DOE/EA-0865

POWER SYSTEMS DEVELOPMENT FACILITY

Environmental Assessment

Prepared by

**United States Department of Energy
Morgantown Energy Technology Center
P.O. Box 880
Morgantown WV 26507-0880**

June 1993

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TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1
1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION	1
2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION	3
2.1 The Proposed Action	3
2.1.1 Project Description	3
2.1.1.1 Advanced Gasifier/Fuel Cell Modules	4
2.1.1.2 PFBC/Combustion Turbine Modules	9
2.1.1.3 Resource Requirements	11
2.1.1.4 Discharge Requirements	14
2.1.2 Description of the Project Location	15
2.1.2.1 General Description of the Area	15
2.1.2.2 Description of the Proposed Site	16
2.2 Alternatives to the Proposed Action	18
2.2.1 No Action Alternative	18
2.2.2 Alternative Sites Dismissed From Consideration	18
2.2.3 Alternative Technologies	19
3.0 ENVIRONMENTAL IMPACTS	19
3.1 The Proposed Action	19
3.1.1 Air Quality	19
3.1.2 Geology and Soils	25
3.1.3 Water Quantity and Quality	26
3.1.4 Solid Wastes and By-Products	33
3.1.5 Land Use	37
3.1.6 Floodplains and Wetlands	38
3.1.7 Occupational Noise	38
3.1.8 Ecosystems	39
3.1.8.1 Terrestrial Ecosystems	39
3.1.8.2 Aquatic Ecosystems	40
3.1.8.3 Threatened and Endangered Species	41

TABLE OF CONTENTS
(Continued)

	<u>Page</u>
3.1.9 Historic, Archeological, Cultural, and Aesthetic Resources	41
3.1.10 Socioeconomic	42
3.1.11 Occupational Safety and Health	43
3.2 Issues Related to Adjacent Activities	43
3.2.1 Introduction	43
3.2.2 Plant Gaston	44
3.2.3 Advanced Coal Liquefaction Facility	44
3.2.4 Selective Oil Agglomeration Test Facility	46
3.2.5 Drum Burial Site	46
3.3 Summary	47
3.3.1 Cumulative Summary	47
3.3.2 Summary of Impacts	47
3.4 No Action Alternative	49
4.0 LIST OF PERSONS AND AGENCIES CONTACTED	49
5.0 REFERENCES	50
APPENDIX A -- Air Quality Modeling Approach	55
APPENDIX B -- Water Quality Data for Yellowleaf Creek and Coosa River	58
APPENDIX C -- Summary of Applicable Alabama Water Quality Criteria in the Vicinity of the PSDF	61
APPENDIX D -- Agency Consultation Comments	63

LIST OF FIGURES

	<u>Page</u>
Figure 1. Site of PSDF	2
Figure 2. PSDF Process Diagram	5
Figure 3. Advanced Gasifier Process Flow Diagram	6
Figure 4. PFBC/CT Process Flow Diagram	10
Figure 5. PSDF and Surrounding Area	17
Figure 6. PSDF Water Balance	29
Figure 7. Adjacent Activities	45

LIST OF TABLES

	<u>Page</u>
Table 2.1. Operating Characteristics for the Proposed PSDF	12
Table 2.2. Characteristics of Possible Coals for Proposed PSDF	13
Table 2.3. Characteristics of Limestone, Longview Mine ...	13
Table 3.1. Air Emissions Criteria Pollutants	20
Table 3.2. Carbon Dioxide and Air Toxic Emissions	20
Table 3.3. Comparison of Predicted Impacts to the PSD Significant Levels	23
Table 3.4. Comparison of Screening and Refined Modeling Impacts to NAAQS for Sulfur Dioxide	24
Table 3.5. Potential Effluents from PSDF	30
Table 3.6. Solid Waste Streams from PSDF	35
Table 3.7. TCLP Test Data for LASH From Transport Reactor Test Unit (TRTU) Test	36
Table A-1. Listing of Modeled Sources and Their Emission Parameters	57

ABBREVIATIONS

AAQS	Ambient Air Quality Standards
AC	Alternating Current
acfm	Actual Cubic Feet Per Minute
ADEM	Alabama Department of Environmental Management
BACT	Best Available Control Technology
BOD	Biochemical Oxygen Demand
CCT	Clean Coal Technology
CFC	Chlorofluorocarbons
CFR	Code of Federal Regulations
cfs	Cubic Feet Per Second
cm/sec	Centimeters Per Second
CRM	Coosa River Mile
CT	Combustion Turbine
dB	Decibels
DC	Direct Current
DO	Dissolved Oxygen
DOE	Department of Energy
EA	Environmental Assessment
EPA	Environmental Protection Agency
F	Fahrenheit
FBHE	Fluidized-Bed Heat Exchanger
GPD	Gallons Per Day
GPM	Gallons Per Minute
GPY	Gallons Per Year
HCCU	Hot Gas Cleanup Unit
HSB	Highest Second Highest (Value)
IGCC	Integrated Gasification Combined Cycle
ISC	Industrial Source Complex
ISCST2	Industrial Source Complex Short-Term
km	Kilometers
kW	Kilowatt
LAER	Lowest Achievable Emission Rates
LASH	Limestone Ash
lb/hr	Pounds Per Hour
lb/mm Btu	Pounds Per Million British Thermal Units
m	Meters
METC	Morgantown Energy Technology Center
mg/L	Milligrams/Liter
mg/m ³	Milligrams Per Cubic Meter
MGD	Million Gallons Per Day
msl	mean sea level
MW	Megawatt
MWe	Megawatt, electricity
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO _x	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standard
ORNL	Oak Ridge National Laboratory
PCD	Particulate Control Device
PETC	Pittsburgh Energy Technology Center
PFBC	Pressurized Fluidized-Bed Combustor

ABBREVIATIONS
(Continued)

pH	Level of Acidity or Alkalinity
PM-10	Particles equal to or less than 10 microns in size
ppm	Parts Per Million
ppmv	Parts Per Million Volume
PSDF	Power Systems Development Facility
psia	Pounds Per Square Inch Absolute
RCRA	Resource Conservation and Recovery Act
SCS	Southern Company Services
SEGCO	Southern Electric Generating Company
SO ₂	Sulfur Dioxide
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TPY	Tons Per Year
TRTU	Transport Reactor Test Unit
TSI	Trophic State Index
TSS	Total Suspended Solids
µg/m ³	Micrograms Per Cubic Meter
USGS	United States Geological Survey
VOC	Volatile Organic Compound

POWER SYSTEMS DEVELOPMENT FACILITY

ENVIRONMENTAL ASSESSMENT

This Environmental Assessment (EA) has been prepared by the Department of Energy (DOE) in compliance with the requirements of the National Environmental Policy Act (NEPA) of 1969. It has been prepared in accordance with Federal regulations implementing NEPA and the DOE regulations for compliance with NEPA (10 CFR Part 1021). The sources of information for this EA include the following: communications with Southern Company Services (SCS), Oak Ridge National Laboratory (ORNL), the Pittsburgh Energy Technology Center (PETC), and Tennessee Valley Authority (TVA); numerous references from the literature; discussions with various environmental agencies directly concerned with the proposed project; and field visits to the proposed site.

In 1991, DOE planned several separate pilot-scale projects involving development of advanced coal-based power systems and clean-up technologies at various locations in the United States, including a Hot Gas Cleanup Unit (HGCU) test facility to be built at the Southern Company Clean Coal Research Center near Wilsonville, Alabama (Figure 1). In the proposed action, these separate projects would be combined into one test facility at the proposed Power Systems Development Facility (PSDF) site.

As required by 40 CFR Part 1508.9, the sections contained in this EA include the following:

- 1.0 Purpose and Need for the Proposed Action
- 2.0 Alternatives Including the Proposed Action
- 3.0 Environmental Impacts
- 4.0 List of Persons and Agencies Contacted
- 5.0 References

1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the proposed action would be to design, construct, and operate a dedicated, flexible research test facility that could be used to develop advanced coal-based power system components and clean-up technologies and to assess the integration and control issues of these systems. The facility would provide a resource for rigorous, long-term testing and performance assessment of hot gas stream clean-up devices, such as particulate control devices, allowing evaluation of the clean-up devices and other components in an integrated operation.

The proposed PSDF would combine a number of pilot-scale processes at a single test facility to reduce the overall capital and operating costs when compared to individual stand-alone test facilities. The proposed PSDF would provide an effective way to implement the DOE/Morgantown Energy Technology Center's (METC's)

Location of Systems Development Facility

FIGURE 1

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objectives of carrying out systems and component testing for advanced coal-based power generation and clean-up technologies.

The major components of the proposed action would include a pressurized, fluidized-bed combustor (PFBC) module, an advanced gasifier module, a set of particle control device modules, a combustion turbine (CT) module, and a fuel cell test skid module. The first four modules proposed would be enclosed in a new 1,350-square foot structure; the combustion turbine module and fuel cell test skid module would be adjacent to the new structure. The new structure would be built on a 12 acre site at the Southern Company Clean Coal Research Center near Wilsonville, Alabama.

The proposed PSDF would also support scale-up of advanced power system technologies in future Clean Coal Technology (CCT) demonstration projects and to provide improvements to earlier CCT projects. Integrated long-term operability of the systems and characterization of emissions would be conducted, particularly to determine the performance of the particle control device (PCD) modules. Incorporation of particle control device modules into these advanced systems would allow the gas streams generated by a gasifier or pressurized combustor to be cleaned while still hot and under pressure. This concept of particle control could offer significant cost savings for an advanced power generation system by increasing plant efficiency, reducing gas turbine maintenance requirements, and eliminating post-turbine particle control requirements to meet the Clean Air Act regulations.

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 THE PROPOSED ACTION

2.1.1 Project Description

The objective of the PSDF would be to provide a modular facility which would support the development of advanced, pilot-scale, coal-based power systems and hot gas clean-up components. These pilot-scale components would be designed to be large enough so that the results can be related and projected to commercial systems. The facility would use a modular approach to enhance the flexibility and capability for testing; consequently, overall capital and operating costs when compared with stand-alone facilities would be reduced by sharing resources common to different modules. The facility would identify and resolve technical barrier, as well as provide a structure for long-term testing and performance assessment. It is also intended that the facility would evaluate the operational and performance characteristics of the advanced power systems with both bituminous and subbituminous coals.

This proposed project would be jointly funded under a cooperative agreement between the Department of Energy (DOE) and Southern Company Services. Under this arrangement, 80 percent of the

estimated project cost of \$145 million would be provided by DOE. The balance of the project cost would be provided through a combination of cash and in-kind contributions from Southern Company Services, the Electric Power Research Institute, and several of the major subcontractors.

Five technology-based experimental modules are proposed for the PSDF: (1) an advanced gasifier module, (2) a fuel cell test module, (3) a PFBC module, (4) a combustion gas turbine module, and (5) a module comprised of five hot gas cleanup particulate control devices. The advanced gasifier and PFBC modules are coal conversion devices that would generate hot gas streams by either combustion or gasification of coal. The combustion gas turbine and the fuel cell modules are power-generating concepts: the turbine would combust products from the PFBC and the fuel cell would use clean fuel gas from the advanced gasifier when it is in the gasifier mode. The final module, the PCD, would capture coal-derived ash and particles from both the PFBC and advanced gasifier gas streams to provide for overall particulate emission control, as well as to protect the combustion turbine and the fuel cell. In general, the experimental operation will mimic commercial systems represented by a gasifier/fuel cell based technology and a PFBC/combustion turbine technology. The PCD module is crucial to the operation of both technologies.

A simplified schematic reflecting the system configuration is shown in Figure 2. The following operational discussions are grouped into two PSDF technology descriptions. Each description corresponds to one of the equipment trains given at the top or bottom of Figure 2.

2.1.1.1 Advanced Gasifier/Fuel Cell Modules

The advanced gasifier module could be operated in either a gasification mode with a reduced oxygen supply (reducing environment) or a combustion mode with excess oxygen (oxidizing environment). It would be used to parametrically test several PCD concepts at representative operating temperatures, pressures, and particulate loadings of advanced gasifiers and PFBCs. The reactor would allow the particulate size distribution, the gas particulate loading, and the particulate coal-based properties to be varied to assess PCD technical issues. This module would also support the commercialization of Integrated Gasification Combined-Cycle (IGCC), and Integrated Gasification Fuel Cell technologies, since both power systems employ a gasifier. A simplified schematic of the advanced gasifier/fuel cell equipment train is shown in Figure 3.

Power Systems Development Facility

Advanced Gasifier / Fuel Cell

PFBC / Combustion Turbine

FIGURE 2

Advanced Gasifier Process Flow Diagram

The transport reactor would be sized to process almost 2 tons of coal per hour and almost a quarter of a ton of limestone per hour to deliver about 1000 actual cubic feet per minute (acfm) of particulate-laden gas to the PCD at a temperature range of 1000° Fahrenheit (F) to 1800°F. For operation in the gasification mode, coal and limestone would be ground to 100 micrometers (μm) (in combustion mode, the coal particle size would be doubled to two hundred microns). These particles would be continuously injected by a pressurized-nitrogen lockhopper/feed system into the transport reactor vessel. Filters would be used on feeder system vents to prevent any entrained solids from escaping each time that the system is depressurized. Limestone injection would be used for controlling emissions of hydrogen sulfide when the transport reactor would be operating in a gasification mode and sulfur dioxide when operating in a combustion mode.

Air, required for both gasification and combustion, would be compressed to about 350 pounds per square inch absolute (psia) and fed directly into the bottom of the reactor, along with superheated steam when operating in the gasification mode. Coal conversion would begin in the mixing zone where solid meets gas, and the reaction mixture would flow upward into the narrow riser section at high velocity and then into the disengager, which knocks many of the entrained particles out of the gas flow. Most of the solids collected in the disengager would be recycled to the reactor, and the remaining coal ash and limestone ash/sorbent (referred to as LASH hereafter) would be sent to the ash cooler to recover some of the heat prior to disposal. This recirculation of finely ground coal and ash in a continuous loop would guarantee that all usable coal energy would be converted to chemical energy or sensible heat.

In the combustion mode, provisions would be made to inject air at several different points along the riser to control the formation of nitrogen oxides. Also, because the combustion would result in more complete oxidation of the coal, some heat must be removed from the reactor system to control the operating temperature. This would be accomplished by removing solids from the disengager, cooling the solids in the combustor heat exchanger, and returning the solids to the reactor system.

The hot gases leaving the disengager would still contain a high loading of particles, so a cyclone system would be located immediately downstream for additional solids recovery before the fuel gas reaches the PCD. The cyclones would be used in different combinations to vary the solids loadings being delivered to the PCD. The solids, separated from the gas stream in the cyclones, would be returned to the gasifier just down stream of the disengager.

Gases from the cyclone system would typically be at temperatures of 1600°F to 1800°F. The PCD would be tested at temperatures of 1000°F to 1800°F. Consequently, varying amounts of gas cooling would be required depending upon the operating temperatures.

This would be accomplished by generating steam in the primary gas cooler that would be located between the PCD and the cyclones.

Upon exiting the primary gas cooler, the raw fuel gas would be sent directly to one of two different PCD systems. There are many other options. These PCD units would be designed to be interchangeable with the smaller PCD on the PFBC module, as well as to handle both types of gases from the transport reactor: combustion flue gas or gasification fuel gas. The PCD system would be designed around an inlet gas flow of 1000 acfm, a maximum temperature of 1800°F, and a maximum pressure of 300 psia during both combustion and gasification modes. The PCD in the transport reactor train would be subjected to parametric testing over relatively short periods of time.

The functional purpose of the PCD would be to remove essentially all of the remaining particles in the gas stream. These captured particles would be sent to the ash hopper for disposal. This hopper would also periodically receive solids from the ash cooler through the ash lockhoppers.

When the transport reactor operates in its combustor mode, solids would be discharged from the ash hopper for disposal in a (non-hazardous) landfill. This would be possible because the sulfur captured in the transport reactor by the limestone sorbent would be in the form of calcium sulfate, which is non-hazardous and suitable for disposal in a non-hazardous landfill. However, when the reactor operates in the gasification mode, the sulfur would be captured as calcium sulfide. Calcium sulfide in an ash matrix is typically not a stable waste suitable for non-hazardous landfilling. To eliminate this disposal problem, all calcium sulfide solid by-products generated in the transport reactor under gasification conditions would undergo oxidation in a sulfator, which would convert the calcium sulfide to calcium sulfate, a non-hazardous waste solid. The gases delivered to and resulting from the proposed sulfator process would be vented through the stack to the atmosphere, after passing through the small cooling tower, a cyclone, and a baghouse to remove any particles.

Part of the cleaned gas leaving the PCD would be sent to the fuel cell test skid, while the remainder would be fed to a gas disposal subsystem. (See discussion at end of section.) This disposal system would begin with a secondary gas cooler, which would use steam generation to cool the gas down to about 600°F. The gas would then be cooled even further to about 350°F by water sprayed directly into the stream. In the gasification mode, the fuel gas not sent to the fuel cell would be combusted in the thermal oxidizer before venting to atmosphere; propane gas would be added to the low heating-value coal gas to ensure complete combustion. In the combustion mode, since the gas has already been fully burned, this step would not be required. The gases would bypass the thermal oxidizer and would go on to the small cooling tower before being vented through the stack to the atmosphere.

While the general operating principles of a fuel cell would not vary greatly from design to design, the particulars of the design to be used at the PSDF would be dependent on the fuel cell developer, which has not yet been decided. For this reason, the following section will be limited to a more general discussion of the fuel cell module.

The objective for the fuel cell module would be to test advanced fuel cell concepts, such as the molten carbonate and solid oxide versions. The proposed fuel cell module would be approximately 100 kilowatts (kW). During initial operation of the PSDF, the fuel cell would receive a portion (10 to 15 percent) of gas flow from the transport reactor. However, before this "cleaned" gas from the gasifier could be used in the fuel cell, it would need to be cleaned further to reduce sulfur and other contaminants. Once the fuel gas passes through this final cleaning stage, steam would be added and the fuel gas temperature would be raised to a level close to the operating temperature of the fuel cell. Next, the gas would pass into the anode side of the fuel cell where hydrogen is converted to water. The operating temperature of a molten carbonate fuel cell would be about 1200°F, and the operating pressure would be slightly above ambient. A solid oxide fuel cell would operate at approximately 1800°F and at the pressure that the gasifier operates. Unconverted fuel gas containing moisture and carbon monoxide would leave the anode and then be burned with added air. In molten carbonate fuel cells, the burner effluent would then be passed through the cathode side of the fuel cell where carbon dioxide and oxygen are consumed to complete the electrochemical reaction. The hot (1250°F) exhaust gas from the cathode side of the fuel cell would then be cooled and sent up the stack.

The output direct current (DC) power from the 100 kW fuel cell stack is expected to be approximately 192 volts, 701 amps at rated power. The DC power generated from the fuel cell would be dissipated as heat in a resistive load bank. This approach is being taken to hold down the capital cost of the PSDF. Normally, the DC output of a fuel cell would be converted to alternating current (AC). Since the AC power from the fuel cell is not needed by SCS, the electricity would be consumed in the resistive load bank.

2.1.1.2 PFBC/Combustion Turbine Modules

The PFBC would consist of two main units: (1) an air-blown carbonizer that produces low-Btu gas and coal char, and (2) a circulating pressurized fluidized-bed combustor. The PFBC would be state-of-the-art, utilizing its advanced technology to attain very high operating efficiencies. For a simplified schematic of the PFBC/CT equipment train, see Figure 4.

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As with the transport reactor, ground coal and limestone would be fed pneumatically to the carbonizer, which would contain a fluidized bed without a heat transfer surface. The bed temperature would be maintained by the air-to-coal feed ratio. The outputs from the carbonizer would be a low-Btu fuel gas and a char/sorbent stream. The char, together with reacted and unreacted limestone, would exit the carbonizer either as bottoms withdrawal or as fines collected from the carbonizer-fuel-gas-stream cyclone and PCD. The collected char would be fed pneumatically to the circulating PFBC, where the balance of the coal conversion would take place.

The circulating PFBC would normally operate with high excess air to ensure complete oxidation. The bed temperature would be controlled by either the char feed rate or by the cooling of recycled solids in the fluid-bed heat exchanger (FBHE), which would produce steam from the heat that it extracts. The circulating PFBC exhaust gas would pass through a single-stage cyclone and a PCD for particulate removal before being combined with carbonizer fuel gas in a topping combustor. Solids captured from the PCD would be sent through ash lockhoppers for disposal. The FBHE would send a fraction of its solids stream through the same ash lockhopper, while the remainder of its solids stream would recirculate to the circulating PFBC.

Once the fuel gas stream from the carbonizer and the flue gas stream from the circulating PFBC have been cleaned of particles by their respective cyclone/PCD combinations, they would be sent through alkali getter beds. The alkali getter bed would capture alkali to reduce or eliminate corrosion in the combustion turbine.

In the topping combustor, the gas streams from the carbonizer and the circulating PFBC would combine with air to produce an exhaust gas stream at 2350°F -- the optimum firing temperature for a utility-size plant. These 2350°F gases would be fed at full temperature to the gas turbine expander. However, due to temperature limitations of the turbine for the PSDF, this gas stream must be quenched with compressor bypass air down to 2000°F before entering the combustion turbine expander. This flow of gases through the AC turbine would power the generator to produce electricity. The current will be fed to the SCS power grid through the power line used to provide electricity to the facility. After the gases exit the turbine, they would be vented to the atmosphere through the stack.

2.1.1.3 Resource Requirements

The proposed overall PSDF resource requirements and operational emissions are shown in Table 2.1. Coal would be purchased from the Bilarning Star Mine in Randolph County, Illinois, and the Eagle Butte Mine in Campbell County, Wyoming. This coal would be transported by truck to the PSDF, stockpiled (7-day supply, 1400 tons of coal and 350 tons of limestone), and managed at the

Table 2.1. Operating Characteristics for the Proposed PSDF

	Advanced Gasifier	PFBC	Total
Total Capacity, MW	2.7 MWe	7 MWe	N/A
<u>Consumptive Characteristics</u>			
Coal Consumption, Tons/Year	10,700	18,450	29,150
Limestone Consumption, Tons/Year	1,500	3,100	4,600
Process Water Consumption, Gal/Year	--	--	53,406,216
Potable Water Consumption, Gal/Year	--	--	1,166,832
Demineralized Water Consumption, Gal/Year	--	--	2,076,120
<u>Air Emissions (Tons/Year)</u>			
Sulfur Dioxide	65	113	178
Nitrogen Oxides	7.24	80.9	88
Particulate Matter	2.70	8.8	12
Carbon Monoxide *	28.9	20.7	50
Volatile Organic Compounds (VOC)	5.2	2.7	7.9
Lead	0.35	0.61	1
<u>Effluents</u>			
Process Water Discharges, Gal/Year	--	--	32,850,000
Sanitary Wastewater, Gal/Year	--	--	1,166,832
Area Runoff, Gal/Year	--	--	Varies
<u>Solid Wastes</u>			
LASH, Tons/Year	2,500	6,000	8,500
Fly Ash, Tons/Year	275	N/A	275

site. Coal analysis is shown in Table 2.2. A primary process material for the facility would be limestone used for in-bed desulfurization. It is anticipated that over the 2-year period for the project, 4600 tons of limestone would be purchased from one or more of the numerous quarries in the region, transported by truck to the PSDF, stockpiled, and managed at the site. Limestone analysis is as shown in Table 2.3.

The proposed test facility would withdraw and use approximately 53 million gallons of process water per year. The water would be withdrawn from Yellowleaf Creek using an existing intake

Table 2.2. Characteristics of Possible Coals for Proposed PSDF

Coal Type	Moisture Free Ultimate Analysis, Percent (%)	
	<u>Illinois No. 6</u> (Bituminous)	<u>Eagle Butte</u> (Subbituminous)
Btu/lb	11,200	9,800
Carbon	71.1	68.7
Hydrogen	5.0	5.1
Chlorine	0.3	0.0
Nitrogen	1.4	0.9
Sulfur	3.0	1.1
Ash	9.9	8.5
Oxygen (By Difference)	9.3	15.7
H ₂ O (Proximate Analysis)	12.9	20.5

Table 2.3. Characteristics of Limestone, Longview Mine

Compound	Wt % Dry
Calcium Carbonate	97.45
Magnesium Carbonate	1.58
Silicon Oxide	0.20
Inerts	0.77

structure. The treated process waste water would be discharged to an unnamed tributary of Yellowleaf Creek consistent with permit requirements of the National Pollutant Discharge Elimination System (NPDES).

Potable water demand (1.2 million gallons per year (GPY)) would be supplied from the City of Wilsonville.

Demineralized water (2.1 million GPY) would be supplied by Plant Gaston through a pipeline and would be consumed by the experimental modules.

The PSDF test facility would occupy approximately 12 acres of land at the existing site. Site preparation plans would be to clear and gravel approximately 9 acres of wooded area and utilize

the decommissioned agglomeration test facility area as part of the occupied area.

An electrical substation that would include a transformer would be built on the proposed site to supply electricity for the operation of the equipment trains. An electrical line would be run from an existing electrical distribution line approximately 400 feet to the substation. The existing electrical distribution line and the connecting line would both be on Southern Electrical Generating Company (SEGCO) property.

Construction of the proposed project would last approximately 18 months. Approximately 200 construction workers would be required. The labor pool geographical source for these temporary workers is expected to be Shelby County and Jefferson County, Alabama. Engineering and construction supervision services would draw upon existing staff of SCS, Southern Electric International, and Alabama Power Company as well as some of their support contractors. During operation, the facility would employ between 90 and 100 people.

Standard construction materials such as steel, concrete, and construction equipment for the facility would be procured locally or regionally when possible. Custom process equipment required by the support contractors would be fabricated or procured in their regional areas.

2.1.1.4 Discharge Requirements

Process derived solid waste (LASH, ash) produced during experimental operations of the proposed PSDF would be handled in accordance with EPA and Alabama Department of Environmental Management (ADEM) standards. When both the PFBC and the advanced gasifier module are in operation, approximately five trucks per day of LASH and fly ash would be generated. A total of 8,800 tons per year (TPY) would be generated. LASH and fly ash would be stored on site in enclosed bins before removal to the Earnst C. Gaston Electric Generating Plant (hereinafter called Plant Gaston) dry ash landfill on a daily basis. Operation of the PSDF would not be expected to result in the generation of hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA).

All construction wastes (cement, debris, etc.) would be disposed of in accordance with local, state, and Federal regulations.

During construction of the PSDF, there would be air emissions of small quantities of dust or occasional smoke in the construction area. These emissions would be generated from construction equipment including cranes and electric generators. Gaseous emissions from the vehicles would include sulphur dioxide, nitrogen oxide, carbon monoxide, and volatile organic compounds (VOC). These emissions would be expected to be minimal in quantity, temporary, and confined to the site. Fugitive dust

emissions would depend on weather; however, such emissions would be minimal since the access roads are semi-paved with gravel.

During operation of the proposed PSDF, there would be air emissions of sulfur dioxide, nitrogen oxides, particulate matter, carbon monoxide, carbon dioxide, and volatile organic compounds. The proposed PSDF would obtain an air permit from the State of Alabama which would comply with all local, state, and Federal air regulations.

Process wastewaters (32,850,000 GPY) and sanitary wastewaters (1,166,832 GPY) after treatment would be discharged under a NPDES permit to an unnamed tributary of Yellowleaf Creek.

Runoff from the site and the coal piles would vary with seasonal rainfall. It would be discharged to the unnamed tributary of Yellowleaf Creek after treatment under a NPDES permit.

2.1.2 Description of the Project Location

2.1.2.1 General Description of the Area

The proposed site would be located at the Southern Company Clean Coal Research Center which is on a utility plant site (Southern Company's Plant Gaston) in an industrial park 1 mile northeast of Wilsonville in Shelby County, Alabama (as shown in Figure 1). The proposed site would be located on 12 acres of land that is zoned industrial. The Research Center property is leased from SEGCO. SEGCO and SCS are both wholly owned subsidiaries of the Southern Company. The proposed site is described in detail in Section 2.1.2.2.

The approximate populations of the city and county are 1,200 and 99,400, respectively. The land surrounding the SEGCO property is primarily rural, with several scattered residences within a half mile of the SEGCO property line. The predominant land use is agricultural (timber, peach, and cotton production), although several industries are located in the county. The closest school, Wilsonville Elementary School, is 2 miles southwest of the proposed site. The closest hospital is Shelby Memorial Hospital in Alabaster, Alabama, 17 miles west of the proposed site. The Talladega National Forest is the closest designated outdoor recreation area located 30 miles east of the proposed site.

The temperatures for Shelby County range from the low 30s °F in January to the high 90s °F in July. On average, 55 inches of rain are received annually. Predominant winds are from the south in winter and spring and from the north in summer and fall. The average wind speed is 7.2 miles per hour.

The proposed site is located in a series of parallel northeast-southwest trending valleys and ridges of the Coosa Valley.

Ridges are typically underlain by sandstones and cherts, whereas the valley areas are developed on carbonates and shales. The soils are part of a Townley soil group, a weathered clay, typically red-brown in color.

The city of Wilsonville obtains its public water supply from two wells which are located 1 mile south of the proposed site. A recent private and public drinking water well inventory investigation found no private drinking water wells within 1/2 mile of the SEGCO property boundary. The only well that is located close to the proposed site was drilled to supply process water for the decommissioned Southern Company Clean Coal Research Center Advanced Coal Liquefaction test facility. This well is 1000 feet northeast of the proposed site. It is no longer used and is currently capped. No groundwater would be used for the proposed PSDF.

2.1.2.2 Description of the Proposed Site

There are three existing facilities or activities on SEGCO property in the vicinity of the proposed action. The first, Plant Gaston, has a total generating capacity of 1906 MWe. It is on the west bank of the Coosa River and is one quarter mile east of the proposed site (Figure 5). The second activity is the Southern Company's Clean Coal Research Center that consists of an administration building and two test facilities: the Selective Oil Agglomeration Test Facility (hereinafter called the agglomeration test facility) and the Coal Liquefaction Test Facility (hereinafter called the liquefaction test facility). The proposed site would use the facilities/area remaining from the decommissioned agglomeration test facility. The liquefaction test facility is currently being decommissioned. As part of this decommissioning process, soil and groundwater remediation investigations would continue on the liquefaction test facility site. The third activity is a CERCLA regulated removal action being conducted at a landfill (i.e., drum burial site) associated with the decommissioned liquefaction test facility and is located approximately 500 yards south of the proposed PSDF site. The cleanup, with oversight by ADEM and EPA, was completed during May 1993. Groundwater monitoring wells installed around the landfill have to date revealed no contaminants from the landfill area.

Highway 25 is located west of the proposed site. The proposed site would share an existing access road to Plant Gaston. The proposed site would consist of the decommissioned agglomeration test facility site and an undisturbed tract of land west of the agglomeration test facility.

The proposed site would contain both preexisting and to be built structures and pieces of equipment. The preexisting structures include the coal and limestone storage and preparation areas and

PSDF Site and Surrounding Area

FIGURE 5

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a sedimentation basin. The structures that would be built include the control room and staff offices; the process test facility to house the PFBC module, the advanced gasifier module, and the PCD modules; the fuel cell module; the combustion turbine module; and an electrical substation. The process test facility would be 180 feet in height. There would be two flares and two stacks on the proposed site at a height of 225 feet. The general appearance of the site would be consistent with that of the surrounding area (i.e., Plant Gaston).

Utilities for interconnection to the proposed site, including municipal water, sanitary sewers, telephone, and electricity, would be presently available within the SEGCO property boundary. The city has the service capacity to provide the utilities required for the proposed project.

2.2 ALTERNATIVES TO THE PROPOSED ACTION

2.2.1 No Action Alternative

Under the No Action Alternative, DOE would not provide cost-shared funding for the construction and operation of the PSDF, resulting in project cancellation. Project cancellation would mean a flexible test bed facility would not be available to help demonstrate cleaner and more efficient advanced coal-based power systems. The no action alternative would significantly limit the options for the DOE/CCT Program objectives to demonstrate the economic feasibility and environmental acceptability of advanced technologies developed to use coal as an energy source.

2.2.2 Alternative Sites Dismissed From Consideration

An alternative site was considered for the proposed PSDF in an area of land north of the proposed site. The site is currently used as recreational (baseball) fields for Southern Company employees. It is on SEGCO property. The advantages as an alternative site were (1) the area was relatively flat; (2) it was close to another "similar" industry (Plant Gaston); (3) roads and utilities were existing; (4) a labor pool was available; and (5) there would be minimal impact on water, noise, ecosystems, historical, or cultural resources.

There were two disadvantages that dismissed the site from further consideration. The site would be north of the liquefaction test facility. Thus, it would share the same complex geology as the coal liquefaction site and would be hydrogeologically down-gradient from that facility, which would be undesirable since the groundwater under the liquefaction test facility is currently contaminated with volatile organic compounds. A remedial investigation for the liquefaction test facility is ongoing; however, if its groundwater contaminant plume is migrating, it would be likely that the alternative site would be affected since it is

downgradient from that facility. In addition, Plant Gaston would not want to move the existing air monitoring station that is located on the alternative site. Any relocation of the air monitoring station would (1) involve resiting a new air monitoring station with the State of Alabama and (2) could possibly invalidate the use of any air monitoring data previously collected. Finally, the destruction of the baseball fields for the area was also considered in making this decision.

Since the preferred site makes use of existing equipment, facilities, and infrastructure, as well as being upgradient from the coal liquefaction site, it became the environmentally acceptable option to pursue.

2.2.3 Alternative Technologies

There are no other existing or proposed coal-based test bed facilities that would provide the flexibility and whole system demonstration information that the proposed PSDF would produce. The proposed integrated advanced technology test facility is necessary to allow power producers to replicate the systems on their own sites.

3.0 ENVIRONMENTAL IMPACTS

3.1 THE PROPOSED ACTION

3.1.1 Air Quality

Air Emissions: Although PFBC and coal gasification processes have been previously demonstrated, the proposed test modules incorporate advanced technology. Thus, predicted air emissions based on analytical measurements are not readily available. However, bench-scale units described in the proposed action (PFBC and advanced gasifier modules) have been developed and characterized. From these bench-scale tests, source models have been developed to predict the quantity of air emissions expected for the proposed pilot-scale facilities.

DOE has developed and used the "Aspen Simulation Model" to estimate the emissions of particles, sulfur dioxide, and nitrogen oxide from the PSDF. The emissions of carbon monoxide and carbon dioxide were calculated using the model. DOE estimated the emissions of the other pollutants, such as VOC, by conducting a literature search and extrapolating the information to PSDF conditions.

The air emissions of the criteria pollutants are estimated (as shown below) in tons per year (TPY) and pounds per hour (lb/hr) for the PFBC/CT module and advanced gasifier modules. Total average Plant Gaston emissions are also presented for comparison:

Table 3.1. Air Emissions Criteria Pollutants

Pollutant	PFBC/CT		Gasifier		Total TPY	Plant Gaston (Average) TPY
	lb/hr	TPY	lb/hr	TPY		
Sulfur Dioxide	33.4	113	19.3	65.0	178	147,456
Nitrogen Oxides	24.0	80.9	2.15	7.24	88	1,234
Particles	2.6	8.8	0.8	2.7	12	3,137
Carbon Monoxide	6.13	20.7	8.57	28.9	50	1,234
VOC	0.8	2.7	1.54	5.2	8	144
Lead	0.18	0.61	0.10	0.35	1	N/A

Other emissions including carbon dioxide and potential air toxics, are estimated as follows:

Table 3.2. Carbon Dioxide and Air Toxic Emissions
(Tons Per Year)

Components	PFBC/CT (TPY)	Gasifier (TPY)	Total (TPY)
Carbon Dioxide	44,003	28,661	72,664
Beryllium	0.00	0.00	0.00
Fluorine	1.15	0.66	1.81
Mercury	0.00	0.00	0.00
Cobalt	0.02	0.01	0.03
Chromium	0.05	0.03	0.08
Iron	0.00	0.00	0.00
Molybdenum	0.14	0.08	0.22
Manganese	0.02	0.01	0.03
Nickel	0.02	0.01	0.03
Titanium	0.02	0.01	0.03
Bromine	0.29	0.17	0.46
Boron	1.92	1.11	3.03
Phosphorous	1.34	0.77	2.11
Copper	0.29	0.17	0.46
Vanadium	0.00	0.00	0.00
Zinc	0.00	0.00	0.00
Antimony	0.00	0.00	0.00
Tin	0.00	0.00	0.00
Zirconium	0.00	0.00	0.00
Arsenic	0.18	0.10	0.28
Cadmium	0.05	0.03	0.08
Selenium	0.04	0.02	0.06
Gallium	0.00	0.00	0.00

In addition to the emissions listed above, the proposed PSDF is also a potential source of chloride, formaldehyde, polycyclic organic matter, radionuclides, phenol, and pyridine from the combustion of coal. Emission of these pollutants would be expected to be negligible. In addition, no chlorofluorocarbons (CFC) would be used or produced by the proposed PSDF. The only CFC emissions associated with the proposed facility would be those that result from incidental leaks from building and vehicle air conditioning systems.

The incorporation of the proposed fuel cell into the PSDF system would not increase (and could possibly decrease) the air emissions when compared to the total baseline emissions from the PFBC/CT and gasifier modules. This is primarily due to the fact that a slipstream from the advanced gasifier would feed this module. Since fuel cells are contaminant sensitive, there would be strict requirements with respect to contaminant content of the fuel stream feeding the fuel cell module. Thus, the fuel gas slipstream entering the fuel cell may require an additional level of cleaning, thereby lowering the total air contaminant levels exiting the PSDF when compared to baseline levels (without a fuel cell module).

National and State Ambient Air Quality Standards: The proposed PSDF would be located in an area which is in attainment for all criteria pollutants with the exception of ozone. The National Ambient Air Quality Standard (NAAQS) for ozone is 0.12 parts per million (ppm) on an hourly basis which can be exceeded no more than three times during a 3-year period.

Based on current nonattainment provisions, all new major facilities and modifications to existing major facilities located in a nonattainment area must undergo nonattainment review. A new major facility is required to undergo this review if the proposed sources have the potential to emit significant levels of the nonattainment pollutant. In the case of the proposed PSDF, the emission of the nonattainment pollutant ozone, (expressed as volatile organic compounds, a precursor to photolytic ozone production) would be 8 TPY, well below 40 TPY (the significant NAAQS level); therefore, nonattainment review would not be required.

The proposed PSDF site would be located in an area designated as Class II under the NAAQS. No impact would be expected on the nearest Class I area, the Sipsey Wilderness Area (Class I areas are those in which the least amount of degradation can occur, such as in national parks and national wilderness areas) since it is located approximately 95 miles northwest of the site. The EPA does not require further impact modeling beyond 100 kilometers (km) (62 miles) from the source, since the proposed emissions would not result in detectable changes in air quality at this distance.

New Source Performance Standards (NSPS): NSPS for small steam generating units utilizing fluidized-bed combustion technology

require that sulfur dioxide emissions be reduced by 80 percent, that sulfur dioxide emissions not exceed 1.2 pounds per million British thermal units (lb/mm Btu), and particulate matter emissions not exceed 0.05 lb/mm Btu. These standards are contained in 40 CFR 60.42c(b) and 40 CFR 60.43c(a), respectively and have been incorporated in the Alabama air management plan. The proposed PSDF's emissions of sulfur dioxide (maximum of 0.54 lb/mm Btu) and particulate matter (0.042 lb/mm Btu) are below these levels; thus, the proposed PSDF would be in compliance with NSPS.

For combustion turbines with heat input at peak load equal to or greater than 10 MM Btu/hr, standards apply for sulfur dioxide and nitrogen oxides. These standards are contained in 40 CFR 60.333 and 40 CFR 60.332(a), respectively. The NSPS nitrogen oxide emission limit can be adjusted upward to allow for fuel-bound nitrogen. The proposed facility's emission levels of sulfur dioxide (maximum sulfur content of 0.6 percent in coal gas) and nitrogen oxides (47 parts per million-volume (ppmv)) are estimated to be below these levels and would comply with NSPS.

Prevention of Significant Deterioration (PSD) Requirements: Alabama's State Implementation Plan, which contains PSD regulations, has been approved by EPA, and therefore PSD approval authority has been granted to ADEM under Alabama Regulation 335-3-14.04.

Plant Gaston is classified as an "existing major stationary source." However, the Southern Company Clean Coal Research Center has been previously permitted by ADEM as a separate minor facility. In order for the PSD regulations to apply, the potential emissions of any regulated pollutant from the proposed PSDF would need to exceed 250 TPY. Since the proposed facility's potential emissions of each regulated pollutant is estimated to be well below 250 TPY for the proposed PSDF, it could be concluded that PSD regulations would not apply in this case.

Air Quality Modeling Results: An air quality impact assessment was conducted to estimate the effect of the proposed PSDF on the area's ambient air quality and to determine compliance with NAAQS and PSD significant levels. This modeling was completed to complement the EA. It was not required by the state as this source is not classified as a major new source or a major modification subject to PSD regulations.

The modeling of the ambient air quality used the most recently released EPA model (the ISC short-term 2 (ISCST2) model using a rural with simple terrain assumption). The modeling effort consisted of two phases: maximum emission impact from building downwash modeling and refined sulfur dioxide emission modeling. Both modeling phases used the following stack characteristics for the PFBC/CT and advanced gasifier modules shown below:

Stack Characteristics	PFBC/CT	Advanced Gasifier
Stack Height (ft)	225	225
Stack Diameter (ft)	3.5	2.0
Stack Gas Flow (acfm)	39,021	11,141
Stack Gas Velocity (ft/sec)	67.5	59.1
Stack Gas Temperature (°F)	980	350

In the first phase of modeling, emissions from the two stacks' building downwash were modeled to assess the PSD significant impact levels of nitrogen oxide, carbon monoxide, particulate matter, and sulfur dioxide. In this initial modeling phase, the modeled area was a coarse grid (5000 meter [m] rectangular area extending from the proposed PSDF and divided into 500 m grid spacing). The results of the modeling indicate that only sulfur dioxide impacts would exceed the EPA significant impact levels. However, additional modeling, as explained in the following paragraphs, indicated that the sulfur dioxide would not exceed the EPA significant impact levels.

A comparison of predicted impacts to the PSD significant levels for the first three pollutants are presented in Table 3.3.

Table 3.3. Comparison of Predicted Impacts to the PSD Significant Levels

Average Time (Hrs)	PSD Significant Impact Levels	
	Standard	Predicted
Nitrogen Oxide (Annual)	1	0.9
Carbon Monoxide (1) (8)	2,000 500	170.6 57.7
Particle Matter/10 (24) (Annual)	5 1	4.3 0.4

All impacts are in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$).

The maximum predicted 3-hour, 24-hour, and annual sulfur dioxide concentrations expected from the proposed PSDF facility are 133.0, 29.0, and $2.2 \mu\text{g}/\text{m}^3$, respectively. Each of these impacts are above the PSD significant impact levels established by EPA and, therefore, further modeling analysis is required to

demonstrate compliance with NAAQS and PSD significant level requirements.

The second modeling phase consisted of refined modeling which included adding all major sulfur dioxide emitting sources within 14 km of the proposed facility and a larger grid area with finer grid spacing. The additional modeled sulfur dioxide sources included in the refined analysis are Plant Gaston, Kimberly Clark pulp mill, and two asphalt batch plants (Asphalt Products and Wilson Brothers).

The maximum 3-hour, 24-hour, and annual average total sulfur dioxide concentrations predicted from the screening and refined modeling (with and without downwash) are presented in Table 3.4. The total concentrations were determined from the impacts of the modeled sources added to the background concentration. These results indicate that the impacts due to the proposed PSDF and all major sulfur dioxide sources within 14 km, would not exceed NAAQS.

Table 3.4. Comparison of Screening and Refined Modeling Impacts to NAAQS for Sulfur Dioxide

	Annual	3-Hour HSH	24-Hour HSH
Preliminary Modeling	9.3	840	139
Refined Modeling	9.6	981	154
Downwash Modeling	9.6	881	149
PSDF Alone	2.9	96	22
NAAQS	80.0	1,300	365

All predicted impacts are in micrograms per cubic meter.

HSH = Highest-Second-Highest

For discussion concerning the air quality modeling approach for determining compliance with NAAQS and PSD significant levels, refer to Appendix A.

Other Impacts: In addition to the proposed PSDF emissions that were modeled from the stack, the storage and handling of coal and ash, along with construction activities, would create small

quantities of dust or occasional smoke. The construction emissions would be generated from construction equipment including personal vehicles for crew, cranes, and electric generators. Gaseous emissions from the vehicles would include sulfur dioxide, nitrogen oxide, carbon monoxide, and VOC. These emissions are expected to be temporary.

Fugitive dust emissions would depend on the weather but would be reduced significantly because the access roads would be semi-paved with gravel. Other mitigation techniques such as watering, use of road surfactants, and temporary barriers would be used to limit and confine these emissions of fugitive dust. Coal and ash storage/handling operations would use covers, where practicable, wind breaks, and water application to control dust.

Summary: Air quality analysis indicate the proposed PSDF would comply with all applicable local, state, and Federal air emissions standards. Impacts associated with the proposed PSDF are not expected to cause violation of any NAAQS or PSD significant level requirements.

Construction of the project and coal/ash handling and storage are expected to cause some localized dust problems. Standard mitigation techniques such as watering, erecting wind breaks, and using covers where practicable would be employed to minimize fugitive dust.

3.1.2 Geology and Soils

The proposed PSDF site would be located in a geologically complex portion of the Coosa Valley in Alabama. The Floyd-Parkwood shale, a dark gray fissile shale that underlies the proposed site, has been extensively folded due to past movement of faults in the area. The inclination of the shale ranges from 5 degrees horizontal to vertical. The majority of the joints and faults observed in an exposed sequence of Floyd-Parkwood shale were tight along the trace of the joint and fault planes rather than open or separated. Many of the joints and bedding surfaces were healed with calcite (calcium carbonate). The presence of calcite indicates the shale is relatively impermeable along these surfaces; thus, groundwater would have little ability to migrate in any direction through this shale formation. Borings drilled in the central portion of the proposed site during a site investigation encountered a minimum of 80 feet of Floyd-Parkwood shale. The weathered profile of the shale ranges from 20 to 35 feet.

Soils underlying the proposed PSDF facility have been derived from the weathering of the Floyd shale. The soil survey of Shelby County prepared by the Department of Agriculture indicates the proposed site is underlain by the Townley soil group. The Townley soil is a moderately deep, well drained soil formed on upland areas with a pH range of 3.6 to 5.5 (mildly acidic). The typical soil profile is comprised of 15 inches of a brown silty loam. The loam is underlain by a mottled, yellowish-red clay to

a depth of 30 inches. The soils are classified as elastic silts to clayey sands to lean clays with varying amounts of sandstone fragments derived from the Floyd shale. Laboratory permeability tests, which describe the ability of a medium to transmit fluid, show the soil to have very low permeability at 1.4×10^{-8} centimeters per second (cm/sec).

3.1.3 Water Quantity and Quality

Water quality and use related to the proposed PSDF facility include both surface water and groundwater. Surface water impacts are addressed in terms of resource requirements and effects that PSDF discharges may have on surface water quality. Groundwater quality is considered in terms of local hydrogeology, potential impact of the proposed PSDF processes, as well as past activities in the area.

Surface Water: Three surface water bodies would be located within one-half mile of the proposed PSDF (Figure 5). These surface water bodies are an unnamed tributary to Yellowleaf Creek, and the Coosa River. Water discharges from the proposed PSDF would flow along the unnamed tributary and discharge to Yellowleaf Creek at a point approximately 4000 feet upstream from the mouth of Yellowleaf Creek. The surface water intake structure which would supply water to the proposed PSDF is located 400 feet downstream of the discharge point. The proposed site would be located approximately 6400 feet (1.2 miles) west of the confluence of Yellowleaf Creek and the Coosa River.

The unnamed tributary (a man-made tributary) to Yellowleaf Creek would receive the NPDES-regulated discharges from the proposed PSDF. The discharge primarily would consist of process water. The length of the unnamed tributary would be approximately 2400 feet.

There are no streamflow data available for Yellowleaf Creek near the unnamed tributary discharge point. The nearest stream gauge on Yellowleaf Creek is located at the United States Geological Survey (USGS) station approximately 15 miles upstream of the discharge point. Based on the only available data collected from 1951 through 1967, (ADEM considers the data to be acceptable) the average annual flow past this gauge is 96 million gallons per day (MGD) (148.5 cubic feet per second [cfs]). The 7-day, 10-year low flow is given as 0 MGD and the 7-day, 2-year low flow as 0.5 MGD (0.77 cfs). The 1-day, 10-year low flow ($1Q_{10}$) is also 0 MGD. An estimate of stream flow near the unnamed tributary discharge point of approximately 192 MGD (297 cfs) is assumed based on the measurements made at the upstream gauge in conjunction with area drainage calculations.

Flow direction of Yellowleaf Creek downstream of the Plant Gaston intake structure is affected by the water demands of Plant Gaston. During periods of low flow and peak power demand, the water withdrawal from Yellowleaf Creek by Plant Gaston can divert

significant portions of the Coosa River flow up into Yellowleaf Creek. At normal full pool, the water in Yellowleaf Creek is maintained to a depth of about 20 feet at the unnamed tributary discharge point.

The primary uses for Yellowleaf Creek upstream of the discharge point of the proposed facility are recreational (swimming and fishing). Access to Yellowleaf Creek is controlled in the vicinity of the discharge and intake structures by Alabama Power.

Coosa River stream flow past Plant Gaston is completely regulated by the operation of the Logan Martin and Lay Dams at Coosa River Miles 99.5 and 51.3, respectively, to form Lay Reservoir for which normal full pool is at 396 feet mean sea level (msl). The minimum pool level is at an elevation of 395 feet msl, and the maximum pool level is at 396.5 feet msl.

Primary water uses for the Coosa River between the Logan Martin and Lay Dams are for industrial process cooling water, potable water supplies, recreation, and hydropower generation.

Surface Water Quality: Water quality data for Yellowleaf Creek and the Coosa River in the vicinity of the proposed PSDF site are presented in Appendix B. The data show Yellowleaf Creek water to be adequately oxygenated, slightly alkaline, moderately well buffered, and soft. The total dissolved solids (TDS) and the electrical conductivity values are relatively low. Comparisons with the data for the Coosa River, which contributes to the backwaters of Yellowleaf Creek, show some similarities in oxygenation, pH, alkalinity, and hardness. In contrast, values for the TDS and the electrical conductivity are consistently higher for the Coosa River. The sanitary and bacteriological parameters of biochemical oxygen demand (BOD) and fecal coliform data indicate Yellowleaf Creek and the Coosa River are both in excellent condition.

The ADEM classifies the reach of the Coosa River beside the Plant Gaston site as eutrophic (relatively rich in nutrients needed to sustain algal growth). This is indicated by the trophic state index (TSI) values of between 52 and 56 for three of the four measurements made. TSI values were not available for Yellowleaf Creek, but nutrient levels appear to be similar to those for the Coosa River.

Yellowleaf Creek is currently designated by ADEM as suitable for two use categories: Swimming and Other Whole Body Water-Contact Sports, and Fish and Wildlife. The Coosa River near the site is classified for the same two uses and an additional category, Public Water Supply. The applicable Alabama water quality criteria for these three use categories are presented in Appendix C. These criteria represent pollutant and other parameter levels necessary to sustain the designated uses. A comparison of the measured parameter values (Appendix B) with the applicable numerical water quality criteria shows that both Yellowleaf Creek

and the Coosa River meet the requirements for most of the water quality parameters. These values, overall, indicate good water quality.

Surface Water Supply: The proposed PSDF would minimize water usage through the use of high-temperature and pressure particle control technologies which require less cooling water and recycling of process water. The service water system would consist of three separate systems to provide potable water, non-potable industrial water, and demineralized water. Potable water would be obtained from the City of Wilsonville municipal supply system. The source of non-potable industrial water (both process and noncontact cooling water) would be from Yellowleaf Creek using the existing Plant Gaston intake structure (Figure 5) which would be modified with an additional pump. The demineralized water would be obtained from Plant Gaston. Figure 6 depicts the sources and amounts of water required for operation of the proposed PSDF, as well as the anticipated discharge yields.

Potable water for domestic and sanitary use would be obtained from the Wilsonville public water supply and metered to determine consumption. Estimated demand for potable water would be 2.22 gallons per minute (GPM) (3197 gallons per day [GPD]). This demand is well within the deliverability capacity of the City of Wilsonville water supply system.

The proposed PSDF would require up to 101.61 GPM (146,318 GPD) of non-potable water that would come from Yellowleaf Creek via the existing Plant Gaston intake structure. Cooling water would require 14.8 GPM (21,312 GPD), individual test process water would require 20 GPM (28,800 GPD), washdown and service water would require 56.81 GPM (81,806 GPD, intermittent), and ash system water would require 10 GPM (14,400 GPD). These quantities of water constitute less than 0.02 percent of the existing intake capacity (735 MGD) for Plant Gaston. The additional capacity required to meet the needs of the PSDF is comparatively insignificant when compared to existing intake demands.

Surface Water Discharge and Impacts: The sources of wastewater streams from the operation of the proposed PSDF would be sanitary wastewater, runoff from the coal/limestone storage area (both piles would be stored on concrete pads), process wastewater (blowdown, washdown, ash system water), and stormwater runoff from the remaining PSDF area. Information on these effluent streams is presented in Table 3.5.

The existing NPDES permit (AL0057479) for the Clean Coal Research Center regulates discharges to the unnamed tributary to Yellowleaf Creek. This existing NPDES permit would be modified to accommodate the discharges from the proposed PSDF. The amended permit would set specific limits for the coal pile runoff, treated process water and stormwater runoff, as well as for the discharge from the sewage treatment system. The coal pile

PSDF Water Balance
FIGURE 6

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Table 3.5. Potential Effluents from PSDF

Effluent	Estimated Flow Rate	Critical Parameters	Treatment
Coal pile runoff	Varies with incident rainfall	pH, suspended solids, iron, manganese	Sedimentation and pH adjustment
Limestone pile runoff	Varies with incident rainfall	Alkalinity	Utilized in adjusting pH in coal pile runoff
Process area wash water	Intermittent and low	Oil and grease, miscellaneous	Oil separation, sedimentation
Sanitary wastewater	Average 2.2 GPM	pH, BOD, suspended solids	Biological
Process Waste Water	62.5 GPM	Selected trace metals as indicated by further monitoring	Chemical precipitation and settling/sedimentation
General area runoff	Varies with incident rainfall	Suspended solid, oil, and grease	Oil separation, sedimentation

storage area runoff would be monitored for flow, pH, total suspended solids (TSS), total iron, and total manganese, while the treated sanitary wastewater from the sewage treatment system would be monitored for pH, BOD, TSS, fecal coliform, and residual chlorine. Effluent from the treatment of process wastewaters would be monitored for flow, pH, BOD, sulfur, total phenols, TSS, and dissolved oxygen (DO). Thermal water discharges from the proposed PSDF would be minimal, at 1.45 GPM or 2 percent of the total process water discharges from the PSDF operations.

The existing sewage treatment system would continue to be utilized for the operation of the PSDF. The sewage treatment system has the capacity to handle the effluent from the proposed PSDF facility.

The existing coal pile runoff basin, which serves primarily as a sedimentation basin with a capacity of 107,000 gallons, could accommodate the runoff from the proposed PSDF coal storage pile. The quantity of coal to be stored (29,000 TPY) would be similar to the amount of coal previously stored for the Clean Coal

Research Center. The treatment of the coal pile runoff would be sedimentation with neutralization as needed. The dissolved and particulate components of the limestone pile runoff, which would be directed to the same basin as the coal pile runoff, should contribute to the neutralization of the coal pile runoff and, therefore, assist in meeting the NPDES limits for pH. Stormwater runoff from other areas directly associated with the PSDF activities would be covered in the permit and treated accordingly. Effluents from the basin would be treated to satisfy the parameter limits set by the ADEM NPDES permit.

Process area wash water would be routed through an oil/water separator before entering the runoff basin. Cooling tower blowdown, the major source of water discharge from the proposed PSDF, would have an estimated average flow of 6,106 GPD (4.246 GPM). The chemical composition of cooling tower blowdown discharge would be a function primarily of the constituents present in the intake/makeup water, which would be concentrated by the evaporative losses within the condenser cooling system. The acceptable number of cycles of cooling water allowed prior to discharge as blowdown would be determined by using information related to the chemical composition of intake/makeup water and the discharge requirements contained in the state NPDES permit.

Comparisons of the water quality data for Yellowleaf Creek and the Coosa River, with the relevant numerical water quality criteria, suggest that the cooling tower blowdown may need limited treatment prior to discharge. The treatment may be as simple as sedimentation and/or filtration. The proposed PSDF would incorporate appropriate unit operations to meet the designated NPDES discharge limits. Boiler blowdown would have an estimated average flow of 2088 GPD (1.45 GPM). This wastewater is typically of better quality than cooling tower blowdown. Boiler blowdown and cooling tower blowdown would be combined prior to treatment. The Federal effluent limitations stipulated for cooling tower blowdown are presented under the NSPS for the Steam Electric Power Generating Point Source Category. These limitations specify loadings for zinc and chromium (used for corrosion prevention in cooling towers), residual chlorine from chlorination against biofouling, and any additions of priority pollutants above background levels in the effluent cooling water. These limitations are minimum standards that must be adopted and would be incorporated in the NPDES permit.

Construction activities could potentially impact water quality through non-point source contributions of particles and limited amounts of oil and grease to surface runoff. Activities of concern would include clearing and grubbing, burning of brush, and earth-moving activities such as excavation and grading. The proposed PSDF would comply with NPDES construction permit requirements.

Surface Water Quality/Quantity Summary: Construction of the proposed PSDF is expected to have minimal impact on surface water

quantity or quality. All run-off generated during construction would be diked to run into the sedimentation basin. Water needed during construction would come from the City of Wilsonville.

Water withdrawal/usage by the PSDF would not impact the existing surface water quantity because the water requirements for the PSDF represent only a very minor portion of the intake demand of Plant Gaston from the Coosa river via Yellowleaf Creek. Operation of the PSDF is expected to have minimal impact on the water quality of Yellowleaf Creek, since operational discharges would be regulated by an NPDES permit. The receiving water (the unnamed tributary to Yellowleaf Creek) would be expected to satisfy the same water quality criteria as Yellowleaf Creek itself.

Groundwater: Regional groundwater supplies are provided from two major aquifers: the Knox-Shady and the Fort Payne-Tuscumbia aquifers. Aquifers in the region are typically associated with valleys that are separated by less permeable rocks outcropping on ridges. The major source of recharge to the aquifers is rainfall, with an estimated surface recharge of 5 inches per year. Most of the aquifers in the area are unconfined and may be susceptible to surface contamination. The majority of the municipalities in Shelby County obtain their water from wells. The City of Wilsonville wells are developed in a different formation (the Copper Ridge Formation) from the formations which underlie the proposed PSDF site.

The proposed site for the PSDF would be located on the Floyd-Parkwood Shale formation which is not recognized as a groundwater aquifer in Shelby County. Field permeability tests conducted in the 10 feet of decomposed shale overburden yielded hydraulic conductivities ranging from 1.62×10^{-4} cm/sec to 3.28×10^{-5} cm/sec, which are values typical of shale material. Field site investigations conducted over the proposed PSDF facility revealed that borings drilled in the Floyd-Parkwood shale did not encounter groundwater except along fractures in the shale and that the occurrence of groundwater was not continuous. During drilling operations, dry rock cuttings were recovered from the boreholes to a depth of 50 feet. However, as augers were removed from the borings, water entered the boreholes from fractures in the shale. Many borings adjacent to locations with perched water were found to be dry. Therefore, data collected from the site investigation indicated that groundwater occurring in this formation would be noncontinuous and that it would be found either perched in the residual clay and decomposed shale or concentrated along joint and fault planes. Water levels measured in the shale indicated that groundwater, if present, would flow away from the proposed PSDF site to the east-southeast.

Borings that were cored through the Floyd-Parkwood shale into the underlying carbonate limestone (depths of 70-90 feet) gave no evidence of voids (limestone solutioning) at the interface nor in

the underlying carbonate limestone formation. Groundwater flow in this carbonate aquifer was in the north-northeast direction.

The only water well that is located close to the proposed PSDF site is one that was drilled to supply process water for the decommissioned Advanced Coal Liquefaction test facility. This well is located 1000 feet northeast of the proposed PSDF site and produces water from Ordovician-aged Newalla limestone. It is currently capped. However, no groundwater would be used for the proposed PSDF.

Groundwater Quality: Water samples taken for water quality analysis from two monitoring wells on the proposed PSDF site in the shale formation and in the limestone formation indicated no groundwater contamination. The formations which underlie the proposed PSDF site have little groundwater. Groundwater flow direction is away from the PSDF site. Therefore, no adverse impact would be expected from surrounding groundwater sources. This was supported by water quality analysis data provided by SCS, which indicated that the proposed site was free of the contamination observed in the groundwater at the coal liquefaction facility. Based on this information, no adverse impact to the quality of the groundwater under the proposed PSDF would be anticipated from the surrounding area.

In addition, since the proposed PSDF would be underlain with clay and concrete, where appropriate as liner material, and collection trenches would be constructed around the coal pile to eliminate leachate percolation, the proposed PSDF site would present a very low potential of impacting the area groundwater.

Groundwater Quality Summary: Operation of the proposed PSDF would not be expected to impact the regional aquifers because no groundwater would be used for the project and all discharges from the proposed PSDF would be controlled by Best Available Control Technologies (BACT) and NPDES. In addition, operations surrounding the PSDF would not impact the groundwater beneath the PSDF due to the groundwater flow direction being away from the PSDF site.

3.1.4 Solid Wastes and By-Products

Solid wastes would be generated by both of the major PSDF technology process systems: the advanced gasifier and the PFBC modules. Solids would be removed from the two modules' process streams by gravity separation, cyclones, baghouse filter, or PCD. Sulfur dioxide/hydrogen sulfide control for the proposed test systems would rely on in-bed desulfurization, using limestone as a sorbent. The inclusion of the sorbent in the coal mix contributes to some additional volume of solid waste that must be properly managed (i.e., LASH). Under reducing conditions, calcium sulfide could be potentially formed which could possibly classify the LASH as being hazardous in nature. For this reason, LASH formed under reducing conditions would be oxidized in a

sulfator in order to convert residual sulfides into sulfates, thus rendering it a nonhazardous waste.

The primary solid waste streams for the proposed PSDF would be (1) the ash derived from the mineral matter of coal, (2) the calcium sulfate formed during in-bed desulfurization, and (3) unreacted sorbent (calcium oxide and magnesium oxide). The coal ash component of the PSDF solid wastes would be comprised of differing proportions of fly ash and bottom ash. These wastes should be similar in gross composition to either the bottom ash or fly ash produced by standard coal combustion technologies.

The solid wastes generated by the proposed PSDF facility would be approximately 8775 TPY. The estimated generation rates for the various waste streams are presented in Table 3.6. The largest waste stream would be the combined ash from the PFBC module at 6000 TPY. The advanced gasifier module would generate LASH under combustion conditions at a generated rate of 2500 TPY and fly ash from the baghouse and PCD at 275 TPY. During those periods when the PFBC and advanced gasifier would be operating, approximately five trucks per day would be sent to the Plant Gaston dry ash landfill. These trucks would travel approximately 2 miles to a nonhazardous permitted waste landfill on private SEGCO roads. Bottom ash and fly ash would be stored on site in enclosed bins before removal to this landfill on a daily basis.

A critical characteristic of a solid waste is whether it is hazardous or nonhazardous, as specified by the RCRA regulations. The solid wastes generated by the proposed PSDF would be subjected to characterization and hazardous classification according to RCRA Toxicity Characteristic Leaching Procedure (TCLP) as well as other RCRA characteristics (i.e., reactivity, ignitability). The RCRA TCLP test has been applied to a LASH material obtained from an advanced gasifier pilot plant in Houston, Texas, referred to as the transport reactor test unit (TRTU), which would be similar in composition to the proposed PSDF LASH (Table 3.7). None of the observed concentrations exceeded the regulatory limits; therefore, this waste would be considered to be nonhazardous using TCLP methodology.

The wastes, such as the fly ash from the PCD and the baghouse, and the PFBC ash from the lockhoppers are similar in gross composition to the LASH and are expected to test as nonhazardous. The RCRA characterization tests would be applied to representative samples of each of the solid wastes including the LASH from the PSDF. If any waste tests out to be hazardous, then it would be managed on site in accordance with the RCRA regulations and disposed of off site at a waste disposal facility that is permitted by the state to accept hazardous waste. A hazardous waste landfill operated by Chemical Waste Management, located in Emelle, Alabama, 185 miles west of Wilsonville, would be a potential disposal site for any hazardous waste generated by the PSDF.

Table 3.6. Solid Waste Streams from PSDF

Waste Stream	Generating Temp ^a , °F	Estimated Generation Rate, TPY	Gross Composition
<u>Advanced Gasifier Module:</u>			
LASH from solids ^b cooler	1600 to 1800	2500	Ash + calcium sulfate + unreacted sorbent
Fly ash from PCD ^b	1600 to 1800	250	Ash + calcium sulfate + unreacted sorbent
Fly ash from baghouse ^b	1600 to 1800	25	Ash + calcium sulfate + unreacted sorbent
<u>PFBC/CT Module:</u>			
Ash from lockhoppers ^b	~ 1600	6000	Ash + calcium sulfate + unreacted sorbent

- a. Fusion temperature for Illinois No. 6, 1950°F to 2450°F.
b. These wastes should test out as RCRA nonhazardous.

The amount of solid waste produced by the proposed PSDF would be small compared to the 380,000 TPY of waste generated by Plant Gaston and, thus, would not be expected to significantly affect the usable capacity of the Plant Gaston dry ash landfill. The generated solid wastes would be stored temporarily on site at the PSDF in enclosed bins prior to disposal at Plant Gaston's dry stack landfill in an area designated to accept the waste. The waste would be moved on a daily basis to the landfill. The landfill waste is managed, molded, stacked, and compacted in a slightly moist condition, which favors the movement of precipitation over the surface of the stack rather than through it. This limits the generation of leachate. Moreover, the area is lined with a compacted natural clay liner. The liner permeability limits the movement of leachate out of the storage area and minimizes the impact on the groundwater. Also, the clays in the liner and in the underlying soil have the capacity to absorb leachate components, thus limiting the potential impact of leachate on the groundwater.

Table 3.7. TCLP Test Data for LASH From Transport
Reactor Test Unit (TRTU) Test

Pollutant	Test Concentration (mg/L)	Maximum Allowed Concentration (mg/L)
Arsenic	<0.05	5.0
Barium	0.65	100.0
Benzene	<0.0005	0.5
Cadmium	<0.01	0.03
Carbon Tetrachloride	<0.0005	100.0
Chloroform	<0.0005	6.0
Chromium	<0.05	5.0
o-Cresol	<0.05	200.0
m-Cresol	<0.10	200.0
p-Cresol	<0.10	200.0
1,4-Dichlorobenzene	<0.0005	7.5
1,2-Dichloroethane	<0.0005	0.5
1,1-Dichloroethane	<0.0005	0.7
2,4-Dinitrotoluene	<0.05	0.13
Endrine	<0.0002	0.02
Heptachlor	<0.0002	0.008
Heptachlor oxide	<0.0001	0.008
Hexachlorobenzene	<0.05	0.13
Hexachlorobutadiene	<0.05	0.5
Hexachloroethane	<0.05	3.0
Lead	<0.02	5.0
Lindane	<0.0001	0.4
Mercury	<0.0002	0.2
Methoxychlor	<0.0003	10.0
Methyl ethyl ketone	<0.0005	200.0
Nitrobenzene	<0.05	2.0
Pentachlorophenol	<0.05	100.0
Pyridine	<0.10	5.0
Selenium	<0.05	1.0
Silver	<0.01	5.0
Tetrachloroethylene	<0.0005	0.7
Toxaphene	<0.00005	0.5
Trichloroethylene	<0.0005	0.5
2,4,5-Trichlorophenol	<0.05	400.0
2,4,6-Trichlorophenol	<0.03	2.0
Vinyl chloride	<0.0005	0.2

Runoff from the part of the existing Plant Gaston dry ash land-fill area, which would be dedicated to the disposal of PSDF solid wastes, would be combined with runoff from the larger remaining area. This runoff is currently covered in the existing Plant Gaston NPDES permit (AL0003140) and discharges to the Coosa River. The State of Alabama would be informed of the intent to include a new nonhazardous waste in the ash fill area. This action would not require permit modification for Plant Gaston.

All construction wastes (cement, debris, etc.) would be disposed of in accordance with local, state, and Federal regulations.

3.1.5 Land Use

The proposed facility would be on SEGCO property that is leased to the Southern Company Clean Coal Research Center. The site would be at least one-quarter of a mile from the border of the SEGCO property. Currently, there are no local land use or zoning requirements applicable to the proposed site. There are no designated Prime and Unique Farmlands in the vicinity of the proposed site. Land use, other than Plant Gaston, is predominantly rural, with forest and some agriculture surrounding the proposed site. The center of the City of Wilsonville is about 1 mile southwest of the site, and scattered residential development extends out Highway 25 as far out as where it meets the SEGCO property.

A total of 12 acres would be directly affected by the proposed project. Six acres would be used for the process test facility and support structures; 3 acres would be used for the coal/limestone storage piles and sedimentation basin for the run off; and the remaining 3 acres would be for parking lots, office space, and coal ash areas. It would be necessary to clear and grade 9 acres for the proposed project. The existing decommissioned agglomeration test facility (3 acres) would be re-used for coal and limestone storage and handling equipment and the sedimentation basin.

During the construction period, work would occur during normal working hours and would be conducted such that the surrounding area (e.g., roads, adjacent properties) would not be encroached upon. For example, there would be adequate space on the proposed site to temporarily store the materials required for construction of the plant. Vehicular traffic related to construction of the plant would follow specified routes intended to avoid significant impact on traffic flow.

Because the PSDF would occupy a small part of the SEGCO site and would be essentially the same kind of land use as the neighboring Plant Gaston, but smaller, it would have insignificant impacts on overall land use during its operations. Upon completion of all testing at the PSDF, it would be decommissioned, dismantled, and the site would be characterized for any significant environmental

impacts requiring remediation. All remediation, if required, would be performed and documented.

3.1.6 Floodplains and Wetlands

The proposed site would not be located within a floodway or the 100-year floodplain of any surface water in the vicinity. The Flood Boundary and Floodway map issued by the Federal Emergency Management Agency shows portions of the SEGCO property to be located on floodplain areas; however, none of the PSDF would be located in these areas. Thus, no impacts to floodplains would be expected, and no state/local floodplain protection programs would be applicable to the proposed project.

While wetlands do occur on SEGCO property, the proposed site would not contain any wetlands. The closest wetland to the proposed site would be 6000 feet northeast. No dredging or filling of wetlands would be required for the proposed project. No water intake or outfall structures built would impact existing wetlands. Therefore, construction and operation of the proposed PSDF is not expected to disturb any wetland habitats.

3.1.7 Occupational Noise

There would be short- and long-term increases in noise levels due to project construction and operation. In the short term, noise associated with vehicular traffic for deliveries of equipment and supplies and the equipment off-loading would occur during the normal work day. Other construction noises from operations such as drilling, pounding, and air compressors would also add to short-term noise during the construction phase. This level of noise would be similar to other construction projects and would stop when construction was complete.

Operation of the proposed project would cause a slight long-term increase in existing ambient noise levels on the SEGCO property. Noise mitigation measures, which would be employed for the proposed project, include equipping the combustion turbine with fiberglass insulation and providing ample space between equipment to disperse noise emissions. The local terrain (rolling hills and trees) would also help reduce noise levels. To assess the potential impacts to residences close to the proposed site, noise levels were calculated using standard equations for the propagation of noise from a point source. These noise levels did not take into account any shielding of noise sources by buildings, other equipment, or terrain; therefore, these values would represent highly conservative estimates of noise levels at the property's limits. The calculated value at the property line (170 feet from the point source) would be 63 decibels (dB), a value that generally results in no disturbance of normal indoor conversation and moderate disturbance of normal outdoor conversation. Again, this value (63 dB) is likely overstated because the approximation did not account for the natural acoustic barrier provided by the rolling hills and trees. The

proposed site is in the vicinity of a coal-fired power plant and the noise to be emitted by the proposed facility would be similar in nature to a light industrial area.

In considering the noise level impact, it is important to note that two test facilities were previously operated on the proposed site for over a decade. The Clean Coal Research Center has no record of complaints received from local residences related to noise. Considering the anticipated level of noise emissions at the property line and the history of operating test facilities in the area, the proposed facility would not be expected to have an adverse impact on its surroundings due to noise emissions.

3.1.8 Ecosystems

3.1.8.1 Terrestrial Ecosystems

The proposed project site would be located in the Oak-Pine Forest Region. This region is transitional between the predominantly evergreen forest further south and the deciduous forests of the Tennessee Valley. As the name implies, this region is characterized by numerous oaks (including white, northern, and southern red) and pines (loblolly pine being the most characteristic). The Oak-Pine forest region is further characterized by a rolling topography and the presence of sourwood, sweetgum, and various hickories in the forest canopy.

The nonforested portion of the proposed site would be a broad, grassy border containing numerous species of grasses and herbs, including fescue, orchard grass, verbena, wild petunia, and Japanese honeysuckle. The forested portion of the proposed site had been previously cleared. Nevertheless, a well-developed oak-pine forest (characteristic for the region) exists. Some of the plants found in the shrub and herb layer would be Japanese honeysuckle, rattan vine, Carolina phlox, round-leaf eupatorium, ebony spleenwort, poison ivy, grass-leaved golden-aster, saw-brier, Virginia creeper, and entire-leaved skullcap.

Species diversity for upland wildlife populations occurring on the proposed site would be limited because of the small area and limited habitat diversity present. Resident species include white-tailed deer, gray squirrel, red-bellied woodpecker, blue jay, Carolina chickadee, tufted titmouse, Carolina wren, brown thrasher, pine warbler, northern cardinal, rufous-sided towhee, and eastern box turtle. The summer tanager and indigo bunting would be present during the summer. Because of the small area of woodlands existing on the site and its separation from more extensive woodlands by the railroad and existing plant facilities, few forest interior species would be expected to occur.

For the site, the forested area functions as edge habitat and provides cover for terrestrial and avian species. Undisturbed portions of the SEGCO property, and adjacent forested areas that

contain similar habitats, would be capable of absorbing species displaced by the proposed project.

3.1.8.2 Aquatic Ecosystems

The source of potential impacts to the aquatic habitat in the vicinity of the proposed PSDF site would differ in the construction and operational phases of the project. Erosion and siltation would be major concerns during construction, whereas, impingement would be the major concern resulting from operation. Impacts during construction should be minimized by using standard procedures preventing erosion and siltation. In assessing potential impacts from operation, the proximity of the proposed site to Plant Gaston is significant in determining the cumulative effect of operation from both facilities on Yellowleaf Creek.

Results from a water quality survey conducted for Plant Gaston indicated no significant effects from impingement or entrainment of organisms in Yellowleaf Creek, which is the intake for Plant Gaston. The proposed test facility would increase water usage over current Plant Gaston operational requirements by 0.02 percent. The effect of this relatively small increment of water intake necessary for operation of the PSDF should have little affect on planktonic organisms in the area. Impingement studies also failed to result in the collections of any rare or endangered species.

Recent adult fish screening studies in Yellowleaf Creek showed a diverse fisheries community with 47 species representing 10 families present. The only species from these collections with any conservation status was the cold water darter, Etheostoma ditrema, which is a candidate for Federal protection. This species has been recently collected from the Yellowleaf Creek. However, the taxonomic status of this population was uncertain. The cold water darter is normally known only from springs or spring-influenced waters, and this Yellowleaf Creek population was somewhat different in form as well. It has been listed as Etheostoma swainia (instead of E. ditrema) in many collections.

Numerous mollusk species (10 snails and 2 mussels) found in Yellowleaf Creek are also listed as being under review for conservation status. Even though the habitat for these species are normally found in the upper reaches of the Yellowleaf Creek drainage, a mollusk survey of an area including Plant Gaston's intake structure showed numerous individuals from three common mussel species and two species of snails. One of the snail species was a common one found in the region, but the other was Tulotoma magnifica, which is listed as endangered. There were only six known populations of this species in the state prior to discovery of the Yellowleaf Creek population. Tulotoma magnifica typically is found in cool, well-oxygenated, clean, free-flowing waters with its habitat including both the mainstream river and the lower portions of large tributaries. The species is strongly

associated with boulder/cobble substrate and usually found clinging tightly to the underside of large rocks. This type of habitat was once present in both Yellowleaf Creek and the Coosa River, but due to the impoundment of the Coosa River, silt now covers most of the suitable habitat. Operation of Plant Gaston's intake structure has apparently sustained sufficient current to provide a suitable habitat in the immediate vicinity of the Plant Gaston intake structure.

Considering the present existence of the Tulotoma magnifica population adjacent to Plant Gaston's intake structure, it would seem unlikely that the incremental effect of the small amount of water necessary for operation of the proposed PSDF would have any significant effect on the aquatic community in Yellowleaf Creek.

3.1.8.3 Threatened and Endangered Species

No plant or animal species currently listed, proposed, or under status review (i.e., Category 2 candidates) for Federal listing were observed at the PSDF site. Therefore, no impacts to any endangered or threatened plant or animal species would be expected as a result of construction and operation of the proposed PSDF. This determination is supported by documentation received from the U.S. Fish and Wildlife Service (Appendix D).

3.1.9 Historic, Archeological, Cultural, and Aesthetic Resources

No historic buildings or sites would be located within the proposed project boundary. The nearest historic site is located 1 mile northeast on SEGCO property. The site consists of the remains of three Confederate forts constructed in 1863 by Confederate troops under the command of Major W. T. Walthall, Commander of the military post at Talladega, Alabama.

No recorded archaeological sites would be located within the proposed project boundaries. In 1989, an archival literature/record search and cultural resources field survey were conducted by the Division of Archaeology of the Alabama State Museum of Natural History in order for Plant Gaston to build an associated railroad spur, near Westover, Alabama. In light of the results of this "no effect" evaluation, a field review of the proposed PSDF site was conducted by the Division of Archaeology and the Alabama State Historic Preservation Office in 1992. This field review determined that the proposed site has been altered to such an extent that construction of the PSDF would not result in any adverse impact to any resources either on or eligible for the National Register of Historic Places. This determination of "no effect" was documented by the Division of Archaeology, Alabama State Museum of Natural History, and the Alabama State Historic Preservation Office (Appendix D).

There are no State-designated scenic highways in the Wilsonville area, and no local programs exist for designating scenic areas or vistas in this area. The nearest park is the Talladega National

Park approximately 30 miles away. Neither Yellowleaf Creek nor the Coosa River are listed on the National Wild and Scenic River System.

The most immediate public vantage points of the proposed site would be from the access road to Plant Gaston to the east. Public view of the proposed project would be mostly shielded by the surrounding scattered wooded ridges exhibiting 500-foot plus elevation changes. Highway views into the actual plant site would be for the most part screened from the highway traveler by a mixed pine/hardwood buffer located on plant property. Only glimpses of the existing Plant Gaston and proposed PSDF building structures would be afforded by existing road entrances and railroad and transmission line rights-of-way.

While Plant Gaston is a departure from the visual characteristics of the surrounding area, the addition of the PSDF should create no additional negative visual impacts. The proposed site for the facility is within the confines of the existing Plant Gaston property and should not be visible to off-site viewers. The proposed project would require the construction of two exhaust stacks and two flares (maximum height of 230 feet) and the process test facility (180 feet high). Plant Gaston has two stacks which are 750 feet in height. If PSDF construction activities, the completed facility, or operational emissions (i.e., plume) would be visible from some vantage points, their presence is expected to be indistinguishable from the existing Plant Gaston.

3.1.10 Socioeconomic

From 1980 to 1990, Shelby County's population grew about 50 percent, 66,298 to 99,358, while Jefferson County lost about 3 percent dropping from 671,324 to 651,525. The combined labor force residing in the two counties is roughly 350,000. Numerous cities, towns, and small unincorporated places are scattered throughout both counties.

The proposed PSDF would be expected to have a positive impact on the labor force in the Wilsonville area. Construction of the PSDF would be expected to take between 15 and 18 months and employ about 200 workers during peak construction. Operation and maintenance of the facility is projected to employ about 90 workers. Approximately 98 percent of the employees are expected to come from the Shelby and Jefferson County area. There would be an ample supply of available and qualified labor in Shelby and Jefferson County to provide the necessary labor for both construction and operation. From a regional economic perspective, the PSDF operational jobs would help offset the 60 jobs lost with the closing of the Southern Company's Clean Coal Coal Liquefaction and Agglomeration test facilities. The project is not expected to have a negative impact on the work force in the Wilsonville area, since the nature of the project is not one that would supplant any other activities or enterprises that provide employment in the area.

Increased traffic associated with construction would consist of passenger vehicles, equipment, and supply trucks. Construction traffic moving to and from Highway 25 would use the Plant Gaston construction access road. Additionally, a 1250-foot access road would be constructed to enter the facility and parking lots. Traffic around the proposed site would be sparse, consistent with the rural area it would be located in. Parking on the proposed site would be provided throughout construction and operation phases. Since the number of visitors would be expected to be small, traffic to and from the facility during the operational phase would be light.

Increased traffic associated with the operation of the proposed PSDF would be passenger vehicles and supply trucks. Again, Highway 25 would be the main approach to the proposed site. An estimated five coal trucks and one limestone truck would make deliveries daily to the facility. The state highway is commonly used by lumber and coal trucks. The additional six trucks is not anticipated to significantly affect the traffic in the area.

3.1.11 Occupational Safety and Health

The site layout would incorporate design aspects to help ensure the protection of personnel safety and health. These measures would comply with standards and requirements set by the Occupational Safety and Health Administration and the State of Alabama. All employees would be instructed in worker protection and safety procedures as a component of the PSDF safety program. An emergency preparedness plan would be developed for the site.

The facility would store very few materials or chemicals which could potentially pose a risk to employees or others with respect to safety and health. Storage facilities for the materials required to operate the facility (coal, limestone) would be designed for minimization of such risk in addition to being designed for spill containment and control of releases.

During the operation of the proposed facility, accidental releases of process gases could potentially impact the health and safety of on-site employees. The flare, which is an integral part of the project design, would be utilized as a relief device for venting and destroying any gases during emergency conditions. To prepare for emergencies, routine safety, emergency response, and emergency evacuation drills would be conducted among the proposed project employees. These measures would help prevent the occurrence of situations that could adversely impact worker health and safety.

3.2 ISSUES RELATED TO ADJACENT ACTIVITIES

3.2.1 Introduction

As mentioned in Section 2.1.2.2, the proposed PSDF site would be in the vicinity of three existing facilities or activities

(Figure 7). The three facilities/activities include (1) Plant Gaston (located to the east), (2) the Southern Company Clean Coal Research Center which includes the liquefaction test facility (located to the east) and the agglomeration test facility (part of the proposed site), and (3) a drum burial site remediation activity (located to the south).

3.2.2 Plant Gaston

Plant Gaston is an existing utility power plant located on the same property as the proposed facility. This plant burns approximately 4 million tons of coal per year for electric power generation. Plant Gaston has one combustion turbine and five boiler units with a total installed capacity of 1906 MWe. Plant Gaston consumes coal, oil, and water. Its coal is received by rail, and its storage and handling areas are located south of the plant and adjacent to the Coosa river.

3.2.3 Advanced Coal Liquefaction Facility

The Advanced Coal Liquefaction facility (east of the proposed site) has been operated by SCS for the Pittsburgh Energy Technology Center (PETC) for 17 years and is currently being decommissioned independent of the proposed action. The site has been contaminated to some degree with liquefaction products and by-products generated by the facility. Oak Ridge National Laboratory (ORNL) is currently characterizing the site to determine the level of soil and groundwater contamination. Three phases of the work have been completed at this time. Phase I results indicated localized soil contamination and some groundwater contamination. Soil contaminants found have been consistent with coal liquefaction constituents such as naphthalene, pyrene, and fluoranthene. Also several volatile contaminants including toluene, xylene, and tetrachloroethylene were identified. The groundwater investigation indicated levels of tetrachloroethylene and trichloroethylene. ADEM has been contacted. Phase II work, performed in October 1992 by ORNL, continued to characterize the soil and groundwater contamination. Soil contamination was found in the oldest section of the liquefaction test facility to a depth of 31 feet. Phase III activities involved conducting a seismic survey of the site that will enable better placement of groundwater monitoring wells and a more detailed understanding of the geology under the liquefaction test facility. A major portion of the liquefaction test facility is located directly on a structurally complex section of the Fort Payne chert formation. Based on recently collected data, the groundwater in the Fort Payne chert formation appears to flow in a north-northeast direction to a low point developed in a structurally faulted area located in the northeast corner of the liquefaction test facility. This flow could result in a concentration of contamination at one area on the site.

Figure 7

Impacts of the liquefaction test facility on the proposed PSDF site have been studied. The two principal areas of impact are in groundwater flow and the remediation activities. The groundwater data being gathered by ORNL indicate only a very remote possibility that the liquefaction test facility and the proposed PSDF site are in hydraulic communication. Both the geological and groundwater data collected to date and the upgradient position of the proposed PSDF site to the liquefaction site suggest that groundwater from the underlying limestone would flow toward the north-northeast and, thus, groundwater contamination from the liquefaction test facility would be moving away from the proposed PSDF site.

The remediation activities that would be proposed by ORNL in their report for the liquefaction test facility are not expected to begin until late 1993. The remediation activities will occur regardless of the outcome of this environmental assessment. Alternatives associated with the remediation of the site are currently being evaluated. Since there is minimal hydraulic communication between the two sites, it would appear that the remediation activities at the liquefaction test facility would have minimal effect on the construction and operation of the proposed PSDF site.

3.2.4 Selective Oil Agglomeration Test Facility

Another test facility being decommissioned and dismantled is the Selective Oil Agglomeration Facility. This facility borders on the west edge of the coal liquefaction facility. The dismantling of this facility has been completed except for those parts which would be used on the PSDF project. This site was operated from 1988 to 1992. Detailed documentation has been kept for all activities at the agglomeration facility in its 4 years of operation. The soil has been sampled as part of ORNL's work and no contamination was found. The site would be used for coal piles, sedimentation basin, weigh scales, and crushing equipment for the proposed PSDF site. There would be no significant impact from the dismantling of the agglomeration test facility on the construction and operation of the proposed PSDF site.

3.2.5 Drum Burial Site

ORNL soil sampling activities at the liquefaction test facility and surrounding area penetrated a buried drum at a depth of approximately 9 feet in May of 1992. The drum burial site is about 200 feet due south from the proposed PSDF site. The area had been previously used for surface storage of products and by-products from the liquefaction test facility. SCS retained a qualified removal contractor to excavate the drums, and to date, 161 drums have been excavated. The drums have contained coal liquefaction wastes and spent solvents (such as 1,1,1-trichloroethane). The majority of the drums have been found intact and SCS is performing a "qualified removal action" under the State of Alabama's CERCLA program with EPA oversight.

The removal action has consisted of removal of all hazardous and non-hazardous soils exceeding state approved alternate contaminant levels on the site. These soils have been sent to EPA permitted landfills. Excavation and removal activities were completed in May 1993. A recommendation was made to EPA Region 4 by ADEM for a Clean Closure Certificate for the site. SCS drilled and installed nine groundwater monitoring wells into the shale lithology surrounding the landfill site. The wells revealed a thickness of up to 150 feet of Floyd shale beneath the drum burial site. Two quarters of groundwater sampling at the drum burial site have shown no groundwater contamination.

SCS has removed the contaminated soil from the site and is currently monitoring nine groundwater wells on the perimeter of the site. SCS will need to continue to monitor this drum burial site for 1 year; but this should have no impact on the construction and operations at the proposed PSDF site.

3.3 SUMMARY

3.3.1 Cumulative Summary

In summary, the cumulative impacts of the adjacent facilities to the proposed site would appear to be minimal since recently gathered soil, geology, and groundwater data indicate that the proposed PSDF site would be fortuitously placed. This statement is supported by data which indicate that soil and groundwater contamination were not found at the PSDF site and that the shale geology appears to be significantly less complex under the proposed site than under the liquefaction test facility site. In addition, the groundwater underneath the drum burial site and the liquefaction test facility site appears to be flowing to the north. This significantly reduces the possibility that any contaminated groundwater under the liquefaction test facility site would impact groundwater quality on the proposed site.

Other than the isolated effects of the proposed project previously discussed in this EA, there are no other known factors that would cumulatively lead to adverse impacts on water quality or any of the physical, biological, or sociocultural resources described in this EA. Therefore, significant cumulative impacts would not be expected to occur.

3.3.2 Summary of Impacts

Overall, adverse impacts expected as a result of the proposed project would be negligible, supported by the following summary statements:

- The proposed site would be an attainment area for all pollutants except ozone. The results from the air quality modeling showed that the proposed PSDF would be in compliance with all other applicable local, state, or Federal

regulations. In particular, the contributions by the PSDF to ambient levels of criteria pollutants is small.

- Existing surface water supplies would be minimally impacted by the proposed PSDF because quantities of water required by the PSDF represent minor portions of the current intake demand of Plant Gaston. Discharges from the PSDF operation would be expected to have minimal impact on the surface water quality of the Yellowleaf Creek due to NPDES permit requirements and the comparatively larger effects associated with Plant Gaston surface water discharges.
- No groundwater would be used by the PSDF and no impact to existing groundwater would be anticipated.
- Grading of 9 acres of the 12 acres for the proposed site would be required for construction of the proposed project facilities. Because the land has been previously disturbed, the project construction would not adversely affect the geology or soils of this area. Land uses associated with the proposed project would be consistent with past and current uses of the SEGC property.
- Noise levels for the proposed project were modeled to determine the levels at the SEGC property boundary. The conservative noise level calculated was 63 dB, a value that generally results in no disturbance of normal indoor conversation and moderate disturbance of normal outdoor conversation.
- The terrestrial ecology species affected by the grading of the land for the project would have ample similar forest conditions to move to in this area.
- The aquatic ecology species would not be affected due to the very small incremental increase in water required by the PSDF when compared to the current level of water drawn from Yellowleaf Creek for Plant Gaston. The additional water drawn would appear to improve the environment for the Tulotoma magnifica snail found near the Plant Gaston intake structure.
- There would be no threatened or endangered species to be affected on the proposed site.
- There would be no wetlands or floodplains which would be affected by construction or operation on the proposed site.
- There would be no expected impact on historic areas.
- Construction and operation employees would be drawn from the local population. The project would be expected to have a direct positive impact on employment in the Wilsonville area as it would provide employment opportunity to displaced

workers from the decommissioned Clean Coal Research Center test facilities.

- Worker health and safety emergency response training and inherent project design and operation procedures would reduce the risk of exposure or harm to project workers or nearby neighbors from potential releases of process gases.

The proposed PSDF is expected to have positive long-term impacts as a result of demonstrating the feasibility of cleaner and more efficient technologies for burning coal.

3.4 NO ACTION ALTERNATIVE

Under the no action alternative, DOE would not co-fund the proposed PSDF, and the project would be cancelled. Thus, the positive environmental impacts of the proposed PSDF would not occur. In particular, the positive impacts of providing timely support and information to the industrial participants under the Clean Coal Technology program for scale-up to demonstration level of hot gas particulate removal technologies, which are economically sound and environmentally superior, would not be realized.

4.0 LIST OF PERSONS AND AGENCIES CONTACTED

The following local, state, and Federal agencies and other contacts provided information for and/or review of the PSDF environmental assessment.

Mr. John Poole
Water Division
Alabama Department of Environmental Management
1751 Congressman W. L. Dickinson Drive
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Mr. Paul Hartfield
Fish and Wildlife Service
Jackson Field Office
U.S. Department of the Interior
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Ms. Francis Thelps
Mayor of Wilsonville
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Wilsonville, Alabama

Mr. John Smith
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Geological Survey of Alabama
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David Frings
Senior Geologist
Alabama Power Company
P.O. Box 2641-GSC7
Birmingham, Alabama 25391

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32. Air Quality Modeling Report for the Proposed Power Systems Development Facility. Attachment to Letter dated June 1, 1992, from Maria Jeffers Burke (SCS) to Randy Dellefield (DOE).
33. Additional Modeling for the Wilsonville Project. Attachment to Letter dated June 19, 1992, from Maria Jeffers Burke (SCS) to Dr. Kelly Pearce (DOE).
34. Additional Information from 6/23/92 NEPA Meeting. Power Systems Development Facility. Attachment to Letter dated June 26, 1992, from Maria Jeffers Burke (SCS) to Dr. Kelly Pearce (DOE) and Ms. Mary Jane Vickers (TVA).
35. Personal Communication with Ms. Mary Jane Vickers (TVA) on June 30, 1992.
36. Personal Communication (Site Visit) with Maria Jeffers Burke (SCS) on July 14, 1992.
37. Telecommunication with Maria Jeffers Burke (SCS) on July 21, 1992.
38. Telecommunication with Dr. Stan Vasa (SCS) on July 28, 1992.
39. Southern Company Services Comments to ENSR Draft Report. Attachment to Letter dated September 4, 1992, from Maria Jeffers Burke (SCS) to Mr. James R. Longanbach (DOE) and Ms. Mary Jane Vickers (TVA).
40. Transmittal dated September 8, 1992 from Mary Jane Vickers (TVA) to Barry Andrews (ENSR).
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APPENDIX A

Air Quality Modeling Approach

The general modeling approach that was developed and conducted by Southern Company Services follows EPA and ADEM modeling guidelines for determining compliance with Ambient Air Quality Standards (AAQS) and PSD increments. In general, when model predictions are used to determine compliance with AAQS and PSD increments, current policies stipulate that the highest annual average and HSH short-term (i.e., 24 hours or less) concentrations be compared to the applicable standard when 5 years of meteorological data are used. The HSH concentration is calculated for a receptor field by:

- Eliminating the highest concentration predicted at each receptor.
- Identifying the second-highest concentration at each receptor.
- Selecting the highest concentration among these second-highest concentrations.

This approach is consistent with the air quality standards which permit a short-term average concentration to be exceeded once per year at each receptor.

To develop the maximum short-term concentrations for the facility, the general modeling approach was divided into two phases. In the first phase of modeling, maximum emissions from the two stacks of the proposed PSDF were modeled in building downwash mode to assess the level of impact. In each case, the maximum emissions were estimated by multiplying the average emissions rate by a safety factor to ensure that a reasonable upper limit situation would be modeled. For the pollutants, SO_2 , NO_x , CO , and particulate matter, the safety factor ranged from 1.6 to 2.18 times the average emission rate.

Since the first phase modeling predicted SO_2 concentrations that were over the significant impact levels, refined modeling was conducted to include additional sources within 14 km (8.7 miles) of the proposed facility and refining the receptor grid. Going out a distance of 14 km (8.7 miles) is consistent with what ADEM has previously prescribed for modeling at Plant Gaston.

Model Selection: The selection of the appropriate air dispersion model was based on its ability to simulate impacts in areas surrounding the proposed PSDF site. Within 50 km (31 miles) of the site, the terrain can be generally described as simple, i.e., flat to gently rolling, except for a small portion of terrain to the northwest on the edge of the 50 km (31 miles) radius. As

defined in the EPA modeling guidelines, simple terrain is considered to be an area where the terrain features are all lower in elevation than the top of the stacks under evaluation. Although there is some elevated terrain within a 3 km radius at the plant, the base elevation of the PSDF construction site and proposed stack heights would alleviate any concerns regarding complex terrain modeling. The highest terrain feature near the stack is a small hill located to the southeast of the proposed stack with an elevation at approximately 525 feet above msl. Considering the proposed plant would be located on a mound with a base elevation of 480 feet above msl and would utilize two 225-foot stacks, the top of the stack would be well above any nearby terrain and, thus, complex terrain modeling is not required.

The ISC short-term 2 (ISCST2) model was selected to evaluate both preliminary and refined modeling of the facility. The ISCST2 was recently released by the EPA for public use.

Meteorological data used in the ISCST 2 model to determine air quality impacts consisted of surface data from Plant Gaston and upper air data from Centerville, Alabama, for the year 1987. The National Weather Service station in Centerville, located approximately 132 miles from the proposed PSDF site, was selected for use in the study because it is the closest primary weather station to the study area that has up-air data. Data from 1987 was used since 1987 is the most recent year in which the on-site meteorological data had been preprocessed for use and ADEM recognizes this data as valid. Plant Gaston is located in the vicinity of the proposed facility and, therefore, the data is representative of the location.

In addition to the stack operating parameters and air emission rates previously presented, all major SO₂ sources within a 14 km (8.7 miles) radius from the PSDF were included in the refined modeling analysis. The facilities which were included in the refined analysis are Plant Gaston, a Kraft pulp mill (Kimberly Clark), and two asphalt batch plants (Asphalt Products and Wilson Brothers). A listing of these modeled sources and their emission parameters is given in Table A-1.

Building Downwash Effects: The controlling structures for the two stacks associated with the PSDF as defined by the Good Engineering Practice stack height and the cavity height were determined to be 336 and 224 feet, respectively. To avoid the effect of the building cavity, a stack height of ~225 feet was selected for both the PFBC and advanced gasifier.

The ISCST2 model requires direction specific building dimensions for downwash analysis. To obtain such dimensions, the BREEZEWAKE program was used.

Table A-1. Listing of Modeled Sources and Their Emission Parameters

Source Name (Point I.D. No. and Description)	UTM Coordinates (km)	SO ₂ Emission Rate (grams/sec)	Stack Parameters			
			Height (m)	Diameter (m)	Temp (K)	Velocity (m/s)
Gaston 1	550.6, 3678.3	4939.20	228.60	10.13	401.49	25.60
Gaston 2	550.4, 3678.1	4939.20	228.60	9.14	416.49	19.51
Asphalt Products	549.3, 3678.8	7.69	14.60	1.50	333.30	9.10
Wilson Brothers	563.7, 3684.0	2.12	6.70	0.90	332.80	9.00
Kimberly Clark	559.82, 3687.6	5.22	39.60	1.30	441.10	14.10
(02/#2 Recovery Boiler)						
(03/#3 21.40 Recovery Boiler)	559.98, 3687.8	57.41	57.00	3.00	460.00	21.40
(11/#2 Lime Kiln)	559.835	0.43	21.30	1.20	350.60	11.50
(25/#1 Coal Boiler)	560.4, 3687.5	74.24	45.70	2.40	480.60	10.50
(26/#2 Coal Boiler)	560.4, 3687.5	74.24	45.70	2.40	480.60	9.30
(27/#3 Coal Boiler)	560.4, 3687.5	74.24	45.70	2.40	479.40	10.70
(28/#4 Coal Boiler)	560.4, 3687.5	74.24	45.70	2.40	477.60	9.60
(32/#3 Lime Kiln)	559.844	0.77	27.40	1.50	352.20	12.50

Receptor Locations: As previously discussed, the general modeling approach considered screening and refined phases to address compliance with AAQS and PSD increments. In the screening modeling scenario, a basic rectangular grid extending out to 5000 m (3.1 miles) from the PSDF, with a grid separation of 500 m (1637 feet), was used.

Refined Modeling: The refined modeling consisted of a grid separated by 100 m (327 feet) extending to 1000 m (3274 feet) in each direction, around the location of the 3- and 24-hour highest and highest second-high impacts. In addition, to estimate the impact of the controlling building, a grid separation at 100 m (327 feet) was used.

APPENDIX B

Water Quality Data for Yellowleaf Creek and Coosa River

Parameter, Units	Yellowleaf Creek	Coosa River					Alabama Water Quality Criteria	
		1992 ^b	1991 ^a		1990 ^a		Acute	Chronic
			August	May	August	April		
Coliform, fecal, org/100 mL	36	30	4	--	5	2	--	-
Conductivity, mmho/cm	104	153	176	116	180	150	--	-
Total dissolved solids, mg/L	78	115	104	86	107	106	--	-
Total suspended solids mg/L	12	6	11	13	6	7	--	-
Turbidity, NTU	16.0	3.4	15.0	--	3.0	4.0	--	-
Total hardness, mg/L as CaCO ₃	59.0	62.0	--	--	--	--	--	-
pH	7.40	7.20	7.2	7.0	7.7	7.4	--	-
Total alkalinity, mg/L as CaCO ₃	59.1	72.1	69.0	50.0	66.0	48.0	--	-
Biochemical oxygen demand, 5 day, mg/L	2	1	--	--	--	--	--	-
Chemical oxygen demand, mg/L	22	10	--	--	--	--	--	-
Dissolved oxygen, mg/L	5.3	6.4	4.6	7.8	8.0	7.9	--	-
Total kjeldahl nitrogen, mg/L	0.63	0.51	1.33	0.49	--	--	--	-
Ammonia nitrogen, mg/L	<0.001	<0.001	--	--	--	--	--	-
Nitrate-nitrite nitrogen, mg/L	0.04	0.12	--	--	--	--	--	-
Total organic nitrogen, mg/L	0.63	0.51	--	--	--	--	--	-
Total phosphorus, mg/L	0.027	0.049	--	--	--	--	--	-
Orthophosphate, mg/L	<0.005	<0.005	--	--	--	--	--	-
Total aluminum, mg/L	0.47	0.14	--	--	--	--	--	-

THE UNIVERSITY OF ALABAMA

ALABAMA MUSEUM OF NATURAL HISTORY

Phone: (205) 348-7774 or 371-2266

FAX: (205) 371-2494

DIVISION OF ARCHAEOLOGY

1 MOUNDVILLE ARCHAEOLOGICAL PARK
MOUNDVILLE, ALABAMA 35474

September 30, 1992

MEMORANDUM

TO: Bennett Graham, Chief Archaeologist
Tennessee Valley Authority

FROM: Carey B. Oakley, Assistant Director
Alabama Museum of Natural History
Division of Archaeology

SUBJECT: Trip Report to APCO Plant Gaston, near Wilsonville, Shelby County,
Alabama

Please be advised that on Friday, September 25, 1992, I met with Mr. Greg Rhinehart, archaeologist for Alabama State Historic Preservation Office, at the plant site for the purpose of evaluating cultural resource potential at the Department of Energy's proposed development sites. These three project areas are illustrated on Exhibits A and B.

Upon examining these sites, it was immediately apparent that all areas have been extensively altered by the removal of several feet of soil. Next, the area has been revegetated to control erosion. Thus, the probability for the occurrence of cultural resources within this area is remote.

I recommend that these areas be cleared from a cultural resources perspective.

A handwritten signature in black ink, appearing to read "Carey B. Oakley", written over a horizontal line.

Carey B. Oakley

CBO/ecs

Enclosures: Exhibits A and B
Invoice

cc: Bill Gardner, APCO
F. Lawrence Oaks, SHPO

Exhibit 4

F. LAWRENCE OAKS
EXECUTIVE DIRECTOR

STATE OF ALABAMA
ALABAMA HISTORICAL COMMISSION

725 MONROE STREET
MONTGOMERY, ALABAMA 36130-5101

TELEPHONE NUMBER
242-3184

October 26, 1992

Mr. Maxwell Ramsey
Tennessee Valley Authority
Norris, TN 37828

Re: Power Systems Development Facility
Wilsonville
Shelby County, AL

Dear Mr. Ramsey:

As a result of the meeting on September 25, 1992, with Carey Oakley of the Division of Archaeology, it has been determined that our office can concur with the proposed project activities due to the amount of previous disturbance to the sites.

Should you have any questions, please contact our office.

Sincerely,

F. Lawrence Oaks
State Historic Preservation Officer

FLO/LAL/gtj

10/30/92--JBG:BB

cc: Mary Jane Vickers, NFE 1D-M

Power Systems Development Facility Proposed Location Exhibit A.

WILSONVILLE QUADRANGLE

ALABAMA

7.5 MINUTE SERIES (TOPOGRAPHIC)

107 1/4 QUANT'S QUARRY 15' QUADRANGLE

UNITED STATES

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Proposed Site
for PSDF

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Alternative Site

1471906 10/31/1986 08:08 ***** PRN/FAX LF-600 *****

Parameter, Units	Yellowleaf ^a Creek	Coosa River					Alabama Water Quality Criteria	
		1992 ^b	1991 ^c		1990 ^c		Acute	Chronic
			August	May	August	April		
Total antimony, mg/L	<0.03	<0.03	--	--	--		--	--
Total arsenic, mg/L	<0.005	0.007	--	--	--		0.36	0.19
Total barium, mg/L	0.04	0.05	--	--	--	--	--	--
Total beryllium, mg/L	<0.01	<0.01	--	--	--	--	--	--
Total cadmium, mg/L	<0.01	<0.01	--	--	--	--	0.002	0.0008
Total calcium, mg/L	13.39	19.19	--	--	--	--	--	--
Total chloride, mg/L	4.8	10.7	--	--	--	--	--	--
Total chromium, mg/L	<0.01	<0.01	--	--	--	--	--	--
Hexavalent chromium, mg/L	<0.005	<0.005	--	--	--	--	0.016	0.011
Trivalent chromium, mg/L	--	--	--	--	--	--	1.14	0.14
Total cobalt, mg/L	<0.01	<0.01	--	--	--	--	--	--
Total copper, mg/L	<0.02	<0.02	--	--	--	--	0.011	0.008
Fluoride, mg/L	0.10	0.08	--	--	--	--	--	--
Total iron, mg/L	0.53	0.12	--	--	--	--	--	--
Total lead, mg/L	0.01	<0.01	--	--	--	--	0.043	0.002
Total magnesium, mg/L	3.22	5.17	--	--	--	--	--	--
Total manganese, mg/L	0.11	0.06	--	--	--	--	--	--
Total mercury, mg/L	<0.0002	<0.0002	--	--	--	--	0.043	0.002
Total molybdenum, mg/L	<0.01	<0.01	--	--	--	--	--	--
Total nickel, mg/L	<0.02	<0.02	--	--	--	--	0.92	0.10
Total potassium, mg/L	1.7	1.7	--	--	--	--	--	--
Total selenium, mg/L	<0.005	<0.005	--	--	--	--	0.02	0.005
Total silver, mg/L	<0.01	<0.01	--	--	--	--	0.002	--

Parameter, Units	Yellowleaf ^a Creek	Coosa River					Alabama Water Quality Criteria	
		1992 ^b	1991 ^c		1990 ^c		Acute	Chronic
			August	May	August	April		
Total sodium, mg/L	5.77	12.66	--	--	--	--	--	--
Sulfate, mg/L	9.3	13.9	--	--	--	--	--	--
Total titanium, mg/L	<0.01	<0.01	--	--	--	--	--	--
Total thallium, mg/L	<0.03	<0.03	--	--	--	--	--	--
Total tin, mg/L	<0.01	<0.01	--	--	--	--	--	--
Total vanadium, mg/L	<0.01	<0.01	--	--	--	--	--	--
Total zinc, mg/L	<0.02	<0.02	--	--	--	--	0.08	0.0
Trophic state index ^d	--	--	53	52	56	44	--	--
Chlorophyll a, mg/L	--	--	9.6	8.9	13.4	4.0	--	--
Secchi depth, cm	--	--	9.5	75	98	102	--	--

- Sample taken in July 1992 by APCO 50 yards upstream of proposed effluent discharge location.
- Sample taken in July 1992 by APCO where Southern RR bridge crosses Coosa River.
- Samples taken by ADEM downstream of Wilsonville near Bullock's Island.
- Reservoirs with trophic state index values between 50 and 70 are considered to be eutrophic.

APPENDIX C

Summary of Applicable Alabama Water Quality
Criteria in the Vicinity of the PSDF^{ab}

Parameter	Public Water Supply	Water-Contact Sports	Fish and Wildlife
pH	pH not to deviate more than 1 unit from normal pH, nor fall out of the range of 6.0 to 8.5	pH not to deviate more than 1 unit from normal pH, nor fall out of the range 6.0 to 8.5	pH not to deviate more than 1 unit from normal pH, nor fall out of the range 6.0 to 8.5
Temperature	Not to exceed 90°F	Not to exceed 90°F	Not to exceed 90°F
	In stream temperature rise not to exceed 50°F due to discharges	In stream temperature rise not to exceed 50°F due to discharges	In stream temperature rise not to exceed 50°F due to discharges
	No withdrawals from nor discharge of heated water to the hypolimnion	No withdrawals from nor discharge of heated water to the hypolimnion	No withdrawals from nor discharge of heated water to the hypolimnion
Dissolved Oxygen	Not less than 5 mg/L at any time	Not less than 5 mg/L at any time	Not less than 5 mg/L at any time
	Under extreme conditions (naturally caused) to 5 mg/L if other parameters favorable	Under extreme conditions (naturally caused) to 5 mg/L if other parameters favorable	Under extreme conditions (naturally caused) to 5 mg/L if other parameters favorable
	Preservation of normal daily and seasonal variations. Measured at 5 ft depth for waters 10 ft or greater in depth, for shallower waters at mid-depth	Preservation of normal daily and seasonal variations. Measured at 5 ft depth for waters 10 ft or greater in depth, for shallower waters at mid-depth	Preservation of normal daily and seasonal variations. Measured at 5 ft depth for waters 10 ft or greater in depth, for shallower waters at mid-depth
Taste and Odor from Wastes	No taste and odor causing difficulties not correctable by treatment or impairing palatability of fish	--	None leading to toxicity, on impairing palataor aesthetic value of waters
Bacteria	Not to exceed a geometric mean of 2000 fecal coliform/100 ml. Not to exceed 4000 fecal coliform/100 ml in any sample	Waters near sewage and similar discharges not acceptable for swimming, etc.	Not to exceed a geometric mean of 1000 fecal coliform/100 ml on a monthly average value. Not to exceed 2000 fecal coliform/100 ml in any sample

Parameter	Public Water Supply		Water-Contact Sports		Fish and Wildlife	
	For incidental water contact and recreation June through September not to exceed geometric mean of 200 fecal coliform/100 ml without other additional tests as specified		For incidental water contact and recreation June through September not to exceed geometric mean of 200 fecal coliform/100 ml without other additional tests as specified		For incidental water contact and recreation June through September not to exceed geometric mean of 200 fecal coliform/100 ml without other additional tests as specified	
Radioactivity	Limit set by Alabama Department of Public Health		Limit set by Alabama Department of Public Health		Limit set by Alabama Department of Public Health	
Turbidity	None to significantly impair natural appearance or interfere with beneficial uses designated		None to significantly impair natural appearance or interfere with beneficial uses designated		None to significantly impair natural appearance or interfere with beneficial uses designated	
	Not to exceed 50 NTU above normal		Not to exceed 50 NTU above normal		Not to exceed 50 NTU above normal	
Toxic Substances ^c (mg/L)	Acute	Chronic	Acute	Chronic	Acute	Chronic
Arsenic	0.36	0.19	0.36	0.19	0.36	0.19
Cadmium	0.002	0.0008	0.002	0.0008	0.002	0.0008
Chromium (III)	1.14	0.136	1.14	0.136	1.14	0.136
Chromium (VI)	0.016	0.011	0.016	0.011	0.016	0.011
Copper	0.011	0.008	0.011	0.008	0.011	0.008
Mercury	0.043	0.002	0.043	0.002	0.043	0.002
Nickel	0.92	0.10	0.92	0.10	0.92	0.10
Selenium	0.02	0.005	0.02	0.005	0.02	0.005
Silver	0.002	--	0.002	--	0.002	--
Zinc	0.08	0.07	0.08	0.07	0.08	0.07

- Freshwater criteria apply.
- This table presents paraphrased material of specific criteria from the Alabama Water Quality Criteria.
- Calculated values assume a hardness of 60 mg/L as CaCO₃; organic parameters are not listed.

APPENDIX D
Agency Consultation Comments

Exhibit 1

United States Department of the Interior

**TAKE
PRIDE IN
AMERICA**

FISH AND WILDLIFE SERVICE
P.O. Drawer 1190
Daphne, AL 36526

September 17, 1992

9/23/92 - DRG:DKT

cc: Stan Davis, OSA 1A-M
J. R. Jordan, NRB 2B-N

Mr. M. Paul Schmierbach, Manager of Environmental Quality
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902

In Reply Refer To:
Log No. 4-3-92-071S

Dear Mr. Schmierbach:

This responds to your letter dated September 8, 1992 concerning a proposal to construct the Wilsonville Power Systems Development Facility (PSDF) in Shelby County, Alabama. We have reviewed the information you enclosed and have the following comments in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. et seq.) and the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

A. Fish and Wildlife Coordination Act

According to the project map and the National Wetlands Inventory Maps of the proposed and alternative sites, there are no low-lying wetland areas located in the project area. Therefore, no further wetland consultation will be required for this project, as currently described.

B. Endangered Species Act

According to our records, no endangered, proposed or candidate species are located in the proposed or alternative sites for the PSDF. Therefore, no further endangered species consultation is required for this project as currently described.

If you need further information regarding our concerns, please contact Sharon Delchamps of our office at 205-441-5181.

Sincerely,

Lee R. J.

Larry E. Goldman
Field Supervisor

[illegible]

Exhibit 2

Reply: Hartfield, FWE, Jackson, MS
To: Bowker, Field Supervisor, Jackson, MS
Date: November 3, 1992

Subject: Dive survey for the tulotoma snail in Yellowleaf Creek.
28 - 29 October 1992

cc: Barry Stalcup, TVA
Malcolm Pierson, APC
Carl Couret, FWS
Fred Harders, DWC
Dr. Art Bogan, Freshwater Molluscan Research

Yellowleaf Creek and the Coosa River provided historical habitat for the tulotoma snail. The species was considered extirpated from the area by the impoundment of Coosa River and lower Yellowleaf Creek when Lay Dam was constructed. Local searches by Fish and Wildlife Service biologists and Malcolm Pierson, Alabama Power Company, had failed to locate the species in 1989. On September 21, 1992, Tennessee Valley Authority divers encountered individual tulotoma snails at three locations in the vicinity of the Gaston Steam Plant intake structure while performing a pre-project assessment for the Department of Energy. At my request, two of the snails collected were sent alive to the Jackson Office, Fish and Wildlife Service, for verification. During subsequent telephone conversations with Barry Stalcup, Larry Neil and Malcolm Pierson, a joint effort to conduct a preliminary assessment of the distribution and density of the tulotoma snail in the Yellowleaf Creek embayment was arranged.

Larry Neil, two other TVA divers, Barry Stalcup, Art Bogan, Malcolm Pierson, and I met at the Gaston Steam Plant, 1 p.m., 28 October. Over the next two days we dove at 17 locations between Yellowleaf Creek at AL 25, and the confluence of Yellowleaf Creek and the Coosa River. Maximum depths varied from 15 to 30 feet. There was no visibility. Scattered potential habitat (large rocks, boulders, etc.) was encountered at most of these locations, but was usually covered by two or more inches of fine silt or mud. Appropriate silt-free habitat was only encountered in the vicinity of the intake basin of Gaston Steam Plant. The apparent current in this reach flows from the Coosa River, up the Creek and into the Plant intake structure. There was no apparent current in the Creek above the Plant.

Four live and three dead tulotoma were collected in the intake basin. Three of the live tulotoma were less than 15 mm in diameter, one was around 20 - 25 mm. The dead animals were large, robust, weathered shells. Large piles of boulders are in about 25 feet of water in front of the intake structure. The three live tulotoma that I found were collected by rolling large rocks and boulders off of these piles and feeling the bottoms and sides for snails. Elimia sp. and Pleurocera c.f. showalteri were common on these rocks. A single Campeloma sp. was also collected in the intake basin. All live tulotoma were returned to the stream.

Mussels were abundant to common in most areas depending upon the substrate. I believe the greatest densities occurred in the intake basin. The

following species were collected: Quadrula apiculata aspera (abundant), Q. rumphiana (common), Megaloniais nervosa (2); Lasmigona complanata (2); Anodonta c.f. suborbiculata; Leptodea fragilis (common); Obliquaria reflexa (4); Amblema plicata (2); Lampsilis teres (3 weathered dead).

In September, the TVA dive crew had collected individual tulotoma snails from areas about 200 meters above and below the intake structure. Limited habitat was observed at these locations during this effort, but it was heavily silted, and no tulotoma were found. Pierson and Bogan took a small boat upstream to where the stream was shallower and flowing, however, they were unable to find tulotoma in apparently suitable habitat in this area. These observations indicate that the remaining tulotoma in this drainage are probably concentrated in, and around, the intake basin of the Gaston Steam Plant. Habitat in this vicinity is peripherally maintained by intake flows from the Steam Plant. Other potential habitat in the area is severely affected by siltation due to impoundment.

FINDING OF NO SIGNIFICANT IMPACT
Power Systems Development Facility

AGENCY: U.S. Department of Energy (DOE)

ACTION: Finding of No Significant Impact (FONSI)

SUMMARY: The DOE has prepared an Environmental Assessment (EA) (DOE/EA-0865) that analyzes the potential environmental impacts of constructing and operating a power systems development facility (PSDF) that would be used to develop advanced coal-based power system components and clean-up technologies. This research and development test facility would be built at Southern Company's Clean Coal Research Center near Wilsonville in Shelby County, Alabama. This effort is part of a broad-based research program in the area of advanced power system demonstration. The proposed action would make available a facility capable of conducting rigorous long-term testing and performance assessments of hot gas stream clean-up devices. Such a facility would allow performance evaluation of the clean-up devices and other system components in an integrated operation. Based on the information and analysis in the EA, DOE has determined that the proposed action is not a major federal action significantly affecting the quality of the human environment, within the meaning of the National Environmental Policy Act (NEPA) of 1969. Therefore, the preparation of an environmental impact statement is not required and the Department is issuing this FONSI.

COPIES OF THE EA ARE AVAILABLE FROM:

Elizabeth N. Dolezal, Environmental Project Manager
Office of Program Support and Evaluation
Morgantown Energy Technology Center
P.O. Box 880
Morgantown, WV 26507-0800
(304) 291-4634

FOR FURTHER INFORMATION CONTACT:

Carol Borgstrom, Director
Office of NEPA Oversight
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585
(202) 586-4600 or (800) 472-2756

BACKGROUND: In 1991, the DOE planned several pilot-scale projects involving demonstration of advanced coal-based power systems and clean-up technologies at various locations. In the proposed action, the objectives of many of these separate projects would be combined into one test facility to reduce the overall capital and operating costs compared to individual stand alone test facilities. The proposed facility would provide an effective way to implement the DOE objectives of carrying out systems and components testing for advanced coal-based power generation and clean-up technologies.

DESCRIPTION OF THE PROPOSED ACTION: The PSDF would be comprised of 5 technology-based experimental modules, as follows: (1) an advanced pressurized fluidized-bed combustor (PFBC) module; (2) an advanced gasifier module; (3) a combustion gas turbine module; (4) a fuel cell test module; and (5) several particulate control devices (PCDs). The first two modules convert coal under gasification or combustion conditions to generate either hot fuel or flue gas streams. The next two modules would utilize these hot gases in a power generating mode: the turbine would combust products from the PFBC and the fuel cell would use clean fuel gas from the advanced gasifier when operating in a gasifier mode. The final modules, the PCDs, would capture coal-derived ash and particles from the PFBC and advanced gasifier gas streams to provide the overall particulate emission control, as well as protect the combustion

turbine and fuel cell. The project would take 30 months to design and construct. Following construction, the proposed PSDF would be operated under both DOE and industry funding for the next 27 months. The units would burn approximately 30,000 tons per year of coal and utilize 5,000 tons per year of limestone. Extensive testing would be conducted during this period to confirm the predicted performance of the various modules.

ENVIRONMENTAL IMPACTS: Potential environmental impacts of the proposed action were analyzed for both construction and operating activities. Review of the available environmental information indicates that no significant environmental impacts are expected to occur as a result of the proposed project. The proposed site is an attainment area for all air pollutants except ozone. The results of air quality modeling indicated that the proposed PSDF would be in compliance with applicable local, state, or federal air regulations and the contribution by the PSDF to ambient levels of criteria pollutants, including ozone (expressed as volatile organic compounds), would be small. Existing surface water supplies would be minimally impacted due to the small quantities of water required by the proposed PSDF. Operational discharges to surface waters from the PSDF are expected to have minimal impacts and would be regulated by a National Pollutant Discharge Elimination System permit. No groundwater would be used by the PSDF and no adverse impact to existing groundwater would be expected. The proposed site would allow for the reuse of facilities remaining from a decommissioned test facility; therefore, its land use is consistent with the area. Because the land has been previously disturbed, construction activities associated with the proposed PSDF would not adversely affect the geology or soils of the area.

Based upon modeling analysis, a conservative estimate of the upper limit on noise level at the boundary of the PSDF was calculated to be 63 decibels on an intermittent basis. Since this is a value that generally results in no disturbance of normal indoor conversation and only moderate disturbance of normal outdoor conversation, no adverse impacts would be expected. Further, no wetlands or floodplains would be affected by the construction or operation of the PSDF and no adverse impacts are anticipated to aquatic or terrestrial ecosystems, as well as any cultural or historical sites. Finally, no federally-listed endangered or threatened plant or animal species have been identified on the proposed PSDF site, and therefore, no adverse impacts to such species are expected.

ALTERNATIVES CONSIDERED: Alternatives to the proposed action were considered in the EA. These included the "no action alternative," "alternative sites," and "alternative technologies." Under the "no action alternative," DOE would not provide funding. Absent such DOE support, the proposed project would be canceled. The "no action alternative" would delay the development and demonstration of integrated, environmentally superior, advanced coal-based power systems. An alternative site was dismissed from further consideration when there was concern raised over a possible migrating groundwater contaminant plume. Also, the alternative site had an existing air monitoring station located on it. Further, since the proposed location makes use of existing equipment, facilities, and infrastructure, as well as having minimal hydrogeological communication with contaminated groundwater underneath adjacent sites, it became the environmentally acceptable option to pursue. There are no existing or proposed coal-based test bed facilities that could

provide the flexibility and whole system demonstration information that the proposed PSDF would produce. Such an integrated demonstration facility would allow power producers to replicate operational aspects of potential systems prior to acquisition and installation of full-scale versions of such systems on their own sites.

PUBLIC AVAILABILITY: Copies of the EA and the FONSI will be distributed to all persons and agencies known to be interested in or affected by the proposed action or alternatives, including appropriate agencies within the State of Alabama. Additional copies of the EA and FONSI are available on request from the Morgantown Energy Technology Center at the address given above.

DETERMINATION: Based upon the information and analyses provided in the EA, DOE has determined that the proposed federal action, to provide a portion of the funding for the construction and operation of the Power Systems Development Facility at the Southern Company Clean Coal Research Center near Wilsonville in Shelby County, Alabama, is not a major federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act. Therefore, an environmental impact statement is not required and DOE is issuing this FONSI.

ISSUED IN WASHINGTON, D.C. this 5th day of August 1993.

Peter N. Brush
Acting Assistant Secretary
Environment, Safety and Health

DISTRIBUTION LIST

This distribution list is for an Environmental Assessment for the Power Systems Development Facility to be located near Wilsonville, Alabama. It was prepared by the Department of Energy in compliance with the requirements of the National Environmental Policy Act of 1969. The project will be done in the State of Alabama and the appropriate addresses are listed below.

Alabama Cooperative Fish and Wildlife Service
ATTN: Dr. Nicholas R. Holler
U. S. Department of the Interior
331 Funchess Hall
Auburn University
Auburn, Al 36849

Alabama Department of Conservation and Natural Resources
ATTN: Mr. James D. Martin
64 N. Union Street
Montgomery AL 36130

Alabama Department of Agriculture and Industries
ATTN: Mr. Albert McDonald
The Richard Beard Building
P.O. Box 3336
Montgomery Alabama 361

Alabama Department of Environmental Management
ATTN: Mr. Lehigh Pegues
1751 Congressman W.L. Dickinson Drive
Montgomery, AL 36130

Forestry Commission
ATTN: Mr. C.W. Moody
513 Madison Avenue
Montgomery, Al 36130

Alabama Wildlife Federation
ATTN: Mr. Rhett Johnson
46 Commerce Street
P.O. Box 2102
Montgomery Al 36102

The Alabama Conservancy
ATTN: Mr. Pete Conroy
2717 7th Avenue South
Suite 201
Birmingham, AL 35233

Alabama Association of Conservation Districts
ATTN: Mr. Jerrel Smalley
Rt.5, Box 16
Arab, AL 35016

PAGE 2--PSDF Distribution List

Alabama Bass Chapter Federation
Attn: Mr. Jerry Pendergrass
3717 Sola Circle
Fort Payne, AL 35067

Alabam Forest Owners' Association
Attn: Ms. Helen Crow Mills
P.O. Box 104
Helena, Al 35080

END

DATE

FILMED

5 / 12 / 94