

**Southern Nuclear
Operating Company, Inc.**
40 Inverness Center Parkway
Birmingham, Alabama 35242

MAR 27 2009



Docket Nos.: 52-025
52-026

ND-09-0446

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

Southern Nuclear Operating Company
Vogtle Electric Generating Plant Units 3 and 4 Combined License Application
Response to Request for Additional Information Letter No. 028

Ladies and Gentlemen:

By letter dated March 28, 2008, Southern Nuclear Operating Company (SNC) submitted an application for combined licenses (COLs) for proposed Vogtle Electric Generating Plant (VEGP) Units 3 and 4 to the U.S. Nuclear Regulatory Commission (NRC) for two Westinghouse AP1000 reactor plants, in accordance with 10 CFR Part 52. During the NRC's detailed review of this application, the NRC identified a need for additional information, involving local intense flooding, required to complete their review of the COL application's Final Safety Analysis Report (FSAR) Section 2.4, "Hydrologic Engineering." By letter dated February 25, 2009, the NRC provided SNC with Request for Additional Information (RAI) Letter No. 028 concerning this information need. This RAI letter contains three RAI questions numbered 02.04.02-1 through -3. The enclosures to this letter provide the SNC response to these RAIs.

If you have any questions regarding this letter, please contact Mr. Wes Sparkman at (205) 992-5061.

DO92
NRO

Mr. C. R. Pierce states he is a Licensing Manager for Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company and to the best of his knowledge and belief, the facts set forth in this letter are true.

Respectfully submitted,

SOUTHERN NUCLEAR OPERATING COMPANY

Charles R. Pierce

Charles R. Pierce

Sworn to and subscribed before me this 27th day of March, 2009

Notary Public:

My commission expires:

Diana J. Bennett
9/14/10

CRP/BJS/dmw

Enclosures:

1. Response to NRC RAI Letter No. 028 on the VEGP Units 3 & 4 COL Application Involving Local Intense Flooding
2. VEGP Units 3 and 4 FSAR Proposed Revised Figure 2.4-201 and Proposed New Figure 2.4-201a

cc: Southern Nuclear Operating Company

Mr. J. H. Miller, III, President and CEO (w/o enclosures)
Mr. J. T. Gasser, Executive Vice President, Nuclear Operations (w/o enclosures)
Mr. J. A. Miller, Executive Vice President, Nuclear Development
Mr. D. H. Jones, Site Vice President, Vogtle 3 & 4 (w/o enclosures)
Mr. D. M. Lloyd, Vogtle Deployment Director
Mr. M. K. Smith, Technical Support Director
Mr. M. J. Ajluni, Nuclear Licensing Manager
Mr. W. A. Sparkman, COL Project Engineer
Document Services RTYPE: AR01.1053
File AR.01.02.06

Nuclear Regulatory Commission

Mr. L. A. Reyes, Region II Administrator (w/o enclosures)
Mr. F.M. Akstulewicz, Deputy Director Division of Safety Systems & Risk Assessment (w/o enclosures)
Ms. S. M. Coffin, AP1000 Manager of New Reactors (w/o enclosures)
Mr. C. J. Araguas, Lead Project Manager of New Reactors
Mr. B. Hughes, Project Manager of New Reactors
Mr. R. G. Joshi, Project Manager of New Reactors
Ms. T. E. Simms, Project Manager of New Reactors
Mr. B. C. Anderson, Project Manager of New Reactors
Mr. M. M. Comar, Project Manager of New Reactors
Mr. M. D. Notich, Environmental Project Manager
Mr. J. H. Fringer, III, Environmental Project Manager
Mr. L. M. Cain, Senior Resident Inspector of VEGP

Georgia Power Company

Mr. O. C. Harper, IV, Vice President, Resource Planning and Nuclear Development (w/o enclosures)

Oglethorpe Power Corporation

Mr. M. W. Price, Executive Vice President and Chief Operating Officer (w/o enclosures)

Municipal Electric Authority of Georgia

Mr. S. M. Jackson, Vice President, Power Supply (w/o enclosures)

Dalton Utilities

Mr. D. Cope, President and Chief Executive Officer (w/o enclosures)

Bechtel Power Corporation

Mr. J. S. Prebula, Project Engineer (w/o enclosures)
Mr. R. W. Prunty, Licensing Engineer

Tetra Tech NUS, Inc.

Ms. K. K. Patterson, Project Manager

Shaw Stone & Webster, Inc.

Mr. K. B. Allison, Project Manager (w/o enclosures)
Mr. J. M. Oddo, Licensing Manager
Mr. D. C. Shutt, Licensing Engineer

Westinghouse Electric Company, LLC

Mr. N. C. Boyter, Vice President, AP1000 Vogtle 3 & 4 Project (w/o enclosures)
Mr. J. L. Whiteman, Principal Engineer, Licensing & Customer Interface

Southern Nuclear Operating Company

ND-09-0446

Enclosure 1

Response to NRC RAI Letter No. 028

on the

VEGP Units 3 & 4 COL Application

Involving

Local Intense Flooding

FSAR Section 2.4, Hydrology Engineering

eRAI Tracking No. 2057

NRC RAI Number 02.04.02-1:

Staff reviewed the local intense precipitation flood event as described in FSAR Section 2.4.2. In accordance with requirements based on 10 CFR 100.20(c) and 10 CFR 52.79(a), staff requests additional information concerning the drainage basins and ditches in the vicinity of Vogtle Units 3 and 4.

Specifically, staff's assessment of the HEC-RAS input files provided by the applicant noted the following: 1) three of the drainage ditches shown in drainage maps referenced in the FSAR are not included in the local flooding analysis, 2) a comparison with HEC-RAS input files provided by the applicant includes a culvert but this feature is not included in Figure 2.4.2.4-102 (FSAR Figure 2.4-201), 3) a map referencing the HEC RAS cross section was not provided, and 4) the feature that appears to cover feeder ditches 2 and 3 at their downstream ends in Figure 2.4.2.4-102 is unclear as to the type of feature or its impact on the drainage system.

The applicant should provide: 1) additional information or clarification regarding the deletion of certain channels from the analysis, 2) clarification regarding the inconsistency of the HEC-RAS model and the figure regarding the culvert, 3) a figure showing the locations of the cross-sections used in developing the HEC-RAS model inputs, and 4) additional information concerning the feature that appears to cover the feeder ditches 2 and 3 at the downstream ends.

SNC Response:

The numbered requests for information in the above paragraph are repeated in the body of this response in italics for reference.

The applicant should provide:

1) Additional information or clarification regarding the deletion of certain channels from the analysis

All of the ditches shown in the drainage area map are accounted for in the models.

The hydrologic model developed in HEC-HMS simulates the local probable maximum precipitation (PMP) runoff for the drainage area containing the proposed Units 3 and 4 power block and includes all the major ditches draining the study area. These are the main ditch and the feeder ditches identified as feeder ditches 1 through 6 in FSAR Figure 2.4-201, which has been modified to clarify issues raised in this RAI.

The subbasins in the hydrologic model are delineated with respect to the contributing areas at specific locations along these ditches in accordance with the ditch layout and site grading. These points are shown as labeled orange dots which are identified in the legend to FSAR Figure 2.4-201 as "HEC-HMS Nodes."

The HEC-HMS model simulates the runoff resulting from the PMP event for each of the contributing areas to selected locations along the drainage ditches and provides a discharge at that section so that the increase in discharge in the downstream direction is represented. The model also accounts for the attenuation of peak discharge along the main channel as the result of channel storage, but this impact is negligible for the size of this drainage system.

The hydraulic model developed in HEC-RAS does not include every ditch simulated in HEC-HMS. It only includes the ditches which have an impact on the flood levels within the Units 3 and 4 power block area. This includes the main ditch and feeder ditches 1 through 4. Because it was predicted that ditch 4 will overtop during a local PMP event, its conveyance is included as an extension of the main ditch cross sections between Stations 0+00 and 23+00. Feeder ditches 5 and 6, south of the cooling towers, are not included in the HEC-RAS model for water surface simulation. However, the flood discharges from feeder ditches 5 and 6, as determined in the HEC-HMS model, are included as inflow to the main ditch in the HEC-RAS model. This ensures that the impact on the water surface profile of the ditches in the model due to the inflow from feeder ditches 5 and 6 is accounted for.

2) Clarification regarding the inconsistency of the HEC-RAS model and the figure regarding the culvert

In the Units 3 and 4 power block area, feeder ditch 1 includes two culverts, feeder ditch 2 includes five culverts, and feeder ditch 3 includes one culvert, as shown in FSAR Figure 2.4-201. All of these culverts in the power block area are assumed to be completely blocked for the local PMP analysis. This is accounted for in the HEC-RAS model by using inline weir structures to simulate the flow over the top of the roadway. The cross sections are extended a sufficient distance from each side of the ditch to allow modeling the full impact of the overflow at each blocked culvert. The culvert at the downstream end of feeder ditch 4 is not included in the HEC-RAS model. Because it is in the backwater area of the main ditch, this is expected to have a negligible impact on flood levels in the power block area. Culverts and discharge pipes within the laydown area west of the Unit 4 power block, as shown in FSAR Figure 2.4-201, are conservatively assumed to be blocked for the PMP analysis and are not included in the HEC-RAS model. Runoff from these areas is included in the HEC-RAS model as inflow to the main ditch channel. Therefore, no culvert is set up in the HEC-RAS model input file.

3) A figure showing the locations of the cross-sections used in developing the HEC-RAS model inputs

A new cross section location figure has been prepared and is attached to this response. This figure, FSAR Figure 2.4-201a, also indicates which of the ditches are included in the hydraulic model, which helps to clarify the narrative response provided above in response to subpart 1) of this RAI.

4) Additional information concerning the feature that appears to cover the feeder ditches 2 and 3 at the downstream ends.

The indicated feature is a temporary at-grade heavy haul road that will be used during construction. Temporary culverts will convey flow from feeder ditches 2 and 3 under the roadway. The local PMP modeling is based on the "built-out" final site conditions after all temporary structures have been removed. Therefore, the temporary road crossings are not included in the HEC-RAS model. For clarification, the heavy haul road has been identified as a temporary feature in revised FSAR Figure 2.4-201.

Associated VEGP COL Application Revision:

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

The sixth paragraph on page 2.4-3, which begins with "The backwater analysis for the PMP drainage network ..." will be modified to reference new Figure 2.4-201 as shown below: [see following RAI 02.04.02-2 response for discussion of the deleted phrase.]

“The backwater analysis for the PMP drainage network was developed in HEC-RAS (Reference 205). Cross sections were developed for the main drainage ditch and feeder channels with topographic data for the overbank area, using the proposed geometric configuration for the channels ~~with adjustments to conveyance as necessary to eliminate flooding~~. The locations of the cross sections used in the HEC-RAS model are shown in Figure 2.4-201a.”

Proposed revised Figure 2.4-201 and new Figure 2.4-201a are provided in Enclosure 2 (on compact disc) and will be included in a future COLA revision.

NRC RAI Number 02.04.02-2:

Staff reviewed the local intense precipitation flood event as described in FSAR Section 2.4.2. In accordance with requirements based on 10 CFR 100.20(c) and 10 CRF 52.79(a), staff requests additional information concerning the drainage associated with local intense precipitation at Vogtle Units 3 and 4.

In FSAR Section 2.4.2.3, the applicant states that adjustments to conveyance were made as necessary to eliminate flooding. However, no information was provided regarding the specific changes that were made. Staff’s analysis must account for any adjustment to cross-sections, roughness or other conveyance parameter in the final design plan.

The applicant should provide more information about what modifications were made to improve conveyance.

SNC Response:

The statement that adjustments to conveyance were made as necessary to eliminate flooding is clarified as discussed below.

The existing channel identified as the main ditch in the FSAR conveys a portion of the runoff from the western part of the Units 1 and 2 site to the west and south, off site. The existing cross section of this channel, which has a bottom width of approximately 6.5 feet, was not designed for the peak discharges that would be associated with the local PMP flow patterns for the Units 3 and 4 site. Increases in PMP runoff resulting from the construction of the new plant will be accommodated by increasing the existing channel bottom widths to between 10 and 14 feet, as noted in the second paragraph of Subsection 2.4.2.3.

The HEC-RAS modeling of the local PMP flood event prepared in support of the Units 3 and 4 FSAR, which is based on final “built-out” conditions, incorporates these increased bottom widths, so the reference to the increase in conveyance will be removed from the FSAR.

Associated VEGP COL Application Revision:

As noted in the RAI 02.04.02-1 response, the phrase “with adjustments to conveyance as necessary to eliminate flooding” is deleted from the sixth paragraph on page 2.4-3, which begins with “The backwater analysis for the PMP drainage network ...”

NRC RAI Number 02.04.02-3:

Staff reviewed the local intense precipitation flood event as described in FSAR Section 2.4.2. In accordance with requirements based on 10 CFR 100.20(c) and 10 CFR 52.79(a), staff requests additional information concerning the drainage basins and ditches in the vicinity of Vogtle Units 3 and 4.

In its review of the applicant's HEC-RAS model, the NRC staff found that the cross-sections for the feeder ditches had top widths of approximately 1000 feet with an overall channel length of about 1200 feet and the topography is relatively flat. Consequently, it is difficult to determine what features constrain the flow into channels and whether the 1-dimensional analysis is appropriate. Additionally, the overbank area constitutes much of the cross-sectional area during peak flow and affects the conveyance properties and water surface elevation.

The applicant should justify the use of a 1-dimensional assumption for the hydraulic analysis. Also, the applicant should provide additional hydraulic information/calculation concerning the conveyance properties of the overbanks and channels.

SNC Response:

Justification of one-dimensional modeling approach

The grading of the plant area was designed to provide positive (essentially one-dimensional) drainage away from safety-related facilities in the Units 3 and 4 power block area. The ditches draining the power block area (feeder ditches 1, 2 and 3) collect runoff from the power block area and discharge to the main ditch, as shown in FSAR Figure 2.4-201. The main ditch initially flows westward and then southward to discharge to the existing Debris Basin 2.

Site drainage from outside the power block area would also discharge to the main ditch, with positive drainage achieved by establishing appropriate invert elevations within the feeder ditches. When discharges increase to the point where the flow spills out into the overbank areas, as occurs for the local PMP flow rates at this site, the fundamental flow pattern remains one-dimensional because the increased bed roughness in the overbank areas restricts lateral flows, maintaining a predominately downstream, unidirectional flow path.

The local PMP modeling indicates that for the highest discharges associated with the PMP flood event, the backwater in the main channel rises to the point where the overbank area of the feeder ditches in the power block area are completely flooded, and the water level may increase to an elevation above the drainage divides between channels. However, any lateral flow would be negligible considering the mild gradients in the backwater area.

For the right bank of the main channel between feeder ditches 2 and 3, the area common to the main and feeder channels has been eliminated with the use of ineffective flow areas, reducing the cross sectional area available for conveyance, and leading to higher water surface elevations, which is conservative.

For HEC-RAS cross sections where the ground surface does not extend high enough to intersect the calculated water surface elevation, the model assumes vertical "levees" at the end of the sections to contain the flow. This leads to higher water surface elevations in the one-dimensional model than would occur if the two dimensional lateral flow pattern were modeled, which is conservative from the point of view of establishing maximum local probable maximum flood (PMF) water surface elevations.

ND-09-0446
Enclosure
Response to RAI Letter No. 028

In summary, the one-dimensional modeling approach used in this calculation results in a reasonable approximation of the flow field, and the locus of maximum water surface elevations is expected to be more conservative than the maximum water surface elevations that would be calculated from a multi-dimensional model.

Information concerning the conveyance properties of the overbanks and channels

As noted in FSAR Subsection 2.4.2.3, we have used Manning's n-values of .014 for the concrete-lined feeder ditches within the power block area, and .015 for all other concrete-lined ditches, with a value of .020 for the gravel and concrete covered overbank areas within the power block, and a value of .030 for the grass-covered over bank areas. These are typical values for ditches and overbanks, as recommended in Chow's Open Channel Hydraulics (see reference 202 in FSAR Subsection 2.4.16).

Associated VEGP COL Application Revision:

None

Southern Nuclear Operating Company

ND-09-0446

Enclosure 2

VEGP Units 3 and 4 FSAR

Proposed Revised Figure 2.4-201

And

Proposed New Figure 2.4-201a

On

Compact Disc (CD)