notification System (ANS). The ANS includes an alerting capability, provided by an outdoor acoustic warning system, and a notification capability, including measures for notifying special facilities and other members of the public of the nature of the event and required protective actions. The system is designed to meet the acceptance criteria of Section B of Appendix 3, NUREG-0654, FEMA-REP-1, Rev. 1, as revised by Supplement 4 (October 2011). In the event of a failure of the primary means, the administrative and physical means for alerting and providing prompt notification to the public includes backup methods that may be implemented by the responsible offsite authorities. As a back-up, State and Local plans maintain the alert mechanism via systems such as emergency vehicles, automated dialing systems, and PA Systems to also alert the public to monitor commercial broadcasts for emergency information. Each county controls the activation of the ANS within its boundaries. A physical description, with methods and means for alert and notification of the public within the plume exposure pathway EPZ, is provided in the FEMA-approved ANS design report. Primary and backup means for the ANS are also described in the North Carolina and South Carolina Radiological Emergency Response Plans. The design objective for the primary ANS is to have the capability to essentially complete the initial alerting and initiate notification of members of the public within the plume exposure pathway EPZ, including those within remote and low population areas, within 15 minutes following a decision by cognizant off-site agencies to notify the public. This capability includes transient populations in remote and rural areas, open water, rivers, hunting, recreational and low population areas that may need special alerting procedures. Backup means of alerting and notifying the public are provided in the event of a partial or complete failure of the primary ANS. The primary and backup alert systems may consist of a combination of fixed sirens, tone alert radios, NOAA weather radios or route alerting. The notification systems may consist of a combination of EAS, NOAA weather radios or route alerting. Appendix 8 of this Plan provides a cross-reference to these provisions in State and Local Plans, as applicable.	Duke Energy Response to RAI LTR 111, Enclosure 1, Attachment 1, WLG2014.02-01
11798	WLS	Pt 05	II.H.1	COLA Part 5, Subsection II.H.1, subheading Technical Support, fourth paragraph is relocated to the discussion under the new sub-heading, Alternate Facilities.	Duke Energy Response to RAI LTR 111, Enclosure 1, Attachment 1, WLG2014.02-01
11799	WLS	Pt 05	II.H.1	COLA Part 5, Subsection II.H.1, is revised to add a new subheading as follows: Alternate Facilities Alternate facility locations have been identified to serve as staging areas for augmentation of emergency response	Duke Energy Response to RAI LTR 111, Enclosure 1,

				staff if the onsite emergency response facilities are not accessible (e.g., due to a threat situation or hostile action). These facilities support a rapid site response to limit or mitigate site damage or the potential for radiological release. Two locations, the Lee Nuclear Station Training Building located on owner controlled property outside of the protected area and the Kings Mountain Generation Support Facility located ~15.5 miles from the site, are used to satisfy the communications and engineering assessment capability requirements for an alternate facility. Together, the alternate facilities have the following features: • Communication links with the EOF, control room and security • Capability to provide timely notification to offsite response organizations of initiation of, or changes to, emergency classification or protective action recommendations; • Capability for engineering assessment activities including, damage control team planning and preparation (items such as general drawings and system information will be accessible to support this capability); and • Computer links to the site to access plant data.	Attachment 1, WLG2014.02-01
11803	WLS	Pt 05	II.H.2	COLA Part 5, Subsection II.H.2, second paragraph under the sub-heading Emergency Operations Facility is revised to read: The Emergency Operations Facility (EOF) is utilized for coordination of off-site activities such as communications with local, State and Federal agencies, and coordination of corporate and other outside support. Anticipated occupants are the EOF organization and appropriate State and Federal agency representatives. Duke Energy maintains the capability for the EOF to simultaneously acquire, display and evaluate radiological, meteorological, and plant system data pertinent to offsite protective measures for each of the facilities that rely on the EOF for offsite emergency response support.	Duke Energy Response to RAI LTR 111, Enclosure 1, Attachment 1, WLG2014.02-01
11800	WLS	Pt 05	II.J.5	COLA Part 5, Subsection II.J.5, third bullet following the second paragraph is revised to read: • Dispersal of key personnel (e.g., licensed operators who must take actions to achieve and maintain safe shutdown conditions)	Duke Energy Response to RAI LTR 111, Enclosure 1, Attachment 1, WLG2014.02-01
11802	WLS	Pt 05	II.N.1.b	COLA Part 5, Subsection II.N.1.b, third paragraph is revised to read: Exercise scenarios shall be varied in a manner that tests all major elements of the plansand preparedness organizations within an eight calendar year period. Exercise scenario content is varied during each eight year cycle to include hostile action, no radiological release or unplanned minimal release that does not require public protective actions, an initial classification or rapid escalation to a Site Area Emergency or General Emergency, implementation of 50.54(hh)(2) strategies, procedures, and guidance; and, the integration of offsite resources with onsite response. In addition, Duke Energy conducts an exercise adequate to test planned emergency response beyond the plume exposure pathway EPZ and within the ingestion exposure pathway EPZ at least once during each eight-year cycle.	Duke Energy Response to RAI LTR 111, Enclosure 1, Attachment 1, WLG2014.02-01
11801	WLS	Pt 05	II.N.2	COLA Part 5, Subsection II.N.2, first paragraph, last sentence is revised to read: Duke Energy provides opportunities for affected State and local esponse organizations located within the plume exposure pathway EPZ to participate in the drills with resources adequate to demonstrate offsite response capabilities.	Duke Energy Response to RAI LTR 111, Enclosure 1, Attachment 1, WLG2014.02-01
11804	WLS	Pt 05	II N.2	COLA Part 5, Subsection II.N.2, second paragraph is revised with a new ending sentence to read: In at least one drill or exercise during each eight-year exercise cycle, the EOF staff will demonstrate their ability to perform consolidated EOF functions.	Duke Energy Response to RAI LTR 111, Enclosure 1, Attachment 1, WLG2014.02-01
11551	WLS	Pt 05	III.A	COLA Part 5, Section III.A, Reference 1 is revised to read:	Editorial

1. U.S. Nuclear Regulatory Commission, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," NUREG-0654/FEMA-REP-1, Rev. 1, November 1980. (supplemented by March 2002 addenda).

Pt 07 (16 COLA Changes)

11592	WLS	Pt 07	A	COLA Part 7, Section A is revised to add WLS DEP 3.11-1 to the Departures Listing, following the entry for WLS DEP 1.8-1 to read: WLS DEP 3.11-1 Revision of "Envir. Zone" numbers for Spent Fuel Pool Level instruments	Duke Energy endorsement of Levy response to RAI Letter 108, Supplement 7, RAI 01.05-1. NPD-NRC-2013-022 (ML13135A17), dated May 13, 2013 for the Lee COL Application.
11748	WLS	Pt 07	A	COLA Part 7, Section A is revised to add WLS DEP 2.0-1 to the Departure Listing, following the entry for WLS DEP 1.8-1 to read: WLS DEP 2.0-1 Lee Site Foundation Response Spectra	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 3, WLG2014.01-02 (ML14064A433)
11593	WLS	Pt 07	A.1	COLA Part 7, Section A.1 is revised to add WLS DEP 3.11-1 to the Listing of Departures That Can Be implemented Without Prior NRC Approval, following the entry for WLS DEP 1.8-1 to read: WLS DEP 3.11-1 Revision of "Envir. Zone" numbers for Spent Fuel Pool Level instruments	Duke Energy endorsement of Levy response to RAI Letter 108, Supplement 7, RAI 01.05-1, NPD-NRC-2013-022 (ML13135A17), dated May 13, 2013 for the Lee COL Application.
11557	WLS	Pt 07	A.1	COLA Part 7, Departures and Exemptions Requests, Section A.1 is revised to add WLS DEP 18.8-1 to the listing of Departures That Do Not Require NRC Approval Prior to Implementation as follows: WLS DEP 18.8-1 Emergency Response Facility locations	Conforming change to Westinghouse TR-207
11594	WLS	Pt 07	A.1	COLA Part 7, Departures and Exemptions Requestse. Section A.1 is revised to add the description for WLS DEP 3.11-1, following the description for WLS DEP 1.8-1 as follows: Departure Number WLS DEP 3.11-1: Affected DCD/FSAR Sections: DCD Table 3.11-1 (Sheet 14 of 51) Summary of Departure: DCD Table 3.11 -1 (Sheet 14 of 51) "Envir. Zone" numbers for Spent Fuel Pool Level instruments SFS- JE-L T019A, SFS-JE-L T019B, and SFS-JE-L T019C are changed to correct an inconsistency in the DCD. All 3 instruments currently have a Environmental Zone number of "11 ". SFS-JE-L T019A is changed to Envir. Zone 6, SFS-JE-L T019B is changed to Envir. Zone 7 and SFS-JE-LT019C is changed to Envir. Zone 6 in DCD Table 3.11-1 (Sheet 14 of 51). Scope/Extent of Departure:	Duke Energy endorsement of Levy response to RAI Letter 108, Supplement 7, RAI 01.05-1, NPD-NRC-2013-022 (ML13135A17), dated May 13, 2013 for the Lee COL Application.

SFS-JE-L T019A is revised to Envir. Zone 6. SFS-JE-L T019B is revised to Envir. Zone 7 and SFS-JE-LT019C is revised to Envir. Zone 6 in DCD Table 3.11-1 (Sheet 14 of 51).

Departure Justification:

The actual location of the Spent Fuel Pool Level instruments is not being changed from the designed location in this departure. The environmental zones the instruments are located in are being revised to be consistent with the designed instrument location. The AP1 000 SFP level transmitters are located in rooms outside of the Fuel Handling Area in the Auxiliary Building.

Per Westinghouse design documents, Spent Fuel Pool Level channels 019A and 019C are in room 12365 and channel 019B is in room 12341 . Room 12365 is in Zone 6 on DCD Table 3.0.5-1 (Sheet 2 of 3). Room 12341 is in Zone 7 on DCD Table 3.D.5-1 (Sheet 2 of 3). Based on this information. SFS-JE-L T019A is being changed to Envir. Zone 6, SFS-JE-L T019B is being changed to Envir. Zone 7 and SFS-JE-L T019C is being changed to Envir. Zone 6 in DCD Table 3.11-1 (Sheet 14 of 51).

DCD Table 3.11-1 Environmental Zone numbers for Spent Fuel Pool Level provide a reference to environmental conditions in the associated instrument location correlated to an environmental zone in DCD Table 3D.5-1 for "Normal Operating Environments", DCD Table 3D.5-4 for "Abnormal Operating Environments Outside Containment" and DCD Table 3D.5-5 for "Accident Environments". The environmental qualification of the instrument is consistent with conditions identified for the associated environmental zone. Revising the Spent Fuel Pool Level instruments' environmental zone to accurately reflect their actual location will ensure they are environmentally qualified to function properly during normal. abnormal, and accident conditions.

Departure Evaluation:

This Tier 2 departure revises SFS-JE-L T019A Envir. Zone from 11 to 6, SFS-JE-L T019B Envir. Zone from 11 to 7. and SFS-JE-LT019C Envir. Zone from 11 to 6 in DCD Table 3.11-1 (Sheet 14 of 51). This departure does not result in any adverse affects to the SFP level indication design function and does not change the environmental qualification methodology. Therefore. this departure does not:

1. Result in more than a minimal increase in the frequency of occurrence of an accident previously evaluated in the plant-specific DCD.
2. Result in more than a minimal increase in the likelihood of occurrence of a malfunction of an SSC important to safety and previously evaluated in the plant-specific DCD.
3. Result in more than a minimal increase in the consequences of an accident previously evaluated in the plant-specific DCD.
4. Result in more than a minimal increase in the consequences of a malfunction of an SSC important to safety previously evaluated in the plant-specific DCD.
5. Create a possibility for an accident of a different type than any evaluated previously in the plant-specific DCD.
6. Create a possibility for a malfunction of an SSC important to safety with a different result than any evaluated previously in the plant-specific DCD.
7. Result in a design basis limit for a fission product barrier as described in the plant-specific DCD being exceeded or altered.
8. Result in a departure from a method of evaluation described in the plant-specific DCD used in establishing the design bases or in the safety analyses.

This departure does not affect resolution of a severe accident issue identified in the plant-specific DCD. Therefore, this departure has no safety significance.

NRC Approval Requirement:

This departure does not require NRC approval pursuant to 10 CFR Part 52. Appendix D, Section VIII.B .5.

11558	WLS	Pt 07	A.1	COLA Part 7, Departures and Exemptions Requests, Section A.1 is revised to add the description for WLS DEP 18.8-1 following the description for WLS DEP 8.3-1 as follows: Departure Number: WLS DEP 18.8-1 Affected DCD/FSAR Sections: 1.2.3, 12.3.1.2, 12.5, 12.5.2.2, 9A.2.1. 18.8.3.5. 18.8.3.6 Summary of Departure:	Conforming change to Westinghouse TR-207

				At Lee Nuclear Station, the Technical Support Center (TSC) is not located in the control support area (CSA) as identified in DCD Subsection 18.8.3.5; the TSC location is as described in the Emergency Plan. Additionally, the Operations Support Center (OSC) is also being moved from the location identified in DCD Subsections 12.5.2.2 and 18.8.3.6 and as identified on DCD Figures 1.2-18, 9A-3 (Sheet 1 of 3), 12.3-2 Sheet 11 of 15), and 12.3-3 (Sheet 11 of 16); the OSC location is as described in the Emergency Plan. Scope/Extent of Departure: This departure is identified in FSAR Subsection 18.8. Departure Justification: The referenced DCD states "The TSC is located in the control support area (CSA)." This is not the case for Lee Nuclear Station. The TSC location is moved to a central location such that a single TSC can serve both Lee Nuclear Station Units 1 and 2 as identified in the Emergency Plan. The referenced DCD also states "The ALARA briefing and operational support center is located off the main corridor immediately beyond the main entry to the annex building" and indicates that the OSC location is identified on Figure 1.2-18. However, the OSC is being moved to the control support area vacated by the move of the TSC in order to better utilize the now available space. Departure Evaluation: This Departure is for a non-safety-related system, and the alternate locations of the TSC and OSC meet applicable requirements. Relocating the TSC and OSC does not adversely affect their function and therefore this Departure does not: 1. Result in more than a minimal increase in the frequency of occurrence of an accident previously evaluated in the plant-specific DCD; 2. Result in more than a minimal increase in the likelihood of occurrence of a malfunction of a structure, system, or component (SSC) important to safety and previously evaluated in the plant-specific DCD; 3. Result in more than a minimal increase in the consequences of an accident previously evaluated in the plant-specific DCD; 4. Result in more than a minimal increase in the consequences of a malfunction of an SSC important to safety previously evaluated in the plant-specific DCD; 5. Create a possibility for an accident of a different type than any evaluated previously in the plant-specific DCD; 6. Create a possibility for a malfunction of an SSC important to safety with a different result than any evaluated previously in the plant-specific DCD; 7. Result in a design basis limit for a fission product barrier as described in the plant-specific DCD being exceeded or altered; or 8. Result in a departure from a method of evaluation described in the plant-specific DCD used in establishing the design bases or in the safety analyses. This Departure does not affect resolution of a severe accident issue identified in the plant-specific DCD. Therefore, this Departure has no safety significance. NRC Approval Requirement: This departure does not require NRC approval pursuant to 10 CFR Part 52, Appendix D, Section VIII.B.6.	
11559	WLS	Pt 07	A.2	COLA Part 7. Departures and Exemptions Requests, Section A.2 is revised to remove WLS DEP 18.8-1 on the listing of Departures That Require NRC Approval Prior to Implementation.	Conforming change to Westinghouse TR-207
11560	WLS	Pt 07	A.2	COLA Part 7. Departures and Exemptions Requests, Section A.2 is revised to remove the description for WLS DEP 18.8-1 from this section.	Conforming change to Westinghouse TR-207
11749	WLS	Pt 07	A.2	COLA Part 7, Section A.2 is revised to add WLS DEP 2.0-1 to the Listing of Departures That Require NRC Approval Prior to Implementation as follows:	Duke Energy Supplemental

				WLS DEP 2.0-1 Lee Site Foundation Response Spectra	Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 3, WLG2014.01-02 (ML14064A433)
11750	WLS	Pt 07	A.2	COLA Part 7, Section A.2 is revised to add the following information:	Duke Energy Supplemental Response 3 to RAI LTR 105, RAI 01.05-1, Enclosure 3, WLG2014.01-02 (ML14064A433)

Departure Number WLS DEP 2.0-1

Affected DCD/FSAR Sections: FSAR Table 2.0-201, Subsections 3.7.1.1.1, 3.7.2.15, Appendix 3I, and 19.55.6.3

Summary of Departure:

The seismic design of the AP1000 standard plant is based on the Certified Seismic Design Response Spectra (CSDRS) as addressed in DCD Subsection 3.7.1.1. The newly released CEUS-SSC model as specified in NUREG-2115, "Central and Eastern United States Seismic Source Characterization for Nuclear Facilities," is considered part of the Lee Nuclear Station site-specific design requirements. Consideration of the CEUS-SSC model along with local and regional refinements results in updated seismic hazards and updated site-specific foundation response spectra (i.e., ground motion response spectra (GMRS), foundation input response spectra (FIRS), and Nuclear Island FIRS [envelope of GMRS and FIRS]) for Lee Nuclear Station that exceed the AP1000 CSDRS.

As shown on Figure 3.7-201, the horizontal Nuclear Island (NI) FIRS for Lee Nuclear Station exceeds the horizontal AP1000 CSDRS at frequencies above approximately 14 hertz. Peak Ground Acceleration (PGA) at 100 hertz for the horizontal NI FIRS is 0.352 g which exceeds the AP1000 CSDRS PGA of 0.30g. Figure 3.7-201 also shows that the horizontal NI FIRS exceeds the horizontal AP1000 HRHF spectrum at all frequencies above approximately 3 hertz. As shown on Figure 3.7-202, the vertical NI FIRS for Lee Nuclear Station exceeds the vertical AP1000 CSDRS at frequencies above approximately 16 hertz. Figure 3.7-202 also shows that the vertical NI FIRS exceeds the vertical AP1000 HRHF spectrum at frequencies between approximately 3 to 55 hertz and 80 to 100 hertz.

The Lee Nuclear Station site provides uniform hard rock support for the Nuclear Island, but the site characteristic horizontal and vertical spectra (NI FIRS) exceed the horizontal and vertical AP1000 HRHF spectra considered in DCD Appendix 3I. Site-specific analysis of the Nuclear Island to demonstrate the adequacy of the design is allowed under the requirements of DCD Table 5.0-1, "Site Parameters for Seismic" (Tier 1) and DCD Subsection 2.5.2.1, Paragraph 4b. The DCD allows a Combined License (COL) applicant to perform a site-specific dynamic analysis of the AP1000 Nuclear Island if the site-specific spectra exceed the AP1000 CSDRS.

Since the site-specific seismic response spectra and accelerations for the Lee Nuclear Station site resulting from the application of the CEUS-SSC model exceed the spectra and accelerations evaluated and documented in the AP1000 DCD, this constitutes a departure from the AP1000 certified design. In order to address these changes in seismic response spectra and accelerations, the following departure from the AP1000 DCD is required.

As indicated above, the Lee Nuclear Station site-specific foundation response spectra and accelerations depart from the DCD in that the horizontal and vertical foundation response spectra (GMRS [Unit 2 FIRS] and Unit 1 FIRS) exceed the AP1000 CSDRS at frequencies above 14 and 16 hertz respectively. The PGA for the horizontal and vertical foundation response spectra exceed the PGA for the horizontal and vertical AP1000 CSDRS. The alternative HRHF response spectra evaluated in DCD Appendix 3I as part of AP1000 design certification are also exceeded by the horizontal and vertical foundation response spectra. Therefore, a reevaluation of the AP1000 standard plant design is required. This departure affects information presented in Table 2.0-201, "Comparison of AP1000 DCD Site Parameters and Lee Nuclear Station Units 1 & 2 Site Characteristics;" Subsection 3.7.1.1.1, "Design Foundation Response Spectra;" Subsection 3.7.2.15, "Site-Specific Analysis of Nuclear Island Seismic Category I Structures;" DCD Appendix 3I, "Evaluation For High Frequency Seismic Input;" and Subsection 19.55.6.3, "Site Specific Seismic Margin Analysis."

Scope / Extent of Departure:

This departure is identified in FSAR Table 2.0-201 and Subsections 3.7.1.1.1, 3.7.2.15, Appendix 3I and 19.55.6.3.

Departure Justification:

The Lee Nuclear Station site-specific foundation response spectra and peak ground acceleration depart from the DCD in that they exceed the AP1000 CSDRS. The Lee Nuclear Station site-specific response spectra also exceed the AP1000 generic hard rock high frequency response spectra. Therefore, a site-specific analysis of the AP1000 Nuclear Island was performed, similar to the analysis described in DCD Appendix 3I to demonstrate that dynamic loads from these high frequency spectra exceedances are within the seismic design margin of the AP1000 certified design.

The AP1000 certified design had previously been analyzed for high frequency (HF) exceedances as part of qualifying the AP1000 standard plant design for the HRHF spectra. The Lee Nuclear Station NI FIRS and the AP1000 HRHF spectra are very similar. Therefore, the same general screening criteria documented in DCD Appendix 3I was used to identify a representative sample of structures, components, supports, piping and equipment to evaluate to demonstrate the acceptability of the AP1000 certified design for the Lee Nuclear Station HF motion. A brief summary of the general screening criteria used to identify a representative sample for evaluation follows:

- Based on their importance to safety and the ability to achieve safe shutdown.
- According to location in areas of the plant that are susceptible to large HF seismic inputs.
- Have exhibited significant modal response within the region of HF amplification.
- Possession of significant total stress as compared to allowable, when considering load combinations that include seismic.

The Lee Nuclear Station site-specific analysis determined that the HF exceedances result in only a minimal increase in the evaluated dynamic loads and would not result in any damage to the AP1000 structures, systems or components (SSCs). The site-specific analysis includes evaluations of building structures, reactor pressure vessel internals, primary component supports, primary loop nozzles, piping and electro-mechanical equipment. Both the Lee Nuclear Station site-specific building forces and equipment support forces are enveloped by the CSDRS building forces and equipment support forces.

The site-specific evaluation reviewed the current AP1000 electro-mechanical equipment qualification test methods and requirements, and compared those requirements to the Lee Nuclear Station site-specific requirements. There are a few minor exceedances between the site-specific in-structure response spectra and the comparable AP1000 qualification required response spectra (RRS) envelopes. However, in all cases the test response spectra (TRS) used in actual equipment qualification testing exceed the site-specific demand by a significant margin.

The site-specific analysis and evaluation concludes that the proposed change does not result in an adverse effect on any plant-specific DCD described design function.

Departure Evaluation:

This Tier 2 departure adds a discussion of the application of the Lee Nuclear Station site-specific response spectra, developed by applying the CEUS-SSC model, for determining the horizontal and vertical seismic demand on the AP1000 Nuclear Island. This departure does not result in any adverse effects on the safety functions of SSCs as demonstrated by the Lee Nuclear Station site-specific evaluation report (WLG-GW-GLR-815, "Effects of William S. Lee Site-Specific Seismic Requirements on AP1000 SSCs"). The site-specific analysis includes evaluation of building structures, reactor pressure vessel internals, primary component supports, primary loop nozzles, piping and electro-mechanical equipment.

1. Site-specific analysis confirms that the exceedances in seismic response spectra and peak ground accelerations result in only minimal increase in the evaluated dynamic loads for AP1000 SSCs, and do not result in damage to the analyzed SSCs. There is no change associated with or impact to AP1000 SSC design features or functions. This change has no impact on the frequency of occurrence of an accident previously evaluated in the plant-specific DCD. Therefore there is not more than a minimal increase in the frequency of occurrence.

2. This change does not impact the likelihood of a malfunction of an SSC. Evaluation coupled with analysis indicates that the high-frequency exceedances in seismic response result in minimal increases in the evaluated dynamic loads for AP1000 building structures, reactor pressure vessel internals, primary component supports, primary loop nozzles, piping, and electro-mechanical equipment, and do not result in damage to the analyzed SSCs. Also evaluations determined that the small site-specific spectral exceedances are bounded by the actual test

				response spectra (TRS) used to qualify high frequency sensitive electrical equipment; therefore, no damage will result to electro-mechanical equipment. 3. This change has no impact on AP1000 design capacities, source term inventories, or evaluated release rates. Therefore, this change does not increase the consequences of an accident previously evaluated. 4. Site-specific analysis confirms that the exceedances result in minimal increases in the evaluated dynamic loads for AP1000 SSCs, and do not result in damage to the analyzed SSCs. There is no change associated with the AP1000 SSC design capacities or source term inventories. Therefore, there is no increase in the consequences of a malfunction of an SSC important to safety. 5. There are no changes associated with the AP1000 design that introduce the possibility of new or different types of accidents. Therefore the change does not create a possibility for an accident of a different type than previously evaluated in the plant-specific DCD. 6. There are no changes associated with AP1000 design that introduce the possibility of new or different types of malfunction. Therefore, there will not be a malfunction of an SSC important to safety with a different result than any previously evaluated in the plant-specific DCD, since analysis along with electrical equipment being qualified to a robust test response spectra (TRS) indicates that the HF exceedances in seismic response result in minimal effects on important to safety SSCs. 7. Other than the design basis seismic source, there are no changes associated with AP1000 design basis limits. This change does not result in a design basis limit being exceeded or altered. 8. The proposed change is based on an evaluation methodology that is described in plant-specific DCD and NRC requirements, and this is not a revision or replacement of a plant-specific DCD described evaluation methodology; nevertheless, since the site-specific response spectra are not bounded by the CSDRS, the response to this question is determined to be yes. (The methodology is consistent but the inputs are selected to be site-specific). The site-specific analysis demonstrates that the minor increase in dynamic loads due to high frequency spectra and peak ground acceleration exceedances are within the seismic design capacity of the AP1000 certified design; therefore, the departure does not affect a resolution of an ex-vessel severe accident design feature identified in the DCD. Therefore, this departure has no safety significance. NRC Approval Requirement: This departure requires NRC approval pursuant to 10 CFR Part 52, Appendix D, Section VIII.B.5.	
11775	WLS	Pt 07	A.2	COLA Part 7, Section A.2 is revised at the first paragraph following "Departure Number WLS DEP 2.0-1" to read: Affected DCD/FSAR Sections: FSAR Table 2.0-201, Subsections 3.7.1.1.1, 3.7.2.8.4, 3.7.2.15, Appendix 3I, and 19.55.6.3	Duke Energy Supplemental Response 4 to RAI LTR 105, RAI 01.05-1, Enclosure 3, WLG2014.02-02
11776	WLS	Pt 07	A.2	COLA Part 7, Section A.2, under the Summary of Departure, third paragraph as follows: The Lee Nuclear Station site provides uniform hard rock support for the Nuclear Island, but the site characteristic horizontal and vertical spectra (NI FIRS) exceed the horizontal and vertical AP1000 HRHF spectra considered in DCD Appendix 3I. Site-specific analysis of the Nuclear Island and Seismic Category II (SC-II) Adjacent Buildings to demonstrate the adequacy of the design is allowed under the requirements of DCD Table 5.0-1, "Site Parameters for Seismic" (Tier 1), DCD Subsection 2.5.2.1, Paragraph 4b, and DCD Subsection 3.7.2.8.4. The DCD allows a Combined License (COL) applicant to perform a site-specific dynamic analysis of the AP1000 Nuclear Island and SC-II Adjacent Buildings if the site-specific spectra exceed the AP1000 CSDRS.	Duke Energy Supplemental Response 4 to RAI LTR 105, RAI 01.05-1, Enclosure 3, WLG2014.02-02
11777	WLS	Pt 07	A.2	COLA Part 7, Section A.2, under the Summary of Departure, fifth paragraph as follows: As indicated above, the Lee Nuclear Station site-specific foundation response spectra and accelerations depart from the DCD in that the horizontal and vertical foundation response spectra (GMRS [Unit 2 FIRS] and Unit 1 FIRS) exceed the AP1000 CSDRS at frequencies above 14 and 16 hertz respectively. The PGA for the horizontal and	Duke Energy Supplemental Response 4 to RAI LTR 105, RAI 01.05-1, Enclosure

				vertical foundation response spectra exceed the PGA for the horizontal and vertical AP1000 CSDRS. The alternative HRHF response spectra evaluated in DCD Appendix 3I as part of AP1000 design certification are also exceeded by the horizontal and vertical foundation response spectra. Therefore, a reevaluation of the AP1000 standard plant design is required. This departure affects information presented in Table 2.0-201, "Comparison of AP1000 DCD Site Parameters and Lee Nuclear Station Units 1 & 2 Site Characteristics;" Subsection 3.7.1.1.1, "Design Foundation Response Spectra;" Subsection 3.7.2.8.4, "Seismic Modeling and Analysis of Seismic Category II Building Structures," Subsection 3.7.2.15, "Site-Specific Analysis of Nuclear Island Seismic Category I Structures;" DCD Appendix 3I, "Evaluation For High Frequency Seismic Input;" and Subsection 19.55.6.3, "Site Specific Seismic Margin Analysis."	3, WLG2014.02-02
11778	WLS	Pt 07	A.2	COLA Part 7, Section A.2, under the "Scope / Extent of Departure" the first paragraph is revised to read: This departure is identified in FSAR Table 2.0-201 and Subsections 3.7.1.1.1, 3.7.2.8.4, 3.7.2.15, Appendix 3I and 19.55.6.3.	Duke Energy Supplemental Response 4 to RAI LTR 105, RAI 01.05-1, Enclosure 3, WLG2014.02-02
11779	WLS	Pt 07	A.2	COLA Part 7, Section A.2, under the "Departure Justification" new fifth and sixth paragraphs are added and the (now) seventh paragraph is revised to read: Site-specific evaluation of the Lee Nuclear Station SC-II adjacent buildings concludes the following: • The Lee Nuclear Station SC-II Turbine Building 1st Bay and Annex Building backfill configuration and backfill properties are uniform and consistent with those evaluated in the AP1000 DCD. • The bearing capacity of the Lee Nuclear Station SC-II Turbine Building 1st Bay and Annex Building backfill material is greater than the corresponding calculated bearing demand. • The maximum relative horizontal seismic displacements between the Lee Nuclear Station SC-II Turbine Building 1st Bay and Annex Building and the nuclear island are much less than the 2-inch foundation and 4-inch top gap clearances provided. • The site-specific Lee Nuclear Station horizontal SC-II foundation input response spectra are very similar to the AP1000 SC-II design envelope foundation spectra, and are of primary importance in assessing potential interactions between nuclear island and the SC-II adjacent structures. • The site-specific Lee Nuclear Station vertical SC-II foundation input response spectra exceed the corresponding AP1000 SC-II design envelope foundation spectra, but are of less importance for potential interactions between the nuclear island and the SC-II adjacent structures. Duke Energy will ensure that the SC-II adjacent buildings are designed for the calculated site-specific foundation spectra to satisfy all AP1000 DCD criteria to confirm that they do not interact with the nuclear island. The site-specific analyses and evaluations conclude that the proposed change does not result in an adverse effect on any plant-specific DCD described design function.	Duke Energy Supplemental Response 4 to RAI LTR 105, RAI 01.05-1, Enclosure 3, WLG2014.02-02
11780	WLS	Pt 07	A.2	COLA Part 7, Section A.2, the "Departure Evaluation" is revised to read: Departure Evaluation: This Tier 2 departure adds a discussion of the application of the Lee Nuclear Station site-specific response spectra, developed by applying the CEUS-SSC model, for determining the horizontal and vertical seismic demand on the AP1000 Nuclear Island. This departure does not result in any adverse effects on the safety functions of SSCs as demonstrated by the Lee Nuclear Station site-specific evaluation reports (WLG-GW-GLR-815, "Effects of William S. Lee Site-Specific Seismic Requirements on AP1000 SSCs" " and WLG-1000-S2R-804, Rev 3, "William S. Lee Site Specific Adjacent Buildings Seismic Evaluation Report"). The site-specific analyses include evaluation of building structures, reactor pressure vessel internals, primary component supports, primary loop nozzles, piping and electro-mechanical equipment. 1. Site-specific analysis confirms that the exceedances in seismic response spectra and peak ground accelerations	Duke Energy Supplemental Response 4 to RAI LTR 105, RAI 01.05-1, Enclosure 3, WLG2014.02-02

result in only minimal increase in the evaluated dynamic loads for AP1000 SSCs, and do not result in damage to the analyzed SSCs. Site-specific analysis also confirms that relative building displacements are small and there are no interactions between the Nuclear Island and SC-II adjacent buildings. There is no change associated with or impact to AP1000 SSC design features or functions. This change has no impact on the frequency of occurrence of an accident previously evaluated in the plant-specific DCD. Therefore there is not more than a minimal increase in the frequency of occurrence.

2. This change does not impact the likelihood of a malfunction of an SSC important to safety and previously evaluated in the plant-specific DCD. Evaluation coupled with analysis indicates that the high-frequency exceedances in seismic response result in minimal increases in the evaluated dynamic loads for AP1000 building structures, reactor pressure vessel internals, primary component supports, primary loop nozzles, piping, and electro-mechanical equipment, and do not result in damage to the analyzed SSCs. Also evaluations determined that the small site-specific spectral exceedances are bounded by the actual test response spectra (TRS) used to qualify high frequency sensitive electrical equipment; therefore, no damage will result to electro-mechanical equipment Evaluation determined that there are no interactions between the Nuclear Island and the SC-II adjacent buildings.

3. This change has no impact on AP1000 design capacities, source term inventories, or evaluated release rates. Therefore, this change does not increase the consequences of an accident previously evaluated.

4. Site-specific analysis confirms that the exceedances result in minimal increases in the evaluated dynamic loads for AP1000 SSCs, and do not result in damage to the analyzed SSCs. Site-specific analysis also determined that there are no interactions between the Nuclear Island and the SC-II adjacent buildings. There is no change associated with the AP1000 SSC design capacities or source term inventories. Therefore, there is no increase in the consequences of a malfunction of an SSC important to safety.

5. There are no changes associated with the AP1000 design that introduce the possibility of new or different types of accidents. Therefore the change does not create a possibility for an accident of a different type than previously evaluated in the plant-specific DCD.

6. There are no changes associated with AP1000 design that introduce the possibility of new or different types of malfunction. Therefore, there will not be a malfunction of an SSC important to safety with a different result than any previously evaluated in the plant-specific DCD, since analysis along with electrical equipment being qualified to a robust test response spectra (TRS) indicates that the HF exceedances in seismic response result in minimal effects on important to safety SSCs and analysis confirms that there are no interactions between the Nuclear Island and SC-II adjacent buildings.

7. Other than the design basis seismic source, there are no changes associated with AP1000 design basis limits. This change does not result in a design basis limit for a fission product barrier as described in the plant-specific DCD being exceeded or altered.

8. The proposed change is based on an evaluation methodology that is described in the plant-specific DCD and NRC requirements, and thus is not a revision or replacement of a plant-specific DCD described evaluation methodology; nevertheless, since the site-specific response spectra are not bounded by the CSDRS, the response to this question is determined to be yes. (The methodology is consistent but the inputs are selected to be site-specific).

The site-specific analyses demonstrate that the minor increase in dynamic loads due to high frequency spectra and peak ground acceleration exceedances are within the seismic design capacity of the AP1000 certified design and that there are no interactions between the Nuclear Island and SC-II adjacent buildings; therefore, the departure does not affect a resolution of an ex-vessel severe accident design feature identified in the DCD. Therefore, this departure has no safety significance.

Pt 09 (1 COLA Change)

11600	WLS	Pt 09	09.01.T / T9.1.0-1 T9.1.0-2	COLA Part 9, Withheld Information, Part 1 Tables 1.0-1 and 1.0-2 are revised to reflect a revision to the project timeframe.	Duke Energy 2013 Integrated Resource Plan

Pt 10 (4 COLA Changes)

11595	WLS	Pt 10	12.B	COLA Part 10, Proposed License Conditions, Section 12.B is revised to read: B. RELIABLE SPENT FUEL POOL LEVEL INSTRUMENTATION Prior to initial fuel load, the licensee shall fully implement the following requirements for SFP level indication using the guidance contained in JLD-ISG-2012-03, Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation, Revision 0. The SFP instrumentation shall be maintained available and reliable through the development and implementation of a training program. The training program shall include provisions to ensure trained personnel can route the temporary power lines from the alternate power source to the appropriate connection points and connect the alternate power source to the safety-related level instrument channels.	Duke Energy endorsement of Levy response to RAI LTR108, LNP RAI 01.05-1, NPD-NRC-2013-041, S8 (ML13269A421), for the Lee COL Application
11561	WLS	Pt 10	13	COLA Part 10, License Conditions and ITAAC, is revised to add Proposed License Condition 13 as follows: 13. RADWASTE BUILDING RADIOACTIVITY LIMITS PROPOSED LICENSE CONDITION: Prior to initial fuel load, the licensee shall develop, implement, and maintain procedural controls limiting radionuclide inventory in each of the Radwaste Building Monitor Tanks, and separately in each of up to three (3) Radwaste Building mobile radwaste processing systems to below A2 quantities for radionuclides specified in Appendix A to 10 CFR Part 71 (Tables A-1 and A-3), as described in FSAR Section 13.5.2.2.5. The procedures shall also ensure that any additional equipment located in the RWB is limited to the A2 quantities and that the total cumulative radioactive inventory contained in unpackaged wastes (including liquid waste, wet waste, solid waste, gaseous waste, activated or contaminated metals and components, and contaminated waste present at any time in the Radwaste Building) is limited so that an unmitigated release, occurring over a two hour time period, would not result in a dose of greater than 500 millirem at the protected area boundary or an unmitigated exposure, occurring over a two hour time period, would not result in a dose of greater than 5 rem to site personnel located 10 feet from the total cumulative radioactive inventory.	Duke Energy endorsement of Levy revised response to LNP RAI LTR 112, RAI 11.02-4, (24734-4), NPD-NRC-2013-039 (ML13259A147), dated September 12, 2013 for the Lee COL Application
11805	WLS	Pt 10	4	COLA Part 10, Section 4, is revised to add: Prior to the full-participation exercise to be conducted in accordance with the requirements of Appendix E to 10 CFR Part 50, Duke Energy will have available for NRC inspection Letters of Agreement with the entities listed in Appendix 7 of the Lee Nuclear Station COLA Part 5, Emergency Plan. These Letters of Agreement will detail each entity's specific emergency planning responsibilities, including response to hostile action affecting the plant site, and certify the entity's concurrence with their responsibilities.	Duke Energy Response to RAI LTR 111, Enclosure 1, Attachment 2, WLG2014.02-01
11806	WLS	Pt 10	4	COLA Part 10, Section 4, is revised to add: Prior to fuel load, Duke Energy will demonstrate the integrated capability and functionality of the Emergency Operations Facility (EOF) for activation and operation of the facility to respond to emergency events at both the Lee Nuclear Station and one additional nuclear facility that is supported by the EOF. Integrated communication and data capability and functionality will include the Technical Support Centers for Lee Nuclear Station and one additional nuclear facility, and other Federal, State, and local coordination centers as appropriate.	Duke Energy Response to RAI LTR 111, Enclosure 1, Attachment 2, WLG2014.02-01

Pt 11 (1 COLA Change)

11607	WLS	Pt 11	11.QAPD	COLA Part 11, QAPD is revised as reflected on Duke Energy Voluntary Submittal, Update to QAPD, WLG2013.06-05.	Duke Energy Voluntary Submittal, Update to QAPD, WLG2013.06-05 (ML13175A265)

SUMMARY

COLA Part A	Number of COLA Changes
Pt 01	8
Pt 02	219
Pt 04	2
Pt 05	13
Pt 07	16
Pt 09	1
Pt 10	4
Pt 11	1
Totals (8 groups)	**264**