MACROINVERTEBRATE ASSESSMENT OF PARR RESERVOIR AND MONTICELLO RESERVOIR NEAR THE VC SUMMER NUCLEAR STATION OPERATED BY SOUTH CAROLINA ELECTRIC AND GAS COMPANY, FAIRFIELD COUNTY, SOUTH CAROLINA

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I. SUMMARY

On September 18, 2008, personnel from SCANA Services, Inc. collected petite Ponar macroinvertebrate samples from Monticello Reservoir and Parr Reservoir near the VC Summer Nuclear Station. The collected macroinvertebrates were identified and the data were analyzed by CARNAGEY BIOLOGICAL SERVICES, LLC (SC DHEC Laboratory Certification No. 32572). The objective of this assessment was to determine the condition of the macroinvertebrate community at the proposed water treatment intake in Monticello Reservoir, the proposed new raw water intake in Monticello Reservoir, relative to a control station up lake of these stations. A second objective of this assessment was to determine the condition of the macroinvertebrate community at the proposed new cooling tower blowdown discharge location in Parr Reservoir, relative to the control conditions at a control station located upstream.

The Parr Reservoir stations showed a number of significant differences. The proposed blowdown discharge station had significantly higher EPT Index values and EPT Abundance as indicated by single factor ANOVA analysis. The percentage of the dominant taxon was significantly higher at the control as indicated by single factor ANOVA analysis.

The Monticello Reservoir stations showed significant differences in all but one of the metrics measured as indicated by single factor ANOVA analysis. The percentage of the dominant taxon showed no significant differences among the stations. Both the taxa richness and the total abundance at the water treatment intake station were significantly lower than at the other two stations. When all three stations were analyzed together the EPT Index values showed a significant difference, however, when the control was analyzed with either of the other stations alone there was not a significant difference. This may be caused by the fact that the water treatment intake station had values of 0 in all five replicates. The EPT abundance at the water treatment intake station was significantly lower than at the other stations. Single factor ANOVA analysis showed that the raw intake station had significantly better NCBI and SCDHEC bioclassification scores than the other two stations.

II. INTRODUCTION

On September 18, 2008, a benthic macroinvertebrate community assessment was conducted on Monticello Reservoir_(6,800 acres) and Parr Reservoir (4,400 acres) near the VC Summer Nuclear Station located Fairfield County, South Carolina. Fairfield Pumped Storage Facility connects the two impoundments allowing for daily fluctuations in water levels at both impoundments. SCE&G has filed a license application with the Nuclear Regulatory Commission for the right to construct and operate two new nuclear units. The two new units will withdraw water from Monticello Reservoir and discharge cooling tower blowdown and other liquid wastes into Parr Reservoir. The objective of this assessment was to determine the condition of the macroinvertebrate community at the proposed water treatment intake in Monticello Reservoir, and the proposed new raw water intake in Monticello Reservoir, relative to a control station up lake of these stations. A second objective of this assessment was to determine the condition of the macroinvertebrate community at the proposed new cooling tower blowdown discharge location in Parr Reservoir, relative to the control conditions at an upstream control station. This assessment is part of a larger study to document the macroinvertebrate community in and around the VC Summer Nuclear Plant.

III. DESCRIPTION OF THE STUDY AREA

Collections of aquatic macroinvertebrates were made from five sampling locations in Monticello Reservoir and Parr Reservoir near the VC Summer Nuclear Station (Figure 1).

Parr Reservoir Control was located upstream of Hellers Creek, approximately 9.0 kilometers above the Parr Shoals dam. The substrate at this station consisted mainly of sand.

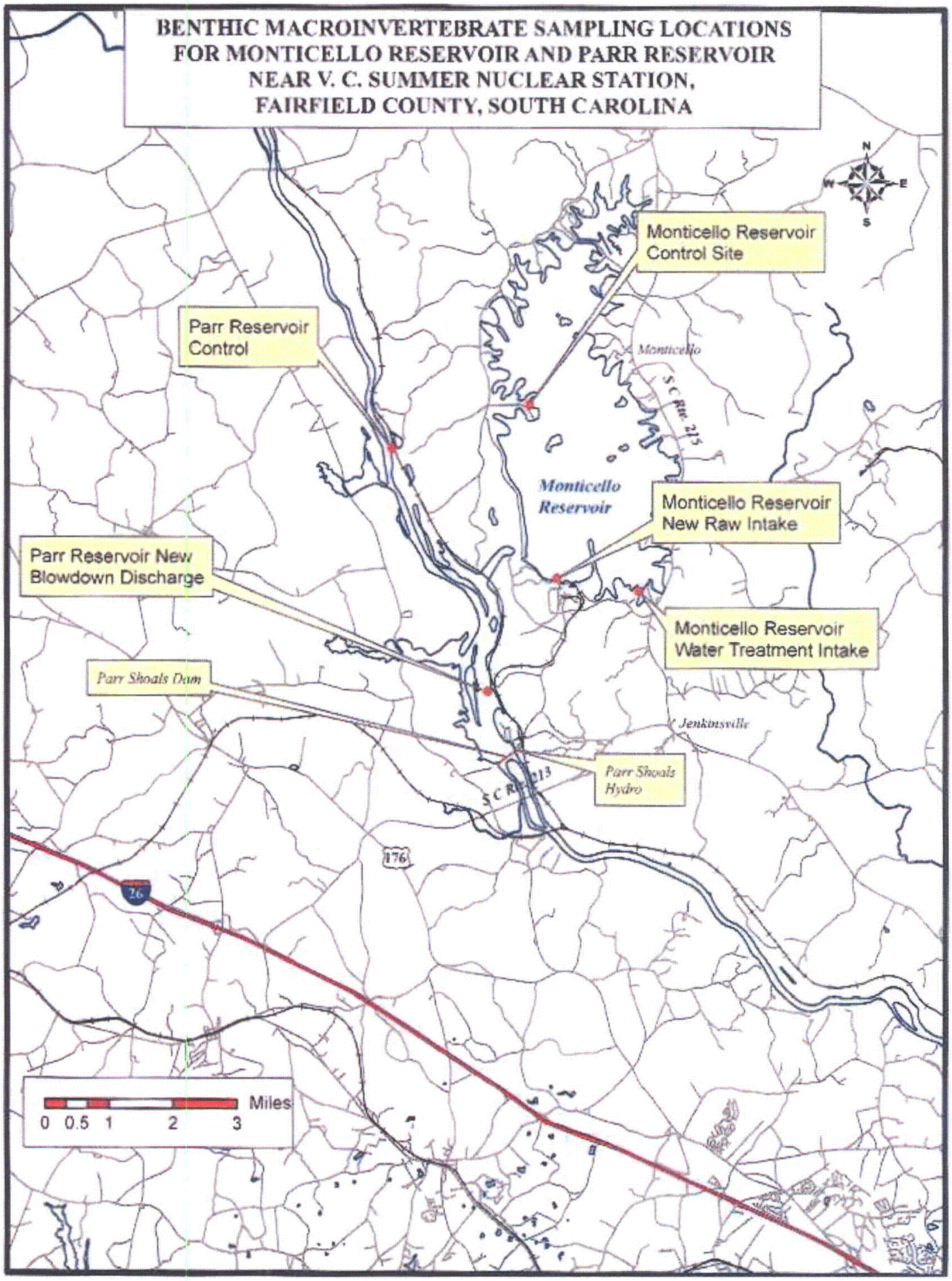
Parr Reservoir New Blowdown Discharge was located at the location of the proposed new cooling tower blowdown discharge from the proposed two new nuclear units at the VC Summer Nuclear Station, and approximately 1.0 kilometers upstream of the Parr Shoals dam. The substrate at this station consisted mainly of sand.

Monticello Reservoir Control, was located on the western side of the lake approximately 5.0 kilometers north of the VC Summer Nuclear Station. The substrate at this station consisted mainly of sand and clay.

Monticello Reservoir_New Water Treatment Intake was located at the proposed intake point for the water treatment plant. The substrate consisted mainly of clay and sand.

Monticello Reservoir Raw Water Intake was located at the proposed intake point for the VC Summer Nuclear Plant. The substrate consisted mainly of clay and sand.

Figure 1. Sampling locations for benthic macroinvertebrates collected from Monticello Reservoir and Parr Reservoir, near the VC Summer Nuclear Station, Fairfield County, South Carolina.



IV. MATERIALS AND METHODS

A. Field Procedures--Petite Ponar Grab Samples

Quantitative sampling of the benthic macroinvertebrate communities of Monticello Reservoir and Parr Reservoir was performed using a petite Ponar grab sampler, as described in method 10500 (APHA, 1995). Five random replicate (15 X 15 cm) Ponar grab samples of sediment were collected from the lake at each location. Replicates were sieved in the field with a U.S. Standard No. 35 sieve (0.500 mm mesh), then placed individually in plastic bags, preserved with 85% ethanol, and transported to the laboratory for analysis.

B. Laboratory Procedures

Upon return to the laboratory, all samples were washed over a U.S. Standard No. 35 sieve and organisms were sorted from the remaining material using forceps and the aid of a stereomicroscope. The organisms were retained in 70% ethanol, and identified to the lowest positive taxonomic level. All specimens will be maintained by Carnagey Biological Services, LLC, in a voucher collection for five years, or placed into the permanent reference collection.

C. Data Analysis

To obtain the most information possible from the data, several types of analysis were performed. Bioassessment metrics allowed comparison of stations based on their overall taxonomic composition. A single factor ANOVA was used to detect trends in macroinvertebrate community composition between the two stations.

1. Bioassessment Metrics

Comparisons of the macroinvertebrate communities were based on changes in taxonomic composition between sampling sites and on the known tolerance levels and life history strategies of the organisms encountered. Changes in taxonomic composition were determined using the metrics outlined in Rapid Bioassessment Protocol III of *Rapid bioassessment protocols for use in streams and rivers* (Plafkin et al. 1989). These metrics include the following:

a) Taxa richness - The number of different taxa found at a particular location is an indication of diversity. Reductions in community diversity have been positively associated with various forms of environmental pollution, including nutrient loading, toxic substances, and sedimentation (Barbour *et al.*, 1996; Fore *et al.*, 1996; Rosenberg and Resh, 1993; Shackleford, 1988).

b) EPT Index - EPT Index is the number of taxa from the insect orders Ephemeroptera, Plecoptera and Trichoptera found at a station. These three insect orders are considered to be intolerant of adverse changes in water quality, especially temperature and dissolved oxygen, and therefore, a reduction in these taxa is indicative of reduced water quality (Barbour *et al.*, 1996; Lenat, 1988).

c) Chironomidae taxa and abundance - The Chironomidae are a taxonomically and ecologically diverse group with many taxa which are tolerant of various forms of pollution. The chironomids are often the dominant group encountered at impacted or stressed sites (Rosenberg and Resh, 1993).

d) Ratio of EPT and Chironomidae abundance - The relative abundance of these four indicator groups is a measure of community balance. When comparing sites, good biotic conditions are reflected in a fairly even distribution among these four groups (Plafkin *et al.*, 1989). The value of this ratio is reduced by impact due to the general reduction of the more sensitive EPT taxa and an increase in the more tolerant chironomid taxa.

e) Ratio of scraper/scraper and filtering collectors - When comparing sites, shifts in the dominance of a particular feeding type may indicate a community responding to an over-abundance of a particular food source or toxicants bound to a particular food source (Rosenberg and Resh, 1993).

f) Percent contribution of dominant taxon - This measures the redundancy and evenness of the community structure. It assumes a highly redundant community reflects an impaired community because as the more sensitive taxa are eliminated, there is often a significant increase in the remaining tolerant forms (Barbour *et al.*, 1996; Shackleford, 1988).

g) North Carolina biotic index (NCBI) - NCBI = TV_iN_i/N where TV_i is the tolerance value for the *i*th taxon, N_i is the abundance of the *i*th taxon, and N is the total abundance of all taxa in the sample. This index utilizes a pollution tolerance value developed over a wide range of conditions and pollution types and taxon abundance to assess the amount of impact (North Carolina Department of Environment, Health and Natural Resources, 1997). The values range from 0-10, increasing as water quality decreases. This metric appears to be adversely affected by the combination of low taxa richness and low abundance, often indicating better conditions than actually exist.

2. Regression Analyses

To detect differences in the two bodies of water, single factor ANOVA analyses were performed on the data. Data were $\log_{10}(x+1)$ transformed prior to analyzing taxa richness, total abundance, percentage of the dominant taxon. EPT index, EPT abundance, NCBI values, and SCDHEC bioclassification

V. RESULTS--Macroinvertebrate Community Analysis

From Parr Reservoir, a total of 321 specimens representing 13 taxa were collected from the two stations on 18 September 2008. The number of specimens collected, their NCBI tolerance values, and functional feeding groups are presented in Table 1 for each sample. Bioassessment metrics for each sample are presented in Table 3.

The bioassessment metrics indicated a few differences between the stations. The EPT index values for the blowdown discharge point were overall somewhat higher than at the control. The control had three of 0 and two with indices of 1, while the blowdown discharge point had three with a value of 1 and two with values of 2. The blowdown discharge also showed a correspondingly higher EPT Abundance. The control was dominated by collector-filterers in all five replicates. The blowdown discharge point was dominated by collector-filterers in two replicates, predators in one replicate and scrapers in two. One replicate was dominated by an equal percentage of collector-filterers and scrapers.

Single factor ANOVA analyses of the data are given in Table 5. There was no significant difference in taxa richness (p-value = 0.2265), Total Abundance (p-value = 0.5736), NCBI index (p-value = 0.9194), or SCDHEC bioclassification (p-value = 0.6364). EPT Index (p-value = 0.0187) and EPT Abundance (p-value = 0.0005) were significantly higher at the blowdown discharge point than at the control. The Percentage of the Dominant Taxon (p-value = 0.0194) was significantly higher at the control.

From Monticello Reservoir, a total of 262 specimens representing 24 taxa were collected from the three stations on 18 September 2008. The number of specimens collected, their NCBI tolerance values, and functional feeding groups are presented in Table 2 for each sample. Bioassessment metrics for each sample are presented in Table 4.

The bioassessment metrics indicated some differences between the stations. The SCDHEC bioclassification values for the control were somewhat lower than at the other two stations. The control had three "poor" ratings and two "fair" ratings. The Raw Intake point had two "fair" ratings and three "good-fair". The Water Treatment Intake point had three "fair" and two "poor" ratings. The control was dominated by collector-filterers in two of the replicates, scrapers in two and predators in one of the replicates. The Raw Water Intake point was dominated by predators in four of the replicates and collector-gatherers in one of the replicates. The Water Treatment Intake point was dominated by collector-filterers in three of the replicates and predators in two of the replicates.

Results of a single-factor ANOVA to detect differences in taxa richness among stations in Monticello Reservoir are presented in Table 6. There was a significant difference (p=0.01234) in taxa richness between stations.

In order to determine which station had significant differences in taxa richness, a multiple comparison procedure consisting of additional single-factor ANOVAs was performed. The averages of the $\log_{10}(x+1)$ transformed taxa richness data are listed in ascending order in Table 7. Since water treatment intake had the lowest average $\log_{10}(x+1)$ transformed taxa richness, an ANOVA was performed without that station's data. The results of this ANOVA showed no significant difference in taxa richness among the control station and the raw intake (p = 0.18568, Table 8).

Results of a single-factor ANOVA to detect differences in total abundance among stations in Monticello Reservoir are presented in Table 9. There was a significant difference (p=0.04412) in total abundance between stations.

In order to determine which station had significant differences in total abundance, a multiple comparison procedure consisting of additional single-factor ANOVAs was performed. The averages of the $\log_{10}(x+1)$ transformed total abundance data are listed in ascending order in Table 10. Since water treatment intake had the lowest average $\log_{10}(x+1)$ transformed total abundance, an ANOVA was performed without that station's data. The results of this ANOVA showed no significant difference in total abundance among the control station and the raw intake ($p = 0.63573$, Table 11).

Results of a single-factor ANOVA to detect differences in percentage of dominant taxon among stations in Lake Monticello are presented in Table 12. There was no significant difference ($p=0.29544$) in percentage of dominant taxon between stations.

Results of a single-factor ANOVA to detect differences in EPT Index values among stations in Monticello Reservoir are presented in Table 13. There was a significant difference ($p=0.00676$) in EPT Index values between stations.

In order to determine which station had significant differences in EPT Index values, a multiple comparison procedure consisting of additional single-factor ANOVAs was performed. The averages of the $\log_{10}(x+1)$ transformed EPT Index values are listed in ascending order in Table 14. Since raw intake had the highest average $\log_{10}(x+1)$ transformed EPT Index values, an ANOVA was performed without that station's data. The results of this ANOVA showed no significant difference in EPT Index values among the control station and the water treatment intake ($p = 0.34659$, Table 15). A second ANOVA was performed using the transformed EPT Index values from the control station and the raw intake. This also showed no significant difference ($p = 0.6332$, Table 16).

Results of a single-factor ANOVA to detect differences in EPT abundance among stations in Monticello Reservoir are presented in Table 17. There was a significant difference ($p=0.00050$) in EPT abundance between stations.

In order to determine which station had significant differences in EPT abundance, a multiple comparison procedure consisting of additional single-factor ANOVAs was performed. The averages of the $\log_{10}(x+1)$ transformed EPT abundance data are listed in ascending order in Table 18. Since raw intake had the highest average $\log_{10}(x+1)$ transformed EPT abundance, an ANOVA was performed without that station's data. The results of this ANOVA showed no significant difference in EPT abundance among the control station and the water treatment intake ($p = 0.34659$, Table 19).

Results of a single-factor ANOVA to detect differences in NCBI values among stations in Monticello Reservoir are presented in Table 20. There was a significant difference ($p=0.00361$) in NCBI values between stations.

In order to determine which station had significant differences in NCBI values, a multiple comparison procedure consisting of additional single-factor ANOVAs was performed. The averages of the $\log_{10}(x+1)$ transformed NCBI values data are listed in ascending order in Table 21. Since raw intake had the lowest average $\log_{10}(x+1)$ transformed NCBI values, an ANOVA was performed without that station's data. The results of this ANOVA showed no significant difference in NCBI values among the control station and the water treatment intake ($p = 0.15857$, Table 22).

Results of a single-factor ANOVA to detect differences in SCDHEC bioclassification values among stations in Monticello Reservoir are presented in Table 23. There was a significant difference ($p=0.00172$) in SCDHEC bioclassification values between stations.

In order to determine which station had significant differences in SCDHEC bioclassification values, a multiple comparison procedure consisting of additional single-factor ANOVAs was performed. The averages of the $\log_{10}(x+1)$ transformed SCDHEC bioclassification values data are listed in ascending order in Table 24. Since raw intake had the highest average $\log_{10}(x+1)$ transformed SCDHEC bioclassification values, an ANOVA was performed without that station's data. The results of this ANOVA showed no significant difference in SCDHEC bioclassification values among the control station and the water treatment intake ($p = 0.23837$, Table 25).

VI. DISCUSSION

The Parr Reservoir stations showed a number of significant differences. The proposed blowdown discharge station had significantly higher EPT Index values and EPT Abundance as indicated by single factor ANOVA analysis. The percentage of the dominant taxon was significantly higher at the control as indicated by single factor ANOVA analysis.

The Monticello Reservoir stations showed significant differences in all but one of the metrics measured as indicated by single factor ANOVA analysis. The percentage of the dominant taxon showed no significant differences among the stations. Both the taxa richness and the total abundance at the water treatment intake station were significantly lower than at the other two stations. When all three stations were analyzed together the EPT Index values showed a significant difference, however, when the control was analyzed with either of the other stations alone there was not a significant difference. This may be caused by the fact that the water treatment intake station had values of 0 in all five replicates. The EPT abundance at the water treatment intake station was significantly lower than at the other stations. Single factor ANOVA analysis showed that the raw intake station had significantly better NCBI and SCDHEC bioclassification scores than the other two stations.

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Table 1. Macroinvertebrates, their NCBI tolerance values (TV) and functional feeding groups (FG) for the two Parr Reservoir stations near the VC Summer Nuclear Station location, Fairfield County, South Carolina, 18 September 2008.

				Control					New Blowdown Discharge				
Seq	**Taxon**	**TV**	**FG**	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 4**	**Rep 5**	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 4**	**Rep 5**
	Annelida												
	Hirudinidae												
1	Hirudinea Genus species		P	1					6	3	14	14	4
	Oligochaeta												
	Lumbriculida												
	Lumbriculidae												
2	Lumbriculidae Genus species	7.13	SC			1							
	Tubificida												
	Tubificidae												
3	Tubifex tubifex	10.10	SC			2	5	7		11	7	6	17
	Arthropoda												
	Hexapoda												
	Coleoptera												
	Elmidae												
4	Dubiraphia sp.	6.03	CG					1					
	Diptera												
	Athericidae												
5	Atherix sp.	2.20	P			1							
	Ceratopogonidae												
6	Culicoides sp.	7.80	P					1					

Functional feeding groups: CF = collector-filterer, CG = collector-gatherer, OM = omnivore, P = predator, SC = scraper, SH = shredder

Table 1. Continued.

				Control					New Blowdown Discharge				
Seq	**Taxon**	**TV**	**FG**	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 4**	**Rep 5**	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 4**	**Rep 5**
Chironomidae													
7	Clinotanypus sp.		P	5	1	4	4	3		2		1	1
8	Procladius sp.	9.20	P								1	1	1
9	Rheotanytarsus exiguus gr.	5.99	CF								1		1
Ephemeroptera													
Ephemerellidae													
10	Ephemerella sp.	2.14	CG	1					3	5	2	2	5
Odonata													
Gomphidae													
11	Gomphus sp.	5.90	P					1					
Trichoptera													
Leptoceridae													
12	Oecetis inconspicua complex	1.95	P					1			2		1
Mollusca													
Bivalvia													
Unionoida													
Corbiculidae													
13	Corbicula fluminea	6.22	CF	36	21	8	33	9	5	8	17	18	16

Functional feeding groups: CF = collector-filterer, CG = collector-gatherer, OM = omnivore, P = predator, SC = scraper, SH = shredder

Table 2. Macroinvertebrates, their NCBI tolerance values (TV) and functional feeding groups (FG) for three Lake Monticello stations near the VC Summer Nuclear Station, Fairfield County, South Carolina, 18 September 2008.

				Control					New Water Treatment Intake					New Raw Intake				
Seq	**Taxon**	**TV**	**FG**	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 4**	**Rep 5**	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 4**	**Rep 5**	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 4**	**Rep 5**
Annelida																		
Hirudinea																		
1	Hirudinea Genus species		P	1				14					2	11	7	14	8	8
Oligochaeta																		
Lumbriculida																		
Lumbriculidae																		
2	Lumbriculidae Genus species	7.13	SC		2	13	1	5										1
Tubificida																		
Tubificidae																		
3	Limnodrilus sp.	9.60	SC					1										
4	Tubifex tubifex	10.10	SC	1	1		2											
Arthropoda																		
Arachnoidea																		
Acariformes																		
Arrenuridae																		
5	Arrenurus sp.	5.63	P					1										
Hexapoda																		
Diptera																		
Chironomidae																		
6	Ablabesmyia peleensis	9.77	P				1	1								1		
7	Clinotanypus sp.		P		1			4		1		2	4	2	2			1
8	Cryptochironomus sp.	6.50	P			1		1								1		

Functional feeding groups: CF = collector-filterer, CG = collector-gatherer, OM = omnivore, P = predator, SC = scraper, SH = shredder

Table 2. Continued.

				Control					New Water Treatment Intake					New Raw Intake				
Seq	**Taxon**	**TV**	**FG**	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 4**	**Rep 5**	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 4**	**Rep 5**	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 4**	**Rep 5**
Chironomidae cont.																		
9	Fissimentum sp. A		CG		1													
10	Parachironomus sp.	9.52	P			1												
11	Polypedilum halterale gr.	7.41	SH			2												
12	Procladius sp.	9.20	P									1		1				
13	Pseudochironomus sp.	5.46	CG					2										
14	Rheotanytarsus exiguus gr.	5.99	CF	1	1	2		1										
15	Tanytarsus sp.	6.86	CF					3										
Ephemeroptera																		
Ephemerellidae																		
16	Ephemerella sp.													2	2	7	5	15
Odonata																		
Gomphidae																		
17	Gomphus sp.	5.90	P	1														
Libellulidae																		
18	Macromia taeniolata	6.26	P									7						
Trichoptera																		
Leptoceridae																		
19	Oecetis inconspicua complex	1.95	P					1										
Polycentropodidae																		
20	Cyrnellus fraternus	7.44	CF					2										

Functional feeding groups: CF = collector-filterer, CG = collector-gatherer, OM = omnivore, P = predator, SC = scraper, SH = shredder

Table 2. Continued.

Seq	Taxon	TV	FG	Control					New Water Treatment Intake					New Raw Intake				
				Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Mollusca																		
Bivalvia																		
Unionoida																		
Corbiculidae																		
21	Corbicula fluminea	6.22	CF	12	4	6		15	2	2	3	7	4					
Unionidae																		
22	Elliptio lanceolata complex	5.20	CF	1														
Gastropoda														5	3	2	3	6
Limnophila																		
Physidae																		
23	Physa sp.	8.94	SC										1					
Mesogastropoda																		
Viviparidae																		
24	Bellamya japonica		SC	1		1		8								2		

Functional feeding groups: CF = collector-filterer, CG = collector-gatherer, OM = omnivore, P = predator, SC = scraper, SH = shredder

Table 3. Bioassessment metrics for the two Parr Reservoir stations near the VC Summer Nuclear Station, Fairfield County, South Carolina, 18 September 2008.

	Station									
	Control					New Blowdown Discharge				
Metric	**Rep 1**	**Rep 2**	**Rep 1**	**Rep 2**	**Rep 1**	**Rep 2**	**Rep 1**	**Rep 2**	**Rep 1**	**Rep 2**
Taxa Richness	4	2	5	3	7	3	5	7	6	8
Number of Specimens	43	22	16	42	23	14	29	44	42	46
EPT Index	1	0	0	0	1	1	1	2	1	2
EPT Abundance	1	0	0	0	1	3	5	4	2	6
Chironomidae Taxa	1	1	1	1	1	0	1	2	2	3
Chironomidae Abundance	5	1	4	4	3	0	2	2	2	3
EPT/Chironomidae Abundance	0.20	0.00	0.00	0.00	0.33	-	2.50	2.00	1.00	2.00
North Carolina Biotic Index	5.85	6.22	6.35	7.12	7.06	4.18	7.88	6.58	6.92	7.18
SCDHEC Bioclassification	2.0	2.0	2.0	1.5	1.5	3.0	1.0	1.5	1.5	1.5
Percent Collector-Filterers	83.72	95.45	50.00	78.57	39.13	35.71	27.59	40.91	42.86	36.96
Percent Collector-Gatherers	2.33	0.00	0.00	0.00	4.35	21.43	17.24	4.55	4.76	10.87
Percent Omnivores	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Percent Predators	13.95	4.55	31.25	9.52	26.09	42.86	17.24	38.64	38.10	15.22
Percent Scrapers	0.00	0.00	18.75	11.90	30.43	0.00	37.93	15.91	14.29	36.96
Percent Shredders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Scraper/Scraper & Collector-Filterers	0.00	0.00	0.38	0.15	0.78	0.00	1.38	0.39	0.33	1.00
Percent Dominant Taxon	83.72	95.45	50.00	78.57	39.13	42.86	37.93	38.64	42.86	36.96
Number Of Dominant Taxa	2	1	5	3	3	3	5	3	3	4

Table 4. Bioassessment metrics for the three Monticello Reservoir stations near the VC Summer Nuclear Station, Fairfield County, South Carolina, 18 September 2008.

	Station														
	Control					New Water Treatment Intake					New Raw Intake				
Metric	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 4**	**Rep 5**	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 4**	**Rep 5**	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 4**	**Rep 5**
Taxa Richness	7	6	7	3	14	1	2	1	4	4	5	4	6	3	5
Number of Specimens	18	10	26	4	59	2	3	3	17	11	21	14	27	16	31
EPT Index	0	0	0	0	2	0	0	0	0	0	1	1	1	1	1
EPT Abundance	0	0	0	0	3	0	0	0	0	0	2	2	7	5	15
Chironomidae Taxa	1	3	4	1	6	0	1	0	2	1	2	1	2	0	1
Chironomidae Abundance	1	3	6	1	12	0	1	0	3	4	3	2	2	0	1
EPT/Chironomidae Abundance	0.00	0.00	0.00	0.00	0.25	-	0.00	-	0.00	0.00	0.67	1.00	3.50	-	15.00
North Carolina Biotic Index	6.39	6.98	7.02	9.00	6.52	6.22	6.22	6.22	6.66	6.90	6.00	5.20	5.41	4.18	3.37
SCDHEC Bioclassification	2.0	1.5	1.5	1.0	1.7	2.0	2.0	2.0	1.5	1.5	2.0	2.7	2.5	3.0	3.0
Percent Collector-Filterers	77.78	50.00	30.77	0.00	35.59	100.00	66.67	100.00	41.18	36.36	23.81	21.43	7.41	18.75	19.35
Percent Collector-Gatherers	0.00	10.00	0.00	0.00	3.39	0.00	0.00	0.00	0.00	0.00	9.52	14.29	25.93	31.25	48.39
Percent Omnivores	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Percent Predators	11.11	10.00	7.69	25.00	37.29	0.00	33.33	0.00	58.82	54.55	66.67	64.29	59.26	50.00	29.03
Percent Scrapers	11.11	30.00	53.85	75.00	23.73	0.00	0.00	0.00	0.00	9.09	0.00	0.00	7.41	0.00	3.23
Percent Shredders	0.00	0.00	7.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Scraper/Scraper & Collector-Filterers	0.14	0.60	1.75	-	0.67	0.00	0.00	0.00	0.00	0.25	0.00	0.00	1.00	0.00	0.17
Percent Dominant Taxon	66.67	40.00	50.00	50.00	25.42	100.00	66.67	100.00	41.18	36.36	52.381	50	51.852	50	48.387
Number Of Dominant Taxa	7	6	4	3	6	1	2	1	4	4	4	4	4	3	3

Table 5. Results of the single factor ANOVA to detect differences in taxa richness, total abundance, EPT index, EPT abundance, NCBI, and percentage of the dominant taxon among sampling stations for the petite Ponar data collected on Parr Reservoir, near the VC Summer Nuclear Station, Fairfield County, South Carolina, 18 September 2008.

ANOVA for Taxa Richness

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F-crit*
Between Stations	0.0388	1	0.0388	1.7165	0.2265	5.3177
Within Stations	0.1810	8	0.0226			
Total	0.2199	9				

ANOVA for EPT Abundance

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F-crit*
Between Stations	0.7836	1	0.7836	32.4438	0.0005	5.3177
Within Stations	0.1932	8	0.0242			
Total	0.9769	9				

ANOVA for Total Abundance

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F-crit*
Between Stations	0.0132	1	0.0132	0.3441	0.5736	5.3177
Within Stations	0.3058	8	0.0382			
Total	0.3189	9				

ANOVA for NCBI

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F-crit*
Between Stations	0.0001	1	0.0001	0.0109	0.9194	5.3177
Within Stations	0.0372	8	0.0046			
Total	0.0372	9				

ANOVA for percentage of the dominant taxon

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F-crit*
Between Stations	0.1150	1	0.1150	8.5067	0.0194	5.3177
Within Stations	0.1081	8	0.0135			
Total	0.2231	9				

ANOVA for SCDHEC Bioclassification

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F-crit*
Between Stations	0.0017	1	0.0017	0.2415	0.6364	5.3177
Within Stations	0.0563	8	0.0070			
Total	0.0580	9				

ANOVA for EPT Index

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F-crit*
Between Stations	0.1576	1	0.1576	8.6368	0.0187	5.3177
Within Stations	0.1460	8	0.0182			
Total	0.3035	9				

Table 6. Results of the single-factor ANOVA to detect differences in taxa richness between stations in Monticello Reservoir, 18 September 2008.

ANOVA for Taxa Richness						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Stations	0.38943	2	0.19471	6.48194	0.01234	3.88529
Within Stations	0.36047	12	0.03004			
Total	0.74990	14				

Table 7. Averages of the $\log_{10}(x+1)$ transformed taxa richness data in Lake Monticello, listed in ascending order.

Average Log (Taxa Richness + 1)			
Station	Water Treatment Intake	Raw Intake	Control
Average	0.49542	0.74049	0.88589

Table 8. Results of the single-factor ANOVA to detect differences in taxa richness between the Control and Raw Intake stations in Monticello Reservoir, 18 September 2008.

ANOVA for Taxa Richness						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Stations	0.05285	1	0.05285	2.09631	0.18568	5.31766
Within Stations	0.20170	8	0.02521			
Total	0.25455	9				

Table 9. Results of the single-factor ANOVA to detect differences in total abundance between stations in Monticello Reservoir, 18 September 2008.

ANOVA for Total Abundance						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Stations	0.82219	2	0.41109	4.09343	0.04412	3.88529
Within Stations	1.20513	12	0.10043			
Total	2.02732	14				

Table 10. Averages of the $\log_{10}(x+1)$ transformed total abundance data in Monticello Reservoir, listed in ascending order.

Average Log (Total Abundance + 1)			
Station	Water Treatment Intake	Control	Raw Intake
Average	0.80314	1.24573	1.34025

Table 11. Results of the single-factor ANOVA to detect differences in total abundance between the Control and Raw Intake stations in Monticello Reservoir, 18 September 2008.

ANOVA for Total Abundance						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Stations	0.02234	1	0.02234	0.24237	0.63573	5.31766
Within Stations	0.73735	8	0.09217			
Total	0.75969	9				

Table 12. Results of the single-factor ANOVA to detect differences in percentage of the dominant taxon between stations in Monticello Reservoir, 18 September 2008.

ANOVA for Percentage of the Dominant Taxon						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Stations	0.05851	2	0.02926	1.35202	0.29544	3.88529
Within Stations	0.25966	12	0.02164			
Total	0.31817	14				

Table 13. Results of the single-factor ANOVA to detect differences in EPT Index values between stations in Monticello Reservoir, 18 September 2008.

ANOVA for EPT Index						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Stations	0.23666	2	0.11833	7.79716	0.00676	3.88529
Within Stations	0.18212	12	0.01518			
Total	0.41878	14				

Table 14. Averages of the $\log_{10}(x+1)$ transformed EPT Index values in Monticello Reservoir, listed in ascending order.

Average Log (EPT Index + 1)			
Station	Water Treatment Intake	Control	Raw Intake
Average	0.00000	0.09542	0.30103

Table 15. Results of the single-factor ANOVA to detect differences in EPT Index values between the Control and Water Treatment Intake stations in Monticello Reservoir, 18 September 2008.

ANOVA for EPT Index						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Stations	0.02276	1	0.02276	1	0.34659	5.31766
Within Stations	0.18212	8	0.02276			
Total	0.20488	9				

Table 16. Results of the single-factor ANOVA to detect differences in EPT Index values between the Control and Raw Intake stations in Monticello Reservoir, 18 September 2008.

ANOVA for EPT Index						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Stations	0.10568	1	0.10568	4.64251	0.06332	5.31766
Within Stations	0.18212	8	0.02276			
Total	0.28780	9				

Table 17. Results of the single-factor ANOVA to detect differences in EPT Abundance values between stations in Monticello Reservoir, 18 September 2008.

ANOVA for EPT Abundance						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Stations	1.70578	2	0.85289	15.32702	0.00050	3.88529
Within Stations	0.66775	12	0.05565			
Total	2.37354	14				

Table 18. Averages of the $\log_{10}(x+1)$ transformed EPT Abundance data in Monticello Reservoir, listed in ascending order.

Average Log (EPT Abundance + 1)			
Station	Water Treatment Intake	Control	Raw Intake
Average	0.00000	0.12041	0.76792

Table 19. Results of the single-factor ANOVA to detect differences in EPT Abundance values between the Control and the Water Treatment Intake stations in Monticello Reservoir, 18 September 2008.

ANOVA for EPT Abundance						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Stations	0.03625	1	0.03625	1.00000	0.34659	5.31766
Within Stations	0.28998	8	0.03625			
Total	0.32623	9				

Table 20. Results of the single-factor ANOVA to detect differences in NCBI values between stations in Monticello Reservoir, 18 September 2008.

ANOVA for NCBI						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Stations	0.06097	2	0.03048	9.31863	0.00361	3.88529
Within Stations	0.03925	12	0.00327			
Total	0.10022	14				

Table 21. Averages of the $\log_{10}(x+1)$ transformed percentage of the NCBI data in Monticello Reservoir, listed in ascending order.

Average Log (NCBI + 1)			
Station	Raw Intake	Water Treatment Intake	Control
Average	0.75983	0.87149	0.91021

Table 22. Results of the single-factor ANOVA to detect differences in NCBI values between the Control and Water Treatment Intake stations in Monticello Reservoir, 18 September 2008.

ANOVA for NCBI						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Stations	0.00375	1	0.00375	2.41783	0.15857	5.31766
Within Stations	0.01240	8	0.00155			
Total	0.01614	9				

Table 23. Results of the single-factor ANOVA to detect differences in SCDHEC Bioclassification values between stations in Monticello Reservoir, 18 September 2008.

ANOVA for SCDHEC Bioclassification						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Stations	0.06607	2	0.03303	11.33469	0.00172	3.88529
Within Stations	0.03497	12	0.00291			
Total	0.10104	14				

Table 24. Averages of the $\log_{10}(x+1)$ transformed percentage of the SCDHEC Bioclassification data in Monticello Reservoir, listed in ascending order.

Average Log (SCDHEC Bioclassification + 1)			
Station	Control	Water Treatment Intake	Raw Intake
Average	0.40108	0.44545	0.55870

Table 25. Results of the single-factor ANOVA to detect differences in SCDHEC Bioclassification values between the Control and Water Treatment Intake stations in Monticello Reservoir, 18 September 2008.

ANOVA for SCDHEC Bioclassification						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Stations	0.00492	1	0.00492	1.62347	0.23837	5.31766
Within Stations	0.02425	8	0.00303			
Total	0.02917	9				

VCSNS UNITS 2 and 3

Response to NRC Information Needs Item

Information Item Number: AQ-15 **Revision:** 0

Statement of the Information Item:

Information Item AQ-15:

Provide a copy of the Geosyntec (2006) impingement report as well as an expert to discuss results of the report. Pg 5.3-3.

SCE&G Follow Up Action:

None.

Response:

The enclosed CDs provide the requested VCSNS unit 1 reports:

- Comprehensive 316(B) Demonstration Study Proposal for Information Collection (June 2005)
- Preliminary Report of Fish Impingement Mortality (May 2007)

COLA Revisions:

No COLA revision is required as a result of the response to this Information Needs item.

VCSNS UNITS 2 and 3

Response to NRC Information Needs Item

Information Item Number: G-5 **Revision:** 0

Statement of the Information Item:

Information Item G-5:

Make available someone who can discuss ownership of the land on which the VCSNS is located.

SCE&G Follow Up Action:

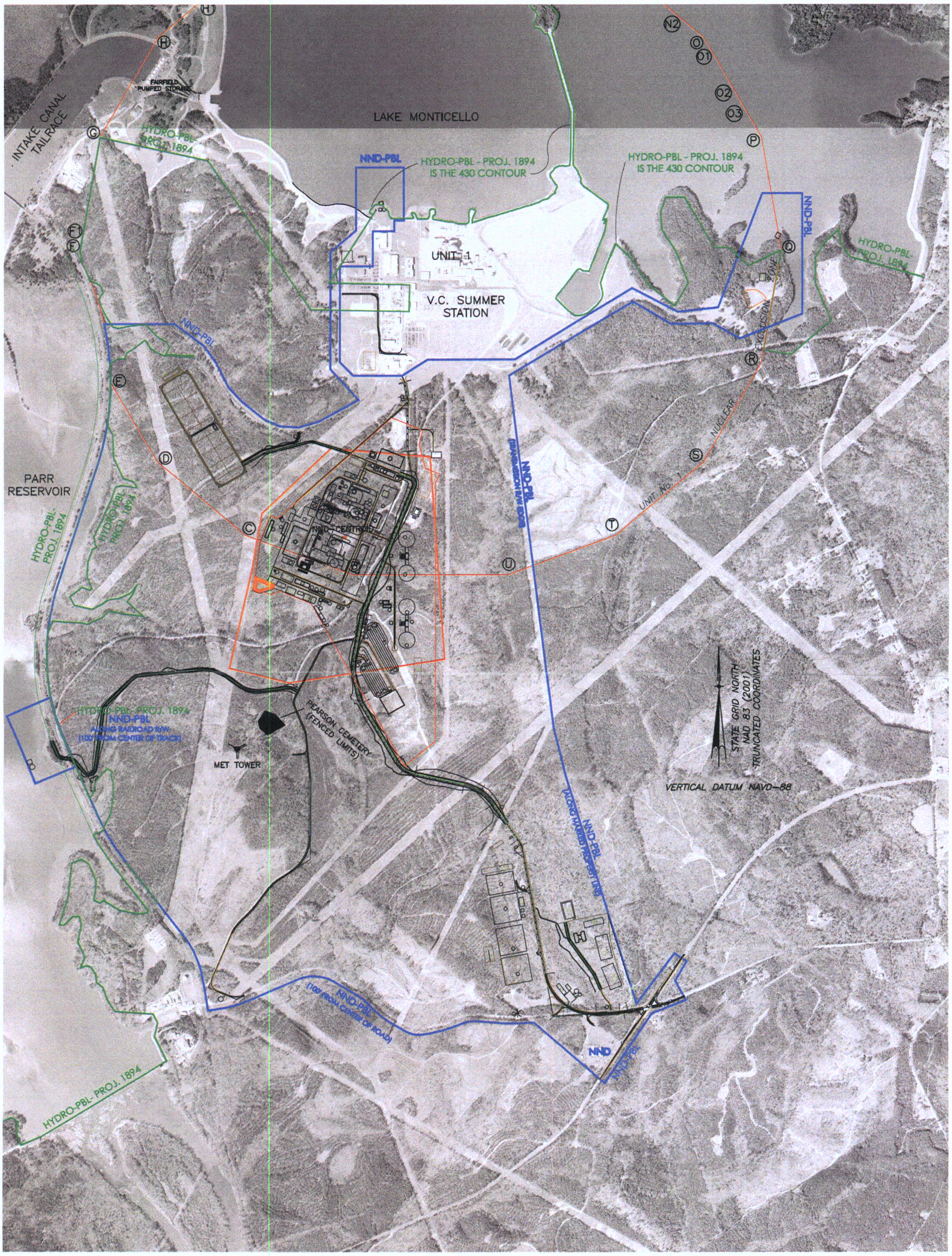
Provide confirmatory statement and map showing property boundaries (see G-6).

Response:

As discussed during the site audit, SCANA owns all of the land on which the VCSNS is located. Santee Cooper, as a partner in the nuclear projects, is a joint owner of all land that has nuclear related facilities. Attached is a map that shows the NND-PBL (e.g. the New Nuclear Deployment Project Boundary Line) marked in blue. The NND-PBL is the maximum expected area of project impact.

COLA Revisions:

No COLA revision is required as a result of the response to this Information Needs item.



NOTE: FOR ILLUSTRATION PURPOSES ONLY!!!

SURVEYOR'S SEAL: SOUTH CAROLINA REGISTERED LAND SURVEYOR 11606 MICHAEL RALPH MILLS

C.O.A. SEAL: SOUTH CAROLINA GLENN ASSOCIATES SURVEYING INC. No.C02238 CERTIFICATE OF AUTHORIZATION

REVISION SCHEDULE

REV.	REVISION DESCRIPTION	DRAWN BY	CHECKED	DATE
0	INITIAL ISSUE	TLM	BBB	2/03/09

PREPARED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, SOUTH CAROLINA 29065
Telephone (803) 345-5297 or GLENNASSOCIATES.COM
MICHAEL R. MILLS; S.C.P.L.S. # 11606

GLENN ASSOCIATES SURVEYING, INC.

OVERLAY MAP

SCE&G SM
A SCANA COMPANY

NEW NUCLEAR DEPLOYMENT

FEBRUARY 4, 2009

0 500' 1000'

REV. 0

101609-2

VCSNS UNITS 2 and 3

Response to NRC Information Needs Item

Information Item Number: G-6 **Revision:** 0

Statement of the Information Item:

Information Item G-6:

Make available someone who can discuss whether all construction and operation activities will occur within the confines of the current VCSNS site.

SCE&G Follow Up Action:

Provide confirmatory statement and map showing property boundaries and construction activities.

Response:

All construction and operation activities for VCSNS units 2 and 3 will occur within the confines of the current VCSNS site with the exception of transmission lines that will be routed to distribute power from the units. Attached is a map that shows the NND-PBL (e.g. the New Nuclear Deployment Project Boundary Line) marked in blue. The NND-PBL is the maximum expected area of project impact. Note that the intake and discharge structure locations are partly located in the Monticello and Parr Reservoirs in order to with draw and discharge cooling water for the plants.

COLA Revisions:

No COLA revision is required as a result of the response to this Information Needs item.

VCSNS UNITS 2 and 3

Response to NRC Information Needs Item

Information Item Number: G-8 **Revision:** 0

Statement of the Information Item:

Information Item G-8:
Make someone available who can discuss whether there is barge or other water transportation access to the site.

SCE&G Follow Up Action:
Provide confirmatory statement regarding barge or water access to site.

Response:

Boat traffic on the Broad River, its associated reservoirs, and its tributaries is primarily recreational in nature, with no known commercial transportation of goods. The Broad River near the VCSNS site is considered navigable by the State of South Carolina, but not by the US Army Corps of Engineers. Monticello Reservoir is not considered navigable either by the US Army Corps of Engineers or the South Carolina Department of Health and Environmental Control.

Due to the fall line (the delineation between the Coastal Plain and the Piedmont geological provinces in South Carolina) occurring near Columbia, SC, river navigation to and upstream of Columbia has always been a challenge. In the 1800's a canal and lock system was constructed at Columbia on the Congaree and Broad rivers. The canal and associated locks, which were designed for the era's narrow, human or animal powered barges, are not functional today. Once the railroad system was expanded, the canal was not longer viable for the transportation of goods. The Columbia Canal is now used as a drinking water source for the City of Columbia and for hydroelectric generation. The Broad River upstream of Columbia has a series of rocky shoals that would preclude any modern day barge traffic. In fact, many of the shoals on the Broad River have become locations for hydroelectric facilities (for instance, the Parr Shoals Dam) which form barriers to river traffic.

The presence of numerous shoals on the Broad River makes barge or other commercial navigation on this river impracticable.

COLA Revisions:

No COLA revision is required as a result of the response to this Information Needs item.

VCSNS UNITS 2 and 3

Response to NRC Information Needs Item

Information Item Number: NRHH-2 **Revision:** 0

Statement of the Information Item:

Information Item NRHH-2:

Provide documentation from consultations with permitting agencies that specify requirements concerning atmospheric emissions.

SCE&G Follow Up Action:

Provide relevant correspondence with DHEC.

Response:

Attached is an email summarizing the consultations that were held with DHEC related to atmospheric emissions requirements for the construction period of the project.

COLA Revisions:

No COLA revision is required as a result of the response to this Information Needs item.

RICE, APRIL R

From: WALLER JR, JOHNNIE
Sent: Tuesday, February 17, 2009 1:10 PM
To: freckje@dhec.sc.gov
Cc: RICE, APRIL R; London, Eileen
Subject: SCE&G's Summarization of Understandings Pertaining to Exemption Qualifications/Notifications

Jerry,

Thank you for taking the time to discuss the air permitting process pertaining to SCE&G's Unit 2 and 3 Nuclear Construction project. Corresponding with you has helped tremendously in determining the process that we need to take as a Company to prevent exceeding current emissions limits onsite as well as to the process pertaining to the documentation of future exempted sources of equipment onsite.

Based on our conversation via phone and email, it was determined that during the period of the construction of Units 2 and 3, SCE&G will follow the following criteria when determining whether to apply for a construction permit for a piece of equipment, whether or not a piece of equipment is exemptible, and whether or not notification is needed for an exempted piece of equipment to your Department. Based on SC Regulation 61-62.1, we find that any piece of equipment that emits over 1 lb/hr of Particulate Matter or greater than 1000 lb/month of VOC would need to obtain a construction permit. Anything below these criteria would be deemed exempted from the permitting process.

Since this construction activity is being looked at not based on individual pieces of equipment, but rather as the overall project, recommendations have been made to create an onsite spreadsheet to be maintained and tracked for certain sources of emissions coming from exempted pieces of equipment, rather than notifying your Department when each individual piece of exempted equipment comes onsite. The criteria for using this would be as follows:

<u>No Notification to DHEC but must Maintain Onsite Records of 12 Month Rolling Sum Emissions</u>

1. If construction equipment is onsite for less than 12 months.
2. Equipment produces less than 1 lb/hr of PM or less than 1000 lb/month of VOC emissions uncontrolled.
3. Equipment used for emergency use only

<u>Notify DHEC and Request Equipment to be Added to Existing Conditional Major Air Permit CM-1000-0012 (Attachment B List)</u>

1. If exempted pieces of equipment will be onsite for more than 12 months (i.e. fuel storage tanks, portable lights, etc.)
2. Equipment produces less than 1 lb/hr of PM or less than 1000 lb/month of VOC emissions uncontrolled.
3. Equipment used for emergency use

To keep up with these sources of equipment, SCE&G is preparing a spreadsheet calculating each month the following: 1) what sources are onsite, 2) what sources have left the site, 3) emissions rate for each source for each criteria pollutant, 4) make, model and number of each source, and 5) a rolling monthly sum total for each criteria pollutant. We have an understanding that SCE&G will keep SCDHEC (Central and Regional Offices) in informed during these construction activities and will submit this data with the reporting requirements of SCE&G V.C. Summer Unit 1 Conditional Major permit reporting frequency. If we see during our monthly sum calculations that we are getting close to exceeding conditional major source threshold limitations, we will meet with the Department to discuss revising our current permit status in order to prevent non-compliance with any State or Federal regulations.

This is SCE&G's summarization of our understanding of our phone conversations with SCDHEC. If you feel that there is an error in our interpretation of our conversation, please feel free to contact me via email or phone at (803) 931-5177.