Air Quality Impact Analysis

MEMO TO : File
GTL Energy (USA) Ltd.
Stark County, North Dakota

FROM : Ryan Mills
Air Quality Impact Analysis Branch
Division of Air Quality

RE : Perform Impact Analysis for Proposed South Heart Beneficiation Plant

DATE : January 5, 2009
RM

Introduction:

North Dakota Department of Health (Department) on behalf of GTL performed AERMOD modeling on the criteria pollutant Particulate Matter less than 10 microns (PM_{10}). The purpose of the modeling analysis was to show compliance with the State and Federal Ambient Air Quality Standards (AAQS) for 24-HR and Annual averaging periods.

The GTL modeling analysis was conducted according to guidance in the "EPA Guideline on Air Quality Models."

Modeling System:

The GTL facility is located in Stark County Southwest of the city of South Heart. The surrounding region is characterized by rolling hills terrain with a few significant elevation variations; thus, complex terrain effects were selected in the PM_{10} modeling analysis.

The proposed exhaust stacks at the GTL facility will be of sufficient height to avoid building downwash effects. These effects occur as the turbulent air flow around nearby structures tends to disperse stack emissions more rapidly, potentially resulting in significantly higher ground-level pollutant concentrations in the immediate vicinity of the stack (i.e., compared to concentrations which would exist if the structure was not present).

For modeling analyses involving building downwash effects in complex terrain, the EPA recommends use of the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD Version 07026). Thus, the AERMOD model was utilized for the GTL PM_{10} analysis.

Source Data:

Source data required by the AERMOD model include pollutant emission rate, stack height, stack diameter, stack gas exit velocity, stack gas exit temperature, stack base elevation, and relative stack location for each emission point. If building downwash effects are determined to be a potential factor, the model also requires the dimensions of the nearby buildings.

PM_{10} at the GTL facility will vent from several stacks, as well as from fugitive sources. Fugitive emissions from the Truck Dump and the Product Coal Load-out will be captured within the facility and are controlled with Baghouses.

Table 1 summarizes the source input data for the GTL facility.

Table 1
AERMOD Model Input Parameters

EPN #	Source Description	Maximum Exhaust Velocity (fps)	Maximum Discharge Concentration (lb/hr)	Stack Height Above Grade (ft)	Stack Diameter (inches)	Exhaust Temperature (°F)
1	Boiler Stack	45.95	0.612	60	36	277
2	Truck Dump Baghouse 1	50	1.5	65	44	Ambient
3	Raw Coal Baghouse 2	50	1.03	65	36	Ambient
4	Dryer Baghouse 3	50	1.297	60	38	200
5	Product Coal Baghouse 4	50	.66	65	29	Ambient

Receptor Data:

Receptors are the locations where a dispersion model calculates ground-level pollutant concentrations. For each receptor utilized, the AERMOD model requires the user to provide the location in rectangular (X,Y) coordinates. The coordinate system must be consistent with that used for source locations.

Receptors must be assigned in sufficient number and density to ensure that the location of the highest pollutant concentration has been resolved with reasonable probability. Generally, a relatively large receptor grid with a few hundred receptors is utilized, with increasing receptor density nearer the source.

The receptor configuration used for GTL PM_{10} is illustrated in Figure 1. Receptors were placed along the plant property fence line at a spacing of 25 meters. Additional receptors were placed at 50 meter intervals form the property boundary to approximately 400 meters from the site, at 100 meter intervals out to approximately

1000 meters from the site, and at 250 meter intervals out to approximately 2000 meters form the site. This receptor configuration appears adequate for the AERMOD PM_{10} analysis for the GTL facility.

Meteorological Data

The meteorological input data provide the dynamics which allow the model to simulate transport and dispersion of pollutant material away from the emission source. The AERMOD model requires historical hourly observations of meteorological data (i.e., wind speed, wind direction, temperature, stability, and mixing height) and calculates hourly average pollutant concentrations for these conditions. Hourly results are then directly comparable with air quality thresholds for 1-hour averaging periods. Concentrations for longer averaging periods are determined by averaging sequential hourly results for an extended period. Any number of hourly sets of meteorological data can be used with AERMOD. Generally, five years of sequential hourly meteorological data, which is representative of the area being modeled, is used to ensure that worst-case seasonal conditions are accounted for in the analysis.

To ensure that meteorological data used with the model are representative, historical hourly observations from the nearest National Weather Service (NWS) station are generally employed. For the GTL analysis, twice-daily upper air and hourly surface observations were used from the five-year period 1990-1994. Upper air data were obtained from the NWS station in Bismarck. Surface data were obtained from the NWS station in Dickinson. These data are considered representative for the GTL facility and were processed with AERMET to provide the necessary meteorological data file for AERMOD.

Technical Options

AERMOD technical operating options deployed for the GTL PM_{10} analysis include:

- Building downwash effects,
- Stack-tip downwash,
- Rural dispersion coefficients,
- Elevated terrain effects,
- Calm wind processing routine,
- Missing data processing
- Land use profile = Grassland
- No exponential decay

These choices are consistent with the "regulatory default options" preferred by EPA.

Results:

Results of the modeling analysis consist of the modeled AERMOD concentrations, as compared to the AAQS. The results are summarized in Table 2. As shown in Table 2, model results indicate compliance with the 24-hour and Annual AAQS levels for PM_{10}.

Table 2
PM_{10} NAAQS Impact.

	Year Met Data	Modeled Concentrations	Background	Total	AAQS
High, 6th high 24-hour	1990-1994	11.95	30.0	41.95	150
Annual Average	1990-1994	1.58	15	16.58	50

Summary:

In summary, modeling results indicate the proposed emission of PM_{10} at GTL facility will comply with all applicable state and national AAQS for the applicable criteria pollutant PM_{10}, provided all emission rates and stack heights, as modeled, are met.

RDM:rdm

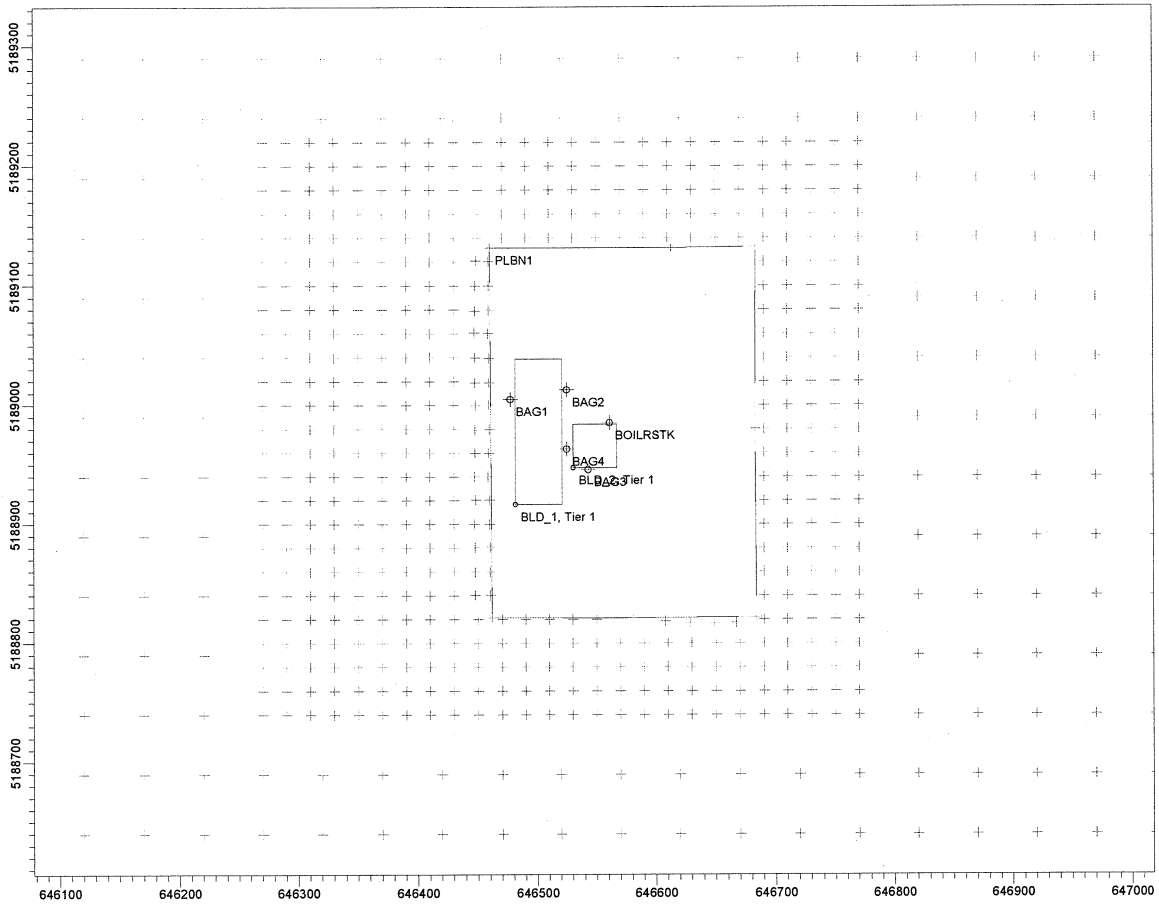
5189300
5189200
5189100
5189000
5188900
5188800
5188700
646100
646200
646300
646400
646500
646600
646700
646800
646900
647000
PLBN1
BAG1
BAG2
BOILRSTK
BAG4
BLD_1, Tier 1

Figure 1