

Health Consultation

New Bedford Kidney Cancer
Follow-Up Investigation

RODNEY METALS
(a/k/a ALLEGHENY RODNEY STRIP DIVISION)
EPA FACILITY ID: MAD001067941

AND

BRITTANY DYEING AND PRINTING CORPORATION
EPA FACILITY ID: MAD001014612

NEW BEDFORD, BRISTOL COUNTY, MASSACHUSETTS

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
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Division of Health Assessment and Consultation
Atlanta, Georgia 30333

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Prepared by:

Massachusetts Department of Public Health
Center for Environmental Health
Community Assessment Program
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

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I. BACKGROUND AND STATEMENT OF ISSUES

This report provides results of a follow-up investigation of the pattern of kidney cancer in the South End area of New Bedford. In July 2003, the Community Assessment Program (CAP) of the Center for Environmental Health (CEH) at the Massachusetts Department of Public Health (MDPH) completed an evaluation of cancer incidence in the South End area of New Bedford to investigate community concerns about the possible role that environmental exposures related to the Allegheny Rodney Company (also known as Rodney Metals) and Brittany Dyeing and Printing Corporation (a.k.a. Brittany Dye) may play in the incidence of cancer in the neighborhoods adjacent to the facilities (ATSDR 2003). Rodney Metals and Brittany Dye are located in the South End area of New Bedford, census tract 6528, on East Rodney French Boulevard to the south of Butler Street and east of Swan Street (refer to Figure 1).

Results of the July 2003 report indicated that the majority of cancer types evaluated occurred approximately at or near the expected rate during 1982-1998 in New Bedford census tract 6528 and, with the exception of kidney cancer, no apparent spatial patterns were observed at the neighborhood level. However, a statistically significant elevation in the incidence of kidney cancer occurred among males in this census tract during the most recent time period evaluated (i.e., 5 diagnoses observed versus 1.3 expected), 1995-1998, and all five individuals diagnosed with kidney cancer during this time were located within close proximity to the Rodney Metals and Brittany Dye facilities. At the time of the initial investigation, available data on smoking and occupation were limited, and the possible role of these and other risk factors, such as family and medical history, could not be evaluated for these individuals making stronger conclusions about environmental etiologic factors difficult at best. In addition, it was not possible to evaluate whether air emissions from the two facilities resulted in the presence of elevated levels of chlorinated volatile organic compounds such as trichloroethylene (TCE) in the ambient air adjacent to these facilities and, if present, whether human exposure may have occurred in the past.

Based on the findings of the July 2003 report, the MDPH recommended additional follow-up for all individuals diagnosed with kidney cancer in New Bedford census tract 6528 since 1982 when the Massachusetts Cancer Registry (MCR) began collecting cancer data. Specifically,

opportunities for personal interviews and/or medical records reviews were offered to those individuals diagnosed with kidney cancer (or their families), who provided informed consent, to determine any possible environmental or other factors that may have contributed to their diagnosis. The purpose of the case interviews was to identify the prevalence of known or suspected risk factors among those diagnosed with kidney cancer, to learn more about the pattern observed, and to help determine whether it is more or less likely that environmental factors related to the two facilities may have played a role in their diagnoses. The purpose of the medical records review was to obtain supplemental information on factors possibly associated with their diagnoses.

It should be noted that present and future air exposure to TCE is not expected since Rodney Metals discontinued use of TCE in 1982 and Brittany Dye discontinued use of TCE just prior to the release of the 2003 cancer incidence report. However, due to unpleasant odors and nuisance conditions reported by individuals living near the two facilities, the MDPH recommended that the Massachusetts Department of Environmental Protection (MDEP) determine any additional actions that could reduce potential nuisance impacts to residents in the surrounding neighborhood. As a result, MDEP conducted site visits at the two facilities, and both companies have since agreed to work with the Massachusetts Executive Office of Environmental Affairs, Office of Technical Assistance, to help identify ways to reduce impacts to the local community.

This project and the initial July 2003 report were conducted under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). A detailed discussion of the history of both Rodney Metals and Brittany Dye, including a review of available environmental data, is included in the first report (ATSDR 2003). The 2003 report is available on the MDPH web site at www.mass.gov/dph/ceh. In addition, a copy of the report is available at the New Bedford Free Public Library (Main Library).

II. OBJECTIVES

The objectives of this follow-up investigation were:

- Using the Massachusetts Cancer Registry (MCR), identify all individuals diagnosed with kidney cancer while living in the South End area of New Bedford since 1982 and contact them to request participation in personal interviews and/or medical records review.
- Obtain all available information about known or suspected risk factors for individuals diagnosed with kidney cancer (e.g. smoking, occupation, family or medical history) through personal interviews and medical records review for those who provide informed consent, as well as information available for all cases through the MCR, death records, and city resident lists.
- Evaluate the prevalence of kidney cancer risk factors together with information on length of residence and the geographic locations of all cases to help determine whether environmental factors related to Rodney Metals and Brittany Dye are more or less likely to have played a role in the pattern of kidney cancer observed among residents of New Bedford's South End.

III. METHODS

The Commissioner of the MDPH approved this study under provisions outlined in M.G.L. c. 111, s. 24A, which protects the confidentiality of all information collected as part of this study. Under the provision of this statute, the MDPH and all its employees and agents involved in the *New Bedford Kidney Cancer Follow-up Investigation* are prohibited from releasing any information provided by study participants or obtained from their medical records in any manner that would allow participants to be personally identified. Furthermore, Section 24A prohibits the disclosure or release through a public records request, court subpoena, or any other legal process, of any personal or medical information participants provide to the MDPH. Every effort is made to maintain participant confidentiality. For example, only personnel directly involved with this project have access to completed questionnaires, medical records, and computer files.

Confidential information and identifiable data collected as a result of this project are archived in locked storage files.

A. Case Definition and Identification

Cases included all individuals who were diagnosed with kidney cancer and reported to the MCR since 1982, when the registry was established, and whose reported address at diagnosis was located in the South End of New Bedford (i.e., CT 6528). We searched data records available from the MCR to identify individuals who met these criteria.

The MCR, a division within the MDPH Center for Health Information, Statistics, Research and Evaluation, is a population based surveillance system that has been monitoring cancer incidence in the Commonwealth since 1982. All new diagnoses of cancer among Massachusetts residents are required by law to be reported to the MCR within 6 months of the date of diagnosis (M.G.L. c.111. s 111b). Individuals are reported to the MCR based on their reported residence at diagnosis, regardless of the hospital or medical facility where they were diagnosed. In addition, Massachusetts residents diagnosed or treated in neighboring states are reported to the MCR through reciprocal reporting agreements with 15 states, including Rhode Island, Connecticut, New York, Vermont, and New Hampshire.

For the diagnosis year 2001, the MCR's total case count was estimated by the North American Association of Central Cancer Registries to be complete. (Completeness for more recent years has not yet been estimated.) Although the MCR data are considered complete through 2001, this is an on-going surveillance system that collects reports on a daily basis. Therefore, it is possible for CAP staff to review case reports for more recent years as the MCR file is updated (i.e., 2002-present).¹

Twelve individuals diagnosed with kidney cancer were identified during the initial investigation, which included a review of kidney cancer diagnoses in New Bedford census tract 6528 between 1982 and 1998. In the process of conducting this follow-up study, three additional residents were identified as having been diagnosed with kidney cancer. These three individuals were

¹ The data summarized here are drawn from data entered on MCR computer files before June 22, 2005. The numbers presented may differ slightly from those published in previous or future reports, reflecting late reported cases, address corrections, or other changes based on subsequent details from reporting facilities.

diagnosed with kidney cancer after 1998. Therefore, the case population for this study includes a total of 15 individuals diagnosed with kidney cancer between 1982 and 2003 who were reported as being residents of New Bedford's South End at the time of their diagnosis. As of September 14, 2005, there were no additional reports to the MCR of kidney cancer diagnoses among residents of this area.

B. Data Collection

1. Participant recruitment

Prior to participant recruitment, a search of death records available from the MDPH Registry of Vital Records was conducted to determine the vital status of each case. If a Massachusetts death record could not be located, it was assumed that the individual was still living and could be contacted directly. For deceased cases, the informant listed on the death certificate, who was considered to be the "next-of-kin," was contacted to request their participation in the interview portion of the study as a proxy for the case and to consent to review of the deceased's medical records.

Address information was obtained from the MCR for cases and from death records for next-of-kin. In addition, searches of city, state, and nationwide directories and the Registry of Motor Vehicles database were conducted to confirm or identify current addresses for cases that may have relocated since the time of their diagnosis and next-of-kin who may have moved since the time of death. For some individuals, address forwarding information was provided by the U.S. Postal Service.

Fourteen of the 15 individuals diagnosed with kidney cancer and next-of-kin were initially contacted by letter in January 2004. Recruitment letters were written in both English and Portuguese to ensure that language would not present a barrier to study participation. The letters reviewed the results of the original investigation, explained the purpose of the current study, and requested individuals to agree to be interviewed as part of the *New Bedford Kidney Cancer Follow-up Investigation* and to consent to a medical records review. Individuals were advised that participation in this study was completely voluntary, that they could withdraw from the investigation at any time, and that their identity and all information provided to or obtained by

the MDPH would be held strictly confidential. Between February and May 2004, three subsequent recruitment mailings reiterating these points were sent to individuals who did not respond to the first letter. The final two recruitment mailings were sent via certified mail with a return receipt to verify delivery. In addition, follow-up telephone calls during the spring and summer of 2004 were conducted for individuals whose initial response suggested possible misunderstanding of study purpose or procedures. A check of updated MCR files in June 2005 identified one additional individual diagnosed with kidney cancer while living in the South End area of New Bedford. In an effort to include this individual as part of the study, a recruitment letter was promptly sent by mail requesting their participation in an interview and medical records review.

2. Interviews

A survey instrument (questionnaire) was developed by CAP staff specifically for the *New Bedford Kidney Cancer Follow-up Investigation*. This questionnaire covered various topics including the case's kidney cancer diagnosis, medical history, residential history, occupational history, lifestyle habits, and family history of cancer. The majority of questions focused specifically on known or suspected risk factors for kidney cancer as identified through published medical and scientific journal articles and other texts. A draft survey instrument was reviewed by an occupational and environmental health physician who consults with the MDPH's CEH and recommended revisions were incorporated as appropriate into the final version (see Appendix A). Questionnaires were identical for individuals diagnosed with kidney cancer and next-of-kin, with the exception that questions for those diagnosed with kidney cancer were phrased in the second person while questions for next-of-kin were phrased in the third person.

Eight interviews were completed as part of this follow-up investigation. With one exception, interviews were conducted in person and took place at the participants' homes in New Bedford. One participant lived out-of-state and therefore the interview was conducted by telephone. Informed consent to participate in interviews was obtained in writing prior to each interview. The same CEH staff member conducted all interviews. Interview length ranged from 45 to 90 minutes.

3. Medical records review

The purpose of the medical records review was to verify information obtained from the interview and to determine the presence of other known or suspected risk factors for kidney cancer among cases that may not have been identified in the interview.

An Authorization for Disclosure of Medical Records was obtained in writing for each participant. Upon informed consent, physicians and/or health care facilities named by the participant were contacted by letter to request copies of medical records relevant to the purposes of this investigation. The physicians and/or health care facilities were responsible for copying and submitting records to MDPH.

Medical records were received for all eight individuals who provided informed consent. It is important to note, however, that for some individuals, complete sets of medical records were not available.

4. Other information sources

The intent and purpose of conducting in-person interviews and medical records reviews was to obtain the best quality information available from those diagnosed with kidney cancer or their next-of-kin that was not readily available when the 2003 investigation was conducted.

Supplemental information for these individuals and information on kidney cancer risk factors for individuals diagnosed with kidney cancer for which interviews and medical records reviews were not possible was sought from alternative sources (i.e., MCR, death records, and city resident lists). These data sources are described below.

In addition to specific data pertaining to the diagnosis of cancer (e.g., date of diagnosis, primary site, and histology classification), the MCR also collects some information regarding risk factors for individuals diagnosed with cancer, such as gender, age at diagnosis, smoking history, and occupation. Case-specific information available from the MCR was reviewed for all 15 individuals diagnosed with kidney cancer, including those who were unable or unwilling to consent to an interview and medical records review.

Massachusetts death records were retrieved from the Registry of Vital Records at the MDPH Center for Health Information, Statistics, Research and Evaluation for all individuals diagnosed with kidney cancer who were deceased at the time this follow-up investigation was initiated (n = 9). In addition to identifying the individual's next-of-kin, death records were reviewed for supplemental information related to occupation, immediate and underlying cause(s) of death, and other significant conditions contributing to death.

The address at the time of diagnosis for each individual diagnosed with cancer was mapped using a computerized geographic information system (GIS) (ESRI 2002). The geographic pattern was determined using a qualitative evaluation of the point pattern of cases in New Bedford CT 01901. In instances where the address information from the MCR was incomplete, that is, did not include specific streets or street numbers, efforts were made to research individuals' residence information using telephone books and city residential lists issued within 2 years of an individual's diagnosis. Address information for the eight individuals who were interviewed was further confirmed and verified. In addition, some of the individuals who were interviewed reported living previously at other locations in the South End and this information was also considered as part of the geographic distribution analysis. Because of confidentiality concerns, maps of individuals diagnosed with kidney cancer cannot be shown.

Finally, annual city directories and street lists of residents for the city of New Bedford were consulted to determine length of residence for those individuals who were not able to be interviewed. Although it is not possible to determine what may have caused any one person's diagnosis with cancer, the length of time in which an individual lived in a particular residence can help determine the importance that their location might have in terms of potential exposure to an environmental source.

C. Data Analysis

Data obtained from the questionnaire, medical records, and other information sources were tabulated and analyzed for known or suspected risk factors for kidney cancer or any common factors among cases. In addition, CEH's consultant occupational and environmental health physician reviewed available medical records and summarized information about the kidney cancer diagnosis, history of illnesses, use of medications, and other factors relevant to the

purpose of this investigation. Finally, temporal trends, information regarding length of residence in the South End and geographic proximity to Rodney Metals and Brittany Dye were considered.

As described previously, an attempt was made to determine the prevalence of known or suspected risk factors for kidney cancer among the case population. For each of these risk factors, the number of cases with the risk factor is reported. The presence of multiple risk factors for several individuals is also discussed, taking into consideration the relative strength of association for different risk factors. Finally, risk factor information, place of residence, and length of residence were evaluated together to assess whether the observed pattern appears atypical for these cases with respect to established incidence trends in the general population or suggests that a common risk factor (environmental or non-environmental) is likely related to these diagnoses.

In accordance with state and federal privacy laws, results are presented as aggregate data only so that no participants can be personally identified.

The results presented here are limited to the available data and therefore should be interpreted with caution. For some cases (e.g., those who participated in an interview and consented to a review of their medical records), more information was available. For others (e.g., those who were unable or unwilling to participate in this study), we relied mainly on information available from the MCR, death records, and city residential lists. In addition, inherent limitations in this type of analysis and the available data make it impossible to determine the precise causal relationships between particular risk factors and the development of cancer or synergistic roles that may have played a part in the development of individual cancers. It is important to stress that this type of analysis cannot determine what may have caused any one individual's cancer.

IV. RESULTS

A. Study Participation

As previously described, the CAP identified 15 individuals who were diagnosed with kidney cancer while reported to be living in the South End area of New Bedford since the year 1982 and contacted them (or their next-of-kin) to request their participation in the follow-up study.

Twelve of these individuals were diagnosed between the years 1982–1998 and identified in the 2003 report; three others were diagnosed after 1998. Of the 15 individuals diagnosed with kidney cancer since 1982, nine were deceased. No other residents of the South End have been diagnosed with kidney cancer and reported to the MCR as of September 2005.

As previously mentioned, four study recruitment mailings were conducted in 2004 and one additional case was contacted by mail in summer 2005. Twelve of the 15 individuals (80%) responded to the requests for participation in this follow-up study. Eight of the individuals who responded agreed to be interviewed and also provided consent for MDPH to obtain their medical records. One South End resident diagnosed with kidney cancer and family members of three other individuals, however, made it clear that they did not want to be interviewed. Three subsequent mailings sent to those participants who did not respond initially did not result in any other potential study participants agreeing to be interviewed or consenting to a medical records review. Figure 2 illustrates these participation results.

B. Evaluation of Kidney Cancer Risk Factor Information

There are a number of known and suggested risk factors for kidney cancer, including age, gender, lifestyle factors such as smoking, environmental and occupational exposures, pre-existing medical conditions such as hypertension, obesity, and advanced kidney disease, family history, and certain inherited genetic conditions. Some information on kidney cancer risk factors available through the MCR (i.e., smoking status, occupation) was evaluated as part of the 2003 cancer incidence investigation. However, for some individuals, relevant risk factor information was missing or not reported. In addition, information on other important factors associated with development of kidney cancer (i.e., family and medical history) is not routinely collected by the MCR.

The intent and purpose of conducting in-person interviews and medical records reviews was to obtain the best quality information available from those diagnosed with kidney cancer or their next-of-kin that was not readily available when the 2003 investigation was conducted. Risk factor information collected for the eight individuals who participated in the interview part of the follow-up study is summarized below. In addition, information on kidney cancer risk factors for the other individuals diagnosed with kidney cancer for which interviews and medical records

reviews were not possible was sought from alternative sources (e.g. MCR, death records, and city resident lists). Where available, information about kidney cancer risk factors from these other sources is also presented. However, for some of the risk factors discussed below, it was only possible to present information for the eight individuals for whom interviews or medical records review were conducted.

1. Age and gender distribution

Kidney cancer most often occurs in the fifth and sixth decades of life (50-70 years age group) and occurs about twice as often in males versus females. The discrepancy in the gender-specific incidence of kidney cancer is thought to reflect the fact that men are more likely than women to be smokers and to be employed in industries where occupational exposures may be important (ACS 2004). Age and gender information for the South End residents diagnosed with kidney cancer was available through the MCR and additionally through the medical records for the eight individuals for whom an interview was conducted. Of the 15 South End residents diagnosed with kidney cancer, the ages at diagnosis ranged from 48 to 80 years. The average age at diagnosis was 68 years which is consistent with the established age pattern for this cancer type and a higher incidence among older age groups. Eleven of the 15 individuals diagnosed with kidney cancer were men and four were women.

2. Histology (cell-type)

The most common type of kidney cancer is renal cell carcinoma, which affects the main part of the kidney and accounts for about 90% of all malignant kidney cancers. Among renal cell carcinomas, clear cell carcinomas make up about 70% to 80% of the diagnoses and papillary carcinomas make up about 10% to 15% of diagnoses. In the general population, transitional cell carcinomas, which begin in the renal pelvis, comprise about 5% to 10% of all malignant kidney cancer diagnoses (ACS 2004).

Information on the specific types of kidney cancer diagnosed among individuals in the South End area of New Bedford was available through the MCR and additionally through the medical records for the eight individuals for whom an interview was conducted. Of the 15 individuals in this cohort, the majority (n = 12) were diagnosed with renal cell carcinoma. In addition, two

individuals were diagnosed with transitional cell carcinoma of the renal pelvis and one was diagnosed with papillary carcinoma of the renal pelvis. The observed histology distribution is consistent with expected patterns of disease in the general population.

3. Smoking history

Cigarette smoking is the most important known risk factor for kidney cancer. Estimates of the increased risk of kidney cancer associated with smoking range from 40% to 100% (ACS 2004; NCI 2004). In both males and females, a statistically significant dose response relationship between smoking and this cancer type has been observed (McLaughlin et al. 1996). That is, a greater risk of developing kidney cancer exists among individuals who smoke more.

Five of the eight individuals diagnosed with kidney cancer for which interviews and medical records reviews were conducted were current or former smokers at the time of diagnosis. For these individuals, it is possible that smoking may have played an important role in their kidney cancer diagnosis. The other three individuals were non-smokers; however, it was reported that two of the three had lived with a person who smoked. The association between second-hand smoke and the development of kidney cancer is unknown.

Information on smoking was available from the MCR for three of the seven individuals for whom interviews and medical records reviews were not possible. One was reported to the MCR as being a current or former smoker at the time of diagnosis and two were reported as being nonsmokers. Information on smoking history was unknown for the remaining four individuals.

4. Occupation

Some studies have suggested that certain environmental and occupational exposures may be associated with the development of kidney cancer. For example, an increased incidence of this cancer type has been observed among leather tanners, shoe workers, and workers exposed to asbestos. Coke-oven workers in the iron and steel industries may be at increased risk (NCI 2004). In addition, exposure to cadmium, a type of metal, is associated with an increased incidence of kidney cancer, particularly among men who smoke. Workplace exposure to some herbicides and organic solvents, such as benzene and TCE, may also increase the risk of this cancer (ACS 2004; ATSDR 1997). More recently, renal cell carcinoma (RCC), the most

common type of kidney cancer, has been suggested to be associated with occupational exposure to petroleum, tar, and pitch products such as gasoline. However, studies of oil refinery workers and petroleum products distribution workers have not identified a definitive relationship between exposure to gasoline or other petroleum products and kidney cancer (Lineham et al. 1997; McLaughlin et al. 1996).

While a person's occupation or job title cannot provide specific information related to actual exposure to workplace chemicals, the information can be helpful in evaluating whether a person's occupation might have played a possible role in their cancer diagnosis. Of the eight individuals who participated in the follow-up study, four were reported to have worked in occupations where exposures to chemicals/solvents related to kidney cancer may have been possible.

Some occupational information was also available from the MCR, death records, and resident lists for six of the seven South End residents diagnosed with kidney cancer who did not participate in the follow-up study. Of these individuals, four reported working in occupations where exposures to chemicals/solvents related to kidney cancer might have occurred.

For the eight individuals with possible occupational risk factors, occupations included jobs in mills and manufacturing environments where exposure to solvents such as benzene or TCE, or petroleum may have occurred. In addition, asbestos exposure was reported for one person.

Of the 15 South End residents diagnosed with kidney cancer, occupations reported for five individuals were not likely to have resulted in exposures that could be related to kidney cancer. Occupation was unknown or incomplete for two individuals and therefore the possible role of a workplace exposure could not be evaluated.

5. Medical history

Hypertension (i.e., high blood pressure) has been linked to kidney cancer. However, the use of diuretics and antihypertensive medications is also associated with an increased risk of kidney cancer, and because most people who have high blood pressure are given medications to treat their condition, it is not clear whether the disease or the medication is the cause of the increased risk (ACS 2004).

Individuals (or their next-of-kin) who were interviewed were asked if they had a history of hypertension. Seven of the eight individuals had a history of hypertension. One individual reported no history of hypertension. Of the seven with a history of hypertension, three reported taking medication for the condition.

No information on a history of hypertension was available for the seven individuals diagnosed with kidney cancer who were not able to be interviewed.

Diuretics are also sometimes used to treat congestive heart failure. Based on information available from death records, congestive heart failure was listed as a contributing cause of death for two individuals. Based on data available through the interview and medical records review, one of these two individuals had known hypertension but no known history of medication to treat either of these conditions. An interview was not conducted for the other individual and therefore, it is unknown whether this person used diuretics to treat their congestive heart failure.

Obesity is an important risk factor for kidney cancer. It is estimated that obesity may be a factor in about 20% of individuals who develop kidney cancer (ACS 2004). According to medical records, one of the eight individuals interviewed was obese.

Heavy use of the pain-reliever phenacetin has been associated with an increased risk of kidney cancer in the past. However, this medication has not been available in the U.S. for over 20 years and therefore, is no longer considered a major risk factor for kidney cancer (ACS 2004). None of the eight individuals interviewed reported a history of phenacetin use.

People with advanced kidney disease (e.g., end-stage renal disease or ESRD) and those who have been on long-term kidney dialysis are at increased risk of developing kidney cancer (ACS 2004; NCI 2004). Based on the available information, this did not appear to be a factor for any of the eight individuals interviewed as part of this study.

Ionizing radiation may be associated with an increased risk of kidney cancer, but the effects are described as weak (McLaughlin et al. 1996). One of the eight individuals interviewed for this study received radiation therapy to treat cancer prior to their kidney cancer diagnosis. It is unknown whether the radiation treatment played a role in the subsequent development of kidney cancer in this individual.

Finally, certain inherited medical conditions, such as von Hippel-Lindau disease, which is characterized by a tendency to develop tumors in multiple organs, and hereditary papillary renal cell carcinoma, are associated with an increased risk of developing kidney cancer (ACS 2004). Based on a review of medical records, there was no evidence of these inherited conditions among the eight individuals who participated in the follow-up study.

6. Family history

Family history appears to be an important risk factor in the development of kidney cancer. Individuals with a strong family history of this disease, particularly those who have a brother or sister with kidney cancer, have a much higher risk of developing kidney cancer themselves (ACS 2004).

Little information was available regarding a family history of kidney cancer for most of the 15 individuals diagnosed with kidney cancer. One of the eight individuals for whom an interview was conducted reported having a family member with kidney cancer.

Information available through the MCR, death records, and resident lists indicated that two of the seven individuals diagnosed with kidney cancer for which interviews were not possible, were first-degree relatives. This suggests that a family history of kidney cancer may have played an important role in the diagnoses of these two individuals as well.

C. **Review of Geographic Distribution and Residential History**

While it is not possible to evaluate whether past air emissions of TCE from Rodney Metals and Brittany Dye resulted in actual exposure to residents in the adjacent neighborhoods, the geographic locations of individuals diagnosed with kidney cancer in proximity to the two facilities can be helpful in evaluating potential opportunities for exposure to air emissions. Cancer in general has a long period of development or latency period (i.e., the interval between first exposure to a disease-causing agent and the appearance of symptoms of the disease [Last 1995]) that can range from 10 to 30 years and in some cases may be more than 40 to 50 years for solid tumors (Bang 1996; Frumkin 1995). Although it is not possible to determine what may

have caused any one person's diagnosis of cancer, the length of time in which an individual lived in a particular residence can also help determine the importance that their location might have in terms of exposure to a potential environmental source.

The 2003 report identified a statistically significant elevation in the incidence of kidney cancer among males in census tract 6528 during the most recent time period evaluated, 1995-1998, and all five individuals diagnosed with kidney cancer during this time lived within close proximity to the Rodney Metals and Brittany Dye facilities. In addition, several individuals diagnosed with kidney cancer in the earlier two time periods (e.g. 1982-1986, 1987-1994) also lived near the two companies. However, at the time of the initial analysis, gaps in the data existed and it was not possible to evaluate the geographic locations of cases in the context of other important considerations such as length of residence or other kidney cancer risk factors.

For the current analysis, the geographic proximity of all 15 individuals diagnosed with kidney cancer in relation to the two companies was evaluated together with available information on the length of time each individual lived in the South End area prior to their diagnosis and the presence of known or suspected kidney cancer risk factors. To evaluate the geographic pattern of those diagnosed with kidney cancer, the approximate distance between the address of each case and the central location of the two facilities combined was measured. Information on length of residence was obtained directly from those who were interviewed and from city resident lists for those who did not participate in the interviews. As stated previously, some of the individuals who were interviewed reported living previously at other locations in the South End and this information was also considered when assessing length of residence as part of the geographic distribution analysis. Prior residential information was not available for those individuals who did not participate in interviews.

Eight of the 15 individuals diagnosed with kidney cancer since 1982 lived within approximately a quarter of a mile from the two facilities, including five for whom interviews and medical records reviews were conducted. Six of the eight individuals lived at their residence for more than 20 years, one individual lived there between 10 and 20 years and one lived there for less

than 10 years. In addition to age, six of the eight individuals within a quarter of a mile had at least two risk factors and two individuals had at least one risk factor associated with the development of kidney cancer.

Seven of the 15 individuals diagnosed with kidney cancer since 1982 were located more than a quarter of a mile from Rodney Metals and Brittany Dye. One of these individuals was reported to have developed kidney cancer prior to moving to the area² and therefore it is very unlikely that environmental factors related to the two facilities would have played a role in this person's diagnosis. Five of the remaining individuals lived at their residence for more than 20 years, and one lived there less than 10 years. In addition to age, two of these six individuals were reported to have at least two risk factors and two individuals had at least one risk factor associated with kidney cancer. The two remaining individuals were not able to be interviewed, so the possible role of kidney cancer risk factors could not be fully evaluated. However, according to the MCR data, one of these individuals was reported as a non-smoker and available occupational information did not indicate employment in a job likely related to kidney cancer.

D. Temporal Evaluation

Dates of diagnosis for the 15 South End residents with kidney cancer were evaluated together with information on risk factors for the disease collected from the interviews, medical records review, and from alternative sources (where necessary) to assess any time trends that might be present since 1982. Other than the statistically significant elevation in kidney cancer reported for males during the 1995-1998 time period in the 2003 report, there were no other notable time trends among kidney cancer cases diagnosed between 1982 and the present. That is, no more than two diagnoses were reported in any given year and no increasing or decreasing trends in kidney cancer were observed. Three of the five males diagnosed during the 1995-1998 time period had at least one kidney cancer risk factor other than age, and the other two had more than one.

² Although the address reported to the MCR for this individual was a South End residence, information available from a close relative indicated that the kidney cancer diagnosis actually occurred prior to the family's relocation to New Bedford. This individual did not participate in an interview.

V. DISCUSSION

The 2003 health consultation identified a statistically significant elevation in the incidence of kidney cancer among males in census tract 6528. During the most recent time period evaluated, 1995-1998, all five individuals diagnosed with kidney cancer during this time lived within close proximity to the Rodney Metals and Brittany Dye facilities. In addition, several individuals diagnosed with kidney cancer in the earlier two time periods (e.g. 1982-1986, 1987-1994) also lived near the two companies. At the time of the initial investigation, available data on smoking and occupation were limited, and the possible role of these and other important risk factors for kidney cancer, such as family and medical history, could not be evaluated for these individuals.

For the current study, all individuals diagnosed with kidney cancer while reported to be living in the South End area of New Bedford since 1982, were identified using the MCR and they or their next-of-kin were contacted to request participation in personal interviews and/or medical records review. The purpose of the follow-up study was to identify the prevalence of any known or suspected risk factors among individuals diagnosed with kidney cancer (e.g. smoking, occupation, family or medical history) and to learn more about the pattern observed in the 2003 cancer incidence investigation. It is unknown whether individuals diagnosed with kidney cancer were exposed to air emissions of TCE from Rodney Metals and Brittany Dye in the past. To evaluate whether environmental factors may have played a greater or lesser role in kidney cancer diagnosed among individuals located in close proximity to the two companies, the prevalence of kidney cancer risk factors and information on length of residence were evaluated together with information on the geographic locations of cases.

Twelve of the 15 individuals contacted for participation in the study responded to the MDPH, and of those, eight agreed to be interviewed and consented to medical records review. Although interviews were not possible for the other seven cases, some important information related to kidney cancer risk factors (e.g., age, smoking status, occupation), as well as information on their length of residence, was available through the MCR, death records, and town resident lists.

Based on the evaluation of all available information, one of the 15 individuals was confirmed as having no known or suggested kidney cancer risk factors other than age. No information was available related to kidney cancer risk factors for two individuals with the disease; however, one

was reportedly diagnosed prior to moving to the area, and the length of residence for the other was less than ten years. Twelve of the 15 individuals with kidney cancer had at least one known or suspected kidney cancer risk factor other than age, and of these, eight had more than one. Individuals who lived in closer proximity to Rodney Metals and Brittany Dye (i.e., within approximately a quarter of a mile) did not appear to have fewer kidney cancer risk factors compared with those who lived farther away.

A review of medical records for the eight individuals who were interviewed was conducted by an occupational/environmental physician to identify any unique or unusual traits that were common among the individuals but that differ from those expected in the general population of patients suffering from kidney cancer. Based on this review, no unusual traits were identified that would suggest that the eight individuals were different from what would be expected.

VI. CONCLUSIONS / RECOMMENDATIONS

Based on the available information, those individuals diagnosed with kidney cancer who lived closer to Rodney Metals and Brittany Dye had no fewer risk factors associated with the development of kidney cancer than South End residents with kidney cancer who lived farther away. Although interviews were not possible for seven individuals and some information was incomplete, multiple risk factors associated with the development of kidney cancer were identified for the majority of the 15 individuals diagnosed with kidney cancer while living in the South End area of New Bedford. Thus, despite the geographic pattern observed in the 2003 investigation, the existence of other risk factors important to the development of kidney cancer among individuals living in close proximity to the two companies makes it less likely that environmental exposures played a primary role in the development of kidney cancer. However, the majority of the 15 individuals were long-time residents of the area, and therefore the possible role of environmental exposure as a contributing factor in the development of kidney cancer among those living near the two facilities cannot be ruled out.

As a result of these findings, the MDPH recommends no further follow-up regarding kidney cancer among these 15 South End residents at this time. However, the incidence of this cancer type will continue to be monitored for New Bedford as MCR data for additional years become

available. In addition, the MDPH supports continuing efforts of the Massachusetts Department of Environmental Protection to address and help minimize nuisance impacts on behalf of the local community associated with emissions from Rodney Metals and Brittany Dye.

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FIGURES

PREPARER

This document was prepared by the Center for Environmental Health at the Massachusetts Department of Public Health (MDPH). If you have any questions about this document, please contact Suzanne K. Condon, Associate Commissioner of MDPH at 250 Washington Street, 7th Floor, Boston, MA 02108.

Certification

This New Bedford Kidney Cancer Follow-up Investigation Health Consultation was prepared by the Massachusetts Department of Public Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodologies and procedures existing at the time the health consultation was initiated. Editorial review was completed by the Cooperative Agreement partner.



Technical Project Officer, CAT, SPAB, DHAC

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.



Team Lead, CAT, SPAB, DHAC, ATSDR



Appendix A

New Bedford Kidney Cancer Follow-up Investigation Case Questionnaire

Massachusetts
Department
Of
Public Health



New Bedford Kidney Cancer Follow-up Investigation

Case Questionnaire

February 2004

Center for
Environmental Health,
Community Assessment
Program

Interview Date: _____

ID: _____

Interview Time Start: _____ End: _____

Interviewer Name: _____

Interviewer should greet the participant and introduce himself.

Before we start, I would like to confirm some information with you to make sure our records are accurate.

Name: _____

Address: _____

Phone #: (h) _____

(w) _____

Thank you for agreeing to participate in this study to help the Massachusetts Department of Public Health evaluate issues related to kidney cancer in the South End of New Bedford. Since little is known about the causes of kidney cancer, I'll be asking you questions to complete a detailed questionnaire. The questions will be mainly about your kidney cancer diagnosis, your personal medical history, your family's history of cancer, and where you lived and worked before you were diagnosed with cancer. Do you have any specific questions before we move forward?

Let me remind you that your cooperation is completely voluntary and a very important contribution to this study. You do have the option to refuse to answer any questions at any time during this interview. All information collected in this study will be kept in the strictest confidence in accordance with Massachusetts General Laws. No use will be made of information that would identify you to anyone outside this project.

Feel free to take as much time as you need to answer these questions. Some of the questions concern events that took place many years ago.

Please answer the questions as completely and carefully as you can. If there are any questions you do not fully understand, please let me know. If you are not sure of an answer to a specific question, please say so. Or if you are uncomfortable answering a specific question, please let me know as well.

As a last note, some of the questions may seem repetitive and sometimes it may be frustrating to hear the same question asked a number of times, but please bear with me. We want to make sure we get the most complete and accurate information possible from each participant.

Let's begin.

A. Personal Information

Gender (*do not ask*): ☐ MALE ☐ FEMALE

First I'd like to ask some background questions.

1. What is your date of birth? __/__/____ (mm/dd/yyyy)
2. What was the date a doctor first told you that you had kidney cancer?
 __/__/____ (mm/dd/yyyy)
3. Did you have tumors in one or both kidneys?
 ☐ ONE KIDNEY ☐ DK
 ☐ TWO KIDNEYS ☐ REF
4. Not including the kidney cancer diagnosed on {__/__/____}, were you ever told by a doctor that you had any other cancer?
 ☐ NO ☐ DK
 ☐ YES (*ask a & b*) ☐ REF
 - a. If YES, was the cancer diagnosed before or after the kidney cancer diagnosis mentioned already?
 ☐ BEFORE ☐ BOTH BEFORE AND AFTER
 ☐ AFTER ☐ DK
 - b. Not including the kidney cancer diagnosed on {__/__/____}, for each separate cancer diagnosis, please note the type of cancer and the date of diagnosis.

 Cancer Type: _____ DOD: __/__/____ (mm/dd/yyyy)
 Cancer Type: _____ DOD: __/__/____ (mm/dd/yyyy)
 Cancer Type: _____ DOD: __/__/____ (mm/dd/yyyy)
 Cancer Type: _____ DOD: __/__/____ (mm/dd/yyyy)
 Cancer Type: _____ DOD: __/__/____ (mm/dd/yyyy)

5. What is your height?

Height: _____

☐ DK

☐ REF

6. What was your average weight approximately one year before you were first diagnosed with kidney cancer?

Average weight: _____

☐ DK

☐ REF

7. Which of the following best characterizes your general diet (i.e., averaged over time) before you were diagnosed with kidney cancer?

☐ Vegetarian or vegan

☐ High in fruits and vegetables

☐ High in carbohydrates (e.g., pasta, breads, rice)

☐ High in protein (e.g., meats, animal fats, milk products, margarine, oils)

☐ High in fat

☐ Balanced (i.e., combination of fruits, vegetables, carbohydrates, protein, & dairy)

☐ Other: _____

☐ DK

☐ REF

B. Pre-Existing Medical Conditions and Use of Medications

Now I'm going to ask you some questions about your personal medical history.

1. Before you were diagnosed with kidney cancer, had a doctor ever told you that you had a kidney defect; that is, something wrong with the shape or structure of the kidney?

☐ NO ☐ DK

☐ YES (*ask a & b*) ☐ REF

- a. If YES, which of the following kidney defects did you have?

☐ large kidneys

☐ horseshoe kidney (also called U-shaped or L-shaped kidneys)

☐ hereditary or familial renal oncocytoma

☐ other: _____

☐ DK

☐ REF

- b. What was the date of diagnosis for this condition?

___/___/___ (mm/dd/yyyy)

2. Before you were diagnosed with kidney cancer, had a doctor ever told you that you had kidney disease; that is, something wrong with the function or mechanism of the kidney?

☐ NO ☐ DK

☐ YES (*ask a & b*) ☐ REF

- a. If YES, which of the following kidney diseases did you have?

☐ polycystic kidney disease

☐ acquired cystic kidney disease

☐ End Stage Renal Disease (ESRD) or End Stage Kidney Disease

☐ other: _____

☐ DK

☐ REF

- b. What was the date of diagnosis for this disease?

___/___/___ (mm/dd/yyyy)

3. Before you were diagnosed with kidney cancer, had a doctor ever told you that you had a specific genetic or hereditary condition?

☐ NO

☐ DK

☐ YES (*ask a & b*) ☐ REF

- a. If YES, which of the following genetic conditions did you have?

☐ von Hippel-Lindau disease

☐ tuberous sclerosis

☐ other: _____

- b. What was the date of diagnosis for this genetic condition?

___/___/___ (mm/dd/yyyy)

4. Before you were diagnosed with kidney cancer, had a doctor ever told you that you had hypertension or high blood pressure?

☐ NO

☐ DK

☐ YES (*ask a*) ☐ REF

- a. What was the date of diagnosis? ___/___/___ (mm/dd/yyyy)

5. Before you were diagnosed with kidney cancer, had a doctor ever told you that you had congestive heart failure (CHF)?

☐ NO

☐ DK

☐ YES (*ask a*) ☐ REF

- a. What was the date of this diagnosis? ___/___/___ (mm/dd/yyyy)

6. Before you were diagnosed with kidney cancer, had a doctor ever told you that you had any other serious medical condition?

☐ NO ☐ DK

☐ YES (*ask a & b*) ☐ REF

a. What was the condition? _____

b. What was the date of diagnosis? __/__/____ (mm/dd/yyyy)

7. Before you were diagnosed with kidney cancer, did you ever receive dialysis treatment for kidney disease?

☐ NO ☐ DK

☐ YES ☐ REF

8. Before you were diagnosed with kidney cancer, did you ever have a kidney transplant?

☐ NO ☐ DK

☐ YES ☐ REF

9. Before you were diagnosed with kidney cancer, had you ever taken medications to relieve pain such as Phenacetin (a drug no longer sold in the U.S.), aspirin, and acetaminophen on a regular basis?

☐ NO ☐ DK

☐ YES (*ask a, b, & c*) ☐ REF

a. What was the name of the medication? _____

b. How many times a week did you take this medication? _____

c. For how many years did you take this medication? _____

10. Before you were diagnosed with kidney cancer, had you ever taken diuretics or antihypertensives (medications used for the treatment of high blood pressure or congestive heart failure) on a regular basis?

☐ NO

☐ DK

☐ YES (*ask a, b, & c*)

☐ REF

a. What was the name of the medication? _____

b. How many times a week did you take this medication? _____

c. For how many years did you take this medication? _____

11. Before you were diagnosed with kidney cancer, had you ever received radiation therapy to treat an illness or condition (e.g., cancer), not including diagnostic or routine X-rays?

☐ NO

☐ DK

☐ YES (*ask a*)

☐ REF

a. If YES, what was the treatment for? _____

C. Tobacco Smoke Exposure

1. Before you were diagnosed with kidney cancer, had you ever smoked tobacco (e.g., cigarettes, pipes, or cigars)?

☐ NO ☐ DK

☐ YES (*ask a & b*) ☐ REF

- a. Approximately how many packs of cigarettes (*or number of pipes or cigars*) did you smoke per week?

- b. For how many years did you smoke?

_____ years

2. Before you were diagnosed with kidney cancer, had you ever lived with someone who smoked?

☐ NO ☐ DK

☐ YES (*ask a & b*) ☐ REF

- a. Approximately how many packs of cigarettes (*or number of pipes or cigars*) did he/she smoke per week?

- b. For how many years did he/she smoke while you were living there?

_____ years

D. Family History of Cancer

Now I'd like to ask some questions about your family history of cancer.

1. Has anyone in your family ever been diagnosed with renal cell carcinoma? Please consider parents, siblings, half-siblings, children, grandparents, aunts, and uncles related to you by blood.

☐ NO ☐ DK

☐ YES (*ask a & b*) ☐ REF

a. What was their relation to you? _____

b. How old were they when they were diagnosed? _____

2. Has anyone in your family ever been diagnosed with kidney cancer?

☐ NO ☐ DK

☐ YES (*ask a & b*) ☐ REF

a. What was their relation to you? _____

b. How old were they when they were diagnosed? _____

3. Has anyone in your family ever been diagnosed with any other type of cancer?

☐ NO ☐ DK

☐ YES (*ask a, b, & c*) ☐ REF

a. What was the (<i>first/next</i>) family member's relation to you?	b. What cancer type were they diagnosed with?	c. How old were they when they were diagnosed?

a. What was the (<i>first/next</i>) family member's relation to you?	b. What cancer type were they diagnosed with?	c. How old were they when they were diagnosed?

E. Occupational History

1. Before you were diagnosed with kidney cancer, did you ever work a job as a . . . ? (*repeat for each of the following jobs*)

		a. How many years did you work this job?
Leather tanner	☐ NO ☐ YES (<i>ask a</i>) ☐ DK ☐ REF	
Shoe worker	☐ NO ☐ YES (<i>ask a</i>) ☐ DK ☐ REF	
Asbestos worker	☐ NO ☐ YES (<i>ask a</i>) ☐ DK ☐ REF	
Shipyard worker	☐ NO ☐ YES (<i>ask a</i>) ☐ DK ☐ REF	
Construction worker	☐ NO ☐ YES (<i>ask a</i>) ☐ DK ☐ REF	
Coke oven worker or steel worker	☐ NO ☐ YES (<i>ask a</i>) ☐ DK ☐ REF	
Oil refinery worker	☐ NO ☐ YES (<i>ask a</i>) ☐ DK ☐ REF	
Laundry worker or dry cleaner	☐ NO ☐ YES (<i>ask a</i>) ☐ DK ☐ REF	

2. Before you were diagnosed with kidney cancer, did you ever work a job in which you may have used or been exposed to any of the following chemicals or products?

		a. What was the job?	b. For how many years did you work there?
Asbestos	☐ NO ☐ YES (<i>ask a, b</i>) ☐ DK ☐ REF		
Cadmium	☐ NO ☐ YES (<i>ask a</i>) ☐ DK ☐ REF		
Organic solvents (e.g., trichloroethylene or TCE)	☐ NO ☐ YES (<i>ask a</i>) ☐ DK ☐ REF		
Coke oven emissions	☐ NO ☐ YES (<i>ask a</i>) ☐ DK ☐ REF		
Petroleum, tar, & pitch products	☐ NO ☐ YES (<i>ask a</i>) ☐ DK ☐ REF		

3. Now I would like to ask you about all the jobs you held for at least 6 months before you were diagnosed with kidney cancer.

Job #	a. What was the name and address of the employer?	b. What did they make or what service did they provide?	c. What were your main duties?	d. How many years did you work there?
1	Name: _____ Address: _____ _____ _____			
2	Name: _____ Address: _____ _____ _____			
3	Name: _____ Address: _____ _____ _____			
4	Name: _____ Address: _____ _____ _____			

ID: ____

Job #	a. What was the name and address of the employer?	b. What did they make or what service did they provide?	c. What were your main duties?	d. How many years did you work there?
5	Name: _____ Address: _____ _____ _____			
6	Name: _____ Address: _____ _____ _____			
7	Name: _____ Address: _____ _____ _____			
8	Name: _____ Address: _____ _____ _____			
9	Name: _____ Address: _____ _____ _____			

F. Residential History

1. Now I'd like to ask you about the places you lived before you were diagnosed with kidney cancer.

Res #	a. What was the street address of the <i>(first/next)</i> place you lived?	b. What year did you start and end residence at this address?
1	_____ Street No. & Name _____ Town & State	Start year: _____ End year: _____
2	_____ Street No. & Name _____ Town & State	Start year: _____ End year: _____
3	_____ Street No. & Name _____ Town & State	Start year: _____ End year: _____
4	_____ Street No. & Name _____ Town & State	Start year: _____ End year: _____

Res #	a. What was the street address of the <i>(first/next)</i> place you lived?	b. What year did you start and end residence at this address?
5	_____ Street No. & Name _____ Town & State	Start year: _____ End year: _____
6	_____ Street No. & Name _____ Town & State	Start year: _____ End year: _____
7	_____ Street No. & Name _____ Town & State	Start year: _____ End year: _____
8	_____ Street No. & Name _____ Town & State	Start year: _____ End year: _____
9	_____ Street No. & Name _____ Town & State	Start year: _____ End year: _____

G. General Comments

1. Considering the types of questions we have asked, is there anything else you feel we should know?

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface.

That concludes the interview. I would like to thank you again for taking the time to answer these questions. You have been very helpful. If you have any questions or concerns about the study, or any additional comments, please feel free to contact staff in the Community Assessment Program of the Massachusetts Department of Public Health at (617) 624-5757.

Appendix B

ATSDR Glossary of Environmental Health Terms

ATSDR Glossary of Terms

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S. Environmental Protection Agency (EPA), which is the federal agency that develops and enforces environmental laws to protect the environment and human health. This glossary defines words used by ATSDR in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-42-ATSDR (1-888-422-8737).

General Terms

Absorption

The process of taking in. For a person or an animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute

Occurring over a short time [compare with chronic].

Acute exposure

Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with intermediate duration exposure and chronic exposure].

Additive effect

A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with antagonistic effect and synergistic effect].

Adverse health effect

A change in body function or cell structure that might lead to disease or health problems

Aerobic

Requiring oxygen [compare with anaerobic].

Ambient

Surrounding (for example, ambient air).

Anaerobic

Requiring the absence of oxygen [compare with aerobic].

Analyte

A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Analytic epidemiologic study

A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Antagonistic effect

A biologic response to exposure to multiple substances that is less than would be expected if the known effects of the individual substances were added together [compare with additive effect and synergistic effect].

Background level

An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biodegradation

Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

Biologic indicators of exposure study

A study that uses (a) biomedical testing or (b) the measurement of a substance [an analyte], its metabolite, or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance [also see exposure investigation].

Biologic monitoring

Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

Biologic uptake

The transfer of substances from the environment to plants, animals, and humans.

Biomedical testing

Testing of persons to find out whether a change in a body function might have occurred because of exposure to a hazardous substance.

Biota

Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

Body burden

The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly.

CAP [see Community Assistance Panel.]

Cancer

Any one of a group of diseases that occur when cells in the body become abnormal and grow or multiply out of control.

Cancer risk

A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen

A substance that causes cancer.

Case study

A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study

A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

CAS registry number

A unique number assigned to a substance or mixture by the American Chemical Society Abstracts Service.

Central nervous system

The part of the nervous system that consists of the brain and the spinal cord.

CERCLA [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980]

Chronic

Occurring over a long time [compare with acute].

Chronic exposure

Contact with a substance that occurs over a long time (more than 1 year) [compare with acute exposure and intermediate duration exposure]

Cluster investigation

A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

Community Assistance Panel (CAP)

A group of people from a community and from health and environmental agencies who work with ATSDR to resolve issues and problems related to hazardous substances in the community. CAP members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

Comparison value (CV)

Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway [see exposure pathway].

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)

CERCLA, also known as Superfund, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances. This law was later amended by the Superfund Amendments and Reauthorization Act (SARA).

Concentration

The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant

A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Delayed health effect

A disease or an injury that happens as a result of exposures that might have occurred in the past.

Dermal

Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact

Contact with (touching) the skin [see route of exposure].

Descriptive epidemiology

The study of the amount and distribution of a disease in a specified population by person, place, and time.

Detection limit

The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Disease prevention

Measures used to prevent a disease or reduce its severity.

Disease registry

A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

DOD

United States Department of Defense.

DOE

United States Department of Energy.

Dose (for chemicals that are not radioactive)

The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An "exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose (for radioactive chemicals)

The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

Dose-response relationship

The relationship between the amount of exposure [dose] to a substance and the resulting changes in body function or health (response).

Environmental media

Soil, water, air, biota (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism

Environmental media include water, air, soil, and biota (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The environmental media and transport mechanism is the second part of an exposure pathway.

EPA

United States Environmental Protection Agency.

Epidemiologic surveillance [see Public health surveillance].

Epidemiology

The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure

Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].

Exposure assessment

The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure-dose reconstruction

A method of estimating the amount of people's past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

Exposure investigation

The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure pathway

The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as an abandoned business); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

Exposure registry

A system of ongoing followup of people who have had documented environmental exposures.

Feasibility study

A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Geographic information system (GIS)

A mapping system that uses computers to collect, store, manipulate, analyze, and display data. For example, GIS can show the concentration of a contaminant within a community in relation to points of reference such as streets and homes.

Grand rounds

Training sessions for physicians and other health care providers about health topics.

Groundwater

Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with surface water].

Half-life ($t_{1/2}$)

The time it takes for half the original amount of a substance to disappear. In the environment, the half-life is the time it takes for half the original amount of a substance to disappear when it is changed to another chemical by bacteria, fungi, sunlight, or other chemical processes. In the human body, the half-life is the time it takes for half the original amount of the substance to disappear, either by being changed to another substance or by leaving the body. In the case of radioactive material, the half life is the amount of time necessary for one half the initial number of radioactive atoms to change or transform into another atom (that is normally not radioactive). After two half lives, 25% of the original number of radioactive atoms remain.

Hazard

A source of potential harm from past, current, or future exposures.

Hazardous Substance Release and Health Effects Database (HazDat)

The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

Hazardous waste

Potentially harmful substances that have been released or discarded into the environment.

Health consultation

A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health

consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with public health assessment].

Health education

Programs designed with a community to help it know about health risks and how to reduce these risks.

Health investigation

The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to evaluate the possible association between the occurrence and exposure to hazardous substances.

Health promotion

The process of enabling people to increase control over, and to improve, their health.

Health statistics review

The analysis of existing health information (i.e., from death certificates, birth defects registries, and cancer registries) to determine if there is excess disease in a specific population, geographic area, and time period. A health statistics review is a descriptive epidemiologic study.

Indeterminate public health hazard

The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence

The number of new cases of disease in a defined population over a specific time period [contrast with prevalence].

Ingestion

The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].

Inhalation

The act of breathing. A hazardous substance can enter the body this way [see route of exposure].

Intermediate duration exposure

Contact with a substance that occurs for more than 14 days and less than a year [compare with acute exposure and chronic exposure].

In vitro

In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with in vivo].

In vivo

Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with in vitro].

Lowest-observed-adverse-effect level (LOAEL)

The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Medical monitoring

A set of medical tests and physical exams specifically designed to evaluate whether an individual's exposure could negatively affect that person's health.

Metabolism

The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite

Any product of metabolism.

mg/kg

Milligram per kilogram.

mg/cm²

Milligram per square centimeter (of a surface).

mg/m³

Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Migration

Moving from one location to another.

Minimal risk level (MRL)

An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see reference dose].

Morbidity

State of being ill or diseased. Morbidity is the occurrence of a disease or condition that alters health and quality of life.

Mortality

Death. Usually the cause (a specific disease, a condition, or an injury) is stated.

Mutagen

A substance that causes mutations (genetic damage).

Mutation

A change (damage) to the DNA, genes, or chromosomes of living organisms.

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or NPL)

EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

National Toxicology Program (NTP)

Part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

No apparent public health hazard

A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL)

The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard

A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL [see National Priorities List for Uncontrolled Hazardous Waste Sites]

Physiologically based pharmacokinetic model (PBPK model)

A computer model that describes what happens to a chemical in the body. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

Pica

A craving to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

Plume

A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure

The place where someone can come into contact with a substance present in the environment [see exposure pathway].

Population

A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Potentially responsible party (PRP)

A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

ppb

Parts per billion.

ppm

Parts per million.

Prevalence

The number of existing disease cases in a defined population during a specific time period [contrast with incidence].

Prevalence survey

The measure of the current level of disease(s) or symptoms and exposures through a questionnaire that collects self-reported information from a defined population.

Prevention

Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

Public availability session

An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public comment period

An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public health action

A list of steps to protect public health.

Public health advisory

A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA)

An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with health consultation].

Public health hazard

A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or radionuclides that could result in harmful health effects.

Public health hazard categories

Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are no public health hazard, no apparent public health hazard, indeterminate public health hazard, public health hazard, and urgent public health hazard.

Public health statement

The first chapter of an ATSDR toxicological profile. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public health surveillance

The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

Public meeting

A public forum with community members for communication about a site.

Radioisotope

An unstable or radioactive isotope (form) of an element that can change into another element by giving off radiation.

Radionuclide

Any radioactive isotope (form) of any element.

RCRA [see Resource Conservation and Recovery Act (1976, 1984)]

Receptor population

People who could come into contact with hazardous substances [see exposure pathway].

Reference dose (RfD)

An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Registry

A systematic collection of information on persons exposed to a specific substance or having specific diseases [see exposure registry and disease registry].

Remedial investigation

The CERCLA process of determining the type and extent of hazardous material contamination at a site.

Resource Conservation and Recovery Act (1976, 1984) (RCRA)

This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

RFA

RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

RfD [see reference dose]

Risk

The probability that something will cause injury or harm.

Risk reduction

Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Risk communication

The exchange of information to increase understanding of health risks.

Route of exposure

The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

Safety factor [see uncertainty factor]

SARA [see Superfund Amendments and Reauthorization Act]

Sample

A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see population]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size

The number of units chosen from a population or an environment.

Solvent

A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

Source of contamination

The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an exposure pathway.

Special populations

People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Stakeholder

A person, group, or community who has an interest in activities at a hazardous waste site.

Statistics

A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance

A chemical.

Substance-specific applied research

A program of research designed to fill important data needs for specific hazardous substances identified in ATSDR's toxicological profiles. Filling these data needs would allow more accurate assessment of human risks from specific substances contaminating

the environment. This research might include human studies or laboratory experiments to determine health effects resulting from exposure to a given hazardous substance.

Superfund [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)]

Superfund Amendments and Reauthorization Act (SARA)

In 1986, SARA amended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water

Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with groundwater].

Surveillance [see public health surveillance]

Survey

A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see prevalence survey].

Synergistic effect

A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see additive effect and antagonistic effect].

Teratogen

A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

Toxic agent

Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile

An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology

The study of the harmful effects of substances on humans or animals.

Tumor

An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor

Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a safety factor].

Urgent public health hazard

A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs)

Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Other glossaries and dictionaries:

Environmental Protection Agency (<http://www.epa.gov/OCEPAterms/>)

National Center for Environmental Health (CDC)
(<http://www.cdc.gov/nceh/dls/report/glossary.htm>)

National Library of Medicine (NIH)
(<http://www.nlm.nih.gov/medlineplus/mplusdictionary.html>)

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