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CONFIRMATION STUDY
STEP 1A (VERIFICATION), ROUND ONE

Naval Supply Center, Cheatham Annex, Williamsburg, VA
and
Naval Supply Center, Yorktown Fuels Division, Yorktown, VA

A/E Contract No. N62470-85-C-7974

Prepared for:

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# 1.0 INTRODUCTION

This report presents the analytical results of the first round of sampling for Step 1A (Verification) of the Confirmation Study for Naval Supply Center (Norfolk) (NSC) Cheatham Annex and NSC Yorktown Fuels Division. Environmental samples were collected in the winter of 1986 from three study sites at NSC Cheatham Annex (locations shown in Figure 1-1) and from the general area of NSC Yorktown Fuels Division (shown in Figure 2-4). The schedule of samples and analyses for Step 1A is given in Table 1-1; this table also gives the schedule of samples and analyses for Step 1A at Naval Weapons Station (NWS) Yorktown since sites at NWS Yorktown were investigated as part of the same contract.

Subsections 1.1 through 1.4 of Section 1.0 discuss criteria and standards relevant to the data generated during Step 1A. These include EPA drinking water standards, EPA water quality criteria, and Virginia water quality standards and criteria, and reference standards for nitroaromatics in soils. Subsection 1.5 discusses the significance of false positives in laboratory method blanks. Section 2.0 discusses results on a site by site basis, and Section 3.0 presents recommendations for Round Two.

## 1.1 EPA NATIONAL PRIMARY DRINKING WATER REGULATIONS

Drinking water maximum contaminant levels (MCL) and recommended maximum contaminant levels (RMCL) established by these regulations are not directly applicable to waters sampled during this study since the regulations pertain to public water systems. RMCL's are nonenforceable health goals, which are set at levels that would result in no known or anticipated adverse health effects with an adequate margin of safety. RMCL's for substances considered to be probable human carcinogens have been set at zero. MCL's are enforceable standards that are normally set as close to the RMCL's as feasible. MCL's may be important in that they may be used to establish cleanup levels at sites covered by the Resource Conservation and Recovery Act (RCRA) and the Safe Drinking Water Act (SDWA). MCL's are also important to the enforcement of RCRA regulations because they have been used in the past to establish maximum concentration levels under the EP toxicity test and groundwater monitoring requirements. The current MCL's and RMCL's for contaminants addressed in this study are listed in Table 1-2.

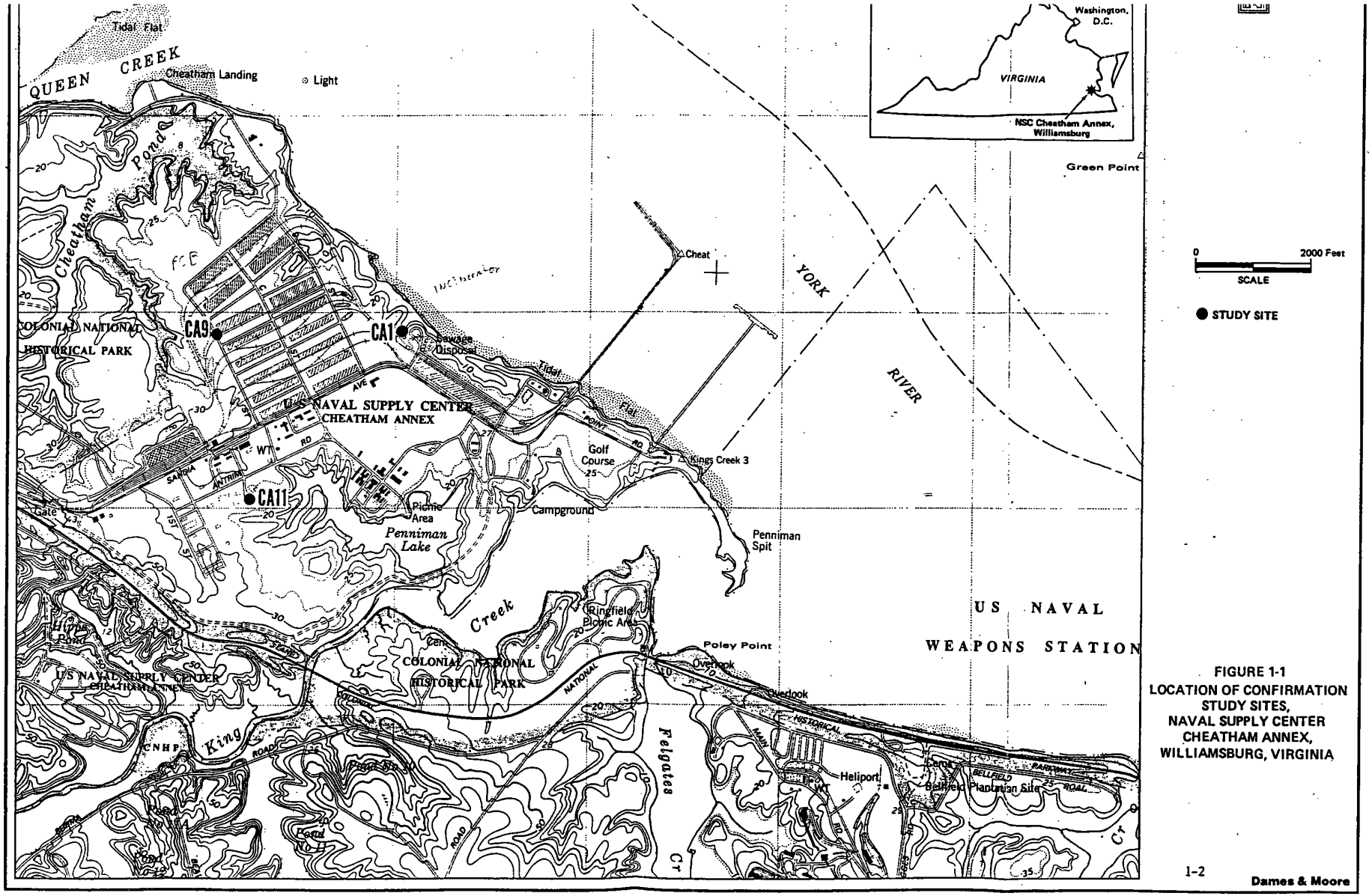



FIGURE 1-1
LOCATION OF CONFIRMATION STUDY SITES, NAVAL SUPPLY CENTER CHEATHAM ANNEX, WILLIAMSBURG, VIRGINIA

Table 1-1. Confirmation study sampling and analysis plan.

| Site No. | Wells to be Installed | Ground-water Samples | Surface water Samples | Bottom Sediment Samples | Soil Samples | Other Samples | Analytical Parameters(a) |
|---|---|---|---|---|---|---|---|
| Cheatham Annex | | | | | | | |
| 1 | 2 | 6 | - | - | - | - | A,C,J,L,M(Cr+6),N |
| 9 | - | - | - | - | 13 | - | I |
| 10 | - | - | - | - | - | - | Magnetometer Survey |
| 11 | 3(b) | 3(b) | 3 | 3 | 9(c) | - | B,C,J,K,L,M(Pb),N |
| 11 | - | - | - | - | - | 20 drum/tank | R |
| Yorktown Fuels Division | | | | | | | |
| 13,14-26 | 8 | 8 | 5 | 5 | 8(c) | - | D,E,F,J,M(Pb) |
| 27,31 | 5 | 5 | 1 | 1 | 5(c) | - | D,E,F,J |
| General | - | - | - | - | - | 5 fuel | F (As standards) |
| Naval Weapons Station, Yorktown | | | | | | | |
| 1,3,11,17 | 9 | 9 | 2 | 2 | - | - | A,C,H,J,L,M(Ba,Cr+6),N |
| 2 | 4 | 4 | 3 | 3 | - | - | A,C,J,M(Cr+6),N Magnetometer survey |
| 4 | 5 | 5 | 2 | 2 | - | - | A,C,H,J,M(Ba,Cr+6),N |
| 5 | - | - | - | - | 10 | - | I |
| 6 | - | - | 3 | 3 | 4 | - | B,H,N |
| 7 | - | - | 2 | 2 | 2 | - | B,H,N |
| 8 | - | - | 2 | 2 | 2 | - | A,C,H,J,M(Cr+6),N |
| 9 & 19 | - | - | 2 | 2 | 8 | - | B,H,N |
| 12 | 3(d) | 3(d) | 3 | 3 | - | - | A,C,H,J,L,M(Ba,Cr+6),N |
| 16 | 5 | 5 | 2 | 2 | - | - | A,C,J,L,M(Cr+6),N |
| 18 | - | - | - | - | 3 | - | M(Hg,Cd,Ni,Pb,Cr,Cr+6,Zn),N |
| 20(e) | 3 | 3 | - | - | 9(f) | - | G,L,N |

NOTES:

(a). List of analytical parameters, as follows:
- A - Priority pollutants (except asbestos)
- B - VOAs and Base-Neutrals
- C - Xylene, MEK, MIBK
- D - Toluene, Xylene
- E - PAHs
- F - Fuels (NSFO, JP-4, JP-5, MOGAS, and AVGAS)
- G - Propylene glycol dinatrate
- H - Explosives (TNT, RDX, 2,4-DNT, HMX, and the 4 TNT degradition products specified in the scope of work.)
- I - PCBs and TCDDs
- J - EDB
- K - Phenols, total
- L - Oil and grease
- M - Metals (indicated by chemical symbol)
- N - pH (Water samples only, in the field)
- R - RCRA Characterization analyses

(b). Modification to scope of work from contract negotiations.

(c). Soil samples collected during drilling of each well at these sites will be blended to make one composite soil sample per well.

(d). Modification to scope of work from site reconnaissance.

(e). Otto Fuel site.

(f). Soil samples for analysis will be taken from each well at depths

TABLE 1-2

Relevant EPA RMCL's and MCL's and State of Virginia Water Quality Criteria and Standards (ug/l)

| Parameter | RMCL | MCL | Virginia Criteria for Protection of Aquatic Life |
|---|---|---|---|
| **Purgeable Organics** | | | |
| Benzene | 0 | 5.0 | |
| Carbon tetrachloride | 0 | 5.0 | |
| Chlorobenzene | 60 | | |
| Ethylbenzene | 680 | | |
| Toluene | 2,000 | | |
| 1,2-dichloroethane | 0 | .005 | |
| 1,1,1-trichloroethane | 200 | 200 | |
| 1,1-dichloroethylene | 7 | 7 | |
| 1,2-dichloropropane | 6 | | |
| Tetrachloroethylene | 0 | | |
| Trichloroethylene | 0 | 5 | |
| Vanyl chloride | 0 | 1 | |
| 1,2-trans Dichloroethylene | 70 | 5 | |
| **Acid Extractable Organics** | | | |
| Pentachlorophenol | 200 | | |
| **Pesticides/PCB** | | | |
| Aldrin | | | 0.003 |
| Chlordane | | | 0.004 |
| DDT | | | 0.001 |
| Demeton | | | 0.1 |
| Dieldrin | | | 0.0019 |
| Endosulfan | | | 0.0087 |
| Endrin | | 0.2 | 0.0023 |
| Heptachlor | 0 | | 0.0038 |
| Heptachlor epoxide | 0 | | |
| Toxaphene | 0 | | 0.0007 |
| **Metals** | | | |
| Arsenic | 50 | 50 | 63 |
| Barium | 1,500 | 1,000 | |
| Cadmium | 5 | 10 | |
| Chromium | 120 | 50 | |
| Copper | 1,300 | | 2.0 |
| Cyanide | | | 0.57 |
| Hexavalent chromium | | | 54 |
| Lead | 20 | 50 | 8.6 |
| Mercury[a] | 3. | 2. | 0.1 |
| Selenium | 45. | 10 | 54 |
| Silver | | 50 | 0.023 |
| Zinc | | | 48 |
| Xylene | 440 | | |
| Etylene dibromide (EDB) | 0 | | |
| PCB | 0 | | 0.03 |
| Phenols | | | 1.0 |
| Phthalate esters | | | 3.0 |
| pH | 6.5-8.5 | | 6-9 |

SOURCE: EPA (1985) National Primary Drinking Regulations, 40CFR Part 141; Code of Virginia, section 62.1-44.15 (3) 1950, Amendments 1984.

[a]The Virginia standard for mercury in freshwater streams and sediments is 0.05 ug/l/300 ng/g.

## 1.2 EPA WATER QUALITY CRITERIA

EPA has established water quality criteria for 64 toxic pollutants or pollutant categories (EPA, 1980). Criteria are given for saltwater aquatic life and human health. A summary of criteria for parameters analyzed in the Confirmation Study Step 1A is given in Table 1-3.

Human health criteria are derived from animal toxicity data and are given as ambient criteria for noncarcinogenic pollutants and as concentrations estimated to cause a specified level of incremental cancer risk (ICR) for carcinogens. Human health criteria assume that lifetime intake of the pollutant comes from two sources--drinking an average of 2 liters of water per day, and ingesting an average of 6.5 grams of fish per day. Concentrations for ICR in Table 1-3 show those pollutants that are estimated to cause a lifetime carcinogenic risk of $10^{-6}$, or one cancer in a population of 1 million. These concentrations are conservative (low) and are often well below analytical detection limits. Methods for determining human health criteria are discussed in detail by EPA (1980).

EPA water quality criteria are intended as guidelines and have no regulatory effect. Ambient criteria provide guidelines for potable water and consumption of aquatic organisms.

## 1.3 COMMONWEALTH OF VIRGINIA AMBIENT WATER QUALITY STANDARDS AND CRITERIA

Virginia Water Quality Standards (VWQS) contain specific water quality criteria only for parameters such as bacteria, solids, dissolved oxygen, pH, and temperature. Standards for these parameters are devised for drinking water supplies and all categories of surface waters. One standard that does apply in some cases at the Yorktown Naval Weapons Station/Naval Supply Center is the total recoverable mercury standard of 0.05 ug/l in freshwater streams and 300 ng/g (ppb) in freshwater sediments (amendment 1984 to section 62.1-44(3), Code of Virginia). This is an enforceable Virginia standard.

Virginia has also promulgated chronic criteria for the protection of aquatic life (water quality criteria) based on EPA criteria from the Federal Water Pollution Control Act, but these may or may not be set at the present EPA levels. The criteria are not mandatory, but are established so that "when not exceeded, should generally protect the water environment for aquatic life and various reasonable

## TABLE 1-3

### Relevant EPA Water Quality Criteria

| Parameter | Criteria for Saltwater Aquatic Life (ug/l) | | | | Human Health Criteria (ug/l) | | |
|---|---|---|---|---|---|---|---|
| | Acute Toxicity Level[a] | Chronic Toxicity Level[a] | Maximum 24-Hour Average | Maximum Concentration | Potable Water Taste/Odor Control[b] | Ingestion of Water and Aquatic Organisms | |
| | | | | | | Ambient Criterion | $10^{-6}$ ICR |
| **Purgeable Organics** | | | | | | | |
| Acrolein | 55 | | | | | 320 | |
| Acrylonytrile | | | | | | 0[c] | 0.058 |
| Benzene | 5,100 | | | | | 0[c] | 0.66 |
| Carbon tetrachloride | 50,000 | | | | | 0[c] | 0.40 |
| Chlorinated ethanes | 113,000 | | | | | | |
| 1,2-dichloroethane | | | | | | 0[c] | 0.94 |
| 1,1,2-trichloroethane | | | | | | 0[c] | 0.60 |
| 1,1,2,2-tetrachloroethane | 9,020 | | | | | 0[c] | 0.17 |
| 1,1,1-trichloroethane | 31,200 | | | | | 18,400 | |
| Chloroalkyl ethers | | | | | | | |
| bis-(chloromethyl)-ether | | | | | | 0[c] | $0.38 \times 10^{-6}$ |
| Chloroform | | | | | | 0[c] | 0.19 |
| Dichloroethylenes | 224,000 | | | | | | |
| 1,1-dichloroethylene | | | | | | 0[c] | 0.033 |
| Dichloropropanes | 10,300 | 3,040 | | | | | |
| Dichloropropenes | 790 | | | | | 87 | |
| Ethylbenzene | 430 | | | | | 1.4 | |
| Halomethanes | 12,000 | 6,400 | | | | 0[c] | 0.19 |
| Tetrachloroethylene | 10,200 | 450 | | | | 0[c] | 0.80 |
| Toluene | 6,300 | 5,000 | | | | 14,300 | |
| Trichloroethene | 2,000 | | | | | 0[c] | 2.7 |
| Vinyl chloride | | | | | | 0[c] | 2.0 |

[a] Toxicity may occur at lower concentrations among species more sensitive than those tested.

[b] Organoleptic data used as basis for taste and odor control have no demonstrated relationship to adverse human health effects.

[c] Zero level may not be attainable at this time.

SOURCE: EPA, 1980.

TABLE 1-3 (cont'd)

| Parameter | Criteria for Saltwater Aquatic Life (ug/l) | | | | Human Health Criteria (ug/l) | | |
|---|---|---|---|---|---|---|---|
| | Acute Toxicity Level[a] | Chronic Toxicity Level[a] | Maximum 24-Hour Average | Maximum Concentration | Potable Water Taste/Odor Control[b] | Ingestion of Water and Aquatic Organisms | |
| | | | | | | Ambient Criterion | $10^{-6}$ ICR |
| **Base/Neutral Extractable Organics** | | | | | | | |
| Acenaphthene | 970 | 710 | | | 20 | | |
| Benzidine | | | | | | 0[c] | 0.00012 |
| Chlorinated benzenes | 160 | 129 | | | | | |
| Hexachlorobenzene | | | | | | 0[c] | 0.00072 |
| Hexachloroethane | 940 | | | | | 0[c] | 1.9 |
| Chlorinated napthalenes | 7.5 | | | | | | |
| bis(2-chloroethyl) ether | | | | | | 0[c] | 0.03 |
| bis(2-chloroisopropy) ether | | | | | | 34.7 | |
| Dichlorobenzenes | 1,970 | | | | | 400 | |
| Dichlorobenzidines | | | | | | 0[c] | 0.0103 |
| 2,4-dinitrotoluene | 590 | | | | | 0[c] | 0.11 |
| 1,2-diphenylhydrazine | | | | | | 0[c] | 0.042 |
| Fluoranthene | 40 | 16 | | | | 42 | |
| Hexachlorobutadiene | 32 | | | | | 0[c] | 0.45 |
| Hexachlorocyclopentadiene | 7 | | | | 1 | 206 | |
| Isophorone | 12,900 | | | | | 5.2 | |
| Napthalene | 2,350 | | | | | | |
| Nitrobenzene | | | | | 30 | 19.8 | |
| Phthalate esters | 2,944 | 3 | | | | | |
| Dimethyl phthalate | | | | | | | 313,000 |
| Diethyl phthalate | | | | | | | 350,000 |
| Dibutyl phthalate | | | | | | | 34,000 |

TABLE 1-3 (cont'd)

| Parameter | Criteria for Saltwater Aquatic Life (ug/l) | | | | Human Health Criteria (ug/l) | | |
|---|---|---|---|---|---|---|---|
| | Acute Toxicity Level[a] | Chronic Toxicity Level[a] | Maximum 24-Hour Average | Maximum Concentration | Potable Water Taste/Odor Control[b] | Ingestion of Water and Aquatic Organisms: Ambient Criterion | Ingestion of Water and Aquatic Organisms: $10^{-6}$ ICR |
| **Phenolic Compounds** | | | | | | | |
| Chlorinated Phenols | | | | | | | |
| 4-chloro-3-methelphenol | | | | | | | |
| 2,3,5,6-tetrachlorophenol | 440 | | | | | | |
| 4-chlorophenol | 29,700 | | | | | | |
| 3-monochlorophenol | | | | | 0.10 | | |
| 4-monochlorophenol | | | | | 0.10 | | |
| 2,3-dichlorophenol | | | | | 0.04 | | |
| 2,5-dichlorophenol | | | | | 0.50 | | |
| 2,6-dichlorophenol | | | | | 0.20 | | |
| 3,4-dichlorophenol | | | | | 0.30 | | |
| 2,3,4,6-tetracholorophenol | | | | | 1.0 | | |
| 2,4,5-trichlorophenol | | | | | 1.0 | 2,600 | |
| 2,4,6-trichlorophenol | | | | | 2.0 | 0[c] | 1.2 |
| 2-methyl-4-chlorophenol | | | | | 1,800 | | |
| 3-methyl-4-chlorophenol | | | | | 3,000 | | |
| 3-methyl-6-chlorophenol | | | | | 20 | | |
| 2-chlorophenol | | | | | 0.10 | | |
| 2,4-dichlorophenol | | | | | 0.30 | 3,090 | |
| 2,4-dimethylphenol | | | | | 400 | | |
| Nitrophenols | | | | | | | |
| 2,4-dinitro-o-cresol | 4,830 | | | | | 13.4 | |
| dinitrophenol | | | | | | 70 | |
| Pentachlorophenol | 53 | 54 | | | 30 | 1,010 | |
| Phenol | 5,800 | | | | 0.30 | 3.5 | |

TABLE 1-3 (cont'd)

| Parameter | Criteria for Saltwater Aquatic Life (ug/l) | | | | Human Health Criteria (ug/l) | | |
|---|---|---|---|---|---|---|---|
| | Acute Toxicity Level[a] | Chronic Toxicity Level[a] | Maximum 24-Hour Average | Maximum Concentration | Potable Water Taste/Odor Control[b] | Ingestion of Water and Aquatic Organisms | |
| | | | | | | Ambient Criterion | $10^{-6}$ ICR |
| **Chlorinated Hydrocarbon Pesticides** | | | | | | | |
| Aldrin | | | | 1.3 | | | 0.000074 |
| Chlordane | | | 0.0040 | 0.08 | | 0 | 0.000046 |
| Dieldrin | | | 0.0019 | 0.71 | | 0[c] | 0.000071 |
| DDT | | | 0.0010 | 0.13 | | | 0.000024 |
| DDE | 14.0 | | | | | | |
| Endrin | | | 0.0023 | 0.037 | | 1 | |
| Heptachlor | | | 0.0036 | 0.53 | | 0[c] | .00028 |
| Lindane | | | | 0.16 | | | |
| Polychlorinated biphenyls | | | 0.030 | | | 0[c] | .00079 |
| **Heavy Metals** | | | | | | | |
| Arsenic | 500 | | | | | | 0.0022 |
| Beryllium | | | | | | 0[c] | 0.0037 |
| Cadmium | | | 4.5 | 59 | | 10 | |
| Chromium, trivalent | 10,300 | | | | | 170,000 | |
| Chromium, hexavalent | | | 0.18 | 1,260 | | 50 | |
| Copper | | | 4.0 | 23 | 1,000 | | |
| Lead | 668 | 25 | | | | 50 | |
| Mercury | | | .025 | 3.7 | 0.144 | | |
| Nickel | | | 7.1 | 140 | | 13.4 | |
| Silver | | | | 2.3 | | 50 | |
| Zinc | | | 47 | | 5 | | |
| Cyanide | 2.0 | | | | | 200 | |

beneficial uses with an adequate degree of safety." These criteria are shown in Table 1-2. For substances in surface water and groundwater not covered by the aforementioned criteria, the Code of Virginia states that:

> "All State waters shall be maintained at such quality as will permit all reasonable, beneficial uses and will support the propagation and growth of all aquatic life, including game fish, which might reasonably be expected to inhabit them. Reasonable beneficial uses include, but are not limited to, recreational uses, e.g., swimming and boating; and production of edible and marketable natural resources, e.g., fish and shellfish."

and

> "All State waters shall be free from substances attributable to sewage, industrial waste, or other waste in concentrations, amounts, or combinations which contravene established standards or interfere directly or indirectly with reasonable, beneficial uses of such water or which are inimical or harmful to human, animal, plant, or aquatic life. Specific substances to be controlled include, but are not limited to: floating debris, oil, scum, and other floating materials; toxic substances; substances that produce color, tastes, turbidity, odors, or settle to form sludge deposits, and substances which nourish undesirable or nuisance aquatic plant life. Effluents which tend to raise the temperature of the receiving water will also be controlled."

In addition, the "antidegredation policy for groundwater" further prohibits introduction of "the concentration of any constituent" that would exceed the natural quality for that constituent, if the present level is less than the groundwater standard (as stated above), and if the concentration of any constituent in groundwater exceeds the limit in the standard, no addition of that constituent to the naturally occurring concentration shall be made.

## 1.4 PRELIMINARY POLLUTANT LIMIT VALUES FOR NITROAROMATICS

As demonstrated in Tables 1-2 and 1-3, only 2,4-dinitrotoluene limit concentrations are addressed. The only reference standards for environmental contamination at this time for other nitroaromatics were established by the U.S. Army (USAMBDL). Preliminary pollutant limit values (PPLV) were devised for various land uses (see Table 1-4) and can be used as guidelines in this analysis. Concentrations are based on the risk of one excess cancer death in a 100,000 population ($10^{-5}$) and are valid for soil matrices only.

TABLE 1-4

Preliminary Pollutant Limit Values (PPLV)
for Various Land Uses

| Name of Contaminant | PPLV's (ug/kg of soil) | | | |
|---|---|---|---|---|
| | Subsistence Farming | Residential Housing | Apartment Dwellings | Industrial Use[a] |
| 2,4,6-trinitrotoluene | 2,400 | 2,200 | 13,000 | 2,600,000 |
| Dinitrotoluene[b] | 42 | 37 | 210 | 45,000 |
| Tetryl | 1,100 | 1,100 | 6,200 | 37,500 |
| Nitrobenzene | 4,000 | 3,700 | 21,000 | 127,500,000 |
| 1,3-dinitrobenzene | 840 | 720 | 4,100 | 25,000,000 |
| 1,3,5-trinitrobenzene | 670 | 650 | 3,700 | 781,000 |
| Aniline | 8,700 | 7,200 | 41,000 | 250,000,000 |
| N,N-dimethylaniline | 22,000 | 18,000 | 103,000 | 625,000,000 |
| Diphenylamine | 35,000 | 35,000 | 200,000 | 250,000,000 |
| Lead | 200,000 | 150,000 | 150,000 | 3,750,000 |
| Nitrocellulose[a] | 1,000,000 | 1,000,000 | 1,000,000 | -- |

[a]USAMBRDL would set all PPLV's at no higher than 1,000,000 ug/kg.

[b]PPLV developed based on a risk level of $10^{-5}$ (one excess cancer death in 100,000 population).

SOURCE: USATHAMA, 1981.

## 1.5 LABORATORY METHOD BLANKS

As standard laboratory procedure, blanks of organic free water are run with analytical lot for organic compounds to help verify the data. The presence of a given compound in the blank casts doubt on positive results for that compound in a given analytical lot. Contaminants detected in the method blanks are summarized in Table 1-5. One compound, methylene chloride, was so common in method blanks that only the exceptions are noted in Table 1-5. Methylene chloride, it should be noted, is a very common contaminant in most laboratories, and consequently data for this compound are generally open to question. In this study, the data for methylene chloride are reported in the tables but are not discussed in the text.

Table 1-5. Contaminants detected in laboratory method blanks.

| Compounds | Samples in lot | Concentration in blank. |
|---|---|---|
| :Volatiles | | |
| Methylene chloride | All samples. | Soils 4 to 59 ug/l<br>Water 4 to 16 ug/l |
| 1,1,1-Trichloroethane | NW2SD01, 02, 03. | 14 ug/kg |
| | NW2SW01, 02, 03. | 3 ug/l |
| Toluene | NW12SW02, 03. | 3 ug/l |
| :Base Neutrals | | |
| Anthracene | YFSW01 - YFSW06 | 0.09 ug/l |
| | YFSW03,YFGW09, 11, 12, 13 | 0.0893 ug/l |
| Isophorone | NW6S001 - NW6S004. | 332 ug/kg |
| Di-n-Butylphthalate | NW7S001, 02, CA11S002, 03, 04, 05, NW9S002. | 76 ug/kg |
| b2EHP | NW11GW03, 09, NW1GW04, NW3GW06, 07, 08, NW4GW01, 02, NW1GW05, NW2GW01. | 182 ug/l |
| :Nitroaromatics | All in same lot. | |
| 2,4-Diamino-6-NT | NW1GW04, 05, NW3GW06, 07, 08, | 0.539 ug/l |
| 2-Amino-4,6-DNT | NW4GW01, 02, NW11GW03, 09, | 2.49 ug/l |
| 2,4-DNT | NW17GW01, 02 | 1.75 ug/l |
| TNT | | 3.53 ug/l |
| RDX | | 1.03 ug/l |

NOTES
1. Prefixes are as follows:
   NW = NWS Yorktown
   CA = NSC Cheatham Annex
   YF = NSC Yorktown Fuels Division

# 2.0 SUMMARY OF RESULTS, NAVAL SUPPLY CENTER (NORFOLK) CHEATHAM ANNEX AND YORKTOWN FUELS DIVISION

The Confirmation Study included three sites at NSC Cheatham Annex (Figures 2-1 through 2-3) and the general area of the Yorktown Fuels Division (Figures 2-4 through 2-6). Site 1 at Cheatham Annex (Landfill Near Incinerator, Figure 2-1) was sampled for groundwater quality at six wells. The sampling survey at Site 9, the Transformer Storage Area (Figures 2-2 and 2-2A), consisted of 13 soil samples chemically analyzed for polychlorinated biphenols (PCB's) and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) content, and Site 11 (the Bone Yard, Figure 2-3) was sampled for groundwater and surface water quality (three wells and three surface water/sediment samples), soil, and drum contents.

## 2.1 RESULTS OF SAMPLING PROGRAM—NSC CHEATHAM ANNEX

### 2.1.1 Site 1 (Landfill Near Incinerator)

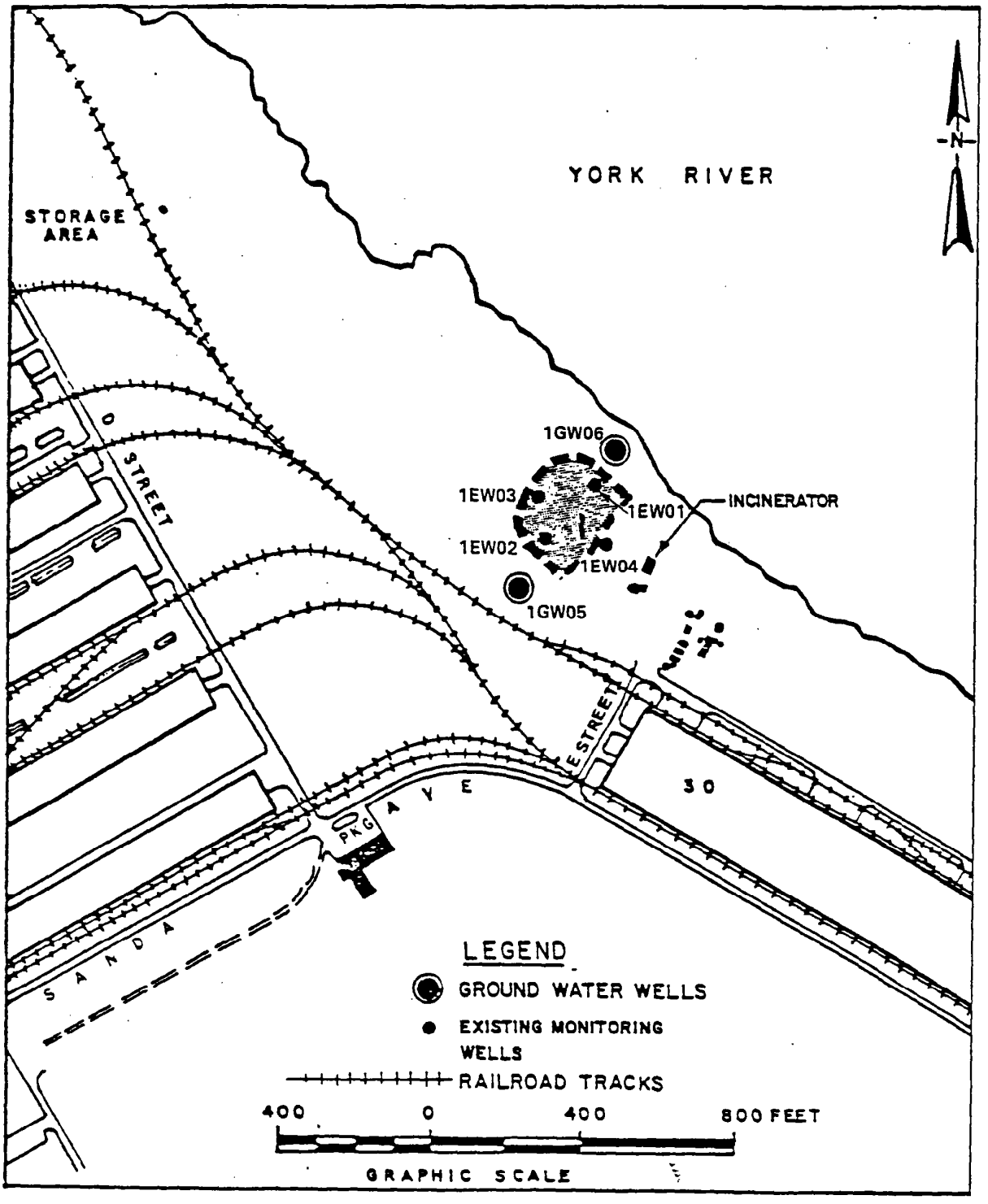
The sample schedule for the landfill designated as Site 1 at Cheatham Annex (Figure 2-1) consisted of sampling the groundwater from four steel and two PVC wells, the results of which can be found in Table 2-1.

The chemical analysis of the six wells at Site 1 detected one base-neutral extractable (BNE) organic compound, one pesticide, oil and grease, and three metals above the detection limits established.

The upgradient well, 1GW05, was found to contain 4.2 ug/l antimony and 2.8 ug/l lead (below any criterion). Water from well 1EW01 had detectable concentrations of antimony (7.3 ug/l), lead (2.3 ug/l), and zinc (1,550 ug/l). The value for zinc exceeds maximum 24 hour average for saltwater aquatic life, (MAX24AV), of 47 ug/l and the Virginia ambient criterion of 48 ug/l and the human health criterion for potable water taste/odor control (PWTOC) of 5 ug/l. Well 1EW02 produced a sample that contained 72 ug/l bis (2-ethylhexyl) phthalate, (B2EHP), which exceeded the Virginia criterion of 3 ug/l for phthalate esters, 5.2 ug/l antimony, and 0.21 ug/l mercury (exceeds Virginia criterion for mercury of 0.1 ug/l, MAX24AV of 0.025 ug/l and the ambient criterion of 0.144 ug/l), 909 ug/l zinc (exceeds Virginia ambient criterion of 48 ug/l and MAX24AV of 47 ug/l, and the PWTOC of 5 ug/l). The only other constituent found at well 1EW02 was 118.9 mg/l oil and grease; however there are no standards or criteria for oil and

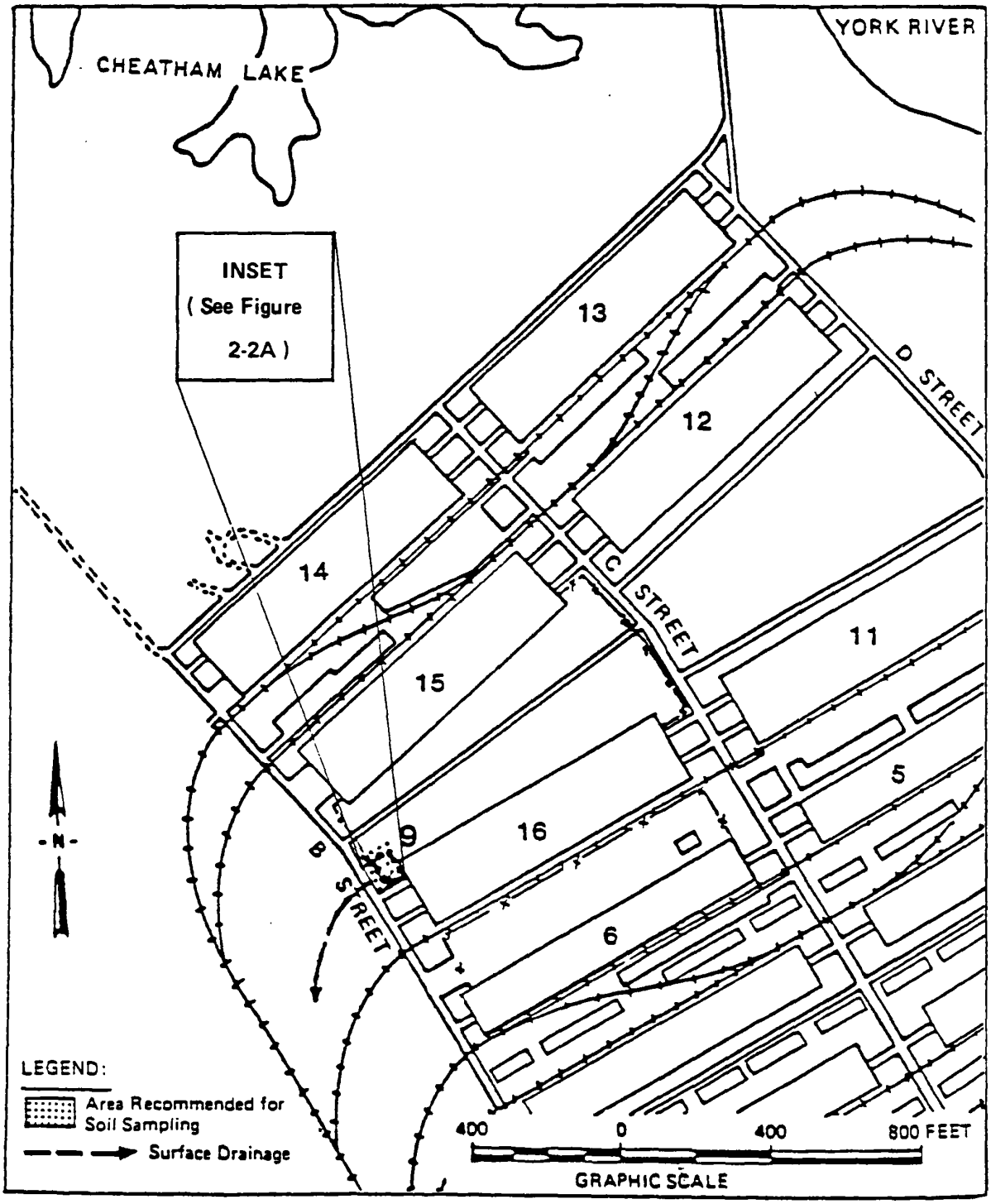
# Figure 2-1

## Site 1-Landfill Near Incinerator
## Sampling Points



# Figure 2-2

## Site 9-Transformer Storage Area
## Soil Sampling Points



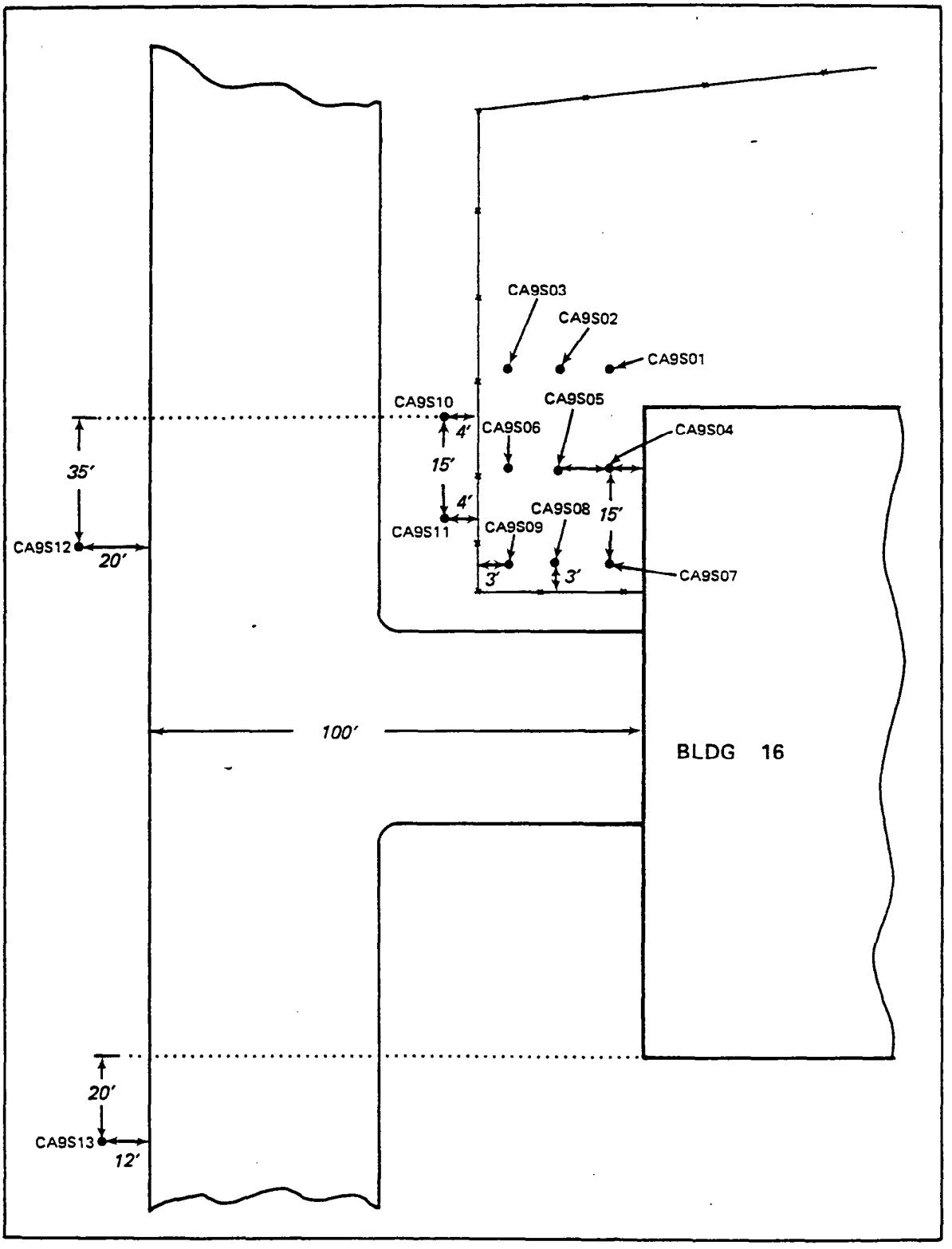
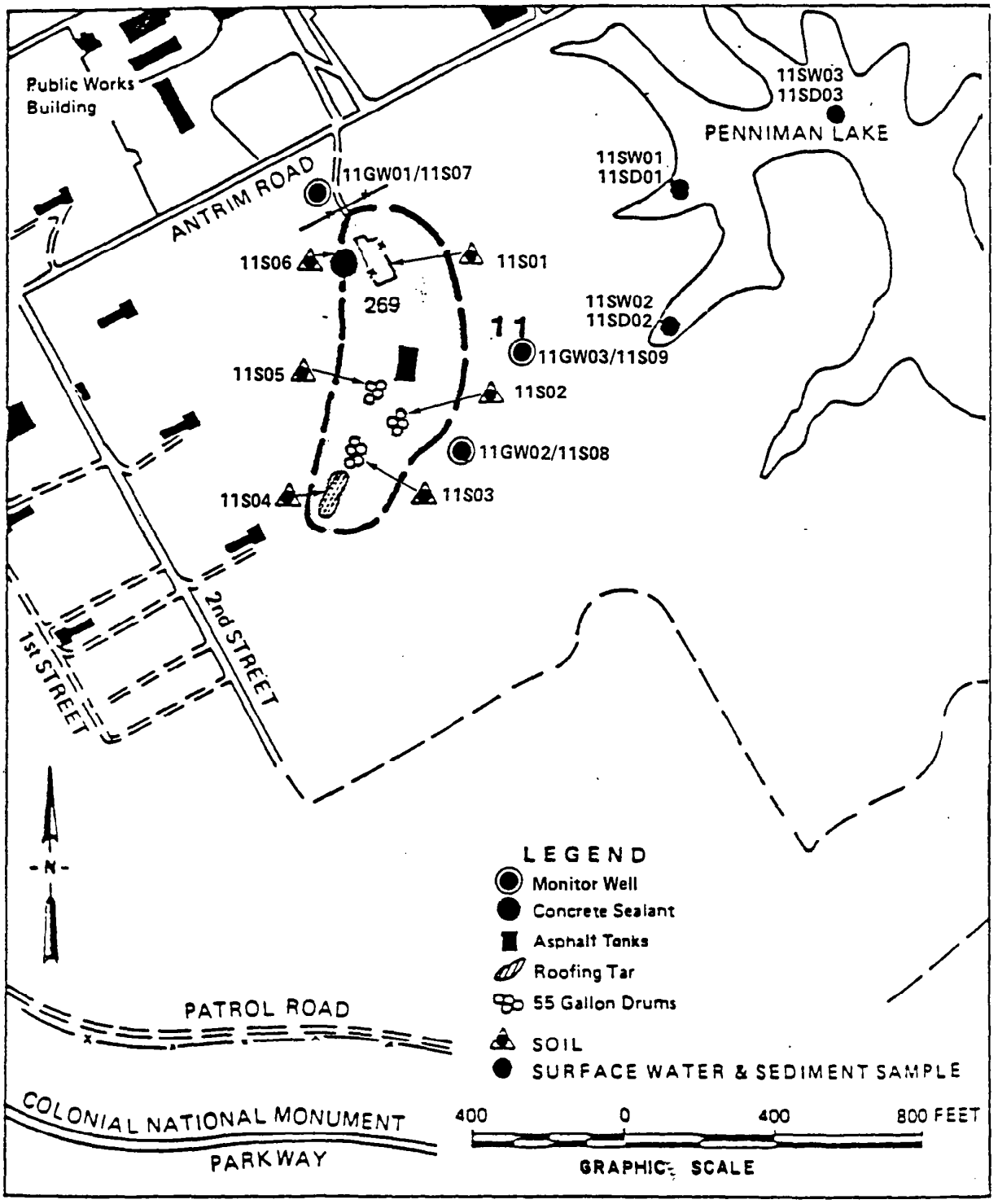


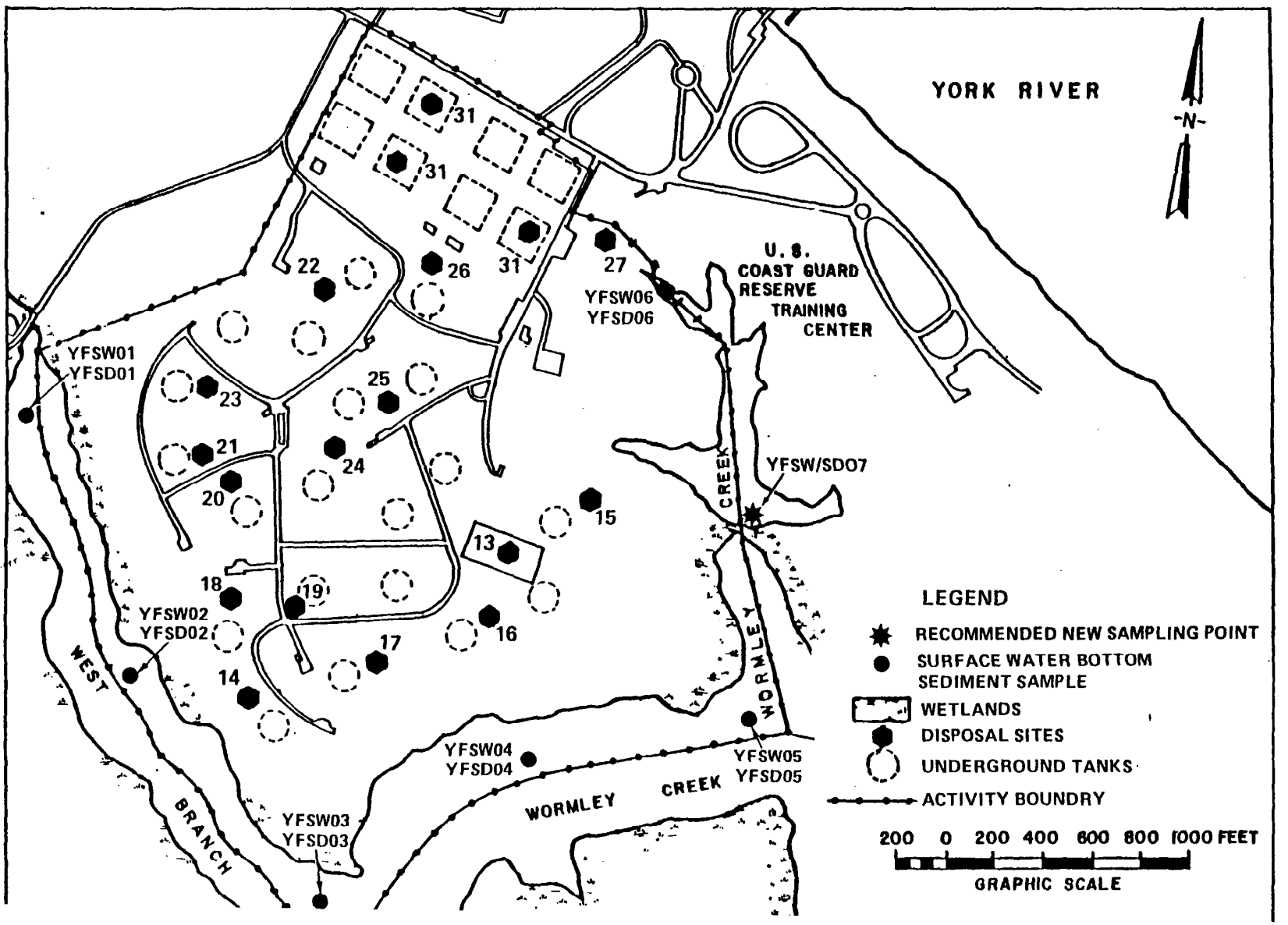

FIGURE 2-2A
SITE 9
TRANSFORMER STORAGE AREA SOIL SAMPLING LOCATIONS

# Figure 2-3

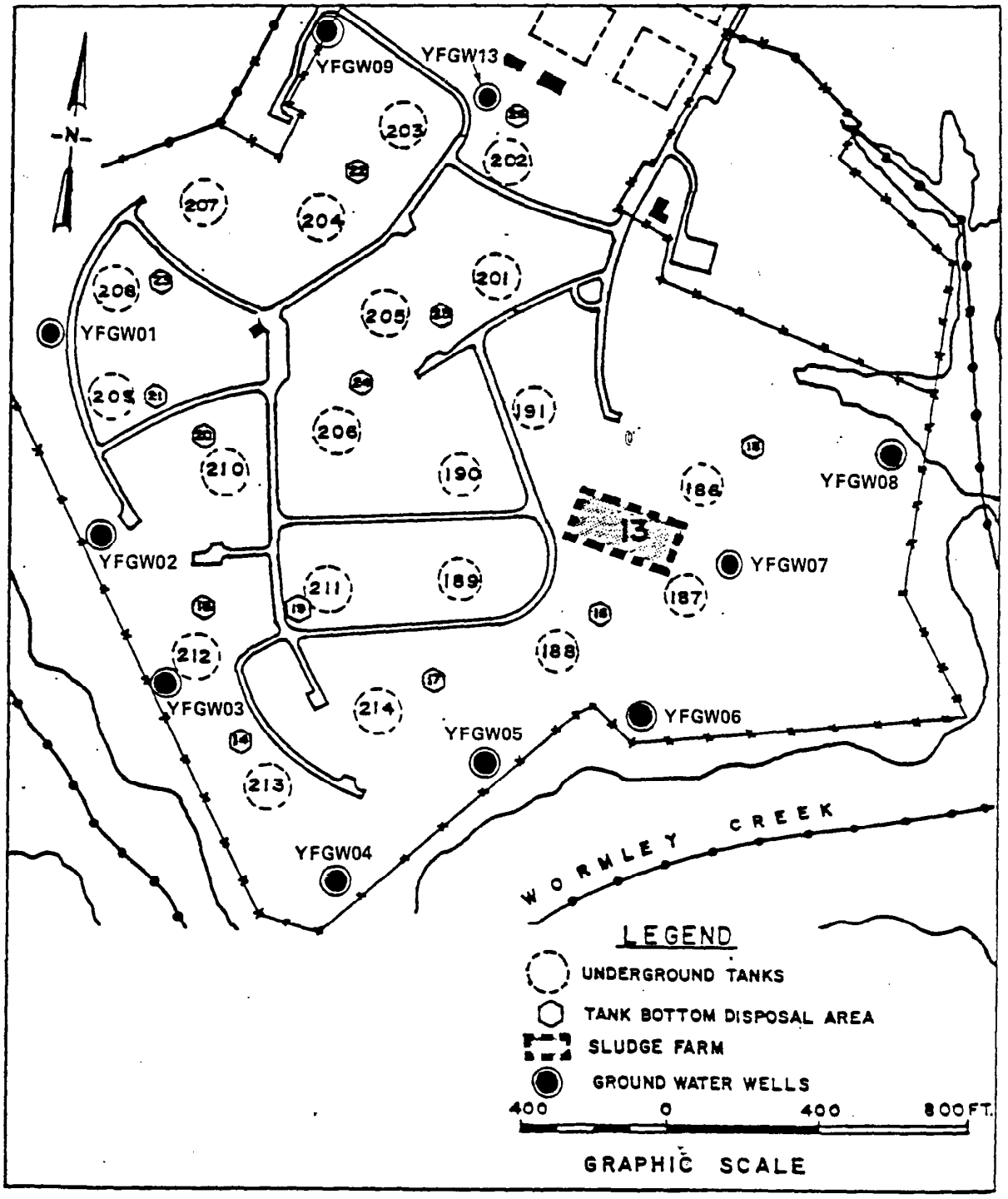
## Site 11-Bone Yard Recommended Sampling Points



# Naval Supply C[illegible]er (Norfolk)
## Yorktown Fuels Division
## Surface Water/Bottom Sediment Sampling Stations



# Figure 2-5
## Site 13-Sludge Farm
## Sites 14 thru 26-Tank Bottoms Disposal Area
## Sampling Points



# Figure 2-6
# Site 27-Fuel Pit at Building YK 215
# Site 31-Abandoned NSFO Tanks
# Sampling Points

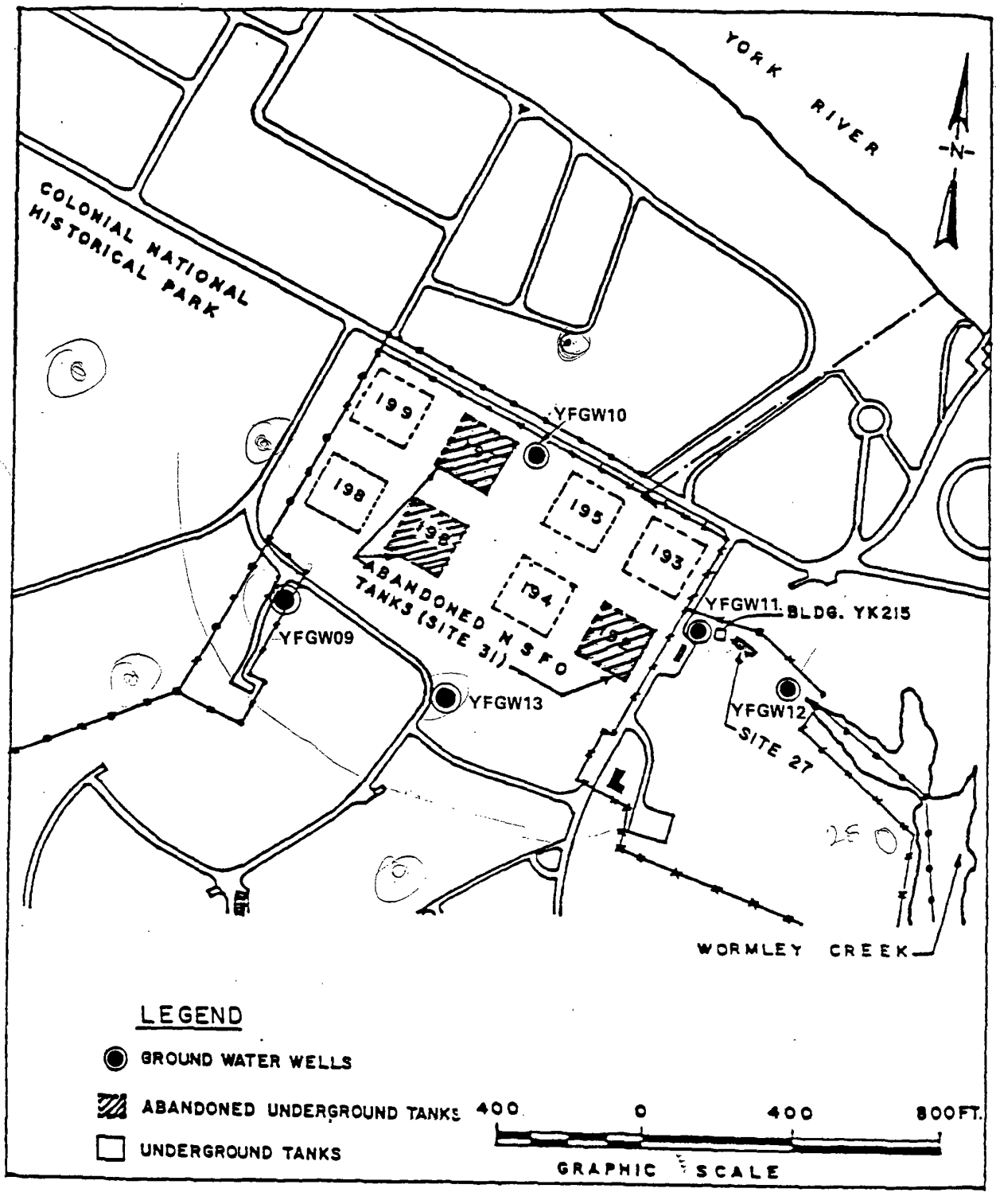


TABLE 2-1 RESULTS OF ANALYSES OF SAMPLES C IN THE VICINITY OF CHEATHAM ANNEX SITE 1, WINTER 1986.

| | SAMPLE STATIONS | | | | | |
|---|---|---|---|---|---|---|
| Analytical Parameters | 1EN01 | 1EN02 | 1EN03 | 1EN04 | 1GW05 | 1GW06 |
| PURGEABLE ORGANICS | UG/L | UG/L | UG/L | UG/L | UG/L | UG/L |
| Benzene | <0.45 | <0.45 | <0.45 | <0.45 | <0.45 | <0.45 |
| Toluene | <0.42 | <0.42 | <0.42 | <0.42 | <0.42 | <0.42 |
| Ethylbenzene | <0.36 | <0.36 | <0.36 | <0.36 | <0.36 | <0.36 |
| Carbon tetrachloride | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 |
| Chlorobenzene | <0.63 | <0.63 | <0.63 | <0.63 | <0.63 | <0.63 |
| 1,2-Dichloroethane | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 |
| 1,1,1-Trichloroethane | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 |
| 1,1-Dichloroethene | <0.84 | <0.84 | <0.84 | <0.84 | <0.84 | <0.84 |
| 1,1-Dichloroethylene | <1.9 | <1.9 | <1.9 | <1.9 | <1.9 | <1.9 |
| 1,1,2-Trichloroethane | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 |
| 1,1,2,2-Tetrachloroethane | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 |
| Chloroethane | <2.4 | <2.4 | <2.4 | <2.4 | <2.4 | <2.4 |
| 2-Chloroethyl vinyl ether | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 |
| Chloroform | <0.82 | <0.82 | <0.82 | <0.82 | <0.82 | <0.82 |
| 1,2-Dichloropropane | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 |
| Trans-1,3-Dichloropropene | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 |
| Cis-1,3-Dichloropropene | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 |
| Methylene chloride | 2.0 | 8.0 | 27 | 4.0 | 3.0 | 6.0 |
| Methyl chloride | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 |
| Methyl bromide | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 |
| Bromoform | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 |
| Dichlorobromomethane | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 |
| Trichlorofluoromethane | <6.7 | <6.7 | <6.7 | <6.7 | <6.7 | <6.7 |
| Chlorodibromomethane | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| Tetrachloroethylene | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 |
| Trichloroethylene | <1.3 | <1.3 | <1.3 | <1.3 | <1.3 | <1.3 |
| Vinyl Chloride | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 |
| 1,2-trans-Dichloroethylene | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 |
| BASE/NEUTRAL EXTRACTABLE ORGANIC COMPOUNDS | UG/L | UG/L | UG/L | UG/L | UG/L | UG/L |
| 1,2-Dichlorobenzene | <5.4 | <5.4 | <5.4 | <5.4 | <5.4 | <5.4 |
| 1,3-Dichlorobenzene | <5.6 | <5.6 | <5.6 | <5.6 | <5.6 | <5.6 |
| 1,4-Dichlorobenzene | <5.4 | <5.4 | <5.4 | <5.4 | <5.4 | <5.4 |
| Hexachloroethane | <12.0 | <12.0 | <12.0 | <12.0 | <12.0 | <12.0 |
| Hexachlorobutadiene | <13.4 | <13.4 | <13.4 | <13.4 | <13.4 | <13.4 |
| Hexachlorobenzene | <15.0 | <15.0 | <15.0 | <15.0 | <15.0 | <15.0 |
| 1,2,4-Trichlorobenzene | <7.4 | <7.4 | <7.4 | <7.4 | <7.4 | <7.4 |
| bis (2-Chloroethoxy) methane | <3.9 | <3.9 | <3.9 | <3.9 | <3.9 | <3.9 |
| Naphthalene | <2.1 | <2.1 | <2.1 | <2.1 | <2.1 | <2.1 |
| 2-Chloronaphthalene | <3.8 | <3.8 | <3.8 | <3.8 | <3.8 | <3.8 |
| Isophorone | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 |
| Nitrobenzene | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 | <4.5 |
| 2,4-Dinitrotoluene | <14.2 | <14.2 | <14.2 | <14.2 | <14.2 | <14.2 |
| [illegible] | <15.9 | <15.9 | <15.9 | <15.9 | <15.9 | <15.9 |

| | SAMPLE STATIONS | | | | | |
|---|---|---|---|---|---|---|
| Analytical Parameters | 1EW01 | 1EW02 | 1EW03 | 1EW04 | 1GW05 | 1GW06 |
| bis (2-Ethylhexyl) phthalate | <9.8 | 72 | <9.8 | <9.8 | <9.8 | <9.8 |
| Di-n-octyl phthalate | <6.5 | <6.5 | <6.5 | <6.5 | <6.5 | <6.5 |
| Dimethyl phthalate | <3.5 | <3.5 | <3.5 | <3.5 | <3.5 | <3.5 |
| Diethyl phthalate | <3.8 | <3.8 | <3.8 | <3.8 | <3.8 | <3.8 |
| Di-n-butyl phthalate | <3.4 | <3.4 | <3.4 | <3.4 | <3.4 | <3.4 |
| Fluorene | <4.0 | <4.0 | <4.0 | <4.0 | <4.0 | <4.0 |
| Fluoranthene | <4.9 | <4.9 | <4.9 | <4.9 | <4.9 | <4.9 |
| Chrysene | <9.0 | <9.0 | <9.0 | <9.0 | <9.0 | <9.0 |
| Pyrene | <5.1 | <5.1 | <5.1 | <5.1 | <5.1 | <5.1 |
| Phenanthrene | <3.8 | <3.8 | <3.8 | <3.8 | <3.8 | <3.8 |
| Anthracene | <3.8 | <3.8 | <3.8 | <3.8 | <3.8 | <3.8 |
| Benzo(a)anthracene | <9.0 | <9.0 | <9.0 | <9.0 | <9.0 | <9.0 |
| Benzo(b)fluoranthene | <11.2 | <11.2 | <11.2 | <11.2 | <11.2 | <11.2 |
| Benzo(k)fluoranthene | <11.2 | <11.2 | <11.2 | <11.2 | <11.2 | <11.2 |
| Benzo(a)pyrene | <12.5 | <12.5 | <12.5 | <12.5 | <12.5 | <12.5 |
| Indeno(1,2,3-c,d)pyrene | <7.4 | <7.4 | <7.4 | <7.4 | <7.4 | <7.4 |
| Dibenzo(a,h)anthracene | <16.4 | <16.4 | <16.4 | <16.4 | <16.4 | <16.4 |
| Benzo(g,h,i)perylene | <14.2 | <14.2 | <14.2 | <14.2 | <14.2 | <14.2 |
| 4-Chlorophenyl phenyl ether | <8.8 | <8.8 | <8.8 | <8.8 | <8.8 | <8.8 |
| 3,3'-Dichlorobenzidine | <160.9 | <160.9 | <160.9 | <160.9 | <160.9 | <160.9 |
| bis(2-Chloroethyl) ether | <4.3 | <4.3 | <4.3 | <4.3 | <4.3 | <4.3 |
| Hexachlorocyclopentadiene | <12.5 | <12.5 | <12.5 | <12.5 | <12.5 | <12.5 |
| N-Nitrosodiphenylamine | <81.7 | <81.7 | <81.7 | <81.7 | <81.7 | <81.7 |
| Acenaphtylene | <2.5 | <2.5 | <2.5 | <2.5 | <2.5 | <2.5 |
| Acenaphthene | <4.4 | <4.4 | <4.4 | <4.4 | <4.4 | <4.4 |
| Butyl benzyl phthalate | <13.0 | <13.0 | <13.0 | <13.0 | <13.0 | <13.0 |
| N-Nitroso-Di-n-Propylamine | <6.1 | <6.1 | <6.1 | <6.1 | <6.1 | <6.1 |
| bis(2-Chloroisopropyl) ether | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 |
| ACID EXTRACTABLE ORGANIC COMPOUNDS | UG/L | UG/L | UG/L | UG/L | UG/L | UG/L |
| Phenol | <4.0 | <4.0 | <4.0 | <4.0 | <4.0 | <4.0 |
| 2-Nitrophenol | <11.4 | <11.4 | <11.4 | <11.4 | <11.4 | <11.4 |
| 4-Nitrophenol | <35.0 | <35.0 | <35.0 | <35.0 | <35.0 | <35.0 |
| 2,4-Dinitrophenol | <52.5 | <52.5 | <52.5 | <52.5 | <52.5 | <52.5 |
| 4,6-Dinitro-2-Methylphenol | <38.3 | <38.3 | <38.3 | <38.3 | <38.3 | <38.3 |
| Pentachlorophenol | <34.1 | <34.1 | <34.1 | <34.1 | <34.1 | <34.1 |
| 4-Chloro-3-Methylphenol | <7.6 | <7.6 | <7.6 | <7.6 | <7.6 | <7.6 |
| 2-Chlorophenol | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 |
| 2,4-Dichlorophenol | <7.9 | <7.9 | <7.9 | <7.9 | <7.9 | <7.9 |
| 2,4,6-Trichlorophenol | <12.2 | <12.2 | <12.2 | <12.2 | <12.2 | <12.2 |
| 2,4-Dimethylphenol | <9.5 | <9.5 | <9.5 | <9.5 | <9.5 | <9.5 |
| PESTICIDES/PCBs | UG/L | UG/L | UG/L | UG/L | UG/L | UG/L |
| Endosulfan-I | <0.008 | <0.008 | <0.008 | <0.008 | <0.008 | <0.008 |
| Endosulfan-II | <0.019 | <0.019 | <0.019 | <0.019 | <0.019 | <0.019 |

SAMPLE STATIONS

| Analytical Parameters | 1EN01 | 1EN02 | 1EN03 | 1EN04 | 1GM05 | 1GM06 |
|---|---|---|---|---|---|---|
| Alpha-BHC | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| Beta-BHC | <0.006 | <0.006 | <0.006 | <0.006 | <0.006 | <0.006 |
| Delta-BHC | <0.005 | <0.005 | 0.008 | <0.005 | <0.005 | <0.005 |
| Gamma-BHC | <0.004 | <0.004 | <0.004 | <0.004 | <0.004 | <0.004 |
| Aldrin | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Dieldrin | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 |
| 4,4'-DDE | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 |
| 4,4'-DDD | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 |
| 4,4'-DDT | <0.037 | <0.037 | <0.037 | <0.037 | <0.037 | <0.037 |
| Endrin | <0.022 | <0.022 | <0.022 | <0.022 | <0.022 | <0.022 |
| Endrin aldehyde | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 |
| Heptachlor | <0.004 | <0.004 | <0.004 | <0.004 | <0.004 | <0.004 |
| Heptachlor epoxide | <0.007 | <0.007 | <0.007 | <0.007 | <0.007 | <0.007 |
| Chlordane | <0.625 | <0.625 | <0.625 | <0.625 | <0.625 | <0.625 |
| Toxaphene | <0.521 | <0.521 | <0.521 | <0.521 | <0.521 | <0.521 |
| Arochlor 1016 | <0.047 | <0.047 | <0.047 | <0.047 | <0.047 | <0.047 |
| Arochlor 1221 | <0.081 | <0.081 | <0.081 | <0.081 | <0.081 | <0.081 |
| Arochlor 1232 | <0.096 | <0.096 | <0.096 | <0.096 | <0.096 | <0.096 |
| Arochlor 1242 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Arochlor 1248 | <0.063 | <0.063 | <0.063 | <0.063 | <0.063 | <0.063 |
| Arochlor 1254 | <0.139 | <0.139 | <0.139 | <0.139 | <0.139 | <0.139 |
| Arochlor 1260 | <0.179 | <0.179 | <0.179 | <0.179 | <0.179 | <0.179 |
| METALS | UG/L | UG/L | UG/L | UG/L | UG/L | UG/L |
| Antimony | 7.3 | 5.2 | 5.9 | 5.5 | 4.2 | 10.6 |
| Arsenic | <4 | <4 | <4 | <4 | <4 | <4 |
| Beryllium | <1 | <1 | <1 | <1 | <1 | <1 |
| Cadmium | <1 | <1 | <1 | <1 | <1 | <1 |
| Chromium | <4 | <4 | <4 | <4 | <4 | <4 |
| Copper | <4 | <4 | <4 | <4 | <4 | <4 |
| Lead | 2.3 | <1 | 2.9 | 2.8 | 2.8 | <1 |
| Mercury | <0.2 | 0.21 | <0.2 | <0.2 | <0.2 | <0.2 |
| Nickel | <4 | <4 | <4 | <4 | <4 | <4 |
| Selenium | <4 | <4 | <4 | <4 | <4 | <4 |
| Silver | <1 | <1 | <1 | <1 | <1 | <1 |
| Thallium | <2 | <2 | <2 | <2 | <2 | <2 |
| Zinc | 1550 | 909 | 2550 | 7940 | <2 | 105 |
| MISCELLANEOUS | | | | | | |
| Total cyanides MG/L | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Total phenols MG/L | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| Total Xylene UG/L | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 |
| Methyl Ethylketone UG/L | <10.0 | <10.0 | <10.0 | <10.0 | <10.0 | <10.0 |
| Methyl isobutylketone UG/L | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 |
| Ethylene dibromide UG/L | <0.006 | <0.006 | <0.006 | <0.006 | <0.006 | <0.006 |
| OIL and GREASE MG/L | <5 | 118.9 | <5 | <5 | <5 | 12.9 |

SAMPLE STATIONS

| Analytical Parameters | 1EW01 | 1EW02 | 1EW03 | 1EW04 | 1GW05 | 1GW06 |
|---|---|---|---|---|---|---|
| METALS | | | | | | |
| Hexavalent chromium UG/L | <10 | <10 | <10 | <10 | <10 | <10 |
| pH | 7.2 | 7.4 | 7.4 | 7.1 | 7.2 | 6.8 |
| Sp Cond (umhos/cm @25 deg C) | 640 | 370 | 525 | 500 | 380 | 817 |

CHEATHAM ANNEX SITE 9

SAMPLE STATIONS

| PCB'S AND TCDD'S | 9S01 | 9S02 | 9S03 | 9S04 | 9S05 | 9S06 | 9S07 | 9S08 | 9S09 | 9S10 | 9S11 | 9S12 | 9S13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG |
| Arochlor 1016 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Arochlor 1221 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Arochlor 1232 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Arochlor 1242 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Arochlor 1248 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Arochlor 1254 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Arochlor 1260 | <10 | <10 | <10 | 41 | 35 | 22 | <10 | <10 | 195 | 21 | 29 | 321 | 82 |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 |

grease. There was one pesticide detected at Site 1--Delta-BHC (0.008 ug/l) in the sample from 1EW03; any concentration of a synthetic organic chemical (SOC) could be considered to violate the Virginia antidegradation policy. Also detected at 1EW03 was 2.9 ug/l lead, 5.9 ug/l antimony, and 2,550 ug/l zinc (exceeds Virginia ambient criterion of 48 ug/l, MAXAV of 47 ug/l and the PWTOC of 5 ug/l). Metals and oil and grease were the only detectable constituents in wells 1EW04 and 1GW06. Lead (2.8 ug/l) 5.5 ug/l antimony, and 7,940 ug/l zinc (exceeds Virginia criterion of 48 ug/l and MAX24AV of 47 ug/l and the PWTOC of 5 ug/l) were found in water from well 1EW04, and 10.6 ug/l antimony, 105 ug/l zinc (exceeds previously stated criteria), and 12.9 mg/l oil and grease were detected in the sample from well 1GW06.

2.1.2 Site 9 (Transformer Storage Area)

A former transformer storage location, Site 9 (Figures 2-2 and 2-2A) was sampled at 13 locations for PCB and TCDD content in soils. Nine samples were within the fenced perimeter near building 16, whereas two sets of two samples were taken outside the fenced perimeter along drainage pathways from the site. The results of these analyses are in the last section of Table 2-1.

The only detected PCB isomer (8 of 13 samples) was Arochler 1260. Four of the nine samples within the fenced perimeter produced detectable concentrations of Arochlor 1260. Sample 9S04 contained 41 ug/kg Arochlor 1260 whereas samples 5, 6, and 9 contained 35 ug/kg, 22 ug/kg, and 195 ug/kg of detectable Arochlor 1260, respectively,. All four samples outside the fenced perimeter produced concentrations of Arochlor 1260 demonstrating that spill debris had migrated offsite via local drainage routes. Samples 10, 11, 12 and 13 contained 21 ug/kg, 29 ug/kg, 321 ug/kg and 82 ug/kg of Arochlor 1260, respectively.

2.1.3 Site 11 (The Bone Yard)

The Bone Yard (Figure 2-3) sampling schedule consisted of three groundwater samples, three surface water/sediment samples, nine soil samples (11S07, 11S08, 11S09 were composite samples taken during drilling operations) and 18 drum samples (from 15 drums). The results of the chemical and physical parameter analyses are in Tables 2-2 and 2-3.

2.1.3.1 Soil Samples. Soil sample 11S05 contained the greatest concentrations and the largest number of detectable compounds at Site 11 (Figure 2-4 and Table 2-2).

| Analytical Parameters | SAMPLE LOCATIONS 11GW01 | 11GW02 | 11GW03 | 11S01 | 11S02 | 11S03 | 11S04 | 11S05 | 11S06 | 11S07 | 11S08 | 11S09 | 11SD01 | 11SD02 | 11SD03 | 11SW01 | 11SW02 | 11SW03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PURGEABLE ORGANICS | UG/L | UG/L | UG/L | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/L | UG/L | UG/L |
| Benzene | <0.45 | <0.45 | <0.45 | <0.45 | <0.45 | <0.45 | <0.45 | <0.45 | <0.45 | <0.45 | <0.45 | <0.45 | <0.45 | <0.45 | <0.45 | <0.45 | <0.45 | <0.45 |
| Toluene | 0.8 | 0.6 | 0.9 | <0.42 | 3 | <0.42 | <0.42 | <0.42 | <0.42 | 1 | <0.42 | 0.5 | <0.42 | <0.42 | <0.42 | <0.42 | <0.42 | <0.42 |
| Ethylbenzene | <0.36 | <0.36 | <0.36 | <0.36 | <0.36 | <0.36 | <0.36 | <0.36 | <0.36 | <0.36 | <0.36 | <0.36 | <0.36 | <0.36 | <0.36 | <0.36 | <0.36 | <0.36 |
| Carbon tetrachloride | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 |
| Chlorobenzene | <0.63 | <0.63 | <0.63 | <0.63 | <0.63 | <0.63 | <0.63 | <0.63 | <0.63 | <0.63 | <0.63 | <0.63 | <0.63 | <0.63 | <0.63 | <0.63 | <0.63 | <0.63 |
| 1,2-Dichloroethane | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 |
| 1,1,1-Trichloroethane | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | 3 | 2 | 9 | 2 | 12 | 8 | <1.2 | 3 | 9 | <1.2 |
| 1,1-Dichloroethane | <0.84 | <0.84 | <0.84 | <0.84 | <0.84 | <0.84 | <0.84 | <0.84 | <0.84 | <0.84 | <0.84 | <0.84 | <0.84 | <0.84 | <0.84 | <0.84 | <0.84 | <0.84 |
| 1,1-Dichloroethylene | <1.9 | <1.9 | <1.9 | <1.9 | <1.9 | <1.9 | <1.9 | <1.9 | <1.9 | <1.9 | <1.9 | <1.9 | <1.9 | <1.9 | <1.9 | <1.9 | <1.9 | <1.9 |
| 1,1,2-Trichloroethane | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 |
| 1,1,2,2-Tetrachloroethane | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 |
| Chloroethane | <2.4 | <2.4 | <2.4 | <2.4 | <2.4 | <2.4 | <2.4 | <2.4 | <2.4 | <2.4 | <2.4 | <2.4 | <2.4 | <2.4 | <2.4 | <2.4 | <2.4 | <2.4 |
| 2-Chloroethyl vinyl ether | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 | <5.9 |
| Chloroform | <0.82 | <0.82 | <0.82 | <0.82 | <0.82 | <0.82 | <0.82 | <0.82 | <0.82 | <0.82 | <0.82 | <0.82 | <0.82 | <0.82 | <0.82 | <0.82 | <0.82 | <0.82 |
| 1,2-Dichloropropane | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 |
| Trans-1,3-Dichloropropene | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 |
| Cis-1,3-Dichloropropene | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 |
| Methylene chloride | 3.0 | 7.0 | 8.0 | 18 | 39 | 17 | 22 | 25 | 16 | 23 | 86 | 32 | 37 | 61 | 266 | 28 | 861 | 20 |
| Methyl chloride | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 | <1.6 |
| Methyl bromide | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 |
| Bromoform | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 | <3.2 |
| Dichlorobromomethane | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 | <1.1 |
| Trichlorofluoromethane | <6.7 | <6.7 | <6.7 | <6.7 | <6.7 | <6.7 | <6.7 | <6.7 | <6.7 | <6.7 | <6.7 | <6.7 | <6.7 | <6.7 | <6.7 | <6.7 | <6.7 | <6.7 |
| Chlorodibromomethane | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| Tetrachloroethylene | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 |
| Trichloroethylene | <1.3 | <1.3 | <1.3 | <1.3 | <1.3 | <1.3 | <1.3 | <1.3 | <1.3 | <1.3 | <1.3 | <1.3 | <1.3 | <1.3 | <1.3 | <1.3 | <1.3 | <1.3 |
| Vinyl Chloride | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 |
| 1,2-trans-Dichloroethylene | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 | <1.5 |
| BASE/NEUTRAL EXTRACTABLE ORGANIC COMPOUNDS | UG/L | UG/L | UG/L | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/L | UG/L | UG/L |
| 1,2-Dichlorobenzene | <5.4 | <5.4 | <5.4 | <90 | <90 | <90 | <90 | <90 | <90 | <90 | <90 | <90 | <90 | <90 | <90 | <5.4 | <5.4 | <5.4 |
| 1,3-Dichlorobenzene | <5.6 | <5.6 | <5.6 | <93 | <93 | <93 | <93 | <93 | <93 | <93 | <93 | <93 | <93 | <93 | <93 | <5.6 | <5.6 | <5.6 |
| 1,4-Dichlorobenzene | <5.4 | <5.4 | <5.4 | <90 | <90 | <90 | <90 | <90 | <90 | <90 | <90 | <90 | <90 | <90 | <90 | <5.4 | <5.4 | <5.4 |
| Hexachloroethane | <12.0 | <12.0 | <12.0 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <12.0 | <12.0 | <12.0 |
| Hexachlorobutadiene | <13.4 | <13.4 | <13.4 | <223 | <223 | <223 | <223 | <223 | <223 | <223 | <223 | <223 | <223 | <223 | <223 | <13.4 | <13.4 | <13.4 |
| Hexachlorobenzene | <15.0 | <15.0 | <15.0 | <250 | <250 | <250 | <250 | <250 | <250 | <250 | <250 | <250 | <250 | <250 | <250 | <15.0 | <15.0 | <15.0 |
| 1,2,4-Trichlorobenzene | <7.4 | <7.4 | <7.4 | <123 | <123 | <123 | <123 | <123 | <123 | <123 | <123 | <123 | <123 | <123 | <123 | <7.4 | <7.4 | <7.4 |
| bis (2-Chloroethoxy) methane | <3.9 | <3.9 | <3.9 | <65 | <65 | <65 | <65 | <65 | <65 | <65 | <65 | <65 | <65 | <65 | <65 | <3.9 | <3.9 | <3.9 |
| Naphthalene | <2.1 | <2.1 | <2.1 | <35 | 1515 | <35 | <35 | 174 | <35 | <35 | <35 | <35 | <35 | 251 | <35 | <2.1 | <2.1 | <2.1 |
| 2-Chloronaphthalene | <3.8 | <3.8 | <3.8 | <63 | <63 | <63 | <63 | <63 | <63 | <63 | <63 | <63 | <63 | <63 | <63 | <3.8 | <3.8 | <3.8 |
| Isophorone | <2.3 | <2.3 | <2.3 | <38 | <38 | <38 | <38 | <38 | <38 | <38 | <38 | <38 | <38 | <38 | <38 | <2.3 | <2.3 | <2.3 |
| Nitrobenzene | <4.5 | <4.5 | <4.5 | <75 | <75 | <75 | <75 | <75 | <75 | <75 | <75 | <75 | <75 | <75 | <75 | <4.5 | <4.5 | <4.5 |
| 2,4-Dinitrotoluene | <14.2 | <14.2 | <14.2 | <237 | <237 | <237 | <237 | <237 | <237 | <237 | <237 | <237 | <237 | <237 | <237 | <14.2 | <14.2 | <14.2 |
| 2,6-Dinitrotoluene | <15.9 | <15.9 | <15.9 | <265 | <265 | <265 | <265 | <265 | <265 | <265 | <265 | <265 | <265 | <265 | <265 | <15.9 | <15.9 | <15.9 |
| 4-Bromophenyl phenyl ether | <16.3 | <16.3 | <16.3 | <272 | <272 | <272 | <272 | <272 | <272 | <272 | <272 | <272 | <272 | <272 | <272 | <16.3 | <16.3 | <16.3 |

| Analytical Parameters | SAMPLE LOCATIONS 11GW01 | 11GW02 | 11GW03 | 11S01 | 11S02 | 11S03 | 11S04 | 11S05 | 11S06 | 11S07 | 11S08 | 11S09 | 11SD01 | 11SD02 | 11SD03 | 11SW01 | 11SW02 | 11SW03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Di-n-octyl phthalate | <6.5 | <6.5 | <6.5 | <108 | <108 | <108 | <108 | <108 | <108 | <108 | <108 | 289 | <108 | <108 | <108 | <6.5 | <6.5 | <6.5 |
| Dimethyl phthalate | <3.5 | <3.5 | <3.5 | <58 | <58 | <58 | <58 | <58 | <58 | <58 | <58 | <58 | <58 | <58 | <58 | 11 | <3.5 | 11.0 |
| Diethyl phthalate | <3.8 | <3.8 | <3.8 | <63 | <63 | <63 | <63 | <63 | <63 | <63 | <63 | <63 | <63 | <63 | <63 | <3.8 | <3.8 | <3.8 |
| Di-n-butyl phthalate | <3.4 | <3.4 | <3.4 | 41 | <57 | 99 | 114 | 72 | 119 | <57 | <57 | <57 | <57 | <57 | <57 | <3.4 | <3.4 | <3.4 |
| Fluorene | <4.0 | <4.0 | <4.0 | <67 | <67 | <67 | <67 | 327 | <67 | <67 | <67 | <67 | <67 | <67 | <67 | <4.0 | <4.0 | <4.0 |
| Fluoranthene | <4.9 | <4.9 | <4.9 | <82 | <82 | 134 | <82 | 1937 | <82 | <82 | 1104 | <82 | <82 | <82 | <82 | <4.9 | <4.9 | <4.9 |
| Chrysene | <9.0 | <9.0 | <9.0 | <150 | <150 | <150 | <150 | 928 | <150 | <150 | 1395 | <150 | <150 | <150 | <150 | <9.0 | <9.0 | <9.0 |
| Pyrene | <5.1 | <5.1 | <5.1 | <85 | <85 | <85 | <85 | 1881 | <85 | <85 | <85 | <85 | <85 | <85 | <85 | <5.1 | <5.1 | <5.1 |
| Phenanthrene | <3.8 | <3.8 | <3.8 | <63 | <63 | 105 | <63 | 2108 | <63 | <63 | <63 | <63 | <63 | <63 | <63 | <3.8 | <3.8 | <3.8 |
| Anthracene | <3.8 | <3.8 | <3.8 | <63 | <63 | <63 | <63 | 642 | <63 | <63 | 279 | <63 | <63 | <63 | <63 | <3.8 | <3.8 | <3.8 |
| Benzo(a)anthracene | <9.0 | <9.0 | <9.0 | <150 | <150 | <150 | <150 | 851 | <150 | <150 | 849 | <150 | <150 | <150 | <150 | <9.0 | <9.0 | <9.0 |
| Benzo(b)fluoranthene | <11.2 | <11.2 | <11.2 | <187 | <187 | <187 | <187 | 550 | <187 | <187 | 358 | <187 | <187 | <187 | <187 | <11.2 | <11.2 | <11.2 |
| Benzo(k)fluoranthene | <11.2 | <11.2 | <11.2 | <187 | <187 | <187 | <187 | 528 | <187 | <187 | 315 | <187 | <187 | <187 | <187 | <11.2 | <11.2 | <11.2 |
| Benzo(a)pyrene | <12.5 | <12.5 | <12.5 | <208 | <208 | <208 | <208 | 729 | <208 | <208 | <208 | <208 | <208 | <208 | <208 | <12.5 | <12.5 | <12.5 |
| Indeno(1,2,3-c,d)pyrene | <7.4 | <7.4 | <7.4 | <237 | <237 | <237 | <237 | 429 | <237 | <237 | <237 | <237 | <237 | <237 | <237 | <7.4 | <7.4 | <7.4 |
| Dibenzo(a,h)anthracene | <16.4 | <16.4 | <16.4 | <273 | <273 | <273 | <273 | <273 | <273 | <273 | <273 | <273 | <273 | <273 | <273 | <16.4 | <16.4 | <16.4 |
| Benzo(g,h,i)perylene | <14.2 | <14.2 | <14.2 | <237 | <237 | <237 | <237 | 295 | <237 | <237 | <237 | <237 | <237 | <237 | <237 | <14.2 | <14.2 | <14.2 |
| 4-Chlorophenyl phenyl ether | <8.8 | <8.8 | <8.8 | <147 | <147 | <147 | <147 | <147 | <147 | <147 | <147 | <147 | <147 | <147 | <147 | <8.8 | <8.8 | <8.8 |
| 3,3'-Dichlorobenzidine | <160.9 | <160.9 | <160.9 | <2680 | <2680 | <2680 | <2680 | <2680 | <2680 | <2680 | <2680 | <2680 | <2680 | <2680 | <2680 | <160.9 | <160.9 | <160.9 |
| bis(2-Chloroethyl) ether | <4.3 | <4.3 | <4.3 | <72 | <72 | <72 | <72 | <72 | <72 | <72 | <72 | <72 | <72 | <72 | <72 | <4.3 | <4.3 | <4.3 |
| Hexachlorocyclopentadiene | <12.5 | <12.5 | <12.5 | <208 | <208 | <208 | <208 | <208 | <208 | <208 | <208 | <208 | <208 | <208 | <208 | <12.5 | <12.5 | <12.5 |
| N-Nitrosodiphenylamine | <81.7 | <81.7 | <81.7 | <1360 | <1360 | <1360 | <1360 | <1360 | <1360 | <1360 | <1360 | <1360 | <1360 | <1360 | <1360 | <81.7 | <81.7 | <81.7 |
| Acenaphtylene | <2.5 | <2.5 | <2.5 | <42 | 4967 | <42 | <42 | 72 | <42 | <42 | <42 | <42 | <42 | <42 | <42 | <2.5 | <2.5 | <2.5 |
| Acenaphthene | <4.4 | <4.4 | <4.4 | <73 | <73 | <73 | <73 | 173 | <73 | <73 | <73 | <73 | <73 | <73 | <73 | <4.4 | <4.4 | <4.4 |
| Butyl benzyl phthalate | <13.0 | <13.0 | <13.0 | <217 | <217 | <217 | <217 | <217 | <217 | <217 | <217 | <217 | <217 | <217 | <217 | <13.0 | <13.0 | <13.0 |
| N-Nitroso-Di-n-Propylamine | <6.1 | <6.1 | <6.1 | <102 | <102 | <102 | <102 | <102 | <102 | <102 | <102 | <102 | <102 | <102 | <102 | <6.1 | <6.1 | <6.1 |
| bis(2-Chloroisopropyl) ether | <3.2 | <3.2 | <3.2 | <53 | <53 | <53 | <53 | <53 | <53 | <53 | <53 | <53 | <53 | <53 | <53 | <3.2 | <3.2 | <3.2 |
| | UG/L | UG/L | UG/L | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/L | UG/L | UG/L |
| Total Xylene | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 |
| Methyl Ethylketone | <10.0 | 10.0 | <10.0 | 15 | <10.0 | <10.0 | <10.0 | 12 | 12 | 15 | <10.0 | 13 | <10 | 30 | 68 | 12 | 15 | 13 |
| Methyl Isobutylketone | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 | <2.3 |
| Ethylene dibromide | <0.006 | <0.006 | <0.006 | <0.163 | <41 | <0.163 | <0.163 | <0.163 | <0.163 | <0.163 | <0.106 | <0.163 | <0.106 | <0.106 | <0.052 | <0.001 | <0.001 | <0.006 |
| MISCELLANEOUS | | | | | | | | | | | | | | | | | | |
| Total Phenols MG/L AND UG/G | <0.002 | <0.002 | <0.002 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.002 | <0.002 | <0.002 |
| OIL and GREASE MG/L AND UG/G | <5 | <5 | <5 | <50 | 420900 | 655.8 | 133.9 | 797.2 | 109 | 94 | <50 | <50 | 326.8 | 1316 | 865 | <5 | <5 | <5 |
| METALS | | | | | | | | | | | | | | | | | | |
| Lead UG/L AND UG/G | 1.5 | 1.8 | 1.2 | 55.0 | 195.0 | 81.0 | 79.0 | 11.0 | 16.0 | 23.0 | 17.0 | 15.0 | <10 | 39.0 ppm | 16.5 ppm | <1 ppb | <1 ppb | <1 ppb |
| pH | 6.4 | 6.9 | 6.6 | | | | | | | | | | | | | 8.4 | 8.2 | 8.1 |
| | --- | --- | --- | | | | | | | | | | | | | 785 | 820 | 432 |

TABLE 2-3 RESULTS OF ANALYSES OF SAMPLES COLLECTED IN THE V...ITY OF CHEATHAM ANNEX SITE 11 - TANK/DRUM PAD, WINTER 1986.

| CHEATHAM ANNEX DRUM/TANK | SAMPLE LOCATIONS 11DT01 | 11DT02 | 11DT03 U-OIL | 11DT03 L-H20 | 11DT04 | 11DT05 | 11DT06 | 11DT07 U-OIL | 11DT07 L-H20 | 11DT08 U-OIL | 11DT08 L-H20 | 11DT09 | 11DT10 | 11DT11 | 11DT12 | 11DT13 | 11DT14 | 11DT15 | EP TOXICITY STANDARDS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reactivity | +# | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Ignitibility Degree C | >60 | >60 | >60 | >60 | >60 | >60 | >60 | >60 | >60 | >60 | >60 | >60 | >60 | >60 | >60 | 54 | >60 | >60 | |
| Corrosivity | NEGATIVE | NEGATIVE | NEGATIVE | NEGATIVE | NEGATIVE | NEGATIVE | NEGATIVE | NEGATIVE | NEGATIVE | NEGATIVE | NEGATIVE | NEGATIVE | NEGATIVE | NEGATIVE | NEGATIVE | NEGATIVE | NEGATIVE | NEGATIVE | |
| EP Toxicity | | | | | | | | | | | | | | | | | | | |
| METALS | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L |
| Barium | <0.04 | <0.04 | 0.076 | <0.04 | <0.04 | <0.04 | <0.04 | 0.076 | <0.04 | <0.04* | 0.05 | 0.337 | 0.105 | 0.230 | 0.414 | <0.04 | <0.04 | <0.04 | 100 |
| Cadmium | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 0.494 | <0.02 | <0.02 | 0.619 | 0.094 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 1.0 |
| Chromium | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | 5.0 |
| Lead | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 360 | 1.52 | <0.1 | 505 | 19 | 30.6 | <0.1 | <0.1 | 2.18 | 2.28 | <0.1 | 0.17 | 5.0 |

# = POSITIVE REACTIVITY DUE TO SULFIDE

EP TOXCITY STANDARDS FROM 40 CFR 261.24

In this sample, 16 of 43 BNE compounds tested were found in concentrations that varied from a low of 72 ug/kg for acenaphtylene to 2,108 ug/kg for phenanthene. Of the BNE compounds, the data for Di-n-butyl phthalate are open to question for soil samples 11SO02, 11SO03, 11SO04, and 11SO05 since this compound was detected in the accompanying laboratory method blank at a concentration of 76 ug/kg (Table 1-5). No priority pollutant volatiles were detected in 11S05, but 12 ug/kg of methyl ethylketone (MEK), plus 797.2 mg/kg oil and grease, and 11 ug/g lead were present. Soil sample 11S08, a composite soil sample (0-25 feet) taken during drilling well 11GW02, produced the second greatest number of compounds detected in a soil sample at Site 11. Here, 9 ug/kg of 1,1,1 trichloroethane (1,1,1 trichlor), 17 ug/g lead and six base neutral organics were detected 91104 ug/kg flouranthene, 1,395 ug/kg chrysene, 279 ug/kg anthracene, 449 ug/kg, benzo (a) anthracene, 358 ug/kg benzo (b) fluoranthene and 315 ug/kg benzo (k) fluoranthene).

Soil sample 11S01 contained 41 ug/kg D-n-BP, 15 ug/kg MEK, and 55 ug/g lead, and 11S02 contained 3 ug/kg toluene, 1,515 ug/kg napthalene, 4,967 ug/kg acenaphtylene, 420,900 ug/g oil and grease, and 195 ug/g lead. While not having detectable concentrations of purgeable organics, sample 11S03 did have three base-neutral organics (99 ug/kg D-n-BP, 134 ug/kg fluoranthene, and 105 ug/kg phenanthrene as well as 655.8 ug/g oil and grease and 81 ug/g lead. Sample 11S04, on the other hand, was found to contain only one base-neutral organic, D-n-BP at 114 ug/kg plus 133.9 ug/g oil and grease and 79 ug/g lead. Soil sample 11S06, near the entrance of the Bone Yard did have a detectable concentration of a purgeable organic, 1,1,1 trichlor (3 ug/kg) and two base-neutral organics, 510 ug/kg b2EP and 119 ug/kg D-n-BP. Also detected in 11S06 were 109 ug/g oil and grease and 16.0 ug/g lead. The last two soil samples were composite samples obtained during the drilling of wells 11GW01 (11S07) and 11GW03 (11S09). Composite sample 11S07 produced concentrations of 1 ug/kg toluene, 2 ug/kg 1,1,1 trichlor, 15 ug/kg MEK, 94 ug/g oil and grease and 23 ug/g lead. Sample 11S09, on the other hand, contained 0.5 ug/kg toluene, 2 ug/kg 1,1,1 trichlor, 289 ug/kg Di-N-octyl phthalate (D-n-OP), 13 ug/kg MEK and 15 ug/g lead.

2.1.3.2 Groundwater and Surface Water/Sediment. The well samples from the Bone Yard and the surface water and sediment samples obtained from Penniman Lake were found to be relatively contaminant free when compared to the soil

samples. Toluene and lead were detected in all three groundwater samples but at concentrations well below established standards or criteria; although the presence of toluene may be contrary to the Virginia antidegradation policy for groundwater. Water from well 11GW02 also contained 11 ug/l b2EHP (exceeds Virginia criterion of 3 ug/l for phthalate esters.

Three surface water and sediment samples in Penniman Lake were found to have detectable concentrations of 1,1,1 trichlor, Dimethyl phthalate, napthalene, b2EHP, MEK, oil and grease, and lead. Of these compounds, only Dimethyl phthalate was not detected in any of the previously discussed soil or groundwater samples.

Sample 11SW01 contained 3 ug/l 1,1,1 trichlor (exceeds no criteria), 11 ug/l Dimethyl phthalate (exceeds Virginia criterion for 3 ug/l for phthalate esters) and 12 ug/l MEK. The sediment sample here, 11SD01, also contained 1,1,1 trichlor (12 ug/kg), but it was found to contain an additional 163 ug/kg b2EHP and 326.8 ug/g oil and grease. The compound 1,1,1 trichlor (9 ug/l) was also detected in 11SW02, the second water sample obtained from Penniman Lake. The only other detectable contaminant in 11SW02 was 15 ug/l of MEK. The sediment sample (11SD02) associated with the surface water sample just described was found to have an 8 ug/kg concentration of 1,1,1 trichlor, the purgeable organic found in all but the third sample at Penniman Lake. Additionally, two base-netural organics (251 ug/kg napthalene and 233 ug/kg b2EHP) were detected in 11SD02. MEK was detected in 11SD02 at a concentration of 38 ug/kg. Oil and grease and lead concentrations in 11SD02 were with 1,316 ug/g oil and grease and 39.0 ug/g lead. The surface water and sediment samples, 11SW03 and 11SD03, contained the least number of contaminants from Penniman Lake. The water sample here did contain MEK at a concentration of 11 ug/l; 13 ug/l of dimethyl phthalate (exceeds Virginia phthalate ester criterion of 3 ug/l) was also present. Sediment sample 11SD03 contained 68 ug/kg MEK, 865 ug/g oil and grease, and 16.5 ug/g lead.

2.1.3.3 Drum Sample. In the vicinity of the Bone Yard, 15 drums determined to have an appreciable quantity of material were sampled, and the RCRA characterization analyses were performed on the samples obtained (see Table 2-3). Twelve of the 15 drums were found to have contents in a single phase, whereas drums 3, 7, and 8 contained a lower aqueous phase and an upper oil phase. Contents of five drums failed the RCRA characterization analyses. One drum's

contents (11DT01) are a hazardous waste under RCRA because of a positive reactivity due to sulfide. Another drum, 11DT13, contained an ignitible hazardous waste with a flash point of 54°C. The remaining three drums that failed the RCRA characterization tests (11DT06, 11DT08, and 11DT09) are hazardous wastes on the basis of lead content in excess of 5 mg/l. The EP Toxicity analysis was limited to the metals barium, cadmium, chromium, and lead.

## 2.2 RESULTS OF SAMPLING PROGRAM--AT YORKTOWN FUELS DIVISION

The sampling schedule for the Yorktown Fuels Division consisted of 13 composited soil samples obtained during the drilling of wells YFGW01 through YFGW13, the sampling of the groundwater from the wells, and six surface water and sediment samples taken from Wormley Creek (see Figures 2-4 through 2-6). The chemical analyses here included toluene, xylene, ethylene dibromide (EDB), 16 polynuclear aromatic hydrocarbons (PAH's) and five fuels (NSFO, JP-4, JP-5, MOGAS and AVGAS). Lead was analyzed for composite soil and groundwater samples in YFGW01 to YFGW08 and all surface water/sediment samples except YFSW/SD06. Specific conductance, and pH were measured in the field for water samples. The results of the analyses can be found in Tables 2-4 and 2-5.

### 2.2.1 Groundwater and Composite Soil Samples--Sites 13 and 14-26

Results of analyses for groundwater and composite soil samples collected at locations YFGW01 through YFGW08 are on the first page of Table 2-4.

SOCs, primarily PAHs, were detected at varying concentrations in groundwater samples from all wells except two--YFGW03 and YFGW04. Groundwater from YFGW06 also contained toluene, and samples from YFGW07 and YFGW08 contained xylene. Of the soil samples, only YFSO02, 04, and 07 contained no detectable SOCs. As mentioned previously, the presence of SOCs in groundwater may be considered contrary to the Virginia antidegradation policy for groundwater; however none of the SOC concentrations in water exceeded established standards or criteria. Lead was detected in all the groundwater samples, except YFGW01, at concentrations well below the MCL of 50 ug/l; the concentrations of lead in the associated composite soil samples varied from less than detection limits (10 ug/g) to 18 ug/g. Fuel was detected in both groundwater (21.4 mg/l) and soil (102.7 ug/g) from YFGW06. In YFGW06, the fuel was identified as a probable match for motor gasoline (MOGAS), but in YFSO06, the fuel was a

| Analytical Parameters | SAMPLE STATIONS | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | YFGW01 | YFGW02 | YFGW03 | YFGW04 | YFGW05 | YFGW06 | YFGW07 | YFGW08 | YFS001 | YFS002 | YFS003 | YFS004 | YFS005 | YFS006 | YFS007 | YFS008 | YFSW01 |
| | UG/L | UG/L | UG/L | UG/L | UG/L | UG/L | UG/L | UG/L | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/L |
| Toluene | <0.42 | <0.42 | <0.42 | <0.42 | <0.42 | 3.0 | <0.42 | <0.42 | <0.42 | <0.42 | <0.42 | <0.42 | 1 | 45 | <0.42 | <0.42 | <0.42 |
| Total Xylene | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | 4.0 | 10.0 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | 1592 | <0.48 | <0.48 | <0.48 |
| Ethleyne dibromide | <0.006 | <0.006 | <0.006 | <0.006 | <0.006 | <0.006 | <0.006 | <0.006 | <0.163 | <32 | <0.106 | <0.106 | <0.106 | <0.106 | <0.106 | <0.106 | <0.001 |
| POLYNUCLEAR AROMATIC HYDROCARBONS | UG/L | UG/L | UG/L | UG/L | UG/L | UG/L | UG/L | UG/L | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/L |
| Acenaphthene | <0.34 | <0.34 | <0.34 | <0.34 | <0.34 | 19.7 | <0.34 | <0.34 | <34 | <34 | <34 | <34 | <34 | 124 | <34 | <34 | <0.34 |
| Acenaphthylene | <0.22 | <0.22 | <0.22 | <0.22 | <0.22 | 8.47 | <0.22 | 2.20 | <22 | <22 | <22 | <22 | <22 | <22 | <22 | <22 | <0.22 |
| Anthracene | <0.005 | <0.005 | <0.005 | <0.005 | 0.059 | <0.005 | <0.005 | <0.005 | <0.5 | <0.5 | <0.5 | <0.5 | 2.75 | 0.96 | <0.5 | 5.96 | <0.005 |
| Benzo(a)anthracene | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.06 | <0.01 | <0.01 | <1 | <1 | <1 | <1 | <1 | 9.7 | <1 | <1 | <0.01 |
| Benzo(a)pyrene | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <0.02 |
| Benzo(b)fluoranthene | <0.01 | <0.01 | <0.01 | <0.01 | 0.05 | <0.01 | <0.01 | <0.01 | <1 | <1 | 10 | <1 | <1 | <1 | <1 | <1 | <0.01 |
| Benzo(g,h,i)perylene | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <4 | <4 | <4 | <4 | <4 | <4 | <4 | <4 | <0.04 |
| Benzo(k)fluoranthene | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <0.02 |
| Chrysene | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <1 | <1 | 2.61 | <1 | 5.15 | 5.68 | <1 | <1 | <0.01 |
| Dibenzo(a,h)anthracene | <0.06 | <0.06 | <0.06 | <0.06 | <0.06 | <0.06 | <0.06 | <0.06 | <6 | <6 | <6 | <6 | <6 | <6 | <6 | <6 | <0.06 |
| Fluoranthene | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | 4 | <4 | <4 | <4 | 54 | <4 | <4 | 37.5 | 0.05 |
| Ideno(1,2,3-cd)pyrene | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <0.02 |
| Napthalene | <0.17 | <0.17 | <0.17 | <0.17 | <0.17 | <0.17 | <0.17 | <0.17 | <17 | <17 | <17 | <17 | <17 | 60 | <17 | <17 | <0.17 |
| Phenanthrene | 0.04 | 0.04 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <1 | <1 | <1 | <1 | 14.0 | 14.9 | <1 | 14.1 | <0.01 |
| Pyrene | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <0.03 |
| Fluorene | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <3 | <3 | <3 | <3 | <3 | 3.51 | <3 | <3 | <0.03 |
| FUELS | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L | MG/L | UG/G | UG/G | UG/G | UG/G | UG/G | UG/G | UG/G | UG/G | MG/L |
| Total Fuels | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | 21.4 | <1.2 | <1.2 | <0.8 | <0.8 | <0.8 | <0.8 | <0.8 | 102.7 | <0.8 | <0.8 | <1.2 |
| NSFO | | | | | | | | | | | | | | | | | |
| JP-4 | | | | | | | | | | | | | | | | | |
| JP-5 | | | | | | | | | | | | | | | | | |
| MOGAS | | | | | | * | | | | | | | | * | | | |
| AVGAS | | | | | | | | | | | | | | | | | |
| * = Probable Match | | | | | | | | | | | | | | | | | |
| METALS | | | | | | | | | | | | | | | | | |
| Lead UG/L AND UG/G | <1 | 2.2 | 2.7 | 1.9 | 1.2 | 5.3 | 2.1 | 1.0 | 13.0 | <10 | 18.0 | 12.0 | <10 | 18.0 | <10 | <10 | 30 |
| Ph | 6.7 | 7.0 | 6.9 | 7.0 | 7.4 | 7.2 | 6.8 | 6.8 | | | | | | | | | 6.6 |
| Sp Cond (umhos/cm @25 deg C) | 636 | 1,152 | 987 | 887 | 1,038 | 819 | 869 | 760 | | | | | | | | | 20,260 |
| Product Thickness (ft) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | | | |

| Analytical Parameters | YFSW02 | YFSW03 | YFSW04 | YFSW05 | YFSD01 | YFSD02 | YFSD03 | YFSD04 | YFSD05 |
|---|---|---|---|---|---|---|---|---|---|
| | UG/L | UG/L | UG/L | UG/L | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG |
| Toluene | <0.42 | <0.42 | <0.42 | 1.5 | 3.1 | 7.4 | <0.42 | 2.2 | <0.42 |
| Total Xylene | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 | <0.48 |
| Ethleyne dibromide | <0.001 | <0.001 | <0.001 | <0.001 | <0.128 | <0.128 | <0.128 | <0.128 | <0.128 |
| POLYNUCLEAR AROMATIC HYDROCARBONS | UG/L | UG/L | UG/L | UG/L | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG |
| Acenaphthene | <0.34 | <0.34 | <0.34 | <0.34 | <34 | <34 | <34 | <34 | <68 |
| Acenaphthylene | <0.22 | <0.22 | <0.22 | <0.22 | <22 | <22 | <22 | <22 | <44 |
| Anthracene | <0.005 | <0.005 | <0.005 | <0.005 | <0.5 | <0.5 | 6 | <0.5 | 16 |
| Benzo(a)anthracene | <0.01 | <0.01 | <0.01 | <0.01 | <1 | 13 | 18 | 23 | 30 |
| Benzo(a)pyrene | <0.02 | <0.02 | <0.02 | <0.02 | <2 | 160 | 61 | 84 | <4 |
| Benzo(b)fluoranthene | <0.01 | 0.24 | <0.01 | <0.01 | 31 | 84 | 24 | 39 | <2 |
| Benzo(g,h,i)perylene | <0.04 | <0.04 | <0.04 | <0.04 | <4 | <4 | <4 | 170 | 26 |
| Benzo(k)fluoranthene | <0.02 | <0.02 | <0.02 | <0.02 | 79 | 180 | 73 | 84 | <4 |
| Chrysene | <0.01 | <0.01 | <0.01 | <0.01 | <1 | 16 | 24 | 32 | 44 |
| Dibenzo(a,h)anthracene | <0.06 | <0.06 | <0.06 | <0.06 | <6 | 320 | 79 | 710 | <12 |
| Fluoranthene | <0.04 | 0.29 | <0.04 | <0.04 | <4 | 58 | 82 | <4 | 220 |
| Ideno(1,2,3-cd)pyrene | <0.02 | <0.02 | <0.02 | <0.02 | <2 | 19 | <2 | 90 | <4 |
| Napthalene | <0.17 | <0.17 | <0.17 | <0.17 | <17 | <17 | <17 | 140 | <34 |
| Phenanthrene | <0.01 | 0.022 | <0.01 | <0.01 | <1 | <1 | 9 | <1 | 96 |
| Pyrene | <0.03 | <0.03 | <0.03 | <0.03 | <3 | 26 | 29 | <3 | 140 |
| Fluorene | <0.03 | <0.03 | <0.03 | <0.03 | <3 | <3 | <3 | <3 | 122 |
| FUELS | MG/L | MG/L | MG/L | MG/L | UG/G | UG/G | UG/G | UG/G | UG/G |
| Total Fuels | <1.2 | <1.2 | <1.2 | <1.2 | <0.8 | <0.8 | <0.8 | <0.8 | <0.8 |
| NSFO | | | | | | | | | |
| JP-4 | | | | | | | | | |
| JP-5 | | | | | | | | | |
| MOGAS | | | | | | | | | |
| AVGAS | | | | | | | | | |
| METALS | | | | | | | | | |
| Lead UG/L AND UG/G | 15.3 | <1 | 11.1 | 82.4 | <10 | 11 | 16 | 11 | <10 |
| pH | 6.5 | 6.7 | 7.6 | 7.5 | | | | | |
| Sp Cond (umhos/cm @25 deg C) | 22,900 | 20,040 | 22,020 | 23,030 | | | | | |

YRK27 TABLE 2-5 RESULTS OF ANALYSES OF SAMPLES COLLECTED IN T TY OF YORKTOWN FUELS DIVISION SITES 27 AND 31, WINTER 1986.

| Analytical Parameters | SAMPLE STATIONS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | YFGW09 | YFGW10 | YFGW11 | YFGW12 | YFGW13 | YFSD06 | YFS009 | YFS010 | YFS011 | YFS012 | YFS013 | YFSW06 |
| | UG/L | UG/L | UG/L | UG/L | UG/L | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/L |
| Toluene | <0.42 | 0.5 | <0.42 | 0.7 | <0.42 | 10 | 0.55 | <0.42 | <0.42 | <0.42 | <0.42 | <0.42 |
| Total Xylene | <0.48 | 1.0 | 10 | <0.48 | <0.48 | 168 | <0.48 | <0.48 | 4 | <0.48 | <0.48 | 1.3 |
| Ethylene dibromide | <0.006 | <0.006 | <0.006 | <0.006 | <0.006 | <32 | <0.106 | <0.106 | <0.106 | <0.106 | <0.106 | <0.015 |
| POLYNUCLEAR AROMATIC HYDROCARBONS | UG/L | UG/L | UG/L | UG/L | UG/L | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/KG | UG/L |
| Acenaphthene | <0.34 | <0.34 | <0.5 | <0.34 | <0.5 | 880 | 80.4 | <1100 | <34 | <34 | <850 | <0.68 |
| Acenaphthylene | <0.22 | 15.4 | 72.3 | <0.22 | 30.3 | <2200 | <22 | <1100 | <22 | <22 | <550 | <0.44 |
| Anthracene | <0.005 | 2.25 | 4.88 | <0.005 | 0.843 | 2200 | 1.91 | 701 | <0.5 | 3.3 | 1050 | 0.024 |
| Benzo(a)anthracene | <0.01 | 0.38 | 5.99 | <0.01 | <0.25 | 4500 | 49.1 | <50 | <1 | 19.3 | <25 | <0.02 |
| Benzo(a)pyrene | <0.02 | 0.12 | 13.3 | <0.02 | 0.48 | 4400 | <2 | 715 | <2 | <2 | 570 | <0.04 |
| Benzo(b)fluoranthene | <0.01 | <0.01 | 8.42 | <0.01 | <0.25 | 3200 | 3.64 | <50 | <1 | <1 | 343 | <0.02 |
| Benzo(g,h,i)perylene | <0.04 | <0.04 | 1.02 | <0.04 | <1.0 | 2100 | 21.9 | <200 | <4 | <4 | 274 | <0.08 |
| Benzo(k)fluoranthene | <0.02 | 0.30 | 13.3 | <0.02 | <0.5 | 3100 | <2 | <100 | <2 | <2 | 429 | <0.04 |
| Chrysene | <0.01 | 0.12 | <0.25 | <0.01 | <0.25 | <100 | 6.82 | 717 | <1 | <1 | <25 | <0.02 |
| Dibenzo(a,h)anthracene | <0.06 | <0.06 | 0.08 | <0.06 | <1.5 | 7900 | <6 | 810 | <6 | <6 | 576 | <0.12 |
| Fluoranthene | <0.04 | 7.39 | 53.2 | 0.14 | 6.63 | 24000 | 21.3 | <200 | <4 | <4 | <100 | 3.22 |
| Ideno(1,2,3-cd)pyrene | <0.02 | <0.02 | <0.5 | <0.02 | <0.5 | 1000 | 4.18 | <100 | <2 | <2 | <50 | <0.04 |
| Naphthalene | <0.17 | 8.04 | 57.3 | <0.17 | 37.4 | 330 | <17 | <850 | <17 | <17 | <425 | 9.82 |
| Phenanthrene | 0.080 | 5.82 | 20.4 | 0.064 | 6.28 | 191 | 5.48 | 2390 | <1 | <1 | 2310 | 2.70 |
| Pyrene | <0.03 | 5.14 | <0.75 | <0.03 | <0.75 | 24000 | <3 | <150 | <3 | <3 | <75 | <0.06 |
| Fluorene | <0.03 | 5.95 | 15.1 | <0.03 | 10.9 | 356 | <3 | 536 | <3 | <3 | <75 | 2.30 |
| FUELS | MG/L | MG/L | MG/L | MG/L | MG/L | UG/G | UG/G | UG/G | UG/G | UG/G | UG/G | MG/L |
| Total Fuels | <1.2 | <1.2 | 4.64 | <1.2 | <1.2 | 6166 | <0.8 | <0.8 | <0.8 | <0.8 | <0.8 | <1.2 |
| NSFO | | | | | | * | | | | | | |
| JP-4 | | | | | | | | | | | | |
| JP-5 | | | * | | | * | | | | | | |
| MOGAS | | | | | | | | | | | | |
| AVGAS | | | | | | | | | | | | |
| * = Probable Match | | | | | | | | | | | | |
| pH | 6.5 | 11.8 | 6.7 | 7.2 | 6.6 | | | | | | | 6.9 |
| Sp Cond (umhos/cm @25 deg C) | 431 | 1,153 | 102 | 760 | 501 | | | | | | | 630 |
| Product Thickness (ft) | 0.1 | 0 | 0.2 | 0 | 0.2 | | | | | | | |

probable match for naval aviation jet fuel (JP-5). None of wells YFGW01 through YFGW08 contained a measurable thickness of free-floating fuel product.

### 2.2.2 Composite Soil Samples and Groundwater Samples--Sites 27 and 31

Analytical results for groundwater and composite soil samples from wells YFGW09 through YFGW13 are in Table 2-5; well locations are shown in Figure 2-6. A wide variety of PAHs were present the groundwater samples from YFGW10, 11, and 13; fewer PAHs were present and in lower concentrations in samples YFGW09 and 12. Purgeable organics (toluene or xylene) were detected in samples YFGW10, 11, and 12. Although none of the PAHs or purgeable organics exceeded established standards or citeria, the presence of these compounds in groundwater from the site may be inconsistent with Virginia's antidegradation policy for groundwater. Total fuels in YFGW11 were 4.64 mg/l; the fuel was a probable match for JP-5. Free-floating fuel product was noted at the time of sample collection in wells YFGW09, 11, and 13 in thickness of 0.1, 0.2, and 0.2 feet, resepectively.

All composite soil samples, except YFSO11, contained PAHs, but purgeable organics were detected only in YFSO09 (toluene) and YFSO11 (xylene). The pattern of contaminant detection in soils YFSO09 through YFSO13 contrasts sharply with contaminant detection in the companion groundwater samples. For example, YFSO09 contained nine detectable PAHs and toluene, but YFGW09 contained only one detectable PAH. In contrast YFSO11 contained no detectable PAHs and xylene, but YFGW11 contained 12 PAHs plus xylene. Cases in which a wider variety of contaminants were detected in soil than in groundwater may be attritubed to the adsorptive capacity of soils, a concentration of contaminants in soils well above the water table, or both of these. Cases in which more contaminants were detected in groundwater than in the composite soil sample are probably attributable to the dilution effect of compositing soil samples.

### 2.2.3 Surface Water/Sediment Samples--Wormley Creek

Due to the considerable contamination of both soil and groundwater at the Yorktown Fuels Division, impact on surface waters and sediments fed by the migration of these materials was imminent. This impact is manifest in the results of YFSW06 and YFSD06 in Table 2-5. Although only xylene and 5 PAH's were detected at low concentrations in the water sample at the head of Wormley Creek (YFSW06), toluene, xylene, fuels (probable match for NSFO and JP-5--see

Table 2-5), and 15 of 16 PAH's were detected in high concentrations (2,200 ug/kg to 24,000 ug/kg) in the sediment sample YFSD06. Downstream somewhat (see Figure 2-4) only toluene (1.5 ug/l--see Table 2-4) was detected in the surface water sample YFSW05 whereas 8 of 16 PAH's were found to occur in the bottom sediments (YFSD05--see Table 2-4). At the location of sample 4 (YFSW04/YFSD04), no detectable contaminant concentrations were determined to be in the surface water but toluene and 9 of 16 PAH's were found above detection limits in the sediment (YFSD04). The surface water sample at location 3 (YFSW03) did produce results that indicate the presence of 3 PAH's but it was the sediment sample (YFSD03) that showed detection of 10 of 16 PAH's, the concentrations of which were within the same order of magnitude as those found in YFSD04 and YFSD05. As was characteristic of the upstream samples, the surface water at sample 2 (YFSW02) produced no detectable contaminant concentrations, but the sediments were found to have nearly the same type and concentrations of PAH's (9 of 16 detected) and toluene as YFSD03 through YFSD05. It was only at the sediment sample furthest upstream on the West Branch of Wormley Creek (YFSD01) that the number of PAH's detected in the sediments fell to only two. The concentrations, though, were still similiar to those found in other samples. Toluene (3.1 ug/kg) was also detected in this sample (Table 2-4). The surface water at this location, YFSW01, was also found to have 1 PAH, fluoranthene at 0.05 ug/l.

Concentrations of lead in surface water samples YFSW01 through YFSW05 varied from below detection limits (1 ug/l) to 82.4 ug/l. Lead in samples YFSW01 (30 ug/l), YFSW04 (71.1 ug/l), and YFSW05 (82.4) exceeded the chronic toxicity criterion for saltwater aquatic life of 25 ug/l. Lead concentrations in sediments varied from below detection limits to 16 ug/g. Lead was not included in the schedule of analyses for YFSW/SD06.

# 3.0 RECOMMENDATIONS FOR STEP 1A, ROUND TWO SAMPLING AND ANALYSIS, NSC CHEATHAM ANNEX AND NSC YORKTOWN FUELS DIVISION

The first round of sampling and analysis has found evidence of varying degrees of contamination at the Confirmation Study sites at NSC Cheatham Annex and NSC Yorktown Fuels Division. In many instances, it would be useful to obtain additional data, following the original sampling and analysis plan to build a data base on the sites to be used as a basis for deciding upon further actions. At some of the sites, consideration of the Round One data suggests the need for a modified sampling scheme for Round Two. In one instance (Site 9), there is a need for additional background information on the site before proceeding with a second round of sampling and analysis. Round Two recommendations are summarized in Table 3-1.

## 3.1 GENERAL RECOMMENDATION

It would be worth considering installing dedicated submersible pumps in all wells if it seems probable that long term sampling and analysis will be performed at the study sites to meet installation RCRA permit requirements. This method has been shown to be the most effective and efficient method of sampling, especially for gas-sensitive parameters. PVC pump bodies should be used in PVC wells, and Teflon pump bodies should be used in stainless steel wells.

## 3.2 RECOMMENDATIONS FOR NSC CHEATHAM ANNEX

### 3.2.1 Site 1 (Landfill Near Incinerator)

1. Repeat previous analyses.

### 3.2.2 Site 9 (Transformer Storage Area)

1. According to the Toxic Substance Act regulations, actions in the case of PCB-contaminated soil depend upon the PCB content of the original transformer oil which should have been determined following implementation of these regs in 1978. The next step should be locating these data.
2. If the content of the original transformer oil is high enough to dictate a cleanup action (>50 mg/l), then perform a second round of sampling to better define the extent of contamination; otherwise no additional sampling would be required.

Table 3-1. Confirmation study Round Two sampling and analysis recommendations.

| Site No. | Wells to be Installed | Ground-water Samples | Surface water Samples | Bottom Sediment Samples | Soil Samples | Analytical Parameters(a) |
|---|---|---|---|---|---|---|
| **Cheatham Annex** | | | | | | |
| 1 | - | 6 | - | - | - | A,C,J,L,M(Cr+6),N |
| 9 | - | - | - | - | - | Determine PCB content of transformers. |
| 11 | - | 3 | 3 | 3 | 6 | B,C,J,K,L,M(Pb),N |
| **Yorktown Fuels Division** | | | | | | |
| 13,14-26 | - | 8 | 5 | 5 | - | D,E,F,J,M(Pb) |
| 27,31 | - | 5 | 2 | 2 | - | D,E,F,J,M(Pb) |
| **Naval Weapons Station, Yorktown** | | | | | | |
| 1,3,11,17 | - | 9 | 2 | 2 | - | A,C,H,J,L,M(Ba,Cr+6),N |
| 2 | - | 4 | 3 | 3 | - | A,C,J,M(Cr+6),N |
| 4 | - | 5 | 2(b) | 2(b) | - | A,C,H,J,M(Ba,Cr+6),N |
| 5 | - | - | - | - | - | Determine PCB content of transformers. |
| 6 | - | - | 3 | 7 | - | B,H,N |
| 7 | - | - | 2 | 2 | 3 | B,H,N |
| 8 | - | - | 2(b) | 2(b) | 2 | A,C,H,J,M(Cr+6),N |
| 9 & 19 | - | - | 2 | 2 | 8 | B,H,N |
| 12 | - | 3 | 5 | 5 | - | A,C,H,J,L,M(Ba,Cr+6),N |
| 16 | - | 5 | 2 | 2 | - | A,C,J,L,M(Cr+6),N |
| 18 | - | - | 3 | 3 | - | M(Hg,Cd,Ni,Pb,Cr,Cr+6,Zn),N |
| 20 | 2 | 5 | - | - | 8(c) | D,E,G,L,N |

NOTES:

(a). List of analytical parameters, as follows:

- A - Priority pollutants (except asbestos)
- B - VOAs and Base-Neutrals
- C - Xylene, MEK, MIBK
- D - Toluene, Xylene, Benzene
- E - PAHs
- F - Fuels (NSFO, JP-4, JP-5, MOGAS, and AVGAS)
- G - Propylene glycol dinatrate
- H - Explosives (TNT, RDX, 2,4-DNT, HMX, and the 4 TNT degradation products specified in the scope of work.)
- I - PCBs and TCDDs
- J - EDB
- K - Phenols, total
- L - Oil and grease
- M - Metals (indicated by chemical symbol)
- N - pH (Water samples only, in the field)
- R - RCRA Characterization analyses

(b). Recommend combining upstream surface water/sediment samples for Sites 4 and 8.

(c). Soil samples for analysis will be taken from each well at depths of 10 ft., 20 ft., 30 ft., and 40 ft. below land surface.

3. Since interpretation of the regulations may vary from region to region, it would also be well to obtain an opinion from state and regional regulatory officials.

3.2.3 Site 11 (Bone Yard)

1. Repeat surface water, sediment, surface soil, and groundwater samples. Collect surface water samples during a storm event to determine the immediate effects of runoff from Site 11 on water quality in Penniman Lake.

2. Analyze samples for the same parameters used in the Round One program.

3.3 RECOMMENDATIONS FOR NSC YORKTOWN FUELS DIVISION

1. Add YFSW/SD07, as shown in Figure 2-4, and resample groundwater, surface water, and sediments.

2. Add lead to analyses to those samples for which lead was not analyzed previously.

3. Add benzene to analyses for all samples since benzene's relative mobility in soil and groundwater make it a good indicator parameter.

4. Perform a second round of analyses on all stations at the site.

## REFERENCES CITED


Code of Virginia (1950), Amendments to Water Quality Standards, 1984 Section 62 1-44.15(3).

USATHAMA (1981), Environmental Assessment Decontamination/Cleanup Operations for the Leaseback Area of the Alabama Army Ammunition Plant. U.S. Department of the Army, August.

U.S. Environmental Protection Agency (EPA), 1980. Water Quality Criteria Documents; Availability. Federal Register, Vol. 45, No. 231. November 28, 1980, pp. 79318-79379.

U.S. Environmental Protection Agency (EPA), 1985. National Primary Drinking Water Regulations; Synthetic Organic Chemicals, Inorganic Chemicals and Microorganisms, proposed rule. Federal Register, 40 CFR Part 141, November 1985.