Derenzo and Associates, Inc.
Environmental Consultants

June 2, 2006

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BUREAU OF AIR REGULATION

Mr. Cleve Holladay
Engineer-4
2600 Blairstone Road
Mail Stop 5505
Tallahassee, FL 32399-2400

Subject: Trail Ridge Energy, L.L.C.
Air Quality Modeling Protocol (Appendix I of Permit Application Package)
Project No.: 0310358-004, PSD Permit No.: PSD-FL-374

Dear Mr. Holladay:

Derenzo and Associates, Inc. (Derenzo and Associates), on behalf of the Trail Ridge Energy, L.L.C., is submitting to the Florida Department of Environmental Protection, Division of Air Resource Management (FDEP-DARM) the enclosed Air Quality Modeling Protocol document for a new landfill gas (LFG) fueled internal combustion (IC) engine electricity generation facility at the Trail Ridge Landfill.

Preconstruction and Operating Permit Application documents for this project were previously submitted to the FDEP-DARM.

The Air Quality Modeling Protocol (referenced as Appendix I in the permit application documents) is being submitted to the FDEP-DARM for review of the specified modeling analyses.

Please contact us at (517) 324-1880 or arusnak@derenzo.com should you have any questions or require additional information.

Sincerely,

DERENZO AND ASSOCIATES, INC.

Andy Rusnak
Environmental Engineer

c: Mr. Syed Arif, FDEP-DARM
Enclosure

APPENDIX I

AIR QUALITY MODELING PROTOCOL
FOR
TRAIL RIDGE ENERGY, L.L.C.

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TABLE OF CONTENTS

Table of Contents Continued

LIST OF FIGURES

LIST OF TABLES

APPENDICES

AIR QUALITY MODELING PROTOCOL
AND
EMISSION RISK ASSESSMENT
FOR
TRAIL RIDGE ENERGY, L.L.C.

1.0 INTRODUCTION TO AIR QUALITY IMPACT ANALYSES

Trail Ridge Energy, LLC (Trail Ridge Energy) plans to construct and operate an electricity generation facility that will result in the beneficial use, after treatment, of landfill gas (LFG) that is collected from the Trail Ridge Landfill, Inc. Municipal Solid Waste (MSW) Landfill (Trail Ridge Landfill). The proposed facility will be located on a leased site within the boundaries of the Trail Ridge Landfill in Baldwin, Duval County, Florida.

Trail Ridge Landfill owns and operates an active LFG collection system that directs the LFG to an open utility flare for destruction of methane and hydrocarbons in the LFG. Trail Ridge Energy will treat the recovered LFG and produce electricity using gas that would otherwise be combusted in the flaring system. The proposed facility is presented in this protocol as a new emission source; however, it is important to note that emissions from the proposed facility will replace air pollutant emissions that would otherwise be released by the flaring system (i.e., the reduction in LFG flaring is a secondary benefit of this project).

1.1 Criteria Pollutants

The proposed Trail Ridge Energy LFG-fueled electricity generation facility will be a major source of CO relative to federal Prevention of Significant Deterioration (PSD) regulations. Therefore, air quality impact analyses are required for all criteria pollutants (CO, NO_X, SO_2, PM_{10}, except ozone) that have the potential to be emitted by the proposed facility in order to demonstrate that that these emissions will not cause or significantly contribute to a violation of National Ambient Air Quality Standards (NAAQS).

Results of the analyses presented in this modeling protocol demonstrate that none of the criteria air pollutant emissions will produce ambient air impacts that exceed the significant impact concentrations defined under the PSD permitting program.

This protocol presents technical information and procedures that were used for performing air pollutant dispersion modeling analysis to predict maximum ambient air impacts that are produced by the proposed electricity generation facility emissions. Initial results are compared to the significant impact levels for Class II and Class I areas established for each criteria air pollutant.

Section 3.0 of this protocol presents technical information and procedures that were used to perform the Class II area impact analyses.

Section 4.0 of this protocol presents technical information and procedures that were used to perform the Class I area impact analyses.

1.2 Visibility

New PSD sources that are located within 100 kilometers (km) of a Class I area are required to perform analyses to demonstrate that the plume of the proposed air pollutant emission processes will not have an adverse impact on visibility within the Class I area.

The nearest Class I area to the proposed electricity generation facility is the Okefenokee Wilderness Area. The nearest section of the Okefenokee Wilderness Area relative to the location of the proposed facility is situated northwest of Boggy, Georgia. To determine the closest distance from the proposed electricity generation facility (which is located in South Baldwin, Florida) to the Class I area (which is located to the northwest of Boggy, Georgia), a representative coordinate was assigned each location as defined by the Universal Transverse Mercator (UTM) system. The distance between the proposed electricity generation facility and the nearest portion of the Okefenokee National Wilderness Area was calculated to be 45 km. This distance value is less than 100 km. Therefore, visibility impact analyses are required to be performed for the project.

Section 4.0 of this protocol presents technical information and procedures that were used to perform the visibility impact analyses.

2.0 SITE CHARACTERISTICS AND FACILITY INFORMATION

Trail Ridge Landfill owns approximately 3.95 km^2 of land to the west of US Highway 301, south of Baldwin on the western edge of Duval County. The property owned by Trail Ridge Landfill has dimensions of 8,911 feet running north/south and 4,721 feet running east/west. The landfill (portion of the property currently used for waste disposal) sits on approximately 0.60 km^2 of land located in the southwest corner of the Trail Ridge Landfill property. The landfill has dimensions of 2,545 feet running north/south and 2,535 feet running east/west. The proposed electricity generation facility will be located at the northeast corner of the landfill.

The LFG fueled IC engines will be housed in a single building (with dimensions of 62.7 feet by 108.7 feet) constructed in a leased area (at the landfill facility) near the existing LFG collection system header and control system flare. A gas transmission line (fuel supply pipe) will be connected to the header of the existing LFG collection system and a dedicated gas blower/compressor will be used to draw methane-rich gas (fuel) from the existing LFG collection system to the proposed gas treatment system and electricity generation facility.

A single meter (flow totalizer) will be installed and operated at the Trail Ridge Energy electricity generation facility to measure the total amount of LFG fuel that is supplied to power the six (6) IC engines (i.e., individual engine fuel use meters will not be installed).

Trail Ridge Landfill currently owns and operates a utility flare to control landfill gas emissions. Trail Ridge Landfill has submitted a separate application to replace the existing flare with a larger flare. The replacement open utility flare will have a maximum capacity of 5,000 cubic feet per minute of landfill gas. After the installation of the proposed engine facility the flare will serve as a back-up control device and only be used when an excess amount of gas exists (i.e., if an engine is taken off-line for maintenance or if the landfill gas production rate exceeds the amount that can be controlled in the engines). Initially, the flare will only be used as a backup emission control device (producing electricity from combustion of the LFG in the IC engines is the preferred use for the gas). Throughout the lifetime of the electricity generation project, it is anticipated that the amount of LFG recovered from the landfill will require the flare to operate at less than 65% capacity (the total LFG recovery rate will not exceed the fuel use rate of the electricity generation facility plus 65% of flare capacity). Therefore, the analyses presented in this document are based on a worst-case scenario of continuous electricity generation facility operation (at 100% capacity) and simultaneous continuous operation of the flare at 65% capacity.

2.1 Land Use

The general classification of the land use surrounding the landfill is rural, therefore, rural dispersion coefficients were used in the modeling demonstration. The land use was determined using the Population Density Procedure. The population density of the area within a radius of 3 km from the proposed source was determined using a county population density map from the 1990 census. Because the area surrounding the proposed Trail Ridge Energy facility has a population density significantly less than 750 persons per square kilometer the land use of that area can be considered rural. No significant development has occurred within the 3 km area since 1990 that would impact the rural classification. The facility location is not located in an industrial area that would significantly impact the population density analysis (in heavy industrial areas the non-resident population may be much larger than those indicated by standard population density plots).

2.2 Topography

The topography of the land that surrounds the Trail Ridge Landfill is relatively flat. The base elevation of the proposed Trail Ridge Energy electricity generation facility is approximately 35 meters (115 ft.) above sea level and the minimum stack heights of the proposed IC engine exhaust stacks is 23 feet (as measured from local grade), which results in an exhaust stack release elevation of 138 feet above sea level. Based on review of topography plots of the surrounding area there is no terrain within 3 km that has elevations greater than 138 feet above sea level.

Appendix I-1 provides a site plan of the proposed electricity generation facility building and surrounding topography.

2.3 Exhaust Stack Parameters

2.3.1 IC Engines

The proposed Trail Ridge Energy electricity generation facility will use IC engines that are fueled with treated LFG and designed to operate at base load (100% capacity) conditions. Each of the proposed IC engines is expected to exhaust effluent gas at a rate of 12,050 actual cubic feet per minute (acfm) at 900°F through an 18-inch diameter stack. These engines will operate continuously with the exception for planned maintenance shutdowns or automatic engine shutdowns (instantaneous, automatic engine shutdowns if monitored operating parameters are outside of preset ranges). The amount of time required for an engine start-up is minimal. Since the engines are operated at base load conditions and the durations of engine shutdown and startup times are minimal, no air quality impact concentrations analyses were performed for these specific events (i.e., the engines will not be operated for any appreciable amount of time at loads other than 100%).

2.3.2 Open Utility Flare

Trail Ridge Landfill currently owns and operates a 2,800 cfm utility flare to control LFG emissions. Trail Ridge Landfill has submitted a separate application to replace the existing 2,800 cfm utility flare with a 5,000 cfm utility flare. The replacement flare will be used to control excess emissions of LFG (i.e., during times where the amount of LFG produced exceeds the amount that can be controlled in the IC engines). The proposed flare is manufactured by the Parnell Biogas, Inc. company, will have a height of approximately 51 feet from grade and have an 18 inch tip. The proposed flare was designed to meet USEPA criteria for an open flare *40 CFR 60.18*. The flare is designed to achieve a 98% destruction of total hydrocarbons if the LFG has a methane content between 40-60%. A flare exhaust temperature of 1000°C and maximum exit velocity of 20 m/s was used in the modeling demonstration. The equivalent stack height and diameter for the proposed flare were calculated using the following equations from the TSCREEN users manual:

$H_{equiv} = H_{actual} + 0.00128(Q_c^{0.478})$; and
$D_{equiv} = 1.754*10^{-4} * \text{sqrt}(Q_c)$

Where: H_{equiv} = Equivalent stack height
H_{actual} = Actual stack height (15.54 m)

D_{equiv} = Equivalent stack diameter (m); and
Q_c = Flared gas heat release ($150.12*10^6$ Btu/hr)

The equations above account for the flared gas plume rise based on an effective buoyancy flux parameter. Using a gas heat release rate equivalent to the combustion of 5,000 scfm of gas at 500 Btu/scf results in an equivalent flare height and diameter of 85.0 and 7.05 feet, respectively.

Table I-2.1 presents exhaust stack parameters for the six (6) identical IC engines and proposed utility flare that will be used in the air quality impact analyses.

Appendix I-2 provides a plot plan of the proposed electricity generation facility building, IC engine exhaust stacks and flare on a UTM coordinate system.

2.4 GEP Stack Height Analysis and Influencing Structures

The proposed IC engines will be installed within a 62.7 ft. (width) by 108.7 ft. (length) building that has a roof height of 8 ft. The individual exhaust stacks will be located on the roof of the building and set approximately 20 feet from the western edge of the building. The stacks will extend above the roof at least 15 feet (i.e., overall engine exhaust release height of 23 ft. as measured from grade of the land that surrounds the building) and exhaust vertically. The proposed electricity generation facility will have a maximum projected crosswind width of 125.5 feet (i.e., the diagonal of the rectangular building).

In general, air pollutant dispersion models consider the influence of building structures on exhaust stack plumes (i.e., downwash conditions) when the exhaust stack has a height that is less than its Good Engineering Practice (GEP) stack height. The GEP stack height for the proposed engine exhaust stacks is 37.5 ft. (11.43 meters) determined with the following equation:

$$H_{GEP} = H_b + 1.5L$$

where: H_{GEP} = formula GEP stack height (ft.)
H_b = height of adjacent building (15 ft.)
L = lesser of height or maximum projected width of adjacent building (15 ft)

There are no other structures located near the proposed electricity generation facility that have the potential to increase the calculated GEP stack height (i.e., the dimensions of the proposed facility control the GEP stack height determination). The release height of the proposed identical engine exhaust stacks is less than the GEP stack height (based on the dimensions of the structure in which the engines will be installed); therefore, emissions from the proposed electricity generation facility exhaust stacks have the potential to be influenced by aerodynamic downwash created by the building that houses the equipment. The influence of stack downwash on emission impacts was included in the dispersion modeling analyses.

Other nearby structures have the potential to influence the plume rise of the engine exhaust stacks if the distance between the stacks and the nearby structure is less than five times the L dimension (lesser of the building height or maximum projected width) of the structure. There are no other nearby structures located within the 5L radius.

The UTM coordinate locations and heights of the influencing structure (i.e., the building that houses the proposed engines) and proposed engine exhaust stacks were input to the USEPA Building Profile Input Program, Plume Rise Enhancement version (BPIP-PRIME). This computer program calculates projected building widths and heights for the influencing structure as a function of wind direction for use in the building downwash algorithms of the dispersion model that is used for the significant impact analysis (which is described in the following section of this document).

Appendix I-3 provides a compact disc that contains the BPIP input files (.PIP and .GPW files) and output building parameter files (.TAB, .SUM and .SO files) that were used in the significant impact analysis.

Table I-2.1 Exhaust stack parameters for the proposed LFG combustion devices, open utility flare and Trail Ridge Energy facility

Source ID	Location (UTM) East (m)	Location (UTM) North (m)	Base Elev. (m)	Stack Height (m)	Stack Height (ft)	Stack Diameter (m)	Stack Diameter (ft)	Temp. (K)	Exit Velocity (m/s)
ICE01	399,891	3,344,341	35	7.01	23.0	0.457	1.5	755	34.64
ICE02	399,891	3,344,336	35	7.01	23.0	0.457	1.5	755	34.64
ICE03	399,891	3,344,331	35	7.01	23.0	0.457	1.5	755	34.64
ICE04	399,891	3,344,326	35	7.01	23.0	0.457	1.5	755	34.64
ICE05	399,891	3,344,321	35	7.01	23.0	0.457	1.5	755	34.64
ICE06	399,891	3,344,316	35	7.01	23.0	0.457	1.5	755	34.64
FLARE[1]	399,893	3,344,251	35	25.9	85.0	2.14	7.05	1273	20.00

1. Data presented for height, diameter, temperature and exit velocity are equivalent values calculated for open flares, using equations from the TSCREEN users manual.

3.0 CLASS II AREA SIGNIFICANT IMPACT ANALYSIS

3.1 Purpose

A new source that has potential criteria air pollutant emissions in excess of PSD significant emission thresholds is required to perform analyses to determine whether its regulated air pollutant emissions will significantly impact the ambient air of designated Class II areas.
In NAAQS attainment areas, a demonstration that indicates the maximum predicated ambient air pollutant impacts (concentrations) caused by the emissions of a proposed source are less than the applicable PSD significant impact levels is equivalent to a demonstration of compliance with federal and State ambient air standards.

Table I-3.1 presents PSD significant impact levels established for Class II areas.

Air pollutant emissions from major sources that result in predicted ambient air impacts that exceed the significant impact levels are required to perform additional modeling to consider the cumulative impact caused by background emission sources and regional air pollutant background concentrations to demonstrate compliance with PSD increment consumption requirements and applicable federal ambient air quality standards.

For the purposes of the Class II modeling demonstration the criteria pollutant emissions from the operation of the IC engines, at 100% capacity, and utility flare, operating at a capacity of 65%, were considered in order to provide the most conservative (i.e., maximum) estimate of ambient air impacts. In actual practice it will not be possible for the engines and flare to operate simultaneously at the modeled capacities (i.e., there is not enough landfill gas being produced to support operation of the engine facility and flare at the modeled capacities).

3.2 Criteria Pollutant Emission Rates

Table I-3.2 presents criteria pollutant emission rates for the proposed electricity generation facility that were used in the significant impact analysis (SIA). These emission rates are the same as those presented in Table 3 of the main permit application document. The maximum annual NO_2 and SO_2 impacts produced by the proposed electricity generation facility that are required to be evaluated in the SIA were based on the total conversion of SO_X compounds to SO_2 and 75% conversion of NO_X compounds to NO_2.

Table I-3.3 presents criteria pollutant emission rates for the proposed utility flare that were used in the SIA. The emission rates are based upon data provided by the manufacturer for NO_x and CO emissions. PM-10 emissions are based on default USEPA AP-42 Chapter 2.4 data and SO_2 emissions are based on LFG sampling data performed by Trail Ridge Landfill representatives and presented in the replacement flare permit application.

3.3 Refined Modeling

Screening modeling may be performed for an initial determination of maximum impacts and the radius of significant impact. However, the screening model (e.g., SCREEN3) only calculates impacts associated with a single representative emission source. Due to the differences between the IC engine and flare exhaust parameters, no screening modeling was performed for this project (the SIA was performed using a refined model).

3.3.1 Model Selection

The AERMOD (American Meteorological Society/Environmental Protection Agency Regulatory Model) air pollutant dispersion model (version No. 04300) was used to calculate ground-level pollutant concentrations resulting from the proposed electricity generation facility and flare air pollutant emission rates and exhaust configuration. AERMOD is the most recent Gaussian steady-state plume dispersion model released by USEPA for use in assessing ambient air impacts associated with air pollutant releases and was adopted by the USEPA as the preferred general purpose dispersion model (Federal Register Notice November 9, 2005). The USEPA *Guideline on Air Quality Models* (40 CFR Part 51, Appendix W) specifies that impacts calculated with most steady-state Gaussian plume models are applicable at distances up to 50 km from the origin of the emission source.

The use of the AERMOD model is recommended because it:

- Can be used to model concentrations at both simple and complex terrain receptors.
- Uses the plume rise enhancement (PRIME) building downwash algorithm, which has been shown to be superior to the downwash algorithm in previously released Gaussian steady-state plume dispersion models.

The following sections present input data and processing options that were used in the AERMOD model for the SIA. The AERMOD input files were prepared by entering appropriate data (applicable to the specific emission process) and model operating parameters into a Windows-based graphical user interface (GUI) developed by BEE-Line Software (BEEST for Windows, current version 9.46).

3.3.2 Model Options

The AERMOD dispersion model was executed with regulatory default options, which include the use of stack-tip downwash and incorporate the effects of elevated terrain (if applicable). In regulatory default mode, no calculations are performed for deposition or plume depletion.

Based on information presented in Section 2.1 of this protocol, the land use for the area surrounding the proposed electricity generation facility is predominantly classified as rural (as opposed to urban). Therefore, no options for urban dispersion were used to calculate air quality impact concentrations produced by the modeled emission sources.

3.3.3 Meteorological Data

The meteorological data used in the AERMOD modeling analyses should be representative of the proposed electricity generation facility location. The closest NWS meteorological monitoring sites are located at the Jacksonville International Airport (Jacksonville, FL), which is located approximately 36 miles (58 km) from the proposed electricity generation facility and the Waycross-Ware County Airport (Waycross, GA), which is located approximately 90 miles (145 km) from the proposed site.

Meteorological data (hourly surface measurements and upper-air soundings) for the five-year period 1990 through 1992 and 1994 through 1995 (raw data files for 1993 were incomplete) were provided by the National Climatic Data Center for this project. Default site characteristics (surface roughness, albedo and Bowen Ratio) for deciduous forest were used in the modeling demonstration. The surface data were obtained from meteorological stations near the Jackson International Airport in HUSWO (Hourly United States Weather Observation) format. The upper-air data were obtained from meteorlogical stations near the Waycross-Ware County Airport in FSL (Forcast Systems Laboratory) format. The data were preprocessed using the AERMET meteorological preprocessor program to produce two types of data files for each meteorological year that are used by AERMOD; surface scalar parameters (*filename*.sss) and vertical profiles (*filename*.pfc). A profile base elevation of 35 meters (115 feet) was used with the meteorological data for the execution of AERMOD.

Table I-3.4 presents information for the National Weather Service stations that were used for the surface and upper air meteorological source data for the modeling analysis.

The AERMET data files are provided on the compact disc in Appendix I-3.

3.3.4 Receptor Network

Ground-level pollutant impact concentrations are required to be calculated for all nearby areas that are considered to be ambient air (i.e., areas in which public access is not precluded or restricted by the stationary source). Preliminary refined modeling results (using AERMOD) indicate that none of the criteria pollutants exceed PSD Class II significance levels outside of property owned by the Trail Ridge Landfill. The receptor network (locations at which air pollutant impact concentrations are calculated) used in the AERMOD modeling analyses was developed by creating a grid of receptors on a Cartesian coordinate system having a spacing of 100 meters was developed to determine off-site impacts up to 1.6 km from the facility to ensure that all maximum impacts were within the boundary of the receptor grid. Receptors were placed at the landfill facility boundary and extended 1.6 km in all directions from the proposed facility.

No flagpole receptors for use in the air quality impact analyses have been identified in the area surrounding the proposed facility location.

3.3.5 *Terrain Data*

As presented in Section 2.2 of this protocol and the site plan in Appendix I-1, complex terrain will not be considered as part of the refined modeling analysis, as there are no offsite receptors at elevations that exceed the stack height. The terrain in the region surrounding the Trail Ridge Landfill property is at elevations lower than the stack release elevation of the proposed facility, therefore, the terrain was classified as simple.

USGS 30-meter (7.5 minute) ASCII Digital Elevation Models (DEM) files were obtained for the geographical area surrounding the facility. The DEM data were based on the North American Datum of 1927 (NAD27). USEPA's AERMAP computer program was used to extract data from the DEM files and calculate source base elevations and receptor elevations using the default algorithm (inverse distance squared of the nearest four terrain nodes).

The DEM data files and AERMAP output files that were used in the model are provided on the compact disc in Appendix I-3.

3.3.6 *Pollutant Impact Averaging Times*

Maximum ambient air pollutant impact concentrations produced by the proposed emission sources were determined for the specified five-year meteorological period. These results were compared to the PSD significant impact levels, and if applicable, to establish the radius of significant impact (i.e., the geographic areas that surround the proposed emission facility that are determined to have impacts which are greater than the significance values). The sixth-high PM_{10} impact concentrations were considered in the significant impact analysis for the 24-hr averaging period (i.e., the SIA was based on the highest impact over the five-year meteorological data set for each pollutant averaging period except the 24-hr PM_{10} averaging period).

Have to use highest

The impact concentration(s) calculated for:

- SO_2 were based on maximum 3-hr, 24-hr and annual average impacts.
- PM_{10} were based on maximum impact for the annual averaging period and sixth-highest impact for the 24-hr averaging period.
- CO were based on the maximum 1-hr and 8-hr average impacts.

- NO_2 was based on the maximum annual average impact.

3.4 Refined Modeling SIA Results

Appendix I-4 presents results from the significant impact analysis obtained using the procedures described in this section and a plot depicting the maximum impacts.

These results indicate that emissions from the combined operation of the replacement utility flare and proposed electricity generation facility result in maximum impact concentrations that are below the Class II significant impact level for all pollutants and averaging times.

Table I-3.5 presents the proposed Trail Ridge Energy facility and proposed utility flare emission rates used in the modeling demonstration, and the predicted impacts from the proposed facility, flare and combined impact.

Table I-3.1 Significant Impact Levels for Class II Areas ($\mu g/m^3$)

Pollutant	Annual	24-Hr	8-Hr	3-Hr	1-Hr
Nitrogen Dioxide (NO_2)	1.0	--	--	--	--
Carbon Monoxide (CO)	--	--	500	--	2000
Sulfur Dioxide (SO_2)	1.0	5.0	--	25.0	--
Particulates (PM_{10}/TSP)	1.0	5.0	--	--	--

Table I-3.2 Criteria pollutant emission rates for the proposed Trail Ridge Energy facility used in the air quality analysis

Pollutant	LFG-Fired ICE Emission Factors		Single ICE[3] Emissions (lb/hr)	Facility Emission Rate for Six (6) ICE (lb/hr)	Facility Emission Rate for Six (6) ICE (TpY)	Facility Emission Rate for Six (6) ICE (g/s)
Nitrogen Dioxide (NO_x)[1]	0.60	g/bhp-hr	2.95	17.72	77.6	1.67
Carbon Monoxide (CO)	2.75	g/bhp-hr	13.54	81.23	355.8	10.24
Sulfur Dioxide (SO_2)	32.2	lb/MMcf	0.96	5.76	25.23	0.73
Particulates[2]	0.24	g/bhp-hr	1.18	7.09	31.05	0.89

1. Emission factor of 0.60 g/bhp-hr is for total oxides of nitrogen (NO_x), USEPA guidance specifies that 75% of NO_x can be considered NO_2, which is reflected only in the (g/s) emission rate.
2. Particulate emission rate for TSP, PM_{10} and $PM_{2.5}$.
3. Based on operation of a single engine at base load (100% capacity) conditions; engine output of 2233 hp and maximum theoretical fuel consumption of 35,075 scfh LFG .

Table I-3.3 Criteria pollutant emission rates for the proposed Trail Ridge Landfill utility flare used in the air quality analysis

Pollutant	LFG Utility Flare[2] Emission Factors		Utility Flare Emission Rate (lb/hr)	(TpY)	(g/s)
Nitrogen Dioxide (NO_x)[1]	0.04	lb/MMBtu	5.88	25.8	0.56
Carbon Monoxide (CO)	0.37	lb/MMBtu	54.4	238	6.85
Sulfur Dioxide (SO_2)	3.65	lb/MMscf LFG	1.10	4.82	0.14
Particulates	17.0	lb/MMdscf CH_4	2.55	11.2	0.32

1. USEPA guidance specifies that 75% of NO_x can be considered NO_2, which is reflected only in the (g/s) emission rate.
2. Presented in Trail Ridge Landfill replacement flare permit application.

Table I-3.4 NWS station information for meteorological data used in the modeling analysis

Data Type	Station Name	WBAN ID	Years Available[1]	Location North	West
Surface	Jackson International Airport	13889	1990-1995	30.49	-81.69
Upper	Waycross-Ware County Airport	13861	~~1969-1995~~ 1990?	31.25	-82.39

1. Data set for 1993 is incomplete.

Table I-3.5 Air impact results compared to PSD Class II Significant Impact Levels

Pollutant	Averaging Time	Replacement Flare Emission Rate (g/s)	Potential TRE Facility Emission Rate (g/s)	Maximum Predicted Replacement Flare Impact (µg/m^3)	Maximum Predicted TRE Facility Impact (µg/m^3)	Combined TRE and Flare Impact (µg/m^3)	Class II Significant Impact Levels (µg/m^3)
NO_2	Annual	0.56	1.67	0.06	0.92	0.985	1.0
CO	8-hr	6.85	10.24	9.02	66.7	67.1	500
	1-hr	6.85	10.24	11.0	92.9	93.0	2000
SO_2	Annual	0.14	0.73	0.01	0.41	0.42	1.0
	24-hr	0.14	0.73	0.11	2.80	2.82	5.0
	3-hr	0.14	0.73	0.22	6.43	6.44	25.0
PM_{10}	Annual	0.32	0.89	0.03	0.51	0.54	1.0
	24-hr	0.32	0.89	0.18	2.36	2.40	5.0

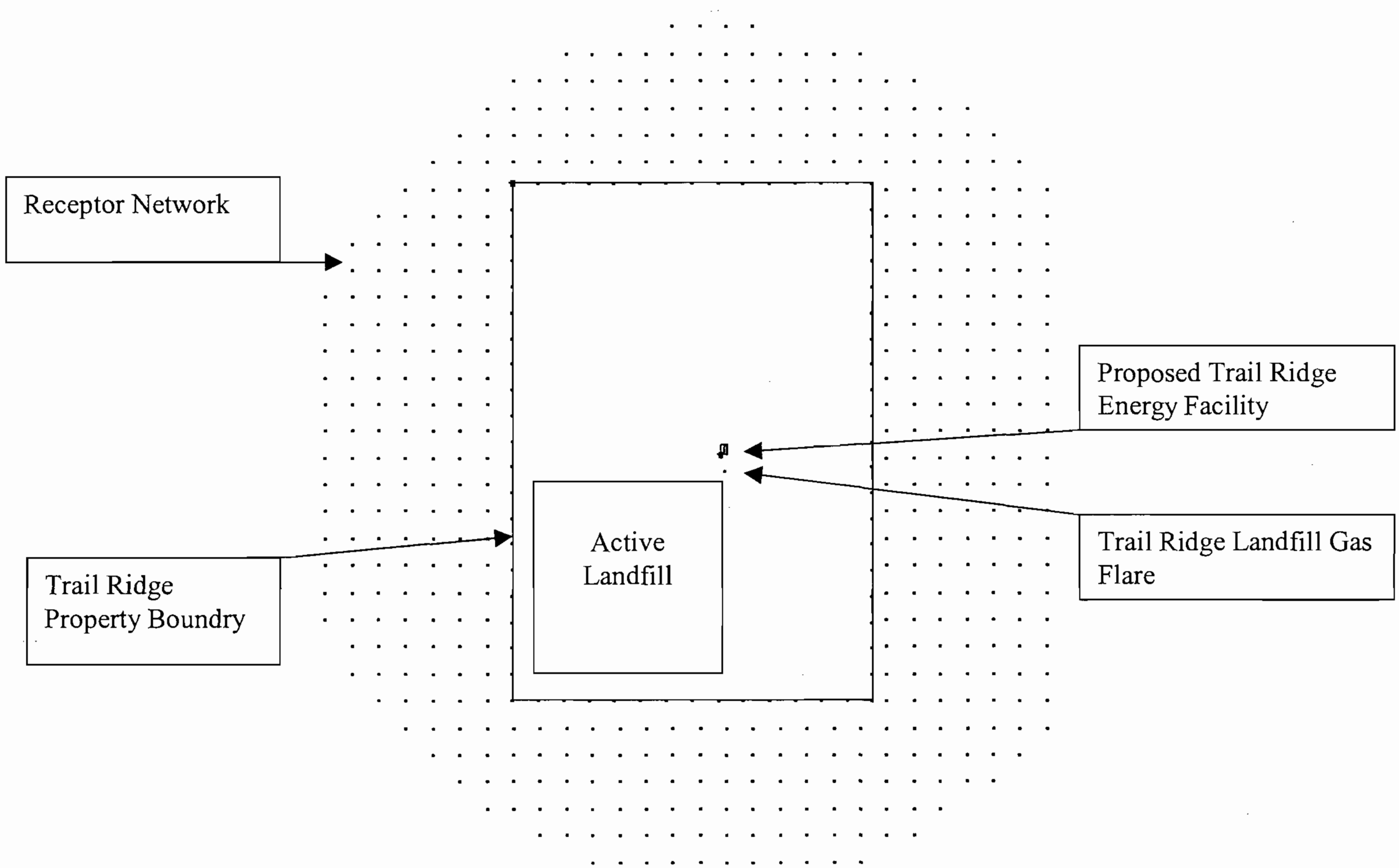


Figure I-3.1 Receptor network used in refined modeling analysis

4.0 CLASS I AREA MODELING

The proposed Trail Ridge Energy facility will be located approximately 45 km from the closest portion of the Okefenokee National Wilderness Area Class I area and approximately 100 km from the furthest portion of the Okefenokee Class I area. Pursuant to USEPA guidance, a Class I area PSD increment and visibility analysis must be performed since the proposed facility is a potential major source that will be located within 100 km of a designated Class I area.

Table I-4.1 presents the location of Class I area relative to the proposed Trail Ridge Energy facility.

4.1 Model Selection

Because the distance between the proposed facility and Class I area is between 45 and 100 km, FDEP guidance recommended that the AERMOD model (as described in the previous section) be used to assess criteria pollutant impacts located in the Okefenokee National Wilderness Area between 45 and 50 km from the proposed facility and that the CALPUFF model be used for areas located between 50 and 100 km from the proposed facility (Gaussian steady-state plume dispersion models (i.e., AERMOD) are only recommended up to 50 km).

The FDEP also recommended that for the visibility degradation modeling the VISCREEN model be used to assess visibility degradation in areas of the Okefenokee National Wilderness Area located between 45 and 50 km from the proposed facility and the CALPUFF model be used to assess visibility degradation in areas located between 50 and 100 km from the proposed facility.

Guidance issued by USEPA indicates that the CALPUFF dispersion model can be used to assess haze impairment that may be attributable to the emissions from a single source. CALPUFF is a multi-layer, multi-species non-steady-state puff dispersion model that simulates the effects of time- and space-varying meteorological conditions on air pollution transport, transformation and removal. A screening version of CALPUFF, CALPUFF Lite that is distributed by BEE-Line Software, was used to determine potential criteria pollutant impacts and visibility degradation in the Okefenokee National Wilderness Area from the emissions produced by the proposed electricity generation facility. Pursuant to guidance provided by FDEP, the use of CALPUFF Lite for this project is only allowed if the calculated pollutant impact concentrations calculated by CALPUFF Lite are below the significance level for Class I areas.

VISCREEN is a screening tool that calculates the potential impact of a plume of specified emissions for specific transport and dispersion conditions. The model was obtained from the USEPA Support Center for Regulatory Atmospheric Modeling website and used to assess visibility degredation in the area surrounding and including the Okefenokee National Wilderness Area up to 50 km from the proposed source.

4.2 Model Options

The AERMOD model, used to assess criteria pollutant impacts, was set up and executed as described in Section 3.0. Additional receptors were added to the model in the area of the Okefenokee National Wilderness Area that is located within 50 km of the proposed source.

The CALPUFF Lite model requires the user to input several parameters that are used to determine the impacts at the specified receptor network. The source data (i.e., UTM coordinates and stack parameters) that were used for the Class II area significant impact modeling demonstration (presented in Section 3.0 of this protocol) were entered into the CALPUFF Lite model. Default values of zero meters for the initial sigma y and initial sigma x were used and the momentum flux was set to a value of 1 meter. The computer model requires the user to enter information relating to the Class I area under consideration. The Okefenokee National Wilderness Area area was classified as a forested area with a roughness length of 1.0 meters and leaf index of 7.0. For the visibility screening a maximum relative humidity of 98% and Rayleigh Scattering value of 10.0 was used as recommended in the Interagency Workgroup on Air Quality Modeling (IWAQM) *Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts* (IWAQM Recommendation Document).

The VISCREEN model requires the user to input several parameters that are used to determine if visual impacts inside the specified area are exceeded. Level-1 default parameters were used for the meteorological inputs and transport scenario specifications. Default screening thresholds were selected to determine if the visual impacts exceeded Class I Area screening criteria.

4.3 Receptor Network

For the portion of the Okefenokee National Wilderness Area that is located at a distance of 45 km to 50 km from the facility, and evaluated using AERMOD, a set of 48 discrete receptors was set up to evaluate criteria pollutant impacts. The location of the receptors correspond to a list of Class I receptors (located within a 50 km radius from the proposed source) specified by the National Park Service (downloaded from the National Park Service website for the Okefenokee National Wilderness Area).

For the portion of the Okefenokee National Wilderness Area that is located at a distance of 50 km to 100 km from the facility, and evaluated using CALPUFF Lite, a receptor grid was developed to calculate air pollutant impact concentrations at receptors spaced at 2-degree radial intervals placed on concentric rings that encircle the electricity generation facility and pass through the Class I area in accordance with guidance provided in the IWAQM Recommendation Document. A total of five (5) concentric rings, located between 50 km and 100 km from the proposed electricity generation facility spaced 10 km apart was used as the receptor network.

The Okefenokee National Wilderness Area is a marshy area, encompassing approximately 950 square miles, located in southeast Georgia. Its southern border runs along the northern border of Florida. Topographical maps of the area indicate that elevations range from 35 to 40 meters above sea level. The rings of the receptor grid were assigned an elevation of 35 meters above sea level.

The VISCREEN model was set to evaluate visual impacts between 39.5 and 95.8 km from the proposed facility. Topography and elevations are not used in VISCREEN modeling.

4.4 Meteorological Data

For the AERMOD modeling demonstration the meteorological data described in Section 3.3.3 of this document was used.

The standard meteorological data used in the AERMOD demonstration is not compatible with the screening version of CALPUFF. Meteorological data provided by the National Climatic Data Center that is compatible with CALPUFF was used in the modeling demonstration. The most recent available five years (1990 to 1992 and 1994 to 1995) of surface meteorological data in HUSWO format (Hourly United States Weather Observations) for station 13889 (Jacksonville International Airport) were obtained from the National Oceanic and Atmospheric Administration (NOAA). The HUSWO surface data were combined with the corresponding mixing height data available for station 13861 (Waycross-Ware County Airport) and processed with CPRAMMET for use in the CALPUFF screening model.

The following CPRAMMET input parameters were used to generate the CALPUFF screening meteorological data:

- Minimum Monin-Obukhov length, 2.0 meters
- Anemometer height, 6.0 meters (Jacksonville International Airport)
- Surface roughness at measurement site, 1.3 meters (deciduous forest, summer)
- surface roughness at the application site, 1.3 meters (deciduous forest, summer) ? Too high
- Noon-time albedo, 0.12 (deciduous forest, summer)
- Bowen ratio, 0.3 (deciduous forest, summer)
- Anthropogenic heat flux, 0.0
- Fraction net radiation absorbed by the ground, 0.15 (rural)

These data files are provided on the compact disc in Appendix I-3.

Default Level-1 modeling meteorological parameters for wind speed (1.0 m/s) and the stability index (6) were used in the VISCREEN modeling demonstration.

4.5 Class I Area Significant Impact

For the PSD Class I significant impact analysis, impacts calculated at the specified receptors resulting from significant criteria pollutant emissions from the proposed Trail Ridge Energy facility and replacement flare were determined for comparison to the significant impact concentrations for PM_{10} (24-hr and annual averaging periods), and NO_2 (annual averaging period). Only those pollutants for which the potential emission rate exceeds the corresponding significance level were considered in the Class I Area modeling (SO_2, which is below the 40 ton per year significance level, was not considered).

Table I-4.2 specifies significant impact levels for Class I areas.

4.6 Visibility

The presence of fine particulate matter (sulfates, nitrates and organic carbons) in the atmosphere has the potential to cause visibility impairment by the scattering or adsorbing of light. USEPA has concluded (*Guideline on Air Quality Models*, 40 CFR Part 51, Appendix W, §7.2.1) that the long-range transport of fine particulate matter can significantly impair visibility in areas that are located hundreds of kilometers from the source of these emissions. Therefore, based on the distance between the proposed electricity generation facility and the nearest Class I area (the Okefenokee National Wilderness Area, located approximately 46 km to the northwest), the FDEP requires that analyses be performed to evaluate the potential impacts of the emission plume produced by the proposed facility on the identified Class I area.

Emission rates for PM_{10} and those constituents exhausted by the proposed IC engine operation that have the potential to undergo chemical transformation to form nitrate particulate compounds (NO_X) were used in the visibility analyses as input for the CALPUFF Lite calculations. The MESOPUFF II chemistry option were utilized, which uses the chemical species SO_2, SO_4, NO_x, HNO_3, NO_3 and primary particulate for assessing haze contributions within the Class I area.

The operating parameters of the CALPUFF Lite screening model wwereill be configured to calculate light extinction values at the receptors identified in Section 4.3. A regional haze visibility degradation of 5% or less was considered acceptable visibility (i.e., visibility degradation calculated with CALPUFF Lite compared to the existing default background visibility impairment (b_{ext}) of 10.0 Mm^{-1}).

For the VISCREEN modeling potential particulate and NOx emission rates for the proposed facility were entered into the model. Default (zero) emission rates for NO2, soot and sulfates were used. The Level-1 default background ozone concentration of 0.04 ppm and plume offset angle of 11.25 degrees was used. The modeling program was set to compare the visibility imparement results with Class I Area Screening Criteria to determine if the visual impacts are exceeded.

4.7 Class I Modeling Results

Appendix I-5 presents results from the Class I modeling analysis obtained using the procedures described in this section.

These results indicate that emissions from the proposed electricity generation facility result in maximum impact concentrations that are below the Class I significant impact level for all pollutants modeled and averaging times (evalutated using AERMOD and CALPUFF Lite). Regional haze visibilities are below 5% for all areas considered in the CALPUFF Lite Class I modeling demonstration. The maximum visual impacts do not exceed screening criteria in any of the areas considered in the VISCREEN modeling demonstration.

Table I-4.3 presents the maximum combined Trail Ridge Energy facility and replacement flare impacts in the Class I Area.

Table I-4.4 presents the results of the CALPUFF Lite visibility impairment analysis in the Class I Area.

Table I-4.1 Location of Class I area relative to the proposed Trail Ridge Energy facility

	Proposed Trail Ridge Energy Facility	Class I Area Okefenokee National Wilderness Area (closest point)	Class I Area Okefenokee National Wilderness Area (furthest point)
Counties	Duval, FL	Charlton, GA	Ware, GA
Municipality	South Baldwin	Moniac	Hoboken
Easting (km)	399.9	383.4	371.4
Northing (km)	3,344.3	3,385.0	3,439.2
Distance to Proposed Facility (km)	NA	45	100

Table I-4.2 Significant Impact Levels for Class I Areas ($\mu g/m^3$)

Pollutant	Annual	24-Hr	3-Hr
Inhalable Particulates (PM_{10})	0.2	0.3	--
Nitrogen Dioxide (NO_2)	0.1	--	--

Table I-4.3 Results of Class I area significant impact analysis

Pollutant	Averaging Period	Met. Year	Maximum Landfill Sources Impact ($\mu g/m^3$)	Class I Significant Impact Levels ($\mu g/m^3$)
PM_{10}	24-hr	1992	0.12	0.03
PM_{10}	Annual	~~1992~~ 1994	0.084	0.02
NO_2	Annual	1994	0.004	0.01

Note – SO_2 was not modeled, per guidance provided by FDEP representatives

Table 4.4 Results of CALPUFF Lite visibility impairment analysis for the Okefenokee National Wilderness Area Class I area

Met. Year	Background Visibility (Mm^{-1})	Days with > 5% Light Extinction	Greatest Light Extinction Change
1990	10.0	0	2.54%
1991	10.0	0	3.39%
1992	10.0	0	4.78%
1993	10.0	0	4.94%
1994	10.0	0	4.25%

5.0 SPECIAL MODELING CONSIDERATIONS

5.1 Particle Deposition

Based on the design and operation of the proposed IC engines and the treatment (dewatering, compression and filtration) of LFG received from the landfill prior to its use as a fuel and combustion, the amount of particulates emitted from the combustion process are expected to be relatively small. Therefore, it is anticipated that compliance with the particulate matter ambient air quality standards can be achieved without considering particle deposition (i.e., the removal of particulates from the exhaust plume over the distance of maximum ground-level impacts due to deposition are expected to be minimal).

5.2 Fugitive Emissions

The proposed Trail Ridge Energy electricity generation facility will utilize LFG that is supplied by the Trail Ridge Landfill gas collection and control system. The proposed Trail Ridge Energy electricity generation facility will not be a source of fugitive emissions.

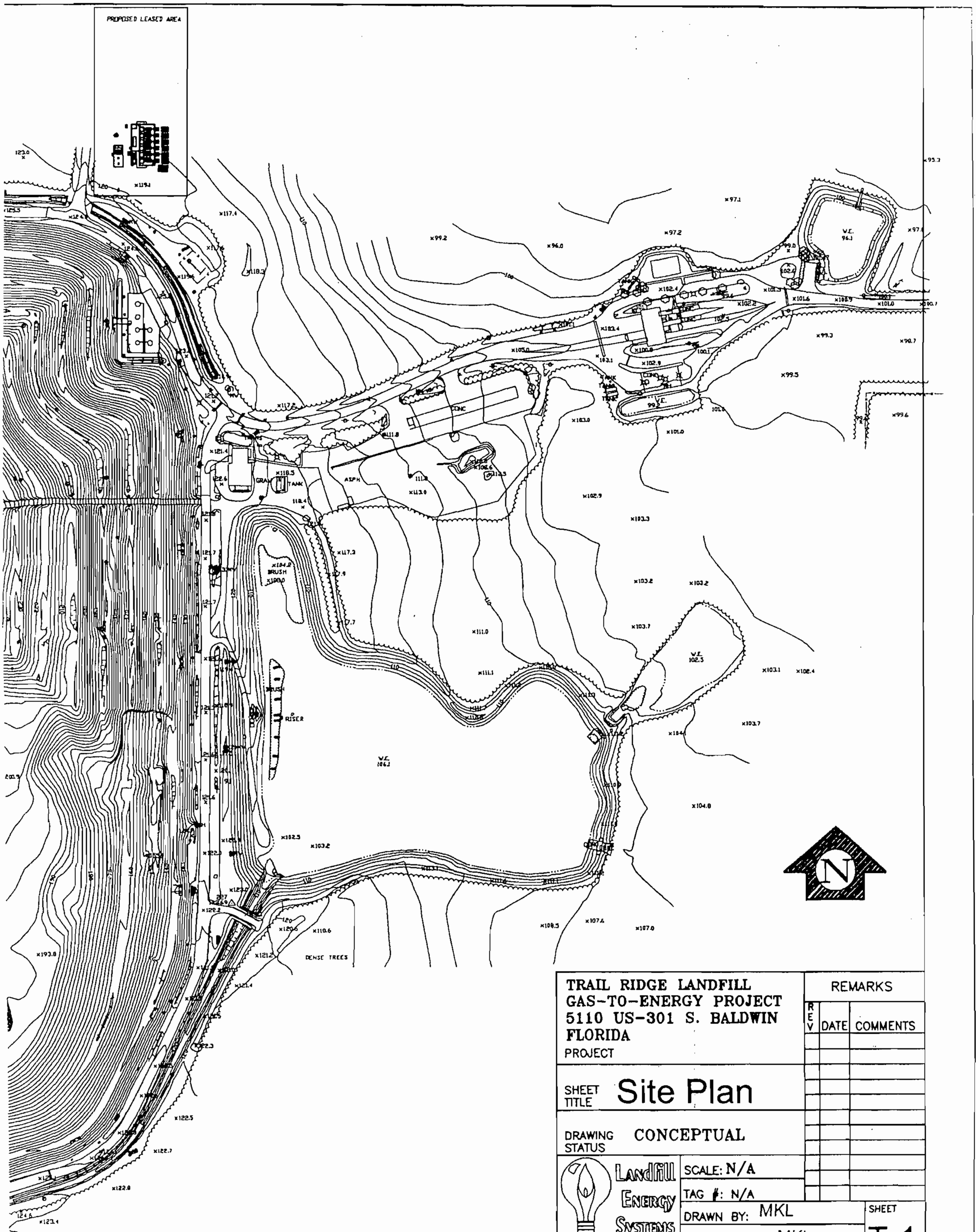
5.3 Start-Up / Shutdown / Low Load Scenarios

The proposed electricity generation facility will use LFG-fueled IC engines that are designed to operate as base load (100% capacity) conditions. These engines will operate continuously with the exception for planned maintenance shutdowns or automatic engine shutdowns (instantaneous, automatic engine shutdowns if monitored operating parameters are outside of preset ranges). The amount of time required for an engine start-up is minimal. Since the engines are operated at base load conditions and the durations of engine shutdown and startup times are minimal, no air quality impact concentrations analyses will be performed for these specific events.

APPENDIX I-1

LANDFILL AND TRAIL RIDGE ENERGY SITE PLANS
AND
TOPOGRAPHICAL PLOT

BEST AVAILABLE COPY



TRAIL RIDGE LANDFILL
GAS-TO-ENERGY PROJECT
5110 US-301 S. BALDWIN
FLORIDA
PROJECT

SHEET TITLE: Site Plan

DRAWING STATUS: CONCEPTUAL

REMARKS		
REV	DATE	COMMENTS

Landfill Energy Systems
29261 WALL ST.
WIXOM, MI. 48393
248 380-3920

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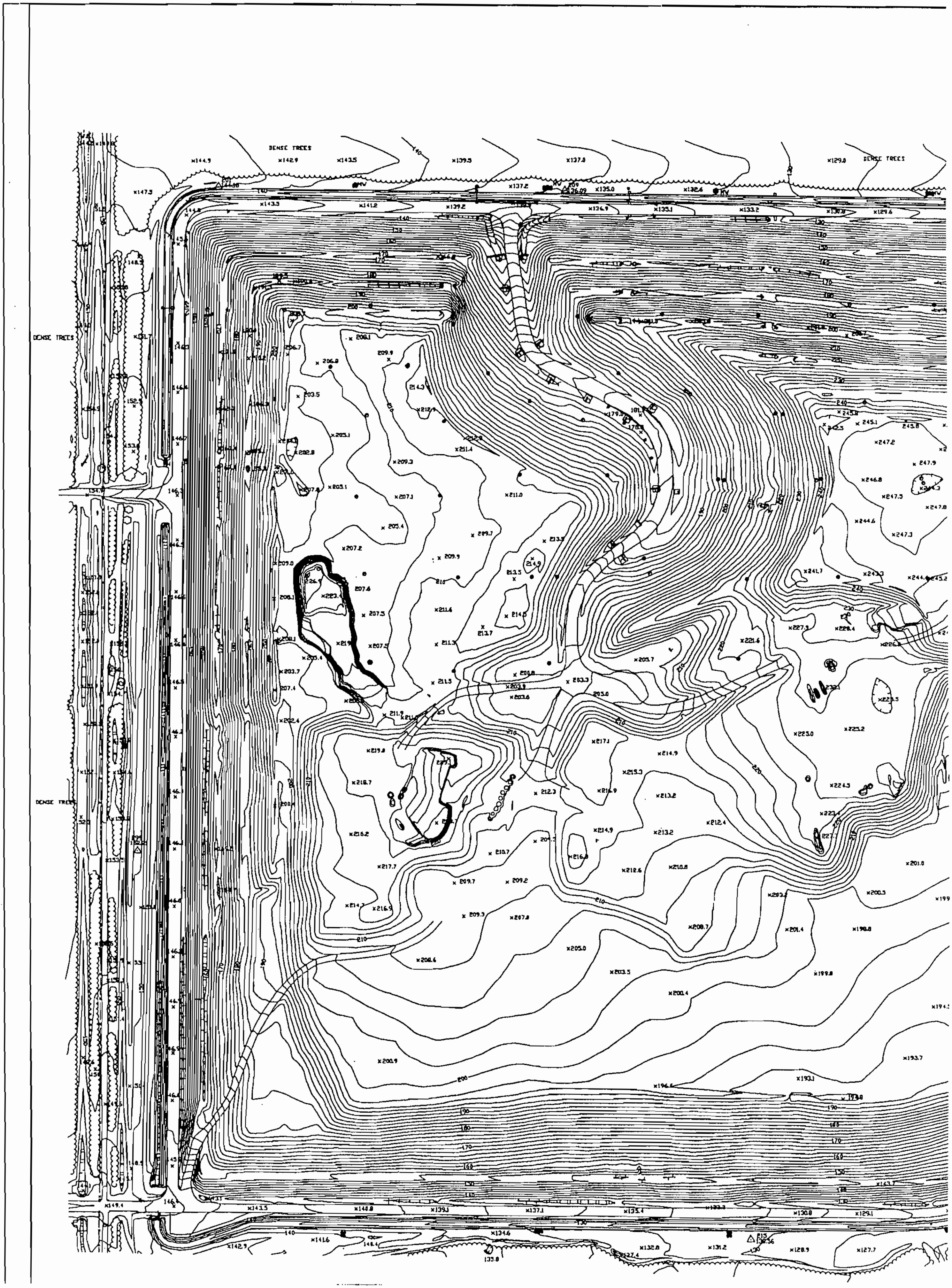
TAG #: N/A
DRAWN BY: MKL
CHECKED BY: MKL
DATE ISSUED: 09/14/05
SHEET T-1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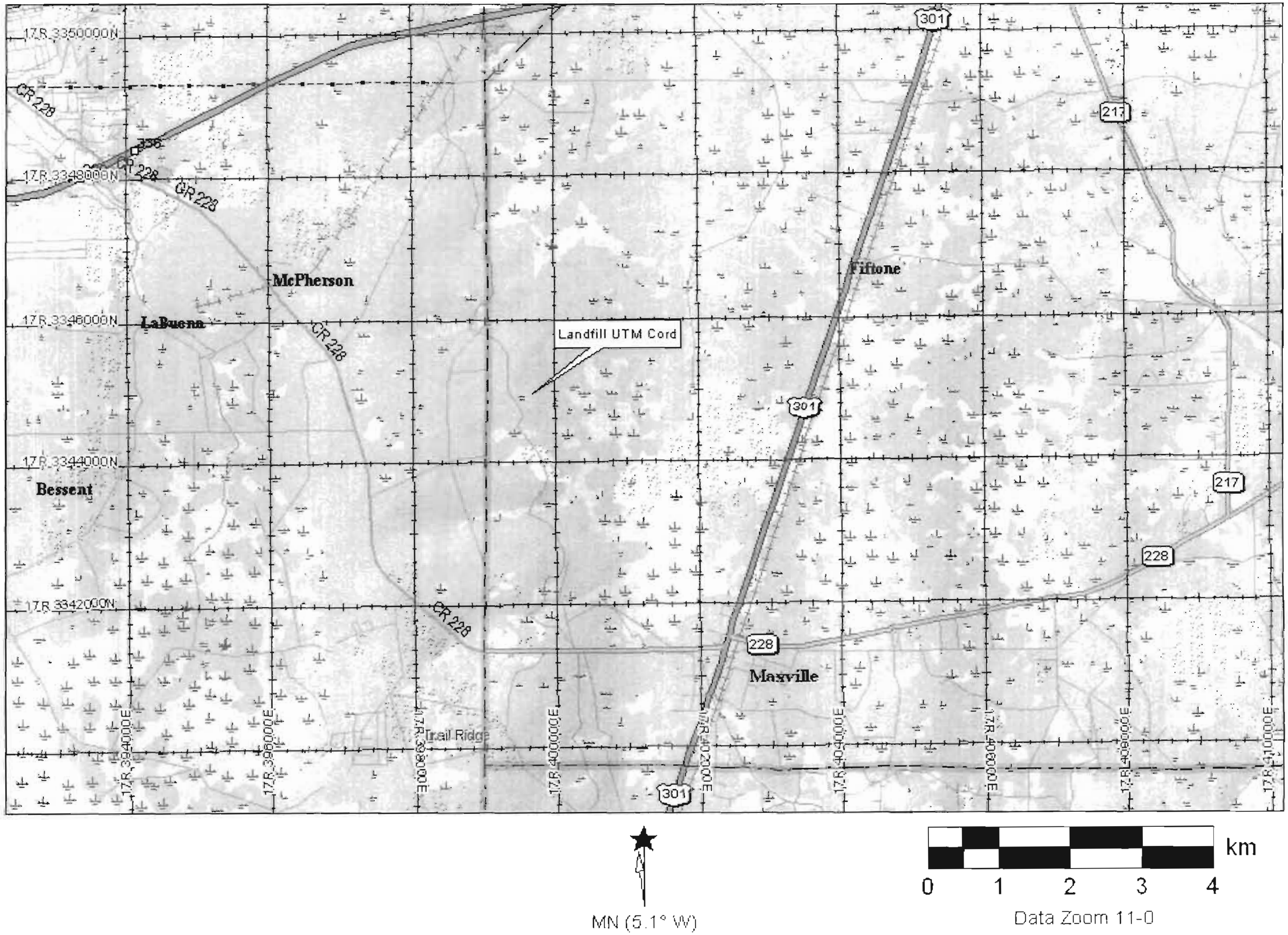
APPENDIX I-2

COORDINATES FOR PROPOSED FACILITY AND STACKS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17R 406000E
17R 408000E
17R 410000E
CR 228
301
217
228
McPherson
LaBuena
Bessent
Fiftone
Maxville
Trail Ridge
Landfill UTM Cord
MN (5.1° W)
km
0
1
2
3
4
Data Zoom 11-0

APPENDIX I-3

MODELING INPUT FILES

APPENDIX I-4

RESULTS OF CLASS II SIGNIFICANT IMPACT ANALYSIS

6th High?

	Model	File	Pol	Average	Group	Rank	Conc.	East(X)	North(Y)	Elev	Time	Met File	Sources	Groups	Rec.
1	AERMOD	TrailRidge04_92_SO2.USF	SO2	ANNUAL	ALL	1ST	0.42	400,490	3,344,266	29.10	1 YRS	Jackso92.SFC	7	3	493
1	AERMOD	TrailRidge04_93_SO2.USF	SO2	ANNUAL	ALL	1ST	0.41	400,490	3,344,266	29.10	1 YRS	Jackso93.SFC	7	3	493
1	AERMOD	TrailRidge04_90_SO2.USF	SO2	ANNUAL	ALL	1ST	0.38	400,490	3,344,266	29.10	1 YRS	Jackso90.SFC	7	3	493
1	AERMOD	TrailRidge04_91_SO2.USF	SO2	ANNUAL	ALL	1ST	0.35	400,490	3,344,170	29.69	1 YRS	Jackso91.SFC	7	3	493
1	AERMOD	TrailRidge04_94_SO2.USF	SO2	ANNUAL	ALL	1ST	0.32	400,490	3,344,362	28.96	1 YRS	Jackso94.SFC	7	3	493
2	AERMOD	TrailRidge04_92_SO2.USF	SO2	ANNUAL	TRNRG	1ST	0.41	400,490	3,344,266	29.10	1 YRS	Jackso92.SFC	7	3	493
2	AERMOD	TrailRidge04_93_SO2.USF	SO2	ANNUAL	TRNRG	1ST	0.40	400,490	3,344,266	29.10	1 YRS	Jackso93.SFC	7	3	493
2	AERMOD	TrailRidge04_90_SO2.USF	SO2	ANNUAL	TRNRG	1ST	0.38	400,490	3,344,266	29.10	1 YRS	Jackso90.SFC	7	3	493
2	AERMOD	TrailRidge04_91_SO2.USF	SO2	ANNUAL	TRNRG	1ST	0.34	400,490	3,344,170	29.69	1 YRS	Jackso91.SFC	7	3	493
2	AERMOD	TrailRidge04_94_SO2.USF	SO2	ANNUAL	TRNRG	1ST	0.31	400,490	3,344,362	28.96	1 YRS	Jackso94.SFC	7	3	493
3	AERMOD	TrailRidge04_92_SO2.USF	SO2	ANNUAL	FLARE	1ST	0.01	400,490	3,344,458	28.96	1 YRS	Jackso92.SFC	7	3	493
3	AERMOD	TrailRidge04_93_SO2.USF	SO2	ANNUAL	FLARE	1ST	0.01	400,490	3,344,362	28.96	1 YRS	Jackso93.SFC	7	3	493
3	AERMOD	TrailRidge04_90_SO2.USF	SO2	ANNUAL	FLARE	1ST	0.01	400,490	3,344,554	28.96	1 YRS	Jackso90.SFC	7	3	493
3	AERMOD	TrailRidge04_94_SO2.USF	SO2	ANNUAL	FLARE	1ST	0.01	400,490	3,344,458	28.96	1 YRS	Jackso94.SFC	7	3	493
3	AERMOD	TrailRidge04_91_SO2.USF	SO2	ANNUAL	FLARE	1ST	0.01	400,490	3,344,554	28.96	1 YRS	Jackso91.SFC	7	3	493
4	AERMOD	TrailRidge04_93_SO2.USF	SO2	3-HR	ALL	1ST	6.44	400,490	3,344,362	28.96	93021324	Jackso93.SFC	7	3	493
4	AERMOD	TrailRidge04_92_SO2.USF	SO2	3-HR	ALL	1ST	5.93	400,490	3,344,170	29.69	92092306	Jackso92.SFC	7	3	493
4	AERMOD	TrailRidge04_90_SO2.USF	SO2	3-HR	ALL	1ST	5.66	400,490	3,344,170	29.69	90092106	Jackso90.SFC	7	3	493
4	AERMOD	TrailRidge04_94_SO2.USF	SO2	3-HR	ALL	1ST	5.57	400,490	3,344,170	29.69	94082303	Jackso94.SFC	7	3	493
4	AERMOD	TrailRidge04_91_SO2.USF	SO2	3-HR	ALL	1ST	5.57	400,490	3,344,458	28.96	91021103	Jackso91.SFC	7	3	493
5	AERMOD	TrailRidge04_93_SO2.USF	SO2	3-HR	TRNRG	1ST	6.44	400,490	3,344,362	28.96	93021324	Jackso93.SFC	7	3	493
5	AERMOD	TrailRidge04_92_SO2.USF	SO2	3-HR	TRNRG	1ST	5.93	400,490	3,344,170	29.69	92092306	Jackso92.SFC	7	3	493
5	AERMOD	TrailRidge04_90_SO2.USF	SO2	3-HR	TRNRG	1ST	5.66	400,490	3,344,170	29.69	90092106	Jackso90.SFC	7	3	493
5	AERMOD	TrailRidge04_94_SO2.USF	SO2	3-HR	TRNRG	1ST	5.57	400,490	3,344,170	29.69	94082303	Jackso94.SFC	7	3	493
5	AERMOD	TrailRidge04_91_SO2.USF	SO2	3-HR	TRNRG	1ST	5.56	400,490	3,344,458	28.96	91021103	Jackso91.SFC	7	3	493
6	AERMOD	TrailRidge04_92_SO2.USF	SO2	3-HR	FLARE	1ST	0.22	400,490	3,344,170	29.69	92011006	Jackso92.SFC	7	3	493
6	AERMOD	TrailRidge04_93_SO2.USF	SO2	3-HR	FLARE	1ST	0.21	400,490	3,344,362	28.96	93030506	Jackso93.SFC	7	3	493
6	AERMOD	TrailRidge04_94_SO2.USF	SO2	3-HR	FLARE	1ST	0.20	400,490	3,344,170	29.69	94031906	Jackso94.SFC	7	3	493
6	AERMOD	TrailRidge04_91_SO2.USF	SO2	3-HR	FLARE	1ST	0.19	400,490	3,344,554	28.96	91070224	Jackso91.SFC	7	3	493
6	AERMOD	TrailRidge04_90_SO2.USF	SO2	3-HR	FLARE	1ST	0.18	400,490	3,343,882	30.91	90012206	Jackso90.SFC	7	3	493
7	AERMOD	TrailRidge04_90_SO2.USF	SO2	24-HR	ALL	1ST	2.82	400,490	3,344,266	29.10	90111224	Jackso90.SFC	7	3	493
7	AERMOD	TrailRidge04_91_SO2.USF	SO2	24-HR	ALL	1ST	2.66	400,490	3,344,458	28.96	91021024	Jackso91.SFC	7	3	493
7	AERMOD	TrailRidge04_92_SO2.USF	SO2	24-HR	ALL	1ST	2.65	400,490	3,344,362	28.96	92010624	Jackso92.SFC	7	3	493
7	AERMOD	TrailRidge04_93_SO2.USF	SO2	24-HR	ALL	1ST	2.01	400,490	3,344,362	28.96	93120624	Jackso93.SFC	7	3	493
7	AERMOD	TrailRidge04_94_SO2.USF	SO2	24-HR	ALL	1ST	1.67	400,490	3,344,362	28.96	94051224	Jackso94.SFC	7	3	493
8	AERMOD	TrailRidge04_90_SO2.USF	SO2	24-HR	TRNRG	1ST	2.80	400,490	3,344,266	29.10	90111224	Jackso90.SFC	7	3	493
8	AERMOD	TrailRidge04_91_SO2.USF	SO2	24-HR	TRNRG	1ST	2.65	400,490	3,344,458	28.96	91021024	Jackso91.SFC	7	3	493
8	AERMOD	TrailRidge04_92_SO2.USF	SO2	24-HR	TRNRG	1ST	2.63	400,490	3,344,362	28.96	92010624	Jackso92.SFC	7	3	493
8	AERMOD	TrailRidge04_93_SO2.USF	SO2	24-HR	TRNRG	1ST	1.99	400,490	3,344,362	28.96	93120624	Jackso93.SFC	7	3	493
8	AERMOD	TrailRidge04_94_SO2.USF	SO2	24-HR	TRNRG	1ST	1.62	400,490	3,344,362	28.96	94051224	Jackso94.SFC	7	3	493
9	AERMOD	TrailRidge04_92_SO2.USF	SO2	24-HR	FLARE	1ST	0.11	400,490	3,344,170	29.69	92010424	Jackso92.SFC	7	3	493
9	AERMOD	TrailRidge04_93_SO2.USF	SO2	24-HR	FLARE	1ST	0.10	400,490	3,344,170	29.69	93021324	Jackso93.SFC	7	3	493
9	AERMOD	TrailRidge04_94_SO2.USF	SO2	24-HR	FLARE	1ST	0.09	400,490	3,343,786	30.91	94122324	Jackso94.SFC	7	3	493
9	AERMOD	TrailRidge04_91_SO2.USF	SO2	24-HR	FLARE	1ST	0.09	400,490	3,343,978	30.34	91011324	Jackso91.SFC	7	3	493
9	AERMOD	TrailRidge04_90_SO2.USF	SO2	24-HR	FLARE	1ST	0.08	400,490	3,344,266	29.10	90111024	Jackso90.SFC	7	3	493

25

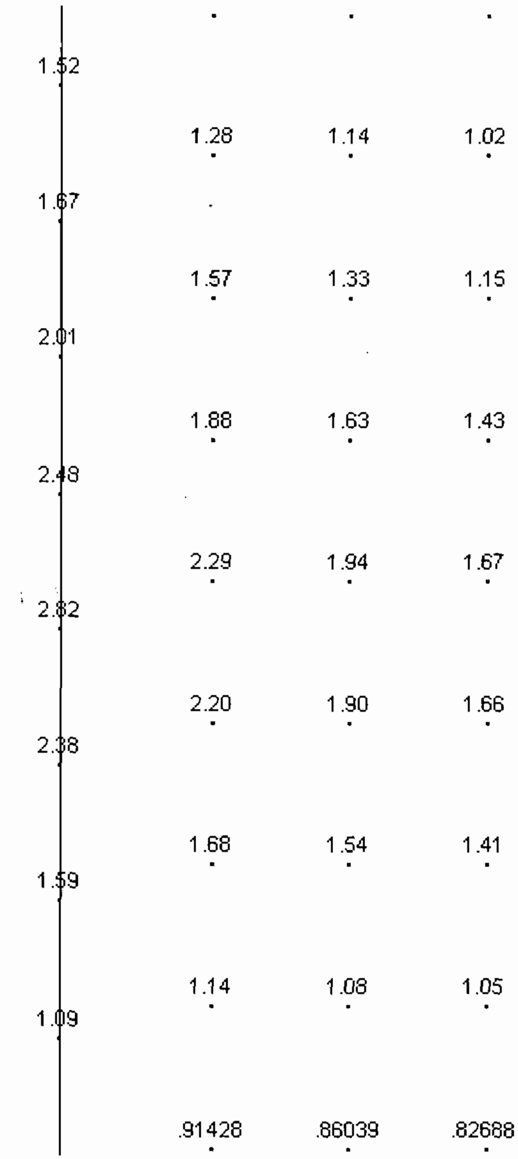
Trail Ridge Energy, L.L.C. Class II AERMOD Modeling Results - NOx

	Model	File	Pol	Average	Group	Rank	Conc.	East(X)	North(Y)	Elev	Time	Met File	Sources	Groups	Rec.
1	AERMOD	TrailRidge04_92_NOX.USF	NOX	ANNUAL	ALL	1ST	0.99	400,490	3,344,266	29.10	1 YRS	Jackso92.SFC	7	3	493
1	AERMOD	TrailRidge04_93_NOX.USF	NOX	ANNUAL	ALL	1ST	0.96	400,490	3,344,266	29.10	1 YRS	Jackso93.SFC	7	3	493
1	AERMOD	TrailRidge04_90_NOX.USF	NOX	ANNUAL	ALL	1ST	0.89	400,490	3,344,266	29.10	1 YRS	Jackso90.SFC	7	3	493
1	AERMOD	TrailRidge04_91_NOX.USF	NOX	ANNUAL	ALL	1ST	0.80	400,490	3,344,170	29.69	1 YRS	Jackso91.SFC	7	3	493
1	AERMOD	TrailRidge04_94_NOX.USF	NOX	ANNUAL	ALL	1ST	0.74	400,490	3,344,362	28.96	1 YRS	Jackso94.SFC	7	3	493
2	AERMOD	TrailRidge04_92_NOX.USF	NOX	ANNUAL	TRNRG	1ST	0.93	400,490	3,344,266	29.10	1 YRS	Jackso92.SFC	7	3	493
2	AERMOD	TrailRidge04_93_NOX.USF	NOX	ANNUAL	TRNRG	1ST	0.90	400,490	3,344,266	29.10	1 YRS	Jackso93.SFC	7	3	493
2	AERMOD	TrailRidge04_90_NOX.USF	NOX	ANNUAL	TRNRG	1ST	0.85	400,490	3,344,266	29.10	1 YRS	Jackso90.SFC	7	3	493
2	AERMOD	TrailRidge04_91_NOX.USF	NOX	ANNUAL	TRNRG	1ST	0.76	400,490	3,344,170	29.69	1 YRS	Jackso91.SFC	7	3	493
2	AERMOD	TrailRidge04_94_NOX.USF	NOX	ANNUAL	TRNRG	1ST	0.69	400,490	3,344,362	28.96	1 YRS	Jackso94.SFC	7	3	493
3	AERMOD	TrailRidge04_92_NOX.USF	NOX	ANNUAL	FLARE	1ST	0.06	400,490	3,344,458	28.96	1 YRS	Jackso92.SFC	7	3	493
3	AERMOD	TrailRidge04_93_NOX.USF	NOX	ANNUAL	FLARE	1ST	0.06	400,490	3,344,362	28.96	1 YRS	Jackso93.SFC	7	3	493
3	AERMOD	TrailRidge04_90_NOX.USF	NOX	ANNUAL	FLARE	1ST	0.05	400,490	3,344,554	28.96	1 YRS	Jackso90.SFC	7	3	493
3	AERMOD	TrailRidge04_94_NOX.USF	NOX	ANNUAL	FLARE	1ST	0.05	400,490	3,344,458	28.96	1 YRS	Jackso94.SFC	7	3	493
3	AERMOD	TrailRidge04_91_NOX.USF	NOX	ANNUAL	FLARE	1ST	0.05	400,490	3,344,554	28.96	1 YRS	Jackso91.SFC	7	3	493

	Model	File	Pol	Average	Group	Rank	Conc.	East(X)	North(Y)	Elev	Time	Met File	Sources	Groups	Rec.
1	AERMOD	TrailRidge04_91_CO.USF	CO	1-HR	ALL	1ST	92.96	400,490	3,344,362	28.96	91121707	Jackso91.SFC	7	3	493
1	AERMOD	TrailRidge04_91_CO.USF	CO	1-HR	ALL	1ST	92.96	400,490	3,344,362	28.96	91121707	Jackso91.SFC	7	3	493
1	AERMOD	TrailRidge04_90_CO.USF	CO	1-HR	ALL	1ST	92.45	400,490	3,344,362	28.96	90120907	Jackso90.SFC	7	3	493
1	AERMOD	TrailRidge04_94_CO.USF	CO	1-HR	ALL	1ST	92.45	400,490	3,344,362	28.96	94010601	Jackso94.SFC	7	3	493
1	AERMOD	TrailRidge04_93_CO.USF	CO	1-HR	ALL	1ST	91.88	400,490	3,344,362	28.96	93021324	Jackso93.SFC	7	3	493
2	AERMOD	TrailRidge04_91_CO.USF	CO	1-HR	TRNRG	1ST	92.93	400,490	3,344,362	28.96	91121707	Jackso91.SFC	7	3	493
2	AERMOD	TrailRidge04_91_CO.USF	CO	1-HR	TRNRG	1ST	92.93	400,490	3,344,362	28.96	91121707	Jackso91.SFC	7	3	493
2	AERMOD	TrailRidge04_90_CO.USF	CO	1-HR	TRNRG	1ST	92.40	400,490	3,344,362	28.96	90120907	Jackso90.SFC	7	3	493
2	AERMOD	TrailRidge04_94_CO.USF	CO	1-HR	TRNRG	1ST	92.40	400,490	3,344,362	28.96	94010601	Jackso94.SFC	7	3	493
2	AERMOD	TrailRidge04_93_CO.USF	CO	1-HR	TRNRG	1ST	91.83	400,490	3,344,362	28.96	93021324	Jackso93.SFC	7	3	493
3	AERMOD	TrailRidge04_94_CO.USF	CO	1-HR	FLARE	1ST	11.03	400,490	3,344,266	29.10	94050820	Jackso94.SFC	7	3	493
3	AERMOD	TrailRidge04_90_CO.USF	CO	1-HR	FLARE	1ST	11.00	400,490	3,344,170	29.69	90080220	Jackso90.SFC	7	3	493
3	AERMOD	TrailRidge04_93_CO.USF	CO	1-HR	FLARE	1ST	10.98	400,490	3,344,266	29.10	93122921	Jackso93.SFC	7	3	493
3	AERMOD	TrailRidge04_91_CO.USF	CO	1-HR	FLARE	1ST	10.97	400,490	3,344,266	29.10	91011923	Jackso91.SFC	7	3	493
3	AERMOD	TrailRidge04_91_CO.USF	CO	1-HR	FLARE	1ST	10.97	400,490	3,344,266	29.10	91011923	Jackso91.SFC	7	3	493
4	AERMOD	TrailRidge04_91_CO.USF	CO	8-HR	ALL	1ST	67.07	400,490	3,344,362	28.96	91021008	Jackso91.SFC	7	3	493
4	AERMOD	TrailRidge04_91_CO.USF	CO	8-HR	ALL	1ST	67.07	400,490	3,344,362	28.96	91021008	Jackso91.SFC	7	3	493
4	AERMOD	TrailRidge04_94_CO.USF	CO	8-HR	ALL	1ST	64.68	400,490	3,344,074	29.99	94112208	Jackso94.SFC	7	3	493
4	AERMOD	TrailRidge04_90_CO.USF	CO	8-HR	ALL	1ST	63.53	400,490	3,344,362	28.96	90102508	Jackso90.SFC	7	3	493
4	AERMOD	TrailRidge04_93_CO.USF	CO	8-HR	ALL	1ST	57.74	400,490	3,344,266	29.10	93121624	Jackso93.SFC	7	3	493
5	AERMOD	TrailRidge04_91_CO.USF	CO	8-HR	TRNRG	1ST	66.73	400,490	3,344,362	28.96	91021008	Jackso91.SFC	7	3	493
5	AERMOD	TrailRidge04_91_CO.USF	CO	8-HR	TRNRG	1ST	66.73	400,490	3,344,362	28.96	91021008	Jackso91.SFC	7	3	493
5	AERMOD	TrailRidge04_94_CO.USF	CO	8-HR	TRNRG	1ST	64.66	400,490	3,344,074	29.99	94112208	Jackso94.SFC	7	3	493
5	AERMOD	TrailRidge04_90_CO.USF	CO	8-HR	TRNRG	1ST	63.03	400,490	3,344,170	29.69	90092108	Jackso90.SFC	7	3	493
5	AERMOD	TrailRidge04_93_CO.USF	CO	8-HR	TRNRG	1ST	56.52	400,490	3,344,266	29.10	93121624	Jackso93.SFC	7	3	493
6	AERMOD	TrailRidge04_91_CO.USF	CO	8-HR	FLARE	1ST	8.53	400,490	3,343,978	30.34	91011308	Jackso91.SFC	7	3	493
6	AERMOD	TrailRidge04_91_CO.USF	CO	8-HR	FLARE	1ST	8.53	400,490	3,343,978	30.34	91011308	Jackso91.SFC	7	3	493
6	AERMOD	TrailRidge04_93_CO.USF	CO	8-HR	FLARE	1ST	8.19	400,490	3,344,170	29.69	93021308	Jackso93.SFC	7	3	493
6	AERMOD	TrailRidge04_90_CO.USF	CO	8-HR	FLARE	1ST	7.20	400,490	3,344,458	28.96	90111008	Jackso90.SFC	7	3	493
6	AERMOD	TrailRidge04_94_CO.USF	CO	8-HR	FLARE	1ST	6.93	400,490	3,344,458	28.96	94011424	Jackso94.SFC	7	3	493

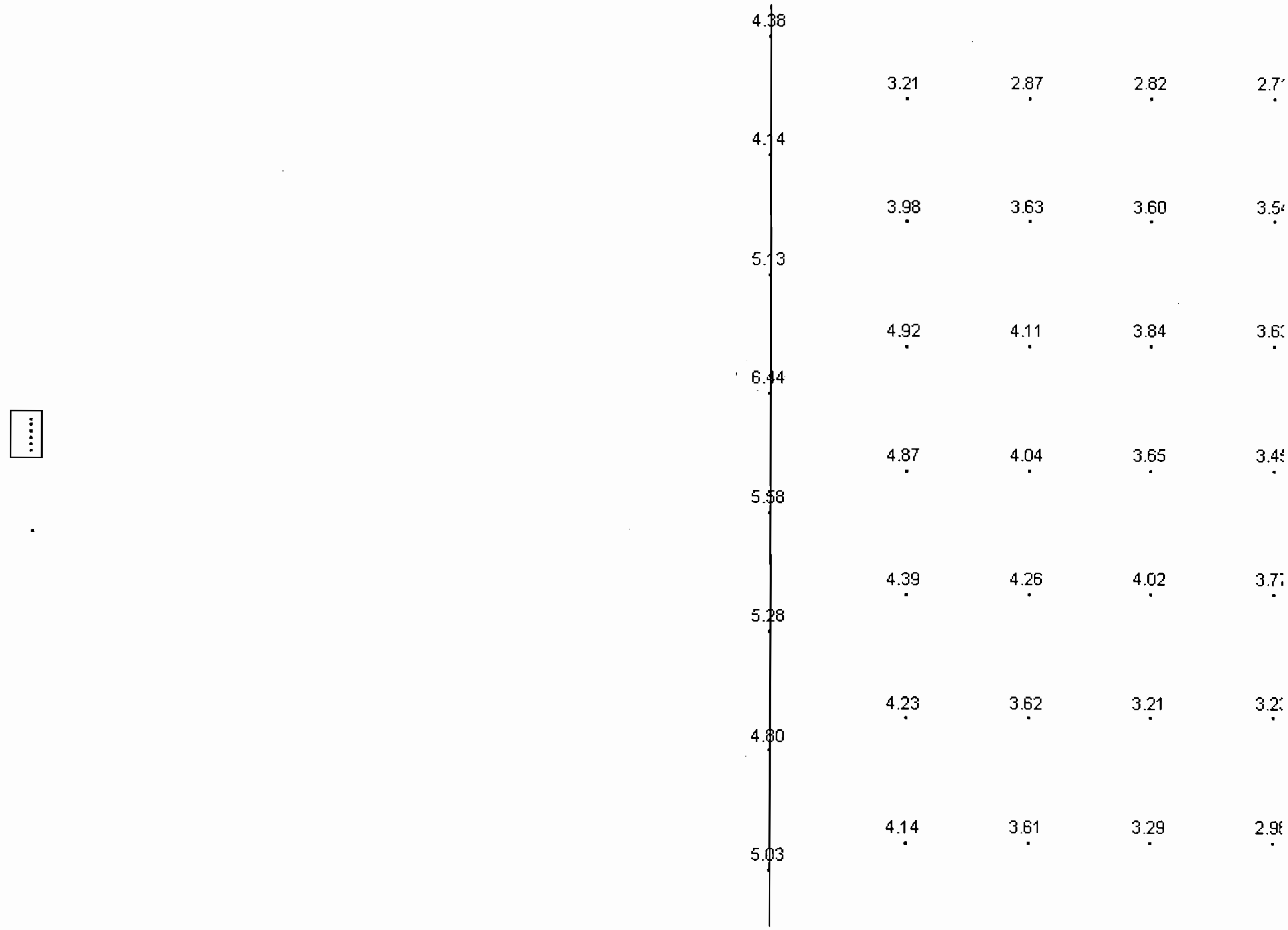
Not for significance

	Model	File	Pol	Average	Group	Rank	Conc.	East(X)	North(Y)	Elev	Time	Met File	Sources	Groups	Rec.
6	AERMOD	TrailRidge04_94_PM10.USF	PM10	24-HR	FLARE	6TH	0.18	400,490	3,344,074	29.99	94010424	Jackso94.SFC	7	3	493
6	AERMOD	TrailRidge04_93_PM10.USF	PM10	24-HR	FLARE	6TH	0.18	400,490	3,344,170	29.69	93121524	Jackso93.SFC	7	3	493
6	AERMOD	TrailRidge04_92_PM10.USF	PM10	24-HR	FLARE	6TH	0.17	400,490	3,344,170	29.69	90022424	Jackso92.SFC	7	3	493
6	AERMOD	TrailRidge04_91_PM10.USF	PM10	24-HR	FLARE	6TH	0.16	400,490	3,344,458	28.96	91031424	Jackso91.SFC	7	3	493
6	AERMOD	TrailRidge04_90_PM10.USF	PM10	24-HR	FLARE	6TH	0.14	400,490	3,344,554	28.96	90111024	Jackso90.SFC	7	3	493
5	AERMOD	TrailRidge04_93_PM10.USF	PM10	24-HR	TRNRG	6TH	2.36	400,490	3,344,362	28.96	92120124	Jackso93.SFC	7	3	493
5	AERMOD	TrailRidge04_94_PM10.USF	PM10	24-HR	TRNRG	6TH	2.36	400,490	3,344,362	28.96	92120124	Jackso94.SFC	7	3	493
5	AERMOD	TrailRidge04_92_PM10.USF	PM10	24-HR	TRNRG	6TH	2.29	400,490	3,344,362	28.96	92070624	Jackso92.SFC	7	3	493
5	AERMOD	TrailRidge04_91_PM10.USF	PM10	24-HR	TRNRG	6TH	2.01	400,490	3,344,362	28.96	90121024	Jackso91.SFC	7	3	493
5	AERMOD	TrailRidge04_90_PM10.USF	PM10	24-HR	TRNRG	6TH	1.72	400,490	3,344,266	29.10	90092124	Jackso90.SFC	7	3	493
4	AERMOD	TrailRidge04_93_PM10.USF	PM10	24-HR	ALL	6TH	2.40	400,490	3,344,362	28.96	92120124	Jackso93.SFC	7	3	493
4	AERMOD	TrailRidge04_94_PM10.USF	PM10	24-HR	ALL	6TH	2.40	400,490	3,344,362	28.96	92120124	Jackso94.SFC	7	3	493
4	AERMOD	TrailRidge04_92_PM10.USF	PM10	24-HR	ALL	6TH	2.35	400,490	3,344,362	28.96	92070624	Jackso92.SFC	7	3	493
4	AERMOD	TrailRidge04_91_PM10.USF	PM10	24-HR	ALL	6TH	2.07	400,490	3,344,362	28.96	90102524	Jackso91.SFC	7	3	493
4	AERMOD	TrailRidge04_90_PM10.USF	PM10	24-HR	ALL	6TH	1.77	400,490	3,344,266	29.10	90072224	Jackso90.SFC	7	3	493
3	AERMOD	TrailRidge04_92_PM10.USF	PM10	PERIOD	FLARE	1ST	0.03	400,490	3,344,458	28.96	8784	Jackso92.SFC	7	3	493
3	AERMOD	TrailRidge04_93_PM10.USF	PM10	PERIOD	FLARE	1ST	0.03	400,490	3,344,458	28.96	8760	Jackso93.SFC	7	3	493
3	AERMOD	TrailRidge04_94_PM10.USF	PM10	PERIOD	FLARE	1ST	0.03	400,490	3,344,458	28.96	8760	Jackso94.SFC	7	3	493
3	AERMOD	TrailRidge04_90_PM10.USF	PM10	PERIOD	FLARE	1ST	0.02	400,490	3,344,554	28.96	8760	Jackso90.SFC	7	3	493
3	AERMOD	TrailRidge04_91_PM10.USF	PM10	PERIOD	FLARE	1ST	0.02	400,490	3,344,554	28.96	8760	Jackso91.SFC	7	3	493
2	AERMOD	TrailRidge04_92_PM10.USF	PM10	PERIOD	TRNRG	1ST	0.51	400,490	3,344,266	29.10	8784	Jackso92.SFC	7	3	493
2	AERMOD	TrailRidge04_93_PM10.USF	PM10	PERIOD	TRNRG	1ST	0.51	400,490	3,344,266	29.10	8760	Jackso93.SFC	7	3	493
2	AERMOD	TrailRidge04_94_PM10.USF	PM10	PERIOD	TRNRG	1ST	0.51	400,490	3,344,266	29.10	8760	Jackso94.SFC	7	3	493
2	AERMOD	TrailRidge04_90_PM10.USF	PM10	PERIOD	TRNRG	1ST	0.47	400,490	3,344,266	29.10	8760	Jackso90.SFC	7	3	493
2	AERMOD	TrailRidge04_91_PM10.USF	PM10	PERIOD	TRNRG	1ST	0.47	400,490	3,344,266	29.10	8760	Jackso91.SFC	7	3	493
1	AERMOD	TrailRidge04_92_PM10.USF	PM10	PERIOD	ALL	1ST	0.54	400,490	3,344,266	29.10	8784	Jackso92.SFC	7	3	493
1	AERMOD	TrailRidge04_93_PM10.USF	PM10	PERIOD	ALL	1ST	0.54	400,490	3,344,266	29.10	8760	Jackso93.SFC	7	3	493
1	AERMOD	TrailRidge04_94_PM10.USF	PM10	PERIOD	ALL	1ST	0.54	400,490	3,344,266	29.10	8760	Jackso94.SFC	7	3	493
1	AERMOD	TrailRidge04_90_PM10.USF	PM10	PERIOD	ALL	1ST	0.49	400,490	3,344,266	29.10	8760	Jackso90.SFC	7	3	493
1	AERMOD	TrailRidge04_91_PM10.USF	PM10	PERIOD	ALL	1ST	0.49	400,490	3,344,266	29.10	8760	Jackso91.SFC	7	3	493

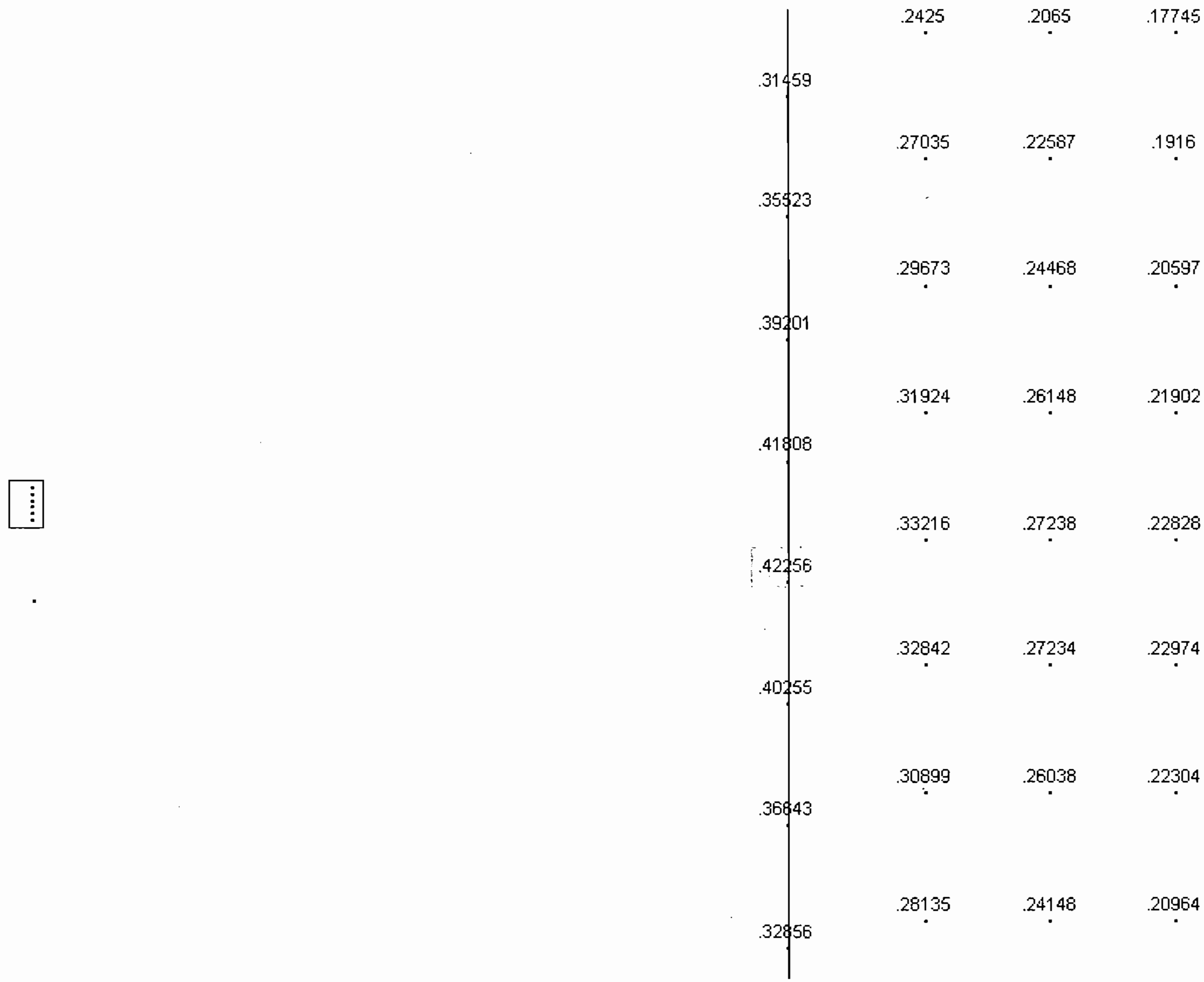


Maximum SO_2 24 Hour Impact

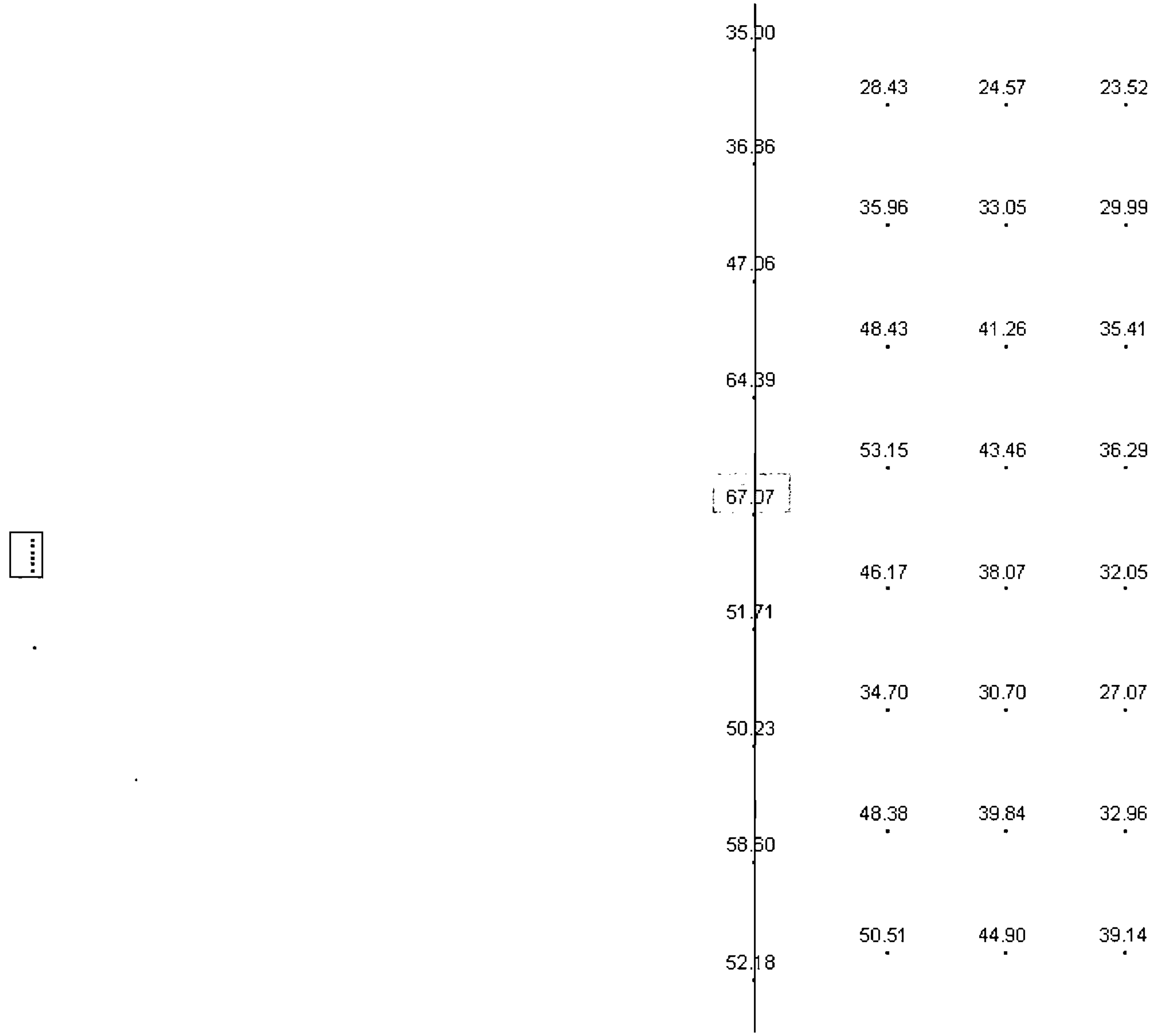
Derenzo and Associates, Inc.



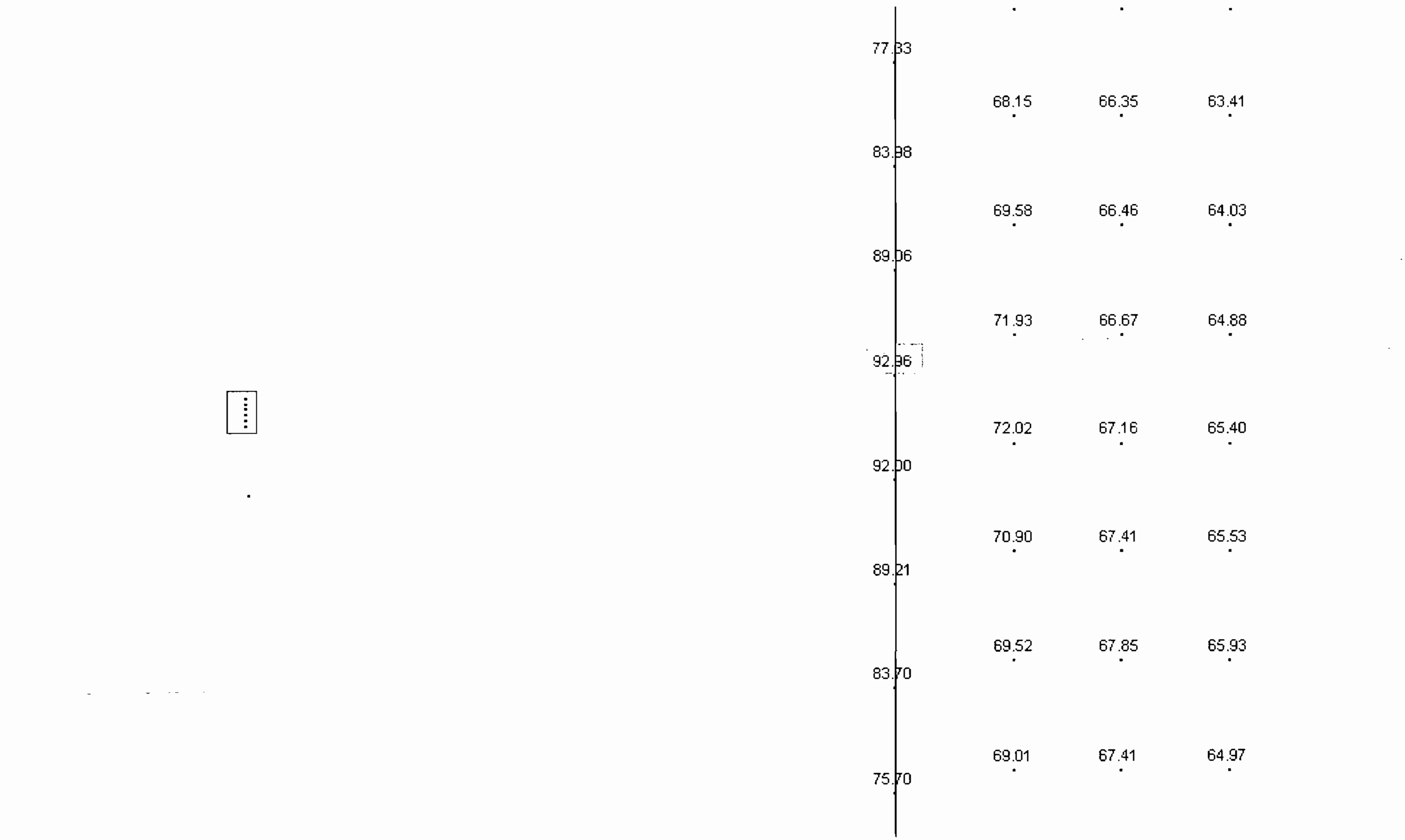
Maximum SO_2 3 Hour Impact



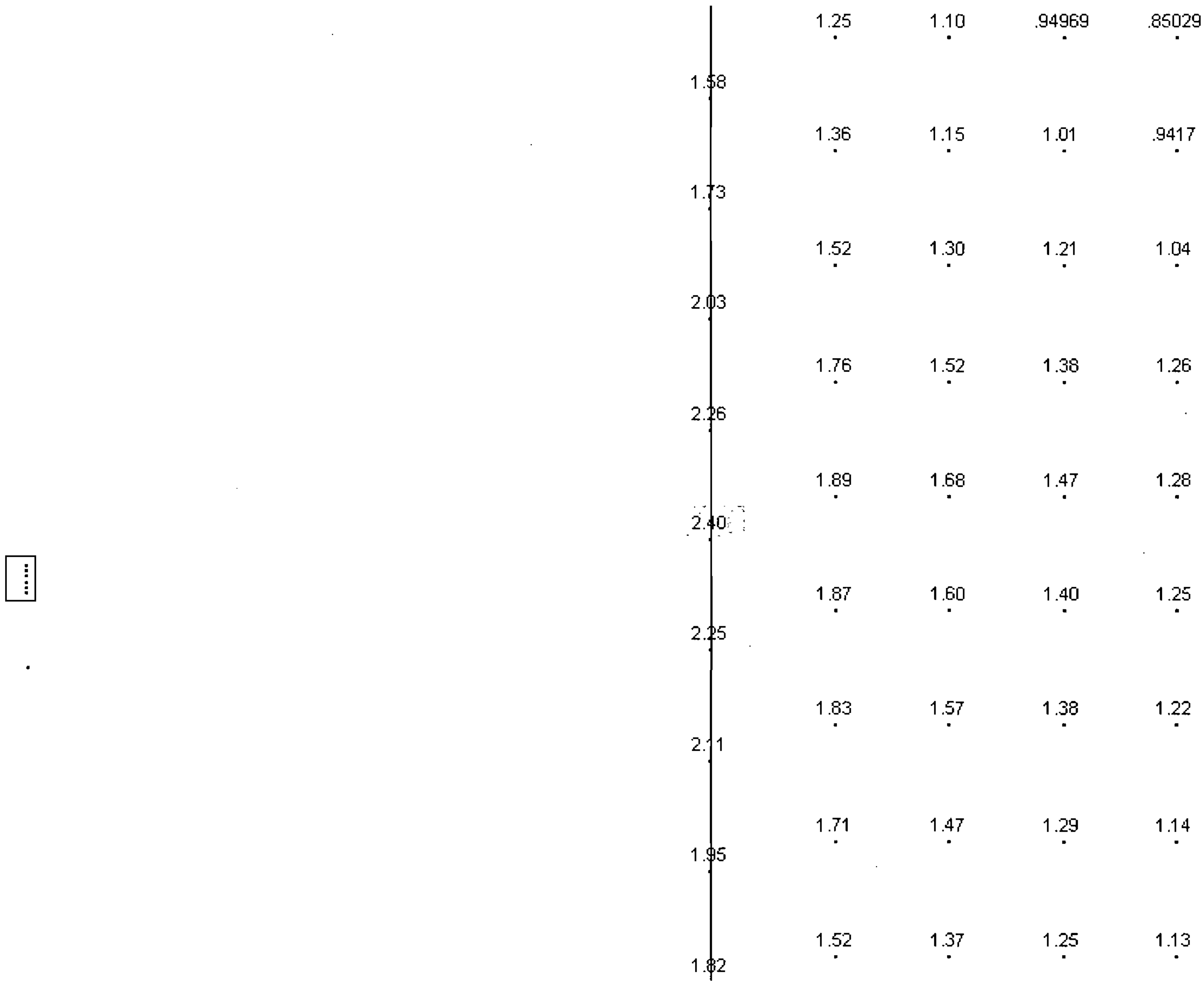
Maximum SO_2 Annual-Average Impacts



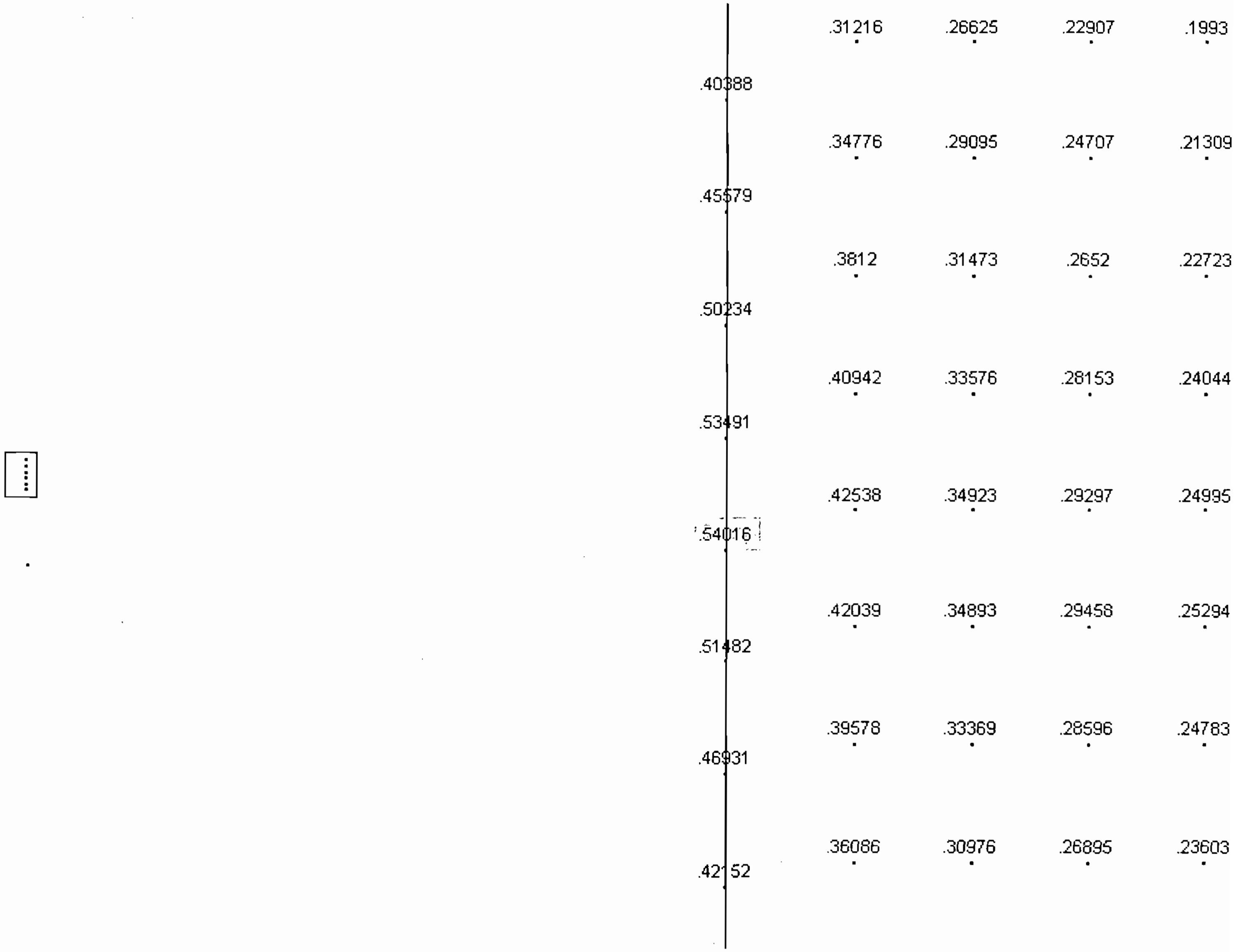
Maximum CO 8 Hour Impact



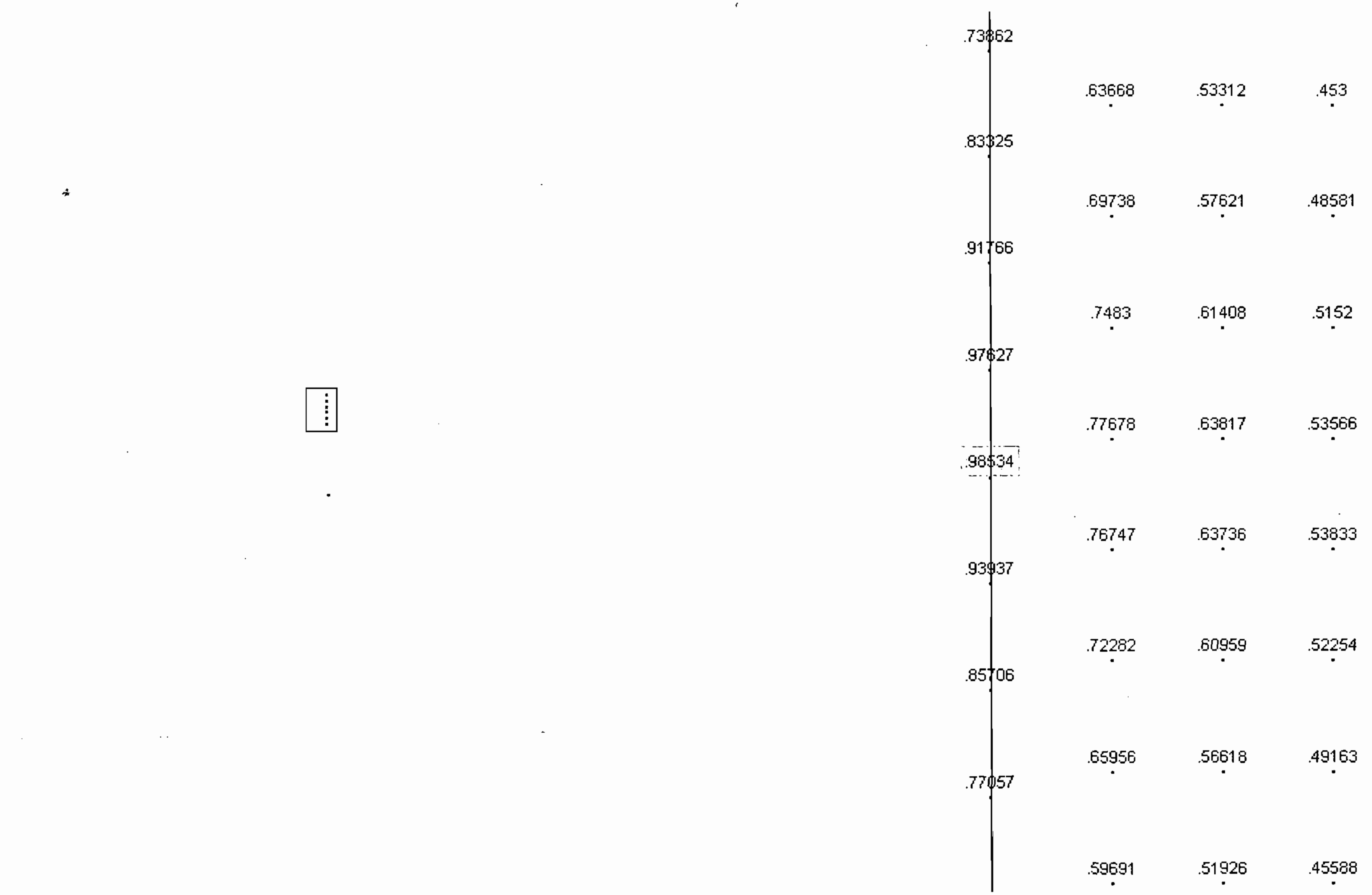
Maximum CO 1 Hour Impact



Maximum PM_{10} 24 Hour 6th High



Maximum PM_{10} Annual-Average Impacts



Maximum NO_2 Annual-Average Impacts

APPENDIX I-5

RESULTS OF CLASS I SIGNIFICANT IMPACT ANALYSIS

PM10							
Receptor	Coordinates (km)		Type	Peak	(Year, Day, Ending Time)	Rank	Average Period
164	372.50	3386.40	Discrete	0.086	1990, 190, 0000	1	24 Hour
22	433.73	3379.97	Discrete	0.072	1990, 260, 0000	2	24 Hour
115	360.70	3311.86	Discrete	0.0067		1	Annual

NO_X							
Receptor	Coordinates (km)		Type	Peak	(Year, Day, Ending Time)	Rank	Average Period
114	361.84	3310.54	Discrete	0.0033		1	Annual

PM$_{10}$							
Receptor	Coordinates (km)		Type	Peak	(Year, Day, Ending Time)	Rank	Average Period
44	448.97	3345.75	Discrete	0.092	1991, 286, 0000	1	24 Hour
53	447.06	3330.22	Discrete	0.083	1991, 231, 0000	2	24 Hour
58	443.94	3322.08	Discrete	0.0068		1	Annual

NO$_X$							
Receptor	Coordinates (km)		Type	Peak	(Year, Day, Ending Time)	Rank	Average Period
112	364.27	3308.03	Discrete	0.0033		1	Annual

PM$_{10}$							
Receptor	Coordinates (km)		Type	Peak	(Year, Day, Ending Time)	Rank	Average Period
59	443.15	3320.53	Discrete	0.116	1992, 335, 0000	1	24 Hour
46	448.97	3342.26	Discrete	0.068	1992, 022, 0000	2	24 Hour
37	447.06	3357.78	Discrete	0.0084		1	Annual

NO$_X$							
Receptor	Coordinates (km)		Type	Peak	(Year, Day, Ending Time)	Rank	Average Period
31	443.15	3367.47	Discrete	0.0033		1	Annual

PM$_{10}$							
Receptor	Coordinates (km)		Type	Peak	(Year, Day, Ending Time)	Rank	Average Period
72	428.39	3303.55	Discrete	0.090	1994, 091, 0000	1	24 Hour
26	438.40	3374.78	Discrete	0.067	1994, 234, 0000	2	24 Hour
27	439.45	3373.39	Discrete	0.0074		1	Annual

NO$_X$							
Receptor	Coordinates (km)		Type	Peak	(Year, Day, Ending Time)	Rank	Average Period
113	363.03	3309.27	Discrete	0.0041		1	Annual

PM$_{10}$							
Receptor	Coordinates (km)		Type	Peak	(Year, Day, Ending Time)	Rank	Average Period
64	438.40	3313.22	Discrete	0.102	1995, 359, 0000	1	24 Hour
61	441.40	3317.50	Discrete	0.083	1995, 359, 0000	2	24 Hour
114	361.84	3310.54	Discrete	0.0076		1	Annual

NO_X							
Receptor	Coordinates (km)		Type	Peak	(Year, Day, Ending Time)	Rank	Average Period
61	441.40	3317.50	Discrete	0.0031		1	Annual

1990

Number of days with Extinction Change => 5.0 % :	0
Number of days with Extinction Change => 10.0 % :	0
Largest Extinction Change =	2.54%

1991

Number of days with Extinction Change => 5.0 % :	0
Number of days with Extinction Change => 10.0 % :	0
Largest Extinction Change =	3.39%

1992

Number of days with Extinction Change => 5.0 % :	0
Number of days with Extinction Change => 10.0 % :	0
Largest Extinction Change =	4.78%

1994

Number of days with Extinction Change => 5.0 % :	0
Number of days with Extinction Change => 10.0 % :	0
Largest Extinction Change =	4.94%

1995

Number of days with Extinction Change => 5.0 % :	0
Number of days with Extinction Change => 10.0 % :	0
Largest Extinction Change =	4.25%

Visual Effects Screening Analysis for
Source: TRNRG
Class I Area: OKE

*** Level-1 Screening ***

Input Emissions for

Particulates	.89	G /S
NOx (as NO2)	1.78	G /S
Primary NO2	.00	G /S
Soot	.00	G /S
Primary SO4	.00	G /S

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	.04 ppm
Background Visual Range:	40.00 km
Source-Observer Distance:	39.50 km
Min. Source-Class I Distance:	39.50 km
Max. Source-Class I Distance:	95.80 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	39.5	84.	2.00	.210	.05	.002
SKY	140.	84.	39.5	84.	2.00	.070	.05	-.002
TERRAIN	10.	84.	39.5	84.	2.00	.134	.05	.002
TERRAIN	140.	84.	39.5	84.	2.00	.024	.05	.001

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	0.	1.0	168.	2.00	.251	.05	.002
SKY	140.	0.	1.0	168.	2.00	.042	.05	-.002
TERRAIN	10.	0.	1.0	168.	2.00	.315	.05	.003
TERRAIN	140.	0.	1.0	168.	2.00	.092	.05	.003