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TREASURE ISLAND
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MEMORANDUM

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FROM: Tracy L. Behrsing, Ph.D. MJW for Tracy Behrsing
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DATE: September 4, 2012

SUBJECT: DRAFT HUMAN HEALTH RISK ASSESSMENT ADDENDUM, INSTALLATION RESTORATION SITE 21, NAVAL STATION TREASURE ISLAND, SAN FRANCISCO, CALIFORNMIA

PCA: 18019 Site: 201210-18

DOCUMENT REVIEWED: Draft Human Health Risk Assessment Addendum, Installation Restoration Site 21, Naval Station Treasure Island, San Francisco, CA. Prepared for Department of the Navy, Base Realignment and Closure, Program Management Office West Naval Facilities Engineering Command, San Diego, California. Prepared by Shaw Environmental Inc., Concord, CA. Document dated July 2012.

BACKGROUND (based on information in the submission): Naval Station Treasure Island (NSTI) Installation Restoration (IR) Site 21 is the former Vessel Waste Oil Recovery Area. Site 21 extends from the southeast corner of Building 3 to the southwest margin of TI and the San Francisco Bay, and comprises approximately 2.2 acres. In 2007, the Site 21 Remedial Investigation (RI) Report was finalized. Chlorinated volatile organic compounds (VOCs) including trichloroethylene (TCE), tetrachloroethene (PCE), dichloroethene (DCE), and vinyl chloride (VC) were identified as chemicals of concern (COCs) in groundwater.

A baseline human health risk assessment (HHRA) for Site 21 was conducted as part of the 2007 RI Report. Johnson and Ettinger (J&E) modeling of groundwater data identified potential risks to current and future receptors from the subsurface vapor intrusion to indoor air pathway. (Soil gas data were not available when the RI HHRA

was conducted; and therefore, the indoor air evaluation was based on groundwater only.) To address concerns regarding groundwater contamination, a treatability study was initiated in 2005, with the last phase of treatment performed in early 2009 (no further in situ bioremediation treatment is currently planned). A Focused Feasibility Study (FFS) for Site 21 was prepared in 2008, and a Proposed Plan/Draft Remedial Action Plan (RAP) was published in 2011 identifying Alternative 2 from the FFS as the Navy's preferred alternative for Site 21. Alternative 2 consists of institutional controls (ICs) to: 1) Prohibit all uses of groundwater including groundwater extraction except for dewatering purposes, 2) Require evaluation and potential installation of engineering controls if new noncommercial buildings are constructed or the current land use of existing buildings changes, and 3) Prohibit residential use unless appropriate engineering controls are implemented that are protective of residential receptors.

In response to the request by regulators, the Navy collected soil gas data at Site 21 between 2010 and 2011 for use in further evaluating potential risk from the vapor intrusion pathway following the treatability study. VOCs were detected at concentrations exceeding preliminary soil gas screening levels, resulting in the collection of additional soil gas data between late 2011 and early 2012. In addition, the HHRA Addendum (reviewed herein) was prepared to evaluate the subsurface vapor intrusion to indoor and outdoor air pathways based on soil gas investigation at the site subsequent to the 2007 baseline HHRA.

At this time, Site 21 is fully covered by asphalt, concrete, and buildings. Building 3 is currently empty, but is occasionally used for movie productions. Building 111 is currently used to store antiques. There is also a sailing facility which supports sailing lessons for area youth and storage of boats and equipment. The 2011 Final Environmental Impact lists the proposed future uses of the portion of Treasure Island that includes Site 21 as open space and Island Center district (described as a dense mix of residential, retail, restaurant, and office space). The Environmental Impact Report states that Building 3 will be rehabilitated and reused for commercial, retail, entertainment, community services, and food production uses. Building 111, an ancillary building attached to Building 3, will be demolished and portions of Site 21 will be used for mixed use which may include residential use.

B. Davis of HERO previously reviewed the soil gas screening criteria for Site 21 in a memorandum dated October 24, 2011. In a memorandum dated February 14, 2012, HERO reviewed the Draft Response to Comments on the Proposed Parameters and Soil Gas Evaluation for Site 21 (T. Behrsing to R. Sunga).

SCOPE OF REVIEW: Our review focused on aspects of the submission related to human health risk assessment (HHRA). We assume that regional personnel have evaluated the sampling methods for environmental media, the adequacy of site characterization, analytical chemistry methods, and quality assurance procedures. Any future changes to the submission should be clearly identified.

GENERAL COMMENTS

1. Groundwater Contamination. The HHRA Addendum evaluates the vapor intrusion to indoor air pathway based on J&E modeling of soil gas only. It is HERO's understanding based on communication with the project team that the 2007 baseline HHRA vapor intrusion evaluation presents risks based on J&E modeling of groundwater data and concentrations used in the 2007 HHRA no longer reflect current site conditions due to groundwater treatment completed in 2009. While HERO has previously agreed with the Addendum's evaluation of soil gas only, we recommend the following be considered.

   a. Section 2.5 (Nature and Extent of Contamination) discusses historical groundwater contaminant concentrations prior to the treatability study (e.g., concentrations of PCE, TCE, and VC as high as 1300 µg/L, 2300 µg/L, and 100 µg/L, respectively). However, because of groundwater treatment, the extent of the chlorinated ethene plume in excess of 100 µg/L has been reduced to the vicinity of one substrate injection point as of January 2012. Furthermore, concentrations of ethene at this location indicate continuing bioremediation activity. To allow for a more direct comparison of the pre- and post-treatment data, please update this section to list individual groundwater COC concentrations as of 2012.

   b. The HHRA Addendum focuses on evaluating the vapor intrusion pathway using soil gas data collected subsequent to the RI Report. However, results of the soil gas evaluation are discussed relative to the 2007 baseline HHRA vapor intrusion findings based on J&E modeling of groundwater. HERO is concerned that results of the HHRA Addendum and 2007 baseline HHRA are not directly comparable for at least two reasons. First, there have been important updates in toxicity criteria for TCE (a Site 21 COC). As noted in the document, current toxicity criteria for TCE (recently finalized by USEPA) are more health protective than previous values. Updated J&E modeling of groundwater assuming the same concentrations as those used in the 2007 evaluation, but using current TCE toxicity criteria, would likely result in higher risks and noncancer hazard indices (HIs). Alternatively, groundwater treatment has occurred, so if current groundwater concentrations are lower, this would also impact the groundwater modeling results.

   To address this concern, we recommend these issues be noted in locations where the 2007 baseline HHRA and HHRA addendum results are compared so that such comparisons are placed in context. In addition, this is an important issue to recognize when considering multiple lines of evidence for the vapor intrusion pathway as part of risk management decisions.

2. Soil Gas Investigation, 2010 to 2012 (Section 2.6).

   a. Soil gas sampling results for PCE and TCE are discussed relative to "preliminary comparison limits" of 180 µg/m^3 and 257 µg/m^3, respectively. These comparison limits are also used to define the isoconcentration contours depicted on Figure 3

(PCE and TCE in Soil Gas). Please provide the basis for these comparison limits at the first location in which they are referenced in the document. Section 6.3 (Exposure Concentrations and Chemicals) appears to indicate that they represent residential shallow soil gas California Human Health Screening Levels (CHHSLs). While the PCE comparison limit corresponds to the residential CHHSL (0.180 µg/L), the TCE criterion (0.257 µg/L) does not match the current residential CHHSL of 0.528 µg/L. This appears to be due to incorporation of the newer USEPA toxicity criteria for this constituent, but the difference should be explained for clarity.

b. Figure 3 (PCE and TCE in Soil Gas) presents VOC concentrations in soil gas collected from both subslab and subsurface (4.5 feet below ground surface [bgs]) samples. Isoconcentration contours for PCE and TCE are also depicted based on the "preliminary comparison limits" discussed above. As shown in the risk isopleth figures (Figures 5, 6, and 7), VOC concentrations in subslab and subsurface samples are not directly comparable from an indoor air risk perspective. This is an important point to consider when reviewing Figure 3 from a nature and extent of contamination perspective. For clarity, we recommend the submission specifically point out this issue when discussing Figure 3.

3. Toxicity Assessment (Section 5, Table 8).

a. PCE. HERO concurs with the use of the more health protective Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA) inhalation toxicity factors for PCE, as compared to the 2012 USEPA inhalation criteria for this volatile.

i. Section 5 refers to use of Cal/EPA criteria for the trench scenario only. Please update the text to address both the indoor air and trench scenarios.

ii. Table 14 (Summary of Risk Driver COCs for Vapor Intrusion Pathway) and Section 9.2 appear to imply that the 2012 USEPA PCE inhalation reference concentration (RfC) is 6.75-fold more health protective than the Cal/EPA inhalation criterion based on noncancer effects. In fact, the Cal/EPA reference exposure level (REL; 35 $\mu g/m^3$) is very similar and slightly more protective than the USEPA RfC (40 $\mu g/m^3$). Please address this issue.

b. TCE. In 2011, USEPA released updated Integrated Risk Information System (IRIS) toxicity criteria which are more stringent than the former values. HERO appreciates the Navy's use of these newer criteria in the current document. As a point of clarification however, we recommend that the Section 5 text be modified slightly. As written, the text indicates that because TCE exhibits carcinogenic health endpoints via a mutagenic mode of action with greater impacts on children, USEPA has chosen to implement an age-dependent adjustment factor (ADAF). The text further indicates that USEPA has published toxicity factors considering the mutagenic mode of action, and those values were used in the risk assessment.

Review of Table 8 indicates that the USEPA IRIS inhalation unit risk (IUR) of 4.1E-6 per $\mu g/m^3$ was used. As noted on IRIS, this IUR is calculated using data from adult exposure, and does not reflect presumed increased early-life susceptibility to kidney tumors for this chemical. Generally, USEPA recommends using ADAFs when assessing cancer risks for carcinogens with a mutagenic mode of action. However, the IRIS evaluation references a detailed example calculation for inhalation exposures to TCE. IRIS states that "because the ADAF adjustment applies only to the kidney cancer component of the total cancer risk estimate, the impact of the adjustment on full lifetime risk is minimal and the adjustment might reasonably be omitted, given the greater complexity of the ADAF calculations for TCE. Nonetheless, for exposure scenarios with increasing proportions of exposure during early life, the impact of the ADAF adjustment becomes more pronounced and the importance of applying the ADAFs increases." The text should be clarified accordingly.

c. Surrogates for Total Petroleum Hydrocarbons (TPH). The surrogates used to represent noncancer toxicity for C5-C8 (aliphatics), C9-C12 (aliphatics), and C9-C12 (aromatics) fractions were reported to have been selected from DTSC's 2009 Interim Guidance for Evaluation Human Health Risks from TPH. For future reference, guidance on TPH evaluation is anticipated in a forthcoming revision of DTSC's Preliminary Endangerment Assessment (PEA) Manual. In the interim, we concur with the current evaluation, particularly since chemical-specific toxicity associated with TPH-related constituents was evaluated. (No response is needed.)

4. Conceptual Site Model (CSM; Section 6.1 and Figure 4).

a. Soil. Figure 4 depicts inhalation and dermal contact with soil, but soil ingestion is not shown. Please address this issue, since incidental ingestion of soil is generally evaluated as a complete exposure pathway.

b. Construction Workers. The text indicates that in the 2007 baseline HHRA, dermal contact with groundwater was evaluated for construction workers under a trench scenario. In the current submission, inhalation of volatiles from soil gas emitted from the faces of a trench was evaluated using a hypothetical box model.

Because shallow groundwater is present at Site 21 (and dermal contact under a trench scenario was evaluated), please clarify whether inhalation of volatiles emitted from groundwater in the base of a trench has been evaluated. In general, for sites with shallow groundwater, HERO recommends that both inhalation of volatiles emitted from groundwater as well as dermal contact be evaluated. In these cases, the Virginia Department of Environmental Quality (DEQ) trench model is often used to evaluate this scenario. While we agree that soil gas contamination may contribute to VOCs in trench air, there is also potential for exposure to volatiles emitted from groundwater in the base of the trench. This needs to be addressed.

5. Exposure Intake Rate (Section 6.3 and Table 9). HERO concurs with the exposure parameters used to derive the site-specific risk-based screening levels (RBSLs) as listed in Table 9 and the Appendices. In the case of the construction trench worker, HERO often recommends use of a default exposure frequency (EF) of 250 days per year. In this case, the assumed EF of 125 days per year is acceptable, since this evaluation is specific to a trench scenario and it was conservatively assumed that a worker would be in the trench 8 hours per day. Updating the HHRA in this regard also would not impact the overall conclusions for this receptor. (No response is needed.)

6. Subslab and Subsurface Soil Gas RBSLs for Vapor Intrusion to Indoor Air (Section 6.4 and Appendix B). The HHRA Addendum derives subslab and subsurface soil gas RBSLs based on vapor intrusion to indoor air under the current commercial/industrial (C/I) scenario, as well as future hypothetical exposure scenarios, including C/I and residential land use. HERO has reviewed the subsurface RBSLs and concurs with the assumptions used to derive these site-specific values. For the subslab RBSLs however, HERO is concerned with Navy assumptions which may have resulted in an underestimate of risk.

a. In our February 2012 memorandum, HERO recommended using a default attenuation factor of 0.05 to derive RBSLs for subslab samples. This recommendation was made for consistency with DTSC's 2011 Vapor Intrusion Guidance (http://www.dtsc.ca.govIAssessingRiskiupload/Final VIG Oct 2011.pdf) and to allow for a health-protective evaluation. Use of the 0.05 default attenuation factor is also consistent with DTSC recommendations for other facilities where subslab soil gas screening levels have been derived. In the Responses to Comments for HERO's February 2012 review, it was agreed that Site 21 subslab screening levels would be calculated using the default subslab attenuation factor (0.05) as recommended.

b. Review of the current submission indicates that while the subslab RBSLs were in part based on the recommended attenuation factor (0.05), modifications to this default were incorporated as described below to account for C/I air exchange rates and the presence of engineered fill under future land use scenarios. We discuss these modifications, and provide our recommendations in the following comments.

7. Subslab RBSLs for Current C/I Scenario. The attenuation factor for current C/I subslab RBSL calculations was modified 2-fold to account for the C/I air exchange rate of 1 exchange per hour, instead of the residential air exchange rate of 0.5 exchanges. Therefore, an attenuation factor of 0.025 was used, and this resulted in subslab RBSLs which are 2-fold higher (less protective) than would be calculated using DTSC's recommended default of 0.05.

a. While a higher air exchange rate for C/I buildings is assumed as part of J&E modeling, the DTSC default subslab attenuation factor for existing C/I buildings (0.05) is derived from USEPA's national empirical vapor intrusion database. DTSC

guidance states that because the national database lacks sufficient information concerning commercial buildings to conclusively infer a subslab attenuation factor for this building scenario, the residential subslab attenuation factor of 0.05 should also be used for commercial buildings. This attenuation factor (0.05) is an empirically-derived model (rather than model-derived), and reflects the cumulative effects of many factors and conditions. Furthermore, because the estimated indoor air concentration is calculated as the attenuation factor multiplied by the soil gas concentration, the building ventilation rate is not a factor in the indoor air calculation.

HERO recommends that the current C/I subslab RBSL calculations (and corresponding risk and hazard calculations) be updated to reflect the DTSC default subslab attenuation factor of 0.05. Based on the HHRA Addendum results presented, the maximum risk and noncancer hazard index (HI) for current C/I workers are 3E-5 and 3, respectively. Because the noncancer HI exceeds one (even using the Navy's "modified" attenuation factor which is 2-fold less protective than the DTSC default), this indicates that a potential human health risk exists at a subarea within the site.

b. It is acceptable to include an additional evaluation incorporating the Navy's modified attenuation factor for bounding purposes. If this is done, we recommend providing support for such a deviation from the default using the USEPA literature and database as well as site-specific factors of the existing building.

8. Subslab RBSLs for Future C/I Scenario. The attenuation factor used to calculate subslab RBSLs for the future C/I scenario was assumed to be 0.0125. This value was derived by adjusting the DTSC default for existing buildings (0.05) by two factors: 1) a factor of 2 to account for the C/I ventilation rate and 2) a factor of 2 to account for the presence of engineered fill beneath the slab. As a result of the modifications, the subslab RBSLs for the future C/I scenario are 4-fold lower than be calculated using the DTSC default of 0.05.

a. Please see our comments above regarding modifications to account for the air exchange rate.

b. HERO concurs that J&E modeling conducted by OEHHA to derive their CHHSLs indicates that the presence of engineered fill at future buildings results in attenuation factors 2-fold lower than those estimated for existing buildings. However, the recommended DTSC default attenuation factor is empirically-derived, rather than J&E model derived. In addition, the submission indicates that Building 3 may be rehabilitated and reused for commercial, retail, entertainment, community services, and food production uses. Therefore, one cannot assume that engineered fill would be present under a future C/I scenario. For these reasons, we recommend use of the DTSC default attenuation factor. Again, an additional evaluation incorporating the Navy's modifications can be presented for bounding purposes.

However, based on the results of even the currently submitted document, a potential human health risk exists under the C/I scenario.

9. Subslab RBSLs for Future Residential Scenario. The attenuation factor used to calculate subslab RBSLs for the future residential scenario was assumed to be 0.025, based on a 2-fold correction to account for the presence of engineered fill beneath the slab in future construction. The residential risk and HI (2E-4 and 11, respectively) even using the Navy's modified attenuation factor justify the submission's current recommendation for ICs against residential use. In general, HERO recommends using the DTSC default attenuation factor as a health protective assumption. If this were done, the risk and HI estimates would be approximately 2-fold higher.

10. Need to Revisit Sections 7 (Risk Characterization), 8 (Results), and 10 (Conclusions and Recommendations). As commented above, HERO is concerned with the subslab RBSLs, and recommends the document be updated for consistency with DTSC's vapor intrusion guidance. Such updates will result in higher vapor intrusion to indoor air risk and HIs than currently reported, and the risk characterization, recommendations, and conclusions will need to be revisited accordingly. We have the following comments on these sections at this time.

11. Risk Characterization (Section 7).

a. Future Commercial/Industrial Worker. Section 7.1.2 needs to be updated to reflect the future C/I risk and noncancer hazard at existing onsite buildings. Currently, only the results for a future default commercial building (which assumes the presence of engineered fill) are presented in the text.

b. Future Construction Trench Worker.

i. The risk and HI for trench workers based on inhalation of VOCs emitted from soil gas were 1E-09 and 0.002, respectively. Again, please provide clarification as to whether inhalation of volatiles emitted from groundwater in the bottom of a trench was previously considered. Given the presence of shallow groundwater as well as the evaluation of dermal groundwater exposures in the 2007 baseline HHRA, it appears that there is potential for groundwater to be present in the base of the trench.

ii. At this time, this reviewer is unaware of standard guidance for calculating trench air VOC concentrations emitted from soil gas at the faces of a trench. We have reviewed the submission and find it acceptable on a site-specific basis. It also seems that construction worker exposures will need to be addressed regardless of trench air concentrations given the dermal exposure HI exceeding one. Please be aware that HERO's acceptance of the trench modeling from soil gas in this submission this does not necessarily apply to other sites. (No response is needed.)

12. Results of the Supplemental HHRA (Section 8), Conclusions and Recommendations (Section 10).

a. Current Land Use (C/I Scenario).

i. TCE. As submitted, TCE detected in subslab soil gas at a single soil gas well (21-SG-27) resulted in a HQ of 2 based on the USEPA RfC of 2 $\mu g/m^3$. Please be aware that the scientific evidence suggests that TCE is a cardiac teratogen, causing birth defects in rats. One of the USEPA IRIS candidate RfC endpoints is based on increased fetal cardiac malformations with a short exposure window for effects. How to apply the inhalation RfC is still unclear under the C/I worker scenario to ensure protectiveness for the most sensitive group, adult women. Our understanding is that USEPA's Office of Research and Development is working with the Agency for Toxic Substances and Disease Registry (ATSDR) to set a screening level for the short-term exposure scenarios. For the Site 21 HHRA Addendum, the current noncancer HQ for TCE is based on an adjusted *average* daily exposure concentration which considers exposure frequency and duration. It is possible that short-term exposure scenario screening levels developed in the future would result in a higher HQ, and this should be considered by the risk manager.

ii. Exposure Duration (ED). The text states that the current C/I evaluation is based on ED of 25 years which may be overly conservative considering the potential for redevelopment over within the next 10 years. As a result, risk and hazard estimates based on an ED of 10 years are presented (1E-5 and 1, respectively).

While it is acceptable to include an additional evaluation based on a hypothetical 10 year ED, HERO does not recommend risk management decisions be based on the results of such an evaluation. Rather, we recommend the DTSC project manager use the results of the default 25 year ED evaluation given the potential for longer-term exposures if redevelopment is delayed, as well as the potential for reuse of current onsite buildings which is acknowledged in the document (e.g., Section 8.2.1 Future C/I Land Use). If the document does include an additional 10 year ED evaluation, the HI calculations need to be checked and updated as appropriate. Because noncancer inhalation exposures are averaged over the ED, this term does not appear to impact the inhalation hazard calculations.

iii. Current and Future C/I Scenarios. Sections 8 discusses the fact that the current area identified with a C/I risk greater than 1E-5 and HI exceeding one is in the area of a single soil gas well which is located in a hallway (with an approximately 20 foot ceiling) just inside the southeast entrance of Building 3. Ultimately, in Section 10, the submission recommends ICs to prevent residential

use, but vapor intrusion for current and future C/I scenarios appear to be dismissed based on: 1) the current site use, 2) short timeframe until transfer of Site 21 to the City of San Francisco, 3) uncertainty in the redevelopment activities, 4) the effect the activities may have on the vapor intrusion pathway, and 5) the Navy's preferred remedial action alternative for Site 21 (ICs) as presented in the 2011 Proposed Plan.

Based on the comments herein, HERO is concerned with the current recommendation. The maximum noncancer HI at Building 3 exceeds one, and only a single soil gas sampling event has occurred at this particular probe (February 2012). DTSC's 2011 vapor intrusion guidance states that when evaluating subslab soil gas for a building, permanent sampling points should be installed so that repeated sampling can be conducted, as necessary, to evaluate seasonal or temporal variations. At a minimum, two subslab sampling events are warranted before a final risk determination is made. Also, while the current submission only identified one location with a HI exceeding one, use of the DTSC default subslab attenuation factor could identify other areas as well.

We recommend discussion on the need for additional evaluation of this exposure pathway under the current and future C/I scenario in areas where significant VOC concentrations have been detected. This could potentially include additional soil gas monitoring, groundwater J&E modeling using current concentrations and toxicity criteria, and/or indoor air sampling. While we recognize that the HHRA Addendum focuses on soil gas only, given the presence of shallow groundwater, we would generally recommend that both soil gas and groundwater be considered for consistency with the multiple lines of evidence approach recommended in DTSC's vapor intrusion guidance.

13. Risk Drivers (Section 8.3).

a. The submission indicates that in 2007, the Navy made a risk management decision for Site 21 that for nonresidential receptors, COCs would be identified at those presenting a risk greater than 1E-5 or a chemical-specific HQ of 1. HERO defers to the DTSC Project Manager on this decision. We concur with the use of the 1E-06 for identifying residential COCs. (No response is needed.)

b. The text and Table 14 need to be updated to reflect the future C/I scenario COCs based on the existing buildings which may be reused under a future scenario. Currently, no COCs are listed.

SPECIFIC COMMENTS.

1. Section 1.1, bullet one appears to be missing the word "under." Please change the text to: "...hazards to human health associated with the inhalation pathway *under* current and hypothetical future conditions at Site 21."

2. Tables 3 and 4 present site-specific RBSLs for soil gas. For each contaminant and exposure scenario, two screening levels are presented and both columns are entitled "Carcinogenic Effects." Presumably, one set is based on carcinogenic effects and the other noncancer endpoints. Please update to columns to correct this error.

CONCLUSIONS

HERO has reviewed the Draft Human Health Risk Assessment Addendum for Installation Restoration Site 21, Naval Station Treasure Island, San Francisco, CA. HERO has identified several issues for which resolution is needed. In particular, HERO is concerned with the modification of DTSC's default subslab attenuation factor (0.05) which impacts the calculated subslab risk-based screening levels and the risk assessment results. While we acknowledge that the current results indicate a concern at only a portion of the site, HERO is concerned with the Recommendations and Conclusions which would allow for continued and future commercial / industrial land use despite the maximum cancer risks and noncancer hazard exceeding one. We recommend all issues identified herein be resolved, and the document updated as appropriate prior to making risk management decisions at the site. In particular, the need for additional evaluation of the indoor air pathway under a commercial / industrial scenario (e.g., indoor air sampling) is needed.

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