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TECHNICAL MEMORANNDUM REGARDING RESPONSE TO COMMENTS ON DRAFT PHASE I VAPOR INTRUSION INVESTIGATION REPORT OPERABLE UNIT 1 (OU1) MCAS CHERRY POINT NC

10/18/2010

CH2MHILL

Response to Comments
Draft Phase I Vapor Intrusion Investigation Report Operable Unit No. 1
Marine Corps Air Station Cherry Point, North Carolina

PREPARED FOR: Partnering Team

PREPARED BY: CH2M HILL

DATE: October 18, 2010

This technical memorandum presents the responses to regulatory agency comments received regarding the Draft Phase I Vapor Intrusion Report, Operable Unit No. 1 prepared by CH2M HILL. Comments were received from the United States Environmental Protection Agency (USEPA) Region 4 on August 31, 2010. On August 16, the North Carolina Department of Environment and Natural Resources (NCDENR) indicated by email that it did not have any comments. Responses to each comment are provided below.

General Comments

Comment 1: Buildings 133 and 137 were the only buildings in this phase of investigation that had subslab soil gas samples collected inside the buildings. Eight of eight of these subslab 'in the building' soil gas samples had detections in excess of the screening values. The majority of groundwater and soil gas samples collected through paving adjacent to buildings did not have exceedances of the screening values. As a general observation, there were some soil gas samples taken above the groundwater plumes (as defined by the figures in Section 2) that had no exceedances of the screening values and some soil gas samples collected above areas outside the plume boundaries that did have exceedances of the screening criteria.

As comprehensive and organized as this document is, it appears to have a short coming in the conceptual site model (CSM). A key point in the generic vapor intrusion CSM is the chimney effect. Simply, the presence of a building concentrates vapors in the subsurface below the building. The figure directly below illustrates this concept, keeping in mind that the 3 values on the figure are from the article and are not related to MCAS Cherry Point.

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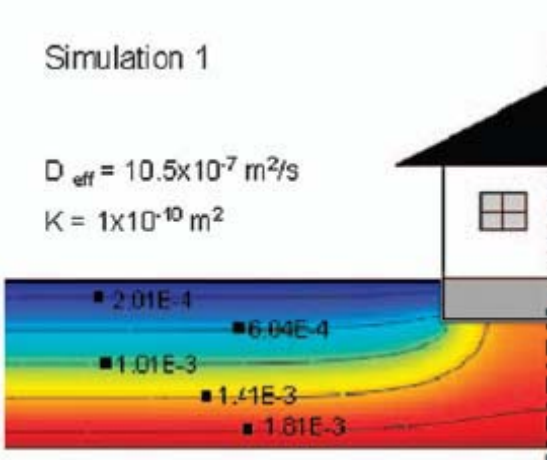


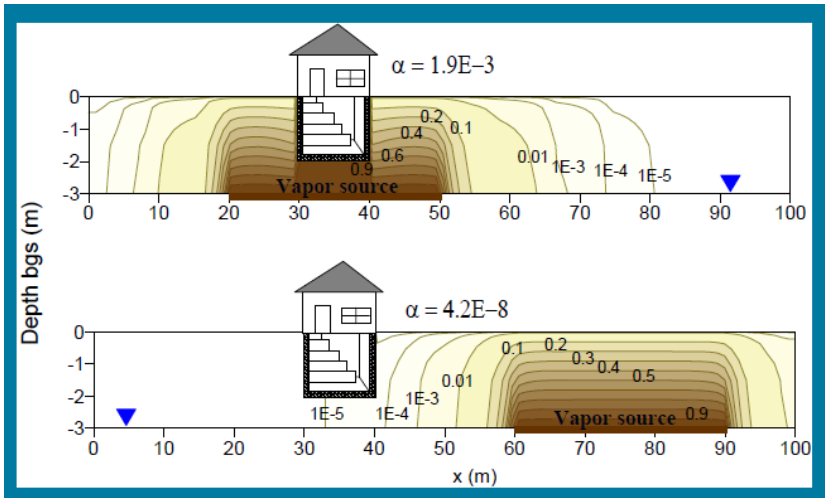
Ozgur Bozkurt, et. al., Simulation of the Vapor Intrusion Process for Nonhomogenous Soils using a Three-Dimensional Numerical Model, Groundwater Monitoring & Remediation 29, no. 1, Winter 2009, pages 92-104

Response 1: While reference to the chimney effect is respectfully acknowledged, this effect is unlikely the driver behind the elevated sublab concentrations detected beneath Buildings 133 and 137 and the differences observed between subslab and exterior results. As discussed in Section 2.2.4, the VOC releases at Building 133 have been determined to be related to the historical sump within the building and the drainage ditches that were subsequently covered as the building was renovated and expanded. Building 133 was targeted for subslab sampling knowing that: 1) the subslab soil gas concentrations would likely be higher beneath the building based on the interior locations of the primary VOC source areas; 2) the two TCE groundwater "hot spot" plume areas are beneath the building footprint (see Figure 2-5); and 3) exterior soil gas concentrations (even right above the water table) would likely not predict subslab concentrations. The results confirmed these assumptions.

As discussed in Section 2.4, there is a distinct TCE groundwater plume located entirely beneath building 137 (Figure 2-5) and for similar reasons discussed above, building 137 was targeted for subslab soil gas sampling during the Phase I investigation. Subslab concentrations beneath building 133 were expected to be different than exterior soil gas samples and this was confirmed based on the Phase I data. The report will be clarified to explain the rationale for subslab sampling at these two buildings, along with some additional discussion to supplement the CSM writeup. The figures will also be updated to show the location(s) of the likely primary vapor sources beneath buildings 133 and 137 (e.g., the sumps and drainage ditches).

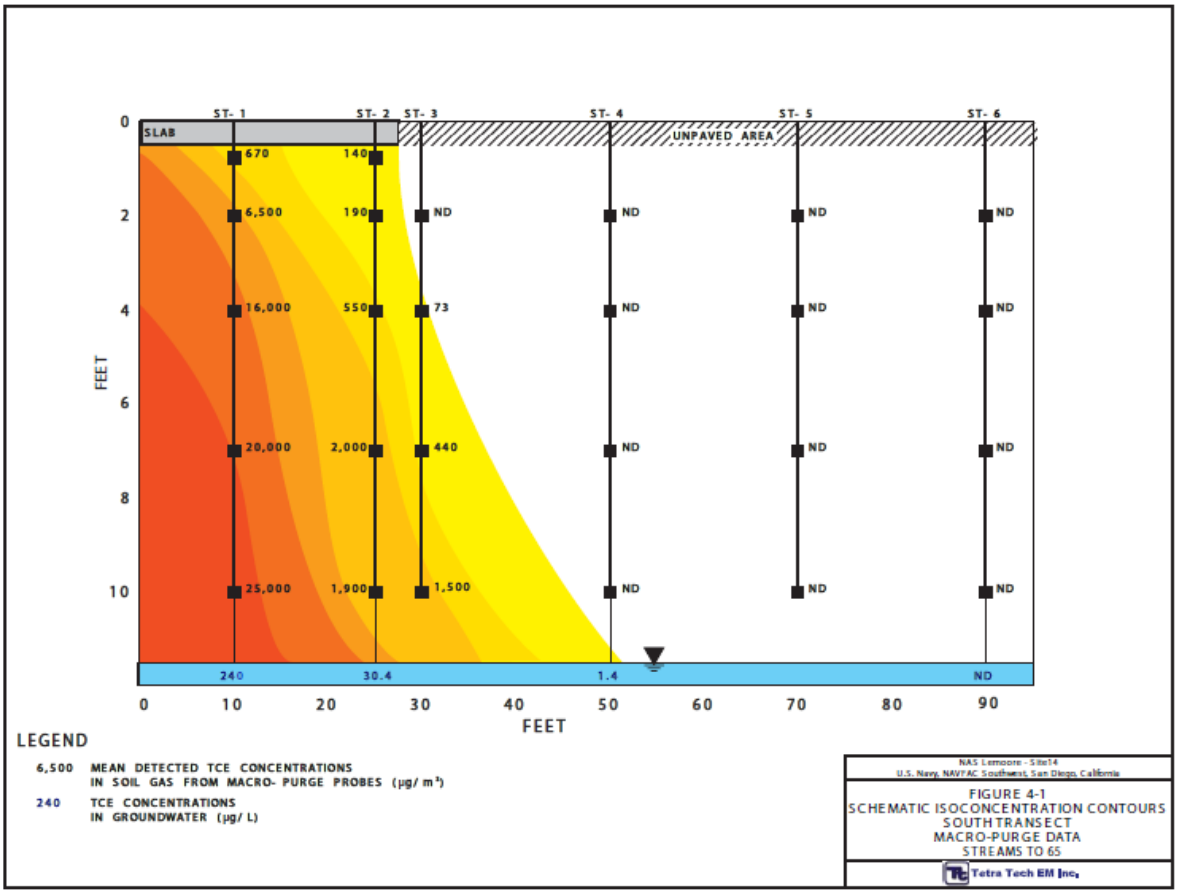
The distribution of soil gas concentrations shown in the figure the commenter provided above is only one of the multiple modeling simulations performed by EPA as they develop their vapor intrusion conceptual model scenario document that will be released shortly. As presented at the USEPA March 2010 workshop on vapor intrusion (http://iavi.rti.org/WorkshopsAndConferences.cfm), the Abreu and Johnson 3D vapor intrusion model can be used to illustrate the effect of various site conditions on the fate and transport of vapors in the subsurface and into buildings.

Three of the site conditions described in the Abreu presentation that likely have the greatest impact on our understanding of the VI CSM for buildings 133 and 137 include vapor source strength, source depth, and source lateral distance. For example, an illustration of the impact source lateral distance has on the subsurface soil gas distribution is provided below and was taken from the March 2010 Abreu talk:



As shown in these figures, vapor sources located immediately beneath a building result in the highest subslab concentrations, which is what was observed at buildings 133 and 137.

Comment 2: There is an EPA publication that collected specific data for the distribution of vapors in the subsurface collected specifically to demonstrate the chimney effect where the vapors are concentrated under the building slab and depleted a short distance away from the building. One specific detail in this figure is the soil adjacent to the building is unpaved. That is not the case at MCAS Cherry Point where most of the outside sample collection points appear to be through a parking lot. Many of the outside sample locations were actually close to the buildings but given the preponderance of low detections especially in areas that have the VOC groundwater plume (as defined in the RI maps) it is recommended that this investigation focus more on inside, subslab gas samples for its VI evaluation.



Vertical Distribution of VOCs in Soils from Groundwater to the Surface/Subslab, EPA/600/R-09/73, August 2009

Response 2: As noted in the response to Comment 1, the chimney effect is unlikely to be the driver behind the elevated subslab concentrations beneath Buildings 133 and 137. This conclusion is further suggested as a possibility by the figure provided above. The concentrations listed in the blue bar are the TCE groundwater concentrations. The figure indicates that, similar to the conditions at Buildings 133 and 137, the highest TCE groundwater concentrations are located directly beneath the slab and drop off significantly at the edge of the slab. Thus, the concentration of TCE in soil gas would also be expected to be lower at the edge of the slab.

The uncertainties/variability associated with exterior shallow soil gas samples collected from areas with or without a pavement cover outside the building was minimized by targeting the soil gas sampling locations immediately above the water table (approximately one foot above the capillary fringe). The non-detect soil gas results mentioned in the comment were generally from sampling locations where the co-located water table results were either non-detect or very low, which likely better explains the results than the presence or absence of a cover outside the building. The document will be revised to include more discussion on the correlation between the co-located grab groundwater and exterior soil gas results. Emphasis was placed on this correlation between the co-located grab groundwater and soil gas results and not necessarily correlation with the historical groundwater plume shown on Figure

2-5 since vapor concentrations above the capillary fringe are known to correlate better with water table concentrations.

Additional subslab and indoor air sampling is planned for Phase II. The additional data collected will be used to evaluate the chimney effect specific to MCAS Cherry Point OU1.

Comment 3: It is understandable from a regulatory authority point of view that the petroleum constituents detected during the RI and this VI Investigation be evaluated but the Base's petroleum program. From a scientific perspective, all of the samples collected were probably run with an analytical method that included the traditional BTEX petroleum components. The above comments on the chimney effect should also be taken into consideration when evaluating the sufficiency of the data from the petroleum program's VI evaluation. Hopefully, all this CERCLA work can greatly assist the petroleum program's efforts.

Response 3: This comment is respectfully acknowledged.

Comment 4: It would assist the technical review of this data if there was a map which showed the Freon detections. Freon usually has much higher screening levels than other VOCs. Also, during analysis, Freon co-elutes with several VOCs of concern, such as TCE. It is possible that elevated Freon detections could mask the presence of TCE and therefore provide an incomplete picture of the compounds detected and the associated risk. Please provide an evaluation of the Freon detections and if there are any locations where its occurrence may have masked the detection of other VOCs.

Response 4: Based on the results in the RI and RI addendum, the presence of Freon in groundwater is not widespread. This is also supported by the general lack of Freon detections in the groundwater samples collected during the Phase I VI investigation. Rather, the Freon detected may be related to leaky refrigerant lines at specific buildings. In most cases where Freon was detected in subslab soil gas, other VOCs were also detected (e.g. 1,1-DCA and 1,1-DCE). Therefore, the presence of Freon in these samples is unlikely to affect the overall VI conclusions. For example, subslab and indoor air sampling is planned for Buildings 3997 and 131, where the most-elevated Freon concentrations were detected. The document will be revised to include a discussion on the validity of the Freon results and potential sources.

Comment 5: Section 6, the Refined Conceptual Site Model for Vapor Intrusion may warrant a more detailed review at a later date. The issues with the chimney effect and sample collection location described above may cause significant revisions to this section.

Response 5: Additional phases of VI investigation are planned. Building CSMs will be updated as additional data are collected, including an evaluation of the chimney and other fate and transport effects, and documented in subsequent reports.

Specific Comments

Comment 1: Section 4.2 contains several paragraphs on the analysis of gas samples collected specifically with Summa canisters and how they might result in elevated detection limits. It is understood that there is specific language in the UFP-SAP about the assigning elevated

detection limits. However, this results in portions of this operable unit being unevaluated. This may be seen in the results for the samples collected near Building 4533 as seen on Figure 5-7. Please evaluate and implement other sampling and analysis procedures that will allow for an evaluation of the soil gas concentrations in this area.

> **Response 1**: The elevated detection limits observed at Buildings 4533, 4497, and 4498 were confirmed to be related to elevated detections of petroleum compounds, which were not specifically reported under this investigation. Further evaluation of these buildings will be conducted under the UST section as stated in the report. Data will be shared between the programs and the appropriate action taken should a risk be identified.

Comment 2: It is noted that the areas in Figures 5-1, 5-2, and 5-3 appear to have no TCE detections and yet this area is over the TCE plume as depicted in Figure 2-5.

> **Response 2**: The groundwater detections depicted on Figure 2-5 were detected in permanent monitoring wells installed at OU1. The screen depths (i.e., sampled interval) of these wells vary vertically, but are generally located in the 8-30 ft bgs range. The grab samples collected during the Phase I VI investigation were all collected from the top 2 to 4 ft of the water table. TCE typically moves downward in the aquifer due to the downward vertical gradient present in this area. Thus, deeper groundwater samples would be expected to contain higher TCE concentrations.

Comment 3: Table 7-1 lists the Summary of Recommendations. There are several buildings that the EPA feels should be included in the Phase II evaluation. This includes Buildings 159, 4630, 4032, 4172, 4533, 4498 and 4497.

> **Response 3**: As noted in the response to Specific Comment 1 and in Table 7-1, Buildings 4533, 4498, and 4497 will be evaluated by the UST Program due to the elevated detection limits being related to petroleum compounds.
>
> Buildings 159, 4630, 4032, and 4172 are addressed individually below:
>
> Building 159: As outlined in the conclusions, four top-of-the-water table and four exterior soil gas samples (collected just above the water table) did not contain VOCs at concentrations exceeding the screening levels. In addition, the building is a large warehouse with a large indoor air volume and would likely result in mixing and dilution of indoor air concentrations. Based on these lines of evidence, it is unlikely the vapor intrusion pathway would result in unacceptable risk within this building. While further investigation of this building was not recommended for Phase II, a recommendation was included to monitor top-of-the-water table concentrations due to the building's downgradient location from Building 133 and the potential migration of impacted groundwater beneath the building.
>
> Building 4630: As outlined in the conclusions, two top-of-the-water table and two exterior soil gas samples (collected just above the water table) did not contain VOCs at concentrations exceeding the screening levels. In addition, the building is a large warehouse with frequent opening of doorways for access by delivery carts and

would likely result in mixing and dilution of indoor air concentrations. Based on these lines of evidence, it is unlikely the vapor intrusion pathway would result in unacceptable risk within this building.

Building 4032: As outlined in the conclusions, four top-of-the-water table and three exterior soil gas samples (collected just above the water table) did not contain VOCs at concentrations exceeding the screening levels. In addition, the building contains several laboratories containing vented hoods which would mitigate vapor transport and VOC concentrations. Based on these lines of evidence, it is unlikely the vapor intrusion pathway would result in unacceptable risk within this building.

Building 4172: As outlined in the conclusions, two top-of-the-water table and two exterior soil gas samples (collected just above the water table) did not contain VOCs at concentrations exceeding the screening levels. Based on these data, it is unlikely the vapor intrusion pathway is significant for this building.

It should also be noted that the soil gas screening levels used in this evaluation are based on the EPA default attenuation factor (AF) for shallow soil gas of 0.1. This AF is 2 to 3 orders of magnitude more conservative than empirically derived AF's at other military bases, such as nearby Marine Corps Base Camp Lejeune. As co-located subslab and indoor air data are collected at MCAS Cherry Point OU1, an empirically derived AF specific to MCAS Cherry Point OU1 will be developed. Should the empirically based AF be more conservative than what has been seen at other Bases, the need to conduct further investigation at these buildings will be re-evaluated.

Further, as discussed in the responses to General Comments 1 and 2, the data collected to date are likely not explained by the chimney effect. As noted, additional subslab and indoor air sampling is planned for Phase II and the chimney and other fate and transport effects specific to MCAS Cherry Point OU1 will be evaluated at that time. If the Phase II data indicate a significant chimney effect is present and affecting the results, the need for additional sampling at Buildings 159, 4630, 4032, and 4172 will be re-evaluated for Phase III.