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THE MEMPHIS DEPOT
TENNESSEE

ADMINISTRATIVE RECORD
COVER SHEET

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Public Health Assessment for

MEMPHIS DEFENSE DEPOT (DEFENSE LOGISTICS AGENCY)
(a/k/a USA DEFENSE DEPOT MEMPHIS)
MEMPHIS, SHELBY COUNTY, TENNESSEE
EPA FACILITY ID: TN4210020570
NOVEMBER 14, 2000

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

PUBLIC HEALTH ASSESSMENT

MEMPHIS DEFENSE DEPOT (DEFENSE LOGISTICS AGENCY)
(a/k/a USA DEFENSE DEPOT MEMPHIS)

MEMPHIS, SHELBY COUNTY, TENNESSEE

EPA FACILITY ID: TN4210020570

Prepared by:

Superfund Site Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

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.

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 & Disease Registry . . . Jeffrey P. Koplan, M.D , M P H , Administrator
Henry Falk, M.D., M P.H , Assistant Administrator

Division of Health Assessment and Consultation. . . . . Robert C Williams, P E., DEE, Director
Sharon Williams-Fleetwood, Ph.D., Deputy Director

Community Involvement Branch . . . . . Germano E. Pereira, M.P A , Chief

Exposure Investigations and Consultation Branch. . . . . John E Abraham, Ph D, Chief

Federal Facilities Assessment Branch. . . . . Sandra G. Isaacs, Chief

Program Evaluation, Records, and Information . . . . . Max M Howie, Jr., M S , Chief

Superfund Site Assessment Branch . . . . . Acting Branch Chief

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FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, 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. 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. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues at hazardous waste sites. For example, a public health assessment could be one document or it could be a compilation of several health consultations the structure may vary from site to site. Nevertheless, the public health assessment process is not considered complete until the public health issues at the site are addressed.

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 own environmental sampling data but reviews information provided by EPA, 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 evaluate whether or not these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. 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 public health actions are needed.

Conclusions: The report presents conclusions about the public health threat, if any, posed by a site. When health threats have been determined for high risk groups (such as children, elderly, chronically ill, and people engaging in high risk practices), they will be summarized in the conclusion section of the report. Ways to stop or reduce exposure will then be recommended in the 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, fullscale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

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:

Attention: Chief, Program Evaluation, Records, and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E56), Atlanta, GA 30333.

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SUMMARY

DDMT was a fenced and guarded military supply, storage, and maintenance facility on the south side of Memphis from 1942 to 1997. The population within a mile of the site is nearly all African-American.

The Agency for Toxic Substances and Disease Registry (ATSDR) determines that no known exposures to DDMT contaminants exist off-site or have existed since 1989 that could result in health effects. ATSDR was unable to determine whether exposures to contaminants from DDMT prior to 1989 could have resulted in health effects because of a lack of environmental data.

Surface water and sediment, and ground water are the principal ways DDMT contaminants can move, are moving, or have moved off the site. For surface water and sediment, human contact with water from DDMT is almost entirely restricted to 3 surface-water drainages. These drainages are the Tarrent Branch that flows off the west side of the Main Facility, the ditches that flow from Dunn Field into or by the Rozelle neighborhood, and the drainage that flows south from the southeast corner of the Main Facility. Between 500 and 3,000 individuals could potentially have contact with water in these 3 drainages. The current levels of the site-contaminants in those drainages do not represent a public health hazard. Data are lacking on whether DDMT contaminants in these 3 drainages could have been a past public health hazard. For ground water, movement of site contaminants off site is primarily restricted to the northwest corner of Dunn Field. No one drinks this contaminated ground water.

Short-term exposure to air-borne contaminants from DDMT has occurred at least once. There is little indication in the data available to ATSDR that long-term exposure of all or most of the residents around DDMT to air-borne site contaminants occurred.

Food chain (e.g., rabbits, squirrels, fish, plants) and offsite soil do not appear to be viable exposure pathways.

This document fulfills ATSDR's commitment to DDMT area residents to reevaluate the 1995 DDMT Public Health Assessment (PHA). ATSDR has also fulfilled commitments to review cancer data for the DDMT area and establish the Greater Memphis Environmental Justice Work Group. Enhancement of the environmental medicine capabilities of DDMT area health care providers or clinics, another ATSDR commitment, is currently being planned. A specific health education program will be designed once this PHA is released.

This public health assessment (PHA) was written to evaluate new sampling data for the Defense Depot - Memphis, Tennessee (DDMT) National Priorities List (NPL) site, review existing data on the Dunn Field portion of DDMT, and respond to health issues and concerns raised by residents living near the site. This PHA is the fulfilment of a commitment made in 1997 by the Agency for Toxic Substances and Disease Registry (ATSDR) to review and update the DDMT PHA issued in 1995 (1,2).

In developing this public health assessment, ATSDR solicited and received many comments, concerns, or clarifications from the various stakeholders with DDMT. These stakeholders included area residents; and the various local, state, and federal agencies and elected officials involved with DDMT. However, no individual or organization outside of ATSDR approved this document before its release.

SITE HISTORY AND BACKGROUND

Site History

As indicated on Figure 1, the Defense Depot Memphis Tennessee is located on the south side of Memphis on land that was originally a cotton field (3). It was a fenced and guarded military supply, storage, and maintenance facility from 1942 to 1997. Commodities distributed from DDMT included food, clothing, medical supplies, electronic equipment, petroleum products, construction materials, and industrial chemicals.

Most depot operations occurred on the Main Facility (Figure 2) (3). Food, clothing, medical supplies, and similar items were stored in 28 large brick buildings called utilities. Construction materials, drums of chemicals, tires, wooden pallets, repair parts, and other supplies were kept in open-sided metal sheds. A variety of vehicles, trailers, and drums of chemicals were stored in open areas. Facilities were also available for painting, sand blasting, vehicle maintenance, disposal of medical items, plus a cafeteria, base exchange, medical clinic, gas station, and an administrative building. In addition, there were a swimming pool, nine-hole golf course, two ponds, and eight units of base housing. Most of the 26 miles of railroad tracks and 28 miles of hard surfaced roads, were or are on the Main Facility (4). The rail tracks ran north onto Dunn Field where they merged into one track, then joined the main rail line (3).

Chemical warfare-related materials were stored at DDMT from 1942 to 1961 (5). From 1942 - 1945, two of the warehouses and two sections of another plus 85,000 square feet of shed space were used to store chemical warfare-related hazardous materials. Most of this storage took place in the buildings near the northwest corner of the Depot (Figure 2).

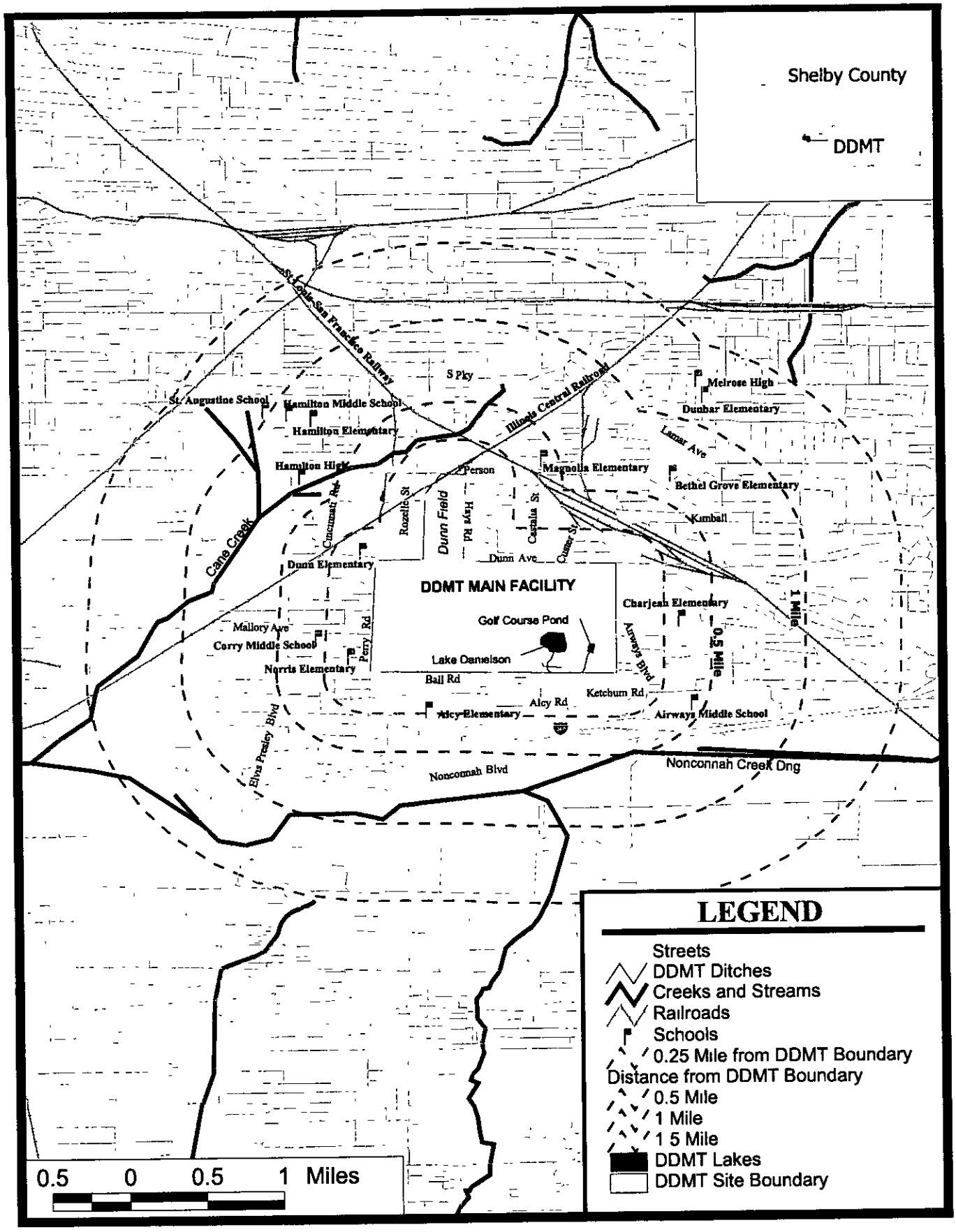

FIGURE 1
DEFENSE DEPOT MEMPHIS, TENNESSEE NPL SITE
Memphis, Shelby County, Tennessee

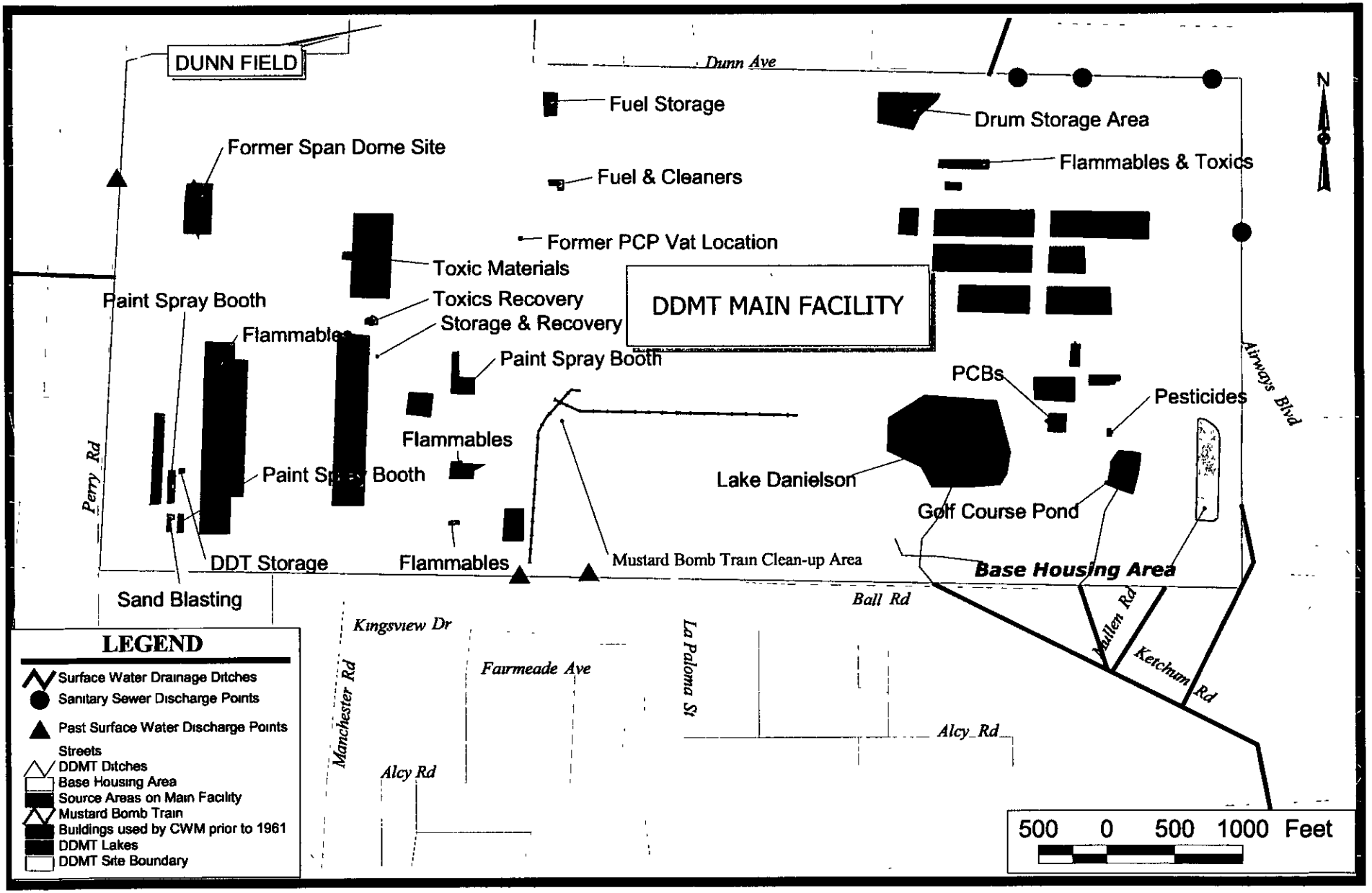

FIGURE 2 - Contaminant Source Areas on the DDMT Main Facility*

* Adapted from Drawing 2 in 1995 Generic RI/FS Workplan, Map M-2 in Archives Search Report, and Storage Location Map in Restoration Advisory Board Manual

These hazardous materials include non-persistent agents like tear gas, phosphorus grenades, and incendiary bombs; and flammable, corrosive, or toxic liquids and solids. Inert (non-hazardous) materials like gas masks, respirators, decontamination apparatus, and related materials were also stored. Persistent chemical warfare agents (e.g., mustard agent, nerve gas) were not stored at DDMT.

The amount of chemical warfare-related hazardous materials dropped rapidly after World War II (5). The main mission of the Chemical Section at DDMT became the servicing of gas masks; testing of flame throwers; and storage of decontamination materials, Chemical Agent Identification Sets (CAIS), and gas mask parts.

Ordnance such as explosive bombs, chemical warfare weapons, biological warfare weapons, and nuclear weapons was never stored or distributed from the site (5). The only exception to this is the small arms munitions used by the facility security force.

The Dunn Field portion of DDMT was used for many years to dispose of chemical and solid wastes from depot operations [Figure 3] (3). It was also used to store national stockpiles of bauxite and fluorspar, and was the location for a firing range used by the security staff.

While mustard agent was not stored at DDMT, there is one reported incident of it being disposed of at DDMT. In 1946, German mustard bombs, being transported by rail through the Memphis area, were found to be leaking (5). The train was brought to the DDMT Main Facility where the leaking bombs were unloaded and the train decontaminated. Locations where this was done are identified on Figure 2. The bombs were taken to Dunn Field where an attempt to detoxify the mustard agent was made by shooting holes in the bombs, then draining the agent into a pit of bleach which was then covered with soil. The bomb casings were buried in a separate pit on Dunn Field (Figure 3).

Burial of chemicals on Dunn Field was done without the impermeable (i.e, liquids can't flow through) liners and caps now required (3). This, along with chemicals from other non-federal sources, resulted in extensive contamination of the fluvial aquifer, both on and off the northwest corner of Dunn Field, with 1,1,2,2-tetrachloroethane, trichloroethylene, tetrachloroethylene, and related compounds. The fluvial aquifer starts about 60-80 feet below the surface and continues down another 10-20 feet. Flow of the contaminated groundwater is towards the Allen Well Field, which is used by the City of Memphis as a primary source of drinking water.

This proximity of contaminated ground water to drinking water wells was a major reason why the U.S. Environmental Protection Agency (EPA) placed DDMT on the National Priorities List (NPL) in 1992 (6). It was also placed on the NPL because of a surface water migration pathway. This pathway included a lake on the facility (Lake Danielson) which had fish and sediment contaminated with chlordane, DDT, and polychlorinated biphenyls (PCBs).

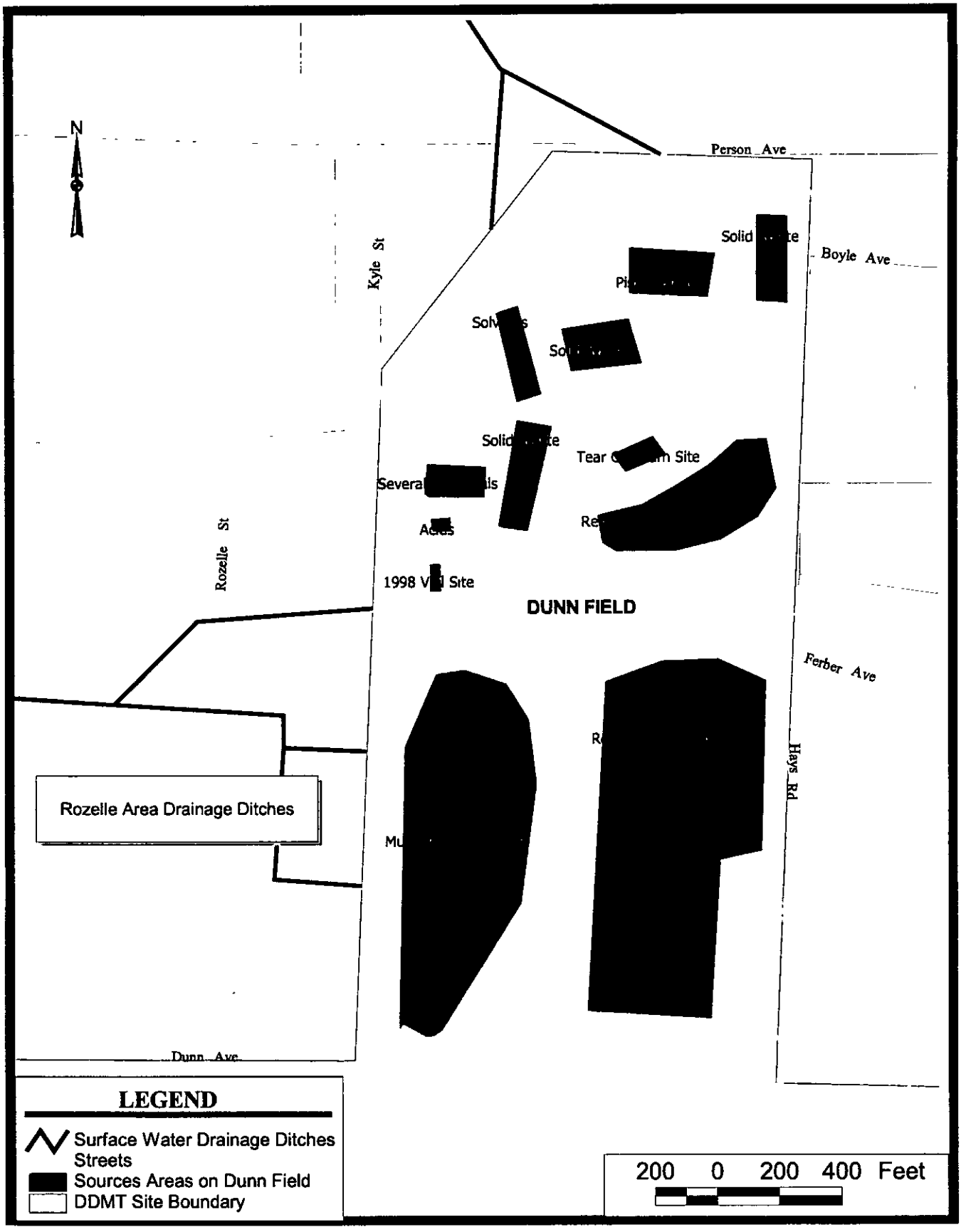

FIGURE 3 - Contaminant Source Areas on the Dunn Field Portion of DDMT*

* Adapted from Drawing 1 in 1995 Generic RI/FS Workplan

FIGURE 4
Summary Demographic Statistics for the Mempis Depot Area

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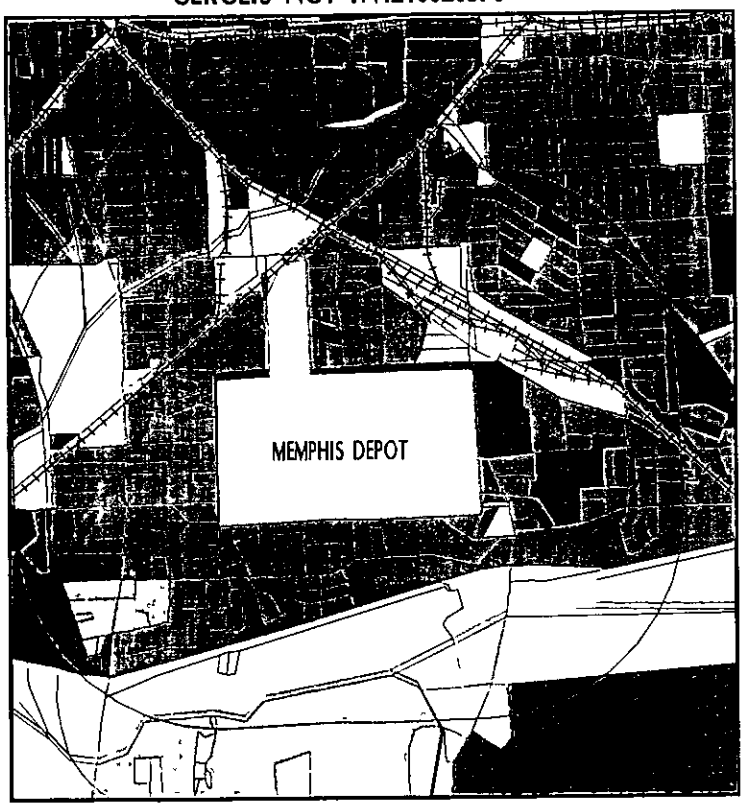


PERCENTAGE AFRICAN-AMERICANS

- ☐ No Residents
- ☐ No African-Americans
- ☐ Less than 50% African-American
- ■ 50% –90% African-American
- ☐ Greater than 90% African-American
- ☐ Boundary of Memphis Depot

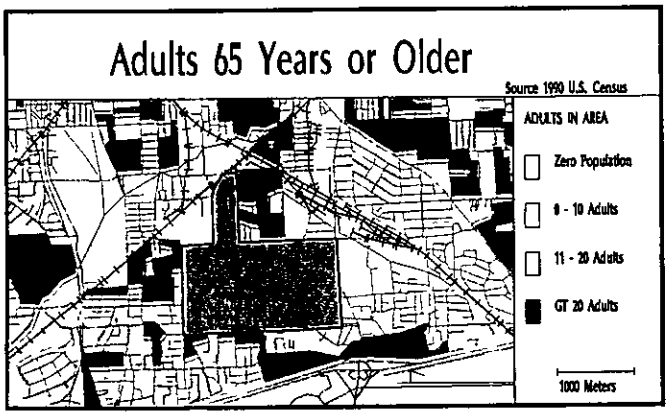
Summary Statistics Within One Mile of the Site	
Total Number of People	30,720
Total Children 6 Years or Younger	3,684
Total Adults 65 Years or Older	3,826
Total Females Aged 15-44	7,448
Number of African-Americans *	29,650
Number of Whites *	983
Number of American Indians *	14
Number of Asians *	3
Number of Hispanics *	57
Other *	13

* Figures assume even distribution

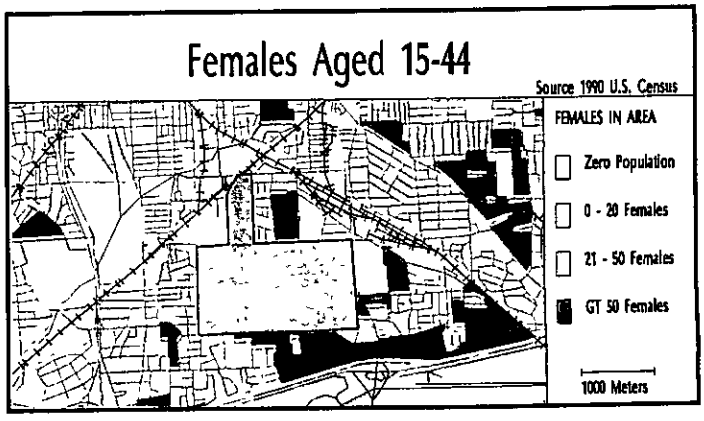
Population Density

Children 6 Years or Younger

Adults 65 Years or Older



Females Aged 15-44



The process to clean up hazardous materials spilled, leaked, or disposed of at DDMT began in 1980 under the Department of Defense's Installation Restoration Program [IRP] (7). However, reports on the handling and impact of hazardous materials at DDMT go back to the 1960s (3).

These reports include industrial hygiene (workplace) and environmental investigations of chemical and radioactive substances. In addition to the IRP, environmental investigations address NPL-related issues, the closure of DDMT, and its restoration as a site for light industry, recreation, and other activities (8-10). These environmental investigations will be described in the next section of this PHA (Current Conditions of Site).

Recent remediation activities at the Depot include installation of a groundwater treatment on Dunn Field in 1998, removal of dieldrin-contaminated soil around the base housing units in 1998, removal of mustard agent and other chemical warfare-related materials from Dunn Field in 2000, and removal of lead-contaminated soil from the Old Paint Shop area in the Southwest corner of the Main Facility in 2000 (11-15). In addition, deed restrictions will be placed on several areas on the Main Facility to prevent their use for residences and day-care facilities (16).

Demographics

The demographic characteristics of the population within a mile of DDMT are displayed on Figure 4. Nearly 97% of residents in this area are African-American.[1] About 12.5% of this population is 65 years or older which is the same percentage as for the United States, but is greater than the 8.1% for African-Americans in Shelby County. About 12% of the people living within a mile of DDMT are six years old or younger, while for African-Americans in Shelby County this age group is about 13.5% of the population. Women of child-bearing age (15-44 years old) make up 24% of both the population within a mile of DDMT and of African-Americans in Shelby County.

The demographics of area around DDMT has changed since DDMT opened in 1942. In 1950, the area west and south of DDMT had about equal numbers of African-Americans and Whites (17). By 1970, the racial distribution in the area had become similar to what was observed in the 1990 census.

Information Provided to the Public

The possible impact of DDMT on groundwater and the process to clean up the site became public information through a series of newspaper articles, public meetings, the Restoration Advisory Board (RAB), and regular mail-outs of information (18-41). Memphis residents were made aware, through a 1991 newspaper article, that one of the city well fields was contaminated and that DDMT was a possible source (18). Two articles in 1992 revealed that the shallow

[1] The information in this section is based on comparison of the data displayed on Figure 4 to 1990 U.S. Census data for Shelby County

groundwater under Dunn Field was contaminated (19,20). The listing of DDMT on the National Priorities List (NPL) was also described in a 1992 article (21). Eight articles in 1993 - 1995 covered clean-up activities and public meetings (22-29). Extensive sampling of DDMT, concerns of the DDMT-Concerned Citizens Committee (CCC), a 1998 incident with some vials, the 1999 public comment release of this public health assessment, and the cleanup of the mustard agent were among the topics of the articles from 1996 to 2000 (30-14).

Since the site went on the NPL list in 1992, DDMT has made efforts to communicate with people around the facility through public meetings, establishment of a RAB, and informational mailings to the community (23,40). For example, health concerns were identified in May 1993 at a meeting with about 150 residents of the Orchid Homes community, and at an August 1993 meeting with about 60 area residents.

At Department of Defense sites, local citizens and elected officials; facility staff; and local, state and federal environmental agency staff participate in Restoration Advisory Boards (RAB). The DDMT RAB was formed in July 1994 and holds monthly meetings (41). The RAB receives briefings on and discusses activities related to site cleanup and restoration.

DDMT regularly distributes a newsletter, notices of meetings, and similar information to about 5,000 individuals.[2] They also announce activities through press releases.

Public Concern about DDMT

Persons living around DDMT have high levels of concern about this site as indicated in a survey conducted recently by the Memphis-Shelby County Health Department (42). Results of this survey revealed that over 90% of survey respondents desired more information on the potential for exposure to and health effects from DDMT contaminants, the results of environmental sampling of DDMT, and how the Depot would be cleaned up and restored. A similar percentage of survey participants indicated that additional off-site environmental sampling should be done.

ATSDR Activities

ATSDR's first major activity at DDMT was in 1992 when a preliminary evaluation was made to identify whether immediate action was needed at the site to protect public health (43). It was concluded that no immediate action was necessary.

In 1995, ATSDR evaluated the possible public health impact of the site in the DDMT Public Health Assessment (1). The soil, groundwater, surface water, air, and food chain exposure pathways were analyzed using information on site activities, the geology around DDMT, and limited environmental sampling. All these environmental pathways were classified as "no apparent public health hazard". In a 1996 letter to a concerned citizen, ATSDR indicated that

[2] Based on several discussions with DDMT staff.

this meant that, "Contamination at the depot does not pose a health concern to people living on or near the depot, and it did not pose a health hazard in the past." (44).

In 1996, ATSDR evaluated sediment sampling that was conducted after the release of the 1995 PHA (45). Of the 18 samples taken from the drainage ditches that emanate from the facility, nine were taken in or near the Rozelle area west of Dunn Field. They were analyzed for a wide variety of chemicals including volatile and semi-volatile chemicals, metals, pesticides, polychlorinated biphenyls (PCBs), and dioxins. Low levels of contaminants were found at most locations. The conclusion of the evaluation was that, "Although numerous contaminants were detected, they were not of the type and amounts that would pose a public health hazard..." (45). Results of this sediment sampling will be discussed in more detail on page 17.

In 1996, a group of area residents (DDMT-Concerned Citizens Committee [CCC]) contacted ATSDR with their concerns about the site and the 1995 DDMT PHA (46). This led to a commitment by ATSDR in 1997 to: 1) update the 1995 public health assessment, 2) review cancer incidence data gathered by the State of Tennessee in 1996, 3) review a plan for ongoing medical surveillance of residents, and 4) work with the DDMT-CCC, the Health and Human Services (HHS) Region IV Office, Memphis Health Center, the Congress of National Black Churches, local affiliates, and Shelby County/State of Tennessee to pursue the provision of primary care services with an environmental health focus(2).

Since these commitments were made, ATSDR personnel have made numerous trips to Memphis (47-59). During these trips, staff identified additional community health concerns; toured the site; represented ATSDR at the monthly RAB meeting; identified possible sampling locations; and met with DDMT-area residents and staff from DDMT, EPA, Tennessee Department of Environmental Conservation (TDEC), the Memphis-Shelby County Health Department (MSCHD), and Meharry Medical College.

ATSDR helped organize the Greater Memphis Environmental Justice Work Group. This group has met on February 27 and October 17, 1998. The working group is addressing environmental and health concerns of Memphis area residents with a focus on African-Americans and the DDMT area (52).

Objectives of the Greater Memphis Environmental Justice Work Group are being met through the activities of several sub-groups (52). Members of these subgroups include area residents and representatives of MSCHD, TDEC, ATSDR, EPA and DDMT. The health education and promotion sub-group is identifying the specific health messages that will be communicated to Memphis Depot area residents. The health concerns sub-group has reviewed and commented on the cancer incidence study being done by ATSDR and the Tennessee Department of Health. The health care sub-group is insuring that appropriate health care is provided to area residents possibly affected by environmental contaminants. In the October 1998 meeting of the Greater Memphis Environmental Justice Work Group, the site characterization sub-group described how contamination at the Memphis Depot has and is being identified. There were also subgroups for other environmental hazards and the public health assessment.

ATSDR has had considerable interaction with DDMT-area residents besides the Greater Memphis Environmental Justice Work Group, including 3 public availability sessions and 2 public meetings to identify community health concerns and solicit input from area residents on ATSDR activities (47,48,55,60,61). ATSDR staff have made 4 tours of the DDMT area with members of DDMT-CCC or other area residents to identify possible exposure pathways and gain general knowledge about DDMT and the surrounding community (47,50,51). All the activities described in this paragraph were done with the cooperation and foreknowledge of DDMT-CCC.

DDMT-area residents and staff from ATSDR, EPA, and MSCHD meet regularly as the health education and promotion sub-group of the Greater Memphis Environmental Justice Work Group to identify the specific health messages for DDMT-area residents (62-65). Members of this group receive detailed briefings of ATSDR activities and make comments and suggestions.

CURRENT CONDITIONS OF SITE

Available environmental data for the site are evaluated in this section of the PHA. Emphasis will be on what the results mean as far as the potential for exposure of area residents to site contaminants.

Introduction

Environmental Data Evaluated

There are 4 major sources of environmental data on DDMT (3,8-10). The first was a 1990 remedial investigation done under the Installation Restoration Program (IRP) of the Department of Defense (3). Based on historical data, the investigation focused on possible sources of contamination. Samples of ground water were obtained from 9 monitoring wells on Dunn Field, 3 wells just west of Dunn Field, and 15 wells located on the DDMT Main Facility. Surface soil samples were taken from 45 locations on the Main Facility and 5 on Dunn Field. Samples of subsurface soil were taken at 3-4 different depths at 4 locations on the Main Facility and 4 on Dunn Field. Samples were taken of surface water from ditches draining the site at 13 locations on the Main Facility and 3 on Dunn Field. Sediment samples were taken at five locations on the DDMT Main Facility. No sampling of sediment was done on Dunn Field. About 130 chemicals were tested for in soil, groundwater, surface water, and sediment including volatile organic compounds (VOCs), semi-volatile organic compounds, pesticides and PCBs, and metals.

In 1995 - 1999, samples were taken from about 450 locations on the Main Facility, over 70 Dunn Field locations, and 22 locations in the area around DDMT during 4 related sampling programs (Screening Sites, Remedial Investigation, Base Realignment and Closure [BRAC], and DDMT

area) (8-10,66).[3] The media tested were air from inside six of the warehouses, surface and subsurface soil, surface water, ground water, and sediment. About 200 parameters were analyzed in the Screening Sites program, 60 in the Remedial Investigation program, 120 in the BRAC program, and 170 in the background sampling. The specific parameters tested in these four sampling efforts are listed in Appendix A starting on page 61.

Results of these 4 sampling programs (except for the air, subsurface soil, and ground water data) were provided as electronic files to ATSDR by the U.S. Army Corps of Engineers' contractor, CH2MHILL, in September 1998, March 1999, and December1999. The Corps of Engineers is the agency responsible for conducting environmental sampling at federal facilities like DDMT. Data on the geographic locations where samples were taken were included in the information that ATSDR received.

Results from the sampling of the air inside six of the 28 warehouse or typical buildings, subsurface soil, or ground water is reported in the *Final Memphis Depot Main Installation Remedial Investigation Report* issued in January 2000 (11). No one is, was, or will be exposed to contaminants in subsurface soil and ground water so data from these media need not be evaluated in a public health assessment (67). ATSDR did not become aware of the sampling of the air inside the six warehouses until a copy of Main Installation RI was received in June 2000. These data are briefly mentioned in a discussion of worker issues on page 43.

How Data Were Evaluated

The process by which ATSDR evaluates the possible health impact of contaminants is summarized here and described in more detail in Appendix B starting on page 66. ATSDR uses comparison values to determine which chemicals to examine more closely (Appendix C). Comparison values are health-based thresholds below which no known or anticipated adverse human health effects occur. Exceeding a comparison value does not mean that health effects will occur, just that more evaluation is needed.

Further evaluation focuses on identifying which chemicals and exposure situations could be a health hazard. The first step is the calculation of child and adult exposure doses, as described in Appendix D. These are then compared to an appropriate health guideline for a chemical. The results of these calculations are presented in Tables D1 and D2 starting on page 71. Any

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[3] Sampling of the area around DDMT was done in late 1995. Sampling locations were selected by staff from DDMT and its contractors, EPA, TDEC, and ATSDR; and a local environmental activist. This last individual was at the time a co-chair of the DDMT RAB. DDMT titled this sampling as "background" (11). Because there is often confusion about the meaning of this term, ATSDR has chosen to identify this sampling as "area sampling " Background can be defined as being what is typical for an area without any human influence (natural) or without any influence of site contaminants. This later definition is what was used by DDMT because lay people often use the first definition and equate background with natural. See footnote 4 for documentation of the 1998-1999 sampling data for Dunn Field.

exposure situation, in which the exposure dose is lower than a health guideline, is eliminated from further evaluation.

The next step is the revision of the exposure dose to better match probable rather than worst-case exposure scenarios. Lastly, these revised exposure doses are compared to known toxicologic values for the chemical of concern. This is mainly the no observed and lowest observed adverse health effects levels (NOAEL & LOAEL) identified in ATSDR Toxicological Profiles. If the chemical of concern is a carcinogen, the cancer risk is recalculated using the revised exposure dose. These comparisons are the basis for stating whether the exposure is a health hazard.

The comparison values and health guidelines that ATSDR uses in its evaluation are based on the lowest valid health-based thresholds available for a contaminant. This results in conclusions where there is much more certainty that health effects will not occur than that they will occur.

Evaluation of Dunn Field Data

No contaminants were found in the extensive sampling of Dunn Field that represented a health hazard either because concentrations were too low or because opportunity was not sufficient for exposure to result in health effects.

Results of Environmental Sampling

Surface Soil

There was limited sampling of Dunn Field surface soil in 1989 and extensive sampling in 1998 and 1999 (3)[4]. The locations on Dunn Field where hazardous and other materials were probably buried has been determined and are displayed on Figure 3 (5).

ATSDR's review of the data for Dunn Field indicates that 85 of the approximately 240 chemicals tested for in surface soil were actually detected at least one sampling location. As displayed in Table 1, 11 chemicals had at least one concentration above its comparison value (CV). These 11 were alpha-chlordane, arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, dieldrin, indeno(1,2,3-c,d)pyrene, iron, and lead.

[4] The results of the 1998-99 sampling of Dunn Field surface soil, sediment, and surface water were supplied to ATSDR in December 1999 as an electronic file by CH2MHILL, the contractor for the Corps of Engineers.

Table 1 - Soil Contaminants in Dunn Field Surface Soil Above Comparison Values (CV)*

Contaminant	Range in Soil in mg/kg	Samples > DL	Samples > CV	CV	CV Source[4]
Alpha-chlordane	ND - 1.5	18/72	1/0[5]	0.5/3[6]	CREG[7]/EMEG[8]
Arsenic	ND - 43.7	82/83	82/7[5]	0.5/20[6]	CREG[7]/EMEG[8]
Benzo(a)anthracene	ND - 81	24/66	8	0.9	EPA SSL[9]
Benzo(a)pyrene	ND - 68	24/66	20	0.1	CREG[7]
Benzo(b)fluoranthene	ND - 68	23/66	11	0.9	EPA SSL[9]
Benzo(k)fluoranthene	ND - 28	18/66	1	9	EPA SSL[9]
Dibenz(a,h)anthracene	ND - 26	16/66	8	0.09	EPA SSL[9]
Dieldrin	ND - 4.8	46/72	24/1[5]	0.04/3[6]	CREG[7]/EMEG[8]
Indeno(1,2,3-c,d)pyrene	ND - 44	24/66	7	0.9	EPA SSL[9]
Iron	6,360 - 36,400	27/27	12	23,000	RBC[10]
Lead	2 -2,100	83/83	4	400	EPA SSL[9]

* The sources for these data are the 1990 Remedial Investigation and electronic files of the 1998-99 sampling program provided to ATSDR by CH2MHILL in December 1999.
1 - mg/kg = milligrams of chemical per kilogram of soil. mg/kg = parts per million.
2 - DL = detection limit
3 - CV = comparison value
4 - These comparison values are described in Appendix C starting on page 68.
5 - The first number is the samples above the CREG and the second is samples above the EMEG or RMEG.
6 - The first number is the CREG and the second is the EMEG or RMEG.
7 - CREG = cancer risk evaluation guide
8 - EMEG = environmental media evaluation guide
9 - SSL = soil screening level
10 - RBC = EPA Region III's risk-based concentration. For iron, this is based on non-carcinogenic health effects for a 15 kilogram child ingesting 200 micrograms of soil a day.

Sediment

In sediment, 81 chemicals were detected among the 16 locations sampled on or near Dunn Field (3,66).[4] Among the chemicals detected were arsenic, dieldrin, lead, and several members of the dioxin and polycyclic aromatic hydrocarbon (PAH) groups. As displayed on Table E1 on page 74, only eight of the 81 had at least one concentration above a comparison value. These six were arsenic, beryllium, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, dieldrin, and indeno(1,2,3-c,d)pyrene.

Surface Water

In surface water, 23 chemicals were detected in the seven Dunn Field surface water samples taken (3)[4]. As indicated in Table E2 on page 74, only one, arsenic, of the 23 substances detected exceeded a comparison value.

Possible Health Consequences of Chemicals found on Dunn Field

When a sample concentration exceeded a CV, the maximum level of that chemical was used to calculate an exposure dose, which is then compared to an appropriate health guideline. The results of these evaluations are summarized here and described in more detail in Appendix F on page 79.

Soil Contaminants

As discussed starting on page 79, health effects due to exposure to any of the 11 contaminants found in Dunn Field surface soil above a comparison value are not likely to occur because the maximum concentrations are not high enough when compared to the known toxicity levels. More importantly, opportunities for exposure were limited for adults because no one regularly worked on Dunn Field, and nearly nonexistent for children because the facility has always been fenced (68).[5]

Sediment Contaminants

As discussed in more detail on page 81, health effects due to the contaminants in Dunn Field sediment are very unlikely, even with daily exposure. Daily exposure to contaminated sediment appears unlikely. As indicated on Table E2, the average levels of arsenic, beryllium, and PAHs from the 16 locations are similar to the means identified in the background sampling of the DDMT area. In addition, the PAH concentrations are within the levels of 0.2 - 61 ppm typically found in urban soil (69). While the mean concentration of dieldrin found in Dunn Field sediment samples is greater than mean in samples from the DDMT area, health effects are unlikely to occur because the concentrations found are not high enough when compared to the known toxicity levels.

Surface Water Contaminants

Health effects due to arsenic in Dunn Field surface water are unlikely. The maximum concentration of 0.01 milligrams of arsenic per liter of water is 30 times lower than the noncarcinogenic comparison value. The risk of cancer from daily exposure to the maximum level is not significant (5 in 1,000,000). Daily exposure is not plausible because no one regularly worked on Dunn Field, and nearly nonexistent for children because the facility has always been fenced (68).[6]

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[5] A former worker indicated to John Crellin on September 9, 1999, that some workers performed cleanup and other tasks on Dunn Field periodically. They would work on Dunn Field 8 hours a day for several days in a row

Evaluation of Main Facility Data

Very extensive sampling has been done of the soil, sediment, and surface water from the DDMT Main Facility. About 100 different chemicals were found among these three media. However, only polycyclic aromatic hydrocarbons (PAHs) in soil were found at concentrations that might have been harmful if an individual contacted PAH contaminated soil at a few specific locations on the Main Facility on a daily basis. However, it appears very unlikely that this occurred and thus this exposure situation is not a health risk.

Results of Environmental Sampling

The BRAC, Screening Sites, and 2000, 1997and 1990 Remedial Investigation data were evaluated together (3,8-10,11).

Soil

Thirty-one of the 114 chemicals identified in surface soil had at least one concentration above a comparison value (CV) as displayed in Table E3 on page 75. The 10 contaminants with the most concentrations above a CV are on Table 2 on page 21. Further evaluation will focus on those 10 chemicals. The locations where arsenic, benzo(a)pyrene, dieldrin, DDT, lead, and PAHs were sampled for are displayed on Figures G1 - G6 beginning on page 87.

Sediment

Fifteen of the 95 chemicals identified in sediment had at least one concentration above a CV as displayed in Table E4 on page 76. Further evaluation will focus on those 15 chemicals. The locations where the contaminant levels for arsenic and benzo(a)pyrene exceeded their CVs are displayed on Figures G7 and G8 beginning on page 93.

Surface Water

Two of the 40 chemicals identified in surface water had at least one concentration above a CV as displayed in Table E5 on page 76. Further evaluation will be of these 2 chemicals. The locations where the contaminant levels for arsenic and dieldrin exceeded their CVs are displayed on Figures G9 and G10 beginning on page 95.

Possible Health Consequences of Chemicals found on DDMT Main Facility

When a sample concentration exceeded a CV, the maximum level of that chemical was used to calculate an exposure dose, which was then compared to an appropriate health guideline. Results of these evaluations are summarized here and described in more detail in Appendix F starting on page 82.

Soil

Of the 10 chemicals present on Table 2, it is unlikely that health effects could occur from exposure to any of them. These were arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, dieldrin, DDT, indeno(1,2,3-c,d)pyrene, iron, and lead. For these chemicals, contaminant concentrations were too low to result in health effects given the amount of exposure that could have occurred or is occurring. There is a chemical-by-chemical evaluation of the possibility of health consequences from exposure to these 10 chemicals beginning on page 82.

In the public comment release of this public health assessment, it was concluded that there was a risk of cancer to workers with daily exposure to soil contaminated with benzo(a)pyrene, dibenz(a,h)anthracene, and other PAHs at certain locations. The rationale for changing this conclusion is described starting on page 84.

Sediment

Chemicals in sediment with concentrations above a CV (Table E4), do not represent public health hazards. The 15 chemicals above their CVs are arsenic, antimony, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, beryllium, cadmium, chromium, dibenz(a,h)anthracene, DDT, gamma-chlordane, iron, lead, and total polycyclic aromatic hydrocarbons (PAHs). Regular exposure to sediment from any of the sampling locations with concentrations above a CV does not appear to be plausible for anyone. This is because no facility operations appear to have been conducted at these locations so worker contact would have been minimal (50). More information on the possibility of health consequences from exposure to chemicals in on-site sediment is on page 85.

Surface Water

Chemicals in surface water with concentrations above CVs (Table E5), do not present public health hazards. Arsenic and dieldrin were the chemicals above CVs. The maximum levels of arsenic and dieldrin are well below the noncarcinogenic health effects comparison values. The additional lifetime cancer risk from exposure to them is not significant (2 in 1,000,000 to 4 in 100,000). This conclusion is based on the great difference between the average lifetime risk of cancer in the United States of 3 cancers per 10 individuals, and the 2 in 1,000,000 to 4 in 100,000 additional risk for exposure to these contaminants.

Table 2 - Top Soil Contaminants*

Contaminant	Range in Soil in mg/kg[1]	Mean[2] in mg/kg[1]	Samples > DL[3]	Samples > CV[4]	CV in mg/kg[1]	CV Source[5]
Arsenic	ND - 101	14.3	352/361	351/70[6]	0.5/20[7]	CREG[8]/EMEG[9]
Benzo(a)pyrene	ND - 450	5.5	164/349	121	0.1	CREG[8]
Dieldrin	ND - 10	0.4	180/324	125/9[6]	0.04/3[7]	CREG[8]/EMEG[9]
Benzo(b)fluoranthene	ND - 540	5.7	174/359	59	0.9	EPA SSL[10]
Lead	ND - 17,500	300.6	371/372	42	400	EPA SSL[10]
Benzo(a)anthracene	ND - 970	7.1	167/352	59	0.9	EPA SSL[10]
Indeno(1,2,3-c,d)pyrene	ND - 310	5	132/302	48	0.9	EPA SSL[10]
Iron	1,360 - 242,000	23,409	108/108	18	23,000	HEAST[11]
Dibenz(a,h)anthracene	ND - 160	0.7	21/334	15	0.09	EPA SSL[10]
DDT	ND - 59	0.6	205/334	15/1[6]	2/30[7]	CREG[8]/RMEG[12]

1 - mg/kg = milligrams of chemical per kilogram of soil mg/kg = parts per million (ppm)
2 - Non-detected chemicals were accounted for by calculating the mean using ½ of the detection limit as the value for the non-detected chemical
3 - DL = detection limit
4 - CV = comparison value
5 - These comparison values are described in Appendix B starting on page 66
6 - The samples above a CREG are the first number and those above a EMEG or RMEG is the second
7 - The first number is a CREG and the second is an EMEG or RMEG
8 - CREG = cancer risk evaluation guide
9 - EMEG = environmental media evaluation guide
10 - SSL = soil screening level
11 - HEAST = Health Effects Assessment Summary Table
12 - RMEG = remedial media evaluation guide
* These data come from ATSDR's evaluations of files identifying sampling results and other pertinent information for each sampling location that were provided directly to ATSDR by DDMT

Evaluation of Residential Areas around DDMT

With the possible exception of the Rozelle neighborhood west of Dunn Field, contaminants from DDMT do not currently represent public health hazards (i.e., either exposure is nonexistent or not enough to cause harm) and have not since at least 1989. This conclusion is based on an evaluation of the possible ways that residents in the area around DDMT might be exposed to site contaminants, and a review of available contaminant data. Included in these data are the results of sampling of surface soil, sediment, and surface water from locations around DDMT. Exposure pathways analyses indicate that limited exposure to site contaminants may have occurred through the water-borne transport to two areas other than the Rozelle neighborhood. These areas are 1) south of the southeast corner of the Main Facility, and 2) the yards on either side of Tarrent Branch which flows from the west edge of the Main Facility. The number of individuals in the residential areas around DDMT that could have been exposed is between 500 and 3,000.

Determining whether site-related health effects could have occurred from exposures since the opening of DDMT in 1942 until 1989 is not possible.

The basis for these two conclusions will be described in the following paragraphs.

Analysis of Environmental Exposure Pathways

Surface water and sediment, and ground water are the principal ways DDMT contaminants can move, are moving, or have moved off the site. Short-term exposure to airborne contaminants from DDMT has occurred. Long-term air exposures may have occurred but appear to have been limited to the area near the southwest corner of the Main Facility. Food chain and soil do not appear to be viable pathways for long-term exposure.

For surface water and sediment, current human contact with contaminants in water from DDMT is almost entirely restricted to 3 surface water drainages. An estimated 500 - 3,000 persons could potentially have regular contact with water in these drainages. This contact would be limited to chemicals in surface water or sediment, or soil contaminated by surface water. Contact with contaminants that become airborne from the surface water probably does not occur because the contaminant levels are too low for this to happen.

The contaminant levels in those drainages since at least 1989 were not and are not a public health hazard to individuals living around DDMT. Sampling data are insufficient before 1989 to estimate what the contaminant levels in those drainages might have been.

For ground water, movement of site contaminants off-site is primarily restricted to the northwest corner of Dunn Field. No one drinks this contaminated groundwater.

Surface Water and Sediment

Movement of surface water and sediment off DDMT is focused at specific locations around the Main Facility and Dunn Field as seen on Figure 5 (page 25) and discussed in Appendix H (page 97) (3). Contact would have been to contaminants in surface water or sediment, or soil contaminated by site surface water, but would not have included chemicals that become airborne after leaving the site in water. Contaminant concentrations are too low to move into the air (70-72).

Where Exposure to DDMT Contaminants in Surface Water could be occurring

Current and past exposure to site contaminants carried off DDMT in water and sediment could occur and could have occurred in the following areas.

(1) *In or near the un- and concrete-lined ditches that pass through or by the Rozelle neighborhood just west of Dunn Field.* This exposure is ongoing and could have occurred in the past. Little or no opportunity for exposure exists once the water has passed through the Rozelle neighborhood because the ditches join, then this ditch flows into a pipe at the Illinois Central Railroad tracks (Figure 5). In the Rozelle neighborhood, exposure to site contaminants would be daily for individuals contacting soil contaminated by surface water or sediment from Dunn Field. The areas where soil contamination appears possible are yards at the southern end of Rozelle Street, and to either side of the shallow ditch that runs through the middle of the neighborhood.

However, although daily contact with site surface water or sediments may occur, health effects from that contact are unlikely. The concentrations of chemicals in sediment and surface water on Dunn Field and in sediment from the ditches in the Rozelle neighborhood are too low. As discussed on pages 16 - 18, these levels do not present health risks. In addition, sediment levels from western Dunn Field and the Rozelle neighborhood are similar to the levels for 22 samples taken off-site in the DDMT area.

Soil, now present in the Rozelle area, may have been contaminated in the past through the overflowing of ditches in this neighborhood. No sampling has been done of the soil around these ditches.

(2) *In or near Tarrent Branch.* As indicated on Figure 5, Tarrent Branch drains the western third of the DDMT Main Facility, which is the area where most of the hazardous materials storage took place (3,5,7). This intermittent stream runs through the neighborhood west of DDMT and eventually flows into Nonconnah Creek. Tarrent Branch was a natural stream but is now a concrete-lined and fenced ditch. Therefore, exposure is currently unlikely because regularly contacting water and sediment from this ditch would be difficult.

Even if contact with surface water and sediment from DDMT were ongoing, it would not result in health effects. As indicated on pages 19 - 20, the contaminants identified in sediment and surface water on the Main Facility do not represent health risks. This includes the sampling points on the western edge of DDMT.

Regular exposure to the water and sediment could have occurred before the ditch (Tarrent Branch) was fenced. A long-time resident indicates that she and others used to play in Tarrent Branch as children.[6] Another resident related in a recent meeting that her yard flooded on a regular basis before Tarrent Branch was lined.[7]

It is not possible to determine whether exposures prior to the fencing and lining of Tarrent Branch could have resulted in health effects. There are insufficient environmental data prior to 1989 to estimate contaminant levels which are needed to evaluate the possibility of health effects.

(3) *In or near the 4 ditches that flow south from the southeast corner of the DDMT Main Facility* (Figure 5). These 4 ditches drain the southeast corner of the Main Facility where a golf course, clubhouse, swimming pool, Lake Danielson, a pond, and the base housing units are located (3,5,7). These ditches join south of the DDMT boundary and then flow into Nonconnah Creek. At least some portions of these ditches are shallow and unlined which means that more opportunity exists for contamination of the soil around the ditch with site contaminants. Thus, exposure to site contaminants could occur to individuals who had daily or nearly daily contact with sediment or surface water from the ditches or the soil immediately around the ditches. These exposures could occur now and in the past. One of the 4 ditches passes along Mullen Street between Ball and Ketchum Roads. ATSDR staff recently observed children playing in this ditch (57).

Health effects due to regular current contact with surface water and sediment from these 4 ditches in the southeast corner of DDMT are unlikely. As described on pages 19 - 20, the contaminant levels in sediment and surface water identified on the Main Facility, including sampling points on the southern side of DDMT, do not represent a health risk.

It is not possible to determine whether site contaminants levels in this drainage were great enough prior to 1989 to result in health effects. There are insufficient environmental data prior to 1989 to estimate contaminant levels which are needed to evaluate the possibility of health effects.

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[6] Conversation with DDMT-CCC member in November 1998.

[7] This was described during a meeting in Memphis on February 24, 2000 and is recorded on page 105 in the public comments section.

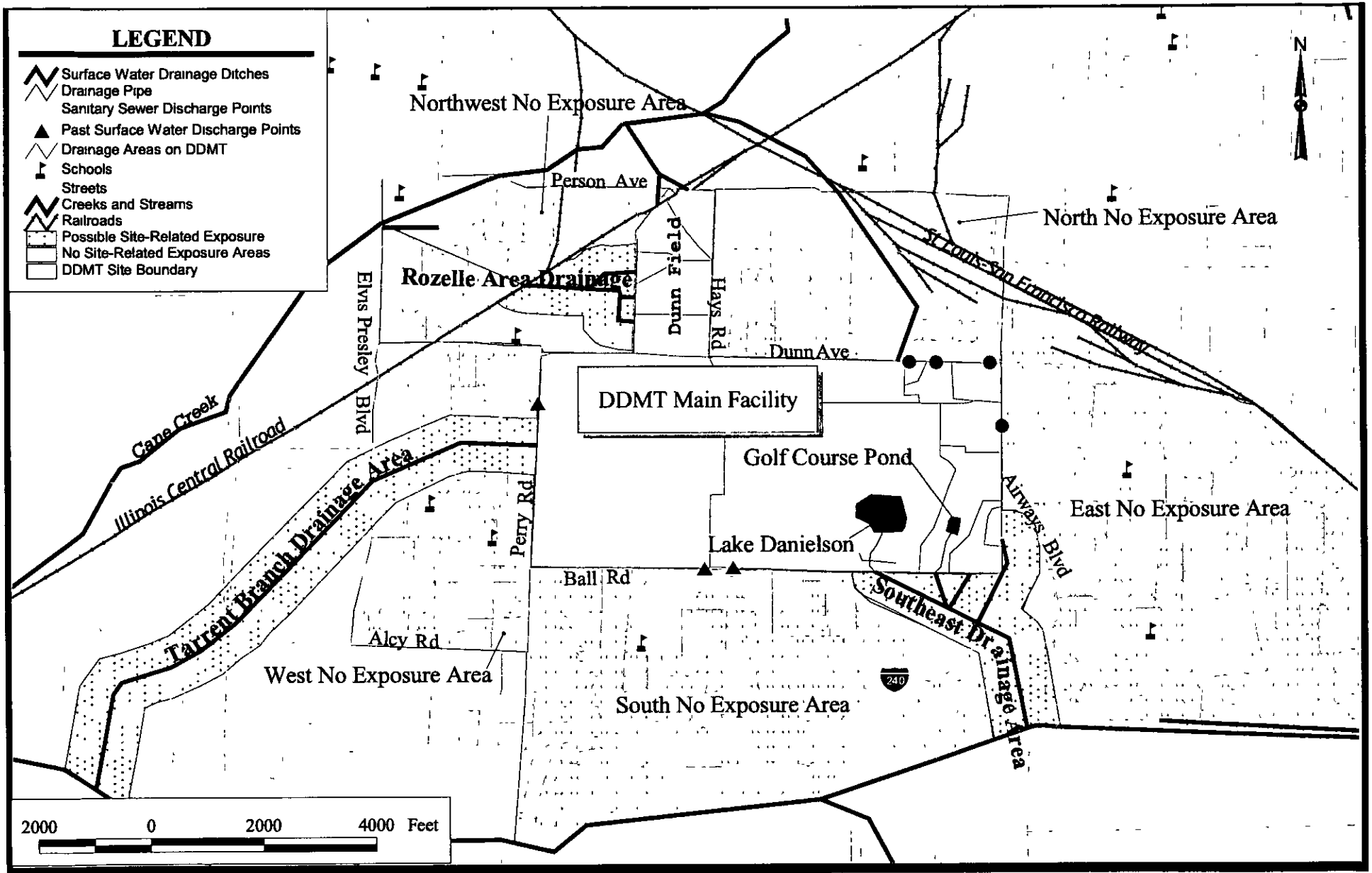

Figure 5 - Surface Water Drainage From DDMT

Where Exposure to DDMT Contaminants in Surface Water is not occurring

Regular exposure to site contaminants carried off DDMT in water and sediment does not occur in the following areas. As will be described, exposure to site contaminants may have occurred in some of these drainages in the past. (For additional explanation of the rationale for these conclusions see Appendix H on page 97.)

(1) *The area north of the DDMT Main Facility and east of Dunn Field.* This area is bordered by Hayes Road on the west, Airways Boulevard on the east, Person Avenue on the north, and Dunn Road on the south. As indicated on Figure 5, water from the site flows north and northwest through an industrial park in pipes or lined ditches and eventually discharges into Cane Creek. The ditches or pipes carrying water away from the northeast side of the DDMT Main Facility do not run through the residential portion of this area (56). Thus, individuals in this area would not have opportunity to contact surface water and sediment from DDMT either currently or in the past.

Please note that there are two drainage ditches that carry water from the residential area just east of Hayes Road into the northeast corner of Dunn Field near the corner of Hayes and Boyle. These two ditches join on Dunn Field and this ditch is the northeast most discharge point indicated on Figure 5.

(2) *The area east of the DDMT Main Facility.* This area is bordered by Airways Boulevard on the west, the St. Louis-San Francisco Railroad tracks on the east and north, and Nonconnah Creek on the south. The only flow of surface water from DDMT through this area occurs presently in Memphis storm sewer pipes. The opportunity for exposure does not currently exist and likely has not existed since at least 1953 (56,73). This conclusion is based on a 1953 Drainage Plan for DDMT that identified the storm sewer drainage points as existing then (73).

(3) *Most of the area on the south side of the Main Facility.* This area is bordered by Orchard Street on the east, Ball Street on the north, Perry Street on the West, and Nonconnah Creek on the south. This area is identified as the Alcy neighborhood by many area residents after Alcy Boulevard which runs east to west through the area. The drainage at the southeast corner of the Main Facility is not included in this area. The opportunity for contact with site surface water is currently non-existent because no open drainage ditches exist (3). In the past, 2 discharge points existed midway between the east and west ends of the Main Facility (3,5). Ditches from these 2 points joined shortly after crossing Ball Road, and this single ditch then flowed south into Nonconnah Creek. It is assumed that this ditch was unlined and therefore it was likely that water from the DDMT could have overflowed into the area around this ditch.

(4) *The area west of the DDMT Main Facility with the exception of homes near Tarrent Branch.* This is the area bordered by Perry Road on the east, Elvis Presley Boulevard on the west, Dunn Road on the north, and Alcy Road on the south. The only current

opportunity for contact with site surface water is restricted to the area around Tarrent Branch (56). In the past, a second open ditch existed west of DDMT and between Dunn Road and Tarrent Branch as shown on maps of the DDMT area from 1982, 1960, and 1953 (7,73,74). The maps we examined did not identify the course of this ditch.

(5) *The area northwest of the Main Facility and Dunn Field.* The Illinois Central Railroad tracks on the east, Person Avenue on the north, and Elvis Presley Boulevard on the west are the borders of this area. This includes the area around and south of Hamilton High. The only drainage in this area where water from DDMT might flow is Cane Creek (56). However, DDMT is only one of many areas providing water to Cane Creek (75). The opportunity for contact with water in Cane Creek is limited because the creek is concrete-lined and fenced from the Ragan Street Bridge to the Elvis Presley Boulevard Bridge.

As indicated in Appendix H, sources for water from DDMT in Cane Creek upstream of Hamilton High are the northeast corner of the DDMT Main Facility and a small portion of Dunn Field. The contribution of water from DDMT to the overall flow of Cane Creek appears to be small. This would further dilute the already low levels of contaminants coming from DDMT.

However, the opportunity for exposure probably was greater in the past because water from the Dunn Field area used to flow through the area between the western side of Dunn Field and Hamilton High School in an open ditch rather than in the pipe in which it currently flows.[8]

Estimate of Number of Persons in Surface Water Exposure Pathways

ATSDR estimates that about 500 - 3,000 persons could have had at least occasional contact with surface water from DDMT. This represents about 2 -10 % of the 30,720 persons living within a mile of DDMT. This estimate was made by determining the number of people living within 100 feet and within 500 feet of the five drainage areas identified on Figure 5. One hundred feet from a ditch is a health protective estimate (i.e., trending towards an overestimate to be protective of health) of the extent of contamination that might occur during flooding. Five hundred feet from a ditch is an estimate of the maximum distance that a small child might reasonably be able to travel to have regular contact with contaminated sediment, surface water, or soil.[9]

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[8] Conversation with a member of DDMT-CCC during a site visit in June 1997.

[9] These population estimates were made by John Crellin using geographic information systems (GIS) techniques. After creating 100- and 500-foot zones around the five drainage ditches, population numbers for these 2 zones were then identified using 1990 census data for Shelby County.

Ground Water

Contaminants from DDMT have moved off site in ground water at the northeast corner of Dunn Field, the southwest corner of the DDMT Main Facility, and a small area near the corner of Ball and Ketchum Road which is in the southeast part of the DDMT Main Facility (3,56,11). In the Dunn Field area about 8-10 contaminants were found in offsite groundwater above an EPA maximum contaminant level (MCL) or risk-based concentration (RBC) in sampling conducted in October of 1998 (56). About half of these chemicals (all volatile organic compounds [VOCs]) were clearly site-related. The rest were considered to be background or natural levels. The principal contaminant found in the groundwater in the two areas off the Main Facility is tetrachloroethylene (PCE) (11). A detailed discussion of the groundwater pathway including an evaluation of groundwater flow patterns can be found in sections 32 - 35 of Volume II of the *Final Memphis Depot Main Installation Remedial Investigation Report* (11).

Available data indicate that contaminants from DDMT have not moved into the Allen Well Field which lies 1.5 to 2 miles west of Dunn Field and the Main Facility (3,56,11). This well field is one of several used to supply drinking water to Memphis area residents. Concern exists that site contaminants may eventually pollute this well field, so a system of wells was recently installed at the edge of Dunn Field to stop or reduce flow of groundwater contaminants off Dunn Field. It appears very unlikely that the groundwater contamination in the Main Facility area could reach the Allen Well Field because contaminants do not appear to be able to move down into the Memphis Sand Aquifer from which this well field draws water (11).

Exposure to site contaminants in drinking water does not appear to have been possible. This is because the likely sources of contaminants in groundwater were not buried in Dunn Field until 1955 (50). All residences around the site were connected to the Memphis public water supply by 1953 (6).

Air

Short-term exposure to airborne contaminants from DDMT probably has occurred at least once (76). In 1988, the cover of a hazardous materials storage building called a Span Dome collapsed during a severe thunderstorm (76). This collapse resulted in release to the air of 327 - 2,000 gallons of the 250,000 gallons of the hazardous materials stored in this building (76,77).[10] The chemicals stored were acetone, isopropyl alcohol, methyl ethyl ketone, methyl isobutyl ketone, toluene, and xylene, which are all commonly-used solvents (78).

The Memphis Fire Department's (MFD) report indicates that, during the first hours of this incident, the leaking materials were detected at high levels at the northern perimeter of the

[10] The Memphis Fire Department estimated immediately after the incident that 1,500 - 2,000 gallons were released (76). After the incident, the Depot estimated that only 327 gallons had been released and that this was diluted by 37,000 gallons of rainwater (77).

DDMT Main Facility (76). This location is about 1,300 feet north of the collapsed Span Dome (79). The Span Dome was located near the western boundary of the Main Facility and north of the corner of Perry and Elliston Roads. Thus, some exposure could have occurred in the area west and northwest of the Span Dome. A more detailed description of this incident starts on page 40.

Long-term residents have indicated that several other air releases from DDMT have occurred (49,52). DDMT operated for 55 years and stored large amounts of hazardous substances, so some likelihood exists that accidental releases could have taken place (7). However, ATSDR could not evaluate these reports further because there were no data on what and how much was released.

Although short-term exposures to airborne DDMT chemicals may have occurred occasionally, there is little in the data available that indicates to ATSDR that long-term exposure to site contaminants of all or most residents around DDMT occurred via the air (3,5,7). Only one operation, spray painting of vehicles and equipment, appears to have existed on DDMT that could have resulted in regular release of contaminants to the air. As indicated on Figure 2, three or four paint spray booths existed at various times on the Main Facility. The stacks from these booths appear to have been relatively short which would result in contaminants being carried only short distances.

This is confirmed by soil sampling data for the areas around the booths. The soil near these paint booths does have elevated levels of lead, PAHs, and other chemicals. However, levels of these chemicals are not elevated in samples taken at the DDMT perimeter. This indicates that very little of the chemicals, emitted from the paint booths, actually moved off-site.

Food Chain

Exposure to site contaminants through food is unlikely. The known contaminant concentrations in surface water appear to be too low to result in significant contamination of crops, fish, or wild or domestic animals from the DDMT area.

The nearest location available for DDMT area residents to catch and eat fish is and was Nonconnah Creek. The ditches draining DDMT are often dry and thus could not sustain a fish population. Nonconnah Creek, which eventually receives all the water draining from DDMT, has been posted as a no fish consumption area since 1982 This is primarily because of chlordane contamination from a nearby pesticide production facility and chlordane's use around homes (80).

Individuals catching and eating fish from the bodies of water on DDMT, Lake Danielson and the golf course pond, may have had some exposure to chlordane, DDT, and PCBs because these chemicals were found in fish, sediment, and water from this lake and pond (3,6,8-10). There are no longer any fish in these bodies of water. Former workers indicated to John Crellin that people did catch fish from the lake and pond.

Soil

No systematic evaluation has been done of surface soil from any specific off-site area. Indirect evidence suggests that any contamination of soil off-site with DDMT materials would be limited. Off-site soil could have been contaminated through the overflow of ditches that drain DDMT and the deposition of chemicals carried in this surface water and sediment. However, as discussed earlier, only a limited number of places exist where this could occur. ATSDR is recommending that at least some of these areas be sampled.

Soil could also have been contaminated by the deposition of airborne materials from the site. As discussed earlier, only the paint spray booths could have been such a source, and soil sampling data do not indicate that a significant amount of the materials moved off site.

Evaluation of Sampling Data from the Area around DDMT

Low concentrations of chemicals are in soil, sediment, and surface water from the area around DDMT. Available data indicate that DDMT is not a major source for these chemicals.

Surface soil, surface water, and sediment samples from the area around DDMT were analyzed for about 170 parameters.[11] Soil samples were taken from 11 locations just off DDMT and 11 locations away from DDMT including four schools (Alcy, Charjean, and Dunn Elementary Schools; and Airways Middle School), Alcy West Park, and Pine Hills Golf Course. Surface water and sediment were sampled at 22 locations including Nonconnah and Cane Creeks; and lakes in Medal of Honor and Audubon Parks, and Botanical and Chickasaw Gardens.

The best indication that no widespread contamination of the area occurred around DDMT by chemicals from the site can be found in Table 3. In this table, the average concentrations of the most common contaminants found in DDMT soil are compared with averages for the same chemicals from soil sampling locations around DDMT. With the exception of arsenic and iron, on-site levels are considerably higher than those off-site. In addition, little difference was found in concentration between the soil samples taken at the perimeter of DDMT and those taken further away (Table 4).

Most surface water and sediment sampling locations from the area around DDMT receive little or no water from DDMT. Thus, chemicals found in this sampling program come from sources other than DDMT. Recent sampling indicates that polluted surface water is found throughout Memphis (81).

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[11] These data were provided to ATSDR in September 1998 as an electronic file. The actual sampling of these locations was done in late 1995. Sampling locations were selected by staff from DDMT and its contractors, EPA, the Tennessee Department of Environmental Conservation, and ATSDR; and a local environmental activist. This last individual was at the time a co-chair of the DDMT RAB.

Table 3 - Comparison of BRAC[1]/RI[2], SS[3], and DDMT Area Soil Means*

Contaminant	BRAC/RI Mean in mg/kg**	SS Mean in mg/kg**	DDMT Area Mean in mg/kg**
Arsenic	13.8	15.2	10.9
Benzo(a)pyrene	7.9	1.8	0.3
Dieldrin	0.5	0.05	0.07
Benzo(b)fluoranthene	8.2	1.7	0.3
Lead	398	125.7	21.3
Benzo(a)anthracene	10.7	1.5	0.3
Indeno(1,2,3-c,d)pyrene	6.7	1.3	0.3
Beryllium	43	0.5	0.4
Dibenz(a,h)anthracene	5.1	0.5	0.3
DDT	0.7	0.2	0.009
Chromium	214.3	62.7	13.7
Iron	21,629	21,616	18,607

* Non-detected chemicals were accounted for by calculating the mean using ½ of the detection limit as the value for the non-detected chemical
** mg/kg = milligrams of chemical per kilogram of soil
1 - BRAC = base realignment and closure
2 - RI = remedial investigation
3 - SS = screening sites

Table 4 - Comparison of Perimeter And Off Site Soil Means*

Contaminant	Perimeter Mean in Mg/kg**	Off Site Mean in Mg/kg**
Arsenic	11.9	10.1
Benzo(a)pyrene	0.4	0.2
Dieldrin	0.1	0.01
Benzo(b)fluoranthene	0.4	0.2
Lead	20.8	21.8
Benzo(a)anthracene	0.4	0.2
Indeno(1,2,3-c,d)pyrene	0.4	0.2
Beryllium	0.6	0.2
Dibenz(a,h)anthracene	0.4	0.2
DDT	0.02	0.003
Chromium	14.9	12.5
Iron	20,100	17,114

* Non-detected chemicals were accounted for by calculating the mean using ½ of the detection limit as the value for the non-detected chemical
**mg/kg = milligrams of chemical per kilogram of soil

Tables E6 and E7 on page 77 identify the 13 chemicals found in sediment and one in surface water with at least one concentration above a comparison value. Although comparison values were exceeded, further analysis identified no significant health risk. Even daily exposure to the highest concentrations represents insignificant cancer risk (maximum risk of 1 in 100,000).

Evaluation of Health Outcome Data

The Superfund law requires that health outcome (i.e., mortality and morbidity) data (HOD) be considered in a public health assessment (82). This consideration is done using specific guidance in ATSDR's *Public Health Assessment Guidance Manual* and a 1996 revision to that guidance (67,83). The main requirements for evaluating HOD are presence of a completed human exposure pathway, great enough contaminant levels to result in measurable health effects, sufficient persons in the completed pathway for health effects to be measured, and a health outcome database in which disease rates for population of concern can be identified (83).

This site does not meet the requirements for including an evaluation of HOD in this public health assessment. Although completed human exposure pathways exist at this site, neither the contaminant levels nor the exposed population are great enough to permit meaningful measurements of possible site-related health effects as identified in existing HOD.

However, although using HOD to identify health effects possibly related to DDMT is not possible, evaluating HOD to determine whether the community's assertions of excess disease can be confirmed is good public health practice. Two preliminary evaluations of cancer mortality have already been done by the Tennessee Department of Health (TDH) and ATSDR to evaluate these assertions (84,85).

In the most recent report, TDH and ATSDR investigated the age- and race-adjusted cancer rates within 1-1½ miles of DDMT for 1990 - 1996 by evaluating 23 types of cancer for men and women.(85). Overall, the cancer rates for the area around DDMT were near or below the rates expected from Shelby County and the State of Tennessee.

Although this investigation did not identify overall excesses of cancer, the rates for other diseases or health conditions might be excessive. In addition, the results of this investigation only reflect cancer incidence for a relatively short period and do not mean that cancer rates could not have been excessive in the past. ATSDR is recommending that these other diseases be investigated, if possible, and is working with DDMT area residents and the Tennessee Department of Health to identify data on the past occurrence of cancer (85).

COMMUNITY HEALTH CONCERNS

The following issues were identified in conversations and meetings with DDMT area residents and former workers, and in ATSDR's review of the data for the site.

1. *Were people exposed to ANY depot chemicals and radiation (49)? -- please give a direct answer, not an indirect one as in 1995 public health assessment.*

Response: The answer is yes for depot chemicals based on the discussion in the previous section. Some residents may have had infrequent, short-term exposure to depot chemicals in air due to accidental releases, or in surface water or sediment due to accidental leaks or spills or intentional discharges. **However, daily or nearly daily long-term exposure of area residents to depot chemicals is not very likely. If it did occur, it could have taken place in 3 surface water drainages and to an estimated 500 - 3,000 people.** In the past, two additional surface water drainages appear to have existed.

The answer is no for radiation. No DDMT area resident was likely to have been exposed to site-related radiation (radioactive materials) because only small amounts were stored on-site. This storage appears to have been properly done so very little chance of releases to the environment existed.[12]

2. *Depot had uncontrolled access until the 1960s or 70s and children played on-site (49).*

Response: The DDMT Main Facility and Dunn Field have been fenced and guarded since the facility opened in 1942 according to DDMT staff and the literature available to ATSDR (68).

3. *Residents around DDMT were exposed to contaminants through surface water flowing off-site in 21 open drainage ditches (49). Exposure was not only to contaminants in surface water, but also to site contaminants in the air and in the food chain (e.g., fish, rabbits, plants) (52).*

Response: Transportation of contaminants off-site could have occurred whenever sufficient rain created water flow in the ditches draining the site. Exposure to site contaminants could have been through ingestion or having skin contact with surface water, or soil or sediments contaminated by chemicals in the surface water. These ditches could have been polluted by leaks, spills, or intentional discharges of DDMT chemicals.

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[12] Discussion with Michael Grayson, Health Physicist, Federal Facilities Branch/DHAC/ATSDR.

ATSDR confirmed that 14 points do or did exist where water discharges from DDMT into open ditches (Figure 5). Eleven of these currently exist and 3 existed in the past. One of these 3 ditches was located between Tarrent Branch and Dunn Road on the westside of the Main Facility and the other 2 on the southside of the Main Facility about midway between the east and west ends.

ATSDR identified seven other points where water is and was discharged off site through storm sewers. These discharges into storm sewers appear to have been occurring since 1953 (73). Before 1953, we were unable to determine whether water flowed off-site at these 7 locations in storm sewers or in open ditches. Therefore, there may have been 21 open drainage ditches coming off DDMT before 1953.

As indicated earlier (page 22), about 500 - 3,000 residents may be at risk of exposure to small amounts of site contaminants transported off-site in surface water. The chance of exposure appears to have been the greatest in the Rozelle neighborhood just west of Dunn Field. The current chance of exposure in that neighborhood could be more accurately evaluated by determining levels of site contaminants in residential soil. ATSDR is planning to conduct sampling to do this.

However, any exposure to site contaminants through air or food is and was very unlikely. The known contaminant concentrations in surface water appear to be too low to result in releases of site contaminants to the air. Levels also appear to be too low to result in substantial contamination of crops grown in the area, or in fish, or wild or domestic animals.

Exposure of individuals off-site through ingestion of contaminated fish from the ditches draining DDMT does not appear to be possible because the ditches draining the site are often dry. Thus these ditches would not sustain a fish population. The nearest location from which DDMT area residents could have eaten fish is Nonconnah Creek which does have a viable fish population and which eventually receives all the water draining from DDMT. This creek has been posted as a no fish consumption area since 1982 largely because of chlordane from a nearby pesticide production facility and its use around homes (80).

4. *Individuals living in the Bunker Hill area and students at Hamilton High School were exposed to contaminants through surface water run-off in drainage ditches (49).*

Response: As described starting on page 27, residents of the Bunker Hill area or students at Hamilton High School are very unlikely to currently be exposed to site contaminants transported off-site by surface water. Water from the western side of Dunn Field does go through the residential areas between Dunn Field and

Hamilton High, but, except for the Rozelle area, currently does so entirely in pipes.

Currently, direct contact with water-borne site contaminants is very unlikely in the area around Hamilton High. Cane Creek, which runs under Hamilton High, has been fenced and concrete-lined between the Ragan Street and Elvis Presley Boulevard bridges since the early 1970s. In addition, the concentration of site contaminants in the water going under Hamilton High would be much lower than levels at the site boundaries because DDMT contributes only a small portion of the water that flows under the school. See section (5) on page 27 and Appendix H on page 97 for more details.

However, direct contact with contaminants could have occurred before Cane Creek was fenced and lined in the 1970s, and when water from Dunn Field flowed through the Bunker Hill area in an open ditch.

Indirect contact of Hamilton High students and staff with DDMT contaminants moving from water in Cane Creek into the air appears extremely unlikely. The known surface water concentrations at the DDMT boundary are too low to result in release of contaminants to the air (70-72).

5. *One resident was concerned about possible health effects from playing in the drainage ditches in the Rozelle area in 1945 (53). This same individual indicated that he and his family drank water from a private well at that time. His father's fruit trees either didn't grow or didn't produce fruit. Another individual asserted that children played in drainage ditches, immediately off-site, and found many items including gas mask canisters (49). When this occurred was not indicated.*

Response: Very little information exists about the operation of the Depot for 1942 - 1945 so we are unable to provide a specific response to the concerns about playing in the ditches and about the fruit trees (5). Exposure to site contaminants in drinking water from private wells before 1950 does not appear possible. This is because the likely sources of contaminants in groundwater were not buried in Dunn Field until 1955 (6,50).

6. *Exposure took place to liquid toxic substances from the Depot that drained near Perry Avenue (49). Drainage of these toxic substances occurred on a regular basis because DDMT workers disposed of large quantities of toxic substances such as DDT and expired medicines in the facility drains as instructed by their bosses (60).*[13]

[13] Conversation among a DDMT-CCC member, John Crellin, Rueben Warren, Sandee Coulberson, and others on September 9, 1999.

Response: Contaminants from DDMT could have gotten into on-site drains and ditches from intentional disposal, leaks or accidental spills. This is indicated by the marginal management of toxic substances and contamination identified in a 1982 report (7). However, this apparently did not result in substantial exposure off-site, at least in the recent past. This conclusion is based on the fact that known contaminant levels in soil, surface water and sediment on DDMT are low. An example of this is DDT whose on-site levels are depicted on Figure G3 on page 89. Known contaminant levels in surface water and sediment are also low as described starting on page 22.

The disposal of toxic substances down facility drains could not have led to contamination of the drainage ditches and surrounding areas on- and off-site if most, if not all, of this disposal was in the drains inside DDMT buildings. This is because drains inside DDMT buildings were and are connected to the sanitary sewer system (3,7). Thus, no opportunity would exist for off-site exposure because the sanitary sewer system is entirely closed with no open drainage.

In addition, disposal of substantial amounts of substances such as DDT and related compounds would have been difficult because they are insoluble in water (59). It would have taken large amounts of water to wash them down the drains.

7. *Outbreaks of rashes occurred because of contact with soil in the Freemont and Cascade areas (49).*

Response: Although people may have experienced these rashes, DDMT contaminants are not likely to have been the cause. ATSDR did not identify a mechanism by which DDMT contaminants could have been transported to the surface soil in the Freemont/Cascade area. A ditch from DDMT exists to the east of Freemont (Figure 5). However, materials from this ditch are unlikely to have contaminated Freemont area surface soil because the ditch appears to be at an elevation lower than Freemont.[14] See page 26 and Appendix H (page 97) for more discussion of drainage in this area.

8. *Did exposure to site contaminants in drinking water occur from private wells used before 1950 (49)?*

Response: Exposure to site contaminants in drinking water from private wells before 1950 does not appear possible. This is because the likely sources of contaminants in groundwater were not buried in Dunn Field until 1955 (6,50). All residences around the site were connected to the Memphis public water supply by 1953.

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[14] This is based on an evaluation of the ground elevations found on the USGS topographic map for the DDMT area and my (John Crellin) observations of the area

9. *Have contaminants from the Depot affected the aquifer near site (52)?*

Response: Contaminants buried on Dunn Field have polluted the Fluvial (shallow) aquifer under and to the west of the northern tip of Dunn Field. Contamination also occurred to a small portion of the shallow aquifer under the Main Facility (3). Three aquifers are under DDMT: the Fluvial, Memphis Sand, and Fort Pillow Sand with the Fluvial the shallowest and Fort Pillow the deepest. Contaminants from Dunn Field or the Main Facility have not moved down to the Memphis Sand Aquifer. This aquifer provides 95% of the drinking water in Memphis. However, a clear potential exists for the contaminants to move down to the Memphis Sand some time in the future. Currently, there is an extensive program underway at Dunn Field to prevent further migration of the contaminants (11).

10. *Fumes released from the Depot in the evenings and nights of 1968 caused people to have reoccurring skin rashes and burning eyes, and caused animals to die (49).*

Response: We were unable to identify any information about this issue.

11. *People were exposed in the evenings of 1978 to air releases from Dunn Field near the corner of Person and Hayes (49). These releases had a foul odor, and those who inhaled it experienced nausea and sleepless nights.*

Response: We are unable to provide a definitive answer to this concern. ATSDR did not identify any information about air releases from DDMT in 1978. This location is the northeast corner of Dunn Field. Available data do indicate that this area of Dunn Field appears to have been used as a burial area for impregnite in the 1940s (50). This substance was used to make clothes and shoes resistant to chemical agents. This material is unlikely to have produced the reported air releases in 1978 because it is solid. ATSDR did not find any other indication in the documents reviewed that other materials were buried in this area.

12. *Persons across the street from the mounds on Dunn Field were exposed to dust blowing off them (49).*

Response: Exposure to dust from these mounds probably has not resulted in any health effects. The mounds are national stockpiles of bauxite and fluorspar. These substances are not very toxic (i.e., it takes a lot to cause harm). In recent times, these mounds were covered most of the time thus eliminating or greatly reducing the amount of dust blowing into the neighborhood east of the mounds (Figure 3). However, several citizens have reported that considerable amounts did blow off these mounds before they were covered.[15]

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[15] See page 131 for a description of the problem given by a resident during a meeting on February 24, 2000

13. *The mustard bomb casings are in publicly accessible areas near Dunn and Perry Roads (49).*

Response: As displayed on Figure 3, the information available to ATSDR indicates that the mustard bomb casings were buried on Dunn Field (3,5). Public access is unlikely because Dunn Field reportedly has always been fenced.

14. *Depot-related exposures caused various illnesses such as cancer, breast cancer, prostate cancer, strokes, heart attacks, hypertension, thyroid diseases, miscarriages, birth defects, liver disease, numbness (hands, feet, or face), ear-nose-throat problems (49,52,55).This was asserted to have been confirmed in state reports (52).*

Response: ATSDR found 3 reports that focus on or mention disease or death in the DDMT area (84-86). None of them identify any diseases that are attributed to exposure to DDMT contaminants.

Reviews of cancer data have taken place, one by the Tennessee Department of Health (TDH), and the other by TDH and ATSDR (84,85). In the most recent report, TDH and ATSDR investigated the age- and race-adjusted cancer incidence rates within 1-1½ miles of DDMT for 1990 - 1996 (85). Twenty-three types of cancer were evaluated for men and women. Overall, the cancer rates for the area around DDMT were near or below the rates expected from Shelby County and Tennessee. The only cancer with an elevated rate was Endometrial (corpus uteri) cancer in women. Six cancers had rates lower than expected - esophageal and lung cancer in men; and lung, breast, pancreatic, and bladder cancer in women. As described starting on page 22, off site exposures were probably too infrequent and at concentrations too low to cause any health effects from long-term exposures. The one cancer that was elevated, Endometrial, is not known to be caused by any of chemicals found on DDMT (87).

The third report was a 1998 article in the Memphis Commercial Appeal in which the Memphis-Shelby County Health Department (MSCHD) reported the number of deaths in Shelby County for 1993 - 1997 (86). The deaths were broken down by census tracts. The census tracts with the highest numbers of deaths were in the South Memphis area including a tract close to DDMT. This higher number of deaths was attributed to there being proportionally greater number of elderly people in these census tracts compared with the other census tracts. As described in the Demographics section on page 11, a larger portion of the population within a mile of DDMT is 65 or older compared to the rest of Shelby County. This report had no information on the causes of death.

15. *Toxicity data for a chemical come from studies of Caucasian males and the results might not apply to African-American communities (49).*

Response: The toxicity data used in this public health assessment come from animal studies and epidemiologic investigations of actual human exposures. They did not come from studies of Caucasian males. The toxicity data used in this document are applicable for African-Americans and all other racial groups.

ATSDR prefers to use data from investigations of human exposures to a chemical. However, most of the data used come from studies of laboratory mice and rats, or other animals such as dogs and monkeys because valid human data are lacking for many chemicals (67).

In this document, human toxicity data were used for arsenic, cadmium, and lead (88-90). For arsenic, the main study used to identify toxicity was of non-Caucasians (residents of Tawain) who had drunk arsenic-contaminated water for years (88). For cadmium, the main study is of Japanese (89). For lead, toxicity data come mostly from studies of children exposed to lead in urban areas (90). The children evaluated included African-Americans, Caucasians, and other racial or ethnic groups.

16. *In 1970s or 1980s, people wearing protective clothing and masks tested the west side of Depot, removed contaminated soil, and replaced it with new soil and gravel (49).*

Response: This was probably the removal of the pentachlorophenol (PCP) dipping vat and contaminated soil in 1985 (91). The location of this vat is identified on Figure 2. The vat was used regularly to treat wood with the preservative PCP from about 1952 to 1971 and infrequently after that until it was removed in 1985. The emptying and repacking of PCP in the vat would require workers to wear protective clothing and masks.

17. *German prisoners of war, who were housed in a camp on the southwest portion of the Main Facility, may have contaminated the environment during World War II (49).*

Response: ATSDR was unable to identify any information on this issue. However, even if these prisoners of war contaminated the environment, the environmental data reviewed in this document indicate that the current amount of contamination on-site is relatively low.

18. *The Depot is similar to Love Canal where chemicals were buried in a dump, and health effects appeared 27 years later (49).*

Response: At Love Canal, many homes were built on top of areas where hazardous waste was dumped (92). At DDMT, all available data indicate that homes were not built on top of hazardous waste disposal sites.

19. *Fallen and damaged trees were observed on Dunn Field in 1997 (49). Were any tests performed to determine why this occurred, and if they were, what were the results?*

Response: The two arborists (tree doctors) who evaluated the dead or damaged trees for DDMT, indicated that this problem was due to natural causes such as wind damage and the trees reaching the end of their lifespan (93).

20. *In March 1998, two residents found two dead birds just off-site of the west boundary of Dunn Field.[16] They were concerned that the birds' deaths were due to site contaminants possibly released from nearby location on Dunn Field. A few days before, small vials had been uncovered at that location during the installation of a utility line.*

Response: It appears unlikely that these birds died because of this incident because the descriptions of what happened do not indicate that anything was released. The materials uncovered in this incident were metal canisters with small glass vials packed in them (35,94,95).[17] The burial site for these vials was not identified in the records of materials disposal at Dunn Field. However, the crew doing the remedial work was checking for buried materials before they disturbed the soil and had indications that something was there. What they found were metals canisters with small glass vials inside. These canisters were similar to those in which 35MM film is packaged. Some of the vials contained small amounts of liquid. The materials uncovered at this location (whole and damaged canisters and glass vials, and the soil around them) were certified as non-toxic by the Tennessee Department of Environmental Conservation (TDEC). These materials were disposed of at a Shelby County landfill.

21. *A resident wondered whether students at Dunn School had been medically evaluated after the chemical warfare building blew up in 1988. Another resident asked why Norris Elementary School wasn't closed during this incident, if Dunn School, which is about the same distance from DDMT, was closed.[18]*

Response: Dunn Elementary School was closed during a hazardous materials incident in 1988, but no medical evaluations of the students from this school were performed

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[16] Phone call to John Crellin from a DDMT-CCC member on March 24, 1998.

[17] John Crellin had several conversations concerning this issue: conversations with a DDMT-CCC member in March and April 1998, with Ben Moore (ATSDR) in March 1998, with Glen Kaden (DDMT) in March 1998, and with Shawn Phillips (DDMT) in August 1999.

[18] This is based on a discussion with a DDMT-CCC member on January 21, 1999. This individual drove me (John Crellin) by Norris and Dunn Elementary. I agreed that these two schools are about the same distances from the western boundary of DDMT.

(76). This incident had nothing to do with chemical warfare materials because the large scale storage of them ended in 1947 and all were gone by 1961 (5).

In the January 19 - 21, 1988, hazardous material incident, the cover of a hazardous materials storage building called a Span Dome, as identified on Figure 2, collapsed during a severe thunderstorm (76). This building was located about 1,400 feet south of the corner of Perry and Dunn Avenues and about 500 feet from Perry Avenue (79). The collapse resulted in the release to the environment of about 327 - 2,000 gallons of the 250,000 gallons of the hazardous materials stored in this building and an identical building right beside it (76). The chemicals stored were acetone, isopropyl alcohol, methyl ethyl ketone, methyl isobutyl ketone, toluene, and xylene. All these are commonly-used solvents (78).

The Memphis Fire Department's (MFD) report indicates that, during the first hours of this incident, "The odors of the products and gas trac readings of flammability were very high at the north perimeter of the Depot (Dunn Street), indicating much leakage. These readings and odors were surprising at this distance considering the first four to five hours of the incident occurred while heavy thunderstorms were crossing the Memphis area" (76). [Note: As indicated on Figure 2, Dunn Avenue is about 1,300 feet north of the building (79).] MFD took measures to prevent or greatly reduce air releases. However, short-term exposures to these hazardous materials could have occurred before these measures were taken.

On January 20, Dunn School was closed as a precautionary measure while the collapsed structure was being cleared away and the spilled chemicals cleaned up (76). A shut-in was also evacuated from his or her house on the 20th.

As indicated on Figure 1, Norris Elementary School is near the southwest corner of DDMT and Dunn School is near the northwest corner. Both are about the same distance from the Span Dome. Decisions to close or evacuate schools or residential areas during hazardous materials incidents are largely based on wind direction. It appears that MFD assumed that the wind was blowing to the north (i.e., towards Dunn School) on the day the structure was cleared away. Thus, they closed Dunn School but left Norris School open.

22. *Could the cleanup of the dieldrin-contaminated soil near the base housing units on the Airways Boulevard side of DDMT have polluted the soil in the apartment complex just across the fence from where the cleanup was done?*

Response: This cleanup probably did not result in contamination of apartment complex soil with dieldrin. DDMT staff indicated in presentations to the DDMT Restoration Advisory Board (RAB) that the cleanup was done using procedures that would prevent this from happening (12,13). This included monitoring the air during the

removal in which dieldrin was not detected. In addition, dieldrin levels in soil represented a risk for cancer if someone was exposed to them for a long time, but not a risk for other health effects.

ATSDR is recommending that soil from this complex be sampled because it is not known whether past use of dieldrin and other chemicals in the base housing area could have led to contamination of the soil across the DDMT boundary fence.

23. *Could the combined effect of the mixture of chemicals found at DDMT have caused cancer or other health effects, even though the concentration of each chemical may not be harmful by itself?*[19] [20]

Response: The answer to this question is no, based on the information available to ATSDR on the health effects of mixtures and the actual concentrations of chemicals found on DDMT. ATSDR has sponsored research for many years on the mixtures issue because of its importance in evaluating the possible health impact of a site and because it is often a community concern. A common finding of the ATSDR-sponsored and other investigations of this issue is that adverse effects are unlikely when the chemicals in a mixture are present at concentrations well below the toxicologic thresholds[21] for that chemical (96-99). ATSDR identified the toxicologic thresholds for the site contaminants and found that the maximum contaminant levels result in doses many times (100s to 1,000s) lower than the thresholds. This suggests that exposures to combinations of DDMT contaminants are unlikely to result in adverse effects.

Further analysis of exposure to a mixture of DDMT contaminants was done by identifying the possible interactions among the chemicals contributing most of the potential risk. For soil and sediment, 4 metals (lead, iron, chromium, and arsenic) contribute more than 95% of the total noncarcinogenic hazard. The chemical interactions that would increase risk appear to be counterbalanced by those that reduce risk. For example, cadmium may enhance the noncarcinogenic toxicity of arsenic but chromium reduces it (88,89,100).

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[19] This concern was expressed to John Crellin on October 17, 1998 by a DDMT-CCC member.

[20] This response was developed with the guidance of Allan Susten, Ph.D., DABT. He is the Assistant Director of Science in ATSDR's Division of Health Assessment and Consultation.

[21] These toxicologic thresholds would be the no or lowest observed adverse effects levels (NOAELs and LOAELs) for the chemical of interest.

24. *Do any data exist that indicate that DDMT workers were exposed to site contaminants at concentrations great enough to cause health effects?*[22]

Response: Concentrations of benzo(a)pyrene, dibenz(a,h)anthracene, or all polycyclic aromatic hydrocarbons (PAHs) together were elevated in the soil at several locations at DDMT. However, a detailed evaluation of this exposure situation and the carcinogenicity of PAHs indicate that it is unlikely that anyone was harmed by exposure to PAHs at DDMT. A more detailed discussion of those possible exposures is on page 83.

Besides these possible exposures in areas around specific buildings, former workers reportedly could have been exposed to toxic substances because of work practices inside the DDMT buildings that resulted in contact with chemicals (60). Evaluation of these situations is not within the scope and purpose of a public health assessment. As indicated in the response to the next concern, ATSDR's Office of Urban Affairs is conducting a medical records review.

As referenced in the 1990 remedial investigation, there are some industrial hygiene reports that may provide information on this issue (3). Also possibly relevant to this issue are data from the sampling of the air from six of the 28 warehouses in 1998 for some of the pesticides stored or used in those warehouses (11). The pesticides tested for included heptachlor, heptachlor epoxide, beta-benzene hexachloride (BHC), dieldrin, DDD, DDE, DDT, endrin ketone, chlordane, and methoxychlor. DDT, DDE, heptachlor, and chlordane were detected in most of the buildings but at levels well-below the health-based criteria for workers.

25. *The following is a summary of concerns expressed by former DDMT workers at a meeting conducted by ATSDR on July 27, 1998 in Memphis (60).*

- *Ten individuals indicated that their exposure to chemicals at DDMT had caused health effects including Hodgkin Disease; other cancers; problems with the skin, kidneys, respiratory tract, eyes, or female reproductive system; miscarriages; or headaches. One individual identified that the main exposure that she received was to DDT being used to treat around the warehouses. She also stated that the DDT killed many squirrels and other rodents on DDMT. The other workers did not know what chemical(s) they were exposed.*

[22] This has been expressed by former workers on several occasions including the January, March, and April 1999 Restoration Advisory Board (RAB) meetings.

- *Three individuals expressed concern that exposure to asbestos in the office they had worked resulted in respiratory tract problems or asthma*

- *Three individuals indicated that the water coming from the taps in DDMT buildings was often brown colored and of poor quality. Mr. John DeBack of DDMT was at this meeting and indicated that this problem was ongoing.*

- *One former DDMT worker reported that her father, also a former worker, had brought dust home on his clothes which he thought was harmful so would not allow his children to touch him until he had removed the dusty clothes. She indicated that her father was now sick.*

- *One former worker indicated that she had disposed of expired medicines by putting them down the drains within the building that she worked.*

Response: At this meeting in 1998, Dr. Rueben Warren, the ATSDR Associate Administrator for Urban Affairs indicated that Dr. Jewell Crawford who is a physician in his office was developing activities to assist workers. This will include an evaluation of the medical records of former workers.

26. *Residents know of locations where materials from DDMT were dumped or buried off-site. In at least one instance, this may have led to the sinking of a portion of a residential yard (47).*

Response: Anyone knowing of locations where DDMT materials were dumped or buried off-site should report this to Mr. Jim Morrison (901-368-7953) at the Memphis Office of the Tennessee Department of Environmental Conservation, or Mr. Turpin Ballard (404-562-8553) at EPA/Atlanta. These agencies have the responsibility to investigate reports of buried hazardous materials.

CONCLUSIONS

1) **No known exposures exist or have existed off-site since at least 1989 to contaminants from the Defense Depot Memphis Tennessee (DDMT) NPL site that could result in health effects.** This conclusion is based on available sampling data and descriptions of facility operations.

   The Rozelle neighborhood, which is that portion of Rozelle Street just west of Dunn Field, is a possible exception to this conclusion. Soil sampling needs to be done in that neighborhood to identify whether DDMT contaminants, possibly deposited in the area from past overflows of surface water and sediment, might still be present.

   Note: The conclusion from the public comment release of this PHA that there was an increased chance of cancer for workers with daily exposure to polycyclic aromatic hydrocarbon (PAH)-contaminated soil has been changed. Further evaluation of the exposure situation and the carcinogenicity of PAHs indicated that harm was unlikely. This is discussed beginning on page 84.

2) There is insufficient information to determine whether a health hazard existed prior to 1989 because of a general lack of environmental data.

3) Three surface water drainages are the only exposure pathways where residents of the area around DDMT could have experienced long-term exposure to site contaminants. These 3 drainages are: (1) the ditches that run through the Rozelle neighborhood west of Dunn Field, (2) the Tarrent Branch which flows through the neighborhood west of the Main Facility, and (3) the 4 ditches that flow south from the southeast corner of the Main Facility. About 2 - 10% of the population within a mile of DDMT live close enough (100 - 500 feet) to have had contact with water or sediment from these drainages because the ditches are relatively small and could affect only the area immediately around the ditch.

   The current contaminant levels in these surface water drainages are too low to cause health effects. No data exist on contaminant levels in surface water and sediment before 1989.

4) Short-term exposure to DDMT contaminants in the air probably has occurred at least once. This documented incident occurred in 1988 when a building collapsed during a thunderstorm, releasing some of the chemicals stored within. These chemicals moved off-site but whether anyone experienced health effects from exposure to them is not known. Little indication exists in the data available to ATSDR that long-term exposure to site contaminants of all or most of the residents around DDMT occurred via the air.

5) Exposure of area residents to DDMT contaminants in ground water does not appear to have occurred because an opportunity to drink contaminated ground water was lacking.

Everyone around DDMT appears to have been on public water before the ground water was contaminated.

6) Exposure of area residents to DDMT contaminants in soil does not appear to have occurred due to the lack of an opportunity for area residents to contact soil on DDMT. DDMT reportedly has been fenced and guarded since it opened in 1942.

ATSDR CHILD HEALTH INITIATIVE

As part of ATSDR's Child Health Initiative, the possibility of health effects in children due to exposures to site contaminants was carefully considered in this public health assessment. This evaluation indicates that, since 1989, health effects in children exposed to site contaminants are unlikely because exposure levels were too low to cause harm or because children couldn't access contaminated areas. Before 1989, the possibility of health effects can't be determined because of a lack of environmental data.

ATSDR's Child Health Initiative recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination of their water, soil, air, or food. Children are at a greater risk than are adults from certain kinds of exposures to hazardous substances emitted from waste sites and emergency events. They are more likely to be exposed because they play outdoors and they often bring food into contaminated areas. They are more likely to come into contact with dust, soil, and heavy vapors close to the ground. Also, they receive higher doses of chemical exposure because of their lower body weights. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.

PUBLIC HEALTH ACTIONS

A major purpose of this public health assessment is to identify actions needed to protect public health, evaluate whether exposure is occurring or could occur, or identify whether site-related health effects exist. The following public health actions were identified.

Completed Public Health Actions

ATSDR has completed the following public health actions for DDMT: [1] with this public health assessment, the reevaluation of the 1995 PHA, [2] evaluation of the cancer occurrence in the area around DDMT by the Tennessee Department of Health and ATSDR, and [3] establishment of the Greater Memphis Environmental Justice Work Group.

Planned Public Health Actions

1) ATSDR is working with the DDMT Concerned Citizens Committee (CCC) and other local residents, MSCHD, DDMT, and others to develop a program to inform and educate area residents about DDMT.

2) ATSDR is planning a program to sample soil and other media in areas around DDMT. ATSDR will coordinate the planning and execution of this sampling with Howard University, EPA, DDMT and its contractors, the Tennessee Department of Environmental Conservation, MSCHD, DDMT-CCC, and community members of the DDMT RAB.

3) ATSDR is working with the Health Resources Services Administration (HRSA), Memphis/Shelby County Health Department (MSCHD), and Meharry Medical College to enhance the environmental medicine capabilities of the existing HRSA clinic in Memphis.

PUBLIC COMMENTS

The Memphis Defense Depot Public Health Assessment (PHA) was available for public review and comment at 4 locations in Memphis, Tennessee (the Cherokee and Main Branches of the Memphis/Shelby County Public Library, the Memphis/Shelby County Health Department, and Memphis Depot) from December 27, 1999 to March 31, 2000. The public comment period was announced in local newspapers and through a notice sent to over 4,500 residents around the Memphis Depot. The PHA was sent to over 100 individuals or agencies including area residents; representatives of the neighborhood organizations in the DDMT area; DDMT-CCC; members of the DDMT Restoration Advisory Board (RAB); local, state, and federal elected officials; Congress of National Black Churches; Howard University; Memphis Shelby County Health Department; Tennessee Departments of Environmental Conservation and Health; National Center for Health Statistics (NCHS); U.S. Environmental Protection Agency (EPA); DDMT; Defense Logistics Agency (DLA); and Department of Defense (DOD). Comments on the PHA were received verbally in 2 meetings at the South Memphis Senior Center on February 24, 2000 and in writing. The over 170 comments received and ATSDR's responses to them are described in Appendix I starting on page 101.

Comments on Working Draft of Final Release of Memphis Depot Public Health Assessment

In late September 2000, the working draft of the Final Release of Memphis Depot Public Health Assessment was distributed to those individuals or agencies who commented on the public comment release of the public health assessment (PHA), attended the February meetings at which the Agency for Toxic Substances and Disease Registry (ATSDR) received public comments on the PHA, or who had a long time involvement with the site. Comments were received only from the Department of Defense. These 13 comments and ATSDR's responses can be found on pages 192 to 195.

PREPARER OF REPORT

John R. Crellin, Ph.D.
Senior Environmental Epidemiologist
Superfund Site Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

Regional Representative

Ben Moore
Regional Representative
Region IV
Regional Operations
Agency for Toxic Substances and Disease Registry

REFERENCES

1. ATSDR. Public Health Assessment for USA Defense Depot Memphis., Memphis, Tennessee. Atlanta, GA: Agency for Toxic Substances and Disease Registry. November 8, 1995.

2. ATSDR. Letter to Ball A (Memphis Health Center) and Bradshaw D (DDMT-CCC) from Johnson B. ATSDR involvement at DDMT. May 12, 1997.

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

4. DLA. DLA Memphis Profile. Memphis, TN: Defense Logistics Agency (DLA) Defense Distribution Region Central - Memphis, TN. January 1992

5. Corps of Engineers. *Defense Environmental Restoration Program for Department of Defense Sites. Ordnance and Explosive Waste - Chemical Warfare Materials. Archives Search Report - Findings. Memphis Defense Depot, Memphis, TN.* Huntsville, AL: U.S. Army Corps of Engineers, Huntsville Division, St. Louis District. January 1995.

6. EPA. Hazard Ranking System (HRS) Scoring Sheet. Atlanta, GA: U.S. Environmental Protection Agency (EPA) Region IV. 1991.

7. Gross D, Bane JM, Jonas RL, Whitten CB, Wienand JD, Yon RL. Installation assessment of Defense Depot Memphis, Memphis, Tenn. Report. No. 191. Aberdeen Proving Grounds, MD: Installation Restoration Branch, Environmental Technology Division, Chemical Systems Laboratory. July 1982.

8. CH2MHILL. *Screening Sites Sampling Program for Defense Depot Memphis, Tennessee* Montgomery, AL: CH2MHILL. Prepared for U.S. Army Engineering and Support Center, Huntsville, AL. May 1997.

9. CH2MHILL. *Remedial Investigation Sampling Program for Defense Depot Memphis, Tennessee.* Montgomery, AL: CH2MHILL. Prepared for U.S. Army Engineering and Support Center, Huntsville, AL. May 1997.

10. CH2MHILL. *BRAC Sampling Program for Defense Depot Memphis, Tennessee.* Montgomery, AL: CH2MHILL. Prepared for U.S. Army Engineering and Support Center, Huntsville, AL. May 1997.

11. USAESCH. *Memphis Depot Main Installation. Remedial Investigation Report (Volumes 1 & 2). Final.* Huntsville, AL: U.S. Army Engineering and Support Center, Huntsville. January 2000.

12. DDMT RAB. Minutes of February 17, 1998, Restoration Advisory Board (RAB). Memphis, TN: Defense Depot Memphis, Tennessee (DDMT). March 1998.

13. DDMT RAB. Minutes of July 16, 1998, Restoration Advisory Board (RAB). Memphis, TN: Defense Depot Memphis, Tennessee (DDMT). August 1998.

14. Charlier T. Depot tent to contain toxic cleanup. Memphis Commercial Appeal, p B1, March 15, 2000.

15. DDMT RAB. Presentation at Restoration Advisory Board (RAB) on Soil Removal and Building Cleanup: Old Paint Shop and Maintenance Area. Memphis, TN: Defense Depot Memphis, Tennessee (DDMT). September 21, 2000.

16. DDMT. Memphis Depot Main Installation Proposed Plan Public Comment Meeting. Memphis, TN: Defense Depot Memphis, Tennessee (DDMT). August 24, 2000.

17. Smith LJ (Co-chair DDMT RAB). Letter to Dan J. Spariosu (EPA) regarding environmental justice issues relating to the Depot. June 14, 1996. *A copy of this letter can be found on page 146.*

18. Charlier T. Toxic seep heightens risk level to city water. Memphis Commercial Appeal, p A1, April 8, 1991.

19. Charlier T. Soil toxins at depot could taint city water. Memphis Commercial Appeal, p A1, March 1, 1992.

20. Charlier T. Corps to treat depot's polluted groundwater. Memphis Commercial Appeal, p A4, March 6, 1992.

21. Charlier T. Depot, landfill added to waste cleanup list. Memphis Commercial Appeal, p A8, October 15, 1992.

22. Charlier T. Area sites id'd as having buried toxic munitions. Memphis Commercial Appeal, p B1. April 21, 1993.

23. Craig A. S. Memphis residents cite hazards from depot. Memphis Commercial Appeal, p A6, May 25, 1993.

24. Charlier T. Officials unearth answers to base waste. Memphis Commercial Appeal, p A1, June 20, 1994.

25. Charlier T. Cleanup plans target underground chemical seepage. Memphis Commercial Appeal, p A1, December 19, 1994.

26. Charlier T. Closing could quicken depot pollution cleanup. Chemical woes traced to disposal field. Memphis Commercial Appeal, p A12, March 1, 1995.

27. Anonymous. Briefly - announcement of town hall meeting on DDMT. Memphis Commercial Appeal, p B3, March 9, 1995.

28. Charlier T. Defense Depot will test area soil. Memphis Commercial Appeal, p B2, October 7, 1995.

29. Garlington L. Neighbors of Depot push for answers. Memphis Commercial Appeal, p A14, October 25, 1995.

30. Charlier T. Depot's soil tested again for pollution. Memphis Commercial Appeal, p A11, January 9, 1996.

31. Charlier T. Tests detect dioxin risk potential in 2 city parks. Fishing may be banned in Audubon, Botanic garden. Memphis Commercial Appeal, p B1, January 19, 1996.

32. Patterson P. Eyeing defense depot future neighbors agree: first, clean it up. Memphis Commercial Appeal, p B1, September 23, 1996.

33. Elliot-Tenort D. Research on toxicity urged before city plans uses for depot land. Memphis Commercial Appeal, p CC7, January 1, 1998.

34. Charlier T. Survey targets concerns of depot neighbors. Memphis Commercial Appeal, p CC1. March 19, 1998.

35. Charlier T. Military residue from past is concern for today. Memphis Commercial Appeal, p B1, April 12, 1998.

36. Charlier T. WWII mustard gas pit to be dug up. Depot buried German bombs. Memphis Commercial Appeal, p A1, February 15, 1999.

37. Charlier T. WWII chemical agents will be removed from depot. Memphis Commercial Appeal, p B4, June 18, 1999.

38. Charlier T. Neighbors worry over depot drain-off. p A1, January 9, 2000.

39. Charlier T. Defense *Depot* pollution is topic. Memphis Commercial Appeal, p A14, February 24, 2000.

40. Campbell GH. Letter to C Jones (AEHA) about public concerns expressed at August 10, 1993 public availability session. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). October 25, 1993.

41. DLA. The Restoration Newsletter Defense Depot Memphis, Tennessee. Vol 1(1): 2. Memphis, TN: Defense Logistics Agency (DLA), Defense Distribution Depot Memphis. 1994.

42. Nelson-Wheeler S. Final Report: Defense Depot Community Environmental Health Educational Needs Assessment and Implementation Components. prepared for the National Association of City and County Health Officials (NACCHO) and Agency for Toxic Substances and Disease Registry (ATSDR). Memphis, TN: Memphis/Shelby County Health Department (MSCHD). December 14, 1998.

43. Jackson D. Trip Report: Site Visit, May 18-21, 1992; Defense Depot Memphis, Tennessee (40EC). Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). June 4, 1992.

44. Jackson D. Letter to D Bradshaw (DDMT-CCC) regarding answers to questions provided to J Kellam on June 26, 1996. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). July 18, 1996.

45. Kellam J. *Health Consultation Defense Distribution Depot, Memphis, Tennessee.* Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). April 18, 1996.

46. Ball A (Memphis Health Clinic) & Bradshaw D (DDMT-CCC). Letter to BJ Johnson (ATSDR) concerning Memphis Depot. Memphis, TN: April 18, 1997.

47. Grayson M. Trip report: USA Defense Depot Memphis, Tennessee June 19-20, 1997. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). July 7, 1997.

48. Grayson M. Trip report: USA Defense Depot Memphis, Tennessee August 20-21, 1997. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). August 26, 1997.

49. Grayson M. Trip report: USA Defense Depot Memphis, Tennessee August 28, 1997. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). September 3, 1997.

50. Grayson M. Trip report: USA Defense Depot Memphis, Tennessee September 23-24, 1997. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). October 2, 1997.

51. Sparrow B. Record of Activity: Tour of USA Defense Depot Memphis, Tennessee January 27, 1998. Nashville, TN: Tennessee Department of Health. February 3, 1998.

52. Grayson M. Trip report: Greater Memphis Environmental Justice Work Group, February 27, 1998. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). March 17, 1998.

53. Moore B. Trip report: Health concerns from September 20, 1996 meeting of Defense Environmental Response Task Force. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). October 3, 1996.

54. Crellin J. Trip report: Need for off-site sampling. USA Defense Depot Memphis, Tennessee April 24, 1998. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). May 4, 1998.

55. Grayson M, Coulberson S, Mahoney J, Williamson D, Conyers C, Crellin J, and Moore B. Trip report: Public availability sessions - USA Defense Depot Memphis, Tennessee May 28-30, 1998. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). June 17, 1998.

56. Crellin J. Site Visit to Memphis to attend Restoration Advisory Board (RAB) and BCT meetings, and evaluate surface water drainage. January 21, 1999. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). January 26, 1999.

57. Moore B. Site Visit to Memphis to attend Restoration Advisory Board (RAB), and evaluate surface water drainage. February 18-19, 1999. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). February 1999.

58. Crellin J. Site Visit to Memphis to attend Restoration Advisory Board (RAB) and evaluate surface water drainage. March 18-19, 1999. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). March 23, 1999.

59. Crellin J. Site Visit to Memphis to attend Restoration Advisory Board (RAB) and evaluate surface water drainage. April 15, 1999. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). April 20, 1999.

60. Videotape of July 27, 1998 public meeting with former DDMT workers at Bethel AME Church in Memphis, TN. Memphis, TN: Memphis Health Clinic.

61. Crellin J. Site Visit to Memphis to participate in July 8, 1999 public meeting. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). November 1, 1999.

62. Maloney J. Minutes of the March 30-31, 1999 Meeting of the Memphis Health Education and Promotion Subgroup, Memphis, TN. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). April 14, 1999.

63. Maloney J. Minutes of the April 19, 1999 Meeting of the Memphis Health Education and Promotion Subgroup, Memphis, TN. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). May 4, 1999.

64. Maloney J. Minutes of the May 11, 1999 Meeting of the Memphis Health Education and Promotion Subgroup, Memphis, TN. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). May 21, 1999.

65. Maloney J. Minutes of the August 24, 1999 Meeting of the Memphis Health Education and Promotion Subgroup, Memphis, TN. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR). August 24, 1999.

66. USASSDC. *Defense Distribution Depot Memphis, Tennessee Sediment Sampling Program - Sediment Sampling Analysis Report.* Huntsville, AL: U.S. Army Space and Strategic Defense Command (USASSDC). January 30, 1996.

67. ATSDR. *Public Health Assessment Guidance Manual.* Atlanta, Georgia: U.S. Department of Health and Human Services, Public Health Service. March 1992. Can be accessed at http://atsdr1.atsdr.cdc.gov:8080/HAC/HAGM/.

68. Office of the Post Engineer. Depot Layout - Memphis Army Service Forces Depot (11-22). Memphis, TN: Memphis Army Service Forces Depot, Memphis, Tennessee. October 12, 1944. *A copy of this map can be found on page 176.*

69. ATSDR. *Toxicological Profile for Polycyclic Aromatic Hydrocarbons (PAHs). Update.* Atlanta, Georgia: U.S. Department of Health and Human Services, Public Health Service. 1995.

70. EPA. *Hazardous Waste Treatment, Storage, and Disposal Facilities - Air emission Models.* Washington, DC: U.S. Environmental Protection Agency. November 1989.

71. MacKay I and Matsugu J. Evaporation rates of liquid hydrocarbon spills on land and water. Canadian J Chem Eng 51. August 1973.

72. Stiver H, Shiu H, and MacKay I. Evaporation times and rates of specific hydrocarbons in oil spills. Env Sci Tech 23(1). 1989.

73. Office of the Post Engineer. Storm drainage system - U.S. Army General Depot Memphis, Tennessee (11-17A). Memphis, TN: U.S. Army General Depot, Memphis Tennessee. November 1953.

74. Office of the Post Engineer. Storm drainage system - U.S. Army General Depot Memphis, Tennessee (11-17A). Memphis, TN: U.S. Army General Depot, Memphis Tennessee. June 24, 1960.

75. City of Memphis. Official City Map of Memphis, Tennessee. Memphis, TN: Executive Division - Department of Engineering. 1985.

76. Looney JW (MFD). Memorandum to JC Fleming (MFD) concerning an hazardous material incident at Defense Logistics Agency (DDMT). Memphis, TN: Memphis Fire Department (MFD). January 25, 1988.

77. Cooper DK (DDMT). E-mail to JR Crellin (ATSDR) providing information on 1988 Span Dome incident. Memphis, TN: Defense Depot Memphis, TN (DDMT). October 8, 1998.

78. Sittig M. *Handbook of Toxic and Hazardous Chemicals and Carcinogens. 2nd Edition.* Park Ridge, NJ: Noyes Publications. 1985.

79. CH2MHILL. *Generic RI/FS Workplan for Defense Depot Memphis, Tennessee.* Montgomery, AL: CH2MHILL. Prepared for U.S. Army Engineering and Support Center, Huntsville, AL. August 1995.

80. Charlier T. Some pollution down, but warnings on fish will stay up. Memphis Commercial Appeal, p B1, April 9, 1997.

81. Charlier T. City storm runoff unclean, tests find. Pollutants flow through rainwater. Memphis Commercial Appeal, p B1. May 31, 1998.

82. US Code 42/103: Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended. Subchapter I - Hazardous Substances Releases, Liability, Compensation. 9604(i)(6)(F).

83. Williams RC. Memorandum to DHAC Supervisors, Public Health Assessors, and Technical Project Officers. Interim guidance for when to use health outcome data in public health assessments. Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR), Division of Health Assessment and Consultation (DHAC). June 17, 1996.

84. Bashor B. Letter to Smith LJ (DDMT Restoration Advisory Board [RAB] Co-Chair) reporting cancer incidence for area around DDMT. Nashville, TN: Tennessee Department of Health. May 23, 1996.

85. ATSDR/DHS. *Health Consultation. Assessment of Cancer Incidence. USA Defense Depot Memphis, TN.* Atlanta, GA: Agency for Toxic Substances and Disease Registry (ATSDR), Division of Health Studies (DHS). August 16, 2000.

86. Davis AB. Shelby County Death Patterns. Memphis Commercial Appeal, p. B5. March 22, 1998.

87. ACS. What is Endometrial Cancer? Atlanta, Georgia: American Cancer Society. Cancer Information Database. http://www3.cancer.org/cancerinfo/main_cont.asp. 1999.

88. ATSDR. *Toxicological Profile for Arsenic. Update.* Atlanta, Georgia: U.S. Department of Health and Human Services, Public Health Service, TP-92/02. 1993.

89. ATSDR. *Toxicological Profile for Cadmium. Update.* Atlanta, Georgia: U.S. Department of Health and Human Services, Public Health Service, TP-92/06. 1993.

90. ATSDR. *Toxicological Profile for Lead. Update.* Atlanta, Georgia: U.S. Department of Health and Human Services, Public Health Service, TP-92/12. 1993.

91. Bailey C. Depot detoxifies dipping vat. Memphis Commercial Appeal, p B4, September 21, 1985.

92. Hogue CJR , Brewster M. Developmental risks: epidemiologic advances in health assessment. In (Gordis L, ed.) *Epidemiology and Health Assessment.* New York, NY: Oxford University Press. 1988. p 63-64.

93. DDMT RAB. Minutes of August 21, 1997, Restoration Advisory Board (RAB). Memphis, TN: Defense Depot Memphis, Tennessee (DDMT). August 1997.

94. DDMT RAB. Minutes of March 17, 1998, Restoration Advisory Board (RAB). Memphis, TN: Defense Depot Memphis, Tennessee (DDMT). April 1998.

95. DDMT RAB. Minutes of June 18, 1998, Restoration Advisory Board (RAB). Memphis, TN: Defense Depot Memphis, Tennessee (DDMT). July 1998.

96. Seed J, Brown RP, Olin SS, Foran JA. Chemical mixtures: current risk assessment methodologies and future directions. Reg Tox Pharmo 22: 76 - 94. 1995.

97. Groten JP, Schoen ED, van Bladeren PJ, Kuper CF, van Zorge JA, Feron VJ. Subacute toxicity of a mixture of nine chemicals in rats: Detecting interactive effects with a fractionated two-level factorial design. Fund Appl Toxicol 36: 15 - 29. 1997.

98. Bond JA, Leavens TL, Seaton MJ, Medinsky MA. Predicting the toxicity of chemical mixtures based on knowledge of individual components. CIIT Activities 17: 1 - 7. 1997.

99. Gaido, KW, McDonald DP, Korach KS, Safe SH. Estrogenic activity of chemical mixtures: Is there synergism? CIIT Activities 17: 1 - 12. 1997.

100. ATSDR. *Toxicological Profile for Chromium. Update.* Atlanta, Georgia: U.S. Department of Health and Human Services, Public Health Service, TP-92/08. 1993.

101. EPA. EPA Region III Risk-based Concentration Table - October 1998 Update. Philadelphia, Pennsylvania: U.S. Environmental Protection Agency (EPA) Region III. 1998. *Can be accessed at http://www.epa.gov/reg3hwmd/risk/riskmenu.htm.*

102. EPA. Integrated Risk Information System (IRIS) file on Toxicology Data Network (TOXNET). Bethesda, MD: National Library of Medicine (NLM). December 1998.

103. Hill RN. Current EPA perspectives on animal selection and extrapolation. in (Roloff MV et al, eds) *Human Risk Assessment. The Role of Animal Selection and Extrapolation.* London: Taylor and Francis. 1987.

104. Stallones RA. Epidemiology and Environmental Hazards. in (Gordis L and Libauer CH, eds) *Epidemiology and Human Risk Assessment.* Oxford: Oxford University Press. 1988.

105. Paustenbach DJ. A survey of health risk assessment. in (Paustenbach DJ, ed) *The Risk Assessment of Environmental Hazards. A Textbook of Case Studies.* New York: John Wiley and Sons. 1989.

106. ATSDR. *Toxicological Profile for Chlordane. Update.* Atlanta, Georgia: U.S. Department of Health and Human Services, Public Health Service, TP-93/03. 1994.

107. ATSDR. *Toxicological Profile for Aldrin/Dieldrin. Update.* Atlanta, Georgia: U.S. Department of Health and Human Services, Public Health Service, TP-92/01. 1993.

108. EPA. *Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons.* Washington, D.C.: U.S. Environmental Protection Agency (EPA). Office of Research and Development. EPA/600/R-93/089. 1993.

109. ATSDR. *Toxicological Profile for Beryllium. Update* Atlanta, Georgia: U.S. Department of Health and Human Services, Public Health Service, TP-92/04. 1993.

110. ATSDR. *Toxicological Profile for 4,4'-DDT, 4,4'-DDE, 4,4'-DDD Update.* Atlanta, Georgia: U.S. Department of Health and Human Services, Public Health Service, TP-93/05. 1994.

APPENDICES

Parameters Tested in the Screening Sites, 1989 and 1995-1998 Remedial, Background, and BRAC Sampling Programs[23]

1-methyl naphthalene
1-bromo-4-fluorobenzene
4-bromofluorobenzene
1,1-dichloroethane
1,1-dichloroethene
1,1,1-trichloroethane
1,1,2-trichloroethane
1,1,2,2-tetrachloroethane
1,2-dichloroethane
1,2-dichloropropane
1,2-dichloroethene (total)
1,2,3,4,6,7,8-heptachlorodibenzofuran
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin
1,2,3,4,7,8-hexachlorodibenzofuran
1,2,3,4,7,8,9-heptachlorodibenzofuran
1,2,3,6,7,8-hexachlorodibenzofuran
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin
1,2,3,7,8-pentachlorodibenzofuran
1,2,3,7,8-pentachlorodibenzo-p-dioxin
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin
1,2,3,7,8,9-hexachlorodibenzofuran
1,2,4-trichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
2-chlorophenol
2-fluorobiphenyl - ss
2-nitrophenol
2-butanone
2-nitroaniline
2-methylphenol
2-methyl naphthalene
2-hexanone
2-fluorophenol - ss
2-chloronaphthalene
2-chlorophenol
2,2'-oxybis(1-chloropropane)
2,3,4,6,7,8-hexachlorodibenzofuran
2,3,4,7,8-pentachlorodibenzofuran
2,3,7,8-tetrachlorodibenzofuran
2,3,7,8-tetrachlorodibenzo-p-dioxin
2,4-dimethylphenol
2,4-dinitrophenol
2,4 DB
2,4-dichlorophenol
2,4-dinitrotoluene
2,4-dichlorophenylacetic acid - ss
2,4-DP (dichloroprop)
2,4-D
2,4,5-T
2,4,5-trichlorophenol
2,4,6-tribromophenol - ss
2,6-dinitrotoluene
3-nitroaniline
3,3'-dichlorobenzidine
4-chloroaniline
4-bromophenyl-phenylether
4-nitroaniline
4-methylphenol
4-chlorophenyl-phenylether
4-chloro-3-methylphenol
4-chlorophenyl-phenylether
4-methyl-2-pentanone
4-nitrophenol
4,6-dinitro-2-methylphenol
acenaphthene
acenaphthylene
acetone
aldrin
alpha-chlordane

[23] This is a list of the substances tested for in any of the 4 recent environmental sampling programs at DDMT. The actual number of parameters tested in any one of the 4 programs varied from about 70 in the 1995 RI program to about 200 in the screening sites program.

alpha BHC
alpha endosulfan
aluminum
aluminum, dissolved
anthracene
antimony, dissolved
antimony
arsenic, dissolved
arsenic
barium, dissolved
barium
benzene
benzo(a)anthracene
benzo(a)pyrene
benzo(b)fluoranthene
benzo(g,h,i)perylene
benzo(k)fluoranthene
benzoic acid
benzyl butyl phthalate
benzyl alcohol
beryllium, dissolved
beryllium
beta endosulfan
beta BHC
bis(2-chloroethoxy)methane
bis(2-chloroethyl)ether
bis(2-ethylhexyl)phthalate
bromodichloromethane
bromofluorobenzene - SS
bromoform
bromomethane
butyl benzyl phthalate
cadmium
cadmium, dissolved
calcium
calcium, dissolved
carbon disulfide
carbon tetrachloride
chlordane
chlorobenzene
chloroethane
chloroform
chloromethane
chromium
chromium, dissolved
chrysene
cis-1,3-dichloropropene
cobalt
cobalt, dissolved
copper
copper, dissolved
dalapon
DDD
DDE
DDT
decachlorobiphenyl - ss
delta BHC
di-n-butyl phthalate
di-n-octylphthalate
dibenz(a,h)anthracene
dibenzofuran
dibromochloromethane
dibromofluoromethane
dicamba
dichloroprop
dieldrin
diethyl phthalate
dimethyl phthalate
dinoseb
endosulfan II
endosulfan sulfate
endosulfan I
endrin ketone
endrin aldehyde
endrin
ethyl benzene
fluoranthene
fluorene
fluoride, free
fluorobenzene
gamma BHC (lindane)
gamma-chlordane
heptachlor
heptachlor epoxide
hexachlorobenzene
hexachlorobutadiene

hexachlorocyclopentadiene
hexachloroethane
indeno(1,2,3-cd)pyrene
iron
iron, dissolved
isophorone
lead
lead, dissolved
magnesium
magnesium, dissolved
manganese
manganese, dissolved
MCPP
mercury
mercury, dissolved
methoxychlor
methyl isobutyl ketone
methyl ethyl ketone (2-butanone)
methylene chloride
n-nitrosodiphenylamine
n-nitroso-di-n-propylamine
naphthalene
nickel, dissolved
nickel
nitrobenzene
octachlorodibenzo-p-dioxin
octachlorodibenzofuran
PCB, total
PCB-1016 (arochlor 1016)
PCB-1221 (arochlor 1221)
PCB-1232 (arochlor 1232)
PCB-1242 (arochlor 1242)
PCB-1248 (arochlor 1248)
PCB-1254 (arochlor 1254)
PCB-1260 (arochlor 1260)
pentachlorophenol
petroleum hydrocarbons
pH
phenanthrene
phenol
potassium, dissolved
potassium
pyrene
selenium
selenium, dissolved
silver
silver, dissolved
silvex (2,4,5-TP)
sodium, dissolved
sodium
styrene
TCDD equivalence
terphenyl-d14
tert-butyl methyl ether
tetrachloro-m-xylene - ss
tetrachloroethylene (PCE)
thallium
thallium, dissolved
toluene
total PAHs
total xylenes
total fuel hydrocarbon, gasoline
total 1,2-dichloroethene
total organic carbon (soil/water)
toxaphene
trans-1,3-dichloropropene
trichloroethylene (TCE)
vanadium, dissolved
vanadium
zinc
zinc, dissolved

APPENDIX B - EXPLANATION OF EVALUATION PROCESS

In evaluating these data, ATSDR used comparison values to determine which chemicals to examine more closely. Comparison values are health-based thresholds below which no known or anticipated adverse human health effects occur. Comparison values can be based on cancer or non-cancer health effects. Non-cancer levels are based on the lowest (i.e., most toxic) valid toxicologic study for a chemical and the assumption that a small child (22 lbs.) is exposed every day. Cancer levels are the media concentrations at which there would be a one in a million excess cancer risk for an adult eating contaminated soil every day for 70 years. For chemicals for which both cancer and non-cancer numbers exist, the more toxic (i.e., lower) level is used. A description of the comparison values used in this evaluation can be found in Appendix C. Exceeding a comparison value does not mean that health effects will occur, just that more evaluation is needed.

Further evaluation focuses on identifying which chemicals and exposure situations are likely to be a health hazard. The first step is the calculation of child and adult exposure doses, as described in Appendix D. These are then compared with an appropriate health guideline for a chemical. An exposure dose is the amount of chemical ingested daily per unit of body weight. Health guidelines are the amount of chemical per unit of body weight where health effects very likely do not occur, based on investigations of human exposures to the chemical, or, if human data don't exist or are not valid, of animal experiments. Most health guidelines are based on animal data. The results of these calculations are presented in Tables D1 and D2 starting on page 71. Any exposure situation, where the exposure dose is lower than a health guideline, is eliminated from further evaluation.

The next step in the evaluation process is determining whether the worst case exposure situations used in earlier calculations need to be revised to better fit the actual situation. For example, both Dunn Field and the DDMT Main Facility have reportedly been fenced and guarded since the Depot opened. Except for the area near the 8 base housing units, small children could not have experienced health effects due to exposure to contaminants on-site because they could not enter the site. Thus, exposure situations involving small children (1-2 years old) were dropped from further evaluation except for those that include the base housing area on Main Facility. Likewise, exposure situations for adults on Dunn Field would assume that exposure is less frequent than for adults on the Main Facility because it appears that no one spent every work day on Dunn Field.

The last evaluation step is the comparison of these revised exposure doses with known toxicological values for the chemical of concern. This would include the no observed and lowest observed adverse health effects levels (NOAEL & LOAEL) identified in ATSDR Toxicological Profiles. If the chemical of concern is a carcinogen, the cancer risk is recalculated using the revised exposure dose. These comparisons are the basis for stating whether the exposure might be a health hazard.

APPENDIX C - EXPLANATION OF COMPARISON VALUES

Health Comparison Values

Health Comparison Values (CVs) are the contaminant concentrations found in a specific media (air, soil, or water) and used to select contaminants for further evaluation. The CVs used in this document are listed below.

Environmental Media Evaluation Guides (EMEGs) are estimated contaminant concentrations in a media where no chance exists for non-carcinogenic health effects to occur. The EMEG is derived from U.S. Agency for Toxic Substances and Disease Registry's (ATSDR) minimal risk level (MRL).

Remedial Media Evaluation Guides (RMEGs) are estimated contaminant concentrations in a media where no chance exists for non-carcinogenic health effects to occur. The RMEG is derived from U.S. Environmental Protection Agency's (EPA) reference dose (RfD).

Cancer Risk Evaluation Guides (CREGs) are estimated contaminant concentrations that would be expected to cause no more than one additional excess cancer in a million persons exposed over a lifetime. CREGs are calculated from EPA's cancer slope factors (CSF).

Risk-Based Concentrations (RBCs) are the estimated contaminant concentrations in which no chance exists for carcinogenic or noncarcinogenic health effects. The RBCs used in this public health assessment were derived using provisional reference doses or cancer slope factors calculated by toxicologists of EPA's Region III (101).

EPA Action Levels (EPA ALs) are the estimated contaminant concentrations in water of which additional evaluation is needed to determine whether action is required to eliminate or reduce exposure. Action levels can be based on mathematical models.

EPA Soil Screening Levels (EPA SSL) are estimated contaminant concentrations in soil at which additional evaluation is needed to determine if action is required to eliminate or reduce exposure.

APPENDIX D - CALCULATION OF ESTIMATED EXPOSURE DOSES

Calculation of Exposure Dose from Ingestion of Contaminated Soil

The exposure doses for ingestion of contaminated soil were calculated in the following manner. The maximum or mean concentration for a chemical in DDMT soil was multiplied by the soil ingestion rate for adults, 0.0001 Kg/day, or the rate for children, 0.0002 Kg/day. This product was divided by the average weight for an adult, 70 Kg (154 pounds), or for a small child, 10 Kg (22 pounds). For adults, we assumed that only DDMT workers could have been exposed. Thus, exposure could have occurred 5 times a week rather than 7, which resulted in the exposure dose being adjusted by a factor of 5/7ths (0.7). Exposure doses for children were calculated. However, it is unlikely that children, especially small children, could have been exposed except for that area around the eight units of Base Housing on eastern edge of the Main Facility. Regular exposure of children on the rest of the DDMT Main Facility and Dunn Field would not have occurred because they have always been fenced and guarded. Those calculations assume frequent daily exposure to soil contaminated at the specified level. The results of the actual calculations are recorded in Tables D1 - D2 on the following pages.

Calculation of Risk of Carcinogenic Effects

Carcinogenic risks from the ingestion of soil were calculated using the following procedure. The adult exposure doses for ingestion of soil were calculated as described previously, then multiplied by the EPA's Cancer Slope Factor (CSF) for that chemical (102). This result was multiplied by 0.4 because maximum exposure length of 30 years was assumed rather than the 70 years assumed for the CSF. This is because we concluded that only workers could be exposed. Results of the calculation of carcinogenic risk from exposure can be found on Tables D1 and D2 on the following pages.

The actual risk of cancer is probably lower than the calculated number. The method used to calculate EPA's Cancer Slope Factor assumes that high dose animal data can be used to estimate the risk for low dose exposures in humans (103). The method also assumes that there is no safe level for exposure (104). Little experimental evidence exists to confirm or refute those two assumptions. Lastly, the method computes the 95% upper bound for the risk, rather than the average risk, which results in there being a very good chance that the risk is actually lower, perhaps several orders of magnitude (105). One order of magnitude is 10 times greater or lower than the original number, two orders of magnitude are 100 times, and three orders are 1,000 times.

Table D1 - Estimated Exposure Doses and Cancer Risk for Dunn Field Soil Contaminants Compared to Health Guidelines for Ingestion[1]

Contaminant	Maximum Level in parts per million (ppm)	Estimated Child Exposure Doses in mg/kg/day*	Estimated Adult Exposure Doses in mg/kg/day*	Health Guideline in mg/kg/day*	Source of Guideline	Cancer Risk
Alpha-chlordane	1.5	0.00003	0.000002	0.0003	MRL[2]	1 in 1,000,000[3]
Arsenic	43.7	0.0009	0.00006	0.0003	MRL[2]	9 in 100,000[4]
Benzo(a)pyrene	68	0.001	0.00007	none	none	2 in 10,000[5]
Beryllium	1.3	0.00002	0.000002	0.002	RfD[6]	7 in 1,000,000[3]
Dieldrin	4.8	0.0001	0.000001	0.00005	MRL[2]	1 in 10,000[3]
Iron	36,400	0.7	0.05	0.1	EPA-PV[7]	not a carcinogen

* mg/kg/day = milligrams/kilogram/day

1 An explanation of how these exposure doses and cancer risk were calculated can be found in the preceding page. No health guidelines are available for iron, lead, benzo(a)anthracene, benzo(b)fluoranthene, indeno(1,2,3-c,d)pyrene, benzo(k)fluoranthene, and dibenz(a,h)anthracene.

2 MRL = ATSDR's minimal risk level. For more information on the MRL for arsenic or alpha- chlordane, see the arsenic or chlordane toxicological profiles.

3 Maximum additional lifetime risk of cancer per 1,000,000 individuals.

4 Maximum additional lifetime risk of cancer per 100,000 individuals.

5 Maximum additional lifetime risk of cancer per 10,000 individuals.

6 RfD = EPA's reference dose. For more information on the RfD for beryllium, see EPA's IRIS database.

7 EPA-PV = EPA's provisional reference dose for EPA region III risk-based concentration table. Go to http://www.epa.gov/reg3hwmd/risk/riskmenu.htm.

Table D2 - Estimated Exposure Doses and Cancer Risk for Soil Contaminants Compared to Health Guidelines for Ingestion[1,2]

Contaminant Level	Level in Parts per Million (ppm)	Estimated Child Exposure Doses in mg/kg/day*	Estimated Adult Exposure Doses in mg/kg/day*	Health Guideline in mg/kg/day*	Source of Guideline	Cancer Risk
Maximum Arsenic	84	0.002	0.0001	0.0003	MRL[2]	2 in 10,000[3]
Mean Arsenic	15.7	0.0003	0.00002	0.0003	MRL[2]	3 in 100,00[4]
Maximum Benzo(a)Pyrene	450	0.009	0.00007	none	none	5 in 1,000[5]
Mean Benzo(a)Pyrene	6.6	0.0001	0.000009	none	none	7 in 100,00[4]
Maximum Dieldrin	10	0.0002	0.00001	0.00005	MRL[2]	2 in 100,000[4]
Mean Dieldrin	0.5	0.00001	0.0000007	0.00005	MRL[2]	1 in 1,000,000[7]
Maximum DDT	59	0.001	0.00008	0.0005	RfD[6]	3 in 100,000[4]
Mean DDT	0.8	0.00002	0.0000008	0.0005	RfD[6]	0.4 in 1,000,000[7]
Maximum Iron	242,000	4.8	0.3	0.1	EPA-PV[8]	not a carcinogen
Mean Iron	23,409	0.5	0 03	0.1	EPA-PV[8]	not a carcinogen

- mg/kg/day = milligrams/kilogram/day
1. An explanation of how these exposure doses and cancer risk were calculated can be found in the preceding pages. No health guidelines are available for lead, benzo(a)anthracene, benzo(b)fluoranthene, indeno(1,2,3-c,d)pyrene, and dibenz(a,h)anthracene.
2. MRL = ATSDR's minimal risk level.
3. Maximum additional lifetime risk of cancer per 10,000 individuals.
4. Maximum additional lifetime risk of cancer per 100,000 individuals
5. Maximum additional lifetime risk of cancer per 1,000 individuals.
6. RfD = EPA's reference dose
7. Maximum additional lifetime risk of cancer per 1,000,000 individuals
8. EPA-PV = EPA's provisional reference dose for EPA region III risk-based concentration table. Go to http://www.epa.gov/reg3hwmd/risk/riskmenu.htm.

APPENDIX E - CONTAMINANT TABLES FOR THE DEFENSE DEPOT - MEMPHIS, TENNESSEE

Table E1 - Contaminants in Dunn Field Sediment above Comparison Value*

Contaminant	Range in Sediment in mg/kg[1]	Dunn Field Mean in mg/kg	DDMT Area Mean in mg/kg	Samples > DL[2]	Samples > CV[3]	CV in mg/kg	CV Source[4]
Arsenic	1.7 - 14.1	5.2	4.7	16/16	16/0	0.5/20	CREG/EMEG
Benzo(a)anthracene	0.07 - 5.4	0.9	0.9	16/16	5	0.9	EPA SSL
Benzo(a)pyrene	ND - 5.9	1.0	0.9	15/16	11	0.1	CREG
Benzo(b)fluoranthene	0.1 - 4 9	1.5	0.9	16/16	9	0.9	EPA SSL
Beryllium	ND - 1.2	0.8	0.2	12/16	12/0[5]	0.2/300[6]	CREG/RMEG
Dibenz(a,h)anthracene	ND - 0.5	0.2	0.8	9/16	8	0.09	EPA SSL
Dieldrin	ND - 0.3	0.07	0.008	14/16	9/0	0.04/3	CREG/EMEG
Indeno(1,2,3-c,d)pyrene	ND - 5.1	0.8	0.8	13/16	4	0.9	EPA SSL

* The source of these data is the 1990 RI (3), and the 1995, 1998, and 1999 sediment sampling data provided directly to ATSDR by DDMT
There is a legend for this table following Table E7.

Table E2 - Contaminants in Dunn Field Surface Water above Comparison Value *

Contaminant	Range in Water in mg/L *	Samples > DL[2]	Samples > CV[3]	CV in mg/L **	CV Source[4]
Arsenic	ND - 0.01	4/7	4/0	0.002/0.3	CREG/EMEG

* The source of these data is the 1990 RI (3), and the 1995, 1998, and 1999 sediment sampling data provided directly to ATSDR by DDMT
** These comparison values are multiplied by 100 because it is assumed that daily ingestion of surface water for a small child is 10 milliliters (ml) rather than the 1 liter (1,000 ml) used for drinking tap water
There is a legend for this table following Table E7.

Table E3 - Surface Soil Contaminants above a Comparison Value

Contaminant	Range in mg/kg[1]	Samples ≥ DL[2]	Samples ≥ CV[3]	CV in mg/kg	CV Source[4]
Alpha-chlordane	ND - 4	50/243	5/1[5]	0.5/3[6]	CREG/RMEG
Antimony	ND - 2,420	114/323	8	20	RMEG
Arsenic	ND - 101	352/361	351/70[5]	0.5/20[6]	CREG/EMEG
Barium	6 - 7,300	158/158	3	4000	RMEG
Benzo(a)anthracene	ND - 970	167/352	59	0.9	EPA SSL
Benzo(a)pyrene	ND - 450	164/349	121	0.1	CREG
Benzo(b)fluoranthene	ND - 540	174/359	59	0.9	EPA SSL
Benzo(k)fluoranthene	ND - 450	151/338	23	9	EPA SSL
Beta BHC	ND - 2.5	11/168	2	0.4	CREG
Bis(2-ethylhexyl) phthalate	ND - 250	45/110	1/0[5]	50/1,000[6]	CREG/RMEG
Cadmium	ND - 159	187/347	6	10	EMEG
Chlordane	ND - 1.2	9/66	1/0[5]	0.5/30[6]	CREG/EMEG
Chromium	5 - 16,200	370/370	17	300	RMEG
Chrysene	ND - 620	178/357	2	88	EPA SSL
Copper	ND - 28,500	370/372	2	3,100	HEAST
DDD	ND - 3.6	116/316	1	3	CREG
DDE	ND - 39	187/333	9	2	CREG
DDT	ND - 59	205/334	15/1[5]	2/30[6]	CREG/RMEG
Dibenz(a,h)anthracene	ND - 160	21/334	15	0.09	EPA SSL
Dieldrin	ND - 10	180/324	125/9[5]	0.04/3[6]	CREG/EMEG
Gamma-chlordane	ND - 4	60/310	7/0[5]	0.5/30[6]	CREG/EMEG
Heptachlor	ND - 1.1	3/159	1/0[5]	0.2/30[6]	CREG/RMEG
Heptachlor epoxide	ND - 0.3	4/161	2/0[5]	0.08/0.7[6]	CREG/EMEG
Indeno(1,2,3-c,d)pyrene	ND - 310	132/302	48	0.9	EPA SSL
Iron	1,360 - 242,000	108/108	18	23,000	HEAST
Lead	ND - 17,500	371/372	42	400	EPA SSL
PCB-1254 (Arochlor 1254)	ND - 10	2/114	1	1	RMEG
PCB-1260 (Arochlor 1260)	ND - 18	11/166	7	0.4	CREG
Thallium	ND - 42	3/222	1	5.5	HEAST
Zinc	9 - 28,200	378/378	3	20,000	EMEG

Table E4 - Contaminants in Sediment Samples above a Comparison Value

Contaminant	Range in mg/kg[1]	Samples > DL[2]	Samples > CV[3]	CV in mg/kg	CV Source[4]
Arsenic	ND - 14	25/37	25/0[5]	0.5/20[6]	CREG/EMEG
Antimony	ND - 56.7	4/37	1	20	RMEG
Benzo(a)anthracene	ND - 2.1	22/37	5	0.9	EPA SSL
Benzo(b)fluoranthene	ND - 2.3	24/37	5	0.9	EPA SSL
Benzo(k)fluoranthene	ND - 25	21/37	1	9	EPA SSL
Benzo(a)pyrene	ND - 2	24/37	18	0.1	CREG
Beryllium	ND - 0.6	31/39	19/0[5]	0.2/300[6]	CREG/RMEG
Cadmium	ND - 168	14/37	1	10	EMEG
Chromium	9 - 3,400	37/37	1	300	RMEG
DDT	ND - 2.9	16/37	1/0[5]	2/30[6]	CREG/RMEG
Dibenz(a,h)anthracene	ND - 0.3	4/37	2	0.09	EPA SSL
Gamma-chlordane	ND - 0.7	7/18	1/0[5]	0.5/30[6]	CREG/EMEG
Iron	ND - 49,300	19/29	1	23,000	HEAST
Lead	ND - 7,640	31/37	2	400	EPA SSL
Total polynuclear aromatic hydrocarbons	ND - 16.5	7/11	4	0.1	CREG*

* This is the CREG for benzo(a)pyrene

There is a legend for this table after Table E7.

Table E5 - Contaminants in Surface Water above a Comparison Value

Contaminant	Range in Water in mg/L[1]	Samples > DL[2]	Samples > CV[3]	CV in mg/L*	CV Source[4]
Arsenic	ND - 0.08	24/43	24/0[5]	0.002/0.3[6]	CREG/EMEG
Dieldrin	ND - 0.0004	18/51	2/0[5]	0.0002/0.05[6]	CREG/EMEG

* These comparison values are multiplied by 100 because it is assumed that daily ingestion of surface water for a small child is 10 milliliters (ml) rather than the 1 liter (1,000 ml) used for drinking tap water

The legend for this table follows Table E7.

Table E6 - Contaminants in Background Sediment above a Comparison Value

Contaminant	Range in Sediment (mg/kg)[1]	Samples > DL[2]	Samples > CV[3]	CV in mg/kg	CV Source[4]
Arsenic	ND - 11.1	18/22	18/0[5]	0.5/20[6]	CREG/EMEG
Beryllium	ND - 0.8	6/22	6/0[5]	0.2/300[6]	CREG/RMEG
Benzo(a)pyrene	ND - 2.5	7/22	3	0.1	CREG
Benzo(b)fluoranthene	ND - 2.6	7/22	2	0.9	EPA SSL
Benzo(a)anthracene	ND - 2.9	6/22	2	0.9	EPA SSL
Dibenz(a,h)anthracene	ND - 0.7	2/22	2	0.09	EPA SSL
Iron	3,330 - 30,700	22/22	1	23,000	HEAST
Indeno(1,2,3-c,d)pyrene	ND - 1.7	7/22	1	0.9	EPA SSL
Alpha-chlordane	ND - 2.4	5/22	1/0[5]	0.5/3[6]	CREG/RMEG
Gamma-chlordane	ND - 2	5/22	1/0[5]	0.5/30[6]	CREG/EMEG
Cadmium	ND - 38	4/22	1	10	EMEG
Heptachlor Epoxide	0.2	1/22	1/0[5]	0.08/0.7[6]	CREG/EMEG

The legend for this table can be found after Table E7.

Table E7 - Contaminants in Background Surface Water above a Comparison Value

Contaminant	Range in Surface Water (mg/L)[7]	Samples > DL[2]	Samples > CV[3]	CV in mg/L*	CV Source[4]
Arsenic	ND - 0.01	13/22	13/0[5]	0.002/0.3[6]	CREG/EMEG

* Comparison values for drinking water were multiplied by 100 because it was assumed that daily ingestion of surface water for a child was 10 ml rather than the 1,000 ml used for drinking tap water.
The legend for this table can be found after this table.

Footnotes for Tables E1 - E7

1 - mg/kg = milligrams of chemical per kilogram of soil. mg/kg = parts per million (ppm)
2 - DL = detection limit
3 - CV = comparison value. See Appendix C for an explanation of comparison values.
4 - These comparison values are described in Appendix C starting on page 68.
5 - The samples above a CREG are the first number and those above an EMEG or RMEG is the second.
6 - The first number is a CREG and the second is an EMEG or RMEG.
7 - mg/l = milligrams of chemical per liter of water.

APPENDIX F - TOXICOLOGICAL EVALUATION

This appendix is a detailed chemical-by-chemical evaluation of the possible health consequences of exposure to DDMT contaminants. These evaluations are summarized on pages 18 and 19.

Possible Health Consequences of Chemicals found on Dunn Field

When a sample concentration exceeded a CV, the maximum level of that chemical was used to calculate an exposure dose, which was then compared with an appropriate health guideline.

Soil Contaminants

Of the 12 chemicals in soil with concentrations above CVs, five - arsenic, alpha-chlordane, beryllium, dieldrin and iron, had health guidelines for non-carcinogenic health effects. There were health guidelines to identify cancer risk for arsenic, alpha-chlordane, benzo(a)pyrene, beryllium, and dieldrin (69,88,106,107,109). Table D1 on page 71 contains the results for these five chemicals. A qualitative evaluation of the possibility of health consequences was done for the seven chemicals (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene, iron, and lead) for which there were no health guidelines.

Arsenic

Health effects due to exposure to arsenic are not likely to occur. As indicated on Table D1, the adult exposure dose for the maximum concentration is lower than the health guideline for arsenic. The child exposure dose for the maximum level is greater than the health guideline. Additional evaluation indicates that health effects would be very unlikely because the exposure dose is about the same as the no observed adverse effects level for arsenic of 0.0008 mg/kg/day but is 15 times lower than the lowest observed adverse effects level of 0.014 mg/kg/day. In addition, regular exposure of young children to Dunn Field soil was and is extremely unlikely because Dunn Field has always been fenced, making access difficult. The risk of cancer due to exposure to arsenic is not significant even if workers were assumed to be exposed 5 days a week for 30 years.

Alpha-chlordane

Health effects due to alpha-chlordane are not likely to occur. As indicated on Table D1, the child and adult exposure doses for the maximum concentrations found in extensive sampling of Dunn Field are below the health guidelines for alpha-chlordane. The risk of cancer due to exposure to alpha-chlordane is not significant even if workers were assumed to be exposed 5 days a week for 30 years.

Beryllium

Health effects due to beryllium are not likely to occur. As indicated on Table D1, the child and adult exposure doses for the maximum concentrations found in extensive sampling of Dunn Field are below the health guidelines for beryllium. The risk of cancer due to exposure to beryllium is not significant even if workers were assumed to be exposed 5 days a week for 30 years.

Dieldrin

Health effects due to dieldrin are not likely to occur. As indicated on Table D1, the adult exposure dose for the maximum concentration is lower than the health guideline for dieldrin. The child exposure dose for the maximum level is greater than the health guideline. Additional evaluation indicates that health effects would be very unlikely because the exposure dose of 0.0001 is about 45 times lower than the no observed adverse effects level for dieldrin of 0.0045 mg/kg/day. The exposure dose is also 450 times lower than the lowest observed adverse effects level of 0.045 mg/kg/day. In addition, regular exposure of young children to Dunn Field soil was and is extremely unlikely because Dunn Field has always been fenced, making access difficult. The risk of cancer due to exposure to dieldrin is not significant even if workers were assumed to be exposed 5 days a week for 30 years.

PAHs

Six of the substances in Dunn Field soil found above comparison values are members of the chemical group, polycyclic aromatic hydrocarbons [PAHs] (69). These six are benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene. EPA's guidance for the quantitative risk assessment of PAHs was used to identify maximum cancer risk for the 6 PAHs (108). This was done because the other 5 PAHs do not have health guidelines. The additional maximum excess cancer risk for each of the six PAHs is moderate (about 1-2 in 10,000) if someone was exposed 5 days a week for 30 years. The cumulative maximum excess risk for same length of exposure to all six PAHs is elevated (1 in 1,000).

However, although cancer risk is elevated, the actual chance of anyone being harmed is very low or non-existent because regular long-term exposure of any individual was unlikely. This conclusion is based on that fact that all PAH concentrations above background from Dunn Field came from one location. The PAH levels at the other 65 locations were 8.2 PPM or lower and are within the PAH levels of 0.2 - 61 ppm typically found in urban soil (69). The one sampling location with elevated concentrations was an area where petroleum products, food, or other materials were burned (3). PAHs are produced when such materials are burned (69). This area contaminated with PAHs would be a problem only if someone regularly worked at that spot. This appears unlikely (3,5).

Iron

Health effects due to exposure to iron are not likely to occur. As indicated on Table D1, the adult exposure dose for the maximum concentration is lower than the health guideline for iron. While the child exposure dose for the maximum level is greater than the health guideline, regular exposure of young children to Dunn Field soil was and is extremely unlikely. This is because Dunn Field has always been fenced, making access difficult.

Lead

Health effects due to exposure to lead are not likely to occur because regular exposure of young children to Dunn Field soil was and is extremely unlikely. This is because Dunn Field has always been fenced, making access difficult. A review of the ATSDR Toxicological Profile for Lead indicates that none of the lead levels identified on Dunn Field are great enough to cause health effects in adults (90).

Sediment Contaminants

Health effects due to the contaminants in Dunn Field sediment are very unlikely, even if exposure was daily. Daily exposure to contaminated sediment appears unlikely. As indicated on Table E2, the average levels of arsenic, beryllium and PAHs from the 16 locations sampled are similar to the means identified in the background sampling of the DDMT area. In addition, the PAH concentrations are within the levels of 0.2 - 61 ppm typically found in urban soil (69).

The eight chemicals in Dunn Field sediment above comparison values were arsenic, beryllium, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, dieldrin, and indeno(1,2,3-c,d)pyrene. Of these eight, arsenic, beryllium, and dieldrin had health guidelines for non-carcinogenic health effects. The highest concentration for arsenic was 1.5 times lower than its health guideline, for beryllium it was 250 times lower, and for dieldrin it was 10 times lower (88,107,109).

Health guidelines exist to identify cancer risk for arsenic, benzo(a)pyrene, beryllium, and dieldrin (69,88,107,109). EPA's guidance for the quantitative risk assessment of PAHs was used to identify maximum cancer risk for the 5 PAHs (108). This was done because the other 4 PAHs do not have health guidelines. The risk of cancer from daily exposure to Dunn Field sediment is not significant as it ranged from 3 in 100,000 for arsenic to 6 in 1,000,000 for benzo(a)pyrene. Daily exposure has and is not occurring because no one worked on Dunn Field on a regular basis and because children could not access the area because it is fenced.

Possible Health Consequences of Chemicals found on DDMT Main Facility

When a sample concentration exceeded a CV, the maximum level of that chemical was used to calculate an exposure dose, which was then compared was an appropriate health guideline.

Soil Contaminants

Of the top 10 chemicals in soil with concentrations above CVs, four (arsenic, beryllium, dieldrin, and DDT) had health guidelines for non-carcinogenic health effects. Health guidelines exist to identify cancer risk for arsenic, benzo(a)pyrene, beryllium, dieldrin, and DDT (69,88,109,110). Table E2 on page 72 contains the results for these 5 chemicals for adult exposure doses. Exposure doses for small children were also calculated because they could have been exposed if they lived in the base housing which is located near the southeast corner of the Main Facility. Access of small children living around the DDMT Main Facility to on-site contaminants appears very unlikely because the Main Facility is and, reportedly, has always been fenced. A qualitative evaluation of the possibility of health consequences was done for the 5 chemicals [benzo(a)anthracene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene, and lead] for which no health guidelines exists.

Arsenic

Health effects due to arsenic in on-site soil samples are not likely to occur. The adult exposure doses for the maximum (84 ppm) and mean (15.7 ppm) arsenic concentrations are below the health guideline for non-carcinogenic health effects. The child exposure dose for the maximum arsenic level was above the arsenic health guideline, and for the mean level was below. In Figure G1, the 30 locations are identified where arsenic concentrations are above 20 ppm. Concentrations above 20 ppm result in a child exposure dose that exceeds the health guideline if exposure were all day every day. However, none of these locations appear close enough to base housing for small children to be regularly exposed. The cancer risk for the maximum arsenic level is low and not elevated for the mean level.

Dieldrin

Health effects due to dieldrin in on-site soil samples are not likely to occur. The adult exposure doses for the maximum and mean dieldrin concentrations are below the health guideline for non-carcinogenic health effects. The child exposure dose for the maximum dieldrin level was above its health guideline, and for the mean level, it was below. In Figure G2, the 9 locations are identified where the dieldrin concentration is above 3 ppm. Above 3 ppm results in exceeding the child comparison value if exposure is all day every day. Only one location appears close enough to base housing for daily exposure to be likely. However, the dieldrin level at that spot (5.5 ppm) does not represent a public health hazard. The exposure dose for this level (0.0001 mg/kg/day) is 45 times lower than the no observed adverse health effects level [NOAEL] and 450 times lower than the lowest observed adverse health effects

level [LOAEL] seen in the lowest valid animal study (107). No valid human investigation has been done. The cancer risk for the maximum and mean levels is not elevated.

DDT

Health effects due to DDT in on-site soil samples are not likely to occur. The locations were DDT was sampled for are identified on Figure G3. The adult exposure doses for the maximum and mean DDT concentrations are below the health guideline for non-carcinogenic health effects. The child exposure dose for the maximum DDT level of 59 ppm was above its health guideline, but not any other concentration. However, this DDT level does not represent a public health hazard. The exposure dose for this level (0.001 mg/kg/day) is 50 times lower than the NOAEL and 250 times lower than the LOAEL seen in the lowest valid animal study (110). No valid human investigation has been done. The cancer risk for the maximum and mean levels is not elevated.

Iron

Health effects due to exposure to iron are not likely to occur. While, as indicated on Table D2, the adult exposure dose for the maximum concentration is higher than the health guideline for iron, it above the guideline at only two of the 108 locations sampled. It is unlikely that workers would have sufficient contact with the soil at either of these two locations to ingest enough soil to result in harm. In addition, even if there was sufficient contact, the concentrations do not appear high enough to result in health effects given the wide margin of safety between the health guideline and where health effects actually appear to occur.

Health effects due to exposure to iron by small children are unlikely due to the lack of opportunity for exposure. Child exposure doses for the maximum and mean levels are greater than the health guideline. However, regular exposure of young children to soil was and is extremely unlikely because the Main Facility has always been fenced, making access difficult.

Lead

A review of the ATSDR Toxicological Profile for Lead indicates that daily exposure to lead at the locations identified on Figure G4 where lead levels were above 400 ppm, could be a health hazard for children less than 6 years old (90). However, small children probably could not have had enough exposure to result in health effects because none of the locations with lead levels greater than 400 ppm are near the base housing units. Base housing appears to be the only location where small children could regularly contact soil on DDMT. All but 2 of the locations with lead concentrations above 400 ppm are located on the west or north side of DDMT. The 2 locations on the same side of the facility (east) as base housing are about 600 feet away. A child under 6 could not likely travel to these two locations frequently enough to result in harm.

PAHs

Five of the top 10 substances found above comparison values are members of the chemical group, polycyclic aromatic hydrocarbons [PAHs] (69). These 5 are benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene. EPA's guidance for the quantitative risk assessment of PAHs wasused to identify maximum cancer risk for the 5 PAHs (108). This was done because the other 4 PAHs do not have health guidelines. The additional maximum excess cancer risk for each of the 5 PAHs was low (1 in 10,000) to elevated (5 in 1,000) for the maximum levels but was not elevated for the mean levels if someone were exposed 5 days a week for 30 years. The cumulative additional excess risk for exposure to the maximum concentrations of all 5 PAHs is elevated (7 in 1,000).

However, further evaluation of this exposure situation and the carcinogenicity of PAHs indicates that it is unlikely that anyone was harmed by exposure to PAHs at DDMT. Regarding the exposure situation, the elevated PAH levels are focused around the west side of Building 629, the south side of Building 249 and between Buildings 689 and 690. However, as displayed on Figure G5, the nine locations with levels above 10 ppm near Buildings 249, 629, 689, and 690 are surrounded by 61 sampling locations with much lower levels including many non-detects. The mean level for these 61 locations is about 1 ppm which represents a maximum excess cancer risk from long-time exposure of 1 in 100,000. This lower risk is probably more representative of what a worker might experience if he or she had direct daily contact (e.g., touched or dug in the dirt) with the contaminated soil.

However, it appears that few, if any, workers had direct contact with the contaminated soil based on descriptions of the operations that took place in these buildings and the make-up of the areas around the buildings. The work operations at these buildings took place inside the buildings (11). This means that most of a worker's contact with the contaminated soil would be walking over it, not working in it. In addition, it appears that workers would have little opportunity to actually contact contaminated soil even when they were outside. Nearly all the areas around these buildings were either covered with asphalt or gravel (11).

Besides the lack of sufficient exposure to PAH-contaminated soil, the uncertainty about whether exposure to PAHs in soil would actually result in cancer in humans further supports the conclusion that it is unlikely that anyone was harmed by PAHs at DDMT. Coal tars, which have PAHs as their major constituent, are identified as human carcinogens by the U.S. Public Health Service, EPA, and other agencies (69). However, the evidence on coal tars being carcinogenic indicates that cancer is caused through long-term contact with skin and not through ingestion or other routes of exposure. Animal studies support this observation. Since the possible exposures at DDMT were ingestion of PAH-contaminated soil, it is unlikely that these exposures, even if they did occur, could have resulted in cancer.

Risk of cancer does not appear to be elevated for the rest of the DDMT Main Facility because PAH concentrations are considerably lower (see Figure G6). In addition, the PAH levels found at most of the rest of the Main Facility sampling locations are within the PAH levels of 0.2 - 61 ppm typically found in urban soil (69).

Sediment

The 15 chemicals in on-site sediment samples with concentrations above a CV (Table E4), do not currently present a public health hazard. These 15 are arsenic, antimony, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, beryllium, cadmium, chromium, dibenz(a,h)anthracene, DDT, gamma-chlordane, iron, lead, and total polynuclear aromatic hydrocarbons (PAHs). All the samples with concentrations above CVs, except for gamma-chlordane, were taken from Lake Danielson or the golf course pond. Figures G7 and G8 (pages 93 and 94) display the contaminant levels for arsenic and dieldrin. The sampling locations for the other 13 contaminants are the same as for these 2 chemicals.

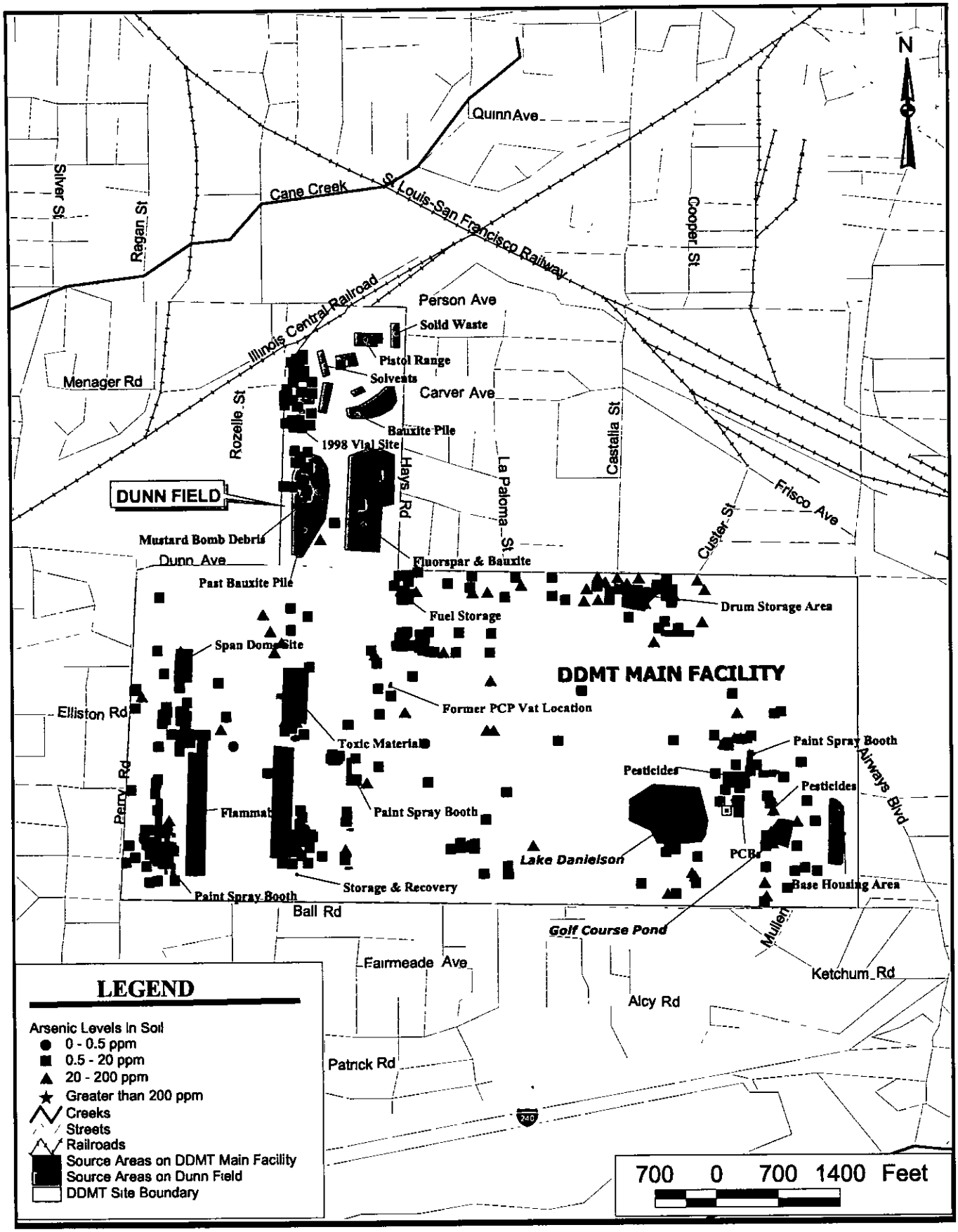
It is not plausible that anyone could have been exposed on a regular basis to the sediments in the lake or pond as they would have to ingest the sediment. Indirect exposure to sediment contaminants through ingestion of fish from Lake Danielson or the golf course pond may have occurred before 1986 when fishing was banned because elevated levels of DDT, dieldrin, chlordane, and chlorpyrifos were found in sediment and fish tissue samples (3). The single sample of gamma-chlordane above the CV was found in the drainage for the western side of the Main Facility. For anyone to have regular exposure to sediment from any of these locations does not appear to be plausible because there appears to have been no facility operations at these locations (50).

Surface Water

The chemicals in the on-site surface water samples with concentrations above CVs (Table E5), do not present public health hazards because the risk of cancer and other effects is not significant. Two chemicals, arsenic and dieldrin, were above CVs (Figures G9 & G10). The maximum levels of arsenic and dieldrin are well below the noncarcinogenic health effects comparison values and the additional lifetime cancer risk from exposure to them is not significant (2 in 1,000,000 to 4 in 100,000).

APPENDIX G - CONTAMINANT MAPS

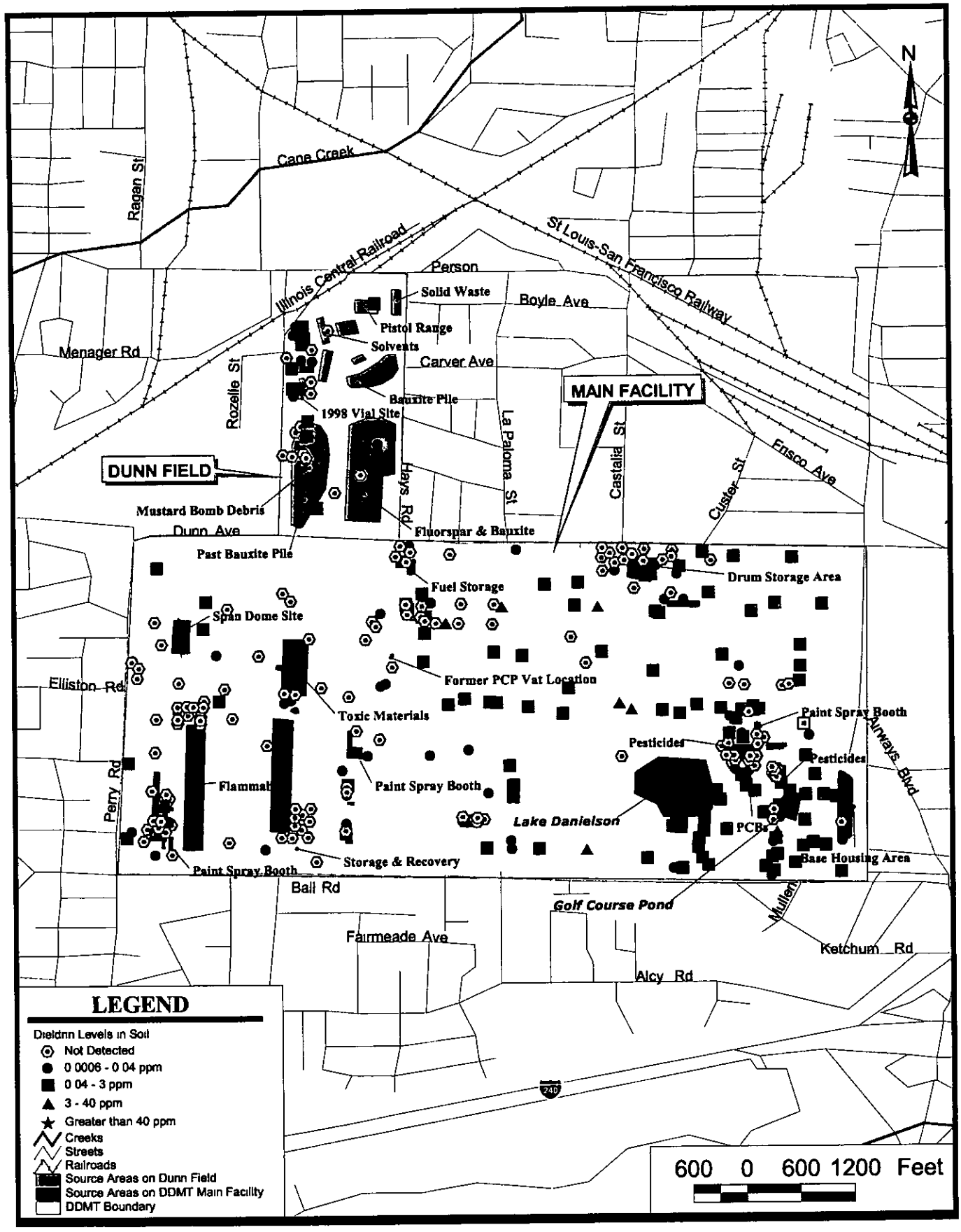
Note: The 10 maps in this appendix display the sampling locations and concentrations for the top contaminants at DDMT. These were arsenic, benzo(a)pyrene, dieldrin, DDT, lead, and PAHs in soil; arsenic and benzo(a)pyrene in sediment; and arsenic and dieldrin in surface water. The concentration ranges displayed on these maps are based on the comparison values for each contaminant. The contaminant data displayed on these maps came from electronic files provided by DDMT through the Corps of Engineers and their contractor, CH2MHILL. The latitudes and longitudes for nearly all the sampling locations were also provided electronically to ATSDR by CH2MHILL. Some sampling locations for the 1990 RI were estimated by ATSDR using Figure 2-1 in the 1990 RI (3). The streets, creeks, and railroads displayed on the maps in this appendix come from the TIGER files generated by the U.S. Census Bureau. The locations of the open drainage ditches and the DDMT site boundaries were estimated by ATSDR using Figure 3-1 from 1990 RI and Drawings 1 & 2 from the 1995 Generic RI/FS Workplan (3,79).



DDMT Public Health Assessment

FIGURE G1 - ARSENIC IN SOIL

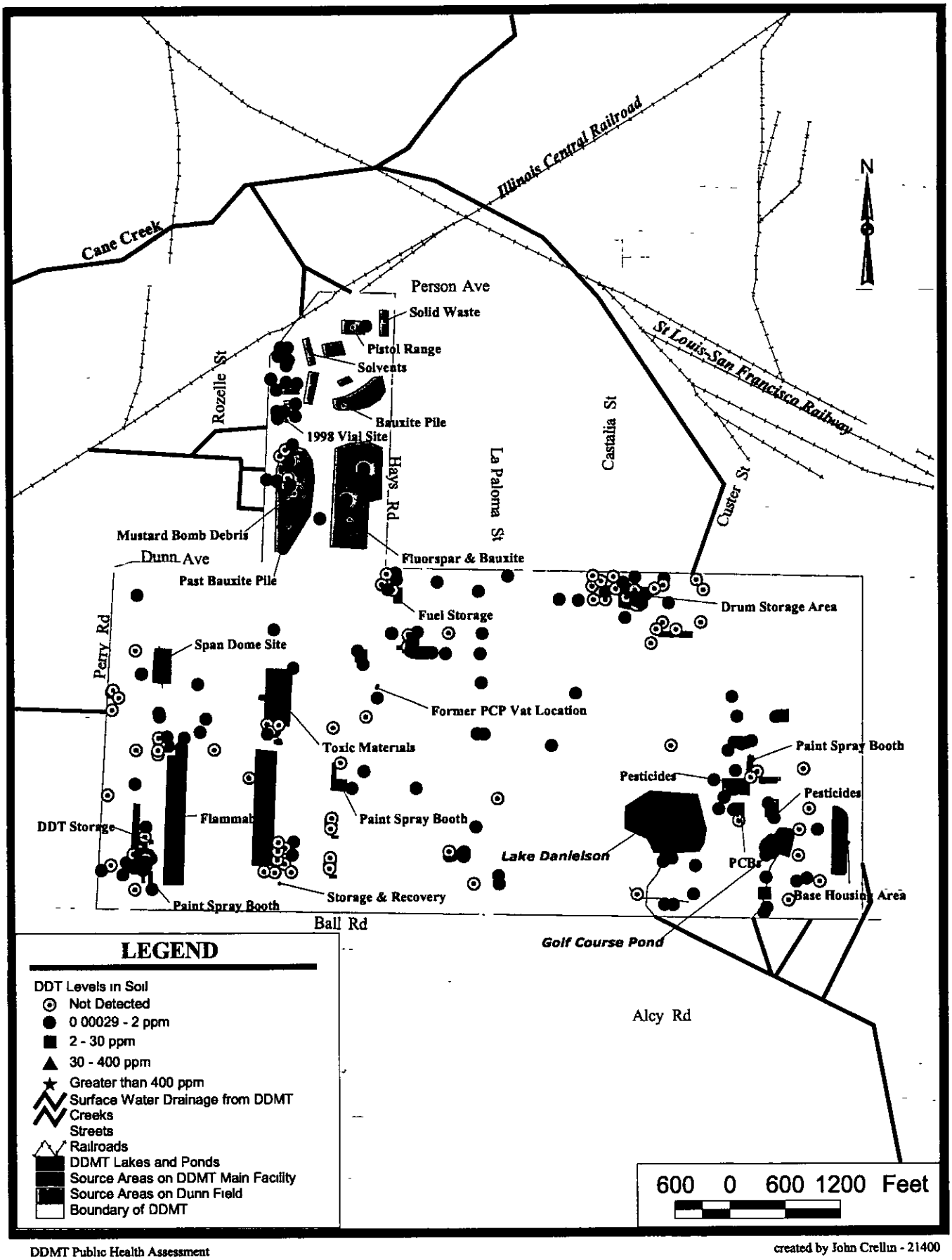
created by jrc - 4999



DDMT Public Health Assessment

FIGURE G2 - DIELDRIN IN SOIL

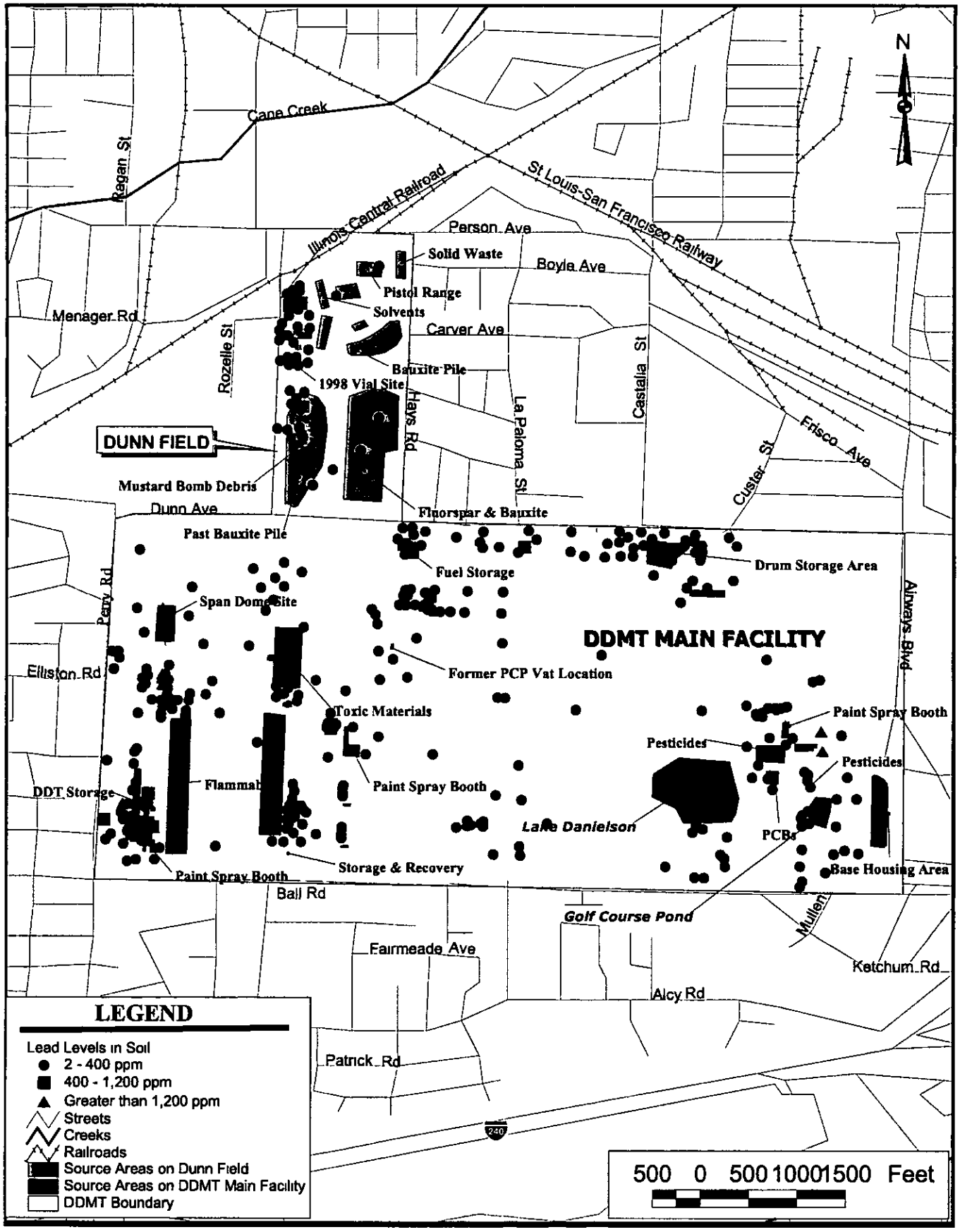
created by jrc - 4999



DDMT Public Health Assessment

created by John Crellin - 21400

FIGURE G3 - DDT LEVELS IN SOIL



DDMT Public Health Assessment

FIGURE G4 - LEAD IN SOIL

prepared by jrc - 41099

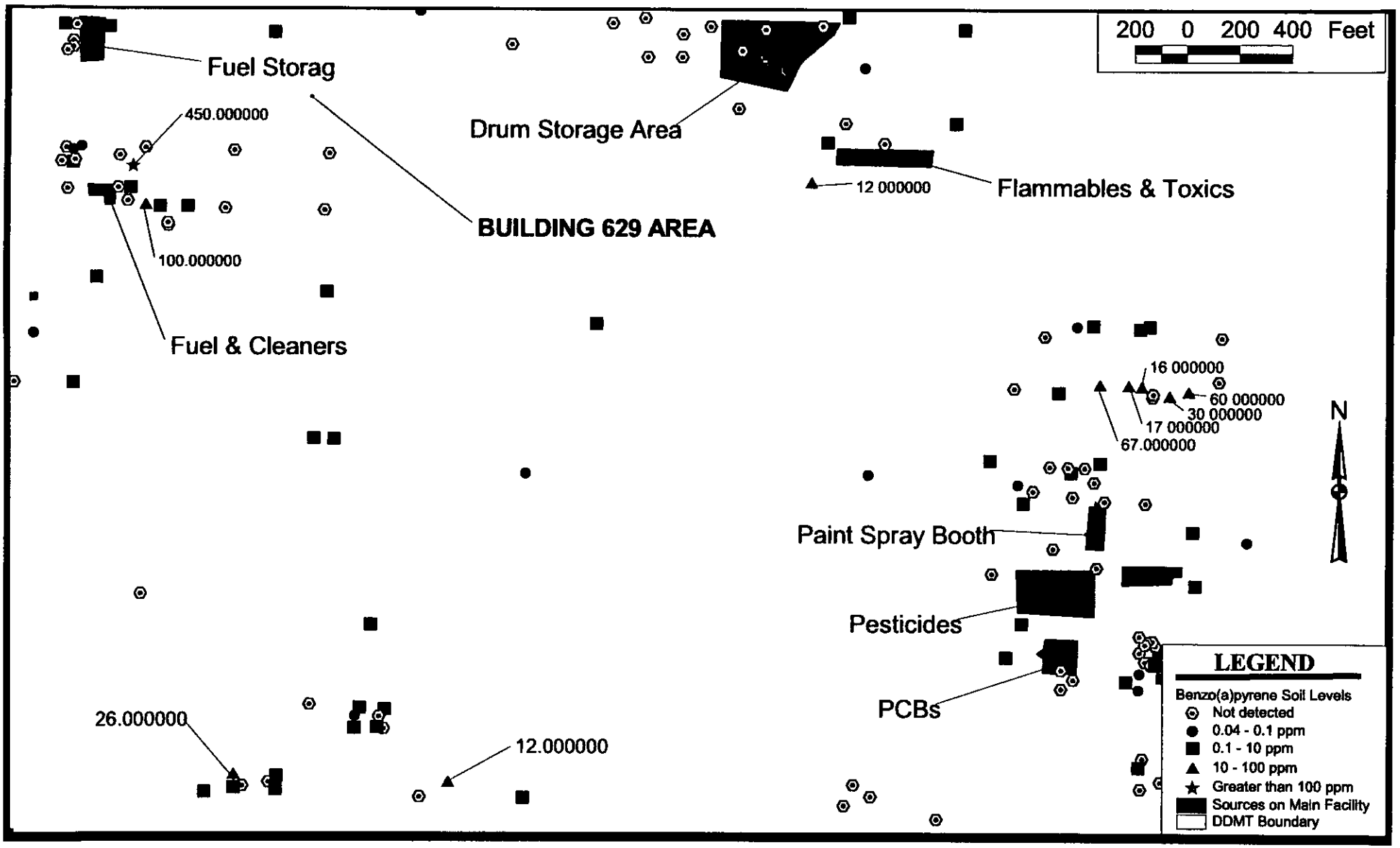
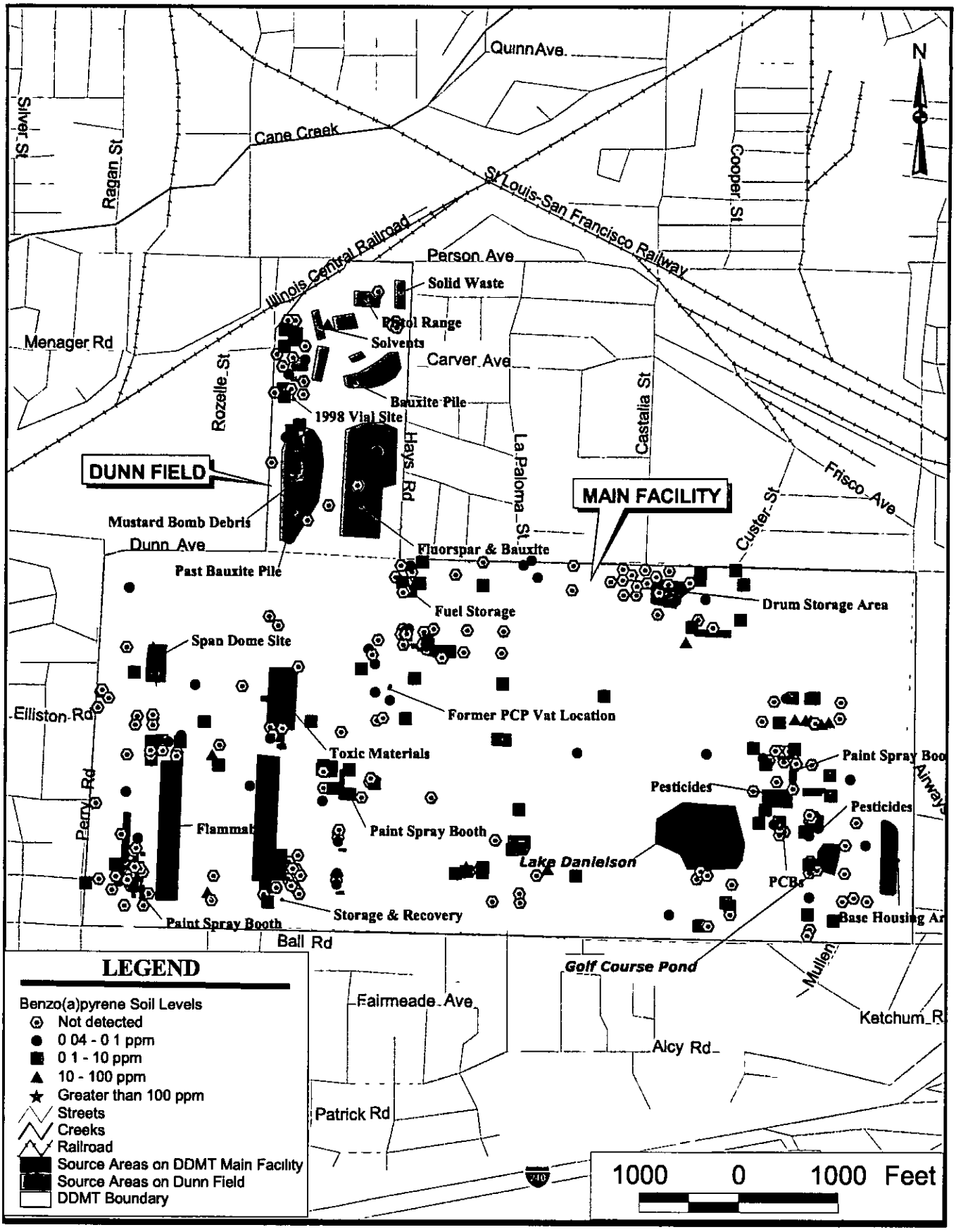


Figure G5 - Benzo(a)pyrene Levels and Possible Worker Exposures



DDMT Public Health Assessment

FIGURE G6 - BENZO(a)PYRENE IN SOIL

prepared by jrc - 41299

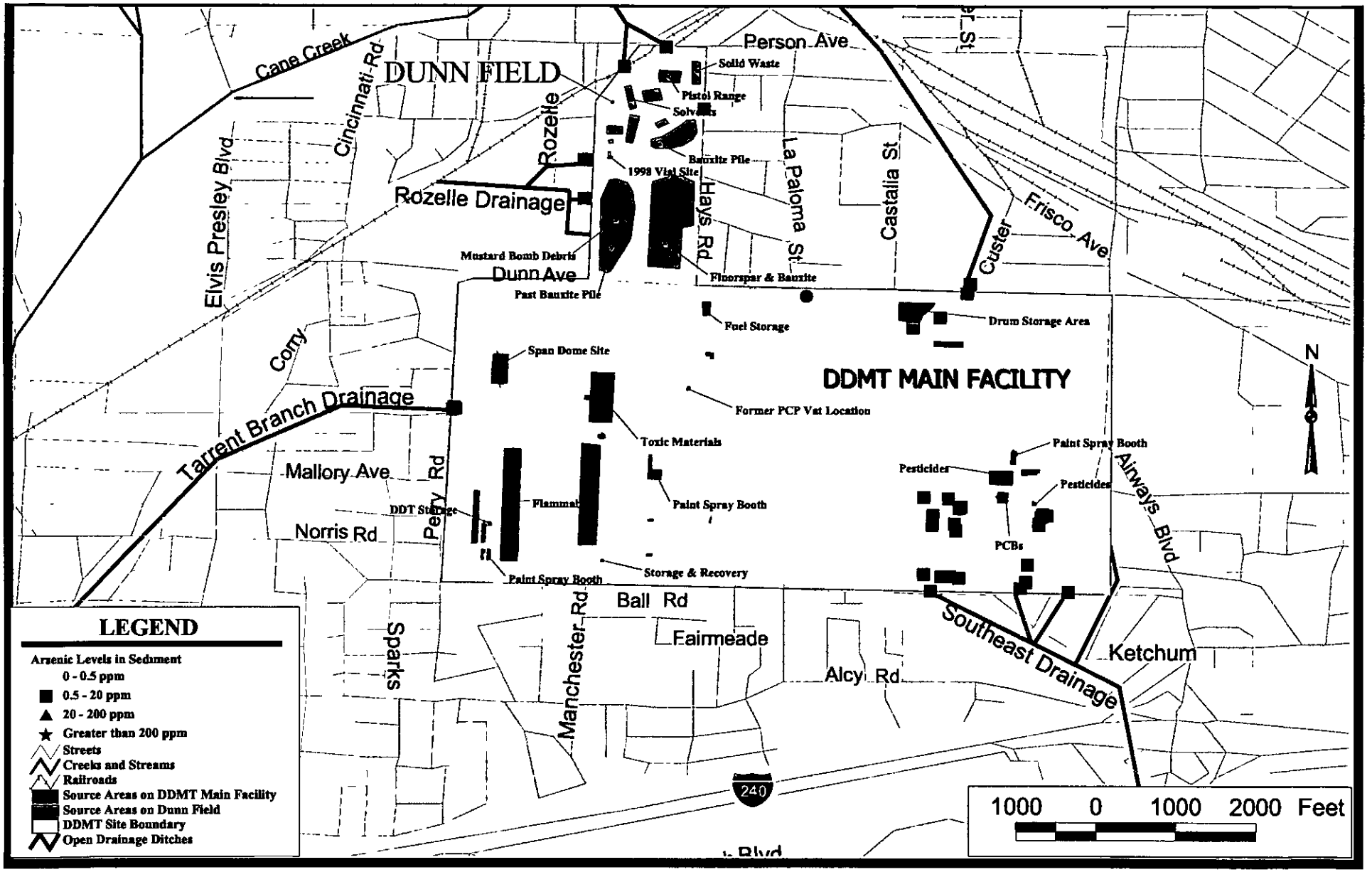


FIGURE G7 - ARSENIC SEDIMENT LEVELS ON THE MEMPHIS DEPOT

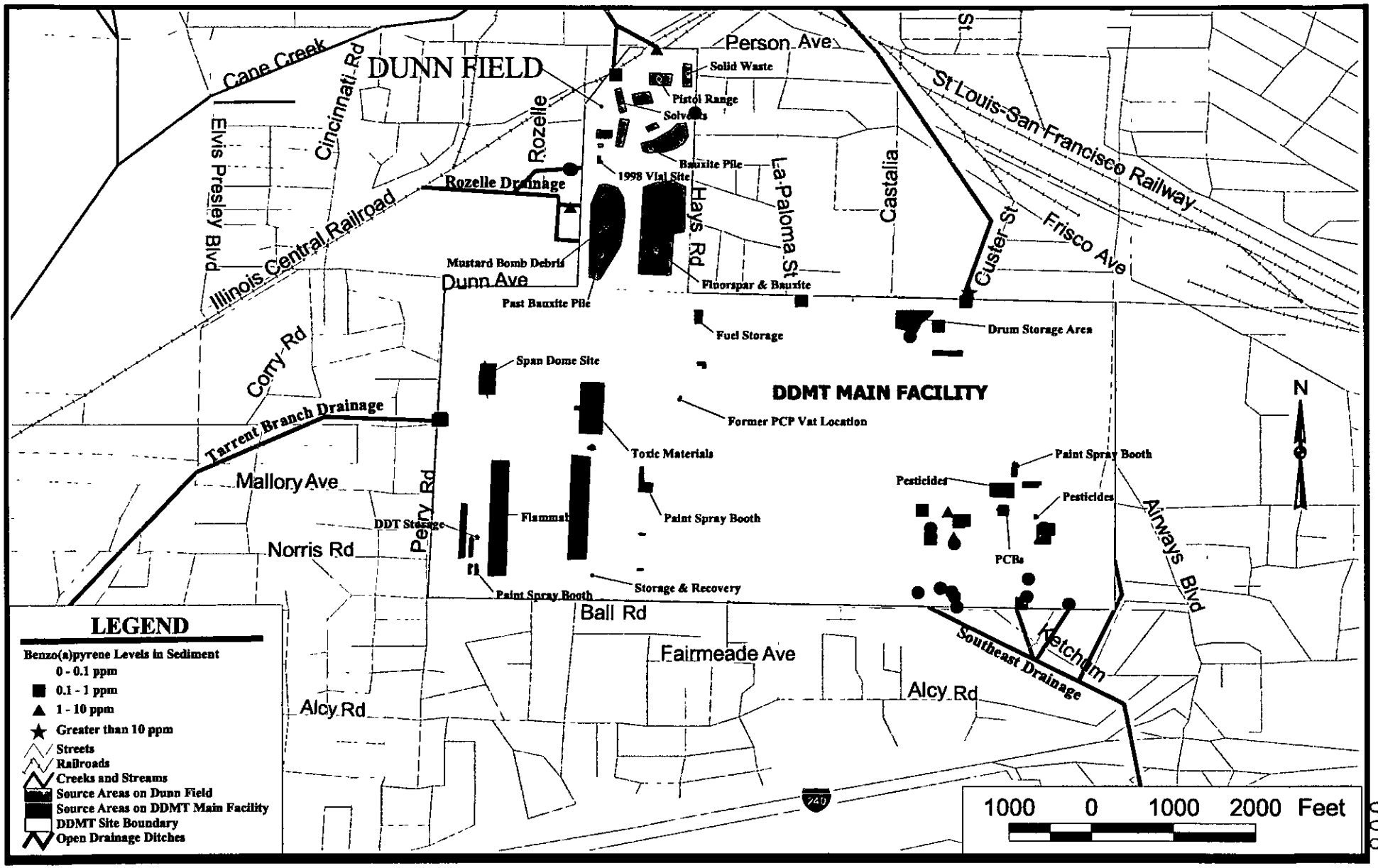
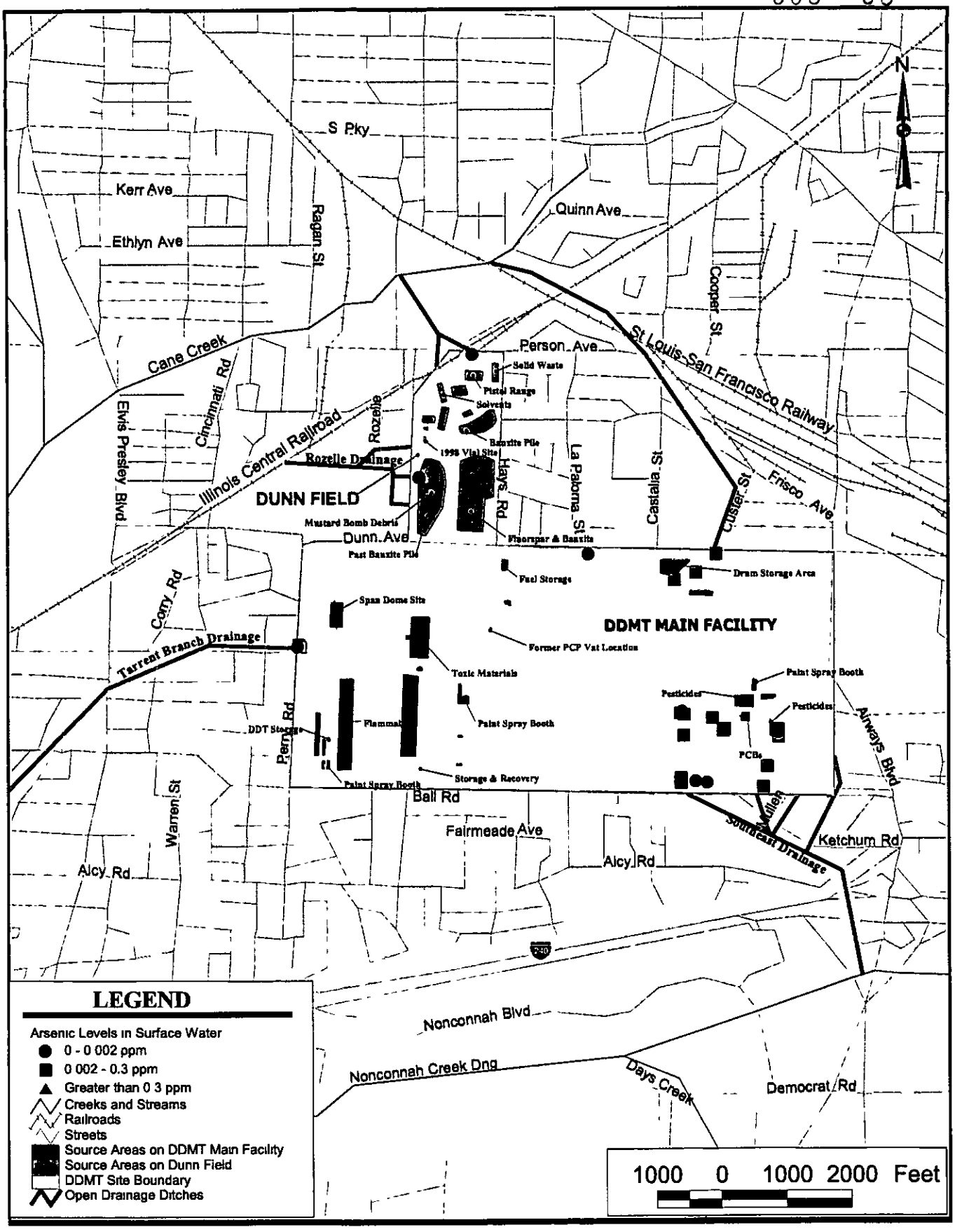


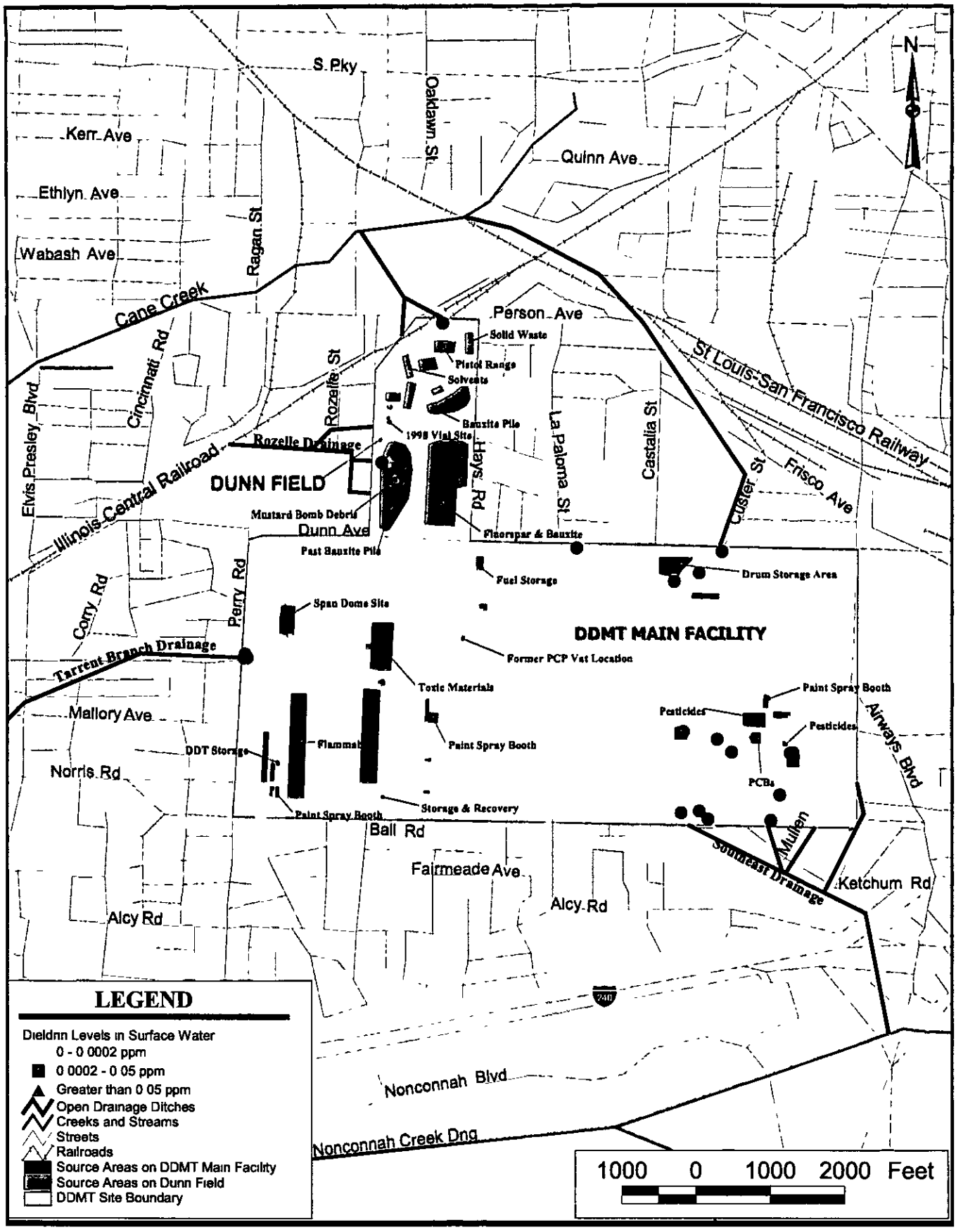
FIGURE G8 - BENZO(a)PYRENE SEDIMENT LEVELS ON THE MEMPHIS DEPOT



DDMT PUBLIC HEALTH ASSESSMENT

FIGURE G9 - ARSENIC IN SURFACE WATER

prepared by jrc - 10499



DDMT PUBLIC HEALTH ASSESSMENT

FIGURE G10 - DIELDRIN IN SURFACE WATER

prepared by jrc - 10199

APPENDIX H - ANALYSIS OF SURFACE WATER PATHWAY

Evaluation of Surface Water Drainage around DDMT[24]

(1) Water on the southeast side of the Main Facility flows through concrete-lined ditches to four discharge points near the southeast corner [56]. The water then flows into 4 shallow unlined ditches off-site. These ditches eventually combine and discharge into Nonconnah Creek to the west of the airport. One of these 4 ditches flows through a neighborhood (Muller Road) between Ball and Ketchum Roads [58]. ATSDR staff have observed children playing in this ditch [57].

(2) On the westside of the Main Facility, water flows through pipes and ditches to a discharge point midway between the north and south ends of the Main Facility [56]. This water flows west through the neighborhood west of DDMT in the Tarrent Branch, which is now a lined ditch but earlier was a natural intermittent stream. This branch eventually runs into Nonconnah Creek near the junction of I-240 and I-55.

As displayed on Figure 5, drainage plans for DDMT from 1953 and 1960 identify a second open ditch coming off the west side of DDMT between Tarrent Branch and Dunn Avenue (74,73). This ditch was not displayed on a 1982 map, so it appears that sometime between 1960 and 1982, the on-site drainage was altered so that the water that once left the site in this ditch, was rerouted to Tarrent Branch (7).

(3) Drainage from all of Dunn Field, except the northeast corner, flows to the west side of Dunn Field and exits at three points [56]. Water at the northern most of these points flows in a shallow unlined ditch through that portion of Rozelle Street to the west of Dunn Field. This ditch then discharges into a lined ditch that runs east and west at the south end of this isolated segment of Rozelle Street. This lined ditch also receives the water from several industrial discharge points before it runs by the end of Rozelle Street.

After leaving the Rozelle area, this ditch goes into a pipe, then goes under the Illinois Central railroad line, and then goes northwest [58]. This pipe discharges into Cane Creek between Hamilton High and the Elvis Presley Blvd. Bridge, just downstream from the high school. Therefore, water from the Dunn Field/Rozelle area apparently does not currently flow under Hamilton High. However, long-term residents indicate that an open ditch used to carry water from Dunn Field to Cane Creek so people living in this area could have had contact with water from Dunn Field.

(4) Water from the northeast corner of Dunn Field drains into 2 lined ditches that cross Dunn Field [56]. These ditches drain at least some of the neighborhood south of Person and Hayes. These 2 ditches join before leaving Dunn Field. Another discharge point drains the north end of Dunn Field (Figure 5). These 3 ditches run into Cane Creek north of the Ragan

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[24] See Figure 5 on page 25 for a visual depiction of these areas.

Street Bridge and upstream of Hamilton High School. Thus, water from the northeast corner of Dunn Field does flow under Hamilton High School.

(5) Water from the northern side of the Main Facility moves off-site in a lined ditch at Dunn and Custer Streets or in storm sewers [3,56]. The ditch at Dunn and Custer switches from a lined ditch to a pipe and back to a lined ditch before flowing into a large-lined ditch that runs southeast to northwest to the northeast of the Main Facility [56]. This large ditch flows into Cane Creek to the north of the Ragan Street Bridge [3]. The storm sewers appear to flow directly into Nonconnah Creek [3]. Thus, some of the water from the northern side of the DDMT Main Facility does flow under Hamilton High School, but the rest goes directly to Nonconnah Creek.

(6) Water from the central east portion of the Main Facility, which is the area around the DDMT Administration Building, leaves the site in storm sewers which appear to discharge into Nonconnah Creek [3,5]. Thus, water from around the administration building does not flow under Hamilton High School.

APPENDIX I - PUBLIC COMMENTS

Public Comments and Responses

The Memphis Defense Depot Public Health Assessment (PHA) was available for public review and comment at 4 locations in Memphis, Tennessee. These were the Cherokee Branch (3300 Sharpe Avenue) and Main Branch (1850 Peabody) of the Memphis/Shelby County Public Library, the Memphis/Shelby County Health Department (814 Jefferson Avenue), and Memphis Depot (2163 Airways Boulevard) from December 27, 1999 to March 31, 2000. The public comment period was announced in local newspapers and through a notice send to over 4,500 residents around the Memphis Depot. The notice indicated that a copy of the PHA could be obtained by calling a toll-free number.

The PHA was sent to over 100 individuals or agencies including representatives of all the neighborhood organizations in the DDMT area including DDMT-CCC, all the members of the DDMT Restoration Advisory Board (RAB), and over 30 area residents not associated with any organization. Documents were also sent to 9 local, state, or federal elected officials; the Congress of National Black Churches; and Howard University. The following local, state, or federal agencies were given copies: Memphis Shelby County Health Department, the Tennessee Departments of Environmental Conservation and Health, National Center for Health Statistics (NCHS), U.S. Environmental Protection Agency (EPA), DDMT, Defense Logistics Agency (DLA), and Department of Defense (DOD).

Sixty-five comments on the PHA were received verbally in 2 meetings at the South Memphis Senior Center, 1620 Marjorie in Memphis on February 24, 2000. Comments were also receiving in writing from one private citizen (1), Howard University (15 comments), the Depot Redevelopment Corporation of Memphis and Shelby County [DRC] (4 comments), the Tennessee Department of Environment and Conservation [TDEC] (8 comments) and the Department of Defense [DOD](94 comments). The 170+ comments received and ATSDR's responses to them are described in the following pages. The comments from the public can be found on pages 102 to 148, Howard University on pages 149 to 153, DRC on pages 154 to 155, TDEC on pages 156 to 158, and DOD on pages 159 to 192.

Comments on Working Draft of Final Release of Memphis Depot Public Health Assessement

In late September 2000, the working draft of the Final Release of Memphis Depot Public Health Assessment was distributed to those individuals or agencies who commented on the public comment release of the public health assessment (PHA), attended the February meetings at which the Agency for Toxic Substances and Disease Registry (ATSDR) received public comments on the PHA, or who had a long time involvement with the site. Comments were received only from the Department of Defense. These 13 comments and ATSDR's responses can be found on pages 192 to 195.

Comments Received During Two Public Meetings On February 24, 2000

The comments in this section were received during two public meetings at the South Memphis Senior Center on February 24, 2000. A court reporter transcribed the comments word for word. The transcripts of these two meetings were edited for this document to focus on the actual comments on the Public Health Assessment. The names of those making comments have been deleted from this document. In editing the comments, some text has added to facilitate the understanding of the comment. These additions are indicated by *italics*.

During the afternoon meeting, there was the opportunity to provide responses to the comments during the meeting. At least a partial response was given during the meeting. These responses were transcribed and are presented here. Editorial additions to or explanations about comments are indicated in *italics*. Places where text from the original transcript was deleted are identified by a series of periods like this .... At the evening meeting on February 24, 2000, there was only an limited opportunity for responding to comments because many of the participants choose to leave once they had given their comments. The responses given during this meeting are presented in regular type and the responses written after the meeting are in *italics*.

Copies of the full transcripts of these meetings are available by contacting John Crellin at 1-888-42-ATSDR (1-888-422-8737), 404-639-0635, or JCrellin@cdc.gov. You can write him at ATSDR/DHAC; 1600 Clifton Road; Mail Stop E32; Atlanta, GA 30333.

Comments from the 1 - 3 PM Session on February 24, 2000

1) I am an ex-employee at the Defense Depot. There were several times that warehouses were exposed to the soil and the dirt accumulated over a period of years and it was never disturbed until the last five years when all of the material was being moved. Now, if a person was working in this environment where this dirt had sat and accumulated for a period of 25 or 30 years and then now they are in there for about maybe three years moving this material, is there a possibility, since this dirt has accumulated for so long, that they can reach some kind of contamination?

RESPONSE

> I didn't have data that would directly address your question. I would need to know what was on that specific stock that was shipped to be able to address your concern and tell you what possible health problems could have been from those levels. And clearly, ... those levels could have been higher than what we found in the soil outside....*As discussed starting on page 82, the known concentrations of*

contaminants in soil on the DDMT Main Facility and Dunn Field were not great enough, given the known exposures, to have resulted in health effects.

2) I understand that according to the best science available, it only goes back to 1989. ..... Now, you've got people that worked over there, bought their homes, raised their families. Is there any kind of way to send a survey out to them concerning maybe the amount of cancer incidence in their family that can be responded to and incorporated into in this study? ..... it would be an effort to show people in the neighborhood that you are trying to give them an opportunity to have a voice in this survey.

RESPONSE

...We basically need contaminant data *to evaluate whether people could be exposed to site contaminants and whether that exposure could result in health effects...* That's why I say *that* before 1989, we can't *make any conclusions whether site contaminants could have caused harm.* We need contaminant type of information to be able to make that -- look at pathways and see contaminants in the pathway and be able to trace it back to the Depot...

3) In reference to the survey *mentioned by the last speaker*, I would like to have incorporated in the document the title and the location of that survey. I have been looking for that survey. I'm not aware that the *Memphis/Shelby County* Health Department ever completed the survey. I request that I be provided a copy of this survey. *Another participant indicated he would like to receive a copy of this survey.*

RESPONSE

...I will see that you get a copy of it. It was provided to me, and I will provide it to you or anybody else that wants to look at it. The thing about this document is ... *that* it is essentially a survey of attitudes. It's not a survey of specific health concerns. It basically was asking people, "Are you concerned about the site, are you not concerned about the site, are you getting enough information about the site, do you know enough, do you need to know more." ... *The purpose of the survey was basically to* aid the Health Department in designing a program to better inform people who lived in the area. ***These participants were provided copies of this survey on March 16, 2000.***

4) ...I have looked at the survey *(the speaker was referring to the public health assessment)* in detail, and this is one of the -- I guess I am going with *an earlier speaker* on this, and it's a legitimate and valid problem with the whole study, especially as it concerns *the* cancer incidence *review referenced in the public health assessment.* You are going from '90 to '96, and this does not include the years from, what -- when did *the Depot* start, '40 or '42. So, in

essence if you are using a sample between '90 and '96 and excluding all the preceding years, this in essence is not a legitimate or a valid study.

RESPONSE

> ... There's a separate document that will be coming out shortly that looks specifically in detail at the cancer incidence data and I showed you-all the area that data was from -- that we looked at -- we looked at all of the available data, cancer incidence data that was available, and that was only from 1990 to 1996.... It doesn't give ....the Depot a clean bill of health. And frankly, it doesn't really apply to the Depot or any exposure. All it does is say that cancer for this time period for this specific area ... does not appear to be excessive but it doesn't address ... *whether* there could be an excess of ... cancer ... along Elliston or other specific locations.... Because *the data available to us had as evaluated a population of* ... 30,000 people *and not any smallest population groups*, it may not *have not been possible to* pick up ... specific clusters. I *will revise the public health assessment* ... to make that clearer ....***The public health assessment was revised to address this concern. Go to page 32 to see the revised section.***

5) I represent the Defense Logistics Agency who operates the Depot. We have received copies of the documents during the same period of time as the rest of the public. We are reviewing them. Like a lot of the public, we appreciate the extension on the comment period date because we would like to provide comments to the Agency for Toxic Substances and Disease Registry...

RESPONSE

> Thanks!

6) Since there seems to be a concern about this document, why was there not any extra documents made available so when people come through the door, they can be given a copy as they walk in. And I would like to see this document made more readily available to those people sacrificing their time to come to these public meetings because I believe repositories are nice and libraries are nice and somebody would come up here to see a slide show, it would be nice if they had a document to follow up with the slide show.... But I would like if you have any extra documents that you brought from Atlanta to just be distributed to these people today if they care to have one, so that when they come, they will leave with something rather than having to go to the repository or library or anywhere else. In the future, I would like to have some of these documents. If cost is prohibitive, just stop me now.

RESPONSE

(Response given to meeting participants) All you have to do is put a star by your name or say you would like a copy on the attendee list and we will mail you out one in a couple of days. The reason why we didn't bring a bunch of copies is basically ... that we didn't know how many people were going to show up. *The copies that ATSDR staff had with them were passed out to meeting participants.*

... *A*n invitation to this meeting *went* to over 4500 people and *in it* ... people *were notified* that the document was available for comment... *T*here was a toll free number in *that invitation* ... for them to request *a copy*. ....*O*nly 11 requests *were* received for *the* document. .... Also, ... *if* you have questions or comments after the meeting is over, ... you *can contact us* ... using *the* toll free number *(1-888-422-8737)* to contact us.

7) ...If you have questions that you feel need to be addressed by them formally, you probably do need to get that on the record and -- am I clear on this, that if it's asked after this *meeting* is over with, it will not be addressed formally*?*

RESPONSE

*We will try to provide a response today to any question asked or comments made during this meeting. T*he official response *to all questions or comments made today or any received before the comment period ends on March 31, 2000* will come when we make our official response to it. I will respond today the best I can, but in the ATSDR, as any bureaucracy, we go through a *review* process *where the response becomes that of the agency and not any single individual's opinion. .... W*hen the next version *of* this document comes out, it ... will have *ATSDR's* responses to the comments.... The document will be changed based on what you say.

8) I *have* lived *right by the Tarrent Branch drainage* .... that runs the water from the Defense Depot for about 35 years. And sometimes it would just float in my yard. Could I have been exposed? *Also I have lupus. Could that have been caused by contaminants from the Depot?*

RESPONSE

Part of the problem *regarding your question about exposure* is we don't know what the levels were onsite ... *when your yard was being floated,* nor do we know what they were offsite..... We can *say* -- based on the levels that we know about, basically 1989 on, *that the levels were/are* .... not high enough to cause you harm. *However,* ... I don't know what took place 35 years ago and especially when -- before the ditches were lined and the fence was there. Obviously if it flowed into your yard or

whatever, we don't know what the levels were or how high or whether they could have caused you harm.

Regarding ... Lupus, ... the scientific data is kind of shaky over whether *chemicals can cause* it .... I will be frank about it, that I know personally, and I have looked into this personally because my wife has Lupus.

9) *(This is the same individual as in comment 8)* But I just know that everybody that lived on Elliston, one out of the family has died with cancer, all up and down from Perry back to Bellevue. There's one person or two out of their family is dead, had cancer. I do know that.

RESPONSE

.... our goal in the health assessment is to look at data about the site, you know, the contaminant data and see if that connects back to whether or not those levels can cause harm. The problem with your concerns is that ... if we can't connect the site to *a concern about excess cancer like you have reported,* basically our process *and our responsibility as an agency ends.* Your concern is one that ... is more appropriately addressed by the State Health Department and the County Health Department... *ATSDR along with several area residents has talked with the Tennessee Department of Health (TDH) about the issue of excess cancer in the area around the Memphis Depot. TDH is currently evaluated whether anything can be done to investigate concerns as reported in this comment.*

... Unfortunately, ... one out of every three people will have cancer sometime in their life. Most of that occurs when people are 55 or older. .... So they need to look at that specifically and see whether what you observed over the time period that you are speaking of is actually in excess ....

10) *(This is the same commenter as in #s 8 & 9.)* Well, actually my daughter first came down with *Lupus* and then I *got* it. Could we have been exposed to something from it coming over there, because they would turn that water loose and it would just float in my yard a lot of the time.

RESPONSE

Again, the evidence on Lupus *as far as whether any chemical can cause it* is not particularly good.... Mostly with Lupus they don't know what causes it. It's something that is much more common in women than it is in men. It is something that is more common in African-Americans than it is in whites.... We don't know why that is occurring. Also it tends to occur in people in their 30's and it's much less common ... in people that are older than that. That's *about* all we know about it. Unfortunately, there's a lot more unknown than known.

11) *This commenter related this quote from the last paragraph of page 20 of the public health assessment.* "Exposure pathways analyses indicate that limited exposure to site contaminants may have occurred through water-borne transport to two areas other than the Rozelle neighborhood. These areas are 1) south of the southeast corner of the Main Facility to the yards on either side of Tarrent Branch, which flows from the west edge of the Main Facility. The number of individuals in these residential areas around the DDMT that could have been exposed is between 500 and 3,000 people." Is there any kind of way to send a survey to them, because the science is not in on these people yet, and incorporate everybody else into that survey?

RESPONSE

> ... Our agency is driven by exposure *which* is the reason *why* in the document we *are* proposing to do an exposure investigation where we actually go out and sample the soil... What we are proposing on doing *in the* Tarrent Branch *area* .... is *to* sample the soil right around the ditch just offsite.... If we found... levels of health concern in those samples, then additional sampling would be done *by us or more likely by EPA or DDMT*.... once we started identifying the extent of contamination... then we *would* start doing surveys, health studies, *or related investigations that would identify possible site-related health effects.*

12) I live on Mallory and have been there 37 years.... Is the only kind of disease you can have from this chemical is cancer?

RESPONSE

> No. The different chemicals that are onsite can cause a wide variety of things if you were exposed to them....

13) *(This is the same individual as in #12)* What about a rash, a rash, just break out, you know, you itch a lot. What about that?

RESPONSE

> It depends on which chemical. Some of them that were on the site -- I would have to look back and get a list of them or whatever -- may cause ... rashes. Usually with rashes you have to be exposed to quite a bit, either you get it on your skin or you would have had to have ingested it.... With some chemicals, if you ingest quite a bit into your body, you become sensitized to it and then just getting a little bit on your skin can cause you to break out in rashes. Again, usually you have to start out with high exposure.... The levels that ... *have been* found on the site, even if you worked there, wouldn't be high enough .. to cause rashes.

14) On page 35 *of the public health assessment it is stated that* contaminants buried on Dunn Field have polluted the Fluvial aquifer under and to the west and the north tip of Dunn Field. *It is also that stated that* a small portion of the shallow aquifer under the Main Facility *is contaminated....* Could you tell us the pattern and the depth of this contamination; like is it flowing north, south or east or west ...?

RESPONSE

> I *will* have to research *this issue* and *will* put it in ... *the next version of the public health assessment. Information on the groundwater contamination on and near the Main Facility has been added to the discussion of the groundwater exposure pathway on page 28. An in-depth discussion of this issue can be found in Sections 32 - 35 of Volume II of the* Final Memphis Depot Main Installation Remedial Investigation Report *which is available from the Depot* (11).

15) *(This is the same commenter as for #14)* So my other question, the contaminated plumes, *both near Dunn Field and the Main Facility,* and the pathways to these ditches, there's no possible way that they are connected?

RESPONSE

> Geologists tell me that the answer is most likely no... *It is* very unlikely that *the contaminants in the groundwater* could have gotten ... into the ditches. The thing about it, even if it *is* get*ting* into the ditches ..., the concentrations ... are so low, ... *there would not be* enough contamination to *result in health effects....* If that same level ... *is* coming up inside the house and your house is built pretty tight, ... the concentrations ... could potentially build up inside the house to a level where it may be a health concern.... That's why we want *to do flux* sampling *in the Rozelle area to* see if *this process is* occurring at all .....

16) One follow-up question. On page 35, you said, "This aquifer provides 95 percent of the drinking water. However, a clear potential exists for the contaminants to move down to the Memphis Sand some time in the future." Have the geologists decided how long that would be in the future?

RESPONSE

> ...I'll need to do research on that ... *and will* provide *an* update later when I revise this document. *I was not able to identify a specific estimate of when contaminants from DDMT might reach the Allen Well Field. Most of the debate appears to be focused on whether the contaminants might ever reach the Allen Well Field not when. If it operates as designed, the groundwater treatment system that was recently installed at the northwest end of Dunn Field should greatly reduce or eliminate the flow of*

contaminants and perhaps resolve this issue. Sources for additional information are the Final Memphis Depot Main Installation Remedial Investigation Report and the Remedial Investigation Report for Dunn Field that will be released in the relatively near future (11).

17) All right. This is my last question. As you know, we all have water pipes coming into our home serving water to us. The contaminated plume and the runoff in the ditches, is there any chance ... for those chemicals to saturate *those water pipes and get into our drinking water* ...?

RESPONSE

It's my understanding ... that, ... because the water comes to your house is under pressure, that even if the contamination happened to be up around those pipes or whatever, that if a leak developed in those pipes because the water in your pipes is under pressure, it's going to leak out and *the contaminants are* not going to leak in....

Comments from the 7 - 9 PM Session on February 24, 2000

18) *Commenter 1: The individual comments are numbered and responded to by that number.*
① I am a member of the Restoration Advisory Board. I am also here tonight as a private citizen from the community. I want to first tell you that I respect you, Dr. Crellin. Beyond that, I want to say that your ATSDR Public Health Assessment is a sham. It is based on a pack of lies, inaccurate information, it doesn't appear that anybody has reached to try to find the truth to report to the community what is needed. I am ashamed of you for trying to put this over on us. I don't understand why you continually try to not hear what we are saying. If you want to find out about the instance of cancer in the area, you got to knock on some doors. Don't go to the Public Health Department of the city of Memphis and pull some old data, fluff it up and try to pass it off as being accurate.

② Even that information is inaccurate. I am just going to read a few pages here. I do acknowledge that you say you want our comments. But what I would like you to acknowledge is our comments. You got several photos in here of pictures or maps of the Dunn Field location. I notice what is missing on every one -- there's an absence of a drainage inlet at the foot of Boyle Street as it intersects Hayes. I don't know how you got that. If you drove a bus, and you drove it down Boyle and crossed Hayes, you are going through a drainage ditch ... If you get in your car and drive around Boyle towards Hayes and keep going, before you hit the defense depot, you are going to go into the drainage ditch.

Based on that alone, this entire study is a waste of government money and again another sham. Nothing about this is real. And if it is just something to appease the people, the people are not appeased.

③ Forgive me if -- don't take it personally. I am just telling you the truth. And then you acknowledge that employees who worked in some of the buildings may have been exposed to carcinogens or dangerous chemicals while working on the main installation.

④ You say in your report several times that no one had access to the property. You didn't do your research, sir. Because prior to 1966, the Boy Scouts of America were holding annual campground meetings there, the white boys. We had to look through the fence.

Forgive me for not being as prepared as I need to be, but my opening statements are clear enough. This is a sham. You are taking inaccurate, erroneous information and coming to a conclusion. That is a waste of time. If you got a Ph.D., I think you know a little better than that.

⑤ I also want to speak about -- you acknowledge that the people in the Rozelle area -- which is a little north of Dunn Field -- may have been exposed to this from 1989 until now. I am concerned about the people on the other side of Dunn Field as well, which would be to the east, where the greatest impact of the population really is, at the foot of Boyle where it crosses Hayes, all along Hayes Road, where the names -- *(The commenter listed the names of 5 individuals.)* -- all residents of Hayes, some former employees of the defense depot -- all deceased. These men lived on Hayes Road.

Let me take you a little further deeper into the neighborhood. ... *(Three more names are mentioned including a father and son.)*, these men are all deceased. All since 1989. But you know you can't see in your report a need to look east of the defense depot, Dunn Field. I notice in your comments you say that you were going to try to identify things. Maybe you tried, but you identified nothing, resulting in no actions.

⑥ I just want to close by saying, you ought to rescind and recall this study, apologize to the people and talk to the people and impact the community before you try to put out a rat -- r-a-t -- sheet to the public.

⑦ One other comment, you got in here you talked to so many people from the Defense Depot of Memphis Tennessee. Sir, could you list more than one person from the Defense Depot of Memphis Tennessee? I don't think you know one name in that group or that organization. You haven't done your work, sir.

I just asked you not to try to give me this junk back. I asked you to take it back, recall it honorably. Do the right thing.

And if you are going to list the Commercial Appeal as a reference, it is enough to say that you haven't done your job... *The spouse of one of the deceased individuals I mention before is still alive*. The rest of these people, their spouses are deceased. But they have children

alive.... *One of these decreased residents of the Hayes Road area,* before he died took me to his front porch and showed me where all this crap was buried on Dunn Field.

You just haven't done the job. I just don't know what else to say. It is a sin, it is a shame, and you will not be blessed for this, sir. You will not.

RESPONSE

① The request by this member of the Memphis Depot Restoration Advisory Board (RAB) to withdraw the Memphis Depot Public Health Assessment was responded to in a letter dated March 9, 2000 from Lisa Hayes, P.E., the Acting Chief of Superfund Site Assessment Branch in the Division of Health Assessment and Consultation of ATSDR. Copies of Ms. Hayes' letter were provided to all the participants of the evening session. Here is the body of the letter. Responses to the rest of the comments made by this RAB member follow this quote.

"This is a response to your request that the public comment release of the Memphis Depot Public Health Assessment be withdrawn. You made this request to Dr. John Crellin during a meeting to receive public comments on the Memphis Depot Public Health Assessment on February 24, 2000. At this meeting, you stated that the public health assessment should be withdrawn because it was a "sham and based on a pack of lies". You indicated that the Agency for Toxic Substances and Disease Registry (ATSDR) needed to go door-to-door and talk with residents. You also identified what you considered to be significant mistakes in the public health assessment.

ATSDR has considered your request and has decided not to withdraw the Memphis Depot Public Health Assessment because we've made it very clear since 1997 what would be produced, what our preliminary conclusions would be, and how we derived those conclusions.

★Presentations on what ATSDR planned to do were made to the Restoration Advisory Board (RAB) in August 1997, the Greater Memphis Environmental Justice Working Group in February 1998, and public meetings in May 1998.

★Preliminary conclusions and how they were reached were described at the October 1998 Greater Memphis Environmental Justice Working Group, a January 1999 RAB meeting, and a July 1999 public meeting.

⑥ Your suggestion that ATSDR go door-to-door and talk with residents has been made and addressed several times since 1997. Door-to-door surveys do not help document exposure and are not part of the public health assessment

process. As explained at the RAB, the Greater Memphis Environmental Justice Working Group, and at public meetings, an ATSDR Public Health Assessment identifies whether exposure to hazardous substances at a site is or has occurred and determines (if exposures are found) whether or not they might cause harm. Once exposure is documented, then a door-to-door survey may be appropriate as a follow-up to the public health assessment to help determine whether harm has occurred.

① The Memphis Depot Public Health Assessment was extensively reviewed within ATSDR to insure that it met agency standards and criteria for such evaluations. Drs. Reuben Warren and Jewel Crawford and other members of the ATSDR Memphis team also reviewed the public health assessment and provided comments. Significant components of the document were provided to *the Executive Director of DDMT-CCC* and Dr. Cynthia Warrick of Howard University prior to release. At the July 1999 public meeting, the map in the public health assessment that describes the drainage around the Memphis Depot was distributed to the participants. All these steps were taken to insure that the public comment release was valid and accurate."

Here are the responses to the rest of this commenter's concerns. They are referenced by the numbers given each concern.

② Figure 5 accurately displays the drainage from DDMT. However, Figure 5 identifies only the locations where water ***is being discharged*** *from DDMT. To avoid confusion, the locations where water flowed onto DDMT were not shown because they not pathways by which people could have been exposed to contaminants from DDMT. The points identified by the commenter are the those two locations where water flows onto DDMT from the area outside of the Depot.*

③ The exposure of workers was mentioned in the document. On page 42 of the public health assessment it is stated "Besides these possible exposures in areas around specific buildings, former workers reportedly could have been exposed to toxic substances because of work practices inside the DDMT buildings that resulted in contact with chemicals..." *More information on this issue has been including in this document including a summary of workers' concerns given at a meeting that ATSDR held in 1998.*

④ The issue about access is that area residents could not easily get on the Main Facility or Dunn Field because DDMT has been fenced and guarded since the facility opened in 1942 (68). This is important because the fencing and guards would make it very difficult for anyone other than DDMT workers to have daily or even regular exposure to the chemicals on the facility. This

would be especially true for small children. The exposure of Boy Scouts during the annual campground meetings prior to 1966 would be a problem for these boys only if they had direct contact with the chemicals being stored on DDMT by going into the storage areas, opening the containers, and getting the chemical on themselves. Exposure to contaminated soil once a year would not be enough to cause them harm.

⑤ ATSDR did not identify a way that the people living in the area east of Dunn Field, especially those individuals living along Hayes Road could have been exposed to the chemicals on Dunn Field other than the dust blowing off the bauxite and fluorspar piles. Water flows from this neighborhood into Dunn Field not from Dunn Field into the neighborhood. Water from Dunn Field does drain into the Rozelle area which is why ATSDR is concerned about that neighborhood. As described on page 37, bauxite and fluorspar are not very toxic.

⑥ This concern was responded to in Ms. Hayes's letter and is identified with a ⑥ in the text of the letter.

⑦ ATSDR held about ten meetings with DDMT area residents including a number of individuals who identified themselves as members of DDMT-CCC. It is ATSDR policy not to identify private citizens by name in their documents so a list can not be provided.

19) *Commenter 2:* Do not use me, the organization of the Defense Depot of Memphis Tennessee Concerned Citizens, because I am not here to represent that organization. And I see the name of the organization slandered all through this booklet, as on page 12, and I want you to take it out because we have no business being there... you talked to *me or other or* our members of the community. On page 12, you got "All these activities were done with the cooperation and the foreknowledge of the DDMT-CCC." Why were you trying to get credibility on our backs? We didn't approve this document. As a matter of fact, John Crellin had no discussion beforehand with us about this document. We seen this document when everybody else saw it. So whether we disapprove, or whatever, our name don't have any business being in here.

Now, if you had said, "I talked to *(the speaker identified herself)* on this particular date"; but not saying that I approved or I cooperated or I acknowledged what you was doing. That's a lie. And it is a flat out lie. I know the tactics the ATSDR uses to divide and conquer communities. If they can't get you to work with them, they will go get an innocent group that knows nothing about them and have them -- make them feel they are doing something really worthy in the community to help them push along their document.

This is not -- nothing that I approved of. I seen this the same time everybody else seen it. And going through the community, there's a lot of people that have not seen these documents. And the faces in our community speaks for itself. I am like *the previous speaker*. I lived on Mallory Street most of my life. And I am ashamed because I see, even when we were trying to tell you what happened, you dropped solid portions, you took those questions and concerns out, and then you turn around and you fixed the questions the way that you wanted them to be.

RESPONSE

Regarding the use of the phrase, "DDMT-CCC." *ATSDR requires that adequate documentation be made of any comments, documents, or data used in its documents. The phrase "DDMT-CCC member" was used to identify comments received from members of this group so that readers would know that the source of the comment was a community member with specific concerns and knowledge about the situation. The use of this phrase does not mean nor is it implied anywhere in the document that DDMT-CCC endorsed the public health assessment in whole or in part.*

Regarding the statement on page 12, **"All these activities were done with the cooperation and the foreknowledge of the DDMT-CCC."** *This statement is true for the activities described in that particular paragraph. Dr. Rueben Warren, Ms. Sandra Coulberson, or other ATSDR staff discussed all the activities described in the paragraph on page 12 with the Executive Director of DDMT-CCC.*

Regarding ATSDR not discussing the public health assessment with the commenter before its release. *This is simply not true. As described in Ms. Hayes letter on page 111, ATSDR described how the public health assessment would be done on several occasions, indicated what the preliminary conclusions would be in 1998 and 1999, and provided several portions of the document to the commenter.*

The commenter is correct that she did not see the whole document before anyone else. However, this is exactly what ATSDR promised to do in February 1998 at the first meeting of the Greater Memphis Environmental Justice Working Group. The commenter raised the concern at that meeting and in her organization's newsletter that DOD had reviewed and approved the 1995 public health assessment before it was released for public comment. To address this concern, John Crellin promised at the first Greater Memphis meeting in 1998 that no one outside of ATSDR would see the document before its release for public comment. That promise was kept.

Regarding the comment that ATSDR was trying to divide and conquer the community. *ATSDR, especially through the efforts of Dr. Rueben Warren, has to been trying to unite the community and address its concerns ATSDR agreed to review the 1995 public health assessment and conduct other activities at the request*

of DDMT-CCC. Members of this organization were notified of and participated in every meeting that ATSDR held with area residents since the commitment to DDMT-CCC was made in 1997.

Regarding the concern that the community was not given sufficient opportunity to review the public health assessment. *The community was given greater notice and a longer opportunity to review the document than for any other public health assessment issued by ATSDR. A notice that the public health assessment was available for review was sent to over 4,500 DDMT area residents. The document was send to over 110 individuals and was available for review at four locations in Memphis. The period to review the document was 90 days while the usual period for ATSDR public health assessments is 30 days.*

Facilitator: Could you help by being more specific so the next draft will be better, please?

20) *Commenter 2:* You got "Short-term exposure in airborne contamination." You say one time only this happened with the Span Dome collapsing. That is a lie. I remember smelling eel and salmon and real funky smells in the community. I can remember summers when we had blisters all over our legs from being out in the grass. I mean blisters where they run and the sores just leaked. And I remember these things as a child. I remember the vegetables in our backyard were, if it rained, when the stench was in the air, that the vegetable leaves would curl up like somebody scalded them. Or they would shrink and the vegetables sometimes would be spotted. I remember that in the Sixties, and I remember it in the late Fifties. I remember the bombs that laid on Perry and Dunn. And I remember seeing the kids up on top of those playing. The DLA said that they didn't have (inaudible) or whatever was on the cases. But the DLA has lied to us before.

I don't know what type of data that you are using, but their data is not correct. The people have the data. And it is in every last one of us. We experience massive sickness. And I don't know if you should call this a public health assessment, because it needs to be identified. And this is one thing that I feel, it shouldn't even be called a public health assessment. It should be called data that I looked at from defense logistics aides. Because you didn't get this from the community. And it has nothing -- this actually has nothing to do with us.

RESPONSE

Regarding short-term exposures to DDMT contaminants in the air. *On page 27 of the public comment release, it was stated that* "Short-term exposure to airborne contaminants from DDMT probably has occurred at least once.." *We were able to identify written documentation only of the 1988 span dome incident. The public health assessment does identify several other occasions where residents reported that air releases had occurred. ATSDR was unable to find any additional information on*

these reports. Without at least some indication on what was released, it is not possible to evaluate whether these releases could have caused health effects.

Regarding the concern that ATSDR did not do the public health assessment properly. *As indicated earlier, ATSDR described how it would conduct this public health assessment on several occasions. The document was given a very extensive review within ATSDR, far greater than the typical public health assessment, to insure that it conformed with ATSDR's policies and procedures and published guidance (67). In addition, the commenter participated in a workshop on how public health assessments are done conducted by senior ATSDR staff.*

Regarding the data used in this public health assessment. *ATSDR reviewed all the data available to it on DDMT including considerable information related by DDMT area residents in developing this public health assessment.*

21) *Commenter 2:* On page 29, where you got all these schools that was tested, *the previous speaker* and I both *serve* on *the RAB*, and if I didn't sit on it, I was there *at the meetings*. ... Never have I seen a piece of data that stated that they went off site and sampled Alcy and Charjean. I remember them going to Audubon Park. And the lake was contaminated by the defense depot, they claim. And they used some of the clean-up money to clean up the lake.

If that is not racism -- they went out to where the white folks, to where their children had a fishing area. And they cleaned because all the white children didn't need to be contaminated. What about the contamination that flows throughout our community in these ditches that kill our senior citizens?

RESPONSE

The commenter was present at a meeting with Howard University and ATSDR in early February 2000 where this issue was discussed. As a result of that discussion, ATSDR provided Howard and the commenter with copies of the data on the sampling of four schools within a mile of DDMT.

22) *Commenter 2:* I call ATSDR a murderer too. Because you allow this information to go along, you are murderers, also. You are in cahoots with the DOD and you won't listen to us. Because if you had listened, these questions, where you got these questions on the back, would not have been listed like this.

I see where some of the questions are not even clear, and it is not what some of the people have said. And it looks like you picked around these questions and you left things off --

Facilitator: Are there specific ones? It may help --

Commenter 2: -- the drainage ditches that I told you about that came out of the defense depot, there was drains that came off of that site -- and I am not going to say no more after today -- off the Main Facility. And from what I know, it was 21 drains. My information may be clouded. There is a lot of them. But in the Fifties and the Sixties these drains was mud ditches.

Commenter 1: -- Right.

Commenter 2: -- And in the Fifties and the Sixties, these drains was like little puddles that rain would set in and flooded in people's yards. That is what happened in the Fifties and the Sixties. It probably happened in the Forties, because an elderly person said, "Well, it was just water that would rush down our backyard when it rained." So you know after years of corrosion, it turned into ditches. It turned into mud ditches. And you know we played in those ditches because we didn't know. And one day, I can remember looking at the ditch at Mallory and Sparks, over the little bridge, and seeing the water green, yellow, and white. And going down in there and kicking in the water and saying, "That is some cute water." Because a child don't know.

But the most frightening thing that happened to me is when my son said, "Momma, we went down in these ditches, down in the tunnels, and we went everywhere. And we ended up -- guess where we ended up? At Hamilton School?" That is coming from my house.

Facilitator: When was that?

Commenter 2: You said that it didn't happen.

Facilitator: When was that in a time frame?

Commenter 2: This happened in the Eighties. These children still played in these ditches. But, see, you got to understand; it may look like a main ditch coming from the facility, but it is like spouts. It has wells. It has tunnels everywhere, all in our yards and everywhere.

RESPONSE

ATSDR agrees with the commenter on the number of discharge points from DDMT as being 21. It does not agree that the ditches coming off DDMT branch and sprout. The surface water drainage follows the natural drainage patterns of the Memphis area and thus the ditches run along the low points of an area. The ditches do not branch out but do merge together. It is true that some of the surface water drainage now goes through pipes/tunnels where once they were open ditches. This is described in the document and indicated on Figure 5. The commenter's son could have very well followed a pipe/tunnel to Hamilton High as there are two that discharge into Cane Creek just downstream from the high school. However, he most likely entered

that pipe several blocks north of his house since his home is in a different drainage area than Hamilton High.

23) *Commenter 2:* So when in 1978 when there was an exposure of DDT and when the defense -- all the animals died in the community, you said we didn't even know what we was talking about. But in 1978, I bet you go to the veterinarians in Memphis, and you will find much information about the animal kingdom of dogs, prized German Sheppards, just in the backyard just died. Couldn't get out.....

Something also happened in the early part of the Eighties, when workers talked about the dead animals that was laying in their sight where they used to jog and play and go to the park, and thought they was getting fresh air; and they was getting contaminated.

Facilitator: One of the things that you will notice in the health assessment is that we really can only put evidence in there if it is referenced and cited and documented. So otherwise it has to have the word "allegedly," or have the format like you saw where it said "Comment." So if you have information where maybe people kept diaries or journals or specific maps of where they saw things happening or anything along --

Commenter 2: I asked these people to call *(an individual is named)* in Detroit. *She* was there at the time of the explosion of the Span Dome. But, you know, the DLA told that it was a thunderstorm, that nothing happened. That is a lie. It was not a thunderstorm. But this is what the Government can put on record and say this has happened, but that is real because they wrote it down.

.... We are looking at our people, we are looking at our children coming up with uterine cancer. I took ten kids to Washington, and three of these children are sick. These are friends that grew up together. You can't tell us that the government is doing all they can for us. Because they don't. That is a lie. This is the Tuskegee incident.

Facilitator: That is why we are here.

Commenter 2: If you are here to help us, to get some medical help, get these people out of the community, get the clinic here to treat cancer and everything else we have to pay for, then you do it.

Facilitator: See, this is a process.... --

Commenter 2: The process is not working. And I think that what we end up being is like Oakridge. We are tired. We was the first group that you put together, this working group. But I feel like that Dr. Warren has done everything that he can. But I cannot support the other part of the agency. I feel like they didn't work hard enough.

And when we asked them to work hard enough, maybe they was divided out into too many areas where people couldn't focus on the main things that needed to be done. But as I see it -- and I don't want nobody to take it as an attack on them personally -- but it may be an attack on the agency of not having enough people here to do what they need to do.

RESPONSE

> ***Regarding the 1978 incident.*** *Public health assessments evaluate available data to ascertain whether exposure to site-related contaminants could have resulted in health effects. For this situation, ATSDR was unable to identify any information on what the release might have been, and how much was released. Without that information, the public health assessment process can go no further.*
>
> ***Regarding the 1988 Span Dome Incident.*** *In the public health assessment, ATSDR described what was in the report from the Memphis Fire Department and the Commercial Appeal newspaper article about the cause of the Span Dome collapse (5,76).*
>
> ***Regarding medical help.*** *As indicated at the February and October 1998 Memphis Environmental Justice Working Group and July 1999 public meeting, ATSDR has neither the authority or funding to provide medical treatment.*
>
> ***Regarding the process.*** *A review of the 1995 public health assessment is what ATSDR committed to do in 1997 and, because of the large amount of new environmental data, it was decided to conduct a second public health assessment to fulfil that commitment. ATSDR not only communicated that to DDMT-CCC and the RAB, but also has indicated that ATSDR does not have the legislative authority to do what the commenter is requesting that the agency do.*

Facilitator: ... I think will be really helpful to make the best use of this time is, you mentioned there was some questions and comments that had been distorted at the end of the document. If you could be specific, tell us how you would word them -- it sounded like maybe some of them were yours -- and give those suggestions to us either in writing -- it doesn't have to be tonight if you want to put more thought into it. That is exactly what gets incorporated into the document and that's --

24) *Commenter 2*: On page 39, March 1998, it says: "Two residents found two dead birds just off-site of the west boundary of Dunn Field. They were concerned the birds' deaths were due to site contaminants probably released from the nearby location of Dunn Field. A few days before, small vials had been uncovered at the location." *The commenter then quoted the end of this section.* It says: "It appears unlikely that these birds died because of that incident."

How in the heck do you know? I don't know -- unless you tell me you found these birds and you went ahead and examined these birds, how in the heck can you verify that these birds didn't die because of this chemical warfare material that was found? And that is what it was. I identified and sent pictures off. I sent them to an expert. It was chemical warfare material that was unearthed. And so you tell me -- if you did a check on these birds, you tell me what kind of analysis you did on the canisters they sent to the dump site which was in the Commercial Appeal.

Facilitator: You want a further explanation of how the conclusion was reached; is that correct?

Commenter 2: It is stated clearly that it was nothing wrong. And I want to know if they did an autopsy on these birds.

Because when the explosion happened, at least in 1999, October 30, 1999, then no one went and took air samples. No one took soil samples. I videotaped the ground, so that I could walk back to the places where I saw the burn spots. And the conclusion was, it was fireworks. I never known fireworks to shake the foundation on houses.

And so I'm saying if this is supposed to be the Agency for Toxic Substances and Disease Registry, and if you are doing work on data as it come up, to insure us of our safety, then I think you need to go back to the wheel again, because this is not getting -- this is just one incident. The other question -- I don't have my book –

RESPONSE

> *ATSDR concluded that it was unlikely that birds died due to this incident based on the descriptions of what can be found in the reports on what happened that were made available to the Memphis RAB at March and June 1998 meetings. The amount of material present and therefore the amount released was very small. Based on the reports to the RAB, it is unclear what pictures of this incident that this commenter could have since the materials were uncovered and disposed of before the incident was made public.*

Facilitator: Let's move on and do other people's five minutes. But if you could just make a note as to each one that you see as inaccurate, and be as specific as possible as to why and how you would like to see your comments or question rephrased; because that way, the next draft, we can incorporate your thoughts into it.

25) *Commenter 2*: Another thing, "public health assessment," it needs to be clarified, and I told John that before. And I know that he tried to do a clarification on the flight. But you need to do a clarification -- what is a public health assessment and what do you mean no

health impact, because that scientific jargon that he used means something totally different to the community people.

..... There was then a discussion between commenter 1 of the session and the facilitator with some participation from commenter 2 about who would speak next. Commenter 1 then related this – I am not sitting down. Hold it just one minute, ma'am. You haven't read the report. You couldn't have came to the conclusions saying there was no health hazard west of Dunn Field. You say you read the RAB board minutes. You haven't gotten into what our concerns are or you couldn't have possibly put this out. The whole report is bogus. I am finished.

RESPONSE

> ***Regarding what a public health assessment is.*** *As indicated before, ATSDR described the public health assessment process to the community on several occasions. In addition, this commenter participated in a special workshop on public health assessments conducted by senior ATSDR staff.*
>
> ***Regarding what no health impact means.*** *In the conclusions section, no health impact is explained as* "Currently, no known exposures exist off-site to site contaminants that could result in health effects." *This explanation will be included in the Summary section to better communicate ATSDR's conclusion.*
>
> ***Regarding the conclusion in the public health assessment about the west side of Dunn Field.*** *The conclusion about there being no apparent public health assessment is specifically qualified by the statement,* "**The Rozelle neighborhood, which is that portion of Rozelle Street just west of Dunn Field, is a possible exception to this conclusion.**"

Facilitator: Thank you. Basically, what I would like to do is just make sure everybody's questions are on the record and then open it up for discussion, so it is not just you speaking to us and we can have interactive dialogue. And you could maybe get a response from Dr. Crellin, who would probably be able to respond much better than I.

26) *Commenter 1*: We are here to put on record our problems with your report; can't call it an assessment because it wasn't professionally done.

Facilitator: If everybody could be as specific in their comments. I mean I completely understand that you are not pleased in any way with it. But if you see some constructive ways, little steps that the agency could take, because you, being close to the community, you know how to get the information, who to talk to, who might have a record or a log going years back because that's the kind of information we need to cite –

Commenter 1: Ma'am, if you could listen and read, and you just read what I said to the stenographer, if you just read, I got very specific.

Facilitator: And what I heard was we can put in testimonials and comments --

Commenter 1: No. What you heard is you haven't done your job. You haven't come to the community. You haven't done a public health assessment but you are trying to pass one off. That is what you heard. I specifically told you the report is bogus because you don't have all the drainage ditches located on there. You didn't put the reports of the RAB board meeting in there. How much more specific do I need to be to tear this report apart? This report is worthless. It was worth more money before it got printed than it is with the information in it.

Let me just say this to you, ma'am. I don't understand your role here. You seem to be more trying to defend this report: As a facilitator, I would think you would have a neutral position. But you've been exposed as trying to defend the report. And you have done a poor job, also.

Facilitator: Well, I am sorry.

Commenter 1: You should be sorry.

Facilitator: I am trying to be neutral. Basically what I am trying to do is to take away the attacks on the agency and the personal attacks against Dr. Crellin and to try --

Commenter 1: He signed his name to this report. And as a professional, he needs to stand behind it. I don't know nothing about this man. I don't dislike him. His work stinks. That is all I am saying. There is nothing in here of value.

Facilitator: I will let Dr. Crellin respond in a minute.

Commenter 1: I don't need a response.

Facilitator: If you don't need a response, does anybody else have anything that they would like to discuss in their response, because I think there could be some constructive dialogue, as opposed to attacking and getting the divide any greater.

Commenter 1: The truth is never destructive. You got to start with the truth to build anything. You don't seem to be interested in the truth. So don't sit up there and try to color this any other way than you haven't done your job and you are up there trying to get paid for something that you're obviously not qualified to do. So, please, don't go there, because you are not qualified.

Facilitator: It is pretty much like I am here, and we are trying to do our best and --

Commenter 1: Your best ain't good enough. You are sorely lacking as a facilitator.

Facilitator: This is your one chance to enter your public comments in this point in time --

Commenter 1: I thought it wasn't finished until March 31.

Facilitator: It is. But I am taking about this evening, tonight.

Commenter 1: I am excusing myself from this meeting.

Facilitator: Thank you for your comments.

Commenter 1: Don't take any joy in my leaving. Consider this a man trying to keep the peace.

Facilitator: Okay.

RESPONSE

As indicated earlier, the public health assessment was what ATSDR said that it was going to do. The document is ATSDR's evaluation of the information available and follows the requirements for a public health assessment mandated by Congress. Extensive efforts were made to identify the community's health concerns and to include them in the document. The document was extensively reviewed within ATSDR. Individuals reviewing the public health assessment included the Director (Rear Admiral Robert Williams) and Assistant Director for Science (Dr. Allan Susten) for the Division of Health Assessment and Consultation, the Associate Administrator for Urban Affairs (Dr. Rueben Warren), and all the members of the ATSDR Memphis team.

27) *Commenter 3*: I was at the morning meeting. And I raised the same question. And I am going to bring it up again. We had a public survey from the health department that said that 90 percent of the people in that impacted area responded to your survey. I think it is important and necessary that we look at other ways to reach out and document some of these activities or actions or incidents that occurred in the neighborhood and impacted the community that only the people in the neighborhood can tell you about. Whatever we have to do to get more input, surveys sent out, we need do. Because there are a lot of stories as *Commenter 1* talked about.

I live on Boyle Street about 100 feet from Hayes. I know all those people personally. I grew up in the neighborhood. I have been there since 1965. And all those gentlemen he described died from cancer. And I would say roughly 80 percent of them worked at the depot in the bad old days during segregation, where whatever you handled, they probably

told you, "Boy, don't worry about it. Just do your job to keep your job." That's a fact. I am not making this up. People would talk at the depot. It was segregated. It was in the Sixties. So that people had a legitimate fear of what went on over at the depot. And sometimes people just don't come forward readily enough.

But we need to make this extra effort to get out there and send a survey around and ask people what they saw, when they saw it, and what were the effects of it. It may not be scientific, but it is more information and data that can go in your report. I made this point in the morning, and I am making it again. I am just concerned about the database that the community is happy with. Thank you.

RESPONSE

ATSDR has offered to Howard University to distribute such a survey to the about 4,500 individuals on the mailing list that ATSDR recently used to notify the community that the public health assessment was available. The survey would have assisted Howard in its efforts to identify additional locations for off-site sampling. Howard decided not take up ATSDR on its offer because of time constraints but will consider it in the future.

28) *Commenter 4:* I don't know if I can add much to what has already been said; except, some pretty important points were made. But I had some problems with the health assessment document, too.

And just to give one example -- I am not going to go through everything, because that would take too long -- but, like, on page17, there is a discussion of the cumulative risk from six different polycyclic aromatic hydrocarbons. And the statement is that there is only a comparison value for one of them, and ... I don't see that there is much data that is based on. I think it is very wrong to have something like that where you don't even have data on five of them. You are making a wild guess about what the combined effects might be of exposure to all six of these when there are probably no studies at all dealing with that. And, yet, there is a conclusion made that people are unlikely to have -- let's see. "The actual chance of anyone being harmed is very low or nonexistent." That is a quote from it.

RESPONSE

In evaluating the cumulative risk of PAHs, ATSDR used procedures developed by EPA. These procedures have been published and peer reviewed and were not a wild guess.

29) *Commenter 4:* And that seems to me a typical methodology in this report and other ones done by ATSDR, that uncertainty is stressed when it is a question of -- that you can say, if the level of a certain chemical is above the comparison value, than that doesn't necessarily

mean that anyone is hurt. But the opposite is also true. When we don't know for sure someone is going to be hurt from it, you are not stressing the fact that we don't know for sure.

RESPONSE

ATSDR establishes its comparison values using a methodology that insures that nearly all the uncertainty is above the comparison value and very little is below. This insures that the public health is protected.

30) *Commenter 4:* And I think that you have statements in here like: "There is no apparent public health hazard;" and "This does not represent a public health hazard," over and over again; and everyone knows that these statements are going to be taken out of context and used by politicians and decision-makers to justify not doing anything.

RESPONSE

As indicated in the ATSDR Public Health Assessment Guidance Manual, these statements are intended to indicate that no action needs to be taken to prevent exposure (67).

31) *Commenter 4:* So I think this is a biased report. And this is also reflected in the way that official documentation is privileged, as the facilitator was explaining, which I know is the government's position.

For example, on page 27 in what I have, is the discussion of the Span Dome and the release of hazardous substances into the air. And then there is a statement that "Long-term residents have indicated that several other air releases from the depot have occurred; however, ATSDR did not identify other reports of confirmed air releases from DDMT." So anything that is written down in a government document is confirmed: If the people who live here and report it, who observe these things, say it, it is not confirmed. I think there is a real problem with that.

RESPONSE

ATSDR uses whatever information is available in its public health assessment, no matter what the source. To evaluate the possible health impact of an air release, at least some sampling data are needed on what and how much was released. It was for this reason, not that they weren't government reports, that the reports from community members weren't evaluated further. This sentence in the public health assessment has revised to make this clear.

32) *Commenter 4:* Another example of what I think is a bias is on the very next page. There is a discussion of Nonconnah Creek being the nearest off-site body of water with a viable population. And the conclusion is that "Very little or no opportunity was available for residents to catch and eat fish within a mile of the site." The explanation on Nonconnah Creek is, that it has been posted as a no fish consumption area since 1982. Now, I don't think with Audubon Park they decided it was good enough to post "No Fishing" signs. And I am not naive enough to think that just because there are "No Fishing" signs that nobody is going to fish in there. So this conclusion is completely unwarranted.

RESPONSE

ATSDR agrees that the discussion of fishing and Nonconnah Creek is unclear and has revised it.

33) *Commenter 4:* In general, I think that it reflects that there are two totally different world views at work here, the people who live around the community that have the experience of people suffering and dying -- that is what people have been talking about tonight. And you have a report like this that doesn't even take any of that up at all. I know you didn't choose the name public health assessment, but it doesn't deserve to have that name. It just looks like an attempt to prove that the depot was not responsible.

RESPONSE

The ATSDR staff working at Memphis have extensive training, experience, and prior success in understanding and responding to the concerns of the community around a site. These staff realize that some DDMT area residents have concluded that most of the death and disease in the area is due to exposure to something from DDMT. However, these same community members refuse to accept that ATSDR is mandated by Congress to first identify whether exposure to site contaminants is or has occurred, then try to link that exposure to excesses of death or disease As described in this public health assessment, no known exposures exist or have existed off-site since at least 1989 to site contaminants that could result in health effects. In addition, ATSDR's review of the limited amount of data on disease in the DDMT area did not identify any excess of cancer.

34) *Commenter 4:* And the 1995 public health assessment was even worse. I notice that there are a few things that were admitted in this one that weren't admitted in the other one. I don't think anyone has ever explained why they weren't admitted in the first one. I think all the same problems still exist.

RESPONSE

The commenter did not identify what was admitted in this public health assessment that was not admitted in the 1995 public health assessment so we are unable to provide a response.

35) *Commenter 4:* So the problem is that there are all these different agencies and they have each their own jurisdiction and their own agendas. None of them is the agenda of the health of the people who live in the neighborhood and who worked here.

RESPONSE

ATSDR is mandated by Congress to evaluate health problems as related to exposures to contaminants from Superfund Sites.

36) *Commenter 4:* And I don't understand things like, in the -- what I have as page 42, which is part of the Responses to Community Concerns, and there is a discussion of how workers could have been exposed to toxic substances because of work practices that resulted in contact with chemicals. "Evaluation of these situations is not within the scope and purpose of a Public Health Assessment." That may be true according to the rules that the Agency goes by. But I don't understand why the Agency which is following that agenda would have called the meeting where the workers testified about all these things that happened to them, tried to give them the impression that they were going to do something for them, and, of course, never did. And what this statement says to me is, we are not going to do anything for you. So these are the kinds of concerns I have. I am going to stop now, because I think that is enough to explain it.

RESPONSE

The meeting mentioned by this commenter was conducted by ATSDR's Office of Urban Affairs. They are the process of responding to these concerns. For additional information, contact Dr. Jewel Crawford at (404)639-5060 or pzc6@cdc.gov.

Facilitator: Are there any other comments, questions we should get on the record before Dr. Crellin begins to address some of these issues?

37) *Commenter 2*: If they had any kind of -- the -- everything exists. Everybody knows that. There is no question whether it exists or not. It does exist. It look like everybody chooses to ignore it.

I just have to say this. At least you could help the children, the young people, because they need that type of help. They are exposed -- a lot of these kids, a lot of the families maintain homes and -- a lot of these men and women that worked there, came home and their children

were messed up with this type of -- things that they brought home on their clothes and different things like that. And I know that as a fact. And these children do not have -- there is not any places you could go for help. It is just pathetic in Memphis. I could give you some documents on that. It is pathetic here. We don't have any kind of health places to go to get the type of help that these young people need.

You go to the clinics -- actually, you can't hold a job. I feel sorry for the people; because if you go to the clinic, you'll be sitting up there at least four or five hours before somebody will even talk to you. When they wait on you -- I know because I have to take the children to the clinic. And they don't get any kind of response. I am a victim of the same abuse. That is just breaking it down for you so you can understand where I am coming from. And it seems like everybody wants to ignore it. Thanks to the clinics coming back to the school kids in the neighborhood – but you don't have any kind of clinics, any kind of -- it is just pathetic.

RESPONSE

ATSDR's Office of Urban Affairs (OUA) is working with the community and many local, state, and federal agencies to enhance the capability of the existing health clinic in Memphis. This commenter is familiar with these efforts and working with OUA.

38) *Commenter 1*: ... Again this report refers to lack of data available. What about the studies done in Dunn Field and other locations of Defense Depot of Memphis Tennessee? That fact indicates -- solidifies to me and to anybody who may still have a question that you really didn't even try to get to the facts of the matter. I just want to say again, you ought to recall this report. Do the honorable thing. Recall this report. Take your time.

RESPONSE

As described in the public health assessment, the earliest report on the levels of contaminants on DDMT is from 1982. These data were too limited in scope to be evaluated in the public health assessment. All the environmental reports on DDMT since this 1982 report were used in this public health assessment.

39) *Commenter 1*. Mr. Moore -- a man I respect -- I am sure you gave him a car, a hotel for everybody who comes here from Atlanta on a regular basis. Dr. Crellin, I've even seen you driving a -- but according to this report, it doesn't sound like you even mention it. You got a court reporter here. You got some facilitator here. You are spending a lot of money. You got a place for the community -- it is far away from where it should be, by the way. This is not the place to hold a meeting about the defense depot in this community. You are spending the money. Spend it properly. Hire 1,500 gentlemen more, send them to the door to talk to those 5,000 to 6,000 residents and impact the community and do a health assessment for real.

RESPONSE

Your suggestion that ATSDR go door-to-door and talk with residents has been made and addressed several times since 1997. Door-to-door surveys do not help document exposure and are not part of the public health assessment process. As explained at the RAB, the Greater Memphis Environmental Justice Working Group, and at public meetings, an ATSDR Public Health Assessment identifies whether exposure to hazardous substances at a site is or has occurred and determines (if exposures are found) whether or not they might cause harm. Once exposure is documented, then a door-to-door survey may be appropriate as a follow-up to the public health assessment to help determine whether harm has occurred.

40) *Commenter 2*: On page 25, I think you were talking about the Alcy community itself. And I know I raised this issue more than once, about how the off-site dumping, illegal dumping was done -- well, it might have not been illegal. The depot just took barrels of stuff and dumped it over on our Alcy community before it was built. And the residents that lived over there the longest -- most of them are dead. But you may find one or two. And they didn't die at an old age. They died at a young age. There was off-site dumping recorded by some of the workers, and also recorded by *(named an individual)* when she lived on La Paloma. *This individual* said in the early Sixties before the Alcy community was leveled, she said they were really doing off-site dumping. She said you could see the trucks roll from the depot, and you could hear the thunder of the drums falling down the ditches. You told me I need to know specifically where the barrels was buried. And I call that an insult. *(An individual is named)* don't know where the barrels was buried. Because there were so many and so long that no one knows exactly where the barrels were buried. But you should be testing.

And most of all, we was also informed that the school of Alcy community, it was an open pit of chemicals there. Now, I am not a scientist. I don't know how to sink a sampling tool. But I know it would take more than 3 inches of soil to find out what is going on.

If you want to know the truth -- we don't want just sampling in the community, but I think the Alcy community itself, there needs to be an examination of everything that happened over there in that community. Because I think it is a crime that has been committed and I think people actually know about it that are from that depot, if they are still alive.

RESPONSE

The reference to the Alcy neighborhood on page 25 is actually a discussion of the surface water drainage in the area not of illegal dumping. ATSDR has had a number of discussions with this commenter about illegal dumping. ATSDR does not have the expertise nor the responsibility to identify illegal dumping. The agency has encouraged the commenter to provide any information she has on the specific

locations where such dumping might have occurred to the Tennessee Department of Environmental and Conservation (TDEC) or the U.S. Environmental Protection Agency (EPA). They are the agencies with the responsibility and technical expertise to investigate such reports.

ATSDR does conduct limited environmental sampling to identify ongoing exposure to site contaminants. Ongoing exposures occur because of contact with surface soil which ATSDR considers to be the first three inches of soil.

41) *Commenter 2:* Now, you couldn't get *(an individual is named who is a RAB member and a former worker)* to tell the truth about anything. He is going to lie to the end because he worked at the depot for 32 years. But that is what the depot used as the archive. And I want to know why in the hell you-all can't use the community as the archive. We are the archive also. These reports, they are verbal reports, but they are our archives.

RESPONSE

ATSDR considers the community a valuable and valid archive in evaluating the possible health impact of a site. ATSDR conducts a careful evaluation whenever it receives specific information on possible exposures from community members. For example, ATSDR recently decided to fund medical evaluations of possible arsenic exposures in Fort Valley, Georgia based largely on information provided by community residents. In June 2000, ATSDR conducted a exposure investigation in one neighborhood of Fort Valley based on information from community members.

In the Memphis situation, Howard University is conducting interviews with DDMT area residents to gather information on locations in the community where exposure to DDMT contaminants might be occurring. ATSDR has agreed to consider conducting environmental sampling at the locations that Howard proposes.

42) *Commenter 2:* Now, if this lady states that there was dumping being done there, when she lived on La Paloma, it was being done. She also states to witnessing the blowing down, the explosion of the Span Dome. I thought it was in 1985.

RESPONSE

This incident occurred in 1988 according to the reports on it from the Memphis Fire Department and the Commercial Appeal (5,76)

43) *Commenter 2:* I see you have no report of the airplane crashing in Dunn Field in 1985. Now, I feel like that was a cover-up. Why is this not in the report? It was an explosion of some type. The plane burned. And instead of them removing the plane, they buried, plane

and all. We asked, "What was on that plane that it was so critical for you-all to bury it?" Jet fuel for one thing. And I doubt if it all burned up.

RESPONSE

The commenter has raised this issue at the Memphis Depot Restoration Advisory Board (RAB) and was been provided a detailed response. ATSDR did not identify any more information on this crash than what has already been provided to the commenter.

44) *Commenter 5*: ... I moved out there in 1954, right *across the street from the bauxite piles on Dunn Field.*. When I moved out there, all that stuff was bolted up. On a Wednesday all of this from those things that they had covered up, it wasn't covered then. It was only laid over there. And we couldn't leave our windows open when it was a windy day or our house would be filled with white dust coming in. I was a witness to that. We went through something like that. And a lot of people moved out because they came down with different diseases, that they couldn't sleep at night. They would have to sit up. And I am -- and I am a witness -- in fact, I had cancer. I come down with cancer in 1998. Of course, I had been suffering with different things. But I am still under the doctor's care. And I know that when the people started complaining, that is when they covered those things up. And when they went there, they dig it out, root it out, from Dunn back to Person Street. It is a vacant lot out there now. But when they was uncovering it and moving it, we come through something then. Because on a windy day we couldn't go outdoors. I know people have suffered out there. I just want to give you my information.

RESPONSE

Thanks for the information. It will be referred to in the body of the public health assessment.

45) *Commenter 6:* I lived out there all of my life. I was born and reared there. Your first dump site was at Parkway and -- Parkway. Your next dump site was where Hamilton used to be up now. Then the entire area was military. Where you see Hamilton School, now the Diablo School, they were on the barracks.

My father worked for the railroad, the IC Railroad. Then they would breathe those -- when all these different things would come in. There was a train that derailed with mustard gas on it. I'm learning more about that now. At that time the only hospital in Memphis was College Chapel that would serve Black people. So with this, my father came home to us. You should have been at our house; it was just nothing but -- we couldn't hardly breathe in the house. They shipped my father out to Illinois -- let's see -- to Redwell Hospital. That's where he lived for the next I don't know how many years. And my mother could see him. He passed away.

Also my brother worked there, too. But it was something about that area that we didn't -- all we could see as little kids and things were people had to be protected, with -- they were dressed all in white. All you could see is maybe where they would look out of their eyes when they would go in and out of the place at times.

We never knew what was going on and nobody ever said anything. And then all at once everybody deserted the area because we lived there. Later on they started the area which is called Alcy, over in that part of the neighborhood, there be an odor. There are houses on all the dump sites. At times -- they are as far as the cemetery. There were three cemeteries. They just covered all the stuff in those ditches. So nobody never questioned it. Nobody never -- you know. But the intelligent people, I guess you would say, that knew what was going on, they tried to help. They tried to help us and they did help us. I lived -- I mean that was my residence in the neighborhood, but I didn't spend all my life just sitting there. They would move us out and move us back.

RESPONSE

Thanks for the information.

46) *Commenter 7: I live* on the corner of Alcy and Manchester. When we first moved there in 1962, we were in the county. The county is on one side and the city is on the other. And no city -- there's a cove. You know, that wasn't through streets. But since we been there -- and that was a city dump. Where my residence is right now, that was a dump. And every house from that corner on the south side of Manchester, every house have a crack in it right now all the way down to that coal, where that coal was. And honest to goodness, we are sitting on a rat foundation. They are as big as cats right now. And I just wish you'd come out there right now. They move my bricks just like a man would do. That is all I have to say about that. It is a pity.

RESPONSE

Thanks for the information.

47) *Commenter 1:* The south end of Dunn Field where they had the flurospar and bauxite piles that *(named commenter 5)* spoke about that has been removed, and when *was gone* they installed an above ground sprinkler system to ... *help* ... grow grass. In the heat of the summer, most of the grass won't grow. Something must be wrong. The sprinkler system is still there. The grass that did grow turned brown. They never cut it. I wonder why they won't cut what would come up. Huge bald spots where the grass never came up with an elaborate above ground sprinkler system on. Something is wrong with that ground too.

RESPONSE

This commenter as a member of the Memphis RAB has brought this issue with the DDMT staff and it has been addressed.

48) *Commenter 3:* It is really not a question. Basically I will just be brief. Is there any way in this public health assessment that we can send out a notice to residents or former workers stating that if you have witnessed, have seen any illegal dumping activities or anything that you deem that may have contributed to your health problems, send out to the people affected in that area, so that they can respond in writing those incidents that are documented by their own eyesight that they saw, so that they can incorporate this into the health study.

This is just a statement that we might want to send out, a statement asking people to come forward and voluntarily give this information that all these ladies and all these people in town evidenced that they have seen, so that we could adequately explore Dunn Field, the depot, and the illegal dumping that was done at the depot. Thank you.

RESPONSE

As indicated earlier in these responses to comments, ATSDR has offered Howard University the use of its mailing list to essentially accomplish what the commenter is suggesting. Howard decided not to use the list at this time because of time constraints but will consider its use in the future.

49) *Commenter 2*: I want to respond to that. When Jeff Kellam did the *1995* health assessment, there were only a few of these that went out. I want to know how many of these went out to the community. I want to know what -- where did they go.

I want to know exactly where did these booklets *(referring to the public health assessment)* go because people I asked -- even *(she named commenter 1)* didn't even have one. I asked people who received these brown documents. And when Jeff Kellam did the first health assessment, we challenged him because just on my street, there were only two books. And I think it is about 30 homes on my street. And I think it is a lack of communication.

I am not going to get out and do your job. I stopped having meetings with DDMT-CCC because I felt like the ATSDR should do their own. If they want to talk to people, they need to go door to door and talk to them. I stopped, and I wasn't going to cooperate. That is the reason why I didn't call a mass meeting. And I would never do it for ATSDR.

RESPONSE

ATSDR made extensive efforts to notify the community that the public health assessment was available for public review and comment and to distribute copies to

those expressing an interest in receiving one. The document was available for review at 4 locations in Memphis, Tennessee from December 27, 1999 to March 31, 2000. The public comment period was announced in local newspapers and through a notice send to over 4,500 residents around the Memphis Depot. The notice indicated that a copy of the PHA could be obtained by calling a toll-free number.

The public health assessment was sent to over 100 individuals or agencies including representatives of all the neighborhood organizations in the DDMT area including DDMT-CCC, all the members of the DDMT Restoration Advisory Board (RAB), and over 30 area residents not associated with any organization. Documents were also sent to 9 local, state, or federal elected officials; the Congress of National Black Churches; and Howard University. The following local, state, or federal agencies were given copies: Memphis Shelby County Health Department, the Tennessee Departments of Environmental Conservation and Health, National Center for Health Statistics (NCHS), U.S. Environmental Protection Agency (EPA), DDMT, Defense Logistics Agency (DLA), and Department of Defense (DOD).

50) *Commenter 2:* If you talking about getting us some health care in here and talking about setting up a clinic, if your talking about giving us the service that we need with doctors that can deal with these type of impacts, then we can talk. Other than that, with this bull that you are trying to pass down, giving these people a false sense of security, saying that everything is okay since 1989. And I want to know what happened since 1989 that make us so healthy, happy, to live in this community.

RESPONSE

As indicated in the public health assessment, the community has not been exposed to significant amounts of site contaminants since at least 1989. In addition, the effort to clean up and reuse the Depot is well under way.

51) *Commenter 2:* And I want to know, are you looking at the schools, are you doing any documenting of the students that is coming down with this type of illness that live in this community? Are you doing any type of study, tissue sampling of the students that is going to this high school of the contaminated ditch? Dunn was -- from this book, going back to the testing of that school, Dunn was the only school I can remember any testing was -- Audubon Park was supposed to have the contamination from the depot. That was like a charge, a recharge system. That was my understanding back in 1980 -- 1996, was it? -- when they did the testing at Audubon Park.

Commenter 1: It might have been 1996.

Commenter 2: 1996 or 1997.

Commenter 1: But they haven't -- if they had read the report, they would have the correct date.

RESPONSE

The testing of students at Dunn School would be done by ATSDR only if there were evidence of ongoing or past exposure to DDMT contaminants. There is no indication of a long-term exposure pathway from DDMT to anyone at Dunn Elementary School. In addition, the soil samples taken at Dunn School in 1995 did not identify any chemicals at levels above what is typical for the Memphis area.

52) *Commenter 2*: That is right. Why wasn't the concerns placed in the book from the community people that came out from the time that we have a court reporter. I know back *when the RAB first started* ...we didn't have a court reporter. And also documents from the concerns of people, I want to know why it wasn't included when ATSDR made site visits; and whomever was in the community at the time go back and do what you call a trip report. I think that is what you all call it. Do you all call it a trip report?

RESPONSE

All the trip reports of visits related to DDMT since 1997 are referenced in the public health assessment and are provided to this commenter on an ongoing basis.

Facilitator: Yes.

53) *Commenter 2*: Because during the time of DERTF in 1996, Dr. Hughart -- I think that was his name, ... He was from ATSDR. Chris Kartman took the group, the staff from ATSDR, and the Army -- there was a lady that dealt with environmental health from the army, from the DERTF meeting and took them back in the office.

And her statement was "I want you to work with the community, but I don't want you to find nothing." And I see -- and Dr. Hughart sent me that statement. Dr. Hughart sent me that statement. ... And I feel like that you did a very good job working with the community and doing nothing.

RESPONSE

The ATSDR staff working on DDMT since 1997 never received any instructions from anyone, including the Department of Defense or related agencies or its contractors, on how to conduct its activities or what conclusions to reach. *The health assessor assigned to this site, John Crellin, had no previous involvement with Department of Defense sites. As can be observed by the number and tone of the nearly 100 comments submitted by the Department of Defense, that agency is no*

more pleased with this public health assessment than the commenter. DOD has not funded the activities that ATSDR has conducted related to DDMT since 1997.

54) *Commenter 2:* -- and that is what we got -- what that is what I was telling you, until you clarify this booklet, this is the most dangerous book that can go out.

RESPONSE

DR. CRELLIN: This is a public comment draft, and it very much means, especially the way that I write it, that we want the public comments. The comments that we get, can and do change the document. We would have liked to -- in most other sites that we work with, the sites that I worked that are not federal sites, I like to have constant interaction with the citizens as I am writing the document. That is the method I much prefer.

When we started this process in February of 1998, I announced at that time that we would be unable to do that step-by-step process because we had -- first, *(referring to commenter 2 by name)*, you had concerns that we were handing the document to the depot before it was released and getting their approval. Essentially that --

Commenter 2: I really thought that we --

DR. CRELLIN: *(Identified commenter 2 by name)*, may I finish my statement -- that was the process that actually does occur. I find it extremely distasteful. And I made my *concern about this* known within the agency. But we were bound by a written agreement *with DOD* that anytime *a* document *is released by* ... ATSDR ... that the federal people would get a document at the same time that everybody else did. And so as I announced in February of 1998, what we did is that, when I sent the document to you, basically the people of the depot were fedexed the same document at the same time. The first time they'd ever seen the whole document is the first time that you had ever seen the whole document.

I did discuss specific parts and shared specific parts of the document with you *(commenter 2)*, including the community health concerns. We talked about the document in some detail, including the conclusions in July of 1999. We did that, in part, with the interjection of Dr. Warren ... to get some information out to give you all the opportunity to comment at that time. At that meeting, I received very few comments. I was hoping that people --

55) *Commenter 2*: Each time you come into the community and each time we ask the question, when we get the question back, it is twisted around or when we ask the question that we ask -- like we asked the question about the data that came out of that office, and I don't know how those two things sound alike. Maybe I have so much of a southern drawl

you may not understand me that clearly. But the questions would be so distorted that it made people so angry they didn't want to come. Why is it every time that we ask something, when we look at it on paper, it is a totally different definition or a totally different statement from what we said? And that was the problem.

RESPONSE

> DR. CRELLIN: This is the opportunity, if you find that things have been distorted, this is the opportunity for you to ask for them to be corrected. Most of the comments that are in the document -- there are 25 comments listed there -- about twenty of those comments were compiled in some initial meetings that we did where Michael Grayson was involved. And I remember that Michael compiled those, put those in the list. And he sent them to you and asked for your comments on them. And I took those comments from that list and compiled the list that is in there. I also sent that whole section to you, *(commenter 2 was referred to by name)*. I was hoping that you would respond back and correct the record if you felt --

56) *Commenter 2:* I don't remember getting it. I got a few questions; and like the first page, the first ten questions was missing. And I think I made a statement, I said, What is this?

(A community member is mentioned by name), a concern about her yard sinking; that is the first place I took you on the tour of the community -- was to *(the individual is named again)* house, where she was talking about a hole in her yard that she could never fill. And she was constantly putting grass, dirt, anything, trimmings from her yard. And that every time -- like in a few days that hole -- something was there. I didn't see that in the concerns at all. And that is what I am saying. Earlier concerns -- I get tired of going back over the same thing. And I am pretty sure the community people, too, that they get tired of going back over and over and over. People are just not going to meet like that.

Once we say something, it is over with. And I don't know -- I don't know about this agency anymore. I don't. We didn't have faith in the beginning, so it wasn't a disappointment because of what had happened earlier. But at least we was thinking that -- and I know Barry Johnson is gone. He is the one that said this needs a look at. You know I just feel sorry for you all that you can't see things the way that we do. And it looks like that you are looking through rose-colored glasses.

RESPONSE

> *The concern from this individual was mentioned in concern #25 on page 42 of the document*

57) *Commenter 2:* It is, they got the data. We don't want to hear what the community is saying; their data, since it is verbal, it doesn't mean anything. If we write it down, it still

don't mean anything. The tapes of the workers, they made statements of how they poured chemicals down the drains, how they poured chemicals in the pond, and, apparently, it doesn't mean anything.

DR. CRELLIN: As far as the statements from the workers, I did not -- was not given a copy of that tape or allowed to see that tape until about ten days ago. And so I did not have the opportunity to incorporate that into --

Commenter 2: But you did see the tape of the workers before.

DR. CRELLIN: Until 2 weeks ago, no, I did not.

Commenter 2: I am talking about now. You have seen the full tape?

DR. CRELLIN: Yes, I have seen the full tape, yes.

Commenter 2: Okay. That's fine.

DR. CRELLIN: I protested about it, and I finally got a copy from --

Commenter 2: I want to tell you, they ain't going to meet with you no more. They are not going to meet with anyone anymore, unless they read –

DR. CRELLIN: They don't want --

Commenter 2: The response came to me, "*(Commenter 2 identified herself)*, they wouldn't help us then, so why are we wasting our time now?"

Commenter 8: ATSDR did that meeting. Aren't you working together? Isn't it one agency? Are we supposed to believe that they care about us? They wouldn't even give us the tape. *(Commenter 2 was named)* tried to get --

Commenter 2: I got it now.

Commenter 8: How long did it take you to get that tape?

Commenter 2: Over six months.

Commenter 8: What's going on? They wouldn't give you this tape until ten days ago?

DR. CRELLIN: I don't know. You have to ask the people at --

RESPONSE

As indicated in the response to comment 41, ATSDR considers the community a valuable and valid archive in evaluating the possible health impact of a site. ATSDR conducts a careful evaluation whenever it receives specific information on possible exposures from community members.

Now that the health assessor has had the opportunity to review the video of the meeting with the former DDMT workers, a summary of these concerns is included on page 43 of this document.

58) *Commenter 2*: See, what has happened with workers is there has been retaliation on government jobs. And we heard this all over the country. Fordor (phonetic) was one example, and Oakridge especially, and Paducah; these are called the whistle blowers, when an employee stands up and says, "You are wrong," they are blackballed from decent government jobs. And the retaliation is so severe all over this country that even we have asked ATSDR to intervene and to give that as a comment to the Labor Board to ask the Labor Board to come forward. I know you can't do anything about it. But you can give a recommendation, and somebody will look at it. And they will say "Dag, people come in and talk" -- that is the reason why they won't talk. They are afraid of the retaliation. Because *(a former worker was named)* was massively persecuted by the DLA before -- she had to just quit. And it wasn't her; it was other workers that when they you found out there was talking, they don't have a decent job now. Since that place closed, they don't have decent government jobs now. But the white folks have.

RESPONSE

ATSDR's Office of Urban Affairs is working with the former DDMT employees.

Commenters 1, 2, 4, 5, 7, and 8 plus 3 other individuals began to leave the meeting indicating that they were leaving in protest.

DR. CRELLIN: ... Before you go, *(commenter 1 was identified by name)*,... Could you please -- you mentioned a comment about another drainage than this one existing now. And I didn't quite understand where it was. Could you point to that on the map and show me where it is?

59) *Commenter 1*: (Indicating *a location on a map of the DDMT area that was being projected on a wall in the meeting room.*) Right there. This is Boyle Avenue. You keep going. There is a huge drainage ditch. It is big enough for a horse to get in.

DR. CRELLIN: Thank you.

Commenter 2: These drainage ditches here (indicating *the drainage from the northeast corner of the DDMT Main Facility*), you got them going that way, but they come down. And they used to flood.... My husband used to work over here and the lane used to flood. You got it like it is going one way. And it doesn't go that way. It goes underground. It's got spires that goes all the way out to the community now. But it used to just go over the people.

RESPONSE

These concerns about drainage by these two commenters were responded to on pages 112 and 117.

DR. CRELLIN: *(Identifying commenter 3 by name)*, I addressed your comment this afternoon. Did I need to say more than what I said this afternoon?

60) *Commenter 3*: Fine with me.

RESPONSE

DR. CRELLIN: The idea about sending a list -- you made a comment about sending -- to send something out to have people send their concerns back, or whatever. I'll think about that. That is a constructive idea. I'm not sure how far -- again, the problem gets back to what impact does it have now upon the situation, other than the -- yes, it does document a lot of concerns. But as far as the purpose of the agency -- and basically we deal with now and the future, my division. But I will have to think about it. It seems like a worthwhile thing to do, as far as to see how much concern we have from people. It includes basically everybody that is within a half mile of the site. *(This question was directed to the community involvement specialist for DDMT.)* Isn't your mailing list everybody within a quarter mile or half mile --

DDMT community involvement specialist: A mile.

DR. CRELLIN: Okay.

61) *Commenter 3:* My statement along that line, as you see, there are obviously strong, strong feelings about the study. A lot of people have put a lot more work in on this study than I have. And I respect *(naming commenter 1 and 2)*. They have been active since 1995. And I respect their concerns, and I am sure they are legitimate. And my only concern is we have to make every effort, extra effort, and above effort to try to reach out and touch the community in more than normal methods. And that is why I would like that sent out to former residents, current residents on the mailing list to let them know, You don't have to worry about losing your job, the depot is closed now; you don't have to worry about somebody saying this or that. Bring us your concerns, send it to them, and we will try our best to address it.

RESPONSE

As indicated earlier in these responses to comments, ATSDR has offered Howard University the use of its mailing list to essentially accomplish what the commenter is suggesting. Howard decided not to use the list at this time because of time constraints but will consider its use in the future.

62) *Commenter 9:* ... What about the hazardous waste material in the area? Has there been --

DR. CRELLIN: In which area?

Commenter 9: The defense depot area, over by Ball Road.

RESPONSE

DR. CRELLIN: The buildings that I am displaying here *(pointing to a map being projected on the wall that displayed information similar to that on Figure 2)* -- and you see I am not displaying all the buildings that used to be there -- these are essentially the buildings where at least sometime in the past hazardous materials were handled. And one of the things that I do here is that with data that we have about the site, it basically shows the different places where arsenic was sampled on the site and the levels that were found. *(This information is similar to that on Figure G1.)* And that is in the document. It just doesn't relate all these things together.

Commenter 9: Was it a high content?

DR. CRELLIN: Of the arsenic?

Commenter 9: Yes.

DR. CRELLIN: There were a few locations, but, overall, no. Compared to other sites that I worked on in other places I have been, the levels of arsenic aren't especially high. There are lots of locations that have arsenic.

63) *Commenter 9*: Would it be feasible to build there or invest in the area --

DR. CRELLIN: On Ball Road or on the site itself?

Commenter 9: No. Ball Road area?

DR. CRELLIN: Would it be feasible to --

Commenter 9: -- feasible to invest money, per se, community centers, churches, day-care centers?

RESPONSE

DR. CRELLIN: The data available to us, as far as the site having an impact on the neighborhood along Ball Road and basically south of the site, yes, you could build things there. Again, based on as far as the site data and what the site -- it doesn't mean that there aren't other sources of contamination or other reasons to build or either to not build there. But as far as the site, no there is no reason not to build there.

64) *Commenter 9*: What is the overall conclusion? That there is no contamination that could affect -- you know -- as to the –

RESPONSE

DR. CRELLIN: The best data that we have and the data available to us indicates that, you know, the people off-site that -- from the data we have basically since 1989 -- that the levels weren't high enough to -- the levels of the site contaminants weren't high enough to harm the people that lived off the site. Before that, there is lots of uncertainty. And one of the things -- we had a number of people here before you came that expressed in quite a bit of detail their concerns about what happened in the past, their encounter with things that happened in the past, where they thought they saw chemicals coming down ditches in the area and that things were different. And in part, that is why we concluded that, because of those stories and, in part, because we simply don't know what the environmental levels were on the site or off the site much prior to 1989 -- that is why we concluded that we just can't make conclusions about that.

65) *Commenter 9*: A lot of people in the area had cancer. My brother-in-law died with cancer. And he lived at Ketchum and Crosby. All those houses are gone now. Two friends across the street, they got cancer. On that street it was like ten people developed cancer. But it was at Ketchum and Crosby, from Ketchum and Crosby up to Pecan Circle, off of Ketchum. And that was back -- he died in 1982.

RESPONSE

Thanks for the information.

Facilitator: Then I guess we will officially close the meeting. But Dr. Crellin can stay later if you have any last minute things. Or if there are any notes to hand in, just pass them up front. And of course, until the 31st, submit written comments, if you have any other questions or comments, to the agency. Thank you very much for attending.

Comments Received in Writing from the Public

These comments were submitted in writing from a member of the Memphis RAB who worked for the Depot and lived in the area for many years.

For the record, I found the Agency for Toxic Substances and Disease Registry (ATSDR) Public Health Assessment update to be thorough and comprehensive - it certainly addresses all areas of major concern.

I find that you have presented your findings very clearly, along with supporting figures, charts and tables. I was impressed with your response to the Community Health concerns, pages 31 through 42.

First of all, would like to present some background information to address an issue that is re-occurring continually. Is the general public raising the health issue question (cancer cluster area) in the surrounding Depot community? This issue causes me great concern and I try to look at it in an objective way, being a good listener with an open mind.

.... I retired from the Defense Depot Memphis ... after 27 years of highly dedicated work for the U.S. Department of Defense. Over this period of time, I have vast knowledge of what has transpired there. Also, in the early years, especially before the Environmental Protection Agency was formed in 1970, I feel at times I worked under adverse environmental working conditions. ... From 1964 to 1996 (32 years), I lived within one mile of the Defense Depot Memphis.

In review of my comments on July 10, 1996, regarding the "Environmental Baseline Survey Report," potential contamination areas, I quote:

> "Looking at many of the general purpose warehouses, and under visual evidence of contamination, the phrase "Potential Fumigation" is used. In addition, another phrase "No data exists to determine if buildings were fumigated or the impact of fumigations". The buildings were fumigated two timed a year (some say fogged) by highly trained personnel during warm months (April through September) and the majority (95%) was conducted over the weekend (usually Saturday and Sunday). Occasionally, some residue was noticeable on material (on top of cardboard cartons), and also in transportation aisles. If you could see a small area that looked slightly white, this had to be cleaned up because it was slick and could cause an accident.
>
> "In warehouse 549, Section 5, regarding fumigation chamber (Methyl Bromide) when used clothing and bedding was returned from bases for credit, it was mandatory to process this material through the gas compression chamber before reissue as condition "B" material."

For 19 years, I worked in warehouse 630, just west of the building was the dipping vat where pallets were treated with Pentachlorophenol (PCP).

Every 10 years, the foundation of the 20 typicals were treated with chlordane and every year along the transportation aisles beneath the pallets the building was treated with pesticides (Chlordane, DDT or Dieldrin) until such times their use was banned.

I have tried to compare myself working within the Defense Depot to citizens living in the surrounding community. I feel that I had an opportunity to come into contact through dermal, ingestion or inhaling exposure, however based upon the toxicity level at the contaminants they were low, therefore it appears unlikely that my workplace posed a threat to my health. I must say with all my honesty that I have been blessed with good health.

Reflecting back to previous meetings, the citizens of the Defense Depot Community seemingly reiterate that the U.S. Army built the Depot in the very early 1940's and encroached upon the community in an environmental way, that has harmed the community health wise by indicating the high rate of cancer cases reported in the area.

In my review of the environmental test data made available by the United States Environmental Protection Agency (EPA), the Tennessee Department of Environment and Conservation (TDEC) and the U.S. Engineers (Environmental Contractors) from sampling locations offside, it shows contamination at a low level and considering a long term risk assessment (period of 30 years), it's highly unlikely there is a health risk threat to citizens of the community.

On June 14, 1996, Mr. Larry J. Smith, Director of the Mid-South Peace and Justice Center and also the Community Co-chair of the RAB, wrote a letter to Dr. Dan J. Spariosu, U.S. Environmental Protection Agency, Region 4, outlining how the Depot community became segregated by a method called redlining. Enclosed is a copy of the letter.

As a strong rebuttal to redlining by Banks, there is another side to this issue in the form of a drab to the Mayor of the City of Memphis and the City Council, to adopt into an ordinance for the Memphis landmarks Commission. The Memphis City Council Agenda for November 4, 1997, in reference to Item #58, showed the vote was unanimous to adopt the ordinance.

> **"Despite a vast number of rehabilitations in Midtown and several high profile downtown development projects, population continues to shift to suburbia. Out migration from the urban core has exacerbated residential segregation according to economic class. Core areas have increased concentrations of lower income populations, although there are numerous exceptions to this generalization with enclaves of high and low-income populations in all areas. An important result of this population shift has been the tendency of businesses to follow the higher income population. Retail and consumer service businesses**

have been especially likely to leave the urban core for regional and strip malls, arterial nodes, ribbon developments, and specialized functional areas. These offer greater visibility and convenience to the suburban consumer."

"Historically, Memphis has not had a particularly strong industrial base. However, today Memphis is seen as attractive for industry because of its location, competitive wage rates, and quality of life. Unfortunately, to date, industry has largely located outside the urban core. The result has been that low income inner city residents have been less likely to enjoy the benefits of the new employment opportunities."

To be very candid, one can contribute their best work in reviving the conscience of the people on matters of social justice and in drawing their attention to the past policies of the U.S. Department of Defense, the United States Environmental Protection Agency and the Tennessee Department of Environment and Conservation so that the ordinary man and woman might remain economically and environmentally free in spite of great combinations of wealth or poverty.

Always remember, an individual should remain unafraid of tradition, and unafraid of change and accept the scientific data made available by the Base Realignment and Closure (BRAC) Base Cleanup Team (BCT) and face reality and often times the truth is painful to bear; only then the residents of the Defense Depot Memphis Community can put forth their most strenuous action as human dynamo in search of their common goals.

I trust that the ATSDR" Public Health Assessment update will bring a closure to health issues reported within the Depot community that will be truly acceptable by all concerned.

Being a concerned citizen and also a Restoration Advisor Board Member at DDMT, I consider it an honor and a privilege to have the opportunity to comment on this very important public health assessment update.

Here is the attachment to these comments.

June 14, 1996

Mr. Dan J. Spariosu
U.S. EPA
3.45 Courtland Street N.E.
Atlanta Georgia 30365

Re: Environmental Justice Issues relating to the Depot

The subject of environmental justice has become a buzz word over the last couple of years, but the issue has been around for a long time. When you talk about Memphis, you cannot discuss the term without understanding segregation and how it was implemented. One method was called red lining. It was an open and understood practice for banks to either cut off mortgage money in a neighborhood or conversely only offer African Americans mortgage money in a certain neighborhood. This is where the term "red lining" comes from. If you lived on one side or the other of the line, you either did or did not get credit, depending of on the bank's plans for your community.

In 1942 the Depot was located in an area known as Civil District 8. It had 1,716 people of unknown race living in a large area running from Person south to Nonconnah and from Airways over to Mississippi Blvd. In 1950, the civil district had been changed to census tract 78 and it had 2,626 black and 2,764 white. If this trend continued a "normal" growth pattern could be assumed. Meaning people lived where they wanted to with no outside influence due to their race. But this is not the case, by 1960 the population was 10,342 black and 2,637 white; and by in 1970, it was 15,943 and 1,838 white. In 1980, *census tracts* 78.20 and 78.10 were born. 78.10 became the industrial tract with 4,648 blacks and 92 whites occupying it and 78.20 became the black residential area with 10,595 blacks and 741 whites in it. In 1990, tract 78.20 had nearly become de-populated, 561 blacks and 65 whites and 78.10 was declining at 4,150 blacks and 22 whites.

Race lines are not a comfortable thing for White people to reminisce about. As time goes by and the races move further and further apart the old lines become blurred and forgotten. The races lived much closer together in 1950 than they do now. But segregation was no less a fact, a quick look at census tracts 60 and 75 which adjoin each other will illustrate this. In 1950, census tract 75 was 243 blacks and 1,739 whites and census tract 60 was 2,407 blacks and 502 whites. Between 1960 and 1970, something happened. The whites not only left census tract 60 but a huge migration took place in census 75 so that by 1970, census tract 75 was 3,381 black and 137 white. Red line!

1950 census tract 75 was 243 black and 1,739 white.

1970 census tract 75 was 3,381 black and 137 white.

I have set the stage for the development of the community around the Depot to show that environmental justice is not just a lot of whining but a reality tied to racism in all its forms. The idea that the African American community wanted to live around the Depot is blind to fact that African Americans lived where they were permitted and no where else. Noxious and dangerous industries were cited in black neighborhoods or black neighborhoods were constructed next to noxious dangerous industries, what is the difference in a segregated society?

I also mention all the above to put the decisions that must be made today into context. What is to be done with the Depot site should not be planned with the assumption that the nearby community is happy with the way things were and will blindly accept what is proposed in the future. The economic well-being of the larger community does not have to come at the expense of the nearby community.

The primary EJ issues regarding the Depot are,

1. the level of clean up and investigation proposed for the entire site,

2. the fate of Dunn field and those who live next to it and,

3. the types of uses the facility will be put to in the future.

In reverse order,

A newsletter should be sent to everyone within one half mile of the facility. Ms. Sue Estes has the list and has done a fine job of this before. This newsletter should lay out the options for reuse of the facility and what is being seriously considered for the site. Also it should invite the public to let the reuse committee know of their concerns. I personally think a commitment should be made to allow only non-polluting industries on the site.

New emphasis should be placed on the clean up and removal actions once planned for Dunn Field. The piles of fluorspar and bauxite should be removed at all cost. These piles serve as a constant reminder of what was left behind by the Defense Department when they left town. The residents who must look at those piles everyday should not have this view to remind them.

In regards to the portions of the site that will be reused, a thorough and vigorous investigation should be performed for each parcel deemed suitable for leasing or sale. This will insure that property is not occupied over contaminated sites. It will also avoid the confusion and delay in determining the source of the contamination if the occupier also

happens to have toxic substances on site. If a commitment is made to use only non polluting companies then this is less of a problem.

The Dunn Field removal action should be given equal funding and priority with the base reuse efforts. Vigorous contacts should be made regarding the final disposition of the chemical test kits buried in Dunn Field. The removal action should then move forward with all haste.

Sincerely,
Larry J. Smith
Cc-chair RAB Memphis Depot

cc: Ms. Chris Kartman, Ms. Sue Estes

End of attachment

RESPONSE

Thanks for the information and for the complement. Some of the information provided will be referred to the public health assessment.

Comments from Howard University

Submitted by: Cynthia Warrick, R.Ph., Ph.D.; Howard University; 3/27/00

1) The community adjacent to the Defense Depot Memphis Tennessee (DDMT) is very concerned about health effects that may be related to past, present, and future exposure from hazardous substances migrating from the DDMT site. Residents have documented increased adverse health effects, diseases, and mortalities in their community that they perceive are in some way related to activities on the site. They have increased fear and anxiety that more serious problems might occur when the excavation of the site takes place for proposed remedial action. They are also concerned that unknowing citizens will be placed on a site that has not been cleaned up to residential levels, especially in light of the health disparities in minority and poor communities that make them more sensitive to pollution effects than the majority population.

RESPONSE

ATSDR has never been able to obtain from DDMT area residents any of that documentation of increased adverse health effects. We hope that Howard University will be able to obtain it and share that information with ATSDR.

Regarding the fear that people might be allowed to use an improperly cleaned up location on DDMT, the Depot is working with the community members of the RAB to insure that this does not happen.

2) Department of Health and Human Services (DHHS) has reported that minorities suffer from cancer, cardiovascular disease, diabetes, and HIV-AIDS at more than double the rate of the US white population. Additionally, many minorities have not been immunized properly. Minority residents, with already compromised immune systems, are probably more sensitive to environmental toxicants, than those populations with intact immune systems and proper nutrition. Of course, research will need to done to prove this statement, but precautionary action in light of current data should be adopted.

RESPONSE

ATSDR has always insured that its evaluation procedures include special consideration of minority and other sensitive populations.

3) Only limited sampling of the site has taken place and no off-site sampling has been done. According to the health assessment, on page 13 it says, "No sampling of sediment was done on Dunn Field." However, on page 15, 1st sentence: "Only limited sampling of surface soil has been done at Dunn Field." Additionally, the most recent sampling took place in 1995 with comprehensive sampling results not available yet. It would be more appropriate to

release the health assessment once an evaluation of the comprehensive sampling of Dunn field has taken place.

RESPONSE

Very extensive sampling of the DDMT Main Facility was done and it was evaluated in the public comment release of the public health assessment. Extensive sampling of Dunn Field has now been done and is evaluated in this document. ATSDR's evaluation of these data were provided to Howard University in February 2000.

4) On page 16, the fact that only adult exposure doses were calculated and not children is confusing. Because children are living off-site and the numerous schools in the near-by community, where children are outside more often than adults, not calculating possible exposure doses for sensitive populations is a problem.

RESPONSE

In response to this concern, both adult and child exposure doses were calculated and evaluated in this version of the public health assessment.

5) Off-site sampling needs to be undertaken to determine if there are exposure pathways not only for PAHs, but also for arsenic and dieldrin. According to *Priority Health Conditions*, all three of these substances have been found to cause adverse reproductive outcomes, of which the community has documented to occur at abnormally high rates.

RESPONSE

In its proposal for an exposure investigation in the DDMT area, ATSDR indicated that arsenic and dieldrin would be included in the chemicals tested.

6) It appears to be controversial if in one part of the health assessment, only limited or no sampling of surface soil has been done; and on page 17, it is proposed that doses are too low to cause health effects. Without comprehensive sampling data, how can these conclusions be made? It is also problematic to release a health assessment with "the possible exception of the Rozelle neighborhood". It is recommended that on-site and off-site sampling be done prior to release of the final health assessment and that the community residents be allowed to participate in the sampling plan development.

RESPONSE

Most of this concern has been addressed now that extensive sampling data are available for Dunn Field and were evaluated in this document. The release of the final public health assessment will not be delayed until the completion of ATSDR's

proposed exposure investigation because ATSDR's documents and conclusions are always open to revision whenever new data become available. ATSDR is already working with DDMT-CCC and Howard University in finalizing its proposed DDMT area exposure investigation. *As of November 9, 2000, ATSDR has been unable to reach agreement with Howard University and DDMT-CCC about the proposed ATSDR exposure investigation. Most of the locations originally proposed for sampling by ATSDR are included in sampling that EPA is scheduled to conduct in December 2000. The locations that EPA plans on sampling are the Rozelle area near Dunn Field, drainage ditches near the Southeast corner of the Main Facility, and the Tarrent Branch.*

7) On page 23, it states that ATSDR staff observed children playing in a drainage ditch between Ball and Ketchum roads. Isn't this a current exposure pathway for children especially following a storm or other weather event where soil and runoff could be contaminated? Were residents queried on how often the children play in the ditch? During rain? Etc. . .

RESPONSE

Yes, this could be an exposure pathway if contaminant levels are great enough. The data for the results for the sampling points on the DDMT about 50 feet away from where children could have been exposed do not indicate a problem. The levels for arsenic were 1 ppm, for dieldrin 0.2 ppm, and for lead 7.7 ppm. ATSDR proposed sampling of this location to specifically identify what the concentrations are.

8) Surface water contamination questions from page 25.

Section (1) – When were the industrial pipes and lined ditches installed?
Section (2-3) – Is monitoring data available for Nonconnah Creek?
Section (4) – Were residents near Tarrent Branch asked about the second open ditch from DDMT?
Section (5) – When was Cane Creek concrete-lined?

RESPONSE

Section (1) question - We were unable to identify when the pipes and lined ditches installed.
Section (2-3) question - Monitoring data are available and ATSDR has provided Howard University with what it had in its files.
Section (4) question - Residents near Tarrent Branch were not asked about the second open ditch because ATSDR would not have been able to evaluate the situation since no environmental sampling data on this ditch are available.
Section (5) question - Based on engineering plans found in the City of Memphis files, it was about 1973 which is when Hamilton High opened.

9) ATSDR estimates that about 500 – 3,000 persons could have had regular contact with surface water from DDMT, and that a small child might reasonably travel 500 feet, the distance to a ditch. Thus, children should be accounted for in the exposure calculations.

RESPONSE

Both adult and child exposure doses were calculated and evaluated in this document.

10) What contaminants were tested for in the Allen Well Field? When?

RESPONSE

As required by the Safe Drinking Water Act, the wells from the Allen Well Field are tested for about 130 contaminants at least once a year.

11) Why are arsenic and iron levels high in the area around DDMT? Were these possible exposures calculated for risks to children?

RESPONSE

The arsenic and iron levels are not high based on the typical levels for the Memphis area. The child exposure doses for arsenic and iron were calculated and evaluated and found not be health hazard given the likely exposure scenarios and the toxicity of these chemicals.

12) What is the basis for this statement on page 29? "Most surface water and sediment sampling locations from the area around DDMT receive little or no water from DDMT."

RESPONSE

This conclusion is based on a comparison of the drainage from DDMT with the sampling locations.

13) Were residents polled concerning surface water flow from the site following storm events, floods, etc.?

RESPONSE

No, they were not polled.

14) On page 41, community residents expressed concern for possible cumulative effects from mixtures of chemicals at DDMT. Have studies been made to determine possible cumulative effects on sensitive populations, etc.?

RESPONSE

ATSDR has considerable interest in this topic and the studies it has sponsored have tried to address the issue of sensitive populations.

15) On page 44, the health assessment documents that possible health effects to children was taken into consideration, however, there is no information throughout the report to indicate this.

RESPONSE

In evaluating the possible health impact of contaminants on the DDMT Main Facility, exposure of children was considered. In this document, child exposure doses were calculated for all the exposure situations evaluated.

Comments from Depot Redevelopment Corporation of Memphis and Shelby County

Submitted by Jim Covington, Depot Redevelopment Corporation; 3/9/00

1) **Dunn Field:** The report indicates (p. 15) that "The soil and surface water sampling of Dunn Field is not adequate for public health purposes because it focused on suspected contamination source areas and only a few location were tested." The results of recent comprehensive sampling of Dunn Field will, the report indicates, make a definitive answer possible. We forward to seeing those results in the final version of the PHA.

RESPONSE

These data are included in this document.

2) **Evaluation of Residential Areas Around DDMT:** The report is inconclusive (p. 20-23) in regard to the potential risk from contamination along drainage ditches in three areas - the Rozelle neighborhood, the neighborhood south of the SE corner of the Depot, and residential properties along Tarrent Branch which flows from the west end of the Depot. We understand that the potential risk will be clarified by further testing which will be reflected in the final PHA.

RESPONSE

This information will be included in the final PHA if the exposure investigation has been completed by then. The sampling of the surface water drainage areas proposed in ATSDR's exposure investigation is now going to be conducted by EPA, probably in October 2000. EPA will release the results of their sampling to the public and will report them to the Memphis Depot Restoration Advisory Board (RAB).

3) **Toxicological Evaluation:** The report acknowledges the potential for elevated cancer risk from soil contact due to PAH contamination (p. 78 - 79) in three specific areas of the Depot. We understand that, on two of the three sites (between Buildings 689 and 690 and on the south side of Building 249), encapsulation of any residual contamination will result from planned redevelopment activities (pavement for employee parking). If the sampling west of Building 629 warrants, the Depot Redevelopment Corporation should be advised to design a method of encapsulation for that site into planned improvements.

RESPONSE

Further evaluation of this situation indicates that it is not a public health hazard.

4) **Public Health Actions and Recommendations:** Efforts to improve diagnostic methods within the medical community related to potential health risks associated with the Depot or any other site, which the report indicates ATSDR intends, should be extended to all appropriate treatment facilities in the community. The planned action (p. 45) suggests that such assistance will be limited to "the existing HRSA clinic in Memphis". Former Depot employees intended to benefit from this effort are dispersed throughout the City and County.

RESPONSE

The efforts of ATSDR's Office of Urban Affairs will include this aspect.

Comments from Tennessee Department of Environment and Conservation (TDEC) Division of Superfund (DSF)

Submitted by Jordan English, TDEC/DSF; 3/7/00

1) TDEC, DSF is uncertain what future actions, reports, or assessments may be taken/generated as a result of the soil sampling program planned for the Rozelle neighborhood. Please clarify whether a report from this investigation will be generated or whether there will simply be an addendum to this document provided.

RESPONSE

If this sampling is done, a report will be generated and distributed to area residents, and the various local, state, and federal agencies with DDMT. If this sampling is completed before the public health assessment is completed, then a summary of the sampling results will be included in that document.

2) There are several references through the document alluding to primarily 3 surface water drainages. The maps however show 4. The drainage which exits the facility near Custer St. is apparently the drainage that is excluded. This ditch drains a significant portion of the Main Installation to the north, including the DRMO yard. Please correct all references to 3 drainages, including the Conclusions section.

RESPONSE

While there are four surface water drainages with their origin at DDMT, ATSDR considers only three as potential human exposure pathways and has identified them as such in the public health assessment. There appears to be only limited human contact with the drainage identified by TDEC.

3) Page 7 – TDEC/DSF was unaware that the mustard agent was drained into a **vat** of bleach. It was our understanding that the mustard agent was drained into a **pit** containing bleach.

RESPONSE

Thanks for bringing this to our attention. The document has been revised to change vat to pit.

4) Page 7 – The last sentence of the 5th paragraph is confusing. The Allen Well Field is a primary source of drinking water.

RESPONSE

Thanks, the document has been revised to incorporate your suggestion.

5) Page 22 – The introductory paragraph/sentence on this page is contradictory to the second sentence in the next paragraph. If exposure **is ongoing** then **might** and **may** are inappropriate words to use in the introduction. The wording is awkward and contradictory. Please clarify.

RESPONSE

Thanks for bringing this to our attention. Might and may have been replaced by could to insure consistency in meaning.

6) Page 27 – The fourth paragraph refers to the span dome that collapsed. It **was located** near the western boundary of the Main Facility.

RESPONSE

Thanks, the "is" has been replaced by "was".

7) Page 41 – Sufficient/appropriate sampling should occur to document that dieldrin or other chemicals are correctly attributed to the Depot. Just because there are any chemicals present on the adjacent properties doesn't mean that they necessarily migrated from the Depot.

RESPONSE

ATSDR Exposure Investigations, especially those involving environmental sampling, are designed to identify exposure to site contaminants. The protocol of the exposure investigation ATSDR is proposing to do in the DDMT area was devised to do that by taking a sample just over the DDMT property line then moving progressively further away. Contamination would be considered site-related only if the sampling results show a clear "trail" away from the site.

8) Pages 67-68 – Interpretation of these tables need further explanation. What is the cancer risk at the Health Guideline concentration? How does this compare to the estimated exposures as described? What was the benchmark used for contaminants with no Health Guideline criteria?

RESPONSE

As explained in the text before these two tables, a health guideline is for noncancerous health effects. Cancer risk is a separate calculation using the cancer

slope factor for that chemical. Some chemicals like benzo(a)pyrene have a cancer slope factor but no health guideline. Others have health guidelines but no cancer slope factor even though they are carcinogens.

Comments from the Department of Defense

Submitted by Jan B. Reitman, Defense Logistics Agency; 3/30/00

General Comments

1) The quality of this document is substantially below the quality of documents submitted by the DHAC's Federal Facilities Branch for the following reasons:

- The document is largely judgmental without providing the supporting information and analysis needed to evaluate the conclusions.

- The supporting information and analysis is always included in other DOD documents. Past contaminant data has been missing at other DOD sites, however those documents contain a qualitative or quantitative analysis examining potential risks. The risk analysis includes examination of operations to see if there were any changes from past to current operations; this was not conducted in this document. Conservative exposure assumptions are made in the other documents with an analysis of the risk.

RESPONSE

Every statement in the public health assessment is supported by appropriate references. The evaluation done in this document follows the policy and procedures established by ATSDR. It was reviewed by the Director and Assistant Director for Science of the Division of Health Assessment and Consultation. It was found to have followed that guidance. The risk analysis of past operations is sometimes used in ATSDR's PHA, but only if those analyses can result in a valid estimation of exposure. ATSDR did not identify those data for DDMT but would be willing to evaluate them if they do exist. *The issue of the analysis of past operations is discussed in more detail starting on page 179.*

2) The report did not include concepts of "exposure," "release," and "dose" clearly. Sometimes they are confusing. Release and exposure are used interchangeably in some cases, while they often are different from each other. A release does not always result in an exposure. So also, dose is proportional to the amount of contact with the contaminated area. For example, children play in the ditch does not necessarily mean they are exposed, unless it is clear that they were wet, and played in the unlined ditches, and sediments and surface water got on to their body. In the event they contacted water and sediment, how much area of the skin was in contact, and how often and for what duration all play a role in determining the dose, which in turn determines the risk or hazard. Excessive importance was given to the offsite drainage ditches, without establishing whether there is significant onsite contamination is being released to these water bodies from the Depot. The available data

indicate that offsite releases are not occurring, therefore exposures to the ditches are not important.

RESPONSE

This document complies with the public health assessment process described in the ATSDR Public Health Guidance Manual, other relevant ATSDR policies and procedures, and the legislation by which ATSDR was created and health assessments mandated.

3) Concepts of complete migration and exposure pathways are not clearly presented. It is not clear that there is a complete pathway for transport of onsite soils to offsite receptors. Runoff is channeled through storm drains and flooding is not common for this area. Onsite soils are for the most part stabilized through grassy cover or gravel. The aerosol pathway is possible, however as presented in the draft Dunn Field Remedial Investigation Report, maximum VOC concentrations in surface soil did not result in unacceptable risk for this pathway. Thus such statements where offsite soils may be contaminated by onsite soils contamination should be carefully evaluated prior to including in this PHA. Contaminant fate and transport based on site history, aging of the contaminants and changes in the nature of contamination with time, were not presented.

RESPONSE

The extensive process described by the commenter is not part of the typical public health assessment. This sort of evaluation would included in a public health assessment whenever it would enhance and support the document's conclusions. This sort of evaluation is typically found in EPA Baseline Risk Assessments.

4) Please be consistent with capitalization of Main Facility. Pages 4, 25, 27 and 32 provide examples where capitalization is inconsistent.

RESPONSE

Thanks, the document has been revised to insure that Main Facility is capitalized consistently.

5) Appears to be confusion between the Sediment Sampling Program conducted by USASSDC (reference 57) and the Background Sampling Program conducted by CH2M Hill (no reference). Both occurred in 1995. Sediment Sampling Program was specific to Depot storm water drains. Background Sampling Program was specific to areas where Depot operations would not have had an impact. There is mention of 22 sample locations in connection with both these programs when in fact the Background sampling report included 22 sample locations. Please be specific to the appropriate sampling program. Also, the 1995

Sediment Sampling Program was not technically part of the RI Sampling Program. The Sediment Sampling Program was specifically initiated due to public concerns about the storm drains. The RI sampling plans did not include the sampling that was accomplished by the Sediment Sampling Program. Also, the document speaks of a "DDMT area" sampling program. Was this the Background Sampling Program? If so, be specific and include the Background Sampling Program Report as a reference. See pages: 13, 17, 22, and 29.

RESPONSE

ATSDR has found that there is often confusion among lay and technical people about the meaning of "background". Because of comments by reviewers within ATSDR about this issue the term "area sampling" was used instead of "background". ATSDR received only the data files for the Background Sampling Program and not the actual report.

6) This PHA did not include latest data in its entirety (e.g., soil gas survey data in Dunn field to locate soil sampling locations, and all the soil, sediment and surface water data from Dunn Field, immuno-assay data along the railroad tracks used for highest PAH sample location selection). Dunn Field investigations included exploratory surveys to include highest soil gas emission areas from which soil samples were collected from surface and subsurface. This latest investigation approach and sampling results were not included in this PHA. Therefore, conclusion leading to insufficient data for Dunn Field (Page 14) is mis-representing the site understanding.

RESPONSE

ATSDR did not receive the data from the extensive sampling of Dunn Field until the document was ready for public comment release so it was not possible to incorporate those data in the document. However, ATSDR did know in a qualitative sense what the results were with the exception of the soil gas or immuno-assay data. These new data only reinforced the conclusions already made about Dunn Field. These data were reviewed in this document.

7) The "Background Study" was not referenced in the report. At the end of the report, it was identified as a study carried out to identify how-wide DDMT operations influenced the area. This was not the purpose of the background report, but rather it was conducted to establish urban background conditions around the Depot, following EPA and TDEC guidance.

RESPONSE

Nowhere in the PHA is the "Background Study" identified as a study carried out to identify how-wide DDMT operations influenced the area. ATSDR never received a copy of nor knew of this study so it is difficult to cite it or reference it. In the PHA it

is stated that, "Low concentrations of chemicals are in soil, sediment, and surface water from the area around DDMT. Available data indicate that DDMT is not a major source for these chemicals." This is ATSDR's interpretation of these data.

8) TDEC's name is Tennessee Department of Environment and Conservation, not Tennessee Department of Environmental Conservation. See pages: 12, 39, 42, and 45.

RESPONSE

Thanks, it has been corrected in this document.

9) There are several instances where footnotes are used to provide where/how information was obtained. In most instances, there is a trip report of the same date that should contain the information being referenced. Should use the reference and not a footnote. See pages: 11, 16, 17, 23, 26, 28, 32, 37, 39, 41, and 42.

RESPONSE

This document was edited by a professional editor and was found to comply with ATSDR's guidance for its documents.

10) The summary italicized statements are often confusing and misleading. They are alarming in that they discuss exposure pathways without including the public health analysis. The summaries are often not supported by the accompanying text.

RESPONSE

This style is an effective way to communicate with an audience with a wide range of technical expertise and specific knowledge about a site. It was found to be acceptable to the health educators, editors, and senior technical staff who reviewed the document.

11) Remedial actions conducted so far should be included as part of the site history, including soil excavations in the residential areas, and active groundwater remediation in the Dunn Field area.

RESPONSE

This information is included in this document.

12) The locations of the neighborhoods are not shown on any of the figures. Without this information, it makes review of this PHA difficult.

RESPONSE

Figure 5 has been revised to include this information.

13) In general contamination trends, what was detected, whether it is related to the Depot operations, and what type of contamination may be expected versus detected was not discussed. The interpretation of the data as it relates to the site operations is missing from this PHA. For example, PAHs were detected along the railroad tracks and roadways. Dieldrin was mostly found in the grass strips and Golf Course, and may have been from historical pesticide applications. No mustard bomb related chemicals were reported in the site media.

RESPONSE

It was not possible for ATSDR to consider these interpretations in the December 1999 release of the public health assessment since it did not receive the documents on which they are based until June 2000. They were considered in this document.

14) Surface water drainage ditches are dry for most of the year across the Depot, with only exception being in the northwest area of the Dunn Field. Ponds in the Golf Course contain water throughout the year. The surface water data reported for most of the drainage ditches is from rain events. Additionally most of the surface runoff is collected through storm-water drainage system through out the depot. Figure 5 implies a free offsite flow from surface runoff, however the flow is only through an enclosed drainage system. Also, exposure pathways are incomplete for most of these ditches because of lack of flow.

RESPONSE

The document clearly states in several locations that water flow in most of these ditches is only occasional. Figure 5 shows the location of the drainage ditches and in no way indicates whether flow is occasional or constant.

Specific Comments

15) The Public Health Assessment: A Note of Explanation: Again, in this brief narrative prior to Foreword, there should be a recollection that a PHA was conducted in 1995 and that this is a follow on study. The narrative should also briefly explain why this follow-on document is needed.

RESPONSE

This section is a "boiler plate" that is inserted into every public health assessment by staff in the Program Evaluation, Records, and Information Services Branch. As such the "boiler plate" does not include any reference to a specific site situation.

16) A Note of Explanation: Second paragraph, first and second sentences: Was this document, either in its entirety or some portion thereof, previously released to other groups? Did these other groups consist of private citizens? Were changes affected on the document due to input from these other groups? If so, change this paragraph to reflect what was done. Technically, this document has already been somewhat reviewed by the public.

RESPONSE

Again, this section is a "boiler plate" that is inserted into every public health assessment by staff in the Program Evaluation, Records, and Information Services Branch.

17) Foreword, Exposure paragraph, last sentence: Does ATSDR routinely collect additional information when it is needed? If ATSDR doesn't collect additional samples, who does?

RESPONSE

As mandated by Congress, ATSDR does recommend additional environmental sampling in its PHAs whenever it concludes that such sampling is necessary to fill gaps in the data necessary to properly evaluate the site. These recommendations are directed to the agency responsible for the site. For non-federal sites it would be EPA or the State. For federal sites, it would be the federal agency responsible for the site.

18) Page 3, para 1 - This paragraph lacks description of DoD property (DDMT) and can be perceived that since 1942, a mile radius of DDMT has been nearly an all African-American community. Based on a review of the historic documents, this is not a true perception nor relevant (for this report). Recommend the first paragraph be changed to read:

- *The former Defense Distribution Depot Memphis, Tennessee (DDMT), contains 642 acres and is located in the southern portion of the City of Memphis, Tennessee, about 2.5 miles north-northwest of the Memphis International Airport and about 5 miles southeast of the Mississippi River. DDMT is a Department of Defense (DoD) facility operated by the Defense Logistics Agency (DLA) with the actual property owners being Department of the Army. DDMT was created in 1942 for the Army Quartermaster Corps. The primary mission of DDMT has been to store; ship and receipt military supply items. On October 14, 1992, the Environmental Protection Agency (EPA) placed DDMT on the National Priorities List (NPL) based on a numeric ranking called the Hazardous Ranking System that determines the level of potential risk of a site to human health or the*

environment. In 1995, DDMT was place on the Base Closure and Realignment Commission (BRAC) list for closure and was officially closed on September 27, 1997.

RESPONSE

This is the summary of the document and, as such, the additional information suggested by the commenter is not necessary.

19) Page 3, para 2, last sentence. This statement is confusing, particularly in a summary section. How large are these PAH contaminated areas? Can a worker spend entire day in each area? If this is hypothetical, then it should be clearly stated so. Most of the PAHs onsite are under gravel covers, near railroad ties, and rarely exposed for direct exposure. There are no known workers spending time exclusively in the PAH contaminated areas. Therefore the statement should include 'if exposure were to occur.' In relative risk terms exposures to workers, if they were to occur, will be lower than exposure to other workers such as persons laying the roads (asphalt has higher PAHs).

RESPONSE

This statement on PAHs is has been deleted from this document due to further evaluation of this exposure scenario.

20) Page 3, para 3, third sentence: Is the ditch from the west side of the main installation Tarrent Branch, or does that ditch feed Tarrent Branch? Also, recommend change from "Data are lacking" to "Data is lacking."

RESPONSE

It is Tarrent Branch. In public health/biological literature, the word "data" is almost always considered to be plural so the appropriate verb is "are" rather than "is."

21) Page 3, para 3. Most of the ditches are dry, with only one ditch being an exception. The continuous flow ditch located north and northwest of Dunn Field also receives runoff from areas other than Dunn Field. While exposure pathway could be complete for the drainage ditches, as offsite public has access, the release from Dunn Field is not confirmed. Constituents detected are similar to those within Main Installation and general perimeter conditions, and urban background conditions. The information included in this summary is not conclusive.

RESPONSE

A summary is not intended to be conclusive or comprehensive.

22) Page 3, 3rd full paragraph, last two sentences – The report does not acknowledge the offsite groundwater contamination west of the southwest corner of the Depot. Although the concentrations of VOCs are significantly less than those west of Dunn Field, they are still above MCL and require consideration for remedial action as discussed in the draft Main Installation Feasibility Study.

RESPONSE

The draft Main Installation Feasibility Study was not provided to ATSDR. However, based on a request by one of the members of the Memphis RAB, ATSDR has included information on this groundwater contamination on page 28 of this version of the public health assessment.

23) Page 3, para 4. The short-term air-borne exposure needs to be explained. What are the five elements of the pathway? Later in the document, it states this occurred once.

RESPONSE

This sentence has been revised in this document to include the phrase "at least once" to make this clearer.

24) Page 3, para 4,– This first sentence differs from the statement on page 27, para 3. Which is correct? Did airborne exposure definitely occur or "probably" occur? If the statements in the main part of the document are correct, then the summary should be consistent with those statements. The statement "In the past accidental releases may have occurred", does not mean exposures have occurred. Contaminants may have never reached past property boundary. There are no known exposures.

RESPONSE

The statement in the Summary on long-term air exposures has been replaced by "Little indication exists in the data available to ATSDR that long-term exposure to site contaminants of all or most of the residents around DDMT occurred via the air." This is taken from the discussion of the air pathway on page 27.

25) Page 3, para 5, single sentence. The statement implies there are no concerns for long-term. Is there a possibility for short-term exposures to this indirect pathway?

RESPONSE

Long-term has been deleted from this sentence.

26) Page 3, para 6: While the thoughts on reevaluating the 1995 PHA, examining the cancer data, and the commitment to review additional environmental data seem to be within the purview of a PHA, it is unclear why the Greater Memphis Environmental Justice Workgroup, the enhancement of depot area health care facilities, and the health education are included here. While these are each worthwhile efforts, they do not seem to belong within this document according to the Foreword. Please either explain the relevance or remove these inappropriate references.

RESPONSE

The inclusion of these references in the public health assessment was requested by Dr. Rueben Warren, the Associate Administrator for Urban Affairs as a way to document these public health activities. The request was accepted by Rear Admiral Robert Williams, the Director of the Division of Health Assessment and Consultation.

27) Page 4, para 1, last line. DOD has repeatedly asked that the word "revisit" not be used in conjunction with this assessment. The agreed upon language (per November 1998 meeting between ATSDR and DLA) for this document was a "Site Review and Update". Change "revisit" to "review and update". See also Page 12, Para 1, line 3.

RESPONSE

The health assessor, John Crellin, was not aware of this agreement. This document has been revised to delete "revisit."

28) Page 4, para 2, last sentence: Please verify that no one has reviewed some portion of this document before the release of the document in December 1999.

RESPONSE

Portions of the community health concerns section were shared with DDMT-CCC, DDMT, and others in October 1998. Preliminary drafts of the contaminant maps and tables were provided to DDMT and CH2MHILL in 1998. Those portions of the documents that directly supported the conclusions of the document were sent to Dr. Kathleen Buchi of DOD in June 1999. The community health concerns section was provided to DDMT - CCC in July 1999 to respond to a complaint that community concerns were not being addressed in the document. **No one outside of ATSDR saw or reviewed the whole document before its release for public comment in December 1999.**

29) Page 4, para 3: Please add that ordnance to include explosive bombs, chemical warfare weapons, biological warfare weapons, and nuclear weapons was never stored or distributed

from the site. The only exception to this is the small arms munitions used by the facility security force. This is a concern the DoD staff has heard from the public in the past.

RESPONSE

This suggestion has been incorporated into this document.

30) Page 4, para 3 - Suggest including figure 3 from the 1995 report to show the overall site location.

RESPONSE

Figure 1 has been revised to include a small map identifying DDMT location within Shelby County.

31) Page 4, para 3 - Add a sentence to help readers understand the origins of the depot: "Located on land previously farmed for cotton, the depot was constructed to meet the needs of the Army early in WWII."

RESPONSE

Reference to the cotton field has been inserted but the other information is not germane to the purpose of this PHA.

32) Page 4, para 4, sentence 2 – Replace "and such" with more descriptive terms like "tires, wooden pallets, repair parts, and other supplies" (insert the appropriate descriptions). "Drums of chemicals" were also stored in the open storage areas. The only "medical waste disposal" at the Depot that records indicate is incineration or burial of expired-shelf life items. The term "medical waste" may be confused with biohazardous waste. Please specify what "medical waste" includes or means.

RESPONSE

"Disposal of medical items" has been substituted for "medical waste disposal" in this document.

33) Page 4, para 5. To minimize confusion, add a sentence defining the term chemical warfare materials after the first sentence and move the sentence beginning "Most of this storage..." to the end of the paragraph.

RESPONSE

This paragraph is adequate as written.

34) Page 6, Figures 2 and 3: The northern most drainage off of the west side of Dunn field appear to cross Rozelle. I do not believe that is correct unless the drainage is within a enclosed storm sewer. If that is the case and there is little to no opportunity for exposure to the public, why is it indicated on the two figures? Please also refer to the attached information from the 1995 PHA that states there are two unlined ditches running from the western side of Dunn Field through the Rozelle neighborhood. Please verify these drainage pathways.

RESPONSE

This ditch does run under Rozelle street in a pipe. However, during the rest of its course through the Rozelle area it is an open unlined ditch that anyone in the Rozelle area could easily and regularly access. The 1995 PHA is incorrect as there are three ditches coming off Dunn Field in the Rozelle area.

35) Page 6, Figure 2: The key symbol for "Tracks where 1946 Mustard bomb Train" does not match the actual symbol on the figure. There also is no symbol in the key for housing/residential.

RESPONSE

These problems have been corrected in this PHA.

36) Page 6, Figure 2: The terms "Toxic Materials" and "Toxics Recovery" associated with Buildings 835 and 865 are not technically accurate. Not all hazardous materials are toxic (compressed oxygen, for example), and these two buildings stored/recovered a variety of hazardous materials. The building identified as the "Span Dome Site" is now Building 925. After the span dome collapsed, it was not rebuilt. Suggest inserting either "former" or "spill" into that identifier.

RESPONSE

The labels for these buildings came from maps provided by DDMT.

37) Page 7, para 3 – Replace the parenthetical explanation of the stockpile material with a standalone and accurate description of the purpose of the material. Please delete "agents" as it may be confused with the chemical warfare agents mentioned in the previous and following sentences. Bauxite (aluminum ore- $Al_2O_3 \cdot nH_2O$ with ferric oxide and silica impurities)and Fluorspar (metal smelting flux- primarily CaF_2) are NOT used in the manufacture of chemical warfare materiel or chemical agent. However, the bauxite and fluorspar ore piles do not exist at the Depot anymore.

RESPONSE

This paragraph has been revised as suggested.

38) Page 7, para 4 – Several related comments as follows:

- Sentence 5 is misleading. Replace it with a description of how the bombs were detoxified according to the standard operating procedures required and approved at the time, noting that supertropical lime solution (strong bleach) is the material used today to detoxify mustard agent.

- Please indicate whether the "attempt" of detoxifying the mustard was successful. A statement to this effect is in the Archives Search Report.

- The second line reads "In 1946, German mustard bombs, being transported by rail through the Memphis area, were found to be leaking (5). The train was brought to the DDMT Main Facility where the leaking bombs were unloaded and the train decontaminated". This statement doesn't explain where the Mustard Bombs were heading and/or why they were taken to DDMT. Recommend change to " *In 1946, German mustard bombs that were being transported by rail from Mobile Alabama through Memphis Tennessee in route to Pine Bluff Arkansas, were discovered to be leaking while at the Memphis Station (5). Since DDMT was the nearest military installation, the train was routed to DDMT where the leaking bombs were unloaded and the train, to include train-rails, were decontaminated by trained specialist from Aberdeen Maryland.*"

RESPONSE

The chemical warfare materials cleanup on Dunn Field that began in June 2000 suggests that the paragraph is adequate as written.

39) Page 7, para 5, Several related comments as follows:

① The main solvent in the subsurface of Dunn Field (solvent disposal/burial area) is 1,1,2,2-tetrachloroethane.

② Please change the wording of the second sentence to "This, along with potential private offsite sources, resulted in extensive contamination....." The BRAC Cleanup Team has evidence that there may be a non-federal government contributor to the plume to the north of Dunn field.

③ Please check the 30-40 below surface statement for the fluvial aquifer. Across Dunn Field, the fluvial aquifer starts about 60 – 80 ft below ground surface rather

than 30-40. The saturated thickness of the fluvial aquifer averages about 10-20 ft thick across Dunn Field.

④ No mention is made that the fluvial is not the aquifer used for potable uses by the City of Memphis. Also, per comments by USGS, "Fluvial Aquifer" should not be capitalized.

⑤ Please indicate that the wells in the Allen Well Field draw water from the Memphis Sand aquifer, not the fluvial aquifer.

⑥ Although the flow of the fluvial aquifer is essentially to the west, flow patterns in the contaminated portion of the fluvial aquifer do not correspond to most of the mapped locations around the Depot. Commentator would propose phrasing the final sentence of this paragraph as: "The contaminated groundwater may eventually reach the vicinity of the Allen Well Field, which is used by the City of Memphis as a secondary source of drinking water."

⑦ Check the Allen well field use by the City of Memphis as a *secondary* water source. The commentator believed it was a primary source.

⑧ Regarding the first sentence, this sentence can be perceived that DDMT violated environmental statues by burying chemical in Dunn Field. Recommend change to "At the time when DDMT buried chemicals at Dunn Field, there were no environmental requirements to have an impermeable (i.e., liquids can't flow through) liners and caps as now required."

⑨ DoD has found in the Dunn Field Remedial Investigation, lead and arsenic concentrations are not elevated in the pumped groundwater and are therefore sampling artifacts rather than environmental contamination.

⑩ Lead (maximum concentration was 21 mg/kg) and arsenic (maximum concentration was 17 mg/kg) in the subsurface (burial activity) were similar to background concentrations. This paragraph as written is confusing because it seems to mix subsurface soils with groundwater.

[11] The last sentence is misleading, as the details in the report are contrary (on Page 27 first paragraph).

RESPONSE

The suggestions 1-7, 9, and 10 are accepted and the appropriate revisions have made. The rest of the suggestions are not germane to the document.

40) Page 7, para 6, Please add at the end of second sentence migration pathway 'possibility.'

RESPONSE

This paragraph is acceptable as written.

41) Page 8, Figure 3, comments: 1) The ore piles no longer exist, therefore should be identified as former ore piles. 2) The Mustard Bomb Debris locations should be identified as suspected or reported, as they are confirmed locations. 3) The acid burial area could not be confirmed. 4) The latest Dunn Field investigations indicated presence of solvents in larger area than that reported in this figure. Either, make this figure represent current conditions or indicate in the title that it represent historical conditions only. Additionally, the road that connects Kyle to Rozelle, Menager, does not cross the railroad tracks to the west of Rozelle. The road simply makes a ninety degree turn south to Rozelle. Also, the symbol for the railroad track is not used on the map. In fact, the rail as indicated on the north side of Dunn Field is incorrect.

RESPONSE

The suggested revisions have been made.

42) Page 9, Figure 4: In the percentage African-Americans figure, the gray "Greater than 0-50% African American" key is incorrect. It should be "Less than 50%..."

RESPONSE

Thanks for catching this mistake. It has been corrected.

43) Page 10, para 3 – The specific communications referenced do not include installation press releases, etc. These should be specifically identified just as the newspaper articles are, unless only the press was telling the story. Also, the newspaper articles referenced do not include information on a "1998 hazardous waste incident." Unsure what the "1998 hazardous waste incident" involved. The subjects of the three articles dated 1998 include: research on toxicity related to reuse of the property, a survey regarding depot neighbor's concerns, and past military residue. No mention of a "1998 hazardous waste incident." Please delete this. Also, although the newspaper article cited may have speculated on a connection, clean monitoring and pumping wells between the contaminated Allen Well field pumping well and the Dunn Field plume provide evidence that the Allen Well field contamination is not from the Depot.

RESPONSE

The 1998 hazardous waste incident was the problem with the vials and is reference 28 - Military residue from past is concern for today. The mention of "hazardous waste" has been deleted.

44) Page 12, para 4 – Add at the end a description of what the last two subgroups are doing, since the first three are described.

RESPONSE

These two sub-groups are no longer functioning so no description is needed.

45) Page 13, 2nd full paragraph -- The data sources cited do not include the ongoing (since 1996) groundwater sampling at Dunn Field and the Main Installation, although this information for the Main Installation was provided to ATSDR in the Main Installation dataset. Second, the RI investigation for Dunn Field is not cited here. Surface and subsurface soil, sediment, and surface water analytical data from samples across Dunn Field was provided to Dr. John Crellin/ATSDR on 21 December 1999. This dataset is the basis of the ongoing Remedial Investigation and Risk Assessment at Dunn Field. Dr. Crellin had asked for the information approximately three weeks earlier. At the time of his request we had not completed validation of the Storage Area samples and gave Dr. Crellin the option of receiving a partial dataset at that time or waiting for a full dataset. Dr. Crellin requested the full dataset when it was ready. Subsequent clarification regarding sample points and station identifications were provided to Dr. Crellin on 14 January 2000. Review of communications indicate that there may have been some lingering uncertainty by ATSDR on the location of a couple of samples, but the database was useable.

RESPONSE

Because groundwater was considered an eliminated exposure pathway, the groundwater data were not evaluated. ATSDR did not request nor was it provided the groundwater data for the Main Facility. The groundwater data for Dunn Field were provided without being requested. These data were not evaluated in this document because this pathway was eliminated. The extensive data on surface soil, surface water, and sediment recently made available for Dunn Field are evaluated in this public health assessment.

46) Page 14, 2nd paragraph: The Corps did not conduct the sampling, they provided oversight to contractors who collected the samples and performed the analysis. Should make that distinction.

RESPONSE

This sentence has been revised to substitute "is responsible for conducting" for "conducts."

47) Page 14, para 6 – The format for placing the conclusions in italics at the beginning of a section is confusing. Suggest inserting "Conclusion summary:" at the beginning of the paragraph, or moving the conclusion to the end of the section.

RESPONSE

The author has found that these summary paragraphs are an effective way to help the lay person understand the document. ATSDR public health assessments are supposed to be written with multiple audiences as targets.

48) Page 14, Para 6, line 1. The sentence states that the sampling is not adequate. What is this not adequate for -- public health evaluation? A public health evaluation was completed on the following pages.

RESPONSE

The extensive data provided on Dunn Field since the public comment release and its evaluation in this document makes this comment moot.

49) Page 15 - For consistency, the headings for para 1, 3 and 4 should be reworded to parallel those on pages 17-18. For example, use "Sediment Sampling" instead of "Sediment."

RESPONSE

Thanks, this suggested revision has been made.

50) Page 15, Sediment paragraph: Since the paragraph indicates the "chemical detected included . . . PAH groups," should indicate what group the benzo, dibenz and indeno compounds are in.

RESPONSE

Identifying these compounds as PAHs in this paragraph would not enhance the information communicated in this paragraph so no changes will be made.

51) Page 15, Para 5. This paragraph 5 seems inconsistent with paragraph 4. There were surface water and sediment sampling results available (USASSDC, Jan. 96) outside the depot

fence line from all major drainage's leaving the depot property and surface soil sampling results (CH2M Hill, May 98) also from outside the fence line. The statement that these are inadequate for a public health assessment lacks reasoning that explains why the data is inadequate. The stated reason for the inadequacy of the data is poor. Please explain the data inadequacy in more detail. Regardless, there is now much more data for Dunn Field that is available for use in this report.

RESPONSE

These paragraphs were accurate when written but are now moot as is this comment due to the new Dunn Field data that are evaluated in this document.

52) Page 16, Para 1: Please ensure that conclusions were based on assessment of at least that available data which could significantly impact results. Sufficient analytical data to statistically assess health impacts of soil and surface water contamination at Dunn Field does exist and should be included in evaluation of data.

RESPONSE

As described in comment 45, these data were not provided to ATSDR until December 21, 1999 which was after the official release date for the public comment release of this public health assessment. These data are evaluated in this document.

53) Page 16, Soil Contaminants, 1st paragraph: Please reference Depot Layout map No. 11-44 dated 1944 regarding the fence at the Depot. This map is available for review at the Memphis Depot Caretaker and a copy is attached (See Attachment 1 on next page). This is the source of the statement regarding fences at the Depot. A map is a better reference than limited historical knowledge.

RESPONSE

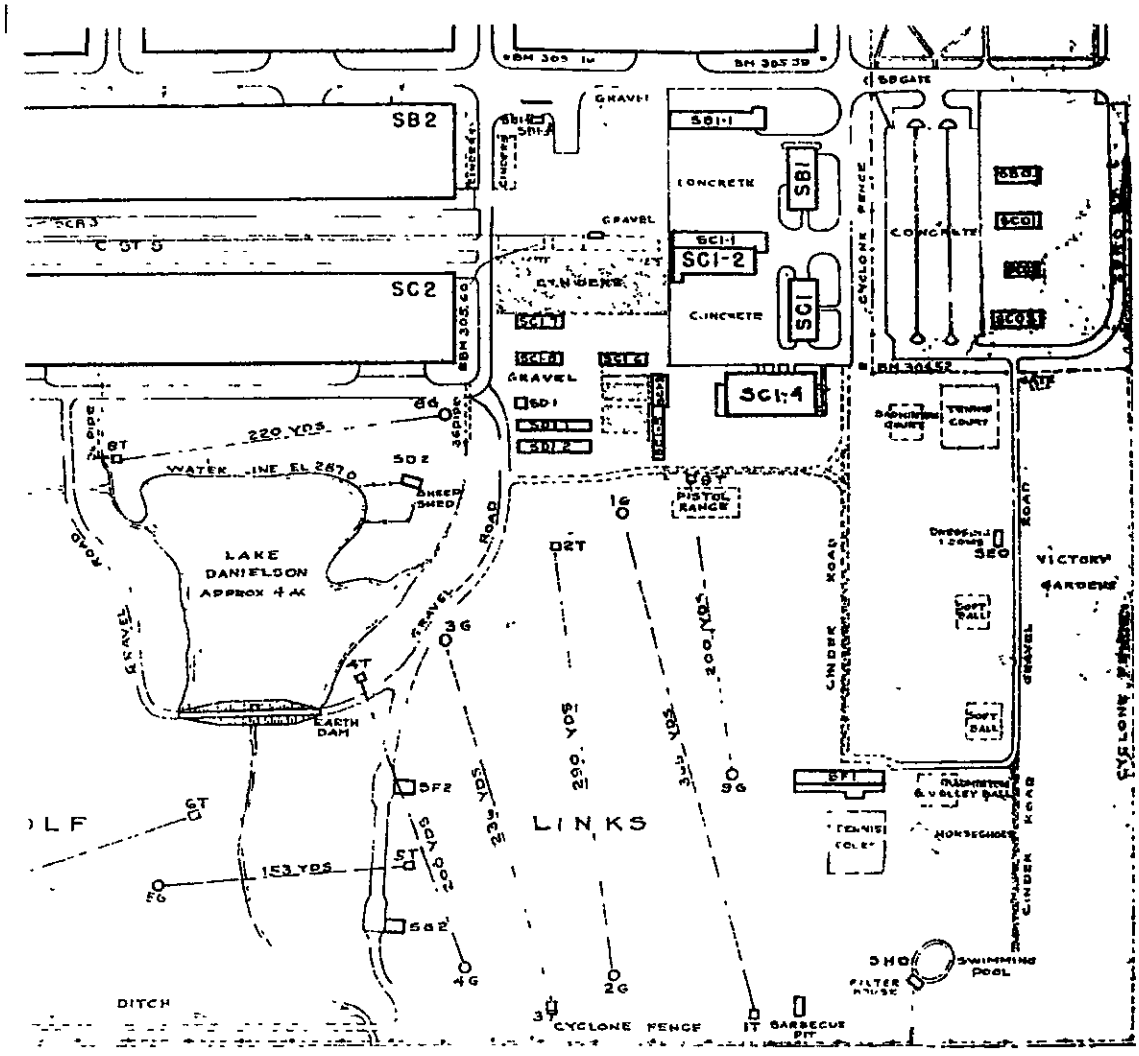
Thanks for providing this information. It is used as reference in this document.

54) Page 17, para 3 and page 20-21 – The format for placing the conclusions in italics at the beginning of a section is confusing. Suggest inserting "Conclusion summary:" at the beginning of the paragraph, or moving the conclusion to the end of the section.

RESPONSE

The author has found that these summary paragraphs are an effective way to help the lay person understand the document. ATSDR public health assessments are supposed to be written with multiple audiences as targets.

ATTACHMENT 1 - provided as part of comment 53



NUMBERED FROM THE CORNER NEAREST
BUILDINGS CARRY NUMERAL SUFFIX
TY TO DESIGNATING CORNER

BY FIRE WALLS ARE NUMBERED
T TO WEST.
DIVIDED BY TRUSSES OR POSTS,
WEST

RED IN 100 FT UNITS DESIGNATED

MEMPHIS ARMY SERVICE FORCES DEPOT
MEMPHIS TENNESSEE

DEPOT LAYOUT

SCALE IN FEET

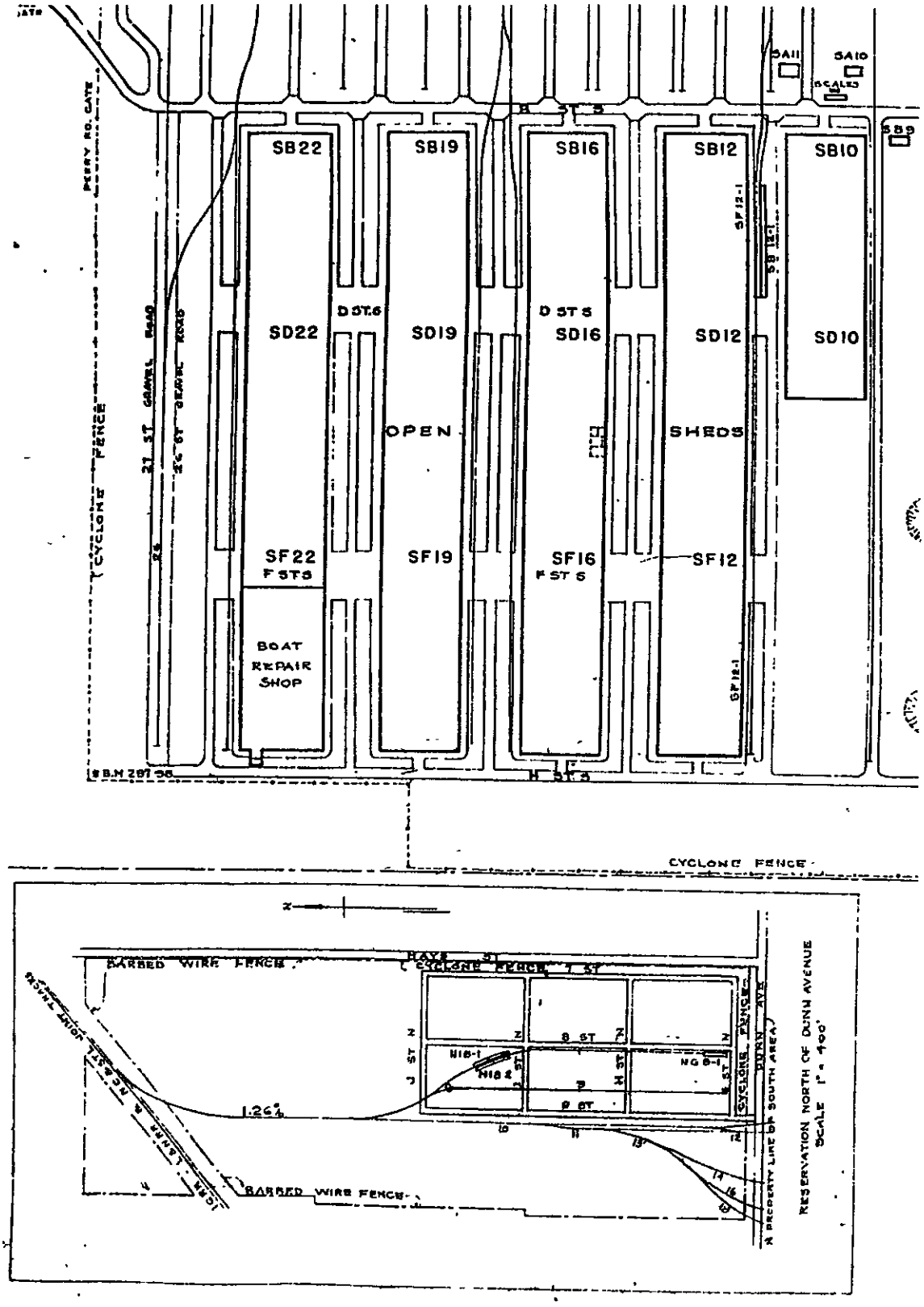
SCALE

OFFICE OF POST ENGINEER

REVISIONS | SUBMITTED BY | RECOMMENDED | APPROVED

DRAWN HEB | CHECKED | DATE 20-12-44 | NO. 11-22

608 180



55) Page 17, para 4 & supporting information in the appendix (77-78). This conclusion is misleading. When referring to page 77, the cancer (PAHs) evaluation that occurred used exposure assumptions - 70 year, 7-days a week. These assumptions are unrealistic for a potential exposure occurring at an industrial complex, which is less than 60 years old. The evaluation should have been done using 5-day a week and no more than a 40-year exposure (most people retire before 40 years), that would reduce the cancer risk. To further state that it is unclear that anyone may have experienced this exposure scenario is an unrealistic statement. The likelihood of someone working in the soil at the cited buildings every day 7-days a week for 70-years is highly improbable. Page 42 states that in order for a cancer risk one would have to work in the soil, not just walk over it. This section implies that all one needs to do is walk over the area to have the increased risk. What was the likelihood of foot traffic over the suspect area? Page 66 indicates that the cancer risk was calculated using a 5-day exposure. Was the cancer rate determined differently for PAHs? If so why? For consistency and accuracy, it is suggested that parallel logic or documentation be used.

RESPONSE

These exposure situations are no longer considered a health risk based on a further evaluation of the data for these contaminants. This document has been revised to reflect this.

56) Page 17, Results of Environmental Sampling, 1st paragraph: Was under the impression that ATSDR was provided sampling data from the 1998 remedial investigation sampling. No "remedial investigation" sampling occurred in 1995, only background sampling at areas that should not have been impacted by Depot operations and the sediment sampling that was not technically part of the RI sampling effort and was not specified in the RI sampling plans. The current RI report references the sediment sampling report as a separate sampling event not related to the RI sampling effort.

RESPONSE

We are both incorrect. A check of the RI data provided to ATSDR by DDMT identifies sample collection dates in 1997. This document has been revised to reflect this date.

57) Page 20, Sediment paragraph: In previous portions of the document, the term PAHs is defined as polycyclic aromatic hydrocarbons, as opposed to this definition - polynuclear aromatic hydrocarbons. Please be consistent.

RESPONSE

Thanks for identifying this mistake. A revision has been made.

58) Page 20, para 4. The conclusions do not appear to be supported by the text. Page 20, para 2 & 3 state sediment and surface water do not represent a public health hazard, page 17 states that even with daily exposure, health effects are very unlikely, and page 15 states that no further evaluation of surface water is necessary, yet this paragraph implies that there is a problem in the Rozelle neighborhood. Why? If there is not a problem with exposure from Dunn Field, or the Main Facility, where is the contamination supposedly originating?

RESPONSE

The meaning of this comment is very unclear. The conclusion in paragraph 4 that contaminants from DDMT do not currently represent a public health hazard is supported by the sampling data. There is a possible data gap for the Rozelle neighborhood which ATSDR is proposing to fill. ATSDR agrees that the likelihood of finding contamination is small. However, ATSDR believes that it is a prudent public health practice to provide the residents of this neighborhood assurance that there is no contamination.

59) Page 21, para 2. DOD does not concur with the conclusion that an evaluation of exposure from 1942 to 1989 is not possible. This evaluation was completed in the PUBLIC HEALTH ASSESSMENT, USA DEFENSE DEPOT MEMPHIS, MEMPHIS, SHELBY COUNTY, TENNESSEE, CERCLIS NO. TN4210020570, *November 8, 1995* Prepared by: The Agency for Toxic Substances and Disease Registry Division of Health Assessment and Consultation (see attached excerpt on next page, Attachment 2). Similar evaluations have been made in other PHAs. As previously stated, when past data has been considered in the past, an attempt to evaluate the public health concerns is made based on current information and information about the processes conducted at the base. There seems to be no attempt to make this evaluation in this assessment based on the same information available during the preparation of the cited PHA.

RESPONSE

This document complies with the public health assessment process described in the ATSDR Public Health Guidance Manual, other relevant ATSDR policies and procedures, and the legislation by which ATSDR was created and health assessments mandated.

Specifically, the public health assessment process is driven by data, especially environmental sampling data. The extensive environmental sampling done since 1995 strongly supports the conclusions of this document.

The modeling or evaluation of industrial processes can provide data useful in the public health assessment or risk assessment process. An example would be a smelter where knowledge of the composition of the ores fed into the smelter and the operation specifications could permit fairly accurate predictions of what was emitted from the

smelter stack. However, DDMT had no industrial processes for which modeling can be done.

As a military supply, storage, and maintenance facility, contamination could have occurred through leaks and accidental spills. The potential for this can be evaluated through examination of reports on the handling and impact of toxic substances at DDMT. However, according to the 1990 RI, these reports go back only to the 1960s so it is not possible to evaluate the potential for releases for the 20 years the Depot existed before that time (3). The 1982 Installation assessment identified a number of problems with the way toxic substances were handled at DDMT (7). This indicates that releases could have occurred and, at least in the case of the pentachlorophenol dipping vat, did occur. Additional support for the potential for past releases of toxic substances comes from the statements made by former DDMT workers at the Memphis RAB meetings.

The environmental sampling done at DDMT since 1989 did not identify any extensive areas of contamination. This indicates that there were no significant releases of the chemicals that persist in the environment such as arsenic, lead, chlordane, and many others. However, these data can't be used to make a similar statement about those chemicals that do not persist in the environment such as the volatile organic compounds. It is not possible to prove or disprove that significant spills of these compounds occurred.

Does all this prove that there was a health hazard in the past as asserted by DDMT-CCC? No, but as discussed above, there are insufficient qualitative or quantitative to prove that wasn't one, especially prior to the 1960s. The statement in this document that there are insufficient information to state whether a health hazard existed is the only reasonable conclusion, given the available data.

ATTACHMENT 2: referred to in comment 59

Please note that the following information is extracted directly out of the PUBLIC HEALTH ASSESSMENT, USA DEFENSE DEPOT MEMPHIS, MEMPHIS, SHELBY COUNTY, TENNESSEE, CERCLIS NO. TN4210020570, *November 8, 1995* Prepared by: The Agency for Toxic Substances and Disease Registry Division of Health Assessment and Consultation, pp 16-18:

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).

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).

ATTACHMENT 2 continued

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 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, it is not likely that these PAHs present a health threat.

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).

ATTACHMENT 2 continued

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.

END OF ATTACHMENT

60) Page 21, Para 4, Line 3: The sentence beginning "Long term air exposures..." should be more completely prefaced by a discussion of contaminants, pathways, and receptors in preceding sections. Sampling discussions on page 20 could include an explanation of transfer of constituents to air. The discussion of Health Consequences beginning on page 20 should clarify what matrix (such as air) is the probable route of exposure.

RESPONSE

These are summary paragraphs and they are followed by more comprehensive discussions. These discussions do not include some of the information suggested by the commenter because it was not considered germane to the public health assessment.

61) Page 21, para 8- page 22. What contact is ATSDR assuming that occurs with surface water and sediment? Is the exposure considered oral or dermal? Why is the contact considered daily? What are the activities the neighbors are engaged in that are causing the daily contact? What analysis was completed to determine risks?

RESPONSE

As indicated in Figures 3 and 5, there is a ditch running through the middle of the neighborhood and between two houses. Anyone walking between the houses could contact the sediment or water depending on whether there is water flowing. Since these ditches are usually dry, children could crawl or play in the sediment.

62) Page 22, 4th paragraph: Were the 22 samples part of the background sampling or the sediment sampling? Should provide document reference number from reference section.

RESPONSE

As indicated earlier, these 22 samples were from what DDMT identified as background samples but which in this document are identified as area samples to avoid confusion over what is mean by background. The source of these data was identified in footnotes earlier in the public health assessment. They can't be formally referenced since DOD did not provide ATSDR with their Background Report.

63) Page 22, Paragraph 5, offsite migration is stated to be occurring for the Dunn Field. There is no concrete evidence for this. Observed chemicals in the ditches could be from pesticide applications directly on to the ditches to prevent insects/mosquitoes. The runoff from roads is more likely than the contaminated sites within Dunn Field. Also, exposures to surface water and sediment are limited to feet and palms, due to shallow water levels. Concrete lined ditches do not have sediment accumulation; therefore sediment exposures are limited only to the unlined ditches.

RESPONSE

It is doubtful that the ditches in this area were sprayed with pesticides as these ditches are not a good habitat for mosquitoes. The ditches have water in them only during rain events. The Rozelle area is sloped east to west so any water in the ditches flows through and does not pool up.

64) Page 22, General Comments (2), **Where Exposure to DDMT.....** :

- The interpretation of exposure pathway on this page is misleading. Certain facts have to be established prior to exposure evaluations such as, what is the nature of the contamination in these ditches? How much of it is coming from the Dunn Field? For an exposure pathway to be considered as occurring, a source, a migration pathway, and an exposure point has to be present. If observed chemicals are ambient concentrations, none were from the Depot, then the exposure to the Depot constituents are not likely to occur. Therefore exposure pathways are incomplete. If the observed contamination is from possible past pesticide application in the ditches, then they are not truly related to hazardous waste operations within the Depot, as pesticide applications generally follow the suggested use. The only constituents detected in these ditches were low level chlorinated pesticides that were detected at similar concentrations in the 'background' samples, and are not specific to the Depot. Therefore, the exposure pathway analysis included on this page is making more definitive statements

implying local residents were exposed to the Depot contaminants, when the contamination is present in ditches throughout urban environment.

- Also soil contaminated by sediment and surface water from Dunn Field is implied. The scenario under which such contamination can occur is not explained. Flow in these ditches is low therefore overflow is highly unlikely.

RESPONSE

The last paragraph in this section has been revised to focus on the lack of sampling.

65) Page 23, 3rd and Last paragraphs, Statement that past exposures are unknown, however overland flow patterns are the same, and exposure receptors are the same. Majority of the chemicals detected is inorganic chemicals, which do not decrease in concentration with time, and are indicators of the past occurrences. The chlorinated pesticides are expected to accumulate in the organic carbon of the sediments with time, therefore are expected to increase in concentration for a time after usage ceases, however are likely to decrease slowly with time. Any other non-persistent compounds are short-lived and are not a chronic exposure concern. There is no obvious offsite release from the Dunn Field (no continuous flow), or direct runoff. Based on these facts, past exposures are not expected to be different from the present exposures. The text should be modified by either including further explanation or these statements should be eliminated from this PHA.

RESPONSE

The paragraphs indicated by the commenter have been revised to better describe this conclusion about evaluating past exposures.

66) Page 23, Para 4: The italicized text prefacing the actual evaluation of residential areas around DDMT provides an overview of conclusions reached in subsequent discussions. Perhaps this text (and similar italicized text in other sections) should be included as a regular section of the report as a "Section Overview". Specific statements made in this text are not fully rationalized in the subsequent sections. It is unclear why a portion of the Rozelle neighborhood is an "exception" It should be clarified if this is an exception to the conclusion that no current hazards exist, or an exception that this area was not assessed. This section should more clearly identify what contaminants, pathways, and receptors may be applicable to creating a risk in each of the "exceptions".

RESPONSE

We are unable to provide a response to this comment as the content of paragraph 4 on page 23 has no relationship to what is described in this comment. For example, the

comment refers to the Rozelle neighborhood while the southeast drainage is the topic of the paragraph referenced.

67) Page 23, Para 4, statement indicates shallow ditches have more potential for overflow. While this is theoretically correct, how often does this happen? If it rarely happens, what types of contaminants are expected to be persistent enough to be concern? For the conditions at the Depot is this scenario expected to be of concern based on low levels of chemicals, absence of known flooding in the operational history and longevity of the chemicals? All these issues need to be addressed at the same time this statement is made, so later on when it is concluded that the Depot does not pose a health concern, the reasons are clearly explained.

RESPONSE

Again, we are unable to provide a response because the comment does not match the paragraph referenced.

68) Page 24, Figure 5 – The diagram includes two types of arrows but the legend only includes one. Include both types in the legend.

RESPONSE

This problem is corrected in this document.

69) Page 26, First full sentence. Has there been a dye test that confirms flow from DDMT reaching Cane Creek? Does the author mean the nearest continuous flow stream is Cane Creek, and this may receive some flow from the Depot? Are there continuous flow ditches between the Depot and the Cane Creek, or is this expected to occur only during rain events? Further clarification is needed with this statement.

RESPONSE

DDMT's 1982 and 1990 reports, and the City of Memphis Drainage Map indicate that water from DDMT flows into Cane Creek (3,7,75). However, we agree that this is sentence is very unclear and it has been revised in this document.

70) Page 26, para 3 - It is unclear how these estimates are made. If the entire population within this area is 30,720, almost 10% are being assumed to live within 500 feet from the Depot boundary (3000) and all are using the ditches. However, it is generally known, youth tend to be playing in the ditches, while adults and younger children are not. Even if 3000 people live within 500 ft from, the depot, only a small percentage of that population are expected to be children between 6-17 years of age, who could be playing in the ditches. Thus, these estimates of persons exposed should be significantly less than what is currently

stated. Also, some of these receptors could be in the ditches only once in their lifetime, while others could be there multiple times, and almost none are expected to be there every day. Please revisit the estimates of exposed population and further clarify the intent of this information.

RESPONSE

The way these estimates were made is clearly described on page 27 of the document and is a commonly used technique to estimate population numbers.

71) Page 26, para 4 headed "Groundwater" – To avoid confusion, include an interpretive statement at the end such as "There is no risk from this contaminated ground water since no wells draw from it."

RESPONSE

There is no need for such a statement here as the lead sentence in the last paragraph of this section states, "Exposure to site contaminants in drinking water does not appear to have been possible."

72) Page 26, last paragraph, and Page 27 first two paragraphs. Groundwater information is oversimplified. Contamination in the Dunn Field has been identified in the shallow aquifer, while Allen Well field wells are greater than 300 feet in depth. Groundwater flow direction is different for Main Installation, where it is through a trough, versus Dunn Field where it flows to the northwest and west. Allen well field is directly west. Groundwater under Dunn Field is being remediated through an active remediation system.

RESPONSE

This information has been revised in this document.

73) Page 27, Air, 2nd paragraph: The Span Dome was torn down after the 1985 incident and is no longer located on the western boundary. Suggest changing verb to "was."

RESPONSE

This change has been made.

74) Page 27, para 3 - The use of the term 'exposure' should be revisited in this write-up since release to the air does not necessarily result in human exposure. Most of the constituents listed in this paragraph exhibit chemical properties indicating these chemicals dissipate in air within few feet from the release point, thus offsite public exposure is highly

unlikely. Also, replace "release to the air" with "the release to the environment." This is more accurate and reflects the same wording used in the description of the same incident on page 40, para 2.

RESPONSE

For the purposes of a public health assessment, this paragraph is acceptable as written.

75) Page 28, para 1, last sentence - Because soils along the perimeter are not expected to receive contaminants from onsite soils, the perimeter samples being referenced are assumed to be from the ditch bottoms. The PAHs are much lower in the paint booth area compared to other locations along the railroad tracks. Further explanation is needed for the statement.

RESPONSE

The type of media sampled was identified in the first sentence of this paragraph, "This is confirmed by **soil sampling data**...." The PAH levels around the paint booth are elevated compared to those at the site perimeter, while they are not as high as the concentrations around the railroad tracks.

76) Page 28, para 2 (and the following other text) - While it true that indirect exposures through food chain consumption/accumulation are not likely, the primary reason is lack of exposure due to absence of surface water bodies that can support fish population. All other reasons (e.g., low concentrations) are secondary, as concentration levels play no role in the absence of habitat.

RESPONSE

This section has been revised.

77) Page 28, para 4 - The text should read to clearly indicate that this is past use only, as there are no fish in the ponds now, and this is anecdotal information.

RESPONSE

This paragraph has been revised to indicate that there are currently no fish in the ponds. The source of the story about fishing in the pond is already identified.

78) Page 28, para 5 – The offsite soil contamination is implied. Historical records of flooding and overflow should be reviewed prior to these statements. Also, with time chemicals are likely to be washed off of surfaces more than they are adhered onto the surfaces by flooding. This is inaccurate prediction and should be thoroughly thought through

before presenting in this PHA document. Also, the first sentence is subjective and the commentator disagrees with the statement in so much as the intent is in regards to the Depot. If the "systematic evaluation" of off-site soils is some Memphis/Shelby County Health Department, Tennessee Department of Environment and Conservation, or Environmental Protection agency initiative, then the statement may be correct. The Depot considers it's off-site sampling effort which included background sampling (CH2Hill, May 98) as well as sediment sampling (USASSDC, Jan 96), to constitute systematic sampling.

RESPONSE

For the purposes of a public health assessment, this paragraph is acceptable as written.

79) Page 29, para 2 - Provide the document reference number from the reference section that contains information regarding the sampling locations being discussed here. If these locations were part of the background sampling program, then the "local environmental activist" referenced in the note did not assist in selecting sampling locations. ATSDR and the activist assisted with locations for the 1995 sediment sampling program (reference 57).

RESPONSE

The source of these data was identified in a footnote on page 29. ATSDR was unable to cite a specific source because this document was not provided. ATSDR has in its files detailed notes taken by Jeffery Kellam that describe the locations where these samples were taken and that the local activist participated in selecting those sites.

80) Page 29, para 3 - The "Background" study was to establish the general background conditions around Shelby County, not to assess influence of DDMT on these areas, as implied in this paragraph.

RESPONSE

ATSDR does not state nor intend to imply the purpose of this sampling.

81) Page 31, para 2 - A complete exposure pathway is mentioned in the second sentence. Although a possible complete pathway to the ditches offsite are identified, no such pathways exist for onsite media and the offsite public. Even in ditches, it is not definitive that children playing in these ditches contacted contaminated sediments. There are no contaminants in surface water above naturally occurring levels. Organic chemicals are mostly from sediments. If the children play in the concrete lined ditches no exposures are likely. Thus, there is considerable uncertainty associated with exposure pathways in general, and for the Depot in particular. The text should be revised to eliminate the certainty associated with exposure pathway statements.

RESPONSE

ATSDR provided an extensive justification of its conclusion. Based on ATSDR's published guidance, it is the only conclusion that can be made.

82) Page 31, 4th paragraph: Delete period after "women."

RESPONSE

This change was made.

83) Page 32, comment response 2: Please reference Depot Layout map No. 11-44 dated 1944 regarding the fence at the Depot.

RESPONSE

This change was made.

84) Page 32, first paragraph, and other places where estimated population numbers are included, please revise the number of people potentially exposed based on comment above made on Page 26. Page 34, comment response 5: Should address the drinking water question as in comment response 8.

RESPONSE

See our response on page 187 about population estimates. The information in comment response 8 has been added to number 5. Thanks for the suggestion.

85) Page 35, Response to Comment 9. The groundwater underneath Dunn Field is being actively remediated in an attempt to prevent future vertical migration of contamination. This should be indicated in the response.

RESPONSE

A mention of this has been included in this document.

86) Page 36, statement 13 – Replace "assessable" with "accessible" to reflect the correct meaning.

RESPONSE

Thanks, this was done.

87) Page 37, comment response 14: Should use reference 46 from the reference section instead of the note.

RESPONSE

Thanks, this was done.

88) Page 39, comment 21: There is a note symbol (2), but no corresponding footnote.

RESPONSE

This has been deleted

89) Page 43, item 4 - This first sentence differs from the statement on page 27, para 3. Which is correct? Did airborne exposure definitely occur or "probably" occur? If the statements in the main part of the document are correct, then the summary should be consistent with those statements.

RESPONSE

They probably occurred. The appropriate revision has been made.

90) Page 47, references 8, 9, and 10: These documents were essentially rough drafts of what became and should be referenced: Final Remedial Investigation Sampling Letter Reports, Final Screening Sites Sampling Letter Reports and Revised Final BRAC Sampling Letter Reports.

RESPONSE

The documents referenced were what was provided to ATSDR.

91) Page 51, reference 51: Change period after "July 27" to a comma.

RESPONSE

Thanks, this was done.

92) Page 70, Table E2 - which included the data used as basis for the statements on exposure includes old data (1990 and 1995), with common laboratory contaminants, indicative lack of data quality evaluation. Chemicals such as acetone and methylene chloride are not expected to last in the surface water therefore, do not represent current site conditions, they are not likely to be site-related, and data quality is questionable. More recent samples did not

indicate presence of such volatiles. Chemicals like dieldrin are not expected to be soluble in water, and are likely from suspended sediment material. All these issues need to be resolved prior to exposure considerations. More recent data collected as part of RI is available for the Dunn Field drainage ditch surface water that was not included in this report.

RESPONSE

The data referred to were not provided to ATSDR until after the public health assessment when out for public comment. These data are evaluated in this document.

93) Page 75, para 3, last sentence - Is this sampling inadequacy the same one identified elsewhere that can be resolved? See comment for Page 15, para 5 and page 16, above.

RESPONSE

This section has been revised to reflect the data on Dunn Field received since the public comment version was released.

94) Page 91-92 – This section is difficult to follow. Figure 5 is helpful in visualizing this section, but this could be improved. The figure currently only shows drainage in open ditches. Adding the locations of referenced drainage in pipes and storm sewers as well would aid in following this major topic in this section.

RESPONSE

Figure 5 has been revised.

COMMENTS FROM DEPARTMENT OF DEFENSE ON WORKING DRAFT OF FINAL RELEASE OF MEMPHIS DEPOT PUBLIC HEALTH ASSESSMENT

Thank you for the opportunity to review this draft document. We are pleased that the quality of the document is substantially improved over the first version.

1) Page 5, paragraph 1. Change "revisit" to "review and update" see response to DOD comment, # 27.

RESPONSE - *Thanks, I missed this one and have changed it.*

2) Page 5, paragraph 4, sentence 4. Based on the placement of the reference to Figure 2, it implies Figure 2 identifies the storage in "open areas", while the figure legend is for all contaminant storage areas. The key on Figure 2 should differentiate between open and other storage areas.

RESPONSE - *I moved the reference to Figure 2 to the first sentence to resolve this problem.*

3) Page 5, paragraph 5. Delete "substantial amounts of" or define. What is meant by this phrase is unclear. The storage amount is not substantial when compared to other DOD sites whose predominate mission involved chemical warfare-related materials.

RESPONSE - *I replaced substantial with a specific mention of the amount of the space that was used.*

4) Page 17, table. The table labels are illegible in the dark box.

RESPONSE - *Thanks, I have reduced the percent fill to make it lighter.*

5) Page 36, paragraph 1. The response discusses a 1982 DOD report, however the reference is to an ATSDR trip report. This is misleading, implying that the DOD report states that management of toxic substances was "marginal". The substances were handled in accordance with the applicable standards at the time.

RESPONSE - *Thanks for catching this. I have corrected it.*

6) Page 103, 3). Request of copy of referenced survey from ATSDR. Also subject survey should be referenced in this report. (Perhaps this is item 37 in the reference listing?)

RESPONSE - *A copy of this survey was already provided to John DeBack. Please ask him for a copy or request directly from Crater Gray of Memphis-Shelby County Health Department.*

7) Page 108, 16). Based on the fact that there is a groundwater treatment system (planned or actual), the contamination should never reach the Allen Well Field. This is an important point to make in responding to the individual's concerns.

RESPONSE - *I have added the following to this section, "If it operates as designed, the groundwater treatment system that was recently installed at the northwest end of Dunn Field should greatly reduce or eliminate the flow of contaminants and perhaps make this issue moot" .*

8) Page 109/110. There is a blank page between p. 109 and p.110. Is this intentional?

RESPONSE - *Thanks, that has been corrected.*

9) Page 135, 53). The commenter is referring to the DERTF, not DEBRA and Dr. Huganaut is CDR Hughart. The "army" should be "Army" when referring to the actual organization.

RESPONSE - *Thanks for providing this information. The appropriate revisions have been made. Joseph Hughart was recently promoted to Captain (O-6).*

10) Page 180, 58). The commenter is simply asking ATSDR to identify what they think the potential source of contamination is for the Rozelle area. In the PHA they had stated it was not from the Main Area and not from Dunn Field. If these two areas are not the source, where is the potential source? DOD did not comment on the recommendation for sampling as implied by the response.

RESPONSE - *The possible source is contaminants that moved from Dunn Field sometime in the past as indicated on page 23,* "Soil, now present in the Rozelle area, may have been contaminated in the past through the overflowing of ditches in this neighborhood. No sampling has been done of the soil around these ditches." *The discussion on page 20 is about the health hazard represented by contaminant levels identified in the sampling conducted since 1989. I admit that the chance of this having occurred in quite small but the most concrete way to deal with this issue is to sample these areas as EPA will do in December.*

11) Page 180-181 59). DOD simply disagreed that ATSDR has done a thorough review of the potential past exposure in this review and update. DOD does not and did not presuppose a conclusion on that investigation. On page 181 paragraph 2, ATSDR incorrectly assigns an assertion to DOD. The DOD commenter did not assert any conclusion, but simply referenced the previous PHA where ATSDR conducted some evaluation of potential past exposures. On page 13 of this previous PHA, ATSDR states "Contamination at the depot does not pose a health concern to people living on or near the depot, and it did not pose a health hazard in the past." Request the first two sentences of paragraph 2 on page 181 be deleted.

RESPONSE - *These two sentences have been deleted.*

12) Page 186-187, 66) ATSDR indicated that no response could be provided as the relationship of the content of the comment and the referenced section was not clear. The comment addressed **Section – CURRENT CONDITIONS OF SITE**, the first paragraph under **Subsection – Evaluation of Residential Areas around DDMT.** This paragraph begins with, "With the possible exception of the Rozelle neighborhood..." at the bottom of page 20. The subsequent sections where the commenter is looking to find the clarification/rationalization for the initial conclusionary statements run fro page 20 through page 23. In other words, clarify better what is the possible potential problem for Rozelle.

RESPONSE - *See the response to number 58.*

13) Page 187, 67) ATSDR was unable to provide a response because the comment did not seem to match the referenced paragraph. The comment addressed **Section – CURRENT CONDITIONS OF SITE, Subsection – Evaluation of Residential Areas around DDMT,** under the heading **Where Exposure to DDMT Contaminants in Surface Water could be occurring**. It starts with 3) In or near the 4 ditches that flow south from the southeast.... The third full sentence indicates that ditches join and flow to Nonconnah Creek. These ditches are dry most of the time, thus there is no flow, except during rain events. The Nonconnah Creek is more than a mile away.

RESPONSE - *In reviewing your original comments and the text you are referring to, I believe the current explanation already provides the justification you are requesting.*

APPENDIX J - GLOSSARY OF TERMS

ATSDR Plain Language Glossary of Environmental Health Terms

Revised -15Dec99 (additional revisions by John Crellin)

Absorption: How a chemical enters a person's blood after the chemical has been swallowed, has come into contact with the skin, or has been breathed.

Acute Exposure: Contact with a chemical that happens once or only for a limited period of time. ATSDR defines acute exposures as those that might last up to 14 days.

Additive Effect: A response to a chemical mixture, or combination of substances, that might be expected if the known effects of individual chemicals, seen at specific doses, were added together.

Adverse Health Effect: A change in body function or the structures of cells that can lead to disease or health problems.

Antagonistic Effect: A response to a mixture of chemicals or combination of substances that is less than might be expected if the known effects of individual chemicals, seen at specific doses, were added together.

ATSDR: The Agency for Toxic Substances and Disease Registry. ATSDR is a federal health agency in Atlanta, Georgia that deals with hazardous substance and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from coming into contact with chemicals.

Background Level: An average or expected amount of a chemical in a specific environment. Or, amounts of chemicals that occur naturally in a specific environment.

Biota: Used in public health, things that humans would eat – including animals, fish and plants.

CAP: See Community Assistance Panel.

Cancer: A group of diseases which occur when cells in the body become abnormal and grow, or multiply, out of control

Carcinogen: Any substance shown to cause tumors or cancer in experimental studies.

CERCLA: See Comprehensive Environmental Response, Compensation, and Liability Act.

Chronic Exposure: A contact with a substance or chemical that happens over a long period of time. ATSDR considers exposures of more than one year to be *chronic*.

Completed Exposure Pathway: See **Exposure Pathway**.

Community Assistance Panel (CAP): A group of people from the community and health and environmental agencies who work together on issues and problems at hazardous waste sites.

Comparison Value: (CVs) Concentrations or the amount of substances in air, water, food, and soil that are unlikely, upon exposure, to cause adverse health effects. Comparison values are used by health assessors to select which substances and environmental media (air, water, food and soil) need additional evaluation while health concerns or effects are investigated.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): **CERCLA** was put into place in 1980. It is also known as **Superfund**. This act concerns releases of hazardous substances into the environment, and the cleanup of these substances and hazardous waste sites. ATSDR was created by this act and is responsible for looking into the health issues related to hazardous waste sites.

Concern: A belief or worry that chemicals in the environment might cause harm to people.

Concentration: How much or the amount of a substance present in a certain amount of soil, water, air, or food.

Contaminant: See **Environmental Contaminant**.

Delayed Health Effect: A disease or injury that happens as a result of exposures that may have occurred far in the past.

Dermal Contact: A chemical getting onto your skin. (see **Route of Exposure**).

Dose: The amount of a substance to which a person may be exposed, usually on a daily basis. Dose is often explained as "amount of substance(s) per body weight per day".

Dose / Response: The relationship between the amount of exposure (dose) and the change in body function or health that result.

Duration: The amount of time (days, months, years) that a person is exposed to a chemical.

Environmental Contaminant: A substance (chemical) that gets into a system (person, animal, or the environment) in amounts higher than that found in **Background Level**, or what would be expected.

Environmental Media: Usually refers to the air, water, and soil in which chemicals of interest are found. Sometimes refers to the plants and animals that are eaten by humans. **Environmental Media** is the second part of an **Exposure Pathway**.

U.S. Environmental Protection Agency (EPA): The federal agency that develops and enforces environmental laws to protect the environment and the public's health.

Epidemiology: The study of the different factors that determine how often, in how many people, and in which people disease will occur.

Exposure: Coming into contact with a chemical substance.(For the three ways people can come in contact with substances, see **Route of Exposure**.)

Exposure Assessment: The process of finding the ways people come in contact with chemicals, how often and how long they come in contact with chemicals, and the amounts of chemicals with which they come in contact.

Exposure Pathway: A description of the way that a chemical moves from its source (where it began) to where and how people can come into contact with (or get exposed to) the chemical.
ATSDR defines an exposure pathway as having 5 parts:

- Source of Contamination,
- Environmental Media and Transport Mechanism,
- Point of Exposure,

- Route of Exposure, and
- Receptor Population.

When all 5 parts of an exposure pathway are present, it is called a **Completed Exposure Pathway**. Each of these 5 terms is defined in this Glossary.

Frequency: How often a person is exposed to a chemical over time; for example, every day, once a week, twice a month.

Hazardous Waste: Substances that have been released or thrown away into the environment and, under certain conditions, could be harmful to people who come into contact with them.

Health Effect: ATSDR deals only with **Adverse Health Effects** (see definition in this Glossary).

Indeterminate Public Health Hazard: The category is used in Public Health Assessment documents for sites where important information is lacking (missing or has not yet been gathered) about site-related chemical exposures.

Ingestion: Swallowing something, as in eating or drinking. It is a way a chemical can enter your body (See **Route of Exposure**).

Inhalation: Breathing. It is a way a chemical can enter your body (See **Route of Exposure**).

LOAEL: **L**owest **O**bserved **A**dverse **E**ffect **L**evel. The lowest dose of a chemical in a study, or group of studies, that has caused harmful health effects in people or animals.

Malignancy: See **Cancer.**

MRL: **M**inimal **R**isk **L**evel. An estimate of daily human exposure – by a specified route and length of time -- to a dose of chemical that is likely to be without a measurable risk of adverse, noncancerous effects. An MRL should not be used as a predictor of adverse health effects.

NPL: The National Priorities List. (Which is part of **Superfund**.) A list kept by the U.S. Environmental Protection Agency (EPA) of the most serious, uncontrolled or abandoned hazardous waste sites in the country. An NPL site needs to be cleaned up or is being looked at to see if people can be exposed to chemicals from the site.

NOAEL: No Observed Adverse Effect Level. The highest dose of a chemical in a study, or group of studies, that did not cause armful health effects in people or animals.

No Apparent Public Health Hazard: The category is used in ATSDR's Public Health Assessment documents for sites where exposure to site-related chemicals may have occurred in the past or is still occurring but the exposures are not at levels expected to cause adverse health effects.

No Public Health Hazard: The category is used in ATSDR's Public Health Assessment documents for sites where there is evidence of an absence of exposure to site-related chemicals.

PHA: Public Health Assessment. A report or document that looks at chemicals at a hazardous waste site and tells if people could be harmed from coming into contact with those chemicals. The PHA also tells if possible further public health actions are needed.

Plume: A line or column of air or water containing chemicals moving from the source to areas further away. plume can be a column or clouds of smoke from a chimney or contaminated underground water sources or contaminated surface water (such as lakes, ponds and streams).

Point of Exposure: The place where someone can come into contact with a contaminated environmental medium (air, water, food or soil). For examples: the area of a playground that has contaminated dirt, a contaminated spring used for drinking water, the location where fruits or vegetables are grown in contaminated soil, or the backyard area where someone might breathe contaminated air.

Population: A group of people living in a certain area; or the number of people in a certain area.

PRP: Potentially Responsible Party. A company, government or person that is responsible for causing the pollution at a hazardous waste site. PRP's are expected to help pay for the clean up of a site.

Public Health Assessment(s): See **PHA**.

Public Health Hazard: The category is used in PHAs for sites that have certain physical features or evidence of chronic, site-related chemical exposure that could result in adverse health effects.

Public Health Hazard Criteria: PHA categories given to a site which tell whether people could be harmed by conditions present at the site. Each are defined in the Glossary. he categories are:

- Urgent Public Health Hazard
- Public Health Hazard
- Indeterminate Public Health Hazard
- No Apparent Public Health Hazard
- No Public Health Hazard

Receptor Population: People who live or work in the path of one or more chemicals, and who could come into contact with them (See **Exposure Pathway**).

Reference Dose (RfD): An estimate, with safety factors (see **Safety Factor**) built in, of the daily, life-time exposure of human populations to a possible hazard hat is not likely to cause harm to the person.

Route of Exposure: The way a chemical can get into a person's body. There are three exposure routes:
- breathing (also called inhalation),
- eating or drinking (also called ingestion), and
- or getting something on the skin (also called dermal contact).

Safety Factor: Also called **Uncertainty Factor**. When scientists don't have enough information to decide if an exposure will cause harm to people, they use "safety factors" and formulas in place of the information that is not known. These factors and formulas can help determine the amount of a chemical that is not likely to cause harm to people.

SARA: The Superfund Amendments and Reauthorization Act in 1986 amended CERCLA and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from chemical exposures at hazardous waste sites.

Sample Size: The number of people that are needed for a health study.

Sample: A small number of people chosen from a larger population (See **Population**).

Source (of Contamination): The place where a chemical comes from, such as a landfill, pond, creek, incinerator, tank, or drum. Contaminant source is the first part of an **Exposure Pathway**.

Special Populations: People who may be more sensitive to chemical exposures because of certain factors such as age, a disease they already have, occupation, sex, or certain behaviors (like cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Statistics: A branch of the math dealing with the collecting, analysis, and summarizing data or information.

Superfund Site: See **NPL**.

Survey: A way to collect information or data from a group of people (**population**). Surveys can be done by phone, mail, or in person. ATSDR cannot do surveys of more than nine people without approval from the U.S. Department of Health and Human Services.

Synergistic effect: A health effect from an exposure to more than one chemical, where one of the chemicals worsens the effect of another chemical. The combined effect of the chemicals acting together are greater than the effects of the chemicals acting by themselves.

Toxic: Harmful. Any substance or chemical can be toxic at a certain dose (amount). The dose is what determines the potential harm of a chemical and whether it would cause someone to get sick.

Toxicology: The study of the harmful effects of chemicals on humans or animals.

Tumor: Abnormal growth of tissue or cells that have formed a lump or mass.

Uncertainty Factor: See **Safety Factor**.

Urgent Public Health Hazard: This category is used when the physical, chemical, or radiological hazards at a site could cause immediate harm or after less than one year of exposure. Quick intervention to stop people from being exposed is required in such situations.

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE