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TECHNICAL MEMORANDUM 2003 AND 2004 GROUNDWATER SAMPLING RESULTS FOR
SOLID WASTE MANAGEMENT UNITS 1, 2B AND 24 NAS OCEANA VA
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CH2M HILL

2003 and 2004 Groundwater Sampling Results for SWMUs 1, 2B, and 24 NAS Oceana- Virginia Beach, VA

PREPARED FOR: Tim Reisch/LANTDIV
Greyson Franklin/USEPA Region III
Steve Mihalko/VADEQ
Valerie Walker/CNRMA

PREPARED BY: Laura Cook/CH2M HILL

COPIES: Paul Landin/CH2M HILL

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This technical memorandum summarizes the results of the field effort and groundwater sampling associated with four rounds of sampling conducted at SWMUs 1, 2B, and 24 (Figure 1), NAS Oceana in January 2003, July 2003, November 2003, and January 2004. The work plan for this sampling event was finalized in January 2003 and is entitled, *Background Investigation and Hot Spot Groundwater Remediation Pilot Testing at SWMUs 1, 2B, and 24*. The objectives for this field effort identified in the work plan include:

- Sampling and analysis of specific organic constituents that exceed Maximum Contaminant Levels (MCLs) or calculated human health based Preliminary Remediation Goals (PRGs) at 14 individual monitoring wells at SWMUs 1, 2B, and 24.
- Evaluation of resulting analytical data and development of potential in-situ "hot spot" remediation alternatives at these 14 monitoring wells.

Based on analytical results from the baseline sampling at SWMUs 1, 2B, and 24, it was determined that hot spot remediation may not be necessary at these SWMUs. Contaminants were detected at concentrations either below or just slightly above corresponding preliminary remediation goals (PRGs). PRGs were developed as part of the feasibility studies conducted for these SWMUs published in *Final Feasibility Study SWMUs 1, 15, and 24* (CH2M HILL, 2001) and *Final Feasibility Study for SWMUs 2B, 2C, and 2E* (CH2M HILL, 2002). Four rounds of quarterly sampling were proposed to determine if natural attenuation was occurring before any decisions were made to perform hot spot remediation. Field procedures and background sampling results are detailed below.

Inspection of Existing Wells

Existing site wells at SWMUs 1, 2B, and 24 were inspected in January 2003 to determine condition prior to sampling. All wells identified in the work plan were determined to be fit for sampling with the exception of three wells at SWMU 2B and one well at SWMU 24. Monitoring wells sampled at each of these SMWUs during this investigation are shown in Figures 2 through 4.

OW2B-MW2, OW2B-MW3, and OW2B-MW4 could not be found at SWMU 2B and are believed to have been removed or covered over by the recent flightline expansion. OW2B-MW13 and OW2B-MW15 were removed as part of the flightline expansion, and have been relocated as shown on Figure 3. OW2B-MW2 and OW2B-MW3 were replaced with one new well after the expansion, but the new well was also paved over shortly after installation. SWMU 24 well, OW24-MW09, also could not be located. A hand-held GPS unit was used to try to locate this monitoring well. A 6'x4'x4' pile of soil/debris (fill) was located in the position the GPS indicated as the well location, so it is believed that the well was covered at the time of the investigation.

Groundwater Sampling and Quality Control

Samples were collected from 10 of the site monitoring wells in January 2003, July 2003, November 2003, and January 2004. Figures 2 through 4 show the locations of the 10 site wells that were sampled. Wells were sampled using a peristaltic pump with low-flow sampling protocol. Wells were purged prior to sampling in order to remove standing water from the well and ensure that samples were representative of the aquifer. Water quality parameters such as pH, conductivity, turbidity, dissolved oxygen, temperature, salinity, and oxidation/reduction potential were monitored during purging. Wells were sampled after water quality parameters stabilized. Stabilization generally took between 25 and 30 minutes. Water levels were measured throughout the sampling process in order to monitor and minimize well drawdown. Wells were sampled for specific organic constituents identified in Tables 1-3. All samples were contained in laboratory prepared and pre-preserved sample containers, packed on ice, and shipped overnight to Severn Trent Laboratories, North Canton, Ohio.

Field Quality Assurance and Quality Control (QA/QC) samples were collected during the field activities in order to evaluate field methodologies (duplicates) evaluate whether cross contamination occurred during sampling or shipping (trip blanks), and establish field ambient conditions (field blanks). Filtration blanks were also collected during each background sampling event to evaluate possible cross-contamination from the field filter. Temperature blanks were included in each cooler so that the lab could confirm cooler temperature to be less than 4 degrees Celsius when the coolers arrived at the laboratory.

Analytical Results

Data Tracking and Validation

Field samples and their corresponding analytical tests were recorded on chains-of-custody. Upon receipt of the samples by the laboratory, a comparison to the field information was made to determine if each sample was listed for analysis of the correct parameters. In addition, a check was made to ensure that the proper number of QA/QC samples was collected for each media.

Analytical results were submitted to a third party data validator for validation. Validated analytical results of detected constituents for the four rounds of sampling are presented in

Tables 1 through 3. Data qualifiers employed during the validation process include J, K, and U. Data qualified with a "J" indicate that the values are estimated. Data may be estimated for several reasons including: exceedance of holding times; intrasample variability; tentatively identified compounds; or if the reported value is below the Contract Required Detection Limit (CRDL) or the Contract Required Quantitation Limit (CRQL). Data qualified with a "K" indicate that the analyte is present, but the reported value may be biased high and the actual value is expected to be lower. Data qualified with a "U" indicate that the analyte was not detected and the associated number indicates the approximate sample concentration necessary to be detected.

SWMU 1 Analytical Results

The validated analytical results for SWMU 1 are presented as Table 1. For the first sampling round at OW01-PZ03, only one compound, benzene, was detected at a concentration exceeding its corresponding MCL. Benzene was detected at a concentration of 6.2 ug/L compared to the MCL of 5 ug/L. There were no exceedances of MCLs or PRGs in the analytical results of the OW01-MW04 sample. There were no compounds detected at concentrations exceeding their corresponding MCL/PRG in samples from either well during the second, third, and fourth rounds of sampling.

Figure 2 shows SWMU 1 well locations and associated water quality guideline exceedances for this investigation and previous investigations.

SWMU 2B Analytical Results

Validated analytical results for SWMU 2B are presented as Table 2. Vinyl chloride (VC) was detected at three wells at concentrations at or above the groundwater MCL of 2 ug/L during the first round of sampling. These wells are OW2B-MW01 (3.9 ug/L), OW2B-MW13 (2 ug/L), and OW2B-MW14 (5.4ug/L). During the second and third rounds of sampling, VC was detected at concentrations above the groundwater MCL in only two samples from monitoring wells OW2B-MW01 and OW2B-MW14. During the fourth round of sampling, VC was detected at OW2B-MW14 at a concentration of 5.2 ug/L, in exceedance of the groundwater MCL of 2 ug/L but the concentration (0.69 ug/L) detected in the sample from OW2B-MW01 was below the MCL. There were no other exceedances of the VC MCL during the fourth round of sampling.

The groundwater samples from OW2B-MW01 also contained concentrations of tetrachloroethene (PCE), trichloroethene (TCE) and cis-1,2 dichloroethene (cis-1,2 DCE) at concentrations above the corresponding MCLs during at least one round of sampling. PCE concentrations at OW2B-MW01 were 57 ug/L (Jan 2003), 36 ug/L (Jul 2003), 230 ug/L (Nov 2003), and 18ug/L (Jan 2004). The MCL for this compound is 5 ug/L. Concentrations of TCE were 160 ug/L (Jan 2003), 170 ug/L (Jul 2003), 270 ug/L (Nov 2003), and 21 ug/L (Jan 2004). The MCL for this compound is 5 ug/L. Concentrations of cis 1,2 DCE were 69 ug/L (Jan 2003), 130 ug/L (Jul 2003), 200 ug/L (Nov 2003), and 20 ug/L (Jan 2004). The MCL for this compound is 70 ug/L. These were the only other detections that exceeded a corresponding MCL at SWMU 2B.

SWMU 24 Analytical Results

Validated analytical results for SWMU 24 are presented as Table 3. The concentration of cis-1,2-dichloroethene detected in the sample from OW24-PZ03S (81 ug/L), exceeded the

groundwater MCL of 70 ug/L during the first round of sampling. This was the only exceedance of a MCL/PRG at SWMU 24 for any of the four sampling rounds.

Figure 4 shows SWMU 24 well locations and associated water quality guideline exceedances for this investigation and previous investigations.

Summary of Historical Data

Table 4 includes available historical analytical data for the specific constituents evaluated at each of the SWMUs from May 1986 until January 2004. These constituents were retained based upon the results of the Human Health Risk Assessments that were completed at each SWMU.

Remediation Alternatives and Recommendations

SWMU 1

Sampling results indicated that benzene remains in the groundwater at SWMU 1 near OW01-PZ03 at a concentration of approximately 5 ug/L. This detected concentration is the same as the MCL for benzene of 5 ug/L. Naphthalene was not detected at concentrations exceeding MCLs during the January 2003, July 2003, November 2003 or January 2004 groundwater sampling events at SWMU 1.

The HHRA for SWMU 1 (CH2M Hill, January 2001) indicated risk from potable use of groundwater by future child and adult resident due to naphthalene. Benzene concentrations above the MCL were included since concentrations would have triggered ARARs if remedial actions were necessary. Existing concentrations of naphthalene and benzene do not pose a risk to human health or the environment.

Based upon the results of the January 2003, July 2003, November 2003, and July 2004 sampling events, the recommendation for SWMU 1 is:

- No further action

SWMU 2B

Sampling results indicated that several organic constituents are still present in groundwater at SWMU 2B, including PCE, TCE, cis-1,2 DCE, trans-1,2 DCE, and VC. Three of the monitoring wells to be sampled were not located during field efforts due to recent expansion of the flight line and hangars. While there are several organic exceedances at SWMU 2B, the highest detected concentrations were in monitoring well OW2B-MW01.

Based upon the results of the January 2003, July 2003, November 2003, and January 2004 sampling events, the recommendations for SWMU 2B are:

- Perform hot spot remediation around OW2B-MW01 by injecting HRC, or equivalent reagent, into the substrate to promote biological reductive chlorination of these chlorinated VOCs. Anaerobic degradation is recommended since it is more effective on the TCE.
- Perform hot spot remediation around OW2B-MW14 by injecting ORC into the substrate to promote degradation of VC.

- No further action at monitoring wells OW2B-MW02 and OW2B-MW03 where low concentrations of VOCs have been historically detected. Although these monitoring wells were not located and sampled during this event, the VC concentration (February 2000) in OW2B-MW03 was equal to the MCL of 2 ug/L and it is likely that natural degradation processes have reduced the VC in groundwater near this location. The TCE in OW2B-MW02 was above the MCL of 5 ug/L during the February 2000 sampling event at a concentration of 14 ug/L. Recent flightline expansion at NAS Oceana has utilized this area as a parking lot and efforts to re-install and sample a monitoring well to perform localized remediation on TCE at this historical concentration when an associated plume has not been identified would not be cost effective when it is highly unlikely site conditions or use will change as long as NAS Oceana remains an active facility.
- No further action at well OW2B-MW04 where bis(2-ethylhexyl)phthalate was detected at a concentration of 30 ug/L during the February 2000 sampling event. This constituent was not detected during the November 2003 and January 2004 sampling events.
- No further action at monitoring wells OW2B-MW05, OW2B-MW13, OW2B-MW17, and OW2B-MW18 where VC was historically detected at concentrations above the MCL of 2 ug/L. VC was not detected in samples from these wells during the January 2004 sampling round. Historic concentrations of 1,1 dichloroethene and benzene were also in exceedance of MCLs at OW2B-MW17, but these constituents were either not detected (1,1 DCE) or detected at concentrations below the MCL (benzene) during the January 2004 sampling event.

SWMU 24

Although OW24-MW09 could not be located during the January sampling event, this monitoring well has historically contained low concentrations of TCE (17 ug/L in March 1995 and 8.8 ug/L in November 1998) that are expected to be continuing to decrease. Efforts to install and sample a new monitoring well for potential localized remediation on TCE with historical concentrations at this level would not be cost effective.

SWMU 24 was the subject of a NoVOCs™ pilot study in 1999 and a considerable reduction in cis-1,2-DCE was observed over the duration of the test. Sample results from January 2004 indicated no detections above MCLs/PRGs.

Based upon the results of the January 2003, July 2003, November 2003, and January 2004 sampling events, the recommendations for SWMU 24 are:

- No further action.

Summary of Recommendations

In accordance with the *Final Groundwater Remediation Plan for SWMUs 2B and 2E (CH2M HILL, June 2004)*, additional samples will be collected at OW2B-MW01 and OW2B-MW14. The results will be used to determine if hot spot remediation (where implemented) was effective. No additional sampling or remedial action is planned at SWMUs 1 and 24.