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May 1, 2007

Shaw Project No. 121525

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BUREAU OF AIR REGULATION

Ms. Debbie Nelson
Florida Department of Environmental Protection
Bureau of Air Regulation
Air Permitting South
2600 Blair Stone Road
MS 5505
Tallahassee, Florida 32399-2400
850-921-9537

Subject: Supplemental Information for Air Construction Permit Application, 1270-2
Class I Area Impact Analysis for Proposed Expansion
Okeechobee Landfill, Facility No. 0930104

Dear Ms. Nelson:

We are providing supplemental information for your review of the above-mentioned permit application. Attached are eight copies of the Class I Area Impact Analysis Report and two copies of the report's Appendix D, which is comprised of 8 computer discs each. If you need any additional information, you may contact me at 508-667-7677.

Respectfully,
Shaw Environmental, Inc.

Bruce K. Maillet

Bruce Maillet
Client Program Manager

Cc(without computer discs):	J. Fasulo, OLI
	D. Thorley, WM
	K. Alzheimer, Shaw
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CLASS I AREA IMPACT ANALYSIS FOR PROPOSED EXPANSION IN OKEECHOBEE LANDFILL

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MAY 02 2007

BUREAU OF AIR REGULATION

Prepared for:

Okeechobee Landfill, Inc.
Okeechobee, Florida

Prepared by:

Shaw® Shaw Environmental, Inc.
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Project No. 121525
March 2007

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1.0 Introduction

As mentioned in Section III, Air Construction Permit Application, 1270-2 the net emissions from the proposed changes in the facility exceeded the significant emission rates for New Source Review (NSR) for the following pollutants: SO_2, NOx, PM10, and CO. Therefore, a Best Available Control Technology (BACT) analysis and an air quality impact analysis in the near filed area were conducted and included in Section III of the permit application submitted on February 28, 2007.

An important element of the air quality analysis is Class I area impact analysis. The analysis requires estimation of impact of the proposed project on nearby federally designated Class I areas in terms of air quality, acidic deposition, and visibility degradation, which are part of the air quality related values (AQRVs).

A brief summary of the results of the Class I area impact analysis was included in the permit application submitted on February 28, 2007. This appendix provides details of the analysis. The appendix is arranged as follows:

- Section 2.0: Background Information
- Section 3.0: Technical Approach and Methodology
- Section 4.0: Class I Area Impact Analysis
- Section 5.0: Conclusions.

2.0 Background Information

The Okeechobee Landfill Facility (Facility), which is owned and operated by Okeechobee Landfill, Inc. (OLI), is comprised of an existing municipal solid waste (MSW) landfill and supporting operations. The facility has been operational since 1981 and under the existing solid waste permit will continue to construct and operate the landfill until approximately 2058. The landfill is an emission unit for nonmethane organic compounds (NMOCs), a landfill gas (LFG) constituent. The typical control device (CD) for NMOCs in LFG is flaring. Other destructive control devices that are sometimes used for LFG combustion are turbines, engines, enclosed combustors, and boilers. The proposed modification to the landfill includes increasing flaring capacity, adding sulfur removal equipment, and constructing a landfill-gas-to-energy (LFGTE) plant.

The Facility currently has two enclosed landfill gas flares with Evap® systems and an open, utility flare as a backup. The two enclosed flares and the backup flare are operated under the current Title V operation permit. There is currently an odor control flare that is operating under a first amended order between FDEP and Okeechobee Landfill Inc. (OLI). A second amended order allows up to five flares to be operated at the Facility. The estimated maximum potential-to-emit (PTE) based on LFG generation estimates occurs shortly after closure and will increase from current 6,000 standard cubic feet per minute (scfm) to 32,400 scfm. There is a current need to install more capacity for control of collected LFG. As the landfill emission unit continues to be constructed, turbines and flares will be installed to control the landfill gas. As the landfill gas increases to allow for the installation of the permitted turbines, the landfill gas will be diverted from the flares to the gas turbines, which will beneficially use the landfill gas by converting it into electricity. Under this preferred scenario, the landfill gas will be always combusted in turbines (numbers increasing with time) and one flare to combust residual gas after full capacity is achieved in turbines, except during turbine maintenance activities which may require additional gas to be sent to the flares. As the gas generation reaches the minimum capacity required for a turbine, gas will be transferred from being flared to a new turbine; and the flare(s) will be ready for excess gas generated from the landfill.

Although the Facility is not a permitted as a major stationary source, recent fuel analysis for hydrogen sulfide indicates that the actual emissions do qualify the Facility as a major stationary source for SO_2. Additionally, the expected emission increases from the current level to the predicted levels at the completion of the landfill construction are above the significant emission rate therefore, triggering PSD review under Chapter 62-212.400. The Application provides the information required by Chapter 62-212.400, F.A.C., for Prevention of Significant Deterioration (PSD) review.

The summary of significant emission rate evaluation for all PSD pollutants as described in Section 5.2 of the Permit Application Report is shown in Table 2-1. The pollutants exceeding the significant emission rates from the proposed changes are: i) SO_2; ii) NOx; iii) PM10; and iv) CO. A BACT analysis has been performed and would require installation of a LFG desulphurization system installed before the destructive control devices (e.g., flares and turbines) to control SO_2.

Table 2-1: PSD Significance Summary

Pollutant	PSD Emission Significant?
Nitrogen Oxides (NOx)	Yes
Carbon Monoxide (CO)	Yes
Sulfur Dioxide (SO_2)	Yes
Particulate Matter, diameter <10 microns (PM10)	Yes
Hydrogen Sulfide (H_2S)	No
Ozone as Volatile Organic Compounds (VOC)	No

Note: Other PSD regulated compounds are not emitted in any appreciable quantity during LFG combustion.

2.1 Description of Site

The Facility is located in Okeechobee County in Central Florida near Lake Okeechobee at approximately 27°20’24” latitude and 80°41’27” longitude. Figure 2-1 shows the site within the state of Florida and nearby natural features. The 4300 acre site contains the existing Berman Road Landfill, the proposed Clay Farms expansion, and auxiliary services.

The terrain surrounding the Facility is mostly flat with terrain heights reaching 60 feet within 5 kilometers (km) from the property boundary line. The vegetation is mostly grassland and mangroves. Land use in the surrounding area is mostly rural. A large water body (Lake Okeechobee) is located approximately 30 km southwest of the Facility.

The area is not industrial and there are no large industrial sources within 10 km from the Facility. Okeechobee County is in attainment for all regulated pollutants with federal NAAQS and FDEP AAQS. The nearest Class I area is Everglades National Park approximately 169 km south of the southernmost property boundary of the Facility. Biscayne Bay National Park, a Class II National Park, is located approximately 193 km from the Facility towards the southwest.

There is no USEPA-approved meteorological monitoring station at the Facility. Meteorological data from nearest National Weather Service (NWS) station in West Palm Beach (approximately 60 km southeast of Facility) shows a predominantly westerly wind pattern. Climatological data shows that average and maximum wind speed in the area are approximately 4 meters per second (m/s) and 10 m/s. Average annual rainfall in the area is 1560 millimeter (mm).

Figure 2-2 shows a plot plan for the existing Facility. The location of the existing flares and the locations of the proposed turbines and proposed flares are also shown in Figure 2-2.

2.2 Description of Emission Sources

The post-BACT operations have been described in detail in Section 2.0 and 3.0 of the Air Permit Application. The BACT for the proposed modification is to install Low-Cat systems for removal of sulfur from the LFG. The cleaned LFG will then be combusted in the LFG turbines, with a potential for combustion in the flares as an alternative operating scenario. For the purpose of air quality analysis, the following LFG combustion emission sources have been considered:

- Primary Operating Scenario after Installation of BACT (Primary Operating Scenario):
  - Seven LFG turbines (CD011 to CD017) used as control devices each rated at 4,000 scfm of LFG;
  - One open flare (CD003) used as a control device rated at 3,300 scfm of LFG; and
  - One open flare (CD004) used as a control device rated at 3,300 scfm LFG, but only operating at one third capacity (1,100 scfm).
- Alternative Operating Scenario after Installation of BACT when LFG turbines are unavailable (Alternative Operating Scenario)
  - Eight open flares (CD003 through CD010) used as control devices each rated at 3,300 scfm of LFG
  - Two existing enclosed flares (CD001 and CD002) used as control devices each rated at 3,000 scfm of LFG.

The emission rates used for the air quality analysis from these emission sources are described in Section 3.2.

The pollutants considered for the Class I impact analyses were: i) NOx, ii) SO_2; and iii) PM10. Other pollutants such as sulfates, nitrates, ammonia, sulfuric acid mist, and nitric acid mist are not emitted from the emission sources in any appreciable amounts. The total emissions of these pollutants and distance of the emission sources from the nearest Class I area (Everglades NP) and Class II area (Biscayne Bay NP) are shown in Table 2-2a and b.

Table 2-2a: Q/D Analysis for Emission Sources for Everglades National Park

Operating Scenario	Nearest Distance to Everglades NP	Total SO_2 Emissions (tpy)	SO_2 Q/D (tpy/km)	Total NOx Emissions (tpy)	NOx Q/D (tpy/km)	Total PM Emissions (tpy)	PM Q/D (tpy/km)
Primary BACT	185.31	574.7	3.10	991.8	5.35	76.7	0.41
Alternative BACT	185.38	574.7	3.10	283.2	1.53	66.6	0.36

Table 2-2b: Q/D Analysis for Emission Sources for Biscayne Bay National Park

Operating Scenario	Nearest Distance to Everglades NP	Total SO_2 Emissions (tpy)	SO_2 Q/D (tpy/km)	Total NOx Emissions (tpy)	NOx Q/D (tpy/km)	Total PM Emissions (tpy)	PM Q/D (tpy/km)
Primary BACT	193.53	574.7	2.97	991.8	5.12	76.7	0.40
Alternative BACT	193.62	574.7	2.97	283.2	1.46	66.6	0.34

2.3 Elements of Class I Area Impact Analysis

Florida's State Implementation Plan (SIP), which contains the PSD regulations, has been approved by USEPA and therefore PSD approval authority has been granted to FDEP. FDEP's PSD regulations are codified in Rule 62.212.400, Florida Administrative Code (F.A.C.) and are same as the federal PSD regulations codified in 40 CFR Part 51.166.

Class I areas are areas of special national or regional value from a natural, scenic, recreational, or historic perspective. Adverse impacts on Class I areas are prevented by:

- Ensuring that Class I area increments are not exceeded; and
- Ensuring that the air quality related values (AQRVs) in the Class I areas are not significantly affected.

Typically, Class I area within 100 km of the proposed source or modification is considered in the analysis. Currently, due to current emphasis in improving visibility in Class I areas via the Regional Haze Rule, Class I areas at greater distances (200 to 300 km) are also being included in the analysis.

The Federal Class I area nearest to the source is the Everglades National Park (Everglades NP) in South Florida, Located approximately 169 kilometers from the facility's southern most property line. The Biscayne Bay National Park (Biscayne Bay NP) is a Class II area located approximately 193 km from the Facility. However, it is considered important relative to air pollution impacts and is also considered in the analyses.

The Class I area air quality analysis is conducted in two phases as follows:

- Significant Impact Analysis: the net emissions increase from project is used in determining the air quality impact in the Class I area and is then compared to the Class I area significance levels concentration. The Draft New Source Review Workshop Manual (1990) lists Class I significance level concentration as 1 ug/m^3 for 24-hour average for all pollutants with NAAQS. USEPA has subsequently proposed lower significance level concentration as shown in Table 2-3. These levels in Table 2-3 have not been officially promulgated as part of the PSD review process. However, FDEP has accepted the use of these significance level concentration for Class I areas.

  If the project's air quality impact does not exceed the Class I significance level concentration, then no further air quality analyses is required.

- Class I area Increment Analysis: This analysis is needed if the project's air quality impact exceeds the Class I area significance level concentration. Table 2-3 shows the Class I area PSD increments, which can not be exceeded by the project's air quality impact.

- AQRV Analysis: The AQRV analysis is required for submission to Federal land Managers (FLM) who are charged with affirmative responsibility to protect the AQRVs. The AQRVs vary with the Class I area being considered. Based on discussions with the National Park Service (NPS), the AQRVs to be considered for the Everglades NP are: i) deposition of total nitrates and sulfates; ii) visibility degradation; and iii) impact of ozone on vegetations. These AQRVs are also considered for the Biscayne Bay NP. The results of these analyses are submitted to NPS for AQRV analyses.

Table 2-3: Reference Concentrations of Regulated Pollutants for Class I Impact Analysis

Pollutant	Averaging Period	Current USEPA Class I Significance Level (ug/m3)	Proposed USEPA Class I Significance Level (ug/m3)	Class I PSD Increments (ug/m3)
NO_2	Annual	N/A	0.1	2.5
	24-hr	1	N/A	N/A
SO_2	3-Hour	N/A	1	25
	24-Hour	1	0.2	5
	Annual	N/A	0.1	2
PM_{10}	24-Hour	1	0.3	10
	Annual	N/A	0.2	5

Note: Proposed Class I significance levels are guidelines a t this time and has not been adopted in PSD regulations.

2.4 Existing Environmental Conditions in Everglades National Park

The existing environmental conditions of the Class I area considered in the analysis is important to the analysis. Some of the Class I areas may show significant impact in concentrations or deposition which would be tolerable in other Class I areas. The following information was obtained from the NPS website for the Everglades NP.

Established in 1947 to preserve the biological features and essential primitive conditions of the subtropical everglades of Florida, Class I Everglades NP is the largest U.S. national park east of the Rocky Mountains. Spanning the southern tip of the Florida peninsula and most of Florida Bay, Everglades NP is the only subtropical preserve in North America. It contains both temperate and tropical plant communities, including sawgrass prairies, mangrove and cypress swamps, pinelands, and hardwood hammocks, as well as marine and estuarine environments. It is the largest continuous stand of sawgrass prairie in North America and the predominant water recharge area for all of South Florida. Everglades NP is consistently listed as one of the most threatened national parks, due primarily to hydrological developments that have disrupted water flow with serious ecological consequences. The park encompasses 1,509,000 acres, of which 1,296,500 acres are designated wilderness. Everglades NP was designated a Biosphere Reserve in 1976, a World Heritage Site in 1979, and a Wetland of International Importance in 1987.

Ambient Air Quality:

South Florida is in attainment status for all criteria pollutants.

Ozone has been continuously monitored at Everglades NP since 1986 (site #120250030). The data indicate no exceedences of the 1-hr human health-based primary national ambient air quality standards (NAAQS).

Acidic Deposition:

A National Atmospheric Deposition Program/National Trends Network (NADP/NTN) wet deposition monitor has been operating at Everglades NP since 1980 (site #FL11). A review of site data shows no trend in concentration of sulfate or nitrate, additionally the data shows that ammonium sulfate, nitrate, and ammonium deposition decreased from 1981 through 1985, then increased from 1989 through the present.

A Clean Air Status and Trends Network (CASTNet) dry deposition site was installed at Everglades NP (site #EVE418) in 1998. Data show no trends in dry nitrogen or sulfur deposition at the site.

Deposition of atmospheric nitrogen contributes to overenrichment and eutrophication in Everglades NP and Florida Bay. Excess nutrient loading has resulted in algae blooms and loss of seagrasses in Florida Bay.

Threatened and Endangered Species:

Drainage of wetlands, alteration of overland water flow and hunting have all contributed to species decline. The Everglades, once known for its abundant bird life, has seen its wading bird population decline drastically since the turn of the century. The Florida Panther once common throughout the state, today is on the verge of extinction. Within the four National Park areas of Everglades National Park, Biscayne National Park, Big Cypress National Preserve and Fort Jefferson National Monument there are 16 endangered and 6 threatened wildlife species. The mere physical boundaries of a National Park do not guarantee a species survival.

For the last decade the South Florida Research Center, Everglades National Park, has been studying how changes occurring outside the parks influence the fragile areas within their boundaries. Research going on today may lead to a brighter future for many species. Known endangered species in Everglades NP are:

- American crocodile (*Crocodylus acutus*)
- Green turtle (*Chelonia mydas*)
- Atlantic Ridley turtle (*Lepidochelys kempi*)
- Atlantic hawksbill turtle (*Eretmochelys imbricata*)
- Atlantic leatherback turtle (*Dermochelys coriacea*)
- Cape Sable seaside sparrow (*Ammodramus maritima mirabilis*)
- Snail (Everglades) kite (*Rostrhamus sociabilis plumbeus*)
- Wood stork (*Mycteria americana*)
- West Indian manatee (*Trichechus manatus*)
- Florida panther (*Felis concolor coryi*)
- Key Largo wood rat (*Neotoma floridana smalli*)
- Key Largo cotton mouse (*Peromyscus gossypinus allapaticola*)
- Red-cockaded woodpecker (*Picoides borealis*)
- Schaus swallowtail butterfly (*Papilio aristodemus ponceanus*)
- Garber's Spurge (*Chamaesyce garberi*).

Plants and Habitats:

The Everglades is a low, flat plain shaped by the action of water and weather. In the summer wet season it is a wide, grassy river. In the winter season the edge of the slough is a dry grassland. Though Everglades National Park is often characterized as a water marsh, several very distinct habitats exist within its boundaries.

Marine/Estuarine

Florida Bay, the largest body of water within Everglades National Park, contains over 800 square miles (2072 square km) of marine bottom, much of which is covered by seagrass. The seagrass shelters fish and shellfish and sustains the food chain that supports all higher vertebrates in the bay.

Mangroves

Mangrove forests are found in the coastal channels and winding rivers around the tip of South Florida. Red mangroves (*Rhizophora mangle*), identified by their stilt-like roots, and the black (*Avicennia germinans*) and white mangroves (*Laguncularia racemosa*) thrive in tidal waters, where freshwater from the Everglades mixes with saltwater.

Coastal Prairie

Located between the tidal mud flats of Florida Bay and dry land, the coastal prairie is an arid region of salt-tolerant vegetation periodically flooded by hurricane waves and buffeted by heavy winds. It is characterized by succulents and other low-growing desert plants that can withstand the harsh conditions.

Freshwater Marl Prairie

Bordering the deeper sloughs are large prairies with marl sediments, a calcareous material that settles on the limestone. The marl allows slow seepage of the water but not drainage. Though the sawgrass is not as tall and the water is not as deep, freshwater marl prairies look a lot like freshwater sloughs.

Freshwater Slough

The slough is the deeper and faster-flowing center of a broad marshy river. This "fast" flow moves at a leisurely pace of 100 feet (30 meters) per day. Dotted with tree-islands called hammocks or heads, this vast landscape channels life-giving waters from north to south. Everglades National Park contains two distinct sloughs: Shark River Slough, the "river of grass;" and Taylor Slough, a narrow, eastern branch of the "river."

Cypress

The cypress tree (*Taxodium spp.*) is a deciduous conifer that can survive in standing water. These trees often form dense clusters called cypress domes in natural water-filled depressions. The trees in the deep soil at the center grow taller than those on the outside. Stunted cypress trees, called dwarf cypress, grow thinly-distributed in poor soil on drier land.

Hardwood Hammocks

Hammocks are dense stands of hardwood trees that grow on natural rises of only a few inches in the land. They appear as teardrop-shaped islands shaped by the flow of water in the middle of the slough. Many tropical species such as mahogany (*Swietenia mahogoni*), gumbo limbo (*Bursera simaruba*), and cocoplum (*Chrysobalanus icaco*) grow alongside the more familiar temperate species of live oak (*Quercus virginiana*), red maple (*Acer rubum*), and hackberry (*Celtis* *laevigata*). Because of their slight elevation, hammocks rarely flood. Acids from decaying plants dissolve the limestone around each tree island, creating a natural moat that protects the hammock plants from fire. Shaded from the sun by the tall trees, ferns and airplants thrive in the moisture-laden air inside the hammock.

Pinelands

The slash pine (Pinus elliottii var. densa) is the dominant plant in this dry, rugged terrain that sits on top of a limestone ridge. The pines root in any crack or crevice where soil collects in the jagged bedrock. Fire is an essential condition for survival of the pine community, clearing out the faster-growing hardwoods that would block light to the pine seedlings. Pine bark is multi-layered, so only the outer bark is scorched during fires. The pinelands are the most diverse habitat in the Everglades, consisting of slash pine forest, an understory of saw palmettos (Serenoa repens), and over 200 varieties of tropical plants.

2.5 Existing Environmental Conditions at the Biscayne Bay National Park

Biscayne National Park (BNP) protects four primary ecosystems: the long stretch of mangrove forest along the mainland shoreline, the shallow southern portion of Biscayne Bay, the northernmost Florida Keys and a portion of the world's third-longest living coral reef. Each of these ecosystems is comprised of a variety of smaller communities like seagrass meadows, hardbottom areas, and hardwood hammocks. Of the park's 180,000 acres, 95% is underwater. The following information was obtained from the NPS website for Everglades NP and BNP, and the United States Geological Survey (USGS) South Florida Information access (SOFIA) website.

Ambient Air Quality:

South Florida is in attainment status for all criteria pollutants.

BNP is not part of the NADP/NTN, but as discussed previously ozone has been continuously monitored at the neighboring Everglades NP since 1986 (site #120250030). The data indicate no exceedences of the 1-hr human health-based primary national ambient air quality standards (NAAQS).

Acidic Deposition:

An NADP/NTN wet deposition monitor has been operating at the neighboring Everglades NP since 1980 (site #FL11). A review of site data shows no trend in concentration of sulfate or nitrate, additionally the data shows that ammonium sulfate, nitrate, and ammonium deposition decreased from 1981 through 1985, then increased from 1989 through the present.

Ammonium sulfate, nitrate, and ammonium deposition decreased from 1981 through 1985, then increased from 1989 through the present.

A Clean Air Status and Trends Network (CASTNet) dry deposition site was installed at Everglades NP (site #EVE418) in 1998. Data show no trends in dry nitrogen or sulfur deposition at the site.

Deposition of atmospheric nitrogen contributes to overenrichment and eutrophication in Everglades NP and Florida Bay. Excess nutrient loading has resulted in algae blooms and loss of seagrasses in Florida Bay.

Plants and Habitats:

Coral Reefs

Over 30 different kinds of corals are found in Florida waters. Individual corals are interconnected colonies of soft, fleshy polyps that secrete complex shells made of calcium carbonate. These colonies can form branching corals or massive head corals depending on species. As the colonies compete for space, and as dead colonies are replaced, they grow on top of each other and build what we call a coral reef. Coral reefs provide habitat for thousands of species of plants and animals.

Dunes

Dunes are created by wind, but are held in place by grasses that trap sand grains as they are being moved across the beach. Dunes stabilized by grasses protect the coast against winds and pounding waves. Florida beaches are important nesting sites for sea turtles and shorebirds.

Freshwater Marsh

Freshwater marshes are generally wetlands with an open expanse of grasses, sedges, rushes, and other herbaceous plants. Freshwater marshes generally contain few, if any, trees and shrubs.

Wet prairies, sawgrass marshes, ponds, and aquatic sloughs are freshwater marsh communities common in South Florida. The word "slough" (pronounced "slew") is used to describe Everglades areas where the water is slightly deeper than in the surrounding marshes and where a slow current is present.

Animals found in the marsh can include fish, invertebrates, frogs, snakes, alligators, white-tailed deer, the Florida panther, and other mammals. Many waterbirds and wading birds nest and forage in marshes as well.

Freshwater Swamps

Freshwater swamps are generally wet, wooded areas where standing water occurs for at least part of the year. During the dry season, their mucky soils may dry out.

Freshwater swamps found in Florida can be dominated by bay trees (i.e. sweetbay, sweet gum) or hardwoods (i.e. oak, elm, red maple). Other plants found in swamps include epiphytes ("air plants") growing on trees, vines, and ferns.

Many animals spend part of their lives in the swamp, moving as water levels rise and fall. Wood storks, herons, many other birds, otters, black bear, and the Florida panther are only a few of the animals that find food, homes, and nesting sites in Florida's swamps.

Hardwood Hammocks

Hardwood hammocks are localized, thick stands of hardwood trees that can grow on natural rises of only a few inches of land. Hammocks in the Everglades perpetuate themselves by building up thick layers of soil and peat, thus providing high ground for the trees to grow. Hammocks may contain trees of a temperate or tropical climate origin, such as the sabal palm, live oak, red maple, mahogany, gumbo limbo, and cocoplum. The diverse flora found in hammocks also includes many additional tree species, epiphytes ("air plants"), and ferns. More epiphytes are found in South Florida hammocks than in any forest in the United States.

Wildlife in hammocks can include tree snails, raccoons, opossums, birds, snakes, lizards, tree frogs, and large animals such as the Florida panther, bobcat, and deer.

Cypress

The cypress tree (*Taxodium spp.*) is a deciduous conifer that can survive in standing water. These trees often form dense clusters called cypress domes in natural water-filled depressions. The trees in the deep soil at the center grow taller than those on the outside. Stunted cypress trees, called dwarf cypress, grow thinly-distributed in poor soil on drier land.

Mangroves

Three species of mangroves are found in Florida: the red mangrove, black mangrove, and white mangrove. Typically, red mangroves grow along the water's edge, black mangroves grow on slightly higher elevations than the red mangrove, and white mangroves grow upland from the red and black. Red mangroves (*Rhizophora mangle*), identified by their stilt-like roots, and the black (*Avicennia germinans*) and white mangroves (*Laguncularia racemosa*) thrive in tidal waters, where freshwater from the Everglades mixes with saltwater. The buttonwood is often associated with the mangrove community. It is usually found growing with the white mangrove, upland of the red and black mangroves. Mangroves grow in saltwater and in areas frequently flooded by saltwater.

Threatened and Endangered Species:

As discussed previously Biscayne National Park is within the Everglades and the national parks share a common list of 16 endangered and 6 threatened wildlife species. The known endangered species in Everglades NP are:

- American crocodile (*Crocodylus acutus*)
- Green turtle (*Chelonia mydas*)
- Atlantic Ridley turtle (*Lepidochelys kempi*)
- Atlantic hawksbill turtle (*Eretmochelys imbricata*)
- Atlantic leatherback turtle (*Dermochelys coriacea*)
- Cape Sable seaside sparrow (*Ammodramus maritima mirabilis*)
- Snail (Everglades) kite (*Rostrhamus sociabilis plumbeus*)
- Wood stork (*Mycteria americana*)
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- Florida panther (*Felis concolor coryi*)
- Key Largo wood rat (*Neotoma floridana smalli*)
- Key Largo cotton mouse (*Peromyscus gossypinus allapaticola*)
- Red-cockaded woodpecker (*Picoides borealis*)
- Schaus swallowtail butterfly (*Papilio aristodemus ponceanus*)
- Garber's Spurge (*Chamaesyce garberi*).

3.0 Technical Approach and Methodology

Air dispersion and deposition modeling was performed to determine ambient concentrations, deposition, and visibility impacts of the proposed modification on the Everglades NP and the Biscayne Bay NP. The air modeling was performed generally in conformance with the following guideline documents, with appropriate modifications based on site-specific data:

- Interagency Workgroup on Air Quality Models (IWAQM) Phase 2 Summary report in Modeling Long Range Transport Impacts (USEPA,1998), commonly referred to as IWAQM Phase 2 Report;
- Federal Land Manager's Air Quality Related Values Workgroup, Phase I Report (12/00), commonly referred to as the FLAG Document.
- CALPUFF User's Guide January 2000

The elements of the analysis have been described in Section 2.3. The rest of this section describes the methodology of the modeling and input data for the model.

3.1 Long Range Transport Model

The California Puff Model (CALPUFF) is currently recommended by USEPA for long range transport of pollutants and for visibility impact analysis. There are various versions of the model used for specific purposes. One of the versions has been developed by the Visibility Improvements in States and Tribal Areas of Southeast (VISTAS), a regional planning organization (RPO), developing plans for improving visibility in Class I areas in the southeast USA. The VISTAS version of the CALPUFF (version 5.756) contains defaults, which are relevant to southeast USA. Florida is in VISTAS region (subdomain 2). Therefore, the VISTAS version of the CALPUFF was used in this analysis.

CALPUFF is a multi-layer, multi-species, non-steady state puff dispersion model which can simulate the time and space varying meteorological conditions on pollutant transport, transformation, and removal. CALPUFF uses three dimensional meteorological fields developed by the meteorological processing program CALMET.

CALPUFF contains alogorithms for near source effects such as building downwash, traditional plume rise, partial plume penetration, subgrid scale terrain interactions, as well as long range effects such as pollutant removal (dry and wet deposition), chemical transformation, vertical wind shear, overwater transport, and coastal interaction effects. Major features of the CALPUFF model are shown in Table 3-1.

Table 3-1: Major Features of CALPUFF Model

Feature Element	Details
Source Type	Point, Line, Volume, Area
Non-steady-state emissions and meteorological conditions	Gridded 3-D fields of meteorological variables
	Spatially-variable fields of mixing height, friction velocity, convective velocity scale, Monin-Obukhov length, precipitation rate
	Vertically and horizontally-varying turbulence and dispersion rates
	Time-dependent source and emissions data
Efficient sampling function	Integrated and Elongated puff formulation
Dispersion coefficient options	Direct measurements of dispersion coefficient
	Estimated values of coefficients based on similarity theory
	Pasquill-Gifford dispersion coefficients
	McElroy-Pooler dispersion coefficients
	CTDM dispersion coefficients
Vertical wind shear	Puff splitting
	Differential advection and dispersion
Plume rise	Partial penetration
	Buoyant and momentum rise
	Stack tip effects
	Vertical wind shear
	Building downwash effects
Building Downwash	Huber-Snyder method
	Schulman-Scire Method
Subgrid scale complex terrain	Above dividing streamline, puff flows over hill and experiences altered diffusion rates
	Below dividing streamline, puff deflects around hill, splits, and wraps around hill
Interface to the Emissions Production Model	Time-varying heat flux and emissions from controlled burns and wildfires
Dry deposition	Gases and particulate matter
	Full treatment of space and time variations of deposition with a resistance model option
	User-specified diurnal cycles for each pollutant option
	No dry deposition option

Feature Element	Details
Overwater and coastal interaction effects	Overwater boundary layer parameters
	Abrupt change in meteorological conditions, plume dispersion at coastal boundary
	Plume fumigation
	Option to introduce subgrid scale Thermal Internal Boundary Layers into coastal grid cells
Chemical transformation options	MESOPUFF II method
	User-specified diurnal cycles of transformation rates
	No chemical conversion
Wet removal	Scavenging coefficient approach
	Removal rate a function of precipitation intensity and type
Graphical user interface	Point-and-click model setup and data input
	Enhanced error checking of model inputs
	On-line Help files

CALPUFF generated estimates of concentration at the selected receptor (e.g. Everglades NP and Biscayne Bay NP). To estimate the deposition and visibility impacts, the results from CALPUFF model were processed with port processing utilities CALPOST and POSTUTIL.

CALPUFF requires several types of input data such as source emissions and locations (Source parameters), meteorological data, land use data and receptor data for simulation of impact of emissions sources on ambient air. These input parameters are discussed in following sections.

3.2 Source Parameters

The emission points considered under the two BACT scenarios in the air dispersion modeling have been listed in Section 2.2. All of the proposed emission points are point sources with identified stacks venting the emissions to the atmosphere. This section describes the parameters required in CALPUFF for point sources and the procedure for estimating the parameters.

Emission Rates: Emission rates were calculated using manufacturer's data where available. If not available, then USEPA's AP-42 emission factor database was used. For SO_2, mass balance was used considering all sulfur bearing compounds converted 100% to SO_2. The details of the calculations are in Appendix A. Table 3-2 summarizes the emission rates of modeled pollutants to be considered in the analyses. The same emission rates were used in the Class II PSD increment and NAAQS analyses.

For both gas turbines and flares, the short-term and annual average emission rates were the same and at full capacity of the units.

Table 3-2: Modeled Emission Rates

Pollutant	Averaging Period	Enclosed Flares[1] (lb/hr)	Open Flares[2] (lb/hr)	LFG Turbines[3] (lb/hr)
NOx	Annual	5.4	6.7	31.1
SO_2	3-Hour	12.1	13.4	16.2
	24-Hour	12.1	13.4	16.2
	Annual	12.1	13.4	16.2
PM_{10}	24-Hour	1.4	1.5	2.2
	Annual	1.4	1.5	2.2

Notes:

1: For Alternative BACT scenarios only.

2: For Primary and Alternative BACT scenario only.

3: For Primary BACT scenario only.

Stack Gas Parameters: Stack gas parameters included: i) stack gas exit temperature, and ii) stack gas exit velocity. These are discussed separately.

Stack gas exit temperatures for the enclosed flares and the turbines were obtained from manufacturer's information. For open flares, stack gas exit temperature could not be measured and is a function of the degree and rate of entrainment of ambient air in the flared gases. Ohio Environmental Protection Agency (OEPA) and Texas Commission on Environmental Quality (TCEQ) have guidelines for estimating stack gas temperature and flow rate from open industrial flares. Upon review, it was determined that the OEPA guidelines were more conservative and, therefore, they were used for the estimation of stack gas temperature. A copy of the guideline (Engineering Guide #69) in included in Appendix A. The guide assumed stack gas temperature of 1273 degrees Kelvin for industrial flares.

Stack exit velocities for enclosed flares were obtained from stack gas flow rates and stack diameters. Stack gas flowrate for enclosed flares were obtained from combustion calculations of landfill gas flow rate through the flares and approximately at 230% excess air conditions, typical of enclosed landfill gas flares. Stack gas velocity for turbines were obtained from manufacturer's data. As per OEPA guide on flares described above, stack exit velocity of all open flares were considered as 20 meters per second (m/s).

Physical Stack Parameters: Physical stack parameters included: i) stack height, stack diameter; and stack location (coordinates). For enclosed flares and combustion turbines, the stack height and diameters were obtained from manufacturer's information.

The physical stack diameter and height were not considered (for air dispersion modeling purposes) for the open flares, as per the OEPA guide. Instead virtual stack diameter and stack height were calculated to be used for air dispersion modeling purposes. The virtual stack diameter were calculated from a buoyant flux based on a default stack temperature of 1273 degrees Kelvin (K), a stack gas flow rate based on the buoyant flux, and the stack diameter based on a default stack exit velocity of 20 m/s. The virtual stack height was calculated as a function of total heat release in combustion of the gas. Details of the calculations are included in Appendix A.

Stack coordinates for all flares and turbines were obtained from equipment layout and a digitized map of the facility. The stack locations were converted to NAD83 UTM coordinates for consistency with receptor coordinates.

Table 3-3 shows the stack parameters used in the air dispersion modeling analysis.

Table 3-3: Modeled Stack Parameters

Control Device ID	Description	Location (UTM) Easting (m)	Location (UTM) Northing (m)	Stack Height (ft)	Stack Exit Gas Temperature (F)	Stack Velocity (ft/s)	Stack Diameter (ft)
CD001	Existing Enclosed Flare	530433.07	3023829.91	45	1,400	38.084	10.000
CD002	Existing Enclosed Flare	530433.07	3023836.01	45	1,400	38.084	10.000
CD003	Utility Flare 1 (backup)	530433.07	3023842.11	62.85	1,831.73	65.616	5.729
CD004	Utility Flare 2 (odor)	530433.07	3023848.2	62.85	1,831.73	65.616	5.729
CD005	Utility Flare 3	530433.07	3023854.3	62.85	1,831.73	65.616	5.729
CD006	Utility Flare 4	530433.07	3023860.39	62.85	1,831.73	65.616	5.729
CD007	Utility Flare 5	530433.07	3023866.49	62.85	1,831.73	65.616	5.729
CD008	Utility Flare 6	530433.07	3023872.59	62.85	1,831.73	65.616	5.729
CD009	Utility Flare 7	530433.07	3023878.68	62.85	1,831.73	65.616	5.729
CD010	Utility Flare 8	530433.07	3023884.78	62.85	1,831.73	65.616	5.729
CD011	Turbine 1	530470.48	3023713.24	50	894	58.68	8.371
CD012	Turbine 2	530470.48	3023719.33	50	894	58.68	8.371
CD013	Turbine 3	530470.48	3023725.43	50	894	58.68	8.371
CD014	Turbine 4	530470.48	3023731.53	50	894	58.68	8.371
CD015	Turbine 5	530470.48	3023737.62	50	894	58.68	8.371
CD016	Turbine 6	530470.48	3023743.72	50	894	58.68	8.371
CD017	Turbine 7	530470.48	3023749.81	50	894	58.68	8.371

3.3 Short-term and Long-term Emission Rates

The flares and turbines are operated only with LFG from the landfill, which is generated in a consistent manner. LFG generation rate varies slowly over time and deployment of turbines or flares are staggered to match the flow. Thus, at all time, the turbines and flares are expected to run at full capacity except for a short period during deployment of a new flare or turbine.

The emissions of SO_2 and PM from turbines and flares depend on the LFG firing rate and decreases with reduced firing rate. Since full LFG firing rate has been considered in the emission rate calculations, this represented maximum emission rate for both short-term and long-term impacts for these two pollutants.

There is a possibility of higher NOx emissions from turbines at lower loads. Thus a load analysis was performed to ensure that the highest LFG flow corresponded to highest ambient NOx impact.

The analysis was conducted at 100%, 75%, and 50% of the operating load for a single turbine. Estimated stack gas flow parameters and emission rates were obtained from the manufacturers. The analysis was performed using USEPA's SCREEN3 model (version 96043). Technically, with USEPA's discontinuation of the ISCST3 model, the SCREEN3 model was also discontinued by USEPA, and a new screening level model AERSCREEN was to be used instead. However, USEPA did not issue a final version of AERSCREEN at the time of this report. With concurrence from FLDEP, the SCREEN3 model was used therefore in this screening level analysis.

The results of the analysis are shown in Table 3-4. Model runs are included in Appendix D. The NOx impacts were highest at full load and therefore this operating load was considered for NOx in subsequent air dispersion modeling analysis.

Table 3-4: Load Analysis for LFG Turbines

Pollutant	Averaging Period	100% Load (ug/m^3)	75% Load (ug/m^3)	50% Load (ug/m^3)
NOx	1-hour	28.73	18.17	12.99

Based on this analysis, the short-term and long-term emission rates were considered same for all pollutants.

3.4 Building Downwash Analysis

Though building downwash was considered in the near filed modeling, it was not considered in the long range transport modeling because the Everglades NP was approximately 169 km from the Facility and Biscayne Bay NP was farther away. At this distance, there would be no appreciable impact of building downwash.

3.5 Meteorological Data

Meteorological data in MM5 format was processed with CALMET to develop the meteorological data set for CALPUFF. The processed data were sent to Shaw for direct use with the CALPUFF. The data was for years 2001, 2002, and 2003 and for subdomain 2 of VISTAS region. FLAG guidance requires that the modeling domain extend at least 50 km upwind of the emission source and 50 km in all sides of the Class I area being modeled. Figure 3-1 shows the extent of subdomain 2 of the VISTAS, which clearly shows that this condition is being met.

Based on information from FDEP, the MM5 data was developed for 4 km grid areas and with 10 vertical layers as required by FLAG for refined analysis.

3.6 Receptor Layout

The National park Service (NPS) has predetermined locations of receptors in each National Park. The receptors for the Everglades NP were obtained from the NPS website and are shown in Figure 3-2a. Since no receptors were available for Biscayne Bay NP in the NPS website, a receptor grid covering this national park was developed. Layout of the receptors is shown in Figure 3-2b.

3.7 Background Concentrations of Ammonia and Ozone

CALPUFF/CALPOST requires background concentration for ammonia and ozone to use the chemical transformation algorithms. The background concentrations were used as follows:

Ammonia background Concentration: There was no ammonia monitoring station in the Everglades NP or Biscayne Bay NP. FLAG recommends use of 0.5 ppb as ammonia background for CALPUFF. This was used in the modeling.

Ozone Background Concentration: One ozone monitoring station (CASTNet site) is located in the Everglades NP. USEPA's Clean Market website from the station for 2001, 2002, and 2003 showed an annual average concentration of 25.1 ppb, 25.7 ppb, and 27.4 ppb, respectively. Based on this data, an conservative value of 30 ppb was considered as the background in all three years. Appendix C includes the printouts from USEPA's "Quick Reports" for this site.

3.8 Background Light Extinction Coefficient

For visibility impact analysis, background light extinction coefficient data is required. The daily background light extinction coefficients was calculated on an hour by hour basis using hourly relative humidity data from the CALMET and hygroscopic and non-hygroscopic extinctions components of 0.9 Mm^{-1} and 8.5 Mm^{-1}, respectively, as specified in the FLAG 2000 document (i.e. MVISBK = 2). Hygroscopic particle growth was capped at relative humidity of 98% per recent FLAG guidance.

3.9 Ammonia Limiting Method

CALPUFF normally considers that all background ammonia is available to all puffs at the same concentration at all times. While this may be reasonable for a single puff or multiple puffs separated from each other, it is not realistic for overlapping puffs, as is expected in this analysis. Additionally, the CALPUFF does not take into consideration the preferential scavenging of ammonia by sulfates over nitrates. As a result, the nitrate deposition and hence overall visibility impact is overpredicted.

The post-processor POSTUTIL offers a method to correct this situation. An option called the Ammonia Limiting Method (ALM), when switched on, would preferentially scavenge the ammonia for sulfates prior to the nitrate chemistry. This option was used in the analysis.

3.10 Relative Humidity Method

Relative humidity is required at the Class I area to estimate the deposition and visibility impacts. Two methods are currently used in CALPUFF for incorporating relative humidity:

- Method 2, which requires hourly relative humidity data to be used in CALMET
- Method 6, which requires monthly averaged relative humidity data.

Per FLAG guidance, Method 2 was used in the analysis.

3.11 Rayleigh Scattering Coefficient

CALPOST uses a default Rayleigh scattering coefficient of 10 Mm^{-1}, which is based on an elevation of 5,000 meters. Rayleigh scattering depends on the density of air, with highest values at sea level (~12 Mm^{-1}) and diminishing with elevation (~12Mm^{-1} at 8,000 m elevation). The Inter agency Monitoring of Protected Visual Environments (IMPROVE) has developed site specific Rayleigh scattering coefficients for all Class I areas based on site specific pressure and temperature data encompassing 10 to 30 years. For Everglades NP, the adjusted Rayleigh scattering value of 11.3 Mm^{-1} from this new IMPROVE equation was used in this analysis. No such site specific data was available for the Biscayne Bay NP. However, since Biscayne Bay NP is in the same general area and same general elevation as the Everglades NP, same value was used.

3.12 Size Fraction of Particulate Matter

There are no reliable particle size data available in the literature for flare or turbine emissions. However, since the particulate emissions are from combustion of a gaseous fuel, the particles are expected to be fine rather than coarse. In addition, the combustion of LFG is considered generally to result in filterable fraction only and negligible, if any at all, condensable fraction.

The light extinction coefficient for filterable coarse particles (PM10 – PM2.5) and fines (PM2.5 and lower) are 0.6 Mm^{-1} and 1.0 Mm^{-1}, respectively. In order to be conservative, all PM emissions were considered as fine fraction (PMF), with the light extinction coefficient of 1.0 Mm^{-1}.

3.13 Summary of CALPUFF Model Settings

Table 3-5 summarizes the CALPUFF model settings used in the analysis.

Table 3-5: CALPUFF Modeling Analyses Features

Model Input/Output	Description
Meteorology	CALMET (10 layers in the vertical); horizontal domain extends at least 50 km beyond outer receptors and sources being modeled; terrain elevation and land-use data processed. Dataset 2001, 2002, and 2003 for VISTAS subdomain 2 used.
Receptors	Within Class I area(s) of concern, receptor data obtained from NPS website. For Class II area, receptors were located throughout area.
Dispersion	CALPUFF with default dispersion settings as per VISTAS version.
Chemical Transformation	MESOPUFF II chemistry with wet and dry deposition.
Background Values	Ozone: 30 ppb (from monitored data) ; Ammonia: 0.5 ppb (default)
Pollutant Species from Emission Source	SO_2; NOx; and PM
Building downwash	None (Nearest NP greater than 169 *kilometers* from source)
Rayleigh scattering	Adjusted to elevation from default value of 11.3 Mm^{-1} (Per Revised IMPROVE algorithms March 2006)
Processing: i) Air quality	1. For Class I significance impact: Highest values (H1H) 2: For PSD Class I increments: Highest, second highest 3-hour and 24-hour average SO_2 concentrations; and highest annual average SO_2, and NO_x concentrations.
ii) Deposition	Maximum deposition at the receptors
iii) Processing: Visibility impairment	Maximum percent change of light extinction over natural background and no. of days of percent change over 5% and 10% of natural background. Natural background estimated using daily relative humidity factor [f(RH)] and FLM supplied background extinction data in the FLAG document.

4.0 Results of Analysis

This section contains the results of the Class I area impact analysis. All modeling input and output files are included in electronic form on computer disks supplied as Appendix D in this report.

The details of the analysis are included in following sections. In summary, results of this modeling analysis revealed no anticipated adverse effects resulting from this project. There were no exceedences of the Class I significant impact level or Class I PSD increment for any pollutant. The deposition flux for sulfates and nitrates were within the deposition analysis thresholds (DAT) of 0.01 kg/ha/yr. The visibility impacts were less than 5% for all 24-hour periods.

4.1 Class I Area Significance Analysis

In the analysis, the impact of the proposed emission points on ambient air quality in the Everglades NP was estimated to determine if these pollutants has "significance level" impact, which required full impact analysis.

The analysis includes emissions from proposed modification only. For the alternative BACT operating scenario, the emissions from proposed modification were the 8 new open flares and these were considered in the analysis. For the standard BACT operating scenario, the two existing enclosed flares each at 3,000 scfm (total 6,000 scfm) would be replaced by seven (7) new LFG turbines each at 4,000 scfm, an one open flare at 3,300 scfm and an open flare operating at 33-percent capacity at 1,100 scfm for a total fuel throughput of 32,400 scfm. The existing flares will be on-site as emergency but will not run under this BACT scenario (if they do run due to an outage in the turbines, their emission rates for all criteria pollutants are lower than the turbines on a cfm of LFG basis).

Thus, the new emissions are from additional 26,600 scfm (32,400 scfm – 6,000 scfm) of LFG. The net emission change (projected allowable or potential – baseline actual) is calculated as follows:

$$E_{net} = E_{BACT} - E_{existing}$$

Where

E_{net} = Net emission increase

E_{BACT} = Potential emissions from 7 turbines and 1.3 new flares, total 32,400 scfm LFG

$E_{existing}$ = Actual emissions from 2 existing flares, total 6,000 scfm LFG

The emission increases and decreases are from two different types of sources (turbines vs. flares) which are located at two different locations in the facility; so the net emission increase could not be used directly in the model. Since the preliminary analysis is used for determination of ambient impact only, the following method was used in the preliminary analysis:

- CALPUFF was run with 7 new turbines and 1 new flare with their full potential emissions and 1 new flare operated at 30-percent capacity (i.e. at total E_{BACT});
- In a different CALPUFF run, the existing two enclosed flares were modeled with total emissions equal to $E_{existing}$; and
- The post-processor POSTUTIL was used to subtract the concentrations resulting from the existing flares from the concentrations resulting from the new sources at each receptor.

This way, the net ambient impacts of the net emissions were determined and compared with the "significance level" concentrations. Concurrence from FDEP was obtained for this approach.

Table 4-1a and b summarize the maximum predicted ground-level concentrations (H1H) and the corresponding PSD/NAAQS significance concentration levels for all pollutants for the interim scenario, the Primary BACT scenario, and the Alternative BACT scenario, respectively. In all cases, these concentrations were lower than the current Class I significance level concentration and also less than the proposed Class I significance level concentrations. In other words, the proposed modifications had no significant impact on the Everglades NP.

Table 4-1a: Significance Analysis Results for the Everglades NP

Scenario	Pollutant	Averaging Period	Maximum Predicted Concentration (H1H)	Class I PSD/NAAQS Signifiance Level	Maximum Predicted Concentration as Percentage of Significance Level	Maximum Predicted Concentration Below Significance Level?
			µg/m³	µg/m³	%	Yes/No
Primary BACT	NO_2	Annual	0.0018	0.1	1.8	Yes
	PM10	24-Hour	0.0108	0.3	3.6	Yes
		Annual	0.0004	0.2	0.2	Yes
	SO_2	3-Hour	0.1731	1	17.31	Yes
		24-Hour	0.0494	0.2	24.7	Yes
		Annual	0.0020	0.1	2.0	Yes

Scenario	Pollutant	Averaging Period	Maximum Predicted Concentration (H1H)	Class I PSD/NAAQS Signifiance Level	Maximum Predicted Concentration as Percentage of Significance Level	Maximum Predicted Concentration Below Significance Level?
			µg/m^3	µg/m^3	%	Yes/No
Alternative BACT	NO_2	Annual	0.0004	0.1	0.4	Yes
	PM10	24-Hour	0.0093	0.3	3.1	Yes
		Annual	0.0003	0.2	0.15	Yes
	SO_2	3-Hour	0.1617	1	16.17	Yes
		24-Hour	0.0529	0.2	25.45	Yes
		Annual	0.0020	0.1	2.0	Yes

Table 4-1b: Significance Analysis Results for the Biscayne Bay NP

Scenario	Pollutant	Averaging Period	Maximum Predicted Concentration (H1H)	Class I PSD/NAAQS Significance Level	Maximum Predicted Concentration as Percentage of Significance Level	Maximum Predicted Concentration Below Significance Level?
			µg/m^3	µg/m^3	%	Yes/No
Primary BACT	NO_2	Annual	0.0009	0.1	0.9	Yes
	PM10	24-Hour	0.0085	0.3	2.8	Yes
		Annual	0.0002	0.2	0.1	Yes
	SO_2	3-Hour	0.1040	1	10.4	Yes
		24-Hour	0.0418	0.2	20.9	Yes
		Annual	0.0011	0.1	1.1	Yes
Alternative BACT	NO_2	Annual	0.0002	0.1	0.2	Yes
	PM10	24-Hour	0.0070	0.3	2.3	Yes
		Annual	0.0002	0.2	0.1	Yes
	SO_2	3-Hour	0.1161	1	11.6	Yes
		24-Hour	0.0378	0.2	18.9	Yes
		Annual	0.0014	0.1	1.4	Yes

4.2 PSD Class I Increment Analysis

Since the impact of proposed modifications were less than the significant impact, PSD Class I increment analysis was not required. However, for informational purposes, Table 4-2a and b show the impact of the proposed modification as percent of Class I area increment.

Table 4-2a: PSD Class I Increment Analysis Results at the Everglades NP

Scenario	Pollutant	Averaging Period	Maximum Predicted Concentration (H1H)	PSD Class I Increment	Maximum Predicted Concentration as Percentage of Class I Increment
			µg/m³	µg/m³	%
Primary BACT	NO_2	Annual	0.0018	2.5	0.07
	PM10	24-Hour	0.0108	10	0.11
		Annual	0.0004	5	0.01
	SO_2	3-Hour	0.1731	25	0.69
		24-Hour	0.0494	5	0.99
		Annual	0.0020	2	0.10
Alternative BACT	NO_2	Annual	0.0004	2.5	0.02
	PM10	24-Hour	0.0093	10	0.09
		Annual	0.0003	5	0.01
	SO_2	3-Hour	0.1617	25	0.65
		24-Hour	0.0529	5	1.06
		Annual	0.0020	2	0.10

Table 4-2b: PSD Class I Increment Analysis Results at the Biscayne Bay NP

Scenario	Pollutant	Averaging Period	Maximum Predicted Concentration (H1H)	PSD Class I Increment	Maximum Predicted Concentration as Percentage of Class I Increment
			µg/m³	µg/m³	%
Primary BACT	NO_2	Annual	0.0009	2.5	0.04
	PM10	24-Hour	0.0085	10	0.09
		Annual	0.0002	5	0.00
	SO_2	3-Hour	0.1040	25	0.42
		24-Hour	0.0418	5	0.84
		Annual	0.0011	2	0.06
Alternative BACT	NO_2	Annual	0.0002	2.5	0.01
	PM10	24-Hour	0.0070	10	0.07
		Annual	0.0002	5	0.00
	SO_2	3-Hour	0.1161	25	0.46
		24-Hour	0.0378	5	0.76
		Annual	0.0014	2	0.07

4.3 Deposition Analysis

Total nitrate (T-NO_3) and total sulfate (T-SO_4) depositions were estimated at the Everglades NP and Biscayne Bay from the proposed modification. For T-NO_3 deposition, the species included:

- Particulate ammonium nitrate wet and dry deposition;
- Nitric acid wet and dry deposition;
- NOx dry deposition; and
- Ammonium sulfate, wet and dry deposition

For T-SO_4 deposition, the species included:

- SO_2 dry and wet deposition; and
- SO_4 dry and wet deposition

The CALPUFF results were processed in CALPOST and POSTUTIL programs to develop deposition impacts. The impacts were then compared with the DAT values as shown in Tables 4-3a and b. A DAT is the incremental amount of deposition from proposed modification or source in a Class I area, below which the impacts are considered insignificant.

Table 4-3a: Deposition Impact Analysis Results for Everglades NP

Scenario	Pollutant	Averaging Period	Maximum Predicted Deposition from CALPUFF	Maximum Predicted Deposition in DAT Units	DAT (1)	Maximum Predicted Deposition as Percentage of DAT	Maximum Predicted Deposition Less Than DAT?
			$\mu g/m^2$-s	Kg/ha-yr(2)	Kg/ha-yr	%	Yes/No
Primary BACT	T-NO_3	Annual	4.16E-06	0.0013	0.01	13	Yes
	T-SO_4	Annual	7.46E-06	0.0024	0.01	24	Yes
Alternative BACT	T-NO_3	Annual	1.57E-06	0.0005	0.01	5	Yes
	T-SO_4	Annual	6.13E-06	0.0019	0.01	19	Yes

Motes:

(1) Deposition analysis thresholds.

*(2) Conversion to DAT units: ug/m2-s * 1E-6 g/ug * 3.154E8 = kg/ha-yr.*

Table 4-3b: Deposition Impact Analysis Results for Biscayne Bay NP

Scenario	Pollutant	Averaging Period	Maximum Predicted Deposition from CALPUFF	Maximum Predicted Deposition in DAT Units	DAT (1)	Maximum Predicted Deposition as Percentage of DAT	Maximum Predicted Deposition Less Than DAT?
			$\mu g/m^2$-s	Kg/ha-yr(2)	Kg/ha-yr	%	Yes/No
Primary BACT	T-NO_3	Annual	1.84E-06	0.0006	0.01	6	Yes
	T-SO_4	Annual	3.57E-06	0.0011	0.01	11	Yes
Alternative BACT	T-NO_3	Annual	7.40E-07	0.0002	0.01	2	Yes
	T-SO_4	Annual	3.13E-06	0.0010	0.01	10	Yes

Notes:

(1) Deposition analysis thresholds.

*(2) Conversion to DAT units: ug/m2-s * 1E-6 g/ug * 3.154E8 = kg/ha-yr.*

4.4 Visibility Impact Analysis

The change in visibility is characterized by a change in light extinction coefficient (b_{ext}). The b_{ext} is the attenuation of light per unit distance due to scattering and absorption by gases and particulates in the atmosphere. The impact of the proposed modification is measured against the natural or background extinction coefficient to determine the percent change as follows:

$$\% \text{ Change} = (b_{ext\text{-}mod} / b_{ext\text{--}background})*100$$

CALPUFF and CALPOST were used to calculate the extinction at each Class I receptor for each day (24-hour period) due to the proposed modification. The analysis was conducted as per FLAG 2000 report. Daily background coefficients are calculated on an hour by hour basis using hourly relative humidity data and hygroscopic and non-hygroscopic extinction coefficients of 0.9 and 8.5 in Mm^{-1}.

The results of the analysis are presented in Table 4-4a and b. The maximum percent change in visibility was 3.5% on January 15th, 2003 for the Everglades NP and 1.28% on February 2, 2003 for the Biscayne Bay NP.

Table 4-4a: Visibility Impact Analysis Results at the Everglades NP

Scenario	Pollutant	Averaging Period	Maximum Predicted Visibility Impairment	Receptor Location UTM		Date	No. of Visibility Impairments Above 5%	No. of Visibility Impairments Above 10%
			(%)	Easting (m)	Northing (m)	Year / Julian Day		
Primary BACT	2001	24-hour	2.38%	1597.324	-1438.11	2001 / 319	0	0
	2002	24-hour	2.35%	1616.652	-1503.886	2002 / 35	0	0
	2003	24-hour	3.50%	1642.531	-1458.911	2003 / 15	0	0
Alternative BACT	2001	24-hour	0.74%	1593.758	-1447.368	2001 / 261	0	0
	2002	24-hour	1.10%	1577.213	-1441.603	2002 / 301	0	0
	2003	24-hour	1.55%	1619.854	-1462.95	2003 / 32	0	0

Table 4-4b: Visibility Impact Analysis Results at the Biscayne Bay NP

Scenario	Pollutant	Averaging Period	Maximum Predicted Visibility Impairment	Receptor Location UTM		Date	No. of Visibility Impairments Above 5% of Natural Background	No. of Visibility Impairments Above 10% of Natural Background
			(%)	Easting (m)	Northing (m)	Year / Julian Day		
Primary BACT	2001	24-hour	0.80%	1709.947	-1444.201	2001 / 326	0	0
	2002	24-hour	1.24%	1699.681	-1459.076	2002 / 88	0	0
	2003	24-hour	1.28%	1704.923	-1473.765	2003 / 33	0	0
Alternative BACT	2001	24-hour	0.51%	1701.047	-1466.646	2001 / 260	0	0
	2002	24-hour	0.78%	1699.681	-1459.076	2002 / 88	0	0
	2003	24-hour	0.83%	1699.681	-1459.076	2003 / 40	0	0

5.0 Conclusions

Class I Area impact analysis was performed for proposed modifications at the Okeechobee Landfill in Okeechobee County. The Class I area evaluated was the Everglades NP located approximately 169 km from the Facility. A nearby Class II national park, namely the Biscayne Bay NP, was also evaluated for informational purposes.

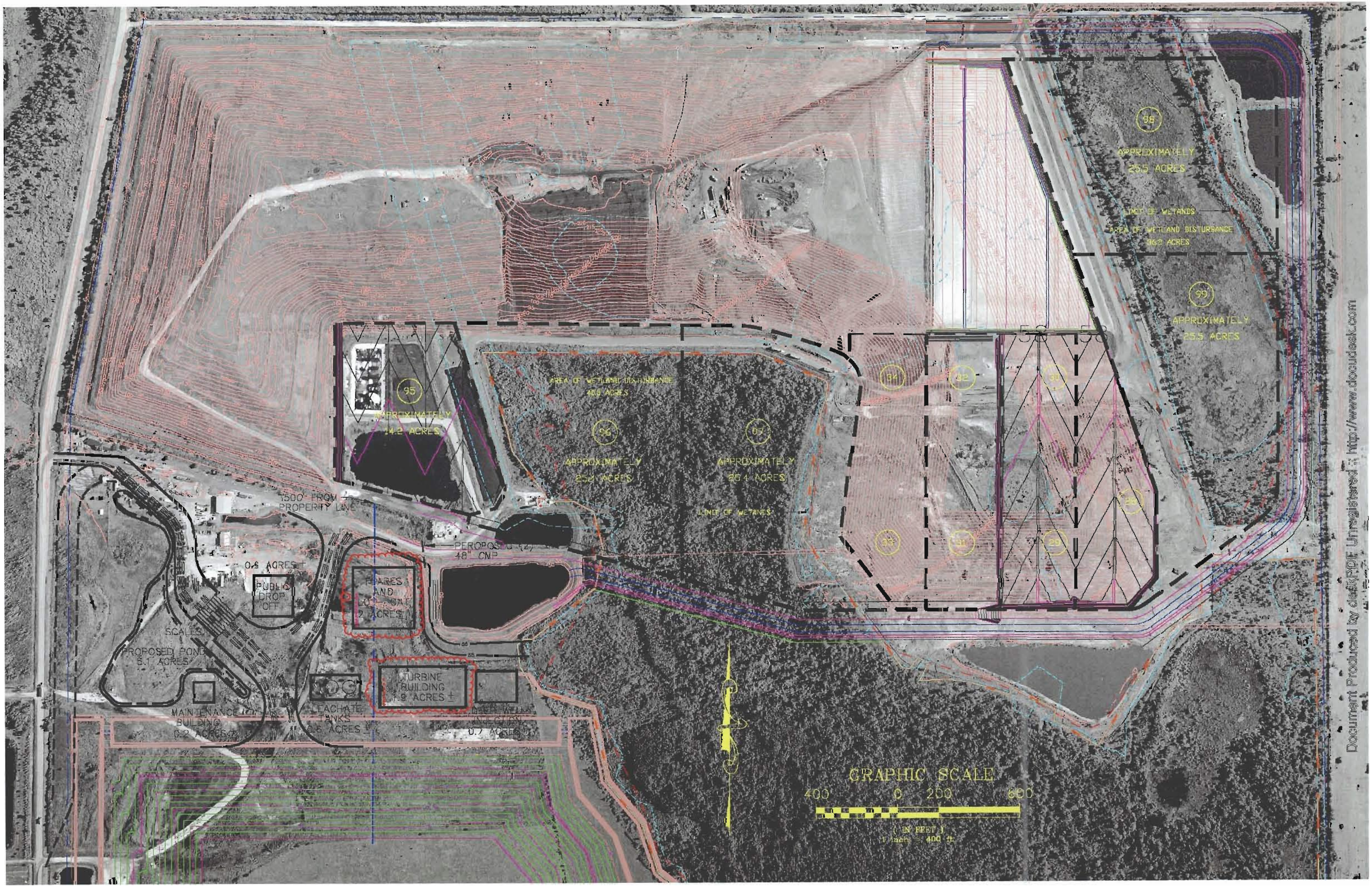
The analyses included were: i) Class I area air quality impact; ii) deposition impact; and iii) visibility impairment impact. Two operating scenarios were considered: i) Primary BACT operating scenario; and ii) Alternative operating scenario.

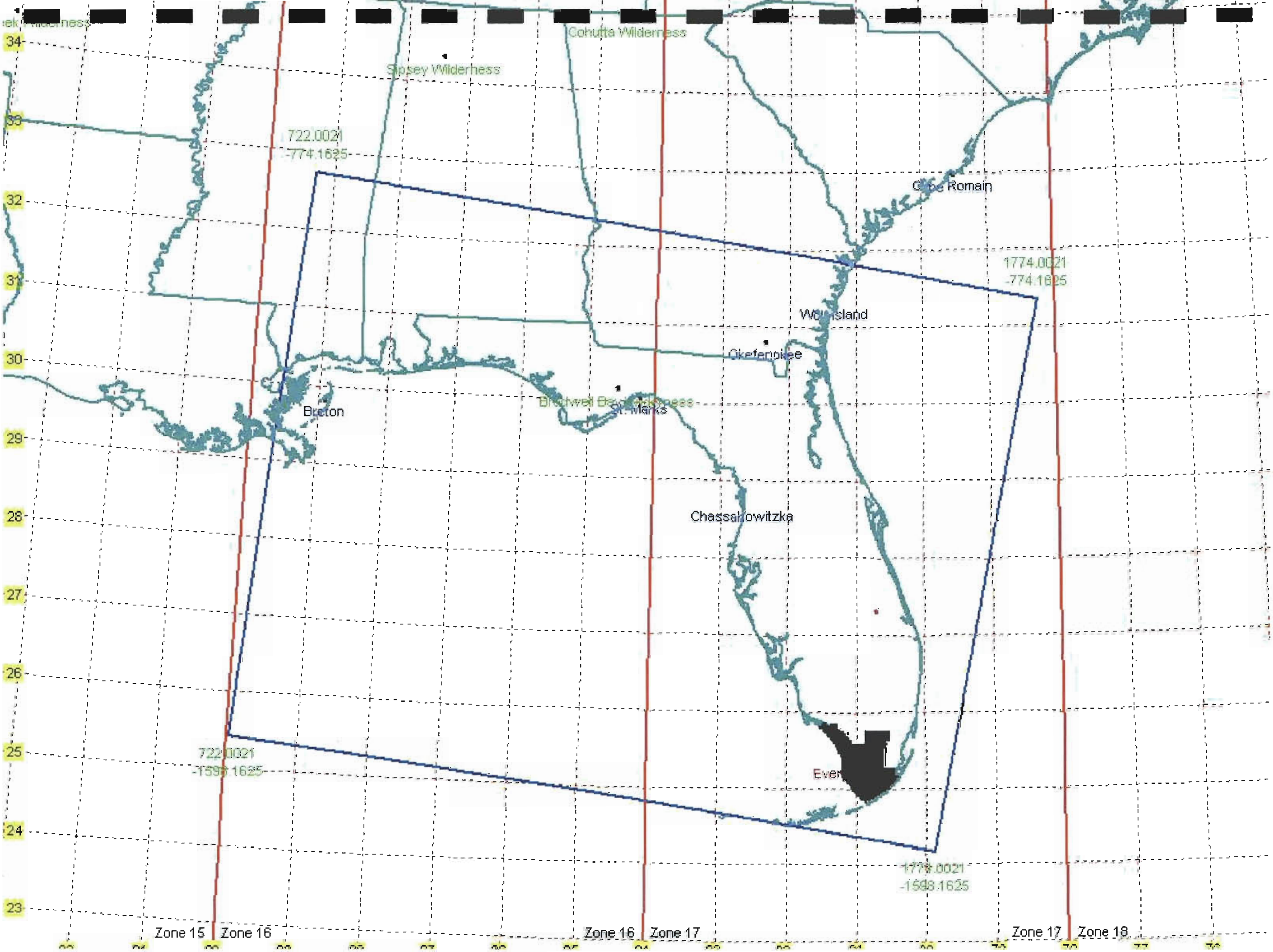
In all scenarios, there was insignificant impact on air quality at the Everglades NP and the Biscayne Bay NP. The deposition flux was estimated to be below significance threshold levels (i.e. DAT) for both nitrates and sulfates in both scenarios. The visibility impairment was measured in terms of light extinction coefficient. For all three scenarios, the percent change in light extinction coefficient over the background was less than 5% in all 24-hour period modeled.

Thus, no adverse impact was predicted on soil, vegetation, wildlife and visibility in the Class I area from this project.

Figures

Figure 2-1 Location of Okeechobee Landfill


98
APPROXIMATELY
25.5 ACRES
LIMIT OF WETANDS
AREA OF WETLAND DISTURBANCE
36.2 ACRES
99
APPROXIMATELY
25.5 ACRES
95
APPROXIMATELY
14.2 ACRES
AREA OF WETLAND DISTURBANCE
40.5 ACRES
96
APPROXIMATELY
25.4 ACRES
97
APPROXIMATELY
25.4 ACRES
LIMIT OF WETANDS
34
32
30
28
33
31
29
1500' FROM
PROPERTY LINE
PEROPOSED (2)
48" CNP
0.9 ACRES ±
PUBLIC
DROP
OFF
FLARES
AND
LO-CAT
2 ACRES ±
SCALES
PROPOSED POND
5.1 ACRES
TURBINE
BUILDING
1.9 ACRES ±
MAINTENANCE
BUILDING
0.2 ACRES ±
LEACHATE
TANKS
0.6 ACRES ±
DEEP WELL
INJECTION
0.7 ACRES ±
GRAPHIC SCALE
400
0
200
600
(IN FEET)
1 inch = 400 ft.



Cohutta Wilderness
Sipsey Wilderness
722.0021
-774.1625
Cape Romain
1774.0021
-774.1625
Wolf Island
Okefenokee
Breton
Bradwell Bay Wilderness
St. Marks
Chassahowitzka
Ever
722.0021
-1598.1625
1774.0021
-1598.1625
34
33
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28
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25
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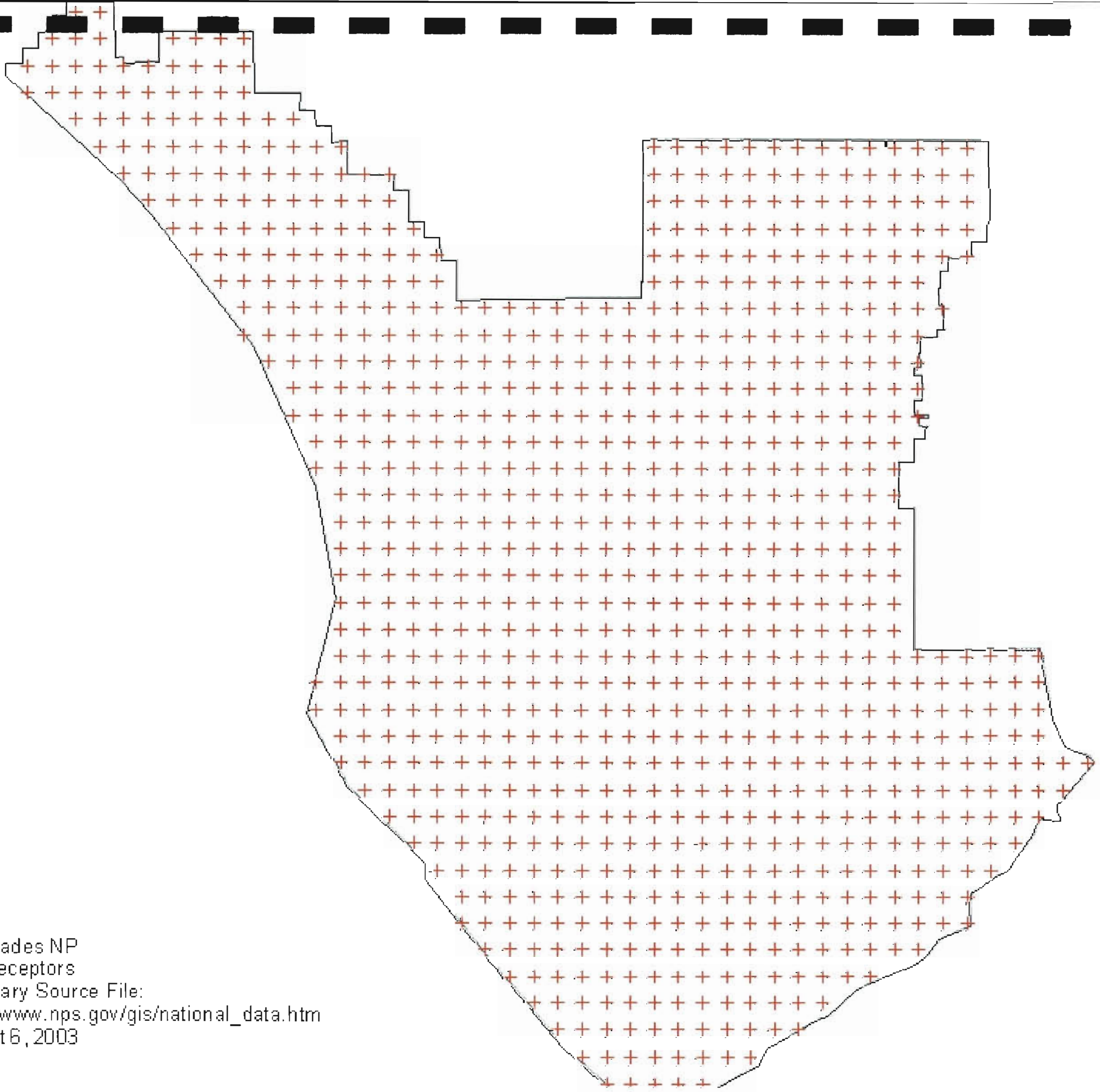
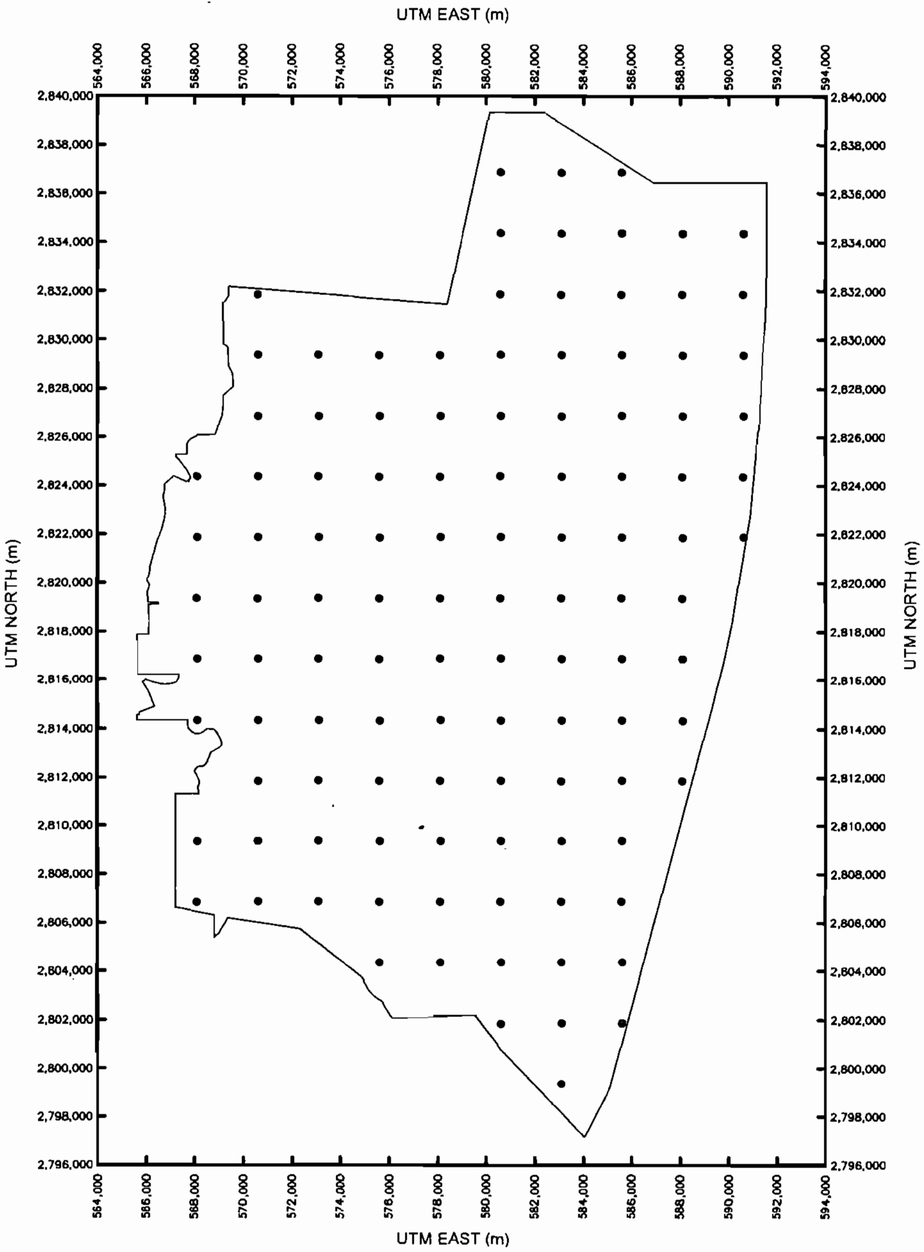
Zone 15
Zone 16
Zone 16
Zone 17
Zone 17
Zone 18



Everglades NP
901 Receptors
Boundary Source File:
http://www.nps.gov/gis/national_data.htm
August 6, 2003



OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Pittsburgh, PA	--/--/--	--	--	--	--	121525-B19

Xref :
Image :

File: O:\Project\121525\121525B19.dwg
Plot Date/Time: Feb 27, 2007 - 10:44am
Plotted By: greg.jones

Shaw Shaw Environmental, Inc.

OKEECHOBEE LANDFILL, INC.
OKEECHOBEE, FLORIDA

FIGURE 3-2
RECEPTOR LAYOUT FOR BISCAYNE BAY NATIONAL PARK
OKEECHOBEE LANDFILL, INC.
OKEECHOBEE, FLORIDA

Appendix A

Calculations and
OEPA Engineering Guide No. 69

BASELINE ACTUAL EMISSIONS

EU NO.	Description	Average 24-month flow rate (scfm)	24-month period Hours of Operation	Units	Emissions									
					NO_x	CO	SO_2 w/o BACT (c)	SO_2 w/ BACT (c)	PM_{10}	NMOC	VOC	HAP (Total)	HAP (Single)	H2S
003	Enclosed Flare Unit 1	2,237	16,902	lb/hr	3.66	12.2	131.6	Not relevent	1.0	0.4	0.1	0.6	0.5	1.4
				tpy	15.5	51.5	556.3		4.0	1.5	0.6	2.6	2.3	5.9
005	Enclosed Flare Unit 2	2,246	17,168	lb/hr	3.67	12.25	129.56		0.96	0.36	0.14	0.62	0.54	1.40
				tpy	15.8	52.6	556.1		4.1	1.6	0.6	2.6	2.3	6.0
004	Open Flare (Backup)	2,240	847	lb/hr	4.57	24.87	131.89		1.06	0.37	0.15	0.61	0.54	0.08
				tpy	1.0	5.3	27.9		0.2	0.1	0.0	0.1	0.1	0.0
NA	Open Flare (Odor Control)	764	5,150	lb/hr	1.6	8.5	45.0		0.4	0.1	0.1	0.2	0.2	0.03
				tpy	2.0	10.9	57.9		0.5	0.2	0.1	0.3	0.2	0.0
CURRENT ACTUAL BASELINE EMISSIONS		7,487		lb/hr	**13.5**	**57.9**	**438.1**		**3.4**	**1.3**	**0.5**	**2.1**	**1.9**	**3.0**
				tpy	**34.3**	**120.4**	**1,198.2**		**8.9**	**3.4**	**1.4**	**5.7**	**5.0**	**12.0**

SUMMARY - PROPOSED POTENTIAL TO EMIT WITHOUT BACT [INTERIM OPERATING SCENARIO]

Control Device ID	Description	Max. Potential LFG Flow (scfm)	Max. Annual Potential Operation (hours)	Units	Emissions										
					NO_x	CO	SO_2 w/o BACT [c]	SO_2 w/ BACT [c]	PM_{10}	NMOC	VOC	HAP (Total)	HAP (Single)	H2S
CD-01	Existing Enclosed Flare w/EVAP [a,b]	3,000	8760	lb/hr	5.4	18.0	176.2	Not relevent	1.4	0.5	0.19	0.8	0.7	1.87
				tpy	23.7	78.8	771.6		6.2	2.1	0.8	3.6	3.2	8.2
CD-02	Existing Enclosed Flare w/EVAP	3,000	8760	lb/hr	5.4	18.0	176.2		1.4	0.5	0.2	0.8	0.7	1.9
				tpy	23.7	78.8	771.6		6.2	2.1	0.8	3.6	3.2	8.2
CD-03	Open Unenclosed Flare (Backup)	0	0	lb/hr	0	0	0		0	0	0	0	0	0
				tpy	0	0	0		0	0	0	0	0	0.0
CD-04	Proposed Utility Flare (odor control)	3,300	8760	lb/hr	6.7	36.6	193.8		1.55	0.53	0.21	0.9	0.80	2.06
				tpy	29.5	160.4	848.7		6.8	2.3	0.9	4.0	3.5	9.0
CD-05	Proposed Utility Flare	3,300	8760	lb/hr	6.7	36.6	193.8		1.5	0.5	0.2	0.9	0.8	2.06
				tpy	29.5	160.4	848.7		6.8	2.3	0.9	4.0	3.5	9.0
CD-06	Proposed Utility Flare	3,300	8760	lb/hr	6.7	36.6	193.8		1.5	0.5	0.2	0.9	0.8	2.06
				tpy	29.5	160.4	848.7		6.8	2.3	0.9	4.0	3.5	9.0
TOTAL Proposed PTE without BACT		15,900		**lb/hr**	**31.0**	**145.9**	**933.7**		**7.5**	**2.6**	**1.1**	**4.4**	**3.9**	**10.0**
				tpy	**135.8**	**639.0**	**4,089.4**		**32.7**	**11.3**	**4.5**	**19.2**	**16.9**	**43.4**

SUMMARY - PROPOSED POTENTIAL TO EMIT FOR TURBINE OPERATING CONDITIONS WITH BACT

Control Device ID	Description	Max. Potential LFG Flow (scfm)	Max. Annual Potential Operation	units	Emissions									
					NO_x	CO	SO_2 w/o BACT $^{(c)}$	SO_2 w/ BACT $^{(c)}$	PM_{10}	NMOC	VOC	HAP (Total)	HAP (Single)	H2S
CD-11	Turbine $^{(a,b)}$	4,000	8760	lb/hr	31.07	31.3	234.9	16.2	2.2	0.6	0.3	1.0	2.5	2.49
				tpy	136	137	1,029	71	10	3	1	4	11	10.92
CD-12	Turbine $^{(a,b)}$	4,000	8760	lb/hr	31.07	31.3	234.9	16.2	2.2	0.6	0.3	1.0	2.5	2.49
				tpy	136	137	1,029	71	10	3	1	4	11	10.92
CD-13	Turbine $^{(a,b)}$	4,000	8760	lb/hr	31.07	31.3	234.9	16.2	2.2	0.6	0.3	1.0	2.5	2.49
				tpy	136	137	1,029	71	10	3	1	4	11	10.92
CD-14	Turbine $^{(a,b)}$	4,000	8760	lb/hr	31.07	31.3	234.9	16.2	2.2	0.6	0.3	1.0	2.5	2.49
				tpy	136	137	1,029	71	10	3	1	4	11	10.92
CD-15	Turbine $^{(a,b)}$	4,000	8760	lb/hr	31.07	31.3	234.9	16.2	2.2	0.6	0.3	1.0	2.5	2.49
				tpy	136	137	1,029	71	10	3	1	4	11	10.92
CD-16	Turbine $^{(a,b)}$	4,000	8760	lb/hr	31.07	31.3	234.9	16.2	2.2	0.6	0.3	1.0	2.5	2.49
				tpy	136	137	1,029	71	10	3	1	4	11	10.92
CD-17	Turbine $^{(a,b)}$	4,000	8760	lb/hr	31.07	31.3	234.9	16.2	2.2	0.6	0.3	1.0	2.5	2.49
				tpy	136	137	1,029	71	10	3	1	4	11	10.92
CD-03	Open Unenclosed Flare	3,300	8760	lb/hr	6.7	36.6	193.8	13.36	1.5	0.5	0.2	0.9	0.8	2.06
				tpy	29	160	849	59	7	2	1	4	4	9.01
CD-04	Open Unenclosed Flare	1,100	8760	lb/hr	2.2	12.2	64.6	4.5	0.5	0.2	0.1	0.3	0.3	0.69
				tpy	10	53	283	20	2	1	0	1	1	3.00
TOTAL Proposed PTE with BACT		**32,400**		lb/hr	**226.5**	**267.8**	**1,902.6**	**131.3**	**17.6**	**5.3**	**2.1**	**8.0**	**18.6**	**20.2**
				tpy	**991.9**	**1,173.0**	**8,333.0**	**574.8**	**76.8**	**23.0**	**9.0**	**35.0**	**81.1**	**88.5**

SUMMARY OF ALTERNATIVE OPERATING SCENARIO - POTENTIAL TO EMIT FOR PROPOSED FLARING														
					Emissions									
Control Device ID	Description	Max. Potential LFG Flow (scfm)	Max. Annual Potential Operation (hours)	Units	NO_x	CO	SO_2 w/o BACT [(c)]	SO_2 w/ BACT	PM_{10}	NMOC	VOC	HAP (Total)	HAP (Single)	H2S
CD-01	Existing Enclosed Flare w/EVAP [(a,b)]	3,000	8760	lb/hr	5.4	18.0	176.2	12.1	1.4	0.5	0.2	0.8	0.7	1.9
				tpy	23.7	78.8	772	53.2	6.2	2.1	0.8	3.6	3.2	8.2
CD-02	Existing Enclosed Flare w/EVAP	3,000	8760	lb/hr	5.4	18.0	176.2	12.1	1.4	0.5	0.2	0.8	0.7	1.9
				tpy	23.7	78.8	772	53.2	6.2	2.1	0.8	3.6	3.2	8.2
CD-03	Open Unenclosed Flare (Backup)	3,300	8760	lb/hr	6.7	36.6	193.8	13.4	1.5	0.5	0.2	0.9	0.8	2.1
				tpy	29.5	160.4	848.7	58.5	6.8	2.3	0.9	4.0	3.5	4.0
CD-04	Proposed Utility Flare (odor control)	3,300	8760	lb/hr	6.7	36.6	193.8	13.4	1.5	0.5	0.2	0.9	0.8	2.06
				tpy	29.5	160.4	849	58.5	6.8	2.3	0.9	4.0	3.5	9.0
CD-05	Proposed Utility Flare	3,300	8760	lb/hr	6.7	36.6	193.8	13.4	1.5	0.5	0.2	0.9	0.8	2.06
				tpy	29.5	160.4	849	58.5	6.8	2.3	0.9	4.0	3.5	9.0
CD-06	Proposed Utility Flare	3,300	8760	lb/hr	6.7	36.6	193.8	13.4	1.5	0.5	0.2	0.9	0.8	2.06
				tpy	29.5	160.4	849	58.5	6.8	2.3	0.9	4.0	3.5	9.0
CD-07	Proposed Utility Flare	3,300	8760	lb/hr	6.7	36.6	193.8	13.4	1.5	0.5	0.2	0.9	0.8	2.06
				tpy	29.5	160.4	849	58.5	6.8	2.3	0.9	4.0	3.5	9.0
CD-08	Proposed Utility Flare	3,300	8760	lb/hr	6.7	36.6	193.8	13.4	1.5	0.5	0.2	0.9	0.8	2.06
				tpy	29.5	160.4	848.7	58.5	6.8	2.3	0.9	4.0	3.5	9.0
CD-09	Proposed Utility Flare	3,300	8760	lb/hr	6.7	36.6	193.8	13.4	1.5	0.5	0.2	0.9	0.8	2.06
				tpy	29.5	160.4	849	58.5	6.8	2.3	0.9	4.0	3.5	9.0
CD-10	Proposed Utility Flare	3,300	8760	lb/hr	6.7	36.6	193.8	13.4	1.5	0.5	0.2	0.9	0.8	2.1
				tpy	29.5	160.4	848.7	58.5	6.8	2.3	0.9	4.0	3.5	9.0
Total Proposed PTE Flaring with BACT		32,400	8,760	lb/hr	**64.7**	**329.1**	**1,902.6**	**131.3**	**15.3**	**5.3**	**2.1**	**8.9**	**7.9**	**19.1**
				tpy	**283.2**	**1,441.2**	**8,333.0**	**574.8**	**66.6**	**23.0**	**9.0**	**39.0**	**34.4**	**83.4**

MAXIMUM POTENTIAL-TO-EMIT TO BASELINE ACTUAL NET INCREASE (highest rate used per pollutant)

					Emissions									
Control Device ID	**Description**	**Max. Potential LFG Flow (scfm)**	**Max. Annual Potential Operation (hours)**	**Units**	**NO_x**	**CO**	**SO_2 w/o BACT**	**SO_2 w/ BACT**	**PM_{10}**	**NMOC**	**VOC**	**HAP (Total)**	**HAP (Single)**	**H2S**
Varies	Control Device with For each pollutant, the	32,400	8760	tpy	957.6	1,320.8	1,320.8	(623.4)	67.9	19.6	7.6	33.3	29.4	71.4
Significant Emission Rates [62-210.200(264) F.A.C.]				tpy	40	100	40	40	15	50	40	NA	NA	10

Solar Turbines
A Caterpillar Company

PREDICTED ENGINE PERFORMANCE

Customer *Waste Management*	Model MARS 100-15000
	Package Type GSC
Job ID	Match 59F MATCH
Run By Donald C Lyons — Date Run 24-Oct-06	Fuel System GAS
Engine Performance Code REV. 3.40 — Engine Performance Data REV. 3.0	Fuel Type CHOICE NATURAL GAS

DATA FOR NOMINAL PERFORMANCE

Elevation	feet	50
Inlet Loss	in H20	3.5
Exhaust Loss	in H20	3.5

		1	2	3
Engine Inlet Temperature	deg F	59.0	59.0	59.0
Relative Humidity	%	60.0	60.0	60.0
Specified Load*	kW	FULL	75.0%	50.0%
Net Output Power*	kW	10924	8193	5462
Fuel Flow	mmBtu/hr	114.28	90.11	68.99
Heat Rate*	Btu/kW-hr	10461	10989	12630
Therm Eff*	%	32.619	31.023	27.015
Engine Exhaust Flow	lbm/hr	342595	306920	263057
Exhaust Temperature	deg F	894	818	778

Fuel Gas Composition (Volume Percent)

Methane (CH4)	50.00
Carbon Dioxide (CO2)	50.00
Sulfur Dioxide (SO2)	0.0001

Fuel Gas Properties

LHV (Btu/Scf)	454.7	Specific Gravity	1.0366	Wobbe Index at 60F	446.6

*Electric power measured at the generator terminals.

Notes
Florida

EMISSIONS DATA PROVIDED BY MANUFACTURER VIA EMAIL

-----Original Message-----
From: Chris D. Lyons [mailto:Lyons_Chris_D@solarturbines.com]
Sent: Tuesday, October 24, 2006 11:52 AM
To: Unger, Dave (Renewable Energy)
Subject: Mars 100 emissions

Dave,

I need to get an official engineering response to your request. The landfill in Paris had a different fuel composition than your site in Florida. I am assuming 50% methane, 50% carbon dioxide.
I have attached the expected performance and below are what I believe will be the emissions.

Full	load			
NOx	=	60 ppmv @15%oxygen	=	31.067 lb/hr
CO	=	60 ppmv @15%oxygen	=	31.517 lb/hr
	75% Load			
NOx	=	42 ppmv @15%oxygen	=	16.782 lb/hr
CO	=	80 ppmv @15%oxygen	=	19.457 lb/hr
	50% Load			
NOx	=	30 ppmv @15%oxygen	=	10.278 lb/hr
CO	=	150 ppmv @15%oxygen	=	31.279 lb/hr

Let me know if you will need any other data. It will take a few days to receive an official response back from engineering.

Regards,
Chris Lyons
Solar Turbines
Phone: 1-858-694-6586

Parameter	Value	Units	Reference
Exhaust Temp	894	F	Mars 100-15000, 100% Load
Exhaust Temp	818	F	Mars 100-15000, 75% Load
Exhaust Temp	778	F	Mars 100-15000, 50% Load
Stack Height	50	ft	Bruce Maillet
Stack Side	87.5	in	Solar Turbines
Stack Side	90.5625	in	Solar Turbines
Stack Interior Diameter	100	in	Calculated
PM10 Rate	0.023	lb/MMBtu	AP-42, Table 3.1-2b
Turbine Inlet	4000	scfm	Solar Turbines
Lanfill gas HHV	400	Btu/scf	AP-42, Table 3.1-2b
PM10 Rate	2.2	lb/hr	Calculated

Calculation of Flow Rate

		100%	75%	50%
Total Mass Out	lb/hr	342,595	306,920	263,057
Solar Turbines Inc. Mass out	lb/hr	354239	Solar Turbine Calcs	
Solar Turbines Inc. Exhaust Flow	acfm	200336		
Total Flow out	acfm	193,751	[illegible]	148,769
Total Flow out	ft/s	58.68	52.57	45.06

Availability	51	weeks/yr	98%

Criteria Pollutant Emissions - Turbines

Operation Period	8,760	hr
LFG inlet flow, standard	4,000	scfm
Heat Input	90	MMBtu/hr
Standard Temperature[a]	60	°F
	520	°R

SO_2 Emission Rate

SO_2 concentration in exhaust gas	400.05	ppmv		
SO_2 emission rate	16.20	lb/hr	71.0	tpy

LFG Compound	CAS	MW (lb/lb-mol)	Conc (ppmv)[a]	Control Eff[a,b]	Individual Compound Contribution to SO_2: No. of S Atoms	S Conc (ppmv)	SO_2 Emiss (lb/hr)
Carbon Disulfide	75-15-0	76.13	0.58	100.0%	2	1.17	0.05
Carbonyl Sulfide	463-58-1	60.07	0.49	100.0%	1	0.49	0.02
Dimethyl Sulfide (methyl sulfide)	75-18-3	62.13	7.82	100.0%	1	7.82	0.32
Ethyl Mercaptan (ethanethiol)	75-08-1	62.13	2.28	100.0%	1	2.28	0.09
Hydrogen Sulfide	7783-06-4	34.08	385.80	100.0%	1	385.8	15.62
Methyl Mercaptan	74-93-1	48.11	2.49	100%	1	2.49	0.10
					Total Contribution to SO_2:	400.05	16.20

NMOC Emission Rate

NMOC conc inlet gas[a]	595	ppmv		
MW hexane	86.18	lb/lb-mol		
destruction efficiency	98%			
mass NMOC inlet gas	32.4	lb/hr		
NMOC emission rate	0.65	lb/hr	2.84	tpy

VOC Emission Rate

NMOC conc inlet gas[a]	595	ppmv		
VOC fraction of NMOC[a]	39%			
VOC concentration in inlet gas	232	ppmv		
MW hexane	86.18	lb/lb-mol		
mass VOC inlet gas	12.6	lb/hr		
destruction efficiency	98%			
VOC emission rate	0.25	lb/hr	1.11	tpy

[a] U.S. E.P.A., *Compilation of Air Pollutant Emission Factors, Volume I, Stationary Point and Area Sources* ("AP-42"), *5th Ed.*, November 1998.

[b] AP-42 gives ranges for control efficiencies. Control efficiencies for halogenated species range from 91 to 99.7 percent. The upper end of the range is used here resulting in maximum calculated emissions of SO_2.

[c] LFG Specialties Inc. (typical)

LFG Inlet flow 4,000 **scfm**

Proposed LFG Turbines

LFG Compound	HAP	CAS	MW (lb/lb-mol)	Compound Conc & Mass in Inlet Gas (ppmv)[a]	Compound Conc & Mass in Inlet Gas (lb/hr)	Control Eff[a,b]	turbine Exhaust (lb/hr)*	turbine Exhaust (tpy)*
1,1,1 - Trichloroethane (methyl chloroform)	x	71-55-6	133.41	0.48	4.05E-02	98.0%	8.10E-04	3.55E-03
1,1,2,2 - Tetrachloroethane	x	79-34-5	167.85	1.11	1.18E-01	98.0%	2.36E-03	1.03E-02
1,1,2 - Trichloroethane (1,1,2 TCA)	x	79-00-5	133.41	0.10	8.43E-03	98.0%	1.69E-04	7.39E-04
1,1 - Dichloroethane (ethylidene dichloride)	x	75-34-3	98.96	2.35	1.47E-01	98.0%	2.94E-03	1.29E-02
1,1 - Dichloroethene (vinylidene chloride)	x	75-35-4	96.94	0.20	1.23E-02	98.0%	2.46E-04	1.08E-03
1,2 - Dichloroethane (ethylene dichloride)	x	107-06-2	98.96	0.41	2.55E-02	98.0%	5.09E-04	2.23E-03
1,2 - Dichloropropane (propylene dichloride)	x	78-87-5	112.99	0.18	1.29E-02	98.0%	2.57E-04	1.13E-03
2-Propanol (isopropyl alcohol)	--	67-63-0	60.11	50.1	1.90E+00	98.0%	3.81E-02	1.67E-01
Acetone (2-propanone)	--	67-64-1	58.08	7.01	2.57E-01	98.0%	5.15E-03	2.25E-02
Acrylonitrile (Propenenitrile)	x	107-13-1	53.06	6.33	2.12E-01	98.0%	4.25E-03	1.86E-02
Benzene	x	71-43-2	78.12	1.91	9.43E-02	98.0%	1.89E-03	8.26E-03
Bromodichloromethane	--	75-27-4	163.83	3.13	3.24E-01	98.0%	6.48E-03	2.84E-02
Butane	--	106-97-8	58.12	5.03	1.85E-01	98.0%	3.70E-03	1.62E-02
Carbon Disulfide	x	75-15-0	76.14	0.58	2.81E-02	98.0%	5.61E-04	2.46E-03
Carbon Tetrachloride	x	56-23-5	153.84	0.004	3.89E-04	98.0%	7.78E-06	3.41E-05
Carbonyl Sulfide	x	463-58-1	60.07	0.49	1.86E-02	98.0%	3.72E-04	1.63E-03
Chlorobenzene (monochlorobenzene)	x	108-90-7	112.56	0.25	1.81E-02	98.0%	3.61E-04	1.58E-03
Chlorodifluoromethane (CFC-22, freon-22)	--	75-45-6	86.47	1.30	7.11E-02	98.0%	1.42E-03	6.22E-03
Chloroethane (ethyl chloride)	x	75-00-3	64.52	1.25	5.10E-02	98.0%	1.02E-03	4.47E-03
Chloroform (trichloromethane)	x	67-66-3	119.38	0.03	2.26E-03	98.0%	4.53E-05	1.98E-04
Chloromethane (methyl chloride)	x	74-87-3	50.49	1.21	3.86E-02	98.0%	7.72E-04	3.38E-03
1,4 Dichlorobenzene (p-dichlorobenzene)	x	106-46-7	147	0.21	1.98E-02	98.0%	3.96E-04	1.73E-03
Dichlorodifluoromethane (CFC-12, freon-12)	--	75-71-8	120.91	15.7	1.20E+00	98.0%	2.40E-02	1.05E-01
Dichlorofluoromethane (freon-21)	--	75-43-4	102.92	2.62	1.70E-01	98.0%	3.41E-03	1.49E-02
Dichloromethane (methylene chloride)	x	75-09-2	84.93	14.3	7.68E-01	98.0%	1.54E-02	6.72E-02
Dimethyl Sulfide (methyl sulfide)	--	75-18-3	62.13	7.82	3.07E-01	98.0%	6.14E-03	2.69E-02
Ethane	--	74-84-0	30.07	889	1.69E+01	98.0%	3.38E-01	1.48E+00
Ethanol (ethyl alcohol)	--	64-17-5	46.08	27.2	7.92E-01	98.0%	1.58E-02	6.94E-02
Ethylbenzene[g]	x	100-41-4	106.17	4.61	3.09E-01	98.0%	6.19E-03	2.71E-02
Ethyl Mercaptan (ethanethiol)	--	75-08-1	62.13	1.25	4.91E-02	98.0%	9.82E-04	4.30E-03
Ethylene dibromide (1,2 dibromoethane)	x	106-93-4	187.88	0.001	1.19E-04	98.0%	2.38E-06	1.04E-05
Fluorotrichloromethane (CFC-11, freon-11)	--	75-69-4	137.37	0.76	6.60E-02	98.0%	1.32E-03	5.78E-03
Hexane	x	110-54-3	86.18	6.57	3.58E-01	98.0%	7.16E-03	3.14E-02
Hydrogen Sulfide	--	7783-06-4	34.08	385.8	8.31E+00	98.0%	1.66E-01	7.28E-01
Mercury (total)	x	7439-97-6	200.61	2.92E-4	3.70E-05	0.0%	3.70E-05	1.62E-04
Methyl Ethyl Ketone (2-butanone)	--	78-93-3	72.11	7.09	3.23E-01	98.0%	6.46E-03	2.83E-02
Methyl Isobutyl Ketone (hexone)	x	108-10-1	100.16	1.87	1.18E-01	98.0%	2.37E-03	1.04E-02
Methyl Mercaptan	--	74-93-1	48.11	2.49	7.57E-02	98.0%	1.51E-03	6.63E-03
Pentane	--	109-66-0	72.15	3.29	1.50E-01	98.0%	3.00E-03	1.31E-02
ethene)	x	127-18-4	165.83	3.73	3.91E-01	98.0%	7.82E-03	3.42E-02
Propane	--	74-98-6	44.1	11.1	3.09E-01	98.0%	6.19E-03	2.71E-02
Toluene (methylbenzene)	x	108-88-3	92.14	39.3	2.29E+00	98.0%	4.58E-02	2.00E-01
Trichloroethylene (trichloroethene)	x	79-01-6	131.38	2.82	2.34E-01	98.0%	4.68E-03	2.05E-02
dichloroethylene)	--	156-60-5	96.94	2.84	1.74E-01	98.0%	3.48E-03	1.52E-02
Vinyl Chloride (chloroethylene, VCM)	x	75-01-4	62.50	7.34	2.90E-01	98.0%	5.80E-03	2.54E-02
Xylenes (m, o, p)	x	1330-20-7	106.17	12.1	8.12E-01	98.0%	1.62E-02	7.11E-02
Hydrogen Chloride	x	7647-01-0	36.50	42.0	9.69E-01	0.0%	9.69E-01	4.24E+00
Total HAP							1.10	4.8
Maximum Single HAP							0.97	4.24

[a] U.S. E.P.A., *Compilation of Air Pollutant Emission Factors, Volume I. Stationary Point and Area Sources* ("AP-42"), *5th Ed.,*

[b] AP-42 gives ranges for control efficiencies. Control efficiencies for halogenated species range from 91 to 99.7 percent and control. Control efficiencies for non-halogenated species range from 38 to 91 percent. For permitting purposes, the lower end

[c] Product of combustion

[d] Because HCl is a production of combustion, a default <u>outlet</u> concentration is listed; AP-42, Section 2.4.4.

Note: "x" denotes a HAP only or a HAP and VOC; "y" denotes a VOC only

EU003 3,000-scfm enclosed flare w/evap

Standard Conditions, Constants, and Typical Values

Category	Value		Equivalent
Standard Temperature[a]	60	°F	520 °R
Universal Gas Constant	0.7302	atm-ft^3/lb-mol°R	
Pressure[a]	1	atm	
Methane Heating Value[b]	1,000	Btu/ft^3	
LFG Methane Component[c]	50%		
LFG Typical Heating Value	500	Btu/ft^3	
LFG Temperature[c]	100	°F	560 °R
LFG Moisture[c]	8%		
Methane Combustion Constant[d]	9.53	ft^3 air/ft^3 CH_4	

[a] Industrial STP (60°F, 30.00 in. Hg, 1 atm)

[b] Typical

[c] Assumed

[d] *Professional Engineering Registration Program*, 23-9.

Fuel & Equipment - Enclosed Flare

Flare Information	Value		Equivalent
Operation Period[a]	8,760	hr	
LFG inlet flow, standard[b]	3,000	scfm	
LFG Inlet Flow, dry standard	2,760	dscfm	
Heat Input	90	MMBtu/hr	
Design Flare Operating Temperature[c]	1,400	°F	1,860 °R
Excess Air for Combustion[c]	230%		
Flare Tip Flow, standard	50,174	scfm	
Flare Tip Flow, actual	179,467	acfm	
Flare Tip Diameter[b]	10.0	ft	
Flare Tip Exhaust Velocity	2,285	ft/min	38.1 ft/s
Flare Tip Height, above local grade[b]	45	ft	

[a] Permit Applicant

[b] Flare manufacturer - based on LFG model EF1045I12

[c] Function of design flame temperature; values are typical and are provided for 1400°F, 1600°F, 1800°F, and 2000°Fby a flare manufactuer

Criteria Pollutant Emissions - Enclosed Flare

EU003 3,000-scfm enclosed flare w/evap

Operation Period	8,760	hr
LFG inlet flow, standard	3,000	scfm
Heat Input	90	MMBtu/hr

SO_2 Emission Rate without BACT

SO_2 concentration in exhaust gas	5800.25	ppmv		
SO_2 emission rate	176.16	lb/hr	771.6	tpy

LFG Compound	CAS	MW (lb/lb-mol)	Conc (ppmv)[a]	Control Eff[a,b]	Individual Compound Contribution to SO_2 No. of S Atoms	S Conc (ppmv)	SO_2 Emiss (lb/hr)
Carbon Disulfide	75-15-0	76.13	0.58	100.0%	2	1.17	0.04
Carbonyl Sulfide	463-58-1	60.07	0.49	100.0%	1	0.49	0.01
Dimethyl Sulfide (methyl sulfide)	75-18-3	62.13	7.82	100.0%	1	7.82	0.24
Ethyl Mercaptan (ethanethiol)	75-08-1	62.13	2.28	100.0%	1	2.28	0.07
Hydrogen Sulfide	7783-06-4	34.08	5786.00	100.0%	1	5786.0	175.72
Methyl Mercaptan	74-93-1	48.11	2.49	100.0%	1	2.49	0.08
					Total Contribution to SO_2:	5800.25	176.16

SO_2 Emission Rate with BACT

Sulfur concentration in exhaust ga	400.05	ppmv		
SO_2 emission rate	12.15	lb/hr uncontrolled	53.2	tpy

LFG Compound	CAS	MW (lb/lb-mol)	Conc (ppmv)[a]	Control Eff[a,b]	Individual Compound Contribution to SO_2 No. of S Atoms	S Conc (ppmv)	SO_2 Emiss (lb/hr)
Carbon Disulfide	75-15-0	76.13	0.58	100.0%	2	1.17	0.04
Carbonyl Sulfide	463-58-1	60.07	0.49	100.0%	1	0.49	0.01
Dimethyl Sulfide (methyl sulfide)	75-18-3	62.13	7.82	100.0%	1	7.82	0.24
Ethyl Mercaptan (ethanethiol)	75-08-1	62.13	2.28	100.0%	1	2.28	0.07
Hydrogen Sulfide	7783-06-4	34.08	385.80	100.0%	1	385.8	11.72
Methyl Mercaptan	74-93-1	48.11	2.49	100.0%	1	2.49	0.08
					Total Contribution to SO_2:	400.05	12.15

PM_{10} Emission Rate

PM emission factor[a]	17	lb/MM dscf CH_4		
PM emission rate	1.41	lb/hr	6.2	tpy

NO_2 Emission Rate

NO_2 emission factor[c]	0.06	lb/MMBtu		
NO_2 emission rate	5.4	lb/hr	23.7	tpy

CO Emission Rate

CO emission factor[c]	0.20	lb/MMBtu		
CO emission rate	18.0	lb/hr	79	tpy

NMOC Emission Rate

NMOC conc inlet gas[a]	595	ppmv		
MW hexane	86.18	lb/lb-mol		
destruction efficiency	98%			
mass NMOC inlet gas	24.3	lb/hr		
NMOC emission rate	0.49	lb/hr	2.13	tpy

VOC Emission Rate

NMOC conc inlet gas[a]	595	ppmv		
VOC fraction of NMOC[a]	39%			
VOC concentration in inlet gas	232	ppmv		
MW hexane	86.18	lb/lb-mol		
mass VOC inlet gas	9.5	lb/hr		
destruction efficiency	98%			
VOC emission rate	0.19	lb/hr	0.83	tpy

[a] U.S. E.P.A., *Compilation of Air Pollutant Emission Factors, Volume I. Stationary Point and Area Sources* ("AP-42"), *5th Ed.*, November 1998.

[b] AP-42 gives ranges for control efficiencies. Control efficiencies for halogenated species range from 91 to 99.7 percent. The upper end of the range is used here resulting in maximum calculated emissions of SQ

[c] LFG Specialties Inc. (typical)

LFG Inlet flow 3,000 **scfm**

EU003 3,000-scfm enclosed flare w/evap

LFG Compound	HAP	VOC	CAS	MW (lb/lb-mol)	Compound Conc & Mass in Inlet Gas (ppmv)[a]	Compound Conc & Mass in Inlet Gas (lb/hr)	Control Eff[a,b]	Flare Exhaust (lb/hr)*	Flare Exhaust (tpy)*
1,1,1 - Trichloroethane (methyl chloroform)	x	–	71-55-6	133.41	0.48	3.04E-02	98.0%	6.07E-04	2.66E-03
1,1,2,2 - Tetrachloroethane	x	x	79-34-5	167.85	1.11	8.83E-02	98.0%	1.77E-03	7.74E-03
1,1,2 - Trichloroethane (1,1,2 TCA)	x	x	79-00-5	133.41	0.10	6.32E-03	98.0%	1.26E-04	5.54E-04
1,1 - Dichloroethane (ethylidene dichloride)	x	x	75-34-3	98.96	2.35	1.10E-01	98.0%	2.20E-03	9.66E-03
1,1 - Dichloroethene (vinylidene chloride)	x	x	75-35-4	96.94	0.20	9.24E-03	98.0%	1.85E-04	8.09E-04
1,2 - Dichloroethane (ethylene dichloride)	x	x	107-06-2	98.96	0.41	1.91E-02	98.0%	3.82E-04	1.67E-03
1,2 - Dichloropropane (propylene dichloride)	x	x	78-87-5	112.99	0.18	9.64E-03	98.0%	1.93E-04	8.45E-04
2-Propanol (isopropyl alcohol)	--	x	67-63-0	60.11	50.1	1.43E+00	98.0%	2.86E-02	1.25E-01
Acetone (2-propanone)	--	--	67-64-1	58.08	7.01	1.93E-01	98.0%	3.86E-03	1.69E-02
Acrylonitrile (Propenenitrile)	x	x	107-13-1	53.06	6.33	1.59E-01	98.0%	3.18E-03	1.39E-02
Benzene	x	x	71-43-2	78.12	1.91	7.07E-02	98.0%	1.41E-03	6.20E-03
Bromodichloromethane	–	x	75-27-4	163.83	3.13	2.43E-01	98.0%	4.86E-03	2.13E-02
Butane	–	x	106-97-8	58.12	5.03	1.39E-01	98.0%	2.77E-03	1.21E-02
Carbon Disulfide	x	x	75-15-0	76.14	0.58	2.10E-02	98.0%	4.21E-04	1.84E-03
Carbon Tetrachloride	x	x	56-23-5	153.84	0.004	2.92E-04	98.0%	5.83E-06	2.56E-05
Carbonyl Sulfide	x	x	463-58-1	60.07	0.49	1.40E-02	98.0%	2.79E-04	1.22E-03
Chlorobenzene (monochlorobenzene)	x	x	108-90-7	112.56	0.25	1.36E-02	98.0%	2.71E-04	1.19E-03
Chlorodifluoromethane (CFC-22, freon-22)	--	--	75-45-6	86.47	1.30	5.33E-02	98.0%	1.07E-03	4.67E-03
Chloroethane (ethyl chloride)	x	x	75-00-3	64.52	1.25	3.82E-02	98.0%	7.65E-04	3.35E-03
Chloroform (trichloromethane)	x	x	67-66-3	119.38	0.03	1.70E-03	98.0%	3.40E-05	1.49E-04
Chloromethane (methyl chloride)	x	x	74-87-3	50.49	1.21	2.90E-02	98.0%	5.79E-04	2.54E-03
1,4 Dichlorobenzene (p-dichlorobenzene)	x	x	106-46-7	147	0.21	1.48E-02	98.0%	2.97E-04	1.30E-03
Dichlorodifluoromethane (CFC-12, freon-12)	--	–	75-71-8	120.91	15.7	9.00E-01	98.0%	1.80E-02	7.88E-02
Dichlorofluoromethane (freon-21)	--	–	75-43-4	102.92	2.62	1.28E-01	98.0%	2.56E-03	1.12E-02
Dichloromethane (methylene chloride)	x	–	75-09-2	84.93	14.3	5.76E-01	98.0%	1.15E-02	5.04E-02
Dimethyl Sulfide (methyl sulfide)	–	x	75-18-3	62.13	7.82	2.30E-01	98.0%	4.61E-03	2.02E-02
Ethane	--	--	74-84-0	30.07	889	1.27E+01	98.0%	2.53E-01	1.11E+00
Ethanol (ethyl alcohol)	–	x	64-17-5	46.08	27.2	5.94E-01	98.0%	1.19E-02	5.20E-02
Ethylbenzene[g]	x	x	100-41-4	106.17	4.61	2.32E-01	98.0%	4.64E-03	2.03E-02
Ethyl Mercaptan (ethanethiol)	–	x	75-08-1	62.13	1.25	3.68E-02	98.0%	7.36E-04	3.23E-03
Ethylene dibromide (1,2 dibromoethane)	x	x	106-93-4	187.88	0.001	8.91E-05	98.0%	1.78E-06	7.80E-06
Fluorotrichloromethane (CFC-11, freon-11)	--	–	75-69-4	137.37	0.76	4.95E-02	98.0%	9.90E-04	4.34E-03
Hexane	x	x	110-54-3	86.18	6.57	2.68E-01	98.0%	5.37E-03	2.35E-02
Hydrogen Sulfide	–	–	7783-06-4	34.08	385.8	6.23E+00	98.0%	1.25E-01	5.46E-01
Mercury (total)	x	–	7439-97-6	200.61	2.92E-4	2.78E-05	0.0%	2.78E-05	1.22E-04
Methyl Ethyl Ketone (2-butanone)	–	–	78-93-3	72.11	7.09	2.42E-01	98.0%	4.85E-03	2.12E-02
Methyl Isobutyl Ketone (hexone)	x	x	108-10-1	100.16	1.87	8.88E-02	98.0%	1.78E-03	7.78E-03
Methyl Mercaptan	–	x	74-93-1	48.11	2.49	5.68E-02	98.0%	1.14E-03	4.97E-03
Pentane	–	x	109-66-0	72.15	3.29	1.13E-01	98.0%	2.25E-03	9.86E-03
ethene)	x	x	127-18-4	165.83	3.73	2.93E-01	98.0%	5.86E-03	2.57E-02
Propane	--	x	74-98-6	44.1	11.1	2.32E-01	98.0%	4.64E-03	2.03E-02
Toluene (methylbenzene)	x	x	108-88-3	92.14	39.3	1.72E+00	98.0%	3.43E-02	1.50E-01
Trichloroethylene (trichloroethene)	x	x	79-01-6	131.38	2.82	1.76E-01	98.0%	3.51E-03	1.54E-02
dichloroethylene)	–	–	156-60-5	96.94	2.84	1.31E-01	98.0%	2.61E-03	1.14E-02
Vinyl Chloride (chloroethylene, VCM)	x	x	75-01-4	62.50	7.34	2.17E-01	98.0%	4.35E-03	1.91E-02
Xylenes (m, o, p)	x	x	1330-20-7	106.17	12.1	6.09E-01	98.0%	1.22E-02	5.33E-02
Hydrogen Chloride	x	–	7647-01-0	36.50	42.0	7.27E-01	0.0%	7.27E-01	3.18E+00
Total HAP[e]								0.82	3.6
Maximum Single HAP								0.73	3.18
Hydrogen Sulfide without BACT				34.08	5785.0	9.35E+01	98.0%	1.87	8.19

[a] U.S. E.P.A., *Compilation of Air Pollutant Emission Factors, Volume I, Stationary Point and Area Sources* ("AP-42"), *5th Ed.*, November 1998.Tables 2.4-1, 2.4-2, 2.4-3.

[b] AP-42 gives ranges for control efficiencies. Control efficiencies for halogenated species range from 91 to 99.7 percent and control. Control efficiencies for non-halogenated species range from 38 to 91 percent. For permitting purposes, the lower end of each ranges is used here.

[c] Product of combustion

[d] Because HCl is a production of combustion, a default outlet concentration is listed; AP-42, Section 2.4.4.

Note: "x" denotes a HAP only or a HAP and VOC; "y" denotes a VOC only

EU NEW - Proposed 3,000-scfm utility flare

Standard Conditions, Constants, and Typical Values

Category	Value	Equivalent	
Standard Temperature[a]	60	°F	520 °R
Universal Gas Constant	0.7302	atm-ft^3/lb-mol°R	
Pressure[a]	1	atm	
Methane Heating Value[b]	1,000	Btu/ft^3	
LFG Methane Component[c]	50%	%	
LFG Typical Heating Value	500	Btu/ft^3	
LFG Temperature[c]	100	°F	560 °R
LFG Moisture[c]	8%	%	

[a] Industrial STP (60°F, 30.00 in. Hg, 1 atm)

[b] Typical

[c] Assumed

Fuel & Equipment - Open Flare

Flare Information	Value	Equivalent	
No. of Hours of Operation Per Day[a]	24	hr	
No. of Days in Averaging Period[a]	365	day	
Operation Period[a]	8,760	hr	
LFG inlet flow, standard[a]	3,300	scfm	
LFG Inlet Flow, dry standard	3,036	dscfm	
Heat Input	99.0	MMBtu/hr	
Design Flare Operating Temperature[b]	1,400	°F	1,860 °R
Flare Tip Flow, standard	3,300	scfm	
Flare Tip Flow, actual	3,554	acfm	
Flare Tip Diameter[b]	1.17	ft	
Flare Tip Exhaust Velocity	3,324	ft/min	55.4 ft/s
Flare Tip Height, above local grade[b]	35	ft	

[a] Permit Applicant

Criteria Pollutant Emissions - Open Flare

Operation Period	8,760	hr
LFG inlet flow, standard	3,300	scfm
Heat Input	99.0	MMBtu/hr

SO_2 Emission Rate

SO_2 concentration in exhaust gas	5800.25	ppmv		
SO_2 emission rate	193.77	lb/hr	848.73	ton/yr

LFG Compound	CAS	MW (lb/lb-mol)	Conc (ppmv)[a]	Control Eff[a,b]	Individual Compound Contribution to SO_2: No. of S Atoms	S Conc (ppmv)	SO_2 Emiss (lb/hr)
Carbon Disulfide	75-15-0	76.13	0.58	100.0%	2	1.17	0.04
Carbonyl Sulfide	463-58-1	60.07	0.49	100.0%	1	0.49	0.02
Dimethyl Sulfide (methyl sulfide)	75-18-3	62.13	7.82	100.0%	1	7.82	0.26
Ethyl Mercaptan (ethanethiol)	75-08-1	62.13	2.28	100.0%	1	2.28	0.08
Hydrogen Sulfide	7783-06-4	34.08	5786.00	100.0%	1	5786.0	193.30
Methyl Mercaptan	74-93-1	48.11	2.49	100.0%	1	2.49	0.08
					Total Contribution to SO_2:	5800.25	193.77

SO_2 Emission Rate with BACT

SO_2 concentration in exhaust gas	400.05	ppmv		
SO_2 emission rate	13.36	lb/hr	58.54	tpy

LFG Compound	CAS	MW (lb/lb-mol)	Conc (ppmv)[a]	Control Eff[a,b]	Individual Compound Contribution to SO_2: No. of S Atoms	S Conc (ppmv)	SO_2 Emiss (lb/hr)
Carbon Disulfide	75-15-0	76.13	0.58	100.0%	2	1.17	0.04
Carbonyl Sulfide	463-58-1	60.07	0.49	100.0%	1	0.49	0.02
Dimethyl Sulfide (methyl sulfide)	75-18-3	62.13	7.82	100.0%	1	7.82	0.26
Ethyl Mercaptan (ethanethiol)	75-08-1	62.13	2.28	100.0%	1	2.28	0.08
Hydrogen Sulfide	7783-06-4	34.08	385.80	100.0%	1	385.8	12.89
Methyl Mercaptan	74-93-1	48.11	2.49	100.0%	1	2.49	0.08
					Total Contribution to SO_2:	400.05	13.36

PM_{10} Emission Rate

PM emission factor[a]	17	lb/MM dscf CH_4		
PM emission rate	1.55	lb/hr	6.78	tpy

NO_2 Emission Rate

NO_2 emission factor[c]	0.068	lb/MMBtu		
NO_2 emission rate	6.73	lb/hr	29.49	tpy

CO Emission Rate

CO emission factor[c]	0.37	lb/MMBtu		
CO emission rate	36.6	lb/hr	160.4	tpy

NMOC Emission Rate

NMOC conc inlet gas[a]	595	ppmv		
MW hexane	86.18	lb/lb-mol		
destruction efficiency	98%			
mass NMOC inlet gas	26.74	lb/hr		
NMOC emission rate	0.53	lb/hr	2.34	tpy

VOC Emission Rate

NMOC conc inlet gas[a]	595	ppmv		
VOC fraction of NMOC[a]	39%			
VOC concentration in inlet gas	232	ppmv		
MW hexane	86.18	lb/lb-mol		
mass VOC inlet gas	10.43	lb/hr		
destruction efficiency	98%			
VOC emission rate	0.21	lb/hr	0.91	tpy

[a] EPA 1998. "Compilation of Air Pollutant Emission Factors, Volume I. Stationary Point and Area Sources" (AP-42), 5th Ed., November

[b] AP-42 gives ranges for control efficiencies. Control efficiencies for halogenated species range from 91 to 99.7 percent. The upper end of t range is used here resulting in maximum calculated emissions of SO_2

[c] LFG Specialties Inc. (typical)

Air Toxics Emissions from Open Flare *The flare's inlet* *3,300* *scfm*

			MW	Compound Conc & Mass in Inlet Gas		Control	Flare Exhaust	
LFG Compound	HAP	CAS	(lb/lb-mol)	(ppmv)[a]	(lb/hr)	Eff[a,b]	(lb/hr)	(tpy)
1,1,1 - Trichloroethane (methyl chloroform)	x	71-55-6	133.41	0.48	3.34E-02	98.0%	6.68E-04	2.93E-03
1,1,2,2 - Tetrachloroethane	x	79-34-5	167.85	1.11	9.72E-02	98.0%	1.94E-03	8.51E-03
1,1,2 - Trichloroethane (1,1,2 TCA)	x	79-00-5	133.41	0.10	6.96E-03	98.0%	1.39E-04	6.09E-04
1,1 - Dichloroethane (ethylidene dichloride)	x	75-34-3	98.96	2.35	1.21E-01	98.0%	2.43E-03	1.06E-02
1,1 - Dichloroethene (vinylidene chloride)	x	75-35-4	96.94	0.20	1.02E-02	98.0%	2.03E-04	8.90E-04
1,2 - Dichloroethane (ethylene dichloride)	x	107-06-2	98.96	0.41	2.10E-02	98.0%	4.20E-04	1.84E-03
1,2 - Dichloropropane (propylene dichloride)	x	78-87-5	112.99	0.18	1.06E-02	98.0%	2.12E-04	9.29E-04
2-Propanol (isopropyl alcohol)	—	67-63-0	60.11	50.1	1.57E+00	98.0%	3.14E-02	1.38E-01
Acetone (2-propanone)	—	67-64-1	58.08	7.01	2.12E-01	98.0%	4.25E-03	1.86E-02
Acrylonitrile (Propenenitrile)	x	107-13-1	53.06	6.33	1.75E-01	98.0%	3.50E-03	1.53E-02
Benzene	x	71-43-2	78.12	1.91	7.78E-02	98.0%	1.56E-03	6.82E-03
Bromodichloromethane	--	75-27-4	163.83	3.13	2.67E-01	98.0%	5.35E-03	2.34E-02
Butane	--	106-97-8	58.12	5.03	1.52E-01	98.0%	3.05E-03	1.34E-02
Carbon Disulfide	x	75-15-0	76.14	0.58	2.31E-02	98.0%	4.63E-04	2.03E-03
Carbon Tetrachloride	x	56-23-5	153.84	0.004	3.21E-04	98.0%	6.42E-06	2.81E-05
Carbonyl Sulfide	x	463-58-1	60.07	0.49	1.53E-02	98.0%	3.07E-04	1.34E-03
Chlorobenzene (monochlorobenzene)	x	108-90-7	112.56	0.25	1.49E-02	98.0%	2.98E-04	1.31E-03
Chlorodifluoromethane (CFC-22, freon-22)	--	75-45-6	86.47	1.30	5.86E-02	98.0%	1.17E-03	5.13E-03
Chloroethane (ethyl chloride)	x	75-00-3	64.52	1.25	4.21E-02	98.0%	8.41E-04	3.68E-03
Chloroform (trichloromethane)	x	67-66-3	119.38	0.03	1.87E-03	98.0%	3.74E-05	1.64E-04
Chloromethane (methyl chloride)	x	74-87-3	50.49	1.21	3.19E-02	98.0%	6.37E-04	2.79E-03
1,4 Dichlorobenzene (p-dichlorobenzene)	x	106-46-7	147	0.21	1.63E-02	98.0%	3.27E-04	1.43E-03
Dichlorodifluoromethane (CFC-12, freon-12)	—	75-71-8	120.91	15.7	9.90E-01	98.0%	1.98E-02	8.67E-02
Dichlorofluoromethane (freon-21)	--	75-43-4	102.92	2.62	1.41E-01	98.0%	2.81E-03	1.23E-02
Dichloromethane (methylene chloride)	x	75-09-2	84.93	14.3	6.33E-01	98.0%	1.27E-02	5.55E-02
Dimethyl Sulfide (methyl sulfide)	--	75-18-3	62.13	7.82	2.53E-01	98.0%	5.07E-03	2.22E-02
Ethane	--	74-84-0	30.07	889	1.39E+01	98.0%	2.79E-01	1.22E+00
Ethanol (ethyl alcohol)	--	64-17-5	46.08	27.2	6.54E-01	98.0%	1.31E-02	5.73E-02
Ethylbenzene[g]	x	100-41-4	106.17	4.61	2.55E-01	98.0%	5.10E-03	2.24E-02
Ethyl Mercaptan (ethanethiol)	--	75-08-1	62.13	1.25	4.05E-02	98.0%	8.10E-04	3.55E-03
Ethylene dibromide (1,2 dibromoethane)	x	106-93-4	187.88	0.001	9.80E-05	98.0%	1.96E-06	8.58E-06
Fluorotrichloromethane (CFC-11, freon-11)	--	75-69-4	137.37	0.76	5.44E-02	98.0%	1.09E-03	4.77E-03
Hexane	x	110-54-3	86.18	6.57	2.95E-01	98.0%	5.91E-03	2.59E-02
Hydrogen Sulfide	--	7783-06-4	34.08	385.8	6.86E+00	98.0%	1.37E-01	6.01E-01
Mercury (total)	x	7439-97-6	200.61	2.92E-4	3.05E-05	0.0%	3.05E-05	1.34E-04
Methyl Ethyl Ketone (2-butanone)	—	78-93-3	72.11	7.09	2.67E-01	98.0%	5.33E-03	2.34E-02
Methyl Isobutyl Ketone (hexone)	x	108-10-1	100.16	1.87	9.77E-02	98.0%	1.95E-03	8.56E-03
Methyl Mercaptan	—	74-93-1	48.11	2.49	6.25E-02	98.0%	1.25E-03	5.47E-03
Pentane	--	109-66-0	72.15	3.29	1.24E-01	98.0%	2.48E-03	1.08E-02
ethene)	x	127-18-4	165.83	3.73	3.23E-01	98.0%	6.45E-03	2.83E-02
Propane	--	74-98-6	44.1	11.1	2.55E-01	98.0%	5.11E-03	2.24E-02
Toluene (methylbenzene)	x	108-88-3	92.14	39.3	1.89E+00	98.0%	3.78E-02	1.65E-01
Trichloroethylene (trichloroethene)	x	79-01-6	131.38	2.82	1.93E-01	98.0%	3.86E-03	1.69E-02
t - 1,2 - Dichloroethene (1,2 dichloroethylene)	--	156-60-5	96.94	2.84	1.44E-01	98.0%	2.87E-03	1.26E-02
Vinyl Chloride (chloroethylene, VCM)	x	75-01-4	62.50	7.34	2.39E-01	98.0%	4.78E-03	2.10E-02
Xylenes (m, o, p)	x	1330-20-7	106.17	12.1	6.70E-01	98.0%	1.34E-02	5.87E-02
Hydrogen Chloride[c,d]	x	7647-01-0	36.50	42.0	7.99E-01	0.0%	7.99E-01	3.50E+00
Total HAP							0.91	3.97
Maximum Single HAP							0.80	3.50
Hydrogen Sulfide without BACT			34.08	5785.0	1.03E+02	98.0%	2.06	9.01

[a] EPA 1998. "Compilation of Air Pollutant Emission Factors, Volume I. Stationary Point and Area Sources" (AP-42), 5th Ed., November

[b] AP-42 gives ranges for control efficiencies. Control efficiencies for halogenated species range from 91 to 99.7 percent and control. Control efficiencies for non-halogenated species range from 38 to 91 percent. For permitting purposes, the lower end of each ranges is used here.

[c] Product of combustion

[d] Because HCl is a production of combustion, a default outlet concentration is listed; AP-42, Section 2.4.4.

Note: "x" denotes a HAP only or a HAP and VOC; "y" denotes a VOC only

EU003 - 3,000-scfm enclosed flare w/evap
E-VAP UNIT #3016

THEORETICAL ORGANIC/METAL/OTHER CONCENTRATIONS and EMISSIONS

Leachate input Rate (gallons/day) = 30,000 gpd 0.030 MGD

COMPOUND	HAP	8/19/1998 ppm [b] (mg/l)	4/29/1998 ppm [b] (mg/l)	2/5/1998 ppm [b] (mg/l)	11/5/1997 ppm [b] (mg/l)	11/5/97 (a) ppm [b] (mg/l)	11/5/97 (a) ppb [b] (ug/l)	Maximum ppm [b] (mg/l)	EPA Theoretical Median Conc(1) (mg/l)	EPA Theoretical Median Conc(1) (ug/l)	Number of Samples by EPA	Max Conc (mg/l)	Pounds per hour	Pounds per year
1,1 Dichloroethane	*					0.0000		0.000	0.165	165	34	0.165	1.72E-3	15.08
(ethylidene dichloride)						0.0000		0.000	0		0	0.0000	0.00E+0	-
1,1,1 Trichloroethane	*	5.00				0.0000		5.000	0.086	86	20	5.0000	5.22E-2	456.85
1,1,2 Trichloroethane	*					0.0000		0.000	0.426	426	4	0.4260	4.44E-3	38.92
1,1,2,2 Tetrachloroethane	*					0.0000		0.000	0.21	210	1	0.2100	2.19E-3	19.19
1,2 Dichloroethane (ethylene dichloride)	*					0.0000		0.000	0.01	10	6	0.0100	1.04E-4	0.91
1,2 Dichloropropane (propylene dichloride)	*					0.0000		0.000	0.009	9	12	0.0090	9.39E-5	0.82
1,2 trans dichloroethylene						0.0000		0.000	0.092	92	40	0.0920	9.60E-4	8.41
1,2,3 Trichloropropane						0.0000		0.000	0.23	230	1	0.2300	2.40E-3	21.02
1-Propanol						0.0000		0.000	11	11000	1	11.0000	1.15E-1	1,005.08
2,4-dimethylphenol						0.0000		0.000	0.019	19	2	0.0190	1.98E-4	1.74
2-Chloroethyl Vinyl Ether						0.0000		0.000	0.551	551	2	0.5510	5.75E-3	50.35
2-Hexanone						0.0000		0.000	0.088	88	11	0.0880	9.18E-4	8.04
Acetone						0.0880	88.00	0.088	0.43	430	23	0.4300	4.49E-3	39.29
Acrolein	*					0.0000		0.000	0.27	270	1	0.2700	2.82E-3	24.67
Acrylonitrile	*					0.0000		0.000	0		0	0.0000	0.00E+0	-
Benzene	*					0.0003	0.27	0.00027	0.037	37	35	0.0370	3.86E-4	3.38
Bis(Chloromethyl) Ether	*					0.0000		0.000	0.25	250	1	0.2500	2.61E-3	22.84
Butanol						0.0000		0.000	10	10000	1	10.0000	1.04E-1	913.71
Carbon tetrachloride	*					0.0000		0.000	0.202	202	2	0.2020	2.11E-3	18.46
Chlorobenzene	*					0.0000		0.000	0.007	7	12	0.0070	7.30E-5	0.64
Chloroform	*					0.0000		0.000	0.029	29	8	0.0290	3.02E-4	2.65
Chloromethane	*					0.0000		0.000	0.175	175	3	0.1750	1.83E-3	15.99
Cis- 1,2 Dichloroethylene						0.0000		0.000	0.33	330	2	0.3300	3.44E-3	30.15
Dichloromethane	*					0.0000		0.000	0.44	440	68	0.4400	4.59E-3	40.20
(methylene chloride)						0.0000		0.000	0		0	0.0000	0.00E+0	-
Diethyl phthalate						0.0000		0.000	0.083	83	27	0.0830	8.66E-4	7.58
Ethanol						0.0000		0.000	23	23000	1	23.0000	2.40E-1	2,101.53
Ethylbenzene	*	3.00				0.0010	1.00	3.000	0.058	58	41	3.0000	3.13E-2	274.11
Isophorone	*					0.0000		0.000	0.076	76	19	0.0760	7.93E-4	6.94
Methyl ethyl ketone	*					0.1900	190.00	0.190	1.55	1550	24	1.5500	1.62E-2	141.62
Methyl isobutyl ketone	*					0.0280	28	0.028	0.27	270	9	0.2700	2.82E-3	24.67
Naphthalene	*					0.0000		0.000	0.012	12	23	0.0120	1.25E-4	1.10
p-Cresol	*					0.0000		0.000	2.305	2305	10	2.3050	2.40E-2	210.61
Perchloroethylene (tetrachloroethylene)	*					0.0000		0.000	0.055	55	18	0.0550	5.74E-4	5.03
Phenols (total)	*					0.0000		0.000	0.378	378	45	0.3780	3.94E-3	34.54
Styrene	*					0.0000		0.000	0		0	0.0000	0.00E+0	-
Tetrahydrofuran						0.0000		0.000	0.26	260	7	0.2600	2.71E-3	23.76
Toluene	*	5.00		4.00	2.00	0.0026	2.60	5.000	0.413	413	69	5.0000	5.22E-2	456.85
Trichloroethylene	*					0.0000		0.000	0.043	43	28	0.0430	4.49E-4	3.93
Vinyl chloride	*					0.0000		0.000	0.04	40	10	0.0400	4.17E-4	3.65
Xylene	*	9.00				0.0022	2.20	9.000	0.071	71	7	9	9.39E-2	822.34
												Total HAP:	2.46E-1	2,156.07

Notes:
HAP = Clean Air Act Hazardous Air Pollutant
mgal = million gallons
Parts per billion = ug/l
Parts per million = mg/l

x - detected below method detection limit
(1) Using EPA "typical" leachate data (median value), Summary Of Data On Municipal Solid Waste Landfill Leachate Characteristics "Criteria For Municipal Solid Waste Landfills" EPA, July 1988 (NTIS PB88-242441).

	HAP	8/19/1998 ppm [b] (mg/l)	4/29/1998 ppm [b] (mg/l)	2/5/1998 ppm [b] (mg/l)	11/5/1997 ppm [b] (mg/l)	11/5/97 (a) ppm [b] (mg/l)	11/5/97 (a) ppb [b] (ug/l)	Maximum ppm [b] (mg/l)	EPA Theoretical Median Conc (mg/l)	EPA Theoretical Conc (ug/l)	Number of Samples by EPA	Max Conc (mg/l)	Pounds per hour	Pounds per year
Hydrogen Chloride[d]	•	660.00	320.00	260.00				660.000	695	695000	0	695.000	-	N/A
Hydrogen fluoride						200.00		200.000	0.4	400	0	200.000	-	N/A
Hydrogen sulfide[e]		96.00	8.00					96.000	108	108000	0	108.000	1.13E+0	9,868.04

Leachate HAPs & metals [c]	HAP	8/19/1998 ppm [b] (mg/l)	4/29/1998 ppm [b] (mg/l)	2/5/1998 ppm [b] (mg/l)	11/5/1997 ppm [b] (mg/l)	11/5/97 (a) ppm [b] (mg/l)	11/5/97 (a) ppb [b] (ug/l)	Maximum ppm [b] (mg/l)	EPA Theoretical Median Conc (mg/l)	EPA Theoretical Conc (ug/l)	Number of Samples by EPA	Max Conc (mg/l)	Pounds per hour	Pounds per year
Bis (Chloromethyl) ether	•					0.0000		0.000	0		0	0.000	0.00E+0	0.0
Isophorone	•					0.0000		0.000	0		0	0.000	0.00E+0	0.0
Naphthalene	•					0.0000		0.000	0		0	0.000	0.00E+0	0.0
p-cresol	•					0.0000		0.000	0		0	0.000	0.00E+0	0.0
phenols (total)	•					0.0000		0.000	0		0	0.000	0.00E+0	0.0
antimony	•					0.0000		0.000	0		0	0.000	0.00E+0	0.0
arsenic	•					0.0000		0.000	0.08		0	0.080	8.34E-7	0.0
barium		0.17	0.06	0.06	0.08	0.0000		0.170	0.383	383	0	0.383	3.99E-6	0.0
beryllium	•					0.0000		0.000	0.0065	7	0	0.007	6.78E-8	0.0
cadmium	•					0.0000		0.000	0.015	15	0	0.015	1.56E-7	0.0
calcium		135.00	21.00	25.00	27.00	0.0000		135.000	336	336000	0	336.000	3.50E-3	30.7
chromium	•	0.17				0.0000		0.170	0.06	60	0	0.170	1.77E-6	0.0
copper		0.10				0.0420	42.00	0.100	0.07	70	0	0.100	1.04E-6	0.0
lead	•					0.0000		0.000	0.08	80	0	0.080	8.34E-7	0.0
mercury	•					0.0000		0.000	0.0006	0.6	0	0.001	6.26E-9	0.0
nickel	•	0.20	0.03	0.02	0.02	0.0000		0.200	0.16	160	0	0.200	2.09E-6	0.0
selenium	•					0.0000		0.000		0	0	0.000	0.00E+0	0.0
sodium		510.00	260.00	330.00	440.00	0.0000		510.000		0	0	510.000	5.32E-3	46.6
thallium						0.0000		0.000		0	0	0.000	0.00E+0	0.0
iron		6.00				3.6000	3600.00	6.000	66.2	66200	0	66.200	6.90E-4	6.0
zinc		0.07				0.0750	75.00	0.075	1.35	1350	0	1.350	1.41E-5	0.1

TOTAL HAP EMISSIONS:

uncontrolled =	0.30 lb/hr	2,646.05 lbs/year
98% control =	0.006 lb/hr	52.92 lbs/year

a - HAPs in both LFG and in leachate

b - from EPA Characterization of MWC Ashes and Leachates from MSW Landfills, Monofills and Co-Disposal Sites, median concentration values

c - draft AP-42 (9/95), Tables 2.4-3; unlisted control efficiencies assumed to be 80%

d - product of combustion

c - Additional HAPs found in leachate > 50 ppb/mgal per reference b

x - HAP present in leachate > 50 ppb

o - non-VOC HAP

Notes:

c - draft AP-42 (9/95), Tables 2.4-1 and 2.4-2; concentration in inlet gas

d - concentration of chloride in leachate; thermal conversion to hydrogen chloride in flare is presented in the "air toxics" sheets

d - concentration of sulfate in leachate; thermal conversion to sulfur dioxides in flare is presented in the "criteria pollutants" sheets

EU005 3,000-scfm enclosed flare w/evap
E-VAP UNIT #PROPOSED on existing flare
THEORETICAL ORGANIC/METAL/OTHER CONCENTRATIONS and EMISSIONS

Leachate input Rate (gallons/day) = 30,000 gpd 0.030 MGD

COMPOUND	HAP	8/19/1998 ppm b (mg/l)	4/29/1998 ppm b (mg/l)	2/5/1998 ppm b (mg/l)	11/5/1997 ppm b (mg/l)	11/5/97 (a) ppm b (mg/l)	11/5/97 (a) ppb b (ug/l)	Maximum ppm b (mg/l)	EPA Theoretical Median Conc(1) (mg/l)	EPA Theoretical Median Conc(1) (ug/l)	Number of Samples by EPA	Max Conc (mg/l)	Pounds per hour	Pounds per year
1,1 Dichloroethane	*					0.0000		0.000	0.165	165	34	0.165	1.72E-3	15.08
(ethylidene dichloride)						0.0000		0.000	0		0	0.0000	0.00E+0	-
1,1,1 Trichloroethane	*	5.00				0.0000		5.000	0.086	86	20	5.0000	5.22E-2	456.85
1,1,2 Trichloroethane	*					0.0000		0.000	0.426	426	4	0.4260	4.44E-3	38.92
1,1,2,2 Tetrachloroethane	*					0.0000		0.000	0.21	210	1	0.2100	2.19E-3	19.19
1,2 Dichloroethane (ethylene dichloride)	*					0.0000		0.000	0.01	10	6	0.0100	1.04E-4	0.91
1,2 Dichloropropane (propylene dichloride	*					0.0000		0.000	0.009	9	12	0.0090	9.39E-5	0.82
1,2 trans dichloroethylene						0.0000		0.000	0.092	92	40	0.0920	9.60E-4	8.41
1,2,3 Trichloropropane						0.0000		0.000	0.23	230	1	0.2300	2.40E-3	21.02
1-Propanol						0.0000		0.000	11	11000	1	11.0000	1.15E-1	1,005.08
2,4-dimethylphenol						0.0000		0.000	0.019	19	2	0.0190	1.98E-4	1.74
2-Chloroethyl Vinyl Ether						0.0000		0.000	0.551	551	2	0.5510	5.75E-3	50.35
2-Hexanone						0.0000		0.000	0.088	88	11	0.0880	9.18E-4	8.04
Acetone						0.0880	88.00	0.088	0.43	430	23	0.4300	4.49E-3	39.29
Acrolein	*					0.0000		0.000	0.27	270	1	0.2700	2.82E-3	24.67
Acrylonitrile	*					0.0000		0.000	0		0	0.0000	0.00E+0	-
Benzene	*					0.0003	0.27	0.00027	0.037	37	35	0.0370	3.86E-4	3.38
Bis(Chloromethyl) Ether	*					0.0000		0.000	0.25	250	1	0.2500	2.61E-3	22.84
Butanol						0.0000		0.000	10	10000	1	10.0000	1.04E-1	913.71
Carbon tetrachloride	*					0.0000		0.000	0.202	202	2	0.2020	2.11E-3	18.46
Chlorobenzene	*					0.0000		0.000	0.007	7	12	0.0070	7.30E-5	0.64
Chloroform	*					0.0000		0.000	0.029	29	8	0.0290	3.02E-4	2.65
Chloromethane	*					0.0000		0.000	0.175	175	3	0.1750	1.83E-3	15.99
Cis- 1,2 Dichloroethylene						0.0000		0.000	0.33	330	2	0.3300	3.44E-3	30.15
Dichloromethane	*					0.0000		0.000	0.44	440	68	0.4400	4.59E-3	40.20
(methylene chloride)						0.0000		0.000	0		0	0.0000	0.00E+0	-
Diethyl phthalate						0.0000		0.000	0.083	83	27	0.0830	8.66E-4	7.58
Ethanol						0.0000		0.000	23	23000	1	23.0000	2.40E-1	2,101.53
Ethylbenzene	*	3.00				0.0010	1.00	3.000	0.058	58	41	3.0000	3.13E-2	274.11
Isophorone	*					0.0000		0.000	0.076	76	19	0.0760	7.93E-4	6.94
Methyl ethyl ketone	*					0.1900	190.00	0.190	1.55	1550	24	1.5500	1.62E-2	141.62
Methyl isobutyl ketone	*					0.0280	28	0.028	0.27	270	9	0.2700	2.82E-3	24.67
Naphthalene	*					0.0000		0.000	0.012	12	23	0.0120	1.25E-4	1.10
p-Cresol	*					0.0000		0.000	2.305	2305	10	2.3050	2.40E-2	210.61
Perchloroethylene (tetrachloroethylene)	*					0.0000		0.000	0.055	55	18	0.0550	5.74E-4	5.03
Phenols (total)	*					0.0000		0.000	0.378	378	45	0.3780	3.94E-3	34.54
Styrene	*					0.0000		0.000	0		0	0.0000	0.00E+0	-
Tetrahydrofuran						0.0000		0.000	0.26	260	7	0.2600	2.71E-3	23.76
Toluene	*	5.00		4.00	2.00	0.0026	2.60	5.000	0.413	413	69	5.0000	5.22E-2	456.85
Trichloroethylene	*					0.0000		0.000	0.043	43	28	0.0430	4.49E-4	3.93
Vinyl chloride	*					0.0000		0.000	0.04	40	10	0.0400	4.17E-4	3.65
Xylene	*	9.00				0.0022	2.20	9.000	0.071	71	7	9	9.39E-2	822.34

Notes:
HAP = Clean Air Act Hazardous Air Pollutant
mgal = million gallons
Parts per billion = ug/l
Parts per million = mg/l

x - detected below method detection limit

(1) Using EPA "typical" leachate data (median value), Summary Of Data On Municipal Solid Waste Landfill Leachate Characteristics "Criteria For Municipal Solid Waste Landfills", EPA, July 1988 (NTIS PB88-242441).

	HAP	8/19/1998 ppm ^{b} (mg/l)	4/29/1998 ppm ^{b} (mg/l)	2/6/1998 ppm ^{b} (mg/l)	11/5/1997 ppm ^{b} (mg/l)	11/5/97 (a) ppm ^{b} (mg/l)	11/5/97 (a) ppb ^{b} (ug/l)	Maximum ppm ^{b} (mg/l)	EPA Theoretical Median Conc (mg/l)	EPA Theoretical Conc (ug/l)	Number of Samples by EPA	Max Conc (mg/l)	Pounds per hour	Pounds per year
Hydrogen Chloride$^{(d)}$	•	660.00	320.00	260.00				660.000	695	695000	0	695.000	-	N/A
Hydrogen fluoride						200.00		200.000	0.4	400	0	200.000	-	N/A
Hydrogen sulfide$^{(e)}$		96.00	8.00					96.000	108	108000	0	108.000	1.13E+0	9,868.04

Leachate HAPs & metals ^{c}	HAP	8/19/1998 ppm ^{b} (mg/l)	4/29/1998 ppm ^{b} (mg/l)	2/5/1998 ppm ^{b} (mg/l)	11/5/1997 ppm ^{b} (mg/l)	11/5/97 (a) ppm ^{b} (mg/l)	11/5/97 (a) ppb ^{b} (ug/l)	Maximum ppm ^{b} (mg/l)	EPA Theoretical Median Conc (mg/l)	EPA Theoretical Conc (ug/l)	Number of Samples by EPA	Max Conc (mg/l)	Pounds per hour	Pounds per year
Bis (Chloromethyl) ether	•					0.0000		0.000	0		0	0.000	0.00E+0	0.0
Isophorone	•					0.0000		0.000	0		0	0.000	0.00E+0	0.0
Naphthalene	•					0.0000		0.000	0		0	0.000	0.00E+0	0.0
p-cresol	•					0.0000		0.000	0		0	0.000	0.00E+0	0.0
phenols (total)	•					0.0000		0.000	0		0	0.000	0.00E+0	0.0
antimony	•					0.0000		0.000	0		0	0.000	0.00E+0	0.0
arsenic	•					0.0000		0.000	0.08		0	0.080	8.34E-7	0.0
barium		0.17	0.06	0.06	0.08	0.0000		0.170	0.383	383	0	0.383	3.99E-6	0.0
beryllium	•					0.0000		0.000	0.0065	7	0	0.007	6.78E-8	0.0
cadmium	•					0.0000		0.000	0.015	15	0	0.015	1.56E-7	0.0
calcium		135.00	21.00	25.00	27.00	0.0000		135.000	336	336000	0	336.000	3.50E-3	30.7
chromium	•	0.17				0.0000		0.170	0.06	60	0	0.170	1.77E-6	0.0
copper		0.10				0.0420	42.00	0.100	0.07	70	0	0.100	1.04E-6	0.0
lead	•					0.0000		0.000	0.08	80	0	0.080	8.34E-7	0.0
mercury	•					0.0000		0.000	0.0006	0.6	0	0.001	6.26E-9	0.0
nickel	•	0.20	0.03	0.02	0.02	0.0000		0.200	0.16	160	0	0.200	2.09E-6	0.0
selenium	•					0.0000		0.000		0	0	0.000	0.00E+0	0.0
sodium		510.00	260.00	330.00	440.00	0.0000		510.000		0	0	510.000	5.32E-3	46.6
thallium						0.0000		0.000		0	0	0.000	0.00E+0	0.0
iron		6.00				3.6000	3600.00	6.000	66.2	66200	0	66.200	6.90E-4	6.0
zinc		0.07				0.0750	75.00	0.075	1.35	1350	0	1.350	1.41E-5	0.1

TOTAL HAP EMISSIONS:

uncontrolled =	**0.30** **lb/hr**	**2,646.05** **lbs/year**
98% control =	**0.006** **lb/hr**	**52.92** **lbs/year**

Note: Existing 20,000-gpd EVAP unit contributed 35.3 lb/yr. Increase for new unit =
35.3

a - HAPs in both LFG and in leachate

b - from EPA Characterization of MWC Ashes and Leachates from MSW Landfills, Monofills and Co-Disposal Sites, median concentration values

c - draft AP-42 (9/95), Tables 2.4-3; unlisted control efficiencies assumed to be 80%

d - product of combustion

c - Additional HAPs found in leachate > 50 ppb/mgal per reference b

x - HAP present in leachate > 50 ppb

o - non-VOC HAP

Notes:

c - draft AP-42 (9/95), Tables 2.4-1 and 2.4-2; concentration in inlet gas

d - concentration of chloride in leachate; thermal conversion to hydrogen chloride in flare is presented in the "air toxics" sheets

d - concentration of sulfate in leachate; thermal conversion to sulfur dioxides in flare is presented in the "criteria pollutants" sheets

Letter Symbol	**Definition**
atm-ft^3/lb-mol°R	atmosphere cubic foot per pound mole degree Rankine
acfm	actual cubic foot per minute
atm	atmosphere
bhp	brake horsepower
Btu	british thermal unit
cal/s	calorie per second
CO	carbon monoxide
ft^3	cubic foot
m^3	cubic meter
d	day
°F	degree Fahrenheit
°R	degree Rankine
dscfm	dry standard cubic foot, feet per minute
dsl/min	dry standard litre per minute
ft	foot
ft/min	foot per minute
ft/s	foot per second
g	gram
hr	hour
HAP	hazardous air pollutant
HV	heating value
HHV	higher heating value
in.	inch
kW	kilowatt
kWh	kilowatt hour
l	litre
LHV	lower heating value
m	meter
m/s	meter per second
CH_4	methane
Hg	mercury
µg	microgram
µg/dsl	microgram per dry standard litre
mg	milligram
MM	million
MMBtu	million british thermal units
min	minute
mol	mole
NO_2	nitrogen dioxide
Nox	nitrogen oxides
NMOC	non-methane organic compounds
PM_{10}	particulate matter less than or equal to 10 microns
Pb	lead
ppmv	parts per million by volume
ppmw	parts per million by weight
lb/hr	pound per hour
s	second
scf	standard cubic foot
scfm	standard cubic foot per minute
STP	standard temperature and pressure
SO_2	sulfur dioxide
ton	ton
ton/yr	ton per year
R	universal gas constant
VOC	volatile organic compound

Sample Calculations

Standard Conditions and Constants

$^{o}R = {}^{o}F + 460$
standard temperature = 60 °F
standard pressure = 1 atm
Universal gas constant (R) = 0.7302 atm-ft^3/lb-mol^{o}R

Flow

dscfm= scfm*(1-%moisture)
acfm = scfm*(actual temp[^{o}R])/(standard temp[^{o}R])*{(standard press[atm])/(actual press [atm])}

CO and NO_x Emissions

(lb/MMbtu)*(MMbtu/hr)= lb/hr

SO_2 Emissions

typically, 86% to 99.7% of sulfur compounds convert to SO_2 during combustion
{(scfm)*(60 min/hr)*(total sulfur concentration [ppmv])*(1-control efficiency)*(MW SO_2)}/{(R)*(T)} = lb/hr

PM_{10} Emissions

(dscfm)*(CH_4 component)*(1E-6 MMscf/scf)* (lb PM/MMscf CH_4)*(60 min/hr) = lb/hr

VOC Emissions

{(scfm*60 min/hr*concentration$_{compound}$[ppmv]*MW$_{compound}$)/(R)*(T)}*(1-control efficiency) = lb/hr
OR
VOCs are 39 percent of NMOC, as prescribed in AP-42
VOC concentration[ppmv] = NMOC concentration[as hexane]*39%
flare and/or engines typically combust 98% of VOCs
{(scfm*60 min/hr*concentration$_{hexane}$[ppmv]*MW$_{hexane}$)/(R)*(T)}*(0.39) = lb/hr

LFG Compound Emissions

{(scfm*60 min/hr*concentration$_{compound}$[ppmv]*MW$_{compound}$)/(R)*(T)}*(1-control efficiency)

HCl Emissions

typically, 86% to 99.7% of chlorine compounds convert to HCl during combustion
(concentration$_{compound}$ [ppm])*(control efficiency)*(no. of chlorine atoms) = HCl concentration [ppm] in outlet gas from each compound
{HCl conconcentration$_{each\ compound}$ [ppm]*scfm*MW$_{HCl}$}/{(R)*(T)}*(60 min/hr) = lb/hr
OR

{(scfm)*(60 min/hr)*(HCl outlet concentration per AP-42 [ppmv])*(1-control efficiency)*(MW}/{(R)*(T)} = lb/hr

Sample Calculations

Standard Conditions and Constants

$^{o}R = {}^{o}F + 460$
standard temperature = 60 ^{o}F
standard pressure = 1 atm
Universal gas constant (R) = 0.7302 atm-ft^{3}/lb-mol^{o}R

Flow

dscfm= scfm*(1-%moisture)
acfm = scfm*(actual temp[^{o}R])/(standard temp[^{o}R])*{(standard press[atm])/(actual press [atm])}

CO and NO$_x$ Emissions

(lb/MMbtu)*(MMbtu/hr)= lb/hr

SO$_2$ Emissions

typically, 86% to 99.7% of sulfur compounds convert to SO$_2$ during combustion
{(scfm)*(60 min/hr)*(total sulfur concentration [ppmv])*(1-control efficiency)*(MW SO$_2$)}/{(R)*(T)} = lb/hr

PM$_{10}$ Emissions

(dscfm)*(CH$_4$ component)*(1E-6 MMscf/scf)* (lb PM/MMscf CH$_4$)*(60 min/hr) = lb/hr

VOC Emissions

{(scfm*60 min/hr*concentration$_{compound}$[ppmv]*MW$_{compound}$)/(R)*(T)}*(1-control efficiency) = lb/hr
OR
VOCs are 39 percent of NMOC, as prescribed in AP-42
VOC concentration[ppmv] = NMOC concentration[as hexane]*39%
flare and/or engines typically combust 98% of VOCs
{(scfm*60 min/hr*concentration$_{hexane}$[ppmv]*MW$_{hexane}$)/(R)*(T)}*(0.39) = lb/hr

LFG Compound Emissions

{(scfm*60 min/hr*concentration$_{compound}$[ppmv]*MW$_{compound}$)/(R)*(T)}*(1-control efficiency)

HCl Emissions

typically, 86% to 99.7% of chlorine compounds convert to HCl during combustion
(concentration$_{compound}$ [ppm])*(control efficiency)*(no. of chlorine atoms) = HCl concentration [ppm] in outlet gas from each compound
{HCl conconcentration$_{each\ compound}$ [ppm]*scfm*MW$_{HCl}$}/{(R)*(T)}*(60 min/hr) = lb/hr
OR
{(scfm)*(60 min/hr)*(HCl outlet concentration per AP-42 [ppmv])*(1-control efficiency)*(MW)/{(R)*(T)} = lb/hr

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Ohio EPA

Division of Air Pollution Control

Air Quality Modeling and Planning Section

Engineering Guide #69

Air Dispersion Modeling Guidance

2003

The Division of Air Pollution Control has received several questions concerning computer modeling of air pollution sources. This guide is intended to respond to those questions. Below is a list of all of the questions. The rest of the Guide contains the Division's responses. The Division welcomes comments on the application of this Guide and additional questions related to air dispersion modeling.

This document will answer the most commonly asked questions to provide a basis for consistent model application although many other questions require case-specific responses. The answers in this document do not reflect a rule or regulation, are not intended to be treated as a rule or regulation, and are subject to change on a case-by-case basis. The information within is provided so that permitting personnel, regulated entities and the public will have an understanding of the expected outcome of the situations described in this document. If you have additional questions on modeling, or comments on this guide, you should contact the Division of Air Pollution Control (614-644-2270).

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Question 1: What specific modeling requirements are incorporated by Ohio EPA in the review of air contaminant sources?

Answer 1: The following is intended to identify current Ohio EPA, Division of Air Pollution Control requirements for air pollution control modeling applications within Ohio. Where applicable, Ohio EPA is consistent with U.S. EPA guidance. In real world applications, the US EPA Guideline on Air Quality Models and supplementary guidance does not always address detailed problems that confront modelers.

The purpose of air dispersion modeling is to predict pollutant concentrations resulting from a source or group of sources under various meteorological conditions. Modeling is necessary to demonstrate that the subject source or sources will not 1) cause or significantly contribute to a violation of the National Ambient Air Quality Standards (NAAQS); 2) cause ambient concentrations which exceed allowable PSD increments; 3) comply with Ohio EPA's policy of no new source consuming more than one half of the available PSD increment (one half the increment is the effective goal for all new source modeling of criteria pollutants, regardless of the size or location of the new source.); and/or 4) cause ground level concentrations which exceed Ohio EPA's maximum allowable ground level concentration (MAGLC) for toxic air pollutants. For criteria pollutants which do not have identified PSD increments, maximum incremental impact of new source emissions is limited to one quarter of the NAAQS.

The combined emission increases from all of the new or modified sources must be evaluated to determine the maximum incremental impact if the total emissions exceed the amounts indicated in Table 3. For criteria pollutants, the incremental impact cannot exceed one half of any PSD increment or, if no PSD increment exists, one quarter of the NAAQS. There is no requirement to model VOC emissions for incremental impact on ozone concentrations (although specific VOC constituents may require air toxic modeling). **For exceptions to the one half PSD increment policy, see Answer 18.**

New or increased emissions of toxics that exceed the levels identified in Table 3 must be evaluated to determine the maximum incremental impact of these emissions for comparison with the MAGLC as described in Ohio EPA's current procedure for reviewing new sources of air toxics.

Where the permit includes both emission increases and decreases (generally restricted to a contemporaneous 5-year period), the net increase should be modeled. Ohio EPA must approve the 'netting' emissions prior to modeling.

Question 2: What models are to be used?

Answer 2: The specific source/receptor situation dictates the appropriate model for determining ambient concentrations for comparison with NAAQS, PSD increments, short or long term exposure limits, etc. The size and complexity of the source, the toxicity of the emissions along with other factors will dictate whether a screening model or a refined model is appropriate.

Screening models are generally the first level tools for evaluating air quality impacts. High predicted concentrations from a screening model may indicate the need for further refined modeling. Larger more significant sources and groups of sources will require the application of a refined model.

Sources in areas where terrain elevation is significant relative to the stack height will require evaluation using receptor elevations. Where terrain exceeds the stack height, a complex or intermediate terrain modeling analysis is necessary. This applies to both criteria and toxic pollutants.

Generally, the most recent version of a model is to be used. The most recent model versions of models contained in The Guideline on Air Quality Models (GAQM) can be obtained by accessing the U.S. EPA Support Center for Regulatory Air Models (SCRAM), Technology Transfer Network at http:\\www.epa.gov\ttn\scram. The SCRAM web page also provides model users manuals, ancillary programs, meteorological data and additional model application information. This Engineering Guide and meteorological data for Ohio sources are available on the Ohio EPA DAPC web page located at http://www.epa.state.oh.us/dapc/aqmp/aqmp.html

Note: The Guideline on Air Quality Models (Appendix W of 40 CFR Part 51) will be revised. AERMOD has been identified as the replacement for the ISC models. Federal guidance has indicated that both AERMOD and ISC will be acceptable for no more than one year after the final rule is published. At which time ISC will no longer be acceptable for PSD and SIP related modeling. Ohio EPA will continue to accept ISC for state-only permits and modeling projects until further notice.

Screening models:

Note: There is currently no screening version of AERMOD to replace SCREEN3. Until further notice, SCREEN3 will still be accepted by Ohio EPA for state-only permit modeling.

The current recommended model for screening point or area sources in simple terrain is the most recent version of SCREEN3 (or its successor), for criteria pollutants or for applications where maximum ambient concentrations of neutral buoyancy pollutants are desired. A fundamental assumption for pollutants being modeled with traditional Gaussian models is that the concentration of the pollutant in the plume will not make the plume disperse or diffuse differently than air.

Applications requiring an evaluation of emergency release scenarios or sources emitting 'light' or 'heavy' plumes may use one of the commercially available toxic release models to determine if ambient impacts exceed the applicable MAGLC. Most routine releases, even of heavy compounds, will have a density close to that of air due to high dilution.

Point sources with stacks less than good engineering height (discussed below) must be evaluated for downwash impacts using the SCREEN3 or SCREEN3C model (or their successors).

Initial screening estimates of source impacts involving intermediate or complex terrain should utilize SCREEN3 or CTSCREEN (or their successors). SCREEN3 is available as an interactive program by itself or within the TSCREEN model set.

The output from these models identifies short term (1-hour) maximum impacts. The following are the conversion factors to be used to convert these short term estimates to the averaging time of concern. Separate conversion factors have been recommended by U.S. EPA for terrain below stack tip (simple terrain) and terrain above stack tip (complex terrain).

Conversion Factors

	Desired Averaging Period						
Model output	1-hr	3-hr	8-hr	24-hr	month	qtr	ann
Simple 1-hr:	1.000	0.900	0.700	0.400	0.180	0.130	0.080
Complex 1-hr	1.000	0.700	0.500	0.150		0.060	0.030

Additional guidance on the use of SCREEN and TSCREEN is provided in Appendix A of this document.

Complex and intermediate terrain screening for state-only permit requirements can also be performed using ISC3 with five years of NWS data.

Refined models:

The most commonly used refined models for point, area and volume sources involving simple, intermediate and complex terrain are the most recent versions of ISCST3 and ISCLT3 (or their successors) using representative meteorological data in the regulatory default modes. Several commercial versions of these models have been granted model equivalency by U.S. EPA and are therefore also acceptable. For refined toxic analyses, the same procedures used for criteria pollutants are used to determine ambient concentrations. There are currently no requirements for deposition calculations. Modeling involving pollutant transformations (ozone, nitrates, sulfates) is not generally required for new or modified sources and is not addressed in this guide.

Question 3: What meteorological data sets are to be used?

Answer 3: Short Term: ISC Data Sets: Hourly surface observations are combined with twice-daily mixing height measurement to create a RAMMET meteorological input file. RAMMET data files can be created using on-site tower measurements or off-site National Weather Service (NWS) surface data sets.

If the modeling is for NAAQS or PSD analyses, at least one year of on-site or the most recent available five years of representative off-site NWS data are required. If the source of concern is located in intermediate or complex terrain, U.S. EPA believes that NWS data are not representative for the above stack portion of the analysis and are therefore not acceptable. For state-only modeling requirements, 5 years of NWS data are considered acceptable for use in a conservative screening analysis.

The most recent five-year off-site NWS data sets currently available from Ohio EPA are for the period 1987-1991. These data are acceptable. Later NWS data are also acceptable but not required. Off-site NWS data sets are assigned by county. Table 1 identifies the appropriate data set for each county in Ohio.

Certain southeastern counties of the state have been assigned Parkersburg/Huntington RAMMET and STAR data for modeling. For counties assigned 'Parkersburg' surface data, 1973-1977 data are the most recent available. This surface site is the most representative available for modeling in this region of Ohio and the older data set is considered more representative for these counties than more recent Huntington or Pittsburgh data.

NOTE: While the State of Ohio accepts NWS data for use in modeling in both simple and complex terrain for state-only modeling requirements, U.S. EPA has a more restrictive interpretation of 'representative' meteorological data when modeling impacts at receptors with elevations above the stack tip. For this and other reasons, it is important when preparing to model major PSD or nonattainment sources, that a protocol is developed and approved to assure that acceptable model calculations will be obtained for each source/receptor relationship.

AERMOD Data Sets: On-site or NWS surface data sets are combined with local surface characteristics and upper air observations within the AERMET preprocessor program to create the needed modeling meteorological data sets for AERMOD. The latest five-year data sets for use in Ohio will be provided on the Ohio EPA web page at http://www.epa.state.oh.us/dapc/aqmp/aqmp.html after Appendix W is finalized and final guidance is issued by U.S. EPA.

Long term: Long term (e.g., monthly, quarterly, annually) meteorological data sets are developed from short term on-site or off-site (NWS) surface data sets. These long term STAR (STability ARray) data sets are necessary to run ISCLT3 or other ISCLT3-based long term models.

ISCST3 and AERMOD can also be used for long term modeling periods by modeling specific blocks of days and selecting appropriate n-day average concentrations.

Question 4: What modeled emission rate(s) should be used?

Answer 4: Tables 9-1 and 9-2 in the Guideline on Air Quality Models (Appendix W of 40 CFR Part 51) identify the various emission rates to be used in modeling a source. In general, the short term maximum potential (allowable) emission rate is used in the evaluation of a short term standard. For an existing source, a representative long term actual emission rate can be used to evaluate a longer term (quarterly or annual) standard. An annual permit restriction can also be used to develop a long term average emission rate to be used in evaluating a long term standard for a new source.

For state permit modeling, including Ohio air toxics modeling, the peak short term increase which the permit will allow is the emission rate to be modeled to determine the peak ambient impact this permit action will allow. This could involve the combined peak impact of several sources if there are several sources included in the same project.

For a federal netting or synthetic minor permit, the difference between existing actual~~s~~ emissions and permit allowable emissions, as determined in the netting calculation, is modeled for comparison to the Ohio acceptable incremental impacts. For state-only netting modeling evaluations, the allowable to allowable difference is usually acceptable. For PSD or federal netting, though, modeled emissions should be consistent with the netting evaluation performed for the permit.

For a modification which involves an emission increase only, the net change allowed by the permit is evaluated. For PSD and other federal analyses, the net change is the difference between the existing actual emissions and the new potential allowable emissions. For state-only review, modeling the difference in allowables is usually acceptable.

For a modification involving a change in stack parameters which could increase the ambient impact due to the source(s), the emissions affected by the modification (potential allowable) are modeled to determine if the impact of the modification is below the Ohio acceptable incremental impacts. If necessary, the present (before modification) emissions can be modeled as negatives in a refined analysis to determine the net impact of the permitted modification for comparison to the Ohio acceptable incremental impacts.

Like-kind replacements would not need modeling if all emissions parameters remain the same since there would be no increase in impact due to the permit action. If, however, the replacement involves the use of a shorter stack, lower temperatures, etc., the replacement may cause an increased peak impact which would need evaluation. As noted above, if the replacement, when viewed alone, exceeds the Ohio acceptable incremental impacts as identified in Table 3, the source being replaced can be modeled with a negative emission rate in a refined modeling analysis to determine the net peak impact for comparison to the Ohio acceptable incremental impacts. Also, see Question 14 for additional information on emission inventories.

Question 4.1: Are fugitive emissions modeled?

Answer 4.1: Major new source PSD and Nonattainment Review includes all significant sources, including fugitive sources such as storage piles and roadways.

In minor source state permit modeling, though, only the boiler or process source criteria and toxic emissions increases (both controlled and fugitive) are to be modeled. Non-process fugitive sources such as roadways and parking lots, material storage and material transfer operations are not modeled. Grinding, crushing, mixing and screening operations are considered processes and should be modeled. An evaluation of all project emissions may be required in a state analysis if circumstances warrant.

Question 4.2: Are there any exceptions to the modeling thresholds for modeling criteria pollutants and toxics contained in Table 3?

Answer 4.2: There are several new source emissions scenarios which Ohio EPA has historically not reviewed for state-only permits. These scenarios generally involve fugitive emissions from parking lots, roadways, material handling and storage piles. These scenarios usually represent situations where modeling results often indicate potential problems due to unreliable emission factors and/or unusual or extreme source configurations. Field experience with these sources, though, indicates that normal operating practices and compliance with required controls result in acceptable ambient impacts as demonstrated by ambient monitoring, field measurements of visible emissions or a lack of verified complaints by local citizens.

Therefore, the following list of source/pollutant scenarios will not be required to perform an air quality analysis in support of a state-only permit **unless factors such as source size, tons of emissions, particle size, pre-existing concerns or proximity to other sources or citizen populations indicate that a modeling review is warranted**:

Toxic or criteria pollutants from parking lots
Toxic or criteria pollutants from storage piles
Toxic or criteria pollutants from storage tanks
Toxic or criteria pollutants from transfer operations
Toxic or criteria pollutants from grain silos or dryers

Toxic or criteria pollutants from emergency generators
Toxic or criteria pollutants from gasoline dispensing

In addition, the following pollutants will be treated as PM but not as a toxic for modeling purposes:

Wood dust
Sand
Glass dust
Coal dust
Silica
Grain dust

Source/Toxic Pollutant combinations subject to a MACT, NESHAP or an NSPS that would restrict the amount of that pollutant that could be released are not subject to toxics modeling. Toxics modeling is also not required for pollutants subject to a NAAQS (e.g., lead).

Question 4.3: Should sources be modeled that emit pollutants listed in the ACGIH book, do not have a TWA, but do have a Ceiling or STEL?

Answer 4.3: Yes, pollutants not having a listed TWA are addressed by multiplying the Ceiling or STEL by 0.737 and then following the procedures in 'Option A' to develop a MAGLC.

Question 4.4: Are minor and exempt sources included in the modeling for a project which exceeds the thresholds in Table 3?

Answer 4.4: All sources or units contained in the permits that make up a project are initially considered significant with respect to the potential impact due to the project. Many small sources, while individually insignificant, could combine to cause or contribute to an ambient problem. Smaller sources can be removed from the modeling analysis if it can be demonstrated that their emissions are insignificant relative to the rest of the project.

Question 4.5: Do you model sources within a building that have no direct vent to the outside or do not have an identified control device for capture, control and release of the emissions from the unit?

Answer 4.5: Sources can be located within an enclosure or building with no obvious control and/or vent moving the emissions to the outside. It must be assumed that all emissions coming from the device are either captured and controlled or are escaping to ambient air. If they are not being captured and controlled (with the cleaned air being reintroduced to the work area), the emissions must be escaping the building and the modeler must determine how the emissions are being removed from the building or enclosure to the ambient air. The emission rate leaving the building or enclosure is assumed to be the same as the emission rate from the source(s). Any credit for some portion of the emissions being retained in the building due to "building capture" must be supportable and will be evaluated on a case-by-case basis.

Often the emissions are removed by the building ventilation system. In other situations, the only exchange between indoor and outdoor air occurs through open doors and windows. In any event, the modeler must identify the egress point(s) and characterize the releases as one of the available modeling release scenarios (i.e., point, area or volume). If best engineering judgement justifies assigning a fraction of the total emissions through specific egress points, the individual points can be modeled with their assigned emission rates. When using a single source screening model, the individual modeled peaks are then added together.

If it is unclear which potential egress point the emissions are actually venting through, the worst case egress point is assumed. If it is not clear which egress point is worst case, each scenario should be tested.

Question 5: Is building downwash required for state modeling?

Answer 5: Any stack source file must include building dimension data if the stack is not at or above good engineering practice (GEP) stack height. GEP is determined by evaluating all nearby structures using the formula GEP = H + 1.5L where H is the height of the structure and L is the lesser of the height or projected width of the structure. The GEP height is the highest height calculated for any nearby structure (a structure is 'nearby' if it is within five times the lesser of its height or width from the stack). If direction specific building dimensions (discussed below) are not calculated, the most conservative dimensions should be used for all directions. The most conservative building dimensions are usually associated with the height and diagonal width of the tallest nearby building.

Direction specific building dimensions may be determined for 36 wind directions for ISCST or AERMOD and 16 wind directions for ISCLT. This allows the model to include the effects of the critical structure for each wind direction. Direction specific building dimensions are calculated using facility plot plans and manually determining the dominant structure dimensions for each wind direction for each stack. Alternatively, the BPIP program provided by the U.S. EPA as well as several commercial software packages are available which will calculate the dimensions for each wind direction from a single building or group of buildings for each stack.

Buildings with multiple segments can be viewed as multiple buildings. For example, a predominantly flat one story building is interrupted by a three-story tower, the flat, one story building is evaluated and the 'four story' building (1 + 3), with lateral dimensions of the tower is also evaluated.

Building dimensions are not contained in state or federal emissions data bases. These data need to be obtained from facility personnel if sources at that facility are subject to building downwash. Distant background sources might be modeled without downwash with Ohio EPA permission since this would most likely maximize those sources' impact in the study area and therefore be 'conservative'.

Question 5.1: What building height do I use if the building has a pitched roof?

Answer 5.1: Pitched roofs present a nonstandard modeling scenario. The horizontal dimensions at the peak are reduced to a single line. A conservative approach is to assume that the entire horizontal dimensions are covered by a flat roof at the elevation of the peak of the pitched roof. An acceptable alternative is to assume a building height one half the distance up the pitched roof and the corresponding horizontal dimensions below that 'roof' (i.e., one horizontal dimension would also be halved).

Question 7: Is there any special guidance for nonstandard point source emissions?

Answer 7: Nonstandard source emissions are not specifically addressed in the above screening or refined models. For example, if emissions do not exit the stack in an upward (vertical) direction, alternative characterizations of the source should be developed to more accurately represent the release point. If a 'point source' is still assumed, even though the exit velocity is blocked or diverted sideways or downward (such as in a rain cap, discussed below), an exit velocity of 0.001 m/s should be input to the model so that a fictitious upward momentum is not credited to that source.

If the temperature of the release is near ambient, a characterization as an area or volume source might be appropriate. If temperature is significant, a virtual stack might be created to represent the emission point. Alternative characterizations should be discussed with Ohio EPA staff prior to modeling.

Question 7.1: How do I model rain caps and horizontal releases?

Answer 7.1: U.S. EPA has provided a specific solution to address hot stack plumes that are interrupted by a rain cap or which are released horizontally. U.S. EPA requires that these sources reduce their stack exit velocity to 0.001 m/s.

While it would be conservative to simply reduce the velocity, the source would lose the effect of the buoyancy that the volume of hot gas would normally have. The Ohio EPA recommended adjustment provides for retention of the buoyancy while addressing the impediment to the vertical momentum of the release. The procedure is as follows (stack parameters' units are assumed to be in metric units):

1) The stack exit velocity (V_s) is set equal to 0.001 m/s (V_s')

2) Stack diameter (d_s) is adjusted using the equation

$$d_s' = 31.6 * d_s * (V_s)^{0.5}$$

(Where V_s is the actual stack exit velocity, <u>NOT</u> 0.001 m/s)

3) Use V_s' and d_s' in the model

The results of this approach can create an extremely large modeled stack diameter. Receptors should not be placed within the calculated diameter, d_s'.

Question 7.2: How do I model flares?

Answer 7.2: For screening purposes, the flare option in SCREEN3 or TSCREEN is acceptable. For refined modeling, it is necessary to compute equivalent emission parameters, i.e., adjusted values of temperature and stack height and diameter. Several methods appear in the literature, none of which seems to be universally accepted. Ohio EPA/DAPC has used the following procedure, which is believed to be consistent with SCREEN3:

1) compute the adjustment to stack height as a function of heat release Q in MMBtu/hr:

$$H_{equiv.} = H_{actual} + 0.944(Q)^{0.478} \quad \text{(a)}$$

Where H has units of meters;

2) assume temperature of 1273 deg. K;

3) assume exit velocity of 20 meters/sec;

4) assume the following buoyant flux:

$$F_b = 1.162(Q)$$

5) back-calculate the stack diameter that corresponds to the above assumed parameters. Recall the definition of buoyant flux:

$$F_b = 3.12(V)(T_{stack} - T_{ambient})/T_{stack}$$

Where V is the volumetric flow rate, actual m^3/sec.

Substituting for F_b and solving for the equivalent stack diameter $d_{equiv.}$:

$$d_{equiv.} = 0.1755(Q)^{0.5}$$

This method pertains to the "typical" flare, and will be more or less accurate depending on various parameters of the flare in question, such as heat content and molecular weight of the fuel, velocity of the uncombusted fuel/air mixture, presence of steam for soot control, etc. Hence, this method may not be applicable to every situation, and the applicant may submit his own properly documented method.

(a) Beychok, M., 1979. Fundamentals of Stack Gas Dispersion, Irvine, CA.

Question 7.3: What special modeling considerations are necessary for modeling combustion turbines?

Answer 7.3: Combustion turbines are unique in that stack temperatures and flow rates, as well as emission rates, are dependant on ambient conditions, especially ambient temperature. Determining a worst case operating scenario resulting in peak source impacts involves evaluating the source at multiple loads (50%, 75% and 100%) as well as average and extreme ambient temperatures. Three general approaches are normally followed to establish the worst case operating scenario. The approaches described below address a PSD application.

<u>Approach 1:</u> Each scenario is modeled using SCREEN3. If each scenario results in insignificant impact, then the demonstration is complete. If one or more scenarios result in significant impact, the worst case scenario is carried forward into the PSD and NAAQS analyses using ISC or AERMOD. If there is no clear cut worst case scenario, multiple scenarios may need to be carried forward into the subsequent comprehensive analyses. All other things being equal, it is preferable to move forward with a 100% load scenario rather than a reduced load scenario.

<u>Approach 2:</u> Each scenario is modeled with ISC or AERMOD using the latest year of meteorology. The worst case scenario(s) is then run with five years of meteorology to determine if the proposed project will have a significant impact. If there is a significant impact, then the worst case scenarios are carried forward into the PSD and NAAQS analyses.

<u>Approach 3:</u> Worst case emission rates and stack parameters from all scenarios are used to estimate a worst case impact. This virtual worst case stack can be used through all phases of the analysis.

The same approaches can be followed for state-only (e.g., synthetic minors) modeling, with the only goal to be achieved being the Ohio Acceptable Incremental Impacts.

Question 9:What receptor grids must I use?

Answer 9: Sufficient receptors are necessary in the vicinity of projected maximum concentrations to assure that the peak concentration(s) has been found. For most applications, the spacing should be 100 meters at the 'hotspot', determined from the preliminary modeling results (either ISC, AERMOD or a screening model), out to a distance sufficient to assure that the maximum concentration has been found. Additional receptors should also be placed in areas of special concern (e.g., areas of source interaction and areas of significant terrain). It is also important that the extent of the grid covers the entire area of significant impact from the proposed project.

Receptor elevations are required unless a demonstration that the study area is flat is made. The absence of terrain above stack height is not sufficient to ignore terrain heights. 'Simple' terrain does not mean 'flat' terrain. Topographical data indicating no significant terrain features in the expected significant impact area of the source(s) or indicating flat but gently sloping terrain could justify not including terrain heights for the receptors in that study area.

Receptor elevation information as well as source and receptor location information can be derived from information contained on United States Geological Service topographical maps as well as from internet sources such as www.topozone.com. Information is also available from Digital Elevation Model (DEM) files which are also available from various host sites on the internet. DEM files are available free of charge at http://data.geocomm.com/dem/.

AERMOD receptor grids must be exclusively developed using the AERMAP preprocessor using DEM data. Receptor information must contain calculated information concerning the relative height of the nearby terrain (receptor height scales) in addition to the location and elevation of the receptor.

Question 10: What are the state significant emission rates which trigger modeling?

Answer 10: A comprehensive list of emission rates which trigger state and federal modeling requirements is contained in Table 3 under the heading "Ohio Modeling Significant Emission Rates." The emissions increase which will be allowed by this permit action (potential allowable increase) are compared to these levels.

Question 10.5: Can a source modification trigger a requirement for modeling even where there is no increase in emission rate?

Answer 10.5: OAC 3745-31-01(VV)(1)(b) defines "modification" to include "Any physical change in, or change in the method of operation of any significant air contaminant source that, for the specific air contaminant . . . for which the source is classified as significant, results in an increase in the ambient air quality impact . ." greater than certain values specified in the rule. Thus, if the source is "significant" (as defined in OAC 3745-31-01(RRR)) and the proposed incremental impact at any receptor exceeds the specified value (listed under the "3745-31-01(VV)(1)(b)" heading in Table 3) then the change is a modification requiring a permit-to-install, notwithstanding the fact that it may entail no increase in emissions.

It should be kept in mind that the provisions for OAC 3745-31-01(VV)(1)(b) were promulgated for the sole purpose of ensuring that the ambient air quality standards are protected. If this provision is triggered, BAT is not required. Also, this provision is not required under any federal regulation and has not been submitted to U.S. EPA for approval as part of the SIP.

It should also be noted that the concentrations in (VV) are only trigger concentrations and are not maximum allowable impacts. The ambient air quality standards and, if applicable, the PSD increments would be the limiting factor.

An example is a coal-fired boiler where a scrubber is proposed to be installed to remove sulfur dioxide. Even though the actual and allowable emissions of NOx might not increase, the reduced stack temperature and velocity associated with the scrubber could result in an increase of ambient concentration at some receptor exceeding the 15 ug/m^3 limit under (VV)(1)(b), thereby triggering the requirement to obtain a PTI before beginning construction. Another example is any reduction of stack height. For either example the need for modeling is apparent, to resolve the PTI question. A screening model may be used, or if a refined model is selected, the controlling concentration will be the high-high increase of concentration anywhere on the receptor grid, for the relevant averaging period, using five years of off-site or one-year of on-site meteorological data.

Question 11: What are the state target concentrations for acceptable incremental impacts?

Answer 11: Table 3 also contains a listing of national ambient air quality standards and PSD increments as well as state target ambient concentrations for criteria pollutants and specific toxic emissions subject to the state air toxic policy. The state target concentrations for criteria and toxic pollutants listed under the heading "Ohio Acceptable Incremental Impact" represent the acceptable incremental impact of the new emissions which are the subject of a state permit requirement. The Ohio significant impacts under OAC 3745-31-01 (VV)(1)(b) identify modeled impact levels which trigger permit to install requirements for a source modification (including stack height changes).

Question 12: What special requirements exist for sources of fluoride?

Answer 12: The potential for secondary impacts due to fluorides is greater than the probability for primary human health effects. Therefore, there may be observable impacts and actual complaints of damage to plants and property when the MAGLC has not been exceeded.

The approach to follow when evaluating the secondary impacts due to fluorides is as follows. The secondary ' target' is 0.5 ug/m^3 as a 30-day average. The screening approach is to model a 1-hour concentration using SCREEN and convert it to a 'monthly' average using the 0.18 conversion. Monthly averages can also be modeled directly using ISCST or ISCLT or AERMOD. The incremental impact of the new emissions is modeled.

This 'secondary' approach would also be appropriate for any other pollutants where it is determined that there may be significant non health related impacts at levels below the MAGLC.

Question 13: How do I obtain background values when performing NAAQS analyses in Ohio?

Answer 13: Modeling analyses which must estimate total concentrations of a pollutant (e.g., PSD analyses which evaluate the NAAQS) must account for those sources which are either too small or too distant to be included in the modeling analysis. This is accomplished by adding a background value to the modeled concentrations.

A separate background value is needed for each NAAQS pollutant and for each NAAQS averaging time. Actual monitored data for the most recent year, from a representative monitoring site(s) are the basis for acceptable background values. Ideally, the monitor should not be impacted by any major sources or any local smaller sources. If an unimpacted monitor is available, the second highest value for each short-term period would represent the short term backgrounds. The annual average is the annual background. The highest quarterly average would be used for lead.

If an unimpacted monitor is not available, nonimpacted values from monitors which are near a limited number of sources and which have nonimpacted sectors (no upwind sources) can be used to develop background values. **Unadjusted impacted monitor values can also be used as a conservative background**.

A nonimpacted value is a monitored value measured during a period when the wind was not blowing from a 90-degree sector centered on a line between the monitor and the potentially impacting source. For a 3-hour value, no winds should be from the impacting sectors. For 24-hour values, no more than two hours should have winds from the impacting sectors. For short term backgrounds, the second highest nonimpacted value is chosen as a fixed background. Long term background values are the average of the nonimpacted values for the specific averaging time period.

Question 14: What sources do I include in a major source PSD and/or NAAQS analysis?

Answer 14: Major Source NAAQS Analysis: All sources within the significant impact area (SIA) of the emissions increase with potential allowable emissions greater than the PSD significant emission rates (listed in Table 3), must be included in a new source review NAAQS analyses. SIA is defined as the region over which any exceedance of a PSD significant impact increment (listed in Table 3) occurs, based on each high-high concentration over five years of modeling (one year if on-site, representative data are available). In addition, all major sources with potential allowable emissions greater than 100 tons/yr outside of the SIA and within 50 km must also be included if they interact with the new source.

Whether to include a potentially interacting source can be determined using the '20D' approach. Under this approach, the modeler may exclude sources whose potential allowable emissions in tons/yr are less than 20 times the distance between the two sources in kilometers. Prior to commencement of final modeling, though, Ohio EPA must be advised as to what sources the modeler chooses to exclude using the 20D method. Ohio EPA reserves the right to require any or all of these sources to be included in a final analysis if Ohio EPA believes that any or all are potentially significant.

Major Source PSD Increment Analysis: All PSD sources located within an area where PSD baseline has been triggered or within the SIA of the new source, whichever is larger, must be included in the PSD increment analysis modeling inventory. PSD sources located outside of the baseline area or SIA which interacts with the new source must also be included. These sources may be screened using the 20D approach.

Inventory data should be obtained from the state emissions inventory system or the AIRS national data base system. Basic modeling source parameters (stack height or release height, diameter, temperature, exit velocity or volume flow, emission rate, etc.) are contained in these data systems.

The DAPC emissions inventory unit has placed several data sets on the Ohio EPA web page at: http://www.epa.state.oh.us/dapc/aqmp/eiu/eiu.html. While the later data sets have significant amounts of current information, it is important to check the 1990 and 1995 data bases which contain information on short term allowable emission rates.

The short term allowable rates and source capacities are included in these earlier data sets. These are important for determining maximum short term allowable emission rates for the significant sources consistent with Section 9.1 of the GAQM. If source information is missing or is suspect, you will need to contact the local air pollution agency or field office to obtain current, correct information.

Question 15: How do I model major sources in nonattainment areas to demonstrate net air quality improvement?

Answer 15: OAC 3745-31-25 discusses the requirements for determination of net air quality benefit for major sources wishing to locate in a nonattainment area (NAA). Both the rule and U.S. EPA guidance indicate the need for demonstrating area-wide benefit and progress toward attainment.

VOC emissions are not required to be modeled for net air quality benefit. All major PM and SO2 emissions increases and corresponding offsetting emissions will need to be modeled for a net air quality benefit. The entire state is attainment for CO, NOx and Pb so no net air quality benefit modeling is required.

In general, PM and SO2 NAAs have undergone SIP modeling at some time and the state has identified receptor areas which were key for the SIP attainment demonstrations. In cases where the potential offsets could impact critical receptors, those receptors must show impacts less than or equal to zero. For the remaining receptors, the receptors within the significant impact area of the increasing emissions must, on average, show no net increase for each averaging period.

If greater than zero impacts at critical receptors or net area-wide increases are modeled, the applicant may present a complete NAAQS demonstration for the significant impact area of the project.

Question 16: Can I use SCREEN to model multiple sources?

Answer 16: While the SCREEN model is a single-source model, it can be used to develop a conservative estimate of the peak potential impact of emissions from multiple egress locations.

A conservative approach combines the peak impact from each individual SCREEN run as if the peak impact from each emission point occurred at the same point in space.

In the case of multiple identical stacks, all of the emissions can be assumed to come from one stack (modeled using the combined emission rate with the stack flow parameters for a single stack).

If the egress points are not identical, all of the emission could be to assume to be emitted from the 'worst case' emission point. Sometimes the determination of worst case is straightforward (e.g., shortest, coldest, lowest flow stack). In other situations, the choice may not be clear and the Local Air Agency, District Office or Central Office should be consulted.

The approaches described above will result in conservative estimates. If the source(s) does not pass using the above assumptions, less conservative approaches can be considered in consultation with the Local Air Agency, District Office or Central Office. A multisource refined model may also be appropriate to use to model the actual separation of emission points and estimate their combined peak impact.

Question 17: If multiple pollutants are being emitted, does an individual model run have to be performed for each pollutant?

Answer 17: If the emission characteristics are identical for each pollutant (all of the pollutants are emitted in the same proportion from each of the egress points) one run can be performed and the results can be adjusted. Gaussian models such as AERMOD, SCREEN and ISC are 'linear' models in that the impacts will vary proportionally to the emission rate. Therefore, in this example case, if one pollutant is being emitted at twice the rate of another pollutant, the impact of the second pollutant will be twice as high.

In the case of multiple pollutants being emitted from a single emission point, an emission rate of 1 gram per second can be modeled and the results multiplied by each allowable emission rate (expressed in grams per second) to determine the predicted ambient concentration of each of the pollutants.

If emission characteristics vary for different pollutants, or the pollutants do not vary proportionately from each egress point, then a separate modeling analysis for each pollutant is necessary.

Question 18: For PSD and non-PSD sources, can facilities be installed if modeling shows that more than ½ the available PSD increment is consumed?

Answer 18: The purpose of PSD is to keep clean areas clean. The intent of the one half increment portion of the policy is to allow future growth by preventing any single emissions increase from consuming all of the available increment.

Non-PSD sources still consume increment and increase background concentrations. Therefore, these emissions can also threaten future growth.

As such, it is Ohio EPA's practice that any new source, whether PSD or not, will not consume more than one half the available PSD increment (In application, state-only permits do not involve modeling which would assess available increment, therefore, one half the increment is the effective goal.) .

In some cases, Ohio EPA will grant exceptions to this policy for new PSD or non-PSD sources where modeling predicts exceedances of one half of, but less than 83 percent of the available increment. (For example: If the available increment were 30 ug/m3, between 15 and 25 ug/m3.) Exceptions will be granted on a case-by-case basis (but only when public health will not be adversely affected or where modeling ~~is~~ results are suspect). The following are examples of where exceptions will be granted:

1) Modeling shows that the exceedance of the one half of the available increment occurs in a very localized area near the emissions source either due to the source parameters or due to downwash and, in the Ohio EPA's judgement, it is unlikely that other new sources located near the facility will significantly impact the same exceedance locations. In other words, if it is unlikely that another source would be negatively impacted by the exceedance then the Ohio EPA may grant the exception. An example of this would be a fugitive source with low release points having close proximity maximum impact areas that in the Ohio EPA's judgement would not be areas that other facilities would impact.

2) If the source is located such that it is unlikely in the Ohio EPA's judgement that any other major source would locate in the same area (for instance, in an extremely remote, rural area).

3) If the source is temporary and the increment consumed will become available in the near future for future growth (for instance, at a clean up site where the source will be operated for only a couple of years.)

4) If the source is locating in a 'brownfield' area and otherwise would locate in a greenfield site.

Question 19: What determines whether a locale is rural or urban?

Answer 19: The Guideline on Air Quality Models-(Appendix W of 40 CFR Part 51) outlines two methods by which an area can be categorized as either 'urban' or 'rural'. These methods rely on evaluating either the land use or population density within a three-kilometer radius circle around the subject source. Either of these methods is acceptable for the determination of the proper classification for that source, although the land use approach is preferred.

In Ohio, many counties have had significant SIP development modeling performed which included sources from across the county. Due to the inability of the models used to incorporate both rural and urban in a single run, a single, predominate classification was assigned for the entire county. Therefore, if multiple facilities over a wider area are being modeled as part of a PSD or NAAQS analysis, the Central Office should be consulted as to the historic classification for the overall analysis so that a consistent approach will be maintained.

WFS/JTT/wfs

July 1, 2003

TABLES

Table 1

METEOROLOGICAL ASSIGNMENTS

(meteorological years 1987-1991 unless otherwise specified)

COUNTY	SURFACE	MIXING HEIGHT
ADAMS	Huntington	Huntington
ALLEN	Dayton	Dayton
ASHLAND	Akron	Pittsburgh
ASHTABULA	Erie	Buffalo
ATHENS	Parkersburg	Huntington (1973-1977)
AUGLAIZE	Dayton	Dayton
BELMONT	Pittsburgh	Pittsburgh
BROWN	Cincinnati	Dayton
BUTLER	Cincinnati	Dayton
CARROLL	Pittsburgh	Pittsburgh
CHAMPAIGN	Dayton	Dayton
CLARK	Dayton	Dayton
CLERMONT	Cincinnati	Dayton
CLINTON	Cincinnati	Dayton
COLUMBIANA	Pittsburgh	Pittsburgh
COSHOCTON	Columbus	Pittsburgh
CRAWFORD	Columbus	Dayton
CUYAHOGA	Cleveland	Buffalo
DARKE	Dayton	Dayton
DEFIANCE	Fort Wayne	Flint
DELAWARE	Columbus	Dayton
ERIE	Cleveland	Buffalo
FAIRFIELD	Columbus	Dayton
FAYETTE	Columbus	Dayton
FRANKLIN	Columbus	Dayton
FULTON	Toledo	Flint
GALLIA	Huntington	Huntington
GEAUGA	Cleveland	Buffalo
GREENE	Dayton	Dayton
GUERNSEY	Pittsburgh	Pittsburgh
HAMILTON	Cincinnati	Dayton
HANCOCK	Toledo	Dayton
HARDIN	Dayton	Dayton

METEOROLOGICAL ASSIGNMENTS

HARRISON	Pittsburgh	Pittsburgh
HENRY	Toledo	Flint
HIGHLAND	Cincinnati	Dayton
HOCKING	Columbus	Huntington
HOLMES	Akron	Pittsburgh
HURON	Cleveland	Buffalo
JACKSON	Huntington	Huntington
JEFFERSON	Pittsburgh	Pittsburgh
KNOX	Columbus	Dayton
LAKE	Cleveland	Buffalo
LAWRENCE	Huntington	Huntington
LICKING	Columbus	Dayton
LOGAN	Dayton	Dayton
LORAIN	Cleveland	Buffalo
LUCAS	Toledo	Flint
MADISON	Columbus	Dayton
MAHONING	Youngstown	Pittsburgh
MARION	Columbus	Dayton
MEDINA	Akron	Pittsburgh
MEIGS	Parkersburg	Huntington (1973-1977)
MERCER	Fort Wayne	Dayton
MIAMI	Dayton	Dayton
MONROE	Parkersburg	Pittsburgh (1973-1977)
MONTGOMERY	Dayton	Dayton
MORGAN	Parkersburg	Huntington (1973-1977)
MORROW	Columbus	Dayton
MUSKINGUM	Columbus	Pittsburgh
NOBLE	Parkersburg	Pittsburgh (1973-1977)
OTTAWA	Toledo	Flint
PAULDING	Fort Wayne	Dayton
PERRY	Columbus	Huntington
PICKAWAY	Columbus	Dayton
PIKE	Huntington	Huntington
PORTAGE	Akron	Pittsburgh
PREBLE	Dayton	Dayton
PUTNAM	Fort Wayne	Dayton
RICHLAND	Columbus	Dayton
ROSS	Columbus	Dayton

METEOROLOGICAL ASSIGNMENTS

SANDUSKY	Toledo	Flint
SCIOTO	Huntington	Huntington
SENECA	Toledo	Dayton
SHELBY	Dayton	Dayton
STARK	Akron	Pittsburgh
SUMMIT	Akron	Pittsburgh
TRUMBULL	Youngstown	Pittsburgh
TUSCARAWAS	Akron	Pittsburgh
UNION	Columbus	Dayton
VAN WERT	Fort Wayne	Dayton
VINTON	Huntington	Huntington
WARREN	Cincinnati	Dayton
WASHINGTON	Parkersburg	Huntington (1973-1977)
WAYNE	Akron	Pittsburgh
WILLIAMS	Toledo	Flint
WOOD	Toledo	Flint
WYANDOT	Columbus	Dayton

Table 2

National Weather Service Anemometer Heights and Station Number

Site	Anemometer Height	Station Number
Akron/Canton	20 feet	14895
Cincinnati/Covington	20 feet	93814
Cincinnati/Abbe Obs.	51 feet	93890
Cleveland	10 meters	14820
Columbus	20 feet	14821
Dayton	22 feet	93815(surface)
Dayton (Wright Pat)	NA	13840(upper air)
Mansfield	20 feet	14891
Toledo	30 feet	94830
Youngstown	20 feet	14852
Buffalo, NY	10 meters	14733
Erie, Pa.	20 feet	14860
Flint, Mi.	21 feet	14826
Fort Wayne, In.	20 feet	14827
Huntington, WV	20 feet	03860
Charleston WV	117 feet	13866
Elkins WV	20 feet	13729
Pittsburgh, Pa.	20 feet	94823
Parkersburg, WV	100 feet	13867

Table 3
Federal and State Modeling Standards and Significant Emission Rates

POLLUTANT	AVERAGING PERIOD	National Ambient Air Quality Standards (NAAQS) (ug/m^3)		CLASS II PSD INCREMENTS	PSD SIGNIFICANT EMISSION RATES	PSD SIGNIFICANT IMPACT INCREMENTS	PSD MONITORING DE MINIMIS CONC	OHIO MODELING SIGNIFICANT EMISSION RATES	OHIO SIGNIFICANT IMPACTS UNDER 3745-31-01(vv)	OHIO ACCEPTABLE INCREMENTAL IMPACT
		PRIMARY	SECONDARY	(ug/m^3)	(tons/year)	(ug/m^3)	(ug/m^3)	(tons/year)	(ug/m^3)	(ug/m^3)
PM10	Annual	50 a	c	17 a	15	1 h	-	10		8.5 a
	24-Hour	150 b	c	30 b	–	5 h	10 h	–	10 (24-hr TSP) i	15 b
Sulfur Dioxide	Annual	80 a	c	20 a	40	1 h	–	25		10 a
	24 Hour	365 b	c	91 b	–	5 h	13 h	–	15 i	45.5 b
	3-Hour	–	1300 b	512 b	–	25 h	–	–		256 b
Nitrogen Dioxide	Annual	100 a	c	25 a	40	1 h	14 h	25	15 (24-hr) i	12.5 a
Ozone	1-Hour	244 d	c	–	40 e	–	–			
Carbon Monoxide	8-Hour	10,000 b	c	–	100	500 h	575 h	100	575ia	2500 b
	1-Hour	40,000 b	c	–	–	2000 h		–		10000 b
Lead	Calendar Quarter	1.5 a	c	–	0.6	–	0.1 h	0.6	0.1 i	0.375 a
Toxics Listed by ACGIH f	1-Hour	–	–	–	–	–	–	1		g, a

a Concentration not to be exceeded
b Concentration not to be exceeded more than once per year
c Same as primary NAAQS.
d Not to be exceeded on more than one day per year, three year average.
e Emissions of volatile organic compounds.
f Any toxics included in the latest handbook of The American Conference of Governmental Industrial Hygienists.
g Value calculated by procedure outlined in current version of the Ohio EPA Division of Air Pollution Control document entitled "Review of New Sources of Air Toxic Emission"
h Peak concentration.
I Concentration that initiates PTI requirements

Appendix A

SCREEN/TSCREEN
Model Application Guidance

The type of SCREEN source to be chosen is dependant on how the emissions leave the source (if the source is not enclosed) or how they leave the building or enclosure if emitted within a building or enclosure. Once the egress points are identified and characterized, one of the following source types is applied to the emissions at the point of egress (stack, window, vent, etc.)

The following information identifies the SCREEN/TSCREEN model choices to be used when modeling for Ohio new source review. Since the TSCREEN model does not directly identify which release scenarios lead to the use of the SCREEN model, "TSCREEN pathways" are identified to assist TSCREEN users in making scenario choices that will lead to the SCREEN model and the desired source type.

Point Source

TSCREEN pathways; There are several TSCREEN release scenarios which utilize the SCREEN3 point source option including Gaseous Release Type, Stacks, Vents, Conventional Point Sources or Particulate Matter Release Type, Stacks, Vents.

- Emission rate (g/s)
- Stack Height (above ground, not roof (m))
- Stack inside diameter (m, diameter of equivalent area circle if stack is not round)
- Stack exit velocity (m/s) or flow rate (ACFM or m^3/s)
- Stack gas temperature (K)
- Ambient temperature (use default of 293 K)
- Receptor height above ground (use 0, ground level)
- Urban/Rural (based on land use within 3 km of the source)
- Building downwash (Building information is necessary if stack is within the influence of a building: i.e., within five times the lesser building dimension)
- Do not consider building cavity calculations. **Note:** After mmm dd, 2002, AERMOD will replace ISC and be the only acceptable refined model. This model does incorporate building wake and cavity effects. After mmm dd, 2002, users of SCREEN will also need to consider the building cavity calculations when determining peak impacts.
- Complex terrain (yes if terrain above stack height is present in the potential impact area of the source)
- Simple or flat (yes for simple: if terrain above stack base is present in the potential impact area of the source. When in doubt, say yes and perform the analysis)
- Choice of meteorology (option 1, full meteorology)
- Automated distance array (yes, minimum distance (m) begins at "ambient air" (usually the fence line) and should extend to a point which ensures that the

maximum concentration has been found, up to a maximum of 50,000 m)
- Discrete distance option (used for informational purposes only)
- Fumigation Option (fumigation calculations are not used for state permit modeling)

Area Source

TSCREEN pathway; There are several TSCREEN pathways which utilize the SCREEN3 area source option including Particulate Matter Release Type, Fugitive/Windblown Dust Emissions or Storage Piles or Gaseous Release Type, Multiple Fugitive Sources. The TSCREEN pathways **do not** allow the characterization of non-square area sources which is now an option with SCREEN3.

General option choices are the same as for point source except for the following;
- Emission rate (g/s/m^2)
- Source height (mean height of source, m)
- Length of longer side of rectangular area, (m)
- Length of shorter side of rectangular area, (m)
- Wind direction search (yes)

Volume Source

TSCREEN pathway:(the SCREEN volume source option is not available through TSCREEN)

General options choices are the same as for point source except for the following;
- Initial lateral dimension (modified per table below (m))
- Initial vertical dimension (modified per table below (m))
- Height of release (the midpoint of the opening (m))

SUMMARY OF SUGGESTED PROCEDURES FOR ESTIMATING
INITIAL LATERAL DIMENSIONS (σ_{yo}) AND
INITIAL VERTICAL DIMENSIONS (σ_{zo}) FOR VOLUME SOURCES

Description of Source	Initial Dimension
(a) Initial Lateral Dimensions (σ_{yo})	
Single Volume Source	σ_{yo} = length of side divided by 4.3
(b) Initial Vertical Dimensions (σ_{zo})	
Surface-Based Source ($h_e \sim 0$)	σ_{zo} = vertical dimension of source divided by 2.15
Elevated Source ($h_e > 0$) on or Adjacent to a Building	σ_{zo} = building height divided by 2.15

Elevated Source ($h_e > 0$) not on or Adjacent to a Building	σ_{zo} =	vertical dimension of source divided by 4.3

Appendix B

Back-up Data

From: Pakrasi, Arijit
Sent: Tuesday, November 21, 2006 4:55 PM
To: Blinn, Leah
Subject: FW:
Please put this up in the portal for records

thanks

Arijit Pakrasi, Ph.D., P.E.
Senior Consultant
Shaw Environmental, Inc.
2790 Mosside Boulevard
Monroeville, PA 15146
Ph: 412 858 3921
Fax: 412 372 8968
email: arijit.pakrasi@shawgrp.com

-----Original Message-----
From: Nelson, Deborah [mailto:Deborah.Nelson@dep.state.fl.us]
Sent: Tuesday, November 21, 2006 4:50 PM
To: Pakrasi, Arijit
Subject:

Just use SCREEN3 for your screening analysis. The AERSCREEN is a beta version and is not ready for distribution.

Debbie Nelson
Meteorologist
Air Permitting South
850-921-9537
deborah.nelson@dep.state.fl.us

```
SOLAR TURBINES INCORPORATED                DATE RUN: 22-Dec-06
ENGINE PERFORMANCE CODE  REV. 3.40         RUN BY: Donald C Lyons
JOB ID:

          --- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
                      POINT NUMBER 1

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL:  CHOICE NATURAL GAS
             29.88  in Hg        AMBIENT PRESSURE
              60.0  percent      RELATIVE HUMIDITY
            0.0038  ---          SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) =   454.7   SG = 1.0366   W.I. @60F (Btu/Scf) =  446.6

 Methane (CH4)                = 49.9999
 Carbon Dioxide (CO2)         = 49.9999
 Sulfur Dioxide (SO2)         =  0.0001

*** Wobbe Index of fuel gas is outside of standard gaseous fuel ***
** limits per ES 9-98.  Please submit SER for this application.  **


*** Landfill and digester gas sources must be disclosed to
 Solar Turbines via an SER. Landfill and digester gases
 may contain Siloxanes which cause rapid deterioration of
 performance and component life. ***


*** Methane content less than 80%. ***
** Please submit SER for this application. **

GENERAL OUTPUT DATA

             20617.  lbm/hr       FUEL FLOW
              5747.  Btu/lbm      LOWER HEATING VALUE
               455.  Btu/Scf      LOWER HEATING VALUE
             77379.  Scfm         EXHAUST FLOW @ 14.7 PSIA & 60F
            200336.  Acfm         ACTUAL EXHAUST FLOW CFm
            354239.  lbm/hr       EXHAUST GAS FLOW
             4214.7  deg R        ADIA STOICH FLAME TEMP, CHOICE GAS
             4674.0  deg R        ADIA STOICH FLAME TEMP, SDNG
              28.96  ---          MOLECULAR WEIGHT OF EXHAUST GAS
              16.24  ---          AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

  ARGON        CO2        H2O        N2         O2

   0.88       5.60       6.15      73.28      14.08  VOLUME PERCENT WET
   0.93       5.97       0.00      78.08      15.01  VOLUME PERCENT DRY
  4283.     30169.     13556.    251097.     55126.  lbm/hr
   0.21       1.46       0.66      12.18       2.67  G/(G FUEL)



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- WARNING!!!  PLEASE SUBMIT FUEL SUITABILITY    -
- INQUIRY TO SAN DIEGO!!!!!!!!!!!!!!!!!!!!!!    -
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SOLAR TURBINES INCORPORATED                 DATE RUN: 22-Dec-06
ENGINE PERFORMANCE CODE  REV. 3.40          RUN BY: Donald C Lyons
JOB ID:

          --- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
                      POINT NUMBER 2

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL:  CHOICE NATURAL GAS
             29.88  in Hg         AMBIENT PRESSURE
              60.0  percent       RELATIVE HUMIDITY
            0.0064  ---           SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) =   454.7   SG = 1.0366   W.I. @60F (Btu/Scf) =  446.6

 Methane (CH4)              = 49.9999
 Carbon Dioxide (CO2)       = 49.9999
 Sulfur Dioxide (SO2)       =  0.0001

*** Wobbe Index of fuel gas is outside of standard gaseous fuel ***
** limits per ES 9-98.  Please submit SER for this application.  **


*** Landfill and digester gas sources must be disclosed to
 Solar Turbines via an SER. Landfill and digester gases
 may contain Siloxanes which cause rapid deterioration of
 performance and component life. ***


*** Methane content less than 80%. ***
** Please submit SER for this application. **

GENERAL OUTPUT DATA

            19862.  lbm/hr       FUEL FLOW
             5747.  Btu/lbm      LOWER HEATING VALUE
              455.  Btu/Scf      LOWER HEATING VALUE
            74854.  Scfm         EXHAUST FLOW @ 14.7 PSIA & 60F
           195493.  Acfm         ACTUAL EXHAUST FLOW CFm
           342170.  lbm/hr       EXHAUST GAS FLOW
            4221.8  deg R        ADIA STOICH FLAME TEMP, CHOICE GAS
            4682.0  deg R        ADIA STOICH FLAME TEMP, SDNG
             28.92  ---          MOLECULAR WEIGHT OF EXHAUST GAS
             16.28  ---          AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

  ARGON       CO2        H2O        N2         O2

   0.87       5.57       6.50      73.00      14.05  VOLUME PERCENT WET
   0.93       5.95       0.00      78.08      15.02  VOLUME PERCENT DRY
  4128.     28994.     13865.    241990.     53186.  lbm/hr
   0.21       1.46       0.70      12.18       2.68  G/(G FUEL)



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-------------------------------------------------
- WARNING!!!  PLEASE SUBMIT FUEL SUITABILITY    -
- INQUIRY TO SAN DIEGO!!!!!!!!!!!!!!!!!!!!!!    -
-------------------------------------------------
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SOLAR TURBINES INCORPORATED                DATE RUN: 22-Dec-06
ENGINE PERFORMANCE CODE  REV. 3.40         RUN BY: Donald C Lyons
JOB ID:

          --- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
                      POINT NUMBER 3

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL:  CHOICE NATURAL GAS
             29.88  in Hg        AMBIENT PRESSURE
              60.0  percent      RELATIVE HUMIDITY
            0.0179  ---          SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) =    454.7    SG = 1.0366   W.I. @60F (Btu/Scf) =   446.6

 Methane (CH4)                = 49.9999
 Carbon Dioxide (CO2)         = 49.9999
 Sulfur Dioxide (SO2)         =  0.0001

*** Wobbe Index of fuel gas is outside of standard gaseous fuel ***
** limits per ES 9-98.  Please submit SER for this application.  **


*** Landfill and digester gas sources must be disclosed to
 Solar Turbines via an SER. Landfill and digester gases
 may contain Siloxanes which cause rapid deterioration of
 performance and component life. ***


*** Methane content less than 80%. ***
** Please submit SER for this application. **

GENERAL OUTPUT DATA

            18132.  lbm/hr       FUEL FLOW
             5747.  Btu/lbm      LOWER HEATING VALUE
              455.  Btu/Scf      LOWER HEATING VALUE
            69041.  Scfm         EXHAUST FLOW @ 14.7 PSIA & 60F
           183969.  Acfm         ACTUAL EXHAUST FLOW CFm
           313581.  lbm/hr       EXHAUST GAS FLOW
            4234.6  deg R        ADIA STOICH FLAME TEMP, CHOICE GAS
            4696.5  deg R        ADIA STOICH FLAME TEMP, SDNG
             28.73  ---          MOLECULAR WEIGHT OF EXHAUST GAS
             16.35  ---          AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

  ARGON       CO2       H2O        N2        O2

   0.86      5.45      8.07     71.78     13.83  VOLUME PERCENT WET
   0.93      5.93      0.00     78.08     15.05  VOLUME PERCENT DRY
  3744.    26188.    15861.   219468.    48314.  lbm/hr
   0.21      1.44      0.87     12.10      2.66  G/(G FUEL)



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--------------------------------------------------
- WARNING!!!  PLEASE SUBMIT FUEL SUITABILITY     -
- INQUIRY TO SAN DIEGO!!!!!!!!!!!!!!!!!!!!!!!    -
--------------------------------------------------
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SOLAR TURBINES INCORPORATED                   DATE RUN: 22-Dec-06
ENGINE PERFORMANCE CODE  REV. 3.40            RUN BY: Donald C Lyons
JOB ID:

                   MARS 100-15000
                   GSC
                   59F MATCH
                   GAS
                   TMF-2 REV. 3.0

           DATA FOR NOMINAL PERFORMANCE


  Fuel Type          CHOICE NATURAL GAS

  Elevation               feet      50
  Inlet Loss            in H20     4.0
  Exhaust Loss          in H20     4.0

  Engine Inlet Temp.     deg F    45.0     59.0     89.0
  Relative Humidity          %    60.0     60.0     60.0
  Elevation Loss            kW      20       19       17
  Inlet Loss                kW     181      175      159
  Exhaust Loss              kW      71       69       65

  Gas Generator Speed      RPM   11168    11168    11168

  Specified Load*           kW    FULL     FULL     FULL
  Net Output Power*         kW   11429    10894     9644
  Fuel Flow           mmBtu/hr  118.48   114.14   104.20
  Heat Rate*         Btu/kW-hr   10367    10477    10804
  Therm Eff*                 %  32.915   32.568   31.582

  Inlet Air Flow        lbm/hr  334793   323440   296487
  Engine Exhaust Flow   lbm/hr  354239   342170   313581
  PCD                     psiG   254.9    246.1    225.3
  Display T5   S/W       deg F    1338     1341     1342
  Exhaust Temperature    deg F     883      895      923

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) =    454.7   SG = 1.0366   W.I. @60F (Btu/Scf) =  446.6

 Methane (CH4)                = 49.9999
 Carbon Dioxide (CO2)         = 49.9999
 Sulfur Dioxide (SO2)         =  0.0001

*** Wobbe Index of fuel gas is outside of standard gaseous fuel ***
** limits per ES 9-98.  Please submit SER for this application.  **


*** Landfill and digester gas sources must be disclosed to
 Solar Turbines via an SER. Landfill and digester gases
 may contain Siloxanes which cause rapid deterioration of
 performance and component life. ***


*** Methane content less than 80%. ***
** Please submit SER for this application. **
```

*Electric power measured at the generator terminals.

From: Nelson, Deborah [Deborah.Nelson@dep.state.fl.us]
Sent: Friday, February 09, 2007 2:55 PM
To: Pakrasi, Arijit
Subject: RE: Clarification on Modeling Net Emissions for Preliminary Air Quality Analysis to Determine if Significance Level Concentration is Exceeded Okeechobee Landfill Project

Yes. This is OK when modeling the Significant Impact Analysis, determining the Significant Impact Area if multi-source modeling is required. In the write-up, explain this so I don't wonder what happened to the 2 exisitng flares. Also, make note that these flares will be for emergency use only.

Debbie Nelson
Meteorologist
Air Permitting South
850-921-9537
deborah.nelson@dep.state.fl.us

From: Pakrasi, Arijit [mailto:Arijit.Pakrasi@shawgrp.com]
Sent: Friday, February 09, 2007 11:51 AM
To: Nelson, Deborah
Cc: Blinn, Leah
Subject: Clarification on Modeling Net Emissions for Preliminary Air Quality Analysis to Determine if Significance Level Concentration is Exceeded Okeechobee Landfill Project

Debbie:

We are conducting the preliminary air quality analysis for the project to determine if the ambient concentrations due to ***net*** emission increases are above the "Significance level". If they are above "significance level" then we will need to do the full impact analysis for Class II PSD increment and NAAQS compliance demonstration. We need a clarification on how we do this for the following case.

To give you a background, the existing emissions are due to 2 existing flares, combusting approximately 6,000 cfm total of landfill gas. The BACT scenario is to replace these flares with 7 LFG turbines @4000 cfm each and a new flare at 3300 cfm, totaling to 31,300 cfm. The existing flares will be on-site as emergency but will not run under this BACT scenario (If they do run due to a outage in the turbines, their emission rates for all criteria pollutants are lower than the turbines on a cfm of LFG basis).

Thus, the net emission change (projected allowable or potential – baseline actual) is calculated as follows:

$$E_{net} = E_{BACT} - E_{existing}$$

Where

E_{net} = Net emission increase
E_{BACT} = Potential emissions from 7 turbines and 1 new flare
$E_{existing}$ = Actual emissions from 2 existing flares

Since the emission increases and decreases are from two different types of sources (turbines vs flares) which are located at two different locations in the facility, we can not just model the net emission increase. So, I was planning to determine the net ambient impact from the net emission increase in the following manner for the preliminary analysis:

- Run AERMOD with 7 new turbines and 1 new flare with their full potential emissions (i.e. at total E_{BACT})
- In the same run, add the existing flares negative emission points with total negative emissions equal to $E_{existing}$

This way, we will have the net ambient impact of the net emissions and we will compare that with the “significance level” concentrations.

Does this seem okay with you?

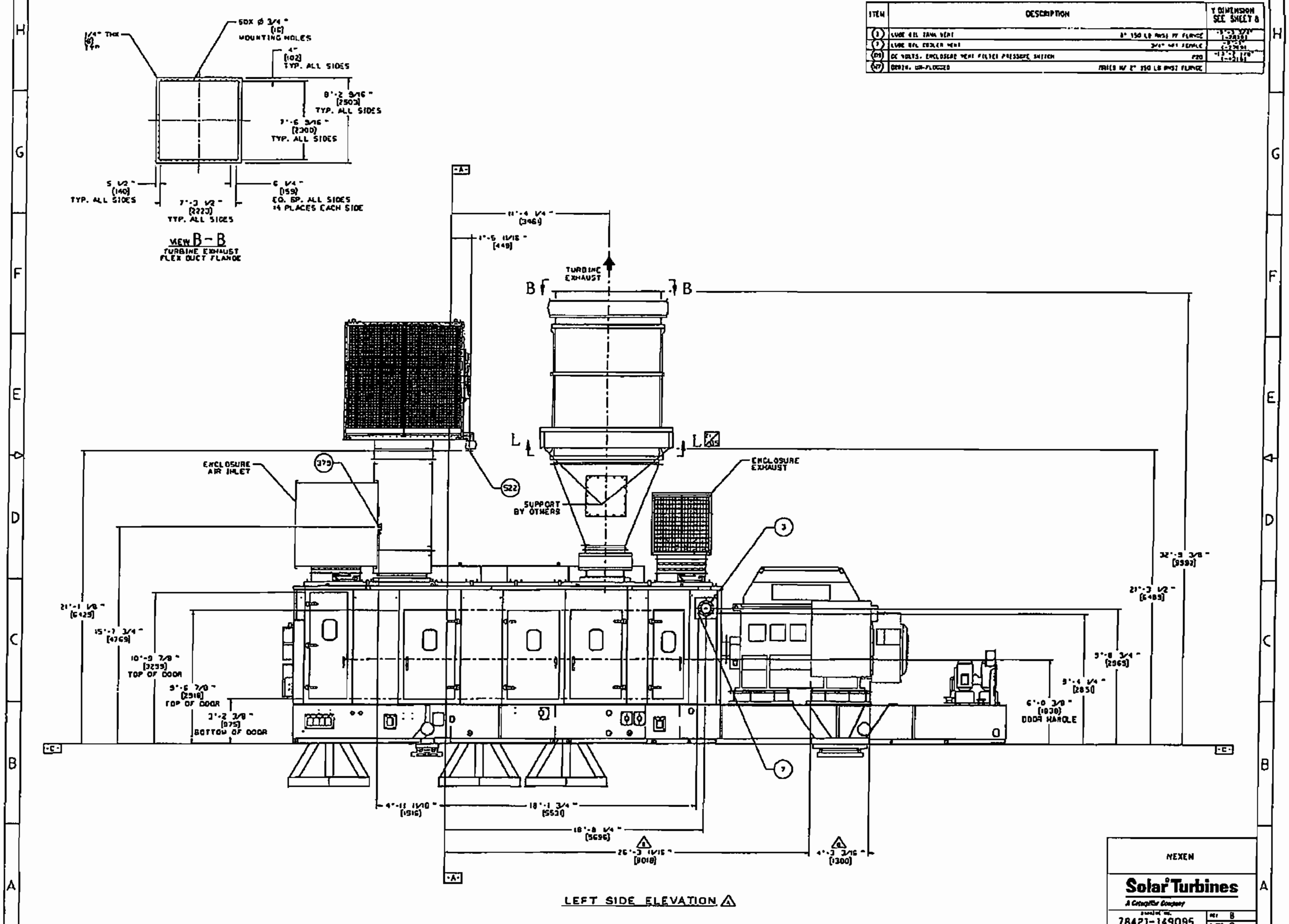
Thanks

Arijit Pakrasi, Ph.D., P.E.
Senior Consultant
Shaw Environmental, Inc.
2790 Mosside Boulevard
Monroeville, PA 15146
Ph: 412 858 3921
Fax: 412 372 8968
email: arijit.pakrasi@shawgrp.com

The Shaw Group Inc.
http://www.shawgrp.com

TABLE 1 - CONNECTIONS

ITEM	DESCRIPTION		Y DIMENSION SEE SHEET 8
③	LUBE OIL TANK VENT	8" 150 LB ANSI FF FLANGE	[illegible]
⑦	LUBE OIL COOLER VENT	3/4" NPT FEMALE	[illegible]
(375)	DC VOLTS, ENCLOSURE VENT FILTER PRESSURE SWITCH	P20	[illegible]
(522)	DRAIN, UN-PLUGGED	[illegible] W/ 2" 150 LB ANSI FLANGE	



VIEW B - B
TURBINE EXHAUST FLEX DUCT FLANGE

LEFT SIDE ELEVATION

NEXEN

Solar Turbines
A Caterpillar Company

DRAWING NO. 78421-149095

REV B

SHEET 9

Solar® Turbines
A Caterpillar Company

PREDICTED ENGINE PERFORMANCE

Customer *Waste Management*	
Job ID	
Run By Donald C Lyons	Date Run 24-Oct-06
Engine Performance Code REV. 3.40	Engine Performance Data REV. 3.0

Model MARS 100-15000
Package Type GSC
Match 59F MATCH
Fuel System GAS
Fuel Type CHOICE NATURAL GAS

DATA FOR NOMINAL PERFORMANCE

Elevation	feet	50
Inlet Loss	in H20	3.5
Exhaust Loss	in H20	3.5

		1	2	3
Engine Inlet Temperature	deg F	59.0	59.0	59.0
Relative Humidity	%	60.0	60.0	60.0
Specified Load*	kW	FULL	75.0%	50.0%
Net Output Power*	kW	10924	8193	5462
Fuel Flow	mmBtu/hr	114.28	90.11	68.99
Heat Rate*	Btu/kW-hr	10461	10999	12630
Therm Eff*	%	32.619	31.023	27.015
Engine Exhaust Flow	lbm/hr	342595	306920	263057
Exhaust Temperature	deg F	894	818	778

Fuel Gas Composition (Volume Percent)		
	Methane (CH4)	50.00
	Carbon Dioxide (CO2)	50.00
	Sulfur Dioxide (SO2)	0.0001

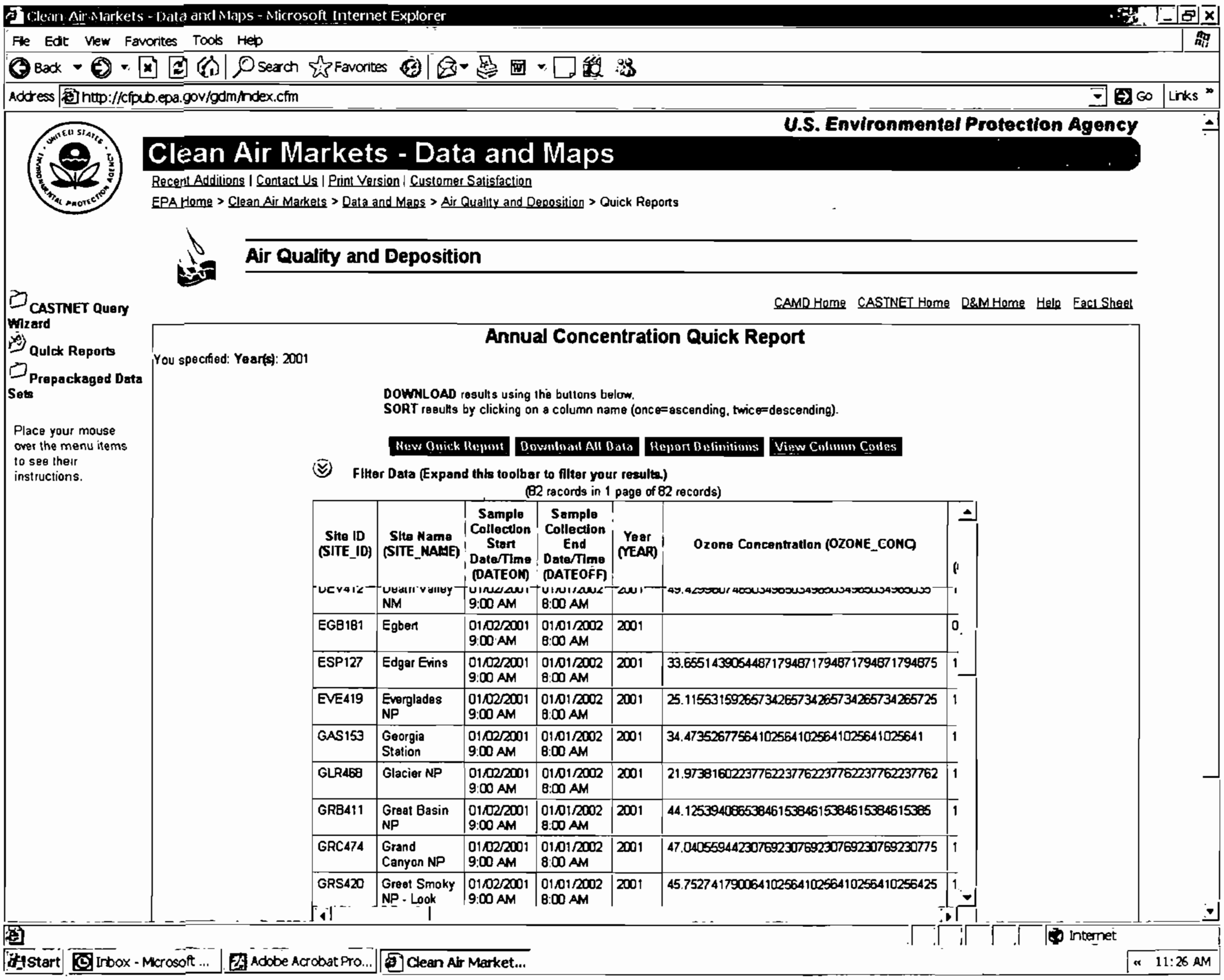
Fuel Gas Properties	LHV (Btu/Scf)	454.7	Specific Gravity	1.0366	Wobbe Index at 60F	446.6

**Electric power measured at the generator terminals.*

Notes
Florida

Appendix C

Background Concentration Data



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Annual Concentration Quick Report

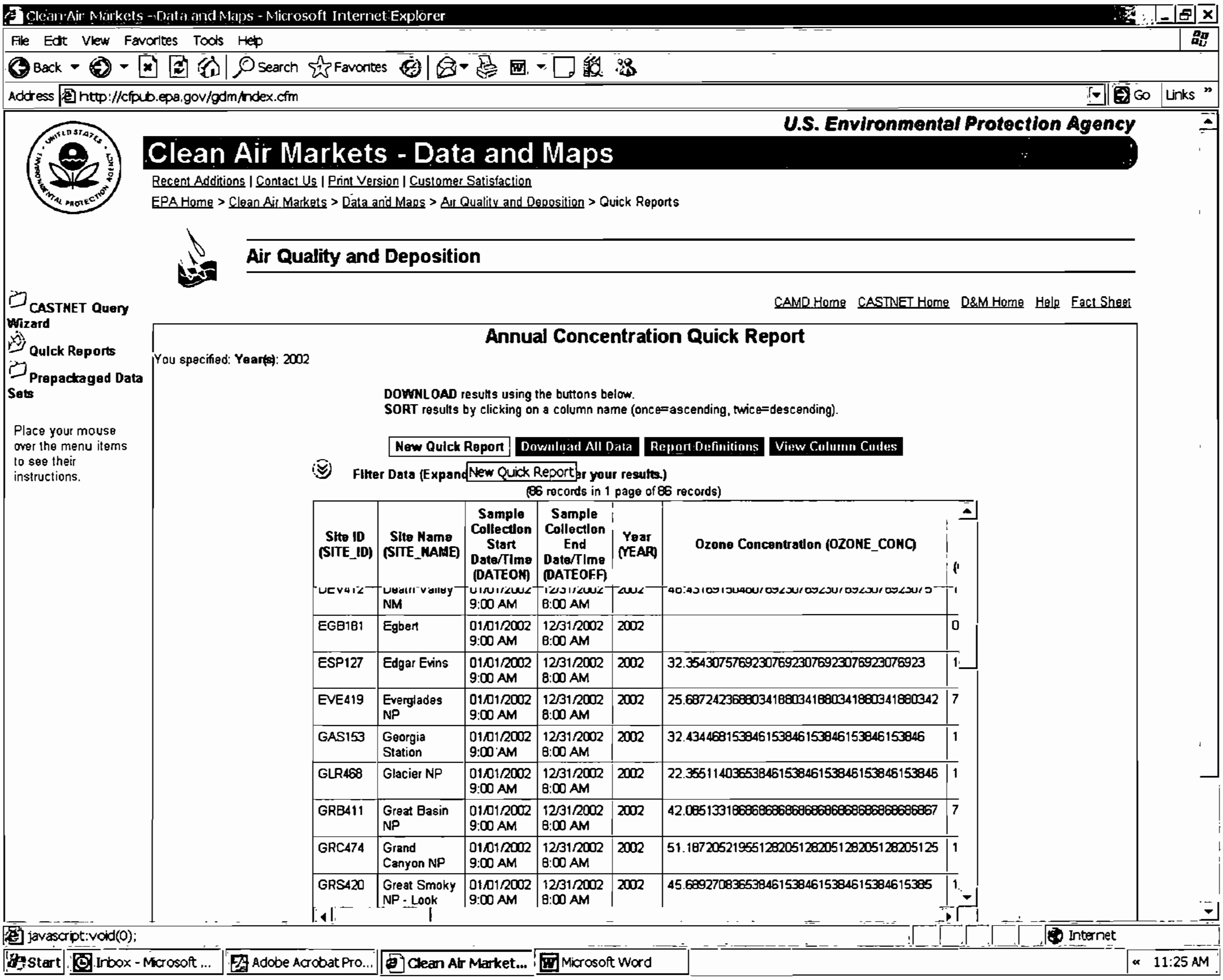
You specified: **Year(s)**: 2001

DOWNLOAD results using the buttons below.
SORT results by clicking on a column name (once=ascending, twice=descending).

Filter Data (Expand this toolbar to filter your results.)
(82 records in 1 page of 82 records)

Site ID (SITE_ID)	Site Name (SITE_NAME)	Sample Collection Start Date/Time (DATEON)	Sample Collection End Date/Time (DATEOFF)	Year (YEAR)	Ozone Concentration (OZONE_CONC)	(
DEV412	Death Valley NM	01/02/2001 9:00 AM	01/01/2002 8:00 AM	2001	[illegible]	1
EGB181	Egbert	01/02/2001 9:00 AM	01/01/2002 8:00 AM	2001		0
ESP127	Edgar Evins	01/02/2001 9:00 AM	01/01/2002 8:00 AM	2001	33.6551439054487179487179487179487179487 5	1
EVE419	Everglades NP	01/02/2001 9:00 AM	01/01/2002 8:00 AM	2001	25.1155315926573426573426573426573426572 5	1
GAS153	Georgia Station	01/02/2001 9:00 AM	01/01/2002 8:00 AM	2001	34.4735267756410256410256410256410256 41	1
GLR468	Glacier NP	01/02/2001 9:00 AM	01/01/2002 8:00 AM	2001	21.9738160223776223776223776223776223776 2	1
GRB411	Great Basin NP	01/02/2001 9:00 AM	01/01/2002 8:00 AM	2001	44.1253940865384615384615384615384615385	1
GRC474	Grand Canyon NP	01/02/2001 9:00 AM	01/01/2002 8:00 AM	2001	47.0405594423076923076923076923076923077 5	1
GRS420	Great Smoky NP - Look	01/02/2001 9:00 AM	01/01/2002 8:00 AM	2001	45.7527417900641025641025641025641025642 5	1

H:\Projects\Itaqs\Okeechobee Landfill Air Modeling 2006\CALPUFF\Calpuff Report\Appendix C\2001 Ozone Data Everglades NP.doc



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Annual Concentration Quick Report

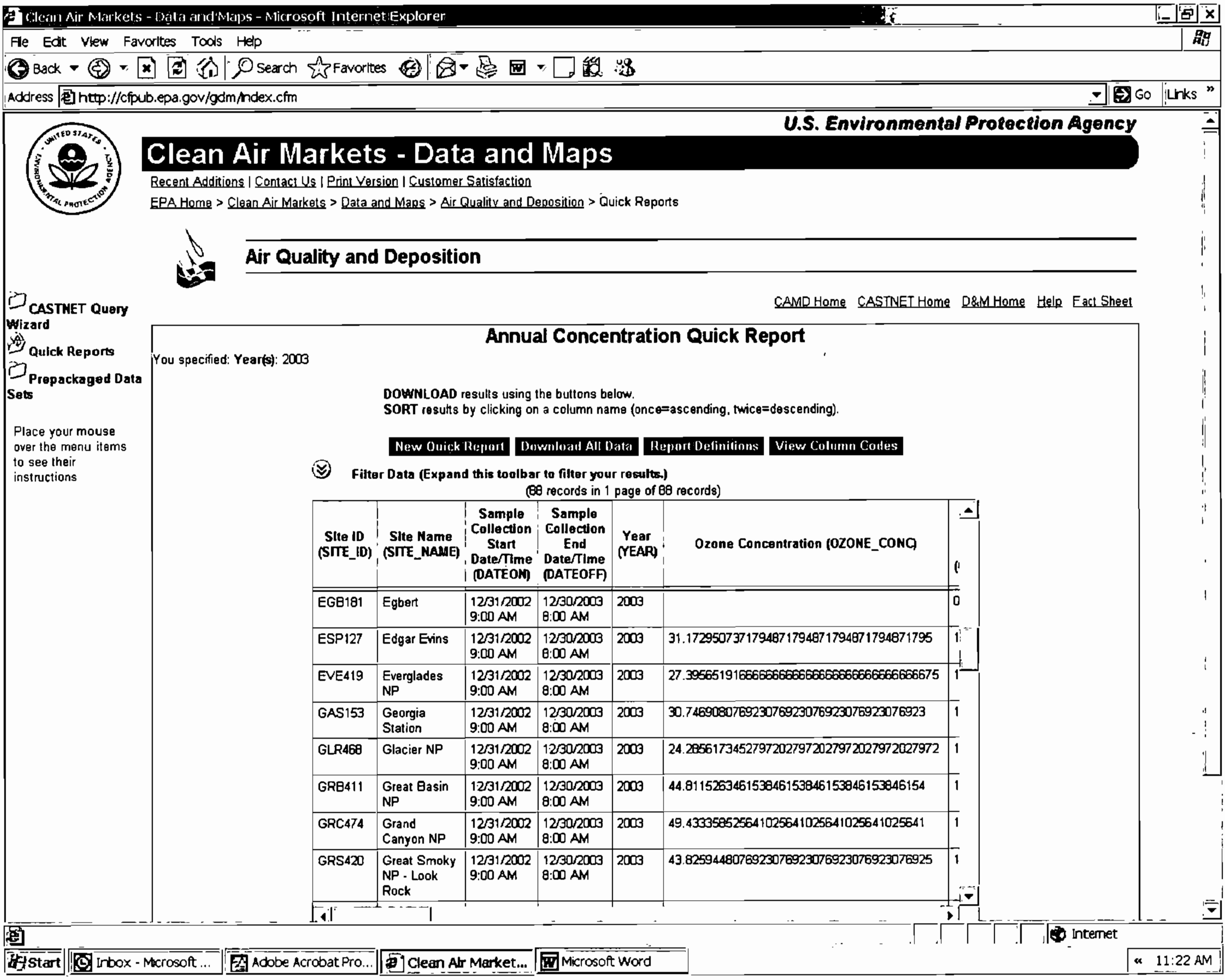
You specified: **Year(s)**: 2002

DOWNLOAD results using the buttons below.
SORT results by clicking on a column name (once=ascending, twice=descending).

Filter Data (Expand New Quick Report **r your results.)**

(86 records in 1 page of 86 records)

Site ID (SITE_ID)	Site Name (SITE_NAME)	Sample Collection Start Date/Time (DATEON)	Sample Collection End Date/Time (DATEOFF)	Year (YEAR)	Ozone Concentration (OZONE_CONC)	(
DEV412	Death Valley NM	01/01/2002 9:00 AM	12/31/2002 8:00 AM	2002	46.4316915048076923076923076923076923075	1
EGB181	Egbert	01/01/2002 9:00 AM	12/31/2002 8:00 AM	2002		0
ESP127	Edgar Evins	01/01/2002 9:00 AM	12/31/2002 8:00 AM	2002	32.3543075769230769230769230769230769230769 23	1
EVE419	Everglades NP	01/01/2002 9:00 AM	12/31/2002 8:00 AM	2002	25.687242368803418803418803418803418803 42	7
GAS153	Georgia Station	01/01/2002 9:00 AM	12/31/2002 8:00 AM	2002	32.434468153846153846153846153846153846	1
GLR468	Glacier NP	01/01/2002 9:00 AM	12/31/2002 8:00 AM	2002	22.355114036538461538461538461538461538 46	1
GRB411	Great Basin NP	01/01/2002 9:00 AM	12/31/2002 8:00 AM	2002	42.085133186868686868686868686868686868 67	7
GRC474	Grand Canyon NP	01/01/2002 9:00 AM	12/31/2002 8:00 AM	2002	51.187205219551282051282051282051282051 25	1
GRS420	Great Smoky NP - Look	01/01/2002 9:00 AM	12/31/2002 8:00 AM	2002	45.689270836538461538461538461538461538 5	1



Annual Concentration Quick Report

You specified: **Year(s)**: 2003

DOWNLOAD results using the buttons below.
SORT results by clicking on a column name (once=ascending, twice=descending).

Filter Data (Expand this toolbar to filter your results.)
(88 records in 1 page of 88 records)

Site ID (SITE_ID)	Site Name (SITE_NAME)	Sample Collection Start Date/Time (DATEON)	Sample Collection End Date/Time (DATEOFF)	Year (YEAR)	Ozone Concentration (OZONE_CONC)	(
EGB181	Egbert	12/31/2002 9:00 AM	12/30/2003 8:00 AM	2003		0
ESP127	Edgar Evins	12/31/2002 9:00 AM	12/30/2003 8:00 AM	2003	31.1729507371794871794871794871794871795	1
EVE419	Everglades NP	12/31/2002 9:00 AM	12/30/2003 8:00 AM	2003	27.3956519166666666666666666666666666675	1
GAS153	Georgia Station	12/31/2002 9:00 AM	12/30/2003 8:00 AM	2003	30.7469080769230769230769230769230769230 76923	1
GLR468	Glacier NP	12/31/2002 9:00 AM	12/30/2003 8:00 AM	2003	24.2856173452797202797202797202797202797 2027972	1
GRB411	Great Basin NP	12/31/2002 9:00 AM	12/30/2003 8:00 AM	2003	44.811526346153846153846153846153846154	1
GRC474	Grand Canyon NP	12/31/2002 9:00 AM	12/30/2003 8:00 AM	2003	49.433358525641025641025641025641025641	1
GRS420	Great Smoky NP - Look Rock	12/31/2002 9:00 AM	12/30/2003 8:00 AM	2003	43.8259448076923076923076923076923076925	1

Appendix D

Input/Output Files (CD)

The data for Appendix D is on 8 computer discs.