TCEQ Interoffice Memorandum

To: Mike Gould, P.E.
Mechanical/Agricultural/Construction Section

From: Robert Opiela, P.E.
Technical Program Support Section

Date: September 24, 2012

Subject: Concrete Batch Plant Standard Permit Protectiveness Review

1. Project Identification Information

The air permits division (APD) performed air quality analysis (AQA) in support of the concrete batch plant standard permit protectiveness review. The AQA included dispersion modeling of a model concrete batch plant at two maximum hourly production levels, 30 cubic yards per hour (cu. yd/hr) and 300 cu. yd/hr. The AQA considered for the 30 cu. yd/hr plant an annual production of 262,800 cubic yards per year (cu. yd/yr) and considered for the 300 cu. yd/hr plant a daily production limit of 6,000 cubic yards per day and annual production of 2,190,000 cu. yd/yr. The emission generating facilities or activities included in the AQA are material handling operations, truck loading, stock piles, cement silos, and an internal combustion engine to generate power for equipment at the site. The analysis represented the operating schedule of facilities or activities at the site as 24 hours per day. The air contaminants evaluated were carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM_{10} and $PM_{2.5}$), nickel (Ni) particulate and formaldehyde (CHOH).

2. Report Summary

The AQA results are in Table 1. The predicted concentrations for all contaminants evaluated are below for all relevant National Ambient Air Quality Standards (NAAQS) levels or effects screening levels (ESLs) at all distances. The APD evaluated compliance with the following NAAQS:

CO

- 40,000 micrograms per cubic meter ($\mu g/m^3$) for 1-hr and
- 10,000 $\mu g/m^3$ for 8-hr

NO_2

- 186 $\mu g/m^3$ for 1-hr and
- 100 $\mu g/m^3$ for annual

PM_{10}

- 150 $\mu g/m^3$ for 24-hr and
- 50 $\mu g/m^3$ for annual

$PM_{2.5}$

- 35 µg/m³ for 24-hr and
- 15 µg/m³ for annual

SO_2

- 196 µg/m³ for 1-hr,
- 1,300 µg/m³ for 3-hr,
- 365 µg/m³ for 24-hr, and
- 80 µg/m³ for annual.

The APD evaluated compliance with the following ESLs:

Ni

- 0.33 µg/m³ for 1-hr
- 0.059 µg/m³ for annual

CHOH

- 15 µg/m³ for 1-hr
- 3.3 µg/m³ for annual

Table 1. Summary of Modeling Results

Scenario	Contaminant	Averaging Time	µg/m³ at 100 feet	µg/m³ at 200 feet	µg/m³ at 300 feet	µg/m³ at 400 feet	µg/m³ at 500 feet	µg/m³ at 600 feet	µg/m³ at 700 feet	µg/m³ at 800 feet	µg/m³ at 900 feet	µg/m³ at 1000 feet
30 cu. yd/hr	CHOH	1-hr	0.02	0.03	0.02	0.02	0.01	0.02	0.02	0.02	0.01	0.01
30 cu. yd/hr	CHOH	Annual	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
30 cu. yd/hr	CO	1-hr	556.12	728.13	628.69	483.46	430.94	468.84	469.91	450.99	423.43	393.71
30 cu. yd/hr	CO	8-hr	377.30	379.73	298.49	250.39	233.48	232.14	220.84	204.21	186.21	175.22
30 cu. yd/hr	Ni	1-hr	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
30 cu. yd/hr	Ni	Annual	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
30 cu. yd/hr	NO_2	1-hr	92.38	171.56	133.12	105.31	114.26	111.99	103.81	96.44	89.70	83.46
30 cu. yd/hr	NO_2	Annual	1.06	7.01	8.34	7.41	6.27	5.34	4.62	4.06	3.61	3.23
30 cu. yd/hr	PM_{10}	24-hr	123.59	80.59	65.75	58.12	51.69	45.54	40.33	35.94	32.24	28.96
30 cu. yd/hr	PM_{10}	Annual	39.24	21.97	13.97	10.50	8.48	7.07	6.00	5.16	4.48	3.93
30 cu. yd/hr	$PM_{2.5}$	24-hr	31.67	22.28	16.86	15.01	14.13	13.03	11.86	10.74	9.71	8.79
30 cu. yd/hr	$PM_{2.5}$	Annual	9.31	5.19	3.34	2.57	2.13	1.81	1.56	1.36	1.19	1.06
30 cu. yd/hr	SO_2	1-hr	0.36	0.47	0.41	0.31	0.28	0.30	0.30	0.29	0.27	0.26
30 cu. yd/hr	SO_2	24-hr	0.15	0.19	0.16	0.12	0.11	0.10	0.09	0.09	0.08	0.08
30 cu. yd/hr	SO_2	3-hr	0.28	0.29	0.27	0.22	0.21	0.19	0.17	0.16	0.14	0.13

Scenario	Contaminant	Averaging Time	µg/m³ at 100 feet	µg/m³ at 200 feet	µg/m³ at 300 feet	µg/m³ at 400 feet	µg/m³ at 500 feet	µg/m³ at 600 feet	µg/m³ at 700 feet	µg/m³ at 800 feet	µg/m³ at 900 feet	µg/m³ at 1000 feet
30 cu. yd/hr	SO_2	Annual	< 0.01	0.01	0.01	0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
300 cu. yd/hr	CHOH	1-hr	0.02	0.03	0.02	0.02	0.01	0.02	0.02	0.02	0.01	0.01
300 cu. yd/hr	CHOH	Annual	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
300 cu. yd/hr	CO	1-hr	556.12	728.13	628.69	483.46	430.94	468.84	469.91	450.99	423.43	393.71
300 cu. yd/hr	CO	8-hr	377.30	379.73	298.49	250.39	233.48	232.14	220.84	204.21	186.21	175.22
300 cu. yd/hr	Ni	1-hr	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
300 cu. yd/hr	Ni	Annual	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
300 cu. yd/hr	NO_2	1-hr	92.38	171.56	133.12	105.31	114.26	111.99	103.81	96.44	89.70	83.46
300 cu. yd/hr	NO_2	Annual	2.98	19.68	23.41	20.79	17.61	14.98	12.96	11.39	10.12	9.08
300 cu. yd/hr	PM_{10}	24-hr	133.01	84.57	70.26	63.46	57.22	51.59	46.58	42.18	38.35	35.21
300 cu. yd/hr	PM_{10}	Annual	42.47	23.31	15.38	12.16	10.30	8.93	7.84	6.94	6.20	5.57
300 cu. yd/hr	$PM_{2.5}$	24-hr	23.98	17.33	13.82	11.83	11.22	10.54	9.80	9.07	8.40	7.80
300 cu. yd/hr	$PM_{2.5}$	Annual	7.19	4.73	3.46	2.59	2.11	1.91	1.75	1.60	1.46	1.34
300 cu. yd/hr	SO_2	1-hr	0.36	0.47	0.41	0.31	0.28	0.30	0.30	0.29	0.27	0.26
300 cu. yd/hr	SO_2	24-hr	0.15	0.19	0.16	0.12	0.11	0.10	0.09	0.09	0.08	0.08

Scenario	Contaminant	Averaging Time	µg/m³ at 100 feet	µg/m³ at 200 feet	µg/m³ at 300 feet	µg/m³ at 400 feet	µg/m³ at 500 feet	µg/m³ at 600 feet	µg/m³ at 700 feet	µg/m³ at 800 feet	µg/m³ at 900 feet	µg/m³ at 1000 feet
300 cu. yd/hr	SO_2	3-hr	0.28	0.29	0.27	0.22	0.21	0.19	0.17	0.16	0.14	0.13
300 cu. yd/hr	SO_2	Annual	< 0.01	0.01	0.01	0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

3. Model Used and Modeling Techniques

ISCST3 (Version 02035) was used.

The APD used a unitized emission rate of 1.0 pound per hour (lb/hr) to predict a generic impact for each source. The generic impact was multiplied by the proposed air contaminant specific emission rates to calculate a maximum predicted concentration for each source. The APD added together each maximum predicted concentration for each source to get a total predicted concentration for each air contaminant.

The APD performed air contaminant-specific modeling for the 24-hour PM_{10} and $PM_{2.5}$, and 1-hour NO_2 NAAQS demonstrations. The air contaminant-specific modeling considered the form the applicable NAAQS, i.e. high sixth high over 5 years for PM_{10}, 5-year average of the high first highs for $PM_{2.5}$ and 5-year average of 98th percentile of the maximum 1-hour daily concentrations for NO_2.

The APD modeled NO_2, using a NO_2/NO_x ratio of 0.5. In EPA's March 1, 2011 guidance memo it is stated, "Although well-documented data on in-stack NO_2/NO_x ratios is still limited for many source categories, we also feel that it would be appropriate in the absence of such source-specific in-stack data to adopt a default in-stack ratio of 0.5 as being adequately conservative in most cases and a better alternative to use of the Tier 1 full conversion." Since the location of the maximum concentrations are very close to the source and travel time very short, giving little time for the NO_x to NO_2 conversion to take place, an in-stack ratio of 0.5 is reasonable for this analysis.

A. Land Use

The modeling considered rural and urban dispersion coefficients. The modeling results depict the highest predicted concentrations whether rural or urban was selected. Since low-level fugitive emissions are significant and these emissions would be terrain following, the modeling only considered flat terrain.

B. Meteorological Data

The ISCST3 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 ISCST3 modeling used a polar receptor grid with 36 radials spaced every 10 degrees from true north. Receptors were located on each radial at distances of every one hundred feet out to 1,000 feet. This was done to determine the plume centerline concentration.

D. Building Wake Effects (Downwash)

Downwash was not modeled since there are no significant structures onsite that would impact the flow of emissions.

4. Modeling Emissions Inventory

The modeling represented emissions from all material handling activities as a series of collocated circular area sources 100 feet in diameter at 5, 10, 15, and 20 feet high. The APD assumed the material handling emissions to be well distributed throughout the site; therefore an area source would be appropriate. The APD assumed that the material handling activities would take place from very near ground level to about 20 feet in height. The APD selected the circular area source type to minimize bias of any one wind direction or source orientation. The modeling represented emissions from baghouses as single point source 40 feet high with no vertical momentum or buoyancy. The modeling represented the engine on site consistent with the parameters furnished by the Mechanical/Agricultural/Construction Section. The source parameters modeled are listed in Tables 2 and 3.

Table 2. Modeled Point Source Parameters

Source ID	Stack height (feet)	Temperature (°F)	Stack velocity (feet/second)	Stack diameter (feet)
SILOS	40	-460	0.003	0.003
ENGINE	8	900	299.1	0.7

Table 3. Modeled Area Source Parameters

Source ID	Release height (feet)	Radius (feet)
FUG-1	5	50
FUG-2	10	50
FUG-3	15	50
FUG-4	20	50

The APD modeled material handling activities as source group FUG. The APD modeled all baghouses as source group SILOS. The APD modeled the engine at the site as source group ENGINE. All sources were collocated. The emission rates modeled are listed in Table 4.

Table 4. Modeled Emission Rates

Source Group	Scenario	Contaminant	Averaging Time	Rate (lb/hr)
SILOS	30 cu. yd/hr	PM_{10}	24-hr	0.02
SILOS	30 cu. yd/hr	PM_{10}	Annual	0.02
SILOS	30 cu. yd/hr	$PM_{2.5}$	24-hr	0.004
SILOS	30 cu. yd/hr	$PM_{2.5}$	Annual	0.004
FUG	30 cu. yd/hr	PM_{10}	24-hr	0.75
FUG	30 cu. yd/hr	PM_{10}	Annual	0.75
FUG	30 cu. yd/hr	$PM_{2.5}$	24-hr	0.18
FUG	30 cu. yd/hr	$PM_{2.5}$	Annual	0.18
FUG	30 cu. yd/hr	Ni	1-hr	2.01E-05
FUG	30 cu. yd/hr	Ni	Annual	2.01E-05
ENGINE	30 cu. yd/hr	PM_{10}	24-hr	0.89
ENGINE	30 cu. yd/hr	PM_{10}	Annual	0.32
ENGINE	30 cu. yd/hr	$PM_{2.5}$	24-hr	0.89
ENGINE	30 cu. yd/hr	$PM_{2.5}$	Annual	0.32
ENGINE	30 cu. yd/hr	NO_2	1-hr	15.10
ENGINE	30 cu. yd/hr	NO_2	Annual	5.38
ENGINE	30 cu. yd/hr	CO	1-hr	18.70
ENGINE	30 cu. yd/hr	CO	8-hr	18.70
ENGINE	30 cu. yd/hr	SO_2	1-hr	0.01
ENGINE	30 cu. yd/hr	SO_2	3-hr	0.01
ENGINE	30 cu. yd/hr	SO_2	24-hr	0.01
ENGINE	30 cu. yd/hr	SO_2	Annual	0.004
ENGINE	30 cu. yd/hr	CHOH	1-hr	6.49E-04

Source Group	Scenario	Contaminant	Averaging Time	Rate (lb/hr)
ENGINE	30 cu. yd/hr	CHOH	AAnnual	6.49E-04
SILOS	300 cu. yd/hr	PM_{10}	24-hr	0.64
SILOS	300 cu. yd/hr	PM_{10}	Annual	0.64
SILOS	300 cu. yd/hr	$PM_{2.5}$	24-hr	0.11
SILOS	300 cu. yd/hr	$PM_{2.5}$	Annual	0.11
SILOS	300 cu. yd/hr	Ni	1-hr	9.93E-06
SILOS	300 cu. yd/hr	Ni	Annual	8.28E-06
FUG	300 cu. yd/hr	PM_{10}	24-hr	0.78
FUG	300 cu. yd/hr	PM_{10}	Annual	0.79
FUG	300 cu. yd/hr	$PM_{2.5}$	24-hr	0.13
FUG	300 cu. yd/hr	$PM_{2.5}$	Annual	0.13
FUG	300 cu. yd/hr	Ni	1-hr	2.72E-05
FUG	300 cu. yd/hr	Ni	Annual	2.27E-05
ENGINE	300 cu. yd/hr	PM_{10}	24-hr	0.89
ENGINE	300 cu. yd/hr	PM_{10}	Annual	0.89
ENGINE	300 cu. yd/hr	$PM_{2.5}$	24-hr	0.89
ENGINE	300 cu. yd/hr	$PM_{2.5}$	Annual	0.89
ENGINE	300 cu. yd/hr	NO_2	1-hr	15.10
ENGINE	300 cu. yd/hr	NO_2	Annual	15.10
ENGINE	300 cu. yd/hr	CO	1-hr	18.70
ENGINE	300 cu. yd/hr	CO	8-hr	18.70
ENGINE	300 cu. yd/hr	SO_2	1-hr	0.01
ENGINE	300 cu. yd/hr	SO_2	3-hr	0.01
ENGINE	300 cu. yd/hr	SO_2	24-hr	0.01

Source Group	Scenario	Contaminant	Averaging Time	Rate (lb/hr)
ENGINE	300 cu. yd/hr	SO_2	Annual	0.004
ENGINE	300 cu. yd/hr	CHOH	1-hr	6.49E-04
ENGINE	300 cu. yd/hr	CHOH	Annual	6.49E-04

The APD modeled maximum hourly emission rates for 1-hour, 3-hour, and 8-hour standards. The APD modeled 30 cu. yd/hr plant, emission rates for 24-hour standards based on maximum hourly production. For the 300 cu. yd/hr plant, the APD modeled emission rates for 24-hour standards based on maximum daily production of 6,000 cu. yd/day, which is the maximum hourly rate multiplied by (6,000/7,200), where 6,000 cu. yd/day is the daily production limit and 7,200 cu. yd/day is the theoretical maximum daily production at 300 cu. yd/hr. The APD modeled annual emission rates based on annual maximum production rates.