DOE/EIS-0383

DRAFT
ENVIRONMENTAL IMPACT STATEMENT
FOR THE
ORLANDO GASIFICATION PROJECT

ORLANDO, FLORIDA

August 2006

U.S. DEPARTMENT OF ENERGY

COVER SHEET

August 2006

RESPONSIBLE AGENCY

U.S. Department of Energy (DOE)

TITLE

Draft Environmental Impact Statement for the Orlando Gasification Project

LOCATION

Orlando, Florida

CONTACTS

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ABSTRACT

This EIS assesses the potential environmental impacts that would result from a proposed DOE action to provide cost-shared funding for construction and operation of facilities at Orlando Utilities Commission's (OUC's) existing Stanton Energy Center near Orlando, Florida. The project has been selected for further consideration by DOE under the Clean Coal Power Initiative (CCPI) to demonstrate advanced power generation systems using Integrated Gasification Combined Cycle (IGCC) technology. Although DOE funding would support only the Orlando Gasification Project (i.e., coal gasifier, synthesis gas cleanup systems, and supporting infrastructure), the project would be integrated with a planned, privately funded, combined-cycle unit, which together would constitute the IGCC facilities. The facilities would convert coal into synthesis gas to drive a gas combustion turbine, and hot exhaust gas from the gas turbine would generate steam from water to drive a steam turbine. Combined, the two turbines would generate 285 MW (megawatts) of electricity.

The EIS evaluates potential impacts of the proposed facilities on land use, aesthetics, air quality, geology, water resources, floodplains, wetlands, ecological resources, social and economic resources, waste management, human health and safety, and noise. The EIS also evaluates potential impacts on these resource areas for a scenario resulting from the no-action alternative (DOE would not provide cost-shared funding) in which the combined-cycle facilities would be built on the site to operate using natural gas with no gasifier, synthesis gas cleanup systems, or supporting infrastructure.

PUBLIC PARTICIPATION

DOE encourages public participation in the NEPA process. Comments are invited on this draft EIS and should be postmarked no later than 45 days after publication of the Notice of Availability in the *Federal Register*. DOE will consider late comments to the extent practicable. Comments should be addressed to Mr. Richard A. Hargis, Jr., at the address provided above. Comments may also be provided orally at a public hearing, which DOE will conduct at Timber Creek High School, 1001 Avalon Park Boulevard, Orlando, Florida, on Wednesday, September 13, 2006, at 7 p.m. Prior to the meeting, an informal session will be held beginning at 5 p.m. for the public to learn more about the proposed project.

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ACRONYMS AND ABBREVIATIONS

ADT	average daily traffic
AERMAP	terrain preprocessing program for the AERMOD air dispersion model
AERMET	meteorological preprocessing program for the AERMOD air dispersion model
AERMOD	AMS/EPA Regulatory MODel (an air dispersion model)
AMS	American Meteorological Society
amsl	above mean sea level
BMP	best management practices
BPIP	Building Profile Input Program
Btu	British thermal unit
°C	degrees Celsius
CCPI	Clean Coal Power Initiative
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
cm	centimeter
CO	carbon monoxide
CO_2	carbon dioxide
COS	carbonyl sulfide
dB	decibel
dBA	decibels as measured on the A-weighted scale
DLL	days of lost life
DOE	U.S. Department of Energy
ECT	Environmental Consulting & Technology, Inc.
EIS	environmental impact statement
EMF	electromagnetic fields
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ERF	Exposure-response function
ERPG	Emergency Response Planning Guide
°F	degrees Fahrenheit
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FR	*Federal Register*
ft	feet
ft^3	cubic feet
FWC	Florida Fish and Wildlife Conservation Commission
FWS	U.S. Fish and Wildlife Service
g	acceleration due to gravity
gal	gallon
GAQM	Guideline on Air Quality Models
GEP	Good Engineering Practice
gpm	gallons per minute
H_2	hydrogen gas
H_2O	water
H_2S	hydrogen sulfide

HCN	hydrogen cyanide
HEM	human exposure model
HRSG	heat recovery steam generator
in.	inch
IGCC	Integrated Gasification Combined Cycle
IPCC	Intergovernmental Panel on Climate Change
ISCST	Industrial Source Complex Short-Term (an air dispersion model)
KBR	(formerly Kellogg, Brown and Root)
kg	kilogram
L	liter
lb	pound
m	meter
m^2	square meter
m^3	cubic meter
µg	microgram
µm	micrometer
µS	microsiemens
MCLG	Maximum Contaminant Level Goal
mg	milligram
mgd	million gallons per day
MIR	maximum individual risk
MRI	Midwest Research Institute
mV	millivolt
MW	megawatt
N	Newton
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NIEHS	National Institute of Environmental Health Sciences
NO	nitric oxide
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	U.S. Nuclear Regulatory Commission
NSC	National Safety Council
O_3	ozone
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
OUC	Orlando Utilities Commission
Pb	lead
pH	hydrogen-ion concentration notation
PHA	process hazard analysis
PM	particulate matter
PM-2.5	particulate matter less than 2.5 µm in aerodynamic diameter
PM-10	particulate matter less than 10 µm in aerodynamic diameter
ppm	parts per million
PRIME	Plume RIse Model Enhancements
PSD	Prevention of Significant Deterioration
psi	pounds per square inch
R&D	research and development
RCRA	Resource Conservation and Recovery Act

RGM	reactive gaseous divalent mercury (Hg^{2+})
RMP	risk management plan
s	second
SAIC	Science Applications International Corporation
SCREEN3	a screening air dispersion model
SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
SPCCP	Spill Prevention, Control, and Countermeasures Plan
SPLP	Synthetic Precipitation Leaching Procedure
U.S.	United States
USC	*United States Code*
USGS	U.S. Geological Survey
VOC	volatile organic compound
yd^3	cubic yard
YLL	years of lost life

1. PURPOSE OF AND NEED FOR THE AGENCY ACTION

1.1 INTRODUCTION

This environmental impact statement (EIS) has been prepared by the U.S. Department of Energy (DOE), in compliance with the National Environmental Policy Act of 1969 (NEPA) as amended (42 USC 4321 et seq.), to evaluate the potential environmental impacts associated with the construction and operation of a project proposed by Southern Company in partnership with the Orlando Utilities Commission (OUC), which has been selected by DOE for further consideration under the Clean Coal Power Initiative (CCPI) program. The proposed project would demonstrate advanced power generation systems using Integrated Gasification Combined Cycle (IGCC) technology at OUC's Stanton Energy Center near Orlando, Florida. The facilities would convert coal into synthesis gas for generating 285 MW (megawatts) of electricity while substantially reducing emissions of sulfur dioxide (SO_2), oxides of nitrogen (NO_x), and mercury, as compared to conventional coal-fired power plants. The EIS will be used by DOE in making a decision on whether or not to provide cost-shared funding for project activities beyond preliminary design, including detailed design, construction, and operation of the proposed facilities.

1.2 CLEAN COAL POWER INITIATIVE

"Clean coal technologies" refer to advanced coal utilization technologies that are environmentally cleaner, and in many cases, more efficient and less costly than conventional coal-utilization processes. These technologies contribute to a major objective of the national energy strategy for reducing U.S. dependence on potentially unreliable energy suppliers. Because the abundant domestic reserves of coal provide one of the nation's most important resources for sustaining a secure energy future, DOE has pursued a research and development (R&D) program to increase the use of coal while improving environmental quality. However, technologies displaying potential at the proof-of-concept scale in an R&D program must be operated at a larger scale to demonstrate readiness for commercialization. The CCPI Program moves promising technologies from R&D to the commercial marketplace through demonstration. Successful demonstrations also help position the United States to supply advanced coal-fired combustion and pollution control technologies to a rapidly expanding world market.

In 2002, the U.S. Congress established the CCPI Program to accelerate commercial deployment of advanced coal-based technologies for generating clean, reliable, and affordable electricity in the United States. Congress indicated that projects in the program should be industry projects assisted by the government and not government-directed demonstrations. The projects are expected to showcase technologies in which coal-fired power plants can continue to generate low-cost electricity with improved efficiency and in compliance with more stringent environmental standards expected in the future.

In the CCPI Program, the project participant (i.e., the non-federal-government participant or participants) must finance at least 50% of the total cost of the project. The government assists the project participant by sharing in the project's cost, as detailed in a cooperative agreement negotiated between the participant and DOE. The government also shares in the rewards of successful projects through a negotiated repayment agreement.

The project participant is responsible for designing, constructing, and demonstrating the project. During project execution, the government oversees project activities, provides technical advice, assesses progress by periodically reviewing project performance with the participant, and participates in decision making at major project junctures. In this manner, the government ensures that schedules are maintained, costs are controlled, and project objectives are met.

The CCPI Program is open to any technology advancement related to coal-based power generation that results in efficiency, environmental, and economic improvement compared to currently available state-of-the-art alternatives. The program is also open to technologies capable of producing any combination of heat, fuels, chemicals, or other useful byproducts in conjunction with power generation. Coal for the demonstration projects is required to provide at least 75% of the fuel energy input to the process. This provision ensures that multiple-fuel concepts such as co-firing are not excluded, but that a focus is maintained on coal-based power generation. Additionally, projects must show the potential for rapid market penetration upon successful demonstration of the technology or concept.

DOE issued the first-round CCPI solicitation in March 2002, received 36 proposals in August 2002, and selected 8 projects in January 2003. DOE issued the second-round CCPI solicitation in February 2004 and received 13 proposals in June 2004. Four projects (including the proposed project) were selected in October 2004. One project withdrew after selection. Evaluation criteria used in the selection process included technical merit of the proposed technology, potential for a successful demonstration of the technology, and potential for the technology to be commercialized. DOE considered the participant's funding and financial proposal; DOE budget constraints; environmental, health, and safety implications; and program policy factors, such as selecting projects that represent a diversity of technologies, utilize a broad range of U.S. coals, and represent a broad geographical cross-section of the United States.

1.3 PROPOSED ACTION

The proposed action is for DOE to provide, through a cooperative agreement with Southern Company, cost-shared funding for the design, construction, and demonstration of the proposed Orlando Gasification Project at OUC's Stanton Energy Center near Orlando, Florida. DOE's share of the funding is estimated to be $235 million (about 41% of the total cost of approximately $569 million) for the proposed project (including a 4.5-year demonstration, data analysis, and process evaluation) to be conducted under the cooperative agreement. Although DOE funding would support the Orlando Gasification Project (i.e., the coal gasifier, synthesis gas cleanup systems, and supporting infrastructure) only, the project would be integrated with a planned, privately funded, combined-cycle unit. Together, the Orlando Gasification Project and the related combined-cycle unit would constitute the IGCC facilities.

Southern Company, in partnership with OUC, conceived and proposed the project in response to the DOE solicitation. DOE's primary role would be to provide cost-shared funding for the proposed Orlando Gasification Project, and DOE's decision is whether or not to fund the project. DOE's limited involvement constrains the range of alternatives considered in the EIS (Section 2), and DOE will make its decision based on those alternatives.

The primary objective of the proposed project is to design, build, and operate a state-of-the-art commercial-scale coal gasifier and integrate them with a planned combined-cycle unit. Other objectives of the project include (1) to design, construct, and operate an advanced synthesis gas cleanup system that includes sulfur removal and recovery; high-temperature, high-pressure particulate filtration; ammonia recovery; and mercury removal; and (2) to demonstrate high availability, high thermal efficiency, low cost, and low emissions from the IGCC technology at commercial scale. The project would also provide an option for reliable and economical electricity to OUC's existing and future customers.

1.4 PURPOSE AND NEED

The purpose of the proposed Orlando Gasification Project is to demonstrate advanced coal gasification for power generation applications using IGCC technology at a sufficiently large scale to allow industries and utilities to assess the project's potential for commercial application. A successful demonstration would generate technical, environmental, and financial data from the design, construction, and operation of the facilities to confirm that the technology can be implemented at the commercial scale. The cost-shared contribution by DOE would help reduce the risk to the Southern Company team in demonstrating the technology at the level of maturity needed for decisions on commercialization.

Two principal needs would be addressed by the proposed project. First, the project would meet the Congressional mandate to demonstrate advanced coal-based technologies that can generate clean, reliable, and affordable electricity in the United States (Section 1.2). Second, the demonstration would provide a more cost-effective fuel supply for integration with a planned combined-cycle unit to generate electricity.

1.4.1 Commercial Demonstration

Since the early 1970s, DOE and its predecessor agencies have pursued a broadly based coal R&D program to ensure available and affordable energy supplies while improving environmental quality. This R&D program includes long-term activities supporting the development of innovative, unproven concepts for a wide variety of coal technologies through the proof-of-concept stage. However, the availability of a viable technology at the proof-of-concept stage is not sufficient to ensure its continued development and subsequent commercialization. Before any technology can be seriously considered for commercialization, it must be demonstrated at a sufficiently large scale. Utilities and industries are generally reluctant to demonstrate technologies at an unproven scale in the absence of strong economic incentives or firm legal requirements. Implementation of the CCPI Program, with cost-shared funding from the federal government, has been endorsed by Congress and industry as a mechanism to accelerate the commercialization of innovative technologies to meet near-term environmental goals in the power industry and to reduce risk to an acceptable level through cost-shared funding. The proposed project was selected for demonstration in the CCPI Program as one of the projects that would best further these goals.

The largest existing gasifier of the type to be demonstrated, with a maximum coal-feed rate of 5,500 lb/hour, began operation in 1996 at the Power Systems Development Facility near Wilsonville, Alabama (a joint research facility sponsored by DOE, Southern Company, and other industrial participants). The design and operating parameters of the basic technology are well understood from the experience gained during this gasifier's operation, and its potential advantages to the power industry have been well established. The technology is now ready to be demonstrated on the proposed project's commercial scale to confirm these advantages, after which it is expected to be widely deployed as an advanced coal-based power generating technology.

The transport gasifier technology that would be demonstrated offers a simpler and more robust method for generating power from coal than other alternatives. It is unique among coal gasification technologies in that it is cost-effective when handling low rank coals and when using coals with high moisture or high ash content. These coals make up half the proven reserves in both the U. S. and the world. Moreover, the transport gasifier is capable of both air- and oxygen-blown operation. This inherent flexibility will allow it to readily adapt to other applications beyond power generation including chemical production and possible future carbon management requirements.

Nearly 50% of current electrical generating capacity in the United States is over 30 years old. Thus, much replacement or refurbishment of aging facilities is anticipated over the next several decades to continue to meet current electricity demand, and new capacity will be needed to keep pace with rising demand for electricity. Currently, about 55% of U.S. electricity requirements are met by power plants fired with pulverized coal. As the most abundant domestic energy source, coal continues to represent an attractive option for future power plants, particularly through advanced technologies that have the potential to dramatically improve environmental performance and efficiency. The abundance of U.S. coal reserves makes coal one of the nation's most important strategic resources for minimizing dependence on imported oil and sustaining a secure energy future. Based on existing mining technology, recoverable reserves of coal in the United States could supply coal consumption at current levels for nearly 300 years. However, advanced coal utilization technologies, such as those in the CCPI Program, must be successfully demonstrated if coal is to provide an environmentally acceptable and economically competitive source of energy in the 21st century.

The ability to show prospective domestic and overseas customers an operating facility rather than a conceptual or engineering prototype would provide a persuasive inducement to replicate the technology. Data obtained on operational characteristics would allow prospective customers to assess the technology's potential for commercial application. Successful demonstration at a commercial scale would enhance prospects of exporting the technology to other nations and could provide the United States with an important advantage in the global competition for new markets. DOE would work closely with the project participants to develop plans for technology transfer and commercialization.

1.4.2 Cost-Effective Integration

The second need to be met by the proposed Orlando Gasification Project is to provide a more cost-effective fuel supply for integration with the planned combined-cycle unit to generate electricity. As a public utility, OUC has an obligation to provide reliable and economical electric power service to its existing and future customers. To meet this obligation, OUC conducts long-range planning to predict its future power supply needs and to evaluate available options, including conservation, to meet those needs. Florida statutes require utilities to prepare 10-year planning documents. The objective of the planning process is to ensure that future service remains economical and reliable, while meeting all environmental regulatory requirements and standards. Based on the anticipated continuing growth in the Orlando area, OUC's latest plan has projected a need for approximately 300 MW of additional generating capacity in the 2010 timeframe (Black & Veatch 2005). The combined-cycle unit is proposed to meet that need, and the Orlando Gasification Project, in turn, is proposed to meet the need for a more cost-effective fuel supply (i.e. coal-derived synthesis gas compared to natural gas) for the combined-cycle unit. A successful cost-effective integration would enhance the potential for widespread commercialization of the technology, as discussed in Section 1.4.1.

1.5 NATIONAL ENVIRONMENTAL POLICY ACT STRATEGY

In compliance with NEPA, this EIS has been prepared for the Orlando Gasification Project for use by DOE decision makers in determining whether or not to provide cost-shared funding for project activities beyond preliminary design, including detailed design, construction, and operation of the proposed facilities. DOE's policy is to comply fully with the letter and spirit of NEPA, which ensures that early consideration is given to environmental values and factors in federal planning and decision making. The EIS evaluates the environmental impacts of alternatives and provides a means for the public to participate in the decision making process. The extent of actions taken by DOE with regard to any proposal, including project selection or award, is limited prior to completion of the NEPA process (i.e., no funds will be provided for project activities that could either have an adverse impact on the environment or limit the choice of reasonable alternatives).

An overall strategy for compliance with NEPA has been developed for the CCPI Program, consistent with the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR Parts 1500-1508) and DOE regulations for compliance with NEPA (10 CFR Part 1021). The DOE strategy has two principal elements. The first element involved proposers completing a DOE environmental questionnaire, along with submission of a technical proposal to the CCPI solicitation. The responses to the questionnaire contained discussions of the site-specific environmental, health, safety, and socioeconomic issues associated with each project.

The second element consists of preparing site-specific NEPA documents for each selected project. For this project, DOE has determined that providing cost-shared funding for the proposed project would constitute a major federal action that may significantly affect the quality of the human environment. Therefore, DOE has prepared this EIS to assess the potential impacts on the human environment of the proposed action and reasonable alternatives. DOE has utilized information from the environmental information volume prepared by the Southern Company team for the proposed project, as well as from sources provided by government agencies and others. The EIS has been prepared in accordance with Section 102(2)(C) of NEPA, as implemented under regulations promulgated by the CEQ (40 CFR Parts 1500-1508) and as provided in DOE regulations for compliance with NEPA (10 CFR Part 1021). The EIS is organized according to CEQ recommendations (40 CFR Part 1502.10).

A Notice of Intent to prepare the EIS and hold a public scoping meeting was published by DOE in the *Federal Register* on August 11, 2005 (70 *FR* 46825–28). The Notice of Intent invited comments and suggestions on the proposed scope of the EIS, including environmental issues and alternatives, and invited participation in the NEPA process. The Notice of Intent and other information to announce the public scoping meeting were sent to 18 publications, radio stations, and television stations in Florida. An advertisement publicizing the public scoping meeting was printed in the *Orlando Sentinel* newspaper on August 23, 2005. An information packet including the Notice of Intent was delivered to 99 stakeholders including federal, state, and local agencies and environmental groups to announce the meeting and solicit comments on the proposed project. Flyers announcing the meeting were distributed in the community. Postcards publicizing the meeting were mailed to 4,313 residents and businesses within a 2-mile radius of the Stanton Energy Center.

Publication of the Notice of Intent initiated the EIS process with a public scoping period for soliciting public input to ensure that (1) significant issues are identified early and appropriately addressed, (2) issues of little significance do not consume time and effort, and (3) delays occasioned by an inadequate EIS are avoided (40 CFR Part 1501.7). DOE held the scoping meeting in Orlando, Florida, on August 30, 2005. The public was encouraged to provide oral comments at the scoping meeting and to submit additional comments in writing to DOE by the close of the EIS scoping period on September 16, 2005.

DOE received 11 oral responses at the public scoping meeting and 11 responses by comment card, mail, e-mail, and telephone from members of the public, interested groups, and federal, state, and local officials. The responses assisted in establishing additional issues to be analyzed in the EIS and in determining the level of analysis required for each of the issues. Issues raised during public scoping are identified in Section 1.6.

1.6 SCOPE OF THE ENVIRONMENTAL IMPACT STATEMENT

This section summarizes the issues and alternatives identified and considered during the preparation of this EIS for the proposed project. The following issues were initially identified as requiring analysis and assessment in the EIS and were included in the Notice of Intent:

1. Atmospheric Resources: potential air quality impacts resulting from air emissions during construction and operation of the proposed project (e.g., effects of ground-level concentrations of criteria pollutants, and trace metals including mercury, on surrounding residential areas and resource areas of special concern, such as Prevention of Significant Deterioration Class I areas); potential effects of greenhouse gas emissions;
2. Water Resources: potential effects from withdrawal of groundwater (the proposed project would discharge no liquid effluent from the site);
3. Infrastructure and Land Use: potential effects on infrastructure and land (including wetlands) resulting from the proposed facilities; potential traffic effects resulting from trains required to transport coal for the proposed project; potential impacts from a new electrical interconnection consisting of a short, onsite transmission line and several associated structures;
4. Solid Waste: pollution prevention and waste management, including potential solid waste impacts caused by the generation, treatment, transport, storage, and disposal of ash and other solid wastes;
5. Visual Impacts: potential aesthetic impacts associated with a new stack, mechanical-draft cooling tower, and other plant structures;
6. Floodplain: potential impacts (e.g., impeding floodwaters, re-directing floodwaters, onsite property damage) of siting new structures and infrastructure within a floodplain (e.g., onsite transmission line for electrical interconnection from the combined-cycle facilities to the existing onsite substation);
7. Wetlands: potential reduction of wetlands due to new construction (e.g., onsite transmission line for electrical interconnection);
8. Ecological Resources: potential onsite and offsite impacts to vegetation, terrestrial wildlife, aquatic wildlife, threatened and endangered species, and ecologically sensitive habitats;
9. Safety and Health: construction-related safety, process safety, and management of chemicals and catalysts;
10. Construction: potential impacts associated with noise, traffic patterns, and construction-related emissions;
11. Community Impacts: potential congestion and other impacts to local traffic patterns; socioeconomic impacts on public services and infrastructure (e.g., police protection, schools, and utilities); noise associated with project operation; and environmental justice with respect to the surrounding community; and

12. Cumulative effects that result from the incremental impacts of the proposed project (e.g., incremental air emissions affecting ambient air quality) when added to other past, present, and reasonably foreseeable future actions, including the existing Stanton Energy Center and the related action of the combined-cycle turbines.

During the scoping process (Section 1.5), the public expressed concerns about (1) consideration of alternatives to the proposed project and (2) potential environmental impacts that could result from the project. The comments on alternatives suggested considering alternatives to coal-based technologies (e.g., solar energy), as well as the need for the project (i.e., consideration of the no-action alternative). The potential effects that the public expressed the most concern about were: (1) air quality impacts due to air emissions from the proposed facilities, including criteria pollutants and hazardous air pollutants such as trace metals (e.g., mercury); (2) impacts (e.g., global climate change) due to greenhouse gas emissions from the proposed facilities; and (3) exacerbation of existing local traffic congestion. Other concerns that were expressed during the scoping process were potential human health risks (e.g., asthma) due to air emissions including carcinogens from the proposed facilities; acidic deposition; impacts to water resources including water use; solid waste, including disposition of hazardous waste and ash, and impacts to the adjacent landfill; floodplain impacts, including flooding and drainage issues; protection of wetlands; ecological impacts, including potential loss of habitat and impacts to protected species; social and economic impacts (positive and negative) including environmental justice; noise impacts; construction impacts; impacts associated with coal mining to obtain feedstock for the proposed project; transportation of coal; regulatory requirements; indirect (induced) impacts; cumulative effects; mitigation measures, including incorporation of carbon sequestration as part of proposed operations; and the use of alternative feedstocks (e.g., biomass) by the proposed facilities.

DOE considered public input obtained during the scoping process to add to the list of issues to be analyzed and to provide additional focus to analysis of initially identified issues. Table 1.6.1 lists the composite set of issues identified for consideration in the EIS (i.e., issues identified in the Notice of Intent, and additional relevant issues identified during public scoping that expanded the scope of the assessment). Issues are analyzed and discussed in this EIS in accordance with their level of importance. The most detailed analyses focus on issues associated with air quality, greenhouse gas emissions, traffic, aesthetics, and ecological resources.

Table 1.6.1. Issues identified for consideration in the environmental impact statement

Issues identified in the Notice of Intent		
Atmospheric resources	Visual impacts	Safety and health
Water resources	Floodplain	Construction
Infrastructure and land use	Wetlands	Community impacts
Solid waste	Ecological resources	Cumulative effects
Additional issues identified during public scoping that expanded the scope of the assessment		
Coal mining impacts	Alternative feedstocks	Asthma from air emissions

An EIS must analyze the range of reasonable alternatives to the proposed action. The purpose of and need for the proposed action determines the range of reasonable alternatives. Alternatives to the proposed project that were considered initially as candidates for analysis in this EIS (i.e., approaches that are practical or feasible both technically and economically) are identified and briefly described in the following bullets:

- ***No-action alternative***. DOE would not provide cost-shared funding for the design, construction, and demonstration of the proposed Orlando Gasification Project at OUC's Stanton Energy Center near Orlando, Florida. In the absence of DOE funding, Southern Company and/or OUC could reasonably pursue at least one option. The combined-cycle facilities could be built at the Stanton Energy Center without the gasifier, synthesis gas cleanup systems, and supporting infrastructure. The combined-cycle facilities would operate using natural gas as fuel without the availability of synthesis gas.
- ***Alternative site***. The proposed project would be demonstrated at another site. However, site selection was governed primarily by benefits that could be realized by the companies participating in the project. The site selected for the project had to provide the maximum benefit to the companies by closely meeting the project's technical needs and integrating with existing infrastructure. The Southern Company team members selected the Stanton Energy Center site in part because the cost associated with construction of the proposed facilities at an undeveloped site would be much higher and the environmental impacts likely would be much greater than at an existing plant. The Stanton Energy Center was the only site given detailed consideration or evaluation by Southern Company team members during their site selection process and was the only location identified in their proposal responding to DOE's second-round CCPI solicitation.
- ***Alternative configuration***. The proposed Orlando Gasification Project would be integrated with the existing Stanton A combined-cycle unit, which would require retrofitting Stanton A to combust synthesis gas. Under this scenario, the planned new combined-cycle unit would still be built, but probably would operate as a natural gas-fired unit. The same gasifer and support facilities would be constructed in nearly the same location, with independent construction of the same planned combined-cycle unit in essentially the same location on essentially the same schedule.

- ***Alternative size***. The proposed project would be demonstrated using a smaller-sized plant. This alternative would not meet the project's purpose (Section 1.4). A smaller-sized plant would not be sufficiently large to demonstrate the commercial viability of the technology. Also, a smaller-sized plant would not satisfy OUC's projected need for additional generating capacity (Section 1.4.2).
- ***Alternative technologies***. DOE would demonstrate other technologies. This alternative would not demonstrate advanced power generation systems using IGCC technology and may not meet DOE's need to demonstrate advanced coal utilization technologies with potential to address domestic energy needs (Section 1.4).

In addition to the proposed project, the no-action alternative was determined to require consideration in the EIS. The four other alternatives were dismissed from further consideration (i.e., alternative site, alternative configuration, alternative size, and alternative technologies). Alternatives and the basis for their consideration or dismissal are discussed in detail in Section 2.

1.7 APPROACHES AND ASSUMPTIONS

The following approaches are used and assumptions are made in this EIS:

- Except as specifically noted in the text, potential environmental effects of the proposed facilities are based on the operating characteristics discussed in Section 2.
- One major exception to the above is that air quality impacts predicted by air dispersion modeling are based on the conservative assumption that the proposed IGCC facilities operate at a 100% capacity factor rather than the expected 85% capacity factor.
- Potential environmental impacts are assessed for the surrounding environment (beyond the boundary of the Stanton Energy Center), as described in Section 3.
- Potential environmental impacts resulting from construction and operation of the proposed facilities during the demonstration period are assessed in Section 4. Section 5 addresses potential impacts of commercial operation following completion of the demonstration.

2. THE PROPOSED ACTION AND ALTERNATIVES

This section discusses the proposed action, the no-action alternative, and alternatives dismissed from further consideration.

2.1 PROPOSED ACTION

The proposed action is for DOE to provide cost-shared funding for the design, construction, and demonstration of the proposed Orlando Gasification Project at OUC's Stanton Energy Center near Orlando, Florida (Section 1.3). The proposed action described in the following sections is DOE's preferred alternative.

2.1.1 Project Location and Background

The proposed project would be located at OUC's existing Stanton Energy Center in eastern Orange County near Orlando, Florida (Figure 2.1.1). The site is located approximately 3 miles east of the eastern city limits of Orlando and about 13 miles east-southeast of the downtown area. Land use in the vicinity includes undeveloped areas interspersed with a mixture of residential and commercial buildings to the north, the Hal Scott Regional Preserve and Park to the east, the Florida Department of Corrections' Central Florida Reception Center to the southeast, and the municipal Orange County Sanitary Landfill to the west. The topography of the area is relatively flat.

The Stanton Energy Center site encompasses 3,280 acres, of which approximately 1,100 acres have been licensed by the state of Florida and have been developed for power generation and supporting facilities. Most of the remaining 2,180 acres are undisturbed, providing a natural buffer between the facilities and the surrounding offsite area. Figure 2.1.2 is an aerial photograph of the site and surrounding area.

The Stanton Energy Center currently generates electricity using two pulverized coal-fired units (Units 1 and 2), each rated at 468 MW, and a natural gas-fired combined-cycle unit (Unit A) rated at 633 MW. The site was certified as a power plant site through the Florida Electrical Power Plant Siting Act in December 1982, with an ultimate site generating capacity of 2,000 MW. Units 1 and 2 began commercial operation in July 1987 and June 1996, respectively. During initial site development, the facilities for coal delivery, handling, and storage and waste handling and disposal (i.e., an onsite landfill) were also constructed. Altogether, Units 1 and 2 combust about 2,360,000 tons per year of low-sulfur bituminous coal from the central Appalachian region, which is delivered to the site by rail. Units 1 and 2 are also permitted to burn natural gas and landfill gas. Unit A, which began commercial operation in October 2003, combusts about 20 million ft^3 of natural gas per year and is also permitted to burn distillate fuel oil.

Figure 2.1.2. Aerial photograph of the Stanton Energy Center site and surrounding area.

Units 1 and 2 are each equipped with low-NO_x burners to limit NO_x formation, a wet limestone scrubber that captures 90% of SO_2 emissions, and an electrostatic precipitator that collects 99.9% of particulate emissions. In addition, Unit 2 has a selective catalytic reduction system to further reduce NO_x emissions. Unit A is equipped with low-NO_x burners and a selective catalytic reduction system.

The scrubbers for Units 1 and 2 use a total of approximately 50,000 tons per year of Florida limestone, which is trucked to the site. All of the sludge generated by the scrubbers is trucked to the onsite landfill. Some of the ash from Units 1 and 2 is blended with the scrubber sludge prior to disposal in the landfill, while some of the ash is sold for beneficial reuse (e.g., as construction material).

The principal existing structures at the Stanton Energy Center include the boiler buildings, turbine buildings, stacks, administration building, scrubbers, electrostatic precipitators, and natural- and mechanical-draft cooling towers. The site also contains a large make-up water pond where reclaimed water from the nearby Orange County Eastern Water Reclamation Facility is stored to provide cooling and other process uses within the plant.

The Stanton Energy Center is a zero-discharge facility regarding wastewater (i.e., no effluents are discharged off the site). All wastewater streams are recycled on the site. After maximum reuse, wastewater is piped to an onsite wastewater treatment facility, where solid material is removed and trucked for disposal at the onsite landfill and water is recycled to the cooling towers.

The Stanton Energy Center has 204 full-time employees, 183 of whom operate Units 1 and 2, while 21 operate Unit A. Another 100 persons from specialty contractors are typically on the site at any given time. Road access to the site is primarily via Alafaya Trail and secondarily via Avalon Park Boulevard (Figure 3.7.1). Limited ingress/egress is allowed from/to the south via an access road connected to the BeeLine Expressway.

The Orlando Gasification Project would be constructed on approximately 35 of the 1,100 acres of land that were previously cleared, leveled, and licensed for power plant use (Section 2.1.5.1). The project equipment would be located between the existing coal-fired units and the existing natural gas-fired combined-cycle unit. A short transmission line (approximately 3,200 ft in length) proposed to serve as an electrical interconnection from the proposed facilities to an existing onsite substation would occupy a small amount of additional land.

2.1.2 Technology and Project Description

The proposed Orlando Gasification Project would demonstrate coal gasification, synthesis gas cleanup systems, and supporting infrastructure, which would be integrated with a combined-cycle power-generating unit to form IGCC technology. IGCC technology uses synthesis gas derived from coal to drive a gas combustion turbine and hot exhaust gas from the gas turbine to generate steam from water to drive a steam turbine. Combined, the two turbines would generate 285 MW (net) of electricity. This proven, reliable combined-cycle approach of using a gas turbine and steam turbine in tandem increases the amount of electricity that can be generated from a given amount of fuel. The project is expected to provide a source of electricity that is reliable, low-cost, environmentally-sound, and efficient (approximately 40% of the energy in the fuel would be converted to electricity compared to about 33% for a conventional coal-fired power plant).

While the proposed project consists of the gasifier, synthesis gas cleanup systems, and supporting infrastructure only, the EIS will address the construction and operation of the gas turbine and steam turbine as a related action (Section 2.2) and include the combined facilities in the analyses of environmental impacts because the facilities are so intertwined. Figure 2.1.3 provides a flow diagram of the proposed project and its integration with the combined-cycle unit.

The air-blown transport gasifier would be based on KBR’s fluidized catalytic cracker design. Southern Company and DOE have been developing the transport gasifier technology since 1996 at a research facility near Wilsonville, Alabama. At full capacity, the new gasifier would use a total of up to 3,300 tons of subbituminous coal per day to produce synthesis gas. The technology is unique among coal gasification technologies in that it is cost-effective when using low-quality coal, as well as coal with high moisture or high ash content. These coals comprise half the proven U.S. and worldwide reserves.

Because the design of the entire plant is highly dependent on the design fuel, the use of alternative coals (e.g., bituminous coal) is not considered practical for this proposed project. Additionally, the use of biomass feedstock is not considered feasible. Although pilot-scale research using biomass feedstock with IGCC technology is ongoing within Southern Company, biomass is not currently planned for the proposed facilities due to the challenges and uncertainties associated with material preparation and with feeding biomass into pressurized systems.

The proposed project would minimize SO_2, NO_x, mercury, and particulate emissions by removing constituents from the synthesis gas. The removal of approximately 80% of the fuel-bound nitrogen from the synthesis gas prior to combustion in the gas turbine would result in appreciably lower NO_x emissions compared to conventional coal-fired power plants. The project is expected to remove up to 95% of the sulfur and over 90% of the mercury. Over 99.9% of particulate emissions would be removed using high-temperature, high-pressure filtration (rigid, barrier-type filter elements). Because the proposed project would be more efficient (i.e., about 40% of the energy in the fuel would be converted to electricity rather than 33%), approximately 25% less fuel would be required (assuming the same coal would be used) and 25% less carbon dioxide (CO_2) would be produced compared to typical emission rates at coal-fired power plants built before 1970. The proposed project would discharge no liquid effluent from the site. Ash generated by the gasifier would be combusted in the existing coal-fired units, marketed for use as activated carbon, or trucked to the existing onsite landfill for permitted disposal. Anhydrous ammonia and sulfur byproducts would be recovered and marketed. A key performance target for the proposed technology would be achieving gasifier availability of at least 80% without the use of a spare gasifier.

In addition to the gasifier and turbines, major new equipment for the project would include a 205-ft stack, 6-cell mechanical-draft cooling tower, synthesis gas cleanup facilities, and particulate filtration systems. Figure 2.1.4 is a computerized drawing of the proposed facilities superimposed on a photograph of the existing Unit A taken from the direction of the existing Units 1 and 2. The project would also require modifications to existing systems such as the coal conveyance and storage system. Wherever possible, existing facilities and infrastructure located at the Stanton Energy Center would be used for the proposed project. These include plant roads, administration building, coal delivery and handling facilities, ash handling and storage facilities, water and wastewater treatment systems, cooling water pond, and electric transmission lines and towers. However, the new 3,200-ft transmission line, including several new structures, would be required from the new turbines to the existing onsite substation to serve as an electrical interconnection.

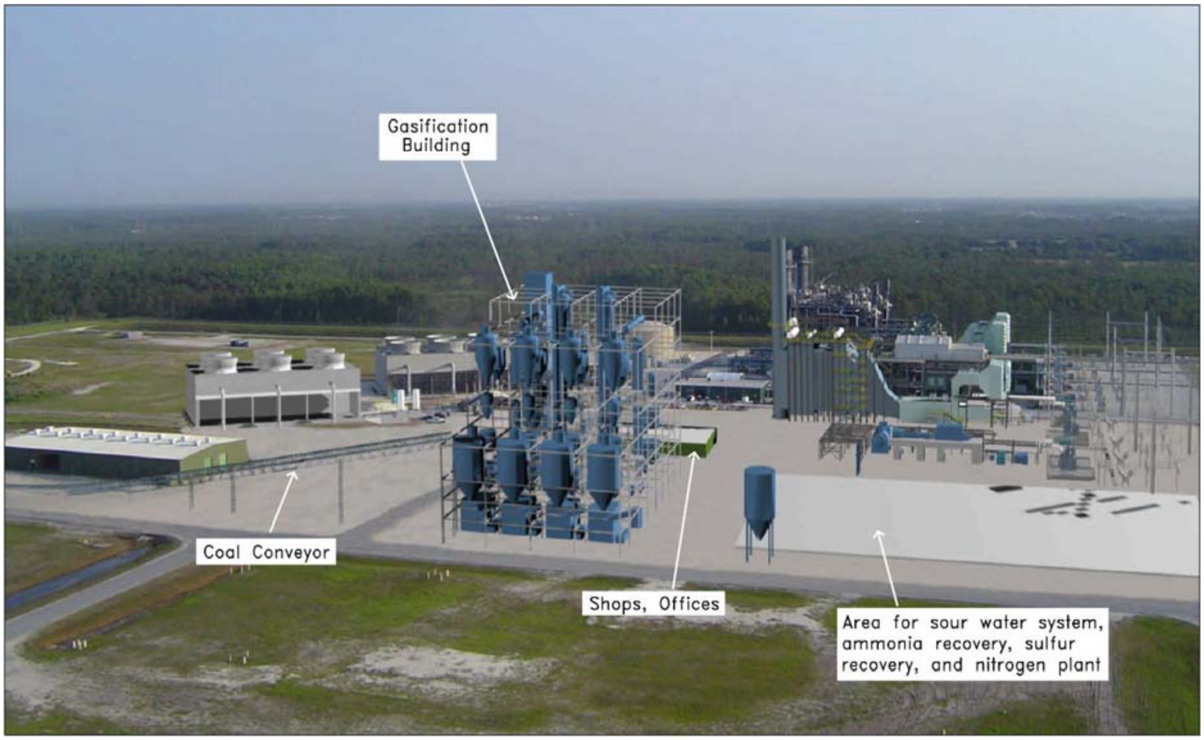

Figure 2.1.4. Computerized drawing of the proposed facilities superimposed on a photograph of the existing Unit A taken from the direction of the existing Units 1 and 2.

The plant would be designed to operate exclusively using low-sulfur subbituminous coal from Wyoming's Powder River Basin. The design coal feed rate to the gasifier would be approximately 137 tons per hour. Most of the sulfur and other pollutants in the coal would be removed from the synthesis gas before delivery to the gas turbine. The gasifier would produce approximately 450 tons of synthesis gas per hour with a lower heating value of about 125.7 British thermal units (Btu) per cubic foot. The following subsections provide details of the key processes within the gasification facilities.

2.1.2.1 Coal Preparation and Feeding

Two to three unit trains per week, each train composed of about 100 rail cars, would deliver subbituminous coal to the existing unloading system for Units 1 and 2. Coal would be unloaded within the existing rail unloading building via bottom dump rail cars. A conveyor would transport the coal into a hopper, and another conveyor would deliver it to a radial-pedestal stacker conveyor that would create a kidney-shaped coal pile with a capacity of 170,000 tons, which is equivalent to 45 days of storage at the design feed rate. The proposed project would use the existing coal storage area at the Stanton Energy Center, but a new coal pile would be formed because the coal would be subbituminous while the coal used by the existing units is bituminous. The new coal pile would be outfitted with a synthetic liner and would use the existing leachate and stormwater runoff collection systems and a retention basin to prevent groundwater seepage and runoff from the area.

Coal from the pile would be conveyed to a single crusher that would reduce the coal size from 3 in. to 0.75 in., and the crushed coal would be conveyed to crushed coal silos. A screw conveyor would feed crushed coal from the storage silos to pulverizers, which would be roll-mill crushers with hot gas to dry the coal. The pulverized coal would be transferred by gravity to high-pressure coal feeders. The coal would enter the feeders at atmospheric pressure and the pressure would then be increased to the operating pressure of the gasifier.

2.1.2.2 Gasifier

The gasifier would consist of an upright looped set of piping with a total height of approximately 160 ft (Figure 2.1.5). Coal, which would be injected near the top of the mixing zone, and air, which would be fed into the bottom of the mixing zone, would mix with gasifier ash recirculated through the J-valve from the standpipe. A total of nearly 350 tons per hour of compressed air would be supplied to the gasifier during operation. About 25% of the air would be extracted from the combined-cycle unit's gas turbine, while the remainder would be ambient air. Oxygen in the air would be consumed by carbon present in the recirculating ash, forming primarily carbon monoxide (CO). This reaction would release the heat required to maintain vessel temperature. The hot recirculating ash would heat the coal rapidly, minimizing tar formation, and the coal would be converted to synthesis gas.

Synthesis gas and gasification ash would pass from the mixing zone up the riser and then to a cyclone where larger, denser particles would be removed by gravity and fall into the standpipe. Synthesis gas would pass to a second cyclone where most of the remaining gasification ash would be removed and would pass into a loop seal. Gasification ash flowing through the cyclone loop seal would combine in the standpipe with gasification ash from the first cyclone. The combined stream would pass down the standpipe and through the J-valve into the mixing zone. To maintain constant gasifier bed inventory, gasification ash would be removed periodically from the lower section of the standpipe.

During gasifier startup, natural gas-fired burners would be used to heat the gasifier until reaching a sufficient temperature to initiate coal feed and gasification. Because the exhaust gas from the natural gas-fired burners would have little heating value, if the gas were sent to the flare (Section 2.1.2.8), natural gas would need to be added to produce a combustible mixture. Consequently, the exhaust gas would be vented to the startup stack instead of the flare. Once the gasifier would reach a sufficient temperature during startup, the injection of coal would begin and the air flow would be reduced until the atmosphere in the gasifier would form a reducing environment rather than an oxidizing environment. Subsequently, the coal would be gasified and synthesis gas would be produced. Because the flow of synthesis gas would initially be insufficient to send to the gas turbine, it would be sent to the flare and burned. Prior to being released through the startup stack or burned by the flare, the exhaust gas or synthesis gas would pass through the gas cleanup process of

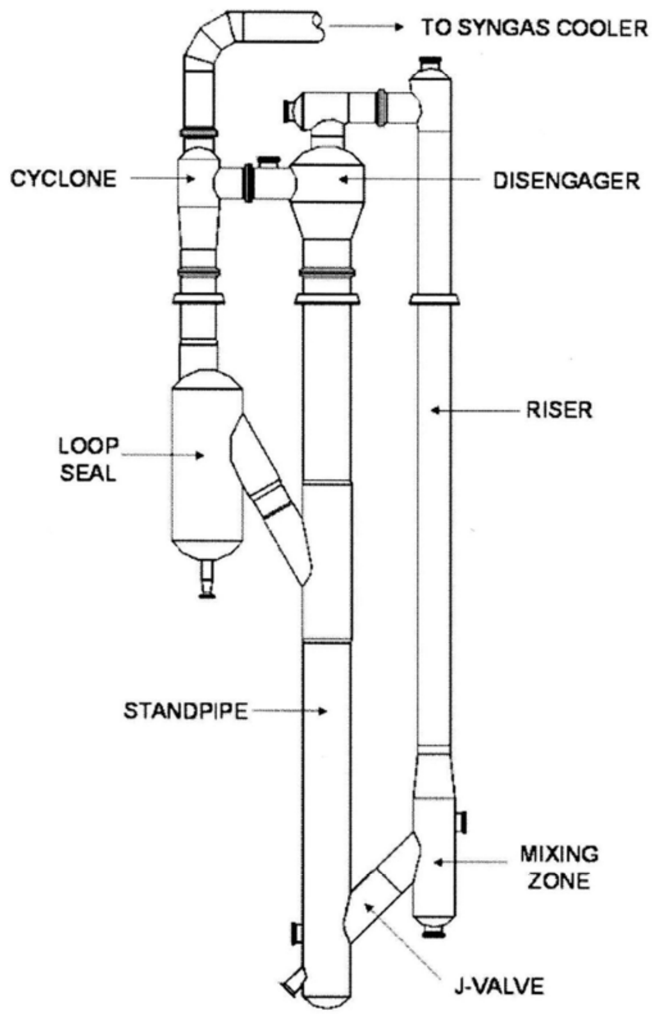

Figure 2.1.5. Side view of a gasifier.

the gasification facilities. When the gasifier would reach a gas production level sufficient to support the operation of the gas turbine, the synthesis gas would be diverted from the flare to the gas turbine.

The duration of the startup sequence would vary, depending on factors such as the starting temperature of the gasifier. During a cold start, up to 24 hours could elapse prior to sending synthesis gas to the gas turbine due to the time required to heat the gasifier refractory. The 24-hour period would include approximately 17 hours of exhausting gas through the startup stack and about 7 hours of combusting synthesis gas in the flare.

2.1.2.3 High Temperature Synthesis Gas Cooling

Synthesis gas leaving the gasifier cyclone would pass via piping to a high-temperature synthesis gas cooler that would lower the gas temperature before it enters a high-temperature, high-pressure filter system. The heat transferred would be used to raise the temperature of high-pressure superheated steam.

The synthesis gas cooler would consist of three stages: an evaporator, a superheater, and an economizer. The evaporator would include a natural circulation steam drum operating at above steam turbine inlet pressure and at saturated temperature. The steam raised in the evaporator would be passed to a superheater that would heat the steam to the steam turbine inlet temperature. This steam would be mixed with superheated steam exiting the combined-cycle unit’s heat recovery steam generator (HRSG) (Section 2.2) before passing into the steam turbine. Boiler feedwater would enter the economizer and would be heated to near saturation before entering the steam drum.

All three stages would use shell and tube heat exchangers, in which the particulate-laden synthesis gas would flow downward in a single pass through vertical tubes. The water or steam providing the cooling would flow upward in a single pass through the shell side of the exchangers.

2.1.2.4 Particulate Removal

After cooling, synthesis gas would pass via piping to a high-temperature, high-pressure filter system for final particulate removal. The filter system would use rigid, barrier-type filter elements to remove essentially all of the particulate matter in the synthesis gas stream. Pulses of recycled, filtered synthesis gas would be used to remove accumulated particulate matter from the filters. Downstream of each filter element, a device would safeguard the combustion turbine from particulate-related damage in the event of a filter element failure.

Each of the two filter systems would remove approximately 5 tons per hour of particulate matter from the synthesis gas stream. The concentration of particulate matter in the cleaned synthesis gas is expected to be less than 0.1 part per million (ppm) by weight. The synthesis gas streams would exit the filter vessels and flow to the low-temperature heat recovery system. The removed particulate matter (fine ash) would be cooled and depressurized to atmospheric pressure before leaving the gasification facilities. The fine ash would flow down through a bank of cooling tubes to transfer heat to the condensate system. The cooled solids would pass into a continuous fine ash removal system.

2.1.2.5 Low Temperature Gas Cooling and Mercury Removal

Before the filtered synthesis gas would be combusted in the gas turbine, the gas would be cooled to the desulfurization process's operating temperature, which would facilitate removal of sulfur, mercury, nitrogen compounds, hydrocarbons, fluorides, and chlorides. Both coolers would condense water and certain hydrocarbons from the sour synthesis gas (i.e., synthesis gas prior to sulfur removal). The water would dissolve nearly all of the nitrogen compounds, chlorides, and fluorides present, as well as lesser amounts of CO_2, CO, hydrogen sulfide (H_2S), and carbonyl sulfide (COS). This aqueous mixture would be removed from the synthesis gas stream in a knockout drum after the last cooler and passed to the sour water treatment plant. A downstream aqueous scrubber would reduce ammonia and other constituents in the synthesis gas. The gas would then flow to the process area for H_2S removal before re-entering the low-temperature gas cooling area to be reheated and conveyed for combustion in the gas turbine.

While being cooled, the gas would flow through additional gas cleanup processes, including a COS hydrolysis unit that would use an alumina-based catalyst to convert most of the COS to H_2S for subsequent sulfur removal because the desulfurization process would not remove COS from the synthesis gas stream. A second reactor would consist of two packed beds of sulfur-impregnated activated carbon to remove mercury from the synthesis gas.

2.1.2.6 Sulfur Removal and Recovery

Synthesis gas would leave the low-temperature gas cooling system at slightly above ambient temperature and would enter the sulfur removal process. In this process, the synthesis gas would be contacted with a solvent to remove a high percentage of the H_2S from the synthesis gas stream. The H_2S in the solvent would be converted to elemental sulfur, which could be sold as a byproduct. The solvent would be regenerated and returned to the sulfur removal process. The sweet synthesis gas (i.e., synthesis gas after sulfur removal) would leave the contactor at slightly above ambient temperature and would then re-enter the low-temperature gas cooling process in which the synthesis gas would be heated before being combusted in the gas turbine.

Upon exiting the low-temperature gas cooling system, approximately 95% of the sweet synthesis gas would flow to the gas turbine, while the remaining 5% would pass to the synthesis gas recycle system. Some of the recycled synthesis gas would be sent to the pulse-gas reservoirs and used to pulse clean the high-temperature, high-pressure filters, while the remainder would be used for aeration in the gasifier.

2.1.2.7 Sour Water Treatment and Ammonia Recovery

The single sour water treatment and ammonia recovery unit would treat approximately 150 gallons per minute (gpm) of water removed during coal preparation, air compression, condensation from synthesis gas in the low-temperature gas cooling process, and sulfur removal. The combined water flow would pass to a filter to remove particulate matter and to an activated carbon bed to remove organic material before entering a degassing drum. The ammonia in the water would retain most of the dissolved H_2S, and the gas released would primarily contain light hydrocarbons, which would pass to the vent gas recycle header. The filter cake and spent activated carbon would be removed periodically for disposal in a manner that complies with applicable regulations.

Next, the sour water would be heated and passed to the steam-heated H_2S stripper where H_2S, hydrogen cyanide (HCN), CO, and CO_2 would be released and passed to the vent gas recycle header. The header synthesis gas stream would be compressed and injected into the oxidation zone of the gasifier, where the HCN would be destroyed. The water from the H_2S stripper would discharge to the steam-heated ammonia stripper to produce a concentrated ammonia solution. The water drawn from the bottom of the ammonia stripper would be sufficiently pure for plant reuse.

The concentrated ammonia solution would be processed further in two additional steam-heated strippers, the first releasing any remaining dissolved H_2S into the vent gas recycle header and the second increasing the ammonia concentration to 99.7%. The water drawn from the bottom of the columns would be sufficiently pure for plant reuse. The ammonia produced would be commercial-grade anhydrous ammonia, which OUC and Southern Company intend to use in the existing generating units at the Stanton Energy Center. Excess anhydrous ammonia could be sold in the commercial market.

Provisions would be made to recycle the ammonia to the mixing zone of the gasifier for destruction if removal of the anhydrous ammonia by truck were to be delayed and the storage tank were approaching full. The recycling of ammonia would be straightforward. The sour water treatment plant would operate at higher pressure, and when the ammonia gas were stripped off, it would be at a pressure of approximately 30 psi above gasifier pressure. Therefore, it need only be vented to the gasifier, and would enter the gasifier in the oxidizing zone for decomposition.

2.1.2.8 Flare

The gasification facilities would be equipped with a flare to combust synthesis gas during startups and shutdowns and during plant upsets (e.g., a sudden shutdown of the combined-cycle unit's gas turbine). Under normal operation of the proposed facilities, only eight pilot lights would be operating. The pilot lights would operate continuously, each fired with natural gas at a flow rate of 80 ft^3 per hour.

A multipoint flare system, which is well proven in the petrochemical industry, would be used rather than the more conventional stack flare design. Figure 2.1.6 shows two photographs of multipoint flare systems similar to that planned for the proposed project. The multipoint flare system was developed to resolve aesthetic issues associated with stack flares. Instead of a 100- to 200-ft single stack with a single flame that may rise several hundred feet above the stack, the multipoint flare divides the gas into a number of smaller flames. A 20-ft tall thermal barrier fence surrounds the burners, which are located approximately 10 ft above ground level. For this project, the footprint of the flare system would be approximately 214 ft by 123 ft.

Figure 2.1.6. Two photographs of multipoint flare systems similar to that planned for the proposed project.

At full load, flame temperature would be approximately 1,800°F and flame height would rise to about 40 ft above the burners. The flames would be smokeless and nearly invisible during the day, except for shadows from heat effects. At night, a blue/purple flame would be visible above the thermal barrier.

2.1.3 Construction Plans

Construction of the proposed facilities would begin in late 2007 and continue until early 2010. Because the proposed project site was cleared and graded during construction of the existing facilities at the Stanton Energy Center (Section 2.1.1), additional clearing and grading would be minimal (e.g., the site would be graded for stormwater runoff directed to existing retention ponds). Site preparation would involve construction of load-bearing concrete piers and foundations for heavy and settlement-sensitive structures. Excavation would be performed for footings and grade beams. Soil removed during site preparation would be stored in stockpiles and later spread on finished graded areas. Following site preparation, other phases of construction would include mechanical installation, piping interconnection, electrical installation, and instruments and controls configuration.

Construction materials would consist primarily of structural steel beams and steel piping, tanks, and valves. Locally obtained materials would include crushed stone, sand, and lumber for the proposed facilities and temporary structures (e.g., enclosures, forms, and scaffolding). Components of the facilities would also include concrete, ductwork, insulation, electrical cable, lighting fixtures, and transformers. Most of the materials would be delivered to the site by truck. If economically feasible, heavier components could be delivered by rail to the existing onsite rail loop. Construction equipment would include cranes, forklifts, air compressors, welding machines, trucks, and trailers. An average of about 30 vehicles would be used for construction activities on the site.

During the 28-month construction period, an average of about 350 construction workers would be on the site during construction of the gasification facilities and the combined-cycle power-generating unit (the related action discussed in Section 2.2). Approximately 600 to 700 workers would be required during the peak construction period between fall 2008 and spring 2009. Of this combined workforce (i.e., including the proposed project and the related action), the combined-cycle unit would require a slightly greater peak workforce, but the gasification facilities would require workers for a slightly longer construction period. Most construction would occur during daylight hours, with the majority of construction workers being present on the site between 7 a.m. and 5:30 p.m.

Land requirements during construction and operation are discussed in Section 2.1.5.1.

2.1.4 Operational Plans

After mechanical checkout of the proposed facilities, demonstration (including data analysis and process evaluation) would be conducted over a 4.5-year period from mid 2010 until late 2014. During the demonstration, the test program would focus on achieving reliable plant operation (at least 80%

gasifier availability) with high thermal efficiency, low emissions, equipment performance improvement, and low operation and maintenance costs. Workers would include a mix of plant operators, craft workers, managers, supervisors, engineers, and clerical workers. An average of about 20 vehicles would be used for operational activities on the site.

If the demonstration is successful, commercial operation would follow immediately (Section 5). The facilities would be designed for a lifetime of at least 20 years, including the 4.5-year demonstration period. An extension beyond 20 years would be based on economic analysis at that time.

Staff size would vary between the demonstration period and the period of commercial operation. Operations staff would be assembled during the last 18 months of construction for training and to assist with startup of the facilities. The combined workforce (i.e., including the proposed project and the related action) would consist of approximately 72 employees added to existing Stanton Energy Center staff. Of those 72 employees, 19 workers would provide support only during the startup and demonstration phases of the project, while 53 employees would be needed over the lifetime of the facilities (i.e., during startup, demonstration, and commercial operation).

For the proposed project alone, the size of the day shift crew would range from 57 during startup and demonstration to 38 during commercial operation. The size of the night shift crew would be about five to seven employees for the lifetime of the facilities. The staff would work two 12-hour shifts a day, with shift changes expected around 5:30 a.m. and 5:30 p.m.

2.1.5 Resource Requirements

Table 2.1.1 summarizes the operating characteristics, including resource requirements, for the proposed facilities, including the related action of the combined-cycle power-generating unit (Section 2.2).

2.1.5.1 Land Area Requirements

Figure 2.1.7 displays a preliminary layout of the proposed facilities within the Stanton Energy Center site. The project would be constructed on approximately 35 of the 1,100 acres of land that were previously cleared, leveled, and licensed for power plant use. The project equipment would be located between the existing coal-fired Units 1 and 2 and the existing natural gas-fired Unit A. An existing temporary warehouse might be dismantled to accommodate the ancillary facilities required by the proposed project.

A short onsite transmission line (approximately 3,200 ft in length) proposed to serve as an electrical interconnection from the proposed facilities to an existing onsite substation to the northeast would occupy a small amount of additional land, which would extend beyond the 1,100-acre developed area of the power plant site. Including the 80-ft wide right-of-way for the transmission line, the total area for the transmission corridor would be slightly less than 6 acres.

Table 2.1.1. Expected operating characteristics of the proposed Integrated Gasification Combined Cycle (IGCC) project and the existing units at the Stanton Energy Center[a]

Operating characteristics	Existing Units 1 and 2	Existing Unit A	Proposed IGCC project	Stanton Energy Center total (with IGCC)
Generating capacity (MW)	936	633	285	1,854
Capacity factor (%)[b]	80	90	85	—
Power production (MW-hr/yr)	6,200,000	2,600,000	2,100,000	10,900,000
Coal consumption (tons/year)	2,360,000[c]	0	1,020,000[d]	3,380,000
Limestone consumption (tons/year)	50,000	0	0	50,000
Production (use) of ammonia (tons/year)	(700)	(80)	7,300	6,520
Natural gas consumption (10^6 ft^3/year)	2[e]	19,400	940	20,342
Fuel oil consumption (10^3 gal/year)	850	127	0	879
Water requirements				
Reclaimed water (net; gpm)	8,811[f]		1,531	10,342
Groundwater (gpm)	326[f]		80	406
Air emissions (tons/year)[g]				
Sulfur dioxide (SO_2)	6,800	18	137	6,955
Oxides of nitrogen (NO_x)	9,325/8,300[h]	177	855	9,332
Particulate matter (PM-10)	400	100	160	660
Carbon monoxide (CO)	800	20	556	1,376
Volatile organic compounds (VOCs)	90	21	110	221
Carbon dioxide (CO_2)	7,118,500	1,240,000	1,809,000	10,167,500
Wastewater (gpm)	All wastewater streams processed/reused on the site			
Solid wastes (tons/year)				
Blended ash and scrubber sludge	503,500	0	0	503,500
Gasification ash	0	0	68,000	68,000
Byproducts (tons/year)				
Anhydrous ammonia	0	0	7,300	7,300
Sulfur	0	0	2,800	2,800

[a]All resource consumption, outputs, emissions, effluents, and wastes are estimated based on stated capacity factors and are not meant to be representative of any specific time period.

[b]Capacity factor is the percentage of energy output during a period of time compared to the energy that would have been produced if the equipment operated at its maximum power throughout the period.

[c]Based on bituminous coal from the central Appalachian region with a heating value averaging 12,700 Btu/lb.

[d]Based on subbituminous coal from the Powder River Basin in Wyoming with a heating value averaging 8,760 Btu/lb.

[e]Landfill gas.

[f]Combined water requirements for existing Units 1, 2, and A.

[g]Emissions from the main combustion units, material handling, and other sources.

[h]For purposes of netting of NO_x, baseline emissions from Units 1 and 2 combined are 9,325 tons per year using calendar year 2004 and 2005. After the start of the demonstration period for the proposed facilities, the NO_x emissions from Units 1 and 2 would be limited to 8,300 tons per year.

Coal for gasification would be stored in a separate pile occupying about 10 acres (included as part of the 35-acre total) immediately north of the existing coal piles for Units 1 and 2 (Figure 2.1.7). Figure 2.1.7 also shows the existing 347-acre onsite landfill, at which up to 25 acres (not included in the 35-acre total) could be required over the lifetime of the facilities assuming all of the gasification ash would be transported to the landfill for disposal (landfill disposal is one of three options, as discussed in Section 2.1.6.3).

About 20 acres of land would be required during construction for equipment/material laydown, storage, assembly of site-fabricated components, staging of material, and facilities to be used by the construction workforce (i.e., offices and sanitary facilities). About 5 acres would be needed as a parking lot to accommodate construction workers' vehicles. The land for these temporary facilities would also be situated between Units 1 and 2 and Unit A (Figure 2.1.7).

2.1.5.2 Water Requirements

Water would be used during construction of the proposed facilities for various purposes including personal consumption and sanitation, concrete formulation, preparation of other mixtures needed to construct the facilities, equipment washdown, general cleaning, dust suppression, and fire protection. Service water for construction activities would be obtained from reclaimed water in the Stanton Energy Center's onsite makeup pond. Potable water associated with construction activities would be obtained from groundwater drawn from onsite wells. Use of potable water during construction would average about 1 gpm. Portable toilets would minimize requirements for additional sanitary water.

During operation, all water for process and potable needs would be obtained from existing Stanton Energy Center sources. Figure 2.1.8 presents a simplified water balance diagram for the proposed facilities. The principal water uses (cooling water and service water) would be supplied from the onsite makeup pond, which receives treated effluent from the nearby Eastern Water Reclamation Facility, recycled onsite wastewaters, and stormwater from the Orange County municipal landfill. Based on annual requirements, the new 6-cell cooling tower would need approximately 1,853 gpm of treated effluent from the onsite storage pond to use as makeup water, which would replace cooling tower evaporative losses and blowdown (i.e., water discharged from the cooling tower to limit the concentration of total dissolved solids). About 80% of the cooling water demand would result from the combined-cycle unit's operation, while the remaining 20% would be attributable to the gasification facilities. About 4 gpm of water droplets would escape beyond the cooling towers' drift water eliminators to the atmosphere.

Chemicals for biocide and corrosion inhibition would be injected into the cooling tower water. Gaseous chlorine would be fed continuously into the system as a biocide. Sulfuric acid would be injected to reduce alkalinity, thereby controlling scaling. A silt dispersant and an iron dispersant would likely be used in the cooling water also.

Groundwater from onsite wells would be used as a source of water for potable use (less than 1 gpm) and demineralized water to replace HRSG blowdown and steam losses (74 gpm). Demineralized water would be produced by the existing Stanton Energy Center demineralizer; a few gpm of groundwater would be consumed in demineralization and water treatment. The incremental requirement of groundwater from onsite wells would be within existing permitted limits established for the Stanton Energy Center.

2.1.5.3 Fuel and Other Material Requirements

The new coal gasifier would operate entirely on coal, consuming a total of approximately 1,020,000 tons per year to produce synthesis gas. Two to three trains per week would deliver low-sulfur subbituminous coal from the Powder River Basin in Wyoming. The heating value of the coal would average about 8,760 Btu/lb and the sulfur content would average about 0.26%. Table 2.1.2 presents a range for the expected composition of the coal. No limestone would be used by the proposed facilities. Small quantities of process chemicals, paints, degreasers, and lubricants would be consumed, as at any industrial facility.

The gas combustion turbine would be capable of continuous, full-load operation firing either synthesis gas or natural gas. Natural gas used in the combustion turbine and duct burners, as well as for coal gasifier startup, would be supplied by the existing pipeline that serves Unit A. No upgrades or major modifications to the existing natural gas supply facilities would be required. Natural gas would not be stored on the site. When operating on natural gas, the combined-cycle power-generating unit (Section 2.2) would consume approximately 2 million ft^3 of natural gas per hour at full load with duct burners operating.

2.1.6 Outputs, Discharges, and Wastes

Table 2.1.1 includes a summary of discharges and wastes for the proposed facilities, including the related action of the combined-cycle power-generating unit (Section 2.2).

2.1.6.1 Air Emissions

During construction, workers’ vehicles, heavy construction vehicles, diesel generators, and other machinery and tools would generate emissions. Fugitive dust would result from excavation, soil storage, and earthwork.

During operation of the proposed facilities, handling and storage of coal and gasification ash would generate fugitive particulate emissions. For coal handling, particulate control would include rail car unloading in the existing enclosed building, water sprays in enclosed coal conveyors, and baghouses at key transfer locations. Gasification ash conveyors would be enclosed, and ash would be wetted to reduce potential fugitive dust emissions during handling. The area’s high humidity, frequent rainfall, and lack of high winds would reduce particulate emissions from uncovered coal at the storage area and from equipment operation on the roads.

Table 2.1.2. Analysis of the composition of subbituminous coal expected to be received for the proposed Orlando Gasification Project

Characteristic	Minimum	Maximum
Proximate (as received)		
Heating value (Btu/lb)	8,300	8,884
Analysis (percent by weight)		
Moisture	26.5	30.6
Ash	4.4	5.5
Volatile matter	30.3	31.7
Fixed carbon	32.9	37.1
Sulfur	0.2	0.4
Proximate (dry)		
Heating value (Btu/lb)	11,942	12,127
Analysis (percent by weight)		
Ash	6.1	7.4
Volatile matter	42.8	45.3
Fixed carbon	47.4	51.1
Sulfur	0.3	0.6
Ultimate (as received)		
Analysis (percent by weight)		
Moisture	26.5	30.6
Carbon	48.6	52.2
Hydrogen	3.2	3.8
Nitrogen	0.6	0.8
Chlorine	0.0	0.01
Sulfur	0.2	0.4
Ash	4.4	5.5
Oxygen	10.7	12.4
Ultimate (dry)		
Analysis (percent by weight)		
Carbon	69.9	71.2
Hydrogen	4.6	5.2
Nitrogen	0.9	1.1
Chlorine	0.01	0.01
Sulfur	0.3	0.6
Ash	6.1	7.4
Oxygen	14.7	17.0

Fugitive emissions of gaseous compounds could be generated from the facilities due to leaks from equipment such as valves, compressor seals, and flanges. These emissions would be minimized by proper maintenance practices. In addition, area gas detectors would be used to alert plant staff of fugitive gas emissions.

Most emissions would result from combustion of synthesis gas in the gas combustion turbine during normal operations. The exhaust gas would be released to the atmosphere via the 205-ft HRSG stack. Table 2.1.3 presents stack emissions at full load; annual emissions in this table are conservatively based on continuous year-round operation (100% capacity factor). The principal pollutants would be SO_2, NO_x, particulate matter, CO, and volatile organic compounds (VOCs). Trace emissions of other pollutants would include formaldehyde, toluene, xylenes, carbon disulfide, acetaldehyde, mercury, beryllium, benzene, arsenic, and others (Table 2.1.3). The list of trace compounds present in flue gas from synthesis gas combustion is based on measurements made at the Louisiana Gasification Technology IGCC project (Radian, 1995).

During gasifier startups, exhaust gas would be released for up to 17 hours through the startup stack, and synthesis gas would be combusted for up to 7 hours in the flare (Section 2.1.2.2). In the unusual event of a process upset involving the gasifier or the combined-cycle unit, synthesis gas would be routed to the flare for combustion. The duration of synthesis gas combustion would vary depending upon the type of upset. Under normal operation of the proposed facilities, minimal emissions would result from the flare because only the eight natural gas-fired pilot lights would be operating (Section 2.1.2.8).

2.1.6.2 Liquid Discharges

During operation, the proposed facilities would produce various process wastewaters, all of which would be discharged to the existing Stanton Energy Center treatment and reuse systems. No process waste streams or water treatment discharges would be released off the site. The principal wastewater streams, which would result primarily from the combined-cycle unit (Section 2.2), would include about 231 gpm of cooling tower blowdown conveyed to the existing wastewater treatment plant and about 134 gpm of low-volume wastes (e.g., sour water cleanup wastes, oil/water separator wastes, condensation from the air compressors) conveyed to the existing recycle basin. All treated blowdown and wastewater would be discharged to onsite systems.

Stormwater would be routed to culverts and directed to existing, onsite stormwater retention ponds. Runoff from areas associated with industrial activity, including the coal storage area, and equipment and floor drains would be routed for pH adjustment, oil separation, and suspended solids removal. Treated stormwater would then be discharged to the recycle basin for reuse.

Table 2.1.3. Estimates of air pollutant emissions from proposed HRSG stack[a]

Pollutant	Short-term synthesis gas (lb/hour)	Short-term natural gas (lb/hour)	Maximum annual (lb/year)
Sulfur dioxide (SO_2)	35.9	1.4	314,000
Oxides of nitrogen (NO_x)	225.4	42.1	1,974,000
Particulate matter (PM-10)	35.8	23.2	314,000
Carbon monoxide (CO)	140.5	138.0	1,231,000
Volatile organic compounds (VOCs)	26.9	29.3	257,000
Lead	0.0069	0.00085	60
Antimony	0.0095	—	83
Arsenic	0.0050	—	44
Beryllium	0.00022	—	1.9
Cadmium	0.0069	—	60
Chromium	0.0064	—	56
Cobalt	0.0014	—	12
Manganese	0.0074	—	65
Mercury	0.0022	—	19
Nickel	0.0093	—	81
Selenium	0.0069	—	60
Acenaphthyalene	0.000062	—	0.54
Acetaldehyde	0.0043	0.070	610
Benzaldehyde	0.0069	—	60
Benzene	0.012	0.022	190
Benzo(a)anthracene	0.0000055	—	0.048
Benzo(e)pyrene	0.000013	—	0.11
Benzo(g,h,i)perylene	0.000023	—	0.20
Carbon disulfide	0.11	—	960
Formaldehyde	0.080	0.57	5,000
2-Methylnaphthalene	0.00086	—	7.5
Naphthalene	0.0013	0.0026	23
1,3-Butadiene	—	0.00075	6.6
Acrolein	—	0.011	98
Ethylbenzene	—	0.056	492
Polycyclic aromatic hydrocarbons	—	0.0039	34
Propylene oxide	—	0.051	450
Toluene	—	0.23	2,000
Xylenes	—	0.11	980

[a]All estimates based on full-load operating scenarios with duct burner firing and an average ambient temperature. Annual emissions conservatively assume continuous, year-round operation using higher of synthesis gas or natural gas hourly emission rate.

Area drains would collect liquid from periodic equipment washdown, as well as unexpected chemical spills or tank overflows. The collected chemical drain effluent would be routed to the waste neutralization system for pH adjustment. Wastewater containing oils (e.g., stormwater runoff, equipment washdown water) would be collected in an oily wastewater sump, and an oil/water separator would remove the oils. Domestic and sanitary wastewater generated by operations personnel would be discharged to a new septic system that would be constructed near the new facilities (OUC 2006).

Chemical wastes would be generated from periodic cleaning of the HRSG and turbines. These wastes would consist of alkaline and acidic cleaning solutions, turbine washwaters, and HRSG washwaters. These wastes likely would contain high concentrations of heavy metals. Chemical cleaning would be conducted by outside contractors who would be responsible for removal of associated waste products from the site.

2.1.6.3 Solid Wastes

Construction

During construction of the proposed facilities, potential waste could include metal scraps, electrical wiring and cable, surplus consumable materials (e.g., paints, greases, lubricants, and cleaning compounds), packaging materials, and office waste. However, much of these materials would be retained at the Stanton Energy Center for future use, and the recyclable paper would periodically be collected and transferred to environmental waste recycling facilities. Metal scraps unsuitable for use at the Stanton Energy Center would be sold to scrap dealers, while the other remaining materials would be collected in dumpsters and periodically trucked off the site by a waste management contractor for disposal in a licensed landfill. These other materials would include packaging material (e.g., wooden pallets and crates), support cradles used for shipping of large vessels and heavy components, and cardboard and plastic packaging.

No hazardous waste generation is anticipated during construction. If any hazardous waste, as defined under the Resource Conservation and Recovery Act (RCRA), were generated as a result of project construction, such small quantities would be handled in accordance with standard procedures currently employed at the Stanton Energy Center.

Operation

During operation of the proposed facilities, the primary solid wastes or byproducts would be gasification ash and elemental sulfur. The gasification process would produce approximately 9 tons per hour of gasification ash from accumulation of noncombustible mineral material originally present in the coal. Based on an 85% capacity factor (the expected percentage for the proposed IGCC facilities), about 68,000 tons of ash would be produced annually. The ash, which would be a fine powder sized at about 15 to 20 µm, would be removed from the gasifier and high-temperature, high-pressure filters and stored in an adjacent silo. Prior to ash transfer, water would be added to the ash at a ratio of approximately one to one (by weight) to moisten the ash and minimize dust emissions.

Test results using ash samples from the research facility near Wilsonville, Alabama, indicate that the gasification ash would meet all regulatory requirements for nonhazardous material (i.e., toxicity, ignitability, corrosivity, and reactivity). Therefore, the ash would not be classified as hazardous, and disposal requirements would be similar to requirements for fly ash. Table 2.1.4 characterizes the composition of the gasification ash on a dry basis.

Table 2.1.4. Expected characteristics of gasification ash generated by the proposed Orlando Gasification Project

Characteristic	Percent by weight
Proximate	
Volatiles	10.3
Fixed carbon	24.9
Ash	64.6
Sulfur	0.2
Ultimate	
Carbon	33.1
Hydrogen	0.4
Nitrogen	0.2
Oxygen	1.6
Sulfur	0.2
Ash	64.6
Ash mineral as oxide	
Silicon dioxide	39.7
Aluminum oxide	13.9
Calcium oxide	27.8
Magnesium oxide	9.4
Sodium monoxide	1.3
Potassium monoxide	0.8
Iron oxide	5.2
Titanium dioxide	1.1
Phosphorus pentoxide	0.8

Three options for management of the gasification ash are possible: (1) combining the ash with coal entering the existing Units 1 and/or 2 for combustion in the boilers, (2) marketing the ash as a useful byproduct, and (3) transporting the ash for disposal in the onsite landfill. Because the gasification ash would have a heating value of approximately 4,000 Btu/lb, the ash could be combusted in Units 1 and/or 2. The ash would be pneumatically conveyed to the existing units. Because the amount of gasification ash would be a small percentage of the coal combusted in the boilers, it should not affect either marketability or disposal requirements of the combustion ash from the existing units. The addition of the gasification ash would reduce the coal feed rate to the total of both existing units by about 1% from approximately 350 tons per hour to 347 tons per hour.

If combusting the gasification ash in the existing Units 1 and 2 were not viable, the ash could be sold commercially to reduce the amount sent to the onsite landfill. Potential commercial applications include using the ash as a source for activated carbon and as a fuel source for the cement industry. Evaluation of the ash as an activated carbon source revealed that its characteristics are similar to those of commercial carbons. Potential use of the ash for higher-grade activated carbon would be possible following beneficiation by chemical activation and acid washing. Evaluation of the ash as a fuel source for the cement industry revealed the potential for the ash to be mixed with the raw material in a cement kiln. Because the offsite transport of gasification ash for commercial applications would require approximately 160 truck loads per week, rail transport would be investigated as an alternative. Any gasification ash not used for combustion in the existing units or sold as a marketable byproduct would be trucked to the onsite landfill.

The gas cleanup system would produce approximately 760 lb per hour of 99% pure elemental sulfur, which would be stored in an adjacent silo sized to hold a 30-day supply. Based on an 85% capacity factor for the proposed IGCC facilities, about 2,800 tons of sulfur would be produced annually. About three truck loads per week would be required to transport the sulfur off the site for commercial applications. If the sulfur could not be sold, it would be trucked for disposal in the onsite landfill.

Other solid wastes would include solids from water and wastewater treatment systems (e.g., sour water treatment), demineralizer resin beds, used air inlet filters, and other maintenance-related wastes such as rags, broken and rusted metal and machine parts, defective or broken electrical materials, and empty containers. Nonhazardous wastes would be transported off the site for disposal in a licensed landfill. Any waste determined to be hazardous under RCRA regulations would be transported off the site by a licensed contractor to a RCRA-permitted treatment and disposal facility or returned to the manufacturer for treatment and recycling (Section 2.1.6.4).

In addition to process wastes, solid wastes generated during facility operation would include used office materials and packaging materials. The disposition of these items would be similar to that discussed previously for these materials during the construction period.

2.1.6.4 Toxic and Hazardous Materials

Operation of the proposed facilities would involve potentially toxic or hazardous materials and wastes generated during operation, including waste paints, solvents, oils, and empty material containers. Hazardous wastes generated during operation would be removed from the site by a waste management contractor at regular intervals and trucked to authorized facilities for disposal.

Approximately 1 ton per hour of anhydrous ammonia (99.7% pure) would be produced as a byproduct of the gasification process and stored in an adjacent tank. Based on an 85% capacity factor for the proposed IGCC facilities, about 7,300 tons of ammonia would be produced annually. The existing onsite selective catalytic reduction systems on Units 2 and A would be consumers of the ammonia produced by the proposed facilities. However, even assuming the proposed facilities were the sole supplier of ammonia for these onsite systems, about 1,600 lb per hour would not be needed and would be transported off the site by truck or rail to be sold commercially. If shipped by truck, approximately six trucks per week would be required. The current once-weekly truck delivery of anhydrous ammonia to the site for use by the existing systems would no longer be needed.

Alumina-based catalysts used to convert carbonyl sulfide to hydrogen sulfide for sulfur removal would be regenerated and reused if possible. Approximately 2,000 ft^3 of these catalysts would require replacement about once every 3 years. Approximately 3,400 ft^3 of sulfur-impregnated activated carbon used for mercury removal would be replaced about once every 12 to 18 months. This mercury sorbent would likely be considered as hazardous waste. Approximately 3,400 ft^3 of activated carbon used for sour water treatment would be landfilled about once per month. Used oils collected from the oil/water separator, spent lubricating oils, and used oil filters from the gas combustion turbine would be transported off the site by an outside contractor for recycling or disposal. Potential sulfur removal chemicals used by the proposed facilities would be characterized for waste treatment requirements. Any waste determined to be hazardous under RCRA regulations would be transported off the site by a licensed contractor to a RCRA-permitted treatment and disposal facility or returned to the manufacturer for treatment and recycling.

The facilities would implement a program to reduce, reuse, and recycle materials to the extent practicable. All light bulbs would be treated as hazardous waste and transported to properly licensed facilities for disposal. The facilities would have a Spill Prevention, Control, and Countermeasures Plan (SPCCP) (40 CFR Part 112) addressing the accidental release of materials to the environment.

2.2 RELATED ACTION

In addition to the proposed Orlando Gasification Project, Southern Company and OUC plan to construct and operate a combined-cycle power-generating unit adjacent to the proposed project and integrate it with the proposed project to demonstrate IGCC technology. Synthesis gas produced by the proposed project would drive a gas combustion turbine, and hot exhaust gas from the gas turbine would generate steam from water to drive a steam turbine. Combined, the gas turbine and steam turbine would generate 285 MW (net) of electricity. This proven, reliable combined-cycle approach of using a gas turbine and steam turbine in tandem increases the amount of electricity that can be generated from a given amount of coal. The combined-cycle unit would include a heat recovery steam generator (HRSG) and associated auxiliary and control systems. Figure 2.2.1 provides a schematic of the combined-cycle system, including the gas combustion turbine, steam turbine, HRSG, and other key components.

The gas turbine would convert energy stored in the synthesis gas into mechanical energy using compressed hot gas (i.e., air and products of combustion) as the working medium. The gas turbine would deliver mechanical energy using a rotating shaft to drive an electrical generator, thereby converting a portion of the mechanical output to electrical energy. Initially, ambient air would be filtered and then compressed by the gas turbine's compressor section, which would increase the pressure of the combustion air stream and also raise its temperature. The compressed combustion air would then be combined with synthesis gas, which would be ignited in the gas turbine's high-pressure combustor to produce hot exhaust gases. These high-pressure, hot gases would expand and drive the turbine section to produce rotary shaft power and electricity.

The heat in the gas turbine's exhaust gases would be used to generate steam from water in an HRSG. The HRSG would be equipped with natural gas-fired duct burners to boost power generation capability during periods of peak demand. The steam would be used to drive a steam turbine and generator to produce additional electricity. The HRSG would be constructed to allow only combined-cycle operation (i.e., the gas turbine would not have a bypass stack allowing simple-cycle operation of the gas turbine alone).

High-pressure superheated steam from the synthesis gas cooler and the HRSG would enter the steam turbine. Steam exhausted from the high-pressure portion of the steam turbine would be reheated in the HRSG, expanded through the intermediate- and low-pressure portions of the steam turbine, and then condensed. The combined-cycle unit would be equipped with a 6-cell wet mechanical-draft cooling tower to provide the cooling necessary to condense the steam.

Construction and installation of the combined-cycle facilities would be completed approximately 6 months prior to gasifier completion and integration of the facilities. The gas turbine would be capable of operating on either natural gas or synthesis gas. During occasions when synthesis gas would not be available (e.g., during gasifier startups and outages), the gas turbine would use natural gas.

The combined-cycle facilities are not part of DOE's proposed action and would be built without DOE funding regardless of DOE's decision on providing cost-shared funding for the proposed project. While the proposed project consists of the gasifier, synthesis gas cleanup systems, and supporting infrastructure only, the EIS will address the construction and operation of the combined-cycle unit as a related action and include the combined facilities in the analyses of environmental impacts because the facilities are so intertwined.

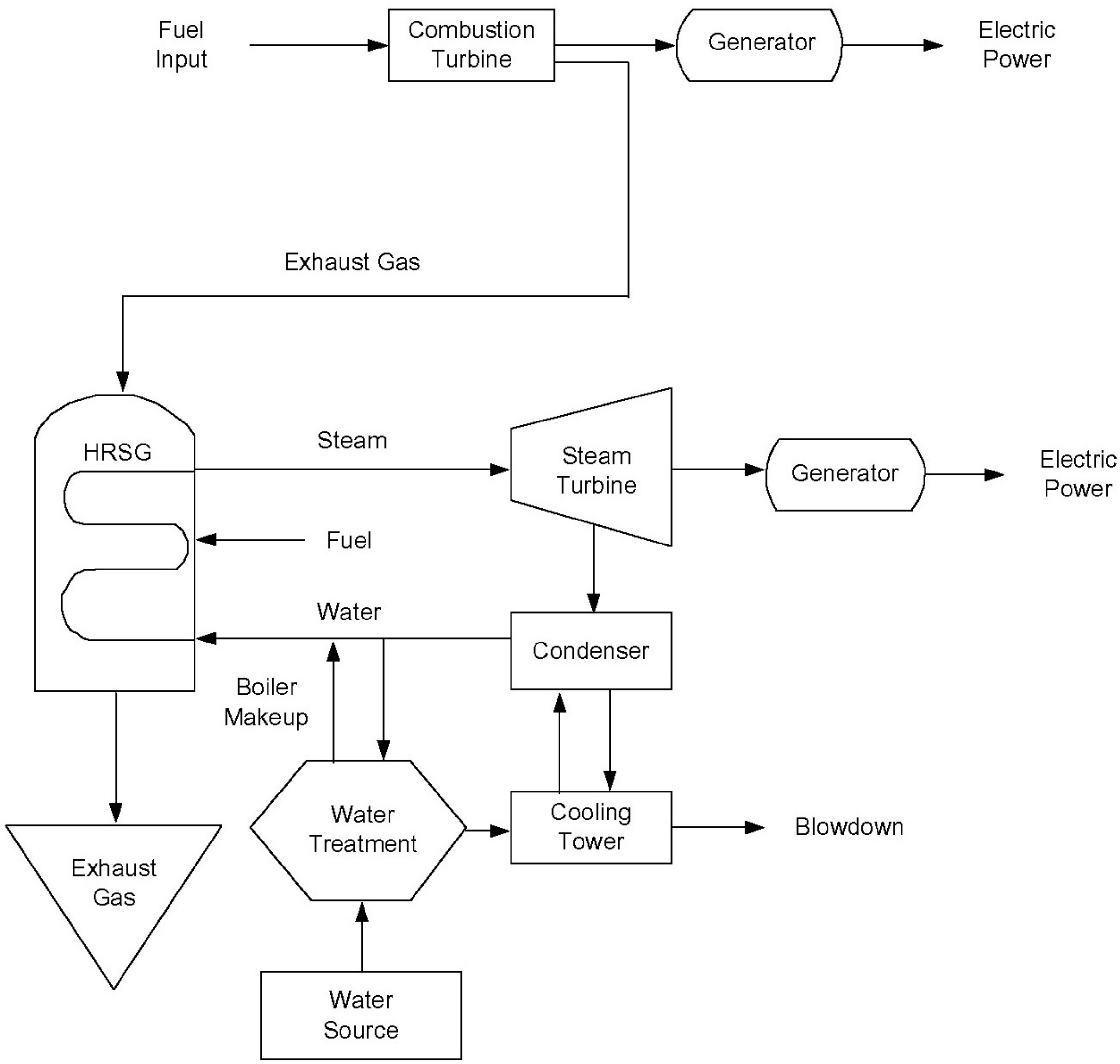

Figure 2.2.1. Schematic of the combined-cycle system, including the gas combustion turbine, steam turbine, heat recovery steam generator (HRSG), and other key components.

2.3 ALTERNATIVES

The goals of a federal action establish the limits of reasonable alternatives under the NEPA process. Congress established the CCPI Program with a specific goal— to accelerate commercial deployment of advanced coal-based technologies that can generate clean, reliable, and affordable electricity in the United States. DOE's purpose in considering the proposed action (to provide cost-shared funding) is to meet the goal of the program by demonstrating the viability of the proposed project (i.e., coal gasification, synthesis gas cleanup systems, and supporting infrastructure, which would be integrated with the related action's combined-cycle power-generating unit to form IGCC technology). Reasonable alternatives to the proposed action must be capable of meeting this purpose [however, CEQ NEPA regulation 40 CFR Part 1502.14(d) requires the alternatives analysis in the EIS to include the no-action alternative].

Congress directed DOE to pursue the goals of the legislation by providing partial funding for projects owned and controlled by non-federal-government participants. This statutory requirement places DOE in a much more limited role than if the federal government were the owner and operator of the project. In the latter situation, DOE would typically review a wide variety of reasonable alternatives to the proposed action. However, in dealing with a non-federal applicant, the scope of alternatives is necessarily more restricted, and DOE gives substantial weight to the needs of the proposer in establishing reasonable alternatives to the proposed action. Moreover, under the CCPI Program, DOE's role is limited to approving or disapproving the project as proposed by the participant.

Thus, the only alternative to the proposed action that has not been dismissed from further consideration is the no-action alternative (Section 2.3.1).

2.3.1 No-Action Alternative

Under the no-action alternative, DOE would not provide cost-shared funding for the design, construction, and demonstration of the proposed Orlando Gasification Project at OUC's Stanton Energy Center near Orlando, Florida. Without DOE participation, Southern Company and/or OUC could reasonably pursue at least one option. The combined-cycle facilities could be built at the Stanton Energy Center without the gasifier, synthesis gas cleanup systems, and supporting infrastructure.

The combined-cycle facilities would operate using natural gas as fuel without the availability of synthesis gas. Consequently, commercialization of the gasification facilities (alone or integrated with the combined-cycle facilities to form IGCC technology) would probably not occur because utilities and industries tend to use known and demonstrated technologies rather than unproven technologies. Employment associated with the combined-cycle facilities would be provided for construction workers and facility operators, but no employment would be provided associated with the proposed project. The associated construction-related traffic would also be reduced in terms of both duration and total volume as compared to the proposed Orlando Gasification Project. Approximately the same amount of electricity would be produced from operation of the combined-cycle unit fired on natural gas. The 3,200-ft transmission line would still be constructed and installed to serve as an electrical interconnection to an existing onsite substation.

Atmospheric emissions would be less than those from the proposed project (based on air emissions displayed in Table 2.1.1 for the existing natural gas-fired combined-cycle Unit A). No gasification ash, elemental sulfur, or anhydrous ammonia would be produced. The Stanton Energy Center's existing units would continue to operate without change. This scenario would not contribute to the CCPI Program goal of accelerating commercial deployment of advanced coal-based technologies that can generate clean, reliable, and affordable electricity in the United States.

2.3.2 Alternatives Dismissed from Further Consideration

The following sections discuss alternatives that were initially identified and considered by DOE or the project participant. The project as proposed meets the needs outlined in the CCPI solicitation that was issued by DOE in February 2004 (Section 1.2). Factors considered in DOE's project selection process included the desirability of projects that collectively represent a diversity of technologies, utilize a broad range of U.S. coals, and represent a broad geographical cross-section of the United States. Otherwise, DOE did not constrain the proposals with regard to site or technology.

The proposals included responses to a DOE environmental questionnaire (Section 1.5). The responses contained discussions of the site-specific environmental, health, safety, and socioeconomic issues associated with each project. Based on the evaluation criteria discussed in Section 1.2, including consideration of environmental implications, DOE selected 4 projects, including the proposed project, for possible cost-shared financial assistance.

Because DOE's role would be limited to providing cost-shared funding for the selected project, DOE is limited to either accepting or rejecting the project as proposed by the participant, including the proposed technology and site. As such, reasonable alternatives to the proposed project are narrowed and the following alternatives have been dismissed from further consideration.

2.3.2.1 Alternative Site

No other sites to host the proposed project were given detailed consideration or evaluation by Southern Company team members during their site selection process. During the preparation of previous proposals for similar efforts to commercialize the gasification technology, Southern Company initially considered other sites, including undeveloped sites and co-location with existing power plants in Alabama, New Mexico, Florida, North Dakota, and Pennsylvania. However, because the Stanton Energy Center is an existing site at which the private partners have already established a business relationship, the Stanton Energy Center was the only location identified in their proposal responding to DOE's second-round CCPI solicitation. The site closely meets the proposed project's technical needs, and the project would easily integrate with existing infrastructure (e.g., roads, rail loop, electrical transmission lines). The site avoids the additional cost associated with construction of facilities and infrastructure at an undeveloped site. The environmental impacts likely would be much greater at a site without existing infrastructure than at the Stanton Energy Center. Based on the above considerations, other sites are not reasonable alternatives and are not evaluated in this EIS.

2.3.2.2 Alternative Configuration

Under this alternative, the proposed Orlando Gasification Project would be integrated with the existing Stanton A combined-cycle unit, which would require retrofitting Stanton A to combust synthesis gas. Under this scenario, the planned new combined-cycle unit would still be built, but probably would operate as a natural gas-fired unit. The same gasifier and support facilities would be constructed in nearly the same location, with independent construction of the same planned combined-cycle unit in essentially the same location on essentially the same schedule. After construction, the Stanton Energy Center would host one natural gas-fired combined-cycle unit and one IGCC facility under both the preferred alternative and the alternative configuration scenario. Thus, the alternative configuration would result in impacts essentially indistinguishable from the preferred alternative (with the possible exception of slightly additional impacts associated with retrofitting Unit A). Southern Company ultimately rejected this alternative because integration of the proposed Orlando Gasification Project with the new combined-cycle unit would avoid retrofitting issues and would promote design efficiencies. Therefore, DOE has determined that this is not a reasonable alternative.

2.3.2.3 Alternative Size

Demonstration of the proposed project using a smaller-size plant has been dismissed as not reasonable. The design size for the proposed project was selected because it is sufficiently large to show potential customers that the gasification technology, once demonstrated at this scale, could be applied commercially without further scale-up. A demonstration indicating that the performance and cost targets are achievable at this scale would convince potential customers that the gasification technology is not only feasible but economically attractive (Section 1.4). A smaller-sized plant would not be sufficiently large to demonstrate the commercial viability of the technology, nor would a smaller-sized plant meet OUC’s projected need for power.

2.3.2.4 Alternative Technologies

Other technologies have been dismissed as not reasonable. The proposed project was selected to demonstrate coal gasification, synthesis gas cleanup systems, and supporting infrastructure, which would be integrated with the related action’s combined-cycle power-generating unit to form IGCC technology. Other CCPI projects were selected to demonstrate other coal-based technologies. The projects selected for demonstration under the CCPI Program are not considered alternatives to each other.

The use of other technologies and approaches that are not applicable to coal (e.g., natural gas, wind power, solar energy, and conservation) would not contribute to the CCPI Program goal of accelerating commercial deployment of advanced coal-based technologies that can generate clean, reliable, and affordable electricity in the United States. Furthermore, DOE has no authority to spend funds on alternative technologies that have been appropriated by Congress for the CCPI Program. However, DOE continues to allocate more funding for energy efficiency and renewable energy than for any other energy activity (i.e., a budget request of $1.2 billion in Fiscal Year 2006).[1] DOE distributes this financial support to demonstrate alternative technologies, such as solar energy, through other comprehensive programs. DOE's Solar Energy Technologies Program sponsors efforts to research, develop, and deploy cost-effective technologies toward increasing the use of solar energy. For example, under the Million Solar Roofs Initiative, which began in 1997, solar energy systems are being installed on homes with the goal of one million home installations by 2010.

[1] Fiscal Year 2006 Budget in Brief at http://www.eere.energy.gov

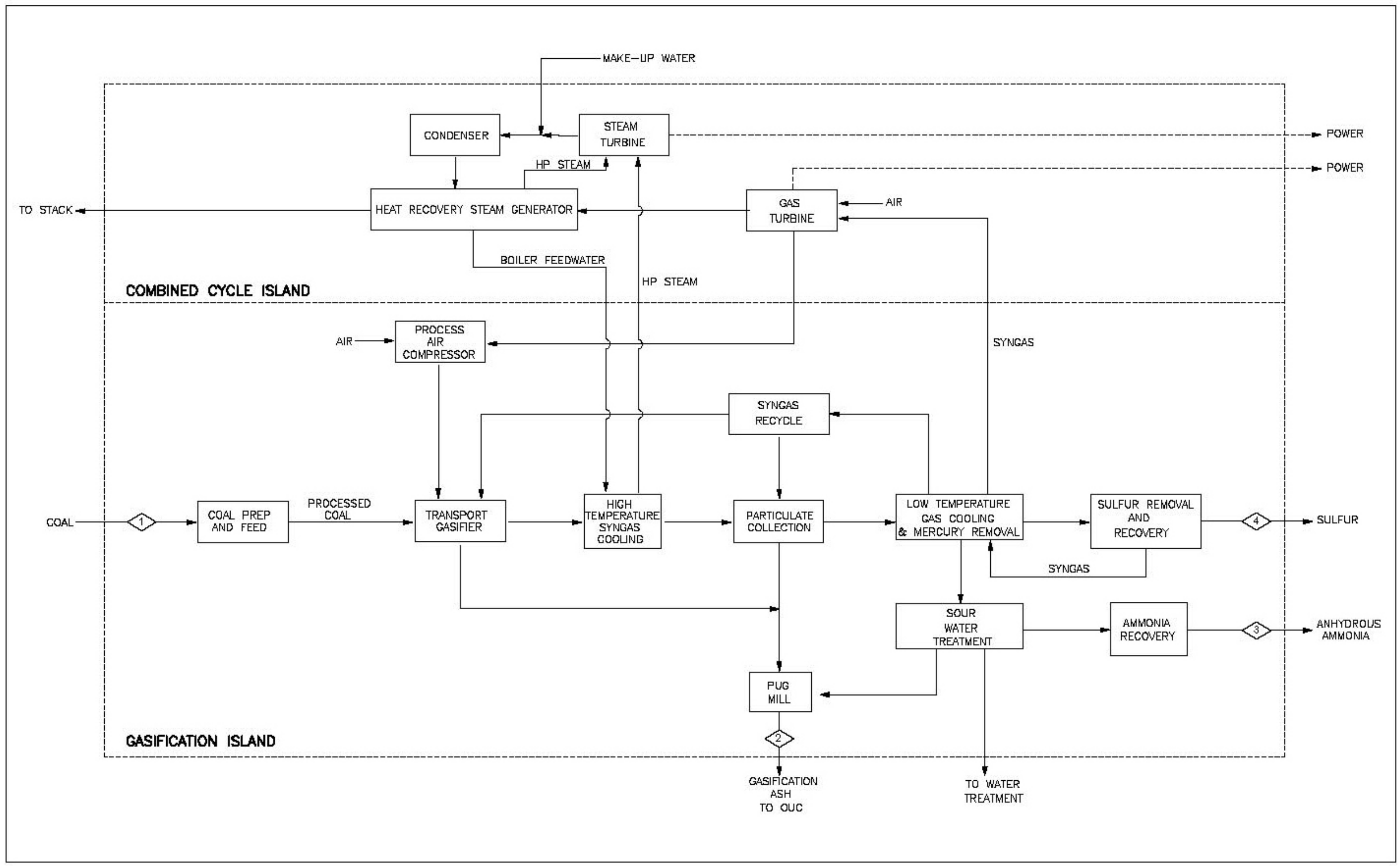

Figure 2.1.3. Process flow diagram of the proposed project and its integration with the combined-cycle unit.

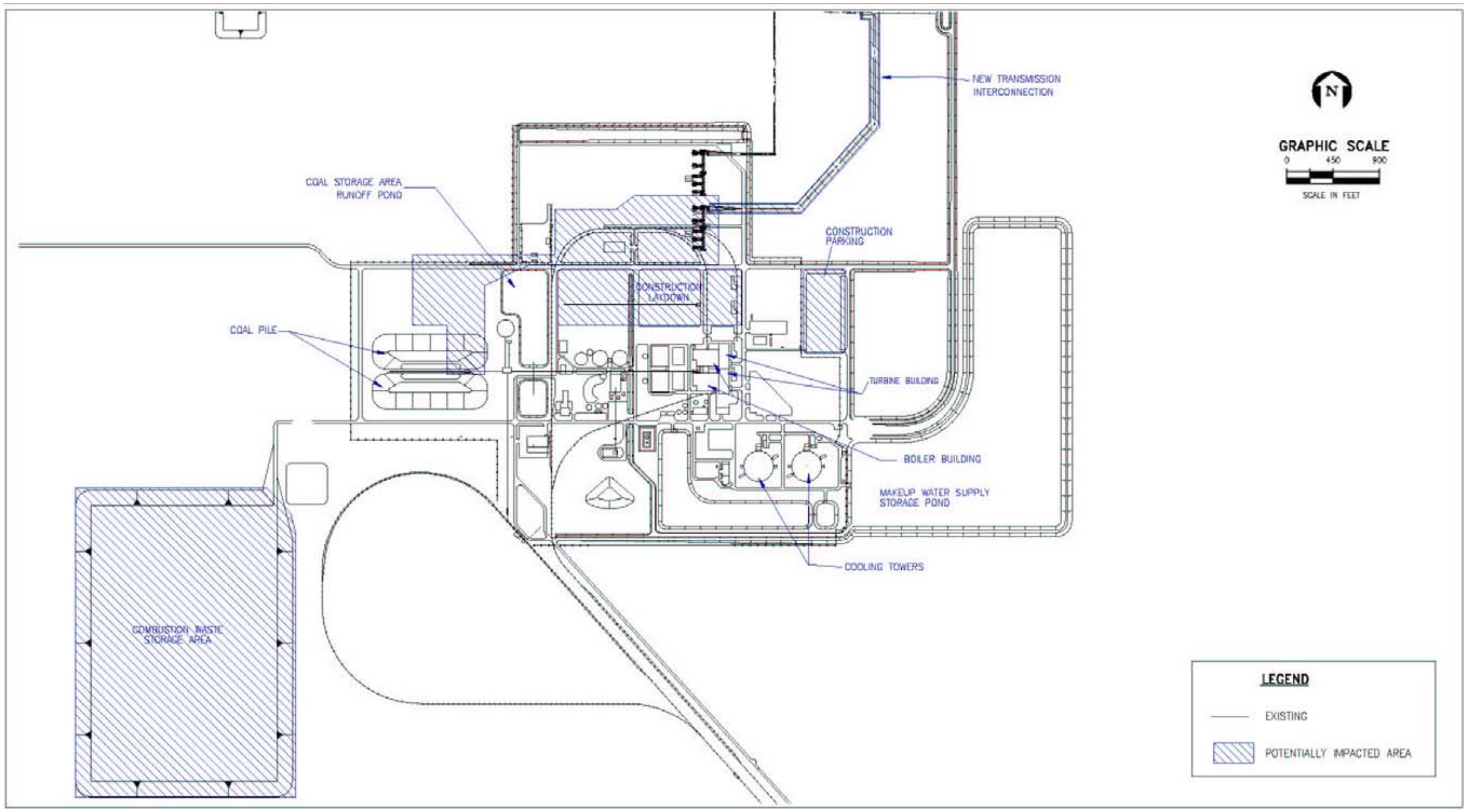

Figure 2.1.7. Preliminary layout of the proposed facilities within the Stanton Energy Center site.

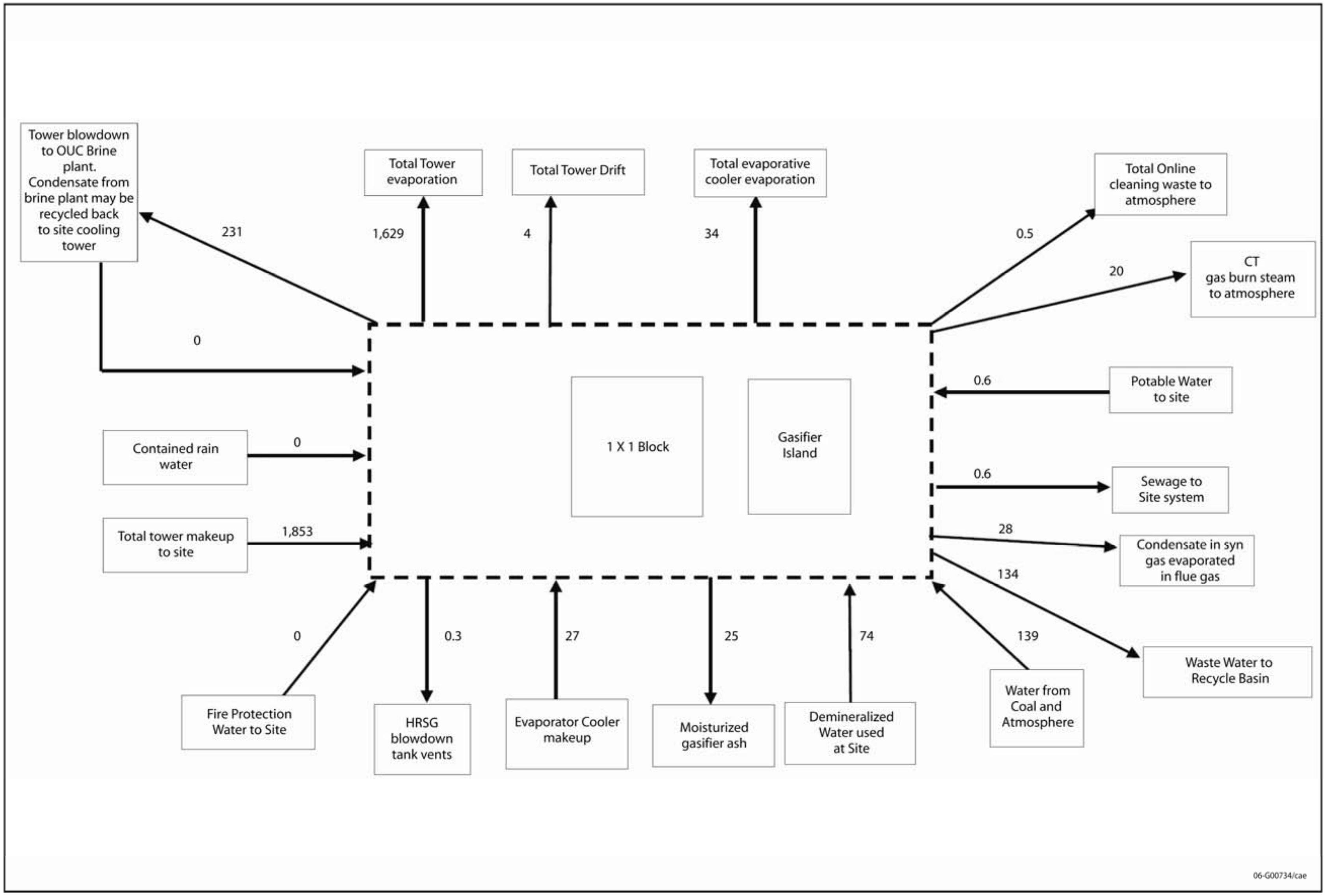

Figure 2.1.8. Simplified water balance diagram for the proposed facilities (flows in gpm).

3. EXISTING ENVIRONMENT

3.1 SITE DESCRIPTION, LAND USE, AND AESTHETICS

3.1.1 Site of the Proposed Facilities

The proposed project would be located on a 35-acre portion of OUC's existing 3,280-acre Stanton Energy Center in eastern Orange County near Orlando, Florida (Figure 2.1.1 and Figure 2.1.2). The project equipment would be situated between the existing coal-fired units and the existing natural gas-fired combined-cycle unit. The nearly level site is located approximately 3 miles east of the eastern city limits of Orlando and about 13 miles east-southeast of the downtown area.

3.1.2 Land Use

The Stanton Energy Center is located in an unincorporated portion of Orange County. Land use in the vicinity includes a mixture of undeveloped and developed areas. The area north of the power plant has experienced much residential development in the past 10 years. Figure 2.1.2 (the aerial photograph of the site and surrounding area) provides a recent characterization of land use in the vicinity. The 8,427-acre Hal Scott Regional Preserve and Park, which borders the Stanton Energy Center to the east, is public land managed by the St. Johns River Water Management District for public recreation. No other sensitive land use, including prime or unique farmland or wild and scenic rivers, is present in the vicinity of the Stanton Energy Center.

The Florida Department of Corrections' Central Florida Reception Center, which borders the power plant to the southeast, is a three-unit correctional facility with a total capacity of 2,520 inmates. Other areas south of the Stanton Energy Center are undeveloped, both north and south of State Route 528 (the BeeLine Expressway) (Figure 2.1.1). However, much of this land is included in a planned development known as the International Corporate Park, which as originally approved would include over 12 million ft^2 of industrial/office use, 240,500 ft^2 of retail/service use, and 321 hotel rooms. Changes to the planned development were recently being considered that would decrease industrial/office use to approximately 4 million ft^2, increase retail/service use to 410,000 ft^2, and add 3,440 residential dwelling units and 10,000 ft^2 of civic space. However, these changes have been withdrawn pending completion of Orange County's Southeast Sector Study (scheduled for 2006).

The 4,800-acre Orange County Sanitary Landfill borders the power plant to the west. The area between the landfill and State Route 408 to the north is primarily undeveloped. The area immediately north of the Stanton Energy Center, which currently is undeveloped, is known as the Morgan Planned units, 496 townhouses, 670 multifamily units, and 120,000 ft^2 of commercial use. The Morgan Planned Development would also have designated wetlands, parklands, and upland buffers.

Residential developments have recently been built or planned north of the Morgan Planned Development. The nearest development to the Stanton Energy Center is a Development of Regional Impact known as Avalon Park, which would include 3,400 single-family units, 1,431 multifamily units, 221,710 ft^2 of office use, 221,260 ft^2 of commercial use, 185,000 ft^2 of industrial use, 300 hotel rooms, and an elementary school and middle school. To date, subdivision plan and site development approvals have been granted for all of the single-family units, 299 of the multifamily units, and 176,620 ft^2 of the office, commercial, and industrial use (East Central Regional Planning Council 2004). Although Avalon Park was originally scheduled for completion in 2007, this date has been extended by about 5 years.

Orange County has proposed a four-lane extension of Avalon Park Boulevard from north of the Stanton Energy Center, which would run along the plant's western boundary and connect with the BeeLine Expressway to the south (Section 3.7.7.1). This expansion/extension project, which is scheduled for completion by 2008, would likely result in residential development in the Morgan Planned Development north of the Stanton Energy Center and industrial and commercial development in the International Corporate Park south of the power plant.

3.1.3 Aesthetics

Because the site is located within the existing Stanton Energy Center, the visual landscape is conspicuously marked with structures of an industrial character, including the boiler buildings, turbine buildings, stacks, administration building, scrubbers, electrostatic precipitators, natural- and mechanical-draft cooling towers, electrical transmission lines, and other associated infrastructure. The tallest structures are the two 550-ft stacks serving Units 1 and 2, the two 431-ft natural-draft cooling towers serving Units 1 and 2, the 225-ft Unit 1 and 2 boiler buildings, and the two 160-ft Unit A stacks. A buffer of predominantly forested land is provided by the undeveloped 2,180 acres of the Stanton Energy Center site, and a similar buffer is provided by many acres of the surrounding offsite land. The power plant is visible from part of the surrounding local area, depending on the viewing distance, the extent of vegetation to visually screen the facilities from specific viewpoints, and the presence of offsite structures to block the view from specific viewpoints. In general, the 550-ft stacks and 431-ft cooling towers are the only onsite structures that can be seen from nearby homes. Emissions including water droplets from the stacks and plumes of water droplets from the cooling towers are occasionally visible.

3.2 CLIMATE AND AIR QUALITY

3.2.1 Climate

The climate of central Florida is characterized as subtropical. Seasonal variations in temperature and humidity are moderated by the influence of the Gulf of Mexico to the west and the Atlantic Ocean to the east. Summers are warm to hot, humid, and long. Average daily maximum and minimum temperatures occurring in Orlando during the summer months are 91 and 73°F, respectively, with relatively humidity ranging from about 90% during the night and early morning to about 60% in the afternoon. Generally, winters are quite temperate and less humid. The region periodically experiences the passage of weak cold fronts, which in rare instances produce a frost. Average daily maximum and minimum temperatures occurring in Orlando during the winter months are 73 and 49°F, respectively. The record maximum and minimum temperatures measured in Orlando during the period 1944–2004 are 102 and 19°F, respectively. On average, fog occurs 28 days annually with a greater frequency during the winter months.

Average annual precipitation is approximately 48 in., with a seasonal distribution ranging from around 2 in. during each of the winter months to around 7 in. during each of the summer months. Rainfall during the winter months results primarily from the passage of frontal systems. The large amount of summer rainfall is attributed to strong afternoon thunderstorms that can become extremely intense at times. During the period 1950–95, 49 tornadoes were reported in Orange County.

No meteorological stations are located at the Stanton Energy Center. Winds at Orlando International Airport, located about 8 miles southwest of the power plant, average about 7.5 mph. The airport wind rose for the period 1996–2000 is shown in Figure 3.2.1. On an annual basis, the predominant winds are from the northeastern quadrant; however, prevailing wind direction varies appreciably with the seasons. Winter winds are predominantly from the north, winds during the spring are quite evenly distributed with winds from the east-southeast being slightly more dominant, winds during the summer prevail from the southwest quadrant, and winds during the fall are strikingly from the northeast quadrant. Because the terrain in the area is relatively flat and homogeneous, wind patterns would likely be very similar at the Stanton Energy Center.

During the period 1900–2004, the center of 43 hurricanes (maximum winds of at least 74 mph) or tropical storms (maximum winds between 39 and 73 mph) passed within 75 miles of Orlando. Based on this same period, the probability of a hurricane passing within 75 miles of Orlando in any given year is approximately 20% and within 25 miles of Orlando in any given year is about 4%.

Hurricane activity in central Florida was extreme in 2004. The centers of three hurricanes (Charley, Frances, and Jeanne) passed within 75 miles of Orlando. Maximum sustained winds recorded at Orlando International Airport for Charley, Frances, and Jeanne were 80 (before instrument failure), 54, and 61 mph, respectively. During Charley, the airport recorded maximum wind gusts up to 105 mph before instrument failure (Pasch, Brown, and Blake 2005). Prior to the arrival of Charley, the Stanton Energy Center hurricane preparedness plans were implemented to secure the facilities and safeguard employees. The resulting impact of this storm on the structures at the power plant was minimal. The electrical generating units remained online throughout the period, responding to load demand as the hurricane crossed through the service area. As a result of the 2004 hurricane season, OUC has updated the plant's hurricane preparedness plans to further protect the facilities and employees from the potential effects of future hurricanes.

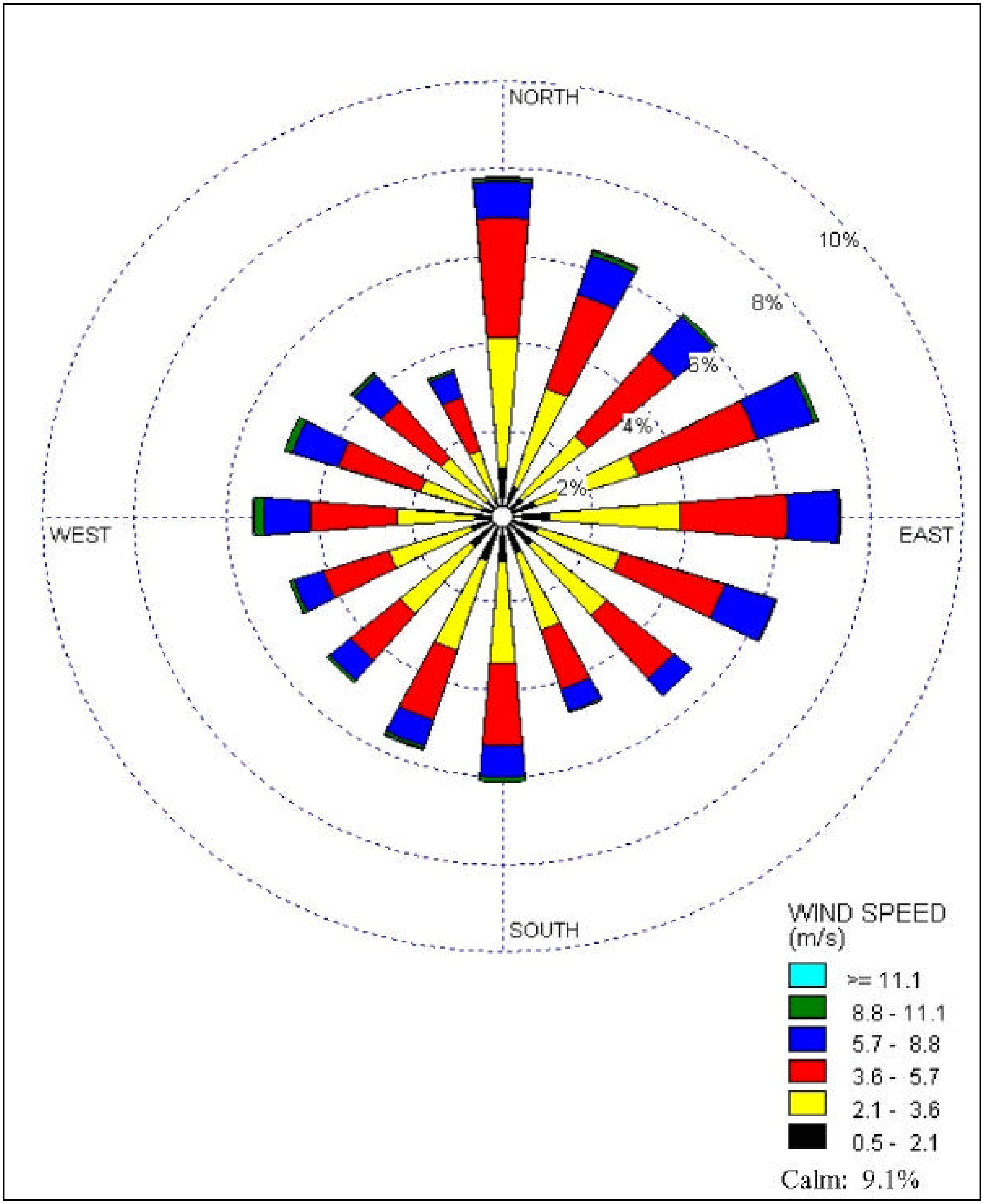

Figure 3.2.1. Wind rose for Orlando International Airport, located about 8 miles southwest of the Stanton Energy Center, for the period 1996–2000.

The height above ground to which appreciable vertical atmospheric mixing occurs (the mixing height) is an important factor influencing atmospheric dispersion of pollutants. If mixing height and wind speed are both very low, atmospheric dispersion of pollutants is limited and the meteorological potential for air quality deterioration is high. Such conditions are rare in Orlando; according to Holzworth (1972), less than one day per year (on average) has a high meteorological potential for air quality deterioration.

3.2.2 Air Quality

Criteria pollutants are defined as those for which National Ambient Air Quality Standards (NAAQS) exist. These pollutants are sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), carbon monoxide (CO), lead (Pb), and particulate matter less than or equal to 10 μm in aerodynamic diameter, designated PM-10. The U.S. Environmental Protection Agency (EPA) has also promulgated NAAQS for particulate matter less than or equal to 2.5 μm in aerodynamic diameter (PM-2.5) (62 *FR* 38652), and a new 8-hour NAAQS for O_3 to replace the 1-hour O_3 standard (62 *FR* 38856).

The NAAQS are expressed as concentrations of pollutants in the ambient air; that is, in the outdoor air to which the general public has access [40 CFR Part 50.1(e)]. Primary NAAQS define levels of air quality that EPA deems necessary, with an adequate margin of safety, to protect human health. Secondary NAAQS are similarly designated to protect human welfare by safeguarding environmental resources (such as soils, water, plants, and animals) and manufactured materials. Florida standards are the same as the NAAQS except for SO_2 annual and 24-hour standards, for which the Florida standards are more stringent. The applicable (most stringent) standards are presented in Table 3.2.1. The entire state of Florida, including Orange County, is in attainment with NAAQS and state ambient air quality standards for all pollutants, including the recently implemented PM-2.5 and 8-hour O_3 standards.

Attainment status for NAAQS is determined primarily by evaluating data from ambient air quality monitoring stations. Table 3.2.1 provides a summary of air quality data at the monitoring stations in Orange County for the period 2000–2004. All concentrations were within the applicable standards. Pb concentrations have not been monitored in recent years because Pb concentrations have been well below NAAQS, largely due to the decreased use of leaded gasoline in automobiles.

In addition to ambient air quality standards, which represent an upper bound on allowable pollutant concentrations, national air quality standards exist for Prevention of Significant Deterioration (PSD) (40 CFR Part 51.166). The PSD standards differ from the NAAQS in that the NAAQS specify maximum allowable concentrations of pollutants, while PSD requirements provide maximum allowable increases in concentrations of pollutants for areas already in compliance with the NAAQS. PSD standards are therefore expressed as allowable increments in the atmospheric concentrations of specific pollutants. Allowable PSD increments currently exist for three pollutants (SO_2, NO_2, and PM-10). One set of allowable increments exists for Class II areas, which cover most of the United States, and a much more stringent set of allowable increments exists for Class I areas,

Table 3.2.1. Summary of air quality data in Orange County for 2000–04

Pollutant	City	Monitor location	Distance from site (miles)	Averaging period	Year	Ambient concentration (μg/m^3) 1[st] high	2[nd] high	Arithmetic mean	Standard[a]	Percent of Standard
PM-10	Winter Park	Morris Boulevard	14	24-hour	2000	46	39		150[b]	31
					2001	46	41			31
					2002	33	30			22
					2003	30	28			20
					2004	41	27			27
				Annual	2000			21	50[c]	42
					2001			20		40
					2002			17		34
					2003			18		36
					2004			18		36
	Orlando	North Primrose Avenue	12	24-hour	2000	37	37		150[b]	25
					2001	48	43			32
					2002	35	31			23
					2003	56	47			37
					2004	41	36			27
				Annual	2000			21	50[c]	42
					2001			22		44
					2002			18		36
					2003			20		40
					2004			19		38
		Sheriff's Department	15	24-hour	2000	48	44		150[b]	32
					2001	53	50			35
					2002	41	38			27
					2003	39	37			26
				Annual	2000			27	50[c]	54
					2001			23		46
					2002			23		46
					2003			21		42
PM-2.5	Winter Park	Morris Boulevard	14	24-hour	2000	35	34		65[d]	54
					2001	--	--			--
					2002	26	25			40
					2003	23	22			35
					2004	28	26			43
				Annual	2000			12	15[c]	79
					2001			11		71
					2002			10		63
					2003			9		62
					2004			10		66
	Orlando	North Primrose Avenue	12	24-hour	2000	35	34		65[d]	54
					2001	52	41			80
					2002	30	27			46
					2003	23	21			35
					2004	38	26			59
				Annual	2000			12	15[c]	80
					2001			11		73
					2002			10		65
					2003			9		63
					2004			10		67
SO_2	Winter Park	Morris Boulevard	14	3-hour	2000	110	71		1,300[e]	8
					2001	84	71			6
					2002	34	29			3
					2003	31	29			2
					2004	37	24			3

Table 3.2.1. Concluded

Pollutant	City	Monitor location	Distance from site (miles)	Averaging period	Year	Ambient concentration (µg/m3) 1st high	2nd high	Arithmetic mean	Standard[a]	Percent of standard
				24-hour	2000	34	24		260[e]	13
					2001	37	21			14
					2002	13	13			5
					2003	16	10			6
					2004	13	13			5
				Annual	2000			8	60[c]	13
					2001			5		9
					2002			3		4
					2003			3		4
					2004			3		4
NO_2	Winter Park	Morris Boulevard	14	Annual	2000			23	100[c]	23
					2001			23		23
					2002			21		21
					2003			21		21
					2004			19		19
CO	Winter Park	Morris Boulevard	14	1-hour	2000	8,571	8,571		40,000[e]	21
					2001	9,143	3,086			23
					2002	4,343	4,000			11
					2003	2,971	2,629			7
					2004	2,743	2,743			7
				8-hour	2000	5,371	2,743		10,000[e]	54
					2001	2,400	2,286			24
					2002	3,200	2,857			32
					2003	1,714	1,714			17
					2004	1,829	1,829			18
	Orlando	Orange Avenue	13	1-hour	2000	5,143	5,143		40,000[e]	13
					2001	4,800	4,343			12
					2002	5,143	5,029			13
					2003	3,886	3,657			10
					2004	4,686	3,086			12
				8-hour	2000	2,971	2,971		10,000[e]	30
					2001	2,743	2,400			27
					2002	3,314	2,857			33
					2003	2,286	2,286			23
					2004	2,171	2,057			22
O_3	Winter Park	Morris Boulevard	14	8-hour	2000	165[f]	159[f]		157[g]	98
					2001	159[f]	153[f]			95
					2002	153[f]	149[f]			94
					2003	149[f]	145[f]			N/A
					2004	151[f]	149[f]			N/A
	Orlando	Winegard Road	13	8-hour	2000	159[f]	155[f]		157[g]	96
					2001	153[f]	153[f]			94
					2002	147[f]	145[f]			92
					2003	145[f]	145[f]			N/A
					2004	147[f]	145[f]			N/A

[a]National Ambient Air Quality Standards, except for the more stringent Florida SO_2 annual and 24-hour standards.
[b]Attained when the expected number of days exceeding the standard is less than or equal to 1 per year.
[c]Arithmetic mean.
[d]Attained when the 98th percentile value, averaged over 3 years, is less than or equal to the standard.
[e]Not to be exceeded more than once per year.
[f]Monitored values represent 3rd and 4th highest 8-hour concentrations.
[g]Attained when the 3-year average of each year's 4th highest daily maximum 8-hour concentration is less than or equal to the standard.

which include many national parks and monuments, wilderness areas, and other areas as specified in 40 CFR Part 51.166(e). Allowable PSD increments for Class I and Class II areas are presented in Table 3.2.2. The PSD Class I area nearest to the Stanton Energy Center is Chassahowitzka National Wildlife Refuge, about 90 miles to the west-northwest on the Gulf of Mexico.

Table 3.2.2. Allowable increments for Prevention of Significant Deterioration (PSD) of air quality

Pollutant	Averaging period	Allowable increment ($\mu g/m^3$)	
		Class I[a]	Class II[b]
Sulfur dioxide (SO_2)	3-hour	25	512
	24-hour	5	91
	Annual	2	20
Nitrogen dioxide (NO_2)	Annual	2.5	25
Particulate matter less than 10 μm aerodynamic diameter (PM-10)	24-hour	8	30
	Annual	4	17

[a]Class I areas are specifically designated areas in which the degradation of air quality is to be severely restricted.
[b]Class II areas (which include most of the United States) have a less stringent set of allowable increments.

Contaminants other than the criteria pollutants are present in the atmosphere in varying amounts that depend on the magnitude and characteristics of the sources, the distance from each source, and the residence time of each pollutant in the atmosphere. In the ambient air, many of these pollutants are present only in extremely small concentrations, requiring expensive state-of-the-art equipment for detection and measurement. Measurements of existing ambient air concentrations for many hazardous pollutants are, at best, sporadic. No ambient air monitoring data are recorded in Orange County for mercury and beryllium, two hazardous pollutants that are evaluated in detail in Section 4.1.2.2. Regulation of hazardous air pollutants is attempted at emission sources based on the National Emissions Standards for Hazardous Air Pollutants (40 CFR Part 61; 40 CFR Part 63).

3.3 GEOLOGY AND SOILS

3.3.1 Physiography

The Stanton Energy Center is located in the Osceola Plain region of the Florida section of the Coastal Plain physiographic province. In general, the Osceola Plain is nearly level, varying from undulating to nearly flat, with a few shallow depressions associated with old marine sandbars or dissolution of underlying carbonate rocks. The depressions often lack surface outlets and may contain lakes or wetlands.

The Stanton Energy Center site is mostly flat, but slopes gently downward from southwest to northeast, with natural elevations ranging from approximately 92 ft msl in the southwest to 52 ft msl in the northeast. The 1,100-acre developed portion of the site was filled and leveled at approximately 80 ft msl during construction of Unit 1 in the 1980s.

The most prominent topographic features in the area are the Orange County Sanitary Landfill, bordering the power plant to the west, and the Stanton Energy Center combustion ash disposal facility, located on the western edge of the property.

3.3.2 Stratigraphy and Structure

Central Florida is underlain by a thick sequence of sediments deposited primarily in marine environments during the Cenozoic Era (i.e., approximately the last 65 million years). Regionally, surficial deposits consist primarily of unconsolidated quartz sand interbedded with layers of clay, freshwater marl, peat, and shell. These materials were deposited as alluvium, lake sediment, and windblown sand during the Pliocene, Pleistocene, and Recent epochs (approximately the last 5 million years). The surficial unit, which varies in thickness, is underlain by the Hawthorn Group, a variable sequence of interbedded sands and clayey sands, calcareous silts and clays, and phosphatic limestone and dolomite deposited during the Miocene epoch (approximately 5 to 24 million years ago).

The base of the Hawthorn Group rests on an erosional surface formed over a thick sequence of carbonate rocks of Eocene age (approximately 35 to 56 million years old) or older. In descending order, these rock units are the Ocala Limestone (late Eocene age), Avon Park Formation (middle Eocene; mostly limestone), Oldsmar Formation (early Eocene; limestone with interbedded dolomite), and the Cedar Keys Formation (Paleocene; primarily dolomite) (Murray and Halford 1996). The orientation of these rock layers is nearly flat, with a gentle eastward dip.

At the Stanton Energy Center, sand predominates to a depth of about 140 ft below the ground surface (i.e., to an elevation range of -56 to -79 ft msl). Two clay layers, one about 4-ft thick and the other 4- to 15-ft thick, are present within the sand under much of the site. A layer of cohesive sandy and silty clay, locally interbedded with sand, separates the sand from the underlying limestone bedrock. This cohesive layer ranges in thickness from 43 to 61 ft. Limestone bedrock is encountered about 200 ft below the ground surface at an elevation range of -121 to -135 ft msl.

3.3.3 Soils

Within the 1,100-acre developed area of the Stanton Energy Center site, the surface soil is sandy fill material to a depth of about 5 ft. Outside of the developed area, the principal soil types at the site include Smyrna fine sand, St. Johns fine sand, and Sanibel muck. All three soil types are nearly level and poorly drained, with severe limitations for building site development, sanitary facilities, and recreational use.

3.3.4 Geologic Hazards

The only geologic hazards with the potential to affect the Stanton Energy Center site are seismic (earthquake) activity and sinkhole formation. The potential for both types of hazards is low.

The Stanton Energy Center is in an area of low seismic activity. Florida is one of the lowest seismic hazard areas in the United States (USGS 2001, 2002). The only historical earthquake known to have caused damage in the state was an event in northeast Florida near St. Augustine in 1879, in which heavy shaking reportedly knocked plaster from walls and articles from shelves. Other seismic events affecting the state include an event in northwest Florida in 1780; a pair of 1880 earthquakes in Cuba that were detected in Key West; the Charleston, South Carolina, earthquake of 1886 that was felt throughout northern and central Florida; small shocks in Jacksonville in 1893 and 1900; and several other minor events in the mid-1900s. In central Florida, the peak horizontal seismic acceleration with an estimated 2% probability of occurrence over 50 years is 4 to 6% of the acceleration of gravity, which is unlikely to cause damage. Therefore, the potential for damage from a seismic event is minimal.

Most of Florida is prone to sinkhole formation because it is underlain by soluble carbonate rocks (limestone and dolomite). Slightly acidic natural water passing through void spaces in these types of rocks dissolves the carbonate minerals in the rock and gradually enlarges the voids. The resulting large cavities are efficient transmitters of water but also are potentially subject to collapse, forming sinkholes. Sinkhole collapse has caused major damage in the Orlando area, notably including a 1981 event in Winter Park in which a sinkhole the size of a city block formed within less than 24 hours. However, no sinkholes have been reported at the Stanton Energy Center site. The site is considered to have a low probability of sinkhole development because the carbonate aquifer is covered by very thick clastic overburden and the potentiometric surface in the carbonate aquifer is substantially above the top of the aquifer. Additionally, geotechnical investigations conducted before the Stanton Energy Center was built found only limited evidence of dissolution cavities (bedrock voids were encountered in only two of eight bedrock borings), supporting the conclusion that the potential for sinkholes is very low.

3.4 WATER RESOURCES

The climate of central Florida is subtropical; on average, Orlando annually receives approximately 48 in. of rainfall (Section 3.2.1). Average annual evapotranspiration is estimated to be 33 to 40 in., leaving 8 to 15 in. for runoff to surface water or recharge to groundwater aquifers.

3.4.1 Surface Water

The Stanton Energy Center property lies in the watershed of the Econlockhatchee River, which flows into the St. Johns River approximately 15 miles northeast of the site. A small portion of the western side of the property, including part of the onsite coal-combustion ash landfill, lies in the watershed of the Little Econlockhatchee River, the largest tributary to the Econlockhatchee River. Other nearby tributaries include Hart Branch and Cowpen Branch Creek, on the northeastern and eastern perimeter of the property, which receive runoff from undeveloped areas of the property. The nearby Orange County Eastern Water Reclamation Facility, which supplies treated effluent for use at the Stanton Energy Center, discharges some of its treated effluent (an average of 4.2 million gal/day during the 12-month period February 2005 through January 2006) to a 150-acre artificial wetland from which water flows to a 150-acre natural wetland that drains to an unnamed tributary of the Econlockhatchee River.

At the nearest river gauging station, which is 6 miles upstream from the Stanton Energy Center, the Econlockhatchee River has a drainage area of about 33 square miles. During 30 years of monitoring at this station, measured streamflow ranged from no flow to 474 ft^3/s, with an average of 27 ft^3/s. Occurrences of no flow are frequent at this location. Approximately 6 miles downstream from the power plant is a former river gauging station where measured streamflow from a 119-square mile drainage area ranged from no flow to 7,840 ft^3/s during 7 years of monitoring, with an average of 88 ft^3/s.

For water quality planning purposes, the Econlockhatchee River and its tributaries are categorized as Class III waters according to Chapter 62-302, Florida Administrative Code. This is the classification for surface waters that are designated for recreation, and propagation and maintenance of a healthy, well-balanced population of fish and wildlife. The water quality of the river is characteristic of a swamp-fed Florida river draining through urbanized areas. The water is low in hardness and moderately low in total dissolved solids, with slightly acidic to neutral pH. The water is brown in color due to tannin from natural sources in the watershed. Portions of the Econlockhatchee and Little Econlockhatchee rivers, including the stretch of the Econlockhatchee River nearest to the Stanton Energy Center, have been determined to be “impaired waters” (FDEP 2004) because elevated levels of fecal coliform bacteria (probably due to cattle ranching operations) prevent them from meeting water quality standards for the designated uses of Class III waters. Other measures of water quality are consistent with designated uses. Limited measurements (0.019 and 0.022 µg/L) of mercury concentrations in the river (Julie Bortles, Orange County Environmental Protection Division, personal communication to Joe Dertien, ECT, August 4, 2005) were barely above the detection limit of 0.018 µg/L. Nevertheless, fish consumption advisories have been issued for the river to warn people not to eat certain fish species that bioaccumulate mercury.

Stormwater runoff from developed portions of the Stanton Energy Center drains to a system of lined collection basins and ponds on the site. The largest of these is the makeup pond, a 93-acre manmade pond located east of the main plant facilities, which is used to store makeup for cooling water. Stormwater runoff from areas associated with industrial activity (e.g., coal storage areas and floor drains) is treated by processes such as pH adjustment, oil separation, and suspended solids removal before being routed to the recycle basin for reuse. The makeup pond receives treated wastewater effluent from the Orange County Eastern Water Reclamation Facility (an average of 10.25 million gal/day during the 12-month period February 2005 to January 2006) and treated cooling tower blowdown and other treated effluents from Stanton Energy Center operations. In July 2005, surface water runoff from the Orange County Sanitary Landfill became an additional source of water supply to the pond. Surface water is received from the landfill intermittently (generally after rainfall events). In an average rainfall year the total volume of landfill runoff is estimated to average 2.47 million gal/day. Between July 2005 and February 2006, the makeup pond received an average of 2.5 million gal/day from the county landfill. The makeup pond holds 485 million gal at its average water depth of 16 ft. The makeup pond's water quality is summarized in Table 3.4.1. Concentrations of chloride and other dissolved solids (represented by the conductivity values in Table 3.4.1) are higher than in area streams and groundwater, but the water would be suitable for many uses.

Table 3.4.1. Water quality data for the Stanton Energy Center makeup pond (January 2004–April 2005)

Parameter	Range	Average
pH	7.4 to 8.2	—
Hardness (mg/L as $CaCO_3$)	130 to 146	135
Silica (mg/L)	9.6 to 13.2	12
Conductivity (µS/cm)	662 to 828	724
Chloride (mg/L)	78 to 129	101
Phosphorus (mg/L)	0.26 to 2.77	0.82

3.4.2 Groundwater

The aquifer system in the region includes three main components: (1) the unconfined surficial aquifer in the surficial deposits (stratigraphic units are identified in Section 3.3.2); (2) a confining unit, formed by the Hawthorn Group, that separates the surficial aquifer from the underlying Floridan aquifer; and (3) the confined Floridan aquifer in the Eocene-age carbonate bedrock. The Floridan aquifer is subdivided into two production zones: (1) the Upper Floridan aquifer, in the Ocala Limestone and the upper Avon Park Formation; and (2) the Lower Floridan aquifer, in the lower Avon Park Formation and Oldsmar Formation. A confining unit in the middle of the Avon Park Formation separates the Upper and Lower Floridan aquifers. The Cedar Keys Formation, which has very low permeability, acts as a confining unit beneath the Lower Floridan aquifer.

Groundwater in the unconfined surficial aquifer occurs at relatively shallow depths (i.e., at or near the ground surface) and under unconfined (water-table) conditions. Recharge is primarily from direct rainfall and irrigation. Natural discharge occurs by evapotranspiration and as seepage to lakes, streams, and ditches. Water levels fluctuate seasonally in response to local rainfall. Aquifer thickness is highly variable, depending on the composition and thickness of the surficial deposits.

At the Stanton Energy Center, depth to the water table is typically within 5 to 10 ft of the ground surface. Subsurface investigations have found that the unconfined surficial deposits extend to variable depths ranging from about 30 to 70 ft below ground surface, where the first cohesive (clayey) layer is encountered. This cohesive layer forms the top of a 125- to 156-ft sequence of sediments that can be considered to be the confining unit between the unconfined surficial aquifer and the Upper Floridan aquifer. Groundwater occurs under confined conditions within an 80-ft-thick sand aquifer within this sequence of sediments.

The Floridan aquifer is one of the most productive aquifers in the world, delivering well yields measured up to several thousand gal/minute. In east central Florida, groundwater in the aquifer, which is under confined conditions (i.e., water in wells and borings rises above the top of the aquifer), is stored and transmitted through interconnected fissures, solution cavities, caverns, and channels. Altogether, the Floridan aquifer ranges in total thickness from about 2,000 to 2,600 ft. Most of this total thickness is formed by the Lower Floridan aquifer, which averages 1,500 ft in thickness. Thicknesses of the Upper Floridan aquifer and the confining unit that separates the Upper and Lower aquifers are more variable.

Principal sources of recharge to the Upper Floridan aquifer include downward leakage from the surficial aquifer, direct rainfall in areas where the overlying confining unit is absent or is penetrated by sinkholes, and drainage wells in the city of Orlando that penetrate through the confining unit to convey stormwater runoff or other wastewater directly into the aquifer (Murray and Halford 1996). Groundwater in this aquifer moves regionally in a southwest to northeast direction. Natural discharge occurs primarily in large springs found near or within major rivers or surface water bodies. The easternmost portion of Orange County near the St. Johns River is a discharge area where the potentiometric surface (i.e., the imaginary surface defined by the elevation to which water would rise in wells completed in this aquifer) is above the ground surface, but no major springs occur.

At the Stanton Energy Center, the top of the Floridan aquifer is approximately 200 ft below the ground surface (elevation about -120 ft msl). The potentiometric surface in the Upper Floridan aquifer is approximately 45 ft below the ground surface (elevation about 35 ft msl).

Flow relationships between the unconfined surficial aquifer and the underlying Floridan aquifer vary with the local thickness and properties of the confining unit that separates the two aquifers (i.e., the confining unit formed by the Hawthorn Group) and the elevation difference between the water table and the potentiometric surface in the Upper Floridan aquifer. In areas where the water table elevation is lower than the elevation of the potentiometric surface in the Upper Floridan aquifer, water can leak upward into the unconfined surficial aquifer, thus recharging the surficial aquifer. Where the water table elevation is higher than the elevation of the Upper Floridan aquifer potentiometric surface, downward leakage can occur through the confining bed, thus recharging the Floridan aquifer.

In the vicinity of the Stanton Energy Center, the confining unit between the two aquifers is relatively thick (more than 100 ft) and the water table in the unconfined surficial aquifer is at a higher elevation than the potentiometric surface in the Upper Floridan aquifer. These conditions allow for downward leakage and a low rate of recharge (estimated at 4 to 8 in/year) to the Upper Floridan aquifer.

The Lower Floridan aquifer has not been investigated as extensively as the Upper Floridan aquifer. Like the Upper Floridan aquifer, it is highly transmissive. In east central Florida, the potentiometric surface in the Lower Floridan aquifer has been determined to be a subdued reflection of the potentiometric surface in the Upper Floridan aquifer, with an elevation 1 to 3 ft lower than in the Upper Floridan aquifer (Lichtler, Anderson, and Joyner 1968). Most recharge from the Upper Floridan aquifer to the Lower Floridan aquifer occurs in topographically higher areas in western Orange County and eastern Lake County, as well as in downtown Orlando where heavy pumping from the Lower Floridan aquifer increases the difference between the potentiometric surfaces in the two aquifers.

Water in the Floridan aquifer system generally is of a calcium and magnesium bicarbonate type, reflecting the chemistry of the carbonate bedrock. Total dissolved solids (TDS) concentrations in the Upper Floridan aquifer in most of the Orlando area, including the Stanton Energy Center, are less than 500 mg/L (the secondary drinking water standard for TDS), with chloride concentrations less than 50 mg/L and sulfate concentrations less than 100 mg/L. The unconfined surficial aquifer generally has lower dissolved solids concentrations than the Upper Floridan aquifer, reflecting its nonreactive mineralogy and shorter groundwater residence times, while the Lower Floridan aquifer generally has somewhat higher concentrations of dissolved solids than the Upper Floridan aquifer, reflecting its longer groundwater residence times.

Salt water is found at a depth below the fresh groundwater in the Floridan aquifer. In the center of the Florida peninsula, the interface between fresh groundwater and the denser brackish water or salt water is generally at or below the base of the Lower Floridan aquifer, but nearer the coast this interface occurs at much shallower depths. At the Stanton Energy Center, the interface between fresh water and the underlying salt water is estimated to be at -1,500 to -2,000 ft msl, within the Lower Floridan aquifer. Additionally, in discharge areas such as near the St. Johns River in the easternmost portion of Orange County, the Upper Floridan aquifer contains water with high solute concentrations. This is considered to be relict sea water that entered the aquifer at a time when sea level was higher (Murray and Halford 1996). In easternmost Orange County, concentrations of both chloride and TDS commonly exceed 1,000 mg/L, making the water unsuitable for drinking water and undesirable for most other uses (the secondary drinking water standard for chloride is 250 mg/L; concentrations above that level are considered undesirable for human consumption). In the vicinity of the Cocoa well field (Section 3.4.3), water from the Upper Floridan aquifer commonly has TDS concentrations above 500 mg/L and chloride concentrations above 50 mg/L. Concentrations of both TDS and chloride have been increasing in that area.

The Florida Environmental Regulation Commission has classified the aquifers beneath the Stanton Energy Center as G-II aquifers. A G-II aquifer is one that is used or can be used for potable water supply and has a TDS content of less than 10,000 mg/L.

On the Stanton Energy Center site, monitoring wells completed in the unconfined surficial aquifer are measured and sampled quarterly as part of the site environmental program. Samples are analyzed for pH, temperature, color, turbidity, radioactivity, TDS, anions (e.g., chloride, nitrate, and sulfate), and metals (including cations such as calcium and sodium). Results from most wells show good-quality fresh water with low to moderate levels of dissolved solids (e.g., TDS concentrations below 100 mg/L in some wells and below 300 mg/L in most wells). During the period 1997–2005, wells on the western side of the property near the landfill have shown increasing levels of TDS, chloride, sulfate, sodium, and other dissolved substances associated with salt water. These dissolved substances may come from facility wastewater treatment residues disposed in the landfill or from wastewater used in waste stabilization and management. Levels of potentially toxic metals have not increased over time. OUC is evaluating potential sources and causes of these elevated concentrations observed in monitoring wells and expects to take corrective actions after the investigation is completed (M. Corbett, OUC, e-mail message to B. Toth, Southern Company, April 14, 2006).

3.4.3 Water Supply

Groundwater from the Floridan aquifer is the principal source of water for municipal, industrial, and agricultural uses in central Florida. Some surface water is used, primarily for agriculture, with most surface water obtained from lakes. Historically, stream water has seldom been used because area streams often have no flow during dry periods (Lichtler, Anderson, and Joyner 1968). The unconfined surficial aquifer supplies some water for agriculture and limited domestic uses. It is not often used as a source of potable water because of low well yields, high iron concentrations, and color that may be objectionable (Murray and Halford 1996). The Upper Floridan aquifer is the main source of water supply, but use of the Lower Floridan aquifer is increasing. The nearest water supply wells to the Stanton Energy Center are located approximately 1.25 miles west of the site boundary (OUC 2006).

Two major municipal well fields are located near the Stanton Energy Center. The Cocoa well field supplies approximately 15.5 million gal/day to central Brevard County from 48 wells completed in the Floridan aquifer and the overlying Hawthorn Group (City of Cocoa 2004). The Cocoa wells closest to the Stanton Energy Center are approximately 3 miles to the south-southeast. The Orange County eastern regional well field, located approximately 6 miles west of the Stanton Energy Center, consists of 10 wells supplying approximately 20 million gal/day from the Floridan aquifer.

Two production wells at the Stanton Energy Center obtain water from the Upper Floridan aquifer to satisfy requirements for potable water and boiler feedwater. Groundwater use averaged 0.861 million gal/day before February 2004, but has been reduced to about 0.469 million gal/day by changing the water source for Stanton Energy Center's service water system from groundwater to reclaimed water. Water for noncontact cooling and other Stanton Energy Center uses that do not require high-quality water is obtained from surface water runoff and treated wastewater effluent cycled through the onsite makeup pond (Section 3.4.1). Facility water requirements that can be met with this lower-quality water are calculated at 12.7 million gal/day (Table 2.1.1). The Orange County Eastern Water Reclamation Facility supplies treated municipal wastewater effluent under a contract that provides for delivery of up to 13 million gal/day and the county's municipal landfill supplies additional water from its collected surface water runoff (Section 3.4.1).

The state of Florida has assigned most responsibility for water resource management and related environmental protection to five regional water management districts that serve regions defined on the basis of watersheds and other natural, hydrological, and geographical features. Most of Orange

County, including the Stanton Energy Center, is in the St. Johns River Water Management District. Water demand in the district is growing rapidly. In 1995, water use in the Orange County portion of the district was about 155 million gal/day, of which groundwater provided 136 million gal/day and surface water supplied 19 million gal/day. Water use in this portion of the district is projected to increase by 56% to about 230 million gal/day by 2025, with surface water use declining and groundwater use increasing by 69%. During this same period, water use in the entire 18-county district is projected to increase 38%, from 1,364 million gal/day in 1995 to 1,880 million gal/day in 2025 (Wilder 2003).

Increased groundwater use in the region continues to lower the potentiometric surface in the Upper Floridan aquifer, resulting in reduced flow to springs and increased potential for saline or brackish water to migrate into water-supply aquifers. In the vicinity of the Stanton Energy Center, the potentiometric surface was estimated to be 10-15 ft lower in 1988 than under predevelopment conditions (Murray and Halford 1996). On a regional scale, the water management district estimates that the district's potential maximum water supply from the Floridan aquifer is 670 million gal/day, and demand is expected to surpass this value before 2010. Accordingly, the water management district is working to increase water conservation and the use of reclaimed water, enhance aquifer recharge, and develop new water supplies, including possible desalination of seawater (SJRWMD undated). The water management district has designated the Orange County portion of the district as a Priority Water Resource Caution Area, meaning that "existing and reasonably anticipated sources of water and conservation efforts may not be adequate to (1) supply water for all existing legal users and reasonably anticipated future needs, and (2) sustain the water resources and related natural systems." In Priority Water Resource Caution Areas, the use of reclaimed water is required when economically, environmentally, and technically feasible.

3.5 FLOODPLAINS AND WETLANDS

3.5.1 Floodplains

Most of the 3,280-acre Stanton Energy Center site lies above the elevation of the Federal Emergency Management Agency's determined 100- and 500-year floodplains (FEMA 2000). The elevation of the 1,100-acre developed section of the site was previously filled to approximately 80 ft msl, raising the entire ground surface of the developed area above the elevation of the Federal Emergency Management Agency's 100- and 500-year floodplains. The proposed facilities would be located on a 35-acre portion of this developed area.

3.5.2 Wetlands

Figure 3.5.1 shows vegetation, land cover (including several wetland categories), and existing land uses for the site and immediate vicinity. The figure uses categories developed according to Level III of the Florida Land Use, Cover and Forms Classification System (FDOT 1999). Wetland

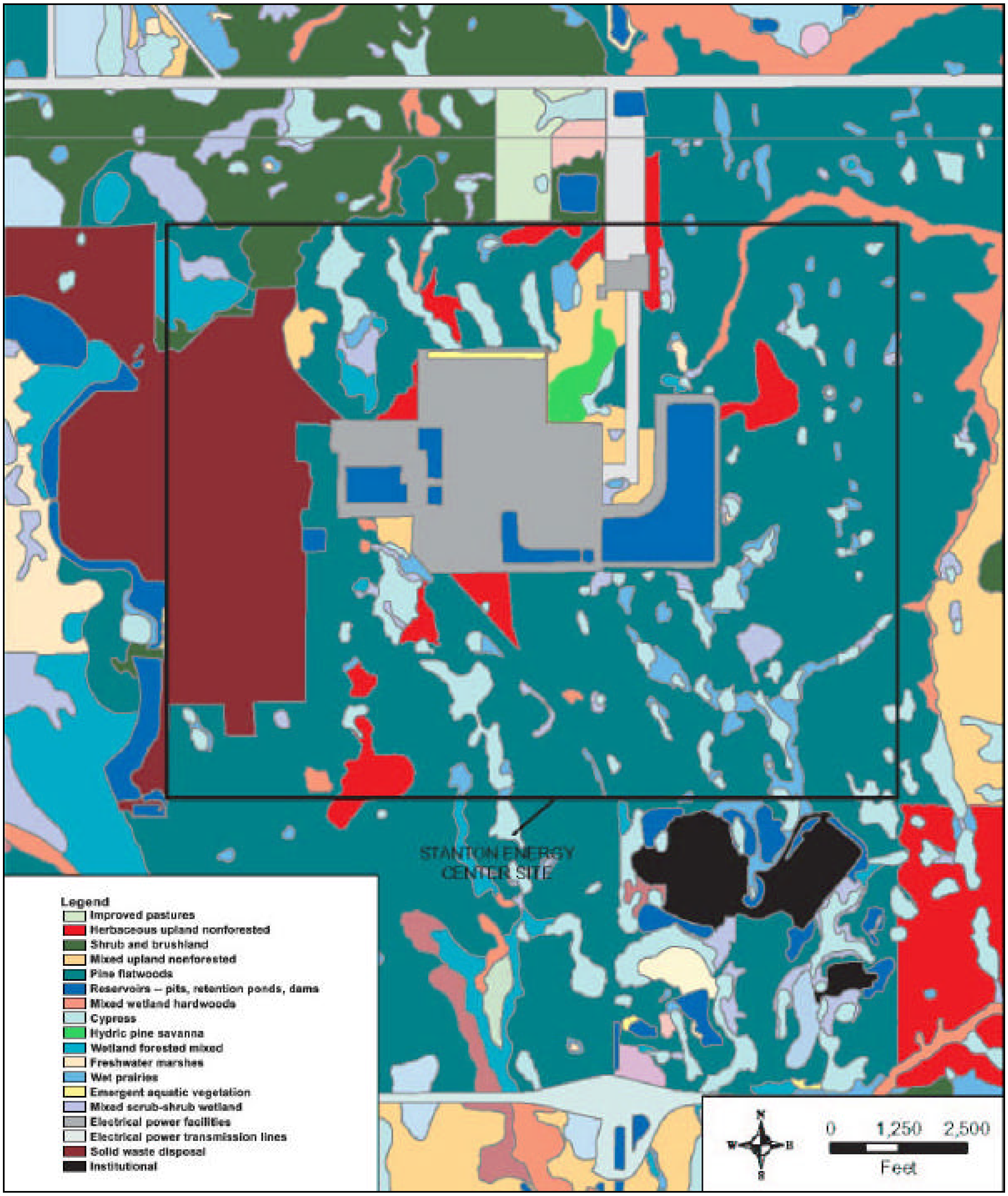

Figure 3.5.1. Vegetation and land cover for the Stanton Energy Center site and immediately surrounding area. *Sources:* SJRWMD 2005; ECT 2005.

determinations were made on the site by Environmental Consulting & Technology, Inc. (ECT), in 2005. Stanton Energy Center and its immediate surroundings are primarily comprised of the following land use/cover types [noted here and initially in the text in all-capital letters]:

(1) IMPROVED PASTURES;
(2) HERBACEOUS UPLAND NONFORESTED;
(3) SHRUB AND BRUSHLAND;
(4) MIXED UPLAND NONFORESTED;
(5) PINE FLATWOODS;
(6) RESERVOIRS;
(7) MIXED WETLAND HARDWOODS;
(8) CYPRESS;
(9) HYDRIC PINE SAVANNA;
(10) WETLAND FORESTED MIXED;
(11) FRESHWATER MARSHES;
(12) WET PRAIRIES;
(13) EMERGENT AQUATIC VEGETATION;
(14) MIXED SCRUB-SHRUB WETLAND;
(15) ELECTRICAL POWER FACILITIES;
(16) ELECTRICAL POWER TRANSMISSION LINES;
(17) SOLID WASTE DISPOSAL, and
(18) INSTITUTIONAL.

No wetlands occur within the developed portion of the Stanton Energy Center. However, wetlands occur within the undeveloped portion, including the northern buffer area where the proposed transmission line would connect the proposed combined-cycle facilities to the existing onsite substation approximately 3,000 ft to the northeast. The wetlands within the buffer areas are interspersed within an upland community type PINE FLATWOODS (Section 3.6.1). The wetlands can be characterized overall as linear strand formations oriented north-south across the property. The more common wetlands occurring within the northernmost undeveloped area of the Stanton Energy Center are pond cypress swamp [CYPRESS], coniferous wetland forest [HYDRIC PINE SAVANNA], pond pine swamp [WETLAND FORESTED MIXED], mixed bay swamp [MIXED WETLAND HARDWOODS], and oak hammock [MIXED WETLAND HARDWOODS] strands.

Pond cypress swamp strands [CYPRESS] are stillwater swamp communities in either circular or linear depressions, which are flooded for most of the year. The vegetation is dominated by a canopy of pond cypress (*Taxodium ascendens*), but also includes pond pine (*Pinus serotina*), swamp tupelo (*Nyssa biflora*), and sweetbay magnolia (*Magnolia virginiana*). The understory ranges from dense to somewhat open and includes wax myrtle (*Myrica cerifera*), St. John’s wort (*Hypericum fasciculatum*), shiny lyonia (*Lyonia lucida*), dahoon holly (*Ilex cassine*), and gallberry (*Ilex glabra*). Characteristic species of the groundcover include beak rushes (*Rhynchospora spp.*), sphagnum moss

(*Sphagnum spp.*), sawgrass (*Cladium jamaicense*), tenangle pipewort (*Eriocanlon decangulare*), grape (*Vitus rotundifolia*), greenbriers (*Smilax spp.*), and net-vein chain fern (*Woodwardia virginica*).

Coniferous wetland forest [HYDRIC PINE SAVANNA] is open pine savanna with a sparse canopy of longleaf pines and a ground cover of grasses, herbs, and wetland shrubs. The overstory layer also supports occasional pond cypress. The understory is almost completely open, except for occasional saw palmetto (*Serenoa repens*), gallberry, and wax myrtle. The wet to flooded ground layer is mostly dominated by wiregrass. Other herbaceous stratum associates include longleaf threeawn (*Aristida palustris*), arrowfeather threeawn (*Aristida purpurascens*), roundpod St. John's-wort (*Hypericum cistifolium*), sandweed, swamp flatsedge (*Cyperus ligularis*), haspan flatsedge (*Cyperus haspan*), Carolina redroot (*Lachnanthes caroliana*), roadgrass (*Eleocharis baldwinii*), blue maidencane (*Amphicarpum muhlenbergianum*), erectleaf witchgrass (*Dichanthelium erectifolium*), giant whitetop (*Rhynchospora latifolia*), narrowfruit horned beaksedge (*Rhynchospora inundata*), Florida tickseed (*Coreopsis floridana*), hairy umbrellasedge (*Fuirena squarrosa*), tenangle pipewort, woolly witchgrass (*Dichanthelium scabriusculum*), white lobelia (*Lobelia paludosa*), bluestems (*Andropogon spp.*), southern shield fern (*Thelypteris kunthii*), yelloweyed grasses (*Xyris spp.*), bighead rush (*Juncus megacephalus*), false fennel (*Eupatorium leptophyllum*), rosy camphorweed (*Pluchea rosea*), pineland daisy (*Chaptalia tomentosa*), pineland rayless goldenrod (*Bigelowia nudata subsp. nudata*), Seminole false foxglove (*Agalinis filifolia*), sugarcane plumegrass (*Saccharum giganteum*), knotroot foxtail (*Setaris parviflora*), sawtooth blackberry (*Rubus argutus*), and laurel greenbrier (*Smilax laurifolia*).

Pond pine swamp strand [WETLAND FORESTED MIXED], a wetland community that is typically dominated by pond pine, occurs on wetter, flat topography with acidic soils. The understory is dominated by gallberry and saw palmetto. Because of the dense shrub and tree canopies, the groundcover is sparse, except for sphagnum moss.

Mixed bay swamp strand [MIXED WETLAND HARDWOODS], a wetland community with flat to slightly sloping topography, may be inundated for up to 6 months per year. The tree canopy is dominated by sweetbay magnolia and loblolly bay (*Gordonia lasianthus*), but other wetland hardwoods are also present. The understory and groundcover plants are similar to those in the cypress swamp, except for bay species including sweetbay magnolia, loblolly bay, and red bay (*Persea palustris*) in the understory.

Oak hammock strand [MIXED WETLAND HARDWOODS] is a wetland community with flat to slightly sloping topography, which may be flooded for up to 6 months per year. The canopy is dominated by water oak (*Quercus nigra*). Other trees present include red maple (*Acer rubrum*), cabbage palm (*Sabal palmetto*), sweetbay magnolia, and live oak (*Quercus virginiana*). The understory is dominated by wax myrtle and also includes persimmon (*Diospyros virginiana*). The ground layer is characterized by a dense cover of mesic herbaceous species such as broomsedge (*Andropogon virginicus*) and bottlebrush threeawn (*Aristida spiciformis*).

The surrounding edges of the referenced swamp systems also support nonforested wetlands [FRESHWATER MARSHES, WET PRAIRIES, EMERGENT AQUATIC VEGETATION] and

MIXED SCRUB-SHRUB WETLANDS. FRESHWATER MARSHES are treeless, seasonally flooded wetlands, which are vegetated by emergent wetland species. While some areas of freshwater marsh are dominated by St. John's wort, most of the freshwater marsh is vegetated by a mixture of coinwort (*Centella asiatica*), sedges (*Cyperus surinamensis, C. spp.*), mermaid's weed (*Prosepinaca pectinata*), camphorweeds (*Pluchea spp.*), grassleaf arrowhead (*Sagittaria graminea*), beak sedges, marsh pennywort (*Hydrocotyle umbellata*), spike rush (*Eleocharis baldwinii*), lemon bacopa (*Bacopa caroliniana*), rushes (*Juncus marginatus, J. megacephalus, J. spp.*), marsh pink (*Sabatia grandiflora*), giant whitetop sedge, southern umbrellasedge (*Fuirena scirpoidea*), and tenangle pipewort. WET PRAIRIES, which are typically shallower than freshwater marshes, are vegetated by a variety of grasses and forbes such as wiregrass, blue maidencane, dichanthelium grasses (*Dichanthelium spp.*), colic root (*Aletris lutea*), sedges, and rushes. EMERGENT AQUATIC VEGETATION communities are deeper zones of freshwater marshes, which support the growth of both floating and partially or completely submerged vegetation. Floating white water lily (*Nymphaea odorata*) is an example of emergent aquatic vegetation. MIXED SCRUB-SHRUB WETLANDS are similar to marshes and wet prairies, except for the presence of a dense to moderately dense shrub layer of wax myrtle and/or willow (*Salix caroliniana*).

3.6 ECOLOGICAL RESOURCES

Under Bailey's (1995) classification system for the ecoregions of the United States, the proposed project site and environs lie in the Outer Coastal Plain Mixed Forest Province, which is 173,800 mile^2 in area. The province consists of the Atlantic and Gulf Coastal Plains, including all of Florida north of Lake Okeechobee. Along the Atlantic coast, the extensive coastal marshes and interior swamps are dominated by gum and cypress. Most upland areas are covered by subclimax pine forest, which has an understory of grasses and sedges called savannas. Undrained shallow depressions in savannas form upland bogs, in which evergreen shrubs predominate (Bailey 1995).

The region provides habitat for a wide variety of animals. Plant communities and animal species on the Stanton Energy Center site are described more fully in the sections below.

3.6.1 Terrestrial Ecology

Figure 3.5.1 displays the upland terrestrial vegetation and land cover types for the site and immediate vicinity (see Section 3.5.2 for an explanation of land use cover types). The land covers associated with the undeveloped portion of the site generally consist of typical central Florida uplands and wetlands. The predominant upland vegetation cover type is PINE FLATWOODS. Pine flatwoods are upland communities with flat to slightly sloping topography and well- to moderately well-drained soils. Pine flatwoods are fire climax communities (i.e., the plant community condition/seral stage is maintained by episodic fires). The pine flatwoods on the site are burned at periodic intervals to maintain their natural state. OUC hires a local control-burn consultant to conduct this maintenance. Longleaf pine (*Pinus palustris*) is the characteristic canopy tree species. The extremely open overstory allows development of a rich understory of shrubs and herbaceous species. Saw palmetto is the most abundant shrub. Other common shrub species include coastal plain staggerbush (*Lyonia fruticosa*), shiny lyonia, paw paw (*Asimina reticulata*), shiny blueberry (*Vaccinium myrsinites*), blue huckleberry (*Gaylussacia frondosa*), gopher apple (*Licania michauxii*), and gallberry. Wiregrass (*Aristida beyrichiana*) dominates the herbaceous layer but is accompanied by a diverse array of herbaceous species, such as black root (*Pterocaulon pycnostachyum*), roundpod St. John's-wort, white-topped aster (*Oclemna reticulatus*), grassleaf roseling (*Callisia graminea*), broomsedge, whitehead bogbuttons (*Lachnocaulon anceps*), yellow star grass (*Hypoxis lutea*), yellow and orange milkworts (*Polygala rugellii* and *P. lutea*), bracken fern (*Pteridium aquilinum*), and Adam's needle (*Yucca filamentosa*).

Other upland vegetation cover types adjacent to the Stanton Energy Center include IMPROVED PASTURE, HERBACEOUS UPLAND NONFORESTED, SHRUB AND BRUSHLAND, and MIXED UPLAND NONFORESTED. IMPROVED PASTURE is land that has been cleared, tilled, reseeded with forage grasses, and managed for livestock grazing. Bahia grass (*Paspalum notatum*) is the dominant forage grass cover.

HERBACEOUS UPLAND NONFORESTED communities are areas of former pasture, which were abandoned and are being reclaimed by native grasses and other pioneer vegetation. These open, grassy areas within pine flatwoods may contain occasional longleaf pine or pond pine in the canopy, and shrubs such as wax myrtle, groundsel (*Baccharis halimifolia*), and gallberry in the understory. The ground layer consists of a mixture of native grasses, forbes, composites, legumes, and other typical flatwoods vegetation such as broomsedge, slender goldenrod (*Euthamia caroliniana*), bahia grass, common carpetgrass (*Axonopus furcatus*), camphorweeds, black root, dog fennel (*Eupatorium capillifolium*), ticktrefoil (*Desmodium incanum*), oakleaf fleabane (*Erigeron quercifolius*), greenbrier (*Smilax auriculata*), climbing hempvine (*Mikania scandens*), prickley pear cactus (*Opuntia humifusa*), and Nuttall's thistle (*Cirsium nutallii*).

SHRUB AND BRUSHLAND communities include treeless areas dominated by one or more species of shrubs, such as saw palmetto (the most prevalent), wax myrtle, and gallberry. For areas in which saw palmetto is dominant, this community type resembles pine flatwoods without the pine canopy.

MIXED UPLAND NONFORESTED communities may include occasional longleaf pine in the overstory. Understory layers consist of a moderately dense shrub layer and open ground layer. The shrub layer is typically dominated by wax myrtle. Other shrub layer species can include groundsel, shiny lyonia, shiny blueberry, Darrow's blueberry (*Vaccinium darrowii*), and gallberry. Due to shading from the shrub layer, the ground vegetation is typically not dense. Typical ground level plants include needlepod rush (*Juncus scirpoides*), orange and yellow milkworts, Elliott's milkpea (*Galactia elliottii*), whitehead bogbuttons, wiregrass, fourpetal St. John's-wort (*Hypericum tetrapetalum*), yellow star grass, broomsedge, black root, vanilla leaf (*Carphephorus odoratissimus*), ticktrefoil, pink sundew (*Drosera capillaris*), gopher apple, St. Andrew's-cross (*Hypericum hypericoides*), Mohr's thoroughwort (*Eupatorium mohrii*), and occasional club-mosses (*Lycopodiella* spp.) and lichens such as reindeer moss (*Cladonia* sp.).

The nonvegetated areas of the site currently consist of power plant-related features, including the power plant facilities, substation facilities, and access roads; transmission lines; and solid waste disposal areas.

Wildlife species that are common to central Florida are found on the Stanton Energy Center site. As expected with a large acreage site containing many upland and wetland habitats, species assemblages are diverse, and types of species are high in number. Except for perhaps the Florida black bear (Section 3.6.3), the whitetail deer is the only large indigenous mammal. Common small mammals include raccoons, opossums, flying squirrels, rabbits, and numerous species of ground-dwelling rodents. Bobwhite and turkey are the principal game birds. Migratory waterfowl and nongame bird species are numerous. Winter birds are diverse and numerous. Many species of reptiles are also present.

3.6.2 Aquatic Ecology

The Stanton Energy Center site contains no appreciable natural aquatic resources (e.g., lakes, rivers, or streams), although some manmade ponds occur within the developed portion. The nearest major aquatic resource is the Econlockhatchee River, approximately 1 mile to the east of the site. This river is in the St. Johns River Water Management District's Econlockhatchee subbasin, which is part of the Middle St. Johns River Basin. The watershed for the Econlockhatchee River (excluding the Little Econlockhatchee River) is about 38 miles long and 25 miles wide, covering part of Orange and Seminole counties. The waterbody is identified as a blackwater river system, characterized by nearly level topography, poorly-drained soils, and scattered swamps with limited flow. The Econlockhatchee River is designated as an "Outstanding Florida Water" (Section 62-302.700, F.A.C.).

For water use, the Econlockhatchee River and its tributaries are categorized as Class III (i.e., designated for recreation, and propagation and maintenance of a healthy, well-balanced population of fish and wildlife). The stretch of the river nearest to the Stanton Energy Center has had biological water quality violations centered on high fecal coliform counts, probably due to extensive cattle ranching operations to the south, upstream of the site.

Water quality improves downstream to the north of the site, where the stream supports a large and diverse macroinvertebrate community and freshwater fisheries population. The river is a popular fishing location. However, in order to lower potential human risk resulting from mercury in fish, the Florida Department of Health (2005) lists a "no consumption" warning for largemouth bass, gar, and bowfin in the Econlockhatchee River. These species are typically predatory in nature and would accumulate mercury in their systems more than other popular sport fish, such as panfish.

3.6.3 Threatened and Endangered Species

Extensive surveys for federal- and state-listed threatened and endangered species have been conducted in support of the two existing Site Certification Applications for the site and the Environmental Resources Permit application for Unit A. Additionally, OUC is required to conduct periodic monitoring of one endangered species, the red-cockaded woodpecker (*Picoides borealis*), which has several colonies on the Stanton Energy Center site. Table 3.6.1 lists the threatened and endangered species that have been documented on or near the site and their current protected status. No federally-listed threatened or endangered plant species are located on or near the site. The special status plants cited in Table 3.6.1 are all protected under the Florida Department of Agriculture and Consumer Services, which guards against overharvesting by collectors. Of the nine listed species, five were found growing along or in the vicinity of the proposed electrical transmission line corridor (Section 4.1.6.3): Catesby's lily (pine lily) (*Epidendrum conopseum*), cinnamon fern (*Osmunda cinnamomeai*), royal fern (*Osmunda regalis*), yellow-flowered butterwort (*Pinguicula lutea*), and hooded pitcher plant (*Tillandsia utriculata*).

Of the wildlife species listed in Table 3.6.1, the eastern indigo snake, Florida pine snake, gopher tortoise, bald eagle, Florida scrub jay, red-cockaded woodpecker, and Sherman's fox squirrel have been documented on the site by past ecological surveys. Kirtland's warbler has not been observed on the site, but possibly could be seen during winter migration. The southeastern kestrel has not been positively identified on the site, although the more common northern migrant has been observed. The Florida black bear has not been observed, although it has been recorded along riverine systems to the east of the property.

The red-cockaded woodpecker is well documented on the site. It may forage in the northern buffer area, but its nesting clans (i.e., groups containing two to nine birds but only a single breeding pair) are all located to the south or east of the existing power plant facilities. The most sensitive habitat type on the site is probably that of the red-cockaded woodpecker nesting clusters. These locations are all south and east of the existing facilities, in habitats about 1,500 ft or more from the proposed construction area (DeLotelle and Guthrie, Inc. 2003).

An eagle nest formerly was located on the property approximately 0.5 mile southeast of the proposed facilities, but was destroyed by hurricanes in 2004. The current location of those eagles is unknown. However, during site reconnaissance in May 2005, an immature eagle was observed in the northern buffer area. Another eagle nest is located off the site approximately 0.5 mile west of the western property boundary and, therefore, more than 1.5 mile from the site of the proposed facilities.

No wading bird colonies are known to exist at the Stanton Energy Center (FWC 2005), although various species, including the threatened wood stork, are likely to forage on the property. Wood storks were observed on the site during the May 2005 site reconnaissance, and snowy egrets have been observed in the proposed electrical transmission line corridor. Florida sandhill cranes, a threatened species, are commonly seen on the site and have become accustomed to human presence.

Table 3.6.1. Threatened and endangered species documented on or near the Stanton Energy Center site.

Common name	Scientific name	Status FWS[a]	Status FWC[b]	Status FDACS[c]
Plants				
Greenfly orchid	*Epidendrum conopseum*			C[d]
Catesby's lily (pine lily)	*Lilium catesbei*			T[e]
Cinnamon fern	*Osmunda cinnamomea*			C
Royal fern	*Osmunda regalis*			C
Yellow-flowered butterwort	*Pinguicula lutea*			T
Rose pogonia	*Pogonia ophioglossoides*			T
Hooded pitcher plant	*Sarracenia minor*			T
Common wild pine	*Tillandsia fasiculata*			E[f]
Giant wild pine	*Tillandsia utriculata*			E
Animals				
Reptiles				
Eastern indigo snake	*Drymarchon corais couperi*	T	T	
Gopher tortoise	*Gopherus polyphemus*		SSC[g]	
Florida pine snake	*Pituophis melanoleucus mugitus*		SSC	
Birds				
Florida scrub jay	*Aphelocoma coerulescens*	T	T	
Kirtland's warbler (migrant)	*Dendroica kirtlandii*		E	
Snowy egret	*Egretta thula*		SSC	
Southeastern kestrel	*Falco sparverius paulus*		T	
Florida sandhill crane	*Grus Canadensis pratensis*	T		
American bald eagle	*Haliaeetus leucocephalus*	T	T	
Wood stork	*Mycteria americana*	E	E	
Red-cockaded woodpecker	*Picoides borealis*	E	SSC	
Mammals				
Sherman's fox squirrel	*Sciurus niger shermani*		SSC	
Florida black bear	*Ursus americanus floridanus*		T	

[a]FWS = U.S. Fish and Wildlife Service
[b]FWC = Florida Fish and Wildlife Conservation Commission
[c]FDACS = Florida Department of Agriculture and Consumer Services
[d]C = commercially exploited
[e]T = threatened
[f]E = endangered
[g]SSC = species of special concern
Sources: FWC 2004; FWS 2005.

3.6.4 Biodiversity

Biodiversity is a general term broadly defined as the variety and variability of life, or the diversity of genes, species, and ecosystems (CEQ 1993). Its components or levels include regional ecosystem diversity, local ecosystem diversity, species diversity, and genetic diversity (CEQ 1993). At all of these levels, the existing biodiversity is high within the Stanton Energy Center environs (i.e., it lies within a regional matrix of diverse ecosystems containing a great variety of species and genotypes). However, biodiversity surrounding the site and throughout the region has decreased due to human population pressure and concurrent clearing of land, habitat fragmentation, and alteration of the hydrological regime from extensive development.

3.7 SOCIAL AND ECONOMIC RESOURCES

This section contains data on the social and economic resources most likely to be affected by construction and operation of the proposed facilities. Most of the data pertain to Orange County, but some data are also included for the city of Orlando because it is the largest municipality in the county and could be the destination of workers relocating to the area for jobs associated with construction or operation of the facilities.

3.7.1 Population

Table 3.7.1 provides population data for the city of Orlando and Orange County. Between 1990 and 2000, both jurisdictions experienced a large population increase, with Orange County growing by over 32%. The U.S. Census Bureau's 2004 population estimates for Orlando and Orange County indicate that the two jurisdictions have continued to grow at a rapid pace since 2000. The Bureau of Economic and Business Research at the University of Florida projects that Orange County's total population will increase to over 1.25 million by 2015, and to over 1.49 million by 2015 (BEBR 2003).

Table 3.7.1. Population data for the city of Orlando and Orange County

	1990 population	2000 population	Percent change 1990–2000	2004 population (estimate)	Percent change 2000–04
City of Orlando	164,674	185,951	12.9	205,648	10.6
Orange County	677,491	896,344	32.3	989,926	10.4

Source: U.S. Census Bureau 2005.

3.7.2 Employment and Income

The U.S. Census Bureau estimates that Orange County had a civilian labor force of 528,779 workers and an unemployment rate of 7.4% (39,328 workers) in 2004. This estimated unemployment rate was similar to that for both the state of Florida (7.1%) and the United States (7.2%) for the same year. Table 3.7.2 lists the major industries in terms of employment in Orange County in 2004 (U.S. Census Bureau 2005).

Table 3.7.2. Employment estimates by industry or economic sector in Orange County in 2004

Industry	Number	Percent of total
Arts, entertainment, and recreation; accommodation and food services	86,326	17.6
Educational services, health care, and social assistance	71,372	14.6
Professional, scientific, and management; administrative and waste management services	68,065	13.9
Retail trade	51,084	10.4
Finance and insurance; real estate and rental and leasing	42,951	8.8
Construction	35,838	7.3
Manufacturing	31,509	6.4
Transportation and warehousing; utilities	25,913	5.3
Other services, except public administration	25,155	5.1
Information	17,643	3.6
Wholesale trade	16,472	3.4
Public administration	14,730	3.1
Agriculture, forestry, fishing and hunting, and mining	2,393	0.5

Source: U.S. Census Bureau 2005.

The largest employer in Orange County is the Walt Disney Company with over 53,800 employees. Other employers in Orange County with more than 10,000 employees include Florida Hospital/Adventist Health System (19,270), Wal-Mart Stores, Inc. (16,757), Publix Super Markets, Inc. (15,606), Universal Orlando (12,500), and Orlando Regional Healthcare System (11,093) (Metro Orlando Regional Development Commission 2005).

The Stanton Energy Center has 204 full-time employees, of which 183 operate Units 1 and 2 and 21 operate Unit A. In addition, about 100 contractor personnel are likely to be on the site at any given time.

Estimated per capita income and median household income in Orange County were $22,722 and $44,490, respectively, in 2004. Orange County's estimated per capita income was lower than that for both the state of Florida ($23,532) and the United States ($24,020). The county's estimated median household income was higher than that for Florida ($41,236), but slightly lower than that for the United States ($44,684) (U.S. Census Bureau 2005).

3.7.3 Housing

Table 3.7.3 provides housing data for Orange County in 2000 and 2004. The county's housing stock was increased by over 13% during that period to meet demand created by the rapid population increase discussed in Section 3.7.1. During the same period, both homeowner and rental vacancy rates in the county dropped. The estimated 2004 homeowner and rental vacancy rates in Orange County (1.2% and 6.0%, respectively) were lower than those for the state of Florida (1.6% and 9.9%). The estimated 2004 median value of owner-occupied housing and median monthly rent in Orange County ($149,999 and $797, respectively) were slightly higher than those for Florida ($149,291 and $766).

Table 3.7.3. Housing data for Orange County

	2000	2004 (estimate)
Total housing units	361,349	409,685
Occupied units	336,286	376,160
Vacant units	25,063	33,525
Homeowner vacancy rate (%)	1.7	1.2
Rental vacancy rate (%)	7.1	6.0
Median value, owner-occupied ($)	107,500	149,999
Median monthly rent, renter-occupied ($)	699	797

Source: U.S. Census Bureau 2005.

3.7.4 Public Services

3.7.4.1 Water and Wastewater Services

OUC provides water service for residents and businesses within the city of Orlando and portions of Orange County. OUC operates eight water treatment facilities that produce almost 30 billion gal of water annually, which is distributed to nearly 365,000 customers (OUC 2005). The city of Orlando's Public Works Department provides wastewater service for residents and businesses within the city of Orlando and portions of Orange County. The Wastewater Department operates three wastewater treatment facilities with the combined capacity to process over 72 million gal per day (City of Orlando 2005).

The Orange County Utilities Department provides water and wastewater services for most of the unincorporated areas of Orange County. The Department's Water Division operates 13 water treatment facilities that produce over 20 billion gal of water annually, which is distributed to more than 121,000 customers. The Department's Water Reclamation Division operates three regional wastewater treatment facilities with the combined capacity to process over 69 million gal per day (Orange County 2005a).

3.7.4.2 Police Protection

In Orange County, police protection is provided by a combination of municipal police departments in the incorporated areas and the Orange County Sheriff's Office countywide. The Orange County Sheriff's Office, which has over 1,340 sworn officers, provides police protection in the unincorporated area around the Stanton Energy Center with 65 officers stationed at the Sector 2 substation.

3.7.4.3 Fire Protection and Emergency Medical Services

Fire protection and emergency medical services in Orange County are provided by a combination of municipal fire departments in the incorporated areas and the Orange County Fire Rescue Department (OCFRD) in unincorporated areas. The OCFRD has over 900 emergency response personnel and handled over 86,000 emergency calls in 2004 (Orange County 2005b). Fire protection and emergency medical services in the unincorporated area around the Stanton Energy Center are provided by OCFRD's Station 85, which is staffed by six firefighters and equipped with both firefighting and rescue vehicles. Additional responding stations in the area include OCFRD Station 80 and Station 83, which has hazardous materials facilities.

3.7.4.4 Schools

Public education in Orange County is provided by the Orange County Public School District, which operates 108 elementary schools, 29 middle schools, and 17 high schools. The District also operates three K-8 grade schools, six ninth grade centers, four technical education centers, 24 alternative education facilities, and five exceptional education facilities. In May 2005, the District had a total enrollment of 173,334 students, with 80,170 in elementary schools, 38,821 in middle schools, 47,485 in high schools, and 6,858 in special schools. Current enrollment exceeds current capacity in each of these school categories (but not necessarily in each school within the categories). Specifically, the elementary schools are at 132% of capacity, the middle schools are at 136% of capacity, and the high schools are at 105% of capacity (capacity figures are not provided for the special schools). However, with the passage of a recent sales tax referendum, the District is implementing a plan to renovate or replace 136 of its schools. The District anticipates that these renovated and new schools will provide excess capacity by the 2010–11 school year (Orange County Public School District 2005).

3.7.4.5 Health Care

The hospital nearest the Stanton Energy Center is the Florida Hospital East Orlando, a 144-bed full-service community hospital with a 24-hour emergency department. The largest hospitals in Orange County are the Florida Orlando Hospital (an 881-bed acute care community hospital) and the Orlando Regional Medical Center (a 517-bed tertiary care center).

3.7.5 Local Government Funds and Expenditures

In its fiscal year 2005 budget, Orange County projected that it would have total funds of over $2.5 billion from the sources listed in Table 3.7.4. Projected expenditures totaling over $2.5 billion from the fiscal year 2005 budget are listed in Table 3.7.5 (Orange County 2005b).

Table 3.7.4. Projected funds in Orange County's fiscal year 2005 budget

Revenues	
Ad valorem taxes	$588,464,140
Sales and use taxes	226,309,000
Franchise taxes	6,205
Licenses and permits	23,017,891
Intergovernmental revenue	219,920,891
Charges for services	289,111,023
Fines and forfeitures	3,865,706
Court related revenue	7,966,980
Interest and profits on investments	11,352,593
Miscellaneous revenues	190,689,665
Non-revenue funds	
Bond/loan proceeds	$330,000
Interfund transfers	328,265,120
Internal service charges	96,799,064
Fund balance	602,245,203

Source: Orange County 2005b.

Table 3.7.5. Projected expenditures in Orange County's fiscal year 2005 budget

Expenditures/expenses	
General government	$180,651,495
Public safety	468,734,304
Physical environment	272,290,881
Transportation	191,907,889
Economic environment	129,441,780
Human services	181,450,602
Internal services	141,426,831
Culture and recreation	53,628,121
Non-expense disbursements	
Debt service	$131,468,103
Reserves	433,994,170
Interfund transfers	328,265,120

Source: Orange County 2005b.

OUC is exempt from paying property taxes in Orange County. However, Southern Company Florida, LLC, has a 65% equity ownership interest in Stanton Unit A, and pays Orange County property taxes on its ownership share of Unit A. For the 2004 tax year, Southern Company Florida paid over $2.4 million in local taxes (Table 3.7.6).

Table 3.7.6. Taxes paid by Southern Company Florida, LLC, in Orange County in 2004

Tax type	Amount
General county	$677,745
School	990,180
Library	57,680
St. Johns River Water Management District	60,084
County fire	338,872
Unincorporated tax district	278,789

3.7.6 Environmental Justice

Table 3.7.7 lists the percentages of the total population that are classified as "minority" and "below poverty level" for the United States, the state of Florida, Orange County, the census tract[1] in which the Stanton Energy Center is located (i.e., Census Tract 167.22), and the six census tracts surrounding Census Tract 167.22 (all of which have their nearest boundary within 7 miles of the power plant). The data in Table 3.7.7 are from the 2000 U.S. Census, the most recent year for which complete data are available at the census tract level. As indicated in Table 3.7.7, Orange County and most of the seven census tracts have higher minority percentages than the state of Florida and the United States. Census Tract 167.22, which includes the population of the Florida Department of Corrections' Central Florida Reception Center, has a slightly higher minority percentage than Orange County, and a much higher minority percentage than Florida and the United States. Conversely, Orange County and six of the seven census tracts have lower percentages of people below the poverty level than the state of Florida and the United States. Census Tract 167.22 has a much lower percentage of people below the poverty level than Orange County, the state of Florida, and the United States.

Table 3.7.7. Environmental justice data for the United States, Florida, Orange County, and seven census tracts near the Stanton Energy Center

Location	Percent minority[a]	Percent below poverty level[b]
United States	30.9	12.4
Florida	34.6	12.5
Orange County	42.5	12.1
Census tracts surrounding the Stanton Energy Center		
Census Tract 166.02	19.1	16.3
Census Tract 167.04	7.2	2.7
Census Tract 167.10	42.4	1.4
Census Tract 167.11	42.8	7.7
Census Tract 167.18	46.3	9.8
Census Tract 167.19	33.7	5.4
Census Tract 167.22 (includes Stanton Energy Center)	45.7	3.5

[a]Includes all persons who identified themselves as not "White alone," plus those who identified themselves as both "White alone" and "Hispanic or Latino."

[b]Represents individuals below the poverty level as defined by the U.S. Census Bureau.

Source: U.S. Census Bureau. 2005.

[1] As defined by the U.S. Census Bureau, census tracts are small, relatively permanent statistical subdivisions of a county. Census tracts, which average about 4,000 inhabitants, are designed to be relatively homogeneous units with respect to population characteristics, economic status, and living conditions.

3.7.7 Transportation

3.7.7.1 Roads

Road access to the Stanton Energy Center is primarily via Alafaya Trail from either Highway 408 (East-West Expressway) or Curry Ford Road, and secondarily via Avalon Park Boulevard from Highway 50 (Figure 3.7.1). Limited ingress/egress is currently allowed from/to the south via an access road connected to the BeeLine Expressway.

Most traffic enters the Stanton Energy Center from the north via Alafaya Trail, a two-lane road classified as a minor arterial in the Orange County functional classification system. In 2003, average daily traffic on the link of Alafaya Trail between Curry Ford Road and the Stanton Energy Center was 24,775 vehicles, with an afternoon peak hour count of 1,971 vehicles (999 vehicles northbound and 972 vehicles southbound). Because it is a two-lane road with such heavy traffic volume, this segment of Alafaya Trail currently operates at an "F" level-of-service during the peak period, which is the lowest possible rating (Myrna Bark, Orange County Traffic Engineering Department, personal communication to Darren Stowe, Environmental Consulting & Technology, Inc., May 11, 2005). Level-of-service is defined as a "qualitative measure describing operational conditions within a traffic stream, based on service measures such as speed and travel time, freedom to maneuver, traffic interruptions, comfort, and convenience" (TRB 2000). An "F" level-of-service, which is used to define forced or breakdown traffic flow, exists:

> "wherever the amount of traffic approaching a point exceeds the amount which can traverse it and queues begin to form. Operations within the queue are characterized by stopping and starting. Over and over, vehicles may progress at reasonable speeds for several hundred feet or more, and then be required to stop. Level-of-service F is used to describe operating conditions within the queue, as well as the point of the breakdown. It should be noted, however, that in many cases, once free of the queue, traffic may resume to normal conditions quite rapidly" (TRB 2000).

Although limited access to the Stanton Energy Center is available from the south via the BeeLine Expressway, this southern access is rarely used except for occasional trips by power plant staff. Thus, almost all traffic to and from the Stanton Energy Center uses Alafaya Trail, thereby contributing to the heavy traffic volume on that road. Under the current shift change schedule, the maximum number of vehicle trips in or out of the power plant property is about 135 vehicles during the peak hour of the afternoon shift change. In addition, an estimated 90 trucks make roundtrip runs to the Stanton Energy Center via Alafaya Trail each day.

The current level-of-service on Alafaya Trail and the approved future development in the area (Section 3.1.2) are major reasons for two planned road improvement projects, which would allow residential and industrial development to proceed in this part of Orange County. These road projects are discussed in this section because activities associated with their construction are likely to be part of the affected environment prior to construction of the proposed facilities. For the first project, private developers have provided design work, construction plans, and permitting to extend the

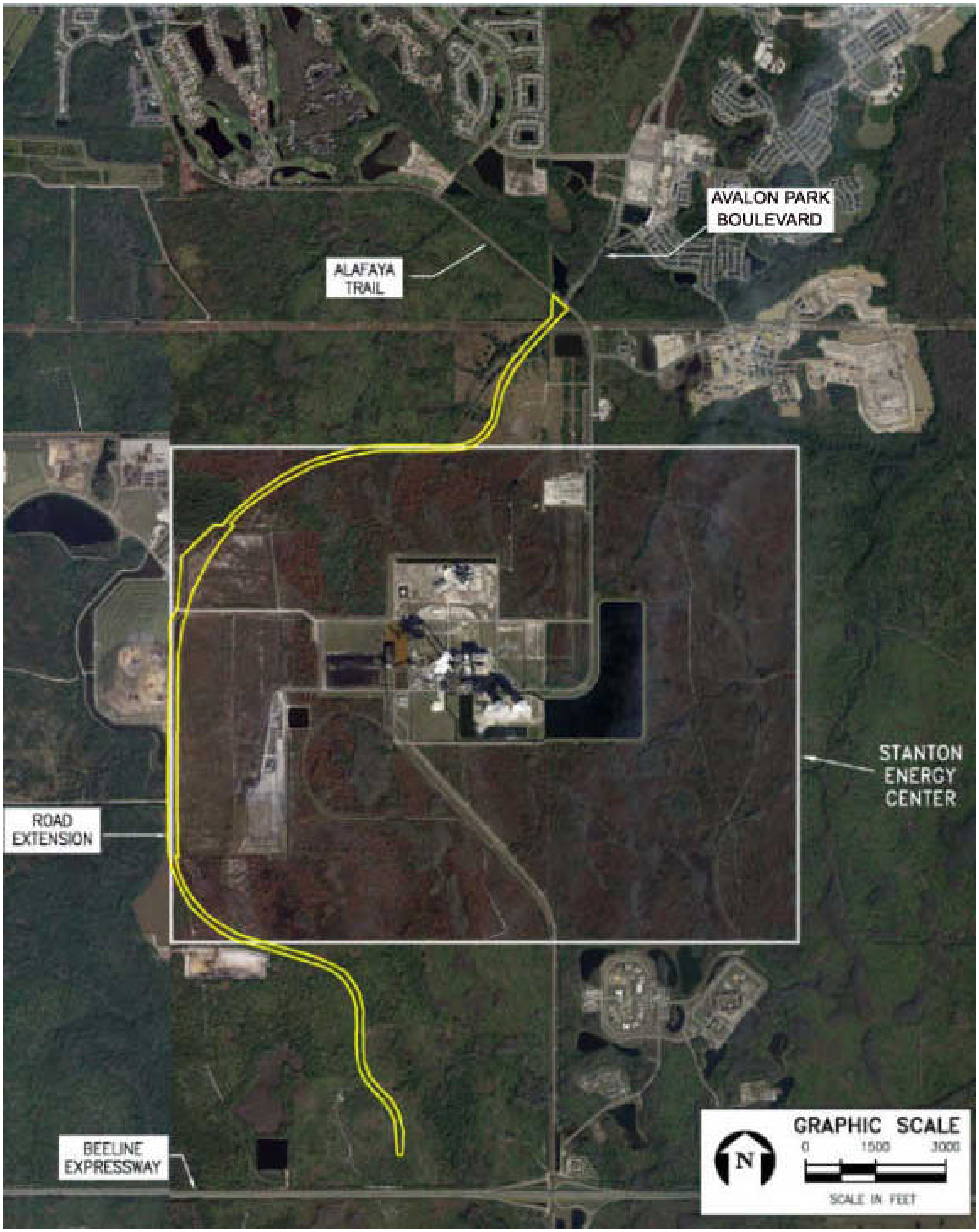

Figure 3.7.1. Planned route of the Avalon Park Boulevard extension (yellow lines).

existing Avalon Park Boulevard, which currently ends at its intersection with Alafaya Trail just north of the Stanton Energy Center. This four-lane extension (also known as Innovation Way) would run westward and southward along the western boundary of the Stanton Energy Center to form a new interchange with the BeeLine Expressway (Figure 3.7.1), and then southward to International Corporate Park.

Orange County plans to commence construction of the Avalon Park Boulevard extension in mid-2006 and to complete the project within 24 months, pursuant to an agreement with the private developer of International Corporate Park. When completed, the Avalon Park Boulevard extension would link primarily residential developments with the proposed, large-scale International Corporate Park, which is expected to create a large volume of commuter traffic. The northern section of this extension, which would begin at the intersection of Avalon Park Boulevard and Alafaya Trail, is intended to help reduce traffic volume on Alafaya Trail.

For the second planned road improvement project, private developers have provided funding to widen Alafaya Trail from two to four lanes from Avalon Park Boulevard north to Curry Ford Road. Orange County plans to complete this expansion in 2009 or 2010. The widening of Alafaya Trail to four lanes would allow for planned development in Avalon Park and the approved Morgan Planned Development.

3.7.7.2 Railways

Rail access to the Stanton Energy Center is from the south via an existing rail spur provided by CSX Transportation, Inc. The rail spur is used to deliver coal to the existing Units 1 and 2, with five train loads delivered in a typical week.

3.7.8 Cultural Resources

According to a recent review of the Florida Master Site File, four previously recorded archaeological sites and no historical structures are located within the boundaries of the Stanton Energy Center. Figure 3.7.2 depicts the location of these sites (OR 255, OR 256, OR 383, and OR 384) relative to disturbed areas within the power plant property. The four archaeological sites were found by personnel from the Florida Secretary of State (Division of Archives, History, and Records Management) during an archaeological and historic survey of the Stanton Energy Center property, which was conducted in 1981 in coordination with the construction of Unit 1. The Division of Archives, History, and Records Management concluded that the sites did not represent significant archaeological resources, and that the construction and operation of Units 1 and 2 within the certified area would not adversely affect any significant archaeological or historical resources (OUC 2001).

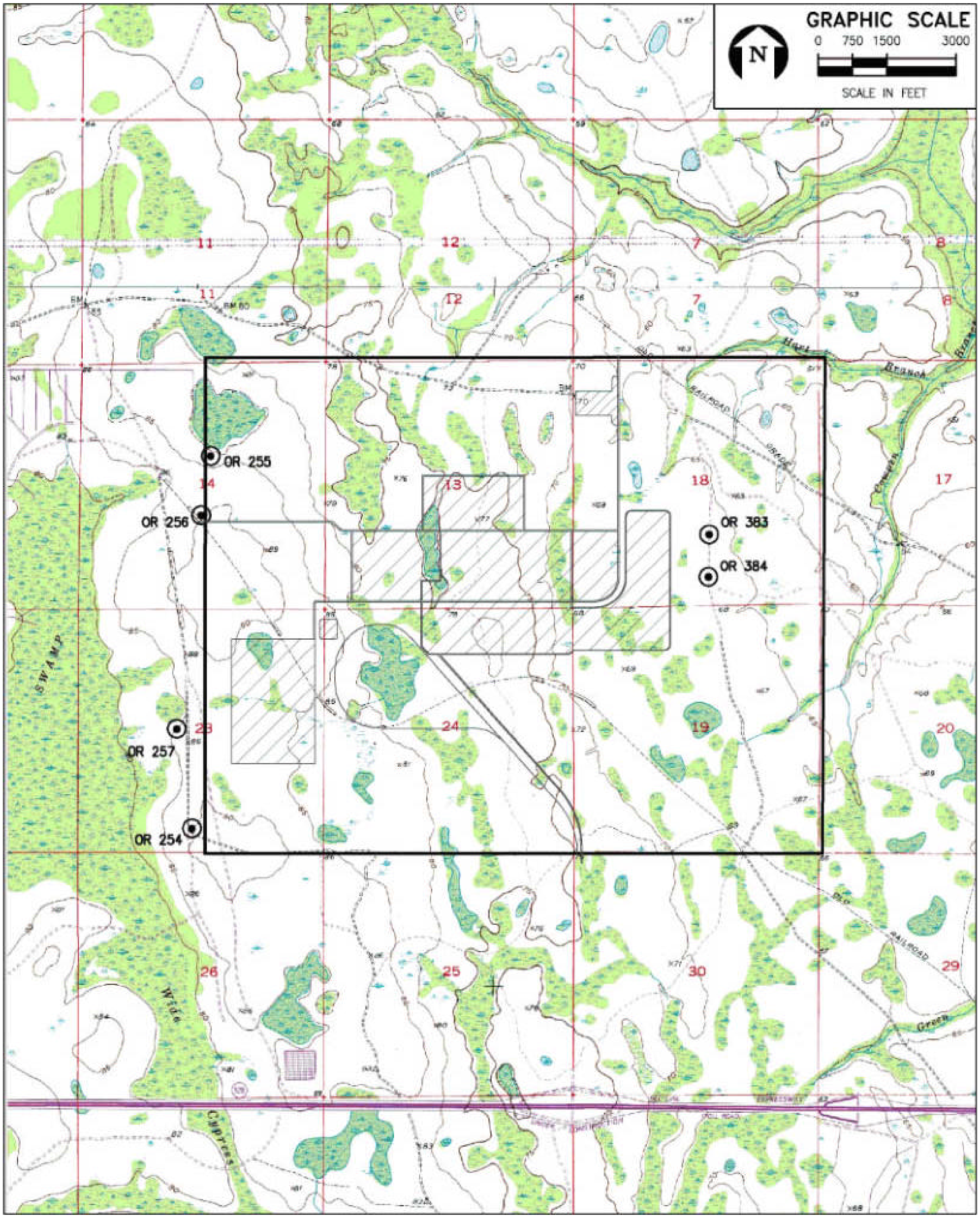

Figure 3.7.2. Location of archaeological sites within the boundaries of the Stanton Energy Center (OR 255, OR 256, OR 383, and OR 384).

3.8 WASTE MANAGEMENT

On the western side of the Stanton Energy Center property, a 347-acre area is permitted by the state of Florida for use as a coal-combustion ash landfill. The principal type of waste disposed in this onsite landfill is sludge generated by the Unit 1 and Unit 2 scrubbers that remove sulfur from the flue gas. Prior to disposal, scrubber sludge is blended with coal-combustion ash from Units 1 and 2 at an approximate ratio of one part ash to two parts sludge. The resulting blend forms a stable concrete-like solid material. Solid residues from water treatment are also taken to the landfill for disposal.

The landfill, which is entirely above natural grade, extends up to a permitted final height of 155 ft above grade. To prevent rain infiltration and leakage to groundwater, the landfill base and final cap are constructed from sludge material blended with ash to achieve a very low permeability (10^{-7} cm/sec or less). Capped portions of the landfill are topped with a layer of soil and vegetated with grasses and sedges.

The onsite landfill receives slightly more than 500,000 tons (wet weight) of blended ash and scrubber sludge annually. In addition, about 180,000 tons of coal-combustion ash from Units 1 and 2 is sold annually for beneficial reuse (e.g., as construction material). As of 2004, the landfill has received a total of 3,911,000 yd^3 of waste material. Approximately 25 acres of the landfill have reached final grade, another 12 acres are in active use for disposal, and the remaining permitted acres are available for future use. Most municipal solid waste in the region is sent to the Orange County Sanitary Landfill for disposal. This county-operated landfill, located adjacent to the western boundary of the Stanton Energy Center property, is permitted for disposal of Class I and Class III solid waste. Class I waste is nonhazardous solid waste, excluding liquids and sludges, while Class III waste includes yard trash, construction and demolition debris, asbestos, paper, glass, and similar materials. Since 1972, this landfill has received more than 20 million tons of waste. In fiscal year 2005, the landfill received 1.35 million tons of waste for disposal. Although landfill operating permits are issued only for 5-year periods, the county has received conceptual approval of plans to provide waste capacity sufficient for approximately the next 20 years. The landfill property is estimated to have sufficient land to provide disposal capacity for approximately the next 50 years.

Stanton Energy Center process wastewater is treated on the site and used within the facilities. Units 1 and 2 have an onsite wastewater treatment plant, while Unit A has onsite septic systems and drain fields. Sanitary wastewater from onsite showers, lavatories, and similar uses is collected and routed to the septic systems and drain fields. No liquid effluent is discharged off the site. Sanitary sewage and other municipal wastewaters from the surrounding area are treated at the nearby Orange County Eastern Water Reclamation Facility, which has a daily capacity of 19 million gal.

Hazardous waste management services are available through an Orange County contractor that is contractually required to provide services to local businesses at the same rates as paid by the county. Hazardous waste is transported to a processing facility in Tampa, Florida.

3.9 HUMAN HEALTH AND SAFETY

3.9.1 Air Quality and Public Health

3.9.1.1 Background

The quality of ambient air plays an important role in the health of the public. Exposure to pollutants is associated with numerous effects on human health, including increased respiratory symptoms, hospitalization for heart or lung diseases, and even premature death. Children are particularly vulnerable to environmental influences because of their narrow airways and rapid respiration rate. Compared to adults, children's fast metabolism, ongoing physical development, and daily behavior place them at increased risk from exposure to environmental pollutants. A recent World Health Organization review (WHO 2003) concluded that the body of epidemiological evidence was sufficient to assign causality for mortality and morbidity to various forms of outdoor air pollution.

Vehicle emissions, fossil-fuel combustion, chemical manufacture, and other sources add gases and particles to the air people breathe. The Clean Air Act required the EPA to set National Ambient Air Quality Standards (NAAQS) for six pollutants considered harmful to public health and the environment:

- **Particulate Matter (PM-10)/ Fine Particulate Matter (PM-2.5):** Many scientific studies have linked breathing particulate matter to a series of health problems, including aggravated asthma, increases in respiratory symptoms (e.g., coughing and difficult or painful breathing), chronic bronchitis, decreased lung function, and premature death.
- **Sulfur Dioxide (SO_2): SO_2** causes a wide variety of health and environmental impacts because of the way it reacts with other substances in the air. When SO_2 reacts with other chemicals in the air to form tiny sulfate particles that are breathed, they gather in the lungs and are associated with increased respiratory symptoms and disease, difficulty in breathing, and premature death. Particularly sensitive groups include people with asthma who are active outdoors, and children, the elderly, and people with heart or lung disease.
- **Carbon Monoxide (CO):** The health threat from lower levels of CO is most serious for those who suffer from heart disease (e.g., angina, clogged arteries, or congestive heart failure). For a person with heart disease, a single exposure to CO at low levels may cause chest pain and reduce that person's ability to exercise; repeated exposures may contribute to other cardiovascular effects. Even healthy people can be affected by high levels of CO. People who breathe high levels of CO can develop vision problems, reduced ability to work or learn, reduced manual dexterity, and difficulty performing complex tasks. At extremely high levels, CO is poisonous and can cause death.

- **Nitrogen Dioxide (NO_2):** NO_2 or its reaction products have effects on breathing and the respiratory system, may cause damage to lung tissue, and may result in premature death. Small particles formed from NO_2 penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease such as emphysema and bronchitis, and aggravate existing heart disease.
- **Ozone (O_3):** Ground-level ozone triggers a variety of health problems including aggravated asthma, reduced lung capacity, and increased susceptibility to respiratory illnesses like pneumonia and bronchitis.
- **Lead (Pb):** Lead causes damage to the kidneys, liver, brain and nerves, and other organs. Exposure to lead may also lead to osteoporosis (brittle bone disease) and reproductive disorders. Excessive exposure to lead causes seizures, mental retardation, behavioral disorders, memory problems, and mood changes. Low levels of lead damage the brain and nerves in fetuses and young children, resulting in learning deficits and lowered intelligence. Lead exposure causes high blood pressure and increases heart disease, especially in men. Lead exposure may also lead to anemia.

Air quality in Orange County and the surrounding region is described in Section 3.2.2.

3.9.1.2 Asthma

Asthma, a disease of the immune system, has a disproportionate effect on children, persons with pre-existing cardiopulmonary conditions, and certain minorities. Asthma is a common chronic disease of childhood, affecting over 4.4 million children in the United States and contributing to over 10 million missed school days annually. Although the cause of asthma is uncertain, indoor and outdoor air quality is believed to be a major contributor to pediatric asthma, and particulate matter exacerbates or induces asthmatic attacks (Environmental Research Foundation 1994). In 2003, the self-reported prevalence of asthma among children in Florida was 9.5%, compared to 8.8% in the United States (National Center for Health Statistics 2003). Asthma is also the leading work-related lung disease, with as much as 20% of adult-onset asthma being work related. In 2003, the self-reported prevalence of asthma among adults in Orange County was 10.8%, compared to 7.7% in the United States.

Asthma-related mortality rates in the United States and asthma-related hospitalization rates in Florida generally decreased during the 1990s (Figure 3.9.1). However, more recent data for asthma hospitalizations in Florida show a reversal of this earlier trend (Figure 3.9.2).

Orange County's chronic disease profile is presented in Table 3.9.1, which includes asthma under the chronic lower respiratory diseases section. Both the percentage of adults with asthma and the asthma hospitalization rates for Orange County are within the middle 50% range of Florida counties.

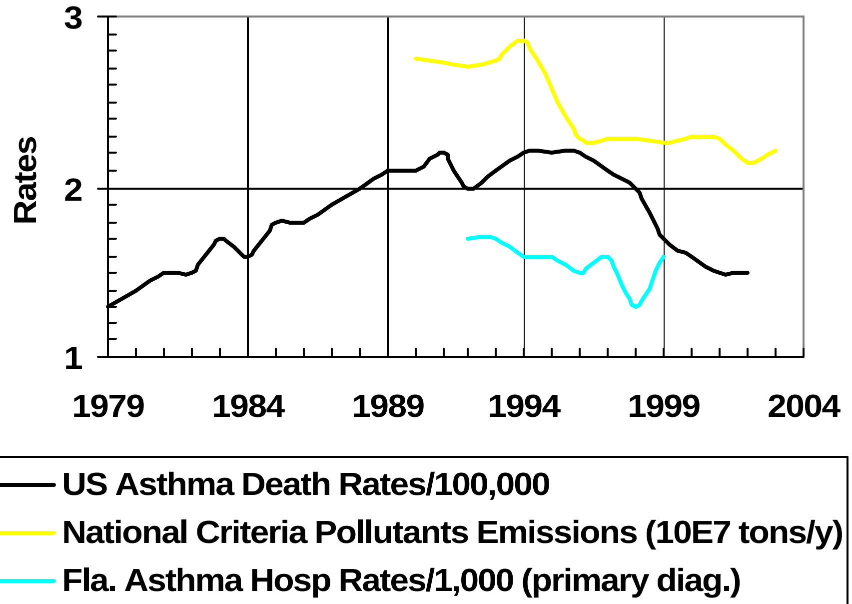

Figure 3.9.1. Asthma trends in the United States and Florida.

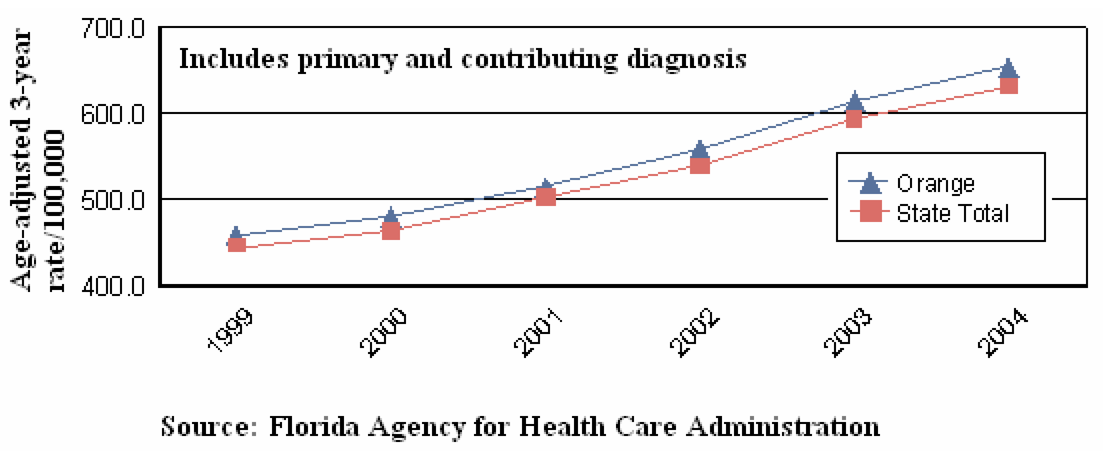

Figure 3.9.2. Recent hospitalization rates in Orange County and Florida due to asthma.

Table 3.9.1. Orange County chronic disease profile

Orange County Chronic Disease Profile

Indicator	Year(s)	Avg. Annual Number of Events	Age-Adjusted Rate[1]	Quartile[2]	State Age-Adjusted Rate
Coronary Heart Disease					
Deaths	2001-03	1,263	166.4	2	166.7
Hospitalizations	2001-03	6,215	747.1	3	748
Stroke					
Deaths	2001-03	367	48.3	2	44.7
Hospitalizations	2001-03	3,041	375.8	4	345.2
Heart Failure					
Deaths	2001-03	94	12.9	3	7.4
Hospitalizations from congestive heart failure	2001-03	2,919	363.3	3	319.8
Lung Cancer					
Deaths	2001-03	423	52.5	1	53.6
Incidence	2000-02	584	74.7	NA	73.9
Percent of Adults who currently smoke	2002		21.40%	2	22.20%
Colorectal Cancer					
Deaths	2001-03	145	18.2	3	17.3
Incidence	2000-02	407	52	NA	53
Percent of Adults 50 and over who have ever had a sigmoidoscopy	2002		53.10%	2	52.60%
Percent of Adults 50 and over who have had a blood stool test in past two years	2002		33.30%	2	33.50%
Breast Cancer					
Deaths	2001-03	116	25	3	22.9
Incidence	2000-02	579	129	NA	122.2
Prostate Cancer					
Deaths	2001-03	78	27.5	3	23.3
Incidence	2000-02	611	175	NA	150.3
Cervical Cancer					
Deaths	2001-03	12	2.4	2	2.8
Incidence	2000-02	51	10.9	NA	10.5
Percent of adult (18+) women who have had a pap test in past three years	2002		82.40%	2	82.20%
Skin Cancer					
Deaths	2001-03	24	2.8	2	2.8
Incidence	2000-02	116	13.8	NA	16.2
Chronic Lower Respiratory Diseases (CLRD)					
Deaths	2001-03	335	43.6	2	39.4
CLRD Hospitalizations	2001-03	2,843	327.5	2	363.9
Percent of Adults (18+) with asthma	2002		10.80%	2	10.70%
Asthma Hospitalizations[4]	2001-03	5,676	613.5	3	592.7
Diabetes					
Deaths	2001-03	192	24.2	2	21.1
Hospitalizations[4]	2001-03	18,561	2,197.70	4	1,813.00
Hospitalizations from amputation due to diabetes[4]	2001-03	244	29.3	3	25.1

Table 3.9.1. Concluded

Percent of Adults who have ever been told by a health professional that they have diabetes	2002		7.40%	2	8.20%
Behavioral Risk Factors (BRFSS) Data (Percent of Adults...)					
Who have been told by a health professional that their blood pressure is high	2002		21.80%	1	27.70%
Whose blood cholesterol is high	2002		27.40%	1	35.20%
Who have had their cholesterol checked in last two years (of those ever measured)	2002		78.30%	4	83.10%
With NO regular moderate physical activity	2002		60.30%	4	55.10%
With NO regular vigorous physical activity	2002		80.10%	3	75.60%
Who engage in no leisure-time physical activity	2002		30.60%	3	26.40%
Who consume < 5 servings of fruits and vegetables per day	2002		75.70%	3	74.30%
Who are overweight (BMI >25)	2002		29.20%	1	35.10%
Who are obese (BMI>=30)	2002		25.70%	3	22.30%

[1]All Age-Adjusted rates are 3-year rates and are calculated using the 2000 Standard US Population These rates also use July 1 Florida population estimates from the Florida Legislature Office of Economic and Demographic Research Click for trend graph Trends not aviailable for BRFSS data

Age-adjusted cancer incidence rates are not displayed for fewer than 10 cases (NA)

[2]Quartile

1 - Most Favorable Situation (25% of counties)
2-3 - Average (50% of counties)
4 - Least Favorable Situation (25% of counties)

Quartiles in this report allow you to compare health data from one county to another in the state Quartiles are calculated by ordering an indicator from most favorable to least favorable by county and dividing the list into 4 equal-size groups In this report a low quartile number (1) always represents more favorable health situations while fours (4) represent less favorable situations Quartiles not available for age-adjusted cancer incidence rates (NA)

[3]Healthy People 2010 goals are single-year rates per 100,000 population (or percentages) at the national level Goals are not available for all indicat
[4]Includes primary and contributing diagnoses

Data Sources
Deaths - Florida Department of Health, Office of Vital Statistics
Risk Factor (BRFSS) - Florida Department of Health, Bureau of Epidemiology
Hospitalizations - Florida Agency for Health Care Administration (AHCA)
Cancer Incidence - University of Miami (FL) Medical School, Florida Cancer Data System

3.9.2 Electromagnetic Fields

3.9.2.1 Background

Electromagnetic radiation is the propagation of energy by time-varying electric and magnetic fields. This energy is transmitted through space or some material medium as a disturbance traveling at or near the speed of light, without the transport of matter. Energy is distributed across the electromagnetic spectrum, which is a continuum composed of spectral regions depicted in Figure 3.9.3.

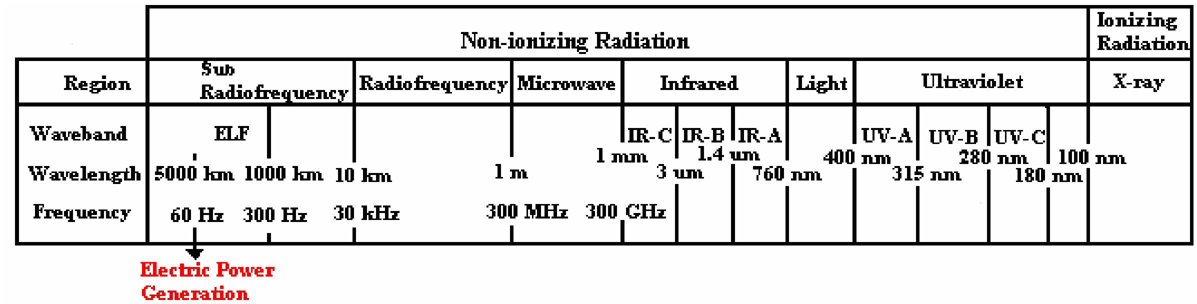

Figure 3.9.3. The electromagnetic spectrum.

An electric field is created by electric charges. The strength of the electric field is expressed in volts per meter. A magnetic field is created by a current (i.e., the movement of electric charges). The magnetic field strength is expressed in amperes per meter, or Gauss. Both the electric and magnetic fields decrease rapidly with distance from the source (e.g., distance from the transmission line). Because the electric field is a function of the voltage impressed on the transmission line, the electric field remains relatively constant with time at any given location. However, magnetic fields fluctuate in relation to the flow of electricity through the line in response to consumer demand for power.

3.9.2.2 Health Implications

Over the past two decades, some members of the scientific community and the public have expressed concern regarding human health effects from electromagnetic fields (EMF) during the transmission of electrical current from power plants. The scientific evidence suggesting that EMF exposures pose a health risk is weak. The strongest evidence for health effects comes from observations of human populations with two forms of cancer: childhood leukemia and chronic lymphocytic leukemia in occupationally exposed adults (NIEHS 1999). The National Institute of Environmental Health Sciences report concluded that “extremely low-frequency electric and magnetic field exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard” (NIEHS 1999). While considerable uncertainty still exists about the EMF health effects issue, the following determinations have been established from the available information:

- Any exposure-related health risk to an individual would likely be small.
- The types of exposures that are most biologically significant have not been established.
- Most health concerns relate to magnetic fields.

- Measures employed for EMF reduction can affect line safety, reliability, efficiency, and maintainability, depending on the type and extent of such measures.

3.9.2.3 Regulatory Requirements

Occupational limits for the portion of the electromagnetic spectrum defined as the radio frequency/microwave region have been established by the Occupational Safety and Health Administration to prevent tissue heating (29 CFR Part 1910.97). No federal regulations have been established specifying environmental limits for the extremely low frequency (ELF) fields from electrical transmission lines.

Florida residents have voiced concerns about the potential for adverse health effects from exposure to electric and magnetic fields. In 1989, as a result of these concerns and a legislative mandate, the Environmental Regulation Commission adopted a rule limiting EMFs from new electrical transmission lines and substations. Due to the lack of conclusive scientific evidence that exposure to transmission line EMFs would produce adverse health effects (Section 3.9.2.2), the Environmental Regulation Commission based the field-strength standards on the premise that new transmission lines and substations should not produce fields greater than the EMFs from existing lines. The Environmental Regulation Commission also required the Florida Department of Environmental Protection to monitor EMF scientific research and to report annually on the findings.

To reasonably protect public health and welfare, the Florida Department of Environmental Protection regulates electric and magnetic fields from electrical transmission lines and substations rated at 69 kilovolts (kV) or greater (Chapter 62-814). Section 62-814.450 specifies electric and magnetic field strengths for existing and new lines and substations. For new lines and substations, limits at the edge of the transmission right-of-way or at the property boundary of the substation are 2 kV/m for electric field strength and 150 milliGauss for magnetic field strength.

3.9.2.4 Existing Conditions

The existing generating capacity of the Stanton Energy Center is approximately 1,569 MW. All electrical transmission lines servicing the power plant are rated at 230 kV. The existing transmission lines and substation are marked by yellow lines in Figure 3.9.4.

3.9.3 Worker Health and Safety

3.9.3.1 Safety Management

Unsafe acts and conditions involving standard industrial hazards that could adversely affect worker health and safety are regulated by the Occupational Safety and Health Administration. Applicable regulations governing occupational safety and health include 29 CFR Part 1910 for general industrial operations and 29 CFR Part 1926 for general construction hazards.

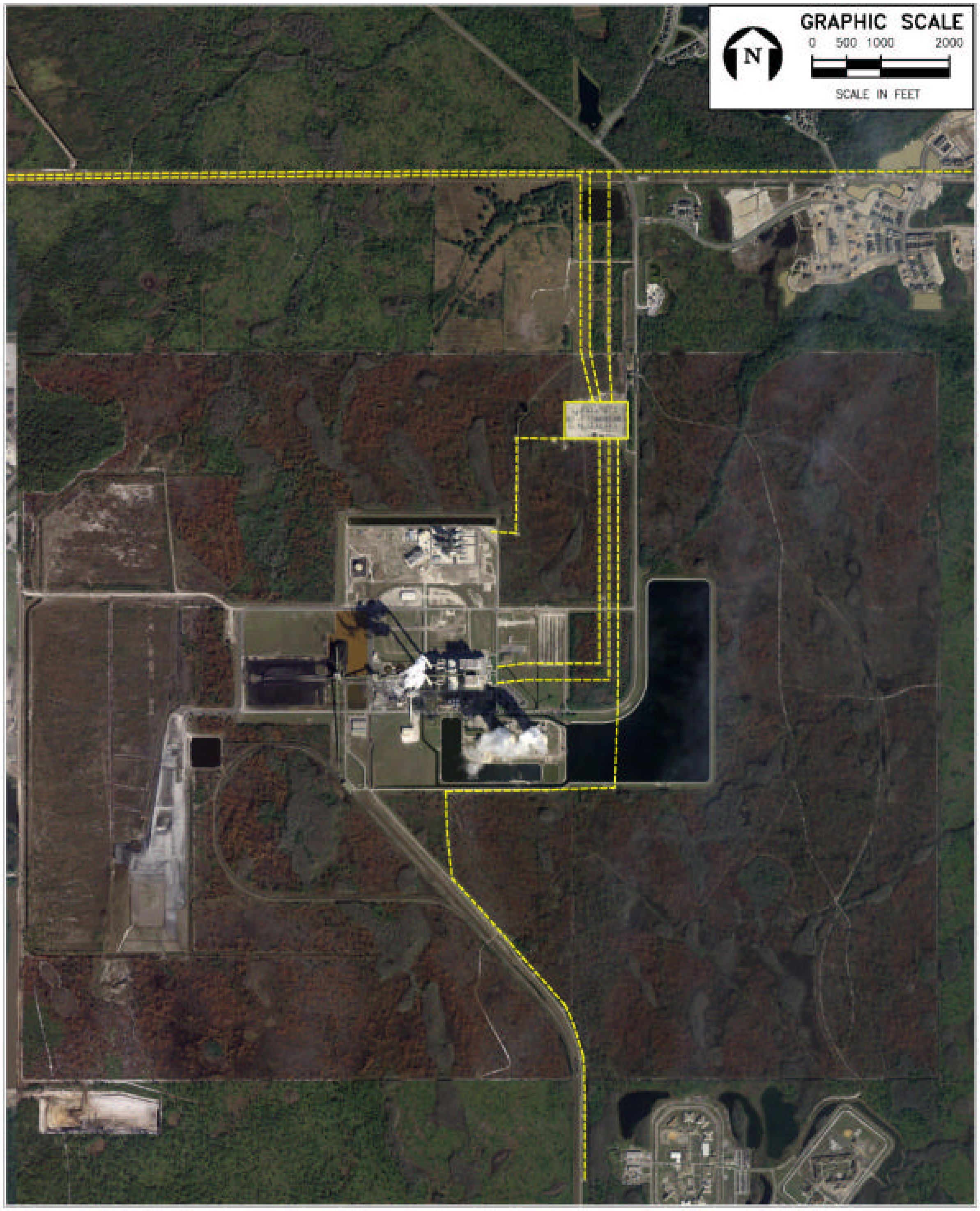

Figure 3.9.4. Location of electrical transmission lines (dashed yellow lines) and substation (solid yellow rectangle) on the Stanton Energy Center site and in the immediate vicinity.

Stanton Energy Center personnel currently maintain written operating procedures and programs for all covered processes, including safety; accident reporting; first aid; fire prevention and protection; hazard communication; welding and cutting; personal protection equipment; tools and equipment; supports and scaffolding; vehicles; material handling, lifting, and storage; excavation and trenches; painting and sandblasting; laboratory safety; electrical maintenance; hazardous energy control; confined space entry; and railway operation.

3.9.3.2 Occupational Illnesses, Injuries, and Fatalities

The Bureau of Labor Statistics annually provides the occupational injury and illness rates and the number of occupational fatalities in the United States and individual states. Such information is useful in identifying industries with high rates and/or large numbers of injuries, illnesses, and fatalities. The results of the annual reports can be used by industry organizations and private companies to start or revise worker safety programs that hopefully will reduce, and ultimately prevent, workplace injuries, illnesses, and fatalities. The Bureau of Labor Statistics (2003a) defines a work-related injury as "any wound or damage to the body resulting from an event in the work environment."

A total of 4.4 million nonfatal injuries and illness were reported in private industry workplaces in the United States during 2003 (the most recent year with complete data), resulting in a rate of 5.0 cases per 100 equivalent full-time workers. Table 3.9.2 provides the overall rate, as well as rates for the construction and utilities sectors (including power generation) for the United States and Florida. The data indicate that the recordable injury and illness rates for utilities are less than for private industry overall, while the construction rates are greater than for private industry overall.

Table 3.9.2. Recordable occupational injury and illness rates for the United States and Florida (2003)

Industry	Total recordable incidence rate per 100 full-time employees	
	United States	Florida
Private industry (overall)	5.0	5.0
Construction	6.8	7.5
Utilities	4.4	4.0

Source: U.S. Department of Labor, Bureau of Labor Statistics 2003. Bureau of Labor Statistics News Workplace Injuries and Illnesses in 2003. http://www.bls.gov/news.release/pdf/osh.pdf.

The Bureau of Labor Statistics (2003b) defines a fatality as "a death that results from a traumatic occupational injury," where injury is defined in this case as "any intentional or unintentional wound or damage to the body resulting from acute exposure to energy, such as heat, electricity or kinetic energy from a crash, or from the absence of such essentials as heat or oxygen caused by a specific event, incident, or series of events within a single workday or shift." In 2003, the construction industry reported 1,131 fatalities in the United States, while the utilities industry reported 32 fatalities (Table 3.9.3). In the state of Florida, 93 construction fatalities and 4 utilities industry fatalities were reported.

Table 3.9.3. Number of fatal occupational injuries (2003)

Industry	Number of U.S. fatalities	Number of Florida fatalities
Construction	1,131	93
Utilities	32	4

Sources: U.S. Department of Labor, Bureau of Labor Statistics 2003. Bureau of Labor Statistics News – National Census of Fatal Occupational Injuries in 2003. http://www.bls.gov/news.release/pdf/cfoi.pdf.

U.S. Department of Labor, Bureau of Labor Statistics 2003. Bureau of Labor Statistics News – Florida Workplace Fatalities, 2003. http://www.bls.gov/news.release/pdf/cfoi.pdf.

A review of the Stanton Energy Center's Occupational Safety and Health Administration Form 300 logs for 2001–05 indicates that (1) no fatalities occurred; (2) Units 1 and 2 have had several reportable injuries since October 2001, but only 11 incidents involving lost workdays; and (3) Unit A has not reported any work-related injuries except for one incident that occurred in March 2004 (the injury consisted of a separated left shoulder resulting in the employee being temporarily transferred, but did not result in any lost workdays).

3.9.3.3 Onsite Hazard Areas

Existing hazard areas at the Stanton Energy Center include the fuel storage area; chlorine storage area; ammonia storage area; power blocks; compressed gases area; transformer areas and substation; cooling water chemical treatment area; waste storage area; water treatment area; coal receiving, storage, and handling areas, including the conveyor system; and transmission lines. The greatest potential hazards are associated with the chlorine, ammonia, and fuel storage areas due to their concentrated storage quantities.

Various types of fuel and oils are stored at the Stanton Energy Center. However, the vast majority of oil is No. 2 diesel oil stored in above-ground storage tanks. Hazards associated with the fuel storage area include fire and explosion or spills and discharges to the environment. To address the fire and explosion potential, the power plant has a written emergency action plan, which meets the requirements of 29 CFR Part 1910.38 (Occupational Safety and Health Administration), providing specific actions to be followed in emergency situations. The plan is designed to address a wide variety of emergencies caused by fire, explosion, natural disaster, or threats that may threaten personnel, property, production, or the environment. In addition, the Stanton Energy Center has a facility response plan, as required by 40 CFR Part 112 for facilities with a total oil storage capacity of greater than 1 million gal that are located at a distance such that a discharge from the facility could possibly affect environmentally sensitive areas.

Chlorine, which is used at the Stanton Energy Center to treat cooling tower water, is stored in 1-ton vessels containing liquefied chlorine gas. Anhydrous ammonia is used in the Unit 2 and Unit A selective catalytic reduction systems to reduce NO_x emissions. Within the Occupational Safety and Health Administration's general industrial regulations, a section titled "Process Safety Management of Highly Hazardous Chemicals" (29 CFR Part 1910.119) addresses requirements for preventing or minimizing the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals. For hazards that may have impact beyond the plant boundaries, applicable regulations include the EPA's 40 CFR Part 68 (Chemical Accident Prevention Provisions), which is also referred to as the risk management program regulation, and the Florida Accidental Release Prevention and Risk Management Planning Act (Part IV of Chapter 252 of the Florida statutes).

3.10 Noise

3.10.1 Background

In air, sound is usually described in terms of oscillations in pressure above and below ambient atmospheric pressure. The human ear can detect a range of pressure that varies by a factor of about 1,000,000. The decibel is a logarithmic rating system used to scale sound that accounts for this large difference in audible intensities. The pressure oscillations generated by a vibrating surface or turbulent fluid flow cause high and low pressure areas to be formed, which then propagate away from the source. The rate at which the pressure oscillations are produced is the frequency, which has units of hertz (Hz). One hertz equals one cycle per second. Pitch is the human perception of frequency, with normal human hearing ranging from about 16 Hz to 20,000 Hz.

Sounds in the ambient air typically contain many superimposed frequencies of varying pressures. People's perception of loudness to sound is both pressure and frequency dependent. Human hearing is best at frequencies of around 500 Hz to 5000 Hz, and people are most annoyed or disturbed by noise in this range. Monitoring instruments are designed to electronically filter the noise signal to emphasize frequencies within the response range of the human ear. The most common noise descriptor used for ambient noise assessments is dBA. Extensive studies have shown that noise passed through the A-weighting network correlates well with noise disturbance perceived by people. A-weighting has the effect of reducing measured levels of very low and very high frequencies, but has less filtering effect on the mid-range frequencies where speech and communication are important.

Typical sound levels of familiar noise sources and activities are presented in Table 3.10.1. The human perception of a doubling of loudness is reflected in the scale as an increase of 10 dBA. Therefore, a 70-dBA sound level would sound twice as loud as a 60-dBA sound level to most individuals. People's perception of noise increases depends on the nature of the background noise compared to the intruding noise. If the background noise is of the same character as the intruding

Table 3.10.1. Common noise sources, sound levels, and human responses

Thresholds/ Noise Sources	Sound Level (dBA)	Subjective Evaluations[1]	Possible Effects on Humans
Human threshold of pain Carrier jet takeoff (50 ft)	140	Deafening	Continuous exposure can cause hearing loss in majority of population
Siren (100 ft) Loud rock band	130		
Jet takeoff (200 ft) Auto horn (3 ft)	120		
Chain saw Noisy snowmobile	110		
Lawn mower (3 ft) Noisy motorcycle (50 ft)	100	Very loud	
Heavy truck (50 ft)	90		
Pneumatic drill (50 ft) Busy urban street, daytime	80	Loud	
Normal automobile at 50 mph Vacuum cleaner (3 ft)	70		Speech interference
Large air conditioning unit (20 ft) Conversation (3 ft)	60	Moderate	
Quiet residential area Light auto traffic (100 ft)	50		Sleep Interference
Library Quiet home	40	Faint	
Soft whisper (15 ft)	30		
Slight rustling of leaves	20	Very faint	
Broadcasting studio	10		
Threshold of human hearing	0		

[1] Note that both the subjective evaluations and the physiological responses are continual without true threshold boundaries. Consequently, there are overlaps among categories of response that depend on the sensitivity of the individuals exposed to noise.

Wallula Power Project DEIS
February 2002

Source: EPA 1971

noise (e.g., new traffic noise added to existing traffic noise), then people generally cannot detect differences less than 1 dBA. However, if the intruding noise is of a different character than the background noise (e.g., the whine of a new turbine superimposed onto rural background noise), then the intruding noise could be easily discernible even if it adds less than 1 dBA to the background noise level.

Characterizing noise that varies with time can be accomplished in a variety of ways. The method consistent with the Orange County noise ordinance (Section 3.10.2) uses the "equivalent sound level" (L_{eq}). The L_{eq} is a single descriptor based on the average acoustic intensity over a specified period of time. The "day-night sound level" (L_{dn}) is similar to the L_{eq}, except that a 10-decibel factor is added to artificially increase noise sources between 10 p.m. and 7 a.m. to apply more stringent standards of compliance for that time period.

3.10.2 Regulatory Requirements

The state of Florida has no applicable noise laws or regulations. However, Orange County ordinance Chapter 15 (Article V) titled "Noise and Vibration Control" was enacted to prevent, prohibit, and provide for the abatement of excessive and unnecessary noise and vibration in the unincorporated area of the county in order to protect the health, safety, and general welfare of the county inhabitants. Chapter 15 stipulates maximum permissible sounds levels; land use categories; times; measurement descriptors; and adjustment for character of sound. For residential areas, the noise limit is 60 dBA from 7 a.m. until 10 p.m. and 55 dBA from 10 p.m. until 7 a.m. For noise-sensitive zones (i.e., quiet zones where serenity is of extraordinary significance), the noise limit is 55 dBA at any time. Motor vehicles operating on a public right-of-way are exempt from the noise ordinance. The ordinance also limits frequency-dependent sound pressure levels and impulsive noise.

3.10.3 Ambient Noise Levels

The Stanton Energy Center currently operates within the noise guidelines stipulated by the Orange County noise ordinance (Section 3.10.2). Sound levels at the plant site are similar to those at other industrial plants surveyed by Goodfriend and Associates (1971). The relatively steady noise resulting from the plant is augmented by the presence of other sound sources in the area, including other industrial activities, vehicular traffic, and nearby passing trains and airplanes. The nearest residential area to the proposed facilities is Avalon Park, located approximately 6,500 ft to the northeast.

Ambient noise to characterize the existing acoustic environment was measured by Environmental Consulting & Technology, Inc., for brief periods at six locations on or near the power plant site. Measurements were made with a sound pressure level meter with "A" frequency weighting and were reported as sound pressures levels referenced to a baseline of 0.00002 N/m^2. During the noise survey, Units 1, 2, and A were in operation, and light winds were generally from the south. These data, collected at the locations shown in Figure 3.10.1, are presented in Table 3.10.2.

The narrow range of noise levels at Location 1 resulted from the steady noise generated by operation of the nearby Unit A, including its cooling tower. Based on the measurements at Location 1, noise attenuation with distance is likely to reduce the noise generated by Unit A to below the 55 dBA and 60 dBA limits imposed by the Orange County noise ordinance in residential areas and noise-sensitive zones (Section 3.10.2). Wider variability in noise levels was measured at most of the other locations, where passing vehicles and other brief events caused higher maximum levels and greater disparity relative to the lowest levels. Noise from the electrical generating units and associated facilities was only faintly observed at the northern property boundary (Location 3) during the evening of August 17 and was not detected at any other location. Noise levels measured at Location 4, the residential location, do not appear to be the result of noise emanating from the Stanton Energy Center site.

Figure 3.10.1. Locations at which noise levels were measured (August 16 and 17, 2005).

Table 3.10.2. Ambient noise survey results (August 16 and 17, 2005)

Location	Date	Time	Duration (min)	Range of noise levels (dBA)	L_{eq} (dBA)	Prevailing noise sources
1	16	10:44	11	68.2 to 77.2	69.2	Unit A, Unit A cooling tower, gas metering station, passing vehicles, Units 1 and 2
2	16	11:04	9	45.7 to 80.9	61.2	Insects, compressor engine, heavy equipment on landfill, passing garbage trucks, heavy equipment
3	16	11:25	19	49.1 to 79.1	58.2	Concrete batch plant, passing trucks, insects
	17	18:50	23	40.1 to 70.1	52.2	Insects, passing trucks, overhead jets, power plant (faint), traffic on BeeLine Expressway (faint)
4	16	13:32	12	44.6 to 94.1	73.3[a]	Passing vehicles, insects
5	16	14:02	14	43.1 to 75.3	54.9	Insects, static from overhead transmission lines, overhead jets, traffic on BeeLine Expressway
6	16	14:23	11	47.6 to 72.2	57.1	Insects, birds, traffic on BeeLine Expressway, trucks on on-ramp, vehicles traveling to/from corrections center

[a]For residential areas, the Orange County noise limit is 60 dBA from 7 a.m. until 10 p.m. and 55 dBA from 10 p.m. until 7 a.m.

Existing steam blowdowns as part of scheduled maintenance at the power plant are estimated to generate noise levels of 102 dBA at a distance of 50 ft from the source. Attenuation with distance is estimated to reduce noise levels to 66 dBA at the northern property boundary and 58 dBA at the Avalon Park boundary.

4. ENVIRONMENTAL CONSEQUENCES

4.1 PROPOSED ACTION

4.1.1 Land Use and Aesthetics

4.1.1.1 Land Use

The proposed facilities would be confined to the existing Stanton Energy Center site and thus would not directly affect offsite land use. The 1,100-acre developed portion of the power plant site is designated specifically for power generation through the site certification process under Florida's Power Plant Siting Act. Through this process, power production has previously been approved by state and local agencies as an activity compatible with offsite land use, and the power plant has been determined to satisfy zoning requirements.

Land in the surrounding area is either (1) already developed (e.g., Avalon Park, Orange County Sanitary Landfill, Central Florida Reception Center), (2) planned for development that would be compatible with (or not affected by) the proposed facilities (e.g., the proposed International Corporate Park), or (3) prohibited from development (i.e., Hal Scott Regional Preserve and Park). The limited in-migration of workers required for construction and operation of the proposed facilities would not increase offsite land use for residential purposes (Section 4.1.7.3).

The entire Stanton Energy Center site is currently zoned as "Farmland Rural (A-2)" in the Orange County Comprehensive Plan, but the plan designates the developed portions of the site as an "Institutional" land use. The Institutional land use designation allows for any zoning district, according to the Future Land Use Element of the Comprehensive Plan. The Land Development Code contains a table of permitted uses, special exceptions, and prohibited uses. The table lists power plants and, within the A-2 zoning district, power plants are identified as a "special exception" required.

A 1981 resolution by the Orange County Board of County Commissioners granted a special exception permitting the construction of the Stanton Energy Center and associated facilities within the A-2 zoning district. The special exception was applied to the entire 3,280-acre site, including future units such as the proposed IGCC facilities.

Construction and operation of the proposed facilities within the "Institutional" portion of the Stanton Energy Center site would be consistent with the Orange County Comprehensive Plan because the facilities (1) would be similar to and compatible with the surrounding area and consistent with the pattern of development, (2) would not be a detrimental intrusion into the surrounding area, and (3) would meet the performance standards and buffer yard requirements of the Farmland Rural (A-2) zone.

4.1.1.2 Aesthetics

The tallest structures to be constructed as part of the proposed facilities would be the 205-ft HRSG stack, the 174-ft structure to house the gasifier, and the 114-ft HRSG. These structures would be shorter than the existing two 550-ft stacks serving Units 1 and 2, the two 431-ft natural-draft cooling towers serving Units 1 and 2, and the 225-ft Unit 1 and 2 boiler buildings. Aesthetic impacts of the proposed facilities would be further reduced because the facilities would be located between existing facilities, appearing as a continuation of the existing industrial character of the site rather than as a change in character. Although the existing power plant is visible from part of the surrounding local area, the 550-ft stacks and 431-ft cooling towers are the only conspicuous onsite structures that can be seen from nearby homes because of the forested buffer that visually screens most of the facilities (Section 3.1.3). Consequently, the proposed facilities, which would be shorter than the existing 225-ft Unit 1 and 2 boiler buildings, would likely not be visible from nearby homes.

The only federal, state, or local scenic, cultural, or natural landmark in the vicinity of the Stanton Energy Center site is the adjacent Hal Scott Regional Preserve and Park to the east of the site. Minimal aesthetic impacts upon this resource would be experienced due to the 1-mile separation of the park from the proposed facilities, the presence of the existing power plant facilities, and the adequacy of forested land to screen much of the plant site.

Because operation of the proposed multipoint flare would produce almost no visible flame during daylight hours, the flare would be nearly undetectable, except for shadows from heat effects (Section 2.1.2.8). Blue/purple flames would be visible during the nighttime from nearby locations with lines of sight to the flare. The flame height would rise to about 40 ft above the burners, which would be located 10 ft above ground level. A 20-ft tall thermal barrier would block the view of the burners and the lowest 10 ft of the 40-ft flames (Section 2.1.2.8). The forested buffer would visually screen at least part of the flare from nearby homes.

As with the existing Stanton Energy Center (Section 3.1.3), water droplets from the stack and plumes of water droplets from the cooling towers would occasionally be visible. Under most meteorological conditions, the atmosphere would be unsaturated and would provide enough mixing so that the water vapor from the stack and cooling towers would not condense. However, during meteorological conditions when the atmosphere is nearly saturated, winds are light, and mixing is very low (i.e., during some early morning hours), condensation is possible, which would appear in the form of a stack plume or cooling tower plume and/or fog (Section 4.1.2.2).

The Federal Aviation Administration would regulate the marking and lighting of temporary and permanent structures associated with the proposed facilities (Section 7.1). Generally, construction cranes and other elevated equipment require lighting if their height above the ground exceeds 200 ft. The 205-ft HRSG stack would probably require medium- or high-intensity flashing white obstruction lights. The lights would operate at reduced intensity during the night. Because this type of lighting is currently installed and operating on the Stanton Energy Center's Unit 1 and 2 stacks and cooling towers, the additional lighting would be consistent with the site's industrial appearance.

4.1.2 Atmospheric Resources and Air Quality

This section evaluates potential impacts to atmospheric resources that could result from construction and operation of the proposed facilities. Section 4.1.2.1 discusses effects of construction, including fugitive dust associated with earthwork and excavation. Section 4.1.2.2 discusses operational effects, including from emissions of criteria and hazardous air pollutants, regional-scale acidic deposition, and global climate change.

4.1.2.1 Construction

During construction of the proposed facilities, temporary and localized increases in atmospheric concentrations of NO_x, VOCs, CO, SO_2, and particulate matter would result from exhaust emissions of workers' vehicles, heavy construction vehicles, diesel generators, and other machinery and tools. An average of about 30 vehicles, ranging from passenger vehicles to earthmovers, would be used for construction activities on the site. Internal combustion engines would be used for activities such as excavation, concrete placement, and structural steel installation. Construction vehicles and machinery would be equipped with standard pollution-control devices to minimize emissions. These emissions would be very small compared to regulatory thresholds typically used to determine whether further air quality impact analysis is necessary [such as 40 CFR Part 93.153(b)].

Fugitive dust would result from excavation, soil storage, and earthwork. Most of this work would occur at the 35-acre principal site of the proposed facilities located between the existing coal-fired units and the existing natural gas-fired combined-cycle unit. Minor clearing and grading activities would occur along the short transmission line (approximately 3,200 ft in length) proposed to serve as an electrical interconnection from the proposed facilities to the existing onsite substation.

The impacts of fugitive dust on particulate concentrations in the ambient air were modeled using the EPA-approved SCREEN3 air dispersion model, which is a single-source, steady-state Gaussian plume model that predicts maximum ground-level concentrations downwind from point, area, flare, and volume sources (EPA 1995a). SCREEN3, a screening version of the Industrial Source Complex Short-Term (ISCST3) model (EPA 1995b), provides conservative results (forming an upper bound) using a full range of 54 potential meteorological conditions (i.e., conditions representing different combinations of atmospheric stabilities and wind speeds). This screening meteorological data set typically results in appreciably greater modeled concentrations compared to modeled concentrations using actual meteorological data. The SCREEN3 model was run using flat terrain, which is conservative for a nonbuoyant ground-level source such as fugitive dust generated during earthwork. Conversion factors were used to adjust the maximum 1-hour concentrations predicted by SCREEN3 to 24-hour and annual averages (EPA 1992), as required for comparison with particulate standards (Table 3.2.1).

The temporary impacts of fugitive dust from construction activities on offsite particulate concentrations would be localized because of the relatively rapid settling of larger-size fugitive dust particles. An average emission factor of 1.2 tons of total suspended particulate matter per acre per month was assumed (EPA 1985a). Of these emissions, roughly 30% of the mass would consist of particulate matter less than 10 μm in aerodynamic diameter (PM-10) (Kinsey and Cowherd 1992). To minimize fugitive dust emissions, water spray trucks would dampen exposed soil at the construction site with water as necessary, which was assumed would reduce fugitive dust by 50% (EPA 1985a). Because the Stanton Energy Center has an existing network of paved access roads, no watering would be required on these roads. Because construction on the 35-acre plot of land would be staggered, the maximum area undergoing heavy earthwork at any one time was assumed to be 10 acres.

For the proposed construction activities, modeling results indicated that the greatest PM-10 concentrations would occur at the proposed construction site, and concentrations would decrease steadily with distance from the site. Consequently, the maximum concentrations in the ambient air would occur at the nearest property boundary, located approximately 3,000 ft to the north of the northern edge of the proposed principal site. The maximum modeled 24-hour PM-10 concentration at this location (adjusted by the conversion factor) was predicted to be 89 $\mu g/m^3$, and the maximum modeled annual PM-10 concentration (adjusted by the conversion factor) was predicted to be 18 $\mu g/m^3$. For comparison with the NAAQS, total PM-10 concentrations were obtained by adding maximum modeled concentrations to their corresponding background concentrations. To parallel the methodology of the standards, the background concentrations used (i.e., 41 $\mu g/m^3$ for the 24-hour averaging period and 27 $\mu g/m^3$ for the annual average) were the 5th highest 24-hour concentration and the maximum annual concentration recorded during the 4-year period at the Sheriff's Department, which recorded the highest concentrations of nearby PM-10 monitoring stations in Orlando (Table 3.2.1). For the 24-hour averaging period, the total PM-10 concentration was predicted to be 130 $\mu g/m^3$ [89 (modeled) + 41 (background) = 130 (total)], which is less than its corresponding NAAQS of 150 $\mu g/m^3$ (Table 3.2.1). For the annual averaging period, the total PM-10 concentration was predicted to be 45 $\mu g/m^3$ [18 (modeled) + 27 (background) = 45 (total)], which is less than its corresponding NAAQS of 50 $\mu g/m^3$ (Table 3.2.1).

A similar modeling analysis of proposed construction activities was conducted for the impacts of fugitive dust on offsite concentrations of particulate matter less than 2.5 µm in aerodynamic diameter (PM-2.5). PM-2.5 emissions of fugitive dust were assumed to be 10% of PM-10 emissions (MRI 2005). As with the PM-10 analysis, modeling results indicated that the maximum concentrations in the ambient air would occur at the nearest property boundary, located approximately 3,000 ft to the north of the northern edge of the proposed principal site. The maximum modeled 24-hour PM-2.5 concentration at this location (adjusted by the conversion factor) was predicted to be 9 $\mu g/m^3$, and the maximum modeled annual PM-2.5 concentration (adjusted by the conversion factor) was predicted to be 2 $\mu g/m^3$. For comparison with the NAAQS, total PM-2.5 concentrations were obtained by adding maximum modeled concentrations to their corresponding background concentrations. To parallel the methodology of the standards, the background 24-hour concentration used was the highest 3-year average of the 2nd highest 24-hour concentrations (34 $\mu g/m^3$), and the background annual concentration used was the maximum annual average (12 $\mu g/m^3$). Both background concentrations were obtained from the 5-year record at North Primrose Avenue, which recorded the highest concentrations of nearby PM-2.5 monitoring stations in Orlando (Table 3.2.1). For the 24-hour averaging period, the total PM-2.5 concentration was predicted to be 43 $\mu g/m^3$ [9 (modeled) + 34 (background) = 43 (total)], which is less than its corresponding NAAQS of 65 $\mu g/m^3$ (Table 3.2.1). For the annual averaging period, the total PM-2.5 concentration was predicted to be 14 μg/m^3 [2 (modeled) + 12 (background) = 14 (total)], which is less than its corresponding NAAQS of 15 μg/m^3 (Table 3.2.1).

Actual concentrations would be less than predicted because of the conservative assumptions, including linking worst-case meteorological conditions (occurring during the nighttime) with the emission factors described above. Actual emissions during these nighttime meteorological conditions would be considerably less because no machinery would be operating and because of the low wind speed (about 2 miles per hour) associated with worst-case meteorological conditions, which would minimize exposed soil from becoming airborne.

4.1.2.2 Operation

Sources of air emissions from the proposed facilities would include the HRSG stack, startup stack, multipoint flare, and 6-cell mechanical-draft cooling tower, of which the HRSG stack would generate the most emissions. Except during occasional startups, shutdowns, and upsets, the flare would normally have only minimal emissions associated with eight natural gas-fired pilot lights. To ensure a conservative estimate, emissions for air quality modeling purposes, are based on 100% load throughout the year (100% capacity factor) using the higher of estimated synthesis gas or natural gas emission rates. On this basis, annual emissions of criteria pollutants from the proposed facilities would include 162 tons of SO_2, 1,006 tons of NO_x, 189 tons of particulate matter, 654 tons of carbon monoxide (CO), and 0.03 tons of lead (Pb). Annual NO_x emissions from the Stanton Energy Center overall would not be expected to increase because, as part of the air permitting process, OUC has agreed to reduce NO_x emissions from other units at the Stanton Energy Center so that there would be a net decrease in NO_x emissions. Annual emissions of volatile organic compounds (VOCs), a precursor of the criteria pollutant ozone, would be 129 tons.

Mobile emission sources would include plant vehicular traffic and personal commuter vehicles. About 20 vehicles, ranging from passenger vehicles to tanker trucks, would be used during operations on the site. These vehicles would be equipped with standard pollution-control devices to minimize emissions, which would be very small compared to regulatory thresholds typically used to determine whether further air quality impact analysis is necessary [such as 40 CFR Part 93.153(b)]. The small amount of traffic would not contribute appreciably to ambient air pollutant concentrations in the area. Emissions from the two to three trains per week delivering coal from the Powder River Basin in Wyoming to the Stanton Energy Center would be modest compared to regulatory thresholds.

Additional particulate matter would be generated from handling, transfer, and storage of coal, process wastes, and byproducts. To reduce these particulate emissions, the number of handling and transfer points would be minimized, the conveyors and material loading and unloading points would be enclosed, and wetting systems and collection devices (e.g., baghouses) would be installed.

Minor atmospheric impacts would be expected in Wyoming from the slightly increased level of coal mining in the Powder River Basin. The active mining area would likely remain the same, but the rate of mining would increase to accommodate the annual requirement of approximately 1.02 million tons by the proposed facilities. For comparison, Wyoming coal production during 2004 was at a level of about 396 million tons. About 96% of that total was produced in the Powder River Basin. Emissions from mining vehicles and equipment and fugitive particulate emissions would increase slightly from the additional mining. Fugitive dust consists primarily of large particles that would settle quickly and pose minimal adverse public health effects.

Criteria Pollutants

As discussed in detail in Appendix D, potential air quality impacts associated with operation of the proposed facilities were evaluated using a two-tiered approach: screening and refined. At the screening level, modeling provided conservative estimates of impacts to determine whether more detailed modeling was required. Screening modeling was also used to identify worst-case operating scenarios for subsequent refined modeling analysis. For the proposed facilities, the current version of EPA's SCREEN3 Dispersion Model (EPA 1995a) (Version 96043; February 12, 1996) was employed as a screening tool to evaluate the various operating scenarios associated with the proposed facilities.

The refined level of air dispersion modeling consists of techniques that provide more advanced technical treatment of atmospheric processes. Refined modeling requires more detailed and precise input data, but also provides improved estimates of source impacts. The American Meteorological Society (AMS)/EPA Regulatory Model (AERMOD) modeling system (EPA 2004a; EPA 2004b), together with 5 years of hourly meteorological data were used in the refined ambient impact analysis. AERMOD was used to obtain refined impact predictions for short-term periods (i.e., periods equal to or less than 24 hours) and was also utilized to obtain refined predictions of annual average concentrations. In the analyses, all particulate emissions were conservatively assumed to be less than or equal to 10 μm in aerodynamic diameter (PM-10) for comparison with the standards.

The refined analysis incorporating multiple years of meteorology was conducted to determine air quality impacts for the worst-case operating scenarios identified by the screening analysis. Because no surface or upper-air meteorological stations are located at the Stanton Energy Center (Section 3.2.1), the refined analysis used five years of surface meteorological data from Orlando International Airport (about 8 miles southwest of the power plant) and upper-air data from Ruskin, Florida (about 90 miles southwest of the power plant near the Gulf Coast). Orlando International Airport is the nearest location at which quality-assured hourly meteorological data are archived. Due to the proximity of the airport to the proposed site and due to the terrain in the area being relatively flat and homogeneous, meteorological data from the airport are considered representative of the project site. For meteorological data input to the AERMOD model, the analysis used the most recent consecutive 5 years of airport data (1996–2000) that satisfied the guideline suggested by EPA (2000) of no more than 10% missing data per year. More recent years were excluded because 11.7% of the airport data was missing in the year 2001.

Mixing height data were generated using Orlando International Airport surface data in conjunction with upper-air data for the same 5-year period (1996–2000) from Ruskin, Florida, the nearest upper-air station. The upper-air data represent large-scale meteorological conditions, which usually are relatively uniform between Ruskin and Orlando compared to surface data. On warm and sunny days, however, when inland areas (e.g., Orlando) can be much warmer than coastal areas (e.g., Ruskin), the height above ground to which convection causes appreciable vertical mixing (the mixing height) is typically higher over inland areas and lower over coastal areas. Consequently, in such cases, the lower mixing height generated by using the upper-air data at Ruskin would tend to underestimate the thickness of the atmosphere available for vigorous mixing and overestimate actual downwind concentrations. The Ruskin data, which are the best available, are conservative (i.e., form an upper bound) under most conditions.

Concentrations were modeled at ground-level locations (receptors) along or outside the Stanton Energy Center property boundary. At the site fence line, receptors were placed at 164-ft intervals. At multiple rectangular grids beyond the fence line, receptors were placed at 328-ft intervals within about 2 miles of the power plant, at 820-ft intervals extending to about 4 miles from the plant, and at 1,640-ft intervals out to about 9 miles. Terrain considerations used by the AERMOD model are discussed in Section D.6 of Appendix D. Because of the large existing buildings nearby, wake effects from building downwash were considered using EPA's Building Profile Input Program (BPIP) to determine the area of influence for each building. The results were used as input to the AERMOD model.

In this analysis, significant impact levels were used to measure the significance of the maximum predicted concentrations (EPA 1990). The significant impact levels are much more stringent than the NAAQS (Table 3.2.1) and PSD Class II increments (Table 3.2.2), and even more stringent or the same as the PSD Class I increments (Table 3.2.2). According to EPA guidelines (1990), a preliminary modeling analysis using significant impact levels should include only the emissions associated with the proposed facilities to determine if the facilities would have a significant impact on ambient air quality. If the maximum predicted concentrations are less than the significant impact levels, additional modeling including other sources and background concentrations is not required for regulatory purposes (EPA 1990).

Results indicate that maximum concentrations are predicted to be less than their corresponding significant impact levels (Table 4.1.1). Therefore, additional modeling including other sources and background concentrations would not be required by EPA for regulatory purposes for any of the pollutants. Because of the conservative assumptions used in the analysis, actual degradation of air quality should be even less than the small amounts predicted. Maximum concentrations for all pollutants and averaging periods were predicted to occur at or near the Stanton Energy Center property boundary at approximately 3,400 ft north of the proposed HRSG stack. Concentrations at other locations, including nearby residences, would be less. Concentrations would be negligible at the nearest PSD Class I area, about 90 miles to the west-northwest (Section 3.2.2), because dispersion of pollutants at that distance would reduce atmospheric concentrations to a small fraction of the maximum modeled concentrations, which are predicted to be less than PSD Class I increments at the location of their maximum impact at or near the Stanton Energy Center property boundary.

Table 4.1.1. Maximum predicted ambient air pollutant concentrations due to emissions from the proposed facilities compared to significant impact levels

Averaging period	SO_2 (μg/m^3)	NO_2 (μg/m^3)	PM-10 (μg/m^3)	CO (μg/m^3)	Significant impact level (μg/m^3)
1-hour	--	--	--	13.7	2,000
3-hour	3.1	--	--	--	25
8-hour	--	--	--	10.2	500
24-hour	1.4	--	4.4	--	5
Annual	0.1	0.6	0.4	--	1

Although additional modeling including other sources and background concentrations is not required for regulatory purposes for any of the pollutants, nevertheless the modeling results in Table 4.1.1 (SO_2, NO_2, PM-10, and CO) were added to the ambient background concentrations measured in the Orlando area (Table 3.2.1, which incorporates all existing sources, including those at the Stanton Energy Center). The results are compared with the ambient air quality standards (Table 4.1.2). The total impact (second column from the right in Table 4.1.2) is the sum of the modeled concentration (Table 4.1.1) and the ambient background concentration measured in the Orlando area (Table 3.2.1). The highest total impact for SO_2, NO_2, PM-10, and CO is less than 60% of its respective standard (the rightmost column in Table 4.1.2). Consequently, cumulative air quality impacts from the sum of the proposed facilities and existing sources, including those at the Stanton Energy Center even without considering offsets in NO_x emissions, would not be expected.

No significant impact levels or PSD increments currently exist for PM-2.5. However, assuming very conservatively that all particulate emissions from the proposed facilities are less than or equal to 2.5 μm in aerodynamic diameter (PM-2.5), the maximum modeled 24-hour PM-2.5 concentration of 4.4 μg/m^3 (Table 4.1.1) would be only 7% of its corresponding NAAQS of 65 μg/m^3 (Table 3.2.1). Similarly, the maximum modeled annual PM-2.5 concentration of 0.4 μg/m^3 (Table 4.1.1) would be about 3% of its corresponding NAAQS of 15 μg/m^3 (Table 3.2.1). These small percentages would not be expected to result in violations of the PM-2.5 NAAQS, for which Orange County is in attainment (Section 3.2.2). The highest total impact for the 24-hour PM-2.5 concentration is about 59% of its respective standard (i.e., the sum of the modeled 4.4 μg/m^3 and the ambient background concentration of 34 μg/m^3 in Table 3.2.1 equals 38.4 μg/m^3, which is 59% of 65 μg/m^3). Similarly, the highest total impact for the annual PM-2.5 concentration is about 83% of its respective standard (i.e., the sum of the modeled 0.4 μg/m^3 and the highest ambient background concentration of 12 μg/m^3 in Table 3.2.1 equals 12.4 μg/m^3, which is 83% of 15 μg/m^3). Consequently, cumulative PM-2.5 impacts from the sum of the proposed facilities and existing sources, including those at the Stanton Energy Center, would not be expected.

The proposed facilities would annually emit about 0.03 tons of Pb, which is much less than the PSD Significant Emission Rate of 0.6 tons of Pb per year (40 CFR Part 51.166). Pb concentrations in recent years have been well below NAAQS, largely because of the decreased use of leaded gasoline in automobiles. Therefore, Pb emissions from the proposed facilities are not evaluated further.

Ozone (O_3) is not emitted directly from a combustion source but is formed from photochemical reactions involving emitted VOCs and NO_x. Because the reactions involved can take hours to complete, O_3 can form far from the sources of its precursors (the VOCs and NO_x that initiate its formation). Therefore, the contribution of an individual source to O_3 concentrations at any particular location cannot be readily quantified. As discussed earlier in this section, annual NO_x emissions from the Stanton Energy Center overall would not be expected to increase as a result of the proposed facilities. Annual VOC emissions from the proposed facilities would be 129 tons, which would be about 0.3% of the county's VOC emissions inventory of 50,342 tons in 2001.

Table 4.1.2. Ambient air quality standards impact analysis for combined effects of the modeled proposed facilities added to ambient background concentrations measuring existing sources

Pollutant[a]	Averaging period	Standard[b] ($\Phi g/m^3$)	Modeled concentration[c] ($\Phi g/m^3$)	Ambient background concentration[d] ($\Phi g/m^3$)	Total impact[e] ($\Phi g/m^3$)	Total impact as a percentage of standard
SO_2	3-hour	1,300	3.1	110	113	9
	24-hour	260	1.4	37	38	15
	Annual	60	0.1	8	8	13
NO_2	Annual	100	0.6	23	24	24
PM-10	24-hour	150	4.4	41	45	30
	Annual	50	0.4	27	27	55
PM-2.5	24-hour	65	4.4	34	38	59
	Annual	15	0.4	12	12	83
CO	1-hour	40,000	13.7	9,143	9,157	23
	8-hour	10,000	10.2	5,371	5,381	54

[a] SO_2 = sulfur dioxide; NO_2 = nitrogen dioxide; PM-10 = particulate matter less than 10 Φm in aerodynamic diameter.
[b] National Ambient Air Quality Standards (NAAQS) except for annual and 24-hour averages of SO_2. The NAAQS are established in accordance with the Clean Air Act to protect public health and welfare with an adequate margin of safety. States may establish standards more stringent than NAAQS; Florida has established such standards for annual and 24-hour averages of SO_2.
[c] Maximum modeled concentration from the proposed facilities alone.
[d] From Table 3.2.1.
[e] The sum of the modeled concentration and the ambient background concentration.

Based on Table 3.2.1, the largest recorded 3-year average of 4th highest 8-hour O_3 concentrations was 154 μg/m^3 at the Morris Boulevard monitoring station in Winter Park during the period 2000–02, which is less than the corresponding standard of 157 μg/m^3. The most recent 3-year average (2002–04) of 4th highest 8-hour O_3 concentrations was 148 μg/m^3 at Morris Boulevard and 145 μg/m^3 at the Winegard Road monitoring station in Orlando. Based on these recorded O_3 concentrations, the small percentage increase in VOC emissions would not be likely to degrade O_3 concentrations sufficiently to cause violations in the O_3 NAAQS, but the magnitude of the degradation cannot be quantified.

Conformity Review

DOE has conducted a conformity review to assess whether a conformity determination (40 CFR Part 93, Subpart B) is needed for the proposed project. Orange County is in attainment with NAAQS and state ambient air quality standards for all pollutants (Section 3.2.2). Further, Orange County is not designated by the U.S. EPA as a maintenance area for any pollutant (an area that previously was a nonattainment area, which is striving to maintain attainment and comply with the state implementation plan). Consequently, no conformity determination is needed to demonstrate that activities associated with the proposed project would conform to applicable implementation plans for bringing the area into attainment with the standards (40 CFR Part 93, Subpart B).

Hazardous Air Pollutants

Based on the proposed facilities operating at 100% load throughout the year using the higher of synthesis gas or natural gas emission rates, annual emissions of hazardous air pollutants from the HRSG stack would include 0.01 tons of mercury and 0.001 tons of beryllium (Table 2.1.3). For comparison, the PSD Significant Emission Rate is 0.1 tons of mercury per year; neither the State of Florida nor the U.S. EPA PSD rules currently include a significant emission rate for beryllium. Mercury can cause ulceration, particularly within the digestive system, liver, and kidneys. Mercury may also disrupt endocrine function, which is of particular significance during fetal development and early childhood, when organ development is most rapid. Beryllium is listed as a known carcinogen (cancer-causing substance) by the American Conference of Governmental Industrial Hygienists (1997). It can also have chronic noncancerous effects such as berylliosis (noncancerous growths in the lungs) and acute effects which primarily affect the lungs.

Ambient air quality standards do not exist for mercury and beryllium. Guideline concentrations are typically obtained by adjusting time-weighted (8-hour) averages specified by the American Conference of Governmental Industrial Hygienists (1997) as maximum allowable concentrations for healthy workers, as follows. The first adjustment to the standards for healthy workers is made because they typically spend an average of 40 hours per week at their workplace rather than 168 hours (around the clock); therefore, the maximum allowable concentration for workers is divided by 4.2 (168/40). The resulting concentration is then divided by 10 because the tolerance of an individual during their years as a healthy adult worker would be greater than for their entire lifetime, especially during childhood and old age. The resulting concentration value is divided again by 10 to account for differing sensitivities to environmental exposures experienced by members of the general population, including the infirm. The final result is a guideline maximum ambient air concentration; for concentrations below the guideline value, it is expected that the public would be protected from adverse impacts. Such guideline values (sometimes referred to as “no-threat levels”) are commonly used as maximum permissible ambient air concentrations of substances regulated by 29 CFR Part 1910.1000 (Patrick 1994).

Using the same modeling procedure as for criteria pollutants, the maximum ambient 24-hour concentration of mercury from the proposed HRSG stack is predicted to be 1.6 x 10^{-4} μg/m^3, which is 0.8% of its corresponding guideline value of 0.02 μg/m^3. The maximum ambient 24-hour concentration of beryllium from the stack is predicted to be 1.6 x 10^{-5} μg/m^3, which is 0.4% of its corresponding guideline value of 0.004 μg/m^3. These results indicate that mercury and beryllium emissions from the proposed facilities would pose no direct threat to human health in the area.

As another measure of risk, reference concentrations provided by the EPA Integrated Risk Information System (http://www.epa.gov/iris/) were used to evaluate maximum predicted annual concentrations. Reference concentrations are estimates of continuous inhalation exposure to human population (including sensitive subgroups) that are likely to be without an appreciable risk of deleterious effects during a lifetime. The maximum ambient annual concentration of mercury from the stack is predicted to be 7.7 x 10^{-6} μg/m^3, which is 0.003% of its reference concentration of 0.3 μg/m^3. The maximum ambient annual concentration of beryllium from the stack is predicted to be 7.6 x 10^{-7} μg/m^3, which is 0.004% of its reference concentration of 0.02 μg/m^3. These results corroborate that mercury and beryllium emissions from the proposed facilities would pose no direct threat to human health in the area.

As a measure of cumulative impacts associated with combining the proposed facilities with existing sources of mercury and beryllium emissions in the area, including the existing sources at the Stanton Energy Center, the maximum ambient annual concentrations for the proposed facilities (7.7 x 10^{-6} μg/m^3 for mercury and 7.6 x 10^{-7} μg/m^3 for beryllium) were compared and combined with EPA’s 1999 National-Scale Air Toxics Assessment: 1999 Data Tables (http://www.epa.gov/ttn/atw/nata1999/tables.html) database that provides (1) modeled concentrations of existing sources within about 30 miles of the site and (2) background concentrations based on monitored values for mercury (because outdoor concentrations of mercury and 27 other air toxics should include background components attributable to long-range transport, unidentified emission sources, and natural emission sources). No background concentrations are available in the EPA database for beryllium. Background concentrations are the contributions to outdoor air toxics concentrations resulting from natural sources, persistence in the environment of past years’ emissions, and long-range transport from sources beyond the 30-mile radius.

For mercury, the National-Scale Air Toxics Assessment lists the annual-average background concentration in Orange County, Florida, as 0.0015 μg/m^3, whereas modeled countywide annual-average ambient concentrations from major stationary sources such as the existing Stanton Energy Center are listed as 3.9 x 10^{-6} μg/m^3 and from multiple other sources (e.g., dry cleaners, small manufacturers, wildfires) as 7.2 x 10^{-5} μg/m^3, for a total existing countywide annual average of 0.001575 μg/m^3 for mercury. These values in EPA’s 1999 National-Scale Air Toxics Assessment are averaged spatially throughout Orange County, whereas the maximum ambient annual-average concentrations predicted for the proposed facilities are the values predicted for the maximum receptor (downwind location in the ambient air). Consequently, the mercury value predicted for the proposed facilities (7.7×10^{-6} μg/m^3) is slightly higher than the countywide annual-average concentrations from major sources (3.9×10^{-6} μg/m^3). The sum of concentrations for all existing sources (0.001575 μg/m^3) and the proposed facilities (7.7×10^{-6} μg/m^3) would be approximately 0.001583 μg/m^3, which is 0.5% of the reference concentration of 0.3 μg/m^3 for mercury. Consequently, this evaluation using EPA's National-Scale Air Toxics Assessment database indicates that the cumulative impact of mercury emissions from the proposed facilities and emissions from existing facilities including the Stanton Energy Center would pose no direct threat to human health in the area.

For beryllium, the National-Scale Air Toxics Assessment lists no annual-average background concentration in Orange County, Florida, or elsewhere throughout the United States; modeled countywide annual-average ambient concentrations from major stationary sources such as the existing Stanton Energy Center are listed as 2.1×10^{-7} μg/m^3, from multiple other sources (e.g., dry cleaners, small manufacturers, wildfires) as 8.1×10^{-6} μg/m^3, and from non-road mobile sources as 1.0×10^{-7} μg/m^3, for a total existing countywide annual average of 8.4×10^{-6} μg/m^3 for beryllium. These values in EPA's 1999 National-Scale Air Toxics Assessment are averaged spatially throughout Orange County, whereas the maximum ambient annual-average concentrations predicted for the proposed facilities are the values predicted for the maximum receptor (downwind location in the ambient air). Consequently, the beryllium value predicted for the proposed facilities (7.6×10^{-7} μg/m^3) is slightly higher than the countywide annual-average concentrations from major sources (2.1×10^{-7} μg/m^3). The sum of concentrations for all existing sources (8.4×10^{-6} μg/m^3) and the proposed facilities (7.6×10^{-7} μg/m^3) would be approximately 9.2×10^{-6} μg/m^3, which is 0.05% of the reference concentration of 0.02 μg/m^3 for beryllium. Consequently, this evaluation using EPA's National-Scale Air Toxics Assessment database indicates that the cumulative impact of beryllium emissions from the proposed facilities and emissions from existing facilities including the Stanton Energy Center would pose no direct threat to human health in the area.

With regard to deposition, much uncertainty exists regarding the spatial distribution of mercury deposition downwind of emissions sources. Likewise, source identification and attribution based on measurements of mercury deposition (i.e., working in the reverse direction to identify sources of measured deposition) have proven difficult. Moreover, not all emissions are produced by human activity, and lack of reliable data about the speciation of mercury in source emissions further contributes to assessment difficulties (Hanisch 1998). Controversy exists regarding the magnitude of the local impact from sources such as power plants. Global and regional models suggest that about 50% of manmade mercury emissions are transported globally, while the remaining 50% deposit on a local or regional scale (EPRI 1994; Bullock, Brehme, and Mapp 1998). Another study has indicated that mercury is more of a global or regional problem than one of local concern because computer modeling has shown that most mercury emissions from power plants are transported over 60 miles away (Constantinou, Wu, and Seigneur 1995). Sullivan et al. (2005) estimated that less than 2% of total mercury emissions are deposited within 9 miles of their source, based on soil and vegetation samples obtained from around three U.S. coal-fired power plants.

However, some field measurements of oxidized, inorganic mercury appear to contradict these findings. This species normally represents only about 3% of total gaseous mercury, but is expected to account for a major portion of mercury dry deposition. On the basis of measurements near the ground in close vicinity to power plants, a study concluded that cutting a local emissions source of oxidized, inorganic mercury could result in some local reduction of deposition (Lindberg and Stratton 1998). Similar uncertainty exists for deposition of other heavy metals.

An assessment of mercury deposition rates that may result from potential emissions from the proposed HRSG stack was conducted. The analysis focused on local deposition (i.e., within about 30 miles) and, because reactive gaseous divalent mercury (Hg^{2+}) (RGM) is the form of mercury emissions (as opposed to elemental or particulate mercury) to dominate deposition at that scale, the analysis estimated the total deposition caused by potential RGM emissions from the proposed facilities. Dry, wet, and total RGM deposition were estimated using the wet and dry algorithms contained in the current version of EPA's AERMOD dispersion model (Version 04300) (EPA 2004a; EPA 2004b) with RGM-specific parameterizations drawn from EPA and literature references.

In the absence of any specific regulatory guidance for performing this type of analysis and in order to provide context for the predicted values, they were compared to available observed data. Since no observations exist for total mercury deposition or its dry deposition component, the modeled wet RGM deposition was compared to observed wet mercury deposition measured at a Mercury Deposition Network monitor located near Orlando and the estimated RGM concentrations were compared to observed ambient air RGM concentrations measured in or near the Everglades.

The combustion of fossil fuels containing mercury may result in emissions of elemental mercury, RGM, and/or particle-bound mercury (Hg_p). Hg_p is emitted in particulate form, while both elemental mercury and RGM are released in the gaseous state. The deposition characteristics of each of these three mercury species differ. Elemental mercury has a long residence time in the atmosphere and travels long distances (i.e., greater than 30 miles) before it is ultimately deposited on the Earth's surface. The other two forms of mercury, RGM and Hg_p, deposit locally (i.e., within about 30 miles) and regionally (i.e., from 30 to several thousand miles). The dispersion of elemental mercury is evaluated on regional and global scales and, therefore, was not considered for this analysis of local mercury deposition.

The proposed IGCC synthesis gas treatment process would include a sulfur-impregnated carbon adsorption system for mercury removal. Due to the nature of the IGCC process, emissions of Hg_p would be low. Combustion of the treated synthesis gas is estimated to result in a potential IGCC total mercury emission rate of 19 lb per year. Of this total, 90% (i.e., 17.1 lb per year) is estimated to be emitted as elemental mercury, 10% (i.e., 1.9 lb/yr) as RGM, and only trace amounts as Hg_p (EPRI 2003). The proposed IGCC HRSG stack parameters and RGM emission rate are summarized in Table 4.1.3 as input to the AERMOD model.

The application of AERMOD for a deposition analysis requires additional parameters associated with the surrounding surface characteristics, transport characteristics of the pollutant, and meteorological data. The selection of each of these model input parameters is discussed below.

Dry gas deposition measures the mass of pollutant transferred to the ground in the absence of precipitation. Because vegetation removes RGM from the atmosphere, information concerning the surface characteristics surrounding the Stanton site was required. The Stanton site vicinity surface

Table 4.1.3. Location, stack parameters, and emission rate used as input for AERMOD mercury deposition analysis

Location, parameters, and emission rate	IGCC HRSG stack
Stack Location	
UTM East (m)	483,620
UTM North (m)	3,150,953
Stack Parameters	
Exhaust gas temperature (°F)	185.6
Stack diameter (ft)	18.5
Exit velocity (ft/s)	66
Stack height (ft above ground)	205
Emission Rate	
RGM (g/s)	2.73E-05

Source: Orlando Utilities Commission (OUC) 2006.

characteristics were identified by land use type and seasons of the year. The land use types were determined by dividing a circular area within about 2 miles of the Stanton Energy Center site into 10° segments. A land use category was then assigned to each 10° segment based on the predefined land use categories described in the addendum to the AERMOD User's Guide (EPA 2004a). Table 4.1.4 shows the land use categories selected for the proposed IGCC RGM dry deposition analysis. In addition, the reactivity factor of RGM is required. An RGM reactivity factor of 1.0 was used in accordance with EPA guidance (EPA 2004a).

To determine the amount of vegetative cover surrounding the Stanton site, seasonal data were developed. Seasons were identified for each month of the year, appropriate for the central Florida climate. Using the available AERMOD predefined seasonal categories, seasons associated with a subtropical climate were selected. The seasons selected for the analysis were 5 months as midsummer (May through September), 3 months as autumn (October through December), 2 months as late autumn (January and February), and 2 months as transitional spring (March and April).

The transport and mobility of a pollutant are determined by the physical properties of the specific pollutant. For deposition modeling, AERMOD requires the following pollutant-specific parameters: (1) diffusivity in air; (2) diffusivity in water; (3) leaf cuticular resistance to lipid uptake; and (4) the Henry's Law constant. The values of these parameters selected to represent RGM are shown in Table 4.1.5.

For the IGCC RGM deposition analysis, the general modeling procedures and options specified in the current versions of the AERMOD User's Guide (EPA 2004b) and the Guideline on Air Quality Models (GAQM) were followed. Modeling was conducted in a manner consistent with EPA guidance

Table 4.1.4. Land use categories selected for AERMOD modeling

Wind sector	Land use category
5° to 15°	6 – Suburban areas, forested
15° to 25°	6 – Suburban areas, forested
25° to 35°	6 – Suburban areas, forested
35° to 45°	4 – Forest
45° to 55°	3 – Rangeland
55° to 65°	4 – Forest
65° to 75°	3 – Rangeland
75° to 85°	4 – Forest
85° to 95°	3 – Rangeland
95° to 105°	4 – Forest
105° to 115°	3 – Rangeland
115° to 125°	4 – Forest
125° to 135°	3 – Rangeland
135° to 145°	6 – Suburban areas, forested
145° to 155°	6 – Suburban areas, forested
155° to 165°	6 – Suburban areas, forested
165° to 175°	4 – Forest
175° to 185°	3 – Rangeland
185° to 195°	4 – Forest
195° to 205°	3 – Rangeland
205° to 215°	4 – Forest
215° to 225°	3 – Rangeland
225° to 235°	5 – Suburban areas, grassy
235° to 245°	5 – Suburban areas, grassy
245° to 255°	5 – Suburban areas, grassy
255° to 265°	5 – Suburban areas, grassy
265° to 275°	5 – Suburban areas, grassy
275° to 285°	5 – Suburban areas, grassy
285° to 295°	3 – Rangeland
295° to 305°	4 – Forest
305° to 315°	3 – Rangeland
315° to 325°	6 – Suburban areas, forested
325° to 335°	6 – Suburban areas, forested
335° to 345°	6 – Suburban areas, forested
345° to 355°	6 – Suburban areas, forested
355° to 5°	6 – Suburban areas, forested

Source: Orlando Utilities Commission (OUC) 2006.

Table 4.1.5. Physical characteristics of reactive gaseous divalent mercury (RGM)

Parameter	Value
Diffusivity in air (cm^2/s)[a]	6.0×10^{-2}
Diffusivity in water (cm^2/s)[b]	3.01×10^{-5}
Cuticular resistance (s/cm)[a]	1.0×10^{5}
Henry's law constant (pa-m^3/mol)[a]	6.0×10^{-6}

Sources: [a]Wesely 2002; [b]EPA 2004c.

and standard practices, including the use of regulatory default options, as appropriate. The following paragraphs provide a brief discussion of the selected AERMOD options concerning building downwash, terrain elevations, receptor grids, and meteorological data.

The building downwash analysis was performed using the most recent version of EPA's Building Profile Input Program (BPIP) (Version 04274) with the plume rise model enhancements (PRIME) building downwash algorithms.

Terrain elevations from 7.5-minute digital elevation models were extracted using the latest version of AERMAP (Version 04300). The elevated terrain option in AERMOD was used to process the terrain data generated by AERMAP.

The receptor grids used for the deposition modeling were consistent with GAQM recommendations and were defined as follows:

- Fence line receptors—Receptors placed on the site fence line spaced 164 ft apart.
- Near-Field Cartesian Receptors—Receptors between the center of the site and extending out to approximately 2 miles at 328-ft spacing.
- Mid-Field Cartesian Receptors—Receptors between about 2 miles and extending to approximately 4 miles at 820-ft spacing.
- Far-Field Cartesian Receptors—Receptors between 4 miles and extending to approximately 9 miles at 1,640-ft spacing.

The latest version of AERMET (Version 04300) was used to process surface meteorological data collected at the Orlando International Airport (OIA) and upper-air data from Tampa Bay/Ruskin. Raw surface and upper air data for the years 1996 to 2000 were obtained. Missing surface and upper air data (i.e., data gaps) were filled in accordance with EPA guidance. Precipitation, relative humidity, and surface pressure data were added to the processed AERMET files as required by AERMOD to compute wet deposition rates.

The results of the analysis are presented in Table 4.1.6. The predicted IGCC maximum annual areal average (i.e., average RGM deposition for receptors located within about 9 miles of the proposed IGCC) total (dry and wet) RGM deposition rate is 0.1374 $\mu g/m^2$ per year for the 5 years of historical meteorological data evaluated (i.e., 1996 through 2000). The dry and wet RGM deposition components of this total deposition rate, which occurred in 1996, are 0.1308 and 0.0066 $\mu g/m^2$ per year, respectively.

No observed data exist for total mercury deposition, which would have provided context for the estimated values. However, observed data do exist for total wet deposition of mercury (which, except in highly polluted urban atmospheres where particulate mercury can be important, is largely driven by RGM scavenging) and ambient RGM concentrations (to which RGM dry deposition is directly related). Using such data, the estimated wet and dry components of total deposition can be assessed separately to provide context for the estimated values. The proposed IGCC estimated maximum annual areal average wet RGM deposition is compared to the observed annual wet deposition rate recorded in 2004 at the National Atmospheric Deposition Program ambient monitoring station (Station No. FL32) located approximately 8 miles north of the Stanton Energy Center (Figure 4.1.1). This monitor has collected data in the Orlando area since September 2003. Using 1997, the year of the estimated maximum annual areal average RGM wet deposition, the IGCC estimated maximum annual areal average wet RGM deposition rate of 0.0083 $\mu g/m^2$ per year is only 0.05% of the observed wet deposition rate of 17.7 $\mu g/m^2$ per year measured at this monitor (National Atmospheric Deposition Program 2006). Because observed dry RGM deposition data are not available, a comparison was made between the predicted IGCC maximum annual areal average ambient air RGM concentrations and measurements of RGM concentrations that have been conducted in Florida. The predicted IGCC maximum annual areal average RGM ambient air concentration is 0.00011 nanograms per cubic meter (ng/m^3), which is slightly less than 1% and slightly over 2% of the RGM ambient air concentrations observed in Florida of 0.015 and 0.005 ng/m^3 for sampling sites located in the Everglades and Pompano Beach, respectively (Malcolm and Keeler 2002; Malcolm et al. 2003).

The observed data are for 1-month sampling campaigns and are not directly comparable to the estimated annual average. Nevertheless, they provide some perspective on the predicted values, which are small in comparison.

Although maximum RGM concentrations and deposition rates predicted for a single receptor are considered less meaningful than the areal average values, the IGCC single point maximum annual deposition and annual-average concentration values are also summarized in Table 4.1.6. The IGCC estimated maximum single-point annual total (dry and wet) RGM deposition for the 5 years of historical meteorological data evaluated is 0.8481$\mu g/m^2$ per year. The dry and wet RGM deposition components of this total deposition rate are 0.8140 and 0.0341 $\mu g/m^2$ per year, respectively. This maximum annual total RGM deposition occurred with 1996 meteorological data at a receptor located near the Stanton Energy Center property boundary approximately 3,400 ft north of the proposed HRSG stack. The IGCC estimated maximum single-point annual-average RGM ambient air concentration is 0.00064 ng/m^3. This ambient air concentration occurred with 1998 meteorological data at a receptor located near the Stanton Energy Center property boundary approximately 3,400 ft north-northeast of the proposed HRSG stack.

Trace emissions of other pollutants from the proposed facilities would include vinyl chloride, sulfuric acid mist, hydrogen sulfide, hydrochloric acid, hydrofluoric acid, benzene, arsenic, and various heavy metals. The overall cancer and noncancer risks to humans from hazardous air pollutants are discussed in Section 4.1.9.1.

Table 4.1.6. AERMOD model results—estimated reactive gaseous divalent mercury (RGM) concentration and deposition for the proposed IGCC facilities

Maximum Annual Impacts	1996	1997	1998	1999	2000
Maximum Impacts					
Total Deposition ($\mu g/m^2/yr$)	0.8481	0.7411	0.8000	0.5714	0.6295
Dry Deposition ($\mu g/m^2/yr$)	0.8140	0.7000	0.7633	0.5464	0.5995
Wet Deposition ($\mu g/m^2/yr$)	0.0341	0.0411	0.0368	0.0250	0.0300
Receptor UTM Easting Coordinate (meters)	483,577	483,676	483,725	483,923	483,874
Receptor UTM Northing Coordinate (meters)	3,151,975	3,151,976	3,151,976	3,151,977	3,151,976
Distance From Unit B (meters)	1,023	1,024	1,028	1,067	1,054
Direction From Unit B (Vector o)	358	3	6	17	14
Concentration (ng/m^3)	0.00062	0.00062	0.00064	0.00052	0.00054
Receptor UTM Easting (meters)	483,527	483,725	483,923	483,973	483,874
Receptor UTM Northing (meters)	3,151,975	3,151,976	3,151,977	3,151,977	3,151,976
Distance From Unit B (meters)	1,026	1,028	1,067	1,083	1,054
Direction From Unit B (Vector o)	355	6	17	19	14
Aerial Average Impacts (within 15-km of Unit B)					
Total Deposition ($\mu g/m^2/yr$)	0.1374	0.1210	0.1287	0.1159	0.1222
Dry Deposition ($\mu g/m^2/yr$)	0.1308	0.1127	0.1224	0.1096	0.1168
Wet Deposition ($\mu g/m^2/yr$)	0.0066	0.0083	0.0062	0.0064	0.0055
Concentration (ng/m^3)	0.00011	0.00011	0.00011	0.00011	0.00011

*Based on modeled emission rate of 1000.0 g/s per CT/HRSG unit.

†Ratio of maximum emission rate (g/s) per CT/HRSG unit to modeled 1000.0 g/s emission rate.

‡Unadjusted AERMOD impact times emission rate factor.

Source: ECT, 2006.

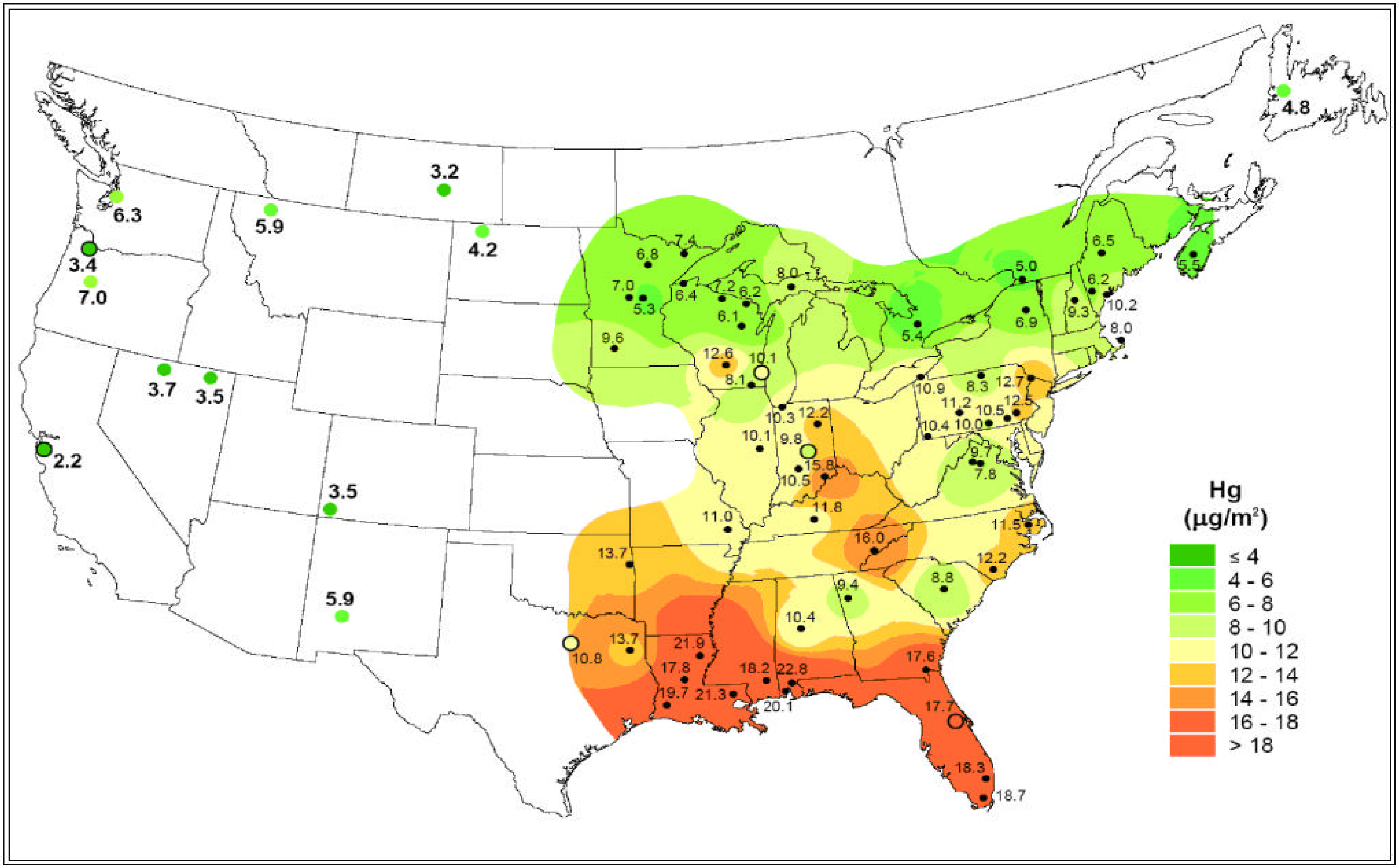

Figure 4.1.1. Mercury wet deposition measured in 2004.

Odors

Some odors would be emitted during operation of the proposed facilities that would be noticeable on the site. Sources for these odors would include diesel engine exhaust from locomotives, trucks, maintenance equipment, and coal yard loaders; the coal pile and coal handling; sulfur storage and handling; and ammonia storage and handling. Any of these potential odors should be limited to the immediate site area and should not affect offsite areas.

Visibility

Visibility, or background visual range, is defined as the maximum distance a large, black object can be observed on the horizon. The scenic quality of natural landscapes and their color, contrast, and texture, are improved by good visibility. Visibility, as a measure of clarity of the atmosphere, has been established as an important air-quality-related value of national parks and wilderness areas that are designated as PSD Class I areas. Concentrations of pollutants from the proposed facilities would be negligible at the nearest PSD Class I area, about 90 miles to the west-northwest (Section 3.2.2), because dispersion of pollutants at that distance would reduce atmospheric concentrations to a small fraction of the maximum modeled concentrations, which are predicted to be less than PSD Class I increments at the location of their maximum impact. Consequently, no degradation in visibility would be perceptible.

Acidic Deposition

Acid rain, the popular name for acidic deposition, occurs when SO_2 and NO_x are chemically transformed and transported in the atmosphere and deposited on the earth's surface in the form of wet (rain, snow, fog) or dry (particle, gas) deposition. SO_2 and NO_x are readily oxidized in the atmosphere to form sulfates and nitrates. Subsequently, the sulfates and nitrates may form sulfuric acid and nitric acid when combined with water, unless neutralized by other chemicals present. Acidic deposition contributes to the acidification of lakes and damage to ecological resources. SO_2 and NO_x can be transported by the wind for hundreds of miles from one region to another. Therefore, air over any given area will contain some residual emissions from distant areas and infusions received from nearby areas. This continuing depletion and replenishment of emissions along the path of an air mass makes it extremely difficult to determine relationships between specific sources of emissions and acidic deposition at any particular location.

As a comparison to evaluate acidic deposition, estimated annual SO_2 emissions from the proposed facilities would be 162 tons, which would be about 1% of Orange County's SO_2 emissions inventory of 12,994 tons in 2001. As discussed earlier in this section, annual NO_x emissions from the Stanton Energy Center overall would not be expected to increase as a result of the proposed facilities. Because these SO_2 and NO_x emissions would be small or zero (respectively) percentage increases of existing county emissions, changes in acidic deposition, if any, would likely not be perceptible.

Global Climate Change

A major worldwide environmental issue is the likelihood of major changes in the global climate (e.g., global warming) as a consequence of increasing atmospheric concentrations of “greenhouse” gases (IPCC 2001). The atmosphere allows a large percentage of incoming solar radiation to pass through to the earth’s surface and be converted to heat energy (infrared radiation) that does not pass back through the atmosphere as easily as the solar radiation passes in. The result is that heat energy is “trapped” near the earth’s surface.

Greenhouse gases include water vapor, CO_2, methane, nitrous oxide, O_3, and several chlorofluorocarbons. The greenhouse gases constitute a small percentage of the earth’s atmosphere; however, their collective effect is to keep the temperature of the earth’s surface about 60°F warmer, on average, than it would be if no atmosphere existed. Water vapor, a natural component of the atmosphere, is the most abundant greenhouse gas. The second-most abundant greenhouse gas is CO_2, which has increased about 30% in concentration over the last century. Fossil fuel burning is the primary contributor to increasing concentrations of CO_2 (IPCC 2001). The increasing CO_2 concentrations likely have contributed to a corresponding increase in globally averaged temperature in the lower atmosphere, which has increased by about 1–1.4°F in the last hundred years (IPCC 2001).

Because CO_2 is relatively stable in the atmosphere and essentially uniformly mixed throughout the troposphere and stratosphere, the climatic impact of CO_2 emissions does not depend upon their source location on the earth. Instead, an increase in CO_2 emissions from a specific source is effective in contributing to global increases in CO_2 concentrations. Based on the proposed IGCC facilities operating at an 85% capacity factor during the year using synthesis gas, global CO_2 emissions resulting from fossil fuel combustion, which were estimated at 26,713 million tons for the year 2000 (IPCC 2001), would increase by about 1.8 million tons per year.

4.1.3 Geology and Soils

Construction and operation of the proposed facilities would not change geologic conditions. A very low potential would exist for adverse effects to the facilities from geologic hazards (Section 3.3.4).

Because the new facilities would be built on a site in which about 5 ft of sandy fill material was deposited during construction of Unit 1 in the 1980s, proposed construction would not cause additional alteration of soil resources. Transmission line construction would disturb small areas of soils along the transmission line corridor. Potential impacts of soil disturbance on wetlands and ecological resources are discussed in Section 4.1.5.2 and Section 4.1.6, respectively.

4.1.4 Water Resources

4.1.4.1 Surface Water

Surface water resources would experience little or no direct impact as a result of proposed facility construction and operation. Facility operations would indirectly affect water volumes in the Econlockhatchee River and in wetlands downstream of the Orange County Eastern Water Reclamation Facility.

Construction

Stormwater runoff from construction sites can affect water quality. However, because facility construction would occur in developed site areas where surface water runoff is directed to onsite stormwater retention ponds and is used in the facilities, no impacts to natural surface waters would be experienced, except in the unlikely event of a major storm that caused overflow of the site stormwater collection system. Transmission line construction outside of the main plant area could result in soil erosion and sediment deposition to streams, but best management practices such as silt fencing, straw bales, and revegetation of graded areas would minimize erosion and sedimentation. If required, an erosion control plan would be developed and implemented to minimize impacts from construction. Accordingly, impacts attributable to construction-related runoff would be minimal.

During construction, accidental spills of materials such as fuels, lubricants, solvents, paint, or other liquids that could be detrimental to surface waters would be cleaned up in a timely manner and in accordance with a spill prevention, control, and countermeasure plan and best management practices. These measures would minimize any potential for the substances to enter streams.

Operation

Water required for facility operations (Section 2.1.5.2) would be obtained from reclaimed water and from groundwater. All water not lost to evaporation or otherwise consumed would be recycled within the Stanton Energy Center (Section 2.1.6.2). Because operation of the proposed facilities would not withdraw surface water or discharge liquid effluent, surface waters would experience no direct impacts. Makeup water for cooling the gasifier and the combined-cycle unit would be obtained from the onsite makeup pond and treated prior to use. Water for other facility needs would be obtained from onsite groundwater wells.

Cooling tower blowdown and other process wastewaters would be collected, treated as needed, and discharged to the existing Stanton Energy Center water treatment and reuse systems. Process wastewaters containing oils would be collected in an oily wastewater sump, where an oil/water separator would remove the oil. Chemical feed area spillage, tank overflows, and liquid from area washdowns would be routed to the waste neutralization system for pH adjustment. Stormwater would be directed to existing, onsite stormwater retention ponds. No effluents would be discharged off the site.

Facility operations would indirectly affect surface water by increasing the use of treated effluents from the Orange County Eastern Water Reclamation Facility. The Stanton Energy Center's use of treated effluent for addition to the on-site makeup pond, which in turn is used for cooling water and service water, would increase by an average of 2.2 million gal per day (from about 10.2 million gal per day currently to about 12.4 million gal per day), thus reducing by a similar amount the water volume discharged to the wetlands downstream from the Eastern Water Reclamation Facility and correspondingly from those wetlands to the Econlockhatchee River. Average daily releases to wetlands would be reduced from 4.2 million gal currently to about 2 million gal, with somewhat larger flow reductions during dry weather when less water would be received from the county landfill. Under all conditions, flows to the wetlands would remain well above the minimum needed to sustain the wetlands hydrologically and as wildlife habitat (T. Madhanagopal and M. Gant, Orange County Utilities, telephone communication to D. Warren, Southern Company, and E. Smith, ORNL, February 28, 2006). In the river, the flow reduction (3.4 ft^3/s on average) would be about 4% of the average flow at the nearest downstream gauging station (Section 3.4.1), but the flow reduction could increase the frequency and duration of no-flow episodes. Because surface water is not used for water supply, reduced flow would not affect water users. Water quality in the river could be affected if reduced streamflow also reduced the river's capacity to dilute contamination discharged from other parts of the watershed. Over time, releases of water from the Eastern Water Reclamation Facility are expected to increase due to continued population growth (and increased wastewater volume) in the facility service area, so any effects from reduced effluent discharge would be temporary.

4.1.4.2 Groundwater

Construction

Dewatering during facility construction, which would be conducted to support initial excavation, backfill, and subsurface construction, would affect shallow groundwater. A low-point well and ditch system would likely be used to lower the groundwater elevation on approximately 20 to 25 acres to below the depth of excavation. Collected groundwater would be pumped into the Stanton Energy Center stormwater system and subsequently would be routed to the onsite stormwater retention ponds for use in operations at the existing generating units. The well and ditch system would be closed and abandoned following the conclusion of subsurface construction activities.

The lowering of the water table would be temporary and would be limited to the unconfined surficial aquifer within a small area of the previously developed portion of the Stanton Energy Center property. Because no effect should be detected on wetlands, surface waters, or recharge to the Upper Floridan aquifer, impacts from lowering the water table would be inconsequential.

Water use for construction would have minimal effects. Service water for construction activities would be obtained from reclaimed water and potable water would be obtained from the existing Stanton Energy Center onsite wells. Construction water use from both sources would be a very small fraction of total water use at the site.

Operation

Proposed facility operations requiring high-quality water would increase the Stanton Energy Center's groundwater withdrawals from the Upper Floridan aquifer by about 0.1 million gal per day. The additional water would be obtained from existing onsite wells. Most of this water would be treated in an existing onsite demineralization facility to supply demineralized water to the gasifier and steam turbine. About 900 gal per day would be used for drinking water and other potable use.

Total withdrawals from the onsite wells (including withdrawals for existing uses) would be about 0.54 million gal per day on average (198 million gal per year), which would be less than the limits (2.0 million gal per day and 321.2 million gal per year) specified in the current Stanton Energy Center conditions of certification (OUC 2003). Previous modeling and other evaluation of these withdrawal limits (OUC 2001; SJRWMD 2001) found that groundwater withdrawal at the permitted rate would cause water level declines of less than 0.6 ft in the Upper Floridan aquifer, less than 0.1 ft in the Lower Floridan aquifer, and less than 0.08 ft in the unconfined surficial aquifer. A small amount of water would be returned to the unconfined surficial aquifer from operation of the onsite septic system. These small changes would not produce discernible impacts to surface waters, wetlands, or the position of interfaces between fresh water and salt water in the Floridan aquifer.

Facility operation could add localized contamination to shallow groundwater from the possible placement of additional waste in the onsite coal-combustion ash landfill (Section 4.1.8), as well as from operation of the onsite septic system. Because any contamination would be limited to the shallow aquifer and any contaminated groundwater would probably discharge to onsite stormwater collection systems, impacts to water users are unlikely. Aquatic biota could be exposed to contaminants in Stanton Energy Center ponds and collection basins, but contaminant types and concentrations would be similar to those currently present in these onsite water bodies (Table 3.4.1).

4.1.5 Floodplains and Wetlands Assessment

4.1.5.1 Floodplains

The 35 acres on which the proposed facilities would be constructed and the existing onsite landfill that would be used for ash disposal lie completely within the 1,100-acre developed portion of the Stanton Energy Center. This 1,100-acre tract was previously filled to an elevation higher than the Federal Emergency Management Agency's determined 100- and 500-year floodplains (FEMA 2000). The corridor for the proposed transmission line interconnection to the existing electrical substation northeast of the principal existing facilities is not within the Federal Emergency Management Agency's determined 100- and 500-year floodplains (FEMA 2000). No construction would occur within a floodplain.

4.1.5.2 Wetlands Assessment

Project Description

DOE proposes to provide cost-shared funding for construction and operation of facilities at OUC's existing Stanton Energy Center near Orlando, Florida. DOE funding would support the coal gasifier, synthesis gas cleanup systems, and supporting infrastructure. The project would be integrated with a planned, privately funded, combined-cycle unit. The facilities would convert coal into synthesis gas to drive a combustion turbine, and hot exhaust gas from the gas turbine would generate steam from water to drive a steam turbine. Combined, the two turbines would generate 285 MW of electricity. Under the no-action alternative, DOE would not provide cost-shared funding but the combined-cycle facilities would still be built on the site to operate using natural gas without the gasifier, synthesis gas cleanup systems, or supporting infrastructure.

Whether the combined-cycle unit would be built to use synthesis gas (under DOE's proposed action), or natural gas (under the no-action alternative), one new 230-kV transmission line would be required to connect the new generating facilities to an existing substation. The proposed route for the transmission line, within the buffer area in the northeast portion of the Stanton Energy Center site, would exit the proposed combined-cycle unit and follow an easterly alignment for approximately 900 ft. The line would then turn northeast for approximately 1,100 ft, where it would intersect a point just south of an existing electrical distribution line. The line would then turn to the north and parallel the existing distribution line to just south of the existing substation, where it would turn to the west for approximately 140 ft before turning to the north into a new substation bay at the substation. The total length of the transmission line would be approximately 3,200 ft. Figure 2.1.7 shows the location of the proposed transmission line within the Stanton Energy Center site; Figure 4.1.2 shows the land use/cover types, including wetland categories (explained in Section 3.5.2), within the proposed transmission corridor. Access to the transmission line would be from existing roads where practical, although a new access road would be required in most of the corridor.

Impacts

The width of the proposed transmission line corridor would be 80 ft. The corridor would traverse one upland habitat type, pine flatwoods (Section 3.6.1 and Figure 4.1.2), and two wetland habitat types, hydric pine savanna and cypress swamp (Section 3.5.2 and Figure 4.1.2). The total area of the corridor would be approximately 5.8 acres. The majority of the corridor (3.83 acres) is currently hydric pine savannah, while cypress swamp occupies 0.12 acre of the corridor, and pine flatwoods occurs in 0.63 acres. Also in the corridor are an old access road (0.53 acres), other electric power facilities (0.67 acres), and a small stretch of roadside ditch (0.02 acres). Within the corridor, all trees and tall-growing vegetation that could interfere with overhead lines would be removed.

The transmission line would be suspended from steel poles anchored by concrete pads. Some of the wetland areas within the corridor (0.06 acres of cypress swamp and 0.98 acres of hydric pine savanna) would be filled during construction of the pads and access road. The roadside ditch would not be disturbed. Corrugated metal pipe culverts would be installed in the new access road to prevent the disruption of any natural flow through the area.

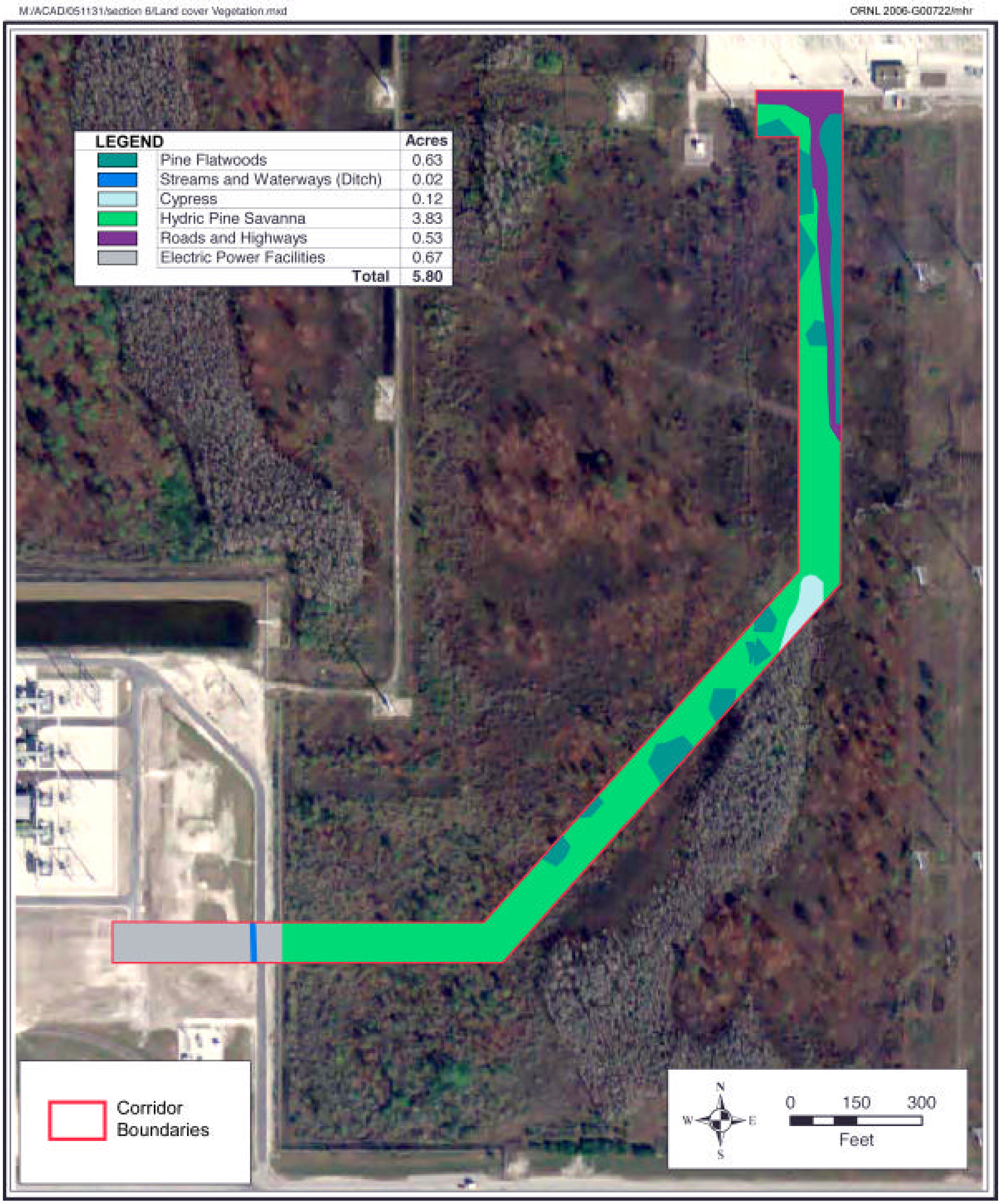

Figure 4.1.2. Land use/cover types, including wetland categories within the proposed transmission corridor.

Because tall-growing vegetation would be cut and kept at a height low enough to prevent interference with the conductors, forest cover habitats would be reduced and shrub or other low-growing vegetation would eventually dominate the corridor. Net wetland impacts would consist of 3.95 acres cleared, of which 1.04 acres would be filled. The transmission line and right-of-way would be maintained by mowing and brush-cutting at intervals of one or more years. Herbicides would be used in areas too wet for vegetation to be cut by mechanical means. In most cases, frequency of application would be one treatment every 3 to 5 years. Limited burning of cleared vegetation could occur.

The net effect of clearing and maintaining 3.95 acres of wetland habitat for the transmission line would be (1) loss of 1.04 acres of wetland due to fill and (2) modification of vegetation in wetlands in the remainder of the corridor due to right-of-way maintenance. This would shift, to a small extent, the balance of wildlife habitat in the area away from wetland and forest toward shrub and brushland. During the permitting process, an acceptable wetland functional assessment methodology (e.g., Wetland Rapid Assessment Procedure or Uniform Mitigation Assessment Method) would be used to determine the function loss resulting from the proposed impacts. The resultant vegetation communities in the corridor would be similar to those on other transmission line rights-of-way in the vicinity. Impacts to protected plants are discussed in Section 4.1.6.3. These and other unavoidable impacts would be mitigated as described below.

Alternatives and Mitigation Sequencing

Alternatives/Wetland Avoidance. A new transmission line would be required under either the proposed action or no-action alternative.

Because wetlands occur throughout the buffer area in the northeast portion of the Stanton Energy Center site, additional wetland impacts could be avoided only by placing the new transmission line parallel to an existing line through the area and sharing a common set of structures. Two such corridor route options were evaluated. Both were rejected as being not prudent, economically feasible, or reliable due to the risk of loss of output from two generators should there be a failure of a common set of structures.

Minimization of Direct and Secondary Impacts. A variety of measures would be used to minimize impacts to wetlands from construction and operation of the proposed transmission line, including:

- Access to the corridor would be from existing roads where practical rather than from construction of new roads.
- Clean, compacted native soil backfill with grass surface and side slope would be used for the access road and pads.
- The access road would not include an adjacent rim ditch.
- Geotextile fabric liner would be used to stabilize the access road and pads, as necessary.
- Best management practices for sediment and erosion control would be employed.
- Corrugated metal pipes would be installed in the access road to permit natural water flow through the area to continue.

- Chain saws and/or light, tracked shear machines would be used for clearing in wetland areas.
- Stumps and root mat would be left in place, except at structure foundation locations.
- Restoration would be conducted, as necessary, including grading of the soil and replanting or reseeding of disturbed areas.
- Herbicides for right-of-way maintenance, which would be EPA- and state-approved, would be used in accordance with label instructions.

Compensatory Mitigation. Construction would require submittal of a joint (1) Corps of Engineers Section 404 dredge-and-fill wetlands application and (2) Florida Department of Environmental Protection environmental resource permit. This permitting/approval process would also require a compensatory mitigation plan, in addition to the measures listed above, for any unavoidable wetland impacts. Subsequent to the determination of wetland functional loss, a compensatory mitigation plan would be designed and may include elements of on- or offsite wetland creation, enhancement and/or preservation, or simply the purchase of mitigation credits from a state- and federally-approved mitigation bank with a service area encompassing the impact site.

4.1.6 Ecological Resources

4.1.6.1 Terrestrial Ecology

Except for the electrical transmission line interconnection, all proposed facilities would be constructed within the 1,100-acre tract of land that was previously cleared, leveled, and licensed for power plant use. This land was then planted with grass and is kept mowed. Although sometimes used by wildlife, the land contains no federally-listed threatened or endangered plant species and is not important habitat for wildlife. Most of the remaining 2,180 acres of the Stanton Energy Center site are undisturbed, providing a natural buffer between the existing and proposed industrial facilities and the surrounding offsite area. Thus, no areas of ecological sensitivity would be affected directly by construction of the proposed facilities and temporary construction laydown and parking areas. Indirect impacts (e.g., noise) to wildlife resources would result from construction activities and operation of the new permanent facilities.

The 3,200-ft onsite transmission line interconnection would have direct impacts to 0.63 acres of pine flatwoods upland habitat and 3.95 acres of wetland habitat (Section 4.1.5.2). Wildlife species typical to the area are present in the vicinity of the corridor and would be directly affected by construction activities and resultant loss of habitat. Smaller less mobile animals would be at greatest risk, whereas larger more mobile animals would likely move from the disturbed areas and increase utilization of surrounding habitats. A pre-construction ecological resources characterization program has been conducted on the site in support of the required Site Certification Application.

Indirect impacts to wildlife species in the vicinity of the proposed facilities could occur as a result of construction noise during the 28-month construction period. Noise levels typically associated with earthmoving equipment range from 73 to 96 dBA at a distance of 50 ft (FHWA 2005; Revelle and

Revelle 1974). Small mammals and birds might be adversely affected by the maximum noise levels produced by construction equipment (Luz and Smith 1976; Brattstrom and Gondello 1983). Most of the animals would be away from the main plant area in the surrounding 2,180-acre natural buffer. Most construction activities would be at least 300 ft from the buffer area, and noise levels at the edge of the buffer would be correspondingly attenuated.

Because any wildlife species sensitive to noise would likely move away from the construction disturbance and reutilize habitats upon construction completion, no impacts on the hearing ability of wildlife species would be expected from construction-generated noise. The main proposed facilities would be located between existing Units 1 and 2 and Unit A in an area with noise levels typical of an operational power plant, where species present are adapted to the noise and human presence. Thus, because noise during proposed facility operations would be similar in character to existing noise and represent only a small addition to existing noise levels at the site (Section 4.1.10.2), the incremental noise would not impact wildlife.

The impacts on wildlife and vegetation from air emissions due to routine operations should be minor. For the criteria air pollutants SO_2, NO_2, PM-10, and CO, modeled estimates of increases in ground-level concentrations due to project emissions are very small (Table 4.1.1), and actual degradation of air quality should be less than the amounts predicted (Section 4.1.2.2). Trace elements and organic compounds would be released at low concentrations and would be diluted further by atmospheric dispersion over a large geographic area, resulting in deposition amounts that should be below levels known to be harmful to wildlife and vegetation or to affect ecosystems through bio-uptake and biomagnification in the food chain (Will and Suter 1995; Suter and Tsao 1996; Jones, Suter, and Hull 1997; Sample, Opresko, and Suter 1996). In particular, maximum predicted ambient concentrations of mercury and beryllium would be less than 2% of their corresponding guideline values (Section 4.1.2.2).

Operation of the proposed mechanical-draft cooling tower has the potential to impact plants through local deposition of water and salts. The magnitude of such impacts was modeled in the Site Certification Application for the mechanical-draft cooling tower previously installed for Unit A. The proposed cooling tower is similar in design to the Unit A cooling tower, but is smaller (6 cells versus 10 cells). A potential effect of water deposition on vegetation is the increased threat of plant fungal diseases. The precipitation rate derived for the Unit A cooling tower, which was estimated conservatively (i.e., assuming no evaporation), was determined to be negligible (i.e., less than 0.1% of the average monthly rainfall of the driest month). Because water precipitation from the proposed cooling tower would be less, this amount would also be negligible. A salt deposition rate of 400 kg/km^2 or greater per month is generally sufficient to cause damage to vegetation (C.L. Mulchi, University of Maryland, personal communication to D.R. Wilkus, Black & Veatch, August 14, 1991), and this level is considered as a screening or trigger level of potentially significant deposition rates. Because the maximum salt deposition rate from the Unit A cooling tower was predicted to be 12 kg/km^2 per month, the lower deposition rate from the smaller proposed cooling tower is expected to have negligible impact on vegetation in the surrounding area.

Operation of the proposed flare (Section 2.1.2.8), which would be nearly invisible during the day, would create an altered visual environment at night when the 40-ft-high flame would be visible to active wildlife, as well as people nearby (Section 4.1.1.2). While birds are known to be attracted to lights and flares, no known incidents involving birds have been experienced during several years of occasional operation of a 180-ft-high flare at the Wabash River Coal Gasification Repowering Project (Amick 2005). As discussed in Section 2.1.2.8, the multipoint flare system was developed to resolve aesthetic issues associated with stack flares. Instead of a 100- to 200-ft single stack with a single flame that may rise several hundred feet above the stack, the multipoint flare divides the gas into a number of smaller flames. A 20-ft tall thermal barrier fence surrounds the burners, which are located approximately 10 ft above ground level. A multipoint flare system with burners only 10 ft above ground level was selected for the proposed gasification facilities rather than a single tall stack because it would be visible to a smaller, more localized area (i.e., birds several miles away from a flare would be less likely to see a ground-based flare than an elevated 180-ft-high flare), and should minimize any incidents with birds. Any impacts would occur infrequently because the flare would be operated only during gasifier startups and shutdowns and during plant upsets, which are anticipated to be uncommon.

4.1.6.2 Aquatic Ecology

The Stanton Energy Center site contains no appreciable natural aquatic resources (Section 3.6.2). The nearest major aquatic resource is the Econlockhatchee River, which is about 1 mile east of the nearest property boundary of the Stanton Energy Center and 2 miles east of the main construction area for the proposed facilities. During construction and operations, stormwater from the main proposed facilities would be routed via sheet flow (i.e., spread out at uniform depth across a flat surface, such as a parking lot) and directed to culverts and existing stormwater retention ponds. During construction of the transmission line interconnection, best management practices would be implemented for sediment and erosion control and stormwater handling, including use of silt fences and geotextile materials. Stormwater runoff from permanent structures associated with the interconnection would be negligible. The coal storage area would include a synthetic liner and would utilize existing leachate and runoff collection systems. Due to implementation of best management practices during construction of the facilities and the current plantwide system of stormwater collection and handling, impacts to aquatic ecological resources, including the riverine habitat of the Econlockhatchee River, would be highly unlikely.

Existing onsite facilities would be used for treatment of wastewater from the proposed facilities. Because no process waste streams or water treatment discharges would be released off the site, no aquatic ecological resources would be directly impacted.

4.1.6.3 Threatened and Endangered Species

No federally-listed threatened or endangered plant species are known to occur within the immediate vicinity of the main proposed facilities or the transmission line interconnection

(OUC 2001). Impacts are unlikely to any such plants in the buffer area around the Stanton Energy Center from air emissions or altered stormwater drainage due to the relatively small output and dispersed nature of these discharges.

Five plant species protected by the Florida Department of Agriculture and Consumer Services (Table 3.6.1) are known to occur along or in the vicinity of the proposed transmission line corridor: Catesby's lily, cinnamon fern, royal fern, yellow-flowered butterwort, and hooded pitcher plant. Clearing and maintenance activities on the right-of-way would be expected to destroy some individuals, but populations would persist in undisturbed areas on and outside of the transmission corridor. Both cinnamon fern and royal fern are fairly common throughout Florida, and sparse populations were observed in hydric pine savanna and cypress swamp along the transmission corridor. Given their range in habitat, cinnamon and royal fern would be expected to persist along the undisturbed areas of the corridor following the construction of the transmission line.

Catesby's lily is a perennial herb with alternate leaves and orange-pink flowers with darker freckles. It grows in wet flatwoods and bogs. Two populations of one or two plants each were seen growing in hydric pine savanna within the corridor. Catesby's lily could potentially persist in the transmission line easement in areas where native shrub layers are not disturbed.

The insectivorous plants yellowflower butterwort and hooded pitcherplant occur along the proposed transmission line corridor. Yellowflower butterwort is a terrestrial plant with a basal rosette of yellowish-green leaves and yellow flowers. It occurs in flatwoods and bogs. Hooded pitcherplant is a perennial herb with erect leaves up to 3 ft in height. It has a green pitcher, which turns reddish in the sun and is marked with white spots. The pitcher has a broad arching hood over the mouth. The flowers are yellow and odorless. It occurs in flatwoods, bogs, and ditches. Only one population of yellowflower butterwort, consisting of approximately 25 plants, was discovered. It is located in hydric pine savanna along the proposed transmission line corridor. The hydric pine savanna was also observed to support several populations of hooded pitcherplant throughout. These insectivorous species could potentially persist along the new transmission line right-of-way within undisturbed areas.

Other than transient or incidental use by some wildlife species (e.g., sandhill crane, bald eagle), no federally-listed threatened or endangered animal species are found within the previously cleared 1,100 acres where all proposed facilities would be located, except for the transmission line interconnection. Use of existing facility areas by these species is indicative of habituation to the current industrial conditions.

Federal- or state-listed threatened or endangered or special status animal species (e.g., gopher tortoise) are present within or near the 2,180-acre buffer area (Table 3.6.1). Red-cockaded woodpeckers forage in the northern buffer area, but the closest nesting clans are at least 1,500 ft south and east of the main proposed construction area (DeLotelle & Guthrie, Inc. 2003) and about 5,000 ft from the proposed transmission line corridor. The closest known active bald eagle nest is more than 1.5 miles from the main proposed construction area and 0.5 miles from the transmission corridor. Because of the distance of most of the buffer area from the proposed facilities, the increased noise levels during construction and operations would be unlikely to impact these animals. No bald eagle nests, wading bird colonies, or red-cockaded woodpecker colonies are known to occur in the vicinity of the transmission corridor. These birds could possibly forage in or around the corridor's habitats, however. Snowy egrets and Florida sandhill cranes have been observed foraging in the transmission corridor. These species would probably avoid the corridor during construction of the transmission line facilities and resume some use of habitat in the right-of-way area upon completion of construction. Other listed species, such as gopher tortoises, have a low likelihood of occurrence in the corridor due to the predominance of wetlands and saturated soils.

Site-specific listed species surveys have been conducted as part of the Site Certification Application for the proposed facilities. Results indicate that no direct impacts are expected to listed species from proposed construction and operations, except for plants listed by the Florida Department of Agriculture and Consumer Services.

In compliance with Section 7 of the Endangered Species Act of 1973, as amended, DOE has consulted with the U.S. Fish and Wildlife Service regarding potential impacts of the proposed facilities on threatened and endangered species and designated critical habitats. Their response (Appendix A) included the following determinations:

Eastern indigo snake - May affect, not likely to adversely affect. The Service recommends use of the Eastern Indigo Snake Standard Protection Measures during construction.

Bald eagle - May affect, not likely to adversely affect. The Service recommends that the proposed 3,200 transmission line be constructed using appropriate spacing between power lines, and raptor deterrent devices to prevent electrocution of bald eagles and other large birds of prey.

Florida scrub jay - No effect. Due to the lack of suitable scrub habitat within the proposed project area, no adverse effects are anticipated.

Red cockaded woodpecker - May affect, not likely to adversely affect. As no suitable foraging area is found within the proposed project area, no adverse effects are anticipated.

Wood stork - May Affect, Not Likely to Adversely. Construction of the proposed facility is not anticipated to remove any quality foraging areas for the wood stork, and no colonies are situated within the energy center.

4.1.6.4 Biodiversity

With the exception of the corridor to be used for the transmission line interconnection, all proposed facilities would be constructed within an industrial area previously cleared and leveled for power generation. Consequently, the predominant impacts on biodiversity within this area occurred prior to planned construction of the proposed facilities. Within the proposed transmission line corridor, about 0.6 acres of pine flatwoods and 3.95 acres of wetland habitat type would be cleared, including 1.04 acres filled. Because of the large amount of these habitat types in the surrounding area, unique genetic information, rare species, or rare ecosystem components would not likely be lost. Thus, discernable impacts to biodiversity would not be expected.

4.1.7 Social and Economic Resources

The social and economic impacts of the proposed facilities would be most noticeable during the 28-month construction period, when an average of 350 additional workers would be on the Stanton Energy Center site. These impacts would peak during a 9-month period when 600 to 700 additional workers would be on the site. The project would also have additional short-term impacts by employing 72 additional operations workers during the 4.5-year demonstration period immediately following construction, and long-term impacts by employing 53 of the 72 demonstration workers as operations workers after completion of the demonstration. This section focuses on the short-term impacts of constructing and demonstrating the proposed facilities. Section 5 describes the long-term social and economic impacts of operating the facilities after the demonstration period to the extent that they would differ from the short-term impacts of demonstration.

In addition to the direct jobs that would be created by facility construction and operations, indirect and induced jobs would be created. Indirect jobs are those created by businesses that provide goods and services essential to the construction and operation of a project (e.g., building materials, construction equipment, maintenance supplies). Induced jobs are those created by businesses that provide goods and services purchased by the direct and indirect workers, but not directly related to the construction and operation of the project (e.g., food, clothing, housing).

Each direct job in Orange County generates about 1.65 indirect and induced jobs (Agency for Workforce Innovation 2005a). Based on this employment multiplier, the average of 350 direct jobs during the 28-month construction period could create as many as 578 indirect and induced jobs, for a total of 928 jobs in Orange County (Table 4.1.7). The 600 to 700 direct jobs during the 9-month peak construction period could create as many as 990 to 1,155 indirect and induced jobs, for a total of 1,590 to 1,855 jobs. Similarly, the 72 direct jobs during the 4.5-year demonstration period could create as many as 119 indirect and induced jobs, for a total of 191 jobs in Orange County.

Table 4.1.7. Potential employment related to construction and demonstration of the proposed facilities

	Average during construction period (28 months)	Peak construction period (9 months)	Demonstration period (4.5 years)
Direct employment	350	600 to 700	72
Employment multiplier[a]	1.65	1.65	1.65
Indirect and induced employment	578	990 to 1,155	119
Total employment	928	1,590 to 1,855	191

[a]Agency for Workforce Innovation 2005a.

The following subsections discuss the potential social and economic impacts of the proposed facilities, particularly those associated with direct, indirect, and induced employment during construction and demonstration.

4.1.7.1 Population

Construction

Because the proposed facilities would be located within Orange County's relatively large and diverse labor market, a minimal number of construction workers would be expected to relocate to the project area. Most of the construction workers already reside in or around Orange County and would commute daily from their homes to the construction site. Although workers would be unlikely to relocate from outside of the region, this analysis assumes as a conservative (upper-bound) estimate that 10% of the peak construction work force (60 to 70 workers) would relocate to Orange County (Table 4.1.8).

Table 4.1.8. Potential population growth related to construction and demonstration of the proposed facilities

	Peak construction period (9 months)	Demonstration period (4.5 years)
Direct employment	600 to 700	72
Percent relocating to the area	10%	20%
Workers relocating to the area	60 to 70	14
Percent relocating with family	40%	70%
Workers relocating with family	24 to 28	10
Average household size	2.46	2.46
Total relocating workers and family	59 to 69	25
Workers relocating without family	36 to 42	4
Total potential population growth	95 to 111	29

Past experience with large, multi-year power plant construction and refurbishment projects indicates that approximately 60% of the in-migrating work force is accompanied by family, while the remaining 40% is not (NRC 1996). However, for this relatively small, 28-month construction project, a more reasonable assumption is that only 40% of the construction workers relocating to the area (24 to 28 workers) would be accompanied by family.

Assuming that 36 to 42 construction workers would relocate without families and that 24 to 28 construction workers would relocate with families, and assuming an average household size of 2.46 persons for Florida (U.S. Census Bureau 2005), the permanent population in Orange County could increase by about 95 to 111 persons as a result of direct construction employment (Table 4.1.8). This population growth would represent about 0.01% of Orange County's 2004 population of 989,926. The potential impacts of this population growth are discussed in Section 4.1.7.3 (Housing) and Section 4.1.7.4 (Public Services).

The indirect and induced jobs that would be created during facility construction would be less specialized than the direct construction jobs, and would be even more likely to be filled by existing area residents. Accordingly, this analysis assumes that none of the indirect or induced work force would relocate to the area during facility construction.

Operation

As with construction, only a small portion of the 72 operations workers associated with the demonstration would be expected to relocate to the project area; accordingly, this analysis assumes that most of them already reside in or around Orange County and would commute daily from their homes to the facilities. Although workers would be unlikely to relocate from outside of the region, this analysis assumes as a conservative estimate that 20% of the demonstration work force (14 workers) would relocate to Orange County (Table 4.1.8). The analysis assumes a higher percentage of relocating workers for demonstration than construction because: (1) the demonstration period (4.5 years) would be longer than the construction period (28 months) (i.e., workers would be more likely to relocate for work of longer duration); (2) the demonstration period would require more specialized positions that might need to be filled with workers from outside of Orange County; and (3) most of the demonstration personnel (53 of 72) would remain at the facilities for long-term operations after a successful demonstration. For these same reasons, this analysis assumes that a higher percentage of the demonstration workers relocating to the area (70% or 10 workers) would be accompanied by family.

Therefore, assuming that 10 of the demonstration workers would relocate with families and that 4 would relocate without families, and assuming an average household size of 2.46 persons, the permanent population in Orange County could increase by about 29 persons as a result of facility demonstration. This population growth would represent less than 0.003% of Orange County's 2004 population of 989,926. The potential impacts of this population growth are discussed in Section 4.1.7.3 (Housing) and Section 4.1.7.4 (Public Services).

The indirect and induced jobs that would be created during facility demonstration would be less specialized than the direct demonstration jobs, and would be even more likely to be filled by existing area residents. Accordingly, this analysis assumes that none of the indirect or induced work force would relocate to the area during facility demonstration.

4.1.7.2 Employment and Income

Construction

The 1,590 to 1,855 total jobs (600 to 700 direct plus 990 to 1,155 indirect and induced) that would be created during the peak construction period would represent less than 0.4% of the total labor force (528,779) in Orange County in 2004. Because most of these direct, indirect, and induced jobs would be filled by workers who currently reside in or around Orange County, construction would have a short-term positive effect on employment in the region.

Wages from facility construction would also have a positive effect on total and per capita income in the region. Assuming the average hourly wage for entry level ($10.75) and experienced ($16.33) construction trades in the Orlando area in 2004 (Agency for Workforce Innovation 2005b) and a 40-hour work week, the total direct payroll for the construction work force (600 to 700) during the 9-month peak construction period would range from $10.1 million to $17.8 million. The total direct payroll for the average construction work force (350) over the entire 28-month construction period would range from $18.2 million to $27.7 million. Further, assuming the current minimum wage in Florida of $6.15 per hour (U.S. Department of Labor 2005) and a 40-hour work week, the total payroll generated by the 578 indirect and induced jobs during the 28-month construction period would be over $17.2 million.

Operation

The 191 total jobs (72 direct plus 119 indirect and induced) that would be created during the demonstration period would represent less than 0.04% of the total labor force (528,779) in Orange County in 2004. Because most of these direct, indirect, and induced jobs would be filled by workers who currently reside in or around Orange County, demonstration would have a short-term positive effect on employment in the region.

Wages from facility demonstration would also have a positive effect on total and per capita income in the region. Assuming the average hourly wage for entry level ($18.66) and experienced ($27.38) power plant operators in the Orlando area in 2004 (Agency for Workforce Innovation 2005b) and a 40-hour work week, the total direct payroll for the operations work force (72) during the 4.5-year demonstration period would range from $11.2 million to $16.4 million. Assuming the current minimum wage in Florida of $6.15 per hour (U.S. Department of Labor 2005) and a 40-hour work week, the total payroll generated by the 119 indirect and induced jobs during the 4.5-year demonstration period would be over $6 million.

4.1.7.3 Housing

Because most of the direct, indirect, and induced jobs during facility construction and demonstration would be filled by workers who currently reside in or around Orange County, demand for housing in the region would not increase appreciably. Housing for the 60 to 70 new construction-related households (i.e., the workers relocating with and without families) assumed as an upper bound in this analysis would represent less than 0.2% of the 33,525 vacant housing units in Orange County in 2004. Similarly, the 14 new demonstration-related households would represent less than 0.04% of the county's vacant housing in 2004. These levels of increased demand would not be likely to have an adverse effect on the availability or cost of housing in Orange County, particularly given the increase in the county's housing stock since 1990.

Because the relatively small increase in demand for housing associated with the proposed facilities would not likely affect housing availability or cost in Orange County, it also would not likely increase residential property values. Conversely, because the proposed facilities would be located entirely within the existing Stanton Energy Center site, construction and demonstration would not likely decrease residential property values in the area. This is particularly true given the extensive amount of relatively expensive residential development that has occurred immediately north of the Stanton Energy Center's northern boundary in the past 20 years.

4.1.7.4 Public Services

Water and Wastewater Services

Because most of the direct, indirect, and induced jobs during project construction and demonstration would be filled by workers who currently reside in the area, demand for water and wastewater services in Orange County would not increase appreciably. OUC and the Orange County Utilities Department have adequate water supplies to meet the additional demand from 60 to 70 new construction-related households and 14 new demonstration-related households. Similarly, Orlando's Public Works Department and the Orange County Utilities Department have adequate wastewater treatment capacity to meet this additional demand. Given that most of these relocating workers would rent or purchase existing housing units rather than build new ones, their additional demand for water and wastewater services would likely result in only a few new water or sewer connections.

Police Protection

As discussed in Section 4.1.7.1, population growth associated with construction and demonstration of the proposed facilities would be minimal, representing less than 0.01% of Orange County's population in 2004. Given such a small population increase, facility construction and demonstration would not create an additional need for police protection.

Fire Protection and Emergency Medical Services

As with police protection, the relatively small population increase and housing demand associated with construction and demonstration of the proposed facilities would not create an additional need for fire protection or emergency medical services.

Schools

Because population growth associated with facility construction and demonstration would be minimal, little effect on the Orange County Public School District would normally be expected. However, Orange County's public schools are already above capacity (Section 3.7.4.4), and even a small increase in the number of students would contribute to the existing problem. The Orange County Public School District plans to renovate or replace 136 of its schools, and expects that these measures will provide excess capacity by the 2010–11 school year (Orange County Public School District 2005). These school upgrades might not occur in time to help meet the additional demand created by the proposed facilities, however, as the peak construction period would occur from fall 2008 through spring 2009. The impact of this additional demand on the local school system would be mitigated somewhat by the taxes paid by Southern Company to the Orange County Public School District. In 2004, these school tax payments totaled $990,180 (Section 3.7.5).

Health Care

Given the small population growth associated with construction and demonstration of the proposed facilities, an additional need for health care facilities would not be likely. The existing health care facilities in Orange County would easily handle an accident associated with facility construction or demonstration.

4.1.7.5 Local Government Funds and Expenditures

As discussed in Section 3.7.5, OUC is exempt from paying property taxes in Orange County. However, Southern Company would pay several types of local taxes (Table 3.7.6) based on its partial ownership of the proposed facilities. No information is yet available on the amount of local taxes that Southern Company would pay on the proposed facilities but, as a rough indication, the company paid over $2.4 million in local taxes in 2004 for its 65% equity share in the existing Unit A.

4.1.7.6 Environmental Justice

Orange County and most of the seven census tracts around the Stanton Energy Center have higher minority percentages than the state of Florida and the United States (Section 3.7.6). Census Tract 167.22, which includes the population of the Florida Department of Corrections' Central Florida Reception Center and in which the proposed facilities would be located, has a slightly higher minority percentage (45.7%) than Orange County (42.5%), and a much higher minority percentage than both the state of Florida (34.6%) and the United States (30.9%). Therefore, the relatively large minority populations in and around Census Tract 167.22 represent "environmental justice" populations to which any adverse impacts of constructing and operating the proposed facilities could be distributed disproportionately. Construction and operation of the proposed facilities, however, would not place impacts and burdens on a community protected by "environmental justice" considerations while exporting all of the benefits (e.g., jobs, power, etc.). Serious air quality, water quality, and health impacts to these populations would not be expected as discussed in Sections 4.1.2, 4.1.4, and 4.1.9, respectively. Construction and operation of the proposed facilities could have positive economic effects for these populations by creating employment and income in the area (Section 4.1.7.2).

Conversely, Orange County and six of the seven census tracts evaluated have lower percentages of people below the poverty level than the state of Florida and the United States as a whole. Census Tract 167.22 has a much lower percentage of people below the poverty level (3.5%) than Orange County (12.1%), the state of Florida (12.5%), and the United States (12.4%). Only Census Tract 166.02 has a higher percentage of people below the poverty level (16.3%) than the county, state, and nation, but the difference is not large enough to classify Census Tract 166.02 as an "environmental justice" population on the basis of poverty. Therefore, none of the populations in and around Census Tract 167.22 represent "environmental justice" populations on the basis of poverty.

4.1.7.7 Transportation

Roads

Construction. As discussed in Section 3.7.7.1, primary road access to the Stanton Energy Center is from the north via Alafaya Trail, a two-lane minor arterial road with an existing "F" level-of-service. Although the Avalon Park Boulevard extension project (also known as Innovation Way) and the widening of Alafaya Trail to four lanes are expected to improve the local road network considerably in the next few years (Section 3.7.7.1 and Section 6), work on these projects has not yet begun. Given the possibility of even minor delays, which are common in major road construction projects, these projects might not be completed in time to alleviate traffic flow during the peak construction period for the proposed facilities (fall 2008 through spring 2009). Much of the work on the road projects could coincide with construction of the proposed facilities, creating a major cumulative impact to traffic flow on the local road network (Section 6).

To provide a conservative assessment of the potential impacts of the proposed facilities on the local road network, this analysis assumes that the Avalon Park Boulevard extension project would not be completed on schedule (i.e., mid-2008) and that the widening of Alafaya Trail to four lanes would not be completed until 2009 or 2010. Further, this analysis assumes that all of the 350 workers during the average construction period for the proposed facilities and all of the 600 to 700 workers during the peak construction period would access the project site via Alafaya Trail as currently configured. Based on past traffic assessments for construction projects at similar power plants, this analysis assumes an average vehicle occupancy rate of 1.4 persons per vehicle, in which the average construction work force would generate about 250 daily round trips and the peak construction work force would generate about 429 to 500 daily round trips.

Regular work hours for construction of the proposed facilities would be weekdays from 6:30 a.m. to 5:30 p.m. Therefore, southbound construction traffic coming to the facility site in the morning would arrive before the peak morning traffic period on Alafaya Trail. As discussed in Section 3.7.7.1, a total of 999 northbound trips were measured during the peak afternoon traffic hour on Alafaya Trail near the Stanton Energy Center in 2003. Thus, the additional northbound afternoon traffic associated with the average construction work force (250 trips) would represent a 25% increase in northbound peak-hour afternoon traffic on Alafaya Trail. Similarly, the additional traffic associated with the peak construction work force (429 to 500 trips) would represent a 43% to 50% increase in northbound peak-hour afternoon traffic on Alafaya Trail.

In addition to the construction workers in their personal vehicles, heavy construction vehicles would access the site from Alafaya Trail during various stages of facility construction. However, upon reaching the site, most of these vehicles would remain for the duration of construction. Because these heavy construction vehicles would not make daily trips to and from the site, their relative impact on the local road network would be minimal.

Because Alafaya Trail already operates at an "F" level-of-service, the additional traffic generated during both the average and peak construction periods would have a considerable impact to traffic flow on the local road network. This impact would be reduced if the Avalon Park Boulevard extension is completed in mid-2008 before the peak construction period.

To address the impacts of facility construction on the local road network, Southern Company and OUC have committed to encourage workers to carpool, use other transit programs, and drive to and from work during off-peak times to the extent possible. In addition, as a condition of the state of Florida's certification of the proposed facilities, Southern Company and OUC would likely be required to develop a program for mitigating traffic impacts. A similar condition included in the Conditions of Certification for the existing Stanton Energy Center units specifies the following:

> "OUC et al shall develop and implement at its own expense a construction traffic impact mitigation program, after consultation with the Florida Department of Transportation (DOT), and report that will be submitted to DOT prior to commencement of construction of Stanton Unit 2. The program will detail the actions that OUC et al will take to reduce the impacts of construction traffic, which report shall address the following actions:
>
> 1. OUC et al shall actively promote and encourage carpooling by construction companies and workers, including contractors and subcontractors, from whom it obtains construction services, and OUC shall further explore with appropriate public mass-transportation providers in the area the possibility of park-and-ride service to the site.
> 2. OUC et al shall utilize to the extent practicable the existing railway access to the Stanton site for the delivery of equipment and materials needed for the project construction.
> 3. OUC et al will explore with its contractors and subcontractors the practicability of staggering construction employee work schedules, and encourage the staggering of shifts to the extent feasible to mitigate peak hour traffic congestion problems.
> 4. OUC et al will consult with the appropriate Winter Park DOT personnel regarding the practicality of providing temporary traffic control devices and alteration of signal times to assist in maintaining proper traffic flow at the most affected intersections, which are the intersections of Alafaya Trail with both the East-West Expressway and State Road 50.
> 5. OUC et al shall suggest and encourage the use by construction personnel of alternate public road access to the Stanton site as appropriate to alleviate traffic congestion."

Any program developed to mitigate the impacts of facility construction on traffic flow and safety on the local road network would include, at a minimum, the measures described above from the Conditions of Certification for the existing Stanton Energy Center units.

Operation. This analysis assumes that all of the 72 demonstration workers would access the proposed facilities from Alafaya Trail and that their average vehicle occupancy rate would be 1.1 persons per vehicle. During the demonstration period, two 12-hour shifts would be established, with workers arriving and leaving each morning and afternoon between 5:00 and 6:00. Because the daytime shift would consist of 57 employees, the projected number of additional southbound trips on Alafaya Trail in the morning would be about 52. These trips would not create a major impact to traffic flow on Alafaya Trail because they would occur before the peak morning traffic period. However, the 52 additional northbound trips generated by these workers each afternoon, which would occur close to the peak afternoon traffic hour on Alafaya Trail, would represent a 5% increase in northbound traffic from the current level of 999 trips during that period. The 15 employees on the nighttime shift would generate about 14 additional trips traveling in the opposite direction of the daytime shift. The additional trips would represent slightly over a 1% increase in southbound traffic from the current level of 972 trips during the peak afternoon traffic hour (Section 3.7.7.1).

In addition to workers' personal vehicles, trucks would generate traffic on Alafaya Trail by delivering materials to the proposed facilities and removing gasification ash, elemental sulfur, unconsumed anhydrous ammonia, and other byproducts from the facilities. Approximately 40 trucks per week would be required for normal deliveries of supplies (mostly on weekdays), 3 trucks per week would transport the sulfur byproduct, and 6 trucks per week would transport the ammonia. Thus, the total number of additional non-employee trips to and from the proposed facilities would be about 50 per week, excluding ash transport. Many of these trips would likely occur during off-peak traffic hours. Because markets for commercial application of the gasification ash have not been finalized, the number of trucks, if any, required for offsite ash transport is not known. If all of the ash were marketed off the site, 160 truck loads would leave the Stanton Energy Center each week. Because existing truck traffic to and from the Stanton Energy Center is about 600 per week, the additional truck traffic associated with the proposed facilities would represent an increase of between 22% (130 trips) and 48% (290 trips).

Combined, the additional traffic generated by the demonstration workers and the delivery trucks would have a noticeable impact to traffic flow on the local road network. This impact would be reduced if the Avalon Park Boulevard extension is completed on schedule in mid-2008, and reduced even further if the widening of Alafaya Trail to four lanes is completed on schedule in 2009. However, if work on these road projects coincides with demonstration of the proposed facilities, a noticeable cumulative impact resulting from traffic congestion on the local road network would continue (Section 6). Southern Company and OUC are considering transporting the sulfur, ammonia, and/or gasification ash off the site by rail as an alternative to using the local roads. Other possible mitigation measures are identified above in the discussion of potential impacts associated with construction-related traffic.

Railways

Construction of the proposed facilities would not affect the existing CSX Transportation rail spur that provides access to the Stanton Energy Center. Some deliveries of large construction equipment could be made via rail, which would generate a minimal amount of additional rail traffic.

Demonstration of the proposed facilities would require 2 to 3 additional train loads of coal per week delivered via the existing CSX Transportation rail spur on the Stanton Energy Center site. This small increase in rail traffic would not likely impact the local rail network. If sulfur, ammonia, and/or gasification ash were transported off the site by rail, the impact on the local rail network from the associated increase in rail activity would likely be minimal.

4.1.7.8 Cultural Resources

Construction and operation of the proposed facilities would not affect cultural resources because the facilities would be sited within an area that previously has been disturbed and the four documented resources within the Stanton Energy Center boundaries are not located within that area (Figure 3.7.2). In compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, DOE has consulted with the Florida SHPO regarding a determination of the potential for impacts associated with the proposed facilities on any historic resources that may be listed in or eligible for the *National Register of Historic Places* or that may have local importance. The SHPO has stated that the proposed facilities would have no effect on historic properties (Appendix B). However, as a condition of the state of Florida's certification of the proposed facilities, Southern Company and OUC would likely be required to notify the Florida Department of Environmental Protection and the SHPO if any historical or archaeological artifacts are discovered at any time within the project site. A similar provision is included in the Conditions of Certification for the existing Stanton Energy Center units.

4.1.8 Waste Management

4.1.8.1 Construction

Waste from construction of the proposed facilities would include excess materials, metal scraps, and pallets, crates, and other packing materials. Excess supplies of new materials would be returned to vendors or retained for future use. Surplus paint and other consumables, partial spools of electrical cable, and similar leftover materials would also be retained for possible future use in maintenance, repairs, and modifications. Other scrap materials could be recycled through commercial vendors. Because the main proposed facilities would be sited on land that has been cleared and leveled with fill material, land preparation for those facilities would produce minimal waste. Any excavated material could be used as fill on the site. Cleared vegetation from preparation of the transmission line right-of-way and debris from installation of the line would be chipped and burned on the site or transported to the Orange County Sanitary Landfill for disposal. Any onsite chipping and burning would require an open burning permit from the Orange County Fire Rescue Department, which would minimize wildfire risk and limit impacts from smoke and odor.

The Orange County Sanitary Landfill (Section 3.8) would have ample capacity to receive project construction wastes. Because the quantity of waste from project construction would be small in comparison with the landfill capacity and waste quantities routinely handled, disposal of these wastes should have negligible impact.

During construction, no hazardous waste generation would be anticipated. In the unlikely event that buried hazardous waste is discovered on the project site during construction, the waste would be reported to appropriate agencies and removed using a commercial hazardous waste management contractor (Section 3.8).

4.1.8.2 Operation

Solid wastes and byproducts from facility operation would include gasification ash, anhydrous ammonia, elemental sulfur, chemical cleaning residues, other residues from water treatment and air emission control systems, and miscellaneous industrial refuse.

Annual production of gasification ash would be about 68,000 tons. Impacts associated with this material would depend on its ultimate disposition. Gasification ash could be transported for disposal in the onsite landfill, where it would increase annual disposal volume by about 14%. However, gasification ash has been evaluated for several possible beneficial uses that could avoid such disposal. These uses include combustion in the Stanton Energy Center's existing coal-fired generating units, sale for use as fuel in a cement production kiln, and sale for use as a precursor for activated carbon (beneficiation by chemical activation and acid washing could make the material suitable for use in flue gas treatment and similar applications). All of these options are technically feasible, but operational factors could limit their implementation, and specific markets have not yet been identified for use as either an activated carbon precursor or a cement-kiln fuel. If the ash were burned as fuel in one of the Stanton Energy Center's existing coal-fired units, its energy value (estimated at 8 million Btu per ton) would be recovered and the amount of coal combustion ash available from Units 1 and 2 for commercial sale would increase by about 47,000 tons per year from the current 180,000 tons per year (Section 3.8) to 227,000 tons per year (based on the assumption that unburned carbon, which would be consumed by burning, constitutes 31% of the gasification ash). Coal requirements for the existing units would be reduced by approximately 1% to 693,000 lb per hour. Sale of the material for use as cement-kiln fuel also would recover the material's energy value, reduce the cement kiln's requirements for other fuels, and avoid disposal at the Stanton Energy Center landfill. Sale for use as an activated carbon precursor would reduce raw material requirements for the activated-carbon producer that buys the material and would avoid disposal at the Stanton Energy Center landfill. Transport for offsite reuse of the gasification ash would require approximately 160 truck loads per week; fewer train shipments (about seven 100-car trains annually) would be needed if rail transport were used.

Gasification ash would be transported for disposal in the onsite landfill only if no beneficial use were found. Disposal of gasification ash would increase the waste volume placed in that landfill, but would not change other potential impacts associated with the landfill. The 347-acre onsite area dedicated for landfill use would provide more than enough space to dispose of the material generated by the proposed facilities during the 4.5-year demonstration period, as well as other coal combustion wastes generated by the Stanton Energy Center during the same period. In the unlikely event that all of the gasification ash generated during the demonstration period required disposal, the additional material would occupy no more than about 1% of the total disposal capacity at the landfill site.

The gasification ash would not be considered a hazardous waste. It would be similar in most characteristics to ash from the Stanton Energy Center's existing coal-fired generating units. Testing of simulated waste indicates that this material probably could be handled in the same manner as the existing ash (OUC 2006). However, because physical and mechanical properties would be somewhat different, facility operators might need to adopt somewhat different handling procedures for this material in order to limit windblown dust and avoid mechanical instability within the waste disposal area.

About 7,300 tons of anhydrous ammonia would be produced annually by the proposed facilities. The existing Stanton Energy Center generating units would use the ammonia to satisfy their requirements, and any excess would be sold commercially. Because this chemical has many uses in agriculture and industry, markets should easily absorb any production in excess of onsite needs.

About 2,800 tons of elemental sulfur would be produced annually. If this material proves to be as pure as it is projected to be, it would be sold commercially. Because sulfur has numerous uses in agriculture and industry (more than 10 million tons are consumed annually in the United States) and because U.S. consumption exceeds domestic production (all of which is byproduct material from environmental control systems) (Ober 2002), the market should easily absorb the quantity that the proposed facilities would generate during the demonstration.

If the sulfur were not sufficiently pure for commercial sale, it would be placed in the onsite landfill. Elemental sulfur would not be a hazardous waste, and the quantity produced would be small in comparison with the total capacity of the landfill. However, disposal of this material could necessitate special handling procedures to assure appropriate containment in order to avoid adverse impacts on waste stability or leachate chemistry. Leaching studies on a mixture of elemental sulfur and coal combustion ash found that this combination promotes production of acidic leachate and release of trace metals from the ash, leading to a recommendation to isolate disposed sulfur from other materials in a landfill (Boegly, Francis, and Watson 1986).

The activated carbon sorbent used to remove mercury from gasification facility emissions would be tested to determine whether it requires management as a hazardous waste under the Resource Conservation and Recovery Act (RCRA). Following testing, it would be returned to the manufacturer for treatment and recycling or managed off the site by a commercial hazardous waste contractor (Section 3.8). Existing processing facilities should have adequate capacity to manage this low-volume waste stream (estimated at about 250 yd^3 every 12 to 18 months), and management in accordance with applicable regulations should minimize potential adverse impacts.

Results of testing of similar materials with much lower mercury loadings suggest that the mercury-bearing activated carbon might not be a hazardous waste and, if placed in the onsite landfill, might produce very low concentrations of mercury in landfill leachate. Leachability testing of mixtures of coal ash and activated carbon from projects that demonstrated the use of activated carbon injection for mercury control found low but variable rates of mercury release from the material (Senior et al. 2003). Mercury concentrations ranged from undetectable (less than 0.01 µg/L) to 0.07 µg/L in waste extracts generated with the Toxicity Characteristic Leaching Procedure (TCLP), which is prescribed in regulations under RCRA and is designed to mimic leaching conditions in a municipal solid waste landfill. Values ranged from undetectable up to 0.05 µg/L using the Synthetic Groundwater Leaching Procedure, which is more representative of the less aggressive leaching conditions in a coal-combustion ash landfill. All reported mercury concentrations were well below potentially applicable criteria, including the primary drinking water standard of 2 µg/L, water quality criteria for protection of aquatic life (1.4 µg/L for acute exposure and 0.77 µg/L for chronic exposure) (EPA 2002), and the threshold for identifying a material as a hazardous waste (200 µg/L). Only one of the ash sources in the study produced extracts with detectable mercury concentrations. The proposed facilities would use sulfur-impregnated activated carbon in the mercury removal process, which means that mercury would likely be captured in the form of mercuric sulfide, which is essentially insoluble and is unlikely to leach.

If the spent sorbent were determined to be nonhazardous, it could be managed in the onsite landfill, which is capped and lined with enhanced, fixated, flue gas desulfurization material to minimize waste leaching and release of leachate. If any mercury were to leach from the disposed activated carbon, the mercury would not be released to offsite waters because any leachate would be retained and managed on the site. Therefore, little or no adverse impact would be expected from management of the mercury-bearing activated carbon sorbent.

Periodic cleaning of the HRSG would result in generation of chemical cleaning wastes consisting of alkaline and acidic solutions containing high concentrations of heavy metals. The independent contractors conducting the cleaning operations would remove these wastes for neutralization, metals recovery, other treatment, and disposal of the residues at offsite locations. The volume of these wastes has not been quantified. Management in accordance with applicable regulations should minimize adverse impacts.

Used gasification-process catalysts would be regenerated and reused to the extent possible, thus avoiding most potential adverse impacts from their management. The used activated carbon sorbent from sour water treatment (volume estimated at 1500 yd^3 per year) would be tested to determine whether it requires management as RCRA hazardous waste. If determined to be nonhazardous, it would be taken for disposal in a municipal landfill; if determined to be hazardous, it would be transported off the site by a hazardous waste contractor for appropriate processing and disposal. Waste volume would be small in comparison to facility capacity, and management in accordance with applicable regulations should minimize adverse impacts.

Because operation of the proposed facilities would increase the Stanton Energy Center's requirements for water, quantities of brine, demineralizer resins, and other residues generated from treatment of intake water and recycling of facility wastewater would also increase, approximately in proportion to the increase in water use. Waste characteristics would not change, and the increased waste volumes could be accommodated in the onsite and offsite landfills where these types of wastes are currently managed (Section 3.8).

Operation of the proposed facilities would also increase the Stanton Energy Center's generation of other wastes typical of power generation operations. Used oils collected from the oil/water separator, spent lubricating oils, and used oil filters would be transported off the site by an outside contractor for recycling or disposal. Office wastes; air inlet filters; maintenance-related wastes such as rags, broken or rusted metal and machine parts, and defective or broken electrical materials; empty containers; and other miscellaneous solid wastes would be removed for disposal in an offsite, licensed landfill such as the Orange County Sanitary Landfill, which would have sufficient space to accommodate the waste. The facility operators would attempt to minimize hazardous waste generation by using nonhazardous solvents, paints, and other maintenance chemicals. The minor quantities of hazardous wastes generated in spite of these efforts would be managed through a commercial contractor in accordance with applicable federal and state requirements. Management of nonhazardous and hazardous maintenance wastes in accordance with applicable regulations and license conditions should prevent adverse impacts.

4.1.9 Human Health and Safety

4.1.9.1 Air Quality and Public Health

Criteria Pollutants

Proposed facility operations would slightly increase air pollutant concentrations (Table 4.1.1), with SO_2, NO_x, and particulate matter being the primary pollutants of particular concern. The greatest exposures to predicted concentrations of primary air pollutants would be experienced by residents of Orange County (2004 population of 1,021,215, including 219,568 children less than 15 years old and 99,131 elderly at least 65 years old); however, apportionment of the exposures (based on maximum predicted ambient air pollutant concentrations due to emissions from the proposed facilities in Table 4.1.1) would not be uniform across the county (exposure to a pollutant is defined as a person's contact with a pollutant of a given concentration over a given time period). The assignment of maximum predicted ambient air pollutant concentrations (Table 4.1.1) which are predicted to occur at or near the northern site boundary, to all members of the county regardless of distance and direction from the proposed facilities would result in values in Tables 4.1.9, 4.1.10, and 4.1.11 that overpredict the health effects. Because most of the concentrations of secondary pollutants (e.g., O_3, sulfates, nitrates) resulting from precursors emitted by the proposed facilities would be formed outside of Orange County, their formation is assumed to not appreciably impact county residents (Rabl et al. 1999). In particular, the small percentage increases in precursor NO_x and VOC emissions would not be likely to degrade O_3 concentrations sufficiently to cause violations in the O_3 NAAQS, but the magnitude of the degradation cannot be quantified (Section 4.1.2.2).

This impact assessment is based on epidemiological studies of public health effects of air pollutants. In general, these studies do not consider personal exposures, but examine health effects among populations in relation to ambient concentrations of pollutants. Exposure-response functions (ERFs) are developed from these associations. Because studies defining ERFs specifically for Orange County are not available, the ERFs used to estimate health impacts of pollutant increases are derived from studies of populations and air pollution sources from a variety of geographic regions, primarily in North America and Europe. This assessment recognizes that varying population demographics, pollution composition, and climates may affect statistical relationships. However, two of the largest studies to date — the National Morbidity, Mortality, and Air Pollution Study (NMMAPS) in the United States (HEI 2004) and Air Pollution and Health: A European Approach (APHEA2) in Europe (Katsouyanni 2001) — have produced remarkably consistent results (American Heart Association 2004). Consequently, this assessment assumes the selected ERFs represent reasonable values applicable to the Orlando area population, pollution composition, and climate sufficient for judging potential impacts.

Mortality. There is a considerable body of evidence associating daily mortality with air pollution. Estimates of increased daily mortality due to the daily increase in criteria air pollutants predicted to be added by the addition of the proposed facilities are annualized and presented in Table 4.1.9. The ERFs are pooled relative risks selected from a meta-analysis of 94 studies. The uncertainties indicated by the confidence intervals reflect only the statistical uncertainties from the studies themselves. Modeled exposure values, selected populations, and underlying disease/death rates, in so much as the selected values depart from the actual conditions, may widen uncertainty on either side of the estimate. Apportionment of the exposures uniformly to all county residents overestimates the health effects. For persons exposed to the maximum predicted increase in annual PM-10 concentration of 0.4 $\mu g/m^3$ at or near the northern site boundary (Table 4.1.1), there is an expected all-cause increase in mortality of about 1.6 deaths per year (Table 4.1.9). Mortality increases associated with other criteria pollutants are smaller (Table 4.1.9). The low, mean, and high values are determined from the statistical uncertainty associated with the estimates of the ERFs alone. The table values likely overestimate the actual effects by a factor of 2 to 5 due to wide uncertainty about individual exposures.

Table 4.1.9. Estimates of annual mortality due to average annual increase in selected air pollutants[a]

Pollutant	Exposure-response functions expressed as relative risk (95% confidence interval)	Estimated additional Orange County deaths per year		
		low	mean	high
PM-10 ($\mu g/m^3$)				
All-cause [b]	1.02 (1.015-1.024)	1.2	1.6	1.9
Respiratory [c]	1.013 (1.005-1.02)	0.06	0.16	0.24
Cardiovascular[c]	1.009 (1.005-1.013)	0.33	0.59	0.86
CO (ppm)[b,d]	1.017 (1.012-1.022)	0.13	0.19	0.24
SO_2 (ppb)[c]	1.009 (1.007-1.012)	0.19	0.23	0.31
NO_2 (ppb)[e]	1.028 (1.021-1.035)	-	-	-

[a]Population at risk is from birth to death, except for the two rows dealing with respiratory and cardiovascular deaths, which are based on populations aged 65+.

[b]Stieb, et al. 2002. Meta-analysis of time-series studies of air pollution and mortality, J. Air & Waste Manage. Assoc. 52:470-84.

[c]Anderson et al. 2004. Meta-analysis of time series studies and panel studies of particulate matter (PM) and ozone (O_3). Report of a World Health Organization task group. Copenhagen, Regional Office for Europe.

[d]Because no National Ambient Air Quality Standard exists for annual-average CO, no air dispersion modeling was performed for this CO averaging period (Table 4.1.1). Consequently, the annual-average CO value for the proposed facilities was estimated by dividing the 1-hour CO value of 13.7 ug/m^3 (Table 4.1.1) by 1,150 to obtain the equivalent in units of ppm, and then multiplying by 0.08 to convert from a 1-hour prediction to an annual-average prediction of 0.001 ppm. The factor of 0.08 has been recognized as providing a conservative estimate (forming an upper bound) of the actual annual-average concentration (EPA 1992).

[e]Samoli, et al. 2003 (Occup Environ Med 2003; 60: 977-82) reports that there is little risk of increased mortality due to NO_2 until the concentration exceeds about 80 ug/m^3.

Based on the predicted 0.4 μg/m^3 increase in annual-average PM-10 concentration (Table 4.1.1) and assuming that the concentration of fine particulate matter (PM-2.5) would be 60% of the PM-10 concentration (Rabl 1998), the predicted annual average PM-2.5 concentration would be 0.24 μg/m^3. Using the World Health Organization years of lost life (YLL) calculator and the all-cause Orange County annual mortality rate, the expected days of lost life (DLL) over a person's remaining life at the increased exposure is less than 5 days per person at any age (Table 4.1.10).

Morbidity. Significant associations between primary air pollutants and hospital admission for a number of health effects including respiratory and cardiovascular diseases have been reported by many organizations and in numerous health effects studies. In one study by Wong et al. (1999), it was reported that persons aged 65+ made up 68% and 38% of admissions for cardiovascular and respiratory diseases, respectively. Manifest health injuries, such as new cases of disease and hospital admissions from disease exacerbation, appear to be much less impacted than quality-of-life effects such as restricted activity and lost work days (Table 4.1.11). The increase in the incidence of adult bronchitis presented in Table 4.1.11 is not statistically significant.

Sulfur dioxide is statistically associated with all-cause hospitalizations, and hospitalizations for respiratory disease, asthma, and cardiovascular disease (Wong et al. 1999). Mortality attributed to sulfur dioxide has a larger relative risk than does hospitalization associated with SO_2 exposure (relative risk 1.013 per 10 μg/m^3 increase in SO_2 reported by Wong et al. (1999). Therefore, the potential SO_2 impacts related to hospitalization should also be less. For example, the total increase in hospitalizations resulting from an increase in SO_2 of 0.1 μg/m^3 (Table 4.1.1) is much less than one additional hospitalization per year. The other health effects categories having lower relative risks are assumed to have little or no impact as well. Linn et al. (1997) reported that the short-term SO_2 threshold of response in asthmatics is approximately 435 μg/m^3, which is much higher than the maximum 3-hour total SO_2 impact of 113 μg/m^3, for the combined proposed facilities and existing sources (Table 4.1.2).

Nitrogen dioxide is statistically associated with total mortality. However there appears to be little if any excess risk until the NO_2 concentration exceeds about 80 μg/m^3. Even without considering the offsets in emissions from Units 1 and/or Unit 2, the small projected increase of 0.6 μg/m^3 (Table 4.1.1) would not be considered sufficient to produce measurable health impacts (Samoli et al. 2003), and the maximum annual total NO_2 impact of 24 μg/m^3, for the combined proposed facilities and existing sources (Table 4.1.2) is much less than the threshold of 80 μg/m^3.

Evidence exists for a correlation between exposure to CO and mortality due to congestive heart failure among the elderly (Schwartz 1995). Table 4.1.9 suggests that the anticipated impacts are small. In much higher concentrations than the predicted incremental increase (Table 4.1.1) and total impacts (Table 4.1.2), carbon monoxide can reduce exercise tolerance, produce chest pain in heart patients, cause headaches, and contribute to death from anoxia.

Table 4.1.10. Lifetime years of lost life (YLL) and days of lost life (DLL) from an average annual increase in PM-2.5 concentration of 0.24 ug/m^3.

Age range	Population	Lifetime YLL per 1,000 persons	Lifetime DLL per person
<1	15,210	3.9	1.5
1-4	55,159	0.7	0.27
5-9	71,593	0.3	0.13
10-14	77,555	0.5	0.20
15-19	76,065	1.3	0.47
20-24	77,017	2.3	0.87
25-34	159,254	4.7	1.7
35-44	165,198	7.6	2.8
45-54	138,377	12.3	4.5
55-64	86,656	12.7	4.7
65-74	51,788	11.5	4.2
75-84	34,691	11.4	4.1
85+	12,652	6.3	2.3

Table 4.1.11. Estimates of increases in annual morbidity effects due to estimated annual increase in particulate matter

Outcome	Pollutant	Estimated annual increase in number of cases		
		Low[a]	Mean	High[a]
Respiratory hospital admissions, age 65+	PM-10	7	33	59
Incidence of adult bronchitis, age 19-65	PM-2.5[b]	0[c]	7	15
Asthma hospital admissions, age < 65	PM-2.5	0.7	3	6
Asthma emergency room visits, age < 65	PM-10	1.3	4	7
Asthma attacks among asthmatics	PM-10	73	307	540
Work loss days, age 19-65	PM-2.5	1,380	1,633	1,887
Adult minor restricted activity days, age 19-65	PM-2.5	7,080	8,693	10,300

[a]Low and high represent the lower and upper bounds of the 95% confidence interval for the mean.

[b]PM-2.5 is estimated as 60% of the PM-10 value.

[c]A low value of zero means that the “no observed increase in effect” falls within the 95% confidence interval and the mean and high values are not statistically significant.

Source: The Particulate-Related Health Benefits of Reducing Power Plant Emissions, October 2000, Prepared for the Clean Air Task Force by Abt Associates Inc. 4800 Montgomery Lane, Bethesda, MD 20814.

Hazardous Air Pollutants

EPA (1998) reported that the vast majority of coal-fired power plants were estimated to pose lifetime human cancer risks (i.e., increased probability of an exposed person getting cancer during their lifetime) of less than 1 x 10^{-6} resulting from inhalation exposure to emissions of hazardous air pollutants. As an upper bound of risks, the increased lifetime cancer maximum individual risk (MIR) within a 31-mile radius of a coal-fired power plant is estimated to be no greater than 3 x 10^{-6} due to inhalation exposure to all carcinogenic hazardous air pollutants. Arsenic and chromium are the hazardous air pollutants contributing the most to the risk (2 x 10^{-6} and 1 x 10^{-6}, respectively). All other hazardous air pollutants, including radionuclides, were estimated to present an inhalation risk of less than 1 x 10^{-6}. The cancer incidence in the United States due to inhalation exposure to hazardous air pollutants (including radionuclides) from all 426 coal-fired plants is estimated to be no greater than approximately 0.2 cancer cases per year, or 1 case every 5 years. The proposed facilities are expected to pose less risk than most of these existing plants, many of which were built decades ago.

The EPA also assessed noncancer risks (i.e., health effects other than cancer) due to short- and long-term inhalation exposure. Manganese, hydrogen chloride, hydrogen fluoride, and acrolein were found to be the four hazardous air pollutants of highest potential concern for noncancer effects. The measure of effect used to evaluate risk was the reference concentration — an estimate, with uncertainty spanning about an order of magnitude, of the daily inhalation exposure of human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a lifetime. Based on modeling hazardous air pollutants with the human exposure model (HEM), estimated long-term ambient hazardous air pollutant concentrations were generally 100 to 10,000 times below the reference concentration or similar benchmark. The highest estimated long-term ambient hazardous air pollutant concentration was 10 times below the reference concentration.

In addition to these EPA studies of coal-fired plants in general, a health risk analysis for specific hazardous air pollutants using ambient concentrations from AERMOD results for the proposed facilities was conducted as part of the Site Certification Application (OUC, 2006). The compounds included in the analysis were presented earlier in Table 2.1.3. A summary of the results is provided in Table D.15 of Appendix D. The total cancer risk for all hazardous air pollutants included in the analysis was 4.1 x 10^{-7}, with chromium being the largest contributor to the total risk, which is almost a factor of ten lower than the upper bound of risk predicted in the EPA study. The total noncancer risk was calculated as 4.8 x 10^{-3}, which is in the range of that predicted by the EPA study.

The EPA believes that mercury from coal-fired power plants is the hazardous air pollutant of greatest potential concern, but uncertainty exists regarding the extent of risk, particularly with regard to deposition downwind of emissions sources (Section 4.1.2.2). Modeling results (Section 4.1.2.2) indicate that mercury emissions from the proposed facilities would pose no direct threat to human health in the area because the maximum ambient concentrations of mercury from the proposed HRSG stack are predicted to be 0.8% of their corresponding guideline value and 0.003% of their reference concentration. However, most of the mercury in the air is elemental mercury vapor, which circulates in the atmosphere for up to a year, and hence can be widely dispersed and transported thousands of miles from emission sources. As mercury cycles between the atmosphere, land, and water, it undergoes a series of complex chemical and physical transformations, many of which are not completely understood. Mercury is a persistent element and bioaccumulates most efficiently in the aquatic food web, predominantly as methylmercury. Given the current scientific understanding of the environmental fate and transport of this element, it is not possible to quantify how much of the methylmercury in fish consumed by the U.S. population is contributed by U.S. emissions relative to other sources of mercury (e.g., natural sources and re-emissions from global sources). As a result, it cannot be assumed that a change in total mercury emissions would result in a linear change in methylmercury in fish, and it cannot be estimated over what time period these changes would occur.

4.1.9.2 Hazardous Material Releases, Fires, and Explosions

During construction, flammable liquids and compressed gases would be stored and used. Liquids would include construction equipment fuels, paints, and cleaning solvents. Compressed gases would include acetylene, oxygen, helium, hydrogen, and argon for welding. Other hazardous material used during construction would include various cleaners, sealants, lubricants, paints, and thinners. Chemicals for cleaning the HRSG and process piping would also be used. The risk of a major release, fire, or explosion during construction of the proposed facilities with potential offsite impact is not credible due to the small quantities and remote locations from public areas.

Natural gas would be available for facility startup and would be fired in the gas combustion turbine and duct burners during periods when the gasifier was not operating. Natural gas would be supplied by the existing onsite pipeline that serves Unit A. Health risk impacts would not change.

Two “highly hazardous chemicals” are currently used at the Stanton Energy Center in quantities that have potential offsite impact: chlorine gas used for water treatment, and ammonia used for removal of oxides of nitrogen. Because of the quantities available, the power plant is subject to EPA’s Accidental Release Prevention Program (ARPP) regulations (40 CFR Part 68), OSHA’s Process Safety Management (PSM) regulations (29 CFR 1910.119), and the Florida Accidental Release Prevention and Risk Management Planning Act, Chapter 252 of the Florida statutes. These regulations require a quality control program to ensure that all equipment used in the system is designed according to industry standards; development of operating procedures; worker training; process hazard analysis (PHA) and risk management plan (RMP) to identify potential scenarios for accidental releases from the system; and mitigation of potential releases identified in the PHA. Existing regulatory requirements would be expanded to include the new applications and quantities. The health risk impact for each of these chemicals would increase due to the larger quantities being handled, but the increased risk would remain exceedingly small. For example, if the probability of a vessel failure resulting in a fire or explosion is taken as 1 occurrence per 100,000 years (based on expected engineering failure rates rather than statistical data) (ConocoPhillips 2003), the addition of a second vessel would nearly double this probability to 1.99 occurrences per 100,000 years. The RMP for onsite storage (EPA 1000 0018 2713) involved one 18,000-gal anhydrous ammonia tank located near the proposed gasification island. Based on air dispersion modeling in the RMP, an ammonia release from the site could travel slightly over 2 miles and potentially involve 2,300 people (worst-case release resulting in total loss of contents over 10 minutes). The possibility of ground or surface water contamination is not considered a credible event because the release would be in the form of a gas rather than a liquid.

Excess ammonia not utilized by the process would be recovered and shipped to offsite customers. Currently, once per week, a truck of ammonia is brought on the site to supply the selective catalytic reduction systems of the existing Units 2 and A (Section 2.1.1). Ammonia generated by the proposed facilities would replace this delivery, but 6 trucks per week would transport ammonia off the site, thus increasing the hazard of anhydrous ammonia transport. The median probability rate of a tank truck accident with a large release is reported as 1.8×10^{-6} per mile (Center for Chemical Process Safety 1995). The most common type of road trailer used by tank trucks to transport anhydrous ammonia has a capacity of 11,500 gal (http://www.mda.state.mn.us/spills/ammonia/transportation.htm); however, a non-insulated cargo tank is not allowed to be filled beyond 82% of capacity (Table E.1). Assuming shipments are made by tank truck to an anhydrous ammonia supplier in Jacksonville, a trip of 143 miles, the estimated probability of a large release is approximately equal to 1 accident per 12.5 years, based on 6 trips per week during 52 weeks of the year for a total of 312 truck trips per year.

As a backup, when ammonia could not be transported off the site (e.g., during a strong hurricane), the ammonia could be recycled back to the gasifier for destruction, which has been shown by KBR to be an effective technique to break down ammonia into nitrogen and hydrogen. Similar experience in recycling ammonia back to the gasifier for destruction has been gained by British Lurgi. If all of the ammonia produced in the proposed gasifier were recycled, an ammonia tank truck would be needed every three weeks from outside the Stanton Energy Center to supply the selective catalytic reduction system of the proposed facilities. This would be in addition to the one truck of ammonia needed every week for the selective catalytic reduction systems of the existing units. So during the periods when all the ammonia is recycled back to the gasifier for destruction, a total of 1 1/3 trucks per week would be brought on the site to supply the selective catalytic reduction systems, but the 6 trucks per week transporting ammonia off the site would be discontinued.

Large releases from rail accidents are less likely than those from truck transport. Because anhydrous ammonia would likely be transported in a rail car with a capacity of 33,500 gal (http://www.mda.state.mn.us/spills/ammonia/transportation.htm), less trips to Jacksonville would be required compared to tank trucks. The probability of a large release from a rail accident similar to the above-calculated probability of a truck accident is about 1 accident per 780 years, based on (1) the same 143-mile trip, (2) current railroad accident rates of 3,979 cars derailed per 1,000,000,000 railcar-miles traveled, and (3) a 2.5% probability of a release resulting from a derailed car (assuming Class I track, excluding railyard operations) (Anderson and Barkan 2004). The calculated probability of an accident also assumed that 3 ammonia rail cars would be included on each of 30 trains required per year to transport the same volume of anhydrous ammonia as the 260 truck trips per year to Jacksonville.

The ALOHA air dispersion model (NOAA 2006) was used to estimate airborne concentrations of ammonia downwind of a 19-ton instantaneous release following a truck accident (selected because a truck accident would be more likely). As an historical precedent, a tank truck instantaneously released about 19 tons of ammonia in an accident near Houston, Texas, on May 11, 1976 (Appendix E). As a conservative (upper-bound) assumption, the average population density of Orange County was applied along the entire length of a hypothetical truck shipment of the same release amount from the Stanton Energy Center to Jacksonville. Appendix E provides the assumptions and various inputs, as well as a graphical representation of the toxic threat zone from which the potential impacts were estimated.

The estimated toxic impacts for ammonia predicted by ALOHA (Appendix E) are based on the American Industrial Hygiene Association's Emergency Response Planning Guide (ERPG) values. Approximately 655 people are predicted by ALOHA to be in the ERPG-3 zone (with ammonia concentrations of at least 750 ppm), which is the area in which a 1-hour exposure would be expected to produce life-threatening health effects. About 1,091 people are predicted to be in the ERPG-2 zone (with ammonia concentrations of at least 150 ppm but less than 750 ppm), which is the area in which a 1-hour exposure would be expected to produce irreversible or other serious health effects or symptoms that might limit their ability to take protective action. Approximately 4,146 people are predicted to be in the ERPG-1 zone (with ammonia concentrations of at least 25 ppm but less than 150 ppm), which is the area in which a 1-hour exposure would be expected to produce mild, transient health effects or a perception of a clearly defined, objectionable odor. Altogether, about 13,000 people would require sheltering in place or evacuation to preclude exposures at the level of ERPG-1 or higher (see confidence lines in Figure E.1) resulting from such a truck accident.

The ALOHA model was also used to calculate a flammable threat zone and overpressure (blast force) threat zone for the same 19-ton instantaneous release of ammonia following a truck accident but, because the consequences were much less than the consequences for the toxic threat zone, those results are not presented in this document.

4.1.9.3 Electromagnetic Fields

The transmission line needed to support the proposed facilities would be an onsite interconnection of the proposed combined-cycle facilities to the existing substation located approximately 3,000 ft to the northeast. The proposed facilities would add 285 MW (18%) of generating capacity to the existing production of approximately 1,569 MW at the Stanton Energy Center.

The Florida Department of Environmental Protection regulates electromagnetic fields (EMF) from electrical transmission lines and substations. For the proposed facilities, compliance with Chapter 62-814 would limit the electric field strength at the edge of the transmission right-of-way or substation property boundary to 2 kV/m and would limit the magnetic field strength to 150 milliGauss (Section 3.9.2.3). The 2003 annual report on EMF research from the Florida Department of Environmental Protection (Section 3.9.2.3) indicated that existing health effects data provided no conclusive scientific evidence justifying making these limits more stringent.

Because no new transmission line would be built off the site, EMF-related health effects, if any, would continue unchanged and small.

4.1.9.4 Worker Health and Safety

Potential health impacts to workers during construction of the proposed facilities would be limited to the normal hazards associated with construction (i.e., no unusual situations would be anticipated that would make the proposed construction activities more hazardous than normal for a major industrial construction project). Most accidents in the construction industry result from overexertion, falls, or being struck by equipment (NSC 2004). Construction-related illnesses would also be possible (e.g., exposure to chemical substances from spills).

The Bureau of Labor Statistics recorded 93 construction-related fatalities in Florida during 2003 (Table 3.9.3). Based on Florida statewide statistics (Table 3.9.2, Table 3.9.3, and http://www.bls.gov/iif/oshwc/osh/os/pr036fl.pdf) applied to an average of 350 workers on the site, the proposed project could expect 0.17 fatalities and 61 nonfatal injuries and illnesses during the 28-month period of construction. During operations for the 4.5-year period ending August 2005, the Stanton Energy Center had 11 injuries resulting in lost time constituting an incidence rate of 1.2 per 100 full-time employees per year. This rate is much lower than the corresponding incidence rate of 4.0 for utilities statewide in 2003 (Table 3.9.2). During the same 4.5-year period, the Stanton Energy Center had no fatalities, while 4 utility-related fatalities were recorded in Florida during 2003 (Table 3.9.3). Based on the Stanton Energy Center statistics and 72 additional full-time employees for the 4.5-year demonstration period, the proposed facilities could expect no fatalities and about 4 lost-time injuries.

The proposed facilities would be subject to the OSHA General Industry Standards (29 CFR Part 1910) and the OSHA Construction Industry Standards (29 CFR Part 1926). During construction and operation of the proposed facilities, risks would be minimized by the proposed facilities' adherence to procedures and policies required by OSHA. These standards establish practices, chemical and physical exposure limits, and equipment specifications to preserve employee health and safety. Construction permits and safety inspections would be employed to minimize the frequency of accidents and further ensure worker safety. Construction equipment would be required to meet all applicable safety design and inspection requirements, and personal protective equipment would be used when needed to meet regulatory and consensus standards.

To maximize worker safety, operations would be managed from a control room. All instruments and controls would be designed to ensure safe start-up, operation, and shut down. The control system would also monitor operating parameters and perform reporting functions. Control stations would be placed at remote locations at which operator attention would be required. Therefore, the overall design, layout, and operation of the facilities would minimize human hazards. Compliance with the Federal Occupational Safety and Health Standards, as well as safety standards carried over from the existing operations would help maintain occupational safety.

The proposed facilities would develop supplemental detailed procedures for inclusion in their Occupational Safety and Health Program to assure compliance with OSHA and EPA regulations and serve as a guide for providing a safe and healthy environment for employees, contractors, visitors, and the community. These procedures would include job procedures describing proper and safe manners of working within the facilities (e.g., handling and storage of ammonia would comply with 29 CFR 1910.111), appropriate personal protective equipment (complying with 29 CFR 1910.132), and appropriate hearing conservation protection devices. The manual would be used as a reference and training source and would include accident reporting and investigation procedures, emergency response procedures, toxic gas rescue-plan procedures, hazard communication program provisions, material safety data sheet accessibility, medical program requirements, and initial and refresher training requirements. In addition, supplemental provisions would be added to the proposed facilities' Emergency Action Plan, Risk Management Plan, and Process Safety Management Plan.

4.1.10 Noise

Anticipated construction and operational noise levels from the proposed facilities would not present a potential for noise-induced hearing loss to the public. From the northern edge of the proposed principal site, the nearest property boundary is approximately 3,000 ft to the north and the nearest residence is about 6,500 ft to the northeast.

4.1.10.1 Construction

During construction of the proposed facilities, noise would be generated by construction equipment including bulldozers, trucks, backhoes, graders, scrapers, compactors, cranes, pumps, pneumatic tools, air compressors, and front-end loaders. Noise levels during construction, which would be typical of industrial plant construction, would increase from current operational levels at the Stanton Energy Center. Table 4.1.12 displays predicted sound levels at three distances from the loudest noise sources during construction activities, including steam blowdown required toward the end of the construction phase. As calculated in Table 4.1.12, sound propagating in air from a point source decreases by 6 dBA for each doubling of distance from the noise source.

With the exception of pile drivers and steam blowdown, noise generated by dump trucks (Table 4.1.12) would be similar in sound level to much of the noise generated by loud construction equipment (e.g., bulldozers, pneumatic tools). Noise generated by dump trucks would attenuate to a level of about 55 dBA at the nearest property boundary and 49 dBA at the nearest residence. These levels are less than existing ambient noise levels measured at many nearby locations (Table 3.10.2). The construction noise would likely not be distinguishable from existing noise at the gate to the Stanton Energy Center at Alafaya Trail, the nearest point of public access. For comparison, the Orange County noise limit is 60 dBA from 7 a.m. until 10 p.m. and 55 dBA from 10 p.m. until 7 a.m. for residential areas (Section 3.10.2). No adverse community reaction would be anticipated as a consequence of noise levels below 50 dBA (EPA 1974), as predicted for the nearest residence.

Table 4.1.12. Sound levels from loudest noise sources during construction activities

Noise source	Sound pressure level at 50 ft (dBA)[a]	Sound pressure level at nearest site boundary (3,000 ft to the north)(dBA)[b]	Sound pressure level at nearest residence (6,500 ft to the northeast)(dBA)[b]
Dump truck	91	55.4	48.7
Pile driver[c]	101	65.4	58.7
Steam blowdown	102	66.4	59.7

[a]*Source (for this column):* EPA (U.S. Environmental Protection Agency) 1971. Community Noise. Prepared by Wyle Laboratories under contract 68-04-0046 for the Office of Noise Abatement and Control, Washington, D.C., December.

[b]Calculations in the two righthand columns are based on starting with the sound pressure levels at 50 ft provided by the EPA 1971 source, and then assuming that sound propagation in air from a point source decreases by 6 dBA for each doubling of distance from the noise source. Not adjusted for additional sound attenuation from structures and vegetation.

[c]Pile driving may not be required.

Steam blowdown is a procedure using pressurized steam to clear specific equipment of debris. For the HRSG and steam turbine, the activity would consist of five blows over a period of six days lasting approximately 18 to 24 hours each. For the gasifier steam lines, four additional blows of about 18 to 24 hours each over a 5-day period would be required. For all of these steam blows, the peak sound pressure level at a distance of 50 ft from the source would be approximately 102 dBA (Table 4.1.12). The noise would attenuate to a level of about 66 dBA at the nearest property boundary and 60 dBA at the nearest residence. A level of 60 dBA would be typical of normal conversation (Table 3.10.1). The estimated noise levels conservatively (i.e., as an upper bound) do not account for any additional sound attenuation that might result from structures or vegetation. The predicted noise levels apply to receptors outdoors; persons indoors would experience a reduced level of noise.

Noise from construction-related truck traffic on Alafaya Trail passing nearby residential areas would be similar to existing levels measured at Location 4, the residential location (Table 3.10.2). Noise during the daytime at Location 4 ranged from 44.6 to 94.1 dBA, with an L_{eq} of 73.3 dBA. Assuming that the measurements were taken 35 ft from Alafaya Trail, the peak sound level of 94.1 dBA would decrease to 91 dBA at 50 ft, which is the same level indicated for a dump truck at 50 ft in Table 4.1.12. Adjusting for a distance of 250 ft from Alafaya Trail to the nearest residence, the peak 94.1 dBA at 35 ft would decrease to 77 dBA at the nearest residence. Similarly, the L_{eq} would decrease to 56 dBA. For comparison, 55 dBA is the approximate level of a quiet subdivision during daylight hours. This level is also given by the EPA as a guideline upper limit with an adequate margin of safety for protection from activity interference and annoyance during the daytime in outdoor locations “in which quiet is a basis for use” (EPA 1974). Motor vehicles operating on a public right-of-way are exempt from the Orange County noise ordinance.

4.1.10.2 Operation

During operation of the proposed facilities, the principal sound sources would include equipment such as the gas combustion turbine/generator, steam turbine/generator, heat recovery systems, turbine air inlets, exhaust stack, 6-cell mechanical-draft cooling tower, coal crusher, coal mill, pumps (e.g., feed, circulating), fans, and compressors, as well as noise from piping flow and flared gas. Most of these sound sources would be enclosed and acoustically insulated. Noise sources within buildings would be fitted with sound-attenuating enclosures or other noise dampening measures that would meet all state and federal regulations. During maintenance or repair events, workers would be required to wear hearing protection equipment.

Estimates of noise characteristics for key operating equipment currently are not available, with the exception of vendor noise data for the ammonia facility's air compressor. For other facility components, near-field A-weighted noise levels were developed based on measurements around corresponding components at the Power Systems Development Facility near Wilsonville, Alabama (Section 1.4). A model was developed using SoundPLAN software to predict sound levels at varying distances from the proposed facilities. The receiver locations were assumed to be 5 ft above the ground, and the terrain was assumed to be flat.

The frequency content of noise is needed to accurately predict noise propagation with distance. Because no frequency content was available for the near-field levels developed from measurements, the frequency content was estimated using the Edison Electric Institute's Power Plant Environmental Noise Guide, which estimates sound power levels at various octave-band frequencies for common power plant equipment. Based on the relative frequency components in the guide, the octave-band levels for the equipment were adjusted until the expected dBA level at a distance of 4 ft matched the levels measured at the Power Systems Development Facility. Worst-case levels were used for sources with levels that varied with time.

During operation of the proposed facilities, a noise level of 53.2 dBA was predicted by the model at a location about 3,000 ft to the northeast of the proposed facilities (the receiver location nearest to the nearest residence). Sound propagating in air from a point source decreases by 6 dBA for each doubling of distance from the noise source. Therefore, the predicted noise level at the nearest residence (about 6,500 ft to the northeast of the proposed facilities) would be 46.5 dBA. For comparison, the Orange County noise limit is 60 dBA from 7 a.m. until 10 p.m. and 55 dBA from 10 p.m. until 7 a.m. for residential areas (Section 3.10.2). A design engineer would determine the need for noise control on any equipment such that the cumulative Stanton Energy Center noise level would achieve the design objective of an L_{dn} in compliance with the Orange County noise ordinance. No adverse community reaction would be expected as a result of noise levels below 50 dBA (EPA 1974).

Because operational steam blowdown would be similar to blowdown during the end of the construction phase, potential impacts should be the same as predicted in Section 4.1.10.1.

4.2 POLLUTION PREVENTION AND MITIGATION MEASURES

Pollution prevention and mitigation measures have been incorporated by Southern Company and OUC as part of the design of the proposed project. The proposed project would minimize SO_2, NO_x, mercury, and particulate emissions by removing constituents from the synthesis gas. The removal of approximately 80% of the fuel-bound nitrogen from the synthesis gas prior to combustion in the gas turbine would result in appreciably lower NO_x emissions compared to conventional coal-fired power plants. The project is expected to remove up to 95% of the sulfur and over 90% of the mercury. Over 99.9% of particulate emissions would be removed using high-temperature, high-pressure filtration (rigid, barrier-type filter elements). Approximately 25% less CO_2 would be produced per unit of power generated compared to typical emission rates at conventional coal-fired power plants. However, there would be a net increase in global emissions of CO_2. Options for mitigation of CO_2 emissions generally include capture and sequestration. For this project, mitigation is not feasible since the sulfur removal technology being used does not generate a concentrated CO_2 stream and sequestration would involve a prohibitively-expensive pipeline to a location amenable to CO_2 sequestration options that have been demonstrated at the scale needed (i.e. enhanced oil recovery). The feasibility and effectiveness of other sequestration options, such as injection into saline formations, are not promising for this area and have not been fully characterized. Sequestration options for all regions of the country are still under investigation in DOE's Carbon Sequestration Program (DOE 2006). A program goal is to initiate at least one large-scale demonstration, at the scale required for a power plant, in 2009 to demonstrate the appropriateness for CO_2 injectivity and validate storage capacity estimates and permanence.

The proposed project would discharge no liquid effluent from the site. Ash generated by the gasifier would be combusted in the existing coal-fired units, marketed for use as activated carbon, or trucked to the existing onsite landfill for permitted disposal. Anhydrous ammonia and sulfur byproducts would be recovered and marketed.

In addition, mitigation measures have been developed to minimize potential environmental impacts. Table 4.2.1 lists the pollution prevention and mitigation measures that Southern Company and OUC would implement during the construction and operation of the proposed facilities.

4.3 ENVIRONMENTAL IMPACTS OF NO ACTION

Under the no-action alternative, DOE would not provide cost-shared funding for the design, construction, and demonstration of the proposed Orlando Gasification Project at OUC’s Stanton Energy Center near Orlando, Florida. Without DOE participation, Southern Company and/or OUC could reasonably pursue at least one option (Section 2.3.1). The combined-cycle facilities could be built at the Stanton Energy Center without the gasifier, synthesis gas cleanup systems, and supporting infrastructure. The combined-cycle facilities would operate using natural gas as fuel without the availability of synthesis gas. Approximately the same amount of electricity would be produced. The

Table 4.2.1. Pollution prevention and mitigation measures developed for the proposed facilities at the Stanton Energy Center

Environmental issue	Pollution prevention or mitigation measure
Atmospheric resources and air quality	During construction, use of modern, well-maintained machinery and vehicles meeting applicable emission performance standards would minimize emissions. The distances of most construction-related activities from the nearest property boundary and residential area would mitigate any potential impacts. During operation, a number of means would be employed to prevent or reduce emissions of air pollutants, including: • Application of Best Available Control Technology, as required. • Enclosure of coal unloading, transfer and conveying equipment, plus application of water sprays, as needed, and use of baghouses at key transfer points. • Use of high-temperature, high-pressure filters within the gasification process to collect particulate matter from the synthesis gas. • Use of sulfur removal technology to reduce sulfur concentrations in the synthesis gas. • Use of activated carbon to remove mercury from the synthesis gas. Monitoring to ensure compliance with emission limits would be carried out during operation. It is expected that the proposed facilities would be subject to Clean Air Interstate Rule (CAIR), Clean Air Mercury Rule (CAMR), applicable New Source Performance Standards, and 40 CFR Part 75 (Acid Rain Program). In general, these federal rules require continuous monitoring and recording of SO_2, NO_x, and mercury emissions. Monitoring would be subject to stringent QA/QC requirements to ensure that the monitored emissions data are accurate and complete. Initial and periodic compliance testing of pollutants emitted by the proposed facilities would be conducted pursuant to Florida Department of Environmental Protection requirements. This stack testing, using EPA reference methods, is expected to address the principal air pollutants emitted by the proposed facilities, including CO, VOCs, and PM-10. An extensive network of area air quality monitors would continually sample for H_2S and other compounds. Detection would trigger actions to eliminate equipment leaks.

Table 4.2.1. Continued

Environmental issue	Pollution prevention or mitigation measure
Surface water resources	Runoff during construction and operation, as well as all effluents from operation of the proposed facilities, would flow through the existing Stanton Energy Center collection and reuse system. No offsite discharges would occur, except during a major storm event and from the small area impacted by the short transmission line interconnection.
	To prevent the deposition of sediments beyond the construction areas, site-specific Best Management Practices would be selected, potentially including silt fences, hay bales, vegetative covers, and diversions, to reduce impacts to surface water.
	As part of the dewatering during construction, surface water monitoring would be consistent with the Noticed General Permits for Consumptive Uses (SJRWMD). Samples collected from the backside of the appropriate turbidity barriers would be analyzed, and the results submitted for agency review, as required.
	Cooling tower blowdown, process effluents, and runoff/leachates generated by/from proposed operations would be discharged to the existing Stanton Energy Center wastewater management and reuse systems. No process wastewater would be directly discharged to any surface waters.
	A Spill Prevention, Control, and Countermeasures Plan would be followed to minimize the opportunity for accidental spills, and identify the appropriate procedures to be followed in case of an accidental spill.
Geological and hydrogeological resources	In the unlikely event of a fuel spill or other release, assessment and recovery of the spill or release would be conducted in accordance with Florida Department of Environmental Protection requirements.
	The new coal pile would be lined and leachate collected to prevent the introduction of pollutants into groundwater.
	Use of treated wastewater effluent and other reclaimed water for cooling water makeup would minimize the withdrawal and consumption of Floridan aquifer groundwater.
	Measurement programs specified in Section XI of the Stanton Energy Center Conditions of Certification would continue to monitor groundwater withdrawal rates from the Upper Floridan aquifer, as well as water levels and quality in the surficial and Upper Floridan aquifers.

Table 4.2.1. Continued

Environmental issue	Pollution prevention or mitigation measure
Floodplains and wetlands	Siting of the proposed facilities on previously disturbed land would prevent any impacts to floodplains and most, if not all, impacts to wetlands. Some wetlands could be impacted by construction of the short transmission line interconnection.
	A survey of all potentially impacted land has identified wetlands that could be disturbed. A plan to mitigate potential impacts would be prepared in accordance with state, DOE, and other federal requirements.
Ecological resources	An ecological resources characterization program has been conducted on the site. Location of the proposed facilities within previously impacted areas (except for the transmission interconnection) would prevent most or all impacts to terrestrial resources, including rare, threatened, or endangered species.
Noise and EMF	During both construction and operation, distance of separation would render most or all noise associated with the project (except perhaps steam blows) imperceptible at offsite locations and below limits set in the Orange County Ordinances. An appropriate level of sound control (baffling, silencers) would be designed into facility equipment to limit operational noise levels.
	Compliance with Florida design and regulatory standards would result in minimal, if any, offsite EMF from the transmission interconnection.
Human health and safety	As required by law, Southern Company and OUC would add project-specific health and safety-related plans to those already in place for existing Stanton Energy Center units to address unique features of proposed operations. Potential adverse impacts would be prevented or minimized by implementation of these plans, which would include appropriate training and supervision of employees and enforcement of workplace safety policies in accordance with regulatory standards.
	All processes and equipment would be designed and constructed for safe operation. An extensive network of area monitors would detect any leaks of potentially hazardous chemicals.

Table 4.2.1. Concluded

Environmental issue	Pollution prevention or mitigation measure
Human health and safety (continued)	Southern Company and OUC would develop and implement a Process Safety Management program for the chlorine and ammonia systems to identify hazards associated with each chemical. The Process Safety Management program would establish emergency response measures as well as specify training protocols. Excess ammonia generated at the proposed facilities would be handled and transported in accordance with the Department of Transportation's hazardous materials regulation.
Cultural resources	Proposed construction would occur at large distances from documented archaeological and historic resources.
Land use	With the exception of the short transmission line interconnection, construction of the proposed facilities would occur on previously disturbed land. Permanent project facilities would occupy only 35 acres (not including area for the gasification ash landfill, if needed). Gasification ash would, as the preferred options, either be burned in the existing Units 1 and 2 or sold for use off the site, thereby eliminating or reducing landfill requirements.
Transportation	A "Construction Traffic Impact Mitigation Program" similar to elements of the one found in the current Stanton Energy Center Conditions of Certification would be developed and implemented. Such a program could include encouraging construction workers to carpool; working with the local mass-transit system to provide workers with a park-and-ride service to the site; using the existing railway access to the Stanton Energy Center site for the delivery of some construction equipment and materials; staggering construction work schedules and shifts to avoid peak traffic hours; and working with Florida DOT to provide temporary traffic control devices and alter signal times to assist in maintaining proper traffic flow. If the Avalon Park Boulevard extension project is completed prior to project construction, traffic issues would largely be mitigated and more modest mitigation would be considered. However, it is not expected that any mitigation steps contemplated would eliminate traffic impacts.
Aesthetics	The proposed facilities would be constructed within an existing power plant site. Screening provided by existing units and intervening vegetation would largely mitigate potential visual impacts of equipment at offsite vantage points.

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3,200-ft transmission line would still be constructed and installed to serve as an electrical interconnection to an existing onsite substation.

Under this no-action scenario, for most resources, environmental impacts would be slightly less or nearly identical to those predicted for the proposed Orlando Gasification Project. The minimal impacts to geology, soils, floodplains, and ecology predicted for the proposed facilities would be the same for this scenario. Construction-related impacts would be similar. Somewhat less land would be needed, because the gasification island would not be built. Therefore, slightly less site preparation would be required. Also, the natural gas-fired unit would require no new coal storage pile.

The construction work force, both peak and average, would be reduced, and the period of construction would be cut from 28 months to 24 months. The associated construction-related traffic would also be reduced in terms of both duration and total volume. Positive economic benefits would be less, relative to the proposed Orlando Gasification Project. The smaller, shorter-duration construction work force would yield fewer wages, associated taxes, and spending for goods and services.

During operation of the natural gas-fired unit, emissions of air pollutants (e.g., SO_2 and NO_x) would be less than those predicted for the proposed Orlando Gasification Project (based on air emissions displayed in Table 2.1.1 for the existing natural gas-fired combined-cycle Unit A). The flare required for the proposed facilities would not be required. Emissions of CO_2 would be lower (about 0.56 million tons per year).

Cooling water requirements would be about 20% less than for the proposed facilities, or about 2.1 million gal per day, on average. Releases of water from the Orange County Eastern Water Reclamation Facility would be reduced by 3.2 ft^3/s, on average, compared to a reduction of 4 ft^3/s, on average, for the proposed facilities. However, the withdrawal and use of Floridan aquifer groundwater would be the same as for the proposed facilities. Noise would essentially be the same.

The two to three additional trains per week associated with the proposed Orlando Gasification Project would not be needed to deliver coal to the Stanton Energy Center. Because no ash would be generated, no disposal sites would be needed to accommodate ash. No elemental sulfur or anhydrous ammonia would be produced. Because no new coal pile would be needed or ash disposal site required, localized contamination would be less likely to shallow groundwater from infiltration of runoff from the coal storage pile or from placement of ash in the onsite coal-combustion ash landfill. Also, somewhat less stormwater runoff would require treatment.

The natural gas-fired unit would require fewer employees to operate (approximately 21 rather than 72), which would reduce traffic, but would also reduce economic benefits. Other traffic associated with delivering supplies and removing byproducts would be less. However, unlike for the proposed Orlando Gasification Project, trucks would continue to deliver anhydrous ammonia to the site once per week for use by the selective catalytic reduction systems on Units 2 and A.

The Stanton Energy Center's existing units would continue to operate without change. Levels of resources used and emissions, effluents, and wastes discharged would remain the same at the existing units.

5. IMPACTS OF COMMERCIAL OPERATION

Following completion of the 4.5-year demonstration in late 2014, three scenarios would be reasonably foreseeable: (1) a successful demonstration of the Orlando Gasification Project followed immediately by commercial operation of the facilities at approximately the same production level; (2) an unsuccessful demonstration followed by continued commercial operation of the combined-cycle power-generating unit using the gasifier to the extent possible, while using natural gas to serve the balance of the combined-cycle unit's requirements not met by the gasifier; and (3) an unsuccessful demonstration followed by continued commercial operation of the combined-cycle unit using natural gas exclusively. The demonstration would be considered successful if the results indicate that continued operation of the gasifier to fully meet the fuel needs of the combined-cycle unit would be economically and environmentally viable (i.e., the project would be demonstrating commercially competitive performance in terms of availability, thermal efficiency, emissions, and cost of electricity). However, if the fuel needs of the combined-cycle unit would need to be met or supplemented by using natural gas for continued commercial operation, then the demonstration of synthesis gas production by coal gasification would be considered unsuccessful.

Under all three scenarios, the expected operating life of the facilities would be at least 20 years, including the 4.5-year demonstration period. An extension beyond 20 years would be based on economic analysis at that time.

Under the first scenario (successful demonstration followed by commercial operation of the facilities), the level of short-term impacts for other resource areas during commercial operation would not change from those described for the demonstration in Section 4 because the proposed facilities would continue operating 24 hours per day with the same operating characteristics. For long-term effects, the level of impacts would be nearly identical to those discussed in Section 4, except for impacts that accumulate with time (i.e., solid waste disposal and CO_2 emissions).

As described in Section 4.1.8.2, gasification ash would be used beneficially to the extent possible and would be placed in the onsite landfill only if no beneficial use were found. Disposal of gasification ash would increase the waste volume in the landfill, but would not change other potential impacts associated with the landfill. Beneficial use of coal combustion ash from the Stanton Energy Center's existing coal-fired generating units has extended the potential operating life of the 347-acre onsite area dedicated for landfill use. Consequently, the landfill site would have sufficient space for at least 50 years' future operation of both the existing coal-fired units and the proposed facilities, assuming continuation of current disposal rates for the existing units plus disposal of all of the gasification ash generated by the proposed facilities. Because the adjacent Orange County Sanitary Landfill (Section 3.8) is estimated to have sufficient capacity to operate for approximately the next 20 years and sufficient land for approximately the next 50 years, that landfill would likely be able to receive other solid wastes from the proposed facilities throughout their lifetime of 20 years or more.

Emissions of CO_2 over the 20-year commercial life of the project would be about 36 million tons.

Commercial sale of elemental sulfur generated by the proposed facilities would continue, if the material were sufficiently pure (Section 4.1.8.2). However, while sulfur consumption currently exceeds production in the United States, global sulfur production is increasing while global demand is decreasing, and supply already exceeds demand globally (Ober 2002). If this trend continues, marketing sulfur could become difficult in the future, which would increase the potential that some or all of the 2,800 tons generated annually by the proposed facilities would need to be placed in the onsite landfill (Section 4.1.8.2).

Commercial sale would continue of a portion of the 7,300 tons of anhydrous ammonia that would be produced annually by the proposed facilities. Because the existing Stanton Energy Center generating units would continue to use the ammonia to satisfy their requirements and because this chemical has many uses in agriculture and industry, all of the ammonia should be used beneficially throughout the 20-year period.

Under the second scenario (an unsuccessful demonstration followed by commercial operation of the combined-cycle unit using the gasifier to the extent possible, while using natural gas for the balance), the types of impacts resulting from the proposed facilities would be similar to those in the first scenario. However, the level of impacts would be reduced because less coal would be used and less ash, elemental sulfur, carbon dioxide and anhydrous ammonia would be produced. Fewer trains would be needed to deliver coal to the Stanton Energy Center than when the gasifier was operating at full load. Disposal requirements and/or transportation off the site for commercial sale of ash, elemental sulfur, and anhydrous ammonia would correspondingly be reduced. During periods when the gasifier was not operating, cooling water demand for project facilities would be about 20% less than under the first scenario. Because the Stanton Energy Center would use less treated wastewater effluent, effluent could be made available for other uses or could be discharged to the wetlands downstream from the Eastern Water Reclamation Facility.

Under the third scenario (an unsuccessful demonstration followed by commercial operation of the combined-cycle unit using natural gas exclusively), operational impacts would be nearly identical to operational impacts for the no-action scenario (the combined-cycle facilities built to use natural gas without the gasifier) (Section 4.3). Because the gasifier and related equipment would no longer be required, they would likely be dismantled and removed from the site, which would result in minor impacts (e.g., fugitive dust and emissions from engines during dismantlement and offsite transport of unneeded equipment, additional traffic associated with hauling the equipment off the site, temporary social and economic impacts from additional workers to perform the dismantlement and removal). Similar minor impacts would be associated with construction and installation of any replacement equipment. Depending on the magnitude of the required conversion, a temporary period of time would likely exist with negligible operational impacts because the facilities would not be operating during the conversion.

As discussed in Section 4.1.7, the social and economic impacts of the proposed facilities would be most noticeable during the construction and demonstration periods rather than during commercial operation. However, the project would continue to have impacts under all three scenarios after completion of the demonstration. Under the first two scenarios, 53 of the 72 demonstration workers would be employed as operations workers. The types of social and economic impacts generated by the presence of this operations work force would be similar to those of the demonstration work force (Section 4.1.7). Although the social and economic impacts during operations would last longer than those during demonstration, the scale of the operations impacts would be smaller than that of the demonstration impacts because fewer workers would be present (i.e., 53 during operations vs. 72 during demonstration). Under the third scenario, the number of workers during operations would drop to 21 because the gasifier and related equipment would no longer be required.

6. CUMULATIVE EFFECTS

This section discusses potential impacts resulting from other facilities, operations, and activities that in combination with potential impacts from the proposed project may contribute to cumulative impacts. Cumulative impacts are impacts on the environment that result from the incremental impact of the proposed project when added to other past, present, and reasonably foreseeable future actions regardless of the agency (federal or non-federal) or person that undertakes such other actions (40 CFR Part 1508.7). An inherent part of the cumulative effects analysis is the uncertainty surrounding actions that have not yet been fully developed. The CEQ regulations provide for the inclusion of uncertainties in the EIS analysis, and state that "(w)hen an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an EIS and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking" (40 CFR Part 1502.22). Consequently, the analysis contained in this section includes what could be reasonably anticipated to occur given the uncertainty created by the lack of detailed investigations to support all cause and effect linkages that may be associated with the proposed project, and the indirect effects related to construction and long-term operation of the facilities.

Because cumulative impacts accrue to resources, the analysis of impacts must focus on specific resources or impact areas as opposed to merely aggregating all of the actions occurring in and around the proposed facilities and attempting to form some conclusions regarding the effects of the many unrelated actions. Narrowing the scope of the analysis to resources where there is a likelihood of reasonably foreseeable impacts accruing supports the intent of the NEPA process, which is "to reduce paperwork and the accumulation of extraneous background data; and to emphasize real environmental issues and alternatives" [40 CFR Part 1500.2(b)]. The resources and impact areas that were identified with a likelihood of such impacts are (1) atmospheric resources, including CO_2 emissions contributing to global climate change; (2) groundwater resources and related withdrawal issues; (3) social and economic resources and related traffic congestion issues; (4) noise issues; and (5) ecological resources, including wetland issues. The lack of impacts to other resources directly affected by the proposed project precludes other resources from this cumulative effects analysis.

Each resource analyzed has an individual spatial (geographic) boundary, although the temporal boundary (time frame) can generally be assumed to equal the 20-year life expectancy of the proposed facilities. For air quality, a 31-mile radius around the Stanton Energy Center was used in the analysis; for greenhouse gases including CO_2 emissions, a global spatial boundary was used; for groundwater resources, the Orange County portion of the St. Johns Water Management District was used as the spatial boundary; for social and economic resources, eastern Orange County was used; and for noise and ecological resources, a few-mile radius around the Stanton Energy Center was used.

For air quality, the analysis in Section 4.1.2.2 indicated that maximum predicted concentrations would be less than the significant impact levels. Therefore, additional modeling including other sources and background concentrations is not required under air quality guidelines for regulatory permitting of the facilities (EPA 1990). Correspondingly, the significant impact levels could be used as thresholds for determining the potential for cumulative impacts under NEPA. Because the analysis indicated that maximum predicted concentrations would be less than the significant impact levels, the proposed facilities would not likely contribute to measurable cumulative air quality impacts under air quality guidelines for regulatory permitting of the facilities.

However, as discussed in Section 4.1.2.2, although additional modeling including other sources and background concentrations was not required for regulatory purposes for any of the pollutants, nevertheless the modeling results in Table 4.1.1 (SO_2, NO_2, PM-10, and CO) were added to the highest ambient concentrations measured in the Orlando area (Table 3.2.1, which incorporated all existing sources, including those at the Stanton Energy Center). The results were compared with the ambient air quality standards (Table 4.1.2). The total impact (second column from the right in Table 4.1.2) was the sum of the modeled concentration (Table 4.1.1) and the ambient background concentration measured in the Orlando area (Table 3.2.1). The highest total impact for SO_2, NO_2, PM-10, and CO was less than 60% of its respective standard (the rightmost column in Table 4.1.2). Consequently, significant cumulative air quality impacts from the sum of the proposed facilities and existing sources, including those at the Stanton Energy Center, would not be expected.

As discussed in Section 4.1.2.2, no significant impact levels or PSD increments currently exist for PM-2.5. However, assuming very conservatively that all particulate emissions from the proposed facilities would be less than or equal to 2.5 μm in aerodynamic diameter (PM-2.5), the maximum modeled 24-hour PM-2.5 concentration of 4.4 $\mu g/m^3$ (Table 4.1.1) would be only 7% of its corresponding NAAQS of 65 $\mu g/m^3$ (Table 3.2.1). Similarly, the maximum modeled annual PM-2.5 concentration of 0.4 $\mu g/m^3$ (Table 4.1.1) would be about 3% of its corresponding NAAQS of 15 $\mu g/m^3$ (Table 3.2.1). These small percentages would not be expected to result in violations of the PM-2.5 NAAQS, for which Orange County is in attainment (Section 3.2.2). The highest total impact for the 24-hour PM-2.5 concentration was about 87% of its respective standard (i.e., the sum of the modeled 4.4 $\mu g/m^3$ and the highest ambient background concentration of 52 $\mu g/m^3$ in Table 3.2.1 would equal 56.4 $\mu g/m^3$, which is 87% of 65 $\mu g/m^3$). Similarly, the highest total impact for the annual PM-2.5 concentration was about 83% of its respective standard (i.e., the sum of the modeled 0.4 $\mu g/m^3$ and the highest ambient background concentration of 12 $\mu g/m^3$ in Table 3.2.1 would equal 12.4 $\mu g/m^3$, which is 83% of 15 $\mu g/m^3$). Consequently, significant cumulative PM-2.5 impacts from the sum of the proposed facilities and existing sources, including those at the Stanton Energy Center, would not be expected.

Furthermore, construction air permits issued after January 1, 2004, by the Florida Department of Environmental Protection for facilities located within 31 miles of the Stanton Energy Center were reviewed to identify other planned emission sources. Although 22 smaller (so-called non-PSD) construction permits were issued, no larger (PSD) permits were issued during this period within this distance from the Stanton Energy Center. Fifteen of the non-PSD permits were issued for locations in Orange County, and the remaining seven permits were issued to facilities in Seminole, Brevard, and Osceola counties. Proposed activities ranged from the construction of spray paint booths to the construction of a drum mix asphalt plant. Each of these activities addressed by the permits would emit air pollutants and, once built and operating, would have some impact on air quality near each source. Potential cumulative impacts with the proposed facilities at the Stanton Energy Center would depend on distance of separation, types and quantities of pollutants emitted by the other sources, and meteorological conditions. Given the small (non-PSD) emission quantities permitted for the other facilities, any potential cumulative impacts with emissions from the proposed facilities would likely be minimal.

As discussed in Section 4.1.2.2, the proposed facilities would increase global CO_2 emissions resulting from fossil fuel combustion, which were estimated at 26,713 million tons for the year 2000, by about 1.8 million tons per year. Emissions of CO_2 over the 20-year commercial life of the project would add about 36 million tons to global emissions over that time frame.

The net effects of market penetration of IGCC technology would depend upon assumptions regarding the mix of technology being displaced. For displacement of conventional coal-fired power plants, the net effects would be less; whereas, displacement of natural gas fired power plants would generally result in net increases in impacts. Although projections of net effects of commercialization of IGCC technology alone are not currently available, DOE has projected that implementation of the fossil energy R&D program, which includes IGCC, would result in emission reductions of NO_x, SO_2, and CO_2 by the year 2025, relative to a scenario that does not involve fossil energy R&D (DOE March 2006).

Use of Upper Floridan aquifer groundwater by the proposed facilities would contribute to the regional trend of increasing withdrawals from the aquifer and the continued lowering of the aquifer's potentiometric surface, which in turn causes reduced flow to springs and increases the potential for saline or brackish water to migrate into water-supply aquifers (Section 3.4.3). The groundwater requirement for the proposed facilities (about 0.1 million gal per day) would be a very small contributor to regional groundwater demand — about 0.1% of the projected increase in groundwater use in the Orange County portion of the St. Johns Water Management District between 1995 and 2025, and less than 0.05% of the total groundwater use projected for that same area in 2025. Because the increment in groundwater use for the project would be within existing permitted limits established for the Stanton Energy Center, the increment has already been accounted for in the water district's assessments of future water supply.

Construction and operation of the proposed facilities would combine with other ongoing and planned activities near the Stanton Energy Center to create cumulative impacts on the area's social and economic resources. The largest contribution to cumulative impacts from the proposed facilities would be the presence of 600 to 700 additional workers during the 9-month peak construction period. Other activities that would contribute to cumulative impacts include the ongoing and planned residential, commercial, and industrial developments north and south of the Stanton Energy Center and the planned Avalon Park Boulevard extension project north and west of the Stanton Energy Center.

As discussed in Section 3.1.2, the proposed Morgan Planned Development and the existing Avalon Park Development are located just north of the Stanton Energy Center. Ongoing and planned developments such as these in eastern Orange County have already created impacts on local socioeconomic resources, particularly water and wastewater services, schools, and the local road network (especially Alafaya Trail). These cumulative impacts would be exacerbated during construction of the proposed facilities. A similar situation exists south of the Stanton Energy Center with the International Corporate Park (Section 3.1.2). Development of the International Corporate Park could combine with construction of the proposed facilities to create cumulative impacts on socioeconomic resources, particularly water and wastewater services and the local road network.

The planned activities that are likely to have the greatest cumulative impacts to socioeconomic resources are the Avalon Park Boulevard extension and the widening of Alafaya Trail from two to four lanes (Section 3.7.7.1 and Section 4.1.7.7). As of spring 2006, work on these road projects has not begun and might not be completed in time to alleviate traffic flow during the peak construction period for the proposed facilities (fall 2008 through spring 2009). If the road projects are completed before the peak construction period, especially if Alafaya Trail is expanded to four lanes, they would help reduce the traffic impacts associated with construction of the proposed facilities. However, if work on the road projects coincides with construction of the proposed facilities, major cumulative impacts would be experienced (i.e., reduced traffic flow and reduced safety on the local road network). This would likely result in considerably longer traffic delays than exist under current conditions ("F" level-of-service) during peak traffic hours on Alafaya Trail. After completion, the roadway would relieve some traffic on Alafaya Trail, and the cumulative effects of the roadway with respect to the proposed project would be beneficial.

Roadway construction, which would occur on the periphery of the Stanton Energy Center site, would generate noise. After roadway completion, traffic on the roadway would also generate noise. Due to the attenuation of noise with distance, an observer subject to noise from two equal sources, one closer to the observer than the other, hears more of the sound generated by the closer source. Thus, noise generated by the proposed facilities would likely be nearly imperceptible at locations along Alafaya Trail and in Avalon Park during periods of noise generated by nearby road construction. The same result is likely at locations along Alafaya Trail and in Avalon Park after the road project is completed (i.e., noise from traffic on the roadway would likely mask noise generated by the proposed facilities).

The Avalon Park Boulevard extension project would impact the buffer area of the Stanton Energy Center. When construction of the road project begins, new stresses would be expected to vegetation, wetlands, and wildlife on the Stanton Energy Center property. The new roadway would impact existing natural resources (i.e., wetlands and listed plant and animal species) along its route, including the Stanton Energy Center site. The roadway would add to the ongoing threat to the area's biodiversity caused by extensive development, which has cleared land, fragmented habitat, altered the hydrological regime, and increased the pressure from human population. An extensive route selection study preceded selection of the proposed route, which attempts to minimize impacts to these resources.

Because the road project would fill a total of 4.2 acres of wetlands, a mitigation plan for wetland impacts has been developed for the project. On the Stanton Energy Center property, the wetlands consist of a long ditch along the western property border, which would be relocated to the eastern edge of the new roadway. Because wetland impacts from the proposed facilities would be minimal, if any, and the project would not interfere with the mitigation plan being implemented for the road project, the proposed facilities should have negligible, if any, wetland impacts that would be cumulative with those of the road project.

Eighteen species of listed plant and animal species were noted in a survey as possibly present on the road project route. The bald eagle, wood stork, red-cockaded woodpecker, scrub jay, alligator, and indigo snake are federally-listed species with a moderate, high, or confirmed likelihood of occurrence on the land to be impacted by the road project. None of these species was found exclusively on the Stanton Energy Center property. The gopher tortoise, a state-listed species of special concern, was documented on the Stanton Energy Center site. A gopher tortoise mitigation plan has been developed for the road project, which includes tortoises on the Stanton Energy Center property.

The presence of the gopher tortoise indicates other listed associated species could also occur, such as the indigo snake, a federally-listed species, and the Florida mouse, a state-listed species. The U.S. Fish and Wildlife Service issued a biological opinion, concluding that the road project would not likely adversely affect the bald eagle or the eastern indigo snake (FWS 2002). However, the biological opinion concluded that the road project would likely negatively affect one cluster of red-cockaded woodpeckers located south of the Stanton Energy Center property on the International Corporate Park property. After review, the U.S. Fish and Wildlife Service allowed for the road project's removal of the red-cockaded woodpecker habitat, contingent upon relocation of the birds to the Hal Scott Regional Preserve and Park, located east of the International Corporate Park and Stanton Energy Center properties. Other contingencies in the approval included (1) creation of artificial nest cavities for the birds on the Hal Scott Regional Preserve and Park and (2) monitoring of the birds' status (i.e., success of the relocation) for at least 5 years.

Because the proposed facilities would be constructed almost entirely on cleared, disturbed lands that contain no significant ecological features and are not important habitats for any listed species, the proposed facilities would not appreciably impact ecological resources in the region. Given that the red-cockaded woodpeckers affected by the road project would be relocated off the site and further from the proposed facilities, no further impacts to them should result from construction and operation of the proposed facilities.

7. REGULATORY COMPLIANCE AND PERMIT REQUIREMENTS

This section lists federal, state, and local regulatory compliance and permit requirements for the proposed facilities.

7.1 FEDERAL REQUIREMENTS

CLEAN AIR ACT

- Enacted by Public Law 90-148, Air Quality Act of 1967 (42 USC 7401 et seq.)
- Amended by Public Law 101-549, Clean Air Act Amendments of 1990
- Comprised of Titles I through VI
- Applicable titles
  - — Title I—Air Pollution Prevention and Control. This Title is the basis for air quality and emission limitations, PSD permitting program, State Implementation Plans, New Source Performance Standards, and National Emissions Standards for Hazardous Air Pollutants.
  - — Title IV—Acid Deposition Control. This Title establishes limitations on SO_2 and NO_x emissions, permitting requirements, monitoring programs, reporting and record keeping requirements, and compliance plans for emission sources. This Title requires that emissions of SO_2 from utility sources be limited to the amounts of allowances held by the sources.
  - — Title V—Permitting. This Title provides the basis for the Operating Permit Program and establishes permit conditions, including monitoring and analysis, inspections, certification, and reporting. Authority for implementation of the permitting program is delegated to authorized states, including Florida.
- On March 10, 2005, the EPA issued the final Clean Air Interstate Rule, also referred to as the Rule to Reduce the Interstate Transport of Fine Particulate Matter and Ozone (40 CFR Parts 51, 72, 73, 77, 78, and 96). The objective of the Rule is to assist states with PM-2.5 and 8-hour O_3 nonattainment areas to achieve attainment by reducing precursor emissions at sources located in 28 states (including Florida) situated upwind of these nonattainment areas. Based on regional dispersion modeling, EPA determined that these 28 upwind states significantly contribute to PM-2.5 and 8-hour O_3 nonattainment in downwind areas. To achieve these goals, the Rule provides for reductions in precursor emissions of SO_2 and NO_x.
- On March 15, 2005, the EPA issued the final Clean Air Mercury Rule (40 CFR Parts 60, 72, and 75). The purpose of the Rule is to reduce national coal-fired power plant emissions of mercury from the current level of 48 tons per year to 15 tons per year by means of a two-phase cap-and-trade program. The first phase national mercury cap (with a cap of 38 tons per year) becomes effective in 2010, while the second 15-tons-per-year cap becomes effective in 2018. The Rule establishes stack mercury emission standards applicable to new sources (i.e., those constructed,

modified, or reconstructed after January 30, 2004). For new IGCC units, stack mercury emissions must not exceed 20×10^{-6} lb of mercury per megawatt-hour.

- The Risk Management Program requirements apply to owners and operators of stationary sources that have more than a threshold quantity of a regulated substance contained in a process (40 CFR Part 68). The proposed facilities would likely require an update or revision to the Stanton Energy Center's current Risk Management Program for storing ammonia and chlorine. To the extent necessary, the revision would (1) describe the planned ammonia and chlorine management systems for the new facilities, (2) present the results of a hazard assessment/offsite consequences analysis, (3) describe the updated Process Safety Management program, and (4) describe updated emergency response plans.
- Regulations implementing the Clean Air Act are found in 40 CFR Parts 50–95.

CLEAN WATER ACT

- Enacted by Public Law 92-500, Federal Water Pollution Control Act Amendments of 1972 (33 USC 1251 et seq.)
- Amended by Public Law 95-217, Clean Water Act of 1977, and Public Law 100-4, Water Quality Act of 1987
- Comprised of Titles I through IV
- Applicable titles
  - Title III—Standards and Enforcement.
    - Section 301, Effluent Limitations, is the basis for establishing a set of technology-based effluent standards for specific industries.
    - Section 302, Water Quality Related Effluent Limitations, addresses the development and application of effluent standards based on water quality goals for the waters receiving the effluent.
  - Title IV—Permits and Licenses.
    - Section 402, National Pollutant Discharge Elimination System (NPDES), regulates the discharge of pollutants to surface waters. Regulations implementing the NPDES program are found in 40 CFR Part 122. Authority for implementation of the NPDES permit program is delegated to authorized states, including Florida.
    - Section 404, Permits for Dredged or Fill Material, regulates the discharge of dredged or fill material in the jurisdictional wetlands and waters of the United States. The U.S. Army Corps of Engineers has been delegated the responsibility for authorizing these actions.
- Regulations implementing the Clean Water Act are found in 40 CFR Parts 104–140. Regulations that affect the permitting of this project include
  - 40 CFR Part 112—Oil Pollution Prevention. This regulation requires the preparation of a Spill Prevention, Control, and Countermeasure Plan.

— 40 CFR Part 122—NPDES. This regulation requires the permitting and monitoring of any discharges to waters of the United States. Construction of the proposed facilities would require an NPDES General Permit for Storm Water Discharges Associated with Construction Activities.

EXECUTIVE ORDERS 11988 AND 11990

Executive Order 11988, Floodplain Management, directs federal agencies to establish procedures to ensure that they consider potential effects of flood hazards and floodplain management for any action undertaken. Agencies are to avoid impacts to floodplains to the extent practical. Executive Order 11990, Protection of Wetlands, requires federal agencies to avoid short- and long-term impacts to wetlands if a practical alternative exists. DOE regulation 10 CFR Part 1022 establishes procedures for compliance with these Executive Orders. Where no practical alternatives exist to development in floodplain and wetlands, DOE is required to prepare a floodplain and wetlands assessment discussing the effects on the floodplain and wetlands, and consideration of alternatives. In addition, these regulations require DOE to design or modify its actions to minimize potential damage in floodplains or harm to wetlands. DOE is also required to provide opportunity for public review of any plans or proposals for actions in floodplains and new construction in wetlands.

The floodplain and wetlands effects anticipated from this proposed project are provided in the following sections of the EIS: Section 3.5.1 (Floodplains—Existing Environment), Section 3.5.2 (Wetlands—Existing Environment), Section 4.1.5.1 (Floodplains— Environmental Consequences), and Section 4.1.5.2 (Wetlands—Environmental Consequences).

RESOURCE CONSERVATION AND RECOVERY ACT OF 1976

- Enacted by Public Law 94-580, Resource Conservation and Recovery Act of 1976 (42 USC 6901 et seq.)
- Amended by legislation including Public Law 98-616, Hazardous and Solid Waste Amendments of 1984, Public Law 99-499, Superfund Amendments and Reauthorization Act of 1986, and Public Law 104-119, Land Disposal Flexibility Act of 1996
- Applicable title

  — Title II—Solid Waste Disposal (known as the Solid Waste Disposal Act). This Title regulates the disposal of solid wastes. Title II, Subtitle C—Hazardous Waste Management, provides for a regulatory system to ensure the environmentally sound management of hazardous wastes from the point of origin to the point of final disposal. Florida has delegated authority to administer most elements of the RCRA Subtitle C program within the state. Title II, Subtitle D—State or Regional Solid Waste Plans, allows states to plan for managing and permitting the disposal of solid wastes and requires each state to develop and implement a regulatory program to ensure that municipal solid waste landfills and other facilities that receive household hazardous waste or conditionally exempt small quantity generator hazardous waste meet federal minimum standards (40 CFR Part 258) for the location, design, operation, closure, and post-closure care of municipal solid waste landfills.

- Project participants would be required to identify any residues that require management as hazardous waste under RCRA (40 CFR Part 261). For some waste streams, this includes testing waste samples using the toxic characteristic leaching procedure or other procedures that measure hazardous waste characteristics.

ENDANGERED SPECIES ACT OF 1973

- Enacted by Public Law 93-205, Endangered Species Act of 1973 (16 USC 1531 et seq.)

  — Section 7, "Interagency Cooperation," requires any federal agency authorizing, funding, or carrying out any action to ensure that the action is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat of such species. Consequently, the U.S. Fish and Wildlife Service will conduct a consultation, in compliance with Subsection (a)(2) of Section 7 of the Act, with regard to the impacts of the proposed project on threatened and endangered species listed by the U.S. Fish and Wildlife Service and any critical habitat of such species in the vicinity of the proposed facilities.

Under Section 7 of the Act, DOE has consulted with the U.S. Fish and Wildlife Service (Appendix A).

NATIONAL HISTORIC PRESERVATION ACT OF 1966

- Enacted by Public Law 89-665, National Historic Preservation Act of 1966 (16 USC 470 et seq.)
- Under Section 106, the head of any federal agency having direct or indirect jurisdiction over a proposed federal or federally assisted undertaking in any state and the head of any federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any federal funds on the undertaking or prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The head of any such federal agency shall afford the Advisory Council on Historic Preservation established under Title II of the Act a reasonable opportunity to comment with regard to such undertaking.

Under Section 106 of the Act, DOE has consulted with Florida's State Historic Preservation Officer (Appendix B).

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

- OSHA General Industry Standards (29 CFR Part 1910). Authority: Sections 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order Numbers 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), 1-90 (55 FR 9033), and 6-96 (62 FR 111), as applicable
- OSHA Construction Industry Standards (29 CFR Part 1926). Authority: 44 FR 8577, February 9, 1979; 44 FR 20940, April 6, 1979

FEDERAL AVIATION ACT OF 1958

- Enacted by Public Law 85-726, Federal Aviation Act of 1958 (49 USC 1101 et seq., as amended)
- Regulations implementing this Act are found in 14 CFR Part 77 and are enforced by the U.S. Department of Transportation, Federal Aviation Administration.
- These regulations require submittal of a notice identifying any structures that, because of construction or alteration, may be a hazard to air transportation. A project located within 3.8 miles of a public airport and/or which contains elements with an elevation of 200 ft above the ground level must receive a clearance from the Federal Aviation Administration. Because the HRSG stack would be 205 ft in height, a Notice of Proposed Construction or Alteration would be filed with the Federal Aviation Administration. Because of existing, taller structures that surround the proposed project site, the Federal Aviation Administration likely would make a determination of no hazard to air navigation.

7.2 STATE REQUIREMENTS

- In Florida, the Florida Electrical Power Plant Siting Act (Chapter 403.501 through 403.518, Florida Statutes) provides for a centrally coordinated application, agency review, and certification process for steam-electric power plants that are 75 MW or greater in size. The Act's site certification process encompasses and fulfills all state, regional, and local regulatory requirements. Although the site certification process supercedes the need to obtain individual agency permits and approvals, the applicant must demonstrate that all applicable state, regional, and local regulations and standards will be fulfilled. These individual agency requirements are addressed by specific Conditions of Certification for the project construction and operation. Federally delegated permit programs, such as PSD, NPDES, and Section 404 dredge-and-fill permitting, do require the approval and issuance of a specific permit as part of the certification process. The certification also includes any of the power plant's directly associated facilities such as transmission lines, fuel and water pipelines, roads, and rail lines. Under the Act's procedures, a Site Certification Application is prepared and submitted by the applicant for joint review by all appropriate state, regional, and local agencies. Other individuals or groups may also request to become parties to the process and review and comment on the Site Certification Application and the proposed project. Under the Act, a supplemental Site Certification Application can be filed for the construction and operation of an additional steam generation unit and associated facilities at a previously certified site, such as the Stanton Energy Center.

- In accordance with Part II of Chapter 373, Florida Statutes, the use of groundwater from the Floridan aquifer for the proposed facilities would require authorization from the St. Johns River Water Management District. Because the combined water requirements of the existing Stanton Energy Center facilities and the proposed facilities would be less than the withdrawal limits (2.0 million gal per day and 321.2 million gal per year) previously authorized by the water management district and specified in the current Stanton Energy Center conditions of certification (OUC 2003), no additional authorization would be required for the proposed facilities. One condition of the authorization is a requirement that the Stanton Energy Center use the lowest quality water source that is economically, environmentally, and technologically feasible; groundwater may be used only for purposes other than cooling water. To comply with this requirement, the proposed facilities would use surface water runoff and treated wastewater effluent for all purposes except potable water supply and process units requiring high-quality water. The Stanton Energy Center also must monitor pumping rates, groundwater levels, and groundwater quality and report the data to the water management district.
- Solid waste generated by construction or operation of the proposed facilities must be managed in accordance with regulations in Chapter 62-701, Florida Administrative Code, entitled "Solid Waste Management Facilities." Any landfills used for disposal of such waste must have an appropriate permit issued in accordance with those regulations by the Florida Department of Environmental Protection. Proposals for beneficial use of gasification ash or other solid wastes from the proposed facilities would require case-by-case review by the Florida Department of Environmental Protection to verify that the proposed use of these wastes would not pose an unacceptable human health risk or cause groundwater or surface water contamination in concentrations above Florida Department of Environmental Protection standards or criteria.

7.3 LOCAL REQUIREMENTS

- The proposed facilities would be required to obtain local construction permits.
- Any onsite chipping and burning of (1) cleared vegetation from preparation of the transmission line right-of-way and (2) debris from installation of the line would require an open burning permit from the Orange County Fire Rescue Department.
- The proposed facilities would be required to comply with the Orange County noise ordinance.
- The proposed facilities would be required to comply with the Orange County Local Government Comprehensive Planning Act of 1975 with Amendments.
- Approvals from the Orange County Health Department and Florida Department of Environmental Protection would be required for construction of an onsite septic system.

8. IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

For the proposed facilities, some of the resource commitments would be irreversible and irretrievable; that is, the resources would be neither renewable nor recoverable for future use. Resources that would be irreversibly or irretrievably used during construction would include crushed stone, sand, lumber, water, diesel fuel, gasoline, and iron ore and coal used to produce steel. Resources that would be irreversibly or irretrievably used during the demonstration would include coal, water, natural gas (used during startup and fired in the gas combustion turbine and duct burners during periods when the gasifier was not operating), and small quantities of process chemicals, paints, degreasers, and lubricants. None of these resources is in short supply relative to the size and location of the proposed facilities.

The proposed facilities would require a commitment of human and financial resources that would prevent use of the resources for alternative projects or federal activities. However, the commitment is consistent with the purpose of and need for the proposed action (Section 1).

9. THE RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

The proposed facilities' main site would occupy about 35 acres, and a short onsite transmission line (approximately 3,200 ft in length) would occupy a small amount of additional land. The facilities would consume resources including coal, natural gas, water, and small quantities of process chemicals, paints, degreasers, and lubricants (Section 8). The proposed facilities would use some of the existing Stanton Energy Center's infrastructure (e.g., roads, rail loop, rail car unloading building, and natural gas line), which would reduce duplication of facilities and infrastructure. The project would generate air emissions, liquid effluents, and solid wastes. However, no process waste streams or water treatment discharges would be released off the site. Gasification ash would be used beneficially to the extent possible and would be placed in the onsite landfill only if no beneficial use were found. Anhydrous ammonia and sulfur byproducts would be recovered and marketed.

The long-term benefit of the proposed project would be to demonstrate advanced power generation systems using IGCC technology at a sufficiently large scale to allow industries and utilities to assess the project's potential for commercial application. The proposed project would minimize SO_2, NO_x, mercury, and particulate emissions. The project is expected to remove up to 95% of the SO_2 produced in the IGCC process using coal that contains up to 0.4% sulfur. The removal of nearly all of the fuel-bound nitrogen from the synthesis gas prior to combustion in the gas turbine would result in appreciably lower NO_x emissions compared to conventional coal-fired power plants. Over 90% of the mercury would be removed. Over 99.9% of particulate emissions would be removed using high-temperature, high-pressure filtration (rigid filters housed in metal cylinders). Approximately 25% less CO_2 would be produced compared to typical emission rates at conventional coal-fired power plants.

The ability to show prospective domestic and overseas customers an operating facility rather than a conceptual or engineering prototype would provide a persuasive inducement to purchase advanced coal utilization technology. The design size for the proposed project was selected to convince potential customers that the IGCC technology, once demonstrated at this scale, could be commercialized without further scale-up to verify operational or economic performance. Successful demonstration would enhance prospects of exporting the technology to other nations and may provide the single most important advantage that the United States could obtain in the global competition for new markets.

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APPENDIX A

CONSULTATION LETTER UNDER SECTION 7 OF THE ENDANGERED SPECIES ACT

United States Department of the Interior

FISH AND WILDLIFE SERVICE
6620 Southpoint Drive, South
Suite 310
Jacksonville, Florida 32216-0912

IN REPLY REFER TO:

FWS Log No. 41910-2006-P-0130

May 3, 2006

Mr. Richard Hargis, M/S 922-342C
U. S. Department of Energy
National Energy Technology Laboratory
P.O. Box 10940
Pittsburg, PA 15236-0940

Dear Mr. Hargis:

Thank you for your email correspondence of February 8, 2006, concerning the proposed Orlando Gasification Project and the request to consult under Section 7 of the Endangered Species Act, as amended (Act) (16 USC 1531 *et seq*), and the Fish and Wildlife Coordination Act. The Service provides the following comments and recommendations pursuant to the information you provided in *Project Facts*, the *Federal Register* Notice of Intent in Vol. 70, No. 154/Thursday, August 11, 2005, and your Preliminary Draft of an environmental assessment dated November 2005.

The proposed gasification facility would be located on 35 acres of a 1,100-acre area that has been cleared, leveled, and licensed for power plant use. Existing infrastructure would be used to the extent possible, except for the installation of a 3,200-foot transmission line proposed to serve as an electrical interconnection from the proposed facilities to an existing onsite substation to the northeast. Including the 80-foot right-of-way for the transmission line, the total area for the transmission corridor would be approximately 5.8 acres.

Threatened and Endangered Species
41910-2006-I-0301

Species that have been documented on the 3,280-acre Stanton Energy Center include the eastern indigo snake, bald eagle, Florida scrub-jay, red-cockaded woodpecker, and the wood stork. As the work for implementation of the proposed project would be confined to disturbed areas used for power generation, the following determinations have been made for these species:

Eastern indigo snake - May affect, not likely to adversely affect. The Service recommends use of the Eastern Indigo Snake Standard Protection Measures during construction. These guidelines may be found on our website at www.fws.gov/northflorida.

Bald eagle - May affect, not likely to adversely affect. The one nest found within the energy center was reported to be destroyed by hurricanes in 2004 and was located 0.5 mile southeast of the proposed project site. The Service recommends that the proposed 3,200-foot transmission line be constructed using a design that creates appropriate spacing between power lines, and includes raptor deterrent devices to prevent electrocution of bald eagles and other large birds of prey.

Florida scrub-jay - No effect. The proposed work would occur primarily within an area cleared, leveled and used for power generation. Due to the lack of suitable scrub habitat within the proposed project area, no adverse effects are anticipated.

Red-cockaded woodpecker - May affect, not likely to adversely affect. A known woodpecker colony is situated within the energy center approximately 1,500 feet or greater southeasterly from the proposed project. As no suitable foraging area is found within the proposed project area, no adverse effects are anticipated in this area. The transmission line corridor would be located away from the cluster site, but the 5.8-acre clearing may affect some foraging habitat, the effects of which are considered minimal. We do encourage that the width of the clearing, now proposed at 80 feet, be minimized to the extent practicable to reduce removal of trees that may potentially be used for foraging.

Wood stork - May Affect, Not Likely to Adversely. Construction of the proposed facility is not anticipated to remove any quality foraging areas for the wood stork, and no colonies are situated within the energy center.

Our comments for threatened or endangered species herein do not constitute a biological opinion for the proposed project, but they do satisfy the requirements of the Act.

Fish and Wildlife Coordination Act

The proposed activity would have minimal effects on fish and wildlife resources within the energy center. The area where the proposed facility would be constructed has been previously disturbed, and affords minimal quality habitat in comparison with the 2,180-acre buffer area that separates the power station site from surrounding developed and undeveloped areas. The Service supports use and management of this buffer area as habitat for wildlife resources, especially Federal and State threatened and endangered species, or species of special concern. Should DOE or the partners involved in the proposed project need technical assistance to promote use of the buffer habitats, the Service will be happy to respond.

Thank you for the opportunity to comment on the proposed Orlando Gasification Project. If additional information becomes available, or significant changes occur in the project design and siting, please reinitiate consultation with the Service. Should you have any questions, please feel free to contact Rob Bittner at 904-232-2580, ext. 120.

Sincerely,

Stephen R. Bittner

for David L. Hankla
Field Supervisor

APPENDIX B

CONSULTATION LETTER UNDER SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT

FLORIDA DEPARTMENT OF STATE
Glenda E. Hood
Secretary of State
DIVISION OF HISTORICAL RESOURCES

Mr. Richard Hargis
U.S. Department of Energy
National Energy Technology Laboratory
P.O. Box 10940
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September 1, 2005

RE: DHR Project File Number: 2005-8734
Received by DHR August 17, 2005
U.S. Department of Energy
Notice of Intent to Prepare an Environmental Impact Statement for the Orlando Gasification Project - Construction & Operation Of An Advanced Power Generation System Using Integrated (IGCC) Technology At Orlando Utilities Commission's Stanton Energy Center
Orlando, Orange County

Dear Mr. Hargis:

Our office received and reviewed the above referenced project in accordance with Section 106 of the *National Historic Preservation Act of 1966*, as amended and *36 CFR Part 800: Protection of Historic Properties* and the *National Environmental Policy Act of 1969*, as amended. The State Historic Preservation Officer is to advise Federal agencies as they identify historic properties (listed or eligible for listing in the *National Register of Historic Places*), assess effects upon them, and consider alternatives to avoid or minimize adverse effects.

Based on the information provided, it is the opinion of this office that the proposed project will have no effect on historic properties.

If you have any questions concerning our comments, please contact Scott Edwards, Historic Preservationist, by electronic mail *sedwards@dos.state.fl.us*, or at 850-245-6333 or 800-847-7278.

Sincerely,

Laura A. Kammerer, Deputy SHPO

for Frederick P. Gaske, Director, and
State Historic Preservation Officer

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☐ Historical Museums (850) 245-6400 • FAX: 245-6433
☐ Southeast Regional Office (954) 467-4990 • FAX: 467-4991
☐ Northeast Regional Office (904) 825-5045 • FAX: 825-5044
☐ Central Florida Regional Office (813) 272-3843 • FAX: 272-2340

APPENDIX C

ORGANIZATIONAL CONFLICT OF INTEREST STATEMENT

NEPA DISCLOSURE STATEMENT FOR PREPARING AN ENVIRONMENTAL IMPACT STATEMENT ON THE ORLANDO GASIFICATION PROJECT

CEQ Regulations at 40 CFR 1506.5(c), which have been adopted by the DOE (10 CFR 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial or other interest in the outcome of the project. The term "financial or other interest in the outcome of the project" for purposes of this disclosure is defined in the March 23, 1981 guidance "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations." 46 FR 18026–18038 at Questions 17a and b.

"Financial or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)." 46 FR 18026–18038 at 1803.

In accordance with these requirements, UT-Battelle, LLC hereby certifies as follows:

Fill in either (a) or (b)

(a) UT-Battelle, LLC has no financial or other interest in the outcome of the Orlando Gasification Project.

(b) ____________ has the following financial or other interest in the outcome of the Orlando Gasification Project and hereby agrees to divest itself of such interest prior to initiating any technical analysis in support of this project.

Financial or Other Interests

1.
2.
3.

Certified by:

Michael J. Frietze 2/16/06

SIGNATURE DATE

Michael J. Frietze

NAME

Director, Prime Contract Administration Division

TITLE

APPENDIX D

AIR QUALITY IMPACT ANALYSIS METHODOLOGY

APPENDIX D. AIR QUALITY IMPACT ANALYSIS METHODOLOGY

D.1 GENERAL APPROACH

The approach to assessing air quality impacts for a new or modified emission source generally begins by determining the impacts of the proposed facilities alone. If the impacts of the facilities are below specified significance impact levels, then no further analysis is required. The significant impact levels were previously presented in Table 4.1.1. If the impacts of proposed facilities are found to exceed a significant impact level, further analysis considering other existing sources and background pollutant concentrations is required for that significant impact level.

The approach used to analyze the potential impacts of the Stanton proposed IGCC facilities, as described in detail in the following subsections, was developed in accordance with accepted practice. Guidance contained in EPA manuals and user's guides was sought and followed. In addition, a proposed modeling protocol was presented to the Florida Department of Environmental Protection for review and comment. Florida Department of Environmental Protection staff subsequently accepted this modeling protocol. The air quality analysis for the proposed IGCC facilities was conducted in accordance with the approved modeling protocol.

Attainment status of criteria pollutants is important information to be considered in the air quality impact analysis. As previously noted in Section 3.2.2, the entire state of Florida, including Orange County, is in attainment with NAAQS and state ambient air quality standards for all pollutants, including the recently implemented PM-2.5 and 8-hour O_3 standards. The PSD Class I area nearest to the Stanton Energy Center is Chassahowitzka National Wildlife Refuge, about 90 miles to the west-northwest on the Gulf of Mexico.

D.2 POLLUTANTS EVALUATED

Most emissions would result from combustion of synthesis gas in the gas combustion turbine during normal operations. The exhaust gas would be released to the atmosphere via the 205-ft HRSG stack. Table 2.1.3 previously presented stack emissions at full load assuming pollutant removal by synthesis gas cleanup systems, but no post-combustion controls (i.e., no selective catalytic reduction or CO catalyst control). Annual emissions are conservatively based on continuous year-round operation (100% capacity factor). The principal pollutants would be SO_2, NO_x, particulate matter, CO, and volatile organic compounds (VOCs). Trace emissions of other pollutants would include formaldehyde, toluene, xylenes, carbon disulfide, acetaldehyde, mercury, beryllium, benzene, arsenic, and others (Table 2.1.3).

D.3 MODEL SELECTION AND USE

Air quality models are applied at two levels: screening and refined. At the screening level, models provide conservative estimates of impacts to determine whether more detailed modeling is required.

Screening modeling can also be used to identify worst-case operating scenarios for subsequent refined modeling analysis. The current version of EPA's SCREEN3 Dispersion Model (EPA 1995a) (Version 96043; February 12, 1996) was employed as a screening tool to evaluate the various proposed IGCC/HRSG operating scenarios.

The refined level consists of techniques that provide more advanced technical treatment of atmospheric processes. Refined modeling requires more detailed and precise input data, but also provides improved estimates of source impacts. The American Meteorological Society (AMS)/EPA Regulatory MODel (AERMOD) modeling system (EPA 2004a; EPA 2004b) and 5 years of hourly meteorological data were used in the ambient impact analysis. AERMOD was used to obtain refined impact predictions for short-term periods (i.e., periods equal to or less than 24 hours). AERMOD was also utilized to obtain refined predictions of annual-average concentrations.

D.3.1 Screening Model Techniques

The proposed IGCC facilities would operate under several operating scenarios. These scenarios include different loads and ambient air temperatures and the optional use of supplemental duct-burner-firing and inlet air evaporative cooling. Plume dispersion and, therefore, ground-level impacts, would be affected by these different operating scenarios since emission rates, exit temperatures, and exhaust gas velocities would change.

The SCREEN3 dispersion model was used to evaluate each IGCC HRSG operating scenario for each pollutant of concern to identify the scenarios that cause the highest impacts. The SCREEN3 model implements screening methods contained in EPA's *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised*. SCREEN3 is a simple model that calculates 1-hour average concentrations over a range of predefined worst-case meteorological conditions. The SCREEN3 model includes algorithms to assess building wake downwash effects and for analyzing concentrations in both simple and complex terrain.

A nominal emission rate of 10.0 grams per second (g/s) was used for all SCREEN3 model runs. The SCREEN3 model results were then adjusted to reflect the maximum emission rate for each operating scenario [i.e., model results were multiplied by the ratio of maximum emission rates (in g/s) to 10.0 g/s]. Summaries of the screening modeling results showing, for each IGCC HRSG operating scenario and pollutant evaluated, the SCREEN3 unadjusted 1-hour average maximum impact, emission rate adjustment ratio, and the adjusted SCREEN3 1-hour average maximum impact are provided in Section D.11.3.

D.3.2 Refined Model Techniques

Regulatory agency recommended procedures for conducting air quality impact assessments are contained in EPA's Guideline on Air Quality Models (GAQM). The GAQM is codified in Appendix W of 40 CFR 51. In the November 9, 2005, Federal Register, EPA approved the use of AERMOD as a GAQM Appendix A preferred model effective December 9, 2005. AERMOD is recommended for use in a wide range of regulatory applications, including both simple and complex terrain. The AERMOD modeling system consists of meteorological and terrain preprocessing programs (AERMET and AERMAP, respectively) and the AERMOD dispersion model. The latest version of AERMOD (Version 04300) was used to assess IGCC project air quality impacts at receptor locations within about 30 miles of the project site.

D.4 MODEL OPTIONS

Procedures applicable to the AERMOD modeling system specified in the latest version of the User's Guide for the AMS/EPA Regulatory Model – AERMOD (September 2004) and EPA's November 9, 2005, revisions to the GAQM were followed. In particular, the AERMOD control pathway MODELOPT keyword parameters DFAULT and CONC were selected. Selection of the parameter DFAULT, which specifies use of the regulatory default options, is recommended by the GAQM. The CONC option specifies the calculation of concentrations. The proposed IGCC facilities would be located in southeastern Orange County. AERMOD options pertinent to urban areas, including increased surface heating (URBANOPT keyword) and pollutant exponential decay (HALFLIFE and DCAYCOEF keywords) were not employed. In addition, the option to use flagpole receptors (FLAGPOLE keyword) was not selected.

The AERMOD modeling system was used to determine short-term and annual average impact predictions by using the PERIOD parameter for the AVERTIME keyword.

D.5 NO_2 AMBIENT IMPACT ANALYSIS

For annual NO_2 impacts, the tiered screening approach described in the GAQM, was used. Tier 1 of this screening procedure assumes complete conversion of NO_x to NO_2. Tier 2 applies an empirically derived NO_2/NO_x ratio of 0.75 to the Tier 1 results.

D.6 TERRAIN CONSIDERATION

The GAQM defines *flat* terrain as terrain equal to the elevation of the stack base, *simple* terrain as terrain lower than the height of the stack top, and *complex* terrain as terrain exceeding the height of the stack being modeled.

Site elevation for the Stanton Energy Center is approximately 70 ft above mean sea level (ft-msl). The proposed IGCC HRSG stack height would be at an elevation of 205 ft above grade. Accordingly, terrain elevations above approximately 275 ft-msl would be classified as complex terrain. U.S. Geological Survey (USGS) 7.5-minute series topographic maps were examined for terrain features in the IGCC impact area (i.e., within an approximate 9-mile radius). Based on this examination, terrain in the vicinity of the site is classified as either flat or simple terrain.

In accordance with the GAQM recommendations for AERMOD, each modeled receptor was assigned a terrain elevation based on USGS 7.5-minute digital elevation model data and use of the AERMAP (Version 04300) preprocessing program. AERMAP was utilized in accordance with the latest version (December 2005) of the user's guide for the AERMOD terrain preprocessor (AERMAP) and EPA's November 9, 2005, revisions to the GAQM. AERMAP prepares terrain data for use by AERMOD in simple and complex terrain situations. This allows AERMOD to account for terrain using a simplification of the procedure used in the CTDMPLUS air dispersion model.

D.7 BUILDING WAKE EFFECTS

The Clean Air Act Amendments of 1990 require the degree of emission limitation for control of any pollutant to not be affected by a stack height that exceeds good engineering practice (GEP) or any other dispersion technique. On July 8, 1985, EPA promulgated final stack height regulations (40 CFR 51). GEP stack height is defined as the highest of 65 meters, or a height established by applying the formula:

$$H_g = H + 1.5\,L$$

where:
- H_g = GEP stack height.
- H = height of the structure or nearby structure.
- L = lesser dimension (height or projected width) of the nearby structure.

Nearby is defined as a distance up to five times the lesser of the height or width dimension of a structure or terrain feature, but not greater than 800 m. While GEP stack height regulations require that stack height used in modeling for determining compliance with NAAQS and PSD increments not exceed the GEP stack height, the actual stack height may be greater. Guidelines for determining GEP stack height have been issued by EPA (1985b).

The height proposed for the Stanton IGCC HRSG stack (i.e., 205 ft above grade level), as well as all other project emission sources, would be less than the *de minimis* GEP height of 65 meters (213 ft). Since the stack heights of the IGCC project emission sources would comply with the EPA promulgated final stack height regulations (40 CFR 51), actual project stack heights were used in the modeling analyses.

While the GEP stack height rules address the maximum stack height that can be employed in a dispersion model analysis, stacks having heights lower than GEP stack height can potentially result in higher downwind concentrations due to building downwash effects. AERMOD evaluates the effects of building downwash based on the plume rise model enhancements (PRIME) building downwash algorithms. For the IGCC ambient impact analysis, the complex downwash analysis implemented by AERMOD was performed using the current version of EPA's Building Profile Input Program (BPIP) for PRIME (BPIPPRM) (Version 04274; September 30, 2004). The EPA BPIP program was used to determine the area of influence for each building, whether a particular stack is subject to building downwash, the area of influence for directionally dependent building downwash, and finally to generate the specific building dimension data required by the model. BPIP output consists of an array of 36 direction-specific (10° to 360°) building heights (BUILDHGT keyword), lengths (BUILDLEN keyword), widths (BUILDWID keyword), and along-flow (XBADJ keyword) and across-flow (YBADJ keyword) distances for each stack suitable for use as input to AERMOD. Dimensions of the building/structures evaluated for the wake effects were determined from engineering layouts and specifications and are shown in Table D.1. The buildings are shown as three-dimensional projections in Figure D.1.

Table D.1. Building/structure dimensions

Building/Structure	Dimensions		
	Width (m)	Length (m)	Height (m)
Natural gas unit steam turbine	18.3	43.2	13.5
Natural gas unit cooling tower	38.2	83.0	18.1
Natural gas unit 1A HRSG	12.1	47.5	25.6
Natural gas unit 2A HRSG	12.1	47.5	25.6
Natural gas unit administration building	18.3	33.2	5.3
Proposed IGCC HRSG	11.7	38.2	34.8
Proposed IGCC combustion turbine	10.3	28.7	9.7
Proposed IGCC fan inlet	9.4	18.0	21.3
Proposed IGCC gasifier structure	53.5	73.2	53.1
Proposed IGCC cooling tower	37.0	50.8	15.0
Proposed IGCC steam turbine	14.2	36.5	9.7
Proposed IGCC control building	18.5	33.2	5.1
Unit 1 cooling tower	—	93.5 (diameter)	131.4
Unit 1 boiler	55.6	78.5	68.6
Unit 2 cooling tower	—	93.5 (diameter)	131.4
Unit 2 boiler	51.7	80.8	68.6
Unit 2 precipitator	37.4	56.8	33.5
Air quality control building for Unit 2	54.3	67.2	32.0
Steam turbines for Units 1 and 2	32.4	158.0	30.5
Coal storage pile	91.4	121.9	10.7

Source: OUC 2006.

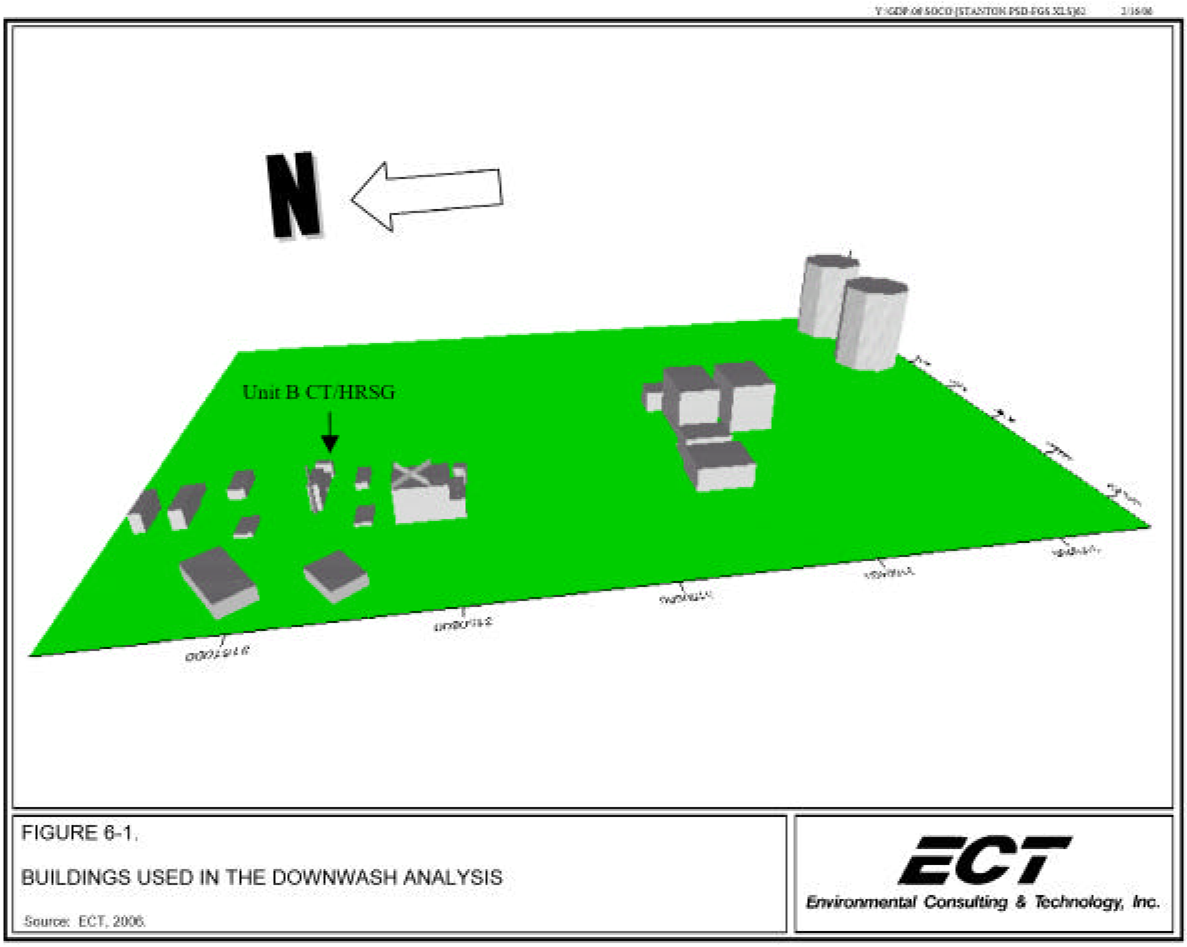

Figure D.1. Buildings used in the downwash analysis.

The entire perimeter of the Stanton Energy Center is fenced. Therefore, the nearest locations of general public access are at the facility fence lines.

Consistent with GAQM and Florida Department of Environmental Protection recommendations, the ambient impact analysis used the following receptor grids:

- Fence line receptors—Receptors placed on the site fence line spaced 164-ft apart.
- Near-Field Cartesian Receptors—Receptors between the center of the site and extending out to approximately 2 miles at 328-ft spacings.
- Mid-Field Cartesian Receptors—Receptors between about 2 miles and extending to approximately 4 miles at 820-ft spacings.
- Far-Field Cartesian Receptors—Receptors between about 4 miles and extending to approximately 9 miles at 1,640-ft spacings.

Figure D.2 illustrates a graphical representation of the near-field receptor grids (out to a distance of about 2 miles). A depiction of the full receptor grid (from about 2 to 9 miles) is shown in Figure D.3.

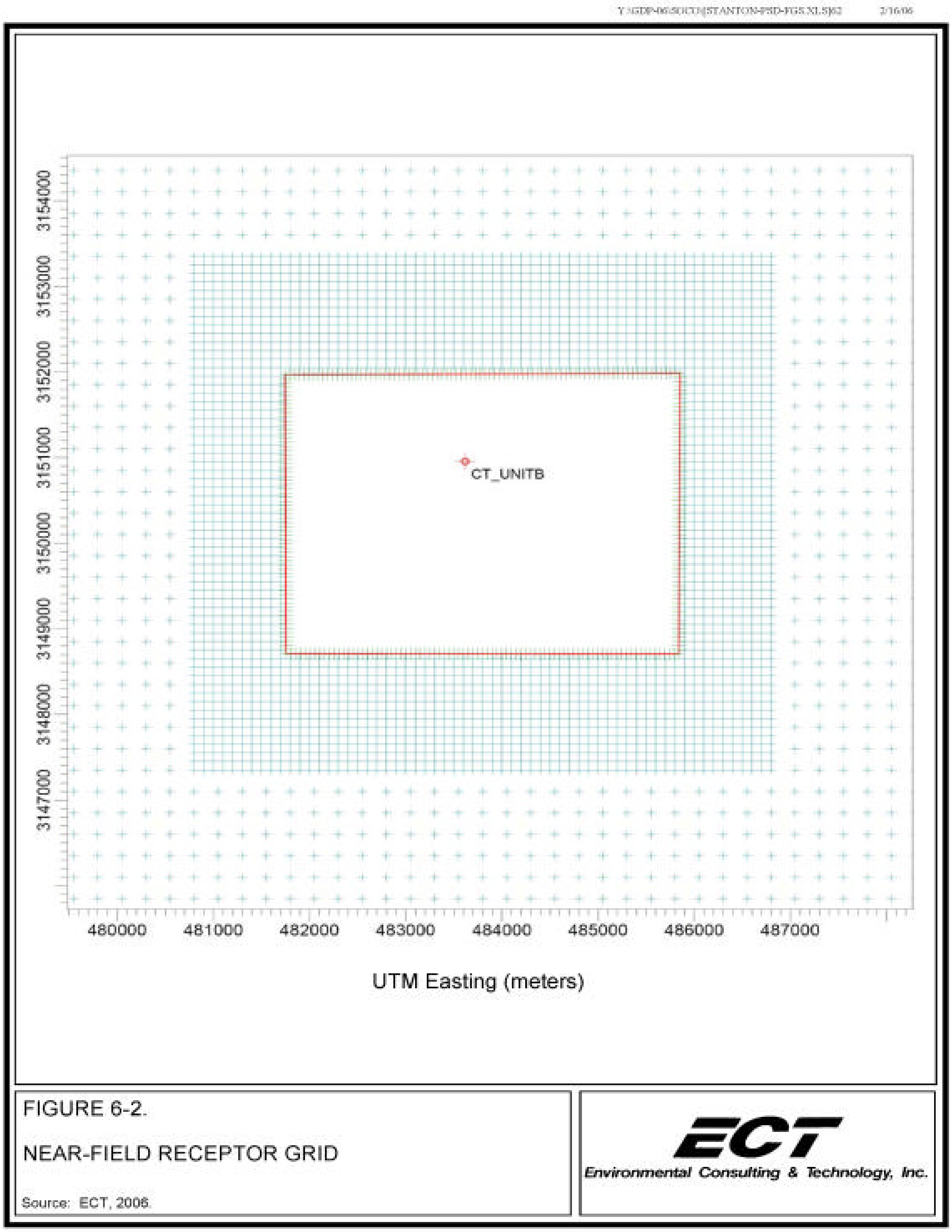

Figure D.2. Near-field receptor grid.

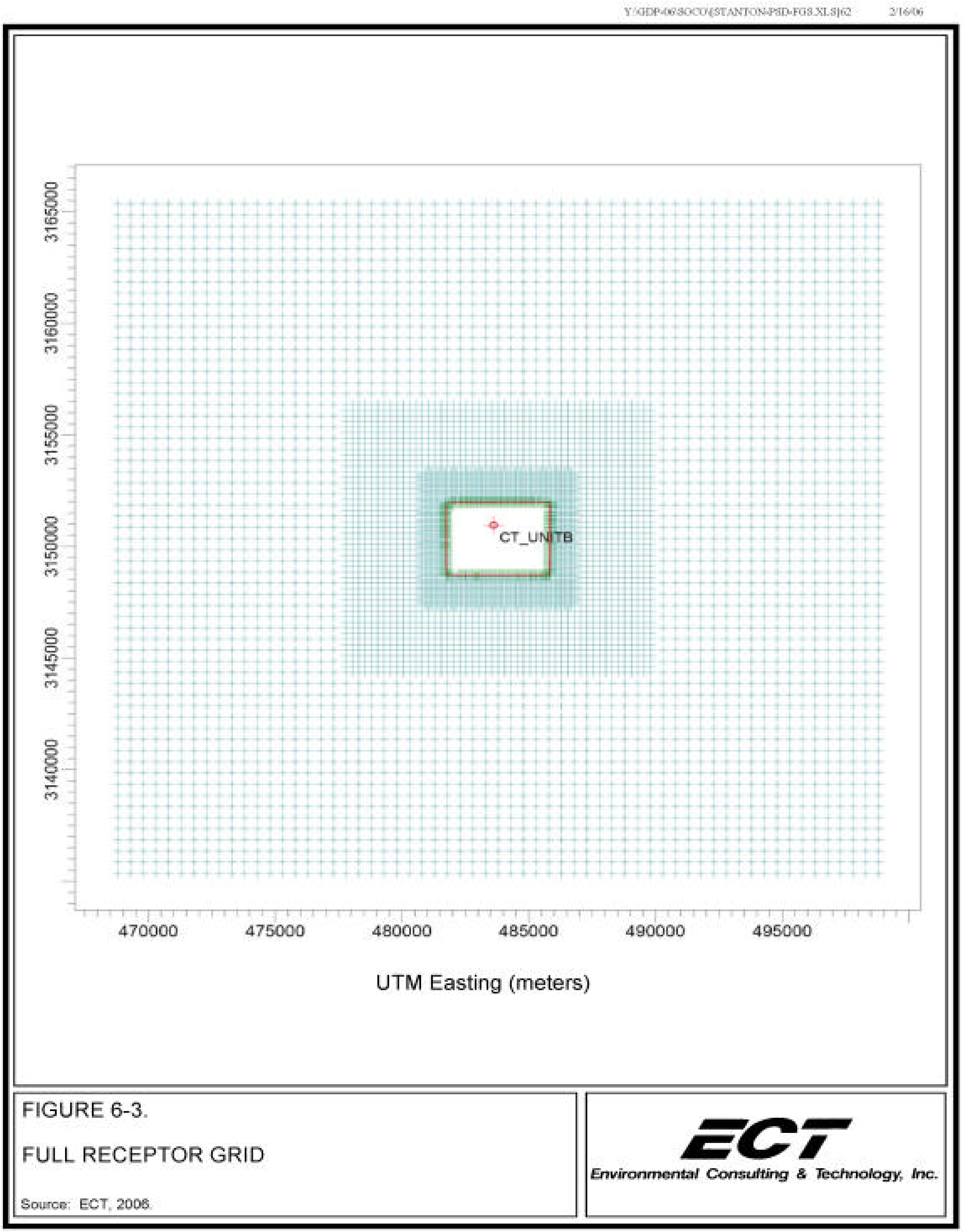

Figure D.3. Full receptor grid.

D.9 METEOROLOGICAL DATA

The AERMOD meteorological preprocessor AERMET (Version 04300) was used to process surface meteorological data collected at the Orlando International Airport (OIA) (Weather Bureau, Air Force and Navy Station No. 12815) and upper air data from Tampa Bay/Ruskin (Station No. 92801). Raw surface and upper air data for the years 1996 to 2000 were obtained from the National Climatic Data Center. Missing surface and upper air data (i.e., data gaps) were filled in accordance with EPA guidance.

AERMET creates two files that are used by AERMOD (i.e., surface and profile files). The surface file contains boundary layer parameters including friction velocity, Monin-Obukhov length, convective velocity scale, temperature scale, convectively generated boundary layer height, stable boundary layer height, and surface heat flux. The profile file contains multilevel data of wind speed, wind direction, and temperature. AERMET was utilized in accordance with the latest version (February 2005) of the User's Guide for the AERMOD Meteorological Preprocessor (AERMET) and EPA's November 9, 2005, revisions to the GAQM.

AERMET calculates hourly boundary layer parameters for use by AERMOD, including friction velocity, Monin-Obukhov length, convective velocity scale, temperature scale, convectively generated boundary layer height, stable boundary layer height, and surface heat flux. In addition, AERMET passes all observed meteorological parameters to AERMOD including wind direction and speed (at multiple heights, if available), temperature, and if available, measured turbulence. AERMOD uses this information to calculate concentrations in a manner that accounts for a dispersion rate that is a continuous function of meteorology.

D.9.1 Selection of Surface Characteristics

The AERMET preprocessing program was used to develop the meteorological data required by AERMOD. Area characteristics in the vicinity of proposed emission sources are important in determining the boundary layer parameter estimates. Obstacles to the wind flow, amount of moisture at the surface, and reflectivity of the surface all affect the boundary layer parameter estimates. The AERMET keywords FREQ_SECT, SECTOR, and SITE_CHAR are used to define the surface albedo, Bowen ratio, and surface roughness length (z_o). Figure D.4 shows the land use in the vicinity of the site that was used to determine the area characteristics.

The albedo is the fraction of total incident solar radiation reflected by the surface back to space without absorption. The daytime Bowen ratio is an indicator of surface moisture and is used for determining planetary boundary layer parameters for convective conditions. The surface roughness length is related to the height of obstacles to the wind flow and represents the height at which the mean horizontal wind speed is zero.

Guidance contained in the AERMET User's Guide (Tables 4-1 through 4-3), in conjunction with vicinity land use and aerial maps, were used to define the seasonal values of surface albedo, daytime

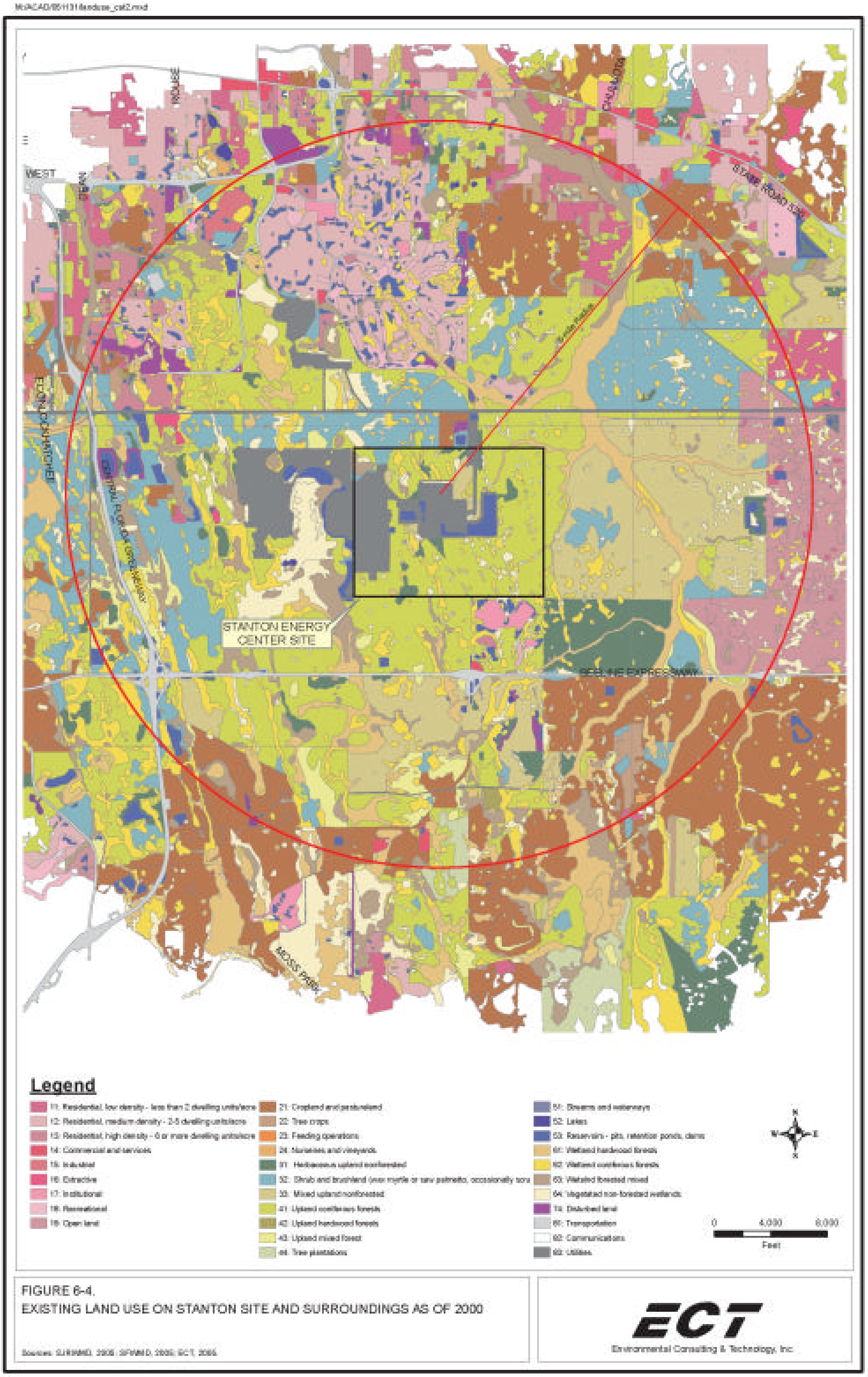

Figure D.4. Existing land use on Stanton site and surroundings as of 2000.

Bowen ratio, and surface roughness length for the proposed IGCC air quality impact assessment. The following specific AERMET parameters were used:

- After examining upwind fetch distances of about 2 miles, five sectors were defined for site characteristics. More than 80% of the land use in this area was found to be rural containing swamp (wetlands) and cultivated land use types provided in the AERMET User's Guide.
- Surface characteristics such as albedo, Bowen ratio, and surface roughness were assumed to vary seasonally, and parameters appropriate for the defined land use types were taken from the AERMET User's Guide.

D.10 MODELED EMISSION INVENTORY

In addition to the combined-cycle unit (the primary proposed emission source), the proposed IGCC facilities would include coal receiving, storage, handling, and feed preparation fugitive and point sources of PM/PM-10, a flare (for combustion of synthesis gas during startups and plant upsets), and a mechanical draft cooling tower.

Because proposed IGCC maximum air quality impacts were below the significant impact levels for all PSD pollutants, a full, multi-source interactive assessment of NAAQS attainment and PSD Class II increment consumption was not required.

D.11 AMBIENT IMPACT ANALYSIS RESULTS

D.11.1 Overview

Comprehensive screening and refined modeling was conducted to assess the air quality impacts resulting from proposed IGCC operations in accordance with the Florida Department of Environmental Protection-approved modeling protocol. This section provides the results of the air quality assessment with respect to near-field impacts (i.e., at receptors located within about 30 miles of the project site).

D.11.2 Conclusions

Comprehensive dispersion modeling using the EPA SCREEN3 (screening) and AERMOD (refined) dispersion models demonstrates that operation of the proposed IGCC facilities would result in ambient air quality impacts that would be well below the significant impact levels for all pollutants and all averaging periods. Accordingly, a multi-source interactive assessment of air quality impacts with respect to the ambient air quality standards and PSD Class II increments was not required.

Assessment of proposed IGCC toxic air pollutant emissions demonstrates that all project ambient air quality impacts for air toxics would be well below the relevant EPA-recommended exposure criteria.

D.11.3 Screening Modeling Results

As previously described, the EPA SCREEN3 dispersion model was used to assess each of the proposed IGCC HRSG operating cases. To aid in assessing the screening results, the operating cases were logically divided into two groups consistent with the emission calculations. Specifically, synthesis gas and natural gas firing operations each have a set of operating conditions defined by combustion turbine load, combustion turbine inlet air evaporative cooling, and HRSG duct burner firing. The combustion turbine HRSG operating cases evaluated for the air quality analyses include combinations of load (i.e., 100, 75, and 50%), ambient temperature (20, 70, and 95°F), and optional use of combustion turbine inlet air evaporative cooling and HRSG duct burner firing. The specific stack parameters (i.e., stack height, diameter, exhaust gas temperature, and velocity) associated with each operating case were previously shown.

The specific exhaust gas temperatures and velocities for each operating case were employed in SCREEN3. Since SCREEN3 model results are directly proportional to emission rates, an emission rate of 10.0 g/sec was used for all IGCC HRSG operating cases so that the model results could be easily scaled to reflect the specific emission rates for each modeled pollutant. Modeling was conducted for the IGCC pollutants that would be projected to exceed the PSD significant emission rate thresholds as previously shown (i.e., NO_x, SO_2, PM-10, and CO).

The SCREEN3 model results were used to identify the specific IGCC HRSG operational cases that would be expected to produce the highest air quality impacts. These worst-case operating cases for each pollutant were then carried forward to the refined modeling analyses.

SCREEN3 model results for NO_2, SO_2, PM-10, and CO while firing synthesis gas and natural gas are shown in Tables D.2 through D.5, respectively. For each of these pollutants, the synthesis gas operating cases resulted in higher impacts than the natural gas cases.

For NO_2, Table D.2 shows that Case No. 6-Syn (100% load at 70ºF, duct firing, and evaporative cooling) results in the highest predicted hourly average concentration of 28.1 $\mu g/m^3$. Therefore, Case No. 6-Syn was selected for the refined NO_2 analyses.

For SO_2, Table D.3 shows that Case No. 10-Syn (100% load at 95ºF, duct firing, and evaporative cooling) results in the highest predicted hourly average concentration of 5.41 $\mu g/m^3$. Therefore, Case No. 10-Syn was selected for the refined SO_2 analyses.

For PM-10, Table D.4 shows that Case No. 10-Syn (100% load at 95ºF, duct firing, and evaporative cooling) results in the highest predicted hourly average concentration of 5.48 $\mu g/m^3$. Therefore, Case No. 10-Syn was selected for the remainder of the PM-10 analyses.

For CO, Table D.5 shows that Case No. 10-Syn (100% load at 95ºF, duct firing, and evaporative cooling) results in the highest predicted hourly average concentration of 22.29 $\mu g/m^3$. Therefore, Case No. 10-Syn was selected for the remainder of the CO analyses.

Table D.2. SCREEN3 model results—NO_2 impacts: annual average operating conditions—IGCC HRSG

Operating Scenarios						1-Hour Impacts			
Case No.	Load (%)	Ambient Temperature (°F)	Emission Rate (g/s)	Evaporative Cooling (Y/N)	Duct Burners[1] (Y/N)	SCREEN3 Unadjusted 10 g/s Results (ug/m^3)	Emission Rate Factor (g/s)	SCREEN3 Adjusted Results (ug/m^3)	Downwind Distance (m)
A. Syngas Operations									
4-SYN	100	70	23.4	N	N	9.89	2.34	23.1	1,072
5-SYN	100	70	23.7	Y	N	9.88	2.37	23.4	1,072
6-SYN	**100**	**70**	**28.4**	**Y**	**Y**	**9.91**	**2.84**	**28.1**	**1,071**
7-SYN	75	70	18.7	N	N	12.33	1.872	23.1	1,106
B. Natural Gas Operations									
5-NG	100	70	4.03	N	N	9.97	0.403	4.02	1,200
6-NG	100	70	4.07	Y	N	9.91	0.407	4.03	1,071
7-NG	100	70	5.30	Y	Y	10.14	0.530	5.37	1,174
8-NG	75	70	3.27	N	N	13.54	0.327	4.43	1,075
9-NG	50	70	2.58	N	N	14.89	0.258	3.84	1,044

[1] Fired exclusively with natural gas.

Table D.3. SCREEN3 model results—SO_2 impacts—IGCC HRSG

Operating Scenarios						1-Hour Impacts			
Case No.	Load (%)	Ambient Temperature (°F)	Emission Rate (g/s)	Evaporative Cooling (Y/N)	Duct Burners[1] (Y/N)	SCREEN3 Unadjusted 10 g/s Results (ug/m^3)	Emission Rate Factor (g/s)	SCREEN3 Adjusted Results (ug/m^3)	Downwind Distance (m)
A. Syngas Operations									
1-SYN	100	20	4.51	N	N	8.60	0.451	3.88	1,115
2-SYN	100	20	4.55	N	Y	8.70	0.455	3.96	1,110
3-SYN	75	20	3.67	N	N	9.79	0.367	3.59	1,074
4-SYN	100	70	4.41	N	N	9.89	0.441	4.36	1,072
5-SYN	100	70	4.48	Y	N	9.88	0.448	4.42	1,072
6-SYN	100	70	4.52	Y	Y	9.91	0.452	4.48	1,071
7-SYN	75	70	3.57	N	N	12.3	0.357	4.40	1,106
8-SYN	100	95	3.97	N	N	13.2	0.397	5.22	1,085
9-SYN	100	95	4.27	Y	N	12.2	0.427	5.20	1,110
10-SYN	**100**	**95**	**4.31**	**Y**	**Y**	**12.6**	**0.431**	**5.41**	**1,100**
11-SYN	75	95	3.27	N	N	16.1	0.327	5.26	1,019
B. Natural Gas Operations									
1-NG	100	20	0.146	N	N	7.79	0.0146	0.114	1,148
2-NG	100	20	0.182	N	Y	8.06	0.0182	0.147	1,136
3-NG	75	20	0.118	N	N	9.79	0.0118	0.115	1,074
4-NG	50	20	0.091	N	N	9.92	0.0091	0.090	1,071
5-NG	100	70	0.131	N	N	9.97	0.0131	0.131	1,200
6-NG	100	70	0.132	N	N	9.91	0.0132	0.131	1,071
7-NG	100	70	0.172	N	Y	10.1	0.0172	0.174	1,174
8-NG	75	70	0.106	N	N	13.5	0.0106	0.144	1,075
9-NG	50	70	0.084	N	N	14.9	0.0084	0.125	1,044
10-NG	100	95	0.121	N	N	13.4	0.0121	0.162	1,078
11-NG	100	95	0.127	N	N	12.8	0.0127	0.163	1,093
12-NG	100	95	0.165	N	Y	13.2	0.0165	0.218	1,082
13-NG	75	95	0.101	N	N	17.0	0.0101	0.172	1,002
14-NG	50	95	0.079	N	N	19.4	0.0079	0.153	962

[1] Fired exclusively with natural gas.

Table D.4. SCREEN3 model results—PM-10 impacts—IGCC HRSG

Operating Scenarios						1-Hour Impacts			
Case No.	Load (%)	Ambient Temperature (°F)	Emission Rate (g/s)	Evaporative Cooling (Y/N)	Duct Burners[1] (Y/N)	SCREEN3 Unadjusted 10 g/s Results (ug/m^3)	Emission Rate Factor (g/s)	SCREEN3 Adjusted Results (ug/m^3)	Downwind Distance (m)
A. Syngas Operations									
2-SYN	100	20	4.57	N	Y	8.70	0.457	3.98	1,110
3-SYN	75	20	3.18	N	N	9.79	0.318	3.11	1,074
4-SYN	100	70	3.83	N	N	9.89	0.383	3.79	1,072
5-SYN	100	70	3.88	Y	N	9.88	0.388	3.83	1,072
6-SYN	100	70	4.51	Y	Y	9.91	0.451	4.47	1,071
7-SYN	75	70	3.10	N	N	12.3	0.310	3.82	1,106
8-SYN	100	95	3.44	N	N	13.2	0.344	4.52	1,085
9-SYN	100	95	3.70	Y	N	12.2	0.370	4.51	1,110
10-SYN	**100**	**95**	**4.37**	**Y**	**Y**	**12.6**	**0.437**	**5.48**	**1,100**
11-SYN	75	95	2.83	N	N	16.1	0.283	4.56	1,019
B. Natural Gas Operations									
1-NG	100	20	2.29	N	N	7.79	0.229	1.78	1,148
2-NG	100	20	2.93	N	Y	8.06	0.293	2.36	1,136
3-NG	75	20	2.29	N	N	9.79	0.229	2.24	1,074
4-NG	50	20	2.28	N	N	9.92	0.228	2.26	1,071
5-NG	100	70	2.29	N	N	9.97	0.229	2.28	1,200
6-NG	100	70	2.29	N	N	9.91	0.229	2.27	1,071
7-NG	100	70	2.93	N	Y	10.1	0.293	2.97	1,174
8-NG	75	70	2.29	N	N	13.5	0.229	3.10	1,075
9-NG	50	70	2.28	N	N	14.9	0.228	3.39	1,044
10-NG	100	95	2.29	N	N	13.4	0.229	3.07	1,078
11-NG	100	95	2.29	N	N	12.8	0.229	2.93	1,093
12-NG	100	95	2.93	N	Y	13.2	0.293	3.88	1,082
13-NG	75	95	2.29	N	N	17.0	0.229	3.90	1,002
14-NG	50	95	2.28	N	N	19.4	0.228	4.42	962

[1] Fired exclusively with natural gas.

Source: OUC 2006.

Table D.5. SCREEN3 model results for CO impacts—IGCC HRSG

Operating Scenarios						1-Hour Impacts			
Case No.	Load (%)	Ambient Temperature (°F)	Emission Rate (g/s)	Evaporative Cooling (Y/N)	Duct Burners[1] (Y/N)	SCREEN3 Unadjusted 10 g/s Results (ug/m^3)	Emission Rate Factor (g/s)	SCREEN3 Adjusted Results (ug/m^3)	Downwind Distance (m)
A. Syngas Operations									
1-SYN	100	20	11.31	N	N	8.60	1.131	9.72	1,115
2-SYN	100	20	18.04	N	Y	8.70	1.804	15.70	1,110
3-SYN	75	20	9.25	N	N	9.79	0.925	9.06	1,074
4-SYN	100	70	11.33	N	N	9.89	1.133	11.20	1,072
5-SYN	100	70	11.42	Y	N	9.88	1.142	11.28	1,072
6-SYN	100	70	17.70	Y	Y	9.91	1.770	17.53	1,071
7-SYN	75	70	9.18	N	N	12.3	0.918	11.32	1,106
8-SYN	100	95	10.45	N	N	13.2	1.045	13.74	1,085
9-SYN	100	95	11.06	Y	N	12.2	1.106	13.47	1,110
10-SYN	**100**	**95**	**17.76**	**Y**	**Y**	**12.6**	**1.776**	**22.29**	**1,100**
11-SYN	75	95	8.78	N	N	16.1	0.878	14.14	1,019
B. Natural Gas Operations									
1-NG	100	20	11.04	N	N	7.79	1.10	8.60	1,148
2-NG	100	20	17.74	N	Y	8.06	1.77	14.31	1,136
3-NG	75	20	8.31	N	N	9.79	0.831	8.13	1,074
4-NG	50	20	7.66	N	N	9.92	0.766	7.59	1,071
5-NG	100	70	9.88	N	N	9.97	0.988	9.85	1,200
6-NG	100	70	9.96	N	N	9.91	1.00	9.87	1,071
7-NG	100	70	17.39	N	Y	10.1	1.74	17.63	1,174
8-NG	75	70	8.21	N	N	13.5	0.821	11.12	1,075
9-NG	50	70	7.11	N	N	14.9	0.711	10.59	1,044
10-NG	100	95	9.21	N	N	13.4	0.921	12.35	1,078
11-NG	100	95	9.54	N	N	12.8	0.954	12.22	1,093
12-NG	100	95	16.67	N	Y	13.2	1.67	22.05	1,082
13-NG	75	95	7.66	N	N	17.0	0.766	13.03	1,002
14-NG	50	95	6.84	N	N	19.4	0.684	13.26	962

[1] Fired exclusively with natural gas.

D.11.4 REFINED MODELING RESULTS

The refined EPA AERMOD modeling system, using five years (1996–2000) of hour-by-hour meteorology and comprehensive receptor grids, was employed to evaluate each of the maximum impact operating cases identified by the SCREEN3 model.

Detailed proposed IGCC AERMOD results for each year of meteorology are summarized in Table D.6 (annual NO_2), Table D.7 (annual SO_2), Table D.8 (24-hour SO_2), Table D.9 (3-hour SO_2), Table D.10 (annual PM-10), Table D.11 (24-hour PM-10), Table D.12 (8-hour CO), and Table D.13 (1-hour CO). These tables provide maximum IGCC impacts, the locations of these impacts, and relevant regulatory criteria.

Maximum IGCC air quality impacts using AERMOD and the identified worst-case operating cases are summarized in Table D.14. The AERMOD results presented in Table D.14 demonstrate that IGCC air quality impacts, for all pollutants and averaging periods, would be below the significant impact levels (also see Table 4.1.1).

D.11.5 AIR TOXICS MODELING RESULTS

The refined AERMOD modeling system was also used to assess IGCC impacts with respect to toxic air pollutants. Table D.15 shows maximum IGCC air quality impacts for a variety of metallic and organic toxic air pollutants in comparison to chronic and acute exposure criteria obtained from EPA's Integrated Risk Information System (IRIS). As shown in Table D.15, all IGCC ambient impacts with respect to air toxics are well below the EPA-recommended exposure criteria.

Table D.6. AERMOD model results—maximum annual average NO_2 impacts

Maximum Annual Impacts	1996	1997	**1998**	1999	2000
Unadjusted AERMOD Impact (µg/m³)[1]	0.0273	0.0269	**0.0277**	0.0207	0.0214
Unit B CT/HRSG Emission Rate (g/s)	28.40	28.40	**28.40**	28.40	28.40
Tier 1 Impact (µg/m³)[2]	0.776	0.763	**0.787**	0.588	0.608
Tier 2 Impact (µg/m³)[3]	0.582	0.573	**0.590**	0.441	0.456
PSD Significant Impact (µg/m³)	1.0	1.0	**1.0**	1.0	1.0
Exceed PSD Significant Impact (Y/N)	N	N	**N**	N	N
Percent of PSD Significant Impact (%)	58.2	57.3	**59.0**	44.1	45.6
PSD *de minimis* Ambient Impact Threshold (µg/m³)	14.0	14.0	**14.0**	14.0	14.0
Exceed PSD *de minimis* Ambient Impact (Y/N)	N	N	**N**	N	N
Receptor UTM Easting (m)	483,577	483,676	**483,676**	483,725	483,775
Receptor UTM Northing (m)	3,151,975	3,151,976	**3,151,976**	3,151,976	3,151,976
Distance From Grid Origin (m)	1,026	1,027	**1,027**	1,031	1,038
Direction From Grid Origin (Vector °)	358	3	**3**	6	9

[1] Based on modeled emission rate of 1.0 g/s.
[2] Unadjusted AERMOD impact times Unit B CT/HRSG emission rate (assumed complete conversion of NO_x to NO_2; i.e., NO_2/NO_x ratio of 1.0).
[3] Tier 1 impact times USEPA national default NO_2/NO_x ratio of 0.75.

Table D.7. AERMOD model results—maximum annual average SO_2 impacts

Maximum Annual Impacts	1996	1997	**1998**	1999	2000
Unadjusted AERMOD Impact (µg/m³)[1]	0.0278	0.0274	**0.0281**	0.0210	0.0215
Unit B CT/HRSG Emission Rate (g/s)	4.31	4.31	**4.31**	4.31	4.31
Adjusted Impact (µg/m³)[2]	0.120	0.118	**0.121**	0.091	0.092
PSD Significant Impact (µg/m³)	1.0	1.0	**1.0**	1.0	1.0
Exceed PSD Significant Impact (Y/N)	N	N	**N**	N	N
Percent of PSD Significant Impact (%)	12.0	11.8	**12.1**	9.1	9.2
Receptor UTM Easting (m)	483,577	483,676	**483,676**	483,725	483,824
Receptor UTM Northing (m)	3,151,975	3,151,976	**3,151,976**	3,151,976	3,151,976
Distance From Grid Origin (m)	1,026	1,027	**1,027**	1,031	1,046
Direction From Grid Origin (Vector °)	358	3	**3**	6	11

[1] Based on modeled emission rate of 1.0 g/s.
[2] Unadjusted AERMOD impact times Unit B CT/HRSG emission rate.

Table D.8. AERMOD model results—maximum 3-hour average SO_2 impacts

Maximum 3-Hour Impacts	1996	1997	**1998**	1999	2000
Unadjusted AERMOD Impact (µg/m³)[1]	0.567	0.700	**0.710**	0.486	0.506
Unit B CT/HRSG Emission Rate (g/s)	4.31	4.31	**4.31**	4.31	4.31
Adjusted Impact (µg/m³)[2]	2.44	3.02	**3.06**	2.09	2.18
PSD Significant Impact (µg/m³)	25.0	25.0	**25.0**	25.0	25.0
Exceed PSD Significant Impact (Y/N)	N	N	**N**	N	N
Percent of PSD Significant Impact (%)	9.8	12.1	**12.2**	8.4	8.7
Receptor UTM Easting (m)	484,567	483,626	**483,626**	483,676	482,686
Receptor UTM Northing (m)	3,151,979	3,151,975	**3,151,975**	3,151,976	3,151,971
Distance From Grid Origin (m)	1,399	1,025	**1,025**	1,027	1,384
Direction From Grid Origin (Vector °)	43	0	**0**	3	318
Date of Maximum Impact	1/2/96	4/28/97	**1/27/98**	1/02/99	11/24/00
Julian Date of Maximum Impact	02	118	**27**	02	329
Ending Hour of Maximum Impact	2100	0300	**0600**	2100	2400

[1] Based on modeled emission rate of 1.0 g/s.
[2] Unadjusted AERMOD impact times Unit B CT/HRSG emission rate.

Table D.9. AERMOD model results—maximum 24-hour average SO_2 impacts

Maximum 24-Hour Impacts	1996	1997	**1998**	1999	2000
Unadjusted AERMOD Impact (µg/m³)[1]	0.241	0.273	**0.328**	0.250	0.200
Unit B CT/HRSG Emission Rate (g/s)	4.31	4.31	**4.31**	4.31	4.31
Adjusted Impact (µg/m³)[2]	1.04	1.18	**1.41**	1.08	0.86
PSD Significant Impact (µg/m³)	5.0	5.0	**5.0**	5.0	5.0
Exceed PSD Significant Impact (Y/N)	N	N	**N**	N	N
Percent of PSD Significant Impact (%)	20.8	23.5	**28.2**	21.6	17.2
PSD *de minimis* Ambient Impact Threshold (µg/m³)	13.0	13.0	**13.0**	13.0	13.0
Exceed PSD *de minimis* Ambient Impact (Y/N)	N	N	**N**	N	N
Percent of PSD *de minimis* Ambient Impact (%)	8.0	9.0	**10.9**	8.3	6.6
Receptor UTM Easting (m)	483,577	483,725	**483,478**	483,478	482,636
Receptor UTM Northing (m)	3,151,975	3,151,976	**3,151,975**	3,151,975	3,151,971
Distance From Grid Origin (m)	1,026	1,031	**1,034**	1,034	1,418
Direction From Grid Origin (Vector °)	358	6	**352**	352	316
Date of Maximum Impact	10/07/96	04/28/97	**03/08/98**	01/23/99	11/24/00
Julian Date of Maximum Impact	281	118	**67**	23	329

[1] Based on modeled emission rate of 1.0 g/s.
[2] Unadjusted AERMOD impact times Unit B CT/HRSG emission rate.

Table D.10. AERMOD model results—maximum annual average PM-10 impacts

Maximum Annual Impacts	1996	**1997**	1998	1999	2000
AERMOD Impact (μg/m3)[1]	0.3075	**0.3463**	0.3331	0.2763	0.2502
PSD Significant Impact (μg/m^3)	1.0	**1.0**	1.0	1.0	1.0
Exceed PSD Significant Impact (Y/N)	N	**N**	N	N	N
Percent of PSD Significant Impact (%)	30.7	**34.6**	33.3	27.6	25.0
Receptor UTM Easting (m)	483,527	**483,577**	483,577	483,181	483,577
Receptor UTM Northing (m)	3,151,975	**3,151,975**	3,151,975	3,151,973	3,151,975
Distance From Grid Origin (m)	1,029	**1,026**	1,026	1,114	1,026
Direction From Grid Origin (Vector ^{o})	355	**358**	358	337	358

[1] Impact for all Unit B PM_{10} emission sourcers.

Table D.11. AERMOD model results—maximum 24-hour average PM-10 impacts

Maximum 24-Hour Impacts	1996	**1997**	1998	1999	2000
AERMOD Impact (µg/m3)[1]	2.748	**4.381**	3.067	3.862	3.412
PSD Significant Impact (µg/m^3)	5.0	**5.0**	5.0	5.0	5.0
Exceed PSD Significant Impact (Y/N)	N	**N**	N	N	N
Percent of PSD Significant Impact (%)	55.0	**87.6**	61.3	77.2	68.2
PSD *de minimis* Ambient Impact Threshold (µg/m^3)	10.0	**10.0**	10.0	10.0	10.0
Exceed PSD *de minimis* Ambient Impact (Y/N)	N	**N**	N	N	N
Receptor UTM Easting (m)	483,500	**483,577**	484,022	483,600	483,428
Receptor UTM Northing (m)	3,148,706	**3,151,975**	3,151,977	3,152,050	3,151,974
Distance From Grid Origin (m)	2,247	**1,026**	1,103	1,100	1,042
Direction From Grid Origin (Vector °)	183	**358**	21	359	349
Date of Maximum Impact	12/31/96	**01/04/97**	09/21/98	06/16/99	07/26/00
Julian Date of Maximum Impact	366	04	264	167	208

[1] Impact for all Unit B PM_{10} emission sourcers.

Table D.12. AERMOD model results—maximum 8-hour average CO impacts

Maximum 8-Hour Impacts	1996	**1997**	1998	1999	2000
Unadjusted AERMOD Impact (µg/m^3)[1]	0.460	**0.573**	0.539	0.393	0.393
Unit B CT/HRSG Emission Rate (g/s)	17.8	**17.8**	17.8	17.8	17.8
Adjusted Impact (µg/m^3)[2]	8.17	**10.2**	9.57	6.98	6.98
PSD Significant Impact (µg/m^3)	500.0	**500.0**	500.0	500.0	500.0
Exceed PSD Significant Impact (Y/N)	N	**N**	N	N	N
Percent of PSD Significant Impact (%)	1.6	**2.0**	1.9	1.4	1.4
PSD *de minimis* Ambient Impact Threshold (µg/m^3)	575.0	**575.0**	575.0	575.0	575.0
Exceed PSD *de minimis* Ambient Impact (Y/N)	N	N	N	N	N
Percent of PSD *de minimis* Ambient Impact (%)	1.4	**1.8**	1.7	1.2	1.2
Receptor UTM Easting (m)	483,626	**483,676**	482,933	483,478	483,923
Receptor UTM Northing (m)	3,151,975	**3,151,976**	3,151,972	3,151,975	3,151,977
Distance From Grid Origin (m)	1,025	**1,027**	1,232	1,034	1,071
Direction From Grid Origin (Vector °)	0	**3**	326	352	16
Date of Maximum Impact	04/30/96	**04/28/97**	02/16/98	02/01/99	01/23/00
Julian Date of Maximum Impact	121	**118**	47	32	23
Ending Hour of Maximum Impact	0800	**0800**	0800	1600	1600

[1] Based on modeled emission rate of 1.0 g/s.
[2] Unadjusted AERMOD impact times Unit B CT/HRSG emission rate.

Table D.13. AERMOD model results—maximum 1-hour average CO impacts

Maximum 1-Hour Impacts	1996	1997	**1998**	1999	2000
Unadjusted AERMOD Impact ($\mu g/m^3$)[1]	0.768	0.763	**0.772**	0.741	0.747
Unit B CT/HRSG Emission Rate (g/s)	17.8	17.8	**17.8**	17.8	17.8
Adjusted Impact ($\mu g/m^3$)[2]	13.6	13.6	**13.7**	13.2	13.3
PSD Significant Impact ($\mu g/m^3$)	2,000.0	2,000.0	**2,000.0**	2,000.0	2,000.0
Exceed PSD Significant Impact (Y/N)	N	N	**N**	N	N
Percent of PSD Significant Impact (%)	0.7	0.7	**0.7**	0.7	0.7
Receptor UTM Easting (m)	483,626	483,725	**483,626**	483,626	483,577
Receptor UTM Northing (m)	3,151,975	3,151,976	**3,151,975**	3,151,975	3,151,975
Distance From Grid Origin (m)	1,025	1,031	**1,025**	1,025	1,026
Direction From Grid Origin (Vector ^{o})	0	6	**0**	0	358
Date of Maximum Impact	06/11/96	09/27/97	**09/03/98**	12/12/99	04/13/00
Julian Date of Maximum Impact	163	270	**246**	346	104
Ending Hour of Maximum Impact	2000	0100	**0500**	0800	1900

[1] Based on modeled emission rate of 1.0 g/s.
[2] Unadjusted AERMOD impact times Unit B CT/HRSG emission rate.

Table D.14. Refined (AERMOD) modeling results—maximum criteria pollutant impacts

Pollutant	Averaging time	Maximum impact (µg/m³)	Significant impact level (µg/m³)
NO_x	Annual	0.59	1
PM-10	Annual	0.35	1
	24-hour	4.4	5
SO_2	Annual	0.12	1
	24-hour	1.4	5
	3-hour	3.1	25
CO	8-Hour	10.2	500
	1-Hour	13.7	2,000

Source: OUC 2006.

Table D.15. Refined (AERMOD) model results—toxic air pollutants; syngas

Chemical Compound	CT/HRSG Emissions[a] (lb/hr)	CT/HRSG Emissions[a] (g/s)	Inhalation Unit Risk Factor[b] $(ug/m^3)^{-1}$	Reference Concentration[b] (ug/m^3)	Cancer Risk[c]	Hazard Coefficient[d]
2-Methylnaphthalene	8.58E-04	1.08E-04	NA	NA	NA	NA
Acenaphthyalene	6.19E-05	7.81E-06	NA	NA	NA	NA
Acetaldehyde	4.29E-03	5.41E-04	2.20E-06	9.00E+00	3.35E-11	1.69E-06
Antimony	9.53E-03	1.20E-03	NA	2.00E-01	NA	1.69E-04
Arsenic	5.01E-03	6.31E-04	4.30E-03	5.00E-01	7.63E-08	3.55E-05
Benzaldehyde	6.91E-03	8.71E-04	NA	NA	NA	NA
Benzene	1.16E-02	1.46E-03	7.80E-06	3.00E+01	3.21E-10	1.37E-06
Benzo(a)anthracene	5.48E-06	6.91E-07	1.10E-04	NA	2.14E-12	NA
Benzo(e)pyrene	1.31E-05	1.65E-06	8.86E-04	NA	4.12E-11	NA
Benzo(g,h,i)perylene	2.26E-05	2.85E-06	NA	NA	NA	NA
Beryllium	2.15E-04	2.70E-05	2.40E-03	2.00E-02	1.82E-09	3.80E-05
Cadmium	6.91E-03	8.71E-04	1.80E-03	2.00E-01	4.41E-08	1.22E-04
Carbon Disulfide	1.07E-01	1.35E-02	NA	7.00E+02	NA	5.43E-07
Chromium*	6.44E-03	8.11E-04	1.20E-02	8.00E-03	2.74E-07	2.85E-03
Cobalt	1.36E-03	1.71E-04	NA	NA	NA	NA
Formaldehyde	7.96E-02	1.00E-02	1.30E-05	NA	3.67E-09	NA
Lead	6.91E-03	8.72E-04	NA	9.00E-02	NA	2.72E-04
Manganese	7.39E-03	9.31E-04	NA	5.00E-02	NA	5.23E-04
Mercury	2.17E-03	2.73E-04	NA	3.00E-01	NA	2.56E-05
Naphthalene	1.27E-03	1.60E-04	NA	3.00E+00	NA	1.50E-06
Nickel	9.30E-03	1.17E-03	2.40E-04	5.00E-02	7.91E-09	6.59E-04
Selenium	6.91E-03	8.71E-04	NA	5.00E-01	NA	4.90E-05
Toluene	1.77E-03	2.23E-04	NA	5.00E+02	NA	1.25E-08
TOTAL					4.08E-07	4.75E-03
Risk Indicators					1.00E-06	1.00E+00
Percent of Indicator					41%	0.47%

[a] Provided by SCS.

[b] Provided by EPA Integrated Risk Information System (IRIS).

[c] Unit risk factor multiplied by maximum annual average impact determined by AERMOD at an 1 g/s emission rate.

[d] Maximum AERMOD annual average impact divided by reference concentration.

Notes:
NA = Not Available
* conservatively assumed all chromium to be hexavalent.

Table D.16. Refined (AERMOD) model results—toxic air pollutants; natural gas

Chemical Compound	CT/HRSG Emissions (lb/hr)	CT/HRSG Emissions (g/s)	Inhalation Unit Risk Factor[a] $(ug/m^3)^{-1}$	Reference Concentration[a] (ug/m^3)	Cancer Risk[b]	Hazard Coefficient[c]
1,3-Butadiene	8.34E-04	1.05E-04	3.00E-05	2.00E+00	8.87E-11	1.48E-06
Acetaldehyde	7.76E-02	9.78E-03	2.20E-06	9.00E+00	6.05E-10	3.05E-05
Acrolein	1.24E-02	1.56E-03	NA	2.00E-02	NA	2.20E-03
Benzene	2.43E-02	3.06E-03	7.80E-06	3.00E+01	6.72E-10	2.87E-06
Ethylbenzene	6.21E-02	7.82E-03	NA	1.00E+03	NA	2.20E-07
Formaldehyde	6.18E-01	7.78E-02	1.30E-05	NA	2.84E-08	NA
Naphthalene	2.81E-03	3.54E-04	NA	3.00E+00	NA	3.32E-06
PAH	4.27E-03	5.38E-04	NA	NA	NA	NA
Propylene Oxide	5.63E-02	7.09E-03	3.70E-06	3.00E+01	7.38E-10	6.65E-06
Toluene	2.54E-01	3.20E-02	NA	5.00E+02	NA	1.80E-06
Xylenes	1.24E-01	1.56E-02	NA	1.00E+02	NA	4.39E-06
TOTAL					3.05E-08	2.25E-03
Risk Indicators					1.00E-06	1.00E+00
Percent of Indicator					3%	0.22%

[a] Provided by EPA Integrated Risk Information System (IRIS).

[b] Unit risk factor multiplied by maximum annual average impact determined by AERMOD at an 1 g/s emission rate.

[c] Maximum AERMOD annual average impact divided by reference concentration.

Notes:
NA = Not Available

APPENDIX E

HAZARD ANALYSIS OF ANHYDROUS AMMONIA TRUCK ACCIDENT

Title: Transport Company of Texas, Tractor Semitrailer (Tank) Collision with Bridge Column and Sudden Dispersal of Anhydrous Ammonia Cargo, Houston, Texas, May 11, 1976.
NTSB Report Number: HAR-77/01, adopted on April 14, 1977. Accessed at http://www.ntsb.gov/publictn/1977/HAR7701.htm

NTIS Report Number: PB-268251

SYNOPSIS

About 11:08 a.m., on May 11, 1976, a Transport Company of Texas tractor-semitrailer (tank) transporting 7,509 gallons (about 19 tons at about 5 lb/gal) of anhydrous ammonia struck and penetrated a bridge rail on a ramp connecting I-610 with the Southwest Freeway (U.S. 59) in Houston, Texas. The tractor and trailer left the ramp, struck a support column of an overpass, and fell onto the Southwest Freeway, approximately 15 ft below. The anhydrous ammonia was released nearly instantaneously from the damaged tank semitrailer. Six persons died as a result of the accident, 78 persons were hospitalized, and approximately 100 other persons were treated for injuries.

AIR DISPERSION MODELING

The ALOHA air dispersion model (NOAA 2006) was used to estimate potential impacts of ammonia downwind of the actual truck accident, as applied to the Orlando area rather than Houston. As a conservative (upper-bound) assumption, the average population density of Orange County was applied along the entire length of a shipment from the Stanton Energy Center to Jacksonville (Section 4.1.9.2). Table E.1 provides the assumptions and various inputs. Table E.2 presents the results from the ALOHA model, and Figure E.1 shows a graphical representation of the toxic threat zone from which the potential impacts were estimated.

The estimated toxic impacts for ammonia predicted by ALOHA are based on the American Industrial Hygiene Association's Emergency Response Planning Guide (ERPG) values (Table E.1). For the route from the Stanton Energy Center to Jacksonville, approximately 655 people are predicted by ALOHA to be in the ERPG-3 zone (with ammonia concentrations of at least 750 ppm), which is the area in which a 1-hour exposure would be expected to produce life-threatening health effects. About 1,091 people are predicted to be in the ERPG-2 zone (with ammonia concentrations of at least 150 ppm but less than 750 ppm), which is the area in which a 1-hour exposure would be expected to produce irreversible or other serious health effects or symptoms that might limit their ability to take protective action. Approximately 4,146 people are predicted to be in the ERPG-1 zone (with ammonia concentrations of at least 25 ppm but less than 150 ppm), which is the area in which a 1-hour exposure would be expected to produce mild, transient health effects or a perception of a clearly defined, objectionable odor. Altogether, about 13,000 people would require sheltering in place or evacuation to preclude exposures at the level of ERPG-1 or higher (see confidence lines in Figure E.1).

The ALOHA model was also used to calculate a flammable threat zone and overpressure (blast force) threat zone for the same 19-ton instantaneous release of ammonia following a truck accident but, because the consequences were much less than the consequences for the toxic threat zone, those results are not presented in this document.

Table E.1. ALOHA model input data for truck accident in Houston, Texas, May 11, 1976, as applied to the Orlando area

SITE DATA

Location: ORLANDO, FLORIDA

Building Air Exchanges Per Hour: 1 (user specified)

Time: April 28, 2006 0440 hours EDT (using computer's clock)

CHEMICAL DATA

Chemical Name: AMMONIA

Molecular Weight: 17.03 g/mol

ERPG-1: 25 ppm ERPG-2: 150 ppm ERPG-3: 750 ppm

IDLH: 300 ppm LEL: 160,000 ppm UEL: 250,000 ppm

Ambient Boiling Point: -28.3° F

Vapor Pressure at Ambient Temperature: greater than 1 atm

Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA

Wind: 7 mph from 235° (true heading) at 3 meters

Ground Roughness: urban or forest

Air Temperature: 85° F

No Inversion Height

Cloud Cover: 7 tenths

Stability Class: D

Relative Humidity: 75%

SOURCE STRENGTH AND CHARACTERISTICS

Leak from hole in horizontal cylindrical tank

Flammable chemical escaping from tank (not burning)

Tank Diameter: 7 ft - tank Length: 39.9 ft

Tank Capacity: 11,500 gal

Tank contains liquid - internal Temperature: 85° F

Chemical Mass in Tank: 23.5 tons - tank is 82% full per DOT restrictions for non-insulated cargo tank

Rectangular opening: 30 x 4 in.

Opening is 3.25 ft from tank bottom

Release Duration: 1 minute

Max Average Sustained Release Rate: 632 lb/s (averaged over one minute)

Total Amount Released: about 7,583 gal or 37,913 lb (about 19 tons)

The chemical escaped as a mixture of gas and aerosol (two phase flow).

Table E.2. Toxic threat zone data, as presented in Figure E.1

Threat modeled: Toxic area of vapor cloud
Model run: Heavy gas
Red: Downwind distance of 1.4 miles --- (750 ppm = ERPG-3)
Orange: Downwind distance of 2.7 miles --- (150 ppm = ERPG-2)
Yellow: Downwind distance of 5.7 miles --- (25 ppm = ERPG-1)
Black: 95% confidence lines for ERPG-1

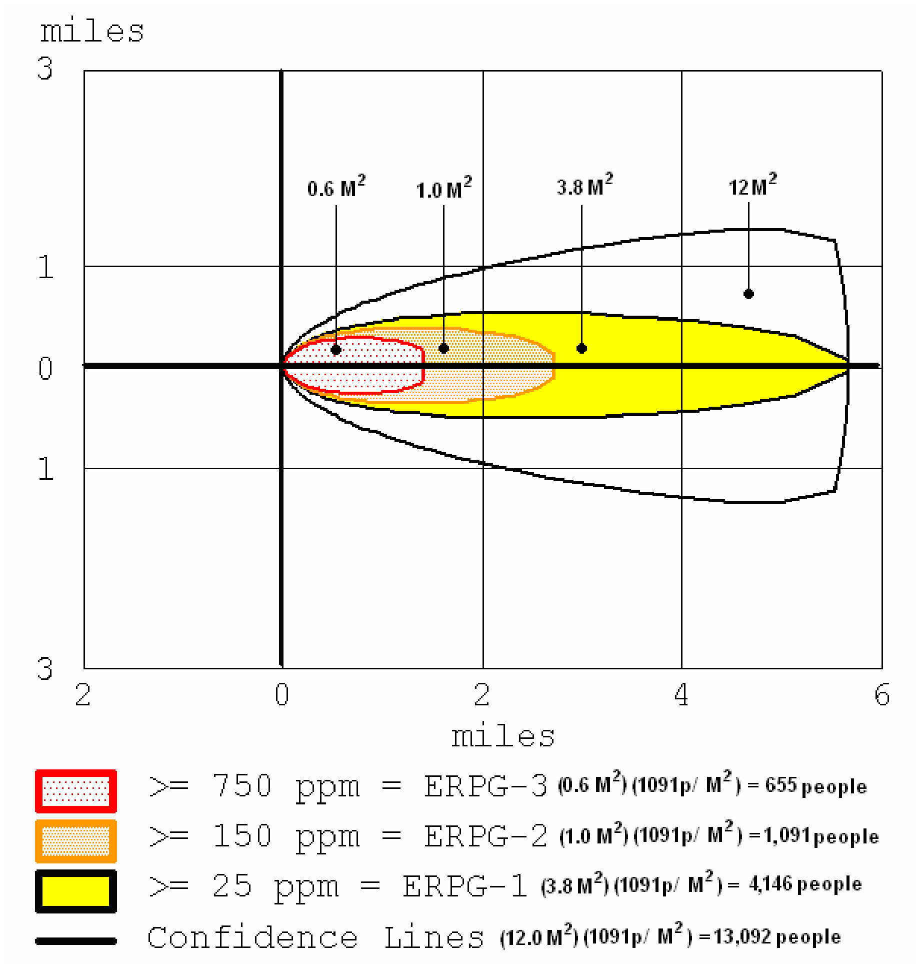

Figure E.1. Downwind area associated with toxic threat zone predicted by the ALOHA model.

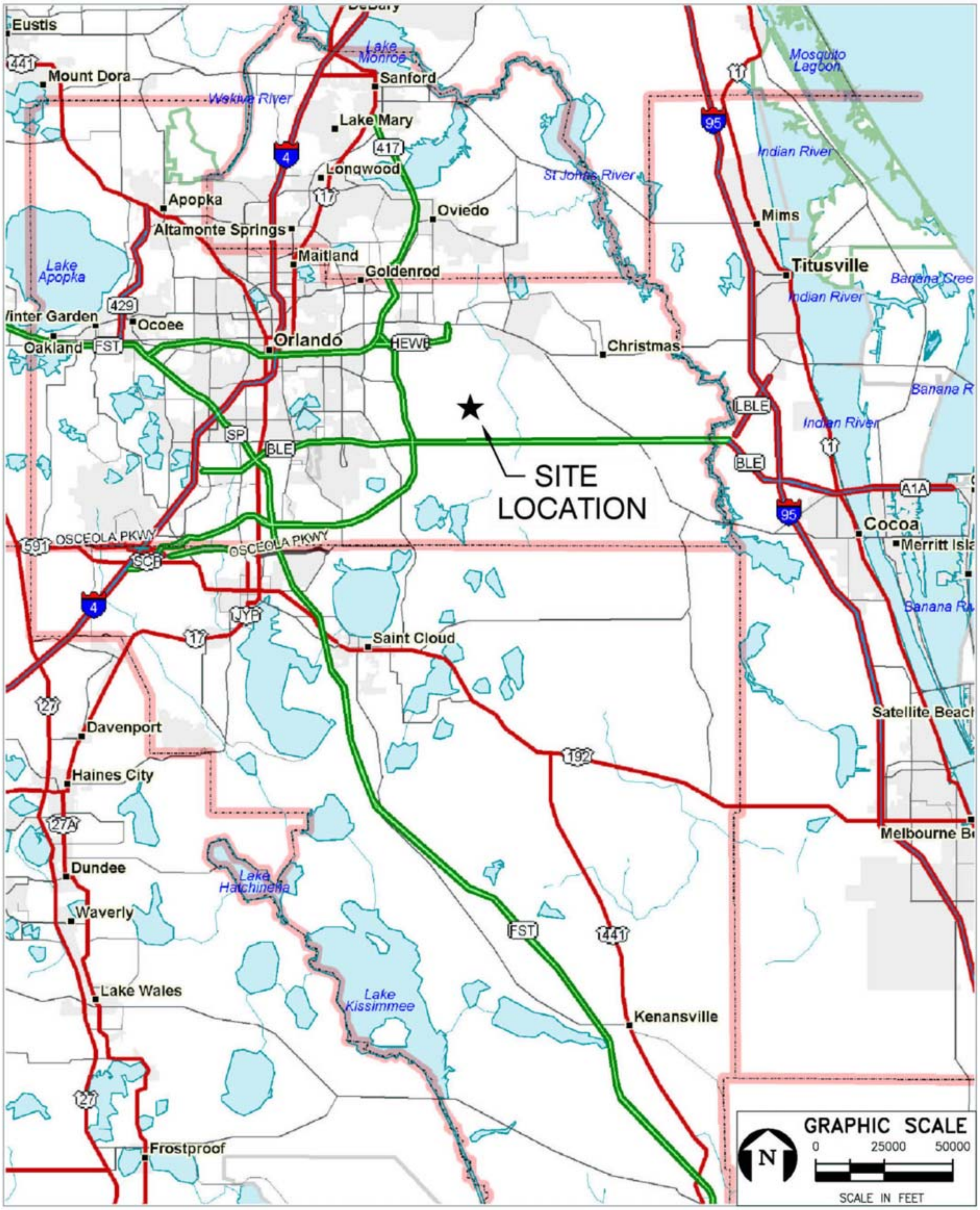

Figure 2.1.1. Location of the Stanton Energy Center in eastern central Florida.