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Date: September 27, 1995

Mr. Dave Forsythe
Atlantic Division, Naval Facilities Engineering Command
Environmental Quality Division
Code: 1822
Building N 26, Room 54
1510 Gilbert Street
Norfolk, Virginia 23511-2699

Re: Norfolk Naval Base, Virginia
CD Landfill
Review of draft *RI/BRA*

Dear Mr. Forsythe:

The U.S. Environmental Protection Agency (EPA) has preliminarily reviewed the Navy's draft *Remedial Investigation and Baseline Risk Assessment* for the CD Landfill, located at the Norfolk Naval Base, Norfolk, Virginia. Based upon that review, we offer the following preliminary comments:

GENERAL COMMENTS

1. The dates of operation for the CD Landfill were not entirely clear. For example, it is unclear regarding operations that may have occurred prior to the Navy's purchase of the site in 1974. It would be helpful, if possible, for the RI to include a table describing the dates of landfill operations and the types and quantities of wastes disposed.

2. A whole-watershed approach should be taken for future ecological assessments of the Bousch Creek drainage. Two potential off-site sources in the watershed were identified in the RI: the asbestos landfill and the inert chemical landfill. Reportedly, 1000 five-gallon cans of roofing tar were disposed at the inert chemical landfill. If this is true, it is a misnomer to label the landfill as the 'inert chemical landfill' because coal tar is not inert and, along with the site itself, may be a source of the PAHs identified Because two sites of concern have been documented in the watershed, the CD Landfill and the Camp Allen Landfill, an inventory of potential contaminant sources should be included in reports on these Norfolk Naval Base sites.

3. Table 1 (attached) indicates the maximum contaminant levels in comparison with their respective AWQC and ER-L/ER-M values. Clarification should be provided regarding detection limits, as the levels in surface water and sediment (as the table shows) are greater than the ecologically sensitive guidelines (e.g. AWQC - chronic and ER-L/ER-M values). Without site-specific information (e.g., contaminant-specific uptake information, bioassays, etc.) these guidelines should be used in developing the screening-level ecological risk assessment.

4. An "emergency chemical stabilization activity" is mentioned repeatedly as the reason a portion of the landfill was not visited in August 1993. However, the nature of, or the reason for, this activity is never explained. This information should be provided.

SPECIFIC COMMENTS

1. Section 1.3.3, Page 1-7, first paragraph; refers to the landfilling of inert chemicals. The type of chemicals as well as justification of inertness should be described in the text, and specifically in the introduction section of the document.

2. Section 1.4.3, Page 1-9, third paragraph; uses language such as high and moderate, the terms are subjective and have little meaning, (i.e. high compared to background, moderate in terms of risk?).

3. Section 1.4.4, Page 1-10, second paragraph; describes samples which are below detection limits for TCLP analyses. It may seem picky but the text attempts to trivialize these exceedances by stating that "four of five were below standards... and three of five were below... and are below Virginia Department of Waste Management action levels". The report also fails to address or propose any action or non-action based upon these findings.

4. Section 2.6.4, Page 2-7, first two paragraphs; describes the potable wells in the area of the site. The report is contradictory in its description of the presence of wells within a four-mile radius of the landfill when identifying the Glenwood Park community. If these wells were ever used for supply of potable water this information should be included.

5. Figure 2-4, General Shallow Groundwater Flow Direction; this figure is of little use in regards to this report. Contouring of equipotential lines should have been included. Due to the information provided in subsequent section of the document, this comment is probably superfluous.

6. Section 3.0, Page 3-1, third bullet and Section 3.3.1, Page 3-13, Page 3-13; the rationale for the field activities conducted during Round 3 should be explained. This should include an explanation of whether it was based upon data gaps or through negotiations with regulatory agencies. Additionally, a summary of the data analyzed should be provided to support the level of work performed.

7. Section 3.3.2.2, Page 3-14; the change in laboratories should be explained. Additionally, a statement that analytical methods and detection limits are either comparable or the same should be made.

8. Section 3.4, Page 3-15; the change in data validation contractor should be explained and an assurance that the validations are comparable.

9. Section 5.2.4.7, Page 5-32 through 5-34; the document should present a narrative describing the on-site detections of radionuclides to background conditions.

10. Section 6.5.2.3 Page 6-22 through 6-23; provides a description of the presence of radionuclides in soils and a rationale for their presence, the analysis presented should be re-analyzed for groundwater sampled from well MW-04B in light of the potential presence of coal fines which are suggested to have been disposed of near the vicinity of the well.

11. An analysis of the statistical differences between on-site wells to an appropriate background well should be made so that a better view of the impacts on groundwater from the landfill can be ascertained. This should also be done for soils sediments and surface water media for all analytical parameter detected. A clear definition of the location and water quality of the background well(s) should be made as well as an over view of the ambient ground water quality of the site setting.

12. An examination of the extent of chlorobenzene contamination should be made. This can be performed using soil gas techniques and the extent confirmed with monitor wells based upon this screening.

13. Data generated during this investigation should be submitted to EPA in electronic media. The data should include a scaled site map (in Digital Exchange Format DXF) which shows all sampling locations as well as physical features, locational data of all sampling points, analytical data in a spreadsheet format.

<u>RI Report:</u>

- **Section 5.0: Analytical Results**
  - The FWQC for beryllium is 0.0037 μg/L.
  - The action level for lead is 400 ppm.
  - The RI report should indicate the RBCs (Risk-based Concentrations) for groundwater.
  - It is not clear if analyses for asbestos fibers or dioxins (from the incinerator ash) were performed.

<u>Risk Assessment:</u>

- **Toxicity Assessment:**
  - Soil residential **COCs** (not RBCs) should **ONLY** be used to identify sediment COCs if no BTAG screening levels for sediment are available for the particular chemical constituent(s) detected. Also, this methodology applies **ONLY** to the identification of COCs, not to the performance of the actual ecological risk assessment.
  - Reference doses (RfDs) for aluminum and thallium are available. They are 1E+00 and 8E-05 mg/kg/day, respectively. These RfDs should be used in the Report to assess risk from these COPCs.
  - Toxicity profiles for radioactive materials were not presented in the Appendix. ←
- **Exposure Assessment:**
  - The current usages of surface water in the area were not adequately addressed in the RI Report. Therefore, it is not known whether there is recreational fishing on-site. If there is recreational fishing on-site, a fish ingestion scenario should be evaluated in the Report.
  - The use of 4 years as a conservative number to use for the exposure duration for a military person is not justified. Where are the data? It seems that 4 years is at best a minimum value.
  - Dermal contact from groundwater is usually only considered for children, while adults are usually assumed to shower only. The Foster and Chrostowski Shower Model (1986) is preferred over Andelman's Model and should be used to estimate VOC concentrations in air during showering.
  - The default PEF (Particulate Emission Factor) currently preferred is 6.79E+08 m^3/kg.
  - Sample calculations for the 95%UCL and the W-test should be presented in the Appendix.

- Potential risk(s) from exposure to contaminants discharged from groundwater into the drainage ditches on-site should have been evaluated.

- It is not clear if the shallow and deeper aquifers are connected. If they are connected, the risk should be based on the maximum levels detected between the two aquifers for any given contaminant.

- **Risk Characterization:**

  - The toxicity criteria used in assessing dermal absorption should be corrected for absorption, if necessary.

  - A risk estimate for ingestion and dermal exposure to chlorobenzene and 1,4-dichlorobenzene should have been presented for GW04. See Table T-24 and T-25. Note that all groundwater COPCs should be evaluated. The RME (reasonable maximum exposure) concentration should be calculated for all COPCs. If GW04 represents the well having the highest levels of some COPCs but not others, then other wells containing the highest levels of all of the other COPCs should be identified.

  - Risks from surface and subsurface soil are not additive, since they represent the same exposure route.

  - Central tendency risk estimates should be presented in the Report.

  - The Lead Uptake/Biokinetic Model (version 0.99) should be used to assessed potential risk(s) from exposure to lead on-site.

  - Potential risk(s) from exposure to radioactive materials should be presented in this Report.

  - Potential risk(s) from exposure to asbestos and/or dioxins should be presented in this Report if the data are available. It appears that analyses of asbestos fibers and/or dioxins (potentially from incinerator ash) were not performed which may indicate a significant data gap in the Report.

Ecological Comments

1. Dichlorobenzene was found in water (at levels well below AWQC) at a station on the northeast boundary of the landfill and, at the same location, monochlorobenzene was identified in sediment. This is likely to be a degradation product of the dichlorobenzenes. At the same site, methylphenol was also found in water at levels well below toxic values, but dieldrin was observed at levels above chronic AWQC. In addition, PCBs in sediments along the southern edge were found at levels above ERLs. These indicate to EPA that contamination by chlorinated hydrocarbons are at least present in 'hot spots' at the site.

2. The total organics presented in Table 5-6 are compared to published standards, which are further defined as federal AWQC in a footnote. Most of these values do not match either acute or chronic/freshwater or marine AQWC.

3. The ecological risk assessment (ERA) did not address groundwater with relation to the potential risk resulting from discharge of contaminated groundwater to surface waters. This should be evaluated especially in light of the shallow nature of groundwater in the area as well as the potential tidal influence. The documents acknowledges this potential discharge on page 8-14 and the high levels of

contamination identified in then groundwater should play a role in the ecological risk assessment for that reason.

4. In Table 8-4, the values which were obtained from the AET database should fall under the ERM column as AET values represent an upper threshold and tend to fall nearer to ERMs than ERLs. The use of AET values in ERA is not recommended as they are not normalized to grain size or TOC. Normalization gives perspective to ERL and ERM values, making them more relevant to correlation than AET values.

5. Page 8-11 offers comparisons between fish found in Willoughby Bay and the "Elizabeth River." Parts of the Elizabeth River are highly industrialized with numerous contaminant sources; adverse impacts in fish and other aquatic life ranging from enzymatic anomalies through tissue impacts such as cancers, all the way up to community level impacts such as depressed fish biomass, numbers, and diversity have been observed in parts of the river. The broad comparison as presented in this document is not very helpful, as the Elizabeth River does not represent a relatively clean reference area. An effort should have been made either to locate a suitable reference area for this portion of the work or establish a surrogate. The latter is done by using either criteria as the reference or substitute values derived from literature and file documents relevant to the area.

6. The assessment endpoints presented are both too broad and too vague to be of much real value, though commendable in their broad scope (i.e., to protect any species). Assessment endpoints are explicit expressions of the actual environmental values to be protected. The endpoint used cannot be assessed with the data collected. Species should have been selected that could most likely be expected to be most sensitive to impacts by the site-related COCs. Use of AWQCs as measurement endpoints does not automatically impart protection to these sensitive species since AWQCs are designed in theory to protect 95% of aquatic species. On the other hand, AWQC - chronic values can be used as surrogates if site-specific data have not been collected, but should be used with care when so many COCs are involved. Synergism can play an important role when so many contaminants exceed conservative screening risk assessment levels.

7. Section 8 fails to address the cumulative impact from exposure to multiple contaminants migrating off-site. As Table 2 (attached) indicates, most stations that had any QIs (also called hazard quotients) over 1, show several higher than that value and, therefore, are considered to be at levels of potential risk. Several studies[1] are available that indicate individual AWQC are not protective when the exposure is cumulative (i.e., several trace elements together at AWQC levels). Likewise, the probability of correctly predicting when a sediment sample is toxic is rather high (80-90%) when more than 5 or 6 COCs exceed ERL values. This risk assessment underestimates the likely impact from the cumulative exposure aquatic organisms would receive.

8. There appears to be some problem in either theory or computation for Copper in Table 8-8. The risk of acute exposure is greater than that shown for chronic. Likewise, the acute surface water screening

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[1] Spehar, R.I. & J.T. Fiandt (1986). "Acute and chronic effects of water quality criteria-based metal mixtures on three aquatic species." Env. Tox. & Chem. 5(10): 917 - 931.

Swartz, R.C., et al. (1988). Effects of mixtures of sediment contaminants on the marine infaunal amphipod, Rhepoxinius abronius. Env. Tox. & Chem. 5(12: 1013 - 1020.

Verriopoulos, G. & S. Dimas (1988). Combined toxicity of copper, cadmium, zinc, lead, nickel, and chrome to the copepod, Tisbe holothuriae. Bull. Environ. Contam. Tox. 41(3): 378 - 384.

level (SWSL) listed in Table 8-2 is lower than the chronic value. These are both counter intuitive and do not follow the same pattern as all other COCs.

9. Section 8.10.1 states that only 5 COCs had QIs greater than 1 for dissolved samples and that this was significant since only the dissolved fraction is bioavailable. While the statement about bioavailability is generally regarded as accurate, the insinuation of significance is erroneous. Total metals values are the data that should be compared to AWQC and they also represent the potential for contaminant migration and ultimate exposure off site. It should be clearly understood that AWQC are enforceable under the Clean Water Act, which is an ARAR.

10. As with most assessments dependent on hazard quotients, the potential risk due to exposure from bioaccumulative substances and carcinogens are not fully addressed. While it is difficult to assess risk for carcinogenicity because of the vagaries of the natural system (e.g., the life expectancy is often too short for this impact to be manifested) the bioaccumulation aspect can be identified and considered in the risk assessment.

11. The claim that the landfill may not be the source of dieldrin in surface water (Section 9.5.2) does not seem to be supported by the fact that it was not detected in upstream samples. The stations where dieldrin was observed are those where discharge of groundwater, according to Figures 4-12 through 4-15, would be most likely.

12. Section 9.8 (and elsewhere) states that COCs do not appear to be migrating downstream. The sampling program, however, is not designed to provide conclusive evidence of this since there appears to be only one station downstream of the landfill and that one is only approximately 300 feet away.

13. Results of the ecological risk assessment summarized on page 9-9 concludes that contaminants of concern in surface water and sediment exceed screening levels, but does not address potential risks to ecological receptors. In addition, the endpoints selected were not addressed in terms of risk. Without this information, the risk manager must fall aback upon the screening level of risk assessment and can only conclude that the potential for risk exists at the site. By the same token, the levels of contaminants in soil area also high, but the impacts to terrestrial ecological receptors "...are not expected to be ecologically significant." Using the screening levels presented in Table 8-7 seems to indicate, with cursory examination, that soil flora and fauna are at risk and the investigator should complete this part of the analysis prior to arriving at this conclusion.

14. Section 9 ends with the statement that "the CD landfill [has] affected soils and the shallow aquifer... [and] because the shallow aquifer is hydraulically connected to the adjacent drainage areas ... surface water and sediment have also been impacted". Despite this and statements of impacts (e.g., Section 8.12.1) plus the calculations of QIs over 1 for numerous COCs at several stations, the risk assessment concludes that there is no risk to aquatic organisms. This conclusion is at variance with the data presented. It is our conclusion that the RI data, used in a screening level risk assessment, shows a potential for risk to aquatic organisms.

15. Some actual verification of the conclusions should be carried out, as per Superfund Eco Risk Guidance. This could take the form of sediment bioassays, benthic invertebrate surveys, biouptake, histopathology, etc. The fact that a saline gradient exists indicates that there is exchange of water, and therefore most likely sediment as well, with Willoughby Bay. If this is true, then contaminant migration off-site cannot be discounted. More thorough studies than those that have gone into this document would be required to disprove this data-based conclusion and we can help with the design for such a set of studies.

16. Elevated metals contamination at SW03 and SW 12, among others, indicates that additional work is needed to determine the source(s) and extent of contamination.

17. Copper and lead levels at SD08S are also elevated (above ERM values) and the copper, lead, nickel, and zinc levels at SD14S exceed ERM values.

18. The source(s) and extent of contamination for semivolatile organic compounds at SD13S also need(s) to be determined.

19. In general, it appears from the data presented that 'hot spots' of contamination are mainly responsible for the relatively high ecological risk potentials at the site. It does not appear at this time that extensive remediation will be needed, but this document is unacceptable in its efforts to minimize risk potential in several environmental media.

Selected References:

Long, E.R., et al. (1992). Natioanl Status and Trends Program Approach. In: Sediment Classification Methods Symposium. EPA 823/R-92-006. EPA Office of Water (WH-556), Washington, D.C.

Persaud, D., et al. (1992). Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of the Environment, Water Resources Branch, Toronto, Canada.

This concludes EPA's preliminary comments on the review of the Navy's draft *Remedial Investigation and Baseline Risk Assessment* for the CD Landfill located at the Norfolk Naval Base. If you have any questions regarding the above, please feel free to call me at (215) 597-1110,

Sincerely,

Robert Thomson

Robert Thomson, PE
VA/WV Superfund Federal Facilities (3HW71)

cc: Diane Bailey (NAVBASE)
Dinesh Vithani (VDEQ, Richmond)
Stacie Driscoll (USEPA, 3HW71)
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Bill McKenty (USEPA, 3HW13)
Bob Davis (USEPA, 3HW13)

Table 1. Maximum concentrations of selected contaminants of concern in surface water and sediments sampled from the drainage ditches surrounding the CD Landfill.

Chemical	Groundwater (µg/l)	Surface Water (µg/l)		Sediment (µg/kg)		
Trace elements	Total		Chronic AWQC		ER-L	ER-M
Cadmium	22	<4	1.1+	2,400	1,200	9,600
Copper	530	430	12+	430,000	34,000	270,00
Lead	860	712	3.2+	1,260,000	47,000	220,000
Mercury	1.1	0.74	0.012	1000	150	710
Zinc	3,800	2,640	110+	750,000	150,000	410,000
Organic Compounds						
Naphthalene	ND	ND	620	1,300	160	2,100
2-Methylnaphthalene	ND	ND	300[2]	1,800	70	670
Acenaphthene	ND	ND	NA	11,000	16	500
Fluorene	ND	ND	NA	15,000	19	540
Phenanthrene	ND	ND	6.3	100,000	240	1,500
Anthracene	ND	ND	300[2]	32,000	85	1,100
Fluoranthene	ND	ND	NA	130,000	600	5,100
Pyrene	ND	ND	300[2]	76,000	670	2,600
Benzo(a)anthracene	ND	ND	300[2]	52,000	260	1,600
Chrysene	ND	ND	300[2]	48,000	384	2,800
Benzo(b)fluoranthene	ND	ND	300[2]	54,000	3,200[1]	NA
Benzo(k)fluoranthene	ND	ND	300[2]	22,000	3,200[1]	NA
Benzo(a)pyrene	ND	ND	300[2]	38,000	430	1,600
Dibenz(a,h)anthracene	ND	ND	300[2]	3,900	63	260
Benzo(ghi)perylene	ND	ND	300[2]	12,000	670[1]	NA
Pesticides/PCBs						
DDT	ND	ND	0.001	110	1.6	46
PCBs	ND	ND	0.014	242	23	180

+: Hardness dependent criteria.
1: Apparent effects threshold.
2: Value for chemical class
ND: Not detected.
NA: Not available.

Table 2. Contaminants of Concern at each sample station.

Stn	COCs
SW01	4 - dieldrin, Cu, Fe, Pb
SW02	6 - DDD, Cr, Cu, Fe, Pb, Zn
SW03	8 - dieldrin, Ag, Cr, Cu, Fe, Hg, Pb, Zn
SW08	7 - dieldrin, DDD, Cr, Cu, Fe, Pb, Zn
SW12	8 - dieldrin, DDD, Cr, Cu, Fe, Pb, Hg, Ag, Zn
SW14	2 - Fe, Pb
SW15	2 - Cu, Ag
SD02	5 - dieldrin, DDT, PCBs, As, Zn
SD03	7 - dichlorobenzene, chlordane, dieldrin, DDT, PCBs, As, Fe
SD04	7 - dieldrin, DDT, As, Cd, Cu, Pb, Zn
SD05	13 - 3 PAHs, chlordane, dieldrin, DDT, PCBS, As, Cd, Cu, Hg, Pb, Zn
SD08	10 -1 PAH, Dichlorobenzene, dieldrin, PCBs, Ag, As, Cu, Fe, Pb, Zn
SD09	4 - dieldrin,DDT, Cd, Zn
SD10	5 - dieldrin, DDT, As, Fe, Hg
SD11	7 - dieldrin, DDT, PCBs, As, Cd, Cu, Pb
SD12	6 - dichlorobenzene, dieldrin, DDT, As, Fe, Pb
SD13	26 - 16 PAHs, dibenzofuran, chlordane, dieldrin, DDT, As, Cd, Cu, Hg, Pb, Zn
SD14	10 - dichlorobenzene, dieldrin, Ag, As, Cr, Cu, Fe, Hg, Pb, Zn
SD15	1 - dieldrin