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EMAIL AND ATTACHED U S NAVY RESPONSE TO THE INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT COMMENTS ON THE DRAFT FINAL RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT SOLID WASTE MANAGEMENT UNIT 11 (SWMU 11) OLD STORAGE BUILDING B-225 NSA CRANE IN
08/18/2015
NAVFAC MID ATLANTIC

From:	Brent, Thomas CIV NAVFAC MIDLANT, PWD Crane
To:	GRIFFIN, DOUG
Cc:	Cole, Linda L CIV NAVFAC MIDLANT, IPTNE; Buel, Jennifer
Subject:	RE: SWMU 11 OSB B-225 RFI Report
Date:	Tuesday, August 18, 2015 9:46:58 AM
Attachments:	Responses to IDEM Comments on Draft Final SWMU 11 RFI_August 10 2015_wit....docx

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Doug,

Attached is the response to your comment on the Draft Final SWMU 11 RFI Report. The attachment also includes proposed changes made to the RFI report. Hopefully, the response and document changes satisfy your concerns. Please review and let us know if you have any further questions or comments.

Thanks,
Tom

-----Original Message-----
From: GRIFFIN, DOUG [mailto:DGRIFFIN@idem.IN.gov]
Sent: Wednesday, October 01, 2014 9:58 AM
To: Cole, Linda L CIV NAVFAC MIDLANT, IPTNE; Brent, Thomas CIV NAVFAC MIDLANT, PWD Crane
Subject: SWMU 11 OSB B-225 RFI Report

May 2015 RFI Report and proposal

The report uses Johnson-Ettinger modeling to dismiss concerns about vapor intrusion. Johnson-Ettinger modeling has not been accepted by IDEM for years and is no longer accepted by EPA. TCE concentrations in groundwater greater than 9.1 ppb for residential, or 38 ppb for industrial, require indoor air sampling (not very practical in this case) or an ERC that requires a vapor mitigation system.

The report recommends a CMS with an emphasis on MNA. This TCE contamination has been in place since at least 1976 and remains at high enough concentrations to represent a vapor intrusion concern. A plan for MNA will need to have a Plan B to take effect if the concentrations in groundwater don't attenuate to a preset goal within a reasonable time frame.

RESPONSE TO IDEM COMMENT DATED 10/1/2014
SWMU 11 DRAFT FINAL RFI REPORT
NSA CRANE, CRANE INDIANA

Comment: The report uses Johnson-Ettinger modeling to dismiss concerns about vapor intrusion. Johnson-Ettinger modeling has not been accepted by IDEM for years and is no longer accepted by EPA. TCE concentrations in groundwater greater than 9.1 ppb for residential, or 38 ppb for industrial, require indoor air sampling (not very practical in this case) or an ERC that requires a vapor mitigation system.

The report recommends a CMS with an emphasis on MNA. This TCE contamination has been in place since at least 1976 and remains at high enough concentrations to represent a vapor intrusion concern. A plan for MNA will need to have a Plan B to take effect if the concentrations in groundwater don't attenuate to a preset goal within a reasonable time frame.

Response: The vapor intrusion pathway will be retained as a future pathway of concern if land use changes such that a building is built over the former Building 225 location. The RFI Report text will be revised to recommend that this pathway proceed to a Corrective Measures Study (CMS) because 1) there are currently no buildings present at the site to evaluate indoor air concentrations 2) IDEM does not accept the use of the Johnson-Ettinger model to estimate indoor air concentrations, and 3) groundwater concentrations greater than the IDEM Vapor Exposure groundwater values have been detected at the site.

For the CMS Report, a statement will be included under the MNA alternative identifying that the Corrective Measures Implementation Plan (CMIP)/Quality Assurance Project Plan (QAPP) will identify preset goals for evaluating the long-term effectiveness of MNA to determine whether additional actions are required; the specific criteria to make these decisions will be identified in the CMIP/QAPP. Land use controls (LUCs) would prevent potential future exposure to unacceptable contamination at the site until the cleanup goals for the site are met.

The proposed modifications to the RFI Report text and tables based on this comment are attached to this response to comments.

EXECUTIVE SUMMARY

Tetra Tech, Inc. (Tetra Tech) prepared this Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report for Solid Waste Management Unit (SWMU) 11 - Old Storage Building, B~~-~~225 ~~(site)~~ at Naval Support Activity (NSA) Crane, located in Crane, Indiana. This report summarizes RFI activities, including sampling and analysis results and human health and ecological risks posed by chemicals detected in soil, sediment and groundwater at the site.

SITE DESCRIPTION AND HISTORY

The site is located near the western boundary of NSA Crane, approximately midway between the northern and southern boundaries of the facility. The site was formerly occupied by Building 225 which was used for storage of chemicals, paints, dyes, solvents, and various other items. The building was destroyed by fire on July 13, 1976.

The site covers approximately 1 acre. It currently contains the former Building 225 concrete floor slab (approximately ~~100~~ 60 feet wide and ~~350~~ 200 feet long) the former loading dock, a railroad siding spur parallel to the loading dock, and a drainage ditch between the railroad spur and the active railroad tracks to the west.

Contamination at SWMU 11 is the result of the release of stored chemicals and combustion products during the 1976 fire and the large quantities of water that were used to fight the fire. The water likely flushed chemicals directly onto the surface soil where it had migrated to subsurface soil and groundwater. Additionally, water runoff from fire fighting activities entered the drainage ditch on the west side of the site, flowed through a drainage pipe under the railroad tracks and then into a drainage channel approximately 200 feet west of the site. Additional areas that may have been affected by the release of chemicals during the fire include areas downwind of Building 225 and the Building 2981 Concrete Storage Tank Area where water from firefighting activities was temporally stored prior to proper disposal.

RFI SAMPLING AND ANALYSIS

Surface soil, subsurface soil, sediment and groundwater samples were collected during the RFI. Surface and subsurface soil samples were analyzed for volatile organic compounds (VOCs); semivolatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs); polychlorinated biphenyls (PCBs); pesticides; dioxins/furans; metals; and cyanide. Sediment samples were analyzed for SVOCs (including PAHs), PCBs, dioxins/furans, metals, cyanide, and total organic carbon. Groundwater was

analyzed for VOCs. During the RFI activities, a total of 28 surface soil, 83 subsurface soil, 10 sediment, and 11 groundwater samples were collected.

NATURE AND ~~/~~ EXTENT OF CONTAMINATION

While PAHs, pesticides, dioxin/furans and metals were detected in the surface soil at concentrations greater than human health or ecological project screening levels (PSLs), the most notable SWMU 11 contamination is the subsurface soil and the groundwater chlorinated VOC contamination. The subsurface soil contamination consists primarily of cis-1,2-dichloroethene (DCE), tetrachloroethene (PCE), trichloroethene (TCE), and the degradation product vinyl chloride (VC). The contamination was identified in the immediate vicinity of the Building 225 concrete slab and appears to have migrated to the west towards the railroad tracks and south of Building 2720. Low concentrations of chlorinated VOCs (cis-1,2-DCE and PCE) were detected in the surface soil below the Building 225 foundation; however, much greater concentrations are present in the subsurface soil demonstrating the downward migration tendency of this chemical class (i.e., halogenated aliphatics) in the environment.

The groundwater samples collected from the SWMU 11 monitoring wells show benzene and chlorinated VOC groundwater contamination. Only PCE and TCE were detected at concentrations greater than Federal Maximum Contaminant Levels (MCLs) for drinking water. Groundwater contamination was identified underneath the northern half of Building 225 slab and has migrated to the west/south west beyond the railroad tracks. The ground elevation decreases to the west and groundwater would be expected to be expressed as seeps before reaching the NSA Crane boundary. Decreases of chlorinated VOC concentrations would occur before the groundwater would be expressed as seeps. Additional decreases in chlorinated solvent concentrations would occur via volatilization once the groundwater seeps are exposed to air. Based on the analytical results from a deeper bedrock well installed underneath the Building 225 concrete slab, contamination has not migrated into the deeper groundwater. The subsurface soil concentrations for several of the chlorinated VOCs exceed their respected migration to groundwater values by at least an order of magnitude, indicating a potential continuing source of contamination to the groundwater. However, the presence of the degradation products cis-1,2-DCE and vinyl chloride shows that natural degradation is occurring.

HUMAN HEALTH RISK ASSESSMENT

An HHRA was conducted to estimate non-carcinogenic and carcinogenic risks [hazard index (HI) and incremental lifetime cancer risk (ILCR), respectively] for potential human receptors posed by the chemicals of potential concern (COPCs) in soil, sediment and groundwater at the site. A summary of risks for all receptors under current and future land use scenarios are presented on Table ES-1. Human health risk

under current land use was found to be acceptable. However, potential unacceptable human health risks for hypothetical future residents were identified associated with direct contact exposure to VOCs in groundwater (cis-~~,~~1,2-DCE, benzene, TCE and VC) as a result of using groundwater as a potable water supply.

Although no chemicals of concern (COCs) were identified for vapor intrusion from groundwater based on estimated indoor air concentrations using the Johnson-Ettinger model, TCE concentrations in groundwater under the Building 225 floor slab were greater than Indiana Department of Environmental Management (IDEM) Vapor Exposure groundwater screening levels. Therefore, potential future unacceptable risks were identified for the groundwater to indoor air pathway (i.e., vapor intrusion) for a future residential and commercial/industrial scenario. ~~. No unacceptable risks were identified for the groundwater to indoor air pathway (i.e., vapor intrusion).~~

Evaluation of the migration from soil to groundwater showed that benzene, cis-1,2-DCE, PCE, TCE, and VC in subsurface soil could represent a source of groundwater contamination. Arsenic and iron were also retained as COCs for the soil to groundwater pathway at SWMU 11 because of exceedance of soil to groundwater migration screening levels and groundwater data are not available to confirm whether migration has occurred.

ECOLOGICAL RISK ASSESSMENT

The ERA evaluated surface soil and sediment to determine the potential for adverse ecological impacts due to site-related contamination. No unacceptable risks for ecological receptors were identified, as summarized on Table ES-1.

CONCLUSIONS AND RECOMMENDATIONS

A summary of the receptor-specific human health risks and hazards, ecological risks, critical exposure pathways and COCs, and recommendations for SWMU 11 is presented in Table ES-1. In addition to COCs identified based on the risk assessments, PCE is also identified as a COC for groundwater because detected concentrations of PCE in groundwater exceeded the MCL. Based on the results of the RFI activities, this report recommends that the site proceed to a ~~focused~~ Corrective Measures Study (CMS) to address future unacceptable human health risks from ingestion of groundwater contaminated with chlorinated organics and the vapor intrusion pathway as identified in the HHRA. The CMS should focus on monitored natural attenuation of chlorinated organics in groundwater with land use controls to address potential future unacceptable risks. An active groundwater treatment action is not necessary because there are no current potential or likely future exposures to contaminated groundwater based on

current site use. Concentrations of VOCs and metals (arsenic and iron) in soil~~s~~ exceed IDEM soil screening levels for protection of groundwater; however, metals in groundwater were not analyzed in SWMU 11 monitoring wells. Therefore, the CMS should also provide for sampling to verify whether ~~metals~~ arsenic and iron are present in SWMU 11 groundwater at concentrations greater than MCLs or facility background.

TABLE ES-1

SUMMARY OF RECEPTOR-SPECIFIC HUMAN RISKS AND HAZARDS, ECOLOGICAL RISKS, AND RECOMMENDATIONS
SWMU 11 - OLD STORAGE BUILDING 225
NSA CRANE
CRANE, INDIANA

Receptor Population	Overall Carcinogenic Risk (Human)	Overall Hazard Index (Human)	Overall Risk (Ecological)	Critical Pathways and Chemicals of Concern	Recommendations
SWMU 11 SURFACE SOIL - BUILDING 225 AREA					
Current/Future Maintenance Worker (Adult)	1E-07	0.006	N/A	N/A	NFA
Current/Future Industrial Worker	1E-06	0.06	N/A	N/A	NFA
Current/Future Trespasser (Adolescent)	2E-07	0.01	N/A	N/A	NFA
Current/Future Construction Worker	8E-08	0.5	N/A	N/A	NFA
Future Child Recreational User	1E-06	0.06	N/A	N/A	NFA
Future Adult Recreational User	3E-07	0.007	N/A	N/A	NFA
Lifelong Recreational User	1E-06	N/A	N/A	N/A	NFA
Future Child Resident	1E-05	0.8	N/A	N/A	NFA
Future Adult Resident	2E-06	0.09	N/A	N/A	NFA
Lifelong Resident	1E-05	N/A	N/A	N/A	NFA
Terrestrial Plants	N/A	N/A	Acceptable	N/A	NFA
Terrestrial Invertebrates	N/A	N/A	Acceptable	N/A	NFA
Mammals and Birds	N/A	N/A	Acceptable	N/A	NFA
SWMU 11 SURFACE SOIL - BUILDING 2981 CONCRETE TANK AREA					
Current/Future Maintenance Worker (Adult)	9E-08	0.005	N/A	N/A	NFA
Current/Future Industrial Worker	9E-07	0.06	N/A	N/A	NFA
Current/Future Trespasser (Adolescent)	2E-07	0.01	N/A	N/A	NFA
Current/Future Construction Worker	6E-08	0.4	N/A	N/A	NFA
Future Child Recreational User	1E-06	0.05	N/A	N/A	NFA
Future Adult Recreational User	2E-07	0.006	N/A	N/A	NFA
Lifelong Recreational User	1E-06	N/A	N/A	N/A	NFA
Future Child Resident	1E-05	0.7	N/A	N/A	NFA
Future Adult Resident	2E-06	0.08	N/A	N/A	NFA
Lifelong Resident	1E-05	N/A	N/A	N/A	NFA
Terrestrial Plants	N/A	N/A	Acceptable	N/A	NFA
Terrestrial Invertebrates	N/A	N/A	Acceptable	N/A	NFA
Mammals and Birds	N/A	N/A	Acceptable	N/A	NFA

TABLE ES-1

SUMMARY OF RECEPTOR-SPECIFIC HUMAN RISKS AND HAZARDS, ECOLOGICAL RISKS, AND RECOMMENDATIONS
SWMU 11 - OLD STORAGE BUILDING 225
NSA CRANE
CRANE, INDIANA

Receptor Population	Overall Carcinogenic Risk (Human)	Overall Hazard Index (Human)	Overall Risk (Ecological)	Critical Pathways and Chemicals of Concern	Recommendations
SWMU 11 - SUBSURFACE SOIL					
Current/Future Maintenance Worker	2E-06	0.02	N/A	N/A	NFA
Current/Future Industrial Worker	2E-05	0.2	N/A	N/A	NFA
Current/Future Trespasser (Adolescent)	4E-06	0.03	N/A	N/A	NFA
Current/Future Construction Worker	1E-05	0.6	N/A	N/A	NFA
Future Child Recreational User	2E-05	0.2	N/A	N/A	NFA
Future Adult Recreational User	4E-06	0.02	N/A	N/A	NFA
Lifelong Recreational User	2E-05	N/A	N/A	N/A	NFA
Future Child Resident	2E-04 (3E-05)[2]	3[1] (2)[1,2]	N/A	Incidental ingestion and dermal contact with VC, arsenic, and chromium	NFA[3]
Future Adult Resident	5E-05	0.4	N/A	N/A	NFA
Lifelong Resident	3E-04 (4E-05)[2]	N/A	N/A	Incidental ingestion and dermal contact with VC, arsenic, and chromium	NFA[3]
Terrestrial Plants	N/A	N/A	N/A	N/A	N/A
Terrestrial Invertebrates	N/A	N/A	N/A	N/A	N/A
Mammals and Birds	N/A	N/A	N/A	N/A	N/A
SWMU 11 SEDIMENT					
Current/Future Trespasser (Adolescent)	4E-06	0.03	N/A	N/A	NFA
Future Child Recreational User	2E-05	0.1	N/A	N/A	NFA
Future Adult Recreational User	4E-06	0.02	N/A	N/A	NFA
Lifelong Recreational User	3E-05	N/A	N/A	N/A	NFA
Sediment Invertebrates	N/A	N/A	Acceptable	N/A	NFA
Mammals and Birds	N/A	N/A	Acceptable	N/A	NFA

TABLE ES-1

SUMMARY OF RECEPTOR-SPECIFIC HUMAN RISKS AND HAZARDS, ECOLOGICAL RISKS, AND RECOMMENDATIONS
SWMU 11 - OLD STORAGE BUILDING 225
NSA CRANE
CRANE, INDIANA

Receptor Population	Overall Carcinogenic Risk (Human)	Overall Hazard Index (Human)	Overall Risk (Ecological)	Critical Pathways and Chemicals of Concern	Recommendations
SWMU 11 GROUNDWATER					
Current/Future Construction Worker)	7E-08	0.2	N/A	N/A	NFA
Future Child Resident	1E-04	22	N/A	Incidental ingestion, dermal contact, and inhalation of TCE and cis-1,2-DCE and PCE based on MCL exceedance	Proceed to CMS
Future Adult Resident	9E-05	12	N/A	Incidental ingestion, dermal contact, and inhalation of TCE and cis-1,2-DCE and PCE based on MCL exceedance	Proceed to CMS
Lifelong Resident	2E-04	N/A	N/A	Incidental ingestion, dermal contact, and inhalation of benzene, TCE, and VC and PCE based on MCL exceedance	Proceed to CMS
SWMU 11 VAPOR INTRUSION					
Future Child Resident	1E-06	0.2	N/A	Inhalation of indoor air of TCE based on groundwater ~~exceedence~~exceedance of screening levels	Proceed to CMS[4]
Future Adult Resident	5E-07	0.2	N/A		
Future Lifelong Resident	2E-06	N/A	N/A		
Future ~~Commerical~~Commercial/Industrial Worker	N/A	N/A	N/A		
SWMU 11 SOIL TO GROUNDWATER PATHWAY					
Future Drinking Water Protection	N/A	N/A	N/A	Subsurface soil migration to groundwater; benzene, cis-1,2-DCE, PCE, TCE, and VC	Proceed to CMS[5]
Future Drinking Water Protection	N/A	N/A	N/A	Subsurface soil migration to groundwater; arsenic and iron	Proceed to CMS[6]

cis-1,2-DCE - cis-1,2-Dichloroethene
MCL - Maximum Contaminant Level
PCE - Tetrachloroethene
VC - Vinyl chloride
CMS - Corrective Measures Study
NFA - No Further Action
TCE - Trichloroethene.
N/A - Not Applicable. Risk were not calculated for the specified receptor/exposure pathway or the calculated risks were acceptable.

Hazard Indices (i.e., child + adult) are not summed for 'Lifelong' receptors because according to United States Environmental Protection Agency (USEPA) risk assessment guidance, it is not correct to sum noncancer risks for child and adult receptors.

1 - Target organs hazard index is less than 1.
2 - Chromium was evaluated in the human health risk assessment as hexavalent chromium. Value in parenthesis is cancer risk or hazard index if chromium is evaluated as trivalent chromium.
3 - NFA recommendation based on risks and HIs using trivalent chromium. The conceptual site model (CSM) does not support the presence of chromium in the hexavalent state.
4 - Recommendation based on site groundwater with concentrations greater than Indiana Department of Environmental Management (IDEM) Vapor Exposure Screening Levels for groundwater under future land use scenario (as per IDEM comments date 10/1/2014).
5 - Recommendation based on possibility that these chemicals are a continuing source of groundwater contamination.
6 - Recommendation to sample groundwater for arsenic and iron as part of CMS activities because of exceedances of the soil to groundwater migration screening levels for these chemicals in subsurface soil and groundwater data are not available to confirm whether migration occurred.

noncancer risks for several substances across different exposure pathways. This assumes that each substance has a similar effect and/or mode of action. Even when compounds affect the same target organs, they may have different mechanisms of action or differ in their fate in the body, so additivity may not have been an appropriate assumption. However, the assumption of additivity was considered acceptable because in most cases it represented a conservative estimate of risk.

Risks to any individual may also have been overestimated by summing multiple assumed exposure pathway risks for any single receptor. Although every effort was made to develop reasonable scenarios, not all individual receptors may have been exposed via all pathways considered.

Also, the risk characterization did not consider antagonistic or synergistic effects. Little or no information was available to determine the potential for antagonism or synergism for the COPCs. Because chemical-specific interactions could not be predicted, the likelihood for risks to be over predicted or under predicted could not be defined, but the methodology used was based on current USEPA guidance.

7.7 SUMMARY AND CONCLUSIONS

This section summarizes the results of the baseline HHRA for SWMU 11 which was performed to characterize the potential risks to likely human receptors under current and potential future land use. Potential receptors evaluated in the HHRA under current land use include maintenance workers, industrial workers, construction works, and adolescent trespassers. Potential receptors evaluated under a future land use include child and adult recreational users, and hypothetical child and adult residents. Although future land use is likely to be the same as current land use, the potential future receptors were evaluated in the baseline HHRA primarily for decision-making purposes.

The selected COPCs at SWMU 11 that were retained for further evaluation in the HHRA are summarized in Table 7-10. Quantitative estimates of noncarcinogenic hazards and carcinogenic risks (HIs and ILCRs, respectively) were developed for potential human receptors. When grouped by target organ, HIs for all receptors were less than or equal to unity (1) for exposures to surface soil, subsurface soil, and sediment at SWMU 11, indicating that adverse non-carcinogenic effects are not anticipated for receptors exposed to these environmental media under the defined exposure conditions. The HI for the construction worker exposed to groundwater during excavation work was less than 1 and the RME and CTE HIs for the hypothetical child resident and the adult resident exposed to groundwater, assuming it is used for domestic purposes, exceeded one. Under these groundwater use conditions, cis-1,2-DCE and TCE were the major contributors to the HIs under the RME scenario and TCE was the major contributor to the HIs under the CTE scenario.

ILCRs for all receptors exposed to surface soil and sediment at SWMU 11 under the RME and CTE scenarios were less than or within USEPA's and IDEM's target risk range of 10^{-4} to 10^{-6}.

ILCRs for all receptors exposed to subsurface soil under the RME scenario were less than or within USEPA's and IDEM's target risk range of 10^{-4} to 10^{-6} with the exception of the hypothetical child and lifelong resident. Vinyl chloride, arsenic, and hexavalent chromium were the major contributors to the ILCRs for exposures to subsurface soil. Chromium speciation was not performed on the subsurface soil samples; therefore, chromium was initially evaluated as hexavalent chromium. However, because the CSM does not support the presence of hexavalent chromium at the site, risks associated with trivalent chromium were also completed in this HHRA. If chromium is evaluated as trivalent chromium, then all ILCRs are within USEPA's and IDEM's target risk levels. ILCRs for all receptors exposed to subsurface soil under the CTE scenario were less than or within USEPA's and IDEM's target risk range.

ILCRs for construction workers and hypothetical adult residents exposed to groundwater under the RME scenario were less than or within USEPA's and IDEM's target risk range. The ILCR for hypothetical child residents was equal to the upper bound of USEPA's and IDEM's target risk range. The ILCR for hypothetical lifelong residents exceeded USEPA's and IDEM's target risk range. Benzene, TCE, and VC were the major contributors to the ILCR for hypothetical lifelong residents exposed to groundwater. ILCRs for all receptors exposed to groundwater under the CTE scenario were less than or within USEPA's and IDEM's target risk range.

At the Building 2981 Concrete Tank Area, HIs for all receptors exposed to surface soil under the RME and CTE scenarios were less than unity (1), indicating that adverse non-carcinogenic effects are not anticipated for these receptors under the defined exposure conditions. ILCRs for all receptors exposed to surface soil at IA 6 under the RME and CTE scenarios were less than or within USEPA's and IDEM's target risk range of 10^{-4} to 10^{-6}.

Based on the results of this HHRA, no COCs were identified for surface soil and sediment. VC, arsenic, and chromium were identified as COCs for direct contact with subsurface soil only if it is assumed that chromium is present in the hexavalent form. Based on the CSM for the site, chromium is expected to be present in the trivalent state and no direct contact COCs are identified for the subsurface soils when chromium is present in the trivalent form. Benzene, cis-1,2-DCE, and VC were identified as COCs for direct contact with groundwater (Table 7-27). While no ~~No~~ COCs were identified for vapor intrusion from groundwater based on estimated indoor air concentrations using the Johnson-Ettinger model, TCE in groundwater was retained as a COC for the groundwater to indoor air pathway because the site groundwater concentrations under the Building 225 slab were greater than the IDEM Vapor Exposure

Screening Levels for residential and commercial/industrial scenarios. IDEM does not accept the use of modeling to dismiss concerns regarding vapor intrusion (see Appendix I).. -

A qualitative analysis was completed to identify COCs for the migration to groundwater pathway (Table 7-28). While Tables 7-4 and 7-6 use the risk-based SSL to determine COPCs, these risk-based numbers are based on soil-to-groundwater prediction models designed to be conservative and typically over predict the extent of future groundwater impacts. For the qualitative evaluation of the soil to groundwater migration pathway, a multiple lines of evidence approach was used to identify chemicals that may migrate from the soil to groundwater in sufficient quantities to pose groundwater quality problems and these chemicals are retained as COCs for the soil to groundwater pathway. The multiple lines of evidence approach evaluated chemicals with consideration given to the following: exceedances of risk-based SSLs verses MCL-based SSLs (if available), frequency of detections/exceedances, magnitude of exceedances, background concentrations, chemical properties, and groundwater concentrations (when available.). As presented on Table 7-28, benzene, cis-1,2-DCE, PCE, TCE, and VC were retained as COCs for the soil to groundwater pathway at SWMU 11 because subsurface soil concentrations could represent a source of groundwater contamination (VOCs). Arsenic and iron were retained as COCs for the soil to groundwater pathway at SWMW 11 because of exceedance of soil to groundwater migration screening levels and groundwater data ~~is~~ are not available to confirm whether migration has occurred.

TABLE 7-27

CHEMICALS RETAINED AS CHEMICALS OF CONCERN FOR DIRECT CONTACT EXPOSURES
SWMU 11 - OLD STORAGE BUILDING 225
NSA CRANE
CRANE, INDIANA

Chemical	Receptor									
	Construction Workers	Industrial Workers	Maintenance Workers	Adolescent Trespassers	Child Recreational Users	Adult Recreational Users	Lifelong Recreational Users	Child Residents	Adult Residents	Lifelong Residents
Surface Soil										
No COCs identified for surface soil.										
Subsurface Soil										
Arsenic								X(1)		X(1)
Chromium								X(1)		X(1)
Vinyl Chloride								X(1)		X(1)
Groundwater - Direct Contact(2)										
Benzene										X
cis-1,2-Dichlroethene								X	X	
Trichloroethene								X	X	X
Vinyl Chloride										X
Groundwater - Vapor Intrusion(3)										
No COCs identified for vapor intrusion based on Johnson-Ettinger model; trichloroethene was retained as a COC based on groundwater screening level exceedance										
Sediment										
No COCs identified for sediment.										

X - Chemical is retained as a chemical of concern (COC).
A chemical is retained as a COC if it contributed to a total cancer risk greater than 1×10^{-4} or to a target organ hazard index greater than 1.
1 - Chemicals are only COCs if chromium is evaluated as hexavalent chromium. If chromium is evaluated as trivalent chromium than total cancer risk is less than 1×10^{-4}.
2 - Tetrachloroethene was not identified as contributing to direct contract risk; however, it is also a COC for ~~groundwtaer~~groundwater based on Maximum Contaminant Level (MCL) exceedances.
~~2~~3 ~~3~~ - Site groundwater concentrations of trichloroethene under Building 225 were greater than the Indiana Department of ~~Enviornmental~~Environmental Management (IDEM) Vapor Exposure Screening Levels for residential and commercial/industrial scenarios.

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9.0 CONCLUSIONS AND RECOMMENDATIONS

The RFI identified subsurface soil and groundwater contamination at SWMU 11 as a result of the 1976 Building 225 fire. The subsurface soil contamination consists primarily of chlorinated VOCs. The subsurface contamination was identified in the immediate vicinity of the Building 225 concrete slab and chlorinated VOC contamination appears to have migrated to the west towards the railroad tracks and south of Building 2720.

An HHRA and ERA were completed to evaluate potential risks associated the contamination at SWMU 11. Human health risk under current land use was found to be acceptable; however, potential unacceptable human health risks for hypothetical future residents were identified associated with direct contact exposure (i.e. potable water use) to VOCs in groundwater (cis-1,2-DCE, benzene, TCE and VC). There were no unacceptable risks identified for vapor intrusion from groundwater based on estimated indoor air concentrations using the Johnson-Ettinger model. Potential unacceptable risks were ~~also~~ identified for the groundwater to indoor air pathway (i.e., vapor intrusion) for TCE under a future residential and commercial/industrial scenario based on a comparison of groundwater concentrations to IDEM Vapor Exposure groundwater screening levels; IDEM does not accept the use of modeling (i.e., Johnson-Ettinger model) to dismiss concerns regarding vapor intrusion. Evaluation of the migration from soil to groundwater showed that benzene, cis-1,2-DCE, PCE, TCE, and VC in subsurface soil could represent a source of groundwater contamination. Arsenic and iron were also retained as COCs for the soil to groundwater pathway at SWMU 11 because of exceedance of soil to groundwater migration screening levels and groundwater data are not available to confirm whether migration has occurred. ~~No unacceptable risks were identified for the groundwater to indoor air pathway (i.e., vapor intrusion).~~ The ERA evaluated surface soil and sediment to determine the potential for adverse ecological impacts due to site-related contamination. No unacceptable risks for ecological receptors were identified.

A summary of the receptor-specific human health risks and hazards, ecological risks, critical exposure pathways and COCs, and recommendations for SWMU 11 is presented in Table ES-1. In addition to COCs identified based on the risk assessments, PCE is also identified as a COC for groundwater because detected concentrations of PCE in groundwater exceeded the MCL.

Based on the results of the RFI activities, it is recommended that the site proceed to a focused CMS to address future unacceptable human health risks from ingestion of groundwater contaminated with chlorinated organics and the vapor intrusion pathway as identified in the HHRA. The CMS should focus on monitored natural attenuation of chlorinated organics in groundwater with land use controls to address potential future unacceptable risks. An active groundwater treatment action is not necessary because

there are no current potential or likely future exposure to contaminated groundwater based on current site use. Concentrations of VOCs and metals (arsenic and iron) in soil~~s~~ exceed IDEM soil screening levels for protection of groundwater; however, metals in groundwater were not analyzed in SWMU 11 monitoring wells. Therefore, the CMS should also provide for sampling to verify whether ~~metals~~ arsenic and iron are present in SWMU 11 groundwater at concentrations greater than MCLs or facility background.