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UNITED STATES ARMY ENVIRONMENTAL HYGIENE AGENCY

ABERDEEN PROVING GROUND, MD 21010-5422

GROUND-WATER CONSULTATION NO. 38-26-0815-87
COLLECTION AND ANALYSIS OF GROUND-WATER SAMPLES
DEFENSE DEPOT MEMPHIS
MEMPHIS, TENNESSEE
8-10 DECEMBER 1986

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DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010-5422

REPLY TO ATTENTION OF

HSHB-ME-SE

7 August 1987

MEMORANDUM FOR: Director, Defense Logistics Agency, ATTN: DLA-WS, Alexandria, VA 22304-6100

SUBJECT: Ground-Water Consultation No. 38-26-0815-87, Collection and Analysis of Ground-Water Samples, Defense Depot Memphis, Memphis, Tennessee, 8-10 December 1986

EXECUTIVE SUMMARY

The purpose and recommendation of the enclosed report follow:

a. Purpose. To assess the potential for ground-water contamination at Dunn Field and establish the ground-water quality in the area.

b. Recommendation. To ensure good environmental practice, the following recommendation is made: Implement a quarterly monitoring program to evaluate future changes in the quality of the ground water in the Dunn Field area.

FOR THE COMMANDER:

Karl J. Daubel

KARL J. DAUBEL
Colonel, MS
Director, Environmental Quality

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Ground-Water Consultation No. 38-26-0815-87, DDMT, TN, 8-10 Dec 86

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1. AUTHORITY. Letter, DLA, DFSC-FQ, 27 May 1986, subject: Requirements for USAEHA Mission Services, FY 87.

2. PURPOSE. To assess the potential for ground-water contamination at Dunn Field and establish the ground-water quality in the area.

3. GENERAL.

a. Briefings. 1LT Porter conducted an entrance briefing on 8 December 1986 and an exit briefing on 10 December 1986 with Mr. Bill Lovejoy, Environmental Office.

b. Abbreviations and Definitions. An explanation of the abbreviations used in this report is provided in Appendix A.

c. Background. Defense Depot Memphis Tennessee is located approximately 0.75 miles south-southwest of the city of Memphis. It is a DLA activity which receives, stores, and ships DOD commodities for the various services within the south-central United States. The Dunn Field area of DDMT is located across Dunn Road, north of the DDMT cantonment area.

4. FINDINGS AND DISCUSSION.

a. Geology.

(1) Memphis is located in the Loess Hills, which parallels the eastern wall of the Mississippi River Valley. It is within the East Gulf Coastal Plain section of the Atlantic and Gulf Coastal Plains Province and is included in a portion of the section called the Mississippi Embayment. The Mississippi Embayment is a downwarped, partially downfaulted trough in the Paleozoic rocks. The axis of the trough approximates the course of the Mississippi River. The trough is filled with unconsolidated gravels, sands, and clays, ranging in age from Upper Cretaceous to Recent. Unconsolidated sediments at Memphis are from 2,700- to 3,000-feet thick. During the Tertiary and Quarternary Periods, streams transported sands, gravels, silts and clays. The sediment forms widespread terraces superimposed on older Tertiary deposits. Windblown silts and clays (Loess) comprise the presently exposed ground surface in the Memphis area.

(2) Defense Depot Memphis is in the Memphis-Grenada-Loring soil association which is characterized by nearly level to sloping, well-drained and moderately well-drained, silty soils on broad uplands. The soils in this association developed in silty deposits more than 20-feet deep. The soils at the DDMT are classified primarily as well graded sand with silty materials. The northeast corner of Dunn Field consists of Memphis silt loam, which is a well-drained silty soil. The upper zone of soil in the Dunn Field area contains soils of very low permeability. The potential for migration of contaminants in these soils is minimal. Sandier zones, where the flow of water is greater, are located at depths of over 30 feet below the land surface.

b. Hydrogeology. The water-table aquifer at DDMT flows west toward the Mississippi River. The drinking-water aquifer for Memphis is separated from the shallow water-table aquifer by a relatively thick and widespread semiconfining bed consisting primarily of clay. Part of the recharge to the drinking-water aquifer may be derived from vertical leakage from the water-table aquifer through the confining bed, or through local channels of sand in the confining bed. If leakage from the water-table aquifer, due to a sand channel, was occurring near a contamination source, hazardous constituents could potentially enter the drinking water aquifer. Defense Depot Memphis receives its water from the city of Memphis and does not maintain any drinking-water wells.

c. Sampling and Analysis.

(1) In June 1982, USAEHA installed six monitoring wells in the Dunn Field area to identify potential ground-water contamination which may be emanating from the chemical storage sites (reference 8). During that study, no significant ground-water degradation or contamination was found in the Dunn Field area. However, that initial sampling of the wells did not include analysis for organic constituents so resampling was needed to assess the ground-water quality in the area.

(2) To assess the ground-water quality in the area, the existing wells were sampled. The well locations and ground-water contours in the Dunn Field area are shown in the Figure. Prior to sampling, approximately three to five well volumes of water were removed from each well, and water level, pH, and conductivity measurements were made. The samples were then collected with a Teflon® bailer. The bailer was washed with laboratory detergent and thoroughly rinsed with tap water and distilled water between each well to avoid cross-contamination. All samples were filtered and preserved as appropriate in the field and kept on ice until they were received by the laboratory. They were refrigerated in the laboratory at 4 °C until analyzed.

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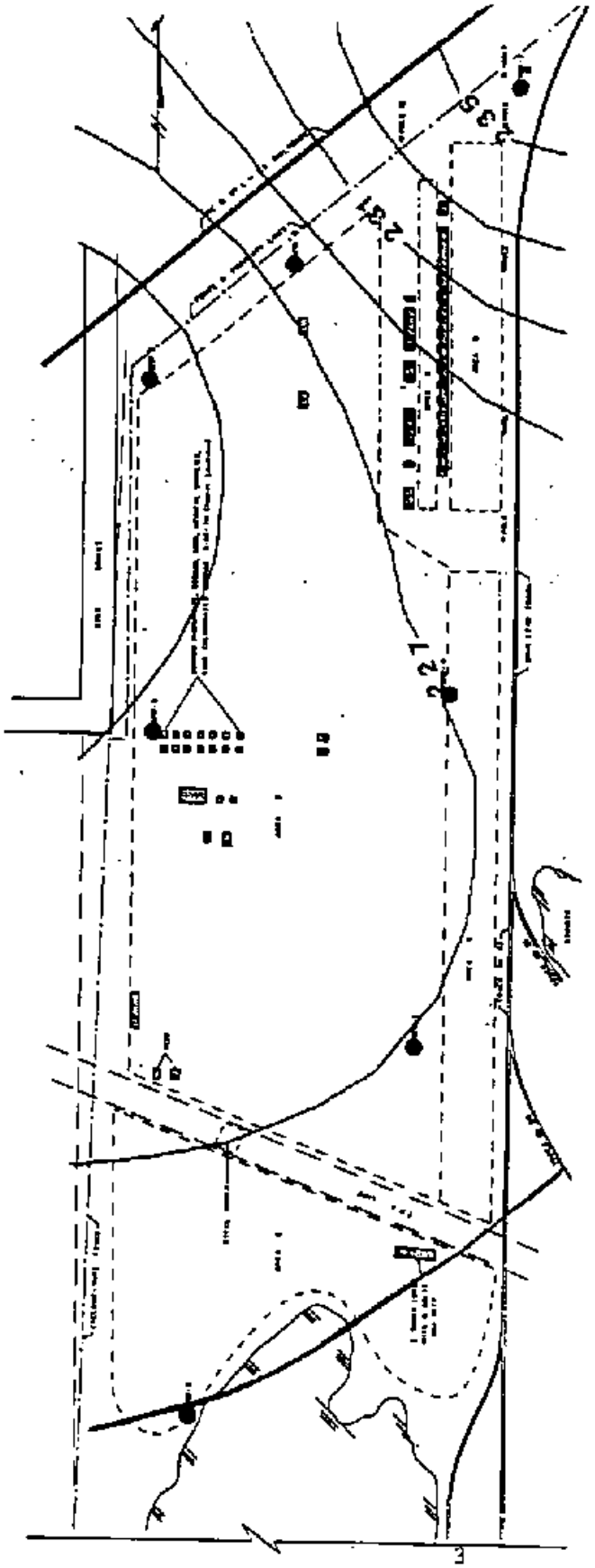

FIGURE. DUNN FIELD: Well locations and ground-water contours.

(3) The analysis of the ground-water samples taken from monitoring wells MW3, MW4, MW5, MW6, and MW7 was performed, and the results are provided in Appendix B. MW2 was also scheduled to be sampled, but the well was dry at the time of the study. MW1 was damaged before initial sampling and could not be used. Each sample was analyzed for total metals, purgeable organics, acid and base/neutral extractable organics, pesticides and PCBs, TDS/conductivity, and pH. A complete list of the parameters that were tested for is in Appendix C.

(4) The results of the analyses reveal contamination of the ground-water by several parameters. The NPDWR, MCL and MCLG were exceeded by several purgeable organic compounds. The MCLG and proposed MCL for 1,1-dichloroethene are both 0.007 ppm. This level was exceeded in MW3 (0.027 ppm) and MW7 (0.075 ppm). The concentration of trichloroethene exceeded the MCLG of 0 ppm in all of the wells, ranging from 0.004 ppm in MW4 to 0.150 ppm in MW6, and exceeded the proposed MCL of 0.005 ppm in all of the wells except MW4 (0.004 ppm). The MCLG of 0 ppm for carbon tetrachloride was exceeded in MW4 (0.004 ppm) and MW6 (0.078 ppm), and the proposed MCL (0.005 ppm) was also exceeded in MW6. The proposed MCLG (0.070 ppm) for trans-1,2-dichloroethene was exceeded in MW6 (0.200 ppm). In addition to these contaminants, the following purgeable organics exceeded the EPA-recommended criteria for 10^{-6} cancer risk: tetrachloroethylene (exceeded the recommended criteria of 0.0008 ppm in all of the wells, ranging from 0.003 ppm in MW6 to 0.081 ppm in MW4); chloroform (exceeded the recommended criteria of 0.00019 ppm in MW4, MW6, and MW7, ranging from 0.003 ppm to 0.019 ppm); 1,1,2,2-tetrachloroethane [exceeded the recommended criteria of 0.00017 ppm in MW6 (0.082 ppm)]; and 1,1,2-Trichloroethane [exceeded the recommended criteria of 0.0006 ppm in MW6 (0.004 ppm)]. These criteria are the concentrations at which there is an estimated increase of cancer risk of one in a million over a lifetime of consumption. All of the above contaminants exceeded final or proposed drinking water regulations, or recommended criteria, which indicates a problem with the ground-water quality. The ground water is not used as a drinking-water source however, so these contaminants should not pose a significant threat to human health.

(5) The NSDWR criterion for manganese (0.05 ppm) was exceeded in MW5 (0.082 ppm) and MW6 (9.11 ppm). High manganese is objectionable in water because of its effect on taste, staining, and spotting of plumbing and laundered clothes. Manganese is a problem from an aesthetic viewpoint in drinking water, but it poses no threat to human health. The NSDWR criterion for iron (0.3 ppm) was exceeded in all of the samples, ranging from 1.13 ppm in MW6 to 11.4 ppm in MW5. Iron is a commonly found constituent in ground water, and its presence at the concentrations indicated does not pose any significant environmental or health hazard. The NSDWR criterion for TDS (500 ppm) was exceeded in the sample from well MW6 (1670 mg/L). High levels of TDS can cause aesthetic problems in drinking water; however, TDS poses no threat to human health. The pH of all of the samples was outside the NSDWR recommended range (6.5-8.5). The pH ranged from 5.1 in MW3 to 6.3 in MW7. The pH of ground-water varies greatly, and the slightly low pH of the samples from these wells could be naturally occurring and should not cause any environmental problems in the area.

(6) Because the ground-water in the area of Dunn Field is not used as a drinking water source, the contamination found in the area should not present any serious threat to human health. The flow of the contaminated water-table aquifer is offpost to the west toward the Mississippi. Most of the contaminants in the ground water are purgeable organics that would volatilize out of the water when it discharges into the river. However, a quarterly monitoring program including analysis for purgeable organics should be implemented for 1 year to fully evaluate the quality of the ground water and to identify any changes in its quality.

5. CONCLUSIONS. The ground water in the Dunn Field area is contaminated with purgeable organics but does not pose a serious threat to human health.

6. RECOMMENDATIONS. To ensure good environmental practice, the following recommendation is made: Implement a quarterly monitoring program to evaluate future changes in the quality of the ground water in the Dunn Field area.

7. REFERENCES. A list of references used in this report is included in Appendix D.

8. TECHNICAL ASSISTANCE. Questions regarding the findings and recommendations of this report may be referred to 1LT Greg Porter or to Chief, Waste Disposal Engineering Division, this Agency, AUTOVON 584-2953.

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APPROVED:

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APPENDIX A

ABBREVIATIONS

Ag	Silver
As	Arsenic
Ba	Barium
Ca	Cadmium
Cd	Cadmium
Cr	Chromium
Cu	Copper
DA	Department of the Army
DDMT	Defense Depot Memphis Tennessee
DEH	Director of Engineering and Housing
Disposal	The discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or onto any water or land so that such waste or any constituent thereof may enter into the environment or be emitted into the air or discharged into any waters, including ground waters
DLA	Defense Logistics Agency
DNB	Dinitrobenzene
2,4-DNT	2,4-Dinitrotoluene
2,6-DNT	2,6-Dinitrotoluene
DOD	Department of Defense
EPA	U.S. Environmental Protection Agency
EP Toxicity	A characteristic of a waste that is capable of causing death or severe temporary or permanent damage of a organism by the concentration of a contaminant (listed in Table I of 40 CFR 261.24) from the extract of a sample waste

Fe	Iron
ground water	Water under earth's surface that is free to move under the influence of gravity
ground-water table	Upper surface of a body of ground water
Hg	Mercury
HMX	1, 3, 5, 7 - Tetranitro - 1, 3, 5, 7 tetraazacyclooctane
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg/L	Milligrams per liter
Mn	Manganese
Na	Sodium
Ni	Nickel
NPDWR	National Primary Drinking Water Regulations
NSDWR	National Secondary Drinking Water Regulations
Pb	Lead
PCB	Polychlorinated biphenyl
ph	The negative logarithm of the effective hydrogen ion concentration used in expressing both acidity or alkalinity
poorly graded	A soil that consists predominantly of one size of soil particle, or it has a wide range of sizes with some intermediate sizes obviously missing
ppm	Parts per million
RCRA	Resource Conservation and Recovery Act
RDX	1,3,5-trinitro - 1,3,5-triazacychlohexane
Se	Selenium
TDS	Total dissolved solids

TEP	Toxic Extraction Procedure. Synonymous with.EP Toxicity
Tetryl	2,4,6-trinitrophenyl-methylnitramine
TNB	Trinitrobenzene
TNT	2,4,6,-trinitrotoluene
uniform graded soil	A soil where the grains are nearly all the same size
USAEHA	U.S. Army Environmental Hygiene Agency
Zn	Zinc

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APPENDIX B

CHEMICAL ANALYSIS

TABLE B-1. WATER LEVEL INFORMATION (MEASURED FROM THE TOP OF THE WELL CASING)

	MW2	MW3	MW4	MW5	MW6	MW7
Depth to Water	DRY	62'11"	70'5"	74'11"	58'4"	64'3"

TABLE B-2. GENERAL CHARACTERISTIC DATA

	MW3	MW4	MW5	MW6	MW7
Conductivity (µmhos/cm)	318	247	290	2481	261
TDS (mg/L)	289	208	245	1670	222
pH	5.1	5.2	6.2	5.6	6.3

TABLE B-3. TOTAL METALS (ppm). ALL SAMPLES WERE PREPARED FOLLOWING EPA METHOD 200.0

	EPA Method	Detection Limits	MW3	MW4	MW5	MW6	MW7
Ba	200.7	0.010	0.135	0.129	0.155	0.674	0.107
Cr	200.7	0.020	BDL	BDL	0.022	0.027	BDL
Fe	200.7	0.100	2.03	2.40	11.4	1.13	0.760
Mn	200.7	0.030	BDL	BDL	0.082	9.110	BDL
Hg	245.2	0.0002	0.0004	0.0002	BDL	BDL	0.0002
Na	200.7	0.500	20.7	24.3	23.8	34.2	16.2
Pb	239.2	0.001	0.006	0.003	0.012	BDL	0.004
Se	270.2	0.001	0.001	BDL	0.001	BDL	0.001
Zn	200.7	0.010	0.048	0.074	0.079	0.079	0.043

BDL = Below detectable limit

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TABLE B-4. PURGEABLE ORGANICS (ppm). ALL SAMPLES WERE ANALYZED FOLLOWING EPA METHOD 624

	Detection Limits	MW3	MW4	MW5	MW6	MW7
1,1-Dichloroethene	0.003	0.027	BDL	BDL	BDL	0.075
1,1-Dichloroethane	0.003	BDL	BDL	BDL	BDL	0.003
1,1,1-Trichloroethane	0.003	0.004	BDL	BDL	BDL	0.009
Trichloroethene	0.003	0.018	0.004	0.007	0.150	0.015
Tetrachloroethene	0.003	0.029	0.081	0.027	0.003	0.039
Chloroform	0.003	BDL	0.006	BDL	0.019	0.003
Carbon Tetrachloride	0.003	BDL	0.004	BDL	0.078	BDL
Trans-1,2-Dichloroethene	0.003	BDL	BDL	BDL	0.200	BDL
1,1,2,2-Tetrachloroethane	0.003	BDL	BDL	BDL	0.082	BDL
1,1,2-Trichloroethane	0.003	BDL	BDL	BDL	0.004	BDL

NOTE: No other purgeable organics were detected.
BDL - Below detectable limit.

TABLE B-5. ACID EXTRACTABLE ORGANICS (ppm). ALL SAMPLES WERE ANALYZED FOLLOWING EPA METHOD 625

	Detection Limits	MW3	MW4	MW5	MW6	MW7
4,6-Dinitro-O-Cresol	0.250	BDL	TRC	BDL	BDL	BDL
4-Nitrophenol	0.025	BDL	TRC	BDL	BDL	BDL
P-Chloro-M-Cresol	0.025	BDL	TRC	BDL	BDL	BDL
Pentachlorophenol	0.025	BDL	TRC	BDL	BDL	BDL
2,4,6-Trichlorophenol	0.025	BDL	TRC	BDL	BDL	BDL

NOTE: No other acid extractable organics were detected.
TRC = Trace amount detected.
BDL = Below detectable limit.

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TABLE B-6. BASE/NEUTRAL EXTRACTABLE ORGANICS (EPA METHOD 625)

No base/neutral extractable organics were detected in any sample.

TABLE B-7. PESTICIDES AND PCBs (EPA Method 608)

No pesticides or PCBs were detected in any sample.

APPENDIX C

CHEMICAL PARAMETERS ANALYZED

TABLE C-1. PURGEABLE (VOLATILE) ORGANICS, IN ppb (µg/L)

	Detection Limits
2-chloroethylvinyl ether	3
chloromethane	3
bromomethane	3
vinyl Chloride	3
chloroethane	3
methylene chloride	3
1,1-dichloroethene	3
1,1-dichloroethane	3
trans-1,2-dichloroethene	3
chloroform	3
1,2-dichloroethane	3
1,1,1-trichloroethane	3
carbon tetrachloride	3
bromodichloromethane	3
1,2-dichloropropane	3
trans-1,3-dichloropropene	3
trichloroethylene	3
benzene	3
cis-1,3-dichloropropene	3
1,1,2-trichloroethane	3
dibromochloromethane	3
bromoform	3
tetrachloroethene	3
1,1,2,2-tetrachloroethane	3
toluene	3
chlorobenzene	3
ethylbenzene	3
trichlorofluoromethane	3

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TABLE C-2. ACID EXTRACTABLE ORGANICS, IN ppb (µg/L)

	Detection Limits
2-chlorophenol	25
phenol	25
2-nitrophenol	25
2,4-dimethylphenol	25
2,4-dichlorophenol	25
4-chloro-3-methylphenol	25
2,4,6-trichlorophenol	25
2,4-dinitrophenol	250
4-nitrophenol	25
2-methyl-4,6-dinitrophenol	250
pentachlorophenol	25

TABLE C-3. TOTAL METALS - IN mg/L (ppm)

	Detection Limits
Ag	0.020
As	0.005
Ba	0.010
Cd	0.001
Cr	0.020
Cu	0.020
Fe	0.100
Mn	0.030
Na	0.500
Ni	0.100
Pb	0.001
Se	0.001
Hg	0.0002
Zn	0.010

TABLE C-4. GENERAL CHARACTERISTIC DATA

Conductivity
TDS
pH
Water Level

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TABLE C-5. BASE NEUTRAL ORGANICS, IN ppb (µg/L)

	Detection Limits
N-nitrosodimethylamine	10
bis (2-chloroethyl) ether	10
1,3-dichlorobenzene	10
1,4-dichlorobenzene	10
1,2-dichlorobenzene	10
bis (2-chloroisopropyl) ether	10
hexachloroethane	10
N-nitrosodi-n-propylamine	10
nitrobenzene	10
isophorone	10
bis (2-chloroethoxy) methane	10
1,2,4-trichlorobenzene	10
naphthalene	10
hexachlorobutadiene	10
hexachlorocyclopentadiene	10
2-chloronaphthalene	10
acenaphthylene	10
dimethyl phthalate	10
2,6-dinitrotoluene	10
acenaphthene	10
2,4-dinitrotoluene	10
fluorene	10
4-chlorophenyl phenyl ether	10
diethyl phthalate	10
1,2-diphenylhydrazine	10
N-nitrosodiphenylamine	10
4-bromophenyl phenyl ether	10
hexachlorobenzene	10
phenanthrene	10
anthracene	10
di-n-butyl phthalate	10
fluoranthene	10
pyrene	10
benzidine	10
butyl benzyl phthalate	10
benzo (a) anthracene	10
chrysene	10
3,3-dichlorobenzidine	10
bis (2-ethylhexyl) phthalate	10
di-n-octyl phthalate	10
benzo (b) fluoranthene	10
benzo (K) fluoranthene	10
benzo (a) pyrene	10
indeno (1,2,3-cd) pyrene	25
dibenzo (a,h) anthracene	25
benzo (ghi) perylene	25
2-methylnaphthalene	10

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TABLE C-6. PESTICIDES and PCBs, IN ppb (µg/L)

	Detection Limits
ALPHA-BHC	10
BETA-BHC	10
GAMMA-BHC	10
DELTA-BHC	10
4,4'-DDD	10
4,4'-DDE	10
4,4'-DDT	10
aldrin	10
dieldrin	10
ALPHA-ENDOSULFAN	10
BETA-ENDOSULFAN	10
endosulfan sulphate	10
endrin	10
endrin aldehyde	10
heptachlor	10
heptachlor epoxide	10
chlordane	10
PCB-1242	50
PCB-1254	50
PCB-1221	50
PCB-1232	50
PCB-1248	50
PCB-1260	50
PCB-1016	50
toxaphene	500

APPENDIX D

REFERENCES

1. Title 40, CFR, 1986 rev, Part 60, Appendix A, Reference Methods.

2. Title 40, CFR, 1986 rev, Part 141, National Primary Drinking Water Regulations.

3. Title 40, CFR, 1986 rev, Part 143, National Secondary Drinking Water Regulations.

4. Title 40, CFR, 1986 rev, Part 261, Identification and Listing of Hazardous Waste.

5. EPA Report 440/5-86-001, May 1982, Quality Criteria for Water.

6. EPA Report 600/4-82-057, July 1982, Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater.

7. EPA Report 600/4-79-020, March 1983, Methods for Chemical Analysis of Water and Wastes.

8. Letter, USAEHA, HSHB-ES-G/WP, 20 January 1983, subject: Geohydrologic Study No. 38-26-0195-83, Defense Depot Memphis, TN, 21 June - 2 July 1982.

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