DEPARTMENT OF THE ARMY
U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND, MARYLAND 21010-5422

REPLY TO ATTENTION OF

MCHB-TS-EHM

HAZARDOUS AND MEDICAL WASTE STUDY NO. 37-EF-5360-99
RELATIVE RISK SITE EVALUATION FOR
NEWLY ADDED SITES AT THE
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
19-23 OCTOBER 1998

1. REFERENCES. Appendix A contains a list of references used while preparing this report.

2. AUTHORITY. USACHPPM Form 250-R, Request for Service, U.S. Army Materiel Command, 24 April 1996.

3. PURPOSE. The purpose of this study was to provide sufficient data to score Ravenna Army Ammunition Plant's (RVAAP's) newly discovered, previously uninvestigated sites, which are Environmental Restoration, Army (ER, A)-eligible, according to the Relative Risk Site Evaluation (RRSE) guidelines. This study is not a Preliminary Assessment/Site Investigation (PA/SI), a Remedial Investigation (RI), or a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI). Data generated during this project will be used for program management purposes only, specifically to determine the order in which remedial/corrective activities will take place on an Army-wide basis. These data are minimal Level III data, as defined by the U.S. Environmental Protection Agency (USEPA) (reference 1), and are not intended to be used as definitive evidence of contamination presence or absence or to support quantitative health risk assessment.

4. GENERAL.

a. Study Personnel. The Project Officer for this study is James Sheehy of the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), Hazardous and Medical Waste Program (HMWP). 2LT Trevor Heringer, USACHPPM HMWP and Mr. G. Duane Manners, USACHPPM Ground Water and Solid Waste Program, also assisted with this project.

b. Personnel Contacted.

(1) Mr. John A. Cicero, Jr., Commander's Representative; Mr. Mark Patterson, Installation Restoration Program Manager; and Ms. Vicki Record, Management Assistant, RVAAP.

(2) Mr. John P. Jent, Louisville District, U.S. Army Corps of Engineers.

(3) Mr. Robert Whelove, U.S. Army Industrial Operations Command.

(4) Ms. Eileen Mohr, State of Ohio Environmental Protection Agency (OEPA).

c. Background.

(1) The current Defense Environmental Restoration Program (DERP) management guidance requires that all sites eligible for cleanup must be scored and ranked to determine the degree of potential risk in relation to other ER, A-eligible cleanup sites prior to the allocation of remediation funding (reference 2). This process combines information about the level of contamination, the possibility of contamination migration, and the probability that the contamination will be contacted by people and by ecologically-sensitive areas, to qualitatively address the risk each site potentially presents. In this manner, all Army sites may be compared on a uniform scale to facilitate a 'worst-first' allocation of funds. This process does not address the quantitative level of human health or ecological risk as defined in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. As a result, a 'High' relative risk score does not indicate a direct risk to human health and the environment exists, and a 'Low' relative risk score does not indicate that the site does not warrant investigation.

(2) The U.S. Army Environmental Center maintains the Defense Site Environmental Restoration Tracking System (DSERTS) to track the Army's environmental sites and their status. At the installation level, the Installation Action Plan (IAP) describes all environmental restoration sites on the installation, their status, and projected future activities. The data necessary to score these sites do not exist for all RVAAP Installation Restoration Program (IRP) sites. In particular, RVAAP has 13 ER,A-eligible sites that need to be added to the DSERTS database following RRSE scoring. These sites have recently been discovered, after the fiscal year 1997 deadline for scoring "Not Evaluated" sites, during a thorough review of past industrial activities on the installation (reference 3). To remain consistent with nomenclature used during remedial activities at RVAAP, the sites will be referred to as Areas of Concern (AOCs) for the remainder of this report.

5. DISCUSSION OF FINDINGS.

a. Evaluation Framework. Guidance for the completion of RRSE scoring is contained in the Relative Risk Site Evaluation Primer (reference 4). This guidance defines six environmental media of concern for site evaluations. These media are ground water (human endpoint), surface water (human endpoint), sediment (human endpoint), surface soil (human endpoint), surface water (ecological endpoint), and sediment (ecological endpoint). Each of these media are to be evaluated when appropriate, assessing the level of relative contamination, contaminant migration potential, and possible receptors of the contaminant. The final 'relative rank' for an AOC is then a combination of these components. These building blocks of the RRSE process and their relation to RVAAP's 'not evaluated' AOCs are described in more detail below. The final phase of the RRSE process is input from stakeholders, including on-post, offpost, and regulatory interests. This phase is not addressed in this report since it can be best handled by installation personnel via existing working groups.

(1) Media Evaluated.

(a) Ground Water (Human Endpoint). Shallow ground-water exists on RVAAP. The depth to ground water in the primary bedrock aquifer is between 3 and 60 feet below the surface. In addition, ground water can also be found in unconsolidated geologic materials at RVAAP. The ground water on RVAAP was used for industrial and drinking water production at the installation through the 1980's (reference 5), and there are still two drinking water wells in use near buildings 1034 and 1037. In addition, according to the OEPA, numerous residences in the vicinity of RVAAP use shallow, unconsolidated materials for drinking water. Due to the potential for ground-water migration of contaminants to reach receptors from RVAAP-39 to RVAAP-44, RVAAP-48, RVAAP-49, and RVAAP-50 this pathway was evaluated. This pathway was based on collected ground-water data at RVAAP-39, RVAAP-40, and RVAAP-50. Subsurface soil data, using a standard linear equilibrium soil/water partition equation (to estimate contaminant release as soil leachate) and a dilution factor (to account for dilution of the leachate as it enters the aquifer), was used to evaluate RVAAP-41, RVAAP-42, RVAAP-43, RVAAP-44, RVAAP-48, and RVAAP-49 since recoverable ground water was not found during the sampling. This method is consistent with the derivation of soil screening levels and the investigation and modeling efforts conducted at Superfund sites by the USEPA to develop soil cleanup goals and ground-water protection goals (references 6, 7, and 8). Ground-water contamination may exist at AOCs other than those listed, but the scope of the RRSE process is to assess the most likely modes of contamination with limited resources. Ground water does not pose a readily available or completed pathway at other locations relative to the surface pathways investigated.

(b) Surface Water (Human Endpoint). Leachate or soil transported by runoff may result in contamination of surface water which may then be available to contact receptors. Surface water was present at one AOC and is present intermittently at other AOCs. Sand Creek is adjacent to RVAAP-51, but with the rapid turnover of a stream, surface water was not the ideal media to sample. The sediment pathway was evaluated instead as being more representative of actual site conditions. RVAAP-41 had a small retention pond (approximately 10 feet in diameter) that is intermittently filled, but was not considered significant for this RRSE. Other AOCs had ditches, for example RVAAP-41 and -44, that will intermittently fill with water during the spring or storm events but were not filled during the sampling for this RRSE. Therefore, for this RRSE, surface water was not evaluated for human endpoints.

(c) Sediment (Human Endpoint). Leachate or soil transported by runoff may result in contamination of sediments associated with site surface water or runoff. Sediment transport at these AOCs can be either from permanent water sources, like Sand Creek, or be transported during spring runoff or rain events. Sediments were evaluated for human endpoints at RVAAP-41, RVAAP-44, RVAAP-47, and RVAAP-51.

(d) Surface Soil (Human Endpoint). The RVAAP climate is continental and most areas have vegetative covering, but there are still areas where the surface soil is exposed. Due to the potential for either pedestrian traffic (e.g., hunters, fishermen, Ohio National Guard soldiers) on or near study areas, the surface soil pathway is considered complete for all 13 locations.

(e) Surface Water (Ecological Endpoint). Surface water was not evaluated for ecological endpoints. The Primer states that surface water should only be evaluated for ecological endpoints when the surface water is part of a critical habitat or a specifically listed environment (reference 4). The only site that met that standard was RVAAP-51, adjacent to Sand Creek. However, with the rapid turnover of a stream, surface water was not the ideal media to sample.

(f) Sediment (Ecological Endpoint). The Primer states that sediments should only be evaluated for ecological endpoints when the sediments are part of a critical habitat or a specifically listed environment. Sand Creek meets the definition of critical habitat if the definition is expanded to include Ohio Endangered Species (mountain brook lamprey). The sediments associated with RVAAP-44, RVAAP-47, and RVAAP-51 could transport to Sand Creek and meet this requirement. Sediment transport at these AOCs can be either from permanent water sources, like Sand Creek, or be transported during spring runoff or rain events. Therefore, sediment was evaluated for ecological endpoints.

(2) Contaminant Hazard Factor Determination. The level of contamination present at a site is evaluated by comparing the maximum contaminant concentrations measured to corresponding standards listed in the Primer's (reference 1) Appendix B. The ratio of

measured concentration to standard concentration is calculated for each contaminant identified. The contaminant hazard factor (CHF) can then be determined by computing the sum of ratios for all identified contaminants and comparing this number to standard values. For ratio sums less than 2, the CHF is *minimal*. For ratio sums from 2 to 100, the CHF is *moderate*. For ratio sums greater than 100, the CHF is *significant*.

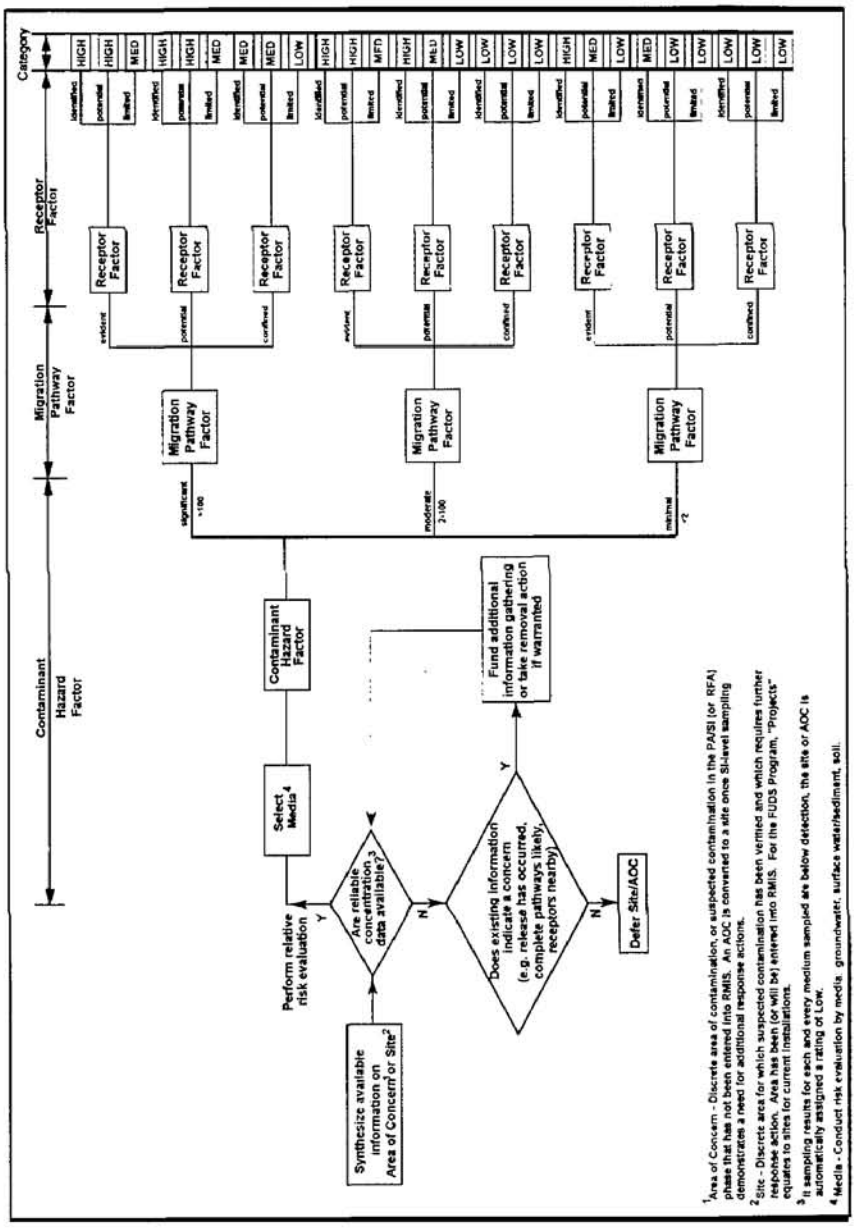
(3) Migration Pathway Factor Determination. The migration pathway factor (MPF) is a qualitative measurement of the possibility a contaminant may move from the identified site to a point allowing exposure to a receptor. An MPF of *evident* means the contamination is known to have moved away from the source toward a point of exposure. An MPF of *confined* means that movement of the contaminant from the source has been restricted in some manner. An MPF of *potential* means that there is no indication that contamination has spread, but the source of contamination has not been confined.

(4) Receptor Factor Determination. The receptor factor (RF) is a qualitative measure of the potential for either humans or plants and animals (depending on the media being evaluated) to come into contact with the contamination. An RF of *identified* means that a known population contacts the contamination. An RF of *limited* means it is unlikely anyone would come into contact with the contamination. An RF of *potential* means there are no identified populations to contact the contamination, but the source is not restricted from access.

(5) RRSE Score. The CHF, the MPF, and the RF are combined to determine the overall relative risk a site may pose and thus the relative priority of the site for action. The Figure displays the decision flow chart from the Primer, which governs the assignment of the overall RRSE Score. All site evaluations contained in this study follow this decision flow chart.

b. Sampling Plan Modifications. The Sampling Plan and the Site Safety and Health Plan governing this study are contained in Appendices B and C, respectively. The approval letter from the OEPA for the sampling is also contained in Appendix B. The only significant modification to the Sampling Plan is that sediment samples were not collected from four of the Load Lines (RVAAP-39, RVAAP-40, RVAAP-42, and RVAAP-43) or the Central Burn Pits (RVAAP-49). Observations onsite and from investigating the recent aerial photographs at the installation did not reveal an obvious sediment pathway at these five AOCs. (One sediment sample was also dropped from the Building F-15/F-16 AOC (RVAAP-46) where 2 samples were planned.) No obvious sediment pathway could be identified near Building F-15. One sediment sample was still collected from near Building F-16, so the sediment pathway was still evaluated. The exact number and location of samples collected at each AOC is identified in the Site Scoring Worksheets located in Appendix D. Appendix E contains a listing of sample concentrations and their associated sites as well as all analytical data in Volume II of this report.

Figure. RRSE Decision Flow Chart.



c. Site Scores. Thirteen sites were evaluated using the sampling data collected and the evaluation framework described above. An RRSE Site Scoring Worksheet has been prepared for each site detailing the scoring procedure. These sheets are contained in Appendix D. The scoring results are shown in the following Table. The following five AOCs scored High: RVAAP-44, RVAAP-46, RVAAP-47, RVAAP-49, and RVAAP-51. The remaining eight AOCs all scored Medium.

d. Quality Assurance/Quality Control (QA/QC).

(1) Criteria. Field split and duplicate samples were collected during this investigation to assess the quality of the data collected. Split samples were collected from both soil and sediment and a duplicate sample was collected for ground water in accordance with the Sampling Plan. The QA/QC samples were evaluated by calculating the relative percent difference (RPD) of the samples and comparing the RPD with USEPA criteria (references 9 and 10). The RPD is 100 multiplied by the difference between the concentrations of the two splits, divided by half the sum of the split concentrations. According to the criteria, an RPD is acceptable if it is less than ±30% in water (±50% in soil) for the organics analysis. For the inorganics analysis the RPD is acceptable if it is less than ±20% in water (±35% in soil). For inorganic samples, a control limit of ± [(detection limit) in water (±2×(detection limit) in soil] is used for split/duplicate samples within 5×(detection limit). These criteria were tested for all detected analytes in this RRSE by first determining the RPD in the split and duplicate samples. If an RPD was not within the acceptable range for an inorganic analyte, the test for samples near the detection limit was used. If a sample failed the test (or both tests for inorganic analytes), that split or duplicate sample failed the QA/QC test. If the split or duplicate samples failed the QA/QC test, the maximum of the two results was used in the calculations for CHF for that analyte at that AOC. If the samples passed the QA/QC test, the mean of the two sample concentrations was used (with 50% of the detection limit being used for non-detects).

(2) Results. The split samples were collected as detailed in the Sampling Plan. The ground-water duplicate sample failed for both metals detected, and passed for the RDX explosive detected. The reason for this failure is believed to be related to the sample collection technique. A temporary well was installed with the hydropunch, and no purging was conducted. The sample jars were filled one at a time. There was significantly more sediment in the initial jars than in later jars. For the soil samples, all of the explosives detected (3/3) and 87% (71/82) of the metals detected met the criteria. The only problem with the soil data was with the polyaromatic hydrocarbons (PAHs) at the Atlas Scrap Yard. Seven PAHs were detected in one of the split samples, but not in the other. This suggests a heterogeneous distribution of the PAH contamination in the sample even after mixing.

Table. RRSE Site Scoring Summary.

Site Number	Site Name	Ground Water	Surface Water	Sediment	Soil	Surface Water-Eco	Sediment Eco	Media of Concern	Score
RVAAP-39	LL-5/Fuze Line 1	Medium	N/E	N/E	Medium	N/E	N/E	2	Medium (2)
RVAAP-40	LL-7/Booster Line 1	Low	N/E	N/E	Medium	N/E	N/E	2	Medium (2)
RVAAP-41	LL-8/Booster Line 2	Medium	N/E	Medium	Medium	N/E	N/E	3	Medium (2)
RVAAP-42	LL-9/Detonator Line	Medium	N/E	N/E	Medium	N/E	N/E	2	Medium (2)
RVAAP-43	LL-10/Percussion Element	Medium	N/E	N/E	Medium	N/E	N/E	2	Medium (2)
RVAAP 44	LL-11/Artillery Primer	Medium	N/E	Medium	Medium	N/E	High	4	High (1)
RVAAP-45	Wet Storage Area	N/E	N/E	N/E	Medium	N/E	N/E	1	Medium (2)
RVAAP-46	Building F-15/Building F-16	N/E	N/E	Medium	Medium	N/E	High	3	High (1)
RVAAP-47	Building T-5301 (Decontamination)	N/E	N/E	Medium	Medium	N/E	High	3	High (1)
RVAAP-48	Anchor Test Area	Medium	N/E	N/E	Medium	N/E	N/E	2	Medium (2)
RVAAP-49	Central Burn Pits	Medium	N/E	N/E	High	N/E	N/E	2	High (1)
RVAAP-50	Atlas Scrap Yard	Medium	N/E	N/E	Medium	N/E	N/E	2	Medium (2)
RVAAP-51	Dump Along Paris-Windham Road	N/E	N/E	Low	Medium	N/E	High	3	High (1)

N/E Not Evaluated

The maximum concentrations of PAHs at this AOC were not at this sample point, so the inconsistent results do not affect the CHF. The sediment split sample had 91% (10/11) of the metals detected meeting the QA/QC criteria. No polychlorinated biphenyls or herbicides were detected in the split samples collected for these analyses.

6. CONCLUSIONS.

a. At the completion of this RRSE, 13 RVAAP sites should be added to the DSERTS database and the IAP. All 13 of these sites are ER, A-account eligible.

b. Using the RRSE criteria, 5 of these 13 sites evaluated scored High. These sites are RVAAP-44, LL-11/Artillery Primer; RVAAP-46, Building F-15/Building F-16; RVAAP-47, Building T-5301 (Decontamination); RVAAP-49, Central Burn Pits; and RVAAP-51, Dump along Paris-Windham Road.

c. Of the remaining 8 sites evaluated, all scored Medium.

d. Stakeholder input, the final phase of the RRSE process, was not included as part of this investigation.

e. The IAP should be updated to reflect the finalized RRSE scores for the sites addressed in this report.

7. RECOMMENDATIONS. Seek stakeholder input from onpost, offpost, and regulatory parties prior to finalization of these RRSE scores. Update the IAP, as appropriate.

8. TECHNICAL ASSISTANCE/FURTHER INFORMATION. Any questions or comments related to this study may be directed to any of the undersigned at commercial (410) 436-3652.

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