TCEQ Interoffice Memorandum

To: Rule Registrations Section Staff

From: Daniel Menendez, Manager
Permit Support Section

Date: May 1, 2024

Subject: **Air Quality Analysis Report – Air Quality Standard Permit for Natural Gas Electric Generating Units**

1. Project Identification Information

An air quality analysis (AQA) was performed in support of the development of the standard permit for natural gas electric generating units. This AQA report summarizes the model inputs and the results obtained from the analysis.

2. Report Summary

Generic modeling was conducted to determine the number of engines and set back distance from a property line that yield predictions that are less than thresholds used in air quality impacts analyses. Significant impact levels (SILs) were used as the threshold for criteria pollutants and two percent of the associated state property line (SPL) standard was used as the threshold for pollutants with a SPL standard. The results are summarized below.

Table 1 contains the thresholds used in the analysis for the various review types. Table 2 contains the maximum number of engines to meet all thresholds at the nearest property line. Table 3 contains the generic modeling results for evaluated distances. Table 4 lists the maximum predicted concentrations. The predicted concentrations in Table 4 were determined by multiplying the generic modeling results in Table 3 by the number of engines in Table 2 for the applicable distance and the emission rates listed in Table 6.

Table 1. Analysis Thresholds

Pollutant	Averaging Time	Review Type	Threshold (µg/m^3)
SO_2	1-hr	SIL	7.8
SO_2	3-hr	SIL	25
CO	1-hr	SIL	2000
CO	8-hr	SIL	500
PM_{10}	24-hr	SIL	5
$PM_{2.5}$	24-hr	SIL	1.2
$PM_{2.5}$	Annual	SIL	0.13

Table 1. Analysis Thresholds (continued)

Pollutant	Averaging Time	Review Type	Threshold (µg/m^3)
NO_2	1-hr	SIL	7.5
NO_2	Annual	SIL	1
SO_2	1-hr	SPL	14.3
H_2SO_4	1-hr	SPL	1
H_2SO_4	24-hr	SPL	0.3

The justification for selecting the EPA's interim 1-hr SO_2 and 1-hr NO_2 de minimis levels was based on the assumptions underlying EPA's development of the 1-hr SO_2 and 1-hr NO_2 de minimis levels. As explained in EPA guidance memoranda[1,2], the EPA believes it is reasonable as an interim approach to use a de minimis level that represents 4% of the 1-hr SO_2 and 1-hr NO_2 NAAQS.

The $PM_{2.5}$ de minimis levels are the EPA recommended de minimis levels. The use of the EPA recommended de minimis levels is sufficient to conclude that a source will not cause or contribute to a violation of a $PM_{2.5}$ NAAQS based on the analyses documented in EPA guidance and policy memoranda[3].

Table 2. Maximum Number of Engines

Distance to Nearest Property Line	Maximum Number of Engines
Equal to or greater than 25 feet and less than 100 feet.	2
Equal to or greater than 100 feet and less than 600 feet	3
Equal to or greater than 600 feet and less than 900 feet	5
Equal to or greater than 900 feet	6

1 www.epa.gov/sites/production/files/2015-07/documents/appwso2.pdf
2 www.tceq.texas.gov/assets/public/permitting/air/memos/guidance_1hr_no2naaqs.pdf
3 www.tceq.texas.gov/permitting/air/modeling/epa-mod-guidance.html

Table 3. Generic Modeling Results at Distance (μg/m^3)/(lb/hr)

Avg. Time	25 feet	50 feet	100 feet	200 feet	300 feet	400 feet	500 feet	600 feet	700 feet	800 feet	900 feet	1000 feet
1-hr	40.0837	40.0837	31.689	36.3399	34.8907	32.2082	28.6532	22.3904	20.5856	18.9766	17.5548	16.3045
3-hr	37.2707	37.2682	26.7166	25.8428	22.2482	19.3372	16.5917	13.0173	11.5111	10.7272	10.154	9.5845
8-hr	35.35	34.8448	22.7764	21.6834	18.6563	16.1196	13.3992	11.1472	9.9592	9.0487	8.2455	7.6888
24-hr	33.6011	31.7647	19.8672	18.4169	14.2458	11.6068	9.541	7.8964	6.8622	6.0876	5.4433	4.9258
Annual	5.6373	4.1886	2.5341	2.8083	2.0662	1.5585	1.2146	0.9769	0.8596	0.7708	0.6957	0.6309

Table 4. Modeling Results

Pollutant	Avg. Time	μg/m^3 at 25 feet	μg/m^3 at 50 feet	μg/m^3 at 100 feet	μg/m^3 at 200 feet	μg/m^3 at 300 feet	μg/m^3 at 400 feet	μg/m^3 at 500 feet	μg/m^3 at 600 feet	μg/m^3 at 700 feet	μg/m^3 at 800 feet	μg/m^3 at 900 feet	μg/m^3 at 1000 feet	Threshold (μg/m^3)
SO_2	1-hr (SIL)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	7.8
SO_2	3-hr	1.0	1.0	1.1	1.1	0.9	0.8	0.7	0.9	0.8	0.8	0.8	0.8	25
CO	1-hr	518.7	518.7	615.1	705.4	677.2	625.2	556.2	724.3	665.9	613.9	681.5	632.9	2000
CO	8-hr	457.4	450.9	442.1	420.9	362.1	312.9	260.1	360.6	322.2	292.7	320.1	298.5	500
PM_{10}	24-hr	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	5
$PM_{2.5}$	24-hr	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.2
$PM_{2.5}$	Annual	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.13
NO_2	1-hr	5.3	5.3	6.3	7.3	7.0	6.4	5.7	7.45	6.9	6.3	7.0	6.5	7.5
NO_2	Annual	0.8	0.6	0.5	0.6	0.4	0.3	0.2	0.3	0.3	0.3	0.3	0.3	1
SO_2	1-hr (SPL)	1.1	1.1	1.3	1.5	1.5	1.4	1.2	1.6	1.4	1.3	1.5	1.4	14.3
H_2SO_4	1-hr	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1
H_2SO_4	24-hr	0.1	0.1	0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.3

The results in Table 4 are a combination of the generic maximum predicted concentration at each distance multiplied by the number of engines in Table 2 for the applicable distance and the emission rates listed in Table 6.

To account for conversion of NO_X to NO_2, a factor of 0.9 was used in the analysis. A factor of 0.9 is the maximum default value for ARM2, and the use of ARM2 is consistent with EPA guidance for conducting a Tier 2 screening approach.

For the 1-hr NO_2 and 1-hr SO_2 analyses, emissions from the power generation engine were evaluated with an annual average emission rate, consistent with EPA guidance for evaluating intermittent source emissions. The emissions from the engine are based on 400 hours per year of operation.

3. Model Used and Modeling Techniques

ISC-Prime (Version 04272) was used.

An emission rate of 1 lb/hr was used to predict generic short-term and annual concentrations from a single engine. The generic concentrations were multiplied by the emission rates listed in Table 6 to determine a maximum predicted concentration for each pollutant. The thresholds in Table 1 were then divided by the maximum predicted concentrations to determine the number of engines that yield predictions that are less than the thresholds.

A. Land Use

Modeling was conducted using both rural and urban dispersion coefficients. The worst-case predictions were then used in the subsequent analyses.

Flat terrain was used in the modeling analysis. Flat terrain is reasonable to use since it is consistent with typical site locations for these facilities and given that the maximum modeled predictions occur near the modeled source.

B. Meteorological Data

The modeling analysis used surface data from Austin and upper air data from Victoria for the years 1983, 1984, 1986, 1987, and 1988. Since the analysis is primarily for short-term concentrations, this five-year data set would include worst-case short-term meteorological conditions that could occur anywhere in the state.

The wind directions were used at 10-degree intervals to be coincident with the receptor radials. This would provide predictions along the plume centerline which is a conservative result.

C. Receptor Grid

The modeling used a receptor grid beginning at 25 feet from the engine. Receptors were located at distances of 25, 50, and 100 feet, and every 100 feet out to 1000 feet from the engine.

D. Building Wake Effects (Downwash)

Two different cases were considered for the downwash analysis. Case 1 is a scenario in which there are no nearby structures; only the engine housing structure is used as input. The dimensions for a typical engine housing structure were used (horizontal dimension of approximately 30 feet by 10 feet, and a vertical dimension of 10 feet). Case 2 is a scenario that considers a nearby structure larger than the engine housing structure. The dimensions for the nearby structure are representative of a typical building (horizontal dimension of approximately 40 feet by 40 feet, and a vertical dimension of 25 feet). The worst-case predictions were then used in the subsequent analyses.

4. Modeling Emissions Inventory

The power generation engine has emissions from a stack and was modeled as a point source with the parameters listed in Table 5. The determination of the modeled source parameters was based on industry information for natural gas power generation engines.

Table 5. Point Source Parameter Information

Source	Release Height (feet)	Exit Temperature (°F)	Exit Velocity (feet/sec)	Exit Diameter (inches)
Engine	25	960.998	442	8

Table 6. Emission Rates

Source	Pollutant	Averaging Time	Rate (lb/hr)
Engine	SO_2	1-hr	0.014
Engine	SO_2	3-hr	0.014
Engine	CO	1-hr	6.47
Engine	CO	8-hr	6.47
Engine	PM_{10}	24-hr	0.0031
Engine	$PM_{2.5}$	24-hr	0.0031
Engine	$PM_{2.5}$	Annual	0.00014155
Engine	NO_2	1-hr	1.62
Engine	NO_2	Annual	0.07397
Engine	H_2SO_4	1-hr	0.002
Engine	H_2SO_4	24-hr	0.002