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Re: Comments to Health Consultation
Soil Gas and Indoor Air Investigations
Cabot/Koppers Superfund Site
Gainesville, Alachua County, Florida

Dear Mr. Merchant:

On behalf of Cabot Corporation, this letter provides comments to the recent health consultation by the Florida Department of Health (FDOH) for the soil gas and indoor air investigations conducted at the Cabot Carbon portion of the Cabot/Koppers Superfund Site (ATSDR and FDOH, 2016). Specifically, FDOH prepared this health consultation on the basis of a 2013 indoor air quality evaluation report prepared by Environmental Consulting and Technology, Inc. (ECT) on behalf of the Alachua County Environmental Protection Department (ACEPD) (ECT, 2013), as well as a soil gas investigation and vapor intrusion evaluation report prepared by Gradient on behalf of the Cabot Corporation (Gradient and Weston Solutions, Inc., 2013). The FDOH report recommends that vapor intrusion related risks be reexamined as part of the 2016 Five Year remedy review for the Site (ATSDR and FDOH, 2016, pp. 1-2, 12).

As further detailed in our comments below, the FDOH analysis assumes that the buildings at the Site are residential structures, both for estimating potential indoor air concentrations and in its selection of health-based benchmarks. These assumptions are not appropriate for commercial buildings. The US Environmental Protection Agency (US EPA) has comprehensive and authoritative guidance for performing vapor intrusion assessments at the Site and Gradient assessment's was conducted consistent with US EPA's approach. US EPA along with the State, County and City authorities were all involved at every stage of the assessment process from study design, planning, execution oversight, and review of findings. The assessment determined that the Site poses insignificant vapor intrusion risks and that no additional investigations are needed. US EPA agreed with this assessment (Miller, 2015). We request that FDOH reconsider its conclusions and also revise the report to address other issues discussed in the comments below.

1. FDOH relied on the draft Gradient vapor intrusion evaluation report and did not consider the final report, which included a sensitivity analysis that tested the robustness of the assessment results and addressed US EPA and other regulatory agency comments.

The FDOH report relied on the draft Gradient soil gas investigation and vapor intrusion evaluation report dated December 2012 rather than the May 2013 final report based on FDOH's health consultation reference list (ATSDR and FDOH, 2016, p. 15). The final Gradient report includes key additional

considerations regarding the vapor intrusion evaluation, including a sensitivity analysis of the assessment that showed that even using upper-bound assumptions vapor intrusion is not a significant concern. The final report also addresses comments provided by ACEPD, the City of Gainesville, and the Florida Department of Environmental Protection (FDEP) summarized in the May 2013 report cover letter (Levy and Sharma, 2013).[1]

2. In its evaluation, FDOH treats the shopping center as residential structures *and assumes lifelong, continuous exposure*. Furthermore, the study does not consider that many of the compounds of concern are commonly found in ordinary homes and businesses (*i.e.*, background) with some present at concentrations above the screening levels used by FDOH.

As part of its evaluation, FDOH compared measured soil gas concentrations to health-based screening levels. In calculating its health-based soil gas screening levels, FDOH relies on a soil gas-to-indoor attenuation factor of 0.03 (further discussed in Section 3 below) and a set of indoor air screening levels (ATSDR and FDOH, 2016, Table 3). These indoor air screening levels include a combination of cancer risk evaluation guide (CREG) values, chronic environmental media evaluation guide (cEMEG) values, reference concentrations (RfC) (one of which, for 1,3-butadiene, is incorrect), and US EPA regional screening levels (RSLs) (one of which, for 2-propanol,[2] is outdated). The indoor air screening levels used by FDOH have the following shortcomings:

- The values used by FDOH assume **lifelong, continuous** – or quasi continuous – exposure to the chemicals (ATSDR, 2005, Appendix F). In other words, the screening values assume that someone lives for their entire life time in the shopping center – an assumption that is not realistic. Even for an assessment in a residential setting, these indoor air quality screening levels would be considered overly conservative.[3]
- The screening levels do not account for background air concentrations. For example, FDOH's screening air quality value for benzene is 0.13 micrograms per cubic meter ($\mu g/m^3$) compared to background levels of benzene in indoor air that are typically on the order of several $\mu g/m^3$ (US EPA, 2011, 2015a).[4]
- For vapor intrusion assessment conducted in non-residential settings (*e.g.*, commercial buildings), US EPA has developed specific indoor air RSLs and vapor intrusion screening levels (VISL) (US EPA, 2015b,c).[5] The US EPA commercial RSLs are summarized in Table 1 below and compared to the screening levels used by FDOH. As can be seen, the screening levels used by FDOH are consistently lower than the US EPA RSLs, some by more than one order of magnitude.

[1] Both the May 2013 final report and its cover letter can be downloaded from the Cabot-Koppers Superfund document repository at the following address: http://bit.ly/1nz43DM.
[2] 2-Propanol is also known as isopropanol or isopropyl alcohol (commonly referred to as rubbing alcohol).
[3] In developing its residential RSLs for evaluating vapor intrusion, US EPA uses a 26-year exposure duration, the upper-bound duration for an individual living in the same home. CREG values used by FDOH represent a lifetime exposure duration, thereby lowering cancer-based screening levels by a factor of 2.7 relative to US EPA's residential RSLs.
[4] Refer to: http://www.epa.gov/indoor-air-quality-iaq/summarized-data-building-assessment-survey-and-evaluation-study.
[5] Refer to the screening level table for worker (*i.e.*, commercial building use): http://www.epa.gov/risk/risk-based-screening-table-generic-tables and http://semspub.epa.gov/work/03/2220573.pdf.

Table 1 Comparison of US EPA Commercial RSL and Screening Levels Used by FDOH for Indoor Air

Detected VOCs	US EPA RSL for Commercial Use ($\mu g/m^3$)[a]	FDOH Reference Screening Level ($\mu g/m^3$)[b]	Screening Level Ratio
Benzene	1.6	0.13 – CREG	12
Ethylbenzene	4.9 (cancer risk)		
	4,400 (non-cancer risk)	260 – cEMEG	17
Total Xylenes	440	220 – cEMEG	2.0
Toluene	22,000	300 – cEMEG	73
1,2,4-Trimethylbenzene	31	7.3 – US EPA RSL	4.2
1,3,5-Trimethylbenzene	N/A	7.3 – US EPA RSL[c]	-
Cumene (Isopropyl Benzene)	1,800	400 – RfC	4.5
Naphthalene	0.36 (cancer)		
	13 (non-cancer risk)	3.7 – cEMEG	3.5
2-Propanol (Isopropyl Alcohol)	880	730 – US EPA RSL[d]	1.2
Trichloroethylene	3.0	0.24 CREG	13
1,3-Butadiene	0.41 (cancer risk)	0.033 – RfC[e]	12
	8.8 (non-cancer risk)		

Notes:
CREG = Cancer Risk Evaluation Guide; cEMEG = Chronic Environmental Media Evaluation Guide; FDOH = Florida Dept. of Health; RfC = Reference Concentration; RSL = Regional Screening Level; US EPA = US Environmental Protection Agency; VOC = Volatile Organic Compound.
(a) US EPA (2015c, pp. 76-87) (10^{-6} cancer risk or non-cancer hazard quotient of 1.0).
(b) ATSDR and FDOH (2016, Table 3).
(c) There is no RSL for 1,3,5-trimethylbenzene. The value of 7.3 $\mu g/m^3$ is the residential RSL for 1,2,4-trimethylbenzene (US EPA, 2015c, pp. 40-51).
(d) This residential RSL value is obsolete and was revised in November 2014 (http://www.epa.gov/risk/regional-screening-table-whats-new).
(e) The RfC for 1,3-butadiene is 2.0 $\mu g/m^3$ (US EPA, 2002).

3 A comparison of FDOH-predicted indoor air concentrations to values actually measured in the building demonstrates that the choice of the soil gas-to-indoor air attenuation factor of 0.03 substantially overestimates the vapor intrusion potential and adds an unnecessary additional layer of conservatism to the already conservative indoor air screening values.

In addition to using overly conservative indoor air quality screening levels for its evaluation, FDOH uses a soil gas-to-indoor air attenuation factor of 0.03, thus including an additional layer of conservatism to the already conservative indoor air screening values. Indoor air and soil gas concentrations measured at and near the Big Lots store, respectively, allow for the calculation of a site-specific attenuation factor and provide a means to "ground truth" the generic attenuation factor used by FDOH. Indoor air concentration measurements conducted at Big Lots found a maximum concentration for isopropyl alcohol of 64 $\mu g/m^3$ (26 parts per billion by volume [ppbv]) (ECT, 2013, Table 2),[6] compared to a predicted concentration of 12,000 $\mu g/m^3$, using the attenuation factor of 0.03 and the maximum soil gas concentration 410,000 $\mu g/m^3$ (Gradient and Weston Solutions, Inc., 2013, Table 1). This disparity by orders of magnitude between the measured and predicted indoor air concentrations (64 *vs.* 12,000 $\mu g/m^3$) demonstrates that: (1) the soil gas-to-indoor air attenuation of 0.03 is overly conservative and concentrations of infiltrating vapors, if any, are expected to be significantly reduced at the Site's commercial buildings; and (2) the

[6] Note that acetone and isopropyl alcohol data shown in Table 2 of ECT (2013) are reversed. Refer to laboratory analytical report included as report attachment (see page 2 of 26 of laboratory report showing isopropyl alcohol concentration of 26 ppbv).

attenuation factor modeled by Gradient using the US EPA-approved model is appropriate (Gradient and Weston Solutions, Inc., 2013).

Additional considerations relative to the generic attenuation factor of 0.03 are provided below:

- The attenuation factor of 0.03 is based on attenuation data for chlorinated volatile organic compounds (VOCs) collected at residential structures (US EPA, 2012, 2015d, Appendix A). Therefore, this generic attenuation factor should not be used to predict indoor air concentrations for non-residential structures, such as the shopping center buildings. These buildings are large and positively pressurized due to mechanical ventilation (HVAC systems). US EPA has recognized this in its most recent vapor intrusion guidance and indicates that an appropriate building-specific analysis be considered when evaluating vapor intrusion into large non-residential buildings (US EPA, 2015d, Appendix A.4).
- The use of the generic attenuation factor of 0.03 (developed using data for chlorinated VOCs as noted above) is not appropriate for petroleum compounds, such as those identified at the Site, due to the biodegradation potential for these compounds (US EPA, 2015d, Section 1.3.1).
- Recent studies have indicated that the generic attenuation factor of 0.03 may underestimate typical attenuation by at least an order of magnitude for warm climate regions such as northern Florida where buildings are cooled rather than heated for a large portion of the year (Brewer *et al*., 2014). Furthermore, the value of 0.03 was obtained from an evaluation of 41 sites representing a total of 913 buildings (US EPA, 2012, Table 1). Of these sites, 18 sites (423 buildings) are located in the northeast (*e.g.*, New York), 14 sites (457 buildings) are located in other regions with cold winters (*e.g.*, Colorado), and only 9 sites (33 buildings) are located in relatively mild to warm regions (*e.g.*, California). This strongly suggests that the generic attenuation factor is not representative of relatively warm regions such as Florida.

Overall, the conclusions of FDOH's health consultation are not appropriate because FDOH assesses risks at the shopping center as if it were a residential home and uses multiple, overly conservative assumptions to derive its screening levels. A more realistic – yet health-protective – study that considers site-specific conditions, *i.e.*, commercial use and presence of large buildings, would have reached a conclusion similar to the Gradient analysis.

4. Gradient's vapor intrusion evaluation relied on multiple lines of evidence and was undertaken consistent with US EPA and ITRC guidance. US EPA agreed with the study's conclusion that vapor intrusion risks were insignificant.

Gradient's analysis included a soil gas sampling program and a site-specific risk assessment that relied on a model approved for use by US EPA. Gradient's risk assessment relied on conservative (*i.e.*, health-protective) assumptions and also included a sensitivity analysis to evaluate the effect of using extreme-end assumptions on health risks. For its vapor intrusion assessment, Gradient relied on multiple lines of evidence consistent with current US EPA guidance (US EPA, 2015d) and guidance by the Interstate Technology & Regulatory Council (ITRC, 2007), including the Site's operational history, current Site conditions and use, shallow groundwater quality trends relevant to vapor intrusion potential, and prior groundwater remediation activities conducted at the Site; this is in addition to the soil gas sampling program and indoor air modeling efforts conducted as part of Gradient's risk assessment. On the basis of its study, Gradient concluded that additional investigations were not warranted. US EPA agreed with Gradient's conclusion as indicated in US EPA's correspondence to FDOH (Miller, 2015).

Aside from the intrusive nature of indoor air sampling, characterizing indoor air quality in a shopping center, including an active grocery store, is challenging and, as noted previously, will make it very difficult to differentiate contributions from ambient air, indoor sources within the building, and subsurface vapor intrusion (if any). Similar to the aforementioned compounds found in indoor air by ECT, the key compounds identified during the soil gas investigation – BTEX,[7] naphthalene, and other petroleum compounds – are ubiquitous in the environment. The above-referenced US EPA study for office buildings indicates a frequency of detection of 100% for BTEX and 90% for naphthalene with median concentrations in indoor air in the range of several $\mu g/m^3$ (US EPA, 2015a). Collecting indoor air samples within buildings of the shopping center would most likely show detections for these compounds, which may not necessarily be attributable to vapor intrusion. This challenge was recognized and discussed during the development of the work plan for the soil gas assessment and was a key consideration in the approach selected to assess vapor intrusion (Gradient, 2012).[8] This work plan was approved by the stakeholders, including the FDEP.

4. Specific Comments

a. There is no need to conduct a seasonal evaluation at the Northside Shopping Center.

In March 2013, ECT conducted indoor air sampling at selected locations of the shopping center. The three VOCs detected were acetone, toluene, isopropyl alcohol (commonly referred to as rubbing alcohol), which are notoriously ubiquitous in the environmental and commonly found in residential indoor air at background levels (*e.g.*, US EPA, 2011). The typical detection frequency for these three compounds in office buildings is 100% (US EPA, 2015a). The indoor air concentrations measured for these compounds at the shopping center are well below very conservative screening thresholds used by FDOH (ATSDR and FDOH, 2016, Table 2) and are well within typical background values measured in indoor air (US EPA, 2011, 2015a; MTDEQ, 2012). Such findings do not warrant the seasonal evaluation advocated by FDOH. Changing the sampling period to from March to January to achieve "worst-case" temperature conditions is unlikely to measurably change ECT's findings, especially in the relatively warm climate of Northern Florida where the heating season is very limited in duration. Furthermore, as noted previously, the likely presence of ubiquitous VOCs in background indoor air will complicate interpretation of results. For those reasons and as was discussed with the stakeholders when the soil gas sampling work plan was prepared, we disagree with FDOH conclusions and recommendations that multiple concurrent soil gas, indoor air, and outdoor air sampling events should be conducted.

b. The characterization of Cabot's ongoing investigation and remedial planning work to address groundwater contamination present in the Hawthorn Group formation is not correct and needs to be modified.

FDOH's characterization of the approach to be used for remediating the Hawthorn Group formation is incorrect. A Feasibility Study is currently being conducted to evaluate remedial technologies that are most appropriate for addressing groundwater contamination in the Hawthorn Group formation. Furthermore, given that the Hawthorn Group formation is at least 35 feet below ground surface deep and is overlain by a clay layer and surficial aquifer groundwater, the presence of groundwater contamination in this unit has no bearing on vapor intrusion.

[7] BTEX stands for benzene, toluene, ethylbenzene, and xylenes.
[8] See Cabbot-Koppers Superfund document repository at the following address: http://bit.ly/1Pk1zmV.

c. The discussion of "Child Health Considerations" is not relevant, given the commercial use of the Site, and should be deleted.

FDOH indicates that children are likely to be present in the Northside Shopping Center buildings and may "play outdoors and sometime engage in hand-to-mouth behaviors that increase their exposure potential," or "breathe dust, soil, and vapors close to the ground," or "are dependent on adults for access to housing and medical care." These statements are not directly relevant to evaluating vapor intrusion inside the shopping center buildings. We recommend that FDOH delete this discussion from the report.

We appreciate the opportunity to provide these comments and are available to answer any questions that you may have relative to our soil gas investigation and vapor intrusion assessment.

Yours truly,

GRADIENT

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