



# U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES Public Health Service

Agency for Toxic Substances and Disease Registry

# **Comment Period Ends:**

# **OCTOBER 6, 1995**



#### THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment-Public Comment Release was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6), and in accordance with our implementing regulations 42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate. This document represents the Agency's best efforts, based on currently available information, to fulfill the statutory criteria set out in CERCLA section 104 (i)(6) within a limited timeframe. To the extent possible, it presents an assessment of the potential risks to human health. Actions authorized by CERCLA section 104 (i)(11), or otherwise authorized by CERCLA, may be undertaken to prevent or mitigate human exposure or risks to human health. In addition, ATSDR will utilize this document to determine if follow-up health actions are appropriate at this time.

This document has been provided to EPA and the affected state in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. Where necessary, it has been revised in response to comments or additional relevant information provided by them to ATSDR. This revised document has now been released for a 30 day public comment period. Subsequent to the public comment period, ATSDR will address all public comments and revise or append the document as appropriate. The public health assessment will then be reissued. This will conclude the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

Agency for Toxic Substances and Disease Registry	Barry L. Johnson, Ph.D., Assistant Administrator
Division of Health Assessment and Consultation	Robert C. Williams, P.E., DEE, Director Juan J. Reyes, Deputy Director
Exposure Investigations and Consultations Branch	Edward J. Skowronski, Acting Chief
Federal Facilities Assessment Branch	
Petitions Response Branch	Cynthia M. Harris, Ph.D., Chief
Superfund Site Assessment Branch	Sharon Williams-Fleetwood, Ph.D., Chief
Program Evaluation, Records, and Information Services Brane	hMax M. Howie, Jr., Chief

Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services.

Please address comments regarding this report to:

Agency for Toxic Substances and Disease Registry Division of Health Assessment and Consultation Attn: Chief, Program Evaluation, Records, and Information Services Branch, E-56 1600 Clifton Road, N.E., Atlanta, Georgia 30333

File: C.G. 541.460 a

-- Defense Distribution Depot Memphis Tennessee --

2

â

Sep 95 (Oat Estimoted)

### PUBLIC HEALTH ASSESSMENT

# USA DEFENSE DEPOT MEMPHIS MEMPHIS, SHELBY COUNTY, TENNESSEE

CERCLIS NO. TN4210020570

Prepared by:

The Agency for Toxic Substances and Disease Registry Division of Health Assessment and Consultation

131

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response. Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6), and in accordance with our implementing regulations 42 C.F.R. Part 90). In preparing this document ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

đ

ľ

L

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30 day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

Agency for Toxic Substances and Disease Registry	Barry L. Johnson, Ph.D., Assigumi Administrator
Division of Health Assessment and Consultation	
Exposure Investigations and Consultations Eranch	Edward J. Skowtanski, Acting Chief
Federal Facilities Assessment Branch	
Peditions Response Brach	
Superfund Site Assessment Branch	
Program Evaluation, Records, and Information Services Branch	

Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services.

Additional capies of this report are available from: Notional Technical information Service, Springfield, Virginia (703) 487-4850

#### FOREWORD

į,

1

ά.

The Agency for Toxic Substances and Disease Registry, ATSDR, is an agency of the U.S. Public Health Service. It was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the Superfund law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. (The legal definition of a health assessment is included on the inside front cover.) If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its cwn environmental sampling data but reviews information provided by EFA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists then evaluate whether or not there will be any harmful effects from these exposures. The report focuses on public health, or the health impact on the community as a whole, rather than on individual risks. Again, ATSDR generally makes use of existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further research studies are needed.

Conclusions: The report presents conclusions about the level of health threat, if any, posed by a site and recommends ways to stop or reduce exposure in its public health action plan. ATSDR is primarily an advisory agency, so usually these reports

identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific

Interactive Process: The health assessment is an interactive process. ATSDR solicits and evaluates information from numerous city, state and federal agencies, the companies responsible for cleaning up the site, and the community. It then shares its conclusions with them. Agencies are asked to respond to an early version of the report to make sure that the data they have provided is accurate and current. When infomed of ATSDR's conclusions and recommendations, sometimes the agencies will begin to act on them before the final release of the report.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

hazardous substances.

i.'

56

Attention: Chief, Program Evaluation, Records, and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E-56), Atlanta, GA 30333.

Defense Distribution Depot Memphis Tennessee	131	7
TABLE OF CONTENTS		
LIST OF FIGURES		. vi
LIST OF TABLES	• • •	. vii
SUMMARY		viii
INTRODUCTION	· · ·	. 1 . 1 . 1
BACKGROUND	- , , - , , - , , , - , , , - , ,	. 6 . 9 . 9 . 11 . 11 . 11
ENVIRONMENTAL CONTAMINATION AND ENVIRONMENTAL EXPOSURE PATHWAYS	3	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
Evaluation of Possible Foodchain Routes	• •	29
QUALITY ASSURANCE AND QUALITY CONTROL	· •	. , 32
PUBLIC HEALTH IMPLICATIONS	· ·	33 33 33 34

.

t

e e

.

١.

9. h. l.

ð

÷,

i r

ĺ.

ļ

Defense Distribution Depot Memphis Tennessee	1	31	Ľ	8
RECOMMENDATIONS			• •	42
PUBLIC HEALTH ACTIONS	-	•	 	43 43
PREPARERS OF REPORT			• •	44
REFERENCES				45
APPENDIX A ACRONYMS AND ABBREVIATIONS	•		• •	49
APPENDIX B GEOLOGY OF DDMT AND VICINITY				51
APPENDIX C ATSDR COMPARISON VALUES				53

ģ

ľ

Defense Distribution Depot Memphis Tennessee	13	1		ç	}	
LIST OF FIGURES						
Figure 1 ATSDR Environmental Exposure Evaluation		•	•	•	. 4	
Figure 2 ATSDR Exposure Evaluation Process		•	•		. 5	
Figure 3 Site Location	• •		-		. 7	
Figure 4 DDMT and Its Operable Units			•	·	. в	
Figure 5 Population Density in the DDMT Vicinity	<i>t</i> -	•	•	•	10	I
Figure 6 DDMT Surface Drainage		•			19	

i L

<u>ال</u> 1

чČ

ġ,

Ì

7

.

t L

Defense Distribution Depot Memphis Tennessee	131	10
LIST OF TABLES		
Table 1: Groundwater Analyses for Dunn Field	· · ·	. 16
Table 2: Water Analysis for DDMT Drainage Ditches		. 20
Table 3 ATSDR Public Health Summary	· • ·	. 41

ς.

۶.

١,

ŝ,

۰,

þ

į,

#### SUMMARY

14 日本の外国の

.

ý T

> ii Je

> 1

r

The Defense Depot Memphis Tennessee (DDMT) is located on 642 acres in Memphis, Shelby County, Tennessee. It is about five miles east of the Mississippi River, and four miles east of the Memphis central business district.

DDMT was constructed in 1941. Operations began in 1942. DDMT has served as a supply, storage and maintenance facility for the U.S. Army since that time. The supplies include a broad range of commodities, such as clothing, food, medical supplies, electronic equipment, petroleum products, construction materials and industrial chemicals. Many of the supplies contain components which are now considered hazardous materials. During the course of normal activities leaks and spills occurred. Also, items were disposed in the onsite disposal area.

In 1981, the Defense Logistics Agency began evaluating the management of hazardous waste materials at its facilities, including DDMT. In 1988, DDMT began to investigate soil and groundwater contamination. To aid in the study, DDMT was divided into four operable units (OUs). The facility was proposed for placement on the National Priorities List in August, 1991, and placed on the NPL in October of 1992. The chemicals contaminants that have been most found are volatile organic compounds (VOCs- mainly cleaners and solvents), petroleum products, pesticides, and metals.

DDMT is *not* the type of facility generally associated with production large amounts of hazardous wastes. The types of contamination that exist are from burial of unusable industrial supplies and chemical agents in Dunn Field, from isolated spills, or from the normal application of pesticides and herbicides to the facility.

The contamination issues at DDMT that will be evaluated for public health implications are:

- contamination buried in Dunn Field (reaching the groundwater under that area);
- the possibility of contamination in drainage channels;
- the possibility of air contamination; and
- isolated areas of soil contamination on the Main Installation.

Contamination buried at Dunn Field has contaminated the shallow groundwater under Dunn Field. However, public water supplies have been provided to neighbors of DDMT since the late 1940's-early 1950's, before the disposal area had been extensively used. Neighbors of DDMT were likely using public water supplies and would not have been exposed to any contaminated groundwater. Public water supplies are monitored and contamination from DDMT has not been detected. Additionally, the municipal water supply can be treated if necessary, so that if contamination from DDMT were to reach the public water supply, it would be treated and would not become a public health problem for drinking water.

The possibility of contamination in the drainage ditches is an issue that is being investigated. Although it is very unlikely that enough contamination exists to present a public health threat, ATSDR is recommending that samples be analyzed to verify that no threat exists.

Operations at DDMT (for example, warehousing and shipping activities) are not generally associated with significant amounts of air contamination. However, over the years, isolated accidents and incidents have occurred that are evaluated in this public health assessment. For the most part, these do not appear have released enough contaminants to present a threat to public health. However, with the absence of air sampling information, ATSDR recommends that soil samples be analyzed from the area of the sandblasting operation. Soil samples in this area will provide information on whether metals from the sandblasting operation were transported by air currents and deposited outside the facility.

Access to areas containing contaminated soil is controlled by warning signs, fencing, or paving. As a result, the areas containing contaminated soil are not a threat to public health.

### INTRODUCTION

ş'

ŝ

•

#### General Information

The Agency for Toxic Substances and Disease Registry (ATSDR) was established under the mandate of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980. (Note: Appendix A provides a listing of abbreviations and acronyms used in this report.) CERCLA, also known as the "Superfund" law, authorized the U.S. Environmental Protection Agency (EPA) to conduct clean-up activities at hazardous waste sites. EPA was directed to compile a list of sites considered hazardous to public health. This list is termed the National Priorities List (NPL). The 1986 Superfund Amendments and Reauthorization Act (SARA) directed ATSDR to perform a public health assessment for each NPL site. In 1990, federal facilities were included on the NPL.

Public health assessments (PHAs) are conducted by scientists from ATSDR (or from states with which ATSDR has cooperative agreements). The purpose of a PHA is to determine whether people have been (in the past) or are being exposed to (in contact with) hazardous substances and if so, whether that exposure is harmful and should be stopped or reduced.

In conducting the PHA, three types of information are used. A major source of information is the extensive environmental data collected for EPA. This information is examined to determine whether people in the community might be exposed to hazardous materials from the NPL facility. If people are being exposed to these chemicals, ATSDR will determine whether the exposure is at levels which might cause harm. A second source of information used in the PHA is community health concerns. ATSDR will evaluate health concerns of community members and determine whether health concerns could be related to exposure to chemicals released from the NPL facility. If ATSDR finds that harmful exposures have occurred, health outcome data (information from local hospitals and other medical organizations) can be used to further assess the occurrence of specific illnesses.

The PHA presents conclusions about whether exposures are occurring, and whether a health threat is presented. In some cases, if enough information is available, it is possible to determine whether exposures occurred in the past. If it is found that a threat exists, recommendations are made to stop or reduce the threat to public health. ATSDR is an advisory agency. Its recommendations identify actions which EPA, the facility or local agencies may undertake. If exposures are occurring at levels which could pose a threat to public health, ATSDR can undertake health education activities or certain additional followup studies. ATSDR can also identify types of information which might be needed to make public health decisions, if such information is lacking.

Exposure Evaluation Process

131 14

-- Defense Distribution Depot Memphis Tennessee --

In order to evaluate the effect on public health of contaminants at NPL sites, the public health assessment focuses on examining whether people have been *exposed* to (in contact with) the contaminants. To this end, the two most important tasks in the public health assessment are;

1) determining whether people have been exposed to hazardous materials from the NPL facility, and,

2) if exposure is possible or has occurred, determining whether the exposure is at a level that could be a threat to public health.

In this PHA we will examine:

- whether contamination exists in the environment,
- whether contamination is in places where people in the surrounding community might come in contact with the contaminants, and
- if there is exposure, whether it is at a level high enough to affect the health of people in the community.

To make these decisions, each of the possible environmental "pathways" will be examined. An environmental pathway can be described as the route that the contamination follows to get from the source to where people may be in contact with it. The environmental routes that this PHA will examine are:

1. groundwater, or underground (well) water, in both public water supplies and private wells,

2. surface water (creeks, ponds), and

3. sediments under the creeks and ponds and on their banks; 4. air;

5. soil; and

6. the "food chain", such as livestock, crops, game and fish (specifically, at DDMT, home gardens).

Figure 1 portrays the environmental routes we will investigate in this PHA. The numbers 1 through 6 on the figure match the numbers for the routes shown above, and will be referred to throughout the text as the pathways and possibility of exposure are discussed. Figure 2 shows the questions ATSDR asks about whether exposures could occur that would cause public health

Figure 1 Legend -- In the environmental exposure evaluation, ATSDR examines the TYPES and AMOUNTS of contaminants present at their SOURCES (such as spills, leaks or landfills). The ROUTE these contaminants might take is then determined (These are noted on the figure by the numbers 1 through 6). ATSDR looks at environmental data to decide whether it is likely that one or more of these ROUTES is in fact contaminated. If contamination is found, ATSDR decides whether people can be in CONTACT with these chemicals, by BREATHING, DRINKING, EATING, or TOUCHING them. Finally ATSDR determines whether the AMOUNT present is sufficient to be a public health problem.

131 ATSDR Environmental Pathways Exposure Evaluation (Figure 1) ٦ ل F shallarv B leaks & spills 9 (d) eff 0 . eily weiter wells .0 Z 1911 - Y

131 17

# **ATSDR Exposure Evaluation Process**

# WHAT ARE THE CONTAMINANTS AT DDMT?

# WHICH ENVIRONMENTAL MEDIA ARE CONTAMINATED? (AIR, WATER, SEDIMENT, SOIL, FOOD) AND HOW MUCH CONTAMINATION IS PRESENT IN EACH?

# HOW DO THE CONTAMINANTS TRAVEL TO WHERE PEOPLE CAN BE IN CONTACT WITH THEM?

## HOW COULD PEOPLE BE EXPOSED? (BREATHE, DRINK, EAT, OR TOUCH)

# ' IF EXPOSURE IS OCCURRING, OR OCCURRED IN THE PAST IS\WAS THERE CONTAMINATION IN AMOUNTS THAT WOULD AFFECT HEALTH?

Figure 2 -- ATSDR Exposure Evaluation Process

problems.

## 131 18

Another important factor is the way that people might contact the contaminant. By this we mean whether the chemical is:

- inhaled;
- ingested (eaten or drunk); or
- absorbed through the skin.

Not all chemicals are a hazard for each of these methods of contact. For example, most metals are not harmful, particularly in very low amounts, if the only contact is by way of the skin.

#### BACKGROUND

#### Site Description

The Defense Depot Memphis Tennessee (DDMT) is located on 642 acres in Memphis, Shelby County, Tennessee. See Figure 3 for the location of the site (1). DDMT lies in the south central section of Memphis. It is about five miles east of the Mississippi River, and four miles east of the Memphis central business district.

Located on land that was previously used for growing cotton, DDMT was constructed in 1941. Operations began in 1942. DDMT has served as a supply, storage and maintenance facility for the U.S. military since that time. In 1962, the Defense Logistics Agency (DLA) assumed command of DDMT. The supplies include a broad range of commodities, such as clothing, food, medical supplies, electronic equipment, petroleum products, construction materials and industrial chemicals (2). Many of the supplies contain components which are now considered hazardous materials. Over the 50+ year history of the facility, during the course of normal activities and due to the large volumes handled, leaks and spills occurred. Also, items containing hazardous materials were disposed onsite. With the exception of the early mustard agent disposal activity, DDMT has kept complete and detailed records of materials spilled or disposed, and their locations. For this reason, the sources and types of contamination at DDMT are generally well identified.

A review by the Army of installation records suggests that about 77 waste disposal sites, spill locations, and other sites of possible environmental concern exist at DDMT. These sites are called Installation Restoration Program (IRP) sites. Many of these IRP sites are located in Dunn Field (2) (See Figure 4).

In 1981, DLA began evaluating the management of hazardous waste materials at its facilities, including DDMT (3). In 1988, DDMT





began to investigate soil and groundwater contamination. To aid in the study, DDMT was divided into four operable units (OUs)(4). These are shown in Figure 4. Based primarily on concern that the groundwater aquifer used to supply drinking water could be contaminated, the facility was proposed for placement on the National Priorities List (NPL) in August 1991, and placed on the NPL in October of 1992. The chemical contaminants of greatest concern are volatile organic compounds (VOCs), mainly cleaners and solvents, petroleum products, pesticides and metals.

## Demographics

5

-•1 According to the 1990 Census, a total of about 825,000 people live in Shelby County, where DDMT is located. In the two census tracts surrounding DDMT, totaling 6.84 square miles, there are about 25,000 residents (15). Figure 5 shows population density of the area around DDMT.

DDMT employs about 1,200 civilians and 16 military personnel. Base housing consists of 8 units with a population of about 24, including military personnel and family members (14). This housing is located in the southeastern corner of the site.

Land Use and Natural Resources

DDMT is located in the metropolitan Memphis area. The vicinity is an area of mixed residential, commercial, and industrial land use.

The facility is divided into two sections. The Main Installation, covering 578 acres, is heavily developed. The land area is graded, paved and built-up with warehouses, storage areas and administrative buildings. There are relatively small open, grassy areas throughout the main facility.

The small base housing areas are located in the extreme southeastern corner of DDMT. The largest grassed area is the golf course, located in the southeastern portion of the facility. The only significant onsite water bodies are the Golf Course Pond and Lake Danielson, both within the golf course area. Fishing and swimming are not allowed in either of these ponds.

The other portion of the facility, Dunn Field, covers 64 acres of level to gently rolling terrain. It is located next to the northwestern portion of the Main Installation. Dunn Field is an open storage area, with about half the land surface covered by grass. The remainder of the area is mostly graded, paved or covered in gravel or by large bauxite piles. A majority of the



Figure 5: Population Density in the DDMT Vicinity

77 listed waste disposal and spill areas are located in Dunn Field (2).

## Surface Water

Surface water drainage from DDMT enters two neighboring creeks, Cane Creek, about <sup>1</sup>/<sub>2</sub> mile northwest of DDMT, and Nonconnah Creek, about one mile to the south. Cane Creek is a tributary of Nonconnah Creek. Nonconnah Creek is a tributary of the Mississippi River. The drainage channels from DDMT are often dry, depending on seasonal rainfall. The creeks are classified by the state of Tennessee for propagation and maintenance of fish and other aquatic species, livestock and wildlife watering and irrigation. Both creeks are also classified for recreation. Some fishing and other recreational use occur on both these creeks.

#### Game and Fish

Bass, bluegill, and catfish are the predominant fish found in surface waters around DDMT. Recreational fishing does occur in Nonconnah Creek and to lesser extent in Cane Creek. Fishing would not occur in the drainage ditches from DDMT because they rarely contain appreciable amounts of water, and are often dry. Wildlife species such as squirrels, red fox, mourning dove and quails have been observed within DDMT and in the vicinity. Due to the extensive urban development in the area, hunting is not allowed within city limits and is therefore not a normal or frequent activity.

## Geology and Groundwater

Soils at DDMT ranges in thickness from six to forty feet. Although not a primary waterbearing unit, following rainfall, the surface soils may briefly contain small, shallow waterbearing zones.

Sediments under the surface soils comprise the shallow watertable aquifer (An aquifer is a water-bearing zone). This aquifer ranges in thickness from 40 feet to about 131 feet. It is this aquifer that is believed to be contaminated by chemicals from DDMT. This aquifer is not believed to discharge to surface waters in the area of DDMT (2).

The groundwater flow in this shallow aquifer, in the DDMT area, is in two general directions. From Dunn Field, the flow is to the west. At the Main Installation, the general direction of groundwater flow is west to nonthwest. Recent information obtained in the northwest portion of the Main Installation and Dunn Field area suggests that, in places, there may be leakage from the shallow aquifer into deeper units (7).

Directly under the shallow aquifer is a layer of clay-like material that provides a barrier that

limits (but does not necessarily eliminate) leakage between that aquifer and the deeper aquifer, called the Memphis Sand Aquifer. The Memphis Sand Aquifer is the primary source of water for the area, providing about 95 percent of the water supplies for the Memphis area. In accordance with EPA and state safe drinking water requirements, the Memphis water supply is monitored on a regular basis and is treated if necessary before the water is used (5). Most of the recharge (replenishment) of this aquifer occurs where the aquifer is at the surface several miles to the east of DDMT. Water in this aquifer is under regionally artesian conditions, which means that in many areas, however, as the Tennessee Department of Environment and Conservation (TDEC) points out, a local water level depression exists, indicating a negative head near the DDMT. This negative head is attributed to the presence of the Allen Well Field to the west. The presence of the local depression in the water level in the DDMT areas could be due to leakage from the fluvial aquifer into the deeper aquifer (6).

MLG&W has in place a monitoring and treatment program for the water supply, in order to protect the supply from the possibility of contamination from any possible source. MLG&W does monitor for the types of chemicals that are possible contaminants from DDMT. Additionally, MLG&W has in place plans to treat the water supply, if necessary, to keep these chemicals from reaching the public (5). Interim remedial plans for DDMT include a program of pumping the contamination for the shallow aquifer and treating the water to further limit the possibility that contamination reaches the water supply (4).

# ENVIRONMENTAL CONTAMINATION AND ENVIRONMENTAL EXPOSURE PATHWAYS

#### Introduction

This section examines each of the environmental routes (water, sediment, air, soil, foodchain) to determine whether contamination is present, and if people in the community are exposed to (or in contact with) the contamination. If people are exposed to contamination in any of the media, we will evaluate whether there is enough contamination to pose a threat. This analysis will follow the pattern depicted in Figure 1 to systematically evaluate each of the environmental routes.

Each section contains a summary box numbered to match the routes as shown in Figure 1.

# Evaluation of Possible Water Routes

People can be exposed to contaminated water by drinking it, bathing or swimming in it, or in some cases, breathing vapors from water (for instance, steam from a hot shower). There are two main water pathways to consider. These pathways are:

- groundwater, that is, water from wells, either private wells or public water supply wells,
- surface water, that is, ponds, lakes, creeks. The sediment on the bottom and along the edges of these water bodies will be considered along with surface water, since any exposure to contaminated sediments would occur in the vicinity of the surface water.

#### <u>Groundwater</u>

Groundwater is actually underground water. People use this water from either private wells or municipal well systems.

Currently there are no known private wells in use within one mile of DDMT (2). Municipal water supplies have been available to the homes and businesses in the vicinity of DDMT for domestic use since the 1940's to early 1950's (12).

	_ + 1. h
- IT IS UNLIKELY THAT NEIGHBORS 1	TO 🐄 👘
- DOMT IN THE PAST WERE EXPOSED TO	A
HAZARD FROM CONTAMINATED	
GROUNDWATER FROM DOMT.	A.0(232)
- GROUNDWATER CONTAMINATION I	FROM.
NUME TODAY IS NOT & HAZARD TO PL	IBI 1C
HEATTH	
(Refer to #1 in Finitre 1)	
	-812 Mrs 4

The shallow groundwater aquifer under DDMT is contaminated (2,4). Memphis Light, Gas and Water Division (MLG&W) obtains this water from the Memphis Sand Aquifer, not the overlying shallow aquifer. The primary contaminants are volatile organic compounds (VOCs) (mainly cleaners and solvents), metals, petroleum products and pesticides. The following sections will describe the levels of contamination and the possibility of exposure.

The shallow aquifer groundwater has not been used by DDMT (9). Domestic water supplies for the facility have always been obtained from municipal sources. As stated above the municipal water supply comes from the deeper aquifer, the Memphis Sand Aquifer. MLG&W has in place a monitoring and treatment program for the water supply. MLG&W does monitor for the types of chemicals that are possible contaminants from DDMT. Additionally, MLG&W has in place plans to treat the water supply, if necessary, to keep these chemicals from reaching the public (5).

Remedial plans for DDMT include a program of pumping the contamination for the shallow aquifer and treating the water to further limit the possibility that contamination reaches the water supply (4). These factors greatly limit the possibility that people have been exposed to contaminated groundwater from DDMT.

- Past Groundwater Effects

٦.

ž

1

i

i,)

1111-111-111-11

. . . . .

ï

ľ

The only location where contaminated groundwater is suspected to have moved offsite is immediately to the west of Dunn Field (2). The following describes the primary contaminants that *might* be of concern, *if* they were present at high enough concentrations, and *if* people drank them regularly for extended periods of time.

According to DDMT disposal records in the 1990 environmental investigation and the 1995 Draft Final RI\FS Work Plan (1,2), with the exception of the chemical agent destruction, very little waste disposal activity occurred before 1954. Material disposed before 1954, listed in the 1990 environmental study, includes food waste, construction material, and "combustible material", presumably not hazardous chemicals, since such chemicals are specifically listed as such in the records. The materials listed as disposed prior to 1954 do not appear to represent a chemical contamination hazard to groundwater. This date is important in that municipal water has been provided since 1953 for the area immediately west of Dunn Field (8). Prior to 1953, water would have been obtained from private wells.

According to the 1990 environmental study (2) and the 1995 draft final work plan for Dunn Field (1), groundwater movement from Dunn Field is to the west. However, since municipal water has been provided to the area west of Dunn Field since 1953 (8), it is unlikely that neighbors to DDMT were exposed to a hazard from contaminated groundwater.

DDMT records show that mustard agent was destroyed and disposed at Dunn Field in 1946.

According to available information, the mustard was treated in a bleach slurry and essentially "deactivated" (10). Mustard agent that is buried without being treated will break down into a number of less toxic chemicals, such as thiodiglycol and hydrochloric acid. The primary problem that would result from exposure to these chemicals (at high enough levels) is skin irritation. The neutralizing process can break the compound into a number of less toxic compounds, including mustard sulfone (*bis* (2-chloroethyl) sulfone) and half-mustard (2-chloroethyl, 2-hydroxy ethyl sulfide) (11,13) and decreases the amount of the natural breakdown chemicals that will be produced.

According to the ATSDR Mustard "Gas" Toxicological Profile (13), mustard agent is not soluble in water. For this reason, any mustard agent that remained would *not* be likely to move offsite in the groundwater. Also, the principal breakdown products of mustard agent tend to deteriorate within a matter of weeks, so they would not likely be health threats. Consequently, the mustard agent destroyed at Dunn Field was not a threat to public health in the past.

- Present-Day Groundwater Effects

51

ŀ

١

Ł

ţ

Allen Well Field is the source of the municipal water supply for the area around DDMT. This facility is located about 1/2 mile west of DDMT. These wells produce water from the Memphis Sand Aquifer. (Appendix B provides more details on the groundwater aquifers in the vicinity of DDMT.) To date, contamination related to DDMT has not been found in MLG&W wells. Contamination appears to be under DDMT and in limited areas immediately outside the base (2). Table 1 lists the contaminants found in groundwater under Dunn Field. DDMT is developing a plan, with oversight by EPA and TDEC, to pump and treat contaminated water from this shallow aquifer. This interim measure will decrease by half the migration of the contaminant plume (2).

The municipal water supply is tested for contaminants (primarily metals and VOCs) and treated, if necessary, according to EPA drinking water standard requirements (5,8). At this time, there have been no hazardous chemicals from DDMT detected which present a danger. As long as people use the readily available municipal water supplies, the groundwater contamination from DDMT is not a

131 28

-. Defense Distribution Depot Memphis Tennessee --

I.

μ

.....

4 1 1

; \_\_\_\_\_

---

2.

, 1 % 1 1

.

.

Table 1: Gr	roundwater Analyses for E	Dunn Field (2)
Contaminants	Maximum Level Detected (ppb)	ATSDR Comparison Value (ppb) - Based on ingestion
1,1,2,2-Tetrachloroethane	1900	0.2 CREG 3000 EMÉG
1,1,1-Trichloroethane	12	200 MCL
1,1-Dichloroethylene	13	7 MCL
1,2-Dichloroethylene	1100	70 MCL
Tetrachloroethene	240	5 MCL
Trichloroethene	5100	5 MCL
N-Nitrosodiphenylamine	7	7 CREG
Arsenic	50	50 MCL
Lead	1000	15 EPA Action Level
Chromium	260	100 MCL
Barium	1900	700 MCL
Nickel	170	100 MCL

NOTE: AISDR Comparison Values are generally derived assuming long-term (many years) exposures. Infrequent and short-term exposure would not result in the same chance of harm. Also, since neighbors currently use public water, no exposures are occurring.

\*MCL - EPA Maximum Contaminant Level is the maximum allowable by EPA for safe drinking water

threat to human health.

#### Surface Water

.

ار •

ŀ

en.

. P. Contamination of water in the DDMT drainage ditches would be caused when rainwater runoff from paved areas or areas with contaminated surface soil enters the ditches. However, hazardous waste buried below the surface at Dunn Field, is not likely to contaminate surface water or cause contamination to accumulate in the drainage



ditches. According to the Remedial Investigation (RI) (17), the water table under the DDMT is about 40 feet below land surface. Rainwater that soaks into the ground (and does not run off) will infiltrate through the subsurface to the watertable, 40 feet below the surface. For this reason, it is not likely that this water could enter the overlying drainage ditches.

## - DDMT Golf Course Ponds

Surface water bodies within the boundaries of DDMT are the Golf Course Pond and Lake Danielson. Surface water from both of these ponds were sampled in the 1980's and were found to be contaminated, primarily by pesticides and metals, with some polynuclear aromatic hydrocarbons (PAHs). The main source of the pesticides is suspected to be chemicals used to maintain the golf course and pesticides stored in a shed adjacent to the Golf Course Pond. Some of the metal and PAH contamination is probably the result of runoff from paved areas and roads within DDMT. (Both PAHs and metals can be components of the paving material used in roads, and can also come from vehicle exhaust). In 1986, both ponds were closed to all recreational activities. Even though the present surface water contamination levels are low, both have remained closed (2). There is no information of significant exposures to contaminants prior to their closing, and no indication that public health has been affected. For these reasons, it is not anticipated that the contamination of these two water bodies poses a threat to public health.

#### - Drainage Ditches

Other surface water pathways that need to be evaluated are the ditches that drain from the site. These ditches are also *possible* routes for contamination to reach the waters and sediment of Cane and Nonconnah Creeks. According to RI information, several ditches or streams drain from DDMT to Cane or Nonconnah Creeks. These are shown in Figure 6 (1).

li.

ŗ

ç...

131 30

An open, concrete-lined channel runs north from Dunn Field into Cane Creek. Two unlined ditches run west from Dunn Field through the Rozelle Street area. During a February 1995 site visit by ATSDR, these were both observed to contain relatively small volumes of water. Tarrant Branch runs west from the main facility, eventually entering Nonconnah Creek to the south. Drainage ditches run from the Golf Course Pond and Lake Danielson south, entering Nonconnah Creek. An unnamed ditch runs east from the Main Installation to the storm sewer system. Each of the ditches except Tarrant Branch are dry for at least part of the year (2).

Since there is little chance that people would drink water from the drainage ditches in any significant quantity, the only possible exposure concern would be dermal exposure (contact with the skin). There are few studies on dermal exposures of people to low levels of these chemicals. However, in general, this is much less likely to be a health problem than exposure by drinking the contaminated water. This is because these chemicals are *not* as easily absorbed into the body through the skin as they would be if they are taken in by drinking water.

Because the most likely exposure would be from walking beside or wading in the ditches, the most likely contact with the chemicals would be a person's feet and possibly hands. These are the parts of the body that are the *least* able to absorb contaminants (18). Also, it is important to remember that for exposure to a low level of contamination to be a problem, the exposure has to occur frequently (generally daily) over a long period of time (many years) (18).

Sixteen drainage ditch samples were collected for the 1990 RI (2). These samples were collected onsite, from each of the ditches that drained from DDMT to offsite. The contaminants found in these samples are listed in Table 2. With the exception of the pesticides DDT and DDE, the VOC bis(2-ethylhexyl)phthalate (DEHP), and the PAHs fluoranthene and pyrene, levels were lower than EPA drinking water standards. For the contaminants found *in these ditches*, dermal exposure is therefore not a public health concern.

DDT and DDE do not enter the body through the skin very easily, so that exposure to these chemicals in the small amounts present in the southern onsite drainage ditches is not likely to be a public health problem (19). DEHP is not easily absorbed through the skin, particularly in small amounts, such as are present in



•

'n

ļ

ļ

		/ears) exposures. Comparison Values	ATSDR COMPATIBOD VALUE values us for DRINKINO WATER therefore more protective than for dermal soniest. This is because themicals are presently more easily absorbed into the body by ingestion than by dermal context.			S MCL	1000 XMEG	20 EMEG	700 MCL 100 MCL 1300 MCL 2000 NCL		6000 RMEG	40000 RMEG 6 MCL		13
	ge Ditches. (2)	ong-term (many ) chance of harm	Concentration ug/l		2010-00-00-00-00-00-00-00-00-00-00-00-00-		5.0	0.16	76.0 20.0 23.0		4.0	0.e		
phi <b>a</b> Tennessce	ter Analysis for DDMT Draina	enerally derived assuming lo buld not result in the same	Chemical	None detected	None detected	voca/svoca	Acetona Acetona Pesticides	Endogulfan	Barium Chromium Copper	zinc vocavocav	2-Butanono	Acetone Benzoic acid bis{2-ethylhexyl}phth <mark>alate</mark>	Metale	20
Depot Men	le 2: W:	za are g posure w	Sample Number	SW-1	<u> 91-16</u>	SW-2					5W-14			
Defense Distribution	Tab	NOTE: ATSDR Comparison Value Infrequent and short-term exi defined in Appendix C	Sample Location	North boundary Dung Field	North boundary Dunn Field	West boundary of DDMT					West boundary of DDMT			

Ì

1 32

	rears) exposures. Comparison Values	ATSDR COMPALISON VALUE values are for DRINKING WATER therefore more protective than for dermal scattert. This is because chanterly are generally more easily absorbed into the bady by ingestion than by dermal contact.	700 MCL 100 MCL 2000 LTHA 5 MCL 5 MCL 6 MCL 5 MCL 1000 RWEG 6 MCL 1000 RWEG 1000 RWEG 6 MCL 1000 RWEG 1000 RWEG 6 MCL 1000 RWEG 1000 RWEG 6 MCL 1000 RWEG 1000 RWEG 100 RWE
	ge Ditches. (2) ong-term (many ) chance of harm.	Concentration ug/l	42.0 10.0 36.0 11.0 13.0 12.0 12.0 60.0 50.0 56.0 56.0 56.0 13.0 13.0 13.0
phis Tennessce	ter Analysis for DDMT Draina	Chemical	Barium Chromium Zinc woc6\Svoc8 wethylene chloride Methylene chloride Acetone Acetone big(2-ethylhexyl)phthalate big(2-ethylhexyl)phthalate Arsenic Arsenic Lead Barium Cadmium Copper Silver Zinc voc8\Svoc8
рерос Жел	lc 2: Wa sare gu osure w	Sample Number	SW-12
Defense Distribution	Thi Nore: ATSDR Comparison Value	defined in Appendix C Sample Location	southwest corner of golf course Southwest corner of golf course

. 24 Ч

•

2

:

.

3

•

21

ļ
Tennessee
Memphis
Depot
Distribution
Defen6e

:

ų

. 

ſ

# Table 2: Water Analysis for DDMT Drainage Ditches. (2)

NOTE: ATSDR Comparison Values are generally derived assuming long-term (many years) exposures.

Infrequent and short-term ex	iposure w	OULD DUC LEBULC IN UNC SWW		4	
Sample Location	Sample Number	Chemical	Concentration ug/l	ATSDR COMPACISON VALUE "values are for DRINKING WATER therefore more protective than for domail contact. This is because chemicals are generally more evaily tharbed into the body by ingestion than by domail contact.	<u> </u>
		Acetone Benzoic acid bis{2.ethylhexyl}phthalate N-Nitrosodiphenylamine	4.0 6.0 7.0	1000 RMEG 4000 RMEG 6 MCL 7 CREG	1
		Perstant and the person of the			
		4,4'DDE 4,4'DDT	0.65 2.2	0.1 CREG 0.1 CREG	1
		Metals			<u> </u>
		Arsenic	30.0	50 MCL 15 EPA Action Level	
		Lead Barium	98.0	700 MCL	
		Cadmium	19.0	5 MCL 100 MCL	_
		Chromium Copper	20.0 150.0	1300 MCL 2000 LTHA	
					<u></u>
Golf Course Pond drainage ditch	0T-MS	Acetone	1.0	1000 RMEG	
(south boundary of DDMT)		bie(2-ethylhexyl)phthalate	3.0	5 MCL 1000 RMEG	
		Di-n-octyl phthalate N-Nitrosodiphenylamine	0.00	T CREG 300 RMEG	
		Pyrene		34	
		22			

		cears) exposures. Comparison Values	ATSDR COMPATIBOLI VALUE "Values are for DRINKING WATER therefore more protective than for dermal contect. This is because chemicals are generally more cavily ablorhed into the body by ingestion than by dermal contact.	0.1 CRBG	0.1 CREG	- ILL - IL	1300 MCL 2000 LTHA		1000 RMEG 20000 RMEG	6 MCL 100 MCL	400 RMBG 300 RMBG		0.1 CREG	0.1 CHEG	13	1
	ge Ditches. (2)	ong-term (many ) chance of harm	Concentration ug/1	0.14	0.27		26.0		4	9.0 8	2.0 9.0		0.98			
his Tennessee	cr Analysis for DDMT Draina	nerally derived assuming lould not result in the same	Chemical	Pésticios	4,4 DDT	Mecala	Barium Conner	Zinc Since S	VOCSASVOCE	Total Xylence bis(2-ethylhexyl)phthalate	Butyl benzyl phonaigue Fluoranthene	Pyrene Wasti ri des	4.4. DDE	4,4 DDT	WELALM	23
Depot Mem	le 2: Wa	ss are ge Josure wc	Sample Number						;	5 M - T T						
Defense Distribution	ldha'f	NOTE: ATSDR Comparison Value Infrequent and short-term exp	Sample Location							Golf Course Pond drainage ditch (south boundary of DDMT)						

2

÷

i.

Barium 55.0 1300 MCL
Copper 2000 LTHA

None Detected

SW-15

East boundary of Dunn Field

1

ï

1

۹۲ ۱۰ ۱۰

e.

these onsite ditches (20). The amount of DEHP present also does not present a public health threat.

If enough fluoranthene and pyrene are present, dermal exposure can result in a noticeable skin irritation. However, neither chemical is believed to cause cancer or other long-term problems (16). These contaminants are not present at levels that would be considered health threats. Based on the low levels present, and the limited possibility of contact, is not likely that these PAHs present a health threat.

37

131

There is currently no information available on contamination in the ditches on western side of Dunn Field. Surface water contamination is not likely to be a problem in ditches draining Dunn Field since, for the most part, the contamination is buried below the surface, and is not likely to affect rainwater runoff. Also, any rainwater soaking into Dunn Field would percolate downward to the water table, which is about 40 feet below ground surface in the DDMT area. It is highly improbable that rainwater percolating into Dunn Field could move laterally off Dunn Field to get into the drainage ditches. The ditches themselves will be "recharged" by groundwater within 10 to 20 feet of their streambanks and would not be affected by groundwater contaminants under Dunn Field.

Additionally, VOCs and metals are the contaminants buried at Dunn Field. VOCs were found at elevated levels in the groundwater samples. Several metals were also detected at elevated levels. Table 1 shows these contaminants. In general, if VOCs had been present at one time in surface soil, they do not remain in surface soils for any length of time and therefore would not be present to be carried in rainwater runoff into the ditches. Also, VOCs are not easily absorbed through the skin in amounts large enough to be a problem, particularly when amounts are as low as could possibly be present in the drainage ditches (23,24,25,26,27,28,29).

The metals found in the groundwater samples at Dunn Field are also not generally a problem in terms of contact with the skin. This is especially true when these metals are in water and are present in such small amounts (30,31,32,33,34).

In summary, it is unlikely that hazardous waste buried in Dunn Field is carried offsite by rainfall runoff. It is not likely that surface water would be contaminated as much as groundwater.

The actual contamination of surface water in the ditches has not been determined. Additional ditch water sampling planned for DDMT will provide information on any contaminants present. *However*, using the assumptions made above, it is unlikely that skin contact with the ditch water (or sediment) is harmful.

- Nonconnah and Cane Creeks

No information is available on the possible contamination of Nonconnah Creek or Cane Creek. However, considering the relatively low levels of contamination found in surface water onsite, and the dilution that would occur when the contaminants reached these creeks, there is very little chance that public health could be affected by contaminants from DDMT in these creeks. Additional sampling of the drainage ditches will provide some information on the likely levels of contamination that might reach these creeks.

## **Evaluation of Possible Sediment Routes**

The only sediments that *might* be a concern are those in the drainage ditches. However, the levels of contamination would have to be far greater than the levels found in surface water at DDMT to be a public health problem.

- IT IS NOT LIKELY THAT SEDIMENTS IN THE DITCHES ARE CONTAMINATED WITH THE TYPES AND AMOUNTS OF CHEMICALS THAT WOULD CAUSE A PUBLIC HEALTH THREAT (Tafer to #3 to Figure 1)

No sediment samples have been collected in the drainage ditches. However, sediment

samples collected from the Golf Course Pond and Lake Danielson detected PAHs, VOCs, pesticides and metals. The Golf Course Pond sediments contained N-Nitrosodiphenylamine, PAHs and pesticides at concentrations that might be a concern for soil. Even for these contaminants there is no health threat from infrequent and short-term exposure. More important however, they are not a hazard since there is no opportunity for contact by people with these sediments.

As stated above, the contamination of the Golf Course Pond sediments is not a threat to public health since there is no contact by the public with these sediments. However, the contaminants in these sediments and in onsite ditch samples can give an indication of what contaminants might be found in offsite ditches which drain them.

The upcoming sample and analysis of offsite ditch sediment samples will provide information on the potential for contamination in these ditches. However, for these sediments to be a threat to public health, the levels of contamination would have to be much higher than the levels of contamination found in onsite ditch water and pond sediment samples.

## **Evaluation of Possible Air Routes**

The normal operations, such as storage and warehousing activities, that occurred at DDMT in the past are not industrial activities which cause large amounts of air contamination. There are not currently any activities occurring at DDMT which could cause air contamination that would be a threat to public health. This determination is based on the

type of activities (storage and warehousing) which are currently occurring at DDMT, and the fact that these activities are regulated by the state and EPA under RCRA. Under delegated authority of the Clean Air Act (Amended 1990), the Memphis\Shelby County Health Department

![](_page_39_Picture_2.jpeg)

is the permitting agency for air emissions at DDMT. Any such emissions would be regulated and limited to safe levels by the Clean Air Act (21). As a part of the CERCLA process, the EPA requires that air quality be protected during any remedial activities that occur at DDMT (22).

The following are activities related to air contamination that occurred in the past that have caused community concerns.

# PCP Diptank Operation

A possible past air contamination issue at DDMT that requires evaluation is the palletdipping operations at DDMT. The dip tanks were located near the center of the Main Installation, about 1,200 feet from the nearest DDMT boundary (See Figure 4). From the 1960's until 1985, pallets were dipped in the preservative pentachlorophenol (PCP), in an enclosed diptank building, and stacked outside to dry. This operation ceased in 1985. In 1986, under the direction of EPA, PCP-contaminated soil was removed (2).

No air samples were collected during the time the diptank was in operation. However, there is no evidence in DDMT occupational health records that worker health problems occurred from exposure to PCP. Although this is not clear-cut evidence that no worker exposures occurred, it provides some support that such exposures did not result in an obvious worker health problem. As such it is not likely that enough air contamination from PCP occurred to be a problem for neighbors. Also, since the diptank operation was located relatively distant from DDMT boundaries, it is unlikely that neighbors would have been exposed to harmful amounts of PCP through air emissions.

Finally, it is known that PCP is not likely to become airborne in significant amounts from contaminated soil, even if it is disturbed, as would occur during excavation. It is therefore not likely to have been a public health problem during soil removals (35).

## Sandblasting Facility

Another site that was evaluated is the sandblasting area, located in the area of Building 1088, about 300 feet from the western boundary of the Main Installation (See Figure 4). Paint with

metallic components was stripped from various types of machinery in this building. Operations were upgraded in the late 1980's to reduce the possibility of airborne transport of metals from this source. No air monitoring records are available for metal in the area of these operations. However, a soil analysis would provide evidence on whether metals in dust had been carried by air currents to the neighborhood surrounding the sandblasting buildings. Sampling of surface soils in the area would provide information on whether metal concentrations (in the soil) are higher than normal. ATSDR has asked that soil samples be collected and analyzed as a part of the ongoing RI activities.

# Mustard Agent Destruction

An issue that has caused some community concern is the report that mustard agent had been buried at DDMT following World War II. Documents from the post-war period suggest that several thousand pounds of mustard were destroyed and buried in 1946 (10,36). This material was from twenty-nine 500-pound aerial bombs captured from Germany during the war. The mustard was drained into bleach slurry pits, neutralized (by the bleach solution) and buried (37). The method used to decontaminate these weapons is generally considered a safe and effective means of neutralizing mustard (38). (The bleaching agent and resulting breakdown products can cause skin irritation if exposures to high enough levels occur.) Any remaining mustard agent would have most likely deteriorated in the time since its burial. In the event that any residual amounts of mustard did not deteriorate in the last 49 years, there is little possibility for air contamination from these burial sites, as long as the required procedures are followed during any digging (38). In view of these facts, air contamination from the 1946 mustard agent burial should not be considered a hazard to public health.

# Chemical Agent Identification Kits

In a related issue, DDMT records reveal the disposal of about six chemical agent identification kits. These kits were used for training military personnel in detection of various chemical warfare agents. Although the specific type of kit discarded is unknown, these kits can contain test tube-sized vials of *diluted* chemical agents, including mustard agent, phosgene, lewisite and chloropicrin (39).<sup>1</sup> It should be emphasized that the amounts believed to be present in these kits is small and, if released, would not be a threat over an area as large as Dunn Field.

<sup>&</sup>lt;sup>1</sup> Mustard and lewisite were developed during World War I and cause blisters. Phosgene was also used in WW I and causes serious lung injury at high doses: it is now used in various industrial processes. Chloropicrin is a riot control agent which has been replaced by newer chemicals which are considered safer (40).

However, there is concern that remedial activities such as well drilling or excavation may uncover and damage these kits, causing a release. Based on the *small amounts* present in these kits and the fact that they are in a dilute form, we have concluded that the potential harm would be restricted to the personnel involved in the drilling or excavation activity. The health of the community would not be affected by excavation of these kits.

Federal law requires that any activity involving the removal, transport or disposal of chemical agents be coordinated with the U.S. Army Chemical Demilitarization Program (USACDP) and the National Center for Environmental Health (NCEH) of the Centers for Disease Control and Prevention (CDC). These two organizations develop safety procedures for chemical agent removal. Safety programs include plans for; drilling and excavation that minimize the possibility of an accident, monitoring during activities to detect any leaks that occur, limiting the spread of any contaminants that might leak, and emergency response and emergency medical procedures, if needed. DDMT is working with these agencies to insure that safety procedures are used that are protective of the health for both workers and the surrounding community (41,42).

# "Spandome" Collapse - 1988

Due to strong winds and heavy rains, a fabric structure known as a "spandome" partially collapsed on the morning of January 19, 1988. The structure was located on the western side of the Main Installation. Memphis/Shelby County emergency response teams reported the detection of airborne bazardous chemicals. The materials released were solvents, such as toluene and xylene (43). The Spandome floor was concrete, with concrete bermed perimeter. Therefore, released chemicals were contained within this concrete area.

The Memphis Fire Department states that the berm held the spilled material. Impact on the neighborhood was termed "neutral" in the Fire Department report of the spill response (43). Based on this information, the incident involving the collapse of the spandome is not believed to have had a negative impact on public health.

## Evaluation of Possible Soil Routes

ŀ

There are several areas within DDMT that have contaminated soil (2). However, access to these areas is controlled by warning signs, fencing, or paving. As a result, the areas containing contaminated soil are not a threat to public health. Currently, DDMT is conducting studies

- THE AREAS CONTAINING CONTAMINATED SOIL ARE NOT A THREAT TO PUBLIC HEALTH (Rater to #3 m Figure 1)

required by the U.S. EPA and the state to measure the contamination. Based on the results

of these studies, cleanup activities will be completed to protect the public health from any harmful contaminants (44).

## Evaluation of Possible Foodchain Routes

Concern has been expressed that contamination could affect food grown in home gardens in the area around Dunn Field, and possibly in the area of the ditch draining west from the Main Installation. The following factors are important in considering the possibility of food contamination:

IT IS NOT LIKELY THAT ENOUGH CONTAMINATION IS PRESENT IN DITCHES TO CAUSE SIGNIFICANT CONTAMINATION OF BACKYARD GARDENS. (Refer to #6 in Figure 1) i de la companya de l a per a second and the second second

- only certain types of contaminants are

ei 1 taken up or remain in the animal or plant to be a threat to people who may eat them,

- for the vegetables to be contaminated, the roots must be in direct contact with contaminated soil or water for a large part of the growing season,

- the amount of contaminant in soil or water must be high enough to be taken up by plants or animals in amounts that would be harmful to people who eat them,

- for locally grown food contamination to be a problem, people would have to have regularly and frequently eaten large amounts of contaminated vegetables for a number of years, and

- as stated in the Surface Water section above, it is very unlikely that groundwater contaminants from Dunn Field have leached into the drainage ditches.

As described in the surface water and sediment sections above, the drainage ditches around Dunn Field are not likely to have large amounts of contamination in either water or sediment. At Dunn Field the main contaminants of interest are: mustard agent, VOCs, and metals. For the ditch draining west from the Main Installation, the main contaminants are VOC and metals.

The mustard agent was neutralized in 1946. Even if some mustard agent had survived the neutralization, the chemical composition of mustard agent is such that it is highly unlikely that the mustard would have migrated through the groundwater into the drainage ditches and even less likely that it would have been absorbed by plants or animals and passed on to people when these plants or animals were eaten (13).

ł

The VOC solvents would not migrate through surface water and do not easily accumulate in plants or animals, so that it is unlikely that they would be a health problem to people through this route (23,24,25,26,27,28,29,45). There is little information to suggest that plants can accumulate enough metals to be a human health problem, especially at the low levels present, as indicated by the samples collected to date (Shown in Table 2)(30,31,32,33,34).

131

43

It may not be possible to make a definite statement about *past* contamination from this source. However, sediment samples from the drainage ditches will provide present levels that can be evaluated.

131 44

# QUALITY ASSURANCE AND QUALITY CONTROL

:

In preparing this Public Health Assessment (PHA), ATSDR relies on the information provided in the referenced documents. The Agency assumes that adequate quality assurance and quality control measures were followed with regard to chain-of-custody, laboratory procedures, and data reporting. The validity of the analyses and the conclusions drawn in this document are determined by the availability and reliability of the referenced information.

The environmental data presented in this public health assessment is from the 1990 report and from the follow-up RI planning documents (1,2). Generally, the methodology used in these reports is appropriate for characterizing contamination at DDMT. Additional information collection is planned for the follow-up RI. This work is scheduled to begin in the Fall of 1995. This information will be evaluated by ATSDR. Conclusions and Recommendations of this PHA will be modified if needed.

# PUBLIC HEALTH IMPLICATIONS

#### General

ATSDR considers that a *confirmed* exposure pathway for people to contaminants is necessary to suggest that a public health threat exists. In order to evaluate the effect on public health of contaminants at NPL sites, ATSDR focuses on examining whether people could have been *exposed* to (in contact with) or are being exposed to the contaminants.

For health problems to result in the community surrounding a hazardous waste site, contaminants must exist in the environment, contaminants must be in places where people in the surrounding community might come in contact with them, and, if there is exposure, there must be enough contamination to affect the health of people.

It is very important to remember that for harm to occur, each of the conditions listed above *must* occur. The American Cancer Society publication <u>Cancer Facts and Figures - 1995</u>, dealing specifically with cancer risks, states; "Although many toxic chemicals contained in such (hazardous) wastes can be carcinogenic at high doses, most community exposures appear to involve very low or negligible dose levels. The degree of hazard (for cancers or other illness) posed depends on the amount of contaminant and the exposure, or "dose" that a person receives. When concentrations and exposures are high, a hazard may exist. Where concentrations are low and exposures are limited, hazards are often negligible" (47).

## Health Outcome Data

Health outcome data (HOD) record health effects that occur in populations. The data can provide information on the general health of the community living near a hazardous waste site. It can also provide information on patterns of specified outcomes. Some examples of health outcome databases are tumor registries, birth defects registries, and vital statistics. Since there is very limited potential for exposure resulting from activities at DDMT, extensive health outcome data would not provide useful information for this health assessment.

Currently, the Tennessee Department of Health (TDH) is looking at information from the state cancer registry. TDH is the appropriate agency to do this work, since the information available is TDH data. This work is intended to study the amounts of various cancers occurring in the census blocks that include DDMT and vicinity. Although this work may provide information about the types of cancers occurring near DDMT, it will not be possible to identify specific causes of those cancers (46).

# Community Health Concerns

The following concerns have been identified by ATSDR through meetings, correspondence, telephone conversations and information from DDMT, EPA, state and local agency files and community members. A number of concerns were expressed in comments to the draft version of this report. They are included in summarized form. Additionally, ATSDR personnel attended a DDMT public availability session on August 10, 1993, and citizens' Restoration Advisory Board meetings on October 20, 1994, and February 16, 1995. At these sessions ATSDR personnel had the opportunity to meet with numerous members of the public to discuss health concerns of members of the community. ATSDR has also reviewed the transcripts of a DDMT public meeting held May 28, 1993 and the federal facilities agreement public hearing held December 20, 1994. These transcripts include a number of health-related concerns.

Concerns include those which relate specifically to DDMT and general health concerns that may not relate to contamination from DDMT. The order that these following concerns are addressed does not imply any priority assigned by ATSDR to the questions.

Drinking contaminated groundwater, especially people living west of Dunn Field.

Memphis Light, Gas and Water Division (MLG&W) has provided water for domestic use to DDMT neighbors since the 1940s and 1950s. This water comes from a deeper aquifer than that which has shown contamination from DDMT. MLG&W regularly monitors its water wells and tests for all contaminants, as required by EPA and state regulations. Although it is not possible to make definite statements about levels of contamination in groundwater in the past, MLG&W was providing water supplies to residents very early in the history of DDMT and Dunn Field. Also, DDMT records show that there was only limited disposal activity at Dunn Field prior to the time that municipal water was made available. For this reason, the period of time that residents might have been exposed to contaminants is relatively short and the amount of possible contamination would have been very small.

Eating vegetables grown in home gardens.

Because there is no specific information available, it is not possible to make definite statements about the past exposure to people through eating vegetables watered with contaminated water. However, it is unlikely that significant amounts of contamination have reached the areas surrounding DDMT via the drainage ditches. It is therefore not likely that the vegetables have been exposed to high enough levels of contaminants to be hazardous. Also, vegetables do not easily accumulate the types of chemicals that might have been present.

Contact with contamination in ditches, especially by children at play.

Since offsite samples have not been collected and analyzed, definite statements can not be made about past exposure, it is unlikely that significant amounts of contamination could have reached the drainage ditches. Also, dermal exposure or other incidental contact is not likely to present health problems for the chemicals that would be present in, at worst, very low levels in these ditches.

Concern over mustard agent disposed at Dunn Field.

Based on records of the disposal activity, it appears that the mustard agent destroyed and disposed at Dunn Field did not in the past and does not today represent a threat to public health. During disposal activities, the mustard agent was broken down into components that are much less hazardous than the original material. The neutralized material would not present a threat to groundwater or surface water in the area of DDMT. The bleaching agent and resulting breakdown products can cause skin irritation if exposures to high enough levels occur. Any remaining mustard agent is not likely to migrate through the groundwater to offsite since it is not mobile in water, including groundwater.

Public concern over the illnesses, especially cancer, in the vicinity of DDMT.

The health of the community is an important concern to ATSDR. DDMT, EPA, and State and local agencies. A primary purpose of the PHA process is to address concerns of neighbors of NPL sites.

There is no evidence that significant amounts of the contaminants from DDMT have been in places where people could come in contact with them. There is no evidence of any significant exposures to DDMT-related contaminants occurring today. And, if similar conditions (similar contaminants at similar concentrations in the environment) occurred in the past, it is not likely that serious exposures occurred in the past. For these reasons it is not likely that adverse public affects have occurred.

 Concern has been expressed that waste disposal records for DDMT are incomplete, and that materials may have been disposed at Dunn Field without records being kept.

DDMT environmental officials have provided the inventory of waste disposals which were recorded to have occurred at Dunn Field during the history of DDMT. These records are presented as being complete and comprehensive. ATSDR evaluations regarding possible exposures are necessarily based on actual, available information. ATSDR is requesting that DDMT undertake all possible efforts to locate existing records of onsite waste disposals. If RI data collection finds evidence of further contamination, ATSDR will provide an evaluation of public health impact. ATSDR will also suggest that the chemical agent disposals be appended to the DDMT waste disposal list.

- -- Defense Distribution Depot Memphis Tennessee --
- Concern has been expressed that contaminated groundwater from under Dunn Field could be leaching onto the surface and affecting the surface water to the west of Dunn Field.

Rainwater that soaks into the ground will percolate almost straight downward until it reaches the watertable. In the area of Dunn Field the watertable is about 40 feet below the ground surface. Even though Dunn Field is at a higher elevation than the surrounding community, it is very unlikely that contaminated groundwater could move laterally above the watertable for any distance (of more than a few feet). For this reason it is very unlikely that any contaminated groundwater is leaching out onto the surface at the lower elevations.

It is also very unlikely that the drainage ditches are being recharged by contaminated groundwater, as they would only be receiving groundwater from the immediate area of their streambanks (no more than 10 to 20 feet away at the most). For buried contaminants to reach the ditches, the source of contamination would have to be within this area immediately adjacent to the ditches.

• The request was made to include, in this PHA, a map showing the location of areas within DDMT that contained soil contamination. The concern was that these area should be known to the public as DDMT is closed and released to other ownership.

The remedial process overseen by EPA and TDEC will ensure that no contaminants remain that would pose a threat to buman health or the environment. The present status and location of soil contamination would not be as important to future owners as would be information on the final status of these areas. ATSDR will coordinate with EPA, State and local agencies, and DDMT to ensure that no potential exposures remain that could result in a threat to public health.

 In a review of the public comment draft of this document, a community member raised several questions about the possibility of exposures at DDMT. These questions are related to four general concerns, which have been grouped as follows:
 proximity of neighborhoods, schools and recreational areas to DDMT;

Merely being located in the area of DDMT is not a public health problem if there are no completed pathways for contamination. As stated in sections above, there is no evidence that environmental exposures have occurred through contamination of offsite air, soil or water. Specifically, current data from offsite does not support a concern that contamination is present that would be in the ditches outside the DDMT fences. Additional data are being collected by DDMT from drainage ditches offsite. These data should provide definite information on the absence or presence of significant amounts of

chemicals from DDMT that might have reached offsite.

- the possibility of contamination of surface water bodies in the general vicinity of DDMT;

As stated in sections above, it is not likely that chemicals buried in Dunn Field could have been transported by any reasonably expected natural process into the surface drainage ditches in the Dunn Field area. Samples collected from drainage ditches in other areas of DDMT do not show chemical contamination of a type or amount that would present a public health threat from the type of contact (contact to the skin and infrequent ingestion of very small amounts) that would occur in these ditches. Again, new samples being collected will address this issue and should provide a final answer.

- the effects of eating fruit or vegetable grown in a one-mile radius of DDMT; and

There is no evidence that chemicals from DDMT have "migrated" offsite through air or water contamination in types or amounts that would cause a public health problem from being present in vegetable or fruit grown in the DDMT vicinity. There *do not* appear to be completed environmental pathways (air, soil, or water) through which chemicals from DDMT could have gotten into fruit or vegetables grown in the DDMT area.

- various illnesses and ailments of people living and working in the DDMT vicinity.

As stated above, there is no evidence that significant amounts of the contaminants from DDMT have been in places where people could come in contact with them. There is no evidence of any significant exposures to DDMT-related contaminants occurring today. And, if similar conditions (similar contaminants at similar concentrations in the environment) occurred in the past, it is not likely that serious exposures occurred in the past. For these reasons it is not likely that adverse public affects have occurred.

 What are current activities that will provide additional information on public health issues in the DDMT area.

New information is being collected by DDMT for the state and EPA as a part of the Remedial Investigation. This information will be evaluated by ATSDR. If this information provides evidence that exposures are occurring, actions will be recommended to protect public health.

١,

i

.

-

à.,

The State of Tennessee is conducting an investigation that may provide information on the general nature of cancers occurring in the community. The results of this study will be available for review in the near future. ۰.

131

## CONCLUSIONS

131 51

The environmental routes, as shown in Figure 1 have been evaluated by ATSDR, using environmental information collected during the remedial process. The following are conclusions reached by the ATSDR following this evaluation. The numbers refer to the numbers of the routes as shown in Figure 1.

- 1. Water from the shallow aquifer under DDMT is not used for domestic purposes. Memphis\Shelby County has provided municipal water for DDMT and neighbors since the 1940s -1950s. Current monitoring procedures sufficient protect of public health from contaminants, including those that might migrate the shallow aquifer contamination under DDMT. As a part of the remediation process DDMT is planning to pump and treat groundwater to halt migration of the contaminated shallow groundwater plume.
- Controls enacted by DDMT in 1986 have greatly restricted, if not completely eliminated, the possibility of contact of people with contaminated water in Golf Course Ponds. Contamination present in water bodies within the base golf course does not represent a hazard to public health. There is no information on past exposure. However, the short term exposure that would have occurred could not be expected to cause significant health problems.

• The onsite drainage ditch water contains low levels of VOCs, metals, petroleum products and pesticides. These levels are not sufficient to cause a threat to public health from dermal contact. Additional sampling scheduled for summer of 1995 will provide further information.

- 3. The onsite drainage ditch sediment contains low levels of VOCs, metals, petroleum products and pesticides. These levels are not sufficient to cause a threat to public health. Additional sampling scheduled for summer of 1995 will provide further information.
- There are currently no air emissions occurring at DDMT that are a threat to public health.

• Information is needed on extent of surface soil contamination resulting from sandblasting operations at DDMT. This information will address the issue of possible offsite air transport of metals from these operations.

 Localized soil contamination exists within the boundaries of DDMT. DDMT has limited access to these contaminated areas so as to sufficiently reduce possible exposure to the public.

6.

ī

nefance Nigherihution Danot Memohik Tennansae

- Home gardens in the area have probably not been exposed to high enough amounts of chemicals from DDMT to have received by the fruit or vegetables. It is unlikely that large amounts of contamination have been present in either the soil in the areas where gardens have been grown, or in the ditch water that might have been used to irrigate these gardens. During the years before municipal water was supplied, Dunn Field disposal records show very little contaminant that could have reached groundwater or private wells. Finally, most of the chemicals that might be present are not easily taken up by dermal contact.
- Community concerns have been expressed about public health effects: from contamination in drainage ditches and from food grown in areas near these ditches; from contaminated groundwater; and from mustard gas destroyed and disposed at DDMT in 1946, as well as other chemical agents disposed at Dunn Field.
- ATSDR Conclusion Categories of No Apparent Public Health Hazard have been assigned to all of the environmental routes. Table 3 provides additional details on each of the routes.

` 			- <u></u>	<del></del>	<u> </u>	<del></del>	<u></u>		128	<u></u>		<del></del>	<u> </u>						_(	<u> </u>		_	1	3.	1	5	53 1	Ĩ
(sencel, prving, other measured) have eliminated possibility of alguithment exposure.	Environmental Evaluation Status		Sufficient Information	Sufficient Information	Sufficient Information	Sufficient Information	Sufficient Information	Sufficient Information	Sufficient Information	Throwner ion Needed	Sufficient Information	Sufficient Information	Sufficient Information	Information Necded		Sufficient Intuineration	Sufficient Information		Sufficient Information	Sufficient Information	Sufficient Information	Sufficient Information	sufficient Information		Sufficient Information	Sufficient Information	Sufficient Information	Information Needed States and S
Ith Summary "controlled" means that institutional controls	g in public lically providen) in hezardowi chemicala and likely in occur.	Status	asst ' controlled*	past controlled	present succession and succe	past Viture - controlled		past controlled	prosent significant exponence unlikely	present\future information lacking	oversense nglikelv	page - converting	present/future - control - nolikelv	past - significant exponent were	present/future - no source *	Dast - significant exposure unlikely	present/future - controlled	erection of the second se	page controlled	province and the poly	past - significant conversion	present/future - controls	past - exposure unitkery	present/future - exposure unlikely	nast - no source likely	<pre></pre>	trescortante unlikely	past - corre - no source likely
Ameno Public Hea	rely mean that sentificant exponent (result)	Route		Groundwater on5100		Groundwater offfite		Surface water ondite		Surface warer or march		Sediment onsite		Sediment offaite			VIT OUBILE		Alr offsite		Soil ongite		Soil offaite			Foodchain orbital		Foodchain offsile
	Table J •• <sup>•</sup> esposure unb	74 J#						2				<u>.</u>	)				4				Ś	2				9		

١,

ì ł

-- Defense Distribution Depot Memphis Tennessee

· • •

💼 🔎 하는 아무는 하는 것이 있는 것이 있는 것이 있는 것이 있는 것이 있다.

ľ

53

## 131 54

-- Defense Distribution Depot Memphis Tennessee --

# RECOMMENDATIONS

The Comprehensive Environmental Response Compensation, and Liability Act (CERCLA; also known as Superfund) as amended, requires ATSDR to conduct needed follow-up health actions in communities living near hazardous waste sites. To identify appropriate actions, ATSDR created the Health Activities Recommendation Panel (HARP). HARP has evaluated the data and information contained in the DDMT Public Health Assessment for appropriate public health actions. HARP determined that health education and health studies follow-up actions by ATSDR are not warranted. There do not appear to have been exposures in the past which resulted in public health problems, and there are no current exposures.

- Access should continue to be restricted to all areas with known contamination until remediation is completed.
- To further assess the potential of offsite surface water and sediment contamination, ATSDR recommends that the DDMT sampling programs should include provisions to sample sediment from drainage ditches near to and beyond the base boundaries, including west and south of the Main Installation and west of Dunn Field. This sampling and analysis will address major concerns on the part of neighbors to DDMT.
- To further assess the possible contamination from the sandblasting areas, ATSDR recommends that the DDMT sampling programs should include provisions to sample soil at the base boundary between the neighboring residences and the sandblasting operations.
- ATSDR recommends that DDMT undertake to verify, to the extent possible, the completeness of records concerning waste disposal at Dunn Field. If additional records are located or if environmental evidence of additional disposals is found during RI activities, ATSDR will provide an evaluation of public health impacts.
- ATSDR recommends that DDMT continue close cooperation with USACDP and CDC over safety procedures concerning remedial operations that may encounter chemical agents disposed at Dunn Field.
- ATSDR will evaluate analytical data from the sampling as described above.

## PUBLIC HEALTH ACTIONS

The public health action plan (PHAP) for the Defense Depot Memphis Tennessee NPL site contains a description of actions to be taken by ATSDR and/or other governmental agencies at and in the vicinity of the site subsequent to the completion of this public health assessment. The purpose of PHAP is to ensure that this public health assessment not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects that would result from any exposure to hazardous substances in the environment. Included is a commitment on the part of ATSDR to followup on this plan. The public health actions to be implemented are as follows:

## Actions Planned

- 1. Groundwater pumping and treatment is planned for the shallow aquifer under DDMT.
- 2. ATSDR will continue to coordinate with DLA, EPA and state agencies to assure that recommendations are implemented.
- 3. DDMT will collect and analyze water and sediment samples from drainage ditches that extend past base boundaries, as a part of ongoing RI activities.
- 4. DDMT will collect and analyze soil samples from the vicinity of the base boundary near the sandblasting operations at Building 972, as a part of ongoing RI activities.
- 5. DDMT will coordinate with USACDP and CDC on safety procedures during remedial operations that may encounter chemical agents disposed at DDMT.
- 6. ATSDR will review the remedial activities at DDMT, to evaluate the proposed remediations in relation to protection of public health. ATSDR comments, and recommendations, as appropriate, will be provided to EPA, the DLA and State of Tennessee.
- 7. MLG&W will continue to monitor for DDMT-related contaminants at the city wells in the vicinity of DDMT.

ATSDR will reevaluate and modify the Public Health Action Plan as needed. New relevant data, or the results of implementing the above proposed actions may determine the need for additional actions at this site.

PREPARERS OF REPORT

Jeff Kellam

÷

Environmental Health Scientist Army Section, Federal Facilities Assessment Branch Division of Health Assessment and Consultations Agency for Toxic Substances and Disease Registry Atlanta, Georgia

ATSDR Regional Representative

Robert Safay Senior Regional Representative ATSDR Regional Operations, Region IV

# 131 57

į i

-- Defense Distribution Depot Memphis Tennessee --

## REFERENCES

٩,

al.

- CH2M Hill, 1995, Generic Remedial Investigation /Feasibility Study Work Plan, for Defense Distribution Depot Memphis, March 1995.
- Law Environmental, 1990, Defense Depot Memphis Tennessee (DDMT) Remedial Investigation Final Report, for U.S. Army Corps of Engineers, Huntsville Division, August 1990.
- U.S. Army Corps of Engineers, 1995, Archives Search Report Findings, Memphis Defense Depot, January 1995.
- Defense Depot Memphis Tennessee, 1994, Draft Proposed Groundwater Action Plan,
  Defense Depot Memphis Tennessee, November 1994.
- 5. ATSDR, 1992, Trip Report, May 18-21, 1992, Defense Depot Memphis, Tennessee, June 4, 1992.
- 6. English, Jordan, 1995, Tennessee Department of Environment and Conservation, Comments RE: Draft of the Public Health Assessment for Defense Depot, Memphis, TDFS#79-736, cc82, August 11, 1995.
- ATSDR, 1995, Record of Communication, Jordan English, Tennessee Department of Environmental Regulation, July 27, 1995.
- 8. Memphis Light, Gas and Water Division, 1991, Correspondence to Engineering Sciences, October, 22, 1991.
- 9. ATSDR, 1995, Record of Communication, DDMT, Frank Novitzki, March 3, 1995.
- 10. Army Chemical Center, 1946, Report of Official Travel, Louis Harris, August 22, 1947.
- 11. Manahan, Stanley, E., 1992, Toxicological Chemistry, Second Edition, Lewis Publishers, Inc.
- 12. ATSDR, 1995, Record of Communication, Memphis Light, Gas, and Water Division, March 7, 1995.

1

ť,

į.

ξ L

1

ť

i N

- 13. ATSDR, 1992, Toxicological Profile for Mustard "Gas", September 1992.
- 14. Defense Depot Memphis Tennessee, 1994, Environmental Restoration Fact Sheet, Ouestions and Answers.
- 15. Bureau of the Census, 1991, Census of Population and Housing, 1990: Summary Tape File 1A (Tennessee).
- 16. ATSDR, 1992, Petitioned Public Health Assessment for Southern Maryland Wood Treating, Hollywood, St. Mary's County, Maryland, CERCLIS No. MDD980704852, November 9, 1992.
- 17. U.S. Army Corps of Engineers, 1995, Operable Unit 1 Field Sampling Plan for Defense Distribution Depot Memphis, Draft Final, March 1995.
- U.S. Environmental Protection Agency, 1992, Dermal Exposure Assessment: Principles and Applications, January 1992.
- 19. ATSDR, 1994, Toxicological Profile for 4,4'-DDT, 4,4'-DDE, 4,4'-DDD (Update), May 1994.
- 20. ATSDR, 1993, Toxicological Profile for Di(2-ethylhexyl)Phthalate, April 1993.
- ATSDR, 1995, Record of Communication, Defense Distribution Depot, Memphis, Tennessee, Denise Cooper, June, 7, 1995.
- ATSDR, 1995, Record of Communication, U.S. EPA Region IV, Manha Berry, June 6, 1995.
- 23. ATSDR, 1995, Draft Update Toxicological Profile for 1,1,2,2-Tetrachloroethane, February, 1995.
- ATSDR, 1994, Toxicological Profile for 1,2-Dichloroethene, Draft Update, August, 1994.
- 25. ATSDR, 1991, Draft Toxicological Profile for Tetrachloroethylene, October, 1991.
- 26. ATSDR, 1992, Draft Toxicological Profile for Trichloroethylene, October, 1991.
- 27. ATSDR, 1989, Draft Toxicological Profile for N-Nitrosodiumethylamine, December,

- -- Defense Distribution Depot Memphis Tennessee -- 131 59 1989.
- 28. ATSDR, 1993, Draft Toxicological Profile for 1,1,1-Trichloroethane, October, 1993.
- 29. ATSDR, 1994, Toxicological Profile for 1,1-Dichloroethene (update), May, 1994.
- 30. ATSDR, 1993, Toxicological Profile for Chromium, April, 1993.

Ì

.

ųi K

) M

1

A. . . . . . . . . .

- 31. ATSDR, 1991, Draft Toxicological Profile for Nickel, October, 1991.
- 32. ATSDR, 1991, Draft Toxicological Profile for Arsenic, October, 1991.
- 33. ATSDR, 1993, Toxicological Profile for Lead, April, 1993.
- 34. ATSDR, 1991, Draft Toxicological Profile for Barium, October, 1990.
- 35. ATSDR, 1995, Internal Record of Communication, Lynn Wilder, January 31, 1995.
- 36. Army Chemical Warfare Service, 1946, Report of Official Travel, Major R.A. Owendoff, March 11, 1946.
- 37. U.S. Army Chemical Materiel Destruction Agency, 1993, Non-Stockpile Chemical Materiel Program Survey and Analysis Report, November, 1993.
- 38. ATSDR, 1995, Record of Communication, Centers for Disease Control and Prevention, National Center for Environmental Health, July 10, 1995.
- 39. U.S. Army Chemical Materiel Destruction Agency, Chemical Agent Identification Sets (CAIS) Information Package
- 40. ATSDR, 1995, Record of Communication, Centers for Disease Control and Prevention, National Center for Environmental Health, August 8, 1995.
- 41. ATSDR, 1995, Record of Communication, Centers for Disease Control and Prevention, National Center for Environmental Health, August 7, 1995.
- 42. ATSDR, 1995, Record of Communication, US Army Chemical Demilitarization Program, August 7, 1995.
- 43. City of Memphis, 1988, Interoffice memorandum, City of Memphis, John Looney,

Jr. Memphis Fire Department, January 25, 1988.

۰.

ţ

1

ĥ

- 44. U.S. Environmental Protection Agency, 1995, Defense Distribution Depot Memphis Tennessee, Federal Facility Agreement, Administrative Docket Number TN4-210-020-570.
- 45. ATSDR, 1995, Record of Internal Communication, TCE Bioconcentration, Richard Canady, February 23, 1995.
- 46. ATSDR, Record of Communication, 1995, Tennessee Department of Health, March 8, 1995.
- 47. American Cancer Society, 1995, Cancer Facts and Figures 1995, January 1995.

# APPENDIX A -- ACRONYMS AND ABBREVIATIONS

٩.

. .

ATSDR	Agency for Toxic Substances and Disease Registry	
BRAC	Base Realignment and Closure	
CDC	Centers for Disease Control and Prevention	
CERCLA	Comprehensive Environmental Response, Compensation and	Liability Act of 1980
CREG	Cancer Risk Evaluation Guides	
CV	comparison value (ATSDR)	
DDD	p,p'-dichlorodiphenyldichloroethane	
DDE	p,p'-dichlorodiphenyltrichloroethene	
DDMT	Defense Depot Memphis Tennessee	
DDT	p,p'-dichlorophenyltrichlorothane	
DEHP	bis(2-ethylhexyl)phthalate	
DLA	Defense Logistics Agency	
EMEG	Environmental Media Evaluation Guides	
EPA	U.S. Environmental Protection Agency	
HOD	Health Outcome Data	
LTHA	Lifetime Health Advisory	
MCL	Maximum Contaminant Level (for safe drinking water)	
MLG&W	Memphis Light, Gas and Water	
NCEH	National Center for Environmental Health (CDC)	
NPL	National Priorities List	
OUs	operable units	
PAH(s)	polynuclear aromatic hydrocarbons	
PCP	pentachlorophenol	
PHA(s)	public health assessment(s)	
PHAP	Public Health Action Plan	
քքն	parts per billion	
ppm	parts per million	
RCRA	Resource Conservation and Recovery Act	
RI	Remedial Investigation	
RMEG	Reference Media Evaluation Guide	
SARA	Superfund Amendments and Reauthorization Act of 1986	
SVOCs	semi-volatile organic compound(s)	
TDEC	Tennessee Department of Environment and Conservat	ion
TDH	Tennessee Department of Health	
ug/l	micrograms per liter (equals parts per billion)	
USACDP	U.S. Army Chemical Demilitarization Program	

131 62

ł

VOC(s) Volatile Organic Compounds

. . .

.

THE REPORT

: : !

•

i.

## APPENDIX B - GEOLOGY OF DDMT AND VICINITY

1

÷

Over 90% of the land area within DDMT is graded and developed. Extensive modification has occurred, including the addition of fill material.

Regionally, the stratigraphy of this area includes, from the land surface downward, loess, fluvial deposits, Jackson Formation/Upper Claiborne Group clays and the Memphis Sand Aquifer. The surface sediments are glacially-derived loess, a fine-grain sediment consisting of silty clay, to fine sandy clayey silt. This loess ranges in thickness from six to forty feet. Although not a primary water-bearing unit, following rainfall, the loess may briefly contain perched water-bearing zones.

Fluvial (river-derived sediment) deposits underlie the loess. These consist of clayey sand to gravelly sand, and range in thickness from 40 feet to about 131 feet. These sediments comprise the shallow watertable aquifer. It is this aquifer that is contaminated by chemicals from DDMT. The fluvial aquifer is not believed to discharge to surface waters in the area of DDMT. Groundwater flow in the DDMT area is in two general directions. As stated in the 1995 CH2M Hill report: "In the Dunn Field area, a westerly direction of flow is apparent in the installation's shallow aquifer...". " At the Main Installation, a different flow regime is suggested by water level data...". "The closure of water level contours around MW-34 and STB-8 suggests that groundwater flow in this area is directed toward what may be a 'sink' or buried stream channel of poorly defined proportions...the flow is to the west." Current information supports that a general west to northwest groundwater flow is indicated for the rest of the Main Installation.

The Jackson Formation/Upper Claiborne Group underlies the fluvial deposits. Regionally, these sediments comprise a significant confining unit separating the shallow, fluvial aquifer from underlying major aquifers. Thickness of this unit ranges from 15 to about 92 feet in the area. This confining layer appears to extend across DDMT and vicinity. Although this is the case, as suggested above, evidence suggests that erosion of this unit may have resulted in stream channels or sinks in its surface that may allow leakage.

The Memphis Sand Aquifer is composed of fine to gravelly sand ranging in thickness from 500 to

## 131 64

# -- Defense Distribution Depot Memphis Tennessee --

890 feet. This is the primary source of water for the area, providing about 95 percent of the water supplies for the Memphis area. Most of the recharge to this aquifer is provided by outcroppings several miles to the east of DDMT. Water in this aquifer is under artesian conditions, Water in this aquifer is under regionally artesian conditions, which means that in many areas, however, as the Tennessee Department of Environment and Conservation (TDEC) points out, a local water level depression exists, indicating a negative head near the DDMT. This negative head is attributed to the presence of the Allen Well Field to the west. The presence of the local depression in the water level in the DDMT areas could be due to leakage from the fluvial aquifer into the deeper aquifer. The remainder of the local water supply is provided by the deeper Fort Pillow Sand aquifer, from a depth of about 1,400 feet.

#### Reference

• •

Law Environmental, 1990, Defense Depot Memphis Tennessee (DDMT) Remedial Investigation Final Report, for U.S. Army Corps of Engineers, Huntsville Division, August 1990.

CH2M Hill, 1995, Defense Distribution Depot Memphis, Generic Remedial Investigation/Feasibility Study Work Plan Draft Final, March 1995.

English, Jordan, 1995, Tennessee Department of Environment and Conservation, Comments RE: Draft of the Public Health Assessment for Defense Depot, Memphis, TDFS#79-736, cc82, August 11, 1995.

## APPENDIX C - ATSDR COMPARISON VALUES

The conclusion that a contaminant exceeds the CV does not mean that it will cause adverse health effects. CVs are contaminant concentrations in specific media that are used to select contaminants for further evaluation to determine the possibility of adverse public health effects.

#### Action Level

化学校 化非常分析的 化合物 化分子分子 化化合物 化分子 化化合物化合物化合物

An EPA Action Level is the contaminant concentration that is high enough to warrant action (such as water treatment) under CERCLA.

## **Background concentrations**

Background concentrations for the state, region, or nation can be used for comparison, when background samples for the medium of concern, such as soil, have not been collected and when other comparison values do not exist. Background concentrations can be used provided the medium has the same basic characteristics as the medium of concern at the site.

## Cancer Risk Evaluation Guides (CREGs)

CREGs are estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million (10E-6) persons exposed over a lifetime. CREGs are calculated from EPA's cancer slope factors (CSFs).

## Environmental Media Evaluation Guides (EMEGs)

EMEGs are based on ATSDR minimal risk levels (MRLs) and factor in body weight and ingestion rates. An EMEG is an estimate of daily human exposure to a chemical (in mg/kg/day) that is likely to be without an noncarcinogenic effects over a specified duration of exposure to include acute, intermediate, and chronic exposures.

## Lifetime Health Advisory (LTHA)

An LTHA represents contaminant concentrations that EPA considers protective of noncarcinogenic health effects during a lifetime (70 years) of exposure. Drinking water concentrations are developed to predict acceptable exposure levels for both adults and children when data on a NOAEL or LOAEL exist from animal or human studies. LTHAs are not legally enforceable standards.

# Maximum Contaminant Level (MCL)

-1

i Li

The enforceable drinking water standard for a specific contaminant. This level is protective of long-term (lifetime) human health.

# Reference Media Evaluation Guide (RMEG)

RMEGs are derived by ATSDR from the EPA oral Reference Dose. It is the concentration in water or soil at which daily human exposure is unlikely to result in adverse noncancerous effects.

![](_page_67_Picture_1.jpeg)

**Í**31 68

![](_page_68_Picture_1.jpeg)