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SOUTHERN COMPANY
Energy to Serve Your World℠

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AR-08-0045

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

Southern Nuclear Operating Company
Vogtle Early Site Permit Application
Response to Request for Additional Information Letter No. 10

Ladies and Gentlemen:

By letter dated August 15, 2007, Southern Nuclear Operating Company (SNC) submitted Supplement 2-S1 for the Vogtle Early Site Permit (ESP) Application to the U.S. Nuclear Regulatory Commission (NRC). That supplement, subsequently incorporated into ESP Revision 3, requested the addition of a Limited Work Authorization (LWA) for selected safety-related construction activities, as part of the Vogtle ESP Application Site Safety Analysis Report (SSAR). By letter dated October 26, 2007, the NRC provided SNC with Request for Additional Information (RAI) Letter No. 9 concerning LWA information contained in Chapters 1, 2, 3 and 13 of the SSAR. SNC responded to the RAIs from that letter in SNC letter AR-07-1802, dated November 28, 2007.

Subsequently, by letter dated January 11, 2008, the NRC provided SNC with RAI Letter No. 10 concerning a second round of LWA information needs for Chapters 2 and 13 of the SSAR. The enclosures to this letter provide SNC's response to RAI Letter No. 10 and a comprehensive Structural Backfill Evaluation Report.

The SNC contact for this RAI response letter is J. T. Davis at (205) 992-7692.

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NRO

Mr. J. A. (Buzz) Miller states he is a Senior Vice President of 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

Joseph A. (Buzz) Miller

Sworn to and subscripted before me this 14th *day of* February, *2008*

Dana M. Williams
Notary Public

My commission expires: 12/29/2010

JAM/BJS/dmw

Enclosures:

1. Vogtle Units 3 and 4 Structural Backfill Evaluation Report
2. Response to January 11, 2008 RAI Letter No. 10 for the Vogtle ESP Application Involving LWA
3. Vogtle Electric Generating Plant Units 3 and 4 Fitness For Duty Program During LWA Construction

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Southern Nuclear Operating Company

AR-08-0045

Enclosure 1

Vogtle Units 3 and 4
Structural Backfill Evaluation Report

Vogtle Units 3 and 4
Structural Backfill Evaluation Report

Background

Category 1 backfill for Vogtle Units 3 and 4 will be onsite sands and silty sands obtained primarily from stockpile materials that were placed during construction of Units 1 and 2 and the excavation for Units 3 and 4. These borrow materials are obtained from the Barnwell Formation. The backfill soils for Units 3 and 4 will be very similar to, if not the same as that backfill placed for Units 1 and 2. Placement procedures, including equipment and equipment variables, lift thickness, and number of equipment passes will be developed through a series of test pads (Phase I and Phase II), which will be constructed prior to commencing production fill placement.

The Phase I program, which is already completed (MACTEC, 2008) focused on demonstrating that a minimum shear wave velocity (V_s) of 1,000 feet/second (fps) could be achieved at or above the foundation depth of the Nuclear Island (NI) with a well-compacted granular backfill soil obtained from onsite borrow sources from the Barnwell Formation. The Phase II program (not yet begun) will focus on establishing specific placement procedures and equipment, and will be combined with the Phase I results to develop the backfill construction specifications and procedures, including the frequency and type of quality control testing.

The Phase II program will concentrate on developing a specification for a dense homogeneous backfill material, utilizing onsite soils from the Barnwell Formation within a narrow gradation envelope with consistent placement procedures, to ensure that a minimum V_s of 1,000 fps will be achieved at the foundation level of the NI. Variability in backfill material properties will be kept to a minimum by controlling the material gradation, placement procedures, and compactive effort. Use of this specification that will result in a homogeneous fill compacted to a minimum of 95% of ASTM D1557, with a minimum shear wave velocity at the foundation level of the NI of 1,000 fps, and strength and compressibility parameters compatible with the design.

Studies performed at the University of Texas at Austin, under the direction of Dr. K. Stokoe (Darendeli, 2001 and Menq, 2003) have demonstrated that the low strain shear modulus, G_{max} or G_0, (and thus shear wave velocity, V_s) and corresponding dynamic properties for granular soils are predominately a function of effective confining pressure, σ'_0, void ratio, e, and median grain size, D_{50}, and uniformity coefficient, C_u. In terms of backfill placement, the factors that control these three parameters are:

- Effective confining pressure: compactive effort (density and moisture content), depth and/or surcharge loads, and at-rest earth pressure coefficient k_0,
- Void ratio: fines content and compactive effort (density), and
- D_{50} and C_u: gradation

The majority of these factors can be controlled by material specification and placement procedures. The effective confining pressure is a function of density (which can be controlled), depth (which is given) and k_0 (which cannot be controlled directly, but can be estimated with reasonable accuracy). The void ratio is controlled by the gradation (including fines content) and

compactive effort, while D_{50} and C_u are controlled by the gradation only. Thus, by controlling the compactive effort and grain size, predictable and consistent values of G_{max} (and therefore V_s) versus confining pressure (or depth) can be determined. Note that generally for sands and gravels, G_{max} (and thus V_s) increases with increasing D_{50}, uniformity coefficient C_u, and confining pressure, and decreasing void ratio e. Given that the proposed backfill materials are very consistent (demonstrated later in Figure 3) in terms of gradation (D_{50} and C_u) with the exception of fines content, it is expected that the confining pressure will have the greatest impact on the values of G_{max} and V_s.

Results

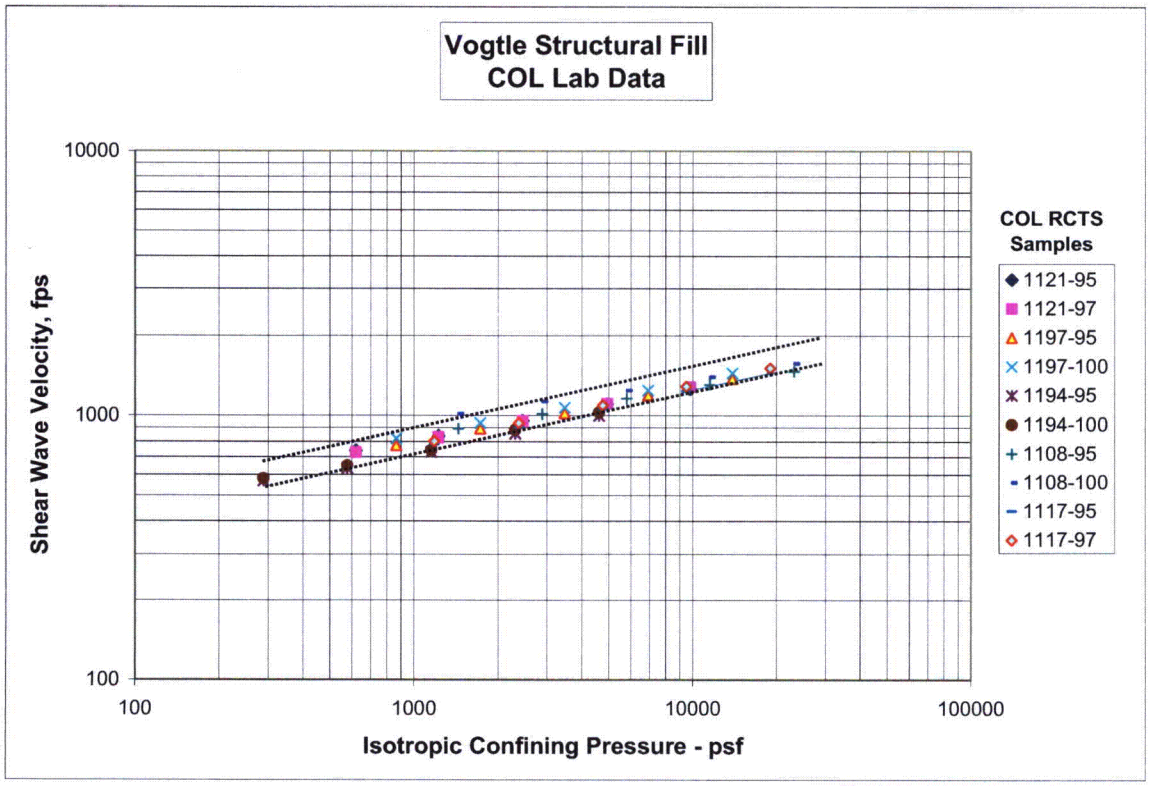
As expected, of the four parameters discussed above, the confining pressure has the greatest impact on V_s (G_{max}). This result is clearly demonstrated in Figure 1, which shows the relationship between the shear wave velocity and isotropic confining pressure for the backfill materials tested (resonant column and torsional shear [RCTS]) as part of the COL subsurface investigation (MACTEC Appendix G, 2008). The tests were performed on materials that are expected to be used for backfill soils. Fines content ranged from less than 10% to slightly over 25%, the median grain size (D_{50}) was within a very narrow range (~0.2 to 0.3 mm), Cu was on the order of 3 to 4 for the silty sands, and compaction ranged from 95% to approximately 100% of ASTM D1557. Table 1 below summarizes some of the pertinent information from the RCTS test samples.

Table 1. RCTS Sample Data

TEST DESIGNATION	TARGET % C (ASTM D1557)	MDD pcf	OMC %	TESTED MD (RCTS) pcf	TESTED MC (RCTS) %	FINES CONTENT %	D_{50} mm	C_U	USCS	EST. VOID RATIO e
TP-B-1108 (B1)	95	120.0	12.2	127.9	12.3	24.9	0.19	-	SC	0.44
TP-B-1108 (B1)	100	120.0	12.2	134.9	12	24.9	0.19	-	SC	0.37
TP-B-1117 (B1)	95	111.3	12.4	118.4	11.9	7.8	0.25	3.2	SP-SM	0.56
TP-B-1117 (B1)	97	111.3	12.4	119.9	12.5	7.8	0.25	3.2	SP-SM	0.55
TP-B-1121 (B1)	95	116.3	6.7	117.9	7.2	12.3	0.24	-	SM	0.5
TP-B-1121 (B1)	97	116.3	6.7	120.6	7	12.3	0.24	-	SM	0.46
TP-B-1194 (B1)	95	112.8	11.6	119.7	11.1	8.4	0.28	3.7	SP-SM	0.53
TP-B-1194 (B1)	100	112.8	11.6	125.9	11.4	8.4	0.28	3.7	SP-SM	0.46
TP-B-1197 (B1)	95	113.2	10.7	119.1	10.4	10.1	0.22	-	SP-SM	0.53
TP-B-1197 (B1)	100	113.2	10.7	125.4	10.1	10.1	0.22	-	SP-SM	0.45

Notes; C – Compaction, MDD – maximum dry density, MD – moist density, OMC – optimum moisture content, D_{50} – median grain size, C_u – uniformity coefficient, USCS – unified soil classification system designation, pcf – pounds/ft^3, DD – dry density, MC – moisture content, mm - millimeters

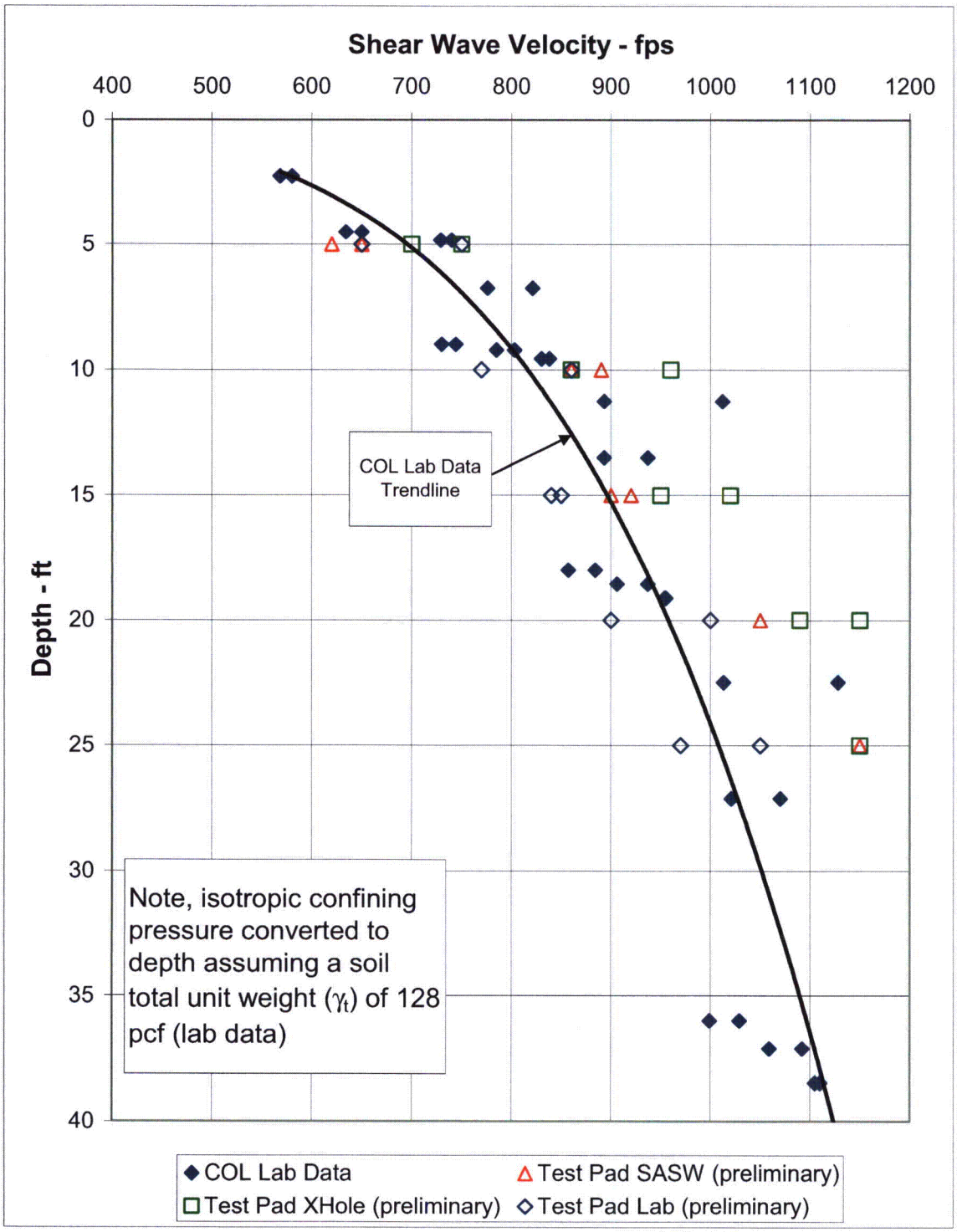
Figure 1. Backfill V_s versus Isotropic Confining Pressure (RCTS)



The laboratory results clearly demonstrate the effect of confining pressure and, just as importantly, show that the variability of computed shear wave velocity with confining pressure, given the materials tested, is relatively small. Further, the results demonstrate that once these materials are compacted in a dense state (≥ 95% ASTM D1557 [modified proctor]) compacting them to a higher compactive effort does not appreciably affect the shear wave velocity, except for test 1108, which has the highest fines content (~25%). The difference in this case is most likely reflected in a decrease in void ratio. Based on these results we conclude the variation of V_s to be relatively small, given the backfill materials to be used and the proposed compactive effort (ASTM D1557).

The results from Figure 1 (laboratory RCTS testing) are combined with the preliminary field V_s measurements (SASW and crosshole) and the preliminary laboratory results performed in the Phase I Test Pad program (MACTEC, 2008) and shown on Figure 2. The results clearly demonstrate the predictability of V_s, given a specific backfill material and confining pressure (depth and degree of compaction). Note the laboratory RCTS data were converted to depth using a representative backfill unit weight of 128 pounds/ft^3 (pcf), which is slightly less than the mean unit weight determined from the Phase I Test Pad data (MACTEC, 2008). The trend line shown for the COL laboratory data (which matches the preliminary Test Pad laboratory data) was developed with all of the COL data shown on Figure 1. However, the trendline, and associated COL laboratory data, are only shown to a depth of 40 feet on Figure 2 to coincide more closely with the results from the Phase I Test Pad, to highlight the results in the V_s range around 1,000 fps, and to illustrate the projected V_s at the depth of the NI foundation (40 ft depth). Note none of the results include the effects of any additional confinement due to structure loading.

Figure 2. Field Vs versus Depth for Compacted Backfill

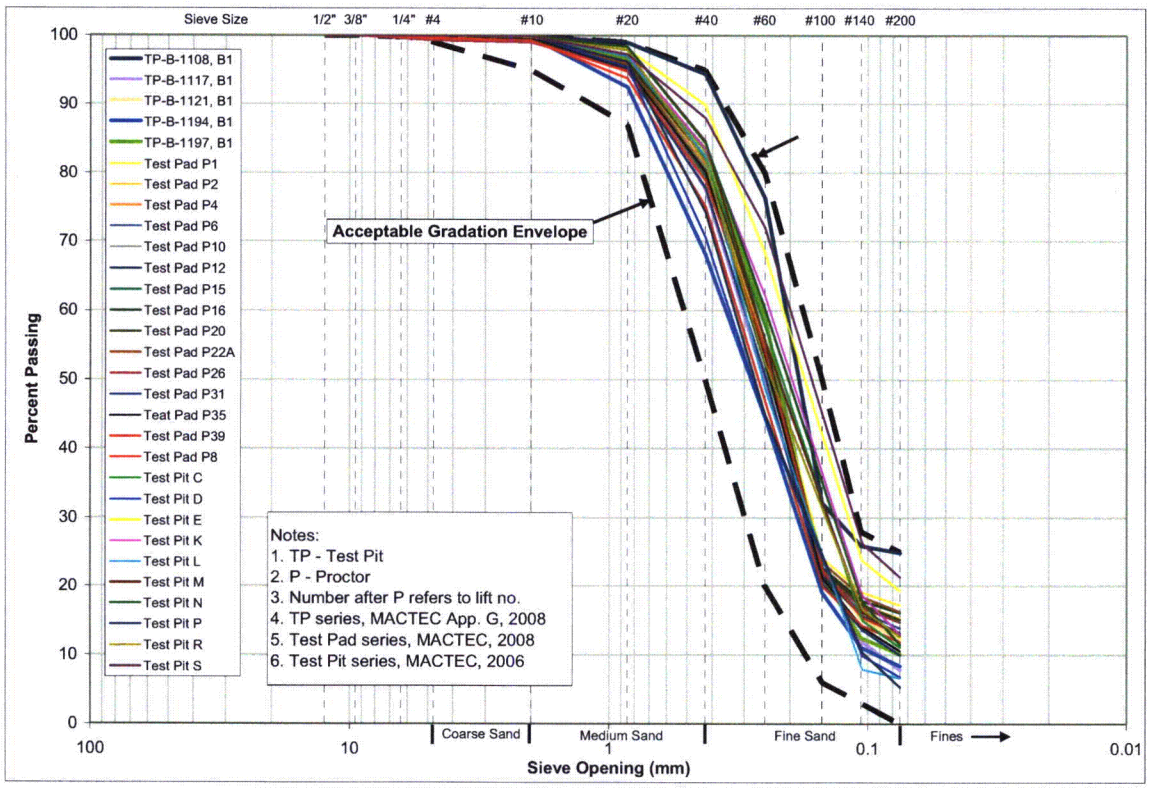


The reason for the small differences between the measured velocity in the field and the laboratory are not fully known, but they are most likely due to state of stress differences related to small sample preparation in the laboratory versus *insitu* compaction in the field with vibratory equipment. For example, the computed void ratio for the two samples compacted to 100% of

ASTM D1557 (TP-B-1194 and 1197 in Table 1) is about 0.45, which is slightly higher than the *insitu* void ratios computed for lifts of similar material in the Phase I Test Pad (P-13, P-35, and P-39), which range from 0.28 to 0.43 (MACTEC, 2008). In any case, the trends are virtually identical with the field results (SASW and crosshole) showing that a depth of about 15 to 20 feet is required to achieve a V_s of 1,000 fps versus 25 feet for the laboratory data (both COL and preliminary Test Pad data). Thus, if the backfill material can be controlled within the gradation ranges specified, and compacted to a minimum unit weight, or level of compaction, then a consistent relationship exists between V_s and confining pressure (or depth) for the onsite granular materials from the Barnwell Formation, with minimum variability. Note the Phase I Test Pad data are preliminary. Once the data becomes final, the results presented herein will be confirmed and reported in ESP Revision 4 currently scheduled for submittal March 31, 2008.

Based on these results, the backfill materials should be placed at a minimum of 95% of ASTM D1557 and should be within the gradation envelope shown on Figure 3. The soils should be non-plastic below the foundation of the NI.

Figure 3. Grain Size Distribution



In order to ensure that the V_s versus depth relationship shown in Figure 2 remains appropriate throughout the construction process, the key parameter (given the specified backfill material) to control is the construction placement procedure. Appropriate checks should be in-place to monitor the material, lift thickness, equipment variables, and number of equipment passes. As discussed previously, specific procedures will be developed from the Phase II Test Pad results. Given this, conventional quality control testing in the form of density and index property testing will be for verification purposes only, and thus the frequency of testing can be reduced.

Nevertheless, it is suggested that the frequency of QC testing be higher at the beginning of backfill placement (corresponds with fill placed under the NI). A suggested frequency is a minimum of one field density and index property test per lift/shift/day, but no less than one test per 500 cubic yards of fill placed. Based on actual results, this requirement can be revised as fill placement proceeds and as more confidence is gained during placement. However the frequency should not be less than the requirements of NQA-1-2004, Section 506.

With these controls on the backfill material gradation, compactive effort, and construction procedures, the shear wave velocity within the compacted backfill is predictable and, as long as the backfill material and placement procedures are controlled, will be consistent throughout the backfill soil. Within the backfill soils, the minimum V_s value of 1,000 fps will be achieved at depths of no more than 25 feet.

Conclusions

The results, summarized herein demonstrate that with proper controls on the backfill gradation and compaction, a homogeneous fill will result, with a minimum shear wave velocity that meets the requirement of the DCD at the foundation level of the nuclear island. Thus, based on the testing performed to date (Phase I Test Pad Program), shear wave velocity testing during production fill is not deemed necessary.

References

1. Darendeli, M.B., (2001). "Development of a New Family of Normalized Modulus Reduction and Material Damping Curves." PhD Thesis, University of Texas at Austin, August 2001.
2. MACTEC, (2006). "Report of Soil and Groundwater Sampling and Laboratory Testing,", Southern Advanced Light Water Reactor, Early Site Permit, MACTEC, Atlanta, GA, June 2006.
3. MACTEC Appendix G, (2008). "Geotechnical Data Report, Attachment G – Resonant Column Torsional Shear (RCTS) Test Results, Vogtle Units 3 & 4 COL Project, Burke County, Georgia.
4. MACTEC, 2008. "Draft Data Report, Vogtle Units 3 & 4 Engineered Fill Below Grade Test Pad Phase1," MACTEC, Atlanta, GA, February 8, 2008.
5. Menq, F.Y., (2003). "Dynamic Properties of Sandy and Gravelly Soils." PhD Thesis, University of Texas at Austin, May 2003.

Southern Nuclear Operating Company

AR-08-0045

Enclosure 2

Response to January 11, 2008 RAI Letter No. 10

for the

Vogtle ESP Application Involving LWA

SSAR Section 2.5.4 Stability of Subsurface Materials and Foundations

2.5.4-19 The staff's review of Southern Nuclear Operating Company's (SNC) response to Request for Additional Information (RAI) 1.1-1 identified the following four issues. SNC is requested to provide additional information to address these four issues.

(1) An issue discussed at the meeting during the limited work authorization-2 (LWA-2) site visit conducted on September 5 and 6, 2007, is how the impact of: compaction equipment size, number of passes, lift thickness, etc. on the uniformity of compaction and soil wave velocity achieved are to be determined. During the second LWA-2 site visit (December 10 and 11, 2007), the staff found that SNC is currently conducting a test bed program that considers several factors (number of passes, lift thickness, use of a single compactor, etc.) to determine the state of compaction of the production fill. Through the discussion during the second LWA-2 site visit, the staff found that SNC may adopt a Phase II compaction program, modified from Phase I of the test bed program, and revise the compaction procedures determined from Phase II of the test compaction program. SNC should provide information on how these modified procedures are to be developed and also indicate if a section of the mechanically-stabilized earth (MSE) wall is to be included in the Phase II program. If so, SNC should provide information on how the planned compaction is to be accomplished in and around the test wall section. SNC should confirm that the compaction procedures developed at the end of the Phase II program will be used during the placement of the production fill. In addition, SNC should provide information on how soil wave velocity testing is to be accomplished during the placement of the production fill in and around the final nuclear island configuration.

Response:

As described in Vogtle 3 & 4 Structural Backfill Evaluation (Enclosure 1) the Phase II test pad program will focus on establishing specific placement procedures and equipment, and will be combined with the Phase I results to develop the backfill construction specifications and procedures, including the frequency and type of quality control testing. Equipment and passes will be optimized consistent with the Phase I testing results, including small compaction equipment that will be used adjacent to the MSE wall. An acceptable compaction methodology will be developed during Phase II using a section of the MSE wall that will be used in construction.

Based on the testing performed to date (COL laboratory testing program and Phase I Test Pad Program), shear wave velocity testing during production fill placement is not deemed to be necessary. The results of the Test Pad Program (summarized in Vogtle 3 & 4 Structural Backfill Evaluation (Enclosure 1)) demonstrate that with proper controls on the backfill gradation and compaction, a homogeneous fill will result, with a minimum shear wave velocity that meets the AP-1000 DCD criteria at the foundation level of the nuclear island.

(2) The second paragraph of the response states that "the construction of the MSE wall begins with installation of a concrete footer, and ... the size and reinforcement of the concrete footer will be as required by the designer of the MSE wall." A description of the design details of the concrete footer (e.g., concrete mix design, reinforcing steel sizes) should be provided in the response for staff review of its design adequacy.

Response:

The MSE wall system is an internally stabilized system. Soil reinforcing elements are installed within and extend beyond the reinforced backfill volume behind the wall. MSE panels, besides acting as forms for pouring NI structures, prevent local raveling and provide an architectural finish for the application of waterproofing membrane that is required per the Design Certification Document. In order to provide a stable, level work surface for the erection of the MSE panels, a thin plain concrete leveling pad will be constructed. This leveling structure can be identified as either a footer or leveling pad of the MSE wall. The MSE wall and its leveling pad and soil reinforcing elements will be designed as a combined system. The designs of MSE wall typically consider that the horizontal soil reinforcements at or most near the leveling pad have full effective pullout length and that the leveling pad takes insignificant or no tension force when lateral pressure is exerted on the wall system.

The 28-day concrete strength for the cast-in-place leveling pad will be specified at 2,500 psi or above. The dead-load pressure to be exerted by the wall (estimated at less than 40 psi) will be insignificant when compared with this specified compressive strength of concrete. It is expected that no reinforcing steel will be required for the leveling pad, as the pad will eventually be confined by its neighboring elements, and concrete shrinkage will be negligible. Concrete mix that can achieve the strength specified for the leveling pad will be designed in accordance with the governing ACI code (ACI-318). Typical profile dimensions of the leveling pad will be approximately 12 inches wide and 6 inches deep. The concrete leveling pad will have approximately the same horizontal length as that of the MSE wall. The leveling-pad concrete will be allowed to adequately cure before beginning MSE panel erection.

(3) In its response, SNC stated that when the lower mud mat slab has reached the specified strength, a layer of waterproof membrane will be applied to the entire top of the slab, and extended vertically up the face of the MSE wall surface. During a conference call on November 14, 2007, Westinghouse stated that in order to develop a friction coefficient of 0.7 between the mudmat and the waterproofing membrane, spikes are to be provided on both sides of the waterproofing membrane by the manufacturer. SNC should explain how the spikes can be anchored into the lower mudmat after the mudmat concrete is hardened and reaches its specified strength. SNC should provide details to explain how the waterproofing material is to be connected to both the top and bottom mudmats.

Response:

The DCD describes two functions for the waterproof membrane. The membrane's primary purpose is to prevent ground water intrusion through the Nuclear Island walls and basemat. The standard plant assumes a water table beginning at two feet below grade. The water table at Vogtle is expected to remain roughly 20 feet below the foundation elevation and thus is not expected to contact the waterproof membrane. The DCD currently provides an ITAAC for the installation of the water barrier in Table 3.3-6, Item 5.a).

The second function of the waterproof membrane is to transmit any horizontal seismic loads between the upper and lower mudmats without allowing sliding to occur. Note that this function only applies to the

horizontal portion of the mudmat beneath the Nuclear Island. The DCD assumes a coefficient of friction on both sides of the membrane of 0.7, and applies this value to both rock and soil sites.

Subsequent to the previous waterproofing RAI response, additional research by Westinghouse and Shaw, Stone, and Webster has identified that a spray-on membrane offers improved constructability and SNC is electing to pursue this option. However, the final solution for the selected waterproof system has not been finalized. Since the possibility of other acceptable options exists, SNC proposes to submit an ITAAC that confirms through testing that the selected waterproof system meets the required DCD design specifications. No testing has been performed to qualify any waterproof system at this time therefore detailed installation requirements cannot be provided at this time. SNC proposes the following ITAAC:

Table 1, Waterproof ITAAC

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
The sliding resistance is based on the friction force developed between the basemat and the foundation.	Testing will be performed to confirm that the mudmat – waterproofing – mudmat interface beneath the Nuclear Island basemat has a minimum coefficient of friction of 0.7	A report exists and documents that the as-built waterproof system (mudmat – waterproofing – mudmat interface) has a minimum coefficient of friction of 0.7 as demonstrated through material qualification testing.

SNC is currently studying various waterproofing-membrane options, including a spray-applied elastomeric waterproofing membrane system. In order to provide the NRC with an understanding of how a spray-on waterproof membrane is installed, the following information representing a typical installation process

In contrast to a hardened high-density polyethylene membrane with micro-spikes, elastomeric membranes are liquid applied, urethane prepolymer-based coatings that cure by reaction with atmospheric moisture to produce a continuous film, which is both rubbery and elastic. These high viscosity liquids can be spray applied using airless spray equipment to properly prepared concrete and other stable, solid substrates. Like paints, these membranes can be applied in layers. The thickness for each dry film of the elastomeric membrane that is under consideration is typically between 40 to 60 mils. In a layered application, the first coat will be applied to the top surface of hardened mudmat concrete (lower mudmat). The primary coat of waterproofing film will be allowed to cure to a sufficient degree before the re-coat of another layer. The re-coat of waterproofing membrane will be performed in layers until the specified total thickness (from 80 to 120 mils) is achieved. Mudmat concrete (upper mudmat) will be poured onto the top surface of the top layer of cured waterproofing membrane.

The static coefficient of friction between spray-applied membrane and concrete is influenced by many factors including temperature, humidity, and contamination between the surfaces of the membrane and the concrete. SNC will initiate a waterproofing membrane qualification program under simulated field conditions to address, at a minimum, the following:

1. Physical properties including surface and texture of membrane,
2. Surface finish requirements for the lower mudmat,
3. Primer, geo-textile, or aggregate scatter required, and
4. Installation procedures necessary to achieve the 0.7 coefficient of friction that is required per the Design Certification Document.

A technical report will document key results of the qualification program including performance data and recommendations on membrane materials, installation procedure, and inspection procedure.

(4) SNC should provide details to explain how the waterproofing membrane (with spikes on both sides) is to be placed against the vertical MSE wall, and how the connection is to be made between the vertical and horizontal sections.

Response:

The selected waterproof system installation methodology will be established as part of the waterproofing membrane qualification program discussed in item (3) above and will be developed by the manufacturer. The selected waterproofing membrane will be applied to both the top surface of mudmat concrete (lower mudmat) and the vertical surface of the MSE wall concrete panel.

In order to provide the NRC with an understanding of how a spray-on waterproof membrane is installed, the following information representing a typical installation process.

If a spray-applied elastomeric waterproofing membrane system is selected the application method will be established through waterproofing membrane qualification program to meet design specifications. Similar to paints, high viscosity liquid waterproofing membranes can be brush or spray applied using airless spray equipment to properly prepared concrete and other stable, solid substrates. With proper coat application and after the top coat is sufficiently cured, proper connection between the vertical and horizontal sections of the waterproofing membrane is expected. A small transition will be provided, as needed, at the junction between the lower-mat concrete and the MSE wall to facilitate smooth transition between horizontal and vertical membrane sections.

Based on initial testing results, a geo-textile may be incorporated to assist in smoothing the transition areas and the face of the MSE wall where small panel gaps may be present. It should be noted that the cured membrane has a degree of flexibility, which allows it to accommodate thermal expansion. Films in the membrane will be color-coded. Post installation testing will determine the continuity of surface and validation of required coating thickness through a combination of visual inspection of film and dielectric testing during and following application.

2.5.4-20 The response to RAI 2.5.4-1 indicates that only 42 borings have penetrated the Blue Bluff Marl (BBM) extending into the Lower Sands and therefore these are the only borings that satisfy the site foundation criteria provided in Regulatory Guides (RG) 1.132 and 1.138, including the boring depth acceptance criteria. SNC is requested to provide additional information to demonstrate how these RG criteria are satisfied. In addition, the statement, "six of the 70 borings penetrated into the underlying Lower Sands (LS) accounting for 611 linear feet of drilling in this stratum," in Page 6 of 32 of the response indicates that only 6 of the borings penetrated the LS. SNC should clarify this inconsistency.

Response:

Regulatory Basis

RG 1.132, Site Investigations for Foundations of Nuclear Power Plants (Ref. 4), describes methods acceptable to the NRC staff for conducting field investigations for determining the geological, engineering and hydrogeological characteristics of a prospective plant site.

In Part B, Discussion, the first part of the third paragraph says, "The aim of site investigation is to gain an understanding of the 3-dimensional distribution of geological features (rocks, soils, extent of weathering, fractures, etc.) at the site, and to obtain the soil and rock properties that are needed for designing foundations for a nuclear plant and associated critical structures. The density of data gathered varies over

a plant site according to the variability of the soils and rocks and the importance assigned to structures planned for a particular location."

In Part C, Regulatory Position, General, the second paragraph says, "Site investigations for nuclear power plants should be adequate, in terms of thoroughness, suitability of the methods used, quality of execution of the work, and documentation, to permit an accurate determination of the geologic and geotechnical conditions that affect the design, performance and safety of the plant. The investigations should provide information needed to assess foundation conditions at the site and to perform engineering analysis and design with reasonable assurance that foundation conditions have been realistically estimated." In the first paragraph of the section, the guide notes, "Because details of an actual site investigation program will be site dependent, such a program should be tailored to the specific conditions of the site using sound professional judgment. The program should be flexible and adjusted as the site investigation proceeds, with the advice of personnel experienced in site investigations."

RG 1.132 provides guidance on spacing and depth of borings, sampling procedures, in situ testing, geophysical investigations, etc. This guidance will be referenced in subsequent paragraphs.

RG 1.138, Laboratory Investigations of Soils and Rocks for Engineering Analysis and Design of Nuclear Power Plants, describes laboratory investigations and testing practices acceptable to the NRC for determining soil and rock properties and characteristics needed for engineering analysis and design for foundations and earthworks for nuclear power plants. The guide describes laboratory equipment (including calibration), handling and storage of samples, and selection and preparation of test specimens. It describes testing procedures for determining static and dynamic soil properties, and testing procedures for determining engineering properties of rock.

Site Layout

The site layout for Units 3 and 4 is complex. Currently, an excavation down to the Blue Bluff Marl (about 90 feet below grade) will be made for each unit. The excavation will be backfilled with compacted backfill. This excavation is necessary to remove the upper sands within the power block footprint. The upper sands were determined to be susceptible to liquefaction. Within the excavation, the Nuclear Island (NI) will be founded at a depth of approximately 40 feet below grade. According to the AP1000 DCD, the seismic Category 1 structures are limited to the NI. The NI includes the containment building and the surrounding auxiliary building. The containment building has a circular footprint (145 feet diameter). The auxiliary building has a rectangular footprint (91 ft on the south end and 116.5 ft on the north end x 256 ft long) surrounding about 206 degrees of the containment building. The combined footprint of these structures is approximately 32,400 square feet. This footprint constitutes a very small portion (about 1/9) of the overall power block excavation footprint for each unit.

Subsurface Investigation

The subsurface investigation program was conducted in three phases. The first phase consisted of reviewing historic documents. The documents included soil boring logs (including borings taken in the footprint of Units 3 and 4) taken during the design and construction of Units 1 and 2; construction records of excavations from Units 1 and 2; and reports of subsurface investigation from nearby sites. These documents were reviewed to gain an understanding of the anticipated subsurface conditions and to aid in developing site specific investigations.

The second phase consisted of conducting a site specific investigation for the ESP application. Fourteen borings were drilled across the site with exploration depths ranging from 90 feet to over 1,300 feet; geophysical measurements were made; and laboratory testing was conducted as described in Section 2.5.4.3.2 of the ESP application.

The third phase consisted of conducting a comprehensive site specific investigation for the COL application. This program was conducted to develop subsurface data at specific proposed structure locations for Units 3 and 4. As described in Section 2.5.4.3.3 of the ESP application, the investigation included 174 borings drilled across the site with exploration depths ranging from 21.5 feet to 420 feet and included cone penetrometer testing, geophysical measurements, test pits, and laboratory testing.

Spacing

For safety-related buildings, RG 1.132, Appendix C states, "Principal borings: at least one boring beneath every safety-related structure. For larger, heavier structures, such as the containment and auxiliary buildings, at least one boring per 10,000 feet^2 (100 feet spacing). In addition, a number of borings along the periphery, at corners, and other selected locations."

In keeping with RG 1.132 guidelines, the borings for the Vogtle COL are located beneath and adjacent to structures to provide the maximum aerial coverage. This generally results in a boring at the center of the safety-related structures, and uniformly spaced borings inside and relatively close to the perimeter of the other power block structures. Additional borings are placed within the power block excavation footprint to provide additional coverage. Table 1 below gives a summary of the borings taken in the power block for each unit for the COL investigation.

Table 1, Summary of COL Power Block Borings

Structure	**Unit 3**	**Unit 4**
Nuclear Island	6	6
Rad Waste Building	2	2
Annex Building	4	4
Turbine Building	6	4
Others (toe and slope of excavations)	12	9
Periphery of Excavation	3	10
Offset Borings (shallow)	1	1
Total No. of Borings	34	36

Notes:
1. Some borings were taken on the common line for 2 foundations and these data will be used to evaluate both structures.
2. The tabulated borings constitute the 70 borings used to characterize subsurface conditions within the power block footprint.

Depth

For structures on soil, RG 1.132 Appendix C states, "Where soils are very thick, the maximum required depth for engineering purposes, denoted dmax, may be taken as the depth at which the change in the vertical stress during or after construction for the combined foundation loading is less than 10% of the effective in situ overburden stress."

Nuclear Island Base Mat

The foundation that will have the largest dmax is the NI base mat. The AP1000 DCD requires a design bearing pressure under the NI of 8.6 ksf. The NI base mat contact area is approximately 32,400 square feet and a resulting dmax on the order of 270 feet. Three borings at each unit were drilled to a depth of at least 250 feet. At Unit 3 one boring was drilled to a depth of 420 feet and at Unit 4, one boring was drilled to a depth of 400 feet.

Other Power Block Structures

The other structures located in the power block are founded nominally at the surface. The exploration depth of borings taken for these structures was generally 150 feet. As stated in RAI 2.5.4-1, 70 borings were taken in the immediate vicinity of the combined excavation footprint for Units 3 and 4.

Density of Borings

Based on 6 borings taken for each NI and a foundation area of 32,400 square feet, the density of borings for the Category 1 structure is one boring per 5,400 square feet, exceeding the guideline of one boring per 10,000 square feet in RG 1.132.

Thirty borings and 25 borings were taken within the power block excavation footprint for Units 3 and 4, respectively. The toe footprint (at the bottom of the excavation) for each excavation will be approximately 347 feet x 812 feet, i.e., about 281,764 square feet for each unit. Therefore, the boring coverage in these excavations equates to one boring per 9,390 square feet for Unit 3 and one boring per 11,270 square feet for Unit 4.

Laboratory Testing

A laboratory testing program was conducted in accordance with RG 1.138 to determine "soil and rock properties and characteristics needed for engineering analysis and design for foundations and earthworks for nuclear power plants". A variety of tests to characterize the engineering properties were conducted on selected, representative samples from each of the strata encountered beneath the power block footprint. RG 1.138 does not provide guidance about the number of laboratory tests that should be performed. This is most likely because the numbers and types of laboratory tests depend on various factors, including (1) the location of the boring with respect to significant structures, (2) the depth of the sample (it may be within a zone of excavation), (3) the type of sample material (cohesive, cohesionless, soil or rock), and (4) the type of sample (undisturbed or disturbed). Tests conducted include a variety of conventional geotechnical tests (index and engineering properties) as well as dynamic soil tests (RCTS) so that the properties of the site soils are sufficiently characterized for purposes of evaluating the stability of the site for the planned construction. A summary of the number of tests conducted within the power block excavation footprint is provided in Table 2.5.4-3a of the ESP application.

Lower Sands Borings Penetrations

This inconsistency is due to a typographical error.

The statement should read:

"Forty-two of the 70 borings penetrated into the underlying Lower Sands (LS), accounting for a total of 976 linear feet of drilling in this stratum."

Six (NI borings) of the 70 borings penetrated the Still Branch Formation (as cited on page 3 of 32 of the original response) and accounted for 863 linear feet of the total 976 linear feet.

2.5.4-21 From its review of the response to RAI 2.5.4-2, the staff requests SNC to provide a clarification of how the formulae provided in the response were used to obtain corrected standard penetration test (SPT) blow counts.

Response:

All of the SPT measurements for the COL subsurface investigation were made using an automatic hammer. The efficiency of each automatic hammer was measured during the COL subsurface investigation. Each measured N-value was energy-corrected to 60% efficiency (N60) based on the efficiency of the automatic hammer with which the N-value was taken. The figure included in the response to RAI 2.5.4-2 provides an illustration of the distribution of N60 with elevation (within the power block excavation footprint). The maximum value of N60 was capped at 100 bpf.

The formula included as a note to the figure was provided as an explanation of how the measured N-values were interpreted in cases where full penetration of the 18-inch sampler was not achieved due to the presence of very dense or very hard material. These occurrences were primarily encountered within the Blue Bluff Marl. Where full penetration was not achieved (e.g. 32-50-50/1" or 12-50/3"), a maximum value of 100 bpf was established as "refusal". "Refusal" was taken as less than 6 inches of penetration of the sample. When the sampler penetrated more than 6 inches (1st increment) but less than 18 inches, the measured N value was determined by adding the blows for the 2nd 6 inch increment to the number of blows for the 3rd 6 inch increment where either of these increments are extrapolated up to the limiting value of 100 bpf if full penetration was not reached.

While this approach of interpreting high measured N-values is very conservative, it is not intuitive and is somewhat confusing. Therefore, to clarify this issue, where full penetration of the spilt-barrel sample was not achieved due to very hard or very dense material, the measured SPT N-values are being recomputed using a simpler, more intuitive approach. This approach will retain a limiting value of 100 bpf where penetration of the 1st six inch increment is not achieved. When penetration ranges from 6+ inches to less than 18 inches, the measured N-value will be determined by linearly extrapolating the N-value based on the penetration rate at the time the N-value was recorded. This value may exceed 100 bpf, but for calculation purposes the value will be capped at 100 bpf. The measured N-values will be corrected to 60% efficiency with a limiting value of 100 bpf. This recomputation will not impact the majority of the measured N-values where full penetration of the split barrel sampler was achieved. Where full penetration was not achieved because of the harness or high relative density of the soil, the majority of computed N-values will be at the capped value of 100 bpf. The data will be recomputed and replotted and will be included in ESPA Revision 4, currently scheduled for March 31, 2008.

2.5.4-22 The last sentence of the third paragraph of the response to RAI 2.5.4-3 states that resonance-column torsional-shear (RCTS) test samples were transported to Fugro's Houston laboratory by automobile using approved transportation procedures. SNC is requested to provide a description of the approved transportation procedures and also describe which sources the procedures are derived from.

Response:

See attached MACTEC procedure.

Work Instruction for Transporting UD Samples
2/23/07
VOGTLE COL Project
MACTEC Engineering and Consulting, Inc.

Issued To: Dan Tibbals
Location: Atlanta Laboratory Date: February 23, 2007
Issued By: Allen Lancaster, Project Manager MACTEC Project No.: 6141-06-0286
Valid Thru: 2/23/07 To 2/28/08 Rev. No. 0

Task Description: Transport selected UD samples from MACTEC Atlanta laboratory to Fugro Laboratories in Houston, Texas for Resonant Column/Torsional Shear Testing at a later date. Samples shall be transported via enclosed vehicle under an unbroken chain of custody.

Applicable Technical Procedures or Plans, or other reference: ASTM D4220-00, Standard Practices for Preserving and Transporting Soil Samples.

Specific Instructions: Handle each UD tube carefully, and keep it vertical during the operations covered by this WI. Secure UD samples within the vehicle and prevent samples from experiencing high temperature, shock, or vibration throughout the transport process. Confirm that all samples are labeled properly and that the samples designated for transport are those identified on the chain of custody record. The purpose is to preserve the inherent sample condition during transport.

Special Instructions: Deliver Samples to: Fugro Consultants LP
6100 Hillcroft
Houston Texas, 77081
Attention: Mr. Bill DeGroff, P. E.
Phone (713) 369-5420, e-mail: bdegroff@fugro.com

Report Format: Prepare sample transportation report with attached digital photographs that document transport type, packing method and materials, and any events that may result in altering the sample condition with a copy of the relinquished test assignment sheet/chain of custody record.

Specific Quality Assurance Procedures Applicable: None

Hold Points or Witness Points: Verify samples prepared for transport are clearly labeled, match the test assignment sheet/chain of custody record, and are sufficiently secured inside the vehicle prior to departing.

Records: All records generated shall be considered QA Records.

Reviewed and Approved By: (*Note: Only one signature is required to issue*)
Project Manager (MACTEC): Date: 2/23/07
Project Principal (MACTEC): Date:
Site Coordinator Date:

No. of Pages: 14 = 1+1 Attached Chain of Custody + GeGroot Card + 11, ASTM 4220-00
B-3001, 3002, 3003, 4001, 4003
Total 12 tubes, 3 transportation boxes. DCN VGCOL-37

Trip Highlights:

2.5.4-23 The staff found that the response to RAI 2.5.4-4 did not address the concern regarding "the effect of the two-dimensional wave velocity configuration of the excavated zone on site response and soil-structure interaction (SSI) effects." Additional information should be provided to justify why the effect of the two-dimensional wave velocity consideration was not considered in the SSI analysis.

Response:

This response provides additional information regarding the adequacy of the site specific GMRS and FIRS computations, as well as site-specific SSI results of the NI, for which the lateral extent of the engineered back fill was assumed to extend to infinity.

To provide the information requested, it is currently planned to perform a 2D site response and SSI analysis to evaluate the effect of the extent of backfill on the site response and on the SSI response of the NI. The plant layout is shown in Figure 2.5.4-23-1. For the 2D analysis, the cross section in the East-West direction shown in Figure 2.5.4-23-2 will be used. A plane of symmetry in between the two units will be considered in the analysis so that the extents of backfill for both units are represented in the analysis. The analysis consists of two parts.

In Part I, a 2D site response analysis will be performed. The 2D SASSI model of the site is based on the section in Figure 2.5.4-23-2 that represents a "bathtub" model of the site with backfill modeled with plane strain elements. The backfill is modeled up to plant grade without the NI. The in-situ upper sand layers will be modeled using the site-specific dynamic properties measured at the site. The properties of the backfill, blue bluff marl, the lower sand layers and layers extending to the rock at the base would be the same as those used in the site response analysis to develop GMRS and FIRS. However, since computation of GMRS and FIRS were based a wide range of soil columns and input motions (60 randomized profiles, 30 time histories for HF and 30 time histories for LF rock motion), only a representative subset of the soil properties and input motion will be considered. The subset is considered to be adequate to evaluate any potential effect of the geometry of backfill on the ground motion. The results of the 2D site response analysis will be compared with the 1D SHAKE results for the same set of input motion and soil properties and the differences in response will be presented and discussed.

In Part II, an SSI model of the NI will be developed that models the backfill as part of the structural model similar to the section shown in Figure 2.5.4-23-2. The strain-compatible soil properties for the in-situ upper sand layer will be used as part of the site profile model in the 2D SASSI model. The analysis in Part II will be limited to the mean soil profile and for a limited number of time histories. The SSI responses at key locations in NI will be compared with the SSI results of NI that assumes backfill extends to infinity in lateral directions using mean soil profile and appropriate time histories. The effects on the structural responses will be demonstrated and discussed.

The results and assessment of the backfill geometry on ground motion and SSI responses will be provided in ESPA Revision 4, currently scheduled for March 31, 2008.

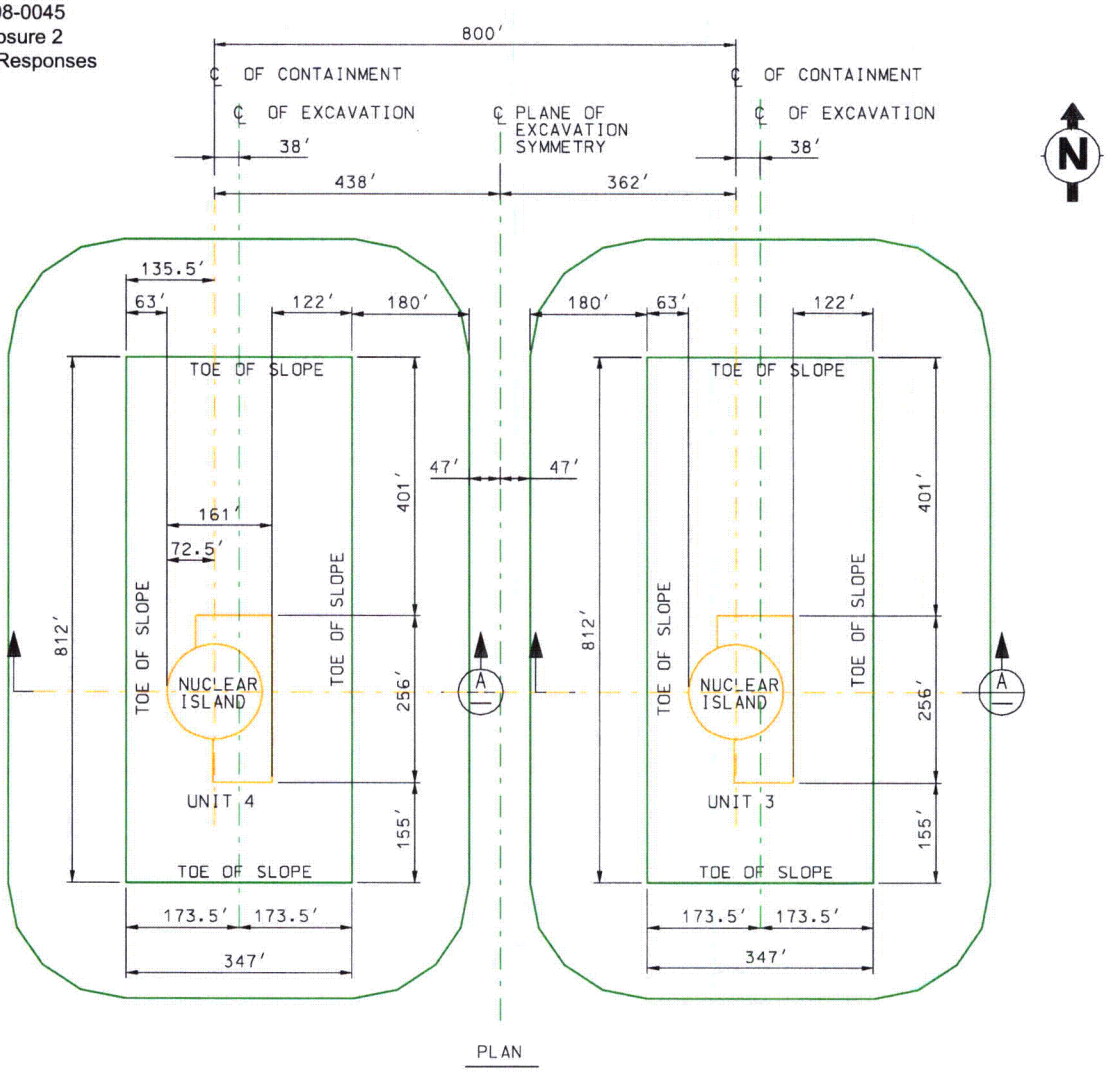


FIGURE 2.5.4-23-1 PLANT LAYOUT

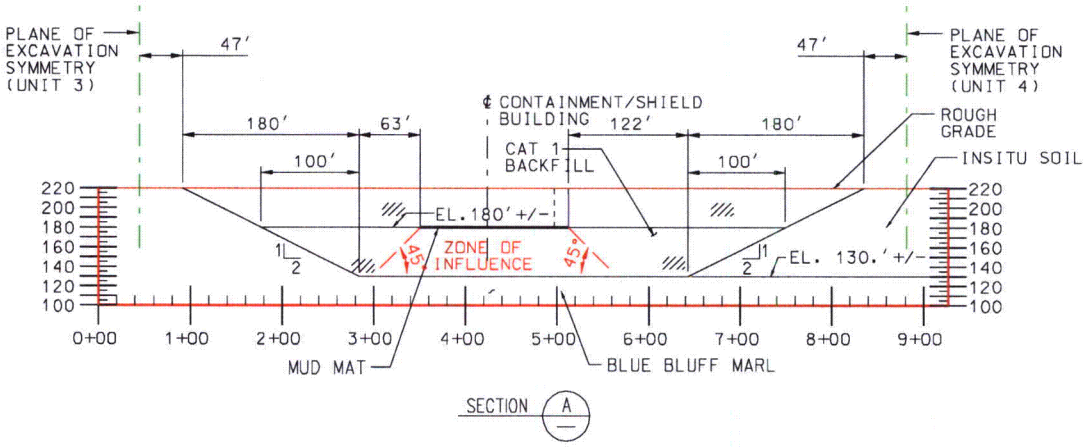


FIGURE 2.5.4-23-2 CROSS SECTION A

2.5.4-24 The staff's review of the response to RAI 2.5.4-6 identified the following concerns:

(1) SNC's response addressed only static bearing capacity evaluations for failure conditions and did NOT consider settlement considerations, which normally control the allowable pressures under large rigid basemats. In addition, the response did not address dynamic effects, which are the overwhelming effects on the computed toe pressures. Additional information is needed.

Response:

SNC is currently evaluating the static and dynamic bearing capacity, including localized punching failure, of backfill materials for purposes of supporting the Nuclear Island. This effort includes assessing the backfill material properties from the recent Phase I Test Pad Program. The static bearing capacity will be evaluated using conventional analyses (i.e. Terzaghi's bearing capacity equation) assuming a safety factor of 3. The dynamic bearing capacity will be evaluated in a similar manner using a safety factor of 2. Localized punching failure will be evaluated assuming an edge width on the order of 10 to 20 feet and a safety factor of 2. The settlement characteristics of the site are also presently being evaluated along with site specific dynamic toe pressures demands. The results of these analyses will be provided in the ESPA Revision 4, currently scheduled for March 31, 2008.

2.5.4-25 During the second site visit (December 10-11, 2007), the staff observed the Phase I Test Fill program and conducted a discussion with SNC staff regarding the application of this program to the production backfill. According to the SNC staff, the controlling values of the program (compaction equipment, number of passes, lift thicknesses, soil water content) were preliminarily selected and these values will be finalized during the Phase II program. One of these values that the staff is concerned with is the acceptable range of sizes of the backfill material, because the grain size of the backfill material may have a significant impact on the shear wave velocity, soil nonlinear degradation properties and the results of the SSI response calculation. For both the test program and production backfill, SNC is requested to explain how the limitation of 25% fines was selected, how different the fines content can be and still be acceptable for the production backfill, and how an acceptable range of sizes will be defined. [This RAI is from the review of the response to RAIs 2.5.4-7 and 3.8.5-1.]

Response:

Comprehensive studies were conducted for Vogtle Units 1 and 2 that focused on qualifying onsite sands from the Barnwell Formation for use as structural backfill. A significant amount of testing and analysis was devoted to the compressibility of those sands. The resulting backfill requirements were that the sands to be used for Category I structural backfill be sands and silty sands with no more than 25% fines to minimize potential settlement. Units 3 and 4 have adopted those criteria. In addition, an acceptable grain size envelope has been developed based on previous recommendations from Units 1 and 2, and testing performed as part of Units 3 and 4. "Vogtle Units 3 & 4 Structural Backfill Evaluation" (Enclosure 1) Figure 3 provides an acceptable grain size envelop which is shown as "Acceptable Gradation." The results of settlement calculations using the geotechnical properties discussed above will be presented in ESPA Revision 4, currently scheduled for March 31, 2008.

2.5.4-26 In the response to the RAI 2.5.4-9, SNC stated in part that "SNC will revise [early site permit] ESP application Section 2.5.4.3 in revision 3 to conform to the testing frequency recommended by NQA-1-2004, Section 506, In-Process Tests on Compacted fill." Table 506 of this standard recommends a frequency for performing field density tests for mass earthwork as one test for every 2,000 cubic yards of compacted material placed. The response further states in part that "... adopting the ASME ... standard will provide an accepted consistent industry testing frequency not tied to lift thickness ..." This does not appear to be completely correct, since the standard still requires one test per lift as part of the criteria, in addition to the criteria of one test for every 2,000 cubic yards of compacted material placed. SNC is requested to provide further clarification on how this standard would be implemented, since two criteria would need to be tracked under the standard. SNC also should provide justification for using this testing density and how this number will provide assurance of adequate uniformity of shear wave velocity.

Response:

SNC will apply both the 2000 cubic yard criteria as well as the lift criteria listed in Table 506. The structural backfill program of testing and analysis described in "Vogtle 3 and 4 Structural Backfill Evaluation" (Enclosure 1) provides the assurance that the backfill will achieve the required shear wave velocity (1000 fps) at the Nuclear Island foundation. Density testing provides a relevant production indicator, that all the backfill quality controls are providing the expected results.

The recommended frequency (i.e., "testing density") for performing field density tests is the minimum amount of testing that will be performed. This minimum frequency of testing for mass earthwork is consistent with the guidance presented in NRC Inspection Manual, Inspection Procedure 88131, Geotechnical/Foundation Activities, dated 10/25/06, which states:

> *Minimum acceptable test frequencies and other recommended in-process testing controls are listed in Table 5.6 of ASME NQA-1 Subpart 2.5.*

This refers to the 1994 edition of NQA-1. Table 5.6 of that edition is the same as Table 506 in the 2004 edition, which is cited in the RAI.

Early during placement of the production fill, the frequency of field density testing is expected to exceed the minimum frequency until sufficient data are developed to document that the required degree of compaction is consistently being achieved, based on field engineering judgment. The frequency of testing during the early stages is expected to be similar to what has been used successfully at other NRC-licensed facilities that currently are under construction, including the MOX facility at the Savannah River Site and the National Enrichment Facility in New Mexico. At each of these facilities, the structural fill in mass earthwork operations was tested using a direct method (i.e., sand-cone or rubber-balloon methods) at a frequency of one test per 500 cubic yards (CY) or one test per lift, whichever was more frequent. That frequency is a little higher than the frequency of testing that was used at Vogtle Units 1 & 2 (one test per 20,000 ft2/ft, which is one test per ~740 CY). The earthwork specifications for both of these projects permitted nuclear methods to be used as a substitute for some of the sand-cone tests if an adequate correlation was documented between the results of the nuclear testing and the direct methods, but a higher frequency of in-place testing was required. For large fills, those specifications required six nuclear tests per lift for areas between 20,000 and 60,000 ft2, four tests per lift for areas between 10,000 and 20,000 ft2, and three tests per lift for smaller areas. See the attached document "Structural Backfill – Vogtle Units 3 & 4" that describes the suggested frequency for QA testing using a direct method for field density testing.

2.5.4-27 In the response to RAI 2.5.4-10, SNC states in part that "Sufficient borrow material ... has been identified and no additional investigations and testing is necessary." The response further states that "These materials (identified) were classified ... as silty sands (SM), poorly graded sands (SP), and lesser amounts of clayey sands (SC)." The response further describes testing of various material properties and borrow sources, but does not include figures or survey results to justify that sufficient material exists. It is also unclear in the response whether all or just part of the stockpiled material is suitable material. SNC is requested to provide further clarification and justification of the quantity of suitable material in the switchyard area stockpiles. Further, SNC states that approximately 30% of the excavated material from the power block will be salvageable for reuse as structural backfill. However, SNC should provide a description of how the 30% value was determined so the staff can evaluate whether sufficient borrow material exists.

Response:

A total of approximately 3,600,000 cubic yards of material is required for backfilling of the power block excavation. Based upon the most recent geotechnical investigations and rough grading plans, approximately 2,400,000 cubic yards of backfill will come from the switchyard area and approximately 1,200,000 cubic yards will come from the excavated power block area. An additional 2,000,000 cubic yards of backfill is expected to be available from excess material in the power block excavation and from Borrow Area 4.

Switchyard Area: A detailed geotechnical investigation of the switchyard area was performed to confirm the suitability of the material in this area for use as backfill. As discussed in SSAR Section 2.5.4.5.4, the subsurface conditions in this area were explored with 15 SPT borings and five test pits during the COL investigation. Laboratory testing was conducted on representative samples to determine their engineering characteristics and to assess their suitability for use as backfill. These data, along with the backfill criteria as discussed in SSAR Section 2.5.4.5.3, were used to estimate the horizontal and vertical extent of suitable borrow material in the switchyard area.

The field and laboratory test data from the switchyard borrow area borings were compiled onto logs of the borings. This information was used to develop subsurface profiles through the switchyard area as shown on Figures RAI 2.5.4-27-2a and 2b. The material identified as suitable for use as backfill is identified as the Sands 1 Belt on these profiles down to the rough grade excavation surface.

The volume of suitable borrow material was calculated using CADD. The surfaces of the suitable materials were projected from the profiles onto a 3-D plot of the borrow area and the volume of suitable material was determined to be approximately 2,400,000 cubic yards.

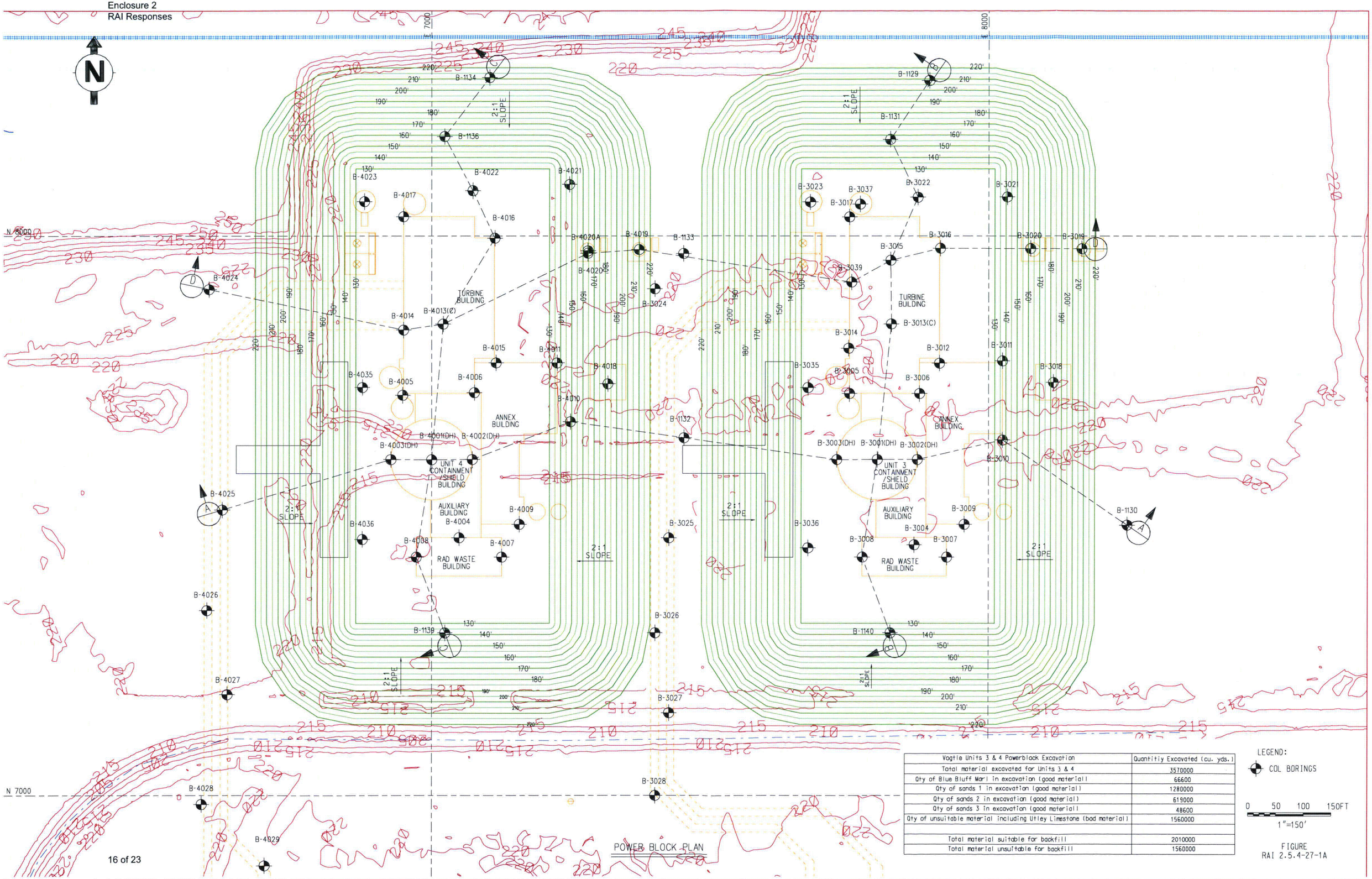
The surfaces of the Sands 1 Belt of suitable borrow material are relatively horizontal (not undulating); therefore, segregation of the suitable material from un-suitable material is not expected to be an issue.

Power Block Area: Field and laboratory data were used to develop subsurface profiles in the power block excavation area. A total of 70 SPT borings in this area were considered, along with borings outside this footprint to add additional data and clarity to interpretation of the subsurface conditions.

Engineering judgment was used to correlate the layers of suitable borrow material identified in the borings for use in developing 3-D CADD surfaces. The Sands 1, Sands 2, and Sands 3 layers constitute suitable borrow material. The total quantity of this borrow material in the excavation calculated using CADD is approximately 2,000,000 cubic yards, see Figures RAI 2.5.4-27-1a, 1b and 1c.

Prior to utilization of the subsurface data from the borings, approximately 30% of excavation materials were judged to be suitable material for backfill. However, analysis of the subsurface data indicated that over 50% of the material was suitable. For estimating purposes, the original conservative estimate of approximately 30% (1,200,000 cubic yards) has been maintained for use as backfill. The remaining 800,000 cubic yards of suitable borrow material will be segregated and stockpiled for potential future use.

Borrow Area 4: As a further contingency, an area known as Borrow Area 4 was previously identified and investigated as described in SSAR Section 2.5.4.5.4. This area is estimated to contain approximately 1,200,000 cubic yards of borrow material.

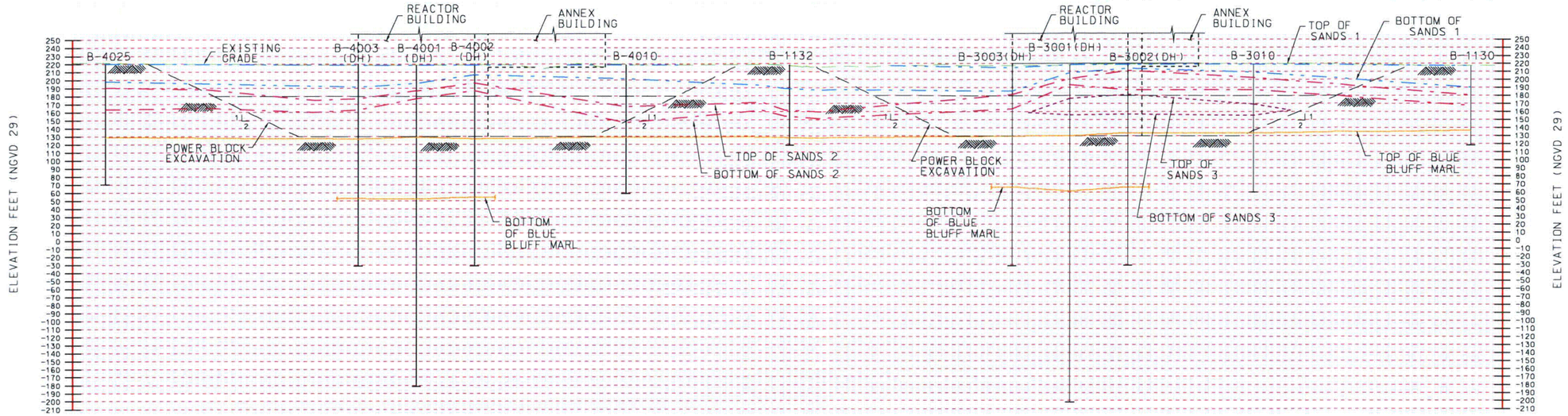


Vogtle Units 3 & 4 Powerblock Excavation	Quantitiy Excavated (cu. yds.)
Total material excavated for Units 3 & 4	3570000
Qty of Blue Bluff Marl in excavation (good material)	66600
Qty of sands 1 in excavation (good material)	1280000
Qty of sands 2 in excavation (good material)	619000
Qty of sands 3 in excavation (good material)	48600
Qty of unsuitable material including Utley Limestone (bad material)	1560000
Total material suitable for backfill	2010000
Total material unsuitable for backfill	1560000

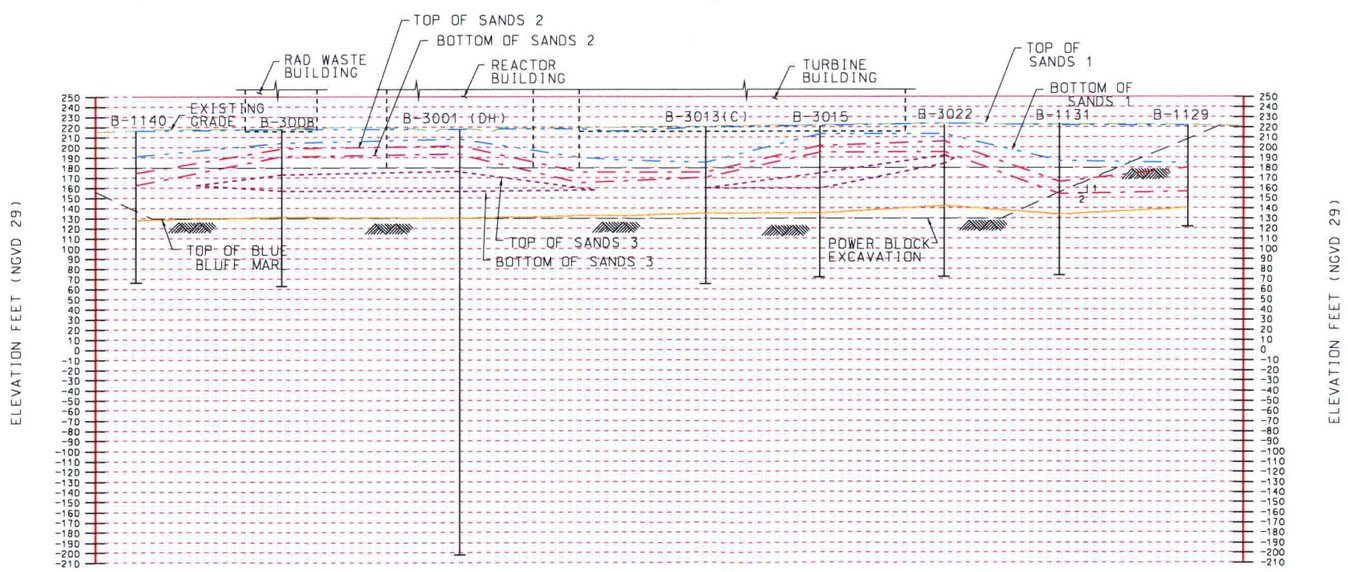
LEGEND:
COL BORINGS

0 50 100 150FT
1"=150'

FIGURE
RAI 2.5.4-27-1A



SECTION A



SECTION B

LEGEND

SANDS 1 BELT

SANDS 2 BELT

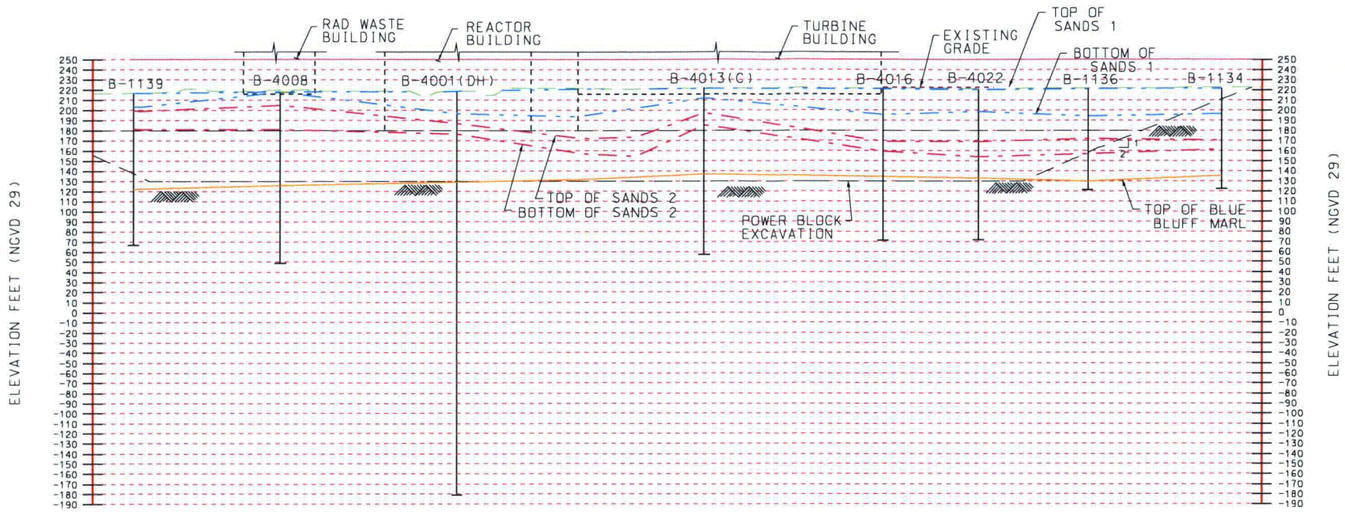
SANDS 3 BELT

0 50 100 150FT

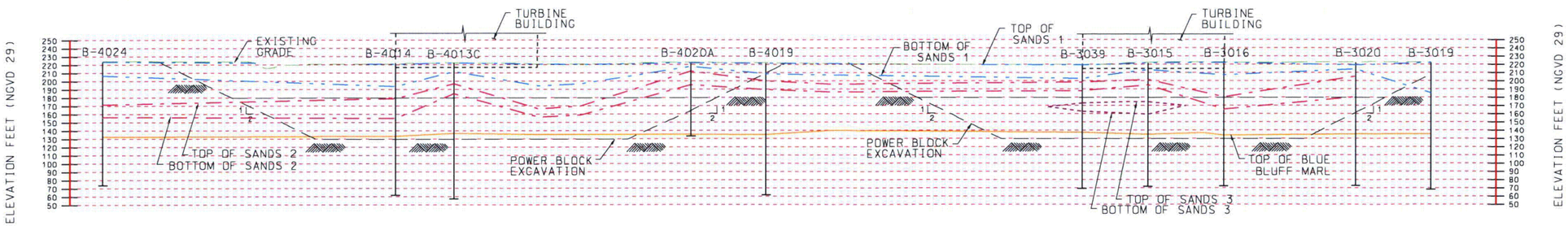
1"=150'

POWER BLOCK PROFILES

FIGURE
RAI 2.5.4-27-1B



SECTION C



SECTION D

LEGEND

SANDS 1 BELT

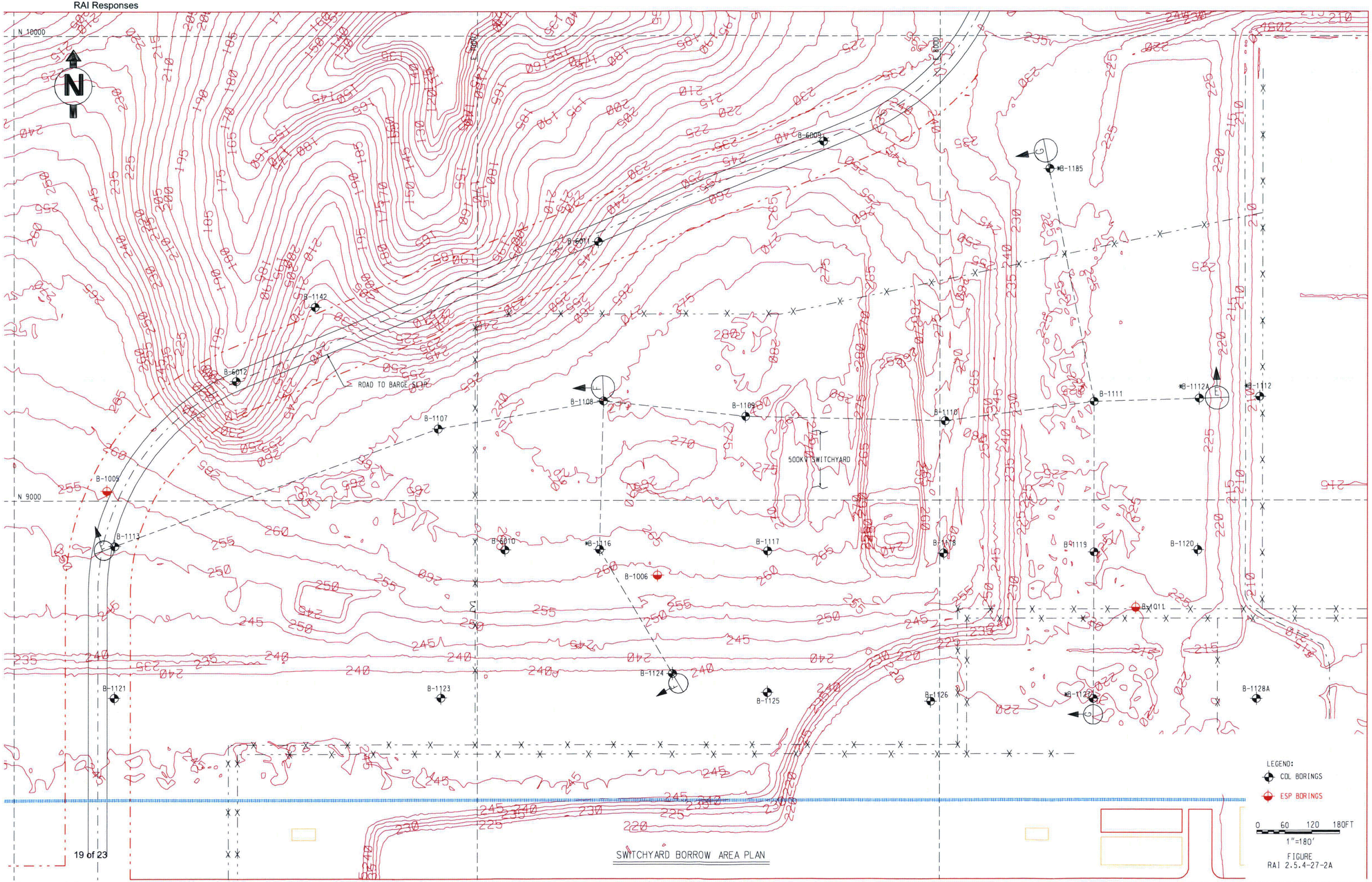
SANDS 2 BELT

SANDS 3 BELT

0 50 100 150FT
1"=150'

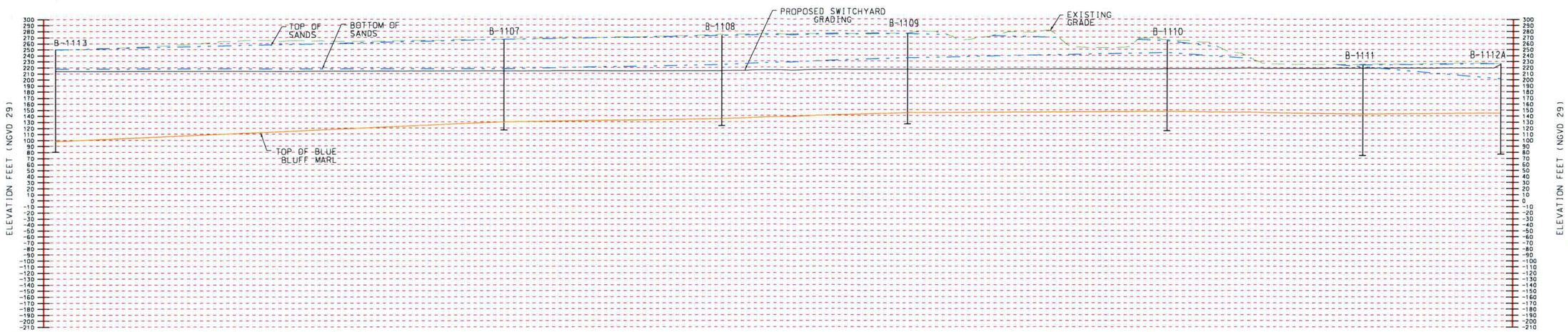
POWER BLOCK PROFILES

FIGURE
RAI 2.5.4-27-1C

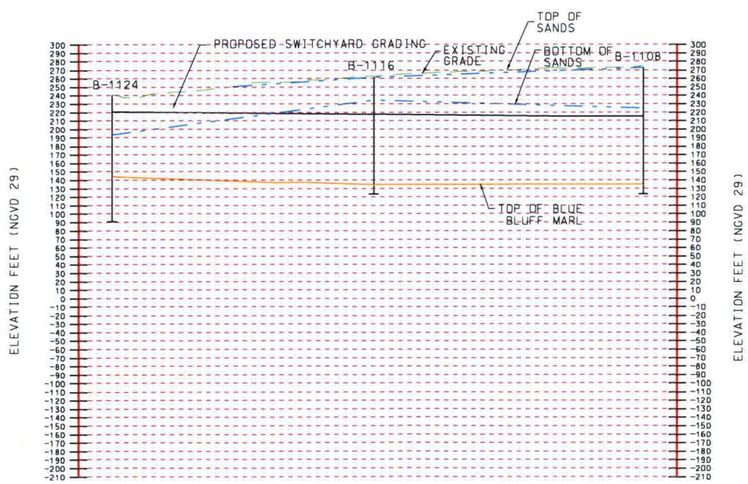


SWITCHYARD BORROW AREA PLAN

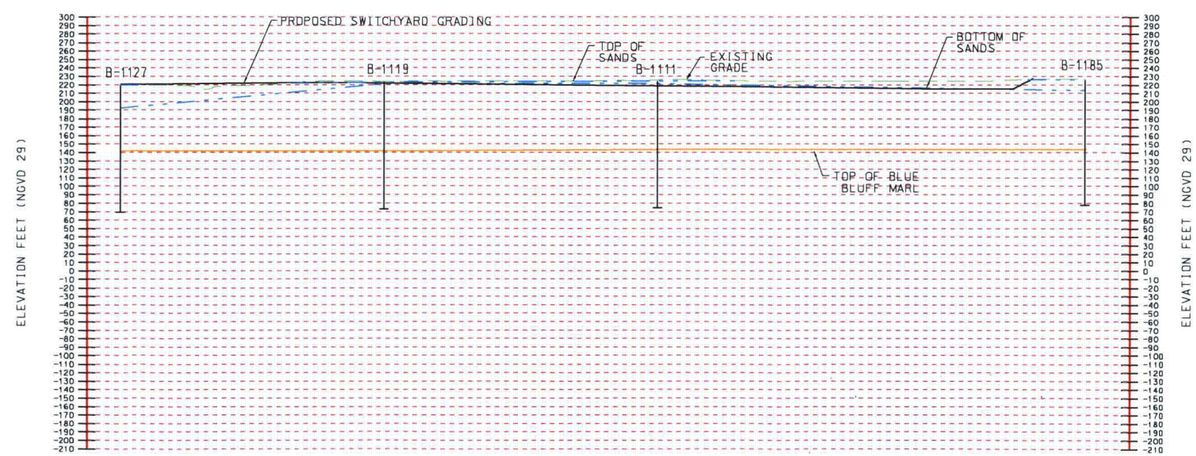
FIGURE
RAI 2.5.4-27-2A



SECTION E



SECTION F



SECTION G

LEGEND

SANDS 1 BELT

0 60 120 180FT
1"=180'

POWER BLOCK PROFILES

FIGURE
RAI 2.5.4-27-2B

2.5.4-28 **From the review of the response to RAIs 2.5.4-14 and 2.5.4-15, it is not clear that the normal variability inherent in the compaction test program (variability of fill grain size distribution, uniformity of water content of compacted soil, etc) will be evaluated sufficiently to capture the variability expected during the production fill program without shear wave velocity testing. In SNC's proposed approach, the wave velocity in its final configuration under the facility and 40 feet of fill to the side will be generated using both analytic approximations for the effects of confinement on in-situ velocity as well as the results from a few RCTS samples of the fill. In-situ wave velocity measurements during production backfill placement are needed for confirmatory purposes to be able to estimate the average velocities of placed soil as well as variability in these velocities under the completed facility. The objective of this confirmatory program is to ensure that in-situ wave velocities in the completed backfill will be equal to or greater than 1,000 fps. SNC is requested to provide additional information and justification of the adequacy of its testing program or a revised testing program.**

Response:

See response to RAI 2.5.4-19 and "Vogtle Units 3 & 4 Structural Backfill Evaluation" (Enclosure 1).

SSAR Section 13.7 Fitness for Duty

13.7-2 **In an October 26, 2007, letter from Christian Araguas, NRC, to J.A. "Buzz" Miller, Southern Nuclear Operating Company (SNC), the NRC requested that the applicant provide a description of the Fitness for Duty (FFD) program and its implementation consistent with the guidance in the August 16, 2007, letter from NRC to Nuclear Energy Institute and the NRC's regulations. The application's description of the FFD program and its implementation in SNC's November 28, 2007, response is not consistent with the NRC's regulations. 10 CFR 26.2(c) describes the required elements of an FFD program for applicants seeking NRC authority to perform certain construction activities, including the activities proposed by SNC. SNC's FFD program plan contains the following deficiencies:**

(a) 10 CFR 26.2(c)(1) requires compliance with 10 CFR 26.20. 10 CFR 26.20(b), (e), and (f) state that the written policies and procedures must: (1) contain a description of programs which are available to personnel desiring assistance in dealing with drug, alcohol, or other problems that could adversely affect the performance of activities within the scope of this part; (2) ensure that persons called in to perform an unscheduled working tour are fit to perform the task assigned; and (3) allow for the Commission at any time to review the licensee's written policy and procedures to assure that they meet the performance objectives of Part 26. Please revise the FFD program plan to comply with 10 CFR 26.20(b), (e), and (f).

(b) 10 CFR 26.2(c)(1) requires compliance with 10 CFR 26.23. 10 CFR 26.23(a)(2) states that personnel that violate a fitness for duty policy will not be assigned to work within the scope of the rule without the knowledge and consent of the licensee. The submitted FFD program plan, however, states that: "A construction site entity can maintain an [individual's access to the construction facility] as long as the person remains in the construction site entity random fitness for duty testing program for new plant construction." Please revise the FFD program plan to comply with 10 CFR 26.23(a)(2).

(c) 10 CFR 26.2(c)(1) requires compliance with 10 CFR 26.70. 10 CFR 26.70 contains provisions for NRC inspections. The FFD program plan does not address NRC inspections. Please revise the FFD program plan to comply with 10 CFR 26.70.

(d) 10 CFR 26.2(c)(1) requires compliance with 10 CFR 26.73. 10 CFR 26.73(a) specifies the FFD events that must be reported to NRC. The FFD program plan does not specify these events. Please revise the FFD program plan to comply with 10 CFR 26.73(a).

Response:

The current 10 CFR 26.2(c) requires, in part, that "persons authorized to conduct the activities under § 50.10(e)(3)," i.e., limited work authorization activities: comply with §§ 26.10, 26.20, 26.23, 26.70, and 26.73; implement a chemical testing program, including random tests; and make provisions for employee assistance programs, imposition of sanctions, appeals procedures, the protection of information, and recordkeeping.

10 CFR 26.10 provides general performance objectives for fitness for duty programs.

10 CFR 26.20 requires, in part, that written policies and procedures be established and implemented to meet the general performance objectives and specific requirements. 10 CFR 26.20 further stipulates what these written policies and procedures must address.

10 CFR 26.23 requires, in part, that contractor and vendor personnel performing activities within the scope of this part must be subject to either the licensee's program relating to fitness for duty, or to a program, formally reviewed and approved by the licensee, which meets the requirements of this part.

10 CFR 26.70 requires, in part, that documents related to the implementation of the licensee's, contractor's, or vendor's fitness for duty program be available for NRC inspection.

10 CFR 26.73 specifies significant fitness for duty events that shall be reported by the licensee to the NRC.

Enclosure 2 of the November 28, 2007 SNC letter to the NRC provided an overview of the fitness for duty program to be implemented for construction of the VEGP Units 3 and 4. Section 1 of this enclosure stated that the "entities implementing this guidance may be Southern Nuclear Operating Company (SNC), contractors/vendors (C/V), or other entities authorized by the NRC and shall hereafter be referred to as construction site entities." Section 3 of this enclosure stated that each construction site entity is responsible to ensure that the applicable elements of 10 CFR 26 are implemented.

10 CFR 26 requires that written policies and procedures be established to implement the fitness for duty program. Enclosure 2 of the November 28, 2007 SNC letter to the NRC was not intended to constitute the required "written policies and procedures" applicable to the construction site entities. Please note that SNC has not yet selected the construction entities, however, compliance with 10 CFR 26 would be a contractual requirement. SNC will ensure that these written policies and procedures, once developed, meet all of the applicable elements of 10 CFR 26.

The FFD program submitted in SNC's letter dated November 28, 2007 has been revised to address the deficiencies noted in RAI 13.7-2 and a revised copy of the program provided in Enclosure 3.

Southern Nuclear Operating Company

AR-08-0045

Enclosure 3

Vogtle Electric Generating Plant

Units 3 and 4

Fitness for Duty Program

During LWA Construction

NOTE: Enclosed following this sheet is a 22-page document, which includes an Attachment A.

Vogtle Electric Generating Plant

Units 3 and 4

Fitness for Duty Program

During Plant LWA Construction

Revision 1

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VOGTLE ELECTRIC GENERATING PLANT UNITS 3 AND 4 FITNESS FOR DUTY PROGRAM DURING LWAPLANT CONSTRUCTION

1 INTRODUCTION

This document provides Vogtle Electric Generating Plant (VEGP) Units 3 and 4 construction site entities a process to authorize and maintain a worker's status in the construction site entity Fitness for Duty (FFD) Program in order to allow an individual to work on a U.S. Nuclear Regulatory Commission (NRC) approved limited work authorization (LWA) construction site. It is acknowledged that entities implementing this guidance may be Southern Nuclear Operating Company (SNC), contractors/vendors (C/Vs), or other entities authorized by the NRC and shall hereafter be referred to as construction site entities.

2 PURPOSE AND SCOPE

This document is applicable to the VEGP Units 3 and 4 construction site entity and applies only to persons who will perform LWA construction activities, at the location where the nuclear plant will be constructed and operated, safety and security related structures, systems, and components (SSCs) that are required to be described in the construction entities site safety analysis report or physical security plans. This document ensures consistent application of regulations and is intended to serve as the FFD Program description for VEGP Units 3 and 4 LWA construction site as required in 10 CFR 52.

The FFD program described herein applies only to LWA construction activities that are performed at the location within the footprint of the new power reactor as well as the nearby areas where safety- and security-related SSCs will be installed and operate when the plant begins operation. LWA construction activities include any fabrication, erection, integration, or testing of safety- or security-related SSCs. LWA construction activities conducted at facilities outside this prescribed area such as another location, city, state, or outside of the U.S. would not be subject to the program described herein.

SNC management and oversight personnel, as listed below, shall be subject to the full VEGP operating plant FFD program that meets the requirements of 10 CFR 26.

- security personnel required by the NRC
- those who perform quality assurance/quality control/quality verification activities related to safety- or security-related construction activities
- individuals directly involved in witnessing or determining inspections, tests, and analyses (ITAAC) certification
- designated individuals to monitor the fitness of individuals
- individuals responsible for oversight and implementation of the licensee fitness-for-duty and access authorization programs
- second-level and higher supervisors and managers

3 RESPONSIBILITY

Each construction site entity is responsible to ensure that the applicable elements of 10 CFR 26 are implemented at their construction sites. In ensuring this is completed, a construction site entity may rely on program elements completed by another construction site entity program. Once it has been determined that an individual has provided a negative drug and alcohol test, the individual may be eligible to gain access to the construction facilitysite. A construction site entity can maintain an individual in this status as long as the person remains in the construction site entity random FFDfitness for duty testing program for LWAnew plant construction and does not provide a positive drug or alcohol test when tested. When an individual provides a positive drug or alcohol test, the construction site entity responsible for the test must notify SNC and the individual shall not be allowed access to the construction facility without the approval of SNC.

Each construction site entity approving a C/V program shall ensure the latest revision of this document has been provided to each of its C/Vs for use and require that the criteria herein be met. Audits are used to assure that licensee and licensee-approved C/V programs supporting the fitness for duty program for the construction site meet regulatory requirements. Construction site entities are responsible for ensuring that program deficiencies are corrected.

4 DEFINITIONS

NOTE: These definitions expand upon but do not replace those found in regulatory documents.

Construction Site – The defined physical location within the owner-controlled area (OCA) where the nuclear plant's security and safety related systems, structures, and components (SSCs) will be constructed and operated

Contractor/Vendors – Any company or individual not employed by the construction site entity that is providing work or services either by contract, purchase order, oral agreement, or other arrangement.

Conviction - A finding of guilt (including a plea of nolo contendere), or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the federal or state criminal drug and/or alcohol statutes.

Criminal Drug Statute - A federal or non-federal, criminal statute involving the manufacture, distribution, dispensing, possession, or use of any controlled substance.

First Level Supervisors – The first level supervisory position that does not perform manual work.

HHS-certified laboratory - *a* laboratory that is certified to perform urine drug testing under the Department of Health and Human Services Mandatory Guidelines for Federal Workplace Drug Testing Programs (the HHS Guidelines), which were published in the

Federal Register on April 11, 1988 (53 FR 11970), and as amended, June 9, 1994 (59 FR 29908), November 13, 1998 (63 FR 63483), and April 13, 2004 (69 FR 19643).

Illegal Drugs - Any drug that is included in Schedules I to V of Section 202 of the Controlled Substances Act [21 U.S.C 812], but not when used pursuant to a valid prescription or when otherwise authorized by law.

Legal Action - A formal action taken by a law enforcement authority or court of law, including an arrest, an indictment, the filing of charges, a conviction, or the mandated implementation of a plan for substance abuse treatment in order to avoid a permanent record of an arrest or conviction, in response to any of the following activities:

- The use, sale, or possession of illegal drugs;
- The abuse of legal drugs or alcohol; or
- The refusal to take a drug or alcohol test.

Under the Influence – A determination that an individual is affected by drugs or alcohol in any detectable manner. The symptoms of influence include but are not confined to those consistent with aberrant behavior or obvious impairment of physical or mental abilities such as slurred speech or difficulty in maintaining balance.

Management and Oversight - The following position classifications are defined as management and oversight personnel:

- security personnel required by the NRC
- those who perform quality assurance/quality control/quality verification activities related to safety- or security-related construction activities
- individuals directly involved in witnessing or determining inspections, tests, and analyses (ITAAC) certification
- designated individuals to monitor the fitness of individuals
- individuals responsible for oversight and implementation of the licensee fitness-for-duty and access authorization programs
- second-level and higher supervisors and managers

MRO (Medical Review Officer) –a licensed physician who is responsible for receiving laboratory results generated by a 10 CFR 26 drug testing program and who has the appropriate medical training to properly interpret and evaluate an individual's drug and validity test results together with his or her medical history and any other relevant biomedical information.

SSC (Systems, Structures or Components)

- *Safety-related SSCs* mean those structures, systems, and components that are relied on to remain functional during and following design basis events to ensure the integrity of the reactor coolant pressure boundary, the capability to shut down the reactor and maintain it in a safe shutdown condition, or the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposure comparable to the guidelines in 10 CFR 50.34(a)(1).

- *Security-related SSCs* mean those structures, systems, and components that the licensee will rely on to implement the licensee's physical security and safeguards contingency plans that either are required under 10 CFR 73 if the licensee is a construction permit applicant or holder as described in 10 CFR 26.3(c), or are included in the licensee's application if the licensee is a combined license applicant or holder as described in 10 CFR 26.3(c).

5 DRUG AND ALCOHOL POLICY & PROCEDURES

Drug and Alcohol Policy

Each construction site entity who implements this FFD program shall ensure that a clear, concise, written FFD policy statement is provided to individuals who are subject to the program. The policy statement must be written in sufficient detail to provide affected individuals with information on what is expected of them and what consequences may result from a lack of adherence to the policy. At a minimum, the written policy statement must:

- Describe the consequences of the following actions:
  i. The use, sale, or possession of illegal drugs on or off site;
  ii. The abuse of legal drugs and alcohol;

- Describe the requirement that individuals who are notified that they have been selected for random testing must report to the collection site within the time period specified by the licensee or other entity;

- Describe the actions that constitute a refusal to provide a specimen for testing, the consequences of a refusal to test, as well as the consequences of subverting or attempting to subvert the testing process;

- Prohibit the consumption of alcohol, at a minimum
  i. Within an abstinence period of 5 hours preceding the individual's arrival at the licensee's or other entity's facility, and
  ii. During the period of any tour of duty;

- Convey that abstinence from alcohol for the 5 hours preceding any scheduled tour of duty is considered to be a minimum that is necessary, but may not be sufficient, to ensure that the individual is fit for duty;

- Describe the consequences of violating the policy;

- Describe the individual's responsibility to report legal actions,

- Describe the responsibilities of managers and supervisors to report FFD concerns;

- Describe the individual's responsibility to report FFD concerns.

Procedures

Construction site entities shall develop, implement, and maintain written procedures that address the following topics:

- The methods and techniques to be used in testing for drugs and alcohol, including procedures for protecting the privacy of an individual who provides a specimen, procedures for protecting the integrity of the specimen, and procedures used to ensure that the test results are valid and attributable to the correct individual;

- The immediate and follow-up actions that will be taken, and the procedures to be used, in those cases in which individuals who are subject to the FFD program are determined to have:

  i. Been involved in the use, sale, or possession of illegal drugs;
  ii. Consumed alcohol to excess before or while constructing safety- or security-related SSCs, as determined by a test that accurately measures breath alcohol content (BAC);
  iii. Attempted to subvert the testing process by adulterating or diluting specimens (in vivo or in vitro), substituting specimens, or by any other means;
  iv. Refused to provide a specimen for analysis; or
  v. Had legal action taken relating to drug or alcohol use; and

- The process to be followed if an individual's behavior or condition raises a concern regarding the possible use, sale, or possession of illegal drugs on or off site; the possible use or possession of alcohol while constructing safety- or security-related SSCs; or impairment from any cause which in any way could adversely affect the individual's ability to safely and competently perform his or her duties.

- FFD documents, policies, and procedures ensure NRC guidance is met. In compliance with 10 CFR 26.20(f), these documents will be made available for NRC review at any time.

Training

All individuals will receive FFD training as new employees and prior to initial granting of unescorted access to vital and protected areas of the plantthe construction site. Refresher training will be conducted at nominal 12-month intervals. All individuals will be trained in behavioral observation techniques per NRC requirements to be able to recognize behavior adverse to the safe operation and security of the facility, and to detect and report aberrant behavior that might reflect negatively on an individual's trustworthiness or reliability. In addition, all badged individuals shall be trained as escorts per NRC requirements.

Managers and supervisors will be trained regarding their role and responsibility in implementing the program. Training will include the role of the medical and Employee Assistance Program staff, techniques for recognizing drugs and indication of the use, sale, or possession of drugs, behavioral observation techniques, and procedures for

initiating corrective action including referrals for mandatory Fitness For Duty evaluations. Managers and Supervisors will be trained regarding their role in documentation of behavioral observation. New supervisors will be trained within 3 months after initial supervisory assignment. Refresher training will be conducted at nominal 12-month intervals.

5.1 USE, POSSESSION, OR SALE OF DRUGS OR ALCOHOL

5.1.1 Illegal Drugs

Using, selling, manufacturing, purchasing, transferring, dispensing, distributing, or possessing illegal drugs by any individual while on the construction site is strictly prohibited.

5.1.2 Alcohol

Using, selling, purchasing, transferring, dispensing, distributing, or possessing alcohol by an individual subject to this program while on a construction site is strictly prohibited.

Consumption of alcohol onsite or within 5 hours of performing construction work to safety-related or security-related SSCs is strictly prohibited. Abstinence from alcohol for the 5 hours preceding any scheduled work is considered to be the minimum that is necessary, but may not be sufficient, to ensure and individual is fit for duty.

Individuals who are called out to perform work outside their normal work hours shall be required by their supervisor to indicate whether alcohol has been consumed within the 5-hour pre-duty abstinence period. Employees may be required to be tested for alcohol upon reporting to work. Employees indicating they have consumed alcohol within this period may be further evaluated and/or tested prior to beginning a tour of duty. These cases must be approved by appropriate management. No disciplinary action will be taken if the employee has informed his/her supervisor of alcohol consumption prior to reporting.

5.1.3 Reporting of Legal Actions

An individual engaged in the performance of construction site entity work at the construction site is required to notify the construction site entity of any legal action involving drugs or alcohol as required by the construction site entity policies.

5.2 DISCIPLINARY ACTIONS

Individuals requiring access to the construction site shall sign a Consent Form (e.g.As an example, see Attachment A.), prior to gaining access, attesting to their understanding of the consequences for a violation of this policy.

The construction site entity shall establish sanctions for FFD policy violations that, at a minimum, prohibit the individuals from being assigned to construct safety- or security-related SSCs unless or until the licensee or other entity determines that the individual's

condition or behavior does not pose a potential risk to public health and safety or the common defense and security.

5.3 DRUG AND ALCOHOL TESTING

The construction site entity shall employ urinalysis, breath tests or other methods approved by 10 CFR 26 to determine fitness for duty, including but not limited to pre-access, for-cause and random testing. An individual must consent to submit to such tests as a condition of access to the construction site entity and refusal to consent shall result in denial of access to the construction site.

Testing of urine specimens for drugs and validity, except validity screening and initial drug and validity tests that may be performed by a construction site entity testing facilities, must be performed in a laboratory that is certified by HHS for that purpose, consistent with its standards and procedures for certification. Any initial drug test performed by a construction site entity subject to this subpart must use an immunoassay that meets the requirements of the Food and Drug Administration for commercial distribution. Urine specimens that yield positive, adulterated, substituted, or invalid initial validity or drug test results must be subject to confirmatory testing by the HHS-certified laboratory, except for invalid specimens that cannot be tested. Other specimens that yield positive initial drug test results must be subject to confirmatory testing by a laboratory that meets stringent quality control requirements that are comparable to those required for certification by the HHS.

Testing for alcohol will be conducted through breath measurement. The initial test for alcohol performed at the collection site shall be conducted by a breath measurement device which meets the requirements of the National Highway Traffic Safety Administration (NHTSA) standards (49 FR 48855) and to any applicable State of Georgia statutes or by using oral fluids (e.g., saliva) using acceptable alcohol screening devices (ASDs) that are listed on the most recent version of NHTSA's Conforming Products List (CPL) for ASDs.

The following initial cutoff levels shall be used when testing specimens to determine whether they are negative for the indicated substances:

Initial Test Cutoff Levels (ng/ml)

Substance*	Cutoff level (ng/ml)
Marijuana metabolites	>50
Cocaine metabolites	>300
Opiate metabolites	>2000**
Phencyclidine	>25
Amphetamines	>1000
Alcohol (1)	>0.04% BAC

(1) Applicable only for breath measurement devices

* Construction site entities may specify more stringent cutoff levels as well other illegal drugs as determined. Results shall be reported for both levels in such cases.

**25 ng/ml is immunoassay specific for free morphine.

Confirmation testing for alcohol must be conducted using a breath measurement device.

Confirmation testing for drugs or drug metabolites must be conducted by a HHS-certified laboratory.

Confirmatory test cut-off levels

Drug	Cut-off level (ng/ml)
Marijuana metabolite	>15*
Cocaine metabolite	>150**
Opiates: Morphine	>2000
Opiates: Codeine	>2000
Opiates: 6-acetylmorphine	>10***
Phencyclidine	>25
Amphetamines: Amphetamine	>500
Amphetamines: Methamphetamine	>500****
Alcohol (1)	>0.04% BAC

(1) Applicable only for breath measurement devices
*Delta-9-tetrahydrocannabinol-9-carboxylic acid.
**Benzoylecgonine
*** Test for 6-AM when the confirmatory test shows a morphine concentration > 2,000ng/ml
****Specimen must also contain amphetamine at a concentration ≥ 200 ng/ml

Testing for additional substances may be ordered on individuals at the direction of the Medical Review Officer for follow-up and for-cause FFD tests. Appropriate cut-off limits shall be established by construction site entities per the protocols of the certified Department of Health and Human Services laboratory. Any individual subject to testing of additional substances at the direction of the MRO shall be informed of this requirement. In addition, construction site entities may specify more stringent cut-off levels. Results shall be reported for both levels in such cases.

On-site Testing Facilities

If used, any construction site entity testing facility shall have an individual to be responsible for day to-day operations and to supervise the testing technicians. The number of individuals required for the facility will be based on the needs of construction staffing and observation. This individual(s) shall have at least a bachelor's degree in the chemical or biological sciences or medical technology or equivalent. He or she shall have training and experience in the theory and practice of the procedures used in the licensee testing facility, resulting in his or her thorough understanding of quality control practices and procedures; the review, interpretation, and reporting of test results; and proper remedial actions to be taken in response to detecting aberrant test or quality control results.

Collector qualifications and responsibilities:

The construction site entity shall ensure the following:

- Urine collector qualifications: Urine collectors shall be knowledgeable of the requirements of the construction site FFD policy and procedures and shall keep current on any changes to urine collection procedures. Collectors shall receive qualification training that meets the requirements of this paragraph and demonstrate proficiency in applying the requirements of this paragraph before serving as a collector. At a minimum, qualification training must provide instruction on the following subjects:

  i. All steps necessary to complete a collection correctly and the proper completion and transmission of the custody-and-control form;
  ii. Methods to address "problem" collections, including, but not limited to, collections involving "shy bladder" and attempts to tamper with a specimen;
  iii. How to correct problems in collections; and
  iv. The collector's responsibility for maintaining the integrity of the specimen collection and transfer process, carefully ensuring the modesty and privacy of the donor, and avoiding any conduct or remarks that might be construed as accusatorial or otherwise offensive or inappropriate.

- Alcohol collector qualifications: Alcohol collectors shall be knowledgeable of the requirements of the construction site FFD policy and procedures and shall keep current on any changes to alcohol collection procedures. Collectors shall receive qualification training meeting the requirements of this paragraph and demonstrate proficiency in applying the requirements of this paragraph before serving as a collector. At a minimum, qualification training must provide instruction on the following subjects:

  i. The alcohol testing requirements of this part;
  ii. Operation of the particular alcohol testing device(s) [i.e., the the alcohol screening devices (ASDs) or Evidentiary Breath Test (EBTs)] to be used, consistent with the most recent version of the manufacturers' instructions;
  iii. Methods to address "problem" collections, including, but not limited to, collections involving "shy lung" and attempts to tamper with a specimen;
  iv. How to correct problems in collections; and
  v. The collector's responsibility for maintaining the integrity of the specimen collection process, carefully ensuring the privacy of the donor, and avoiding any conduct or remarks that might be construed as accusatorial or otherwise offensive or inappropriate.

Alternative Collection and Testing

Construction site entities who are subject to this procedure may rely on a local hospital or other organization that meets the requirements of 49 CFR 40, "Procedures for Department of Transportation Workplace Drug and Alcohol Testing Programs" (65-FR-41944; August 9, 2001) to collect and test specimens for the FFD program listed herein.

5.4 EMPLOYEE ASSISTANCE PROGRAM

The construction site entity recognizes that problems of a personal nature could have an adverse effect on an employee's job performance. The goal of the Employee Assistance Program (EAP) is to provide employees with assistance for early intervention techniques that will improve the quality of their personal lives and prevent the development of job performance problems.

The Employee Assistance Program will provide assistance to any employee requesting services in the areas of alcohol abuse, substance abuse or any other problems.

Information concerning employee counseling will be protected in accordance with federal and state law, and will not be revealed to anyone outside the EAP program except as follows:

1. If disclosure is required by law.
2. If the EAP professional determines that the employee is a serious threat to themselves or to the safety of others.
3. If the EAP professional determines that the employee's condition is such that the employee should not be allowed access to protected and vital areas, access to safeguards information, or be allowed to perform certain safety-sensitive job duties.
4. If the employee authorizes the release of the information to another party or individual.

6 DRUG AND ALCOHOL TESTING PROCEDURE

6.1 CONSENT FORM

Individuals are required to sign the Consent Form (Attachment A) as a condition of access to the construction site. Included in the consent form is the agreement to submit to periodic unannounced (random) testing during the course of their access to the construction site. Refusal to cooperate with or submit to such testing shall result in immediate termination of access to the construction site.

6.2 TESTING PROCEDURES

6.2.1 Pre-Access

Within 30 days of gaining access to the construction site, each individual scheduled to work on SSCs shall have a drug and alcohol test which results in a negative result. Individuals who test positive will be denied access to the construction site.

6.2.2 For Cause

Post Accident

As soon as practical after an event involving a human error that was committed by an individual subject to this plan where the human error may have caused or

contributed to the accident. The construction site entity shall test the individual(s) who committed the error(s), and need not test individuals who were affected by the event but whose actions likely did not cause or contribute to the event. Individuals involved in a work-related accident shall be required to submit to a drug and alcohol test at a designated testing facility.

In all cases treatment of an individual's illness or injury takes precedence over drug and alcohol testing.

For purposes of this policy, an "accident" is defined as the following:

- Work-related injury/illness – A~~n~~ injury or illness, resulting in an OSHA Recordable Incident.
- Work-related motor vehicle accident -- A significant on-site accident that occurs while an individual is in a vehicle performing construction site entity business, as defined the construction entity's procedures.
- Significant property damage -- Damage, during construction, to any safety- or security-related SSC in excess of $100,000.

Occupational Injury and Illness Resulting in an OSHA Recordable Incident

A significant illness or personal injury to the individual to be tested or another individual, which within 4 hours after the event is recordable under the Department of Labor standards contained in 29 CFR 1904.7, and subsequent amendments thereto, and results in death, days away from work, restricted work, transfer to another job, medical treatment beyond first aid, loss of consciousness, or other significant illness or injury as diagnosed by a physician or other licensed health care professional, even if it does not result in death, days away from work, restricted work or job transfer, medical treatment beyond first aid, or loss of consciousness.

- The injured individual must notify their onsite supervisor of the injury or illness if able.
- The construction site entity management shall make arrangements for the individual to submit for a drug and alcohol test at a designated testing facility.
- The results of the drug and alcohol test shall be submitted to the construction site entity management.

Significant Property Damage

- The supervisor shall notify the respective construction site entity management that an incident has occurred that resulted in damage to safety- or security-related SSC in excess of $100,000.
- Construction site entity management shall make arrangements for the individuals involved in the damage to submit for a drug and alcohol test at a designated testing facility.

Observed Behavior

- If observed behavior or a physical condition creates a reasonable suspicion of possible substance abuse, the construction site entity shall perform drug and alcohol testing. The results must be negative before the individual returns to performing on SSCs.
- If credible information is received that an individual is engaging in substance abuse, the construction site entity shall perform drug and alcohol testing.
- If the physical condition is the smell of alcohol with no other behavioral or physical indications of impairment, then only an alcohol test is required.
- For other indications of possible impairment that do not create a reasonable suspicion of substance abuse, the construction site entity may permit the individual to return to work only after the impairing or questionable conditions are resolved and the MRO has determined that the individual is fit to safely and competently perform his or her duties.

Custodial Arrest

- Individuals reporting custodial arrests involving drugs or alcohol will be sent for a fitness for duty evaluation.
- The construction site entity may permit the individual to return to work only after questionable conditions are resolved and the MRO has determined that the individual is fit to safely and competently perform his or her duties.

6.2.3 Random Drug and Alcohol Testing

Random Selection and Frequency

Random testing shall be accomplished for the construction site at the rate of 50 % of the population that is subject to FFD testing for the calendar year. Testing will be conducted during all types of work periods, including weekends and holidays at various times of the day throughout the calendar year. If an individual is selected and is not at work, the individual is not required to report to work for the purposes of random testing. Test selection is statistically random and unannounced, so that all individuals in the population subject to testing have an equal probability of being selected and tested. Testing will be administered in a manner that provides reasonable assurance that individuals are unable to predict the time periods during which specimens will be collected.

Random testing for individuals concurrently authorized Unescorted Access to an operating power reactor shall be deemed adequate to maintain access to a construction site without being subject to additional random testing.

Random selection includes all individuals in the FFD testing pool, for the construction site, on the date the random list is generated. Individuals to be tested (hereinafter the "subject") shall be chosen by use of a method which randomly

selects the number of subjects from among the individuals in the random pool for the construction site. The construction site entity will develop procedures to detail the implementation of the random testing selection process as required herein.

Notification Procedures

At the time of random drug and alcohol testing, the following steps shall be taken:

- A record of the individuals selected for random testing shall be documented.
- The construction site entity shall notify the subject individuals and request they report to the designated collection facility by a specific time.
- If an individual refuses to submit to the testing, the onsite supervisor shall attempt to inform the individual that access to the construction site shall be terminated unless he/she submits to testing.
- Individuals selected for testing from the random pool will be immediately available to be selected the next time the random list is generated.
- Individuals not onsite the day the random selection is determined will not be subject to testing unless they are selected randomly again.
- When the construction site entity receives the results of the tests appropriate action shall be taken in the event of positive results.
- The laboratory forwards a written report to the construction site entity for the drug testing file.

6.3 SPECIMEN COLLECTION AND LABORATORY

Any initial test performed by a construction site testing facility or a HHS-certified laboratory, and the confirmatory test performed by a HHS-certified laboratory, shall use a process which meets the requirements of the Food and Drug Administration (FDA). Testing for drugs and drug metabolites will be conducted through the analysis of urine specimens or other process which meets the requirements of the FDA. Testing for alcohol will be conducted through breath measurement or oral fluids (e.g., saliva). The initial test for alcohol performed at the collection site shall be conducted by a breath measurement device which meets the requirements of the NHTSA standards (49 FR 48855) and to any applicable State of Georgia statutes, or by using oral fluids (e.g., saliva) using acceptable ASDs that are listed on the most recent version of NHTSA's CPL for ASDs.

Analytic methods used for testing will be urinalysis, saliva analysis, or any other method approved in 10CFR26. Testing indicates the presence of specific drugs or drug metabolites, but is not an indication of impairment due to drug use.

Initial analysis and validity testing may be performed by construction site entity testing facility or by HHS-certified laboratories. Confirmatory analysis is performed by a laboratory that meets stringent quality control requirements that are comparable to those required for certification by the HHS. Breath analysis may be performed at the construction site entity collection facility.

Initial cut-off levels shall be detailed in the construction site entity procedures. Those specimens that test negative on the initial test are not subject to further testing unless they are suspected of having been adulterated or diluted.

Confirmatory testing must be performed after a presumptive positive test. Confirmatory drug testing is performed using gas chromatography (GC/MS) techniques. Breath analysis confirmation is performed by use of a breath measurement device. Specimens that are negative on the confirmatory test are reported as negative and are not subject to further testing unless they are suspected of having been adulterated or diluted. If the test is positive for morphine, a test for 6-monoacetylmorphine (6-MAM) shall be included in the confirmatory test for opiates to aid the MRO in determining whether the morphine is from legal drugs.

Specimens with a confirmed positive laboratory result for drugs, other than alcohol, will be evaluated by the MRO who will determine whether there is a legitimate medical reason for the presence of that drug in that specimen. This may involve review of medication history, physical examination and/or personal interview.

Vendor-operated testing facilities authorized by the construction site entity to conduct testing shall comply with the provisions of this program through the use of detailed procedures and shall be subject to assessment by the construction site entity or its representatives prior to implementation of the service and at a specified periodicity to assure continued effectiveness of service.

6.4 SPECIMEN PROCESSING

Construction site entity shall arrange for all testing to be performed either on the construction site or at a nearby qualified facility. The testing should be done as soon as is reasonable after appropriate medical care if required.

Collection site personnel shall arrange to transfer the collected specimens to the HHS-certified laboratory or SNC testing facility. The construction site entity shall take appropriate and prudent actions to minimize false negative results from specimen degradation. Specimens that have not been shipped to the HHS-certified laboratory or SNC testing facility within 24 hours of collection, and any specimen that is suspected of having been substituted, adulterated, or tampered with in any way, must be maintained cooled to not more than 6 °C (42.8 °F) until they are shipped to the HHS-certified laboratory. Specimens must be shipped from the collection site to the HHS-certified laboratory or SNC testing facility as soon as reasonably practical but, except under unusual circumstances, the time between specimen shipment and receipt of the specimen at the SNC testing facility or HHS-certified laboratory should not exceed two business days.

The specimen collection and alcohol testing process will be detailed in the construction site entity procedures and will meet or exceed the requirements of specimen collection as stated in 10 CFR 26. For alternative methods not described in 10 CFR 26, the construction site entity will develop detailed collection and specimen testing procedures.

6.5 POSITIVE RESULTS

A positive confirmatory breath alcohol test indicates a violation of the FFD program.

A presumptive positive drug test result does not always indicate a violation of the FFD program. All presumptive positive drug test results confirmed by the HHS certified laboratory as positive shall be reviewed by the MRO. The MRO will determine whether a legitimate medical reason exists for the positive result and will be the final determination as to whether an individual is in violation of the FFD program. If the MRO determines that there is a legitimate medical explanation for the presumptive positive result, the MRO shall report the result as negative. Substituted, adulterated or diluted samples will also be subject to MRO review for final determination.

Only the MRO can authorize the reanalysis of the original specimen, or the analysis of an aliquot of a split sample. The donor may request the MRO to authorize reanalysis. Such reanalysis shall be conducted by an HHS-certified laboratory.

The MRO shall report all positive results to the construction site entity management person responsible for the FFD program. The construction site entity shall ensure that appropriate action is taken as detailed in the construction site entity procedures. These procedures shall clearly state the consequences of violating FFD program requirements.

Employees who violate the FFD Policy by testing positive for drugs or alcohol are subject to discipline up to and including immediate discharge. In addition, employees who fail to notify supervision of factors that could adversely affect their fitness for duty, or who refuse to submit to FFD tests as required are subject to discipline up to and including immediate discharge.

6.6 REVIEW PROCESS

The construction site entity shall have an alternative review process that is independent and impartial. The construction site entity shall include a description of the process to be used in the procedures that implement this requirement. Construction site entity programs are not intended to modify, subjugate, or abrogate any review rights that currently exist for individuals with their respective employers. An individual who has been denied access to the construction site or whose access has been terminated due to a violation of the FFD program shall have the capability to:

- Be provided the basis for the denial of access;
- Have an opportunity to provide additional information, and;
- Be provided the opportunity to have the decision, together with any additional information, reviewed by another designated construction site entity manager who is equivalent or senior to and independent of the individual who made the decision to deny or terminate access to the construction site due to the program violation. The determination from this independent review is final.

6.7 BEHAVIORIAL OBSERVATION PROGRAM

The construction site entity's Behavioral Observation Program is the primary means to detect behavior that may indicate possible use, sale, or possession of illegal drugs; use or possession of alcohol onsite or while on duty; or any physical impairment or any cause that, if left unattended, may constitute a risk to public health and safety or the common defense and security. Supervision that are responsible for observing individuals subject to a Behavioral Observation Program shall report any FFD concerns about individuals to the personnel designation in the construction site entity's policy.

Supervision that is responsible to observe individuals subject to the Behavioral Observation Programs must be trained to have sufficient awareness and sensitivity to detect degradation in performance which may be the results of being under the influence of any substance, legal or illegal, physical or mental impairment which in any way may adversely affect their ability to safety and competently perform their duties. Training shall communicate the expectation of promptly reporting noticeable changes in behavior or FFD concerns about other individuals to the construction site entity designated personnel for appropriate evaluation and action in accordance with the FFD policy.

6.8 RECORDKEEPING AND CONFIDENTIALITY

Personal information, whether electronic or hardcopy, must not be disclosed to unauthorized persons. The construction site entity shall obtain a signed consent that authorizes the disclosure of the personal information collected and maintained before disclosing the personal information, except for disclosures to the following persons who are authorized:

- Operating plant licensees and other licensees or construction site entities seeking the information as required for determinations of access to construction sites;
- NRC representatives;
- Appropriate law enforcement officials under court order;
- The subject individual or his/her representative who has been designated in writing;
- Licensee or construction site entity representatives who have a need to have access to the information in performing assigned duties, including audits of licensee, contractor or vendor programs, except where specifically excluded by regulation;
- Persons deciding matters on review or appeal;
- Persons who have the authority to change personal data in electronic records, or
- Other persons pursuant to court order.

The construction site entity will establish and maintain a system of files and procedures that clearly indicate that test records and associated documentation shall be retained and used with the highest regard for individual privacy and confidentiality.

Records which must be retained and the retention period shall be identified in the construction site entity program procedures.

Electronic Format Records

For information stored or transmitted in electronic format, access to personal information will be controlled by password protection to control access to personal data and limiting data entry to each authorized individual's area of responsibility.

Hardcopy Records

Hard copy records shall be maintained in secured storage or lockable file cabinets when not in review. Access to the FFD area where files and file cabinets are contained is limited to those authorized above.

Reporting The licensee shall make the following reports:

- Reports to the NRC Operations Center by telephone within 24 hours after the entity discovers the sale, use, or possession of illegal drugs within the construction area and, any acts by supervisory personnel involving the sale, use, or possession of a controlled substance, resulting in confirmed positive tests on such persons, involving use of alcohol within the construction area, or resulting in a determination of unfitness for scheduled work due to the consumption of alcohol.
- Reports to the NRC Operations Center by telephone within 24 hours after the entity discovers any intentional act that casts doubt on the integrity of the FFD program and any programmatic failure, degradation, or discovered vulnerability of the FFD program that may permit undetected drug or alcohol use or abuse by individuals who are subject to the FFD program. These events must be reported under 10 CFR 26.73, rather than under the provisions of 10 CFR 73.71; and
- Annual program performance reports for the FFD program.

6.9 AUDITS

Construction site entities who implement an FFD program shall ensure that audits are performed to assure the continuing effectiveness of the FFD program, including FFD program elements that are provided by C/Vs, and the FFD programs of C/Vs that are accepted by the licensee or other entity.

Construction site entity shall ensure that these programs are audited at a frequency that assures their continuing effectiveness and that corrective actions are taken to resolve any problems identified. Construction site entities may conduct joint audits, or accept audits of C/Vs conducted by others, so long as the audit addresses the relevant C/Vs' services.

Construction site entities need not audit HHS-certified laboratories or the specimen collection and alcohol testing services that meet the requirements of 49 CFR 40 on which the construction site entity may rely to meet the drug and alcohol testing requirements of 10 CFR 26.

The construction site entity will develop procedures to address the implementation of the audit requirements herein.

In accordance with 10 CFR 26.70 the construction site entity FFD program shall be made available for NRC inspection.

ATTACHMENT A

CONSENT FORM

The individual applying for access is required to sign a Consent that authorizes a construction site entity and it authorized agents to test the individual for drug and alcohol use as determined by the construction site entity.

The individual's signature on the Consent confirms that the individual has read and understands the Consent, and has voluntarily agreed to authorize the construction site entity and it authorized agents performing drug and alcohol testing and the individuals and entities releasing information to take the actions set out in the Consent. The Consent includes the following:

- Blank lines to be filled in with the name of the construction site entity and its authorized agent obtaining the Consent.
- Authorization to performing drug and alcohol testing for use in access decisions and the transfer of information among construction site entities and their authorized agents, and their employees who have a need-to-know.
- Authorization to use the information collected solely for the purpose of determining eligibility for access and subsequent work within the boundary of the nuclear power plant construction site.
- Authorization of the retention of collected information in files that are secure for a period required by NRC.
- Language to convey to the applicant that participation in drug and alcohol testing is voluntary. If an individual will not sign the consent or withdraws consent, or does not cooperate with the test process, the process cannot continue. In any of these cases, access to the nuclear plant construction site shall be denied or withdrawn immediately.
- The Consent serves to release construction site entities and their authorized agents, and the officers, employees, representatives, agents, and records custodians of each as well as the officers, employees, representatives, agents, and records custodians of any entity or individual supplying drug and alcohol testing services from any and all liability based on their authorized receipt, disclosure, and use of the information obtained based on the individual's consent.
- The individual's rights and responsibilities relative to reviewing the records collected pursuant to this consent.
- Notice that nothing in the Consent is to be construed to waive any right or responsibility that the individual granting consent, the construction site entity or if different from the construction site entity, the individual's employer may have under Section 211 of the Energy Reorganization Act of 1974, as amended. Section 211 addresses "protected activity" by workers in the nuclear industry.

CONSENT FORM

_____ has my consent to drug and alcohol testing necessary to determine whether to grant me access to a nuclear power plant construction site and to allow me to maintain such access. The Nuclear Regulatory Commission (NRC) requires that this information be used in determining that an individual is fit-for-duty prior to granting and while maintaining access. The results of this determination may be available to other construction site entities.

I understand that the information may be transferred, electronically or otherwise, to other construction site entities and contractor/vendors or the agents of each. This information shall include, but is not limited to:

- Name and Social Security Number;
- Dates when any of the following are completed: drug testing, alcohol testing;
- Dates when access has been authorized or terminated; and
- Dates associated with drug and/or alcohol follow-up testing, if applicable.

I authorize any individual, organization, institution, or entity that now has, or obtains in the future, drug and/or alcohol testing information about me (examples of which are provided in the above paragraph), to release any such information in order to perform the evaluation required for access.

I understand that information obtained pursuant to this Consent shall be treated as confidential. The release of access-related information about me shall be limited to regulatory agencies and such personnel of construction site entities and their contractors/vendors who have been designated as having a "need to know" the information in order to do their jobs.

I understand that all information about me in the database shall be maintained as securely as reasonably practicable for a period determined by the NRC.

I understand that, upon my written request to _____, and at no cost to me, I shall be provided, within ten (10) working days, with a printed copy of the information about me which is in the construction site entity files. If, after my review of such information, I can show that any of the information is incorrect or incomplete, such information shall be corrected and/or completed as soon as is reasonably practical.

I hereby release _____, and the officers, employees, representatives, agents, and records custodians of each as well as the officers, employees, representatives, agents, and records custodians of any entity or individual supplying or using such information from any and all liability based on their authorized receipt, disclosure, or use of the information obtained pursuant to this Consent and to determine my eligibility for construction site access.

I understand that this Consent is not intended to and does not affect any right or responsibility that I, my employer (if not _____), or _____ may have under Section 211 of the Energy Reorganization Act of 1974, as amended. I further understand that nothing herein (1) affects my right or my responsibility to bring potential safety concerns to my employer (if not _____), _____, or the NRC; or (2) prohibits me from participating in any proceeding or investigation regarding such a potential safety concern.

I have read and understand this Consent and authorize _____ to take such actions as are described herein. While I understand that construction site access is dependent upon my accepting the regulatory requirements of this program, the statements made by me in this Consent and my decision to sign this Consent are voluntary. The statements were not induced by any promise nor have I been subjected to any threat, duress or coercion to sign this Consent.

[*Additional provisions required by applicable Georgia State law would be included here.*]

_____	_____
Applicant's Printed Name	*Social Security No.*
_____	_____
Applicant's Signature	*Date*