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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:
DW-8J

March 19, 2003

Mr. Tom Brent
Naval Surface Warfare Center
EPD, Code 095 B-3260
300 Highway 361
Crane, IN 47522-5001

Re: U.S. EPA Comments on SWMU#3
Old Jeep Trail/Little Sulphur Creek
Dated November 2002

Dear Mr. Brent:

The United States Environmental Protection Agency (U.S. EPA) has reviewed the RFI report for Solid Waste Management Unit (SWMU) #3 - Old Jeep Trail/Little Sulphur Creek dated November 2002.

Comments on this report are attached. Please revise the report to address these comments.

If you have any questions regarding this matter, please contact me at (312) 886-7890.

Sincerely,

Peter Ramanauskas
Environmental Engineer
WMB, Corrective Action Section

Enclosure

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cc:	Core Team Members:	Bill Gates, SOUTHDIV (w/ encls) Doug Griffin, IDEM (w/ encls)
	Project Team Members:	Allen Debus, U.S. EPA (w/ encls) Mario Mangino, U.S. EPA (w/ encls) Dan Mazur, U.S. EPA (w/ encls)

COMMENTS ON THE RFI REPORT FOR SWMU 3 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK DATED NOVEMBER 2002 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA

GENERAL COMMENTS

Comment 1:

The Solid Waste Management Unit (SWMU) 3 RCRA Facility Investigation (RFI) Report, dated November 2002 (RFI Report) is not complete with respect to the proposed groundwater investigation, when compared with the approved Quality Assurance Project Plan for Ammunition Burning Grounds Little Sulphur Creek and Jeep Trail Phase III RCRA Facility Investigation, dated April 2001 (QAPP). Section 4.0 of the QAPP contains the Sampling and Analysis Plan (SAP) for the RFI, and Section 4.4.2 describes the locations, analyses, and rationale for groundwater sampling.

In the QAPP, thirteen new wells were proposed for installation depending upon the results of the first round of sampling at existing wells. These included:

- two shallow source wells (03MWT01 and 03MWT02) at the Burn Area and Burn Pit;
- seven shallow perimeter wells (03MWT03 through 03MWT09) downgradient and beyond the existing monitoring network;
- one deep upgradient monitoring well (03MWT10); and
- three deep vertical extent wells (03MWT11 through 03MWT13) located in the area of existing wells 03-12, 03-07, and 03-24, respectively.

It is apparent from the analytical results of the existing monitoring well network that the above new wells are necessary to fully evaluate the nature and extent of contamination at SWMU 3. Section 5.3 of the RFI Report outlines the nature and extent of groundwater contamination, based on the samples collected from the 15 previously existing wells at the unit. As depicted in Figures 5-5 and 5-6 of the RFI Report, nearly all existing wells sampled yielded organic and inorganic analytical results above health-based standards. The following are examples of results indicating the need for further groundwater characterization:

- The maximum chlorinated solvent concentrations were found in existing well 03-07, indicating the need for further characterization with depth as proposed for well 03MWT11.
- Polynuclear aromatic hydrocarbons (PAHs) and energetics were found in the greatest concentrations in subsurface soil samples near the Burn Area and Burn Pit, where no monitoring wells exist, but where wells 03MWT01 and 03MWT02 were proposed.

- Section 5.8 indicates that groundwater concentrations of RDX exceeding chemical of potential concern (COPC) levels extend to the site boundary, indicating the need for wells beyond the existing monitoring network.
- Upgradient well 03-16 had the highest levels of RDX, indicating the need for the upgradient monitoring well (03MWTT10) to determine the upgradient concentration at greater depth.
- Soil borings 03SB24 and 03SB48 showed the greatest metal concentrations of the investigation. These are located near proposed wells 03MWT02 and 03MWT12, respectively.

Revise the RFI Report to address these concerns regarding the incomplete characterization of groundwater at the unit.

SPECIFIC COMMENTS

Comment 1:

Section 2.5.4, Sediment Sampling. A comparison of Figure 1-7 from the RFI Report and Figure 4-1 from the QAPP indicates that sediment sampling location 03SD10 was collected approximately 100 feet upstream from the proposed sample location. Provide the rationale for this deviation from the QAPP.

Comment 2:

Section 5.2, Subsurface Soil, Energetics. The RFI Report indicates that the vertical extent of contamination has not been determined at soil boring 03SB24 and that the deep sample within this boring exceeded COPC screening levels. Since analytical results above COPC screening levels have been found in the deepest soil interval, further deep soil sampling in and around the area of this boring is warranted. Revise the RFI Report to address this issue.

Comment 3:

Section 5.2, Subsurface Soil, Dioxins and Furans. Dioxin and furan sampling and analysis was restricted to only two soil borings at the north and south end of the Burn Pit (03SB19 and 03SB24). These borings yielded positive results for isomers of both dioxins and furans. Therefore, the extent of contamination cannot be determined and is so stated in this section. Based on the apparent subsurface hotspot in the area of monitoring well 03-07 and soil borings 03SB46 through 03SB48, it is suggested that further dioxin and furan sampling and analysis be conducted in this area and in an expanded area around 03SB19 and 03SB24. Revise the RFI Report to address this issue.

Comment 4:

Section 6.3.2, Migration of Ground Water Contaminants to Little Sulphur Creek. This section states that the groundwater in the contaminated area around monitoring well 03-07 flows to the northeast, and refers to Figures 1-19 and 1-20. However, according to these figures, it appears that the area around this monitoring well could potentially be a groundwater recharge area to which groundwater flows not only in a northeastern direction, but also in southeastern, southern, and southwestern directions. Decreasing contamination from the well 03-07 area not only goes in a northeastern direction towards wells 03-15 and 03-24, but also in a southwestern direction toward well 03-12, where contamination was also found. Because of these apparent other directions of groundwater flow, the model of groundwater volatile organic contamination flowing to the northeast, entering the eastern karst conduit, and flowing south toward Spring C (discussed in Section 6.3.2) appears to be incomplete. Revise the RFI Report to address the flow of volatile organic contaminants (VOCs) in these other directions, particularly toward the west and the western karst conduit.

DATA QUALITY COMMENTS

GENERAL COMMENT

Comment 1:

The data quality section provides mean quality control (QC) results. The observed QC range is also reported in some cases. However, when no outliers are discussed it is unclear if all individual associated QC results were acceptable. Clarify if the range represents individual QC results or mean results. If the range applies to mean results, clarify if outliers were detected in cases where only the mean was presented. In addition, clarify if mean or individual QC results have been considered when qualifying the data.

SPECIFIC COMMENT

Comment 1:

Table 3-4, Solid and Aqueous Minimum and Maximum Detection Limits Versus RBTLs and EDQLs. This table indicates that minimum and maximum detection limits (DLs) that exceed laboratory method detection limits/instrument detection limits (MDLs/IDLs) are highlighted. However, it appears that not all values exceeding the MDL/IDL are highlighted. For example, acetone lists the observed maximum DL as 26.00 µg/L. The laboratory MDL/IDL is 0.5 µg/L, but the DL value is not highlighted. In addition, it appears that the trichloroethene observed maximum DL of 1.6 µg/L exceeds the laboratory MDL/IDL of 0.5 µg/L, but the maximum detection limit is not highlighted. Also, Page 1 of Table 3-4 indicates that the observed minimum DL for arsenic was 2.8 µg/L and the observed maximum DL was 1.00 µg/L. It appears that these limits were erroneously reported. Revise the table to ensure that it is

correctly highlighted, and clarify the arsenic minimum and maximum IDL/MDL.

MINOR COMMENT

Comment 1:

Table 3-5, Soil and Sediment Percent Qualification Rates, Qualifier Code Definitions. This section defines the qualifier code "U" as pesticide/polychlorinated biphenyl (PCB) percent difference between columns for positive results. However, it appears that "U" was also used to qualify explosives and herbicides results. Revise the definitions to clarify the qualifier codes for explosives and herbicides.

HUMAN HEALTH RISK ASSESSMENT COMMENTS

SPECIFIC COMMENTS

Comment 1:

Executive Summary (Page ES-4). The third and fourth bullet points in this section describe risks to potential future receptors that exceed a target risk of 10^{-4}or a target hazard index of 1.0. However, risks which fall within the National Contingency Plan (NCP) risk range of 10^{-6} to 10^{-4} are not discussed. From the Administrative Authority's perspective, acceptability of risk levels which fall within the NCP's relative risk range is based on the consideration of the inherent degree of conservatism and level of associated uncertainty in the quantitative point estimates of risk, and must be approved by U.S. EPA Region 5 on a case-by-case basis. All estimates of risk which exceed U.S. EPA's lower bound point of departure (10^{-6}) should be presented in summary sections of the risk assessment. Revise the Executive Summary to include a discussion regarding risks within the NCP risk range at SWMU 3.

Comment 2:

Table ES-1, Summary of Receptor-Specific Human Risks, and Hazards and Ecological Risks, and Recommendations. Although it is stated in the Executive Summary that current exposure scenarios do not result in any adverse risk or hazard, Table ES-1 indicates that current risks to an off-site resident receptor fall within the NCP risk range (9E-06 and 1E-05 for a child and adult residential receptor, respectively). Based on a comparison of the text and tables, it appears that risks that fall within the NCP risk range are not considered to be adverse, and therefore do not indicate a need for remedial action. It is the decision of U.S. EPA Region 5 to determine whether risks to receptors at SWMU 3 that fall within the NCP risk range are acceptable. Replace statements in the RFI report regarding the acceptability of risks that fall within the NCP risk range with something similar to "risk range for which remedial actions are not usually performed."

Comment 3:

Section 4.2, Selection of Human Health Risk Chemicals of Potential Concern. Constituents were selected as COPCs if detected concentrations were greater than screening levels and also exceeded background concentrations. However, U.S. EPA policy no longer supports excluding COPCs from the risk assessment based on a comparison to background conditions (*Role of Background in the CERCLA Cleanup Program*; OSWER 9285.6-07P; April 26, 2002). This OSWER directive recommends that naturally-occurring analytes present at concentrations that exceed risk-based criteria should be carried forward into the quantitative estimates of risk and hazard. In particular, the Directive states: "*...This approach involves addressing site-specific background issues at the end of the risk assessment, in the risk characterization. Specifically, the COPCs with high background concentrations should be discussed in the risk characterization, and if data are available, the contribution of background to site concentrations should be distinguished. COPCs that have both release-related and background-related sources should be included in the risk assessment. When concentrations of naturally occurring elements at a site exceed risk-based screening levels, that information should be discussed qualitatively in the risk characterization.*"

EPA-Region 5 recognizes that NSWC Crane has conducted a site-wide sampling program to establish site-specific background data on the presence of naturally-occurring inorganic constituents (i.e., metals). Consequently, the risk assessment for SWMU 3 should be revised to provide a qualitative discussion (in the risk characterization section) which identifies any constituents that exceed risk-based screening levels but were eliminated from the risk assessment based on comparison to site-specific background levels.

Comment 4:

Section 4.2.1, Lead as a COPC. Contrary to what is stated in the text, the screening levels for lead in soil (e.g., the Region 9 Preliminary Remediation Goal [PRG]) do represent risk-based screening levels. They are calculated on the basis of not exceeding a 10 microgram per deciliter (ug/dL) blood-lead concentration, which represents the level above which adverse health effects are known to occur. Revise the human health risk assessment (HHRA) to correct this error.

Comment 5:

Section 7.3.1.3, Potential Current and Future Receptors of Concern and Exposure Pathways. It is stated under the first bullet point of this section on page 7-5 that hunting activities are permitted at the base. However, it does not appear that potential exposure to contaminants through ingestion of game species has been considered in the risk assessment. At a minimum, this pathway should be qualitatively evaluated, to ensure that all potential exposure pathways have been addressed, especially in consideration of contaminants which have the capacity to bioaccumulate, bioconcentrate and biomagnify within the food chain. Revise the risk assessment to include an evaluation of potential exposure through food obtained while hunting in the vicinity of SWMU 3.

Comment 6:

Section 7.5.2.1, Noncarcinogenic Risks - RME. The second to last paragraph of this section on page 7-27 discusses the noncarcinogenic risks calculated for a future on-site child resident and future on-site adult resident. The hazard indices (HI) for these two receptors were greater than the target hazard index of 1. It is stated that the highest detected concentrations of 2,4,6-trinitrotoluene and RDX (the risk drivers for this receptor population) occurred in two samples, and that if these two samples were to be removed from the dataset, then HIs for the future on-site child and adult resident would be within "acceptable levels." It is not clear, based on this statement, whether estimates of noncarcinogenic hazard will be used as generated in this risk assessment, or whether HIs will be recalculated using a limited dataset. Revise the risk assessment to clarify whether estimates of noncarcinogenic hazard presented in this document will be used, or whether they will be recalculated.
It is also not clear how the dataset will be limited if estimates of noncarcinogenic hazard are recalculated. Specifically, it is not clear whether the areas of contamination identified by these two samples will be remediated, or whether the samples will be identified as statistical outliers, and removed from the dataset without removing the potential area of contamination. If estimates of noncarcinogenic hazard are recalculated, provide an explanation of how the samples in question are "removed from the dataset" as stated in the current version of the risk assessment.

Comment 7:

Section 7.5.2.2, Carcinogenic Risks - RME. This section discusses the estimates of risk for all receptors based on the Reasonable Maximum Exposure (RME). It is stated in the first paragraph of this section that cumulative lifetime incremental cancer risk (LICR) for the adolescent trespasser, off-site child and adult residents, construction worker, maintenance worker, and child and adult recreational users were "less than or within U.S. EPA's target risk range." However, the only risks discussed in the subsequent text are those that exceed the upper bound target risk of 10^{-4} (occupational worker). It appears that estimates of risk that fall within the risk range of 10^{-6} to 10^{-4} are not considered to be adverse. As discussed above, it is the decision of U.S. EPA Region 5 to determine whether risks to receptor populations at SWMU 3 that fall within the NCP risk range are acceptable, and these risks should therefore be discussed within the risk assessment. Revise the risk assessment to incorporate this change.

Comment 8:

Section 7.5.2.2, Carcinogenic Risks - RME. The second paragraph of this section on page 7-28 discusses the carcinogenic risks calculated for a future on-site lifelong resident. The incremental lifetime cancer risk (ILCR) for this receptor is greater than the upper bound target risk of 10^{-4}. It is stated that the highest detected concentrations of 2,4,6-trinitrotoluene and RDX (the risk drivers for this receptor population) occurred in two samples, and that if these two samples were to be removed from the dataset, then the ILCR for the future on-site lifelong resident would be within "acceptable levels." It is not clear, based on this statement, whether risk estimates will be used as generated in this risk assessment, or whether the ILCR will be recalculated using a limited dataset. Revise the risk assessment to clarify whether risk estimates presented in this

document will be used, or whether they will be recalculated.

It is also not clear how the dataset will be limited if risk estimates are recalculated. Specifically, it is not clear whether the areas of contamination identified by these two samples will be remediated, or whether the samples will be identified as statistical outliers, and removed from the dataset without removing the potential area of contamination. If the ILCR is recalculated, provide an explanation of how the samples in question are "removed from the dataset" as stated in the current version of the risk assessment.

Comment 9:

Section 7.5.2.4, Risks from Lead. On page 7-30 the third paragraph of this section discusses the risks from lead calculated for a future on-site child resident. It is stated that lead was detected in only one sample (03SS240002) at a concentration that exceeded the screening level of 400 mg/kg. It is further stated that if this sample was removed from the dataset, then the average blood-lead level generated using the Integrated Exposure Uptake Biokinetic (IEUBK) model for the future on-site child resident would be within acceptable levels" It is not clear, based on this statement, whether risk estimates will be used as generated in this risk assessment, or whether the blood-lead level will be recalculated using a limited dataset. Revise the risk assessment to clarify whether estimates of risk from lead (estimated as blood-lead levels) presented in this document will be used, or whether they will be recalculated.

It is also not clear how the dataset will be limited if blood-lead levels are recalculated. Specifically, it is not clear whether the areas of contamination identified by sample 03SS240002 will be remediated, or whether the sample will be identified as a statistical outlier, and removed from the dataset without removing the potential area of contamination. If blood-lead levels are recalculated, provide an explanation of how the sample in question is "removed from the dataset" as stated in the current version of the risk assessment.

ECOLOGICAL RISK ASSESSMENT COMMENTS

GENERAL COMMENTS

Comment 1:

It is stated throughout the RFI Report that Step 3a is the first step of the baseline ecological risk assessment (BERA) process, and is used to refine the list of COPCs from the screening-level ecological risk assessment (SERA). While the refinement of COPCs after the SERA is acceptable, the scientific management decision point (SMDP), that is recommended to be presented at the completion of the SERA in both the Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (1997 U.S. EPA ERA guidance) and the Navy's ERA method (see Figure 8-1), has not been clearly presented.

The presentation of the SMDP should be based on the results of the SERA Steps 1 and 2, and it should be indicated whether data collected for the SERA are adequate for the decision presented in the SMDP. It is understood that a discussion of data gaps and uncertainties is provided in Section 8.5, STEP 3a - COPC REFINEMENT, and it is not intended that this information be restated for the SMDP. However, the information provided throughout the document should be integrated and presented in the context of an SMDP at the end of SERA Steps 1 and 2 to support the decision made for the SMDP in the context of ecological risk. Revise the RFI Report to include a clear presentation of the SMDP at the completion of U.S. EPA Steps 1 and 2 of the SERA based on information provided in the SERA, before progressing to Step 3a.

Comment 2:

No information is provided in the RFI Report on threatened and endangered (T&E) species for SWMU 3, with the exception of the Indiana Bat. Therefore, it is unclear whether T&E species or other special status species or communities may be present at SWMU 3. Special consideration must be given to T&E species, and measurement and assessment endpoints selected for examining potential exposure to these species should focus on assessing risks to individuals, not populations. Revise the RFI Report to provide information documenting that T&E species and species of special concern, in addition to the Indiana bat, are absent at the site. If complete information cannot be provided to verify that these species are unlikely to use the site, then T&E species and species of special concern must be considered in the SERA. The Illinois natural heritage program or biodiversity database should be consulted in determining the potential presence of special status species or habitats in proximity to SWMU 3, and documentation of the consultation should be provided in the RFI Report as an Appendix.

In terms of the Indiana Bat, it is stated that this species was not used to represent insectivorous mammals for the SWMU 3. This is based on the fact that risk evaluations to the Indiana Bat along Sulphur Creek are considered "low", and the fact that the Navy has not yet received comments on the risk evaluation for the Indiana Bat. However, no information is provided in this document to indicate what "low" risks represent. In addition, although a risk evaluation for the Indiana Bat has been submitted by the Navy (January 2002), no official determination has yet been made on this report. Therefore, until the risk evaluation is officially approved and accepted, the Indiana Bat should be included as a T&E receptor of concern for investigation of the Naval Surface Warfare Center - Crane Division (NSWC Crane) facility. Revise the RFI Report to include this information. Alternatively, the Navy may include the Indiana Bat risk assessment as an Appendix and summarize the risk results and conclusions in the RFI Report.

Comment 3:

The conclusion reached in this document is that based on the results of the SERA and Step 3a, no COPCs are retained as Chemicals of Concern (COCs) in media sampled for SWMU 3. These conclusions were based mainly on home range considerations, bioavailability considerations, and the fact that hazard quotients [Ecological Effects Quotients (EEQs)] were relatively low.

Rather than using qualitative evaluations of home range and bioavailability to discount the risk

results, more site specific exposure assumptions should be incorporated into the wildlife exposure modeling. For the SERA, home ranges should be set at one, in order to provide a conservative estimate for the potential of ecological risk. Any bioavailability adjustments should be justified and documented with literature citations or site specific information.

An alternative to complete revision of the exposure modeling and risk characterization would be to include a more quantitative assessment of risk uncertainties. This would include bounding the current risk estimates in the Uncertainty Section by recomputing some EEQs using less conservative bioavailability and area use assumptions. This is a preferred alternative to the largely qualitative evaluation of uncertainties presented in Section 8.6. A complete reassessment of COPC risks would not be necessary, and should be focused on those contaminants that exceeded an EEQ of one.

More importantly, based on the information provided, it does not appears that all COPCs should be removed from further consideration for SWMU 3. For example, dose modeling for the American robin shows that based on conservative examinations for both No Observed Adverse Effect Levels (NOAELs) and Lowest Observe Adverse Effect Levels (LOAELs), EEQs for chromium, lead, mercury, and zinc all exceed one. Furthermore, EEQs for these analytes still exceed one for less conservative modeling based on the NOAEL, with lead exceeding an EEQ of one using a LOAEL. Cadmium, lead, copper and zinc follow the same trends for raccoon and kingfisher EEQs for conservative dose modeling, with all of these COPCs retained for the raccoon based on less conservative dose modeling using the NOAEL, and lead and zinc retained for the kingfisher. Raccoon EEQs were also above one for copper and zinc for less conservative modeling based on the LOAEL. In addition, a number of these COPCs exceeded benchmarks for plants, earthworms, and aquatic organisms. Therefore, it appears that these analytes should be retained for further examination as COCs. Revise the RFI Report to include copper, zinc, and lead as COCs, or provide further justification that these chemicals should not be retained as COCs. Additional contaminants must also be considered as potential COCs because they were inappropriately excluded in the COPC evaluation because of uncertainty associated with the source of contamination (See Specific Comment 3).

SPECIFIC COMMENTS

Comment 1:

Executive Summary, Page ES-1 to ES-5. The Executive Summary does not adequately convey the ecological risk results, and makes a risk management conclusion that "no acceptable ecological risks were found". Risk management conclusions should be removed and only risk results and uncertainties should be presented in the Executive Summary. The Executive Summary should be revised to include a brief summary of the COPCs identified in both the SERA and Step 3a screening. Additionally, Table ES-1 should be revised by replacing the 'not applicable' (N/A) summary of ecological risks with EEQs for the major constituents of concern identified in both the Step 2 SERA and Step 3a screening.

Comment 2:

Section 4.3, Selection of Ecological Risk Chemicals of Potential Concern. It is stated in the fourth paragraph on page 4-13 that surface soils will be investigated to examine ecological exposures at the site, but it appears that surface soil investigation for ecological receptors will focus on the zero to 2 feet below ground surface (bgs) interval. Soil intervals typically used to evaluate ecological exposures are zero to 0.5 feet bgs for surface soil and 0.5 to 2 feet bgs for subsurface soil. Depending on the nature of contamination and distribution, a composite of data from the zero to 2 feet bgs interval may underestimate risk through extrapolation of a chemical concentration across the entire sampling column, or could overestimate risk for one of the two sampling intervals. Revise this SERA to use the zero to 0.5 feet bgs for surface soil exposures, and the 0.5 to 2 feet bgs for subsurface exposure. If data for surficial soils are lacking, provide a detailed discussion of this information as a data gap and discuss this in the uncertainty section.

It is also noted in Section 4.3 that standard ecological screening values are not available for a number of explosive compounds. Screening values from Lotufo et al. (2001, listed below), based on explosives toxicity to soil dwelling organisms, aquatic organisms and wildlife, should be considered for use in the SERA process. Additionally, U.S. EPA (2000, listed below) has established a wildlife screening value for RDX in soil. It should also be noted that the U.S. Army Center for Health Promotion and Preventative Medicine has recently completed mammalian and avian toxicology studies, which include information on some explosives compounds. Revise the RFI Report to consider these values in the SERA process.

Comment 3:

Section 8.5.2.2, Sediment. While the majority of information in this section is appropriate and provides useful information, a number of analytes are removed as sediment COCs based on the fact that it can not be determined whether detected COPCs are present due to contamination originating from the Old Jeep Trail (OJT), or the Ammunition Burning Ground (ABG). Examples of the COPCs removed from further consideration include 2,4-D, barium, lead and zinc. However, while the origin of sediment COPCs should be determined, it is not acceptable to remove COPCs from further consideration based on the fact that another SWMU, that is not being dealt with in this document, might be the source of contamination. Therefore, all COPCs that were removed from further consideration due to the uncertainty of the source, should be included in this assessment. Revise the RFI Report to incorporate these analytes in the risk assessment process.

References

U.S. EPA. 2000. Ecological Soil Screening Level Guidance. Draft. July 10, 2000. U.S. Environmental Protection Agency, Washington, DC.
http://www.epa.gov/superfund/programs/risk/ecorisk/ecossl.htm
Lotufo GR., Farrar JD, Inouye LS, Bridges TS, Ringelberg DB. 2001. Toxicity of sediment-associated nitroaromatic and cyclonitramine compounds to benthic invertebrates. Environ Toxicol Chem 20:1762–1771.

REVIEW OF THE HYDROGEOLOGIC FEASIBILITY OF USING NATURAL ATTENUATION AND PHYTOREMEDIATION AS REMEDIAL ALTERNATIVES FOR EXPLOSIVES AND TCE CONTAMINATED GROUNDWATER AT THE AMMUNITION BURNING GROUNDS DATED AUGUST 2002

NAVAL SURFACE WARFARE CENTER - CRANE DIVISION CRANE, INDIANA EPA ID NO. IN5170023498

GENERAL COMMENTS

Comment 1:

Throughout the *Hydrogeologic Feasibility of Using Natural Attenuation and Phytoremediation as Remedial Alternatives for Explosives and TCE Contaminated Groundwater at the Ammunition Burning Grounds* Report (Report), NSWC Crane indicates that monitored natural attenuation (MNA) is an appropriate and preferred remedial technology for the Ammunition Burning Grounds (ABG). For example, the Report states in the first paragraph on page vii in the Executive Summary that "Based on past and ongoing investigations the hydrogeologic conditions at the ABG appear to meet all the needed criteria for making monitored natural attenuation the preferred remedial action for groundwater." In the discussion of the numerical modeling activities in Section 8, the Report states (Section 8.2 on page 28) that "The conceptual model . . . forms the foundation for the premise that monitored natural attenuation along with phytoremediation (if needed) is the remedial action of choice." Finally, in the conclusions section of the Report (Section 9), NSWC Crane states in the fifth paragraph on page 31 that "All of these results indicate that natural attenuation is occurring and is causing declining concentrations in explosives over time." NSWC Crane concludes the Report by stating that the U.S. EPA required three "lines of evidence" have been met at the ABG (page 32). However, upon further review, it is not clear that the three lines of evidence have been met as stated in the Report. The concerns with this conclusion are presented in the following paragraphs.

The first U.S. EPA line of evidence requires that historical groundwater and/or soil data demonstrate a clear and meaningful trend of decreasing contaminant mass and/or concentrations over time. In support of this line of evidence, NSWC Crane presents plots of groundwater contaminant concentrations at individual wells over time. These data are presented in Report Figures 18 through 23 and in Table 5. The Report draws two conclusions from these data (refer to Section 4.10, page 14). First, the highest contaminant concentrations were observed in monitoring wells located in the area of the currently ABG while the lowest concentrations were observed in the area where Little Sulphur Creek exits the NSWC Crane facility. Second, most wells show a general decrease in contamination throughout the monitoring period with some wells showing seasonal variations in concentrations.

While the first conclusion is generally true, there are also exceptions to this conclusion. Although most of the highest concentrations were detected in the area of the ABG, several of the wells located within the vicinity of the ABG were non-detect for the various constituents. For example, well C03 is located in the very center of the ABG but was non-detect for the constituents plotted on the graphs [trichloroethylene (TCE), RDX, trinitrotoluene (TNT)]. In addition, wells C04 and C15, which are located along the perimeter of the ABG, were essentially non-detect for all three constituents (with the exception of a minor detection of TCE in well C04). As a result, while it is recognized that the contaminant concentrations at the ABG tend to be higher than the contaminant concentrations at Little Sulphur Creek, there is also a spatial variability of contaminant concentrations within and around the ABG itself. Thus, it is not entirely clear if the reduction in contaminant concentrations are the result of biological degradation or spatial variability of the contamination.

The second conclusion presented in the Report is less clear. Decreasing contaminant concentration trends in the individual monitoring wells are not evident from a visual inspection of the contaminant plots shown in Figures 18 through 23. In fact, from a visual perspective, the contaminant concentrations appear to be variable, but stable throughout the monitoring period. A lack of decreasing contaminant concentrations is also reflected in a statistical analysis of TCE and RDX in each of the monitoring wells/springs/creeks via the Mann-Kendall approach. Trend analysis via this approach indicates that no trends are present in the samples with the exception of two wells and one spring (C08P2 - increasing trend for TCE; C20 - decreasing trend for TCE; and Spring C - increasing trend for RDX). It is important to note that Spring C is located downgradient of the ABG, yet this spring exhibits a slightly increasing statistical trend in RDX concentrations over time. This increasing trend is also apparent through a visual inspection of the plot (Figure 23).

It should be noted that the Report does not present any isoconcentration (isopleth) maps which illustrate the current configurations of the contaminant plumes. Although future plume distribution maps are presented as part of the numerical modeling results in Section 8 (Figures 41 through 46), no maps are presented to show the current configurations of the plumes. More importantly, contaminant isoconcentration maps over time should be used to demonstrate a trend of decreasing contaminant mass and/or concentrations, as specified by the first U.S. EPA line of evidence.

In the absence of: 1) contaminant isoconcentration maps over time, 2) clear and evident trends of decreasing contaminant concentrations in the well graphs shown in Report Figures 18 through 23, and 3) any other visual or statistical methods which can be used to demonstrate plume stability or a loss of contaminant mass and/or concentrations over time, it is not clear that the first U.S. EPA line of evidence has been met.

The second U.S. EPA line of evidence requires the presentation of hydrogeologic or geochemical data which demonstrate indirectly the types of natural attenuation processes active at the site and the rate at which such processes will reduce contaminant concentrations to required levels. In support of this line of evidence, NSWC Crane provides the calculation of biological degradation rates for certain constituent species (e.g, TNT) in the soil as part of the phytoremediation column

studies. There are no concerns with regard to the information presented as part of these studies. However, no biological degradation rates have been determined for contaminant species (e.g., TCE, RDX, HMX, TNT) in the groundwater. The calculation of biological degradation rates in the groundwater is especially critical for a demonstration of the appropriateness of MNA at the ABG considering the very rapid groundwater velocity characteristic of the underlying solution-enhanced limestone aquifer.

In addition, the U.S. EPA MNA Directive entitled *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*, OSWER Directive No. 9200.4-17P, April 1999, indicates that other characterization data may be used to quantify the rates of contaminant sorption, dilution, or volatilization. Although some information regarding contaminant sorption is presented for the site soils as part of the phytoremediation column studies (refer to Report Tables 6 and 8), no information is presented in this regard for the groundwater environment.

Finally, the method used most often to demonstrate the second line of evidence is the measurement of geochemical indicator parameters (including various electron acceptors and metabolic byproducts) and the graphical presentation of their distribution within the groundwater in the area of the contaminant plumes. The Report indicates in Sections 4.4 and 4.7 that many of these geochemical indicator parameters (e.g., dissolved oxygen [DO], pH, specific conductance, temperature, turbidity, oxidation-reduction potential [ORP], alkalinity [carbonate, bicarbonate, and hydroxide], carbon dioxide, ferrous iron, hydrogen sulfide, nitrate, nitrite, and water level) were measured during the field investigation activities. However, none of this information was included in the Report. These data should be presented both in tabular format, and as isoconcentration (isopleth) maps for the various parameters of interest, especially for the electron acceptors and metabolic byproducts (e.g., DO, ORP, carbon dioxide, ferrous iron, hydrogen sulfide, nitrate, and nitrite) so graphical presentations of the groundwater affected by biological degradation are available. Furthermore, if any additional electron acceptor/metabolic byproducts were measured and not reported (e.g., sulfate, ethane, ethene, chloride, and methane), these data should be presented as well.

In the absence of: 1) biological degradation rates for the contaminant species in the groundwater, 2) characterization data which can be used to quantify the rates of contaminant sorption, dilution, or volatilization potential of contaminants in the groundwater, and 3) a tabular and graphical presentation of the distribution of geochemical indicator parameters within the groundwater in the area of the contaminant plumes, it is not clear that the second U.S. EPA line of evidence has been met.

The third U.S. EPA line of evidence requires data from field or microcosm studies which directly demonstrate the occurrence of a particular natural attenuation process at the site and its ability to degrade the contaminants of concern. The phytoremediation and microbial mineralization studies (Report Sections 5 through 7) for the soils at the ABG address this line of evidence and there are no concerns with regard to the information presented as part of these studies. However, it should be noted that no microbial studies have been conducted for the groundwater environment at the ABG.

In summary, given the concerns with the various activities described above for the ABG, it does not appear that the necessary lines of evidence as outlined in the U.S. EPA MNA Directive have been met. If NSWC Crane still intends to pursue MNA as a viable remedial alternative for the ABG, additional information will need to be presented to fulfill the requirement for multiple distinct but converging lines of evidence, especially with regard to the groundwater beneath the ABG.

Comment 2:

The Report indicates in Section 3 (Hydrogeology) that groundwater in the vicinity of the ABG flows through the Big Clifty/Beech Creek Aquifer, which consists primarily of a solution-enhanced limestone unit. The Report also indicates that pump tests conducted in the Beech Creek Limestone yielded transmissivity values ranging from 0.28 to 5.79 meters^2/day. In addition, dye tracer tests conducted in the Big Clifty/Beech Creek Aquifer resulted in an effective conductivity value of 286 meters/hour (Report page 9). Although the average groundwater flow velocity is not provided in the Report, these very high conductivity and transmissivity values indicate that the groundwater flow rate is likely very rapid in the aquifer. In light of the presumed very high groundwater flow rates, it is not clear how NSWC Crane believes that the aquifer is suitable for MNA. According to the U.S. EPA MNA Directive (page 18), MNA is only appropriate in aquifers where "the contaminant plumes are no longer increasing in extent, or are shrinking." Given the advective flow rate of the limestone aquifer beneath the ABG, it is highly unlikely that attenuation mechanisms (e.g., sorption, dispersion, dilution, biological degradation, etc.) could act at sufficient rates to stabilize a contaminant plume and prevent the offsite advective transport of contamination. This is even reflected in the NSWC Crane document entitled *Resource Conservation and Recovery Act Facility Investigation Report for SWMU 03 - Old Jeep Trail/Little Sulphur Creek* (dated November 2002), where it is stated on page 6-15 that "The flow rate through the karst conduits is so quick that there is no time for microbial biodegradation to occur." Furthermore, an extremely rapid flow rate would also not allow for the implementation of contingency remedies as required by the U.S. EPA MNA Directive (page 24 in the Directive). Given these considerations, NSWC Crane should justify the text in the third paragraph on page 9 of the Report where it is stated "The hydrogeology at the ABG appears to be well suited for natural attenuation to be occurring."

Comment 3:

Report Section 5.2 indicates that one soil sample was collected by personnel from the U.S. EPA Ecosystems Research Division for microbial mineralization analyses, determination of bulk density, percent organic matter, percent sand/silt/clay, cation exchange capacity, etc. Additional discussion should be provided to clarify why only one soil sample was collected and how this one sample is believed to be representative of the soils from the areas where phytoremediation is being considered.

Comment 4:

The Report presents a discussion of the TNT adsorption isotherm (Freundlich isotherm) in Section 5.8.2, and provides the values for the partition coefficient (0.00274 l/mg), volume of soil in the column (7.0 kg), and concentration of the TNT solution (10 mg/L). However, the Report does not indicate the value of the empirical constant (1/n) used to derive the sorbed contaminant concentration of 191.9 mg (although it appears to be around 1.0). Provide this value and the source of the value in the Report.

Comment 5:

Section 8 of the Report presents the results of the numerical modeling study conducted for the groundwater beneath the ABG. Several concerns were identified with this section of the Report and are discussed in the following paragraphs.

Section 8.2 indicates that a conceptual model based on the site hydrological and chemical data was developed before the numerical modeling was conducted. However, this conceptual model was not presented in the Report. Since the conceptual model forms the basis for the development of the numerical model, and since the conceptual model "forms the foundation for the premise that monitored natural attenuation along with phytoremediation (if needed) is the remedial action of choice" (fourth paragraph on page 28 of the Report), this model should be included in the Report.

The numerical model input parameters are listed in Table 11 and discussed in Section 8.3 of the Report. Information presented in this table for the MODFLOW routine includes the horizontal and vertical conductivity values and the drain conductance values for the three model layers. However, no information is presented regarding the initial boundary conditions and default parameters for the model (e.g., constant head - constant flux boundaries, sources and sinks, recharge values, solver packages, etc.), discussion of the calibration process, and results of sensitivity analyses, etc. All input and decision criteria should be presented in the Report. In addition, although predictions of future TCE, TNT, and RDX distributions are discussed in Section 8.4, there is no discussion of how the model results compare and calibrate with the field-derived data. It is also assumed that all calibrations were conducted with FY 1999 and FY 2000 data (per the text discussion on page 14). The Report should indicate whether more recent groundwater elevation data were available, and if so, why these data were not used in the calibration process.

Finally, the Report provides a discussion of some of the fate and transport input values for the MT3D routine in Section 8.3 (last paragraph on page 29 of the Report) but does not discuss the source of these values. In particular, it is noted that the values provided in the text are not the same values derived from the soil column studies. Revise the Report to provide the source for these values.