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October 27, 2008

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U.S. Nuclear Regulatory Commission
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
Partial Response to Request for Additional Information
(RAI Nos. 820, 821, 822, 823, 824, and 825)
Ltr# WLG2008.10-14

Reference: Letter from Brian Hughes (NRC) to Peter Hastings (Duke Energy), *Request for Additional Information Letter No. 012 {sic}[017] Related To SRP Section 2.3.4 {sic}[2.4] for the William States Lee III Units 1 And 2 Combined License Application*, dated September 22, 2008

This letter provides the Duke Energy partial response to the Nuclear Regulatory Commission's requests for additional information (RAIs) included in the referenced letter.

Responses to the NRC information requests described in the referenced letter are addressed in separate enclosures, which also identify associated changes, when appropriate, that will be made in a future revision of the Final Safety Analysis Report for the Lee Nuclear Station. Responses to RAIs 826 and 828 will be addressed under a separate cover letter.

If you have any questions or need any additional information, please contact Peter S. Hastings, Nuclear Plant Development Licensing Manager, at 980-373-7820.

Bryan J. Dolan

Bryan J. Dolan
Vice President
Nuclear Plant Development

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NRO

Enclosures:

1) Duke Energy Response to Request for Additional Information Letter 017, RAI 02.04.02-001
2) Duke Energy Response to Request for Additional Information Letter 017, RAI 02.04.02-002
3) Duke Energy Response to Request for Additional Information Letter 017, RAI 02.04.03-001
4) Duke Energy Response to Request for Additional Information Letter 017, RAI 02.04.03-002
5) Duke Energy Response to Request for Additional Information Letter 017, RAI 02.04.03-003
6) Duke Energy Response to Request for Additional Information Letter 017, RAI 02.04.03-004
7) Duke Energy Response to Request for Additional Information Letter 017, RAI 02.04.03-005
8) Duke Energy Response to Request for Additional Information Letter 017, RAI 02.04.04-001
9) Duke Energy Response to Request for Additional Information Letter 017, RAI 02.04.04-002
10) Duke Energy Response to Request for Additional Information Letter 017, RAI 02.04.05-001
11) Duke Energy Response to Request for Additional Information Letter 017, RAI 02.04.05-002
12) Duke Energy Response to Request for Additional Information Letter 017, RAI 02.04.06-001
13) Duke Energy Response to Request for Additional Information Letter 017, RAI 02.04.06-002
14) Duke Energy Response to Request for Additional Information Letter 017, RAI 02.04.11-001
15) Duke Energy Response to Request for Additional Information Letter 017, RAI 02.04.11-002

AFFIDAVIT OF BRYAN J. DOLAN

Bryan J. Dolan, being duly sworn, states that he is Vice President, Nuclear Plant Development, Duke Energy Carolinas, LLC, that he is authorized on the part of said Company to sign and file with the U. S. Nuclear Regulatory Commission this supplement to the combined license application for the William States Lee III Nuclear Station and that all the matter and facts set forth herein are true and correct to the best of his knowledge.

Bryan J. Dolan
Bryan J. Dolan

Subscribed and sworn to me on October 27, 2008

Jimmie O. Stroud
Notary Public

My commission expires: October 31, 2008

SEAL

xc (w/o enclosures):

Michael Johnson, Director, Office of New Reactors
Gary Holahan, Deputy Director, Office of New Reactors
David Matthews, Director, Division of New Reactor Licensing
Scott Flanders, Director, Site and Environmental Reviews
Glenn Tracy, Director, Division of Construction Inspection and Operational Programs
Charles Ader, Director, Division of Safety Systems and Risk Assessment
Michael Mayfield, Director, Division of Engineering
Luis Reyes, Regional Administrator, Region II
Loren Plisco, Deputy Regional Administrator, Region II
Thomas Bergman, Deputy Division Director, DNRL
Stephanie Coffin, Branch Chief, DNRL

xc (w/ enclosures):

Brian Hughes, Senior Project Manager, DNRL

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 017

NRC Technical Review Branch: Hydrologic Engineering Branch (RHEB)

Reference NRC RAI Number(s): RAI 02.04.02-001

NRC RAI:

The applicant needs to describe the process followed to determine the conceptual models for floods from local intense precipitation, probable maximum flood in the drainage area upstream of the site, surges, seiche, tsunami, seismically-induced dam failures, landslides, and ice effects to ensure that the design-basis flood is based on the most conservative of plausible conceptual models.

Duke Energy Response:

The conceptual models to determine the design basis flooding adhere to the requirements of NRC Regulatory Guide 1.206 and NRC Regulatory Guide 1.59. Where applicable, determination of design basis flooding is consistent with the current state of the practice guidance provided in ANSI/ANS-2.8-1992.

The analysis of local intense precipitation utilizes the Rational Method to determine runoff. The Rational Method was selected based on the area analyzed being a small developed area. Precipitation and intensity are maximized using point precipitation from Hydrometeorological Report No. 51 and No. 52. Any site drainage system features, such as culverts and inlets, are assumed non-functional. Runoff is maximized by assuming no precipitation or runoff losses.

Water surface elevations are determined using U.S. Army Corps of Engineers HEC-RAS standard step backwater analysis software. Flow restrictions are maximized by modeling building structures as obstructions and assuming buildings do not provide any flood storage. A sensitivity analysis is also performed by increasing and decreasing the Manning's roughness coefficient.

Make-Up Pond B is the source of the design basis flood for the Lee Nuclear Station. The design basis flood height is 584.3 ft. msl which is more than 5 ft. below the 590 ft. msl grade for safety related structures. The design basis flood for Make-Up Pond B results from the probable maximum precipitation (PMP) for the watershed coincident with the maximum calculated wind water activity for the impoundment. Make-Up Pond A and the Broad River were evaluated for flooding under numerous scenarios. In all cases, flooding from Make-up Pond B was the limiting case for the Lee Nuclear Station.

The process followed to determine the conceptual models for floods from probable maximum flood in the drainage area upstream of the site is discussed in response to RAI Number 02.04.03-001 (this letter).

The process followed to determine the conceptual models for floods from surges and seiches is discussed in response to RAI Number 02.04.05-001 (this letter).

The process followed to determine the conceptual models for floods from tsunami and landslides is discussed in response to RAI Number 02.04.06-001 (this letter).

The process followed to determine the conceptual models for floods from dam failures is discussed in response to RAI Number 02.04.04-001 (this letter).

The process followed to determine the conceptual models for flood from ice effects included consulting the U.S. Army Corps of Engineers ice jam database. Additionally, river temperature readings from U.S. Geological Survey stream gauges in the watershed are used to evaluate the potential for subfreezing water temperatures in the region. No water is required from the Broad River or Make-Up Ponds A and B to support safety-related functions. Therefore, any potential icing of water supply facilities has no effect on safety-related facilities.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

None

Attachments:

None

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 017

NRC Technical Review Branch: Hydrologic Engineering Branch (RHEB)

Reference NRC RAI Number(s): RAI 02.04.02-002

NRC RAI:

Provide input files used in the HEC-RAS analysis described in FSAR Section 2.4.2.3. Provide details of the iterative process used with the HEC-RAS model to determine water surface elevations during the local intense precipitation event described in FSAR Section 2.4.2.3. In Table 2.4.2-204, how were the times of concentration for the site drainage areas determined? Provide the locations of safety-related structures where the maximum water surface elevations for each of the site drainage areas in Table 2.4.2-204 are presented.

Duke Energy Response:

Duke Energy has previously provided the HEC-RAS and HEC-HMS electronic input and output data files for the Broad River, Make-Up Pond A, and Make-Up Pond B in our letter dated July 17, 2008 (ML082050557).

The following supplement to FSAR 2.4.2.3 provides an expanded discussion of the site grading, flow paths, and methodology used to analyze the effects of local intense precipitation.

The grading and drainage plan is provided in FSAR Figure 2.4.2-202. The site is graded to drain runoff away from the power blocks. The finished floor elevation is 590 ft. The areas immediately surrounding the power blocks are elevation 589.5 ft. The immediate surrounding area is flat and generally is bounded by the roadway surrounding the power blocks also at elevation 589.5 ft. The power block area bounded by the roadway is either paved or gravel surface. Further from the power blocks the site gently slopes away from the roadway to a general elevation of 588 ft. Areas beyond the roadway are generally maintained grass surfaces.

To analyze the effects of local intense precipitation, the site was divided into four drainage areas (northwest, northeast, southwest, southeast) based on the grading and drainage plan. Each area was modeled using HEC-RAS version 3.1.3. Cross sections for each of the four areas were determined based on the grading and drainage plan and flows were modeled under steady state conditions. A Manning's roughness coefficient, n = 0.015, was used for the paved or gravel surfaces. A Manning's roughness coefficient, n = 0.035 was used for the grass surfaces, with a sensitivity analysis considering a 50 percent increase and decrease.

In the northwest drainage area, a wide shallow swale directs runoff west to Make-Up Pond B. In the northeast drainage area, a wide shallow swale directs runoff east to the back waters of the Broad River. The swales are bounded by the roadway surrounding the power blocks and the embedded railway track to the north. Beyond the railway tracks are several warehouse structures and open areas with a yard elevation of 588 ft. The yard elevation then slopes steeply into Hold-Up Pond A or the backwaters of the Broad River.

The division for the northern swales begins at the road running between the power blocks to the warehouses. The northeast swale draining runoff to backwaters of the Broad River is about 2500 ft. in length and drops in elevation from 588 ft. to about 586 ft. as it reaches the steeper slopes into the backwaters of the Broad River. The swale begins with a very shallow slope of 0.0004 ft/ft and increases slightly to a shallow slope of 0.0008 ft/ft.

The swale width is about 500 ft. between the roadway surrounding the power blocks and the embedded railway tracks. The swale narrows to about 400 ft. wide as it passes the elevated cooling tower pad for Unit 2 then widens as it approaches the steeper slopes into the backwaters of the Broad River. The narrowing location is used as the critical cross section for determining the time of concentration in the drainage calculations. The northeast analysis includes 12 cross sections.

The northwest swale draining runoff to Make-Up Pond B is about 1600 ft. in length. For the majority of the length, the elevation change is from 588 ft. to about 586 ft. before it drops to areas at elevation 575 ft. adjacent to Make-Up Pond B. The swale begins with a very shallow slope of 0.0008 ft/ft and increases slightly to a shallow slope of 0.0014 ft/ft.

The swale width is about 500 ft. between the roadway surrounding the power blocks and the embedded railway tracks. The swale narrows to about 400 ft. wide as it passes the elevated cooling tower pad for Unit 1 then empties into a wider area adjacent to Make-Up Pond B. The narrowing location is used as the critical cross section for determining the time of concentration in the drainage calculations. The northwest analysis includes 9 cross sections.

In the southwest drainage area, a narrow shallow swale directs runoff west to Make-Up Pond B and in the southeast drainage area, a wide shallow swale directs runoff east to Make-Up Pond A. The swales are bounded by the roadway surrounding the power blocks and further to the south by steeply rising elevation up to a hill feature and the transmission yard.

The division for the southern swales begins at the series of structures identified as the maintenance support building, and administration building. The southwest swale draining runoff to Make-Up Pond B is about 2000 ft. in length as it approaches the banks of Make-Up Pond B. The swale width including adjacent flat areas of the parking lot is about 700 ft. wide between the roadway surrounding the power blocks and the raised transmission yard. The swale narrows to about 70 ft. wide as it passes through a cut area between the elevated cooling tower pad for Unit 1 and a hill feature. The narrowing location is used as the critical cross section for determining the time of concentration in the drainage calculations. The southwest analysis includes 10 cross sections.

The swale maintains a very shallow slope of 0.0006 ft/ft for the majority of the length and through the narrowing section. Beyond the narrowest point the cut swale widens and steepens before it drops into Make-Up Pond B. The elevation changes from 588 ft. to about 585.5 ft. as it reaches the banks of Make-Up Pond B.

The southeast swale draining runoff to Make-Up Pond A is about 2000 ft. in length as it approaches the banks of Make-Up Pond A. The swale width is about 700 ft. wide between the roadway surrounding the power blocks and the raised transmission yard. The swale maintains about 700 ft. in width as it passes between the elevated cooling tower pad for Unit 2 and the elevated transmission yard. This location is used as the critical cross section for determining the time of concentration in the drainage calculations. The southeast analysis includes 11 cross sections.

For roughly half the total length, the swale maintains a very shallow slope of about 0.0008 ft/ft up to the critical cross section. The elevation change for this portion is from 588 ft. to about 587.2 ft. Beyond the critical cross section, the swale widens and the slope gradually increases as the elevation drops to about 585 ft. along the banks of Make-Up Pond A.

Flows were determined by the rational method with no runoff losses assumed. The intensity component of the rational method was determined for each of the four HEC-RAS models using the corresponding time of concentration and the depth duration curve for the local intense PMP shown in FSAR Figure 2.4.2-203. The time of concentration was determined using an iterative process.

For each HEC-RAS model an assumed time of concentration was used for the first trial. The time of concentration was converted to an intensity using the depth duration curve. The rational method was used to determine the flow at each cross section up to the critical cross section using the total drainage area at each cross section. The flow at the critical cross section was carried over to each successive downstream cross section. The calculated flows were inputted into the HEC-RAS models and run.

The resulting flow velocities from the HEC-RAS model runs at each cross section were averaged between successive cross sections and a travel time was determined based on the distance between successive cross sections. The total travel time to the critical cross section was then used as a new time of concentration. The process was repeated until the time of concentration converged.

The resulting water surface elevations at the safety-related structures, located in the Units 1 and 2 power blocks, are identified in FSAR Table 2.4.2-204. For each of the four areas modeled, the table also identifies: the total drainage area, the converged time of concentration for the drainage area, the corresponding PMP depth from the depth duration curve, the converted intensity used in the rational method formula, and the resulting flow rate at the critical cross section.

Duke Energy has modified the text of FSAR Subsection 2.4.2.3 to provide a description of the iterative process used to determine the times of concentration in Table 2.4.2-204 for the site drainage areas and resulting water surface elevations during the local intense precipitation event. A revision of FSAR Subsection 2.4.2.3 text is provided as Attachment 2. Attachment 2 will be incorporated into a future revision of the Final Safety Analysis Report.

The AP1000 safety-related structures are the containment building and auxiliary building. Attachment 3 identifies the location of the safety-related structures. The maximum water surface elevations in Table 2.4.2-204 occur adjacent to the safety-related structures in the respective drainage areas.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

FSAR Subsection 2.4.2.3

Attachments:

1) Revised FSAR Subsection 2.4.2.3
2) RAI Number 02.04.02-002 Figure 1, AP1000 Safety-Related Facilities

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 1 to RAI 02.04.02-002

Revision to FSAR Subsection 2.4.2.3

COLA Part 2, FSAR, Chapter 2, Subsection 2.4.2.3, will be revised as follows:

2.4.2.3 Effects of Local Intense Precipitation

The Lee Nuclear Station drainage system was evaluated for a storm producing the PMP on the local area. The site is relatively flat; however, the site is graded such that overall runoff will drain away from safety-related structures to Make-Up Pond B, Make-Up Pond A, or directly to the Broad River. The PMP flood analysis assumes that all discharge structures are non-functioning. Computed water surface elevations in the vicinity of safety-related structures are below plant elevation of 590 ft. The site grading and drainage plan is shown in **Figure** 2.4.2- 202.

The site is graded to drain runoff away from the power blocks. The finished floor elevation is 590 ft. The areas immediately surrounding the power blocks are elevation 589.5 ft. The immediate surrounding area is flat and generally is bounded by the roadway surrounding the power blocks also at elevation 589.5 ft. The power block area bounded by the roadway is either paved or gravel surface. Further from the power blocks the site gently slopes away from the roadway to a general elevation of 588 ft. Areas beyond the roadway are generally maintained grass surfaces.

To analyze the effects of local intense precipitation, the site was divided into four drainage areas (northwest, northeast, southwest, southeast) based on the contours of the grading and drainage plan. Each area was modeled using the U.S. Army Corps of Engineers HEC-RAS version 3.1.3 (Reference 273) (standard-step, backwater analysis) computer software. Cross sections for each of the four areas were determined based on the grading and drainage plan and flows were modeled under steady state conditions. Buildings were modeled to obstruct flow and were not assumed to provide any storage. Tailwater elevations for the Broad River, Make-Up Pond B, and Make-Up Pond A correspond with the peak PMF water surface elevation provided in Subsection 2.4.3. A Manning's roughness coefficient, n = 0.015, was used for the paved or gravel surfaces. A Manning's roughness coefficient, n = 0.035 was used for the grass surfaces.

In the northwest drainage area, a wide, shallow, flat sloped swale directs runoff west to Make-Up Pond B. In the northeast drainage area, a wide shallow swale directs runoff east to the back waters of the Broad River. The swales are bounded by the roadway surrounding the power blocks and the embedded railway track to the north. The at-grade railroad tracks were not considered to provide any type of obstruction. Beyond the railway tracks are several warehouse structures and open areas with a yard elevation of 588 ft. The yard elevation then slopes steeply into Hold-Up Pond A or the backwaters of the Broad River. Because the yard elevation area is graded flat, approximately half of these areas are assumed to contribute runoff to the modeled areas and are also available for storage. The remaining half of the area is assumed to runoff toward the steeper slopes.

The division for the northern swales begins at the road running between the power blocks to the warehouses. The northeast swale drains runoff to backwaters of the Broad River. The swale width narrows as it passes the elevated cooling tower pad for Unit 2 then widens as it approaches the steeper slopes into the backwaters of the Broad River. The narrowing location is used as the critical cross section for determining the time of concentration in the drainage calculations.

The northwest swale drains runoff to Make-Up Pond B. The swale width narrows as it passes the elevated cooling tower pad for Unit 1 then empties into a wider area adjacent to Make-Up

Pond B. The narrowing location is used as the critical cross section for determining the time of concentration in the drainage calculations.

In the southwest drainage area, a narrow, shallow, flat sloped swale directs runoff west to Make-Up Pond B and in the southeast drainage area, a wide, shallow, flat sloped swale directs runoff east to Make-Up Pond A. The swales are bounded by the roadway surrounding the power blocks and further to the south by steeply rising elevation up to a hill feature and the transmission yard.

The division for the southern swales begins at the series of structures identified as the maintenance support building, and administration building. The southwest swale narrows as it passes through a cut area between the elevated cooling tower pad for Unit 1 and a hill feature. The narrowing location is used as the critical cross section for determining the time of concentration in the drainage calculations. Beyond the narrowest point the cut swale widens and steepens before it drops into Make-Up Pond B.

The southeast swale maintains a relatively constant width as it passes between the elevated cooling tower pad for Unit 2 and the elevated transmission yard. This location is used as the critical cross section for determining the time of concentration in the drainage calculations. Beyond the critical cross section, the swale widens and the slope gradually increases as the elevation drops into Make-Up Pond A.

The local intense PMP is defined by Hydrometeorological Report (HMR) Nos. 51 and 52. PMP values for durations from 6-hr. to 72-hr. are determined using the procedures as described in HMR No. 51 for areas of 10-sq. mi. **(Reference 255)**. Using the Lee Nuclear Station location, the rainfall depth is read from the HMR No. 51 PMP charts for each duration.

The 1-sq. mi. PMP values for durations of 1-hour and less are determined using the procedures as described in HMR No. 52 **(Reference 225)**. Using the Lee Nuclear Station location, the rainfall depth is read from the HMR No. 52 PMP charts for each duration. A smooth curve is fitted to the points. The derived PMP curve is detailed in **Table** 2.4.2-203. The corresponding PMP depth duration curve is shown in **Figure** 2.4.2-203.

HMR 52 guidance indicates that PMP rates for 10-sq. mi. areas are the same as point rainfall. Also indicated in HMR 52, the 1-sq. mi. PMP rates may also be considered the point rainfall for areas less than 1-sq. mi. Therefore, intensities for any drainage areas with durations longer than 1-hr. are derived from the PMP rates for 10-sq. mi. areas. Intensities for drainage areas with durations equal to or less than 1-hr. are derived from the PMP rates for 1-sq. mi. areas.

The AP1000 plant design is based on a PMP of 19.4 in/hr and 6.3 in/5 min. As shown in **Figure** 2.4.2-203, the site is within the plant design limits for PMP. The PMP is identified as a precipitation site characteristic in **Table** 2.0-201. Roofs are sloped to preclude the ponding of water.

~~The grading on the north side of the units, bounded by the at-grade railroad tracks, primarily drains water in the west direction to Make-Up Pond B or east to the Broad River. However, under local intense precipitation, drainage is permitted to freely pass between the areas on both sides of the at-grade railroad tracks.The grading on the south side of the units allows drainage to flow to either Make-Up Pond B or Make-Up Pond A. For modeling purposes the site was divided into four drainage areas shown in Figure 2.4.2-202. Because the areas north of the railroad tracks are graded flat, about half of these areas are assumed to contribute runoff to the modeled areas and are also available for storage. The remaining half is assumed to runoff directly to the Broad River.~~

~~The U.S. Army Corps of Engineers HEC-RAS version 3.1.3 (Reference 273) standard-step, backwater analysis computer software was used to model flows under steady state conditions. Cross sections were determined based on existing contours, proposed contours and key features such as flow restrictions and building locations. In addition, buildings were modeled to obstruct flow and were not assumed to provide any flood storage.~~

~~The at-grade railroad tracks were not considered to provide any type of obstruction. Tailwater elevations for the Broad River, Make-Up Pond B, and Make-Up Pond A correspond with the peak PMF water surface elevation provided in Subsection 2.4.3.~~

~~The core plant area is either paved or gravel. A corresponding Manning's roughness coefficient of n = 0.0 15 was used for these areas. The remaining site areas are grass covered, corresponding to the use of a Manning's roughness coefficient n = 0.035. Sensitivity analyses were also performed assuming a 50 percent increase and a 50 percent decrease of the Manning's roughness coefficient for the grass covered area.~~

~~Because the site is so flat, with slopes less than one-half percent, an iterative process was used to determine the time of concentration for each drainage area. An initial range of assumed discharges were examined to determine initial flow velocities for each HEC-RAS model drainage path. The resulting velocity was then used to determine the time of concentration for each model. Rainfall durations are assumed to be equal to or greater than the time of concentrations for each site drainage area. The corresponding intensity was determined using Table 2.4.2-203 and Figure 2.4.2-203.~~

The rational method (Reference 201) was used to determine peak runoff rates for the areas between each cross section of the four HEC-RAS models. The rational method is given by the equation:

$$Q = k * C * i * A$$

where:

Q = runoff (cfs)

k = constant (1 for English units)

C = unitless coefficient of runoff

i = intensity (in/hr)

A = drainage area (ac.)

No runoff losses were assumed. Therefore the runoff coefficient was assumed equal to one. Rainfall durations are assumed equal to or greater than the time of concentrations for each site drainage area.

The intensity component of the rational method was determined for each of the four HEC-RAS models using the corresponding time of concentration for the drainage area and the depth duration curve for the local intense PMP provided in Table 2.4.2-203 and Figure 2.4.2-203. Because the site is so flat, with slopes less than one-half percent, an iterative process was used to determine the time of concentration.

For each HEC-RAS model an assumed time of concentration was used for the first trial. The time of concentration was converted to an intensity using the depth duration curve. The rational method was used to determine the flow at each cross section up to the critical cross section using the total drainage area at each cross section. The flow at the critical cross section was carried over to each successive downstream cross section. The calculated flows were inputted into the HEC-RAS models.

The resulting flow velocities from the HEC-RAS model at each cross section were averaged between successive cross sections and a travel time was determined based on the distance between successive cross sections. The total travel time to the critical cross section was then used as a new time of concentration. The process was repeated until the total travel time converged with the time of concentration.

The resulting water surface elevations at the safety-related structures are identified in Table 2.4.2-204. All Lee Nuclear Station safety-related structures are located above the effects of local intense precipitation at plant elevation 590 ft. For each of the four areas modeled, the table also identifies: the total drainage area, the converged time of concentration for the drainage area, the corresponding PMP depth from the depth duration curve, the converted intensity used in the rational method formula, and the resulting flow rate at the critical cross section.

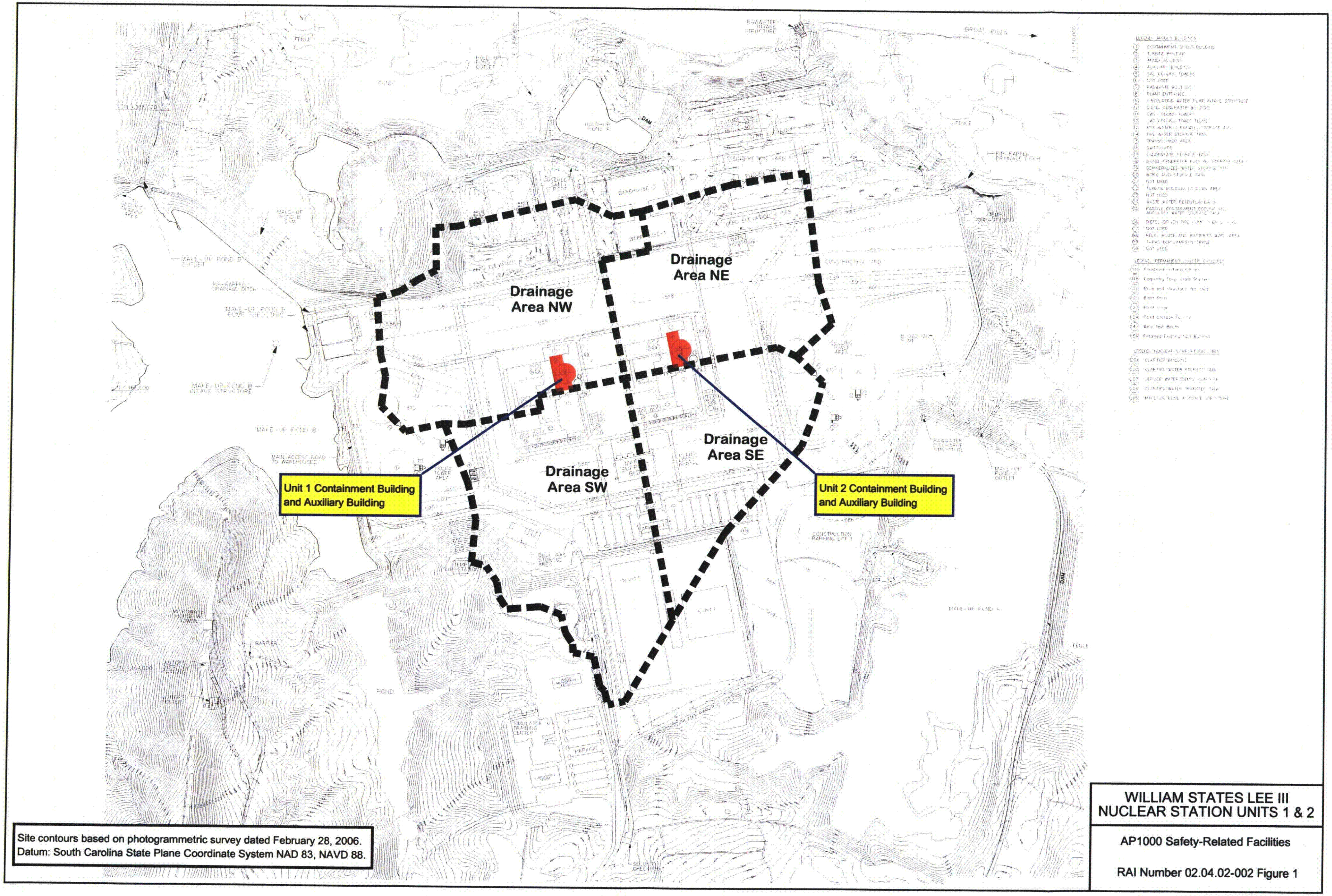
~~The calculated discharge was then applied to the HEC-RAS model at the upper cross section for each area and accumulated throughout the model. Iterations were performed using each resulting velocity to determine a new rainfall intensity until convergence of the water surface elevation was achieved. Site drainage area details and resulting water surface elevations are tabulated in Table 2.4.2-204. All Lee Nuclear Station safety-related structures are located above the effects of local intense precipitation at plant elevation 590 ft.~~

Due to the temperate climate and relatively light snowfall, significant icing is not expected. Based on the site layout and grading, any potential ice accumulation on site facilities is not expected to affect flooding conditions or damage safety-related facilities. Ice effects are discussed in Subsection 2.4.7.

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 2 to RAI 02.04.02-002

RAI Number 02.04.02-002 Figure 1



WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

AP1000 Safety-Related Facilities

RAI Number 02.04.02-002 Figure 1

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 017

NRC Technical Review Branch: Hydrologic Engineering Branch (RHEB)

Reference NRC RAI Number(s): RAI 02.04.03-001

NRC RAI:

The applicant needs to describe the process followed to determine the conceptual models for floods in streams and rivers and in site drainage system to ensure that the design-basis flood is based on the most conservative of plausible conceptual models.

Duke Energy Response:

The conceptual models to determine the design basis flooding adhere to the requirements of NRC Regulatory Guide 1.206 and NRC Regulatory Guide 1.59. Determination of flooding on rivers and streams is consistent with the current state of the practice guidance provided in ANSI/ANS-2.8-1992.

Make-Up Pond B is the source of the design basis flood for the Lee Nuclear Station. The design basis flood height is 584.3 ft. msl which is more than 5 ft. below the 590 ft. msl grade for safety related structures. The design basis flood for Make-Up Pond B results from the probable maximum precipitation (PMP) for the watershed coincident with the maximum calculated wind water activity for the impoundment. Make-Up Pond A and the Broad River were evaluated for flooding under numerous scenarios. In all cases, flooding from Make-up Pond B was the limiting case for the Lee Nuclear Station.

The PMP is maximized using the point precipitation from Hydrometeorological Report (HMR) No. 51 and No. 52. Utilizing the Soil Conservation Service (SCS) unit hydrograph methodology and modified Puls reservoir routing, runoff is maximized for the small watershed by using wet antecedent conditions, no precipitation losses, and examination of multiple time distributions of the PMP. (A similar analysis is performed for Make-Up Pond A and includes coincident wind wave activity, but does not result in the design basis flood.)

The PMP for the Broad River watershed is determined using HMR No. 51 and No. 52. The HMR No. 52 recommended temporal distribution of the PMP for the Broad River is maximized by examining various storm centers, storm sizes, and orientation. Unit hydrographs are derived from USGS unit hydrographs for the region. Significant historical storm events were analyzed to verify watershed parameters, including the SCS curve number model for precipitation losses. Antecedent storm conditions are chosen to maximize resulting runoff. The Broad River probable maximum flood analysis including wind wave activity does not yield the design basis flood.

Any site drainage system features, such as culverts and inlets, are assumed non-functional. Discussion of the conceptual model for the effects of local intense precipitation is provided in the response to RAI Number 02.04.02-001 (this letter).

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

None

Attachments:

None

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 017

NRC Technical Review Branch: Hydrologic Engineering Branch (RHEB)

Reference NRC RAI Number(s): RAI 02.04.03-002

NRC RAI:

Describe the relevance of HMR 53 for determining the PMP in the Broad River basin as presented in FSAR Section 2.4.3.1.

Duke Energy Response:

Duke Energy has modified the text of FSAR Subsection 2.4.3.1 to add this information. The markup of FSAR Subsection 2.4.3.1, provided as Attachment 1, will be incorporated into a future revision of the Final Safety Analysis Report.

The following is a description of the conservative approach of using HMR 53 to address coincident snowmelt as presented in FSAR 2.4.3.1.

As stated in FSAR Subsection 2.4.3.1, the method used to evaluate snowmelt coincident with the winter season precipitation is conservative, assuming the 100-yr. snowpack is distributed across the entire watershed and completely melts during the winter precipitation event. HMR 53 is utilized to evaluate the winter precipitation.

Since HMR 53 only provides seasonal variation of the PMP for 10 sq. mi. drainage areas, a simple ratio is used to derive winter precipitation for the larger Broad River watershed as follows:

$$\frac{\text{10 sq mi Winter Precipitation (HMR 53)}}{\text{10 sq mi All Season PMP (HMR 51)}} = \frac{\text{Broad River Winter Precipitation}}{\text{Broad River All Season PMP (HMR 51)}}$$

Rearranging to solve for Broad River Winter Precipitation:

$$\text{Broad River Winter Precipitation} = \frac{\text{10 sq mi Winter Precipitation (HMR 53)}}{\text{10 sq mi All Season PMP (HMR 51)}} \text{ X Broad River All Season PMP (HMR 51)}$$

Using 72 hr. duration numbers as an example of calculating Broad River Winter Precipitation:

$$\frac{\text{10 sq mi Winter Precipitation (HMR 53)}}{\text{10 sq mi All Season PMP (HMR 51)}} = \frac{26.1}{46.0} = 0.567$$

The 10 sq mi Winter Precipitation is 57% of the 10 sq mi All Season PMP.

Broad River All Season PMP (HMR 51) = 25.48

$$\text{Broad River Winter Precipitation} = \frac{\text{10 sq mi Winter Precipitation (HMR 53)}}{\text{10 sq mi All Season PMP (HMR 51)}} \text{ X Broad River All Season PMP (HMR 51)}$$

Broad River Winter Precipitation = 0.567 x 25.48 in. = 14.46 in.

FSAR Subsection 2.3.1.2.7.1 identifies the 100-yr. snowpack of 17.0 inches of snow to be equivalent to 3.4 inches of water. It is assumed that the 100-yr. snowpack is distributed across the entire watershed and completely melts during a winter precipitation event. When adding the 3.4 in. to the Broad River watershed winter precipitation of 14.46 in., the result is 17.9 in. of potential rainfall runoff. As a ratio, 17.9 in. / 25.48 in., the Broad River winter precipitation is approximately 70 percent of the Broad River all-season PMP. Shorter durations of the Broad River winter precipitation yield lesser percentages of the Broad River all-season PMP. Therefore, snowmelt is not considered to be a factor in modeling the PMF event.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

FSAR Subsection 2.4.3.1

Attachment:

1) Revised FSAR Subsection 2.4.3.1

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 1 to RAI 02.04.03-002

Revision to FSAR Subsection 2.4.3.1

COLA Part 2, FSAR, Chapter 2, Subsection 2.4.3.1, the seventh and eighth paragraphs will be revised as follows:

2.4.3.1 Probable Maximum Precipitation

The PMP estimates are associated with the summer months. HMR 53 (Reference 260) provides estimates for maximum seasonal precipitation. Although HMR 53 applies to 10 sq. mi. drainage areas, it is used as a basis for the larger Broad River watershed. HMR 53 winter precipitation estimates for December through February are less than 57 percent of the ~~PMP estimates provided in Table 2.4.3-201.~~ all-season PMP estimates identified in Table 2.4.3-201 for the 10 sq. mi. drainage area. The 57 percent ratio is applied to the all-season PMP for the Broad River watershed identified in Table 2.4.3-202 to determine the maximum winter precipitation estimates.

According to guidance (Reference 202) the winter precipitation is evaluated coincident with the 100-yr. snowpack. The water equivalent of the 100-yr. snowpack identified in Subsection 2.3.1.2.7.1 is approximately ~~less than 7~~ 13 percent of the 72-hr. PMP for the Broad River watershed identified in Table 2.4.3-202. It is assumed that the 100-yr. snowpack is distributed across the entire watershed and completely melts during a winter precipitation event.~~, then the~~ The combined result of winter precipitation and 100-yr. snowpack is ~~less than 64~~ approximately 70 percent of the PMP. Therefore, snowmelt is not considered to be a factor in modeling the PMF event.

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 017

NRC Technical Review Branch: Hydrologic Engineering Branch (RHEB)

Reference NRC RAI Number(s): RAI 02.04.03-003

NRC RAI:

Explain why unit hydrographs calibrated using observed runoff events produced by precipitation much smaller than the PMP event in the Broad River basin is appropriate to use for estimation of the PMF in the basin, or update the PMF analysis with techniques recommended by other federal agencies or those used in standard practice.

Duke Energy Response:

The PMF analysis presented in FSAR Subsection 2.4.3 is performed in accordance with current applicable guidance and standard practices. However, the impact of a nonlinear basin response at high rainfall rates is examined as a sensitivity analysis for the Make-Up Pond B watershed. As discussed in FSAR Subsection 2.4.3.3, the Natural Resources Conservation Service, formerly Soil Conservation Service (SCS), unit hydrograph method is applied to transform rainfall to runoff utilizing the U.S. Army Corps of Engineers HEC-HMS modeling software. The unit hydrograph for the Make-Up Pond B watershed is derived using the process of deconvolution. This process is based on the HEC-HMS results calculated using the SCS dimensionless unit hydrograph.

To account for a nonlinear basin response, the peak of the derived unit hydrograph is increased by 20 percent. In order to maintain the proper characteristics of a unit hydrograph, i.e. the area under the curve is equal to 1 in., the time base is decreased by approximately 33 percent and intermediate ordinates are adjusted to maintain a smooth curve. The modified unit hydrograph is then substituted for the SCS unit hydrograph method in the HEC-HMS model. Allowing for discharge from the outlet structure, the maximum Make-Up Pond B water surface elevation is 584.25 ft. This elevation occurs during the 72-hr. storm event with an end peaking temporal distribution. This result represents a 0.40 ft. increase to the 583.85 ft. water surface elevation provided in FSAR Subsection 2.4.3.5.

Wind wave calculations were performed subsequent to the submittal of FSAR Revision 0 based on the maximum water surface elevation of 583.85 ft. reported in FSAR Subsection 2.4.3.5. There would be no significant difference in the added effects of wind wave activity by using the sensitivity analysis water surface elevation of 584.25 ft. determined above. Details of the wind wave analysis are provided in the response to RAI Number 02.04.03-005 (this letter). Wind wave calculations were performed in accordance with the U.S. Army Corps of Engineers Coastal Engineering Manual and include wave runup, wave setup, and wind setup. The added effects of coincident wind wave activity would result in an additional water surface elevation rise of 0.38 ft.

In summary, accounting for nonlinear basin response with the added effects of wind wave activity, the maximum water surface elevation of Make-Up Pond B is 584.63 ft. The Lee

Nuclear Station safety-related plant elevation is 590 ft., providing over 5 ft. of freeboard. This result is provided as a sensitivity analysis and does not supersede the design basis flood elevation of 584.3 ft. as discussed in the response to RAI Number 02.04.03-005 (this letter). Based on the significant amount of freeboard available when comparing the maximum flood height for Make-Up Pond A and the Broad River to the design basis flood height resulting from Make-Up Pond B, Duke was able to conclude qualitatively that a nonlinear basin response resulting from high rainfall would not have an impact on the maximum calculated flood height for Lee Nuclear Station.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

None

Attachments:

None

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 017

NRC Technical Review Branch: Hydrologic Engineering Branch (RHEB)

Reference NRC RAI Number(s): RAI 02.04.03-004

NRC RAI:

In FSAR Section 2.4.2.2, Flood Design Considerations, and in Table 2.0-201, Comparison of AP1000 DCD Site Parameters and Lee Nuclear Station Units 1 & 2 Site Characteristics, the maximum flood water surface elevation at the site is stated as 583.85 ft MSL. In FSAR Section 2.4.3.5, Water Level Determinations, the maximum water surface elevation corresponding for McKowns Creek/Make-Up Pond B under conservative PMF conditions is stated as 589.40 ft MSL, followed by a discussion of the need to install a debris collection boom near the Make-Up Pond B spillway. Clarify which of the two analyses forms the basis for selection of the design-basis flood water surface elevation at the Lee Nuclear Station site. Why is installation of a debris collection boom considered? If it is required to maintain the flood water surface elevation below the site grade, would the debris collection boom be considered a safety-related structure or system?

Duke Energy Response:

Duke Energy has reviewed the elevations for Make-Up Pond B, fed by McKowns Creek, and the limitations presented by the outlet structure. The maximum flood level at the Lee Nuclear Station is elevation 584.3 ft. msl. This elevation would result from a Probable Maximum Flood (PMF) event on the Make-Up Pond B watershed with the added effects of coincident wind wave activity. Details of the coincident wind wave activity are provided in response to RAI Number 02.04.03-005 (this letter). The Lee Nuclear Station safety-related structures have a grade elevation of 590 ft. msl, providing over 5 ft. of freeboard from the worst potential flood considerations.

Make-Up Pond B includes an adequately sized outlet structure and is not located on a sizeable river or stream. The Make-Up Pond B impoundment is confined with limited watershed and minimal transport. The potential for significant debris to be picked up by a rise in the water level and then transported to the outlet structure where it could collect as an obstruction is minimal. Therefore, Duke did not assume blockage of the outlet structure in its analysis. In addition, Duke Energy's shoreline management program will consist of removing trees from the water's edge at elevation 570 ft. msl to 50 ft. beyond contour elevation 585 ft. msl around the perimeter of Make-Up Pond B. This area will be grassed, paved, or other suitable alternative where appropriate, and will be maintained in this manner throughout the operational life of the plant. Therefore, blockage of the outlet structure is not considered to be a credible event. The shoreline management plan, included as Attachment 1, shows contour elevation of 585 ft. msl and the additional 50 ft. of buffer around the perimeter of Make-Up Pond B.

Duke Energy has modified the text of FSAR Subsections 2.4.1.2.2.6, 2.4.3.5, and 2.4.14 to reflect the above information. Attachment 2 contains a revision of Subsection 2.4.1.2.2.6.

Attachment 3 contains a revision of Subsection 2.4.3.5, and Attachment 4 contains a revision of Subsection 2.4.14. Attachments 2, 3 and 4 will be incorporated into a future revision of the Final Safety Analysis Report.

Table 2.0-201 has been updated in response to RAI 02.04.03-005 (this letter).

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

FSAR Subsection 2.4.1.2.2.6

FSAR Subsection 2.4.3.5

FSAR Subsection 2.4.14

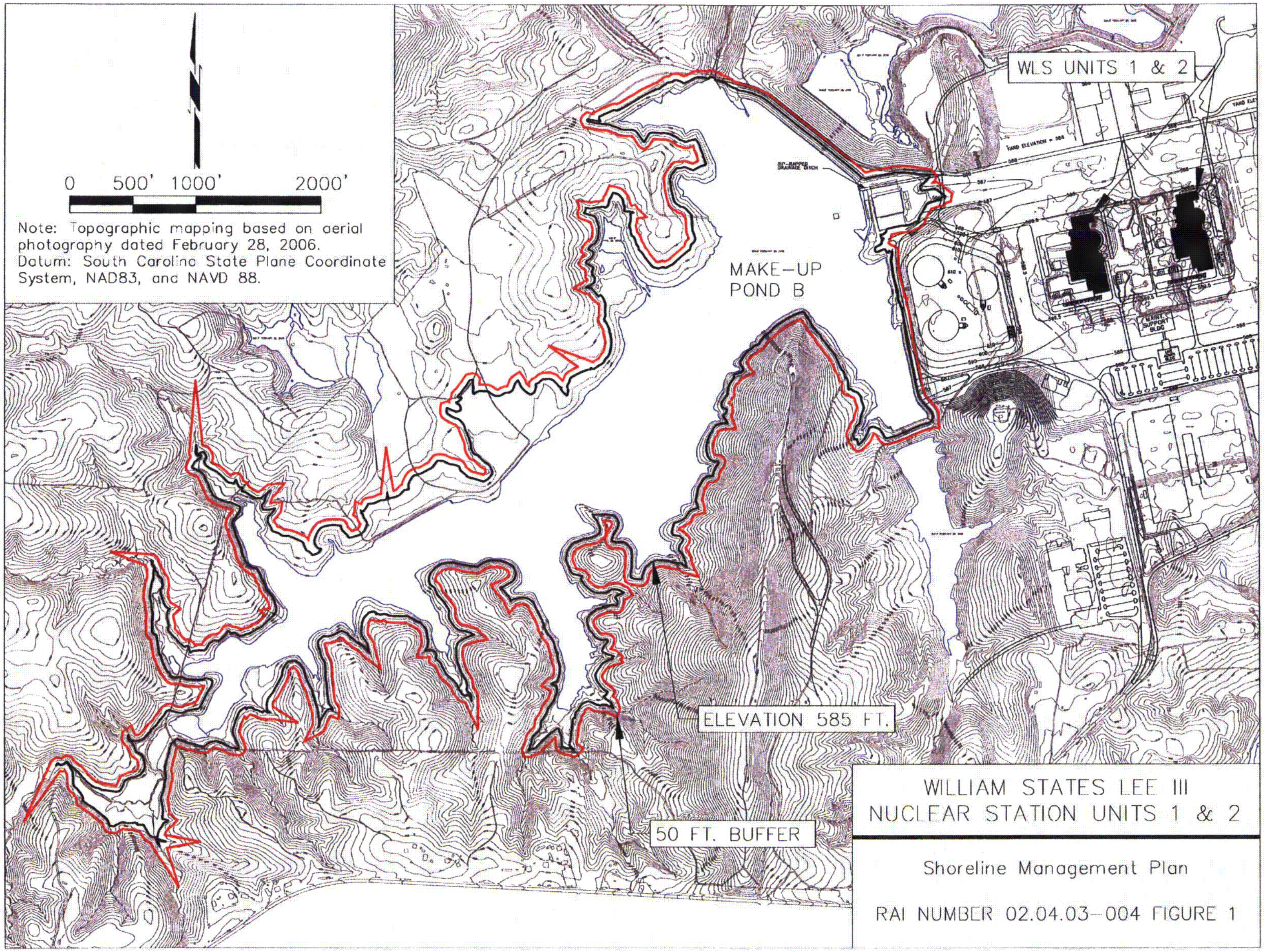
Attachments:

1) RAI Number 02.04.03-004 Figure 1, Shoreline Management Plan
2) Revised FSAR Subsection 2.4.1.2.2.6
3) Revised FSAR Subsection 2.4.3.5
4) Revised FSAR Subsection 2.4.14

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 1 to RAI 02.04.03-004

Shoreline Management Plan Drawing


0 500' 1000' 2000'
Note: Topographic mapping based on aerial photography dated February 28, 2006.
Datum: South Carolina State Plane Coordinate System, NAD83, and NAVD 88.
WLS UNITS 1 & 2
MAKE-UP POND B
ELEVATION 585 FT.
50 FT. BUFFER
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
Shoreline Management Plan
RAI NUMBER 02.04.03-004 FIGURE 1

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 2 to RAI 02.04.03-004

Revision to FSAR Subsection 2.4.1.2.2.6

COLA Part 2, FSAR, Chapter 2, Subsection 2.4.1.2.2.6, the last paragraph under the heading "Make-Up Pond B" will be revised as follows:

2.4.1.2.2.6 Surface Water Impoundments

Make-Up Pond B

A shoreline management program is established along the banks of Make-Up Pond B. The shoreline management program consists of removing all the trees from the water's edge at elevation 570 ft. msl to 50 ft. beyond the contour elevation 585 ft. msl around the perimeter of Make-Up Pond B. This area is paved, grassed, or other suitable alternative where appropriate, and is maintained in this manner throughout the operational life of the plant.

The maximum flood level at the Lee Nuclear Station is elevation ~~583.85~~584.3 ft. msl. This elevation would result from a Probable Maximum Flood (PMF) event on Make-Up Pond B watershed with the added effects of coincident wind wave activity as described in Subsection 2.4.3. The Lee Nuclear Station safety-related structures have a grade elevation of 590 ft. msl, providing over ~~6~~ 5 ft. of freeboard from the worst potential flood considerations.

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 3 to RAI 02.04.03-004

Revision to FSAR Subsection 2.4.3.5

COLA Part 2, FSAR, Chapter 2, Section 2.4, remove FSAR Figure 2.4.3-232 from the FSAR, and revise the FSAR Chapter 2 List of Figures to delete FSAR Figure 2.4.3-232.

COLA Part 2, FSAR, Chapter 2, Subsection 2.4.3.5, the second and third paragraphs under the heading "McKowns Creek/Make-Up Pond B" will be revised as follows:

2.4.3.5 Water Level Determinations

McKowns Creek/Make-Up Pond B

~~Although the majority of the small drainage basin is wooded, there is low potential for significant blockage of the 35 ft. wide outlet structure. Assuming complete blockage of the outlet structure, Make-Up Pond B has enough storage capacity to capture the entire volume of the 6-hr. storm resulting in a water surface elevation of 589.40 ft. For the 72-hr. storm, the plant finished floor elevation will not be exceeded provided the outlet structure maintains greater than 27 percent flow capacity throughout the duration of the event. Alternatively, the outlet structure will also perform adequately should complete blockage of up to the lower 6.9 ft., or 51 percent, of the 13.5 ft. opening occur. Figure 2.4.3-232 illustrates the rating curves for the two blockage scenarios compared to the full capacity rating curve.~~

~~These evaluations are conservative by assuming instantaneous blockage at the onset of the storm. Additionally, some areas of Make-Up Pond B crest are lower than finished floor elevation, but this evaluation does not account for the limited weir flow that would be available. Furthermore, the degree of blockage evaluated is unlikely to occur in combination with any storm event. However, as an added level of protection, a debris collection boom will be installed near the Make-Up Pond B spillway to ensure adequate discharge capacity is available.~~Make-Up Pond B includes an adequately sized outlet structure and is not located on a sizeable river or stream. Therefore, the potential for significant debris to be picked up by a rise in the water level and then transported to the outlet structure where it could collect as an obstruction is minimal. Blockage of the outlet structure was not considered in the analysis. In addition, Duke Energy's shoreline management program includes removal of trees from the water's edge at elevation 570 ft. msl to 50 ft. beyond contour elevation 585 ft. msl around the perimeter of Make-Up Pond B. This area is paved, grassed, or other suitable alternative where appropriate, and is maintained in this manner throughout the operational life of the plant. Therefore, debris blockage of the outlet structure is not considered to be a credible event.

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 4 to RAI 02.04.03-004

Revision to FSAR Subsection 2.4.14

COLA Part 2, FSAR, Chapter 2, Subsection 2.4.14, the first paragraph will be revised as follows:

2.4.14 TECHNICAL SPECIFICATION AND EMERGENCY OPERATION REQUIREMENTS

The maximum flood level at the Lee Nuclear Station is elevation ~~583.85~~584.3 ft. This elevation would result from a Probable Maximum Flood (PMF) event on the Make-Up Pond B watershed with the added effects of coincident wind wave activity as described in Subsection 2.4.3. The Lee Nuclear Station safety-related structures have a plant elevation of 590 ft., providing over 6 ft. of freeboard under the worst potential flood considerations. Also, Subsection 2.4.12.5 describes plant elevation relative to the maximum anticipated groundwater level. The hydrostatic loading is not expected to exceed design criteria.

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 017

NRC Technical Review Branch: Hydrologic Engineering Branch (RHEB)

Reference NRC RAI Number(s): RAI 02.04.03-005

NRC RAI:

Wind-induced wave heights were not estimated in the determination of the design-basis flood. Provide an update to the design-basis flood analysis that accounts for wind-induced waves. Provide wind-induced wave heights for floods other than the design-basis flood to demonstrate that the selected design-basis flood mechanism is appropriately chosen.

Duke Energy Response:

Duke Energy has modified the text of FSAR Subsections 2.4.2.2 and 2.4.3.6 to provide the effects of wind-induced wave activity coincident with the design-basis flood for Make-Up Pond B. For the controlling flood event on the Broad River and Make-Up Pond A, the effects of wind-induced wave activity coincident with dam failure flooding are discussed in the response to RAI Number 02.04.04-002 (this letter). Additional wind-induced wave heights coincident with floods other than the design-basis flood are discussed in the response to RAI Number 02.04.05-002 (this letter).

A revision of FSAR Subsection 2.4.2.2 is provided in Attachment 1. A revision of FSAR Subsection 2.4.3.6 is provided in Attachment 2. A new FSAR Figure 2.4.3-234 associated with the revision of FSAR Subsection 2.4.3.6 is provided in Attachment 3. Revision of FSAR Table 2.0-201 is provided in Attachment 4. Attachments 1, 2, 3, and 4 will be incorporated into a future revision of the Final Safety Analysis Report.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

FSAR Subsection 2.4.2.2

FSAR Subsection 2.4.3.6

FSAR Figure 2.4.3-234

FSAR Table 2.0-201

Attachments:

1) Revised FSAR Subsection 2.4.2.2
2) Revised FSAR Subsection 2.4.3.6
3) New FSAR Figure 2.4.3-234
4) Revised FSAR Table 2.0-201

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 1 to RAI 02.04.03-005

Revision to FSAR Subsection 2.4.2.2

COLA Part 2, FSAR, Chapter 2, Subsection 2.4.2.2, the last paragraph will be revised as follows:

2.4.2.2 Flood Design Considerations

The maximum flood level at the Lee Nuclear Station is elevation ~~583.85~~584.3 ft. This elevation would result from a PMF event on Make-Up Pond B watershed with the added effects of coincident wind wave activity as described in Subsection 2.4.3. The Lee Nuclear Station safety-related plant elevation is 590 ft., providing over ~~6~~ 5 ft. of freeboard under the worst potential flood considerations. ~~Coincident wind waves have not been specifically examined due to the limited fetch distance of Make-Up Pond B and the freeboard available at the Lee Nuclear Station.~~ The maximum flood level is identified as a site characteristic in Table 2.0-201.

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 2 to RAI 02.04.03-005

Revision to FSAR Subsection 2.4.3.6

COLA Part 2, FSAR, Chapter 2, Subsection 2.4.3.6, will be revised as follows:
2.4.3.6 Coincident Wind Wave Activity

~~Broad River~~

~~The Lee Nuclear Station safety-related plant elevation is 590 ft., providing over 40 ft. of freeboard under PMF conditions. Although wind wave activity would be expected to raise water surface elevations to some degree, coincident wind wave activity has not been specifically evaluated. Due to the significant amount of freeboard and limited fetch distances, wind wave activity is judged not to jeopardize the station or safety-related facilities.~~

~~McKowns Creek/Make-Up Pond B~~

~~The Lee Nuclear Station safety-related plant elevation is 590 ft., providing over 6 ft. of freeboard under PMF conditions. Although wind wave activity would be expected to raise water surface elevations to some degree, coincident wind wave activity has not been specifically evaluated. Due to the amount of freeboard and limited fetch distances, wind wave activity is judged not to jeopardize the station or safety-related facilities.~~

~~Intermittent Stream/Make-Up Pond A~~

~~The Lee Nuclear Station safety-related plant elevation is 590 ft., providing over 31 ft. of freeboard under PMF conditions. Although wind wave activity would be expected to raise water surface elevations to some degree, coincident wind wave activity has not been specifically evaluated. Due to the significant amount of freeboard and limited fetch distances, wind wave activity is judged not to jeopardize the station or safety-related facilities.~~

Coincident wind wave activity is evaluated for the Broad River, Make-Up Pond A and Make-Up Pond B. Fetch lengths are determined using the longest straight line fetch based on U.S. Geological Survey quadrangles and the site grading and drainage plan. Wave height, setup, and runup are estimated using U.S. Army Corps of Engineers guidance (Reference 295). A coincident 2-year annual extreme mile wind speed of 50 mph is estimated based on ANSI/ANS-2.8-1992 (Reference 202). Wind setup is estimated using additional U.S. Army Corps of Engineers guidance (Reference 269).

Broad River

Coincident wind wave activity for the Broad River is addressed in Subsection 2.4.4.3.

Intermittent Stream/Make-Up Pond A

Coincident wind wave activity for Make-Up Pond A is addressed in Subsection 2.4.4.3

McKowns Creek/Make-Up Pond B

Wind wave activity on Make-Up Pond B is evaluated coincident with the maximum water surface elevation of the PMF as discussed in Subsection 2.4.3.5. The determined critical fetch length of 1.47 mi. is shown in Figure 2.4.3-234. The 2-year annual extreme mile wind speed is adjusted based on the factors of fetch length, level overland or over water, critical duration, and stability. The critical duration is approximately 36 min. The adjusted wind speed is 50.2 mph.

Significant wave height (average height of the maximum 33-1/3 percent of waves) is estimated to be 2.07 ft., crest to trough. The maximum wave height (average height of the maximum 1 percent of waves) is estimated to be 3.44 ft., crest to trough. The corresponding wave period is 1.8 sec.

The 0.65 percent slopes along the banks of Make-Up Pond B adjacent to the site are used to determine the wave setup and runup. The maximum runup, including wave setup, is estimated to be 0.30 ft. The maximum wind setup is estimated to be 0.08 ft. Therefore, the total wind wave activity is estimated to be 0.38 ft. The PMF and the coincident wind wave activity results in a flood elevation of 584.3 ft. msl. The Lee Nuclear Station safety-related plant elevation is 590 ft. msl and is unaffected by flood conditions and coincident wind wave activity.

COLA Part 2, FSAR, Chapter 2, Subsection 2.4.16, will be revised to add the following text:

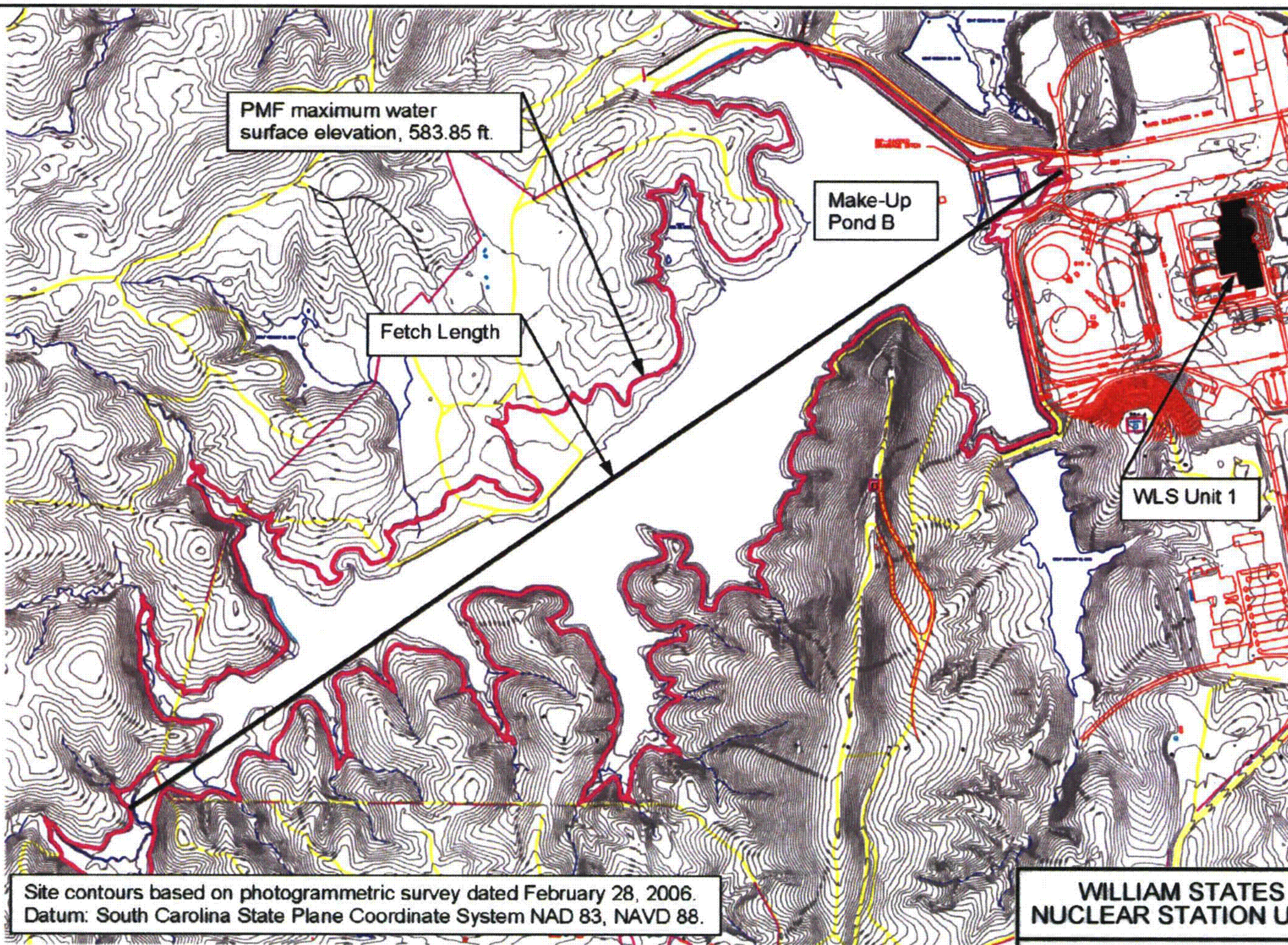
295. U.S. Army Corps of Engineers, "Engineering and Design, Coastal Engineering Manual," EM 1110-2-1100, Change 2: June 1, 2006.

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 3 to RAI 02.04.03-005

New Figure for FSAR Section 2.4

COLA Part 2, FSAR, Chapter 2, Section 2.4, new figure for FSAR Section 2.4 is on the following page. Add the following information to the List of Figures after Figure 2.4.3-233:



WLS COL 2.4-2

WILLIAM STATES LEE III NUCLEAR STATION UNITS 1 & 2

Make-Up Pond B Coincident Wind Wave Fetch Length

FIGURE 2.4.3-234 **Rev 1**

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 4 to RAI 02.04.03-005

Revision to FSAR Table 2.0-201

COLA Part 2, FSAR, Chapter 2, Section 2.0, Table 2.0-201 (Sheet 4 of 6) the entry for "Flood Level" is revised as follows:

	AP 1000 DCD Site Parameters	WLS Site Characteristics	WLS FSAR Reference	WLS Within Site Parameter
Flood Level	Less than plant elevation 100' (WLS Elevation 590' msl)	~~583.85~~584.3' msl	Subsection ~~2.4.3.5~~2.4.3.6	Yes

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 017

NRC Technical Review Branch: Hydrologic Engineering Branch (RHEB)

Reference NRC RAI Number(s): RAI 02.04.04-001

NRC RAI:

The applicant needs to describe the process followed to determine the conceptual models for flood waves from severe breaching of upstream dams, domino-type or cascading failures of dams, dynamic effects on safety-related SSCs, loss of safety-related water supplies, sediment deposition and erosion, and failure of on-site water control or storage structures to ensure that the most conservative of plausible conceptual models has been identified.

Duke Energy Response:

The conceptual models to determine flood waves from failure of water control structures adhere to the requirements of NRC Regulatory Guide 1.206 and NRC Regulatory Guide 1.59. Determination of dam failure flooding is consistent with the current state of the practice guidance provided in ANSI/ANS-2.8-1992.

Upstream dam failure flooding is maximized by the assumption that all major upstream dam failures occur during the probable maximum precipitation for the upstream watershed, and that each dam failure occurs coincident with the peak PMF flood wave. The major dams are Lake Lure Dam, Tuxedo Dam, Turner Shoals Dam, Kings Mountain Reservoir Dam, and Lake Whelchel Dam. Coincident wind wave activity is then added to the resulting water surface elevation. Dam failure parameters are assumed using the more conservative of values provided by U.S. Army Corps of Engineers guidance. Cascading failures of dams is assumed where applicable in the watershed. Tuxedo Dam and Turner Shoals Dam are the only dams located on the same tributary and are assumed to fail in a cascade or domino-type manner.

FSAR subsection 2.4.4.3 summarizes the results of the analyses of upstream dam failures. There are no resulting flooding effects on safety-related structures due to dam failures. No water is required from the Broad River or Make-Up Ponds A and B to support safety-related functions. Therefore, there are no safety-related facilities that would be affected by sediment deposition and erosion. There are no on-site water control or storage structures that may induce flooding of safety-related structures.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

None

Attachments:

None

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 017

NRC Technical Review Branch: Hydrologic Engineering Branch (RHEB)

Reference NRC RAI Number(s): RAI 02.04.04-002

NRC RAI:

Provide wind-induced wave heights coincident with the controlling dam breach flooding scenario described in FSAR Section 2.4.4.

Duke Energy Response:

Duke Energy has modified the text of FSAR Subsection 2.4.4.3 to provide the effects of wind-induced wave activity coincident with the controlling dam breach scenario for the Broad River and Make-Up Pond A. For the controlling flood event on Make-Up Pond B, the effects of wind-induced wave activity coincident with the design basis flood are discussed in the response to RAI Number 02.04.03-005 (this letter). Additional wind-induced wave heights coincident with floods other than the design-basis flood or dam breach scenario are discussed in the response to RAI Number 02.04.05-002 (this letter).

A revision of FSAR Subsection 2.4.4.3 is provided in Attachment 1. New FSAR Figure 2.4.4-201 and Figure 2.4.4-202 associated with the revision of FSAR Subsection 2.4.4.3 are provided in Attachment 2. Attachments 1 and 2 will be incorporated into a future revision of the Final Safety Analysis Report.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

FSAR Subsection 2.4.4.3

FSAR Figure 2.4.4-201

FSAR Figure 2.4.4-202

Attachments:

1) Revised FSAR Subsection 2.4.4.3
2) New FSAR Figure 2.4.4-201 and FSAR Figure 2.4.4.-202

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 1 to RAI 02.04.04-002

Mark-up of FSAR Subsection 2.4.4.3

COLA Part 2, FSAR, Chapter 2, Subsection 2.4.4.3, the paragraph under the heading "Coincident Wind Wave Activity" will be revised as follows:

2.4.4.3 Water Level at the Plant Site

Coincident Wind Wave Activity

~~The Lee Nuclear Station safety-related plant elevation is 590 ft., providing over 25 ft. of freeboard under dam failure conditions. Although wind wave activity would be expected to raise water surface elevations to some degree, coincident wind wave activity has not been specifically evaluated. Due to the significant amount of freeboard and limited fetch distances, wind wave activity is determined not to jeopardize the station or safety-related facilities.~~Coincident wind wave activity is evaluated for the Broad River, Make-Up Pond A and Make-Up Pond B. Fetch lengths are estimated using the longest straight line fetch based on U.S. Geological Survey quadrangles and the site grading and drainage plan. Wave height, setup, and runup are estimated using U.S. Army Corps of Engineers guidance (Reference 295). A coincident 2-year annual extreme mile wind speed of 50 mph is estimated based on ANSI/ANS-2.8-1992 (Reference 202). Wind setup is estimated using additional U.S. Army Corps of Engineers guidance (Reference 269).

Broad River

Wind wave activity on the Broad River is evaluated coincident with the maximum water surface elevation of the PMF including the effects of dam failures as discussed above. The determined critical fetch length of 2.75 mi. is shown in Figure 2.4.4-201. The 2-year annual extreme mile wind speed is adjusted based on the factors of fetch length, level overland or over water, critical duration, and stability. The critical duration is approximately 56 min. The adjusted wind speed is 49.9 mph.

Significant wave height (average height of the maximum 33-1/3 percent of waves) is estimated to be 2.95 ft., crest to trough. The maximum wave height (average height of the maximum 1 percent of waves) is estimated to be 4.92 ft., crest to trough. The corresponding wave period is 2.2 sec.

The 45 percent slopes along the banks of the Broad River adjacent to the site are used to determine the wave setup and runup. The maximum runup, including wave setup, is estimated to be 10.70 ft. The maximum wind setup is estimated to be 0.11 ft. Therefore, the total wind wave activity is estimated to be 10.81 ft. The PMF including effects of dam failures and the coincident wind wave activity results in a flood elevation of 574.9 ft. msl. The Lee Nuclear Station safety-related plant elevation is 590 ft. msl and is unaffected by flood conditions and coincident wind wave activity.

Intermittent Stream/Make-Up Pond A

During severe flooding events, Make-Up Pond A is inundated by backwaters of flooding of the Broad River. Therefore, wind wave activity on Make-Up Pond A is evaluated coincident with the maximum water surface elevation of the PMF on the Broad River including the effects of dam failures as discussed above. The determined critical fetch length of 1.69 mi. is shown in Figure 2.4.4-202. The 2-year annual extreme mile wind speed is adjusted based on the factors of fetch length, level overland or over water, critical duration, and stability. The critical duration is approximately 39 min. The adjusted wind speed is 50.2 mph.

Significant wave height (average height of the maximum 33-1/3 percent of waves) is estimated to be 2.30 ft., crest to trough. The maximum wave height (average height of the maximum 1 percent of waves) is estimated to be 3.84 ft., crest to trough. The corresponding wave period is 2.0 sec.

The 30 percent slopes along the banks of Make-Up Pond A adjacent to the site are used to determine the wave setup and runup. The maximum runup, including wave setup, is estimated to be 6.46 ft. The maximum wind setup is estimated to be 0.05 ft. Therefore, the total wind wave activity is estimated to be 6.51 ft. The PMF including effects of dam failures and the coincident wind wave activity results in a flood elevation of 570.6 ft. msl. The Lee Nuclear Station safety-related plant elevation is 590 ft. msl and is unaffected by flood conditions and coincident wind wave activity.

McKowns Creek/Make-Up Pond B

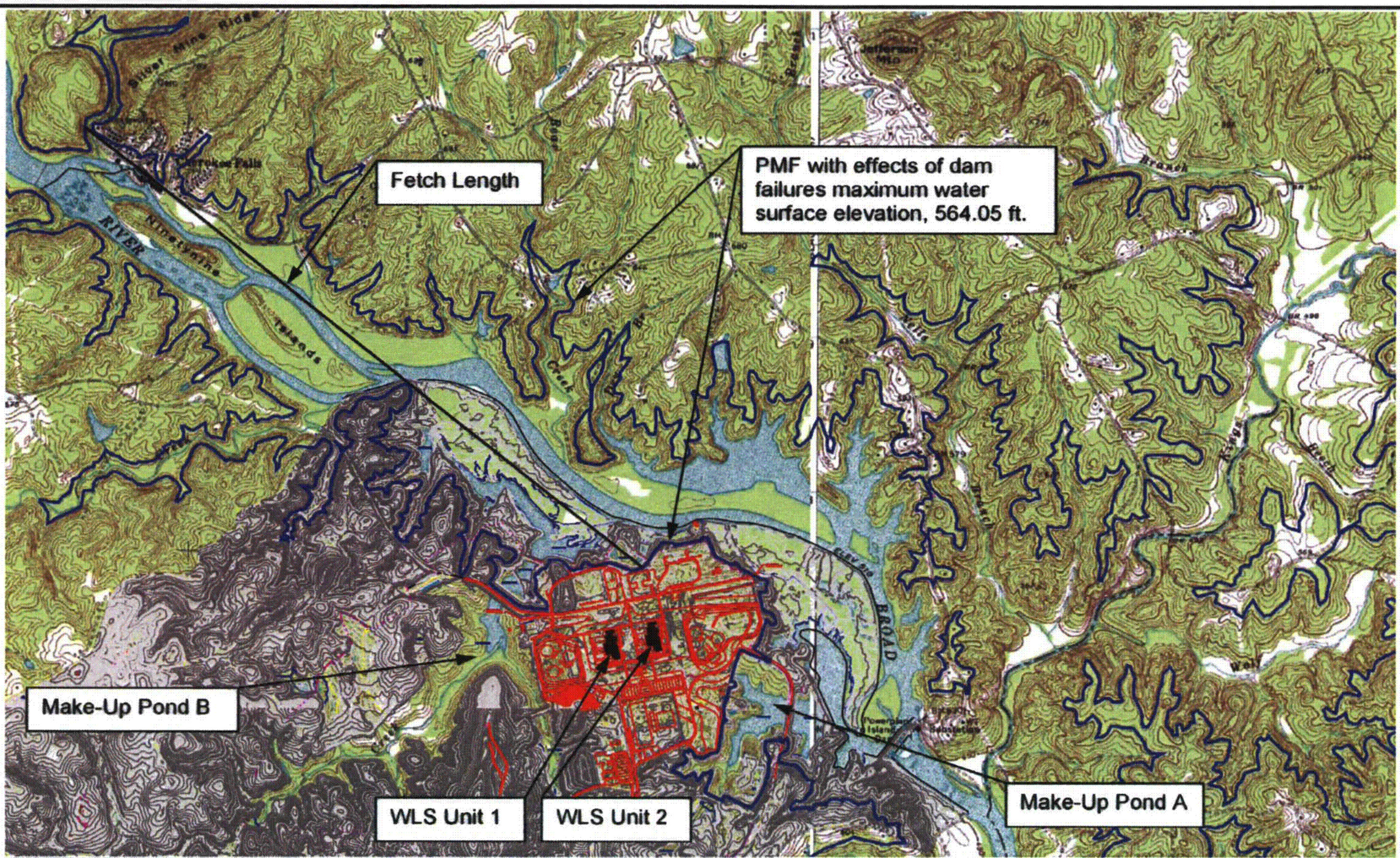
Coincident wind wave activity for Make-Up Pond B is addressed in Subsection 2.4.3.6.

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 2 to RAI 02.04.04-002

New Figures for FSAR Section 2.4

COLA Part 2, FSAR, Chapter 2, Section 2.4, new figures for FSAR Section 2.4 are on the following pages. Add the following information to the List of Figures after Figure 2.4.3-234:



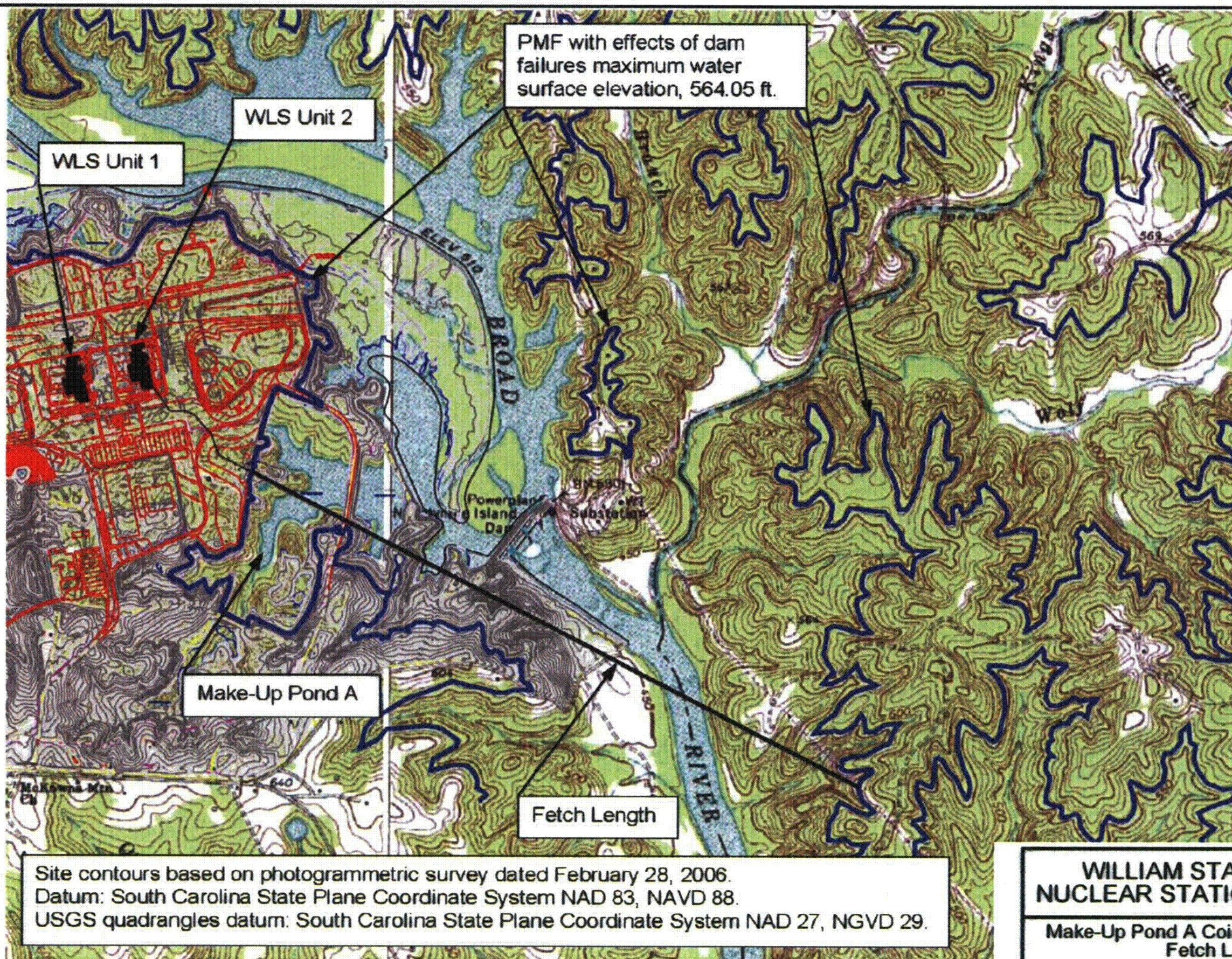
Site contours based on photogrammetric survey dated February 28, 2006.
Datum: South Carolina State Plane Coordinate System NAD 83, NAVD 88.
USGS quadrangles datum: South Carolina State Plane Coordinate System NAD 27, NGVD 29.

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Broad River Coincident Wind Wave Fetch Length

FIGURE 2.4.4-201 Rev 1

WLS COL 2.4-2



WLS COL 2.4-2

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Make-Up Pond A Coincident Wind Wave Fetch Length

FIGURE 2.4.4-202 Rev 1

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 017

NRC Technical Review Branch: Hydrologic Engineering Branch (RHEB)

Reference NRC RAI Number(s): RAI 02.04.05-001

NRC RAI:

The applicant needs to describe the process followed to determine the conceptual models for probable maximum hurricane, probable maximum wind storm, seiche and resonance, wave runup, and sediment erosion and deposition to ensure that the most conservative of plausible conceptual models has been identified.

Duke Energy Response:

The conceptual models to determine flood waves from probable maximum hurricane, probable maximum wind storm, seiche and resonance, and wave runup adhere to the requirements of NRC Regulatory Guide 1.206 and NRC Regulatory Guide 1.59. Determination of hurricane, wind storm, seiche and resonance flooding, and wave runup is consistent with the current state of the practice guidance provided in ANSI/ANS-2.8-1992.

The maximum hurricane storm surge produced along the Atlantic coastline is transposed to the site without any reduction for travel distance or instream structures. Maximum winds are used to evaluate wind wave effects, including wave runup, for the water bodies adjacent to the site. Resulting flood waves reach heights that are less than the design basis flood.

The natural fundamental periods of the water bodies adjacent to the site are significantly shorter than meteorologically induced wave periods. Therefore, there is no potential for seiche flooding.

No water is required from the Broad River or Make-Up Ponds A and B to support safety-related functions. Therefore, there are no safety-related facilities that would be affected by sediment deposition and erosion.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

None

Attachments:

None

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 017

NRC Technical Review Branch: Hydrologic Engineering Branch (RHEB)

Reference NRC RAI Number(s): RAI 02.04.05-002

NRC RAI:

Provide an assessment of meteorologically and seismically-induced seiches in Make-Up Ponds A and B.

Duke Energy Response:

Duke Energy has made an assessment of meteorologically induced waves by determining the wave period for high speed wind waves and the natural fundamental period for Make-Up Pond A and Make-Up Pond B. The wave periods are much shorter than the natural fundamental period for both water bodies. Furthermore, the natural fundamental periods are significantly shorter than meteorologically induced wave periods (e.g., synoptic storm pattern frequency and dramatic reversals in steady wind direction necessary for wind setup). Therefore, Make-Up Pond A and Make-Up Pond B are not susceptible to meteorologically induced seiche waves.

Duke Energy has modified the text of FSAR Subsection 2.4.5 to provide the assessment of meteorologically-induced seiche in Make-Up Ponds A and B. Seismically-induced waves are discussed in the response to RAI Number 02.04.06-002 (this letter). A revision of FSAR Subsection 2.4.5 is provided in Attachment 1. New FSAR Figure 2.4.5-201 and Figure 2.4.5-202 associated with the revision of FSAR Subsection 2.4.5 are provided in Attachment 2. Attachments 1 and 2 will be incorporated into a future revision of the Final Safety Analysis Report.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

FSAR Subsection 2.4.5

FSAR Figure 2.4.5-201

FSAR Figure 2.4.5-202

Attachments:

1) Revised FSAR Subsection 2.4.5
2) New FSAR Figure 2.4.5-201 and FSAR Figure 2.4.5.-202

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 1 to RAI 02.04.05-002

Revision to of FSAR Subsection 2.4.5

COLA Part 2, FSAR, Chapter 2, Subsection 2.4.5, at the conclusion of the subsection, revise to add the following:

2.4.5 Probable Maximum Surge and Seiche Flooding

Surge flooding is evaluated for Make-Up Pond A and Make-Up Pond B using the maximum wind speed identified in Subsection 2.3.1.2.8. This is consistent with the maximum wind speeds identified in U.S. Army Corps of Engineers guidance (Reference 295). Fetch lengths are estimated using the longest straight line fetch directed toward the site for each water body. Wave height, setup, and runup are estimated using U.S. Army Corps of Engineers guidance (Reference 295). Wind setup is estimated using additional U.S. Army Corps of Engineers guidance (Reference 269).

Estimates for surge flooding are made coincident with 100-yr. flood levels of Make-Up Pond A and Make-Up Pond B. Resulting 100-yr. runoff rates for the watersheds are determined using USGS regression equations for small watersheds in South Carolina (Reference 296). The overflow rating curves for the respective ponds, discussed in Subsection 2.4.3.3, are used to determine the resulting coincident water surface elevations.

Make-Up Pond A

Make-Up Pond A surge flooding is evaluated coincident with the 100-yr. water surface elevation of 556.07 ft. The critical fetch length is 0.37 mi. as shown in Figure 2.4.5-201. The wind speed is adjusted based on the factors of fetch length, level overland or over water, critical duration, and stability using U.S. Army Corps of Engineers guidance (Reference 295). The critical duration is 10 min. The adjusted wind speed is 97.4 mph.

Significant wave height (average height of the maximum 33-1/3 percent of waves) is estimated to be 2.36 ft., crest to trough. The maximum wave height (average height of the maximum 1 percent of waves) is estimated to be 3.94 ft., crest to trough. The corresponding wave period is 1.8 sec.

The slopes along the banks of Make-Up Pond A adjacent to the site area are approximately 52 percent at most and are used to determine the wave setup and runup. The maximum runup, including wave setup, is estimated to be 8.79 ft. The maximum wind setup is estimated to be 0.08 ft. Therefore, the total water surface elevation increase due to high speed wind wave activity is estimated to be 8.87 ft. The resulting flood elevation is 565.0 ft. The Lee Nuclear Station safety-related plant elevation is 590 ft. and is unaffected by high speed wind wave activity flooding conditions.

Make-Up Pond B

Make-Up Pond B surge flooding is evaluated coincident with the 100-yr. water surface elevation of 576.22 ft. The critical fetch length is 1.21 mi. as shown in Figure 2.4.5-202. The wind speed is adjusted based on the factors of fetch length, level overland or over water, critical duration, and stability using U.S. Army Corps of Engineers guidance (Reference 295). The critical duration is 21 min. The adjusted wind speed is 90.6 mph.

Significant wave height (average height of the maximum 33-1/3 percent of waves) is estimated to be 3.87 ft., crest to trough. The maximum wave height (average height of the maximum 1 percent of waves) is estimated to be 6.46 ft., crest to trough. The corresponding wave period is 2.6 sec.

The slopes along the banks of Make-Up Pond B adjacent to the site area are approximately 9 percent and are used to determine the wave setup and runup. The maximum runup, including wave setup, is estimated to be 4.49 ft. The maximum wind setup is estimated to be 0.21 ft. Therefore, the total water surface elevation increase due to high speed wind wave activity is estimated to be 4.70 ft. The resulting flood elevation is 581.0 ft. The Lee Nuclear Station safety-related plant elevation is 590 ft. and is unaffected by high speed wind wave flooding conditions.

Seiche evaluation is based on the natural fundamental period for Make-Up Pond A and Make-Up Pond B. The natural fundamental period of both water bodies is determined using Merian's formula (Reference 295).

$$T = 2 * L / (g * h)^{0.5}$$

where;

T = natural oscillation period at the fundamental mode (sec.)

L = fetch length (ft.)

g = gravitational acceleration (ft/sec^2)

h = depth of water (ft.)

Based on bathymetry mapping, an average depth of 29.86 ft. is determined for Make-Up Pond A and used as the depth of water. The resulting natural fundamental period is 2.1 min. The Make-Up Pond B average depth is 33.35 ft. The resulting natural fundamental period is 6.5 min. The wave periods determined above (1.8 sec. and 2.6 sec.) are much shorter than the natural fundamental period for both water bodies (2.1 min. and 6.5 min.). Furthermore, natural fundamental periods are significantly shorter than meteorologically induced wave periods (e.g., synoptic storm pattern frequency and dramatic reversals in steady wind direction necessary for wind setup). Since the natural periods of Make-Up Pond A and Make-Up Pond B are significantly different than the period of the excitations, they are not susceptible to meteorologically induced seiche waves. Seismically induced waves are discussed in Subsection 2.4.6.

COLA Part 2, FSAR, Chapter 2, Subsection 2.4.16, at the conclusion of the subsection, revise to add the following:

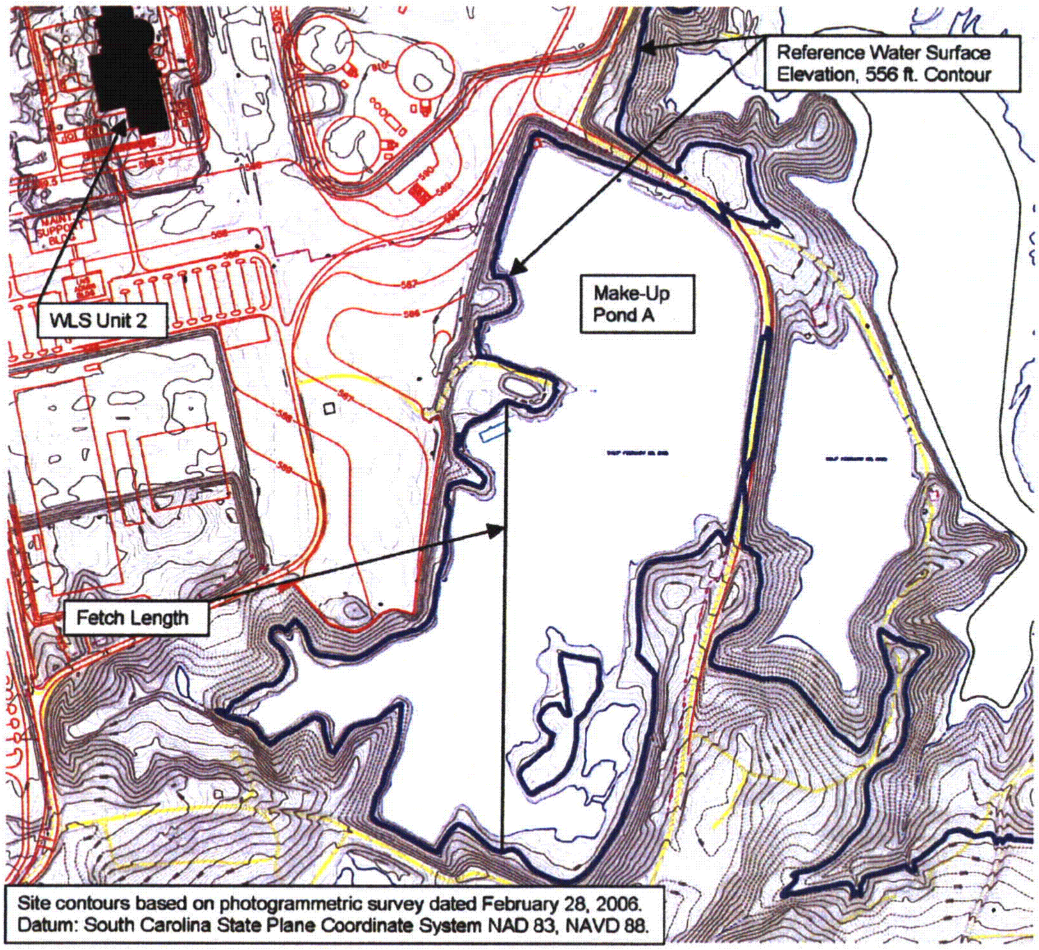
296. U.S. Geological Survey, Estimating the Magnitude of Peak Discharges for Selected Flood Frequencies on Small Streams in South Carolina [1975], Open File Report 82-337, 1975.

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 2 to RAI 02.04.05-002

New Figures for FSAR Section 2.4

COLA Part 2, FSAR, Chapter 2, Section 2.4, new figures for FSAR Section 2.4 are on the following pages. Add the following information to the List of Figures after Figure 2.4.4-202:

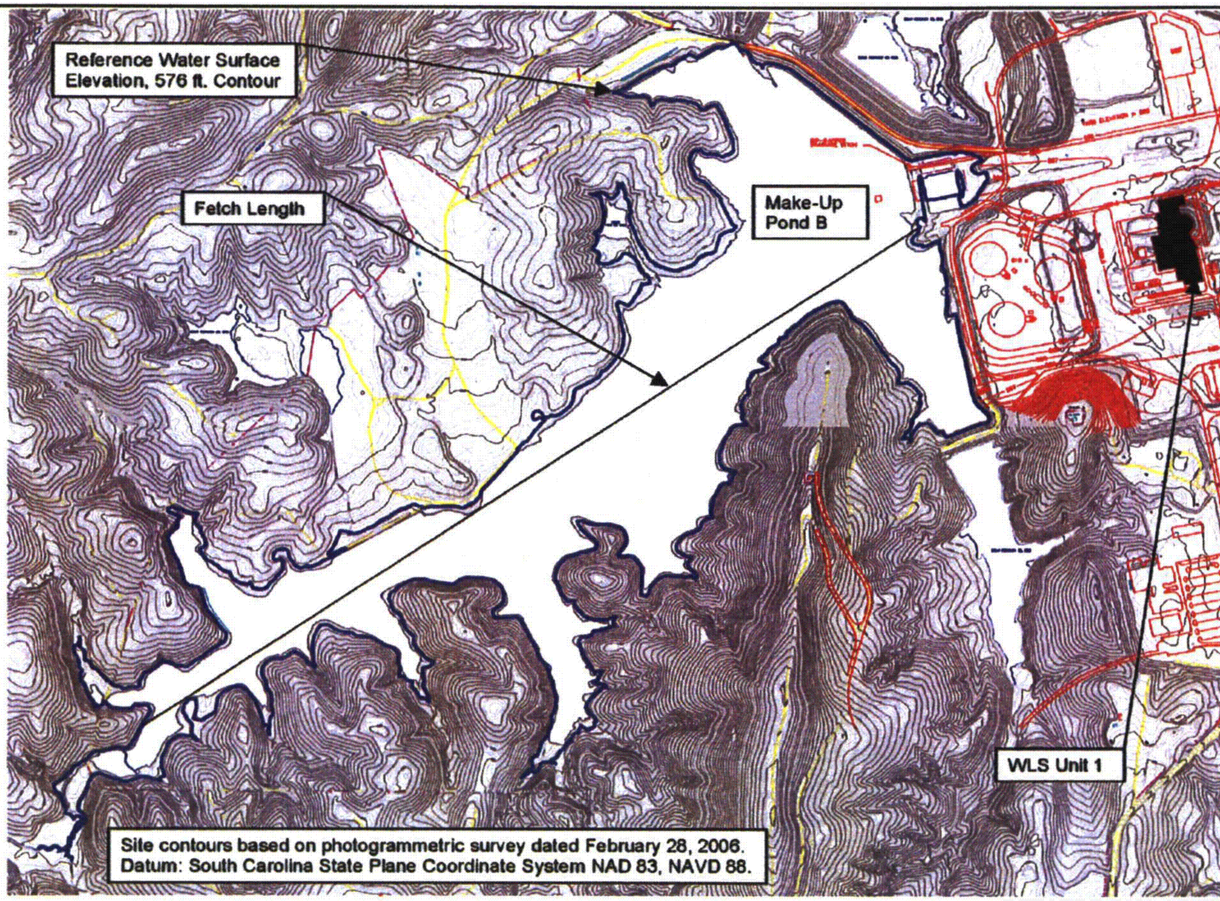


WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Make-Up Pond A
Extreme Wind Speed Fetch Length

WLS COL 2.4-2

FIGURE 2.4.5-201 Rev 1



WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Make-Up Pond B
Extreme Wind Speed Fetch Length

WLS COL 2.4-2

FIGURE 2.4.5-202 Rev 1

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 017

NRC Technical Review Branch: Hydrologic Engineering Branch (RHEB)

Reference NRC RAI Number(s): RAI 02.04.06-001

NRC RAI:

The applicant needs to describe the process followed to determine the conceptual models for probable maximum tsunami, tsunami propagation, wave runup, inundation, and drawdown, hydrostatic and hydrodynamic forces, debris and water-borne projectiles, and sediment erosion and deposition to ensure that the most conservative of plausible conceptual models has been identified.

Duke Energy Response:

The conceptual models to determine flood waves from probable maximum tsunami and tsunami-type waves adhere to the requirements of NRC Regulatory Guide 1.206 and NRC Regulatory Guide 1.59. Tsunami risk map maximum wave heights and historical maximum recorded tsunami wave heights for the East Coast are compared to the available freeboard of the site above the Broad River. Resulting flood waves are less than the design basis flood. Therefore, there is no potential for inundation, hydrostatic and hydrodynamic forces, debris, or water-borne projectiles affecting safety-related facilities.

As discussed in FSAR Subsection 2.5.3, there are no capable tectonic sources in the vicinity of the site. Therefore, there is negligible potential for tectonic fault rupture at the site or in the site vicinity. Because there is negligible potential for tectonic fault rupture, seismic induced waves are not plausible for the water bodies adjacent to the site. There are no irregular conditions or natural landslide hazards in the vicinity of the site. Therefore, landslide generated waves are not plausible.

No water is required from the Broad River or Make-Up Ponds A and B to support safety-related functions. Therefore, there are no safety-related facilities that would be affected by sediment deposition, erosion, or drawdown.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

None

Attachments:

None

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 017

NRC Technical Review Branch: Hydrologic Engineering Branch (RHEB)

Reference NRC RAI Number(s): RAI 02.04.06-002

NRC RAI:

Provide an assessment of landslide and slope-failure potentials on the shores of Make-Up Ponds A and B. Provide an assessment of tsunami-like waves that may be generated by these landslides and slope failures resulting in bank material falling in Make-Up Ponds A and B. Describe the potential of these tsunami-like waves to inundate the site grade, 590 ft msl.

Duke Energy Response:

Duke Energy has determined that significant landslide generated waves triggered by hill slope failure are not plausible for the on-site Make-Up Ponds A and B. No irregular weathering conditions or natural landslide hazards are noted in field investigations, as discussed in FSAR Subsection 2.5.1.1.

Duke Energy has determined that seismic induced waves resulting from surface fault rupture are not plausible. As discussed in FSAR Subsection 2.5.3, there are no capable tectonic sources within the Lee Nuclear Site vicinity (25 mi. radius), and there is negligible potential for tectonic fault rupture at the site and within the site vicinity. Any seismic event that could occur would generate potential waves that would be insignificant compared to the available freeboard of the on-site make-up ponds.

Duke Energy has modified the text of FSAR Subsection 2.4.6 to provide an assessment of landslide and slope-failure potential and seismically-induced waves in Make-Up Ponds A and B. A revision of FSAR Subsection 2.4.6 text is provided as Attachment 1. Attachment 1 will be incorporated into a future revision of the Final Safety Analysis Report.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

FSAR Subsection 2.4.6

Attachments:

1) Revised FSAR Subsection 2.4.6

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 1 to RAI 02.04.06-002

Revision to FSAR Subsection 2.4.6

COLA Part 2, FSAR, Chapter 2, Subsection 2.4.6, at the conclusion of the subsection, revise to add the following:

2.4.6 Probable Maximum Tsunami

Significant landslide generated waves triggered by hill slope failure are not plausible for the on-site Ponds A and B. No irregular weathering conditions or natural landslide hazards are noted in field investigations, as discussed in Subsection 2.5.1.1. There is no documented evidence that landslides of sufficient magnitude (e.g., size and velocity) at the site or adjacent to the ponds would occur. Potential slope failures that could occur would be of limited size and characterized as shallow soil or fill 'popouts'. Landslides of this type are considered minor, contain an insufficient volume of material, and are of low velocity so that potential landslide-induced waves would be insignificant.

Slopes surrounding Make-up Ponds A and B are either natural slopes that have existed for a long period of time (through most or all of the Holocene; natural slopes), or cut and fill slopes developed as part of the Cherokee Nuclear Station construction in the early 1980's. These slopes exhibit acceptable stability without visual evidence of groundwater seepage, past failure, incipient movement, or major creep, as discussed in Subsection 2.5.5.1.

Seismic induced waves resulting from surface fault rupture are also not plausible. As discussed in Subsection 2.5.3, there are no capable tectonic sources within the Lee Nuclear Site vicinity (25 mi. radius), and there is negligible potential for tectonic fault rupture at the site and within the site vicinity. Any seismic event that could occur would generate potential waves that would be insignificant compared to the available freeboard of the on-site make-up ponds.

As shown in Figure 2.4.1-209, Make-Up Pond A and Make-Up Pond B have normal pool elevations of 547 ft. msl and 570 ft. msl, respectively. Safety-related facilities are located at an elevation of 590 ft. Therefore, Make-Up Pond A has an available freeboard of 43 ft. and Make-Up Pond B has an available freeboard 20 ft. The geology and seismology and geotechnical engineering characteristics of the Lee Nuclear Station are presented in Section 2.5.

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 017

NRC Technical Review Branch: Hydrologic Engineering Branch (RHEB)

Reference NRC RAI Number(s): RAI 02.04.11-001

NRC RAI:

Please describe the process followed to determine the conceptual models for low water from drought and from other phenomena and the effects of low water on safety-related water supplies under possible water use limits to ensure that the site characteristics related to low-water events are based on plausible conceptual models that are adequately conservative.

Duke Energy Response:

The conceptual model for establishment of low flow conditions began with a calculation of a long-term 7Q10 flow for the Broad River. The USGS streamflow gauge used for this calculation is the Broad River at Gaffney, South Carolina (gauge no. 2153500). This gauge was chosen due to its proximity to the proposed Lee Nuclear Station located near Gaffney, South Carolina along the west bank of Ninety-Nine Islands Reservoir. Daily average flows for this gauge were compiled using a combination of actual data over the period of available data from the gauge at Gaffney and pro-rated flow data from two upstream USGS gauges on the main stem of the Broad River. The two upstream gauges used were the Broad River at Blacksburg, South Carolina (3.1 river miles upstream from the Gaffney gauge), and the Broad River near Boiling Springs, North Carolina (16.2 river miles upstream from the Gaffney gauge).

Drainage area ratios for the two upstream gauges were used to calculate pro-rated flows, based on drainage area ratios, at the Gaffney gauge for the time periods where flow data was not available. After identifying the annual seven-day low flow for each year in the period of record, a Log-Pearson Type III (LPIII) distribution was used to calculate the ten-year seven-day low flow (7Q10). This is the same methodology recommended and used by the USGS. The 7Q10 calculated for the Broad River at Gaffney is 479 cfs. It is worth noting that this value is very close to the FERC minimum flow requirement for the Ninety-Nine Islands Hydroelectric Station of 483 cfs.

Assuming the FERC minimum flow requirement and the projected Lee Nuclear Station cooling water consumptive water use of 55 cfs, Duke Energy defined the sum of the FERC requirement and consumptive water use (538 cfs) as a trigger to define the minimum flow in the Broad River that would support current water use and quality for downstream users.

No water is required from the Broad River or Make-Up Ponds A and B to support safety-related functions. Therefore, low water has no effect on safety-related facilities.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

None

Attachments:

None

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 017

NRC Technical Review Branch: Hydrologic Engineering Branch (RHEB)

Reference NRC RAI Number(s): RAI 02.04.11-002

NRC RAI:

FSAR Section 2.4.11.5 states: "Make-Up Pond B has sufficient capacity to support full power operations for approximately 35 days. Make-Up Pond A has sufficient capacity to support full power operations for an additional 11 days. Make-Up Pond A has sufficient capacity to conduct a normal plant shutdown." Describe "normal plant shutdown." Describe the extent to which any safety-related water is needed during normal plant shutdown.

Duke Energy Response:

A normal plant shutdown is a non-emergency shutdown and does not require any safety-related water. The water usage for normal shutdown of both units is approximately 106 ac.-ft. The water usage to maintain shutdown conditions of both units for 90 days after normal shutdown is approximately an additional 143 ac.-ft. The 1200 ac.-ft. of useable storage in Make-Up Pond A is a sufficient capacity to conduct a normal plant shutdown and maintain the plant in shutdown conditions for a length of time that is significantly longer than any recorded period of low flow. Duke Energy has no plans to draw down Make-Up Pond A to support power operations.

Duke Energy has modified the text of FSAR Subsection 2.4.11.5 to provide the non-safety related water requirements for a normal plant shutdown. A revision of FSAR Subsection 2.4.11.5 text is provided as Attachment 1. Attachment 1 will be incorporated into a future revision of the Final Safety Analysis Report.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

FSAR Subsection 2.4.11.5

Attachments:

1) Revised FSAR Subsection 2.4.11.5

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 1 to RAI 02.04.11-002

Revision to FSAR Subsection 2.4.11.5

COLA Part 2, FSAR, Chapter 2, Subsection 2.4.11.5, the seventh paragraph will be revised as follows:

2.4.11.5 Plant Requirements

Make-Up Pond B has sufficient capacity to support full power operations for approximately 35 days. ~~Make-Up Pond A has sufficient capacity to support full power operations for an additional 11 days.~~ There are no safety-related water requirements for normal plant shutdown associated with the AP1000. Make-Up Pond A ~~has sufficient capacity to conduct a normal plant shutdown~~nominally provides for 1200 ac.-ft. of usable water storage which corresponds to a reserve capacity that is approximately 11 days of power operations. Make-Up Pond A has sufficient capacity to conduct a normal plant shutdown and to maintain shutdown conditions for both units. Make-Up Pond A can be replenished with water from the Broad River and from Make-Up Pond B.