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NORTH CAROLINA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF WASTE MANAGEMENT

March 3, 1998

Commander, Atlantic Division
Naval Facilities Engineering Command
Code 1823
Attention: MCB Camp Lejeune, RPM
Ms. Katherine Landman
Norfolk, Virginia 23511-6287

Commanding General
Attention: AC/S, EMD/IRD
Marine Corps Base
PSC Box 20004
Camp Lejeune, NC 28542-0004

RE: NC Superfund Comments on the
Focused Remedial Investigation Report
Operable Unit No. 15, Site 88
Marine Corps Base, Camp Lejeune, North Carolina

Dear Ms. Landman:

The referenced document has been received and reviewed by the North Carolina Superfund Section and our comments are attached. The comments of the WiRO are also enclosed. Please call me at (919) 733-2801, extension 278 if you have any questions.

Sincerely,

David J. Lown, LG, PE
Geological Engineer
Superfund Section

Attachments

cc: Gena Townsend, US EPA Region IV
Neal Paul, MCB Camp Lejeune
Diane Rossi, DENR - Wilmington Regional Office

401 OBERLIN ROAD, SUITE 150, RALEIGH, NC 27605
PHONE 919-733-4996 FAX 919-715-3605

ATTACHMENT 1

North Carolina Superfund Section Comments
Focused Remedial Investigation Report - OU 15, Site 88
Marine Corps Base, Camp Lejeune, North Carolina

1. Page 3-9, Section 3.4.2.5 General Groundwater Flow Patterns. This discussion would be greatly enhanced by the construction of flownets.

2. Figure 3-3. The boring termination elevation for MW04I is not correct.

3. Page 4-3. Section 4.4 State and Federal Criteria and Standards. The soil to groundwater pathway must be considered. EPA's *Soil Screening Guidance* provides information on developing target concentrations. The following equation (derived from Equations 10 and 11 in the *Soil Screening Guidance: User's Guide*) can be used to calculate soil screening levels for the soil to groundwater pathway:

$$C_{soil} = C_{gw}\left[K_s + \frac{(\theta_w + \theta_a H')}{\rho_b}\right] df$$

Parameter - Definition [units]	**Value, (Source)**
C_{soil} - Calculated source concentration for soil [mg/kg]	Calculated
C_{gw} - Applicable groundwater target concentration [mg/L]	cis-1,2 DCE - 0.070, trans-1,2 DCE - 0.070, PCE - 0.0007, TCE - 0.0028, (NC 2L Standard)
df - Dilution factor [unitless]	20, (EPA *Soil Screening Guidance* default for 0.5 acre source size)
K_s - Soil-water partion coefficient [L/kg]	$K_s = K_{oc}\, f_{oc}$
K_{oc} - Soil organic carbon-water partion coefficient [L/kg]	Chemical-specific, (See table below.)
f_{oc} - fraction organic carbon in vadose zone soil [g-carbon/g-soil]	0.0057, (Site 88 Focused RI Report)
θ_w - water-filled soil porosity - vadose soils [L_{water}/L_{soil}]	0.30, (*NC Risk Analysis Framework* default)

Parameter - Definition [units]	Value, (Source)
θ_a - air-filled soil porosity - vadose soils [L_{air}/L_{soil}]	0.13, (*NC Risk Analysis Framework* default)
ρ_b - dry bulk density [kg/L]	1.18, (Site 88 Focused RI Report)
H' - Henry's Law Constant [unitless] *where: H' = Henry's Law Constant [atm-m^3/mole]x41(conversion factor)*	cis-1,2 DCE - 0.167, trans-1,2 DCE - 0.385, PCE - 0.754, TCE -0.374 (EPA *Soil Screening Guidance*)

Soil Screening Levels for the Soil-to-Groundwater Pathway - Site 88, Camp Lejeune

COMPOUNDS	CAS #	Screening Level (mg/kg)	Koc[a] (L/kg)
CIS-1,2-DICHLOROETHENE (cis-1,2 DCE)	156592	0.665	35.5
TRANS-1,2-DICHLOROETHENE (trans-1,2 DCE)	156605	0.719	38
TETRACHLOROETHYLENE (PCE)	127184	0.0259	265
TRICHLOROETHYLENE (TCE)	79016	0.0466	94.3

a Source: USEPA, 1996, *Soil Screening Guidance*

4. Page 4-4. Section 4.5.1 Soil Investigation. Second Paragraph and Table 4.1. The soil screening levels for the soil-to-groundwater pathway are exceeded for PCE and TCE.

5. Page 4-6. Section 4.6.1 Extent of Soil Contamination. As indicated in Comment 4, the soil screening levels for the soil-to-groundwater parthway are exceeded for PCE and TCE.

   Additional sampling to delineate the extent of VOC contamination of the subsurface soils is probably warranted. EPA Region IV has modified the standard procedure for collecting and analyzing soil samples for VOCs. The old procedures give results that are biased low. Future sampling events should use the new EPA methods.

6. Page 4-7. Last Paragraph. See Comment 4.

7. Table 5-1. The K_{oc} values listed in the soil screening levels table were obtained from the EPA *Soil Screening Guidance* and should probably be used in place of the value given in Table 5-1.

8. Page 6.2.2.3 State and Federal Criteria and Standards. Method II Category S3:G1 Target Concentrations were calculated in Comment 3 and should be included in this discussion of the criteria for the selecting of the contaminants of potential concern.

9. Page 6-6. Section 6.2.3.1 Subsurface Soil and Table 6-1. PCE and TCE should be retained as COPCs for Site 88 subsurface soil. See Comments 3 and 4.

10. Page 7-1. Comment 7. See Comment 9.

11. David Lilley's Comment on the Risk Assessment:

    Page 6-8, Section 6.5: It is unclear to the reader whether it is intended to include chloroform in the list of COPCs for groundwater. Please clarify this position.

Laura
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DIVISION OF WATER QUALITY
Groundwater Section
February 18, 1998

MEMORANDUM

RECEIVED
FEB 25 1998
SUPERFUND SECTION

TO: Arthur Mouberry

THROUGH: Rick Shiver

FROM: Charles Stehman

SUBJECT: Comments- Draft Phase I Investigation and Focused Remedial Investigation Report
Operable Unit 15, (Site 88)
Marine Corps Base, Camp Lejeune
Onlsow County

Site 88, (Building 25), is located within Camp Lejeune approximately 500 feet east of the intersection of Post Lane Road and Main Service Road. Dissolved and free phase chlorinated solvents are found to contaminate soil and groundwater at this site.

Building 25 has operated as a dry cleaning facility since the 1940's. The facility consists of one main building which is surrounded by several small sheds. The sheds are used to house ancillary equipment. The facility formerly contained five underground storage tanks in an area located on the north side of the building used to store Varsol, (dry cleaning fluid). The tanks were installed at the time the building was constructed and remained in use until the 1970's. In the 1970's, varsol use was discontinued in favor of tetrachloroethene (PCE) which was considered to be a safer and more effective cleaning agent. The PCE was reportedly stored in 150 gallon above ground storage tanks, outside building 25, in the same vicinity as the underground storage tanks. While the facility currently uses dry cleaning machines with self contained units, it is suspected that spent PCE may have been discarded in the past via floor sewer drains.

The underground storage tanks were removed in November of 1995. At the time the tanks were removed, contaminated soils were discovered and four temporary monitoring wells were installed to determine if groundwater impact had occurred. In the initial investigation soil samples were obtained from four well boring locations. Analysis of the subsurface soil samples showed soil contamination of PCE ranging from 13 ug/ kg to 55 ug/kg in three of four well borings, 1,2-dichloroethene (DCE) (total) at 9 ug/kg in one boring. Groundwater samples were obtained from four temporary wells constructed in these borings. Subsequent soil investigative work performed found soil contamination at higher levels. Iron and nickel were detected in two samples and Bis (2-ethyhexyl)phthalate in groundwater, but they are not believed to be associated with the solvent release at this site. TPH was detected in two groundwater samples at 628 ug/L and 552 ug/L, and naphthalene was detected. The Phase I Investigative Report stated that the TPH and naphthalene could be present as a result of Varsol management in the former UST area. All groundwater samples contained PCE in concentrations ranging from 415 ug/L to 29,200 ug/L,

1,2-dichloroethene from 154 ug/L to 10,000 ug/L. The Phase I Investigation report indicated that trichloroethylene was detected in a sample at 2,750 ug/L. No pesticides or PCBs were detected in the four groundwater samples.

In August of 1996, a Phase I investigation field investigation was conducted to include the installation of 15 shallow and 4 intermediate level monitoring wells to further delineate the extent of the contamination. Shallow wells ranged in depth from 15 to 20 feet below ground surface, and the intermediate wells ranged from 44 to 50 feet below ground surface. A total of 20 soil samples were obtained in the Phase I Investigation, and 19 soil samples in the Phase II investigation. It was determined the primary contaminant found in the subsurface soils were chlorinated solvent compounds. The most frequently detected compound detected was PCE and TCE. Other VOC's detected included acetone, 1,2-DEC, chloroform, cis-1,2-DCE, and carbon disulfide. Detections of VOC's ranged from 0.1 ppb (PCE, TCE, and chloroform) to 3,500 ppb (PCE). The study concluded that the impact to the soil contamination appeared to be concentrated in the area of building 25 extending northwest near building 43. The Focused Remedial Report stated that soil and groundwater contamination present was most likely due to past waste management activities. Twenty three temporary monitoring wells were installed and sampled. Trans-1,2-DCE was detected in one sample at 38 ug/L, cis-1,2-DCE was detected ranging from 3 ug/L to 3,725 ug/L, 1,1,1-TCA was detected in three samples ranging from 0.2 ug/L to 3,030 ug/L, and PCE was detected in 19 of 23 samples ranging from 0.2 ug/L to 53,703 ug/L.

The Phase II Investigation conducted in April and May of 1997 further delineated contamination in the area of building 43. A total 19 temporary wells were installed, and 21 permanent monitoring wells were installed. PCE, TCE and cis-1,2-DEC were detected in water samples from both the surficial and intermediate aquifers. Shallow groundwater contamination extended from areas northwest and south of building 25. The highest PCE levels detected were around 55,000 ppb. Samples from wells installed close to building 25 during the DNAPL investigation in the Phase I investigation showed concentrations of 170,000 ppb. The Surficial Aquifer investigation has been subdivided into two distinct units: upper and lower. The lower surficial aquifer groundwater contamination extends to the northwest 500 feet, to the north and 500 feet south of building 25. The highest contaminant levels were in the vicinity of, and northwest of building 25. According to the reports presented, deep groundwater (the upper portion of the Castle Hayne Aquifer), has not been impacted, however, a discontinuous clayey later at approximately 20 feet below ground surface appears not to have completely restricted the vertical migration of the contaminants which are present in the upper portions of the Castle Hayne Aquifer at levels below state standards. Further characterization of the DNAPL plume is being conducted.

Contaminants at the site migrate in both a dissolved state, or as an immiscible liquid. Chlorinated solvents (PCE) have a tendency to sink due to the specific gravity of groundwater. Dense non-aqueous phase liquids (DNAPL), has been detected in the surficial aquifer on the north side of building 25. The presence of the DNAPL source on the north side of building 25 is a continuing secondary source of the dissolved contaminant plume in groundwater. Consistent with geology at Camp Lejeune, site 88 contains a laterally discontinuous clay layer. This discontinuity

hydraulically connects the surficial aquifer to upper portions of the underlying Castle Hayne aquifer. The strong vertical groundwater flow component between the upper and lower surficial aquifers has caused dissolved contaminants to migrate down to the intermediate zone and spread laterally. The vertical extent of the plume is approximately 50 feet below land surface.

The Land Use Demographics section of the Executive Summary in the Focused Remedial Investigative Report states that no active supply wells are within a one mile radius of site 88. One supply well had been identified within a one mile radius of site 88, but was closed and abandoned since the release.

There is some suggestion that a sewer line has enhanced the northwest migration of contaminants from the source. No drinking water supply wells have been identified within one mile of the site. No surface water bodies are located on or adjacent to site 88, and the relatively flat topography of the site tends to cause surface water run-off from buildings, walkways, and parking lots to collect in storm drains. Water that falls on the bare or grassy areas has a tendency to pond, however the surface water does evaporate. According to the "Focused Remedial Investigation", water was discharging, at the time of the investigation, from building 25 to the ground on the north side of the building, and ponding. Shallow groundwater at the site moves multi-directional due to the presence of two groundwater recharge areas. The Castle Hayne aquifer flows north at a very low velocity. The nearest down gradient receptor is Beaver Dam Creek, which is located approximately 1,500 feet to the northeast, however, the plume does not appear to be moving towards this creek, but rather appears to migrate toward the New River. There is some deflection of the plume by the groundwater recharge area at the water tower. No proposal for remedial alternatives has been presented in this document, however a partitioning tracer test is proposed to determine the extent and estimate the amount of DNAPL present at the site.

Qualitative risk assessment evaluates the projected impact of the contaminants of potential concern on human health and/or the environment based on geographic, demographic, physical and biological characteristics of the study area. No contaminants of potential concern were identified of subsurface soils at site 88. Therefore, based on the standards and criteria, it is unlikely that adverse human health effects would result from exposure to subsurface soils at site 88. The groundwater constituents of potential concern at site 88 were 1,1-dichloroethene, tetrachloroethene, trans-1,2 dichloroethene, trichloroethene, and vinyl chloride. Even though contaminants of potential concern were identified in groundwater, due to the current land use of the site, and absence of drinking water supply wells within a one mile radius, it is unlikely that the presence of volatile compounds in the groundwater would present potential for adverse human health effects at the present time.

Commentary

Air Quality Section
There is no commentary from the Air Quality Section at this time.

Water Quality Section
There is no commentary from the Water Quality Section at this time.

Groundwater Section

Diane Rossi with the Groundwater Section of the Wilmington Regional Office reviewed the subject report. The Phase I Investigation appeared to show an area of incomplete delineation of the surficial aquifer contamination on the western portion of the site based on the groundwater flow map presented in the report. However, the complicated groundwater flow patterns, and additional delineation of the site presented in the Focused Remedial Investigation appeared to show adequate delineation of the surficial aquifer. Therefore, the Groundwater Section is in basic agreement with the information presented in these documents. While the Groundwater Section is in agreement with the proposal for remediation, this site is considered to contain a great deal of contamination which should not be overlooked. Additional DNAPL investigation and characterization, and a surfactant enhanced aquifer remediation technology proposal are forthcoming. Further comments from the Groundwater Section are pending review of the proposal report.

If you have questions, please do not hesitate to contact Diane Rossi or myself at (910) 395-3900.

cc: David Lown
WiRO-GWS, WiRO-WQS, WiRO-AQS

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RSS/CFS/CDR/gjg