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THE MEMPHIS DEPOT
TENNESSEE

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 803

Health Consultation

Assessment of Cancer Incidence

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

MEMPHIS, SHELBY COUNTY, TENNESSEE

CERCLIS NO. TN4210020570

AUGUST 16, 2000

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

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Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation 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.

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DEPARTMENT OF HEALTH & HUMAN SERVICES
Public Health Service

Agency for Toxic Substances
and Disease Registry
Atlanta GA 30333

August 22, 2000

Mr. John De Back
Department of Defense Base Transition Coordinator
2163 Airways Boulevard, Suite 104B
Memphis, TN 38114

Dear Mr. De Back:

Enclosed please find a copy of the health consultation for Memphis Defense Depot (Defense Logistics Agency), (a/k/a USA Defense Depot Memphis), Memphis, Shelby County, Tennessee, dated August 16, 2000. This health consultation addresses the citizens living around the Memphis Depot being concerned that there are increased rates of cancer, stroke, heart attacks, miscarriages, thyroid disease and birth defects in the community and that there may be a relationship between these health outcomes and contamination from the depot.

Please address correspondence to the Chief, Program Evaluation, Records, and Information Services Branch, Division of Health Assessment and Consultation, Agency for Toxic Substances and Disease Registry, ATTN: Memphis Defense Depot (Defense Logistics Agency) (a/k/a USA Defense Depot Memphis), 1600 Clifton Road, NE (E56), Atlanta, Georgia 30333.

If there are any questions, please direct them to John Crellin, health assessor, at (404) 639-0635.

Sincerely yours,

Lorraine Adams for

Max M. Howie, Jr.
Chief, Program Evaluation, Records,
and Information Services Branch
Division of Health Assessment
and Consultation

Enclosure

HEALTH CONSULTATION

Assessment of Cancer Incidence

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

MEMPHIS, SHELBY COUNTY, TENNESSEE

CERCLIS NO. TN4210020570

Prepared by:

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

TABLE OF CONTENTS

I. INTRODUCTION

Citizens living around the Memphis Depot are concerned that there are increased rates of cancer, stroke, heart attacks, miscarriages, thyroid disease and birth defects in the community and that there may be a relationship between these health outcomes and contamination from the depot. At the first meeting of the Greater Memphis Environmental Justice Workshop in February 1998, a Health Concerns Subgroup was formed to address these concerns. This group included members of the community and local, state, and federal health officials.

To date, ATSDR has been unable to locate data regarding many of the health outcomes of concern to the community. However, the state of Tennessee does maintain a cancer registry which was utilized to examine cancer incidence rates in the Memphis Depot area. This investigation addresses community members' concern of elevated cancer rates by examining the cancer incidence rates in the depot area and comparing them to cancer incidence rates in Shelby County and in the state of Tennessee. If additional data is identified to address the other community health concerns, they will be provided to the community.

II. GEOGRAPHIC AREA AND POPULATION

The geographic area for the cancer incidence analysis includes a population large enough to provide meaningful statistics but it is restrictive enough to include only those individuals living relatively close to the area of concern. The type of geographic area used in this type of analysis is dependent on the geographic area in which demographic information is available (for example, zip code, census tract, or county). In this case, the smallest geographic area in which demographic information was available was at the census tract level. Census tracts are geographic areas created by the U.S. Census Bureau for the purpose of compiling demographic information (such as age, sex, or race/ethnicity). The target area for this investigation was defined as the six census tracts located around the depot; census tracts 0078.20, 0078.10, 0060, 0065, 0069, and 0081.10. Figure 1 in Appendix A shows the location and boundaries of these census tracts.

The population for this investigation consists of all residents living in the six specified census tracts. To calculate statistics for this investigation, the population estimates of the U.S. Census Bureau for 1990 were used because they provide the most representative description of the population in this area.

III. CANCER CASE ASCERTAINMENT AND TIME PERIOD

All cancer data were provided by the Tennessee Cancer Registry (TCR) of the Tennessee Department of Health. The cancer registry has maintained cancer incidence (new cases of cancer) data for the state of Tennessee since 1986. Cancer incidence data are acquired under the Tennessee Cancer Reporting System Act of 1983 (T.C.A. 68-1-1001 et seq.) which requires that all general and specialty hospitals, clinical laboratories, and cancer treatment centers report all cases of cancer to the Tennessee Department of Health. Every inpatient or outpatient case

diagnosed with or treated for cancer must be reported to the TCR within six months of the end of the calendar year.

The TCR is a passive registry, which means that the registry relies on the facilities to supply the information. The number of expected reports from each institution is monitored, however, and the TCR contacts facilities that fail to report. The number of reports expected are generally predicted by adjusting the reports of the previous years by population growth in the area.

The registry information available for each newly diagnosed cancer case is limited and it is documented from the patient's medical record. Information collected includes demographic and medical data on each individual cancer patient such as name, address at time of diagnosis, census tract code, primary cancer site, histology type, date of diagnosis, age at diagnosis, birthdate, race, sex, and registry identification number. To ensure that reported data are complete and accurate, TCR staff members perform case-finding and other quality control checks at these institutions. All abstracts are reviewed for completeness of required items and if discrepancies suggest a reporting error, the registrars at the reporting facility are contacted for clarification and changes. Currently all abstracts must pass the edits recommended by the North American Association of Central Cancer Registries.

The TCR has determined that cancer incidence reporting is complete for the years 1990–1996. A "case" was defined as an individual residing in one of the selected census tracts who was diagnosed with a new primary malignant cancer during that time period. To ensure that all possible cases for the target area were located, registry data were requested for all cases identified in the six census tracts included in the target area. Cases without census tract codes were identified on street maps and included if their addresses fell within the census tracts under consideration. For eleven cases, however, census tracts were not able to be identified and these cases were not used in the analysis.

IV. RESULTS

Analysis was conducted for all cancer types in the 6 census tract area [1, 2]. The cancer types analyzed were bladder, bone, central nervous system, cervix, colon, corpus uteri, esophagus, female breast, Hodgkin's disease, kidney, leukemia, liver, lung, melanoma, myeloma, non-Hodgkin's lymphoma, oral cavity, ovary, pancreatic, prostate, rectum, stomach, and testis. The category "other" was used for cancer sites that could not be classified. All cancer types were selected for review in order to address concerns raised by citizens living around the depot. Appendix B contains more information about the statistical methods used for this analysis.

During the period of 1990–1996, 665 new cases of cancer were reported in the six census tracts surrounding the depot. Of these, 310 occurred in males, and 355 occurred in females. The highest number of observed cases ($\geq$ 10) in males were prostate, lung, colon, stomach, and kidney cancer, while in females the highest number of observed cases ($\geq$ 10) were breast, colon, lung, corpus uteri (endometrial), cervix, rectum, ovary, myeloma, and kidney cancer.

Table 1 shows that overall cancer incidence occurred at about or below expected rates for males when compared to Shelby County cancer incidence rates. Esophageal and lung cancer occurred significantly less often than expected among males during the 6-year time period evaluated. No significant excess of the remaining cancer sites was observed among males in this area during this same time period. The results for males were the same when compared to the state of Tennessee cancer incidence rates with the exception of oral cavity incidence, which occurred less often than expected but was not statistically significant (Table 3).

A significantly lower than expected number of pancreatic, breast, and lung cancer cases was observed among females residing in the six census tracts surrounding the Memphis Depot when compared to Shelby County cancer incidence rates (Table 2). The number of cases of "other" cancer was also significantly lower than expected in females. An excess of corpus uteri (endometrial) cancer was observed among females during the same period of time in this area, which was marginally significant. No significant excess of the remaining cancer sites was observed in females during this time period. The results for females are the same when compared to the state of Tennessee cancer incidence rates (Table 4), except for pancreatic cancer, which was not significantly lower.

Additional Cancer Analysis

Additional analysis was conducted examining the cancer rates in each of the six individual census tracts included in the initial analysis. Figure 1 in Appendix A shows the location and boundaries of these census tracts. The cancer types analyzed were bladder, bone, central nervous system, cervix, colon, corpus uteri, esophagus, female breast, Hodgkin's disease, kidney, leukemia, liver, lung, melanoma, myeloma, non-Hodgkin's lymphoma, oral cavity, ovary, pancreatic, prostate, rectum, stomach, and testis. The category "other" was used for cancer sites that could not be classified.

The additional cancer analysis examined small geographical areas and there were few observed cases for the majority of the cancer sites. These issues need to be taken into consideration when interpreting the results because small numbers of cases can make the rates unstable. Therefore, the results of this additional analysis need to be interpreted with caution. Due to reasons of confidentiality, the results reported in this section pertain only to those cancer sites that had observed values of five or greater. Also due to reasons of confidentiality, the results from the additional cancer analysis are not given in a table, but presented in summary form.

Overall, cancer incidence occurred at about or below expected rates among males and females in each individual census tract when compared to Shelby County cancer incidence rates and to the state of Tennessee cancer incidence rates. A significantly higher than expected number of cases of myeloma in females was observed in census tract 0065. In census tract 0078.20, a higher than expected number of male prostate cases was observed when compared to Shelby County, but this rate was not elevated when compared to state of Tennessee. The rate of lung cancer in men in census tract 0078.20 was significantly lower than expected. In census tract 0060, the rate of

female breast cancer was significantly lower than expected, while the rate of rectum cancer in females was higher than expected when compared to state of Tennessee rates. The rate of female breast cancer was significantly lower than expected in census tract 0081.10 and lung cancer in males was significantly lower than expected in census tract 0069. In census tract 0078.10 cancer incidence occurred at about or below expected rates among males and females.

V. DISCUSSION

The evaluation of cancer incidence data gives a general picture of the occurrence of cancer in a community, and it may confirm the presence of excess cancer in a community. However, elevated rates of a particular disease may not necessarily be caused by hazardous substances in the environment. Other factors, such as socioeconomic status, occupation, and personal habits (such as diet and smoking), also may influence the development of disease. Information on most risk factors was not available in the abstracted medical information used in this analysis. In contrast, even if elevated rates of diseases are not found, a contaminant may still have caused this or other illnesses or diseases.

Advantages

Advantages of conducting an investigation of this type are that it examines cancer rates in a community and provides a response to community concern about potential excess of cancer in their community. It also provides specific information about the health status of this particular community and can be used to identify areas where further public health investigations or actions may be warranted. Analyzing cancer incidence data lets us examine the number of individuals in a community who have been diagnosed with cancer thus representing a truer picture of cancer in a community than examining only deaths due to cancer.

Limitations

Limitations in the available data make it impossible to determine the cause of disease in a population or to determine other factors that may influence the rate of disease. Also, some of the reported numbers of specific types of cancer are very small and make the rates unstable.

Another limitation of this type of investigation is that cancer is a chronic disease that takes many years to manifest as a clinical disease. The information supplied by the Cancer Registry provides an address at time of diagnosis for each case, but no information on the length of time an individual may have lived at the address before diagnosis. This is an issue with any type of cancer incidence analysis because population mobility cannot be accounted for. In other words, some reported cases of cancer may be for residents who have recently moved into the area which would result in an overcount of cancer cases. Similarly, cancers could have developed among persons who lived in the area in the past, but have moved away. If so, this analysis would have missed these persons and resulted in an undercount of cancer cases.

VI. CONCLUSIONS

The objective of this investigation was to determine whether elevated rates of cancer exist in the community living around the depot site as compared to cancer incidence in Shelby County and the state of Tennessee. The main findings from this investigation are as follows:

- Overall, cancer incidence occurred near or below expected rates in the six census tracts surrounding the Memphis Depot area during the period 1990–1996.
- Males in the six census tracts surrounding the Memphis Depot experienced a lower than expected rates of esophageal and lung cancer.
- Females in the six census tracts surrounding the Memphis Depot experienced a slightly higher rate of corpus uteri (endometrial) cancer than expected during this time, but lower rates of lung, breast, pancreatic, and bladder cancer.
- Additional analyses examining cancer rates in the individual six census tracts found only a small number of observed cases of cancer which made the rates unstable.

VII. COMMUNITY HEALTH CONCERNS EVALUATION

The community health concerns were addressed as follows:

1. Are there higher rates of cancer in this area?

No. Twenty-three cancer types were evaluated in the six census tracts surrounding the Memphis Depot during the period 1990–1996. Overall, cancer incidence in males and females in this area occurred at or below expected rates during this time period. Females experienced a slightly higher rate of corpus uteri (endometrial) than expected, although the increase was marginal.

2. What were the results from this investigation?

The findings from this assessment are as follows:

- A higher than expected number of females who have corpus uteri (endometrial) cancer;
- A lower than expected number of males who have esophageal cancer;
- A lower than expected number of males and females who have lung cancer;
- A lower than expected number of females with breast, pancreatic, and bladder cancer.

3. Should the community be worried about these findings, and what do they mean?

No. These findings mean that there are not increased rates of cancer in the community living in the six census tract area surrounding the Memphis Depot. Although corpus uteri (endometrial) cancer was higher in females than would be expected, this increase was marginal. Although the public should not be worried about these findings, they should be aware that scientific studies have identified a number of factors for various cancers which may increase an individual's risk of developing a specific type of cancer. These factors are known as risk factors and include heredity, diet, age (cancer risk increases with age), family history, exposure to certain chemicals (only a limited number of chemicals show definite evidence of human carcinogenicity), radiation, alcohol, and tobacco smoke. Appendix C contains information regarding general facts about cancer, the ten most commonly reported cancer sites, and specific information regarding corpus uteri (endometrial) cancer.

4. Could the Depot be the cause of the higher number of cancers observed?

Not likely. A careful review of available environmental data by ATSDR indicates that it is unlikely that residents are coming into or have come into contact with significant amounts of chemicals from the Memphis Depot. Thus, it is not likely that the Memphis Depot is associated with these results.

5. Why wasn't another community made up of six census tracts that was similar to the one around the depot used as the comparison population instead of the county or state?

Large populations such as a county or state are used as comparison populations when examining cancer rates in a community because they show all the differences in rates of diseases among people and give a more accurate answer as to whether there is excess disease. If a small population is used as a comparison population, the rates of disease will be greatly influenced by a few cases and therefore comparisons may show an apparent increase or decrease in rates when none exists.

6. Why did you standardize?

The reason for standardizing is to take into account differences among people in the population such as age, race, ethnicity, or sex to see if there are still elevated rates of a disease. We want to standardize because the community we are concerned with may be very different demographically than the comparison population, and we want to take these differences into account. If we did not standardize, we would not be able to draw any type of meaningful conclusions from our analysis. For example, if we were to examine the cancer rates in a community of predominantly older individuals, we would expect higher rates because cancer is more common in older individuals. Also, most cancers take a long time to develop. However, if our comparison population was predominantly younger, we

would not expect much cancer. To get an accurate cancer rate, we must make adjustments for differences in age and/or other characteristics between the groups being compared.

7. Was a map showing the location of the cancer cases made? Wouldn't this show if there was a cluster of cases located closer to the depot?

A map showing the location of the cancer cases was not generated because maps do not generally show if cases of cancer are clustered. In some areas the location of the population is not evenly distributed throughout a census tract and the location of the cancer cases on a map would reflect the location of the population. Therefore, the cancer cases would seem to be clustered in a certain area but in actuality the cases are located in areas that are populated. When examining if there is a clustering of disease, we conduct statistical analysis to see if there is an excess of a specific type of disease. In the examination of cancer rates in the six census tract area around the Depot, we did not find elevated rates of cancer.

Although mapping can be a very important tool when examining health data such as infectious diseases which have a short latency period, it presents many difficulties in interpretation when dealing with cancer which can take ten or more years to develop. Another difficulty is that when examining such a small area as the six census tracts surrounding the Memphis Depot, a map could reveal the identify of a person with cancer.

8. The depot began operating in 1942, but the cancer incidence report only examines cancer data for the years 1990–1996. What about the employees who worked at the depot? Are they included in the analysis?

The Tennessee Department of Health has maintained cancer incidence (new cases of cancer) data for the state of Tennessee since 1986 and has determined that cancer incidence reporting is complete for the years 1990–1996. No data on cancer incidence is available before this time, so we were unable to examine cancer incidence rates from the time the Depot began operations. Employees were included in the analysis only if they lived in one of the six census tracts surrounding the Depot.

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LIST OF TABLES

Table 1 Number of Observed and Expected New Cancer Cases and Race, Age-Adjusted Standardized Incidence Ratios, Memphis Depot Area, Shelby County Rates, 1990–1996				
MALES				
Site	**Observed**	**Expected**	**SIR***	**95% CI**
Oral Cavity	9	15.4	0.6	0.3-1.1
Esophagus	4	11.1	0.4	0.1-0.9†
Stomach	15	12.2	1.2	0.7-2.0
Colon	31	34.8	0.9	0.6-1.3
Rectum	9	14.1	0.6	0.3-1.2
Liver	4	4.1	1.0	0.3-2.5
Pancreas	8	9.0	0.9	0.4-1.8
Lung	60	93.3	0.6	0.5-0.8†
Bone	1	0.6	1.6	0.0-8.8
Melanoma	1	1.2	0.8	0.0-4.6
Prostate	99	102.3	1.0	0.8-1.2
Testis	1	0.6	1.7	0.0-9.6
Bladder	9	12.9	0.7	0.3-1.3
Kidney	10	10.5	0.9	0.5-1.7
Nervous System	3	3.2	0.9	0.2-2.8
Hodgkin's Disease	4	1.6	2.5	0.7-6.4
Non-Hodgkin's Lymphoma	5	8.0	0.6	0.2-1.5
Myeloma	7	7.3	1.0	0.4-2.0
Leukemia	6	6.9	0.9	0.3-1.9
Other Sites	24	34.0	0.7	0.5-1.0

* SIR: standardized incidence rate; when the number of cases observed equals the number expected, the SIR=1.0
† Significantly lower (at the 5% level) than expected.

Table 2 Number of Observed and Expected New Cancer Cases and Race, Age-Adjusted Standardized Incidence Ratios, Memphis Depot Area, Shelby County Rates, 1990–1996				
FEMALES				
Site	**Observed**	**Expected**	**SIR***	**95% CI**
Oral Cavity	6	8.4	0.7	0.3-1.6
Esophagus	3	4.2	0.7	0.1-2.1
Stomach	8	11.9	0.7	0.3-1.3
Colon	54	51.5	1.0	0.8-1.4
Rectum	13	16.6	0.8	0.4-1.3
Liver	3	3.2	0.9	0.2-2.8
Pancreas	8	16.7	0.5	0.2-0.9†
Lung	34	52.9	0.6	0.4-0.9†
Bone	0	0.6	0.0	----
Melanoma	1	1.9	0.5	0.0-2.9
Breast	94	123.4	0.8	0.6-0.9†
Cervix	21	23.9	0.9	0.5-1.3
Corpus Uteri	30	21.0	**1.4**	1.0-2.0
Ovary	11	12.7	0.9	0.4-1.6
Bladder	3	7.2	0.4	0.1-1.2
Kidney	10	9.3	1.1	0.5-2.0
Nervous System	3	4.3	0.7	0.1-2.0
Hodgkin's Disease	2	1.5	1.3	0.1-4.8
Non-Hodgkin's Lymphoma	9	8.5	1.1	0.5-2.0
Myeloma	11	8.0	1.4	0.7-2.5
Leukemia	8	8.0	1.0	0.4-2.0
Other Sites	23	36.8	0.6	0.4-0.9†

* SIR: standardized incidence rate; when the number of cases observed equals the number expected, the SIR=1.0
† Significantly lower (at the 5% level) than expected.
Bold type indicates an excess of borderline statistical significance.

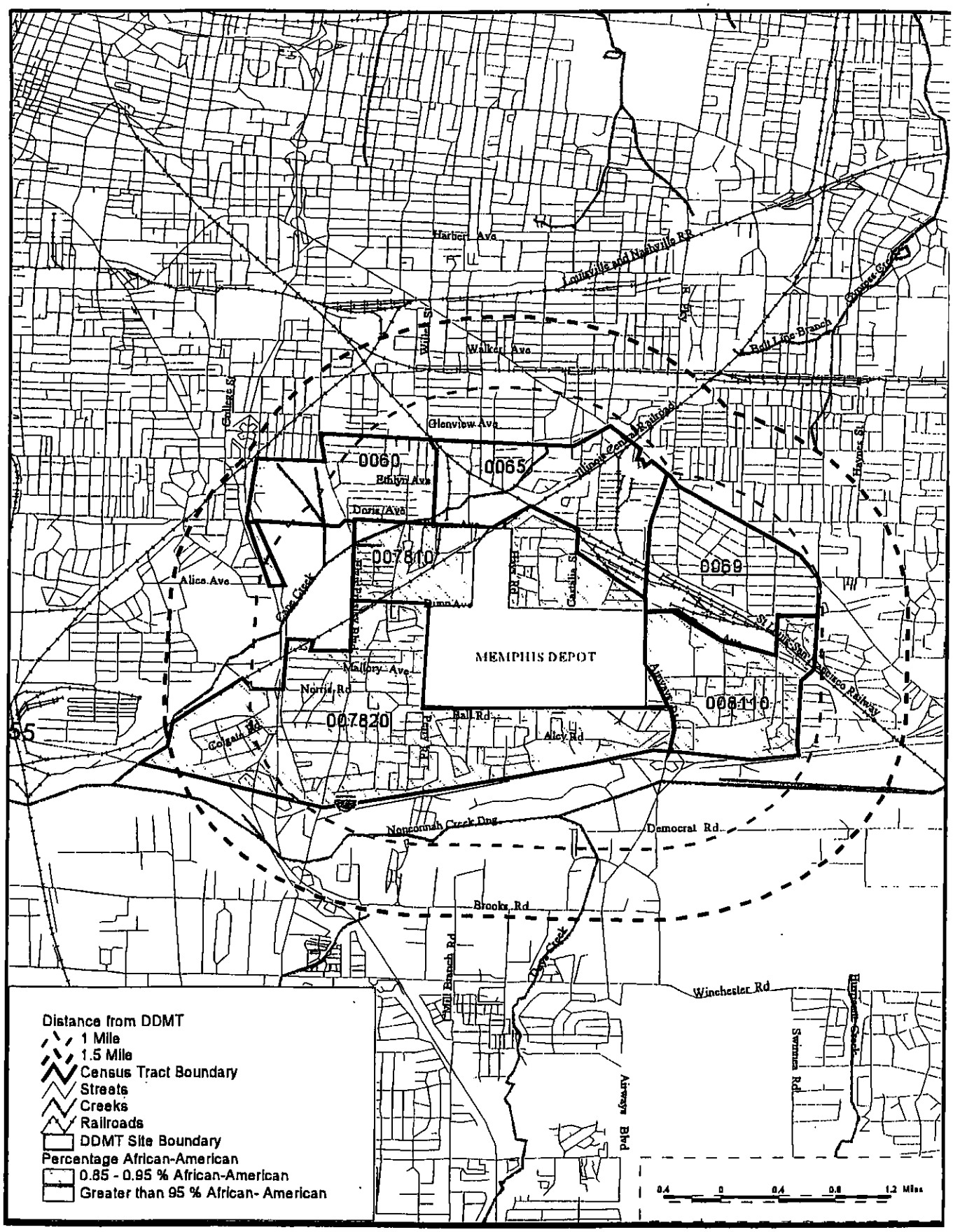
Table 3 Number of Observed and Expected New Cancer Cases and Race, Age-Adjusted Standardized Incidence Ratios, Memphis Depot Area, Tennessee State Rates, 1990–1996				
MALES				
Site	**Observed**	**Expected**	**SIR***	**95% CI**
Oral Cavity	9	16.7	0.5	0.2-1.0
Esophagus	4	11.8	0.3	0.1-0.9†
Stomach	15	12.8	1.2	0.7-1.9
Colon	31	33.8	0.9	0.6-1.3
Rectum	9	13.5	0.7	0.3-1.3
Liver	4	3.2	1.3	0.3-3.2
Pancreas	8	9.2	0.9	0.4-1.7
Lung	60	94.4	0.6	0.5-0.8†
Bone	1	0.7	1.4	0.0-7.7
Melanoma	1	1.2	0.8	0.0-4.6
Prostate	99	110.5	0.9	0.7-1.1
Testis	1	0.7	1.5	0.0-8.3
Bladder	9	13.1	0.7	0.3-1.3
Kidney	10	11.6	0.9	0.4-1.6
Nervous System	3	3.2	0.9	0.2-2.7
Hodgkin's Disease	4	2.2	1.8	0.5-4.7
Non-Hodgkin's Lymphoma	5	7.9	0.6	0.2-1.5
Myeloma	7	6.4	1.1	0.4-2.2
Leukemia	6	6.6	0.9	0.3-2.0
Other Sites	24	33.9	0.7	0.5-1.1

* SIR: standardized incidence rate; when the number of cases observed equals the number expected, the SIR=1.0
† Significantly lower (at the 5% level) than expected.

Table 4 Number of Observed and Expected New Cancer Cases and Race, Age-Adjusted Standardized Incidence Ratios, Memphis Depot Area, Tennessee State Rates, 1990–1996				
FEMALES				
Site	**Observed**	**Expected**	**SIR***	**95% CI**
Oral Cavity	6	7.1	0.8	0.3-1.8
Esophagus	3	4.4	0.7	0.1-2.0
Stomach	8	10.1	0.8	0.3-1.6
Colon	54	46.1	1.2	0.9-1.5
Rectum	13	13.7	0.9	0.5-1.6
Liver	3	2.1	1.4	0.3-4.1
Pancreas	8	13.7	0.6	0.3-1.2
Lung	34	53.8	0.6	0.4-0.9†
Bone	0	0.6	0.0	----
Melanoma	1	1.7	0.6	0.0-3.3
Breast	94	118.1	**0.8**	0.6-1.0
Cervix	21	20.3	1.0	0.6-1.6
Corpus Uteri	30	19.3	**1.6**	1.0-2.2
Ovary	11	12.0	0.9	0.5-1.6
Bladder	3	7.3	0.4	0.1-1.2
Kidney	10	9.3	1.1	0.5-2.0
Nervous System	3	3.9	0.8	0.2-2.3
Hodgkin's Disease	2	1.6	1.2	0.1-4.5
Non-Hodgkin's Lymphoma	9	9.1	1.0	0.4-1.9
Myeloma	11	8.3	1.3	0.7-2.4
Leukemia	8	6.7	1.2	0.5-2.3
Other Sites	23	39.0	0.6	0.4-0.9†

* SIR: standardized incidence rate; when the number of cases observed equals the number expected, the SIR=1.0
† Significantly lower (at the 5% level) than expected.
Bold type indicates an excess of borderline statistical significance.

APPENDIX A



CANCER INCIDENCE STUDY AREA

APPENDIX B

GENERAL FACTS ABOUT CANCER

Cancer is a very common disease, much more common than most people realize. Approximately 1 of every 3 persons alive today will develop some type of cancer in their lifetime. Furthermore, cancer is not one disease, but many different diseases. Different types of cancer are generally thought to have different causes. It also takes time for cancer to develop, usually 20 to 40 years. Conditions that have prevailed for only the last 5 or 10 years are unlikely to be related to the current incidence of cancer in a community.

The incidence of cancer may vary by race/ethnicity, gender, the type of cancer, geographic distribution, and a variety of other factors. Scientific studies have identified a number of factors for various cancers which may increase an individual's risk of developing a specific type of cancer. General cancer risk factors include heredity, geographic area, diet, environmental causes, tobacco smoke, sexual practices, and alcohol consumption.

Most Common Types of Cancer

The National Cancer Institute examined cancer incidence rates in the United States [3] and found that cancer of the prostate gland has become the most common type of cancer among both black and white males (see table below). Lung cancer and colorectal cancer rates are the second and third highest, respectively; for both black and white males. Bladder cancer is the fourth most commonly diagnosed cancer in white males, but ranks only ninth for black males.

Breast cancer is by far the most common cancer among both black and white females. Lung cancer and colorectal cancer are the second and third highest cancers, respectively, among white females compared to ranks of third and second highest, respectively, for black females. Even though lung and colorectal cancers are two of the most common cancers among females, their incidence is much lower than that for males. The fourth most common cancer for females is corpus uteri (endometrial) for both whites and black. Even though the rank is the same, the rate for corpus uteri (endometrial) cancer is higher among whites than blacks, unlike cancer of the cervix, where the rate is higher among black females.

Age-adjusted Cancer Incidence Rates, 1987–1991: 10 Most Common Sites By Race and Gender*

Black Males	White Males	Black Females	White Females
1. prostate gland	prostate gland	breast	breast
2. lung & bronchus	lung & bronchus	colon/rectum	lung & bronchus
3. colon/rectum	colon/rectum	lung & bronchus	colon/rectum
4. oral cavity & pharnyx	urinary bladder	corpus & uterus	corpus & uterus
5. stomach	lymphomas	cervix uteri	ovary
6. esophagus	oral cavity & pharnyx	pancreas	lymphomas
7. lymphomas	melanoma of skin	ovary	melanoma of skin
8. pancreas	leukemia	lymphomas	cervix uteri
9. urinary bladder	kidney/renal	stomach	leukemia
10. kidney/renal	pancreas	multiple myeloma	urinary bladder

* Table taken from reference 3.

Corpus Uteri Cancer

Cancer of the uterine corpus or endometrium is the third most common cancer among U.S. women and accounts for about 9% of cancers in women. Endometrial cancer is rare before the age of 45, but the risk rises sharply among women in their late 40s to mid-60s. In the United States, the age-adjusted incidence rates of whites are nearly twice as high as those for African-Americans; the reason for this discrepancy is unknown [3].

Risk factors for endometrial cancer include high socioeconomic status, never having given birth or having few children, early age at menarche, and late age at menopause. Multiple births have been linked to a decreased risk of endometrial cancer, with women who have had four or more children having only one-third the risk of women who have never had children. Women who have never had children, particularly those with a history of infertility, are at greatest risk. Obesity, which is accompanied by increased levels of endogenous estrogens, has long been recognized as a risk factor for endometrial cancer, with very heavy women having disproportionately high risks. Most risk factors for endometrial cancer have been linked with hormonal imbalances, especially excess estrogen production. It is not surprising, therefore, that increased risk has been found among

users of estrogen replacement therapy [3].

METHODS FOR ANALYZING AND INTERPRETING CANCER INCIDENCE DATA

In order to be able to analyze and interpret cancer incidence data, it is necessary to convert the number of cases we observe to ratios. Using ratios allows us to compare the number of cases in the population living in the area of concern with a reference population to determine if there is an excess of a particular disease or health condition. When interpreting cancer data, an observed occurrence is compared to an "expected" occurrence using ratios. The expected occurrence is based on the occurrence observed in a reference population, in this case the state of Tennessee as a whole. For cancer, the ratio of observed to expected number of cases (incidence) was examined, and the information was further standardized to eliminate possible effects due to race, gender, and age. These ratios are referred to as the standardized incidence ratio (SIR).

Specifically, the SIR is the observed number of cases divided by the expected number of cases. A ratio of 1.0 indicates that the number of cases observed in the population being evaluated is equal to the number of cases expected based on the rate of disease in the reference population. A ratio greater than 1.0 indicates that more cases occurred than expected; and a ratio less than 1.0 indicates that fewer cases occurred than expected. Accordingly, a ratio of 1.5 is interpreted as 1.5 times as many cases as the expected number, and a ratio of 0.9 indicates 0.1 fewer cases than would be expected.

Caution should be exercised, however, when interpreting these ratios. The interpretation of a ratio depends on both the size of the ratio and the number of cancer cases used to calculate the ratio. For example, a ratio of 1.5 based on two expected cases and three observed cases indicates a 1.5 times excess in cancer, but the excess is actually only one case. Conversely, a ratio of 1.5 based on 200 expected cases and 300 observed cases represents the same 1.5 times excess in cancer, but because the ratio is based upon a greater number of cases, the estimate is more stable. It is very unlikely that 100 excess cases of cancer would occur by chance alone.

Experience has shown us that we can expect a certain amount of chance variation when looking at the occurrence of different health conditions. Statisticians have developed methods to take this into account. One method is to calculate a confidence interval for the SIR. A 95% confidence interval (CI) is calculated to determine if the observed number of cases is significantly different from the expected number, or if the difference may be due solely to chance. A 95% CI is the range of estimated ratio values that has a 95% probability of including the true ratio for the population. The confidence interval is a statistical measure of the precision of the risk estimate. If the confidence interval contains 1.0, no statistically significant excess of disease is indicated.

DEFINITIONS*

Standardized (Adjusted) Rates: help control for demographic differences between populations being compared. Adjusted incidence rates estimate what the incidence rates for populations would be if their composition were similar to that of a comparison, or standard, population (and, therefore, to each other). Adjustment can be made for various characteristics that influence incidence rates, including age, race or ethnicity, and gender.

Although a crude rate is a valuable summary measure, comparison of crude rates between populations can be problematic if demographic characteristics (such as age distribution) that affect health outcome differ between the populations. The overall crude incidence rate for a population depends on not only the incidence rate for each age group but also the proportion of people in each age group.

Age-adjustment helps control for differences in the age structure of populations. Age-adjusted incidence rates for two populations are calculated by multiplying the age-specific incidence rates for each age group by the proportion of people in the same age group in the standard population. The sum of these products is the age-adjusted, or age-standardized, incidence rate for each of the populations.

Statistically significant: there is less than a certain percent chance (usually selected as 5%) that the observed difference is merely the result of random fluctuation in the number of observed cancer cases. For example, if the confidence interval does not include 1.0 and the interval is below 1.0, then the number of cases is significantly lower than expected. Similarly, if a confidence interval does not include 1.0 and the interval is above 1.0, then there is a significant excess in the number of cases. If the confidence interval includes 1.0, then the true ratio may be 1.0, and it cannot be concluded with sufficient confidence that the observed number of cases reflects a real excess or deficit. As long as the 95% confidence interval contains 1.0, that indicates that the ratio is still within the range one might expect based on the disease experience of the comparison population.

In addition to the number of cases, the width of the confidence interval also reflects the stability of the ratio estimate. For example, a narrow confidence interval (e.g., 1.03–1.15) allows a fair level of certainty that the calculated ratio is close to the true ratio for the population. A wide interval (e.g., 0.85–4.50) leaves considerable doubt about the true ratio, which could be much lower than or much higher than the calculated ratio.

* Taken from reference 4.

REFERENCES

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3. National Cancer Institute. Uterine corpus (endometrium). In: Cancer rates and risks. NIH Publication No. 96-691. Bethesda: US Department of Health and Human Services; 1996. p. 203-205.

4. US Department of Health and Human Services. Using chronic disease data. Atlanta: Centers for Disease Control and Prevention, 1992.

APPENDIX C

PUBLIC COMMENTS

The Assessment of Cancer Incidence for Memphis, TN Public Health Consultation (PHC) was available for public review and comment in the Cherokee and Main Branches of the Memphis/Shelby County Public Library, Memphis/Shelby County Health Department, and the Memphis Defense Depot in Memphis from May 10 to June 26, 2000. The public comment period was announced in local newspapers and fliers summarizing the report were sent to residents living around the Memphis Depot. In addition, the PHC was sent to several individuals, federal, state, and local officials. The following comments were received:

Comment: Specific demographic information about the community and the comparison populations is lacking in the report. Ideally, comparison populations should be similar to the study population except for the exposure of interest. It would also be helpful to know how long each individual lived within the area; this concern is briefly mentioned within the limitations.

Response: When conducting an analysis of cancer incidence, the comparison population used is usually the county or state. The reason for this is so that the expected rates are generated from a large population and therefore the rates are more stable. Since the populations of the geographic area of interest and the county or state may not be similar with respect to demographic make-up, we use the method of standardizing to take into account these differences. This method basically gives us the answer to the question "If the county or state looked like the geographic area of interest with respect to age and racial composition, what rates of cancer would we expect?". Once we have determined the expected rates, we can compare them to the observed rates of cancer for the area and determine if there is an excess or not. Therefore, with this type of analysis it is not necessary that the comparison population be similar to the study population since we control for this statistically. When conducting an epidemiologic study, then it is imperative that the comparison population be similar to the study population except for the exposure of interest.

Comment: There is no information regarding the exposures of concern, either the material(s) or the route. The exposure information would be helpful to determine if the observed cancer in the community was due to a certain chemical and route of exposure based upon the current knowledge of cancer epidemiology and known cancer-causing agents.

Response: The purpose of this analysis was to address community concern that there were higher rates of cancer in the neighborhoods surrounding the Memphis Depot by examining cancer incidence data from the state registry. We did not have any information on possible risk factors or exposures individuals may have had and so it is impossible from this type of analysis to determine the causes of cancer.

Comment: The authors mention that there is an increased incidence of corpus uteri cancer among women as indicated by the SIR of 1.4 and 1.6 in Tables 2 and 4, respectively. Both of the 95% Confidence Intervals contain 1.0 as their lower boundary limit, which may indicate that no true difference exists between the study population and the reference population; the incidence rate may actually be equal to the expected rate. Overall, there was no significant difference in the rates of cancer within the study population to rates within the reference population during the time period of the study.

Response: Your comment is correct. Strictly speaking, when a confidence interval contains 1.0 the rate is not statistically significant. Therefore, we indicated in Tables 2 and 4 that the rate of corpus uteri cancer was of borderline statistical significance. The reason for this is that although a rate may not be statistically significant, if it is elevated it may influence future health education/prevention activities.

Comment: Why didn't ATSDR examine the spatial relationship of the various cancers to see if the cases tended to increase in closer proximity to the Depot?

Response: GIS (Geographic Information System) can be a very important tool when examining health data. However, when examining disease that has a very long latency period, or that may be related to environmental exposure, the results from this type of analysis can become more ambiguous. In the case of the analysis that was conducted at the Memphis Depot, we examined cancer incidence data from the Tennessee Cancer Registry. We did not conduct additional GIS analysis because no excess of any individual type of cancer was found and also because of the long latency period for cancer.

Comment: Why was the additional analysis of the individual census tracts conducted?

Response: The reason this analysis was conducted was because of community residents working with us on this analysis wanted to know the cancer rates for their specific census tracts. Due to the small number of observed cases and the small geographic area, the results of the analysis were not included in the report except in summary form due to reasons of confidentiality.

Comment: Why is the period of evaluation just for the six year period between 1990-1996?

Response: We evaluated cancer data for the years 1990-1996 because those were the only years in which data from the Tennessee Cancer Registry was complete. We were not able to examine cancer rates in the area during the 1950's - 1980's because data is not available for that time period.

Comment: African Americans were allowed to move into that community [surrounding the Depot] in the late 50's and early 60's. The second generation moved away in the late 60's and early 70's. In my opinion, the population that is in need of cancer screening is no longer in the

community but living elsewhere in the county. The most active years of the Depot were the years of the Korean conflict and the Vietnam conflict. What about this dispersed population that is now suffering from chronic disease and dying at early ages?

Response: Although this analysis did not find high rates of cancer in this community, ATSDR realizes that cancer is a concern of citizens living around the area. In order to address this concern and others regarding environmental health effects, ATSDR is planning on conducting training to health care professionals in the area. If you would like more information regarding this training, please contact Dr. Jewel Crawford at 1-888-422-8737 ext 5060 or at JLCrawford@cdc.gov.

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE