Email: Jason.Holloman@tceq.texas.gov

December 20, 2017

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TCEQ – Region 12
5425 Polk Avenue, Suite H
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Dear Mr. Holloman:

Arkema Inc. (Arkema) has recently received a December 12, 2017 TCEQ Interoffice Memorandum[1] from Mr. Holloman which describes Event 1, STEERS Report Incident No. 267578 that occurred from 12:00 PM to 18:06 PM (a six hour and six minute duration) on August 29, 2017 at the Arkema Crosby, Texas facility. The memorandum gives a report summary referring to the air quality analysis and modeling study performed by Trinity Consultants on behalf of Arkema[2]. The memorandum also found the modeling analysis for Event 1 to be unacceptable based on three deficiencies. No mention is made in the TCEQ memorandum of the Arkema response to Mr. Holloman regarding preliminary deficiencies found earlier by Mr. Cherry and reported by him on November 9, 2017 to Mr. Holloman who requested and obtained a full response on five questions on November 27, 2017 from Arkema.

The noted deficiencies in the current December 12, 2017 TCEQ memorandum along with their suggested manner of addressing them were:

1. **TCEQ deficiency**: When modeling in AERMOD, the regulated entity did not account for daylight savings time.
   TCEQ suggested addressing of deficiency: Update the time range in AERMOD to take into account daylight savings time.

2. **TCEQ deficiency**: The onsite monitor used in the AERMET processing was lowered during the emissions event. The regulated entity did not provide justification for using the altered monitor.
   TCEQ suggested addressing of deficiency: Provide sufficient justification for using an altered monitor for the on-site meteorological data.

3. **TCEQ deficiency**: Insufficient receptor placement located on the northeast of the property without sufficient justification.
   TCEQ suggested addressing of deficiency: Follow established guidance for receptor placement.

Each of these TCEQ-identified deficiencies are addressed in the following numbered responses. Specific deficiencies from TCEQ are shown below in *italic* font. Associated responses are shown in **bold** font.

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[1] *Air Quality Analysis Audit – Arkema Inc. (RN100210301)*, TCEQ Interoffice Memorandum from Justin Cherry, P.E. ADMT to Jason Holloman, Office of Compliance and Enforcement, December 12, 2017.
[2] *Emissions Events Modeling Analysis Arkema, Inc. > Arkema Crosby Plant, Hurricane Harvey Vapor and Fire Events August 29 – September 3, 2017*, Trinity Consultants, Covington, KY and Austin, TX, October 2017.

1. *When modeling in AERMOD, the regulated entity did not account for daylight savings time.*

   In Section 3.B of the TCEQ audit memorandum, Mr. Cherry discusses the range of hours used by Trinity in the modeling to represent the hours Event 1 took place and notes a one hour shift backward would be necessary, thus an event duration of hour 12 to 18 (different from the original modeling analysis of hours 13 -19) to accommodate the 12:00 to 18:06 (CDT) duration of the event. (Recall that the AERMET data is all in CST, so Hour 12 represents the hour from 11:00 am to 12:00 pm and that the reported hour of the beginning of Event 1 was 12:00 CDT on STEERS which is 11:00 am CST).

   We agree. Our original analysis was based on the premise that the STEERS reporting of Event 1, Incident No. 267578, was in Central Standard Time. Thus, we have adjusted the modeling analysis of Event 1 to hours 12 through 18 (hour 18 included to ensure the last six minutes of the event were represented in the modeling analysis).

2. *The onsite monitor used in the AERMET processing was lowered during the emissions event. The regulated entity did not provide justification for using the altered monitor.*

   The modeling did account for the change in tower height over the course of several days during Hurricane Harvey's passage. To respond to the justification for using the lowered monitor two answers are given.

   First, anemometers can be at any height above ground as long as the sensor is located properly on the supporting structure and free of obstructions. Many wind instruments are still located at airports at heights lower than the standard 10 m and are still used in dispersion modeling studies. As long as the height above-grade of the anemometer and vane is used in the model, the AERMOD model has formulations which can adjust the measured wind speed and direction to the height of each source release using the given height of the sensors as the base height in the calculations.

   Perhaps TCEQ's concern is that lower tower height measurements might give inaccurate data or false readings due to nearby obstructions. If this is the case, the following discussion applies. Due to expected high wind speeds, the tower on which the anemometer and vane was mounted was lowered to a height of 4.27 m and remained at that height throughout the modeled period of August 29. For the hours at this lower height, the inputs to AERMET were adjusted to account for the height change while keeping the height at 10 m for all other hours (this can be viewed in the surface files provided to TCEQ earlier, namely, "WALLISVILLE_ARKEMALU_HgtShift_NoADJU.SFC".

   If the TCEQ concern is that a wind measurement is taken too close to the ground, thereby having near-ground mechanical turbulence distorting the wind measurements, EPA's *AERMOD Model Formulation and Evaluation*[3] document addresses this in Section 2 *Model Overview*. As the document states, AERMET and AERMOD use a required minimum wind measurement height above ground level that is equal to 7 times the surface roughness (z_o) in the area. The results of the AERSURFACE land use analysis of the Wallisville monitor location indicated that the highest surface roughness value for any direction around the monitor is 0.26 meters. Thus, using the 7 times z_o gives a minimum

[3] *AERMOD Model Formulation and Evaluation,* EPA-454/R-17-001, U.S. Environmental Protection Agency, Research Triangle Park, NC, May 2017.

acceptable anemometer height for this location at 1.82 m. The 4.27 m tower height in this case is well above this minimum value and thus is appropriate for use with AERMOD.

One comment was made by TCEQ regarding the profile base height in Section 3.B of the audit memorandum that the height of 15 m was incorrect. But as it states in the AERMOD user's guide, the base height of the "primary" tower should be used for this input. The base elevations all around the Wallisville station tower were reevaluated and it was determined that the height of the adjacent trailer had been input into previous modeling rather than the more representative height of 12 m MSL. The 32 m indicated by the memorandum as the correct height was the old base elevation of the Houston Intercontinental Airport (now George Bush) which was shut down in 1972[4]. The new base elevation at the same airport now called George Bush Intercontinental/Houston Airport is 28.96 m. This was not the primary site used in the AERMET calculations.

As per the TCEQ memorandum, "this discrepancy [in this case 3 m] does not significantly affect the modeling results.

3. *Insufficient receptor placement located on the northeast of the property without sufficient justification.*

   As per TCEQ's suggested remedy and following the guidance offered in Section V (subsection on Receptor Design) of the TCEQ Air Quality Modeling Guidelines[5] to have at least a 25 m spacing), additional receptors were added to the northeast just off the property line and prior to the 25 m gridded receptors. This resulted in 17 additional receptors to the northeast. Figure 1 shows the before-adding the receptors northeast grid, while Figure 2 portrays the receptor grid after the incorporation of the additional receptors.

As a result of our responses to the three deficiencies noted in the TCEQ audit, new modeling was performed implementing the hour of day changes in No. 1 above and with the additional northeast receptors. The maximum 1-hour modeling results (used for comparison against relevant standards) were identical to those obtained in November and submitted to TCEQ. The updated Event 1 modeling files will be provided to TCEQ as part of this submittal.

Figure 1. Receptor Configuration in November Modeling Submittal

[4] https://gis.ncdc.noaa.gov/maps/ncei/cdo/hourly)

[5] *Air Quality Modeling Guidelines*, APDG 6232v2, Air Permits division, Texas Commission on Environmental Quality, Austin, Texas, Revised April 2015.

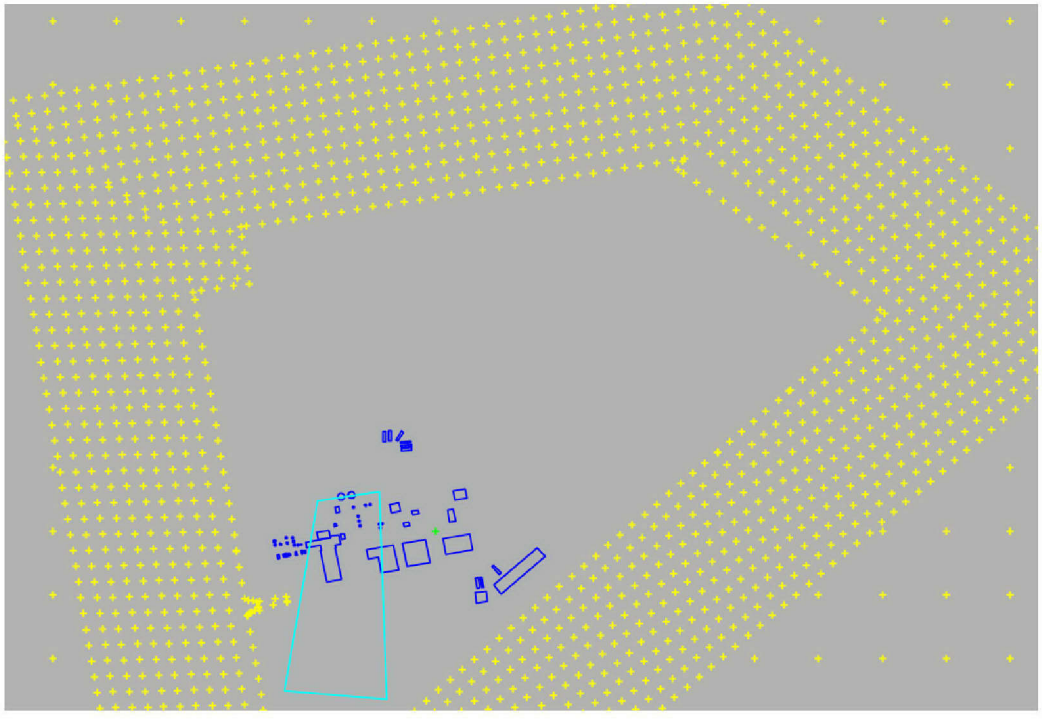
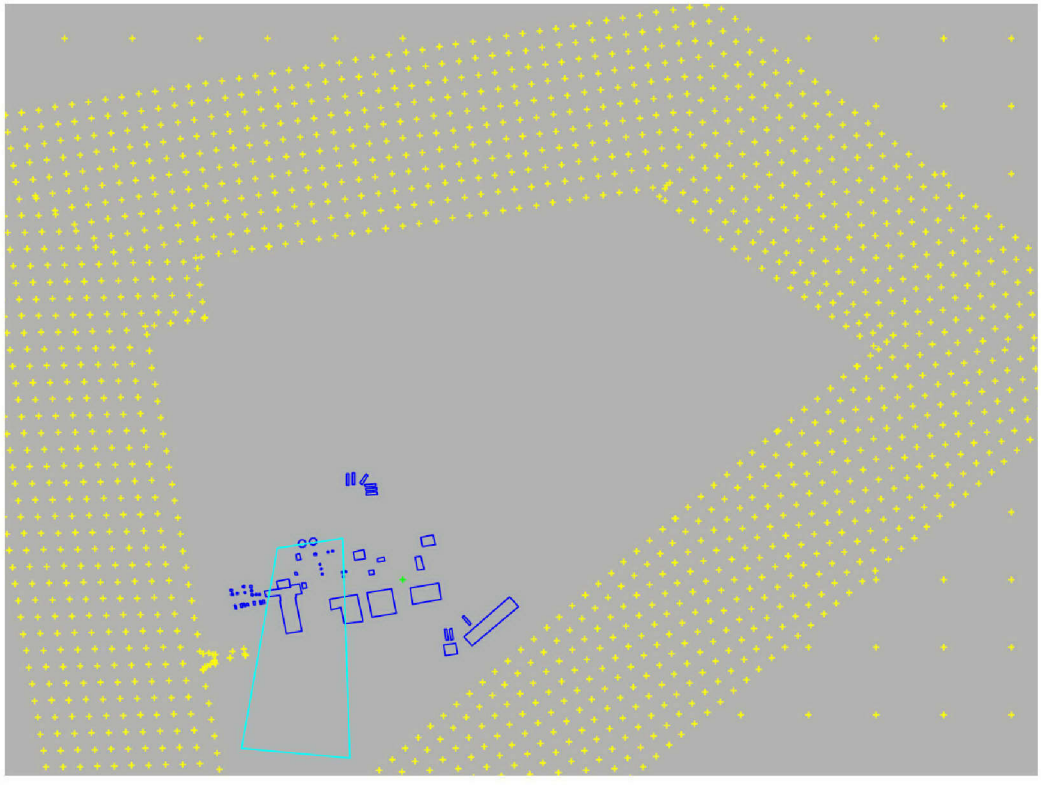
Figure 2. Updated Receptor Configuration with Additional Northeast Receptors