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January 27, 2015

VIA HAND DELIVERY

Commissioner Julie Morita, M.D.
Chicago Department of Public Health
333 South State Street, Room 200
Chicago, IL 60604

Re: Supplement to KCBX Terminals Company's Petition for Variance from Sections 6.0(5) and 6.0(6)

Dear Commissioner Morita:

KCBX Terminals Company ("KCBX"), by and through its counsel Quinn Emanuel Urquhart & Sullivan, LLP, hereby submits this Supplement to its Petition for Variance from Sections 6.0(5) and 6.0(6) ("Petition")[1] of the City of Chicago Department of Public Health's ("CDPH") Rules and Regulations for Control of Emissions from the Handling and Storage of Bulk Material Piles ("Rules"). The purpose of this supplement is to respond to the analyses performed by the CDPH's consultant, CDM Smith, Inc. ("CDM Smith"), as relied upon by the CDPH in its December 9, 2014 Determination on KCBX's Petition for Variance (submitted on June 9, 2014), to the extent that such analyses may be relevant to KCBX's present Petition (submitted on December 17, 2014). KCBX stated its intent to provide a supplement in its Petition, noting that KCBX disagreed with the contractor's opinions and would supplement its Petition to respond thereto. Petition, at 14.

KCBX has demonstrated that issuance of a variance from the enclosure deadlines will not create a public nuisance or adversely impact the surrounding area, in part through Environmental Health and Engineering's ("EH&E") presentation of its soil and surface sampling results, EH&E's and the US EPA's filter sampling analyses, and Sonoma Technology, Inc.'s ("STI") air monitoring data and

[1] Available at: http://www.cityofchicago.org/content/dam/city/depts/cdph/environmental_health_and_food/Dec192014/KCBXPetitionVarianceSec605606.pdf.

associated air modeling. CDM Smith's opinions purporting to contradict some of these conclusions—specifically, its memoranda regarding EH&E's soil sampling, CDM Smith's Electron Microscopy study, and STI's air modeling—are the product of flawed scientific analyses, inaccurate assumptions, and misconceptions about the work performed by experts STI and EH&E.[2] CDPH should not rely on these memoranda in its review of KCBX's Petition. Because KCBX has made a sufficient showing pursuant to the Rules, its Petition for Variance from sections 6.0(5) and 6.0(6) should be granted.

[2] CDM Smith does not dispute the accuracy of EH&E's surface sampling analysis or EH&E's and the US EPA's filter sampling results, which all demonstrate that a grant in the variance will not cause a public nuisance or adversely impact the surrounding area.

I. RESPONSE TO MEMORANDUM REGARDING SOIL SAMPLING

CDM Smith's memorandum regarding EH&E's soil sampling *supports* EH&E's conclusion that KCBX does not adversely impact the soil in the vicinity of its terminals. As explained in KCBX's Petition, EH&E concluded, on the basis of extensive soil sampling, that there is no evidence of pet coke or coal in the soil of the East Side and South Deering neighborhoods and that the composition of the soil in those areas is consistent with control neighborhoods in the City of Chicago. Petition, at 17-18, Exhibit 1.[3] CDM Smith concluded that pet coke and coal-related chemicals already exist in the soil in the neighborhoods near KCBX, and any increases in chemical concentrations related to KCBX would be small in comparison. Appendix 2, at 3-4. Specifically, CDM Smith's concluded that any increase in pet coke-related chemicals in the soil "would generally be small in comparison to background concentrations" of the same chemicals. EH&E agrees; this CDM Smith conclusion offers additional evidence on the absence of adverse impacts. Determination, at Appendix 2, at 4.[4]

EH&E does not agree, however, with CDM Smith's assertion that EH&E's soil sampling methodology is not a useful approach for detecting the deposition of pet coke off-site. Exhibit 1, at 6-8. EH&E's methodology is far more sensitive to detecting changes in background concentrations than CDM Smith acknowledges. *Id*. But further, CDM Smith's analysis is presented out-of-context, because CDM Smith failed to provide any sort of benchmark for the levels of pet coke or coal deposition in the soil that would rise to the level of a nuisance or adverse impact. *Id.* at 6. Nonetheless, any impacts, adverse or otherwise, would likely be measured against the metric of

[3] Available at http://www.cityofchicago.org/content/dam/city/depts/cdph/environmental_health_and_food/Dec192014/Ex1KCBXPetitionVarianceSec605606.pdf.

[4] Available at: http://www.cityofchicago.org/content/dam/city/depts/cdph/environmental_health_and_food/App2CDMSmithTechMemoreSoilSamp.pdf.

background chemical concentrations. CDM Smith's analysis shows that any deposition of pet coke related chemicals attributable to emissions from KCBX would be very low compared to background levels in Chicago. *Id.*

For EH&E's full response to CDM Smith's analysis regarding soil sampling, see Exhibit 1.

II. RESPONSE TO MEMORANDUM REGARDING ELECTRON MICROSCOPY

In addition to reviewing EH&E's soil sampling, CDM Smith performed a separate analysis of sidewalk dust samples in the proximity of KCBX. Determination, at Appendix 4.[5] The sampling and conclusions, however, are not reliable. For example:

- KCBX is not the source of the dust: CDM Smith's study cannot identify the source of the grains collected from the sidewalk. In fact, the source of the dust does not appear to be KCBX. The average concentrations of sulfur, vanadium, and nickel reported for the grains tentatively identified as pet coke are statistically significantly different from the corresponding concentrations reported for samples of KCBX's pet coke, and thus, do not appear to be the same material. Exhibit 1, at 3.

- CDM Smith did not identify the dust samples: In fact, the study does not even definitively identify the dust samples as either pet coke or coal. The study concludes that specified grains "were consistent" with pet coke and that other grains were "consistent with coal or possibly diesel soot, or both," but it fails to confirm the identity of the grains. Determination, Appendix 4, at 24. Other petroleum-based materials, such as asphalt-related products, may have similar chemical profiles and appearance under magnification as pet coke. Exhibit 1, at 4. The report does not provide morphological, physical, or other chemical characteristics to support a more specific determination of material type. Exhibit 1, at 1-2.

- CDM Smith did not collect or analyze control samples: CDM Smith did not obtain dust samples from control locations, such as neighborhoods in Southeast Chicago located away from KCBX's Terminals. In fact, CDM Smith based its entire study on only three samples of sidewalk dust (unlike EH&E, which collected over 100 samples). Exhibit 1, at 2-4.

[5] Available at: http://www.cityofchicago.org/content/dam/city/depts/cdph/environmental_health_and_food/App4CDMSmithTechMemoreElectronMicro.pdf.

Absent a control group, the study cannot make meaningful comparisons between the dust on the sidewalk near KCBX's South Terminal and the dust in other areas of Chicago.

- CDM Smith did not evaluate the likelihood of windborne transport of the particles from KCBX's Terminals: CDM Smith's analysis provides no evidence of windborne transport of dust from KCBX as CDM Smith did not perform any spatial analysis. Exhibit 1, at 5. There is simply not enough information to conclude—on the basis of three samples, collected within two blocks of one another at approximately the same distance from KCBX's South Terminal—that grains that may or may not be pet coke were transported by wind from KCBX's Facility. *Id.*

- CDM Smith did not determine when the dust was deposited or how long the dust had been present on the sidewalk: Even if the grains were in fact pet coke, and even if the grains originated from the location that is presently KCBX's South Terminal, CDM Smith's study cannot determine when the grains were released or deposited on the sidewalk. Exhibit 1, at 4-5. Thus, the grains may have been released prior to KCBX's acquisition of the South Terminal in December 2012.

- CDM Smith did not quantify the amount of dust present on the sidewalk: The study does not quantify or otherwise characterize the amount of supposed pet coke dust present on the sidewalk, and therefore, provides no evidence of a public nuisance or adverse impact on the surrounding area. Exhibit 1, at 4.

Because of the numerous limitations of CDM Smith's sampling analyses, its opinions should not be relied upon by the CDPH in its Determination on KCBX's Petition. For more detailed information on CDM Smith's sampling conclusions, see the attached Exhibit 1.

III. RESPONSE TO MEMORANDUM REGARDING DISPERSION MODELING

As explained in KCBX's Petition, comprehensive air monitoring data and associated air modeling demonstrate that any PM_{10} emissions attributable to KCBX's terminals are consistent with short-term and long-term offsite PM_{10} levels that meet standards that are protective of public health. Petition, at 18-20. CDM Smith's evaluation of KCBX's air monitoring program and STI's associated air modeling does not undermine the clear import of that evidence—that there is no fugitive dust problem in the area surrounding KCBX's facilities resulting from

KCBX's operations, and that an extension of the deadlines for enclosure is therefore appropriate pursuant to the Rules.

CDM Smith's claim that KCBX's air monitoring program is deficient is without merit. Determination, at Appendix 1, 5-6[6]. The US EPA approved the locations of KCBX's air monitors, as well as the methods used for operating those monitors, prior to when KCBX began monitoring PM_{10} at its North and South Terminals on February 18, 2014. Pursuant to approval by the US EPA, KCBX installed four permanent, continuous Federal Equivalent Method ("FEM") PM_{10} source monitors and a meteorological station at its North Terminal, and five permanent, continuous FEM PM_{10} source monitors and a meteorological station at its South Terminal. KCBX also installed two Federal Reference Method PM_{10} filter-based monitors at each of the North and South Terminals. In addition to being approved by the US EPA, KCBX's air monitoring program is in compliance with Section 3.0(4) of the CDPH's Rules, which requires the placement of permanent, continuous FEM PM_{10} monitors at each side of the facility. KCBX has more PM_{10} monitors on its property than the entire rest of the State of Illinois has in total.

Likewise, CDM Smith's assertions that STI's air modeling—which demonstrates that observations of elevated PM_{10} concentrations at KCBX's monitors drop sharply to near-background levels with minimal distance from the terminals—is somehow flawed, should be rejected by the CDPH in its evaluation of KCBX's Petition, because CDM Smith misunderstands and misrepresents the purpose and conclusions of STI's modeling.

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[6] Available at: http://www.cityofchicago.org/content/dam/city/depts/cdph/environmental_health_and_food/App1CDMSmithTechAnalysisLtr.pdf.

First, CDM Smith incorrectly assumes that the modeled PM_{10} concentrations represent incremental contributions from KCBX emission sources, Determination, Appendix 3, at 2,[7] when in reality, the modeled PM_{10} concentrations represent *all contributions* to measured PM_{10} concentrations, inclusive of KCBX and non-KCBX emission sources. Exhibit 2, at 2. The purpose of STI's modeling was to replicate observed instances of elevated PM_{10} concentrations at downwind monitors and to illustrate how those concentrations decrease with downwind distance—not to identify the specified sources of dust emissions for the purpose of modeling any incremental impact of KCBX's actual operations, as CDM Smith seems to believe. *Id.* Next, CDM Smith's assertion that STI's modeling is misleading because it modeled emissions at the "nearest neighborhood location" is simply incorrect. Determination, at Appendix 3, at 4. STI modeled PM_{10} concentrations at the nearest residence aligned with the plume centerline, and therefore selected the residence at which PM_{10} impacts would be the greatest. Exhibit 2, at 4-5. Finally, CDM Smith's critique of STI's use of KCBX's upwind monitor to determine background PM_{10} concentrations is based on the inaccurate assumption that KCBX's emissions affect PM_{10} measurements at all monitors on a given day, on account of "wind fluctuations and variability," and that therefore STI's background estimates are inflated. Determination, Appendix 3, at 2. However, elevated PM_{10} concentrations are observed when high winds occur across multiple hours, and under such conditions, *wind direction is very consistent.* Exhibit 2, at 6-8. For example, on April 12, 2014, when a 24-hour average concentration of 155 $\mu g/m^3$ was observed at the North Terminal, winds were from the south-southwest for each 5-minute period of the day (based on 5-minute wind data from the site's meteorological monitors). *Id.* at 7.

[7] Available at: http://www.cityofchicago.org/content/dam/city/depts/cdph/environmental_health_and_food/App3CDMSmithTechMemoreDispersionMod.pdf.

Because wind speeds are high and primary wind directions consistent when elevated PM_{10} concentrations are observed, any variations in wind direction are overcome by overall air flow. *Id.* at 8. Thus, PM_{10} measurements at KCBX's upwind monitors are representative of background PM_{10} concentrations.

For the complete response to CDM Smith on STI's dispersion modeling, see the attached Exhibit 2.

IV. CONCLUSION

For the reasons discussed above, the CDPH should grant KCBX's Petition. The extension of the enclosure deadines will not create a public nuisance or adversely affect the surrounding area as overwhelmingly demonstrated by EH&E's soil and surface sampling results, EH&E's and the US EPA's filter analyses, as well as STI's air monitoring and modeling conclusions. To the extent that CDM Smith has addressed KCBX's evidence—specifically, EH&E's soil sampling and STI's air modeling—its conclusions do not detract from KCBX's showing, given the substantial weaknesses in CDM Smith's analyses, as detailed above. Neither CDM Smith nor the CDPH has addressed the other evidence supporting KCBX's position that it does not adversely impact the area—particularly, EH&E's surface sampling and EH&E's and the US EPA's filter analyses, which also demonstrate no evidence of pet coke or coal on the surfaces or in the residences near KCBX's terminals. For the reasons set forth herein as well as in KCBX's Petition, KCBX respectfully requests that a variance from the enclosure deadlines be granted.

Dated: January 27, 2015

/s/ Stephen A. Swedlow

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Counsel for KCBX Terminals Company

cc: Alderman Pope
Alderman Burke

Exhibit 1

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January 22, 2015

RE: Response to CDM Smith Technical Memoranda Regarding Soil Sampling and Electron Microscopy (EH&E 19251)

To whom it may concern:

Environmental Health & Engineering, Inc. (EH&E) provides this letter in response to CDM Smith, Inc.'s (CDM Smith) Technical Memorandum regarding Soil Sampling and Technical Memorandum regarding Electron Microscopy, prepared on behalf of the City of Chicago Department of Public Health (CDPH). CDM Smith concluded in those memoranda that migration of petcoke from KCBX's facilities has occurred or may occur in the future based on analyses of sidewalk dust; soil sampling conducted by EH&E; and perimeter air monitoring at the site. Upon review of the memoranda provided by CDM Smith, EH&E determined that CDM Smith's analyses do not change EH&E's prior opinion that information gathered to date reveals no evidence that petcoke or coal has migrated from KCBX's facilities to off-site locations. Nor has EH&E's review of CDM Smith's Electron Microscopy Field Documentation and Analytical Information, made available by the CDPH on January 16, 2015, changed any of EH&E's prior conclusions.

CONCLUSIONS

With respect to CDM Smith's report on sidewalk dust collected from locations near KCBX South, EH&E concludes as follows:

- The dust particles that CDM Smith tentatively identified as petcoke are not consistent with petcoke samples from KCBX's facility. The average concentrations of sulfur, vanadium, and nickel reported for the dust particles are statistically significantly different from the corresponding concentrations reported for the samples of KCBX petcoke, and thus do not appear to be the same material.
- The report does not demonstrate that the sidewalk dust contained petroleum coke or coal, but instead states that select grains of dust *were consistent with petcoke*, while other grains *were consistent with coal, or possibly diesel soot, or both*.

- The report does not contain morphological or physical characteristics of the particles that would support a more specific determination of material type. This additional information would be helpful in identifying the material because other petroleum-based materials, such as asphalt, may have a chemical profile similar to petcoke.
- No dust samples were obtained from control locations such as neighborhoods in SE Chicago far from the KCBX terminals. As a result, the study cannot demonstrate that the amount of petcoke or coal-like particles identified in samples of sidewalk dust near KCBX South is any different from dust in other parts of Chicago.
- The dust sampling is not evidence of windborne transport from KCBX's terminals because CDM Smith performed no spatial analysis of potential impacts. All of CDM Smith's samples were collected in the same immediate area and at the same distance from KCBX South. Observations from locations that range from near too far from KCBX's terminals are needed to evaluate any possibility that grains of petcoke are blowing from the terminals.
- The CDM Smith study cannot determine when the alleged petcoke and coal grains first appeared in the sidewalk dust or for how long petcoke and coal-like grains have been present. Hence, no determination can be made about the timing of a potential release relative to KCBX's use of the property and implementation of dust suppression measures.
- The report does not determine the amount or concentration of material in the sidewalk dust identified as petcoke by CDM Smith. For that reason, the potential impact, if any, cannot be quantified.

With respect to CDM Smith's report on the deposition of petcoke to areas surrounding KCBX's facilities:

- CDM Smith stated that the resulting increases in chemical concentrations in soil would generally be small in comparison to background concentrations of these substances, a conclusion with which I agree.
- CDM Smith does not provide significant impact levels for the metals and PAHs (polycyclic aromatic hydrocarbons) it evaluated. The petcoke deposition and soil contamination impacts presented by CDM Smith hold little value without placing the data within the context of levels that would adversely affect human health or interfere with use and enjoyment of property.
- CDM Smith claims that the deposition rates it calculated are overestimates of any actual deposition. Even so, its calculated values are lower than actual deposition rates for PAHs in Chicago. Actual KCBX-related deposition would be even lower.
- CDM Smith states that EH&E did not have the capability to detect even a 100% increase in background concentrations of metals and PAHs in soil, yet our analyses show that we could

detect much smaller changes in soil composition of neighborhoods that abut the KCBX facilities compared to a control area.

SIDEWALK DUST ANALYSES

CDM Smith collected three samples of sidewalk dust from Buffalo Avenue near KCBX South and submitted the samples to the University of Colorado (UC) for evaluation of individual grains of dust by scanning electron microscopy and electron microprobe analysis. The UC laboratory also analyzed six samples of petcoke collected from KCBX North and South. CDM Smith asserts that these analyses demonstrate the off-site presence of petcoke from KCBX's facilities.

Element Concentrations Not Consistent with KCBX Petcoke

The data provided by CDM Smith indicate that the material it collected did not originate from KCBX. The CDM Smith finding of consistency with petcoke appears to be based in part on the abundance of sulfur (S), vanadium (V), and nickel (Ni) reported for suspect grains of sidewalk dust and for petcoke obtained from KCBX's facilities. We evaluated the posited consistency and found that the average concentrations of S, V, and Ni reported by CDM Smith for the suspect grains of sidewalk dust are statistically significantly different from the corresponding levels reported by CDM Smith for KCBX petcoke. Thus, as shown in Table 1, the sidewalk dust and petcoke located at KCBX do not appear to be the same material.

Table 1 Average (standard deviation) Concentrations of Sulfur, Vanadium, and Nickel in KCBX Petcoke and Alleged Grains of Petcoke in the Sidewalk Dust Samples[1]

Element	KCBX Petcoke (n=12)	Grains of Sidewalk Dust Tentatively Identified as Petcoke by CDM Smith (n=12)	p-value[2]
Sulfur	5.2% (0.96)	6.2% (0.96)	0.0008
Vanadium	0.086% (0.022)	0.11% (0.022)	0.005
Nickel	0.031% (0.01)	0.04% (0.01)	0.008

1 Data obtained from CDM Smith Electron Microscopy Study Technical Memorandum, Tables 3-2, 3-3, 3-4, and 3-5. All analyses performed with R (R Core Team, 2012, R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org)

2 The p-value of each hypothesis test is the probability that the average concentration of a given element (e.g., S) is equal in the grains of KCBX petcoke and the grains of alleged petcoke in sidewalk dust according to a Wilcoxon rank sum test. Results were similar according to a standard t-test (not shown). The conventional practice in hypothesis testing is to use 0.05 as the threshold for statistical significance, where p-values less than 0.05 lead to rejection of the null hypothesis. In this case, the p-value for concentrations of S, V, and Ni are well below 0.05 and hence we reject the null hypothesis that the element concentrations in KCBX petcoke and grains of alleged petcoke in sidewalk dust are observations drawn from the same population.

Material Identification Not Conclusive

The CDM Smith analyses do not demonstrate that the sidewalk dust samples contain petroleum coke or coal at all. Rather, the report states that select grains of dust *were consistent with petcoke*, while other grains *were consistent with coal, or possibly diesel soot, or both*. The report provides little information on the physical characteristics of the dust grains that would support a more specific determination of material type. Similarly, the report does not provide a differential analysis that is needed to distinguish the suspect grains from common petroleum-based materials such as asphalt, which may have a chemical profile similar to petcoke.

No Control

The CDM Smith sidewalk dust analysis is limited further by the absence of data from a control location. Without control data, the study cannot determine whether or not particles identified are common in sidewalk dust of Chicago. This gap is important given that products of petroleum refining are ubiquitous. Moreover, the absence of data from a control area appears to be a departure from prior assessments of source-oriented environmental impact evaluations in Chicago neighborhoods, such as Pilsen and Little Village.[1]

No Quantification of Potential Impact

The CDM Smith study also does not quantify the amount of material tentatively identified as petcoke, except to note that 12 such grains were found in the 3 grams of dust that were analyzed. Therefore, even if the material was petcoke and that petcoke had originated from a KCBX terminal, the information in the CDM Smith report does not characterize the magnitude of any current or future impact. Characterizing the magnitude of a potential impact in relation to a relevant, appropriate, and reasonable benchmark is essential for formulation and practice of effective public health policy. Without a benchmark, a determination of harm can rarely be made.

No Information on Timing

Another limitation of the CDM Smith analyses is that no information is presented on *when* the grains identified were released from their source. For example, even if those grains are petcoke and originated from the property now occupied by KCBX South, the CDM Smith report is silent on whether the material was released before or after KCBX took ownership of the property or before or after KCBX began to operate the current state-of-the-art dust suppression program. For

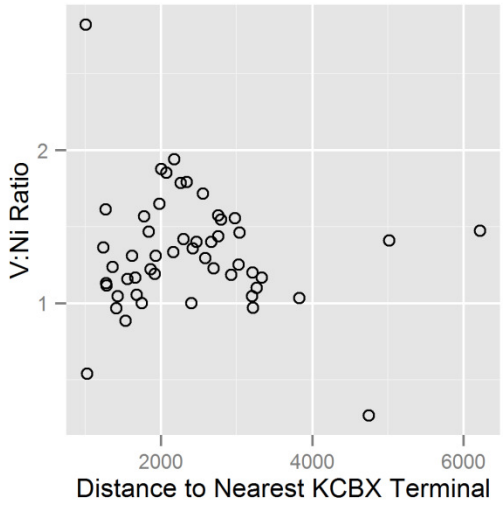
[1] Prior analyses of source-oriented environmental impact evaluations in Chicago neighborhoods, such as Pilsen and Little Village, have included control data. Environmental Issues in Chicago's Little Village & Pilsen Neighborhoods, EPA, *available at:* http://epa.gov/region5/littlevillagepilsen/.

these reasons, knowledge of the timing of any material identified as petcoke in the neighborhoods is important for evaluating current operating conditions for the terminal.

No Spatial Information

The CDM Smith reports do not include any spatial analysis of data available from the neighborhoods to support the implication that meaningful windborne transport of petcoke from KCBX's facilities has occurred or may occur. The sidewalk dust samples collected by CDM Smith do not lend themselves to spatial analysis because all three samples were collected in the same immediate area and distance from KCBX South. This is a notable limitation of the sidewalk dust data because observations are needed from locations that range near and far from the KCBX facilities to evaluate the possibility that grains of petcoke are transported from the facilities.

However, EH&E's prior field campaign does support spatial analysis of potential petcoke impacts, and the data indicate there is no association between proximity to either terminal and petcoke-related contamination of soil. EH&E collected soil samples from locations that range from approximately 200 meters to 6000 meters from the two KCBX facilities. If there was a detectable petcoke signature in the community, then one would expect the V:Ni ratio to decrease with distance away from the adjacent area, but the plot in Figure 1 demonstrates that is clearly not the case in our data.[2]



Pearson Correlation: -0.137 (p=0.33; 95% CI=-0.40, 0.14)
Spearman Correlation: 0.032 (p=0.83; 95% CI=-0.25, 0.31)

Figure 1. Scatter plot of indicator constituents of petcoke and distance (in meters) from the nearest KCBX terminal for soil samples collected from the South Deering and East Side neighborhoods, Chicago, Illinois, November 2013 and April 2014.

[2] Based on the number (n=51) of samples included in this analysis, a correlation with distance as weak as -0.23 (or +0.23) would have been identified as statistically significant.

DEPOSITION AND ACCUMULATION ANALYSIS

CDM Smith conducted a modeling analysis of petcoke deposition from air and accumulation in soil off-site near KCBX. CDM Smith stated that the resulting increases in chemical concentrations in soil would generally be small in comparison to background concentrations of these substances. I agree with the City's conclusion, which is also supported by my analysis of soil from the South Deering and East Side neighborhoods in comparison to reference data for Chicago.

No Benchmark for Significant Impact

CDM Smith does not provide significant impact levels for human health for the metals and PAHs it evaluated. The petcoke deposition and soil contamination impacts presented by CDM Smith hold little value without placing those data within the context of levels that would adversely affect human health or interfere with the use and enjoyment of property. There are no regulatory standards for constituents of petcoke. In that situation, background levels are commonly used as a benchmark for evaluation of source-related environmental impacts.

Deposition Rates Calculated by CDM Smith below Background

CDM Smith states that its analysis overestimates potential impacts from KCBX fugitive dust emissions on soil contamination, and we agree. CDM Smith cites various reasons why its analysis overestimates impacts, including: 1) using a simplified soil mixing model without loss terms; 2) using maximum concentrations of chemicals in petcoke when modeling deposition due to emissions from KCBX; and 3) not accounting for additional dust mass added to the soil that is not petcoke.

Despite the overestimation, CDM Smith's calculated deposition rates for PAHs are up to 150-fold lower than background deposition rates measured in Chicago (Figure 2).[3,4,5] Actual KCBX-related deposition, if any, would be even lower. Therefore, CDM Smith's analysis shows that any deposition of any KCBX-related emissions to the neighborhood would likely be small in comparison to normal, background conditions.

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[3] Franz TP, Eisenreich SJ, Holsen TM, 1998, Dry deposition of particulate polychlorinated biphenyls and polycyclic aromatic hydrocarbons to Lake Michigan, *Environmental Science and Technology*, 32:3681-3688.

[4] Odabasi M, Sofuoglu A, Vardar N, Tasdemir Y, Holsen TM, 1999, Measurement of dry deposition and air-water exchange of polycyclic aromatic hydrocarbons with the water surface sample, *Environmental Science and Technology*, 33:426-434.

[5] Vardar N, Odabasi M, Holsen TM, 2002, Particulate dry deposition and overall deposition velocities of polycyclic aromatic hydrocarbons, *Journal of Environmental Engineering*, March 2002, 269-274.

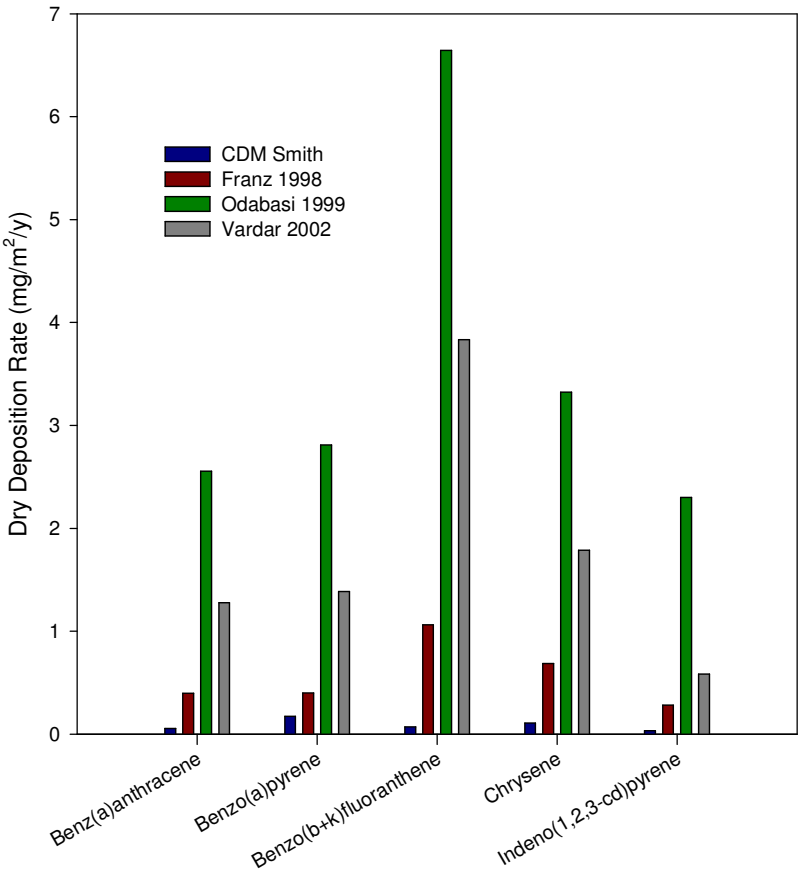

Figure 2. Dry deposition rates for KCBX-related PAHs calculated by CDM Smith in comparison to dry deposition rates measured in the City of Chicago and reported in the peer-reviewed scientific literature.

EH&E Approach Sufficiently Sensitive

CDM Smith opined that the bulk soil sampling and analysis methods used by EH&E would be "*extremely unlikely*" to detect petcoke that has deposited to off-site locations. As support for its finding, CDM Smith referenced its deposition calculations which suggest that 25 to 116,000 years would have to pass for deposition of KCBX petcoke to cause chemical concentrations to double over current background levels. CDM Smith appears to have determined that doubling background concentrations is an appropriate threshold for sensitivity of a field study in this situation, although we are not aware of such a criterion being used in other settings.

EH&E finds that the CDM Smith analysis did not attempt to evaluate the sensitivity of the available measurements to detect deviations from background and that CDM Smith may have reached a different conclusion if it had done so. Notably, the CDM Smith report does not consider the two-population aspect of EH&E's investigation. We collected 51 samples of soil from the neighborhoods that abut the KCBX facilities and an additional 26 samples of soil from neighborhoods in SE Chicago that are remote from KCBX and would not be impacted by

operations of the facilities (i.e., control areas). We demonstrate the utility of this approach with two examples.

First, consider the ratio of V:Ni. In previous reports, we have demonstrated that V:Ni averages 3.5 in petcoke, 4.4 in coal, and 1.2 – 1.4 in normal Chicago soil.[6] Thus, an elevated ratio of V:Ni in soil of the abutting neighborhoods in comparison to normal levels would be consistent with accumulation of petcoke.[7] We found an average V:Ni of 1.23 in soil of the control area. Given the number of samples in our dataset (77 in total) and the variability of V:Ni among the observations in the sample from each population, our approach is able to detect a 0.14 increase in V:Ni of the abutting area as a statistically significant shift above the control area (i.e., from 1.23 to 1.37).[8] This sensitivity is equivalent to a 12% increase in the average background V:Ni ratio of the control area. Hence, EH&E's approach is 8-fold more sensitive than the doubling of background concentrations (an increase of 100%) that CDM Smith suggested as a threshold.

Second, consider the PAH dibenz(a,h)anthracene. This PAH is present in soil throughout Chicago and is also a constituent of petcoke. Dibenz(a,h)anthracene concentrations in soil of the control and abutting areas were distributed approximately lognormally, thus we analyzed the natural log transformed values. We find that EH&E's field sampling would detect an increase as low as 0.49 natural log units in soil of the neighborhoods that abut the KCBX facilities as a statistically significant increase over the control area. This shift represents a 30% increase from the background level of dibenz(a,h)anthracene level in Chicago soil, which is 3-fold more sensitive than the doubling of background concentrations (an increase of 100%) that CDM Smith suggested as a threshold.

If you have any comments or questions regarding this report, please contact me at 1-800-TALK EHE (1-800-825-5343).

Sincerely,

David L. MacIntosh, Sc.D., C.I.H.
Chief Science Officer

[6] See EH&E presentation from October 9, 2014, meeting with EPA Region 5, State of Illinois, City of Chicago, and U.S. Department of Justice.
[7] Although not a specific indicator of petcoke accumulation.
[8] At the 0.05 level of significance and 80% power.

Exhibit 2

Sonoma Technology, Inc.
Environmental Science and Innovative Solutions

Technical Memorandum

January 22, 2015

Re: Response to CDM Smith's Technical Memorandum regarding Dispersion Modeling

To whom it may concern:

This memorandum provides an initial response to analyses performed by CDM Smith, Inc. (CDM Smith) on behalf of the Chicago Department of Public Health. This memorandum primarily focuses on CDM Smith's Technical Memorandum regarding Dispersion Modeling, which reviews the air dispersion modeling performed by Sonoma Technology, Inc. (STI). Overall, we find that CDM Smith:

- Misconstrues the AERMOD modeling we performed for the few individual days when elevated PM_{10} concentrations were observed at KCBX, leading CDM Smith to wrongly conclude that the modeling results are invalid and misleading;
- Incorrectly asserts that variations in wind direction across a day (or hour) mean that KCBX's emissions likely contribute to monitored PM_{10} concentrations at all monitors, irrespective of primary wind direction. In reality, days with elevated PM_{10} concentrations are marked by consistent wind flows (even at sub-hourly time scales), which allow upwind and downwind monitors to be readily identified, and off-site (i.e., non-KCBX) contributions to be evaluated;
- Fails to note the regional background PM_{10} concentrations measured at George Washington High School (GWHS) on the days modeled were 49 $\mu g/m^3$ and 81 $\mu g/m^3$, respectively. Thus, STI's modeling shows that on these days the KCBX Terminals could only contribute at most about one-half to two-thirds of the observed PM_{10} concentrations at its downwind fence lines; and
- Incorrectly asserts that there are data gaps in KCBX's air monitoring program, when, in fact, the terminals each have air monitors located on all four sides, and the locations of each monitor were approved in advance by the United States Environmental Protection Agency (USEPA).

Additional details below provide more explanations in response to issues raised by CDM Smith.

We also have reviewed the air modeling files used by CDM Smith and made available by the City of Chicago on January 16, 2015. Our review of this additional data does not change our conclusions. Notably, CDM Smith fails to provide any original emissions calculations or modeling results to support its criticisms.

STI's Air Quality Modeling Misconstrued

CDM Smith mistakes how background (i.e., non-KCBX) sources were treated in STI's modeling and incorrectly assumes that modeled concentrations represent PM_{10} impacts only from KCBX.

For ground-based sources such as the KCBX material piles, PM_{10} concentrations are known to decrease exponentially with downwind distance from the source. As a result, PM_{10} measurements at KCBX's on-site monitors are not representative of PM_{10} concentrations in the surrounding community. In addition, emissions from KCBX alone cannot account for elevated 24-hr PM_{10} concentrations measured at on-site monitors.

To demonstrate these facts, STI performed "inverse" dispersion modeling with the EPA-approved AERMOD model to replicate observed PM_{10} concentrations on selected days when PM_{10} levels were elevated, and to evaluate changes in PM_{10} concentrations with downwind distance from the facility. As detailed below, the modeling served these purposes well but was not intended to represent KCBX's actual operations. Instead, the modeling illustrates a hypothetical case in which a single, unrealistically large emission source was used to represent both on-site and off-site (i.e., non-KCBX) sources, an approach that was necessary to replicate the observed PM_{10} concentrations. Therefore, CDM Smith's criticisms regarding source configurations and its interpretation of the modeling results as reflective of the impact of KCBX's emissions alone on are not valid.

Inverse modeling is a well-known technique in the air quality management community that starts with observed concentrations (such as those at the KCBX monitors) and examines emission rates required to produce those concentrations. This technique is the inverse of the more typical modeling approach, which starts with known (or assumed) emission rates and examines downwind concentrations resulting from those emissions.

For the inverse modeling at issue, we chose several days with elevated PM_{10} concentrations and modeled a simplified emission source in the vicinity of the monitor with the highest PM_{10} measurement. This source was then assigned an artificial emission rate that replicated the peak PM_{10} concentration and was not designed to be representative of KCBX's actual operations. In fact, on the days with the highest observed PM_{10} levels, the modeled emission rate greatly exceeded reported emissions data for the KCBX Terminals.[1]

These artificially high emission rates were required because measured PM_{10} concentrations at KCBX's facilities reflect the impact of both on-site and background (i.e., non-KCBX) emission sources. Analysis of the on-site monitoring data shows that elevated PM_{10} concentrations occur when wind speeds are high and wind directions are steady across multiple daytime hours (see discussion on page 6 of this document). Under these conditions, elevated PM_{10} concentrations are observed at all KCBX monitoring sites (upwind and downwind), demonstrating the impact of non-KCBX sources on the measured concentrations. As a result of these off-site impacts, it would be impossible to replicate

[1] Because the monitor with peak concentrations and the level of those peak concentrations varied among the days modeled, source locations and emissions rates were altered to replicate those peaks.

instances of elevated PM_{10} measurements modeling emissions from KCBX alone; off-site emissions have to be considered as well.

For example, on April 12, 2014, 24-hr average PM_{10} concentrations at the KCBX North Terminal monitors ranged from 109 to 155 $\mu g/m^3$, with the peak concentration occurring at the Northeast monitoring site. At the South Terminal monitors on the same day, 24-hr PM_{10} concentrations ranged from 86 to 130 $\mu g/m^3$. As CDM Smith notes, our modeling for this day featured a PM_{10} emission rate of 31.3 pounds per hour, which equates to 0.38 tons per day and 11.3 tons per month. However, based on monthly emissions reports compiled by KCBX operators for 2008-2013, actual emission totals for the North Terminal average only 2.7 tons per month. Therefore, the modeled emission rate for this date was a factor of 4.2 higher than the typical value for KCBX.

In summary, the inverse modeling results should be interpreted as follows. An unrealistically large emission source, producing several times the emissions of the entire KCBX facility and sited near the monitor with peak measurements, is required to replicate maximum observed PM_{10} concentrations. This hypothetical situation serves to demonstrate that KCBX's operations are not the primary cause of the elevated concentrations. In addition, even in this extreme hypothetical case, modeled concentrations decrease quickly with distance from the source, returning to background levels within a few hundred yards.

CDM Smith's criticisms regarding source configurations and their interpretation of the modeling results to represent impacts from KCBX's actual operations are wrong and do nothing to contradict the findings outlined above. In addition, CDM Smith's call for modeling that accurately represents all on-site sources overlooks the fact that this very modeling was performed as part of the pile height analysis performed by STI. This modeling corroborates the finding that on-site emission sources alone are not sufficient to produce the peak 24-hr average PM_{10} concentrations observed at KCBX.

CDM Smith wrongly identifies the residences used by STI to evaluate PM_{10} concentrations in the community, leading them to falsely label STI's results as "misleading."

CDM Smith conducted an analysis of inverse modeling performed by STI for March 9, 2014 and April 12, 2014. For those days, STI presented modeling results showing peak monitored concentrations decreasing to near-background levels at the nearest residence that was aligned with the plume centerline (i.e., the residence with peak off-site impacts). In their analysis, CDM Smith wrongly assumes that STI chose a residence that was outside the main PM_{10} plume, leading to an underestimate of residential concentrations.

CDM Smith's error appears to be caused by their mistaken treatment of the inverse modeling to represent only KCBX emission sources. In CDM Smith's mistaken view, the inverse modeling results represent the impact of KCBX alone, and background concentrations must be *added* to the modeling results as a post-processing step. However, as described above, the inverse modeling includes a hypothetical emission source that already represents the impacts of both on-site and off-site sources and produces PM_{10} emissions that are several times higher than actual on-site emissions. Therefore, background PM_{10} (i.e., non-KCBX sources) are already accounted for in the modeling results.

To illustrate CDM Smith's error, **Figure 1** shows 24-hr PM_{10} concentrations produced by the inverse AERMOD modeling for the South Terminal for March 9, 2014. As noted in CDM Smith's analysis, we assumed a background concentration of 29 µg/m^3 for this date, which was based on the lowest (upwind) value measured on-site. To evaluate decreases in PM_{10} concentrations with distance from the source, we followed the plume centerline (i.e., line of peak PM_{10} concentrations) into the community and identified the maximum residential concentration. As shown in Figure 1, modeled concentrations, which represent the impact of both on-site and background (non-KCBX sources), decrease to 29 µg/m^3 at the nearest residence along the plume centerline (note that this is the residence with maximum modeled PM_{10} concentrations).

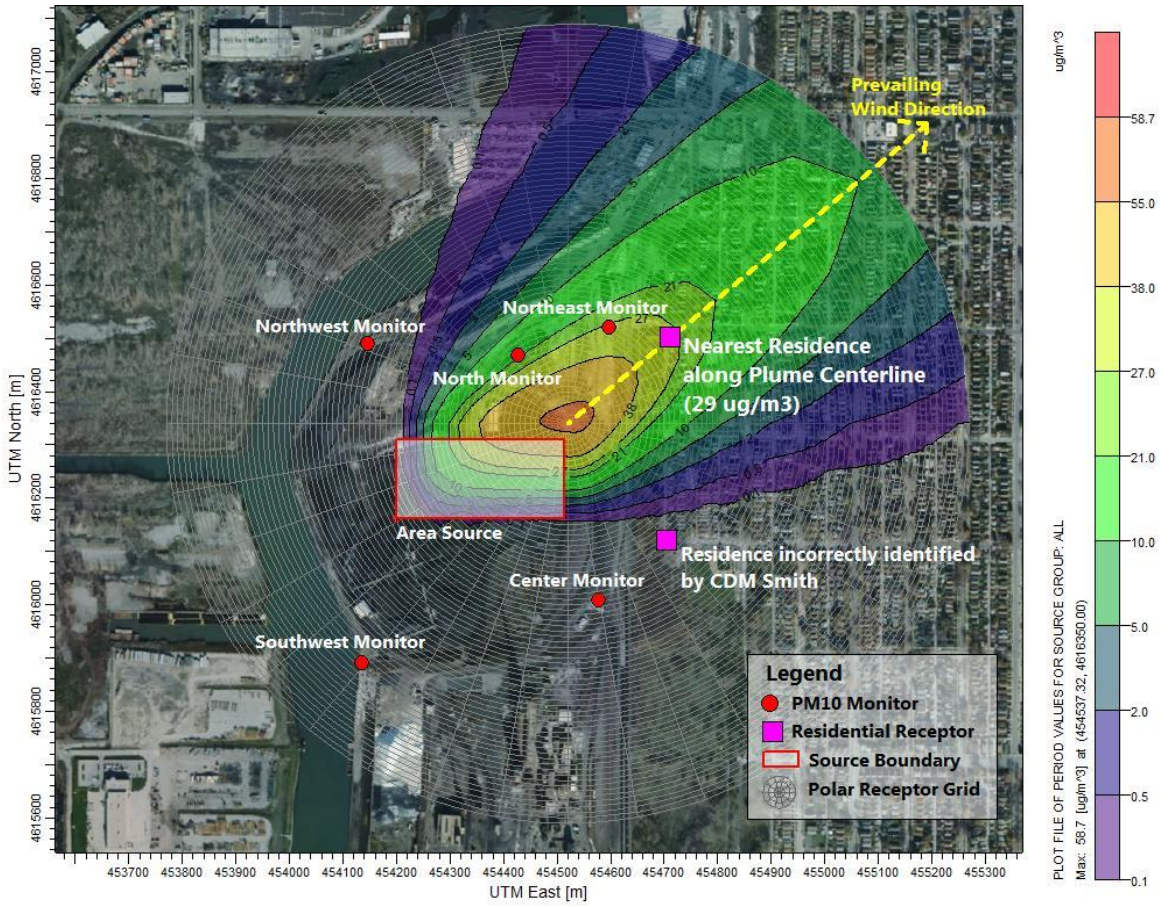

Figure 1. AERMOD contour plot for March 9, 2014 at the South Terminal.

This analysis is the basis for our statement that PM_{10} concentrations decrease to near-background levels at the nearest residence that is in line with the plume centerline. Because CDM Smith wrongly assumed that our AERMOD results reflected on-site emissions only, they apparently believed that background concentrations needed to be added to our modeling results. Therefore, they selected a residence that was outside the PM_{10} plume (as shown in Figure 1) and added the 29 µg/m^3 background value to the near-zero modeled PM_{10} concentration at that location. This approach is incorrect and leads CDM Smith to falsely conclude that our modeling results are "misleading."

For our April 12, 2014 inverse modeling, CDM Smith calls for a modest increase in residential PM_{10} concentrations, stating that the value should be 18 µg/m^3 instead of 8 µg/m^3. These concentrations are very low in either case; however, it is worth clarifying our approach for this particular day. On April 12, the plume centerline is oriented toward industrial sources and does not impact a residence within the domain modeled. Rather than state that there were no residential impacts, we chose a slightly adjusted line that was offset from the plume centerline by 12 degrees that would cross one of the nearby residences (see **Figure 2**).

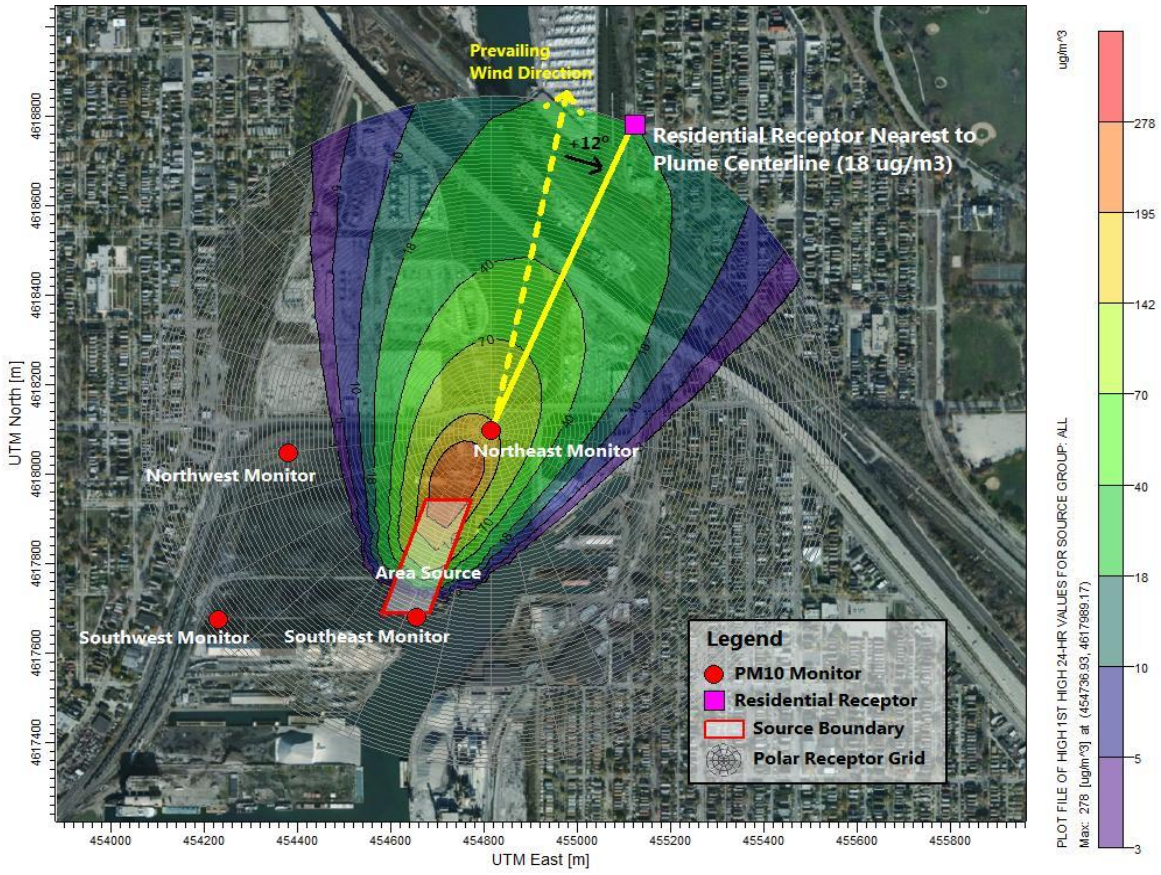

Figure 2. AERMOD contour plot for April 12, 2014 at the North Terminal.

The chosen residence was over 800 yards from KCBX, and the modeled concentration for this location was indeed 18 µg/m^3, which is well below the estimated background concentration of 86 µg/m^3 for this day. Because our hypothetical, on-site emission source captures the impact of non-KCBX sources that would actually be spread through the area, the model predicts PM_{10} concentrations below background levels at this somewhat distant location. This result is reasonable, as nearby industries that impact the KCBX monitors are unlikely to contribute to PM_{10} concentrations at this somewhat distant location. However, to be conservative regarding potential concentrations at this residence, we scaled the model results by

- Removing the background component from the 155 µg/m^3 modeled at the on-site monitor location (155 – 86 = 69 µg/m^3);

- Using the modeled rate of PM_{10} concentrations decreases with distance to determine how much the 69 µg/m^3 value would change over the 800+ yards to the nearest impacted residence (this turned out to be about 8 µg/m^3); and

- Adding the estimated background concentration to the scaled residential value to get the estimated PM_{10} concentration at the residence of interest (8 + 86 = 94 µg/m^3).

Again, this approach makes the conservative assumption that background concentrations in the immediate vicinity of KCBX (which is near other industrial sources) would be the same as those measured at this residence 800 yards away. If lower background concentrations were assumed for this residence, such as the 49 µg/m^3 value from the GWHS monitoring site recommended by CDM Smith, then the method outlined above would result in significantly lower PM_{10} concentrations at the residence of interest (62 µg/m^3 instead of 94 µg/m^3).

In addition, it should be noted that, while the GWHS site may be useful for evaluating regional background PM_{10} concentrations, measurements at this site are unlikely to reflect upwind concentrations in the vicinity of KCBX Terminals. GWHS is about 0.5 miles southeast of the KCBX South Terminal, and given its location and prevailing wind directions, local industrial sources adjacent to KCBX are unlikely to impact PM_{10} concentrations at GWHS.

Effects of Variable Wind Directions Wrongly Stated

CDM Smith wrongly asserts that daily variations in wind direction mean that KCBX's emissions likely contribute to measured PM_{10} concentrations at all monitors, irrespective of primary wind direction.

While the above assumption may be correct when winds are light and variable, this is irrelevant because these are not the conditions that lead to elevated PM_{10} levels in the area. Rather, peak PM_{10} concentrations occur when high wind speeds are observed across multiple daytime hours, and under these conditions, wind directions are very consistent.

Analysis of hourly PM_{10} measurements and sub-hourly (5-minute) wind speed and direction measurements collected on-site at KCBX supports this principle. For example, 24-hr PM_{10} concentrations in excess of 150 µg/m^3 have been observed at KCBX on only two days: April 12, 2014 (155 µg/m^3 at the North Terminal's Northeast site) and May 8, 2014 (156 µg/m^3 at both the North and South Terminals' Northeast sites). Note that on these days, the GWHS monitor measured PM_{10} levels at 49 µg/m^3 and 81 µg/m^3, respectively. **Figure 3** shows that the magnitudes of these 24-hr average concentrations were largely driven by a handful of hours in the late morning and early afternoon when hourly PM_{10} concentrations exceeded 300 µg/m^3.

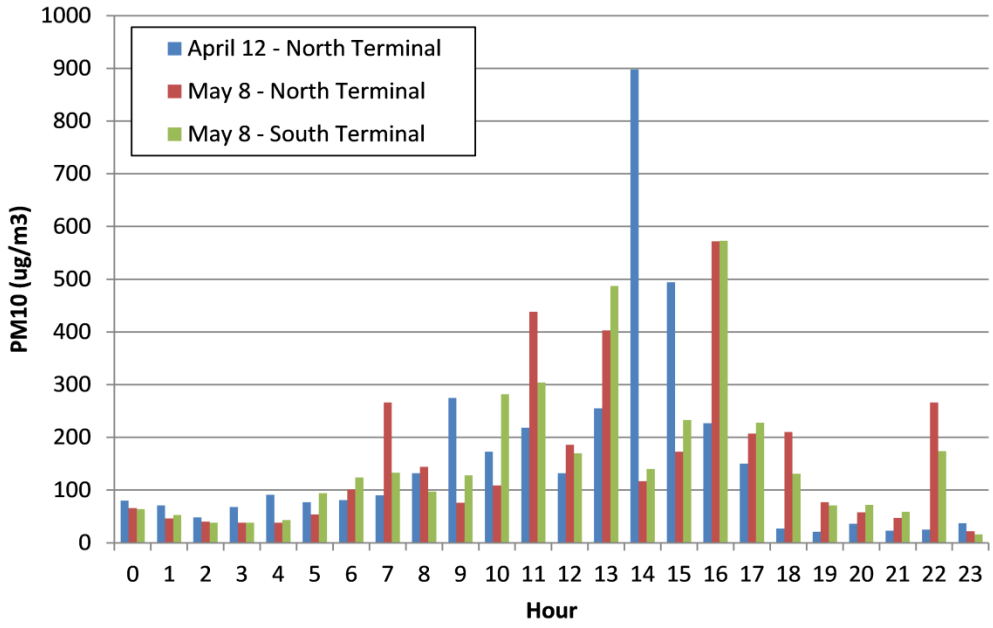

Figure 3. Hourly PM_{10} concentrations at KCBX Terminals on April 12 and May 8, 2014.

Average wind speeds recorded on these two days represented monthly maximums for April and May.[2] In addition, examination of the on-site 5-minute wind data for these days clearly shows that even at sub-hourly time scales, wind directions vary little across the day – particularly during periods with elevated wind speeds. **Figure 4** presents "wind roses" for the 5-minute data from April 12 and May 8, the two days with PM_{10} concentrations above 150 µg/m^3. Wind roses organize wind data into circular frequency plots that show how often winds come from a particular direction, with color bins used to display data proportions by wind speed. Figure 4 clearly shows that wind directions are consistently from the south-southwest for every 5-minute period on these two days. This is a very important finding, as it illustrates the validity of using upwind and downwind monitors on these days to evaluate incremental PM_{10} concentrations added by KCBX's emissions.

By contrast, **Figure 5** presents wind roses for the North Terminal for April 6 and May 24, 2014, days on which the peak 24-hr average PM_{10} concentrations at that terminal were 34 µg/m^3 (April 6) and 30 µg/m^3 (May 24). Figure 5 shows that winds were light and variable on these days, with wind speeds generally below 10 mph (represented by the blue color bins) and wind directions varying across virtually the entire 360 degree plot.[3]

These examples illustrate typical conditions observed with high and low PM_{10} concentrations and demonstrate that on days with elevated PM_{10}, KCBX's emissions do not impact all on-site monitors. In addition, it should be noted that the "swirling" winds which CDM Smith describes as capable of

[2] On April 12, 2014, wind speeds at the North Terminal averaged 12.4 mph, which was the April maximum. On May 8, 2014, wind speeds averaged 12.5 mph at the North Terminal and 13.4 mph at the South Terminal, which were the May maximums at each site.

[3] Though wind directions with very few data points are difficult to discern on the wind roses, 5-minute winds ranged from 2 to 360 degrees on April 6 and 0 to 359 degrees on May 24.

producing upwind impacts are not an issue of concern for daily PM_{10} measurements. Any such eddies that occur at the KCBX terminals would be transient, localized (e.g., in the vicinity of buildings), and overcome by the mean wind flow on days with elevated wind speeds and PM_{10} concentrations.

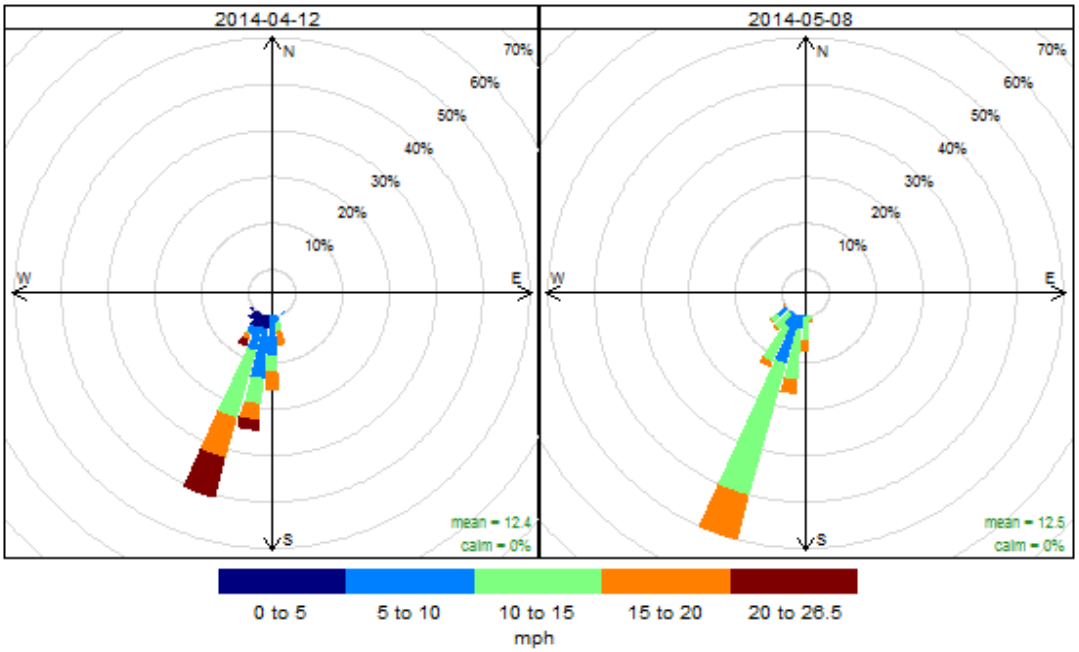

Figure 4. Wind roses for April 12 and May 8, 2014 at the North Terminal, dates with elevated PM_{10} concentrations.

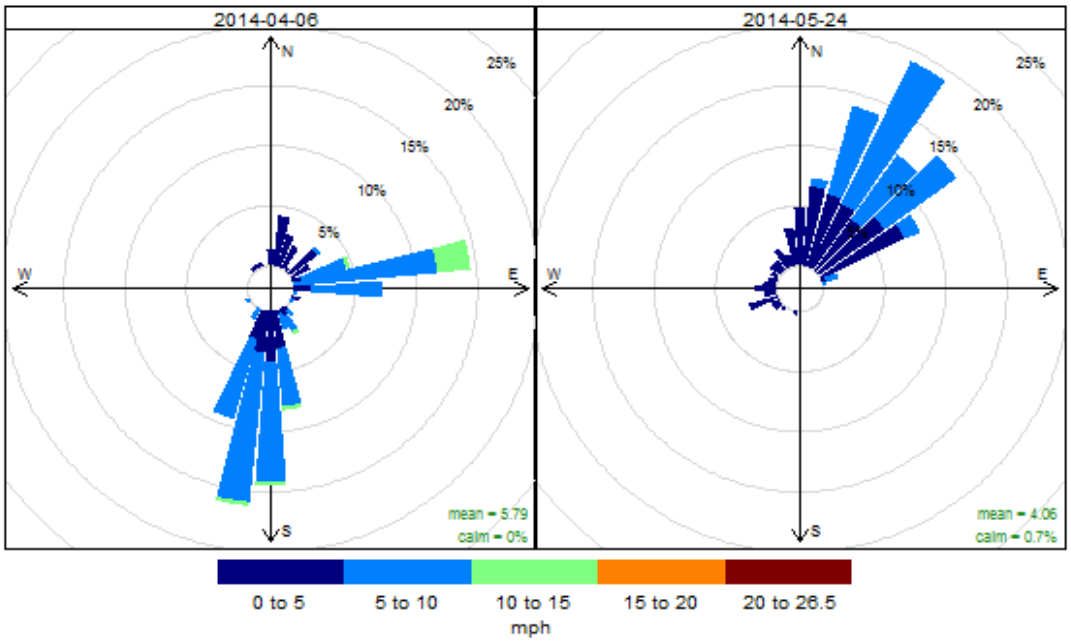

Figure 5. Wind roses for April 6 and May 24, 2014 at the North Terminal, dates with low PM_{10} concentrations.

Summary

This memorandum provides an initial response to analyses performed by CDM Smith regarding STI's dispersion modeling. As documented above, we find that CDM Smith:

- Misconstrues the AERMOD modeling we performed for individual days when elevated PM_{10} concentrations were observed at KCBX, leading them to wrongly conclude that the modeling results are invalid and misleading;
- Incorrectly asserts that variations in wind direction across a day (or hour) mean that KCBX's emissions likely contribute to monitored PM_{10} concentrations at all monitors, irrespective of primary wind direction;
- Fails to note the regional background PM_{10} concentrations measured at GWHS on the days modeled were 49 µg/m^3 and 81 µg/m^3, respectively. Thus, STI's modeling shows that the KCBX Terminals could only contribute at most about one-half to two-thirds of the observed PM_{10} concentrations at its downwind fence lines on these days; and
- Incorrectly asserts that there are data gaps in KCBX's air monitoring program, when, in fact, the terminals each have air monitors located on all four sides, and the locations of each monitor were approved in advance by the USEPA.

For these reasons, CDM Smith's analyses do not change the conclusions we reached in our previous emissions and modeling analyses.

Sincerely,

Lyle R. Chinkin
President