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AIR ✯ WATER ✯ WASTE CONSULTANTS

September 8, 2010 Via email: RAlvarez@edf.org

Environmental Defense Fund
Attn: Dr. Ramón Alvarez
44 East Ave., Suite 304
Austin, Texas 78701

Re: Audit of TCEQ's Air Dispersion Modeling Prepared in Support of Proposed OGS Permit By Rule and Standard Permit

Dear Dr. Alvarez:

We have completed our initial review of the TCEQ's air dispersion modeling that was prepared in support of the proposed OGS PBR and standard permit. During our review, we discovered several items that should be clarified and/or corrected by the TCEQ prior to the promulgation of the proposed OGS PBR and standard permit. Our findings are included in the attached responses to your questions, which were outlined at the beginning of our modeling review. We have also attached excel spreadsheets containing our modeling comparison results.

If you have any questions or concerns, please feel free to contact me at (713) 621-4474.

Sincerely,

Robert Osborn

Robert Osborn, M.S.
Environmental Consultant
Source Environmental Sciences, Inc

Questions/Issues for Independent Consultant Review of TCEQ's Protectiveness Review for its Proposed Oil and Gas Site (OGS) Authorizations (in no particular order of priority)

1. *Comprehensive assessment of the procedures and assumptions used by the TCEQ in its modeling analysis. (As we discussed, depending on timing and budget, alternative model runs may be desirable). Sub-questions of interest include, but are not limited to:*

    a. *Strengths and weaknesses of ISC vs AERMOD (was 40% discount applied to low-level fugitive sources?)*

A TCEQ Memo dated March 6, 2002 from the Air Dispersion Modeling Team Leader, Mr. Dom Ruggeri, allows an applicant to reduce low level fugitive emissions by 40% when using ISCST3). However, this 40% reduction in emissions was not claimed for low level fugitives in the TCEQ's modeling.

To determine how the modeling results would change if the TCEQ chose AERMOD instead of ISCST3, we reran the TCEQ modeling in AERMOD using both Travis and Tarrant county meteorological data. The results of this evaluation are shown in the attached spreadsheet file titled "O&G Tables Comparison.xls". Each tab in this spreadsheet shows the modeling results the TCEQ would have obtained if they used AERMOD with meteorological data from both Travis and Tarrant counties. Comparison tables showing the percent change in predicted concentrations are also provided. As shown in these spreadsheets, the differences in the unit impacts obtained from AERMOD and ISCST3 vary depending on the type of source that is modeled. Some sources yield higher unit impacts in AERMOD while different sources yield higher unit impacts in ISCST3. Based on this analysis, it is evident that the worst-case emissions from one source may be underestimated depending on the model used and the location that is chosen. Therefore, we suggest that the TCEQ perform the analysis described below to ensure (without a doubt) that the proposed OGS PBR and standard permit will be protective of public health and welfare anywhere in the State of Texas:

1. Rerun the modeling in ISCST3 and AERMOD for multiple locations in the state (perhaps include one county for each TCEQ region) and for all identified source categories and
2. For a given source category, choose the highest impacts from all modeling runs combined.

    b. *Representativeness to other parts of Texas of a surface met data set from Austin.*

As shown in the answer to Question 1.a above, Tarrant County meteorological data may result in higher offsite concentrations for certain sources (at least in AERMOD). For a side-by-side comparison of the modeling results that the TCEQ obtained using ISCST3, we chose to rerun ISCST3 using a meteorological data set that simulates conditions that generate theoretical maximum offsite ground-level concentrations. The specific meteorological data set that we used was generated using a computer program called "ISCST Screening Met Program" that creates a data file that instructs ISCST3 to cycle through predefined wind directions and all possible meteorological stability classes when running the model. This program was designed by Mr. Pat Hanrahan of the Oregon Department of Environmental Quality (retired).

The resulting impacts generated using this meteorological data set should theoretically be the "worst-case" impacts that could occur anywhere in the State of Texas (not just in Travis County in the years that the TCEQ evaluated). The results of this analysis are shown in the attached excel spreadsheet file titled "O&G Modeling Comparison – Star Met Data.xls". As shown in this file, the unit impacts modeled by the TCEQ for fugitives, process vents, and blowdown/purging stacks are almost all lower than the worst-case unit impacts that we obtained (excluding 50 foot tall process vents). Therefore, we believe that the unit impacts modeling tables in the proposed OGS PBR and standard permit do not represent the "worst-case" scenario for these types of sources. To ensure that the "worst-case" scenario for all sources has been considered, the TCEQ should perform the evaluation described in our response to question 1.a above.

c. Adequacy of using ISC for sources subject to federal review.

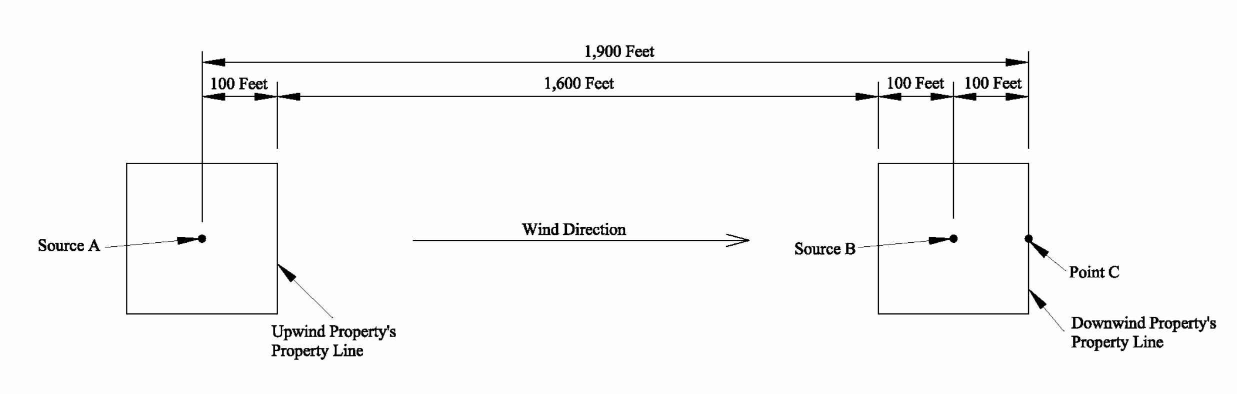
The EPA Guideline on Air Quality Models published in 40 CFR 51, Appendix W does not list ISCST3 as a preferred air quality model for use in regulatory applications. Furthermore the EPA's SCRAM website (http://www.epa.gov/ttn/scram/dispersion_prefrec.htm) states the following:

> "As of December 9, 2006, AERMOD is fully promulgated as a replacement to ISC3, in accordance with Appendix W."

Therefore, ISCST3 should not be used to evaluate impacts from sources subject to federal review (i.e., major sources). If the modeling conducted for the proposed OGS PBR and standard permit is performed in ISCST3, the resulting PBR and standard permit should not be used to authorize facilities at sites that are a major source of air pollutants.

2. *Contributing zone. Is the inclusion of all facilities at an OGS (contiguous or adjacent properties under common control with same 2-digit SIC code) located up to ¼ mile from a facility requiring registration adequately protective? See proposed standard permit (b)(5)(c), p. 104. Said differently, are the residual pollutant concentrations that can be produced at distances beyond ¼ mile sufficiently small so as to be considered insignificant to a particular receptor? Are there potential cumulative impacts from dense network of OGS close to populated areas such as is occurring in the Barnett Shale?*

We can conceive a scenario where two sites owned by the same company located more than ¼ mile from each other would result in offsite impacts that are substantially higher than what one would predict for just one of the sites. An example of one such scenario is illustrated and described below:



> A company owns two OGS facilities on properties that are located approximately 1,600 feet from each other (which is greater than ¼ mile). The upwind property contains a 30-foot tall process vent located 100 feet from its downwind property line with a benzene emission rate of 1.89 lb/hr. This process vent is denoted as Source A in the figure above. The downwind property also contains a 30-foot tall process vent located 100 feet from its downwind property line with a benzene emission rate of 1.89 lb/hr. This process vent is denoted as Source B in the figure above. The distance from the downwind property's downwind property line (Point C) to Source A is 1,900 feet. Calculating the benzene impacts at Point C using the unit impacts for process vents in Table 2 of the proposed OGS PBR and standard permit yields a concentration of 170 µg/m^3 from Source B and a concentration of 86.89 µg/m^3 from Source A, which totals 256.89 µg/m^3. (Please note that benzene emission rate of 1.89 lb/hr was calculated using the maximum hourly emission rate calculation methodology shown in Table 1 of the proposed OGS PBR and standard permit.)

If we consider the impacts from both sites combined, it is clear that the benzene ESL (170 µg/m^3) will be exceeded at the downwind property's downwind property line. This violates the impact evaluation requirement in paragraph (k)(3)(B) of the proposed standard permit and PBR. However, since the company can consider these properties as two different sites, the scenario described above can be authorized under the new standard permit. This evaluation shows that the ¼ mile site separation allowed by the proposed OGS PBR and standard permit may result in offsite impacts that would not be authorized by the standard permit. Therefore, a more comprehensive system for separating sites that is more protective of human health and the environment should be developed by the TCEQ prior to the issuance of the OGS standard permit.

3. *Would the conclusions of protectiveness review change if comparison values for different averaging times were used, such as ATSDR Minimal Risk Level for benzene for acute exposures (1-14 days) of 9 ppb? (If modeling runs are conducted, we may wish to include additional averaging times such as 24-hour and 14-day).*

To answer this question, we first converted the 9 ppb standard for benzene acute exposures into µg/m^3 using atmospheric conditions at Standard Temperature and Pressure (STP; T=293 Kelvin and P=101,325 Pascals). At STP, the ATSDR Minimal Risk Level converts to 29.24 µg/m^3. Running the ISCST3 model for "process vents" at the various specified heights in the proposed standard permit and retaining the 24-hour average concentrations yields a maximum 24-hour unit impact of 174 [µg/m^3 / lb/hr], which occurs 150 feet downwind from a 10 ft tall process vent. Using the equations in Table 1 of the proposed OGS PBR and standard permit, we can calculate a maximum allowable benzene emission rate of 0.168 lb/hr based on maximum allowable impacts occurring 150 feet from a 10 ft tall process vent (0.168 lb/hr = 29.24 µg/m^3 / 174 [µg/m^3 / lb/hr]). Performing the same calculations using the short-term Effects Screening Level (ST-ESL), as proposed in the new OGS PBR and standard permit, yields a maximum allowable emission rate of 0.3625 lb/hr (0.3625 lb/hr = 170 µg/m^3 / 469 [µg/m^3 / lb/hr]). Therefore, if a 10 foot tall process vent located 150 feet from a property line is emitting between 0.168 and 0.3625 lb/hr of benzene, the proposed PBR and standard permit modeling would suggest that the impacts would be protective of public health and welfare. However, comparing the impacts to the ATSDR Minimal Risk Level for a 24-hour average concentration shows that the operation would actually not be protective of public health and welfare. Therefore, the TCEQ should address this issue in the modeling that was conducted for this PBR and standard permit.

Please note that we considered running the model to retain the process vent concentrations based on a 14-day concentration. Unfortunately there is no option to specify this specific averaging time in the model and manually setting the model up to yield this information is very time consuming. Therefore, we only considered the 24-hour averaging time period in our evaluation.

4. *Treatment of emissions sources. How reasonable are the parameters selected to simulate specific types oil/gas emissions sources (especially flares, engines, and truck loading). Do the groupings of sources described on p. 58 adequately capture all the emissions sources typical of an OGS?*

We attempted to contact Ms. Anne Inman, Section Manager of the TCEQ's Rule Registrations Section, and requested that she send us the data that was used to develop the source input parameters for their modeling. She has not responded to our request. Therefore, in an attempt to validate the TCEQ's source input data, we performed our own evaluation of the modeling input parameters used for both large and small engines and turbines to confirm that they are reasonable. This evaluation focused on the exhaust flow rate and temperature of the engines used in the model. Based on 1996 engine performance information for G3400 and G3500 series Caterpillar gas engines (see the attached table titled "Engine Exhaust Parameters"), the exhaust flow rates for both small and large class engines are smaller than the values used by the TCEQ (4,800 cfm for small [≤1,000 hp] engines and 9,500 cfm for large [>1,000 hp] engines). Since the exhaust flow rates for these engines are lower than the flow rates that the TCEQ used in their modeling, the stack exit velocities may also be lower for these engines (assuming that the stack exit diameter is the same for all engines). Therefore, we propose that the TCEQ add a condition to the draft OGS standard permit and PBR language that limits engine and turbine exhaust exit velocities to a minimum of 159 ft/sec for small engines and 315 ft/sec for large engines (these are the exit velocities used in the TCEQ's modeling).

Regarding the other sources modeled for this proposed permit, at face value the modeling input parameters that were used by the TCEQ seem to be reasonable. Therefore, continuing to explore the reasonability of all other source inputs may not be a fruitful exercise.

5. *Applicant modeling. What are the potential problems associated with allowing applicants to conduct their own screening or dispersion modeling in support of a PBR or standard permit or PBR (see, e.g., SP p. 114)?*

To preface our comment on this question, we would like to point out that we did some research on this topic and we were not able to locate any regulation or policy that would prohibit the TCEQ from allowing company's to submit modeling in support of a PBR or standard permit. In fact, there is already a PBR on the books that allows applicants to submit dispersion modeling to demonstrate that the project to be authorized will not cause an exceedance of any NAAQS (specifically 30 TAC §106.512 *Stationary Engines and Turbines* [effective 6/23/2001]).

The concern with allowing applicants to perform their own screening or dispersion modeling for a PBR or standard permit is that any refined modeling that is performed may not be reviewed by the TCEQ as carefully as a modeling study for a regular NSR permit. The reason for this concern is that a permit engineer in charge of reviewing the PBR or standard permit application may not be required to send the applicant's modeling to the TCEQ modeling section for their review. Therefore, issues in the modeling may slip through the cracks. To prevent this from happening, the EDF could propose adding a requirement for the modeling section to review all dispersion modeling that is submitted for an OGS PBR or standard permit.

ADDITIONAL FINDINGS

Stack-Tip Downwash:
The TCEQ's modeling for compressor blowdowns and pipeline purging stacks does not consider stack-tip downwash, which is a non-regulatory default option in AERMOD and ISCST3. Excluding stack-tip downwash from the modeling study ignores the effects of turbulent eddies that form immediately downwind from a stack. The AERMOD Implementation Guide (revised March 19, 2009) states that stack-tip downwash should be turned off for capped or horizontal stacks that are not subject to building downwash. However, the compressor blowdown and pipeline purging stacks were not represented as horizontal or capped stacks. Therefore, the TCEQ should either include stack-tip downwash in their evaluation or should explain why it was not included for these types of sources. (Please note that the TCEQ included stack-tip downwash for all other modeled point sources. Also the predicted concentrations for compressor blowdowns and pipeline purging will increase if stack-tip downwash is included in the model.)

ENGINE EXHAUST PARAMETERS															
Small Engines (≤1,000hp) 100% Load	TCEQ O&G Modeling Input Parameters	G3516 NA (1,500 rpm, 780 hp)	G3512 LE (1,200 rpm, 860 hp)	G3512 TA (1,200 rpm, 815 hp)	G3512 TA (1,500 rpm, 615 hp)	G3508 LE (1,400 rpm, 630 hp)	G3508 TA (1,200 rpm, 545 hp)	G3508 NA (1,500 rpm, 347 hp)	G3412C LE (1,800 rpm, 637 hp)	G3412 TA (1,400 rpm, 465 hp)	G3412 NA (1,400 rpm, 315 hp)	G3408 TA (1,400 rpm, 350 hp)	G3406 TA (1,800 rpm, 345 hp)	Average Value	% of sample data that is less than TCEQ's inputs
Flow Rate (cfm):	4,800	3,955	4,616	3,277	3,023	3,620	2,377	1,882	3,230	2,011	1,433	1,684	1,506	2,992	100%
Exhaust Temp (F):	900	1,152	799	855	1,177	848	943	1,199	849	931	1,056	871	1,039	965	42%
Large Engines (>1,000hp[1]) 75% Load	TCEQ O&G Modeling Input Parameters	G3516 LE (1,400 rpm, 1,265 hp)	G3516 TA (1,200 rpm, 1,085 hp)												
Flow Rate (cfm):	9,500	5,622	3,390											4,506	100%
Exhaust Temp (F):	900	883	840											862	100%

[1] Engine classification is based on horsepower rating at 100% load