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South Carolina. Coastal Zone Management Program

ENVIRONMENTAL/ECONOMIC IMPACTS ASSESSMENT

Prepared for:

Waccamaw Regional Planning and Development Council

Submitted by:

Wickel and Associates

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INTRODUCTION

The purpose of this report is to assess the existing environmental and economic climate of Georgetown and Horry Counties and to project the impacts of the construction, operation and maintenance of three major energy-related facilities. First, because of an unexpected surge in the demand for electrical power throughout its system, the South Carolina Public Service Authority has accelerated its construction program in order to bring two coal-fired 280 MW power generating units on line in 1980 and 1982. These two units currently are being constructed at the PSA's Winyah Steam Generating Station located on Pennyroyal Road near the Sampit River.

Second, the Carolina Refining and Distributing Company has proposed the construction of a fuels separation plant (oil refinery) capable of processing 30,000 barrels of crude oil per day, at the Harmony site located adjacent to the PSA steam generating plant. The facility will receive its crude oil by tanker and will transport it to the site storage facilities by pipeline from the State Ports Authority pier. The facility will be a "Market refiner" producing a variable mixture of products dictated by demand in its market area. At least initially, unleaded gasoline will be the largest volume of produce and jet fuel the second largest. This project is still in a very preliminary planning and engineering stage and, should it be constructed, it will very likely not be ready for operation until mid-1984 or 1985.

Finally, the U.S. Army Corps of Engineers has begun construction of the Santee-Cooper Rediversion Project. This project, located in neighboring Berkeley County, is designed to reduce shoaling in the Charleston Harbor by rediverting substantial amounts of the Cooper River flow through a channel constructed between the northeast corner of Lake Moultrie and the lower Santee River. The canal will cross north of Russellville and St. Stephen and will terminate in Lake Mattassee. Also, the Corps will construct, maintain and operate an 84,000 KW hydroelectric plant and construct a hatchery and fish lift on the new canal at St. Stephen.

The effects on Georgetown and Horry Counties of the construction, operation and maintenance of these projects will likely be felt in a number of diverse ways. Additional contaminants will be placed in the atmosphere or in local surface waters, particularly in the Sampit River; new jobs will be created in construction, operations, or in services; some new population will be attracted to the two counties as a consequence of em-

ployment opportunities; new services will be required of local government; and, new tax or other revenues will be generated.

The nature and potential extent of these impacts will be discussed in the following pages. Also, background or other supportive data will be included to facilitate future decision-making in light of changing situations.

ENVIRONMENTAL ISSUES

AIR

The six air pollutants dicusssed below are those which are regulated by federal and state law in order to prevent concentrations which might be harmful to public health or welfare. Some or all may be of concern to residents of Georgetown or Horry Counties as a consequence of energy related developments under consideration here.

The first two--particulate matter and sulfur oxides--are normally associated with stationary sources (manufacturing, electric power generation, etc.) while the remaining four are generally thought of as being the products of mobile sources (automobile, heavy machinery, airplanes, etc.). Each is summarized in the following paragraphs in order to suggest its nature and its effect upon the environment.

Particulate matter includes any solid or liquid particles produced by natural or man-made means. Dust, sea spray, fly ash, etc. are all examples. In concentrations which are sufficient to reduce visibility to less than three miles with a relative humidity of less than 70%, sensory irritation will result. Additionally, particulates can effect electronic equipment, paints, fabrics, catalytic converters, stone, clay and glass.

Abrasion is one way in which damage occurs. In the case of electronic equipment, particulates which settle on switching contacts can interfere with conduction. They can also speed the rate of metal corrosion in the presence of sulfuric acid. Fly ash particulates contain sulfur oxides which can blister paints and attack fabrics. Particulates are of particular concern in the City of Georgetown where a limited area surrounding Georgetown Steel is presently in compliance with primary (health related) standards but unable to meet secondary (welfare materials) standards.

Sulfur Oxides (SO_x) includes SO_2 and SO_3. The most common is sulfur dioxide (SO_2), a colorless, pungent gas that comes predominately from the combustion of sulfur bearing fuels by electric power generating stations and factories. It can affect building stone, dyes, paints, textiles, paper, metals

and tanned leather. For example, sulfur dioxide speeds oxidation (rusting) of ferrous metals and has a corrosive effect when combined with atmospheric moisture. Sulfur dioxide is also a matter of some concern in Georgetown County and will be treated in greater detail in subsequent sections. Its health effects include:

Dose	Effect
0.05-0.09 ppm average for 24 hours	increased illness rate in older persons with severe chronic bronchitis
0.11-0.19 ppm average for 24 hours	increased number of reported cases of serious respiratory disease
5 ppm for 1 hour	bronchoconstriction
10 ppm for 1 hour	severe distress in humans

Nitrogen Oxides (NO_x) include three distinct air pollutants. Nitrogen dioxide (NO_2), the most common, is a pungent smelling brownish-red gas that comes from motor vehicles exhaust as well as from power plant and factory combustion activities. High concentrations will cause fabrics to fade, will have adverse effects on plants, and will have some health effects as follows:

Dose	Effect
3 ppm for 8 hours	bronchoconstriction in humans
120-220 ppm in short exposure	fibrotic changes in human lungs
0.5 ppm, 6-24 hours per day for 3 weeks	emphysematous condition in mice
0.5 ppm continuously for three months	increased susceptibility to bacterial pnuemonia in mice
2 ppm continuously for lifetime	pathological (pre-emphysematous) changes in bronchiolar epithelium in rats
1 ppm for 1 hour	alteration of lung collagen and elastin in rabbits

1 ppm for 8 hours	reduction in growth in plants
more than 2.4 ppm	acute damage to sensitive plants
0.25 ppm for 1 hour	coloration of atmosphere (daytime)

Carbon monoxide is a colorless and odorless gas resulting largely from the incomplete combustion of carbon containing substances. Carbon monoxide does not seem to be damaging to materials. Its health related effects include:

Dose	Effect
50 ppm for 90 minutes for 10-15 ppm for 8 or more hours	impaired time interval discrimination
30 ppm for eight or more hours	impaired performance in pysochomotor tests
30 ppm for 8 hours or 120 ppm for 1 hour (concentrations in heavy traffic often reach 140 ppm)	interference with oxygen transport in blood (formation of carboxyhemoglobin)

Hydrocarbons generally result from the evaporation of petroleum products, incomplete combustion products, refineries, or partial processing plants. In general, certain hydrocarbons are carcinogenic in animals, and they are the chemical precursor of photochemical smog. Most hydrocarbons are toxic only at high concentrations (several hundred parts per million); however, several are photochemical reactive at low concentrations.

Photochemical oxidant (Ozone) are colorless gasses produced by the reaction of nitrogen oxides and hydrocarbons in the presence of sunlight. Ozone is damaging to rubber, microfilm, paints, and dyes as well as textiles. Although the health and welfare effects of ozone are the subject of continuing scientific debate, several sources have indicated the effects may include:

Dose	Effect
more than .07 ppm	impaired performance in student athletes
0.1 ppm maximum daily value	eye irritation

.15 ppm max./hour	aggravation of asthma attacks
2 ppm for 1 hour	physical health impairment
1 ppm for 8 hours for 1 year	bronchiolitis and fibrosi-tis in rodents
.03 ppm for 4 hours	bleaching, spotting, growth suppression, early asbcis-sion in plants; tips of conifer needles become brown and necrotic

Regulation

The Environmental Protection Agency has adopted contrasting policies for regulating Air Quality Control Regions (AQCR's), one for dirty-air regions and another for clean-air regions. Dirty-air (non-attainment) regions are those in which air pollution levels exceed the National Ambient Air Quality Standards (NAAQS). In these areas, EPA has adopted an emission-offset policy to regulate both new sources and alteration to existing sources. Clean-air regions have air pollution levels that are currently below the NAAQS, and for these areas EPA has promulgated a nondeterioration policy to regulate modifications to existing sources as well as to control new ones.

The nondeterioration regulations were issued under the 1976 Clean Air Amendments to set up "a mechanism for preventing significant deterioration of air quality in areas where air pollution levels are currently below the National Ambient Air Quality Standards".1/

The federal nondeterioration plans require the "best available technology" to control emissions of particulates and sulfur dioxides. These regulations apply to all new sources and to modifications of existing sources.

The legislation requires a review of the proposed additional sources to determine whether they have the capacity to cause "significant deterioration". It also seeks to define a standard between zero (background) level and an upper level established by the National Secondary Standards for Ambient Air Quality as defined in the Clean Air Act.

The nondeterioration policy is based only on particulates and sulfur dioxides because of incomplete data on other pollutants considered under the Clean Air Act. The implementation of the policy requires a classification of areas based on EPA's designated Air Quality Control Regions since smaller areas would not protect those areas that had clean air and still allow

TABLE ONE

NATIONAL QUALITY STANDARDS FOR AMBIENT AIR

(In micrograms or milligrams per cubic meter - ug/m^3 and mg/m^3 and in parts per million - ppm.)

Pollutant	Averaging Time	Primary Standards (Health-related)	Secondary Standards (Welfare-materials)
Particulates	Annual	75 ug/m^3	60 ug/m^3
	24-hour	260 ug/m^3	150 ug/m^3
Sulfur Dioxide	Annual	80 ug/m^3 (.03 ppm)	
	24-hour	365 ug/m^3 (.14 ppm)	
	3-hour	--	1300 ug/m^3 (.5 ppm)
Carbon-Monoxide	8-hour	10mg/m^3 (9 ppm)	Same as primary
	1-hour	40mg/m^3 (35ppm)	
Hydrocarbons (nonmethane)	3-hour (6-9am)	160 ug/m^3 (.24ppm)	Same as primary
Nitrogen-Dioxide	Annual	100 ug/m^3 (.05 ppm)	Same as primary
Ozone	1-hour	240 ug/m^3 (.12 ppm)	Same as primary
Lead	3-month	1.5 ug/m^3 (.006 ppm)	

SOURCE: 40 CFR 50

growth in more developed sections. In its essence, EPA's air quality management strategy permits an increase in levels of sulfur dioxide and particulates as of Jaunary 1, 1975, in those areas where air quality is cleaner than NAAQS.

Under the plan, areas in which air quality exceeds in NAAQS would be designated according to three classifications. Class I includes those pristine areas in which any reduction in air quality would be considered significant. Only the Cape Romain Wilderness was so designated in South Carolina. Class II includes areas in which deterioration normally accompanying moderate, well controlled growth would be considered significant. Class III are areas where deterioration to national standards would be allowed. There are presently no Class III areas designated in South Carolina.

Current National Ambient Air Quality Standards for regulated pollutants are summarized in Table One. Table Two summarizes the allowable increments in ambient concentrations under the non-determination regulations.

TABLE TWO

PSD INCREMENTS

Pollutants	Class I, ug/m^3	Class II, ug/m^3
Particulate Matter		
Annual Geometric Mean	5	19
24-hour maximum	10	37
Sulfur Dioxide		
Annual Arithmetic Mean	2	20
24-hour Maximum	5	91
3-hour Maximum	25	512

Source: 42 Federal Register 212,57461.

Will the proposed action change the kinds or amounts of pollutants in the air of Georgetown or Horry Counties?

Winyah Station

In order to predict the effects of the construction of units III and IV at the Winyah Station, the bureau of air quality control of the South Carolina Department of Health and Environmental Control conducted an extensive analysis utilizing mathematical models. The purpose of the models was to simulate mathematically what would happen to various pollutants after they had been emitted into the atmosphere. More specifically, the models simulated the processes of transport and diffusion. The output obtained from application of the models consisted of hourly, daily, and annual average concentrations

of pollutants at designated "receptor" locations downwind from the Winyah site. The following pages draw heavily from DHEC's determinations based on the models.2/

The computer models were run first to make a determination concerning the Prevention of Significant Deterioration increments; secondly to determine the effect of the two units on a nearby non-attainment area; and, to determine the impact upon ambient air quality standards. In the first runs, the models indicated compliance with the Class II increments in effect at that time. However, the 1977 Clean Air Act Amendments, in addition to lowering the 24-hour and 3-hour sulfur dioxide Class II increments also mandated that the Cape Romain Wilderness Area be designated a Class I area.

The effect on the Winyah review was that the new 3-hour, Class II sulfur dioxide increment would be exceeded, with a predicted value of 622.1 ug/m^3. Also it required study of the impact on Cape Romain to determine if Class I increments could be met.

Plans for reducing sulfur dioxide emissions from Units III and IV were submitted by the Public Service Authority in an addendum to its application. Modeling based on these emission rates was conducted and results indicated continued violation of Class I and Class II increments as follows:

TABLE THREE

SO_2 MODELING

	Pollutant		Allowed ug/m^3	Highest Value Predicted ug/m^3
Class II	SO_2:	3-hour	512	572.6
Class I	SO_2:	24-Hour	5	16.8
		3-hour	25	80.9

Source: Bureau of Air Quality Control, S.C. Department of Health and Environmental Control.

Plans were resubmitted for further reducing sulfur dioxide emissions. This is to be accomplished by:

1. Increasing both the amount of flue gas to be scrubbed and the scrubbing efficiency on Units III and IV;

2. Increasing the scrubbing efficiency on Unit II; and,

3. Reducing the sulfur content in the coal to 1.3% on Unit I.

Modeling was performed based on the lower SO_2 emissions, including the reduction from Unit I. As shown below, the TSP and SO_2 emissions from Winyah Units III and IV would not exceed the class II increments given this configuration.

TABLE FOUR

SECOND SO_2 MODELING-CLASS II

Pollutant		Predicted Concentration from Winyah (ug/m)
TSP:	annual	.4
	24-hour	27.8
SO_2:	annual	.4
	24-hour	28.4
	3-hour	237.4

Source: Bureau of Air Quality Control, S.C. Department of Health and Environmental Control.

Class I increments would not be exceeded at the Cape Romain Wilderness.

TABLE FIVE

SECOND SO_2 MODELING

Pollutant		Predicted Concentration at Cape Romain (ug/m)
TSP:	annual	.2
	24-hour	3.8
SO_2:	annual	.2
	24-hour	3.9
	3-hour	19.7

Source: Bureau of Air Quality Control, S.C. Department of Health and Environmental Control.

With respect to non-attainment of particulate standards, there is such an area located in downtown Georgetown, the closest point of which is 5.8 Km northeast of the Winyah Generating Plant. In order to determine if the maximum predicted concentrations were significant, the following values of of significance were used. The predicted concentrations are:

TABLE SIX

PREDICTED TSP CONCENTRATIONS

Pollutant	Significant Concentration (ug/m^3)	Predicted Concentration (ug/m^3)
TSP: annual	1.0	0.2
24-hour	5.0	3.19

Source: Bureau of Air Quality Control, S.C. Department of Health and Environmental Control.

As indicated, the impact of the TSP emission from Winyah on the non-attainment areas was found not to be significant.

Finally, the PSD Regulations also require an analysis of air-quality to determine that the projected ambient levels of pollutants will not exceed the National Ambient Air Quality Standards. For this review, it was decided that the 1977 ambient air measurement of particulates from the Maryville sampling station would be most representative of particulate concentrations at the Winyah Plant location. Ambient air measurements from the Georgetown Health Department sampling site taken in 1974 were considered to be the most representative date for sulfur dioxide.

As shown in Table Seven, the sum obtained by adding the second highest 24-hour measured concentration obtained from sampling to the maximum predicted concentration attributable to the proposed Winyah Units III and IV is less than the National Ambient Air Standard for all cases.

TABLE SEVEN

PREDICTED PERFORMANCE vs AMBIENT STANDARD

Pollutant	Measured Concentration	Max. Predicted Concentration	Total	Ambient Air Standard
TSP: Annual, G.M, 24-hour	45	1	46	60
	117	28	145	150
SO_2: Annual, A.A.	9	3	12	80
	68	237	305	365

Source: Bureau of Air Quality Control, S.C. Department of Health and Environmental Control.

In summary, the configuration of the plant, its pollution control equipment and prevalent meteorological patterns are such that no contravention of existing federal or state PSD increments or ambient air quality standards will result from operation of Units III and IV. Neither will a significant impact be felt in the Georgetown TSP non-attainment area. In light of the total concentration of pollutants suggested in the Table directly above, however, increased care must be taken in the siting of other facilities emitting suspended particulates or sulfur dioxide. These facilities must be sited in such a fashion as to insure that their contributions do not mix significantly with the emission of Winyah Units I through IV in such a fashion as to threaten the standards.

Other atmospheric pollutants were not judged to be present in significant quantities to represent air pollution problems. Nitrogen oxides emitted into the atmposhere from Winyah Units II, III and IV are regulated by design requirements in the permit in order to insure that not more than 0.70 lb/million BTU input is generated by each unit.

Santee-Cooper Rediversion

Operation of the Santee Cooper Rediversion Project including the new hydroelectric plant at St. Stephen will have no direct effect on any of the air pollutants listed. Some ecologists have argued, however, that depending on a multiplicity of factors including moisture content, temperature, the movement of air masses, regional topography, compass orientation, and the size of the reservoir, the local microclimate, and even gross weather may be changed by a hydroelectric impoundment. They argue further that although the change may be extremely small from man's point of view, the chain of events among other animals (for example, insects) or among plants may have strong ultimate secondary elements of human concern.

Other Energy Related Activity

The only other energy related development proposed in the area at this time is the construction by Carolina Refining and Distributing Company of a fuels separation plant at the Harmony Site adjacent to the Winyah Electric Generating Station. Emissions, emission points, and emission limits for the plant are described in detail in Table Eight which is quoted in its entirety from DHEC's Pre-Construction Review and Preliminary Determination on the plant.3/ The imposition of Best Available Control Technology on hydrocarbon and nitrogen oxides emission points will serve to minimize these emissions.

The allowable sulfur dioxide emissions from the proposed construction are less than 50 tons per year, and thus the plant is exempted from Best Available Control Technology requirements

TABLE EIGHT

Emission Limits for Each Emission Point - Fuels Separation Plant

Emission Point	Pollutant	Allowable Emissions lb/hr	Allowable Emission lb/day	Allowable Emission T/yr	Uncontrolled (Potential) Emissions T/yr
**Crude oil heater (Unit #1) & Residential desulf. heater (Unit #2)	Particulate matter (TSP)	3.8	91.2	16.5	16.5
	Sulfur Dioxide (SO_2)	.13	3.1	0.6	0.6
	Nitrogen oxides (NO_x)	43.8	1051.	191	191
	Carbon monoxide (CO)	0.2	4.8	0.8	0.8
	Hydrocarbons (HC)	4.65	111	20	20
Coking Process Heater Unit #3	Particulate matter (TSP)	2.6	62	11	11
	Sulfur Dioxide (SO_2)	0.09	2.2	0.4	0.4
	Nitrogen oxides (NO_x)	30.2	725	132	132
	Carbon monoxide (CO)	0.1	2.4	0.4	0.4
	Hydrocarbons (HC)	3.21	77	14	14
**Kerosene treating heater (Unit 4) & Naptha treating heater Unit 5)	Particulate matter (TSP)	1.6	38	7	7
	Sulfur Dioxide (SO_2)	0.05	1.2	0.2	0.2
	Nitrogen oxides (NO_x)	18.4	442	80	80
	Carbon monoxide (CO)	0.2	4.8	0.8	0.8
	Hydrocarbons (HC)	1.95	47	9	9

TABLE EIGHT (continued)

Emission Limits for Each Emission Point-Fuels Separation Plant

	Emission Point	Pollutant	Allowable Emissions lb/hr	Allowable Emissions lb/day	Allowable Emissions T/yr	Uncontrolled (Potential) Emission T/yr
4.	** Naptha Reformer Heater (Unit 6) & H_2 Purification Heater (Unit 7)	Particulate matter (TSP)	2.3	55	10	10
		Sulfur Dioxide (SO_2)	0.07	1.7	0.3	0.3
		Nitrogen oxides (NO_x)	26	624	114	114
		Carbon monoxide (CO)	0.2	4.8	0.8	0.8
		Hydrocarbons (HC)	2.76	66	12	12
5.	**Boilers (2) Unit #8	Particulate matter (TSP)	0.6	14.4	2.6	2.6
		Sulfur dioxide (SO_2)	.14	3.4	0.6	0.6
		Nitrogen oxides NO_x)	6.9	166	30	30
		Carbon monoxide (CO)	0.1	2.4	0.1	0.4
		Hydrocarbons (HC)	0.9	21.6	4	4
6.	Gas Turbine Unit 9	Particulate matter (TSP)	Emissions are exhausted to and included with process heaters.			
		Sulfur Dioxide (SO_2)				
		Nitrogen oxides (NO_x)				
		Carbon monoxide (CO)				
		Hydrocarbons (HC)				

** Represents Combined Emissions from Both Units

TABLE EIGHT (Continued)

Emissions Limits for Each Emission Point - Fuels Separation Plant

	Emission Point	Pollutant	Allowable Emissions lb/hr	Allowable Emissions lb/day	Allowable Emissions T/yr	Uncontrolled (Potential) Emissions T/yr
7.	Crude Oil Refining Operation.	Particulate matter (TSP)	0	0	0	0
		Sulfur dioxide (SO_2)	3.12	75	13.6	1363
		Nitrogen oxides (NO_x)	0	0	0	0
		Carbon monoxide (CO)	0	0	0	0
		Hydrocarbons (HC)	0	0	0	0
8.	14 Petroleum Storages Tanks Total Capacity 1.12×10^6 BBLS	Particulate matter (TSP)	Only Emissions are HC emissions. They are burned as fuel gas and the allowable emissions are included in the process unit heater emissions.			0
		Sulfur dioxide (SO_2)				
		Nitrogen oxides (NO_x)				
		Carbon monoxide (CO)				
		Hydrocarbons (HC)				
9.	Total Process Emissions From Plant	Particulate matter (TSP)	10.8	258	47.1	47.1
		Sulfur dioxide (SO_2)	3.6	86	15.7	1367
		Nitrogen oxides (NO_x)	12.5	3005	547	547
		Carbon monoxide (CO)	.173	17.6	3.2	3.2
		Hydrocarbons (HC)	13.5	324	59	1491

TABLE EIGHT (Continued)

Emissions Limits for Each Emission Point - Fuels Separation Plant

Emission Point	Pollutant	Allowable Emissions lb/hr	Allowable Emissions lb/day	Allowable Emissions T/yr	Uncontrolled (Potential) Emissions T/yr
10. Total Fugitive Emissions From Plant	Particulate matter (TSP)	0	0	0	0
	Sulfur Dioxide (SO_2)	0	0	0	0
	Nitrogen oxides (NO_x)	0	0	0	0
	Carbon monoxide (CO)	0	0	0	0
	Hydrocarbons (HC)	716	17184	3127	3127

on sulfur dioxide emissions. Using dispersion modeling, DHEC has predicted that emissions from Carolina Refining will not violate Class I PSD Increment at Cape Romain. The results of their modeling are:

TABLE NINE

FUELS SEPARATION PLANT-SO_2

Class I Increment	Allow. Increment	Previously Alloted Increment	Carolina Refining Predicted Increment
(ug/m^3)	ug/m^3)	(ug/m^3)	(ug/m^3)
SO_2 Annual	2	.2	.01
SO_2 24-hour	5	3.9	.2
SO_2 4-hour	25	19.7	1.3

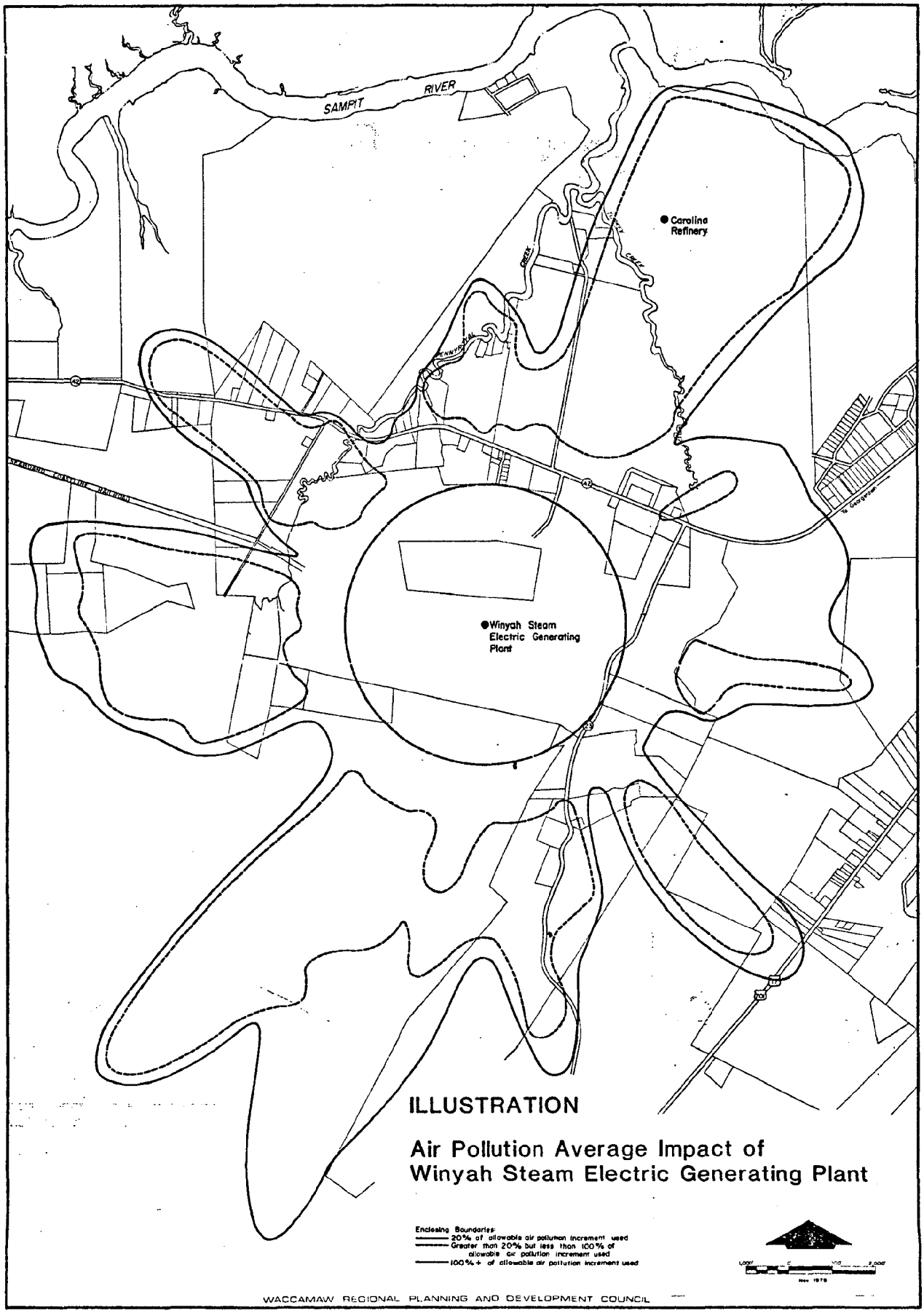
Additionally, the impact of Carolina Refining's SO_2 emissions on the Amoco Plant near Charleston were modeled with the results indicating that the impact would be less than the minimum value considered significant.

Overall Air Quality Impacts

In order to bring together the impacts of the two developments to be located adjacent to the Sampit River and to assess their effects upon the potential for further industrial development in the same area, the Bureau of Air Quality Control agreed to undertake additional mathematical modeling. The model employed was CRSTER, a point source model which is designed to calculate maximum one-hour, 25 hour, and annual average concentrations at a specified set of receptors for a full year of actual hourly meteorological data.

Rather than the traditional grid output, the model was programmed to provide results as a series of concentric rings spaced at a distance of one kilometer, with 36 receptors per ring. The CRSTER concentration value of each of these receptors was divided by the maximum allowed ambient value and the resulting values were plotted. In light of resource limitations, CRSTER was programmed only for SO_2 and a limited number of runs were undertaken. The results are viewed as a valid indication of air quality status insomuch as transport distances for SO_2 are much greater than for TSP, and the Class I PSD, located at Cape Romain, is the key variable in determinations of what and how much industrial development may occur in the Sampit River area.

The findings of the CRSTER modeling are displayed graphically in illustration One. The Public Service Authority site is located at the center of the display, and the SO_2 values are at or near 100%. Moving outward from the center, however, the mea-


SAMPIT RIVER
Carolina Refinery
Winyah Steam Electric Generating Plant
ILLUSTRATION
Air Pollution Average Impact of Winyah Steam Electric Generating Plant
Enclosing Boundaries:
20% of allowable air pollution increment used
Greater than 20% but less than 100% of allowable air pollution increment used
100%+ of allowable air pollution increment used
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sured values drop-off rapidly and significantly. For simplicity of presentation, an isoline has been drawn connecting areas where 20% of the allowable SO_2 increment has been consumed. The line is irregular in shape, suggesting the effects of prevailing wind patterns. More importantly and to the point, however, the 20% isoline extends no further than 4.15 kilometers from the center of PSA property. Beyond the isoline, as much as 80% of the allowable SO_2 increments remains available for assignment to other point sources.

These findings tend to bear out earlier air quality research conducted by the Bureau of Air Quality Control to determine the possibility of locating an aluminum reduction plant similar to the Alumax, Inc. facility in Berkeley County, at a site near the International Paper Company Sampit Sawmill. In that analysis, the reduction facility was found to be feasible (on the basis of hypothetical input parameters) when its emissions were added to those of Winyah Units I through IV.

On the basis of available data and the analysis presented in Illustration One, there is no reason to believe that a similar facility would not be feasible today, even in light of emissions from the fuels separation facility. In brief, air quality in the designated and planned industrial area adjacent to the Sampit River remains good with respect to national standards. A substantial increment of air quality degradation remains available for allocation following adequate air quality modeling.

How Much Dust or Other Construction-Related Pollution Will Result from the Projects?

In general, two kinds of air emissions are generated by site alteration and construction activities. These are combustion emissions from the machinery being used at the sites, and fugitive dust from machinery moving over exposed top soil.

The exhaust from machinery operation at the site will contribute various pollutants to the surrounding environment, principally nitrogen oxides from diesel powered equipment and carbon monoxide from gasoline powered equipment. Emission volumes will depend directly on the numbers and types of machinery used at the site. A summary of emissions information for various commonly used pieces of heavy equipment is found in Tables Ten and Eleven.

The quantity of dust created by heavy equipment moving over exposed top soil will also depend upon a number of variables such as the size of the disturbed area, the types and levels of activities, local weather conditions, and soil characteristics. The Environmental Protection Agency, though, has suggested a rule of thumb for estimating dust emissions.29/ The rule

must be carefully modified and applied to account for localized conditions since it assumes a relatively dry climate with soils which are high in silt content.

The EPA guide suggests 12 tons per acre of construction per month of activity. In light of the relatively high annual precipitation normal for Georgetown County (51.23 inches at the City of Georgetown measuring station over the period of 1941 through 1970[4]/ and the prevalence of clay-based soils with good moisture retention characteristics, the EPA rule of thumb may be adjusted downward to perhaps as low as 2.00 to to 2.25 ton/acre/month. Also, in light of application of particulate control techniques such as water spraying by on site contractors, the amounts may fall to as low as 1.25 to 2.0 tons/acre/month.

Winyah Station

Site preparation for the generating units, cooling towers, ponds, etc. is essentially complete at this time. Only minimal site preparation work remains on one of the ponds and it is limited in large part to moist soils well below the top soil level. During visits to the site, airborne dust was observed to be practically nonexistent. Dust that was observed resulted from vehicular traffic entering the site along an unpaved road.

Although it is possible that more extensive problems of fugitive dust were dealt with at the Winyah site during earlier phases of construction, the extent of the problems cannot be assessed now. Too, the effect has disappeared due to settling and air movement.

During the course of visits to the site, an average of 12 diesel powered motor graders and between six and eleven pieces of miscellaneous diesel and gasoline powered equipment were observed. Assuming that each piece of equipment will be used an average of five hours per day for approximately another 50 days, resulting emissions based on Table Ten and Eleven will be:

Carbon Monoxide	41,374.200	lbs/hour
Exhausted Hydrocarbons	1,726.800	
Evaporate Hydrocarbons	134.400	
Crankcase Hydrocarbons	268.800	
Nitrogen Oxides	7,492.800	
Aldehydes	89.040	
Sulfur Oxides	537.306	
Particulates	448.320	

Santee-Cooper Rediversion

In light of location, particulate matter transport distances,

TABLE TEN

EMISSION FACTORS FOR HEAVY-DUTY
DIESEL-POWERED CONSTRUCTION EQUIPMENT

Equipment	Carbon monoxide		Exhaust hydrocarbons		Nitrogen oxides		Aldehydes		Sulfur oxides		Particulates	
	lb/hr	lb/1000 gallons	lb/hr	lb/1000 gallons	lb/hr	lb/1000 gallons	lb/hr	lb/1000 gallons	lb/hr	lb/1000 gallons	lb/hr	lb/1000 gallons
Tracklaying tractor	0.386	87.5	0.110	25.1	1.47	332.0	0.027	6.22	0.137	31.1	0.112	25.3
Wheeled tractor	2.15	161.0	0.148	50.9	0.994	342.0	0.030	10.3	0.090	31.1	0.136	46.5
Wheeled dozer	0.739	65.9	0.234	20.7	5.05	450.0	0.065	5.76	0.348	31.2	0.165	14.8
Scraper	1.46	98.3	0.626	42.2	6.22	419.0	0.143	9.69	0.463	31.2	0.406	27.3
Motor grader	0.215	78.0	0.054	17.4	1.05	374.0	0.012	4.31	0.086	31.1	0.061	22.2
Wheeled loader	0.553	95.4	0.187	32.3	2.40	408.0	0.041	7.17	0.182	31.2	0.172	29.3
Tracklaying loader	0.160	65.9	0.032	13.2	0.584	240.0	0.009	3.66	0.076	31.2	0.058	24.0
Off-highway truck	1.34	92.2	0.437	30.0	7.63	524.0	0.112	7.74	0.454	31.2	0.256	17.7
Roller	0.184	114.0	0.054	24.3	1.04	488.0	0.016	6.10	0.067	31.1	0.050	24.2
Miscellaneous	0.414	94.2	0.157	34.7	2.27	494.0	0.031	6.78	0.143	31.1	0.139	30.1

Source: "Heavy-Duty Construction Equipment" in Compilation of Air Pollutant Emission Factors, 2nd ed., U.S. EPA 1976, pp. 3.2.7-? and 3,2,7-3.

TABLE ELEVEN

EMISSION FACTORS FOR HEAVY-DUTY
GASOLINE-POWERED CONSTRUCTION EQUIPMENT

Equipment	Carbon Monoxide		Exhaust hydrocarbons		Evaporative hydrocarbons	Crankcase hydrocarbons	Nitrogen oxides		Aldehydes		Sulfur oxides		Particulates	
	lb/hr	lb/1000 gallons	lb/hr	lb/1000 gallons	lb/hr	lb/hr	lb/hr	lb/1000 gallons	lb/hr	lb/1000 gallons	lb/hr	lb/1000 gallons	lb/hr	lb/1000 gallons
Wheeled tractor	9.25	3250.0	0.362	122.0	0.0681	0.0719	0.430	146.0	0.0176	5.82	0.0155	5.20	0.024	8.27
Motor grader	12.1	3910.0	0.410	132.0	0.0661	0.0818	0.320	102.0	0.0194	6.02	0.0167	5.31	0.0207	6.86
Wheeled loader	15.6	3630.0	0.531	124.0	0.0655	0.106	0.518	121.0	0.0213	4.95	0.0234	5.31	0.0298	7.0
Roller	13.4	3840.0	0.611	176.0	0.0622	0.122	0.362	100.0	0.0167	4.86	0.0185	5.28	0.026	7.47
Misc.	17.0	3960.0	0.560	130.0	0.0560	0.112	0.412	95.8	0.0198	4.44	0.0234	5.28	0.0258	6.06

Source: "Heavy-Duty Construction Equipment" in Compilation of Air Pollutant Emission Factors, 2nd edition, U.S. EPA 1976, pp. 3.2.704 and 3.2.7-5.

control techniques employed, and the type of construction involved, development of the rediversion project will not impact air quality (particulates) in either Georgetown or Horry County. Construction of access roads and construction-related buildings is essentially complete at this writing. Although dust has not been measured during this initial phase, its impact has been minimized through the use of standard techniniques including frequent water spraying. Construction of the entrance channel, intake canal, power plant, and tailrace canals will involve some localized particulate problems although the principal problem to be faced by the Corps of Engineers and its contractors will be dewaterization of soils.

At this time, no contract has been awarded for the entrance channel; a contract has been awarded on the intake canal though no work has begun; work is just beginning on the tailrace canal; and, construction is underway on the powerhouse. Thus, little information is available on specific numbers and the types of equipment to be used. In light of both the distance from Horry and Georgetown Counties and the prevailing wind patterns, however, a minimum or even zero impact on nitrogen oxides and carbon monoxide levels is anticipated.

Fuels Separation Plant

Insomuch as fuels separation plant construction plans are at a highly tentative and preliminary stage, little can be said concerning the potential for particulate problems. Based upon the experience at the Winyah Station, however, the following hypothetical projection of construction related pollutants is offered as a planning guideline. The figures will need revision as construction plans take more definite form.

Particulates: two tons per acre per month will total 600 tons during a three month site preparation period and perhaps as much as 50 tons per month during other phases of construction. Assuming ten diesel-powered vehicles of miscellaneous function and ten gasoline-powered vehicles also of miscellaneous function, operating eight hours per day for 22 days per month, the monthly emissions of contaminants would total:

Carbon Monoxide	61,279.2800	lbs/month
Exhaust Hydrocarbons	5,526.4000	
Evaporate Hydrocarbons	197.1200	
Crackcase Hydrocarbons	394.2400	
Nitrogen Oxides	9,440.0640	
Aldehydes	178.8160	
Sulfur Oxides	585.7280	
Particulates	580.0960	

WATER QUALITY

The purpose of this section is to review existing water quality

of the Sampit and Santee Rivers, the two streams most affected by the development under investigation. With respect to the Sampit River, Wickel and Associates has retrieved, averaged, and will quote ten years of data from the EPA's STORET System for two sampling stations; one located on the Sampit River upstream of its confluence with Turkey/Pennyroyal Creeks, and the other located downstream. With respect to the the Santee River, we will quote extensively from a base line study conducted by the South Carolina Water Resources Commission during 1974 and 1975.5/

Dissolved Oxygen (DO) is perhaps the single, universally measured parameter of water quality. It is the amount of available oxygen contained in a water sample under given conditions. Unpolluted surface waters are able to absorb oxygen from the air to a point of equilibrium or saturation depending upon water temperatures and atmospheric pressure. The presence of organic material or waste products may result in a lowering of DO so that the difference between the theoretical and actual DO content is an indicator of water quality. Waters at or near saturation are usually of high quality unless degraded by other factors that do not consume oxygen.

In the Sampit River, dissolved oxygen appears relatively low at both sampling stations, probably as a result of higher concentrations of organic materials:

Location	Measurement	Mean	Minimum	Maximum
Upstream	mg/l	3.155	0.000	7.900
Downstream	mg/l	5.433	.300	10.000
		Saturation		
Upstream	percent	27.967	.000	55.000
Downstream	percent	31.000	4.000	50.000

For the most part, DO levels in the lower Santee River were found to be fairly high. Water temperatures during the May and August sampling periods were roughly comparable. During these same periods, DO readings and percent saturation declined as compared to the October/November and February sampling period. This may be attributed to climatic conditions as well as to increased biological metabolism rather than to waste loading. There were also some indications of DO sag in the October/November data. At this time of the year, leaf fall occurs and natural mortality of annual vegetation takes place.

Biochemical Oxygen Demand (BOD) is a test indicating the relative amount of organic material that may be present in water. It is expressed as the amount of dissolved oxygen taken up by time, usually five days.

For surface waters, readings in the magnitude of 1.0-2.0 milligrams per liter (mg/l) are considered to be low. Even 3.0-4.0 mg/l generally is of no great concern unless consistently high in relation to other stations. Higher readings, particularly if consistent, may bear in-depth investigation. As an illustration of BOD_5 significance, raw sewage may be in the magnitude of 100-200/mg/l and industrial waste of high organic content may register into the thousands.

With respect to the Sampit River:

Location	Measurement	Mean	Minimum	Maximum
Upstream	mg/l	2.562	.700	6.500
Downstream	mg/l	2.380	.700	5.500

Water quality as indicated by BOD_5 is elevated but still good. Occasional maximums can probably be accounted for by natural loadings resulting from swamp run-off, leaf fall, and similar phenomena.

In the Santee River, water quality as indicated by the BOD_5 analysis was high showing no significant imposition on the system from point or non-point pollution sources. Slight loading does occur in the vicinity of municipal treatment plants or industrial facilities; however, such loading is diluted or assimilated as evidenced by rapid recovery in dissolved oxygen at successive downstream sampling points.

pH is an expression of hydrogen ion activity which serves as an indication of relative acidity or alkalinity. On a scale of 0 to 14, neutrality is 7, with acidity increasing toward 0, and alkalinity increasing toward 14. Natural waters can range between 4 and 9 with the most productive waters, biologically, exhibiting a narrower range--about 6.5 to 8.5.

In the Sampit River:

Location	Measurement	Mean	Minimum	Maximum
Upstream	units	6.729	6.100	7.400
Downstream	units	6.693	5.200	7.500

The range encountered in the Santee River was a high of 9.2 and a low of 6.5 mean values at the individual river stations reflected a range of 6.6 to 8.2 with the numerically lower readings at upstream locations. The findings for both rivers indicate streams of generally high productivity potential, and streams not unduly affected by waste loading.

Specific conductance is a measure of the ability of water to conduct an electrical current. The degree of conductivity is roughly proportional to the amount of total dissolved solids (TDS) the water sample contains. Waters of high TDS are

usually objectionable in public or multi-purpose supplies due to their physiological effect, odors, mineral taste, and cost of treatment. In fresh water, an assessment of 500 mg/l TDS appears to be the separation point between acceptance and rejection. Prospective industrial users may also reject sites where raw water supplies have excessive materials in solution.

The relationship between specific conductance and total dissolved solids will vary with the distribution of the major constituent elements present; but, for any given water a relatively uniform relationship exists. TDS is about 65% of specific conductance. Most raw fresh waters range from 50 to 500 microhms in specific conductance and "highly mineralized" water may range up to 1000 microhms or higher.

With respect to the Sampit River:

Location	Measurement	Mean	Minimum	Maximum
Upstream	----------	unavailable	----------	----------
Downstream	microhm	4890.00	300.000	14000.0
	Total Dissolved Solids			
	mg/l	3179.00	195.000	9100.00

The high values observed at the downstream location indicate a loading from natural or man-made sources and/or the effects of saline water introduced through tidal action. Sea-strength water, it should be noted, will have a TDS of about 33,000 mg/l and a specific conductance of about 50,000 microhms/cm.

For the most part, the specific conductance data gathered throughout the Santee River study indicates high quality fresh water in the upper reaches and increasing salinities at a point just above route 17 in the South River and the U.S. 17 Bridge on the North River.

These data also show the influence of increased flows during February, 1975, on the downstream shifting of salinity patterns. One station, located on the North River at the head of Cain Island ranged from approximately 35,000 to 45,000 microhms as highest readings for most of the year; during February, however, with flows of around 16,000 cfs, specific conductance dropped to an average of about 4,000 microhms and a lowest reading of less than 1000 microhms. This represents a range of about 2/3 sea-strength to something less than 1/10 sea-strength. A similar phenomena occurred simultaneously on the South River at Grace Island except the salinities did not drop as dramatically. This shift of salinity profile may be similar to that expected to occur with the rediversion of 12,000 to 13,000 cfs from the Cooper River.

Color is more evident in some natural waters than in others

and it may vary over time in the same waters. Color of water may be produced by such substances as metallic ions, particularly iron and manganese; humus or peaty natural organics; plankton, algae, or vascular plant growth; and industrial wastes.

Color is measured by comparing the sample to a series of standard colors produced in the laboratory by dissolving platinum and cobalt salts in controlled portions of acid and water. Color range using this method may be between 0 and 500 units. The Environmental Protection Agency has recommended a maximum of 75 units for public water supply.

In the Sampit River, the values are high with respect to the EPA standard (see subsequent discussions of iron and manganese):

Location	Measurements	Mean	Minimum	Maximum
Upstream	Units	148.750	60.000	360.000
Downstream	Units	133.548	20.000	200.00

In the Santee River, during the course of the 1974-75 study each of the stations except two averaged less than 75 P/C units with a maximum reading of 200 units.

The maximum reading occurred at several of the middle section stations in February when releases at Wilson Dam were in the magnitude of 15,000 cfs. These inflated readings were attributed to run-off and flushing action which usually introduce greater loads of natural organic material.

Turbidity is an expression of a property of a sample of water that causes transmitted light to be diffused and scattered. In reality, there is no practical correlation between turbidity and the amount of suspended material since the size of particles and their other properties have a significant effect on diffusion of light. In general, however, turbidity is a useful tool for expressing water quality when used along with other indicators.

A simple procedure for measuring turbidity is to use a Jackson Candle Turbidimeter, a device which allows a sample of water to be placed in front of a standardized candle on a moveable frame. The observer views the candle flame through the sample and its container and increases the distance between candle and sample until the flame image becomes indistinguishable. The distance is equivalent to a number of Jackson Turbidity Units (JTU).

Measurement may exceed 1000 JTU's, but raw waters normally used for public supply do not often exceed 1000 JTU's. Water quality in both rivers as measured by turbidity is good. In the Sampit River:

Location	Measurement	Mean	Minimum	Maximum
Upstream	JTU's	31.667	12.000	57.000
Downstream	JTU's	26.000	12.000	50.000

In the Santee River, mean values did not exceed 30 JTU units. For the most part, stations in the upper river did not exceed a mean of 10. There was an increase in turbidity in the saline water stations as expected since these waters normally carry fine particles in suspension longer due to tidal action.

Ammonia nitrogen (NH_3) is found in most surface waters in concentrations of 0.1 mg/l or less. In public water supplies, the presence of ammonia requires above normal addition of chlorine if the desired level of disinfection is to be attained. EPA has recommended that ammonia nitrogen in public supply sources not exceed 0.5 mg/l.

At both measuring stations on the Sampit River, the presence of ammonia nitrogen is well within acceptable limits as demonstrated by the following averages:

Location	Measurement	Mean	Minimum	Maximum
Upstream	mg/l	.0806	.0200	.1800
Downstream	mg/l	.0907	.0200	.2800

In the Santee River, the public water supply standard was exceeded at two stations, and the mean measurements (0.84 mg/l) at Crawl Creek indicated a generally impacted system. The remaining stations, however, did not exceed this criteria. The Crawl Creek Station, it should be noted, is not in the main river, but is located a short distance below the outfall of an industry which utilizes various organic compounds in the manufacturing of plywood. Dilution occurs as Crawl Creek injects into the Santee River at the second station exceeding PWS Standards although the industrial discharge probably accounts for the occasional inflated readings at that measurement station. Even though the readings are occasionally inflated they are well below the PSW Standard as are all other measuring stations.

Nitrite/Nitrate Nitrogen (NO_2/NO_3) are the two remaining forms of nitrogen usually tested for in water quality determinations. Nitrate Nitrogen (NO_3) is the usual form of nitrogen applied to field crops as a nutrient, and this may account for often high concentrations of photoplankton algae, and for emergent aquatic vegetation often found in streams and reservoirs. Nitrates are found in surface waters in trace quantities. Nitrite (NO_2) levels in raw surface waters are usually less than 1.0 mg/l.

In the Sampit River:

Location	Measurement	Mean	Minimum	Maximum
Upstream	mg/l*	.1809	.0500	.5000
Downstream	mg/l*	.0914	.0300	.5000

*.01 mg/l equals 10 micrograms per liter (ug/l).

In the Santee River study, there were some readings as high as (200 ug/l) or .20 mg/l, but for the most part phosphorus levels remained within the range of 40-80 ug/l. Probably as the result of agricultural run-off and treated municipal waste waters, there is a gradual increase of phosphorus downstream. A somewhat inflated situation occured in Crawl Creek (maximum 270 ug/l, mean 130 ug/l) during the fall sampling, but these readings had little effect on the Santee River following dilution.

Heavy metals may occur in surface waters whether naturally or as the result of runoff, industrial activity or outfall from municipal sewage treatment. The potential danger to public health lies in the toxicity of certain metallic compounds. In industry, metals may interfere with certain processes while modern water management techniques provide for treatment of most raw water sources and result in acceptable public supplies. There is a wide variation in the ultimate quality for its production. The limiting values for raw water components including some metals are summarized in Table Twelve.

In the Sampit River, elevated measurements of various heavy metals including cadmium, chromium, iron, lead, manganese, and zinc have been consistently recorded over an extended period of time. Some of the maximum readings were extraordinarily high (i.e., chromium, 1500 ug/l and iron, 2340 ug/l). Concentrations such as were recorded are of concern only as they affect flush and plant life in the stream or in Winyah Bay; as they affect industrial processes; or as they may potentially affect the quality of shallow ground water aquifers.

The elevated concentrations recorded by DHEC may result from a variety of circumstances. The most likely reasons, however, are: inaccurate unrealiable testing procedures employed by the State environmental agency (see discussion below); discharge from permitted sources (some are suggested in the following pages, though the volumes currently discharged are likely not sufficient to account for the recorded concentrations); or, discharges by, or run-off from, unknown and unpermitted sources.

Whatever the sources, water quality testing in the Sampit River bears much more careful monitoring by DHEC. Should future tests indicate continued elevated concentrations, resources

TABLE TWELVE

SUMMARY OF SPECIFIC QUALITY CHARACTERISTICS OF SURFACE WATERS
USED AS SOURCES FOR INDUSTRIAL WATER SUPPLIES

Characteristics	Boiler Makeup Water		Cooling Water				Process Water				
			Fresh		Brackish[a]						
	Industrial 0 to 1,500 psig	Utility 700 to 5,000 psig	Once Through	Makeup Recycle	Once Through	Makeup Recycle	Textile Industry SIC-22	Lumber Industry SIC-24	Pulp and Paper Industry SIC-26	Chemical Industry SIC-28	Petroleum Industry SIC-29
Iron (Fe)	80	80	14	80	1	1	.3	--	2.6	10	15
Manganese	10	10	2.5	10	.02	.02	1.0	--	--	2	--
Copper	--	--	--	--	--	--	.5	--	--	--	--
Calcium	--	--	500	500	1200	1,200	--	--	--	250	220
Ammonia (NH_3)	--	--	--	--	--	180	--	--	--	--	40
Nitrate (NO_3)	--	--	30	30	--	--	--	--	--	--	8
Phosphate	--	50	4	4	5	--	--	--	--	--	--
Dissolved Solids	35,000	35,000	1,000	1,000	35,000	35,000	150	--	1,080	2,500	3,500
pH, Units	--	--	5.0-8.9	3.5-9.1	5.0-8.4	5.0-8.4	6.0-8.0	5.9	4.6-9.4	5.5-9.0	6.0-9.0
Color, Units	1,200	1,200	--	1,200	--	--	--	--	360	500	25
Chemical Oxygen Demand	100	500	--	100	--	200	--	--	--	--	--
Temperature (F)	120	120	100	120	100	120	--	--	95[b]	--	--

a Water containing in excess of 1,000 mg/l dissolved solids.

b Applies to bleached chemical pulp and paper only.

SOURCE: Environmental Protection Agency, 1973, "Water Quality Criteria, 1972", U.S. Government Printing Office, p. 370

and effort should be devoted to tracing the sources. And, finally, existing levels of concentration and their potential toxic effects suggest increased care in consideration of the siting of future point sources along the river.

The STORET data for the Sampit River presented in the following pages covers various periods of time from 1969 through 1977. In mid-1977, the South Carolina Department of Health and Environmental Control discontinued monitoring at the upstream station and, more importantly, changed the type of measurement for heavy metals taken at the downstream site.

Measurement of dissolved metals was discontinued in favor of measurement for total metals since, according to DHEC, the previous method allowed background interference from salt water brought into the river by tidal action, thus producing exaggerated results. 6/ Measurements of total heavy metals at the downstream sampling station from mid-1977 to the present will be included in the following discussions.

There is, however, an apparent anomaly in the post-1977 data. With the change of measurement techniques from dissolved to total metals, one would expect an increase in the quantity of an element detected. In the case of measurements in the Sampit River, however, the quantities actually decreased in some cases by substantial amounts. According to DHEC, the apparent decrease in concentrations may be attributed to the unreliability of the previous data.

Finally, testing for zinc has recently been discontinued as a result of deteriorating laboratory facilities. DHEC asserts that the deterioration in some of its equipment may have allowed background interference with zinc testing and, thus, may have produced artificially high readings.6/

Cadmium is a metal in common use as a protective plating for other metals. It is applied by electroplating, and the effluent from such processes is probably the source of most cadmium contamination in natural waters. Drinking water standards limit concentrations to 10 ug/l.

In the Santee River, the average cadmium concentration in the water column was 1.0 ug/l, or well within the established safety standard. In the Sampit River, however, the measurement were notably higher:

Location	Measurement	Mean	Minimum	Maximum
Upstream	ug/l	30.127	5.000	100.000
Downstream	ug/l	27.259	5.000	100.000
Downstream	Total	10.167	10.000	11.000

Chromium is rarely found in natural waters but may occur as a result of electroplating wastes, cooling tower blowdown, or

from other sources. The EPA suggested safe level for drinking water supplies is a maximum of 50 ug/l total chromium.

In the lower Santee River study, chromium was not detected in the water column, but was in sediments at levels of 10 ug/l. In the Sampit River, chromium was detected at substantially higher levels. Some, though likely not all of the measured concentrations originate at Georgetown Steel and the Winyah Station, both of which hold permits to discharge limited amounts of chromium.

Location	Measurement	Mean	Minimum	Maximum
Upstream	ug/l	139.563	50.000	1750.000
Downstream	ug/l	112.963	50.000	1500.000
Downstream	total	50.00	50.000	50.000

Copper occurs fairly frequently in surface waters and is essential for cell metabolism in humans as well as higher organisms. It is highly toxic to algae and mollusks with some fish species being able to tolerate roughly 10 to 30 ug/l and may be of concern to some industrial users since it enhances corrosion of zinc and aluminum. An upper limit of 100 ug/l has been suggested where aluminum conduits or processes may be involved.

In the Santee River Study, copper was detected in all water samples and range from 2 to 50 ug/l with most of the readings being below 10 ug/l. In the Sampit River:

Location	Measurement	Mean	Minimum	Maximum
Upstream	ug/l	85.869	50.000	100.000
Downstream	ug/l	88.462	50.000	100.000
Downstream	total	100.000	100.000	100.000

Iron in surface waters generally present no health problems though taste is often affected and plumbing fixtures may be stained at higher concentrations. Generally, concentrations of 300 ug/l are acceptable in public water supplies though as noted earlier in Table 12 some industrial uses require lower levels.

The maximum measurement in the Santee River was 200 ug/l, a value well below the limitation for processes, boiler make-up, or cooling waters. In the Sampit River values were significantly higher. These elevated values may reflect higher iron concentrations in soils as well as discharges from Georgetown Ferreduction or other point sources6/:

Location	Measurement	Mean	Minimum	Maximum
Upstream	ug/l	848.704	100.000	2350.000
Downstream	ug/l	823.295	100.000	1870.000
Downstream	total	953.333	700.000	1300.000

Lead is generally insoluable in water and especially so as hardness increases. The recommended maximum allowances in public water supply sources is 50 ug/l. During the course of the lower Santee River study, the maximum concentration in the water column was 26 ug/l and the average concentration was 10.2 ug/l. Data related to the concentrations of lead in the Sampit River have been termed unreliable and exaggerated by DHEC following a challenge of testing procedures by a third party.6/ The values derieved from STORET are:

Location	Measurement	Mean	Minimum	Maximum
Upstream	ug/l	82.385	50.000	200.000
Downstream	ug/l	82.506	50.000	200.000
Downstream	total	68.333	50.000	150.000

Manganese is objectionable because of its effect upon water and its capacity to stain plumbing fixtures. Concentrations less than 50 ug/l are generally acceptable in public water supplies.

In the Santee River, manganese was found in water in concentrations as high as 700 ug/l. That reading on the South River at the US 17 Bridge may represent some salt water influence. Upstream sampling stations generally showed low manganese concentrations and, thus, the river appears to be suitable for most prospective uses. In the Sampit River, a similar salt water influence can be observed:

Location	Measurement	Mean	Minimum	Maximum
Upstream	ug/l	74.211	50.000	120.000
Downstream	ug/l	91.783	50.000	450.000
Downstream	total	85.000	50.000	160.000

Mercury may occur naturally in water systems and, unless subjected to the process of biological magnification, there is little cause for concern. For public water supplies it is recommended that total mercury not exceed 20.0 ug/l. In the Lower Santee River Environmental Quality Study, mercury was detected in the water column periodically. The highest concentration found was 0.7 ug/l, well within the recommended limit for public water supplies. In the Sampit River total mercury commended standard:

Location	Measurement	Mean	Minimum	Maximum
Upstream	total	.767	.100	6.400
Downstream		.527	.160	1.630

Zinc may enter natural waters from any of several sources. Since it is commonly used to prevent corrosion of other metals, the aging process of galvanized water pipes, water heaters, tanks, sheet metal buildings and junk yards results in non-point sources of zinc. The recomended limit for public

water supplies is not to exceed 5 mg/l. There are no general rules for limiting zinc in industrial waters.

The findings of the Lower Santee Study are well within expressed limits for concern being usually less than 10 ug/l with a maximum of 40 ug/l with the latter coming from a saline influenced sampling station. In the Sampit River, the values are high possibly reflecting saline influence, discharges from Georgetown Steel, the Winyah Steam Plant, and discharges from other, unidentified point sources:

Location	Measurement	Mean	Minimum	Maximum
Upstream	ug/l	100.000	100.000	100.000
Downstream	ug/l	100.000	100.000	100.000
Downstream	total	133.333	100.000	300.000

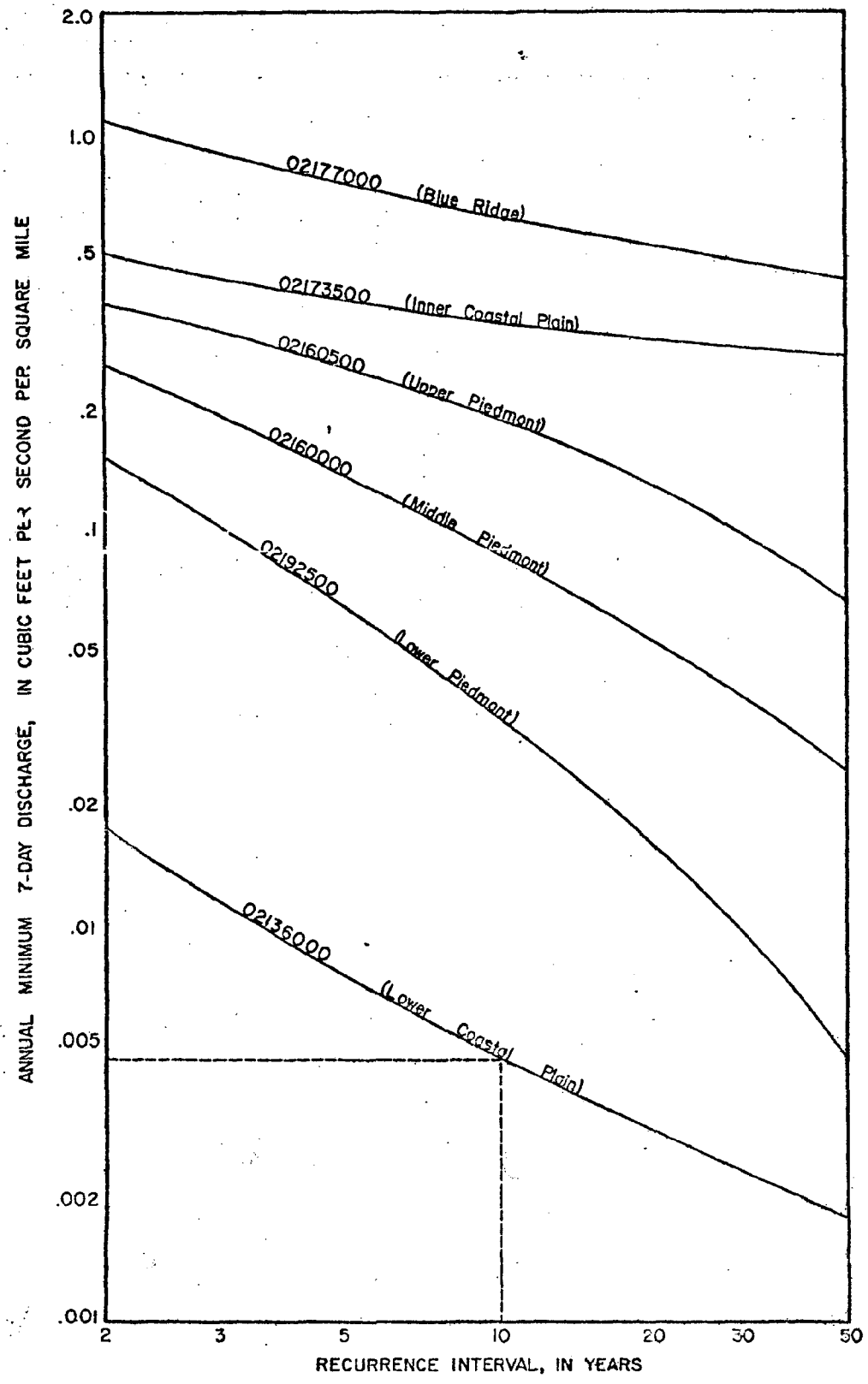
Flow is a final water quality factor significance, particularly with regard to the Sampit River. The Sampit drains approximately one hundred square miles with several tributaries though drainage is poor and water movement is sluggish.

Freshwater inflow to the Sampit River as a result of runoff is known to be very low during seasonal periods of sparse rainfall though no precise figures have been determined. For the purposes of assessing the impact of discharges on the stream, DHEC assumes the annual minimum seven day discharge for a ten year interval to be zero.7/ This assumption is generally supported by more recent research conducted by the South Carolina Water Resource Commission and the U.S. Geological Survey8/ which compares discharge records for several streams located in the lower coastal plain as well as other physiographic regions. Illustration Two shows the annual minimum seven day discharge of the Sampit River, attributable to runoff, to be slightly less than .005 cubic feet per second per square mile over recurrence intervals of ten years. For the total drainage area involved, this amounts to slightly less than one half cubic foot per second.

Additionally, the South Carolina Water Resources Commission estimated that fresh water enters the Sampit River from its mouth during rising tides about ten percent of the time. This occurs when freshwater flows from the Pee Dee River into the northern end of Winyah Bay is sufficient to push salt water below the mouth of the Sampit River.

In a 1978 study of flushing action in the Sampit,9/ the Water Resources Commission determined that flushing was moderate to good in the lower reaches (to about six miles inland from the River mouth, or about one mile west of Ports Creek), but decreases significantly further inland. During the period of April 8 through May 10, 1978, dye injected in the upper reaches of the river diminished by slow dispersion through tidal action, and its gradual movement in a downstream direc-

ILLUSTRATION 2



Source: William M. Bloxham, Low-Flow Frequency and Flow Duration of South Carolina Streams, South Carolina Water Resources Commission. Report No. 11, 1979.

tion took about one week to become pronounced. Such minimal flushing action in the upstream segments of the river must be carefully considered in future industrial siting decisions.

What can be Expected in Terms of Changes in the Kind or Amount of Pollutants Found in the Water Bodies of the Two County Area?

Winyah Station

Winyah Units I and II are designed to recycle boiler and cooling water for maximum reuse. Wastewater enters Turkey Creek from the cooling pond either as a result of overflow during wet periods or blowdown (to control dissolved solids in the cooling water). Table Thirteen summarizes the quantity and chemical nature of such wastewater for a recent one year period.

Winyah Units III and IV are similar in design and, thus, it is anticipated that the various waste streams will be similar in nature to existing discharges. See Illustration Three for a simplified representation of those flows.

In brief, boiler and cooling water for Units III and IV will be drawn from the Santee River at a rate of 15.7 million gallons per day (gpd). This water enters the system at a 400 acre cooling pond where it is mixed with rain water and just over four million gpd of water being returned from the ash pond system for reuse.

Water flows from the cooling pond via an intake canal as make-up water (replacing losses due to evaporation) for the two eight cell mechanical forced draft cooling towers (4.5 million gpd each) as a boiler make-up for the two generating units.

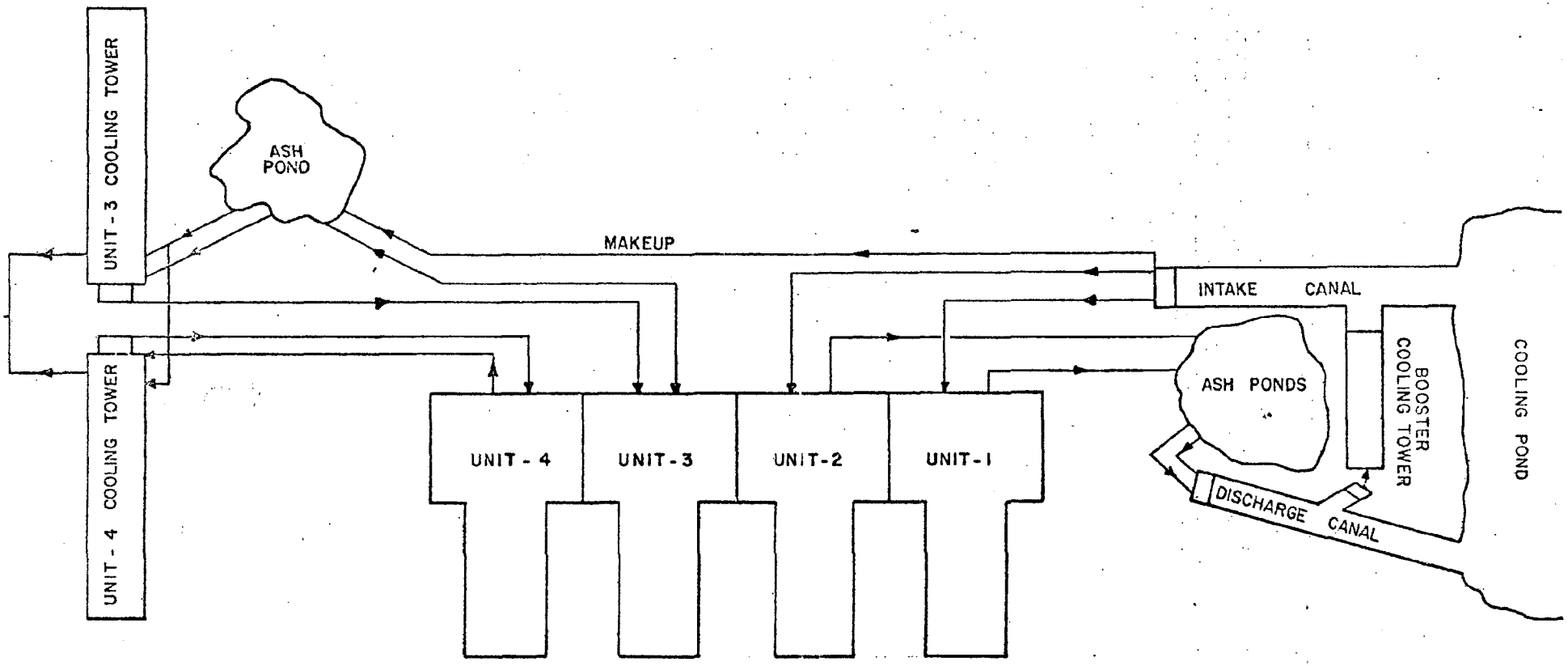
Discharge from the boiler is divided into several waste streams totaling 4.15 million gpd (excluding emergency flyash disposal) for treatment. Following treatment, the waters are channeled to a 69 acre ash pond for retention and settling; transferred to a second ash pond (70 acres) for further settling; and, then returned (4.03 million gpd) via a thermal discharge canal to the cooling pond.

Make-up water for the cooling towers is mixed with condenser water. This water circulates between the cooling towers and the condenser at a rate of 180 million gpd per unit. Discharge (blowdown) from the cooling towers is sent to Pennyroyal Creek at a maximum of 1.2 million gpd at maximum operation.

Again, the nature of the blowdown is expected to be similar to existing waste streams being discharged into Turkey Creek. A principal difference, however, is that the quantity of wastewater to be discharged will be greater. While Table

ILLUSTRATION 3

Winyah Generating Station Circulating Water System



Source: South Carolina Public Service Authority

Thirteen shows discharge volumes to Turkey Creek to be zero for seven of the twelve months covered, it is expected that Units III and IV will generate a continued discharge.

Insomuch as the volume of wastewater will be greater, so too will the total wastes entering Pennyroyal Creek. In light of the already elevated levels of some pollutants in the Sampit River, more careful monitoring and, potentially, increased care in the siting of other point sources along the Sampit is recommended.

Santee-Cooper Rediversion

When the new channel starts feeding additional water into the Santee River in the range of zero to 24,500 cubic feet per second (average 12,600 feet per second) the dilution of localized wastes will be vastly improved and, thus, the overall quality of the stream will be improved. During periods of no flow or minimal flow through the hydroelectric facility, however, quality in these localized areas will again be downgraded.

Downstream from the new canal inlet to the Santee, there will be changes in the size and shape of the river channel. During the increased flow period (5 days a week) bank erosion and some channel scour will occur. Reducing the flow from 12,600 cubic feet per second and on weekends will cause further bank sloughing, making easily erodable material available for movement when discharge is increased again. Along with the widening process, will come the tendency of the river to revert to the meandering stream it has been prior to closure of Wilson Dam.

As the meandering develops, considerable quantities of sand will be transported to the estuarine area. Assuming the littoral drift is southward, additional buildup of sand should occur along Murphy Island. Also, eroded bank material may deposit at the lower end of the Santee in the vicinity of US Highway 17, thereby increasing flood potential in that area.14/

Insomuch as this project essentially involves an increased flow of water, no change in the kind or amount of pollutants except for increased turbidity and increased dilution of existing pollutants is anticipated. The Corps of Engineers asserts that some turbidity will be a temporary phenomenon beginning with the opening of the channel and decreasing rapidly over time as the channel is scoured and the river reestablishes itself.10/

Fuels Separation Plant

Effluent wastewater from the proposed Carolina Refining and Distributing Company Fuels Processing Plant will include

TABLE THIRTEEN

PSA DISCHARGES TO TURKEY CREEK

Time Period	Flow (MGD)	pH	Heavy Metals*						
			Copper	Iron	Chromium	Lead	Mercury	Zinc	Cadmium
7/1/77 - 8/31/77	0	7.24 - 7.69	-	-	-	-	-	-	-
9/1/77 - 9/30/77	0	7.81 - 8.30	.06	.06	.54	0	.000026	.354	.29
10/1/77 - 10/31/77	0	7.51 - 8.10	-	-	-	-	-	-	-
11/1/77 - 11/30/77	0	7.45 - 7.65	-	-	-	-	-	-	-
12/1/77 - 12/30/77	0	7.40 - 9.91	.05	.09	.32	0	.000031	.361	.25
1/1/78 - 1/31/78	1.332	7.44 - 7.79	-	-	-	-	-	-	-
2/1/78 - 2/28/78	1.656	7.05 - 7.37	-	-	-	-	-	-	-
3/1/78 - 3/31/78	2.646	7.17 - 7.60	.098	.03	0	0	.009000	.210	.42
4/1/78 - 4/30/78	1.274	7.40 - 7.88	-	-	-	-	-	-	-
5/1/78 - 5/31/78	9.115	7.51 - 7.80	-	-	-	-	-	-	-
6/1/78 - 6/30/78	0	7.20 - 8.52	.03	.13	<.01	.03	.000500	.020	<.01

* All measurements milligrams per litre
A dash indicates no measurement reported

Source: Wickel and Associates, based on NPDES Discharge Monitoring

cooling water, process water, boiler blowdown water, and sanitary wastes. The quality and volume of wastewater discharge, and the resultant environmental impacts from the operation of the plant, will depend upon the physical and chemical characteristics of the crude oil and refined products, the amount of throughput, the plant complexity and design, and the sensitivity of biota in the receiving waters.

Cooling water represents a significant proportion of the wastewater effluent from a fuels separation plant. Such plants may use a "once through" cooling system, or a combination of these methods. "Once through" systems, in which the heated water is not reused requires the greatest volumes of water and, hence, produce the most waste water Recycle cooling systems (towers or ponds), in which the water is cooled so that it can be reused require less fresh water per unit of oil processed. As a consequence, they produce less effluent as well.

At this point, preliminary engineering data 11/ indicates that Carolina Refining and Distributing anticipates using a combination of once through cooling and recycle cooling for some selected processes. The engineering information, however, is extremely preliminary in nature and affords no definition of the quantities of water to be used, its flow through the system, or even the types of processes which will use recycled water. Intake of water for once through or make-up purposes will be in an unspecified amount from deep wells on the site or from recycled water.

Substances concentrated in cooling water blowdown as well as heat added during the condenser cooling operation are capable of producing serious impacts on receiving waters. Chemicals added to the cooling water stream to reduce corrosion and fouling within the tower and the condenser system (including chromium and chlorine) may be toxic to aquatic organisms (see earlier discussions). Insomuch as engineering data is insufficeint to provide guidance as to anti-corrosion, anti-fouling agents to be used by Carolina Refining and Distributing, Table Fourteen summarizes the chemicals used and their concentrations in other facilities nationwide.

TABLE FOURTEEN

CHEMICAL ADDED TO COOLING WATER

CHEMICAL	CONCENTRATION MAINTAINED
Sulfuric acid	Sufficient to maintain p/H approximately 7
Chromate	30.0 ppm
Zinc	3.0 ppm
Chlorine	0.1-0.2 ppm

Source: Testimony of F.W. Wheeler for the Texas Oil & Gas Association, August 17, 1973.

Maximum effluent discharges of these substances by Carolina Refining and Distributing Company will be regulated by the Department of Health and Environmental Control through enforcement of the discharge limits established by the National Pollution Discharge Elimination System.

Additionally, cooling water, although it is considered to be "not oily", actually comes in contact with oil due to leaks in heat exchangers. Only cooling water with a total organic carbon increment of less than five parts per million can be discharged.12/

Process water, though it does not constitute the greatest volume of water used in fuels separation plant operations, may be the most contaminated. The processing pollutants are added during crude oil desalting, steam distillation, steam stripping, water washing of chemicals following treatment, etc. Some of the typical constituents of refinery wastewater and their concentrations are listed below in Table Fifteen.

TABLE FIFTEEN

COMPONENTS OF REFINERY WASTEWATER

POLLUTANT	CONCENTRATION, ppm
Floating and Dissolved Oil	1-1000
Suspended Solids	---
Dissolved Solids	0-5000
Phenol and Other Dissolved Organics	0-1000
Cyanide	0-20
Chromate	0-60
Organic Nitrogen	0-50

TABLE FIFTEEN (Continued)

POLLUTANT	CONCENTRATION, ppm
Phosphate	0-60
Sulfides and Mercaptans	0-100
Caustics and Acids	2-11 pH

Source: U.S. EPA, PB 238-096, Control of Oil and Other Hazardous Substances, (1974), p.7-3.

Water used in steam generation at a refinery is initially preconditioned to remove suspended solids and hardness, and may even be deionized before it enters the boilers. Again, no information is available concerning preconditioning agents to be used by Carolina Refining and Distributing Company, although Table Sixteen below suggests the chemicals and their concentrations used by other refineries in other parts of the country.

TABLE SIXTEEN

CHEMICALS ADDED TO BOILER WATER

CHEMICAL	CONCENTRATED MAINTAINED
Phosphate	20-60 ppm
Bases Enough To Maintain	pH 10.2 - 10.6
Sulfite	20 ppm
Sludge Conditioners*	20 ppm

* Tanis, lignins, starch organics.

Source: Testimony of F.W. Wheeler for Texas Oil and Gas Association, 8/17/73.

Sanitary sewage from the Carolina Refining and Distributing Plant will be collected and delivered to a package treatment plant on site. Preliminary engineering information indicates that some or all of the treated effluent will be recycled for use in selected processes.

Ultimate discharge of waste from the fuels separation plant will be made directly to the Sampit River at a point just downstream from Turkey Creek. The preliminary engineering data indicates that discharge will be at the magnitude of 0.75 million gallons per day and that anticipated pollutants and their concentrations will include:

TABLE SEVENTEEN

EFFLUENT FROM CAROLINA REFINING AND DISTRIBUTING COMPANY

POLLUTANT	CONCENTRATION
Biochemical Oxygen Demand	10.00 mg/l
Chemical Oxygen Demand	35.00 mg/l
Total suspended Solids	10.00 mg/l
Oil and Grease	10.00 mg/l
Phenols	00.02 mg/l
Ammonia	00.50 mg/l
Sulfide	00.10 mg/l

Source: South Carolina Department of Health and Environmental Control, Environmental Quality Control, Compliance Section.

In light of the foregoing data on stream quality, pollutant discharges at the magnitude suggested above do not create substantial concern. Chemical oxygen demand suspended solids, and ammonia will likely be reviewed carefully by DHEC. Additionally, in light of heavy metal loadings in the receiving stream, discharges of chromium, zinc and other heavy metals should be carefully monitored.

How do these changes related to State and Federal Water Quality Standards?

Water quality classifications and standards for all South Carolina streams have been established by the Department of Health and Environmental Control pursuant to Section 63-195.7 of the 1962 Code of Laws.

The various determinations affecting the Sampit and Santee Rivers are as follows:

* From Lake Marion to the North and South Santee Rivers, Class, B;

* South Santee River from U.S. 17 to 1,000 feet below the intracoastal Waterway, Class SB. From that point to the Atlantic Ocean, Class SA;

* North Santee River from U.S 17 to 1,000 feet below the Intracoastal Waterway, Class SB. From that point to the Atlantic Ocean Class SA;

* Sampit River from the headwaters to salt water intrusion, Class B (swamp), and from salt water intrusion to Winyah Bay, Class SC.

A description of each applicable class of waters and the appropriate standards may be found in Appendix A to this report. These are, however, only guidelines of "policy statements;" determinations as to the ability of an individual industrial source to meet the guidelines is based upon an NPDES-related analysis of the quality of the receiving stream and the nature of the effluent.

In the case of the Winyah Station, DHEC has concluded such analyses and found that the effluent will not bring about a contravention of State or Federal standards when mixed with receiving waters of Turkey Creek or the Sampit River. Detailed analysis of projected effluent from the Carolina Refining and Distributing Company facility is now underway and, based on review of the preliminary projections of effluent, no contravention of standards is anticipated. It should be noted, however, that the projections are tentative or preliminary and may change over time as the facility's design evolves and is finalized.

Again, the effect of the Santee-Cooper Rediversion Project upon water quality is expected to be positive. Temporary problems of tubidity will be clearly in evidence until the stream reestablishes itself. Again, though, the turbidity problems will be temporary in nature and the long-term effect on the project will be positive.

What is Likely To Be The Effect Of The Proposed Action On The Quality Of Any Surface Or Underground Water Used For Water Supply In The Two County Area?

In a recently published evaluation of developing water-well and water-quality problems in the coastal aquifer systems of Horry and Georgetown Counties,13/ the Water Resources Commission observed that large quantities of ground water occur throughout both counties in the saturated sediments above basement rock. Water-table and artesian aquifers generally occur in the shallow and younger sediments above the Pee Dee formation. Locally, these aquifers are commonly used as a source of domestic water though often they are discontinuous subject to large water-level fluxuations, and are largely reliant on local rain fall for recharge. Chemically, the quality of water is quite variable but generally inferior to deeper artesian ground water. Close proximity of water table aquifers to streams and other surface water bodies (including the ocean) can result in degradation of ground water locally.

Below the water-table aquifers and one or more confining clay layers, water occurs under artesian conditions within the Pee Dee, Black Creek, and Middendorf formations. Although large quantities of water are available from the Pee Dee aquifer system it is used only locally because of its inferior quality. Beneath the Pee Dee formation is the Black Creek which is

the most important source of ground water in Horry and Georgetown Counties and is used for municipal, industrial, and domestic water supplies. The Middendorf aquifer system, which lies below the Black Creek aquifer system contains salty (250 mg/l or more of choride) water throughout the Grand Strand and possibly in all of Horry and Georgetown Counties.

Winyah Station

With respect to the Winyah Electric Generating Station, little if any impact upon ground water supplies is anticipated. Such impact as does occur will likely result from hydrologic exchange between the water-table aquifer and the Sampit River, Pennyroyal Creek, and Turkey Creek. But this aquifer, again, is not tapped as a source of public drinking water supply.

Fuels Separation Plant

As with the Winyah Electric Generating Station, little if any impact on ground water supplies is anticipated as a result of construction of the fuels separation plant. In light of present, preliminary plans to provide necessary boiler, cooling and process water from on-site deep wells, care should be exercised as plans are finalized to insure that drawdown within the affected aquifer is compatible with existing and projected water uses in the area.

Santee-Cooper Rediversion

Aquifers within the area of the Santee-Cooper Rediversion project include: (1) a shallow (10-70 feet) water-table, sand and clay aquifer; (2) a deeper artesian limestone aquifer; and, (3) a sand and gravel aquifer, which is a remnant of a buried river channel.13/ Although the Corps of Engineers anticipates no adverse effects on these aquifers or the quality of their water during the construction or operations phase10/, it is reasonable to expect that both the intake and tailrace canals will exercise a recharge effect on the top two aquifers as a consequence of a head difference between the canals and the aquifers. Any effects will likely not be felt in Georgetown and Horry Counties, but rather in St. Stephen where public drinking water supplies are drawn from the limestone aquifer.

> Will The Change In Water Quality As A Result Of The Project Affect Peoples' Ability To Use Any Water Bodies For Swimming, Boating, Fishing, Or Other Recreation?

It is not anticipated that water quality changes resulting from the construction, operation or maintenance of either the electric generating stations or the fuels separation plant will affect current low level recreational use of the Sampit River.

Santee-Cooper Rediversion

The effects of the rediversion on recreational use of the Santee River are expected to be strongly positive. In 1966, the Fish and Wildlife Service of the U.S. Department of Interior produced an evaluation report concerning the affect of the rediversion on fish and wildlife in both the Santee and Cooper Rivers systems.14/ The Department of Interior has recently re-reviewed that evaluation and has determined that the initial findings continue to be valid.10/

The Department of Interior report asserts that the ecology of the Santee River downstream from the diversion canal will be significantly changed. Average flows will return to about 80 percent of historic levels; however, discharge regimens will be somewhat altered. It can be expected that aquatic habitat will greatly increase with corresponding expansion of fishery resource. A situation similar to that presently existing in the Cooper River above the Tee will develop. An estimated 9000 acres of swamp and overflow lands will be inundated permanently or for extended periods of time. These areas will serve as nursery and rearing areas for a variety of fishes. Striped Bass, American Shad and Glut Herring are expected to spawn and thrive in the high-flow areas of the Santee River downstream from the canal.

Fishery resources in the Santee River estuary will be changed to an insignificant degree by greater discharge and lower salinities. The shrimp and crab fisheries are low at present and no appreciable changes are expected. Increased fresh water will destroy about 150 acres of sub-tidal oysterbed. This loss will be offset somewhat by the fact that existing pollution should be diluted sufficently to permit commercial sale of oysters directly from the remaining beds.

As a result of increased streamflow, restoration of permanent swamps will occur downstream from St. Stephen Canal to US Highway 17, thus providing improved wood duck breeding habitat, sanctuary for deer and turkey, and wintering areas for migratory waterfowl. In addition, hardwood timber growth rates and mast production will be improved and winter flooding will make these areas available to wintering waterfowl. As a result, wildlife values for these swamp and bottom-land hardwood areas will be increased.

ECONOMIC ISSUES

The purpose of this section is to assess changes in population, housing, employment, business and government services either directly or indirectly from the construction, operation, or maintenance of the three projects under consideration.

EMPLOYMENT

How Many Jobs Will Be Created In The Two Counties By Construction Of The Project?

Peak construction employment at the Winyah Station will involve 700 workers.15/ Contractors involved in the project employ local labor almost exclusively. However, insomuch as almost all hiring is accomplished through the labor halls in Charleston, workers are drawn from a wider area including the coastal and lowcountry portions of the State. Through interviews with contractors representing 77% of the total work force it was determined that 326 workers or 46.63% of the total are Georgetown County residents; 118 or 16.85% reside in Horry County; and, 256 or 36.52% are drawn from Charleston, Berkeley, Dorchester or other counties within the State.16/

With respect to the Santee-Cooper Rediversion we estimate total employment to be + 400. Estimated distribution of these workers is: Georgetown, 100, Horry, 35; and other counties 185.10/

Based upon the size of the labor force involved in construction of the refinery facilities in other areas of the country, we estimate total construction employment for the Carolina Refining and Distributing Company facility to total 650. Assuming the distribution of workers to be similar or identical to that encountered in the case of Winyah Station, the distribution would be: Georgetown, 303; Horry County, 110; and, other counties, 237.

How Many Jobs Will Be Created in The Two Counties By Its Operation and Maintenance?

With respect to the three developments under consideration, hiring for operations and maintenance personnel will be carried out locally to the maximum extent possible. Total employment and its estimated geographic distribution is summarized below in Table Eighteen.

TABLE EIGHTEEN

OPERATIONS/MAINTENANCE EMPLOYMENT

Name of Facility	Total Employment	Georgetown	Horry	Other Counties
Winyah Station	99	69	20	11
Refinery	100-150	70-105	20-30	10-15
Rediversion	10	0	0	10

Source: Wickel and Associates

How Many Of These Jobs Will Be Filled By People Currently Living In The Two Counties, As Opposed To People Brought In From Outside?

In light of experience with refinery operations in other parts of the country roughly 80% of the work force can be hired from the local labor pool with only a few key employees being imported to the region. Usually, of the total work force, roughly 70% will be in operations and maintenance, another 20% will be administrative personnel, and the remaining 10% will fall into several smaller categories such as safety, security, and laboratory personnel.17/

With respect to the Public Service Authority, the trades of the 99 skilled workers projected for operation and maintenance of Units III and IV are summarized below in Table Nineteen.

TABLE NINETEEN

WINYAH STATION OPERATIONS AND MAINTENANCE PERSONNEL

JOB	NUMBER
Clerk Stenographer	1
Auxilary Operator	34
Lab Technicians	6
Heavy Equipment Operation	5
Coal Handler	18
Mechanic	18
Parts Clerk	2
Electrical and Instrument Technician	18

Source: South Carolina Public Service Authority

With respect to the Santee-Cooper Rediversion, the hydroelectric facility will be operated by remote control from already existing locations. The Corps of Engineers estimated that only 10 additional people will be required for operations and maintenance, all of these will be involved in one aspect or another of groundskeeping.10/

In light of uncertainties concerning skills required and the availability of those skills or trainable unemployed persons within the labor pools of Georgetown and Horry Counties in the future, both a high and a low range of jobs filled by local residents is suggested below in Table Twenty.

TABLE TWENTY

JOBS FILLED BY LOCAL RESIDENTS

	IN GEORGETOWN	IN HORRY	IN OTHER COUNTIES
High Range	108-138	31-39	25-30
Low Range	87-110	25-31	22-26

Source: Wickel and Associates

How Many Jobs Will Be Created As Off-Shoots Of Maintenance Or Operation Of the Project?

Secondary job growth for Georgetown and Horry Counties was calculated using the relationship between maunfacturing and non-agricultural/non-manufacturing employment arrived from a study of the regional populations and economy undertaken in in 1977.18/ Non-manufacturing employment in each County was adjusted downward to eliminate the influence of tourism-related employment. Insomuch as there are no truly reliable or accurate methods for separating tourist from non-tourist related employment, however, the extent of the necessary reduction was estimated using employment patterns in other cities, comparative data on sales tax collections, etc., as guides. The resulting crude ratios--.919 non-manufacturing jobs for each manufacturing job in Georgetown County and 1.314 in Horry County--were then applied to the operating and maintenance employment shown in Table Eighteen. The resulting estimates of secondary employment are summarized below in Table Twenty-One.

TABLE TWENTY-ONE

SECONDARY EMPLOYMENT

	GEORGETOWN	HORRY
High	160	66
Low	128	53

Source: Wickel and Associates

The proportions of the secondary jobs to be filled by persons migrating into Georgetown and Horry Counties is estimated in Table Twenty-Two below.

TABLE TWENTY-TWO

SECONDARY JOBS FILLED FROM OUTSIDE

	GEORGETOWN	HORRY
High	16-40	7-16
Low Range	13-32	5-13

Source: Wickel and Associates

POPULATION

What Changes Are Likely To Occur In Georgetown and Horry County Population Levels As A Result Of The Proposed Actions?

Changes in the population levels of the two counties is assumed here and bear a direct relationship to the numbers of operations, maintenance, or secondary employment jobs to be filled by persons migrating into the area. Based upon an analysis of trends in average household size conducted in the State of South Carolina last year 19/, it is assumed that the average household size of each new potential employee moving into Georgetown County will be 3.4 persons, and 3.0 persons for each potential new employees moving to Horry County. Total projected employment of persons from outside the area and the resulting projected growth in population is summarized below in Table Twenty-Three.

TABLE TWENTY-THREE

TOTAL EMPLOYMENT AND POPULATION CHANGE

	Outside Employment Georgetown	Outside Employment Horry	New Population Georgetown	New Population Horry
High Range	76-82	26-27	258-279	78-81
Low Range	61-65	20-22	207-221	60-66

Source: Wickel and Associates

To What Degree Might Changes In The Distributing Of The Population Of The Two Counties Be Expected?

Both the Electric Generating Plant and the Fuels Separation Plant are located adjacent to major population and employment centers in Gerogetown County, and in areas designated or planned for industrial development. In light of existing housing availability, transportation links, etc., no discernable change to the current population distribution is anticipated. For Horry County, the project population growth is too small to be of concern. The anticipated distribution of new population within Georgetown County is summarized below in Table Twenty-four by Census divisions.

TABLE TWENTY-FOUR

NEW POPULATION DISTRIBUTION

Census Division	High Range	Low Range
City of Georgetown	52-56	41-44
Plantersville	05-06	04-05
Georgetown Rural	54-59	43-46
Sampit-Santee	34-36	27-29
Waccamaw	77-84	62-66
Pleasant Hill-Folly Grove	10-11	08-09
Andrews	26-28	20-22

Source: Wickel and Associates

With respect to the Santee-Cooper Rediversion project, it is anticipated that all jobs will be filled by existing residents of the St. Stephen area. Thus, no employment or population changes are anticipated in either Georgetown or Horry Counties.

HOUSING

Is The Proposed Action Likely To Increase or Decrease The Demand For Housing In The Two County Area?

In light of the positive population growth resulting from both projects as well as secondary employment, a modest demand for new housing units is anticipated. Assuming that both Georgetown and Horry Counties will follow the statewide pattern of decline in average household size (3.4 persons per household in Georgetown County by 1980 and 3.0 for Horry County); and, further assuming that the ratio of homeowners to renters will stabilize in both counties at approximately 66% owners to 34% renters, the extent of the housing demand can be summarized as follows:

TABLE TWENTY-FIVE

HOUSING DEMAND

	Georgetown County Owner	Georgetown County Renter	Horry County Owner	Horry County Renter
High Range	50-54	26-28	17-18	09
Low Range	40-43	21-22	13-15	07

Source: Wickel and Associates

By simply applying the projected household size to the estimated population distribution shown above in Table Twenty-Four, the distribution of new housing units may be calculated. The results of this step are summarized below by census division in Table Twenty-Six.

TABLE TWENTY-SIX

ESTIMATED HOUSING DISTRIBUTION

Census Division	High Range	Low Range
City of Georgetown	15-16	12-13
Plantersville	01-02	01-02
Georgetown Rural	16-17	13-16

TABLE TWENTY-SIX (Continued)

Census Division	High Range	Low Range
Sampit-Santee	10-11	08-09
Waccamaw	23-25	18-19
Pleasant Hill-Folly Grove	03-03	02-03
Andrews	08-08	06-06

Source: Wickel and Associates

Could The Projects Cause A Change In The Types of Housing Desired In Either County?

There is no verifiable data available to indicate that persons moving into the area would influence or bias the existing demand for one type of housing as opposed to another. At least initially, the demand for renter housing may be inflated somewhat above the estimate shown in Table Twenty-Five; as new residents become familiar with the areas, however, it is anticipated that home purchases will occur more rapidly with totals finally becoming more representative of the estimate shown in Table Twenty-Five. Also, in light of housing availability, financing costs, etc. it is anticipated that mobile homes will continue to account for a greater percentage of home sales.

BUSINESS

What Effect Will Construction of the Projects Have On Existing Buiness In The Area?

In light of the experience of the Public Service Authority in construction of Units III and IV, little effect on business within the two county area is anticipated. In the case of Units III and IV, major components of the generating facility were contracted for on the basis of regional or national bids. Local purchases related to the project were confined to incidental building supplies, electrical supplies, etc. The only exception to the pattern was substantial purchases of concrete from suppliers in the region.

What Effect Will The Operations And Maintenance Of The Project Have On Existing Business In The Area?

Winyah Station

During fiscal year 1979, the South Carolina Public Service Authority spent approximately $125,000 in Georgetown County for the following needs of generating Units I and II: outside labor, general mill supplies, general electric and plumb-

ing supplies, waste pickup and disposal, pest control, cleaning supplies, general office supplies, office machine maintenance, and general automobile supplies and repairs, gasoline, lubricants, etc.15/

Assuming economies of scale as much as 50%, the operation and maintenance of Units III and IV should generate an additional $62,500 for similar goods and services.15/

Santee-Cooper Rediversion

In view of the type of project involved and the relatively low level of activity associated with operations and maintenance, no effect on either county is anticipated. Again, operation of the facility is largely by remote control from existing sites and maintenance is limited essentially to groundskeeping.

Fuels Separation Plant

Operations and maintenance expenditures by the fuels separation plant will be similar in nature to those already discussed for the Winyah Electric Generating Plant. Although the dollar volume of such purchases may not be estimated within reasonable bounds of accuracy at this point, an initial planning figure of $45,000 to $60,000 is suggested.

Will Any New Business Growth Be Stimulated By The Project?

The only new business which may be generated by any of the three projects is that related to transportation of the products of Carolina Refining Distribution Company. At this time, gasoline, jet fuels and diesel fuel will be moved by tanker truck with a much smaller proportion being shipped by barge and rail car.20/

In light of the size of the transportation industry in Georgetown and Horry Counties, it is anticipated that an expansion of trucking capacity will be required to handle the firm's projected $600,000 per day volume of saleable product.20/

Is The Project Likely To Have Any Effect On Overall Wage Rates Or Labor Availability By Increasing Competition For Workers in the Two Counties?

Although neither the Santee-Cooper Rediversion nor the expansion of the Winyah Electric Generating Station will affect overall wage rates within the two county area, the Winyah Station will affect labor availability through its hiring at already discussed levels. The projected payroll for Carolina Refining and Distributing Company, however, appears

to have the potential to affect local wage rates significantly. The annual payroll is estimated variously at three million 21/ to four million20/ for a maximum of 150 workers per annum. The lower of the two figures is probably the more realistic insomuch as it reflects current industry averages ($9.80 per hour.)

It is likely that the firm will adjust its wage rates downward in recognition of prevailing local rates. Insomuch as the South Carolina Statistical Abstract, 1978 suggests the median household income in Georgetown County was $11,151, and $10,917 in Horry, the extent of downward adjustment in the fiscal wage scales could exert a significant influence in both counties.

GOVERNMENT SERVICES/COST ISSUES

Will The Project Have Any Effect On Public Facilities Or Services -- Schools, Libraries, Public Roads, Civic Centers, Sewers, Police, Fire, Etc.?

Are The Public Facilities Or Services Adequate To Provide For The Needs Of The Project? (For example, if the project will increase water pollution, are existing wastewater treatment facilities able to process it)?

Each of the projects under discussion will be largely self-contained, exerting minimal if any impact on public facilities and services during the construction, operations or maintenance phases. The greatest projected demanded will be upon public highways and upon local enforcement agencies responsible for traffic control. As with other developments of this scale, the demand will peak during the construction phase as workers equipment and material are moved by highway, but decline during the operations and maintenance phases to several smaller peak demand periods coinciding with shift changes, etc.

Perhaps the greatest single potential demand upon public services or facilities is related to fire hazards associated with the fuels separation plant. Both the fuels separation plant and the electric plant and the electric generating station are located within six miles of the Georgetown City Limits, and thus, the City's Fire Department would respond to a fire. Fire presents a particularly acute danger where large volumes of petroleum are stored, as in the case of the dockside facilities, at the tank farm, and at the refinery. Although a fire itself may be small and easily contained, the intense heat generated by the crude oil in petroleum products present the distinct potential for explosion.27/

Although the frequency of fires at petroleum handling

facilities nation-wide is low, extensive precautions and control is exercised. The specifics of the fire control program to be employed by Carolina Refining and Distributing Company are not available at this time; however, the following paragraphs describe the nature of such controls at either facilities.28/

Fire alarms are placed in the tank area and in the main control room. Complete water systems for fire fighting are usually included in the storage area in addition to portable dry powder extinguishers. A foam fire extinguishing system may also be included for use throughout the tank farm.

In many cases, storage tanks are equipped with individual foam systems, which, when triggered, can contain a fire by covering an entire tank with foam. Additionally, each tank may be diked to prevent fire from spreading.

Dockside fire prevention systems are also extensive. The self-contained systems include a pumping station, foam system, and distribution piping. In addition, raw water may be used directly and is drawn by turbine fire pumps. Underdeck and pile protection by water fog and water sheet systems is often supplied for the loading platforms.

For further detail concerning the probable configuration of the fire control program at the fuels separation plant, refer to the Standard Fire Prevention Code and NFPA Phamplet #30 which will govern the design and content of such a program in South Carolina.28/

> Are the available public facilities or services adequate to provide for any induced growth which might occur as a result of the project?
>
> Will local government have to provide any new services as a result of growth induced by the project? Estimated Cost?

In Horry County, population growth attributable to operations and maintenance of the three projects as well as growth in the secondary job market is projected to be only 60 to a maximum of 81 persons. These new residents of the county will be scattered among existing population centers and, because of their small numbers, are not expected to exert a measurable effect on facilities or services.

In Georgetown County, projected total population change attributable to the projects ranged from a low of 207 to a high of 279. Although, as suggested by Table Twenty-Four, these new residents of Georgetown County will be scattered, some estimates of the costs of providing public services may be developed using the methodology employed by the Waccamaw Regional Planning and Development Council in its 1976 Regional

Developmen Impact Matrix. In brief, that methodology allocates costs for services on a per housing unit basis within four study areas. The cost per housing unit of delivering services will vary within each of these areas due to the level of service provided and the total number of residential units which share the expense. The cost of existing services is shown in Table Twenty-Seven.

In order to identify the potential cost of the same services for new households attributed to the three projects, new household growth shown in Table Twenty-Six was reallocated to the four study areas used in the 1976 report and a cost per housing unit for the various services was calculated. The resulting estimates of new service costs is summarized below in Table Twenty-Eight. Because the numbers of new residents are modest, it is believed that existing public services and facilities will be marginally adequate.

It should be noted, however, that the level of public facilities and services within Georgetown County remains relatively low in comparision to national averages or standards. Fire protection services as well as public water or sewer systems remain largely unavailable to residents of unincorporated areas. Per capita investment in recreation and libraries, as well as the number of law enforcement officers per 1000 population remains below national averages. New residents will exert increasing demand upon the limited supply of services available, and their effect will likely be felt as a decrease in the quality of available service.

Will Local Government Directly Gain Any Revenue From The Project?

The Winyah Station

State law provides that, "...The Public Service Authority shall be required to pay no taxes or assessments upon any of the property acquired by it for (The Santee-Cooper) project or upon its activities in the operation and maintenance thereof..." 22/. Instead, the law provides for payments to the several counties and school districts affected by the project as follows:

(1) Payments in lieu of taxes equivalent to the amounts paid in taxes at the time of property acquisition22/;

(2) Additional payments in lieu of taxes to certain counties (including Georgetown and Horry and school districts therein) on lands acquired prior to the year 1950 in amounts equivalent to that paid in 1964 for payments in lieu of taxes on such lands (see (1) above)23/;

(3) Payments to any county in which the Public Ser-

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(3) Payments to any county in which the Public Ser-

TABLE TWENTY-SEVEN

EXISTING SERVICE COST PER UNIT[a]

Source	Georgetown Urban Fringe	Andrews Urban Fringe	Waccamaw Neck	Rural	Georgetown City
Highways	10.67	58.73	49.36	64.03	114.42
Law Enforcement[b]	23.22	22.87	65.97	36.67	143.77) City 23.31) County
Education					
High School	139.41	137.86	139.75	194.51	180.36
Elementary Schools	154.70	472.20	78.27	132.40	180.36
Technical Education	6.07	6.07	6.07	6.07	6.07
Recreation	3.06	3.06	3.06	3.06	41.41
Libraries[b]	9.80	9.80	9.80	9.80	9.80
Health & Welfare	25.28	25.28	25.68	25.68	25.28

a. Derived from Georgetown County's FY 78 and the City of Georgetown's FY77 Budgets
b. Cost based on all housing units within the County

Source: Wickel and Associates

TABLE TWENTY-EIGHT

ADDITIONAL SERVICES COSTS* ATTRIBUTED TO PROJECT RELATED GROWTH**

Source	Georgetown Urban Fringe	Andrews Urban Fringe	Waccamaw Neck	Rural	Georgetown City	Total
Highways	114	350	1233	2284	2497	6478
Law Enforcement	249	136	1647	1308	3647	6987
Education						
High School	1492	819	3490	6938	3937	16676
Elementary School	1655	2807	1955	4723	3937	15077
Technical School	65	36	151	216	132	600
Recreation	33	18	76	109	904	1140
Libraries	105	58	245	350	214	972
Health & Welfare	271	150	646	916	552	2535
TOTAL	3984	4374	9443	16844	15820	50465

Source: Wickel and Associates

* In 1980 dollars. Costs for services shown in Table Twenty-Seven have been inflated using State Economist provided multipliers of 1.189 for Georgetown County and 1.284 for the City of Georgetown.

** Assumes development of maximum number of housing units shown in Table Twenty-Six.

vice Authority holds legal title to lands undeveloped for commercial or residential purposes, a sum equal to ten percent of the annual rentals received from the lease of those lands24/;

(4) To the counties in which the Public Service Authority owns, leases, or operates electric facilities a sum equal to fifteen percent of the of the amount paid in the fiscal year into the general fund of the State. That amount is allocated among the counties in proportion to the generating capacity installed in each 25/;

(5) To Berkeley, Horry and Georgetown Counties, a sum equal to ten percent of the amount paid during the fiscal year into the general fund of the State. This amount is allocated among the counties in proportion to kilowatt hour sales within each county26/; and

(6) Other payments such as franchise taxes.

The amounts paid by the Public Service Authority for the above purposes during fiscal years 1975-1978 are contained in Table Twenty-Nine. Sums paid in lieu of taxes during fiscal year 1979 are summarized in Table Thirty. Insomuch as Units III and IV will be constructed on lands already owned by the Public Service Authority, no additional payments in lieu of taxes may be anticipated except for those based upon installed generating capacity and kilowatt hour sales. With full operations of both units, payments for these purposes should increase as follows:

TABLE THIRTY-ONE

PROJECTED PAYMENTS IN LIEU OF TAXES

	KWH SALES	INSTALLED GENERATING CAPACITY
Georgetown County*	$60,676.78	$147,502.70
Horry County	76,464.20	32,158.18

*Reflects purchases of approximately 90% of necessary energy by Carolina Refining and Distributing Company.

Source: Wickel and Associates

Santee-Cooper Rediversion

TABLE THIRTY

SUMS IN LIEU OF TAXES PAID IN THE FISCAL YEAR 1979

	Revenue Sums in Lieu of Taxes	Special Reserve Additional Sums in Lieu of Taxes	Reserve Land Rental Taxes	Special Reserve KWH Sales	Special Reserve Generation	Revenue Franchise Taxes	Total Taxes
Atlantic Beach City						2,641.79	2,641.79
Bamberg City	1.45						1.45
Bamberg County	1.62						1.62
Beaufort County					6,229.97		6,229.97
Berkeley County	15,617.53	15,531.77	13,255.94	15,526.04	67,917.50		127,848.78
Briarcliffe City						2,413.92	2,413.92
Calhoun County	634.35	634.35	2,819.80				4,088.50
Charleston County	27.65		70.00				97.65
Clarendon County	5,455.76	5,444.12	20,898.65				31,798.53
Colleton County	.72						.72
Conway City	1,047.21					33,806.72	34,853.93
Dorchester County	2.14						2.14
Fairfield County	2.60						2.60
Georgetown County	1,892.71	698.76	8.50	43,340.56	73,751.35		119,691.88
Georgetown City	4.56						4.56
Horry County	6,648.32	5,911.59		61,171.36	32,158.18		105,889.45
Lexington County	5.80						5.80
Loris City						13,872.05	13,872.05
Myrtle Beach City	513.41					105,155.06	105,668.47
North Myrtle Beach City						43,193.02	43,193.02
Moncks Corner City	73.32					16,615.82	16,689.14
Orangeburg County	2,546.05	2,546.05	11,143.72				16,235.82
Richland County	26.88						26.88
St. Stephen City	25.75					9,207.81	9,233.56
Surfside Beach City						16,718.74	16,718.74
Sumter County	1,977.48	1,977.48	61.50				4,016.46
Williamsburg County	57.60						57.60
	$36,562.91	$32,744.12	$48,258.11	$120,037.96	$180,057.00	$243,624.93	$661,258.03

Source: South Carolina Public Service Authority

TABLE TWENTY-NINE

SUMS IN LIEU OF TAXES

Fiscal Years 1975, 1976, 1977, and 1978

County or Municipality	Sums in Lieu of Taxes $	Additional Sums in Lieu of Taxes $	Land Rental Taxes $	KWH Sales $	Generation $	Franchise $	Total $
Horry County							
Fiscal Year 1978	6,648.32	5,911.59	5.00	69,758.14	40,454.39		122,777.44
1977	6,648.32	5,911.59		102,551.11	58,793.31		173,904.33
1976	6,585.15	5,911.59	2.50	47,719.75	25,522.46		85,741.45
1975	6,571.83	5,911.59		22,698.55	11,882.57		47,064.54
	26,453.62	23,646.36	7.50	242,727.55	136,652.73		429,487.76
Georgetown County							
Fiscal Year 1978	1,892.71	698.76	18.00	38,994.77	46,375.74		87,979.98
1977	1,892.71	698.76	102.00	59,571.69	70,023.93		132,289.09
1976	1,890.71	698.76	9.00	29,301.74	33,570.98		65,471.25
1975	1,980.77	698.76	4.50	12,931.77	15,629.74		31,155.54
	7,566.96	2,795.04	133.50	104,799.97	165,600.39		316,895.86
Municipalities							
Atlantic Beach							
Fiscal Year							
1978						2,404.73	2,404.73
1977						1,900.62	1,900.62
1976						1,706.10	1,706.10
1975						783.25	783.25
						6,794.70	6,794.70

TABLE TWENTY-NINE (Continued)

County or Municipality		Sums in Lieu of Taxes $	Additional Sums in Lieu of Taxes $	Land Rental Taxes $	KWH Sales $	Generation $	Franchise $	Total $
Conway City								
Fiscal Year	1978	1,047.21					31,588.72	32,635.93
	1977	1,047.21					25,798.53	26,845.74
	1976	1,047.21					25,458.48	26,505.69
	1975	1,047.21					12,973.25	14,020.46
		4,188.84					95,818.98	100,007.82
Georgetown City								
Fiscal Year	1978	4.56						4.56
	1977	4.56						4.56
	1976	4.56						4.56
	1975	4.56						4.56
		18.24						18.24
Loris City								
Fiscal Year	1978						14,142.85	14,142.85
	1977						11,427.82	11,427.82
	1976						7,094.51	7,094.51
	1975						3,288.75	3,288.75
							35,953.93	35,953.93

TABLE TWENTY-NINE (Continued)

County or Municipality		Sums in Lieu of Taxes $	Additional Sums in Lieu of Taxes $	Land Rental Taxes $	KWH Sales $	Generation $	Franchise $	Total $
Myrtle Beach City								
Fiscal Year	1978	513.41					93,771.41	94,284.82
	1977	513.41					71,721.97	72,235.38
	1976	513.41					62,523.12	63,036.53
	1975	513.41					25,000.00	25,513.41
		2,053.64					253,016.50	255,070.14
North Myrtle Beach								
Fiscal Year	1978						38,518.18	38,518.18
	1977						29,149.38	29,149.38
	1976						32,251.71	32,251.71
	1975						14,363.25	14,363.25
							114,282.52	114,282.52
Surfside Beach								
Fiscal Year	1978						15,678.69	15,678.69
	1977						12,112.59	12,112.59
	1976						11,374.93	11,374.93
	1975						5,939.62	5,939.62
							45,105.83	45,105.83

Source: South Carolina Public Service Authority

This project will be located wholly outside the boundaries of Georgetown and Horry Counties. Revenue gains or losses will be confined to Berkeley County.

Fuels Separation Plant

Tax payments accruing to local government as a consequence of the construction of this facility are largely controlled by State law. The South Carolina Constitution provides that all new or newly expanded manufacturing facilities are exempt for five years from all county property taxes except those levied for public schools and special taxes.

Although the State does not have a property tax, the State Tax Commission determines the assessment of taxable real and personal property of all manufacturers so as to assure equitable local treatment. This assessment ratio is established at 10.5 percent of fair market value. Neither cities nor counties can change an assessment established by the Commission.

Representatives of Carolina Refining and Distributing Co. have declined comment on tax related matters20/; it is how, ever possible to estimate tax payments to the two counties given a stable set of assumptions.

For purposes of estimating county tax revenues, it will be assumed that:

* Gross investment in the facility will be $100 million;
* Gross investment equals fair market value;
* For purposes of this estimate, gross investment will not be depreciated;
* The plant will pay no special purpose taxes such as for a fire district, watershed district; etc;
* Current tax millage rates for the two counties will remain constant as will the proportion devoted to schools operation and debt retirement.

Thus, Carolina Refining and Distributing Company will pay to Georgetown County during the first year:

Gross investment X 10.5% X tax millages per $100 for school purposes, or (%100,000,000 X 10.5%) X .099 per $100. = $10,395.

Residential Real Property

In addition to tax payments or payments in lieu of taxes by the facilities, workers moving into the area and purchasing homes will make real and personal property tax payments to both counties. For Georgetown County, we assumed a maximum of 54 owner-occupied units with a median value of $12,765, and for Horry County, 18 units with a median value of $16,445. Approximate real property tax receipts may be calculated as follows:

> New Residential Investment (number of new units x estimated median value) X Assessment Ratio (with application by the homeowner this ratio is set by the State at 4%) X Mill Levy (in Georgetown County, for instance, .099 for school purposes and .042 for general government, or a total of .141).

Thus, for Georgetown County:

(689,310. X .04) X .141 = $3,888.

And, for Horry County:

(296,010. X .04) X .145 = $1,717.

Additionally, in the two counties real property taxes will be paid on rental units at the commercial assessment ratio which has been established by the State at 6%. Following the above described procedure:

For Georgetown County:

(357,420. X .06) X .141 = $3,024.

And, for Horry County:

(148,005. X .06) X .145 = $1,289.

Finally, assuming the median personal property tax to be paid by individuals for each new household in both counties to be $115., personal property tax collections will be approximately $9,430. for Georgetown and $3,105. for Horry

On the basis of the foregoing estimates, total collections by the two counties during the first year will approximate:

	Georgetown	Horry
Public Service Authority (total)	$208,179.	$108,622.

Carolina Refining and Distributing Company	10,395.	-
Residential Real Property Tax	6,912.	2,006.
Individual Personal Property Tax	9,430.	3,105.
TOTAL	$234,916.	$113,733.

It should be noted that the above estimates include no increases in personal property taxes paid by businesses. Personal property tax payments by Carolina Refining and Distributing Company have been accommodated by treating gross investment in its entirity as real property. To be certain, the proportions of that investment to be treated as real and personal property will be determined after development and, because of differential depreciation, etc., tax payments to each category will need to be adjusted. The difference in payments for the first year, however, is likely not going to vary more than $\pm$ two percent from the above estimates and thus is not viewed as significant.

Other tax payments to both counties will be generated by new residents, including payments from alcoholic liquor taxes, bank taxes, beer and wine, gasoline, income, insurance and other taxes. No estimates of these revenues are possible or meaningful at this point.

> Will local government lose any tax revenues as a result of the proposed projects?

No loss of tax revenues is anticipated as a consequence of any of the three projects. Winyah Electric Generating Units III and IV are being constructed on land previously owned by the Public Service Authority, and the fuels separation plant will be subject to all state and local taxes except those noted above for which five year exemptions are granted by the State.

The Santee-Cooper rediversion is located wholly within the confines of Berkeley County, and any tax gains or losses which may occur as a result of public acquisition of land, etc. will be limited to that county.

> What are the approximate time periods over which the various economic effects will occur? Will negative effects occur significantly before positive ones, causing a disruption of governmental finance even though the total plus and minus effect equals zero over time?

The costs related to growth in Georgetown County have been de-

fined as being relatively small, just exceeding $50,000, based upon 1977 and 1978 figures adjusted to 1980 dollars to accommodate the effects of inflation. Due to the low level of development anticipated in Horry County, costs will likely be minimal, being far more than offset by increased revenues.

In general, payments in the form of taxes or payments in lieu of taxes may be thought of as following costs to the two counties by as much as one year. This recognizes that payments will in large part be made following the start-up of operations and, though this assumption has some serious flaws, it is utilized here to suggest the "worst case."

In comparision to the budgets of Georgetown and Horry Counties, these costs which may be attributed to energy developments are almost inconsequential. Insomuch as they will be more than offset by increased revenues within the short range, no disruption of the finances of either county is anticipated.

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APPENDIX A

ESTABLISHED CLASSES FOR FRESH SURFACE WATERS AND THE STANDARDS OF QUALITY AND PURITY WHICH SHALL BE APPLIED THERETO

CLASS SA

Waters suitable for propagation, survival, and harvesting of shellfish for market purposes as designated by the Department of Health and Environmental Control. Suitable also for uses requiring water of lesser quality.

QUALITY STANDARDS FOR CLASS SA WATERS

ITEMS	SPECIFICATIONS
1. Garbage, cinders, ashes, oils, sludge or other refuse.	None.
2. Sewage of waste effluents.	None which are not effectively treated and disinfected.
3. Toxic waste, deleterious substances, colored or other wastes.	None alone or in combination with other substances or wastes in sufficient amounts as to be injurious to edible fish or shellfish or culture or propagation thereof, or which in any manner shall adversely affect the flavor, color, odor, or sanitary condition thereof or impair the waters for any other best usage as determined for the specific waters which are assigned to this class.
4. Dissolved oxygen.	Not less than 5 mg/l.
5. Organisms of coliform group.	Not to exceed a median coliform of 70/100 ml, nor shall more than 10% of the samples in a five (5) tube dilution test exceed a MPN of 230/100 ml; or current Department of Health and Environmental Control and U.S. Food and Drug Administration standards.
6. pH.	Shall not vary more than 3/10 of a pH unit above or below that of effluent-free waters in the same geological area having a similar total salinity, alkalinity and temperature.

and propagation of shellfish except shellfishing for market purposes. Suitable also for uses requiring water of lesser quality.

ITEMS	SPECIFICATIONS
1. Garbage, cinders, ashes, oils, sludge or other refuse.	None.
2. Sewage or waste effluents.	None which are not effectively disinfected.
3. Toxic wastes, deleterious substances, colored or other waste.	None alone or in combination with other substances or waste in sufficient amounts as to be injurious to edible fish or the culture or propagation thereof, or which in any manner shall adversely affect the flavor, color, odor, or sanitary condition thereof; to make the waters unsafe or unsuitable for bathing or impair the waters for any other best usage as determined for the specific waters which are assigned to this class.
4. Dissolved oxygen.	Not less than 5 mg/l.
5. Fecal coliform.	Not to exceed a geometric mean or 200/100 ml; nor shall more than 10% of the samples in any 30 day period exceed 400/100 ml.
6. pH.	Shall not vary more than one-half of a pH unit above or below that of effluent-free waters in the same geological area having a similar total salinity, alkalinity and temperature, but not lower than 6.75 of above 8.5.

CLASS SC

Waters suitable for crabbing, commercial fishing and for the survival and propagation of marine fuana and flora.

QUALITY STANDARDS FOR CLASS SC WATERS

ITEMS	SPECIFICATIONS
1. Garbage, cinders, ashes, oils, sludge or other refuse.	None.
2. Toxic wastes, oils, deleterious substances, colored or other wastes.	None alone or in combination with other substances or wastes in sufficient amounts as to be injurious to edible fish or the culture or propagation thereof, or which in any manner shall adversely affect the flavor, color, odor, or sanitary condition of fish or impair the waters for any other best usage as determined for the specific waters which are assigned to this class.
3. Dissolved oxygen.	Not less than 4 mg/l.
4. Fecal coliform.	Not to exceed a geometric mean of 1000/100 ml based on five consecutive samples during any 30 day period; nor exceed 2000/100 ml in more than 20% of the samples examined during such period (not applicable during or immediately following periods of rainfall).
5. pH.	Shall not vary more than one pH unit above or below that of effluent-free waters in the same geological area having a similar total salinity, alkalinity and temperature but not lower than 6.75 or above 8.5