Health Consultation

Public Comment Release

Evaluation of Serum PCB Levels and Cancer Incidence Data

Parker Street Waste Site Neighborhood

(EPA FACILITY ID: MAN000105955)

New Bedford, Bristol County, Massachusetts

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I. INTRODUCTION

In March 2007, the city of New Bedford forwarded a petition signed by 32 individuals to the Massachusetts Department of Public Health's (MDPH) Bureau of Environmental Health (BEH).[1] The petition was signed by 21 New Bedford High School (NBHS) teachers and 11 neighbors of NBHS and Keith Middle School (KMS). The petition requested testing and/or a study of the area around the two schools because of concerns related to historical contamination, particularly polychlorinated biphenyls (PCBs), and potential health implications. The schools occupy an area that formerly contained a PCB burn dump. The schools and the neighborhoods around the former burn dump are now part of what has become known as the Parker Street Waste Site (PSWS)[2] (TRC, 2009). To address the concerns of residents living near PSWS, BEH undertook the following:

- A review of the incidence of nine types of cancer that were either of particular concern to residents or, based on the medical literature, were suggested as possibly being associated with exposure to the major contaminants of concern at the PSWS. The review included the five census tracts (CTs) that surround the PSWS (6509, 6510.01, 6510.02, 6511, and 6515) and the city of New Bedford as a whole.

- An offer to participate in the MDPH/BEH blood testing for concerned residents and school staff to determine levels of PCBs in blood serum and whether patterns might exist to suggest that residence and/or occupation or attendance at the schools played a primary role in PCB exposures.

This report first presents a summary of the results of the serum PCB testing program for residents of the PSWS neighborhood as well as the findings of the cancer incidence data review. A summary and conclusions for both evaluations are also provided. For the purposes of this

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[1] This report was supported in part by funds from a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), U.S. Department of Health and Human Services. This document has not been reviewed and cleared by ATSDR.

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evaluation, the PSWS neighborhood is defined as the five CTs surrounding the PSWS. (New Bedford has a total of 31 CTs.) Concerns specific to the indoor environment and health at the NBHS, including a summary of cancer and the serum PCB test results for NBHS staff, are addressed in a separate BEH report entitled *Health Consultation: Evaluation of Indoor Environmental Conditions and Potential Health Impacts, New Bedford High School, 230 Hathaway Boulevard, New Bedford, MA.*

In response to a petition request from Wasted Away (now CLEAN), the federal Agency for Toxic Substances and Disease Registry (ATSDR) is also conducting a public health assessment (PHA) of the PSWS and a Health Consultation of Walsh Field. In these assessments, ATSDR is reviewing the environmental sampling data from the site, evaluating the ways by which people may come into contact with contamination at the site, and then evaluating the potential for adverse health effects from exposures.

II. BACKGROUND AND COMMUNITY ENVIRONMENTAL CONCERNS

PCBs are a group of 209 different chemicals called congeners (U.S. ATSDR 2000). They are stable organic chemicals, used in products from the 1940s through the late 1970s for their non-flammability and electrical insulating properties (Balfanz et al., 1993; Currado et al., 1998; Vorhees et al., 1999). PCBs were also used in a wide variety of materials in buildings constructed before the late 1970s (MacLeod et al., 1981; Kuusisto et al., 2007). By 1977, companies in the United States stopped manufacturing PCBs (U.S. ATSDR 2000). U.S. Environmental Protection Agency (EPA) officially banned the manufacture of PCBs and their use in open systems in 1979. In New Bedford from 1947 to 1977, PCBs were used by Aerovox and Cornell-Dubilier Electronics to make transformers, capacitors and other electrical equipment (MDPH 1987; MDPH 1995). Prior to the manufacturing ban, PCBs were used for a variety of different purposes including their use in fluorescent light ballasts (Wallace et al., 1996; Staiff et al., 1974; MacLeod et al., 1981; and Currado et al., 1998) and caulking or joint sealants (Kohler et al., 2005; Herrick et al., 2004). Products made with PCBs before the ban may still be in use today in older buildings, as the federal ban did not apply to items already in place in existing buildings at the time of the ban (Wallace et al., 1996).

The PSWS is a hazardous waste site consisting of approximately 114 acres, the boundaries of which still have not been fully delineated. The site includes the New Bedford High School (NBHS), the Keith Middle School (KMS), the former Keith Middle School, Dr. Paul F. Walsh Memorial Field (Walsh Field), a state-owned ice arena (Hetland Rink), City-owned maintenance facilities, a small number of commercial properties, and nearby residential neighborhoods (U.S. EPA 2011). Some properties within the PSWS boundaries are impacted by fill contaminated with PCBs, polyaromatic hydrocarbons (PAHs), and heavy metals (including but not limited to arsenic, lead, and cadmium.) Fill material originated from a former burn dump located in the vicinity of the NBHS campus. NBHS was constructed between 1968 and 1972 and soils displaced during construction may have been deposited on the lot across Hathaway Boulevard, where McCoy Field, an athletic field, was later built and where the KMS is now located (TRC 2009) (See Figures 1 and 2).

The KMS was constructed during 2004-2006 and opened in 2007. The fill used in McCoy Field consisted of sand and silt along with ash, asphalt, and other demolition debris; PCBs and PAHs were detected in this fill. In planning for construction of the KMS, the city hired a consultant to investigate contamination of the property and to evaluate potential exposures to students and school staff and the health risks associated with exposure. As a result, extensive site remediation, including the removal of contaminated soil, occurred before the KMS was built. The removal actions prompted greater concern among long-term residents whose properties abut the area. Steps were taken during school construction to prevent future exposures through the construction of a gas and liquid impermeable vapor barrier under the building and a passive vapor collection system. A Long-Term Monitoring and Maintenance Implementation Plan (MMIP) for the KMS is currently in place to monitor the exposure management barriers as well as levels of PCBs and volatile organic compounds (VOCs) in indoor air, the foundation venting system, groundwater, and wetland sediment on KMS property (BETA 2006a and b). Historical and recent reports on the KMS are available on the city's website (http://www.newbedford-ma.gov/McCoy/sitemap/nbhs.html).

Additional site investigation and clean-up activities at the PSWS and the NBHS are being conducted by the city's contractor, TRC Environmental (TRC), and the EPA in collaboration with the Massachusetts Department of Environmental Protection (MassDEP). These activities

are aimed at further identifying the boundaries of the PSWS, identifying and addressing any data gaps in environmental sampling data, evaluating any potential public health and/or environmental impacts, and conducting clean-up activities when indicated (U.S.EPA 2010a and b). The city's website contains numerous reports and fact sheets on on-going activities related to the PSWS. The portions of the PSWS boundary that require further evaluation are illustrated in Figure 1 (U.S. EPA 2010c).

III. PCB SERUM TESTING

A. METHODS

As previously noted, MDPH/BEH conducted blood serum PCB testing of individuals concerned about opportunities for exposures to PCBs from the PSWS. The blood serum PCB testing program consisted of two phases. The first phase consisted of the administration of an exposure assessment questionnaire designed to obtain information on risk factors that are known to or may affect serum PCB levels (e.g. age, fish consumption, occupational exposures), as well as factors specific to the PSWS, such as length of residence. Prior to completing the exposure assessment questionnaire, MDPH/BEH required that each participant (or parent, in the case of children) sign a consent form (see Appendix A). The questionnaire was administered by an MDPH contractor, the John Snow Institute (JSI) Center for Environmental Health Studies. Interviews occurred at the Normandin Middle School in New Bedford. Interviews were conducted both in English and Portuguese, with translators trained to administer the questionnaire. BEH conducted outreach activities to publicize this offer to both English- and Portuguese speakers. Outreach included a BEH presentation at a Public Involvement Plan meeting for the PSWS, press releases, press interviews, and the distribution of fact sheets.

The original intent of the first phase was to identify approximately 100 individuals most likely to have the highest serum PCB results based upon exposure information reported in the questionnaire. MDPH/BEH planned to score each questionnaire based on its extensive experience in predicting serum PCB levels based on known or likely risk factors for PCB exposure. Due to the low level of participation in Phase I (i.e., 124 people completed the exposure assessment questionnaire), MDPH/BEH decided to offer all phase one participants the opportunity to participate in the phase two blood testing.

The actual blood testing involved the collection of blood samples for serum PCB analysis by MDPH's William A. Hinton State Laboratory Institute (SLI) Division of Analytical Chemistry. BEH worked with the New Bedford Health Department (NBHD) to coordinate the blood draws. The NBHD supplied space and some basic supplies (e.g. gauze, band aides, sharps disposal) for the blood draws and assisted BEH in answering participant questions. BEH contracted with Favorite Healthcare Staffing, Inc. to provide phlebotomy services for the serum PCB testing. Two 10-milliliter (mL) red-top BD Vacutainers® of blood were collected from each participant. A fact sheet was given to each participant at the time of their appointment to explain the process for sample analysis (see Appendix B).

Results of serum PCB testing were compared with biomonitoring data for the civilian U.S. population for the most recent period available at the time of this report (2003-2004) from the U.S. Centers for Disease Control (U.S. CDC) National Health and Nutrition Examination Survey (NHANES). These data provide health professionals with a reference range so that they can determine whether any specific individual or populations of individuals demonstrate a pattern of exposure to higher levels of PCBs than the general U.S. population.

On each day of sampling, BEH transported blood samples from the NBHD to MDPH's SLI in Jamaica Plain. Sample tracking forms were completed to accompany each shipment. SLI staff centrifuged the samples to extract, aliquot, and store the serum samples until all the samples were collected. In addition, SLI transported sample aliquots to MDPH's Lemuel Shattuck Hospital in Jamaica Plain for lipid analysis.

Analysis of serum samples was conducted by SLI using a congener-specific analytical method similar to methods used by the U.S. CDC in the national survey. Serum PCB levels were reported by SLI two ways: the first is on a whole weight basis in micrograms per liter (µg/L) of serum and the second is on a lipid-adjusted basis in nanograms per gram (ng/g) of lipid. Historically, when PCBs were measured in serum, the results were reported on a whole weight basis only. Currently, with advances in analytical chemistry, they are also reported on a lipid-adjusted basis. Blood serum contains lipids (fats) and PCBs concentrate in lipid, or fatty, fractions in the blood. Because different people may have different concentrations of lipids in their blood, PCB concentrations in blood are adjusted (or normalized) based on the lipid content.

This adjustment allows for comparisons of blood serum PCB levels among different people and populations (U.S. CDC, 2009). It should be noted that NHANES currently reports whole weight results in ng/g of serum (U.S. CDC, 2009; MDPH, 2009). To compare whole weight results reported by SLI to NHANES results, the SLI whole weight values were converted from µg/L to ng/g using the average density of serum (1.026 g/mL) (Turner, 2006). The units, µg/L and ng/g, are both equivalent to parts per billion (ppb), which is used throughout the rest of the report for simplicity.

To compare the New Bedford results to NHANES, a total PCB concentration was calculated following NHANES methodology for each of the New Bedford participants by summing the concentrations of the 15 most commonly detected congeners which includes two pair of co-congeners reported together (U.S. CDC, 2009; Patterson, 2009). These congeners are 52, 74, 99, 105, 118, 138/158, 146, 153, 156, 170, 180, 187, 194, 196/203, and 199. It should be noted that, unlike NHANES, SLI reports congeners 196 and 203 separately. The total serum PCB concentrations (whole weight and lipid-adjusted) for each participant were compared to the NHANES total PCB concentrations (whole weight and lipid-adjusted). Because it is well established that PCBs in serum increase with age, it is important to compare a participant's serum PCB level with the comparable age group from the national data (12-19 years, 20-39 years, 40-59 years, and 60+ years) (Miller et al., 1991; Patterson et al., 2009). When comparing to NHANES data, the following summary statistics are used:

- The 50th percentile value (also known as the median). The 50th percentile is the midpoint of the serum PCB levels for all NHANES participants when they are arranged in order from lowest to highest

- The 95th percentile value. The 95th percentile represents serum PCB levels below which 95% of the levels measured in NHANES participants are found; according to the U.S. CDC, the 95th percentile is useful for determining whether serum PCB levels are unusual

In addition to quantitative comparisons, BEH also conducted a qualitative comparison of the specific congener pattern for New Bedford participant results to what is typically seen in the U.S. population based on the latest NHANES data (2003-2004) (U.S. CDC 2008).

B. RESULTS AND DISCUSSION

1) *Phase I*

One hundred and twenty-four individuals completed the initial exposure assessment questionnaire originally intended as a screening mechanism to identify people who had the greatest likelihood of exposure to PCBs. Of the 124 individuals, 57 were current or former residents of the PSWS neighborhood. The majority of interviews were completed in June 2008. A small number of interviews were conducted between July 2009 and March 2010 via phone to accommodate residents who were out of the area at the time of the interviews.

2) *Phase II*

On January 22, 2009, BEH sent letters to the homes of all 124 individuals offering serum PCB testing. A total of 91 individuals asked to participate in the serum PCB testing offer. Of the 33 individuals that did not participate, 21 declined the offer, 10 were lost to follow up, and two had inadequate sample volume but declined an offer to reschedule sample collection.

The majority of the participants submitted blood samples for analysis in February and March 2009 that were collected by the MDPH phlebotomy contractor, Favorite Healthcare Staffing. After the contract expired with Favorite Healthcare Staffing, three individuals submitted samples between April and June 2009 due to scheduling conflicts or the need for a sample redraw; these samples were collected independent of Favorite Healthcare Staffing due to expiration of their MDPH contract. A second questionnaire was administered at the time of the blood draw and included questions relevant to the blood draw (e.g., weight and height).

Out of the 91 participants that consented to and submitted blood samples, 42 individuals were current or former residents in the neighborhood around the PSWS and three others reported that they had spent a significant amount of time at the PSWS, for a total of 45 participants. As mentioned earlier, results for individuals that reported working at NBHS, KMS, or the former KMS (including some current and former residents in the neighborhood around the PSWS) are included in the separate MDPH report. Results for individuals that lived in the neighborhood around the PSWS and worked at the school are included in both reports.

As previously mentioned, the neighborhood around the PSWS includes the five census tracts (CTs) surrounding the PSWS (6509, 6510.01, 6510.02, 6511, and 6515). The location of the five CTs is illustrated in Figure 3.

The ages of the participants included in this report ranged from 14 to 84 years at the time the blood samples were collected. Approximately 67% of the participants were female and 33% male. NHANES comparison data are available by age group or by gender. Summary statistics are presented in this report by age group for males and females combined. Tables 1 and 2 contain summary statistics for total serum PCB concentrations as whole weight and lipid-adjusted values, respectively.

3) Serum PCB Levels Measured in Participants 12-19 Years Old

Two of the 45 participants were between the ages of 12 and 19 years at the time the blood samples were collected. The NHANES 50th percentile value for this age group is 0.155 ppb (whole weight) with a 95% confidence interval of 0.144 to 0.165 ppb and 30.8 ppb (lipid-adjusted) with a 95% confidence interval of 28.2 to 33.4 ppb (U.S. CDC 2009). The 95% confidence interval is a range of estimated values that has a 95% probability of including the true value for the population. No PCB congeners were detected in the serum samples collected from the two participants. Therefore the serum PCB results for participants between the ages of 12 and 19 years do not indicate unusual PCB exposures.

4) Serum PCB Levels Measured in Participants 20-39 Years Old

Two of the 45 participants were between the ages of 20 and 39 years at the time the blood samples were collected. The NHANES 50th percentile value for this age group is 0.322 ppb (whole weight) with a 95% confidence interval of 0.286 ppb to 0.352 ppb and 53.0 ppb (lipid-adjusted) with a 95% confidence interval of 46.9 ppb to 57.7 ppb (U.S. CDC 2009). No PCB congeners were detected in the serum samples collected from the two participants. Therefore the serum PCB results for participants between the ages of 20 and 39 years do not indicate unusual PCB exposures.

5) Serum PCB Levels Measured in Participants 40-59 Years Old

Twenty-one of the 45 participants were between the ages of 40 and 59 years at the time the blood samples were collected. The 50th percentile serum PCB level for participants in this age group is 1.642 ppb (whole weight), with a range of non-detect to 4.904 ppb, and 239.9 ppb (lipid-adjusted), with a range of non-detect to 823.9 ppb. The NHANES 50th percentile value for this age group is 0.927 ppb (whole weight) with a 95% confidence interval of 0.840 ppb - 1.058 ppb and 145.3 ppb (lipid-adjusted) with a 95% confidence interval of 128.7 ppb - 157.9 ppb (U.S. CDC 2009). Therefore, the median serum PCB levels, both whole weight and lipid-adjusted, for the participants in this age group are higher than the respective NHANES median/50th percentiles for the U.S. population.

The NHANES 95th percentile concentration for this age group is 2.780 ppb (whole weight) with a 95% confidence interval of 2.307 ppb to 3.663 ppb and 402.2 ppb (lipid-adjusted) with a 95% confidence interval of 325.1 to 540.2 ppb. The serum PCB concentrations for 19 of the 21 participants in this age group are within the 95th percentile of serum PCB levels available from the national NHANES data for both the whole weight and lipid-adjusted results. For those two individuals, one participant's whole weight and lipid-adjusted results exceed the 95th percentile, the other participant's lipid-adjusted results exceed the 95th percentile, but the participant's whole weight results were within the 95th percentile. Participants whose results are within the 95th percentile are within the range of levels measured in the NHANES 2003-2004 survey. As stated previously in the Methods section of this report, according to the U.S. CDC, the 95th percentile is useful for determining whether serum PCB levels are unusual. Thus, serum PCB results for 19 of the 21 participants between the ages of 40 and 59 years are within the typical variation across this age group in the U.S. population and the serum PCB levels for two of the 21 participants are above the typical range for this age group.

6) Serum PCB Levels Measured in Participants 60+ Years Old

Twenty of the 45 participants were 60 years of age or older at the time the blood samples were collected. The 50th percentile serum PCB level for participants in this age group is 2.455 ppb (whole weight), with a range of 1.276 ppb to 7.742 ppb, and 360.3 ppb (lipid-adjusted), with a range of 154.6 to 906.1 ppb. The NHANES median/50th percentile value for this age group is

1.805 ppb (whole weight) with a 95% confidence interval of 1.694 ppb to 1.874 ppb and 276.0 ppb (lipid-adjusted) with a 95% confidence interval of 251.2 ppb to 295.4 ppb (U.S. CDC 2009). Therefore, the median serum PCB levels for the participants, for both whole weight and lipid-adjusted results, are higher than the respective NHANES median/50th percentiles for the U.S. population.

The NHANES 95th percentile concentration for this age group is 5.123 ppb (whole weight) with a 95% confidence interval of 4.131 ppb to 6.556 ppb and 769.4 ppb (lipid-adjusted) with a 95% confidence interval of 600.0 to 1026.5 ppb. Therefore, the serum PCB concentrations for 19 of the 20 participants in this age group are within the 95th percentile of serum PCB levels available from the national NHANES data for both the whole weight and lipid-adjusted results. One participant's whole weight result slightly exceeded the NHANES whole weight 95th percentile; however, the participant's lipid-adjusted result is within the NHANES 95th percentile. Thus, serum PCB results for 19 of the 20 participants over 60 years of age are within the typical variation across this age group in the U.S. population and the serum PCB result for one of the 20 participants is slightly above the typical range for this age group.

7) Serum PCB Levels Compared with Years of Residence

As mentioned earlier, 42 of the 45 participants reported currently or previously living within the neighborhood surrounding the PSWS (that is, within one of the five CTs surrounding PSWS). Their length of residency ranged from 3 to 63 years. To evaluate whether length of residency (and by proxy, exposure to environmental contaminants in the PSWS) was associated with higher serum levels, participants that reported currently or previously living within the five CTs were grouped into two approximately equal-sized groups by determining the median of years of residency within the five CTs or 25 years. The first group contains all participants that resided in the neighborhood around the PSWS for 3-25 years and the second group contains all participants that resided for 26-63 years. Mean serum levels were calculated for each group by age group because, as discussed, PCBs in serum generally increase with age. To allow for comparison to NHANES data, geometric means instead of arithmetic means were calculated. Calculating the geometric mean is a standard way of looking at biological and environmental data. (Geometric means are reported in the U.S. CDC's *Fourth National Report on Human*

Exposure to Environmental Chemicals.) Table 3 summarizes the number of participants by years of residence in the five CTs and by age group.

Tables 4 and 5 contain summary statistics (geometric means) for total serum PCB concentrations by length-of-residency as whole weight and lipid-adjusted values, respectively. The geometric means by years of residency for the participants in the 12–19 year age group and the 20-30 year age group are not presented in these tables because no PCB congeners were detected in samples collected from participants in these age groups. Thus this analysis focuses on the 40-59 and 60+ year age groups. The tables demonstrate that there is no consistent pattern of high serum concentrations with more years of residency within the five CTs. For the 40-59 year age group, both the mean whole weight and lipid-adjusted values were lower for the participants that resided in the five CTs longest by 0.138 ppb and 68.6 ppb, respectively. However, for the 60+ age group, both the mean whole weight and lipid-adjusted values were higher for the participants that resided in the five CTs longest by 0.313 ppb and 64.8 ppb, respectively. Also, as mentioned previously, there are two participants in the 40-59 year age group and one participant in the 60+ age group whose whole weight and/or lipid-adjusted serum PCB levels exceed the NHANES 95th percentile value. The two participants in the 40-59 year age group with serum PCB levels above the NHANES 95th percentile are in the lower category of years lived in the five CTs (3-25 years) and the one participant in the 60+ year age group with a serum PCB level above the NHANES 95th percentile is in the higher category of years lived in the five CTs (26-63 years). Thus, these data do not show a consistent pattern of higher serum concentrations with more years lived in the 5 CTs and they suggest that length of residence within the five CTs was not a primary indicator of serum PCB levels. It should be noted that the ability to discern differences between the groups is difficult because of the small number of participants and the likely contributions to serum PCB levels by other factors (e.g., fish consumption).

8) Serum PCB Levels Measured in Participants Diagnosed with Cancer

Based on information shared by participants during the exposure assessment interviews and a search of the Massachusetts Cancer Registry database, five of the 45 participants have been diagnosed with cancer since 1982. The serum PCB concentrations for all five participants were

below the NHANES 95th percentile for their respective age groups and therefore fall within the range of levels measured in the NHANES 2003-2004 survey. Thus, serum PCB concentrations for these five individuals diagnosed with cancer are within the typical variation in the U.S. population. Among the five participants, each one was diagnosed with a different type of cancer. Based on the epidemiological literature, three of the 5 different types of cancer have no association with exposure to PCBs. More discussion on the incidence of cancer among New Bedford residents, including the two different types of cancer potentially associated with exposure to PCBs, is provided below.

IV. CANCER INCIDENCE ANALYSIS

As part of this health consultation, a review was conducted of the pattern of nine cancer types in New Bedford as well as in each of five census tracts (CTs) which surround the PSWS (Figure 3). The incidence of these cancers was compared with the cancer incidence experience of the state of Massachusetts as a whole.

Cancer incidence data were obtained from the Massachusetts Cancer Registry (MCR) for the years 1982-2006. The MCR began collecting population-based cancer incidence data in January of 1982. The 25-year time period was evaluated by assessing five time periods: 1982-1986, 1987-1991, 1992-1996, 1997-2001, and 2002-2006; this allowed for consideration of possible patterns or trends as compared to the statewide cancer experience. The nine cancer types included in this evaluation were selected for two reasons: 1) because of their possible association with exposure to PCBs, as reported in the scientific/medical literature, and 2) the concerns of residents of suspected elevations of some cancer types.

In addition to calculating cancer incidence rates, a qualitative analysis of the geographic distribution of individuals diagnosed with each of the nine types of cancer was conducted by mapping their residence at time of diagnosis. This was done to assess whether the geographic pattern of any particular type of cancer in any of the census tracts of interest appeared unusual such that environmental factors were likely to play a primary role in their development. Available risk factor information from the MCR related to age at diagnosis and gender, as well as other factors related to the development of cancer such as smoking and occupation, was reviewed in those instances where the incidence rate of a particular cancer type was higher than

expected. This information was evaluated to compare known or established risk factor patterns, as reported in the medical and epidemiological literature for particular cancer types, to risk factor information for individuals diagnosed in New Bedford and to assess whether any unusual patterns existed among individuals diagnosed in New Bedford.

The information described in this report is a descriptive analysis of cancer incidence data and cannot be used to establish a causal link between a particular risk factor and the development of cancer, nor can it establish the cause of any one individual's diagnosis. However, information from such descriptive analyses can be useful in determining whether or not a common etiology (or cause) of cancers is possible and can serve to identify areas where further public health investigations or actions may be warranted. Such actions may include follow-up environmental investigations or, when an excess of well-established risk factors associated with a disease in a certain geographic area has been identified, public health intervention activities (e.g., cancer screening, smoking cessation, etc).

A. METHODS

1) Case Identification/Definition

Cancer incidence data (i.e., reports of new cancer diagnoses) for New Bedford and the five census tracts included for analysis were obtained from the MCR, a division of the MDPH Bureau of Health Information, Statistics, Research and Evaluation (BHISRE). As mentioned, the MCR is a population-based surveillance system that began collecting information in 1982 on Massachusetts residents diagnosed with cancer in the state. All newly diagnosed cancer cases 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).

Although the medical and epidemiological evidence is sometimes conflicting for several of the cancer types evaluated in this report, and more research is needed to better understand the possible association with exposure to PCBs, most health agencies have concluded that PCBs may reasonably be expected to cause cancer. As stated earlier, nine cancer types were evaluated in

this investigation, including cancers of the biliary tract[3], bladder, breast, colon/rectum, gallbladder, liver/intrahepatic bile duct (IBD), and lung and bronchus as well as melanoma and non-Hodgkin lymphoma. [Coding for these cancer types follows the International Classification of Diseases for Oncology (ICD-O) system. See Appendix C for the incidence coding definitions used in this report.] The strength of the scientific evidence on whether exposure to PCBs can result in an increased risk of a particular type of cancer varies significantly for the different cancer types included in this investigation. Liver cancer, by far, has the strongest evidence in the medical/epidemiological literature of an association with exposure to PCBs (U.S. ATSDR 2000). Following liver cancer, there is some evidence that the following types of cancer may also be associated with exposure to PCBs: biliary tract, melanoma, non-Hodgkin lymphoma, colo-rectal, and breast cancer (Schottenfeld and Fraumeni 2006; U.S. ATSDR 2000). The scientific evidence that exposure to PCBs may result in an increased risk of lung, gallbladder, or bladder cancer appears to be the weakest (ATSDR 2000).

All diagnoses reported to the MCR as primary cancers were included in this analysis. Cancers that occur as the result of the metastases or the spread of a primary site cancer to another location in the body are not considered as a separate cancer and were, therefore, not included. Individuals diagnosed with cancer were selected for inclusion based on their residential address reported to the hospital or reporting medical facility at the time of diagnosis.

The term "cancer" is used to describe a variety of diseases associated with abnormal cell and tissue growth. Epidemiologic studies have revealed that different types of cancer are individual diseases with separate causes, risk factors, characteristics and patterns of survival (Berg 1996). Cancers are classified by the location in the body where the disease originated (the primary site) and the tissue or cell type of the cancer (histology). Therefore, each of the cancer types reviewed in this report was evaluated separately.

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[3] The biliary tract, also known as the bile duct, is the tube that connects the liver to the small intestine. The part of the biliary tract within the liver itself is known as the intrahepatic bile duct (IBD). Cancers within the liver or IBD are evaluated together in this report, consistent with the MCR methodology. Cancers within other sections of the biliary tract are referred to in this report as Other Biliary Tract cancers.

It should be noted that duplicate records have been eliminated from the MCR data used in this report. Duplicate cases are additional reports of the same primary site cancer diagnosed in an individual by another health-care provider. The decision that a case was a duplicate and should be excluded from the analysis was made by the MCR after consulting with the reporting hospital/diagnostic facility and obtaining additional information regarding the histology and/or pathology of the case. However, reports of individuals with multiple primary site cancers were included as separate cases in this report. In general, a diagnosis of a multiple primary cancer is defined by the MCR as a new cancer in a different location in the body or a new cancer of the same histology (cell type) as an earlier cancer, if diagnosed in the same primary site (original location in the body) more than 2 months after the initial diagnosis (MCR 2003).

2) Calculation of Standardized Incidence Ratios (SIRs)

To determine whether an elevation in cancer incidence occurred among individuals diagnosed with cancer in New Bedford or the five CTs surrounding the Parker Street Waste Site, cancer incidence data were tabulated by gender according to eighteen age groups to compare the observed number of cancer diagnoses to the number that would be expected based on the statewide cancer rate. Standardized incidence ratios (SIRs) were calculated for the five time periods, for each of the nine cancer types, for the city as a whole and the five CTs, in order to evaluate patterns or trends in cancer incidence as compared to the statewide cancer experience.

To calculate an SIR, it is necessary to obtain accurate population information. The population figures used in this analysis were interpolated based on 1980, 1990, and 2000 U.S. census data for New Bedford (U.S. DOC 1980, 1990, and 2000), as well as 2010 projected census data. Midpoint population estimates were calculated for each time period evaluated (i.e., 1984, 1989, 1994, 1999, and 2004). To estimate the population between census years, an assumption was made that the change in population occurred at a constant rate throughout the ten-year interval between each census.[4]

[4] Using slightly different population estimates or statistical methodologies, such as grouping ages differently or rounding off numbers at different points during calculations, may produce results slightly different from those published in this report.

A CT is a geographic subdivision of a city or town designated by the United States Census Bureau. Because age group and gender-specific population information is necessary to calculate incidence rates, the CT is the smallest geographic area for which cancer rates can be accurately calculated. Specifically, a CT is a smaller statistical subdivision of a county as defined by the U.S. Census Bureau. CTs usually contain between 1,500 and 8,000 persons and are designed to be homogenous with respect to population characteristics (U.S. DOC 2000). New Bedford census tracts are depicted in Figure 3.

SIRs were not calculated for some cancer types in some time periods and/or CTs due to the small number of observed cases (less than five). It is standard BHISRE policy not to calculate rates with fewer than five observed diagnoses due to the instability of the rate. However, the expected number of diagnoses was calculated during each time period and for each CT, and the observed and expected numbers of diagnoses were compared to determine whether excess numbers of cancer diagnoses were occurring.

3) Interpretation of a Standardized Incidence Ratio (SIR)

An SIR is an estimate of the occurrence of cancer in a population relative to what might be expected if the population had the same cancer experience as a larger comparison population designated as "normal" or average. Usually, the state as a whole is selected to be the comparison population. Using the state of Massachusetts as a comparison population provides a stable population base for the calculation of incidence rates.

Specifically, an SIR is the ratio of the observed number of cancer diagnoses in an area to the expected number of diagnoses multiplied by 100. The statewide incidence rate is applied to the population structure of the area to calculate the number of expected cancer diagnoses. The SIR is a comparison of the number of diagnoses in the specific area (i.e., city/town or census tract) to the statewide rate. Comparisons of SIRs between communities or census tracts are not possible because each of these areas has different population characteristics.

An SIR of 100 indicates that the number of cancer diagnoses observed in the population being evaluated is equal to the number of cancer diagnoses expected in the comparison or "normal" population. An SIR greater than 100 indicates that more cancer diagnoses occurred

than were expected, and an SIR less than 100 indicates that fewer cancer diagnoses occurred than were expected. Accordingly, an SIR of 150 is interpreted as 50% more cancer diagnoses than the expected number; an SIR of 90 indicates 10% fewer cancer diagnoses than expected.

Caution should be exercised, however, when interpreting an SIR. The interpretation of an SIR depends on both the size and the stability of the SIR. Two SIRs can have the same size but not the same stability. For example, an SIR of 150 based on four expected diagnoses and six observed diagnoses indicates a 50% excess in cancer, but the excess is actually only two diagnoses. Conversely, an SIR of 150 based on 400 expected diagnoses and 600 observed diagnoses represents the same 50% excess in cancer, but because the SIR is based upon a greater number of diagnoses, the estimate is more stable. It is very unlikely that 200 excess diagnoses of cancer would occur by chance alone. As a result of the instability of incidence rates based on small numbers of diagnoses, SIRs were not calculated when fewer than five diagnoses were observed for a particular cancer type.

4) Calculation of the 95% Confidence Interval

To help interpret or measure the stability of an SIR, the statistical significance of each SIR was assessed by calculating a 95% confidence interval (95% CI) to determine if the observed number of diagnoses is “significantly different” from the expected number or if the difference may be due solely to chance (Rothman and Boice 1982). Specifically, a 95% CI is the range of estimated SIR values that have a 95% probability of including the true SIR for the population. If the 95% CI range does not include the value 100, then the disease rate in the study population is statistically significantly different from the comparison or "normal" population. "Statistically significantly different" means there is less than a 5% chance that the observed difference (either increase or decrease) in the rate is the result of random fluctuation in the number of observed cancer diagnoses.

For example, if a confidence interval does not include 100 and the interval is above 100 (e.g., 105–130), there is a statistically significant excess in the number of cancer diagnoses. Similarly, if the confidence interval does not include 100 and the interval is below 100 (e.g., 45–96), the number of cancer diagnoses is statistically significantly lower than expected. If the confidence interval range includes 100, the true SIR may be 100. In this case, it cannot be

determined with certainty that the difference between the observed and expected number of diagnoses reflects a real cancer increase or decrease or is the result of chance. It is important to note that statistical significance alone does not necessarily imply public health significance. Determination of statistical significance is just one tool used to interpret cancer patterns in a community.

In addition to the range of the estimates contained in the confidence interval, the width of the confidence interval also reflects the stability of the SIR estimate. For example, a narrow confidence interval, such as 103–115, allows a fair level of certainty that the calculated SIR is close to the true SIR for the population. A wide interval, for instance 85–450, leaves considerable doubt about the true SIR, which could be much lower than or much higher than the calculated SIR. This would indicate an unstable statistic. Again, due to the instability of incidence rates based on small numbers of diagnoses, statistical significance was not assessed when fewer than five diagnoses were observed.

5) Evaluation of Risk Factor Information

Available information reported to the MCR related to risk factors for cancer development was reviewed and compared to known or established incidence patterns for the cancer types evaluated in this report. This information is collected for each individual at the time of cancer diagnosis and includes the individual's age at diagnosis, the stage of disease, and the individual's smoking history and occupation. One or even several factors acting over time can be related to the development of cancer. For example, tobacco use has been linked to bladder, kidney, and lung and bronchus cancers. Other cancer risk factors may include lack of crude fiber in the diet, high fat consumption, alcohol abuse, and reproductive history. Heredity, or family history, is an important factor for several cancers. To a lesser extent, some occupational exposures, such as jobs involving contact with asbestos, have been shown to be carcinogenic (cancer-causing). Environmental contaminants have also been associated with certain types of cancer. Available risk factor information from the MCR was evaluated for residents of New Bedford and the five CTs for cancer types determined to be elevated when compared to Massachusetts as a whole. However, information about personal risk factors such as family history, hormonal events, diet, and other factors that may also influence the development of cancer is not collected by the MCR

or any other readily accessible source; therefore, it was not possible to evaluate these factors in this investigation.

6) Determination of Geographic Distribution

In addition to calculating SIRs, the address at the time of diagnosis for each individual diagnosed with one of the nine cancer types in New Bedford was geographically mapped using a computerized geographic information system (GIS) (ESRI 2006). This allowed assignment of CT location for each individual diagnosed with cancer as well as an evaluation of the spatial distribution of the individuals at a smaller geographic level within CTs (i.e., neighborhoods). The geographic distribution was determined using a qualitative evaluation of the point pattern of cancer diagnoses in New Bedford, with a particular focus on CTs 6509, 6510.01, 6510.02, 6511, and 6515 (that is, the areas in closest proximity to the PSWS). This evaluation included consideration of the population density variability of each CT through the use of GIS-generated population density overlays. 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 those individuals' addresses (e.g., by using telephone books issued within 2 years of an individual's diagnosis or searching files via the Registry of Motor Vehicles). For confidentiality reasons, it is not possible to include maps in this report showing the locations of residence at diagnosis for individuals diagnosed with cancer. [Note: MDPH is bound by state and federal patient privacy and research laws not to reveal the name or any other identifying information of an individual diagnosed with cancer and reported to the MCR.]

B. RESULTS

The following sections present cancer incidence rates for the community of New Bedford and for CTs 6509, 6510.01, 6510.02, 6511, and 6515 during the 25-year time period 1982-2006.

The Parker Street Waste Site is located in CT 6510.02, extending into CT 6515 on its southerly boundary. As mentioned, to evaluate possible trends over time as compared to the statewide cancer experience, these data were analyzed by five smaller time periods, 1982-1986, 1987-1991, 1992-1996, 1997-2001, and 2002-2006. Tables 6A through 6E summarize cancer incidence data for New Bedford as a whole, while Tables 7A through 7E summarize data for

New Bedford's CT 6510.02, Tables 8A through 8E for CT 6509, Tables 9A through 9E for CT 6510.01, Tables 10A through 10E for CT 6511, and Tables 11A through 11E for CT 6515.

1) New Bedford

In the earliest time period evaluated, 1982-1986, the incidence of the nine cancer types was either about as expected, or in most instances, less than expected. For five cancer types -- breast, colorectal, lung and bronchus, melanoma, and non-Hodgkin lymphoma – the incidence was statistically significantly lower than expected. Tables 6A through 6E summarize the cancer incidence data for the city of New Bedford as a whole.

During 1987-1991, the incidence of seven of the nine types of cancer evaluated was either about as expected or less than expected (see Table 6B). For the following cancer types, the incidence was statistically significantly lower than expected: bladder, breast, colorectal, liver/IBD, and melanoma. Although an elevation in lung and bronchus cancer was seen in males during this time period, with 244 diagnoses observed compared to approximately 225 diagnoses expected, the difference was not statistically significant, meaning that it most likely represents natural variability in the number of observed diagnoses. The incidence of two types of cancer -- biliary tract and gallbladder -- was elevated in females during this time period. Ten diagnoses of biliary tract cancer were observed in females when approximately five would have been expected (SIR = 214; 95% CI: 102 - 393); this SIR is statistically significant. For gallbladder cancer in females, 15 diagnoses were observed compared to approximately six expected. This finding is statistically significant (SIR = 255; 95% CI: 142 – 420).

Between 1992 and 1996, with a few exceptions, the incidence of the cancer types evaluated was either about as expected or less than expected (see Table 6C). The incidence of lung and bronchus cancer in females and melanoma in both genders was statistically significantly lower than expected. Elevations occurred in the numbers of diagnoses of both colorectal and liver/IBD cancers in females during this time period; however, the differences were not statistically significant.

In the time period of 1997-2001, the incidence of most of the cancer types evaluated was about as expected (see Table 6D). Breast cancer, melanoma, lung cancer (females only), and

non-Hodgkin lymphoma occurred at a statistically significantly lower rate than expected during this time period. Elevations occurred in the numbers of diagnoses of both colorectal cancer in males and liver/IBD cancer in both genders; these differences were not statistically significant. A statistically significant elevation in the incidence of lung and bronchus cancer was observed among males in New Bedford during this time period, with 246 diagnoses observed compared to approximately 206 expected (SIR = 119, 95% CI: 105 – 135).

During the most recent time period evaluated, 2002-2006, with the exception of two cancer types in males (liver/IBD and lung and bronchus), the incidence of the other types of cancer evaluated was about as expected (see Table 6E). A slight elevation in biliary tract cancer occurred in females (8 diagnoses observed versus approximately 5 expected); the difference was not statistically significant. The rates of breast cancer and melanoma were statistically significantly lower than expected during this time period. As in 1997-2001, a statistically significant elevation in the incidence of lung and bronchus cancer among males was observed (227 diagnoses observed versus approximately 192 expected, SIR = 118, 95% CI: 103 – 134). A statistically significant elevation in the incidence of liver/IBD cancer in males was also observed during this time period (37 diagnoses observed versus approximately 23 expected, SIR = 163, 95% CI: 114 – 224).

2) Census Tract 6510.02

The Parker Street Waste Site is located primarily in census tract 6510.02. This census tract is south of CT 6510.01 and borders Dartmouth to the west (see Figure 3). Tables 7A through 7E summarize the cancer incidence data for CT 6510.02.

During the first two time periods evaluated, 1982-1986 and 1987-1991, the incidence of the nine cancer types evaluated was approximately as expected in CT 6510.02. For breast cancer in the earliest time period, the incidence was statistically significantly lower than expected in this census tract.

During 1992-1996, the incidence of most of the cancer types evaluated was about as expected in CT 6510.02. Breast cancer occurred somewhat more often than expected during this time period, with 27 diagnoses observed when approximately 19 would have been expected;

however, this elevation was not statistically significant. Bladder cancer in males occurred more often than expected with six diagnoses observed when approximately three would have been expected; this elevation was not statistically significant.

During the last two time periods, 1997-2001 and 2002-2006, the incidence of the majority of cancer types was approximately as expected. No statistically significant differences were observed between the numbers of observed and expected diagnoses. Although the incidence of lung and bronchus cancer was somewhat elevated among females in CT 6510.02, the differences were not statistically significant and most likely represent natural variability in the numbers of observed diagnoses. Similarly, although 13 diagnoses of colorectal cancer were observed in females during the most current time period, when approximately eight would be expected, the difference was not statistically significant. During the previous time period (1997-2001), fewer females were diagnosed with colorectal cancer than expected (3 observed versus 9 expected).

3) Census Tract 6509

Census tract 6509 is located in the center of New Bedford, to the northeast of the PSWS (see Figure 3). Tables 8A through 8E summarize the cancer incidence data for CT 6509. For each of the five time periods evaluated, the incidence of the nine types of cancer was approximately as expected. No statistically significant differences between the numbers of observed and expected diagnoses were noted during any time period. No consistent trends were noted in any of the cancer types elevated.

4) Census Tract 6510.01

Census tract 6510.01 is located to the west of CT 6509 and northwest of the Parker Street Waste Site. It borders Dartmouth to the west (see Figure 3). Tables 9A through 9E summarize the cancer incidence data for CT 6510.01.

During the first two time periods, 1982-1986 and 1987-1991, the incidence of the nine cancer types evaluated was either about as expected or less than expected in this census tract.

With the exception of colorectal cancer, during 1992-1996, the incidence of cancer was at or near expected in CT 6510.01 for the cancer types evaluated. A statistically significant elevation in the incidence of colorectal cancer was observed among males and females combined (28 diagnoses observed versus 18 expected, SIR = 156, 95% CI: 104 – 225). The incidence of colorectal cancer was elevated among both males (12 diagnoses observed versus approximately 8 expected) and females (16 diagnoses observed versus approximately 10 expected).

During the last two time periods evaluated, 1997-2001 and 2002-2006, the incidence of the majority of cancer types was approximately as expected. During 1997-2001, there was a slight elevation in the incidence of colorectal cancer among males and females combined; the elevation was due entirely to three excess diagnoses among males. In females during the 2002-2006 time period, there were three diagnoses of biliary tract cancer compared to less than one diagnosis expected. A slight elevation in lung and bronchus cancer also occurred during the 2002-2006 time period. However, no statistically significant differences in the numbers of observed versus expected diagnoses of any cancer type evaluated were observed nor were any trends observed in these time periods.

5) Census Tract 6511

Census tract 6511 is located south of CT 6509 and east of the Parker Street Waste Site (see Figure 3). Tables 10A through 10E summarize the cancer incidence data for CT 6511. With a few exceptions, the incidence of the nine types of cancer was approximately as expected throughout the 25-year time period in this census tract.

Although the number of diagnoses of colorectal cancer in females was somewhat elevated during two time periods, with 12 diagnoses observed compared to approximately seven expected during 1987-1991 and nine diagnoses observed compared to approximately six expected during 1997-2001, these differences were not statistically significant. During the middle time period, 1992-1996, the incidence of colorectal cancer in females was about as expected with seven diagnoses observed compared to approximately six expected. During the remaining two time periods evaluated, the incidence of colorectal cancer in females in this census tract was about as expected. The incidence of breast cancer was statistically significantly

lower than expected during the last two time periods evaluated; during the previous three time periods, breast cancer incidence was as expected or lower than expected.

6) Census Tract 6515

The Parker Street Waste Site extends from CT 6510.02 into CT 6515 on its southerly boundary (see Figure 3). Tables 11A through 11E summarize the cancer incidence data for CT 6515.

During 1982-1986, with the exception of breast cancer, the incidence of the cancer types evaluated was either about as expected or below expected. The incidence of breast cancer was somewhat elevated with 16 diagnoses observed when approximately 11 would have been expected; this elevation, however, was not statistically significant. During the other four time periods evaluated, the incidence of breast cancer in this census tract was either lower than expected or as expected.

During the two time periods 1987-1991 and 1992-1996, all cancer types evaluated occurred approximately at or near expected rates.

In the 1997-2001 time period, all cancer types with the exception of non-Hodgkin lymphoma occurred at or near expected rates in CT 6515. A statistically significant elevation in the incidence of NHL was observed among males and females combined (8 diagnoses observed versus approximately 3 expected, SIR = 283, 95% CI: 122 – 559).

During 2002-2006, the incidence of all cancer types evaluated was as or near expected in CT 6515 with the exception of colorectal cancer. A statistically significant elevation in the incidence of this cancer type was observed for males and females combined (15 diagnoses observed versus approximately 8 expected, SIR = 184, 95% CI: 103 – 304). Although six diagnoses were observed in males when approximately four were expected, the overall elevation was primarily due to an elevation in females with nine diagnoses observed compared to approximately four expected.

A more detailed discussion of cancer incidence and an evaluation of available risk factors for those types of cancer found to be elevated in New Bedford or any of the 5 CTs are found in the following section.

C. REVIEW OF AVAILABLE RISK FACTOR INFORMATION

1) Biliary Tract Cancer

During the 1987-1991 time period, an elevation in the incidence of biliary tract cancer was observed citywide, primarily due to an elevation among females in New Bedford (see Table 6B). The elevation was statistically significant.

According to the American Cancer Society (ACS), more than 2 out of every 3 individuals diagnosed with biliary tract cancer are over the age of 65 at diagnosis (ACS 2010a). Biliary tract cancers occur in certain bile ducts associated with the liver, some that have joined and are just leaving the liver as well as others that are located outside the liver closer to the small intestine. The major risk factors for biliary tract cancer include age, medical conditions that involve chronic inflammation of the bile duct (such as bile duct stones, ulcerative colitis, and cysts), obesity, family history, and exposure to thorotrast (a radioactive substance used in radiology until the 1950s). The ACS reports that other possible risk factors exist for biliary tract cancer that require more research to better understand their role in biliary tract cancer; these include PCBs as well as smoking, diabetes, pancreatitis, infection with hepatitis B or C virus, and exposure to asbestos, dioxins, and nitrosamines (ACS 2010a). The Agency for Toxic Substances and Disease Registry reports that, based on evidence in animal toxicity studies and some evidence in human studies, PCBs can be expected to cause cancer in the liver and the biliary tract (U.S. ATSDR 2000).

Among females in New Bedford diagnosed with biliary tract cancer between 1987 and 1991, the average age at diagnosis was 73. Eight of the 10 females (80%) diagnosed with biliary tract cancer in the five years between 1987 and 1991 were above the age of 65 at diagnosis compared to at least 66% expected to be over 65 at diagnosis, based on national statistics for biliary tract cancer. The geographic distribution of female biliary tract cancer diagnoses between 1987 and 1991 closely followed population density patterns in New Bedford and no unusual

spatial patterns or clustering of diagnoses were observed. The majority of the diagnoses were outside the five census tracts in closest proximity to the PSWS. Information on other possible risk factors for biliary cancer, such as medical conditions and family history, are not available through the MCR.

2) Colorectal Cancer

Excluding skin cancers, colorectal cancer is the third most common cancer diagnosed in both men and women in the United States. Statistically significant elevations in the incidence of colorectal cancer were observed in New Bedford census tracts 6510.01 during 1992-1996 and 6515 during 2002-2006.

According to the ACS (2010b), more than 90% of individuals diagnosed with colorectal cancer will be over the age of 50 at diagnosis. The average age at diagnosis is 72 years. Other known risk factors for colorectal cancer include family history, certain hereditary conditions (such as familial adenomatous polyposis (FAP)), personal medical conditions (such as a history of polyps or inflammatory bowel disease), and lifestyle factors (such as obesity and lack of exercise). Up to 20% of individuals who develop colorectal cancer have family members who have been affected by this disease. About 5% of individuals who develop colorectal cancer have an inherited genetic susceptibility to the disease. Other possible risk factors still under investigation include a diet high in red or processed meat, a diet low in fruits and vegetables, and smoking. (It is important to note that information on hereditary conditions, medical conditions, and most lifestyle factors is not collected by the MCR and therefore could not be assessed for the purposes of this analysis.) Although more research is needed on the possible association between exposure to PCBs and an increased risk of colorectal cancer, some evidence points to industrial PCB exposures as being associated with colorectal cancer (U.S. ATSDR 2000).

Twenty-eight individuals in CT 6510.01 were diagnosed with colorectal cancer between 1992 and 1996 compared to approximately 18 expected. Twelve were male and sixteen were female. As previously stated, age is considered a risk factor for the development of colorectal cancer. In CT 6510.01, the average age at diagnosis of colorectal cancer during 1992-1996 was 72, and 27 of the 28 individuals diagnosed were above the age of 50. These statistics are consistent with what would be expected, based on national statistics reported by the ACS.

Smoking is also considered a possible risk for colorectal cancer. Long-term smokers are more likely than non-smokers to develop and die from colorectal cancer. Smoking is a well-known cause of lung cancer, but because some of the cancer-causing substances in tobacco are swallowed, they can increase the risk of digestive system cancers such as colorectal cancer (ACS 2010b). Smoking status was reported to the MCR for 18 of the 28 individuals in CT 6510.01 diagnosed with colorectal cancer in 1992-1996. Of these 18, 11 (61%) were current or former smokers at the time of their diagnosis. Smoking history was unknown for 10 of the 28 individuals.

The geographic distribution of colorectal cancer diagnoses in CT 6510.01 during 1992-1996 was evaluated. The distribution of diagnoses closely followed population density patterns and no unusual clustering of diagnoses was observed.

It is important to note that although the incidence of colorectal cancer was elevated in CT 6510.01 during the 1992-1996 time period, the elevation did not persist in the other four time periods evaluated. During the other time periods evaluated, the numbers of observed diagnoses of colorectal cancer were either approximately as expected or less than expected.

Fifteen individuals (both male and female) in CT 6515 were diagnosed with colorectal cancer during 2002-2006 compared to approximately eight expected. Six were male and 9 were female. The average age at diagnosis of the 15 individuals was 69 and no diagnoses were observed among individuals below the age of 50. Smoking status was known for 14 of the 15 individuals who resided in CT 6515 at the time of their diagnosis; 8 (57%) were current or former smokers at the time of their diagnosis.

The geographic distribution of the fifteen individuals diagnosed with colorectal cancer in CT 6515 during 2002-2006 was evaluated and was found to closely follow population density patterns within the CT. It is important to note that although the incidence of colorectal cancer was elevated in CT 6515 during the 2002-2006 time period, the elevation was not apparent in the earlier four time periods evaluated.

3) Gallbladder Cancer

During 1987-1991, a statistically significant elevation in the incidence of gallbladder cancer was observed citywide among New Bedford residents (males and females combined), primarily due to an elevation among females. Fifteen females were diagnosed compared to approximately six diagnoses expected. In the five CTs surrounding the Parker Street Waste Site, the incidence of gallbladder cancer was approximately as expected during the time periods evaluated.

According to the ACS, the most common risk factors for gallbladder cancer are related to chronic inflammation of the gallbladder. Older age is also a risk factor; the average age at diagnosis is 73 and 3 out of 4 individuals diagnosed with gallbladder are over the age of 65 at their diagnosis. The ACS also states that gallbladder cancer is twice as common among females as males. Other risk factors for gallbladder cancer include a history of gallstones; other medical conditions such as gallbladder polyps, calcium deposits in the gallbladder (porcelain gallbladder), and choldeochal cysts; and obesity. Because gallbladder cancer is not common, little information exists on potential environmental or occupational exposures that may increase an individual's risk of developing gallbladder cancer. Some animal studies have suggested that chemical compounds called nitrosamines may increase the risk of gallbladder cancer. Other studies have found that gallbladder cancer may be more prevalent among workers in the rubber and textile industries (ACS 2009a). ATSDR reported limited evidence of an increased risk of gallbladder cancer from exposure to PCBs based on a study of causes of death in two capacitor manufacturing plants where PCBs as well as organic solvents were used (U.S. ATSDR 2000).

Among the 15 females diagnosed with gallbladder cancer during the 1987-1991 time period, the average age at diagnosis was 73, which is consistent with national statistics published by the ACS. When the geographic distribution of residence at diagnosis was examined for the 15 females, it was observed to closely follow patterns of population density in New Bedford.

According to the ACS, more than 9 out of 10 gallbladder cancers are of the adenocarcinoma subtype. Of the adenocarcinomas, approximately 6% are papillary adenocarcinomas. Other less common subtypes of gallbladder cancer also exist. Among the 15

females diagnosed with gallbladder cancer during the 1987-1991 time period, 14 (93%) were diagnosed with the adenocarcinoma subtype.

It is important to note that although the incidence of gallbladder cancer was elevated in New Bedford females during the 1987-1991 time period, the incidence fluctuated over the remaining four time periods. Slightly fewer diagnoses were observed than expected in the 1982-1986 and 1997-2001 time periods and slightly more diagnoses were observed than expected in the 1992-1996 and 2002-2006 time periods.

4) Liver / Intrahepatic Bile Duct Cancer

A statistically significant elevation in the incidence of liver and intrahepatic bile duct (IBD) cancer was observed citywide for all New Bedford residents diagnosed during 2002-2006. The overall elevation, however, was due to an elevation among males. Thirty-seven diagnoses of liver and IBD cancer occurred in males compared to approximately 23 expected.

According to the ACS, liver cancers are more common in males than females (2009b). More than 90% of individuals diagnosed with liver and IBD cancer are older than 45 years of age, with an average age at diagnosis of 64 years. The most common form of liver/IBD cancer is hepatocellular carcinoma, accounting for 75 to 90% of all diagnoses. An additional 10–20 % of all liver/IBD cancers are intrahepatic cholangiocarcinomas. A rare form, hepatoblastoma, can occur in children and is usually diagnosed before the age of four.

Cirrhosis is a major risk factor for liver cancer and is usually due to chronic infection with either hepatitis B or C virus or heavy alcohol consumption. Other known risk factors for the development of liver and IBD cancers include certain hereditary conditions (such as particular metabolic disorders) and exposure to thorotrast (a substance used in radiology until the 1950s). Environmental exposures with links to liver and IBD cancer include occupational exposure to vinyl chloride (a chemical used in making some kinds of plastics), PCBs, and chronic exposure to drinking water contaminated with naturally occurring arsenic. Animal studies provide strong evidence of an increased risk of liver cancer from exposure to PCBs (U.S. ATSDR 2000). In addition, although the evidence is considered suggestive, human studies in occupational settings suggest a link between liver cancer and PCBs. The chance of being

exposed to arsenic depends on where you live and whether your water comes from a well or from a system that meets the drinking water standard for arsenic content. According to drinking water quality reports available for the City of New Bedford for the years 1997 through 2008, no arsenic was detected in the city water supply (City of New Bedford, 1997- 2008).

Among the 37 males in New Bedford diagnosed with liver and IBD cancer during 2002-2006, the average age at diagnosis was 60, with 95 percent of the males being over age 45 at their diagnosis. This age distribution is consistent with national statistics reported by the ACS. Seventy-eight percent of the diagnoses were hepatocellular carcinomas, which is also consistent with would be expected based on ACS statistics. The geographic distribution of liver and IBD diagnoses among New Bedford males during 2002-2006 was examined and found to follow population density patterns in the city. In other words, the addresses of New Bedford residents at the time of their diagnosis were fairly evenly spread throughout those areas of the city with the greatest number of residents.

In the earlier time periods evaluated (1982-1986, 1987-1991, and 1992-1996), fewer diagnoses of liver/IBD cancer occurred among New Bedford males than expected. During 1997-2001, more diagnoses occurred than expected with 24 observed compared to approximately 18 expected; this elevation was not statistically significant. Although not a trend over the entire 25-year time period, liver/IBD cancer incidence was elevated among New Bedford males during the last two time periods evaluated.

The incidence of liver/IBD cancer among New Bedford females fluctuated somewhat over the 25-year time period evaluated. In the first two time periods evaluated, the difference between the number of observed and expected diagnoses fluctuated between two above and three below the expected number of diagnoses. In the third time period, 1992-1996, 11 diagnoses were observed compared to approximately six expected. In the following time period, 1997-2001, 12 diagnoses were observed compared to approximately nine expected. During the most recent time period, the incidence of liver/IBD cancer in New Bedford females was as expected (10 observed versus 10 expected).

5) Lung and Bronchus Cancer

Statistically significant elevations in the incidence of lung and bronchus cancer were observed citywide among males in New Bedford during the 1997-2001 and 2002-2006 time periods. Among New Bedford females, the incidence of lung cancer was consistently lower than expected over the 25-year time period evaluated; during the first four time periods evaluated, it was statistically significantly lower than expected.

According to the ACS, over two-thirds of people diagnosed with lung and bronchus cancer are over 65 years of age and fewer than 3% are below age 45 at diagnosis (ACS 2009c). The average age at the time of diagnosis is about 71 years. Between 85-90% of all lung and bronchus cancers are non-small cell lung cancers while 10-15% are small cell lung cancers. Forty percent of all lung cancers are adenocarcinomas, 25-30% are squamous cell carcinomas, and 10-15% are large cell carcinomas.

The greatest risk factor for lung and bronchus cancer is smoking. Almost all small cell lung cancers are caused by smoking. According to the ACS, smokers are many times more likely than non-smokers to develop lung and bronchus cancer (ACS 2009c). Approximately 87% of all lung cancers are caused directly by smoking cigarettes. The longer a person has been smoking and the more cigarettes smoked per day, the greater the risk of lung cancer. The second leading cause of lung and bronchus cancer among smokers is exposure to naturally occurring radon; among non-smokers, this is thought to be the leading cause of lung and bronchus cancer. Other known risk factors include genetics, exposure to secondhand smoke, previous radiation therapy to the chest (e.g., for the treatment of a previous cancer such as Hodgkin disease), and occupational exposure to particular chemicals such as heavy metals (arsenic, beryllium, cadmium, chromium, and nickel), vinyl chloride, mustard gas, chloromethyl ethers, diesel exhaust, silica, and coal products, as well as to radioactive ores such as uranium. ATSDR has reported limited evidence of an association between lung cancer and exposure to PCBs based on animal studies where rats and mice were fed PCBs along with other chemicals known to be carcinogens (U.S. ATSDR 2000).

Age at diagnosis was reviewed for the 473 males diagnosed with lung and bronchus period between 1997 and 2006. Of the 473 males, 66 percent were over the age of 65 at the time

of their diagnosis compared to approximately 66% nationwide. Three percent of the New Bedford males were under the age of 45 at their diagnosis, which is comparable to approximately 3% nationwide based on ACS statistics. The age at diagnosis pattern within the New Bedford male population appears to closely follow national trends.

The histologies (or tissue types) of the lung cancers among the New Bedford males were compared to what would be expected based on national statistics. Seventy-two percent of lung cancer diagnoses among New Bedford males between 1997 and 2006 were non-small cell lung cancers while 12% were small cell lung cancers; the relative percentages of non-small cell versus small cell lung cancers in these New Bedford males is consistent with the pattern of lung cancer subtypes seen nationwide. Twenty-six percent of the New Bedford diagnoses were adenocarcinomas, 27% were squamous cell carcinomas, and 7% were large cell carcinomas. Although there were slightly more squamous cell carcinomas than adenocarcinomas, the distribution of these histologies among New Bedford males approximates those reported by the ACS for the U.S. as whole.

Tobacco use history was reviewed for the male New Bedford residents diagnosed with lung and bronchus cancer during these two time periods. Of all males diagnosed between 1997 and 2006, smoking history was reported to the MCR for 362 individuals. Among the 362 individuals, 350 (97%) were reported to the MCR as current/former smokers at the time of their diagnosis while 12 were reported as non-smokers.

6) Non-Hodgkin Lymphoma

A statistically significant elevation in the incidence of NHL among males and females combined was observed in CT 6515 during 1997-2001. Eight individuals were diagnosed with NHL during these five years, 4 men and 4 women, when approximately three diagnoses would be expected.

Overall, the risk of non-Hodgkin lymphoma is higher in men than in women, but there are certain types of non-Hodgkin lymphoma that are more common in women (ACS 2009d). The average age at diagnosis is in the 60s, and around half of patients are older than 65 at

diagnosis. The risk of developing non-Hodgkin lymphoma increases throughout life. Over 85% of all NHL diagnoses are of the subtype known as B-cell lymphomas.

Major risk factors for NHL include older age, medical conditions involving a weakened immune system, and certain viral infections. Individuals who have had organ transplants or certain autoimmune diseases such as rheumatoid arthritis or lupus are at increased risk of developing NHL. Infection with particular viral agents such as the human immunodeficiency virus (HIV), the human T-cell leukemia/lymphoma virus (HTLV-1), and the Epstein-Barr virus puts individuals at increased risk of developing NHL. Although more research is needed, some studies have suggested that smoking, high-dose radiation exposures associated with atomic bombs and nuclear power plant accidents, and exposure to chemicals such as benzene, PCBs, and certain herbicides and insecticides (weed- and insect-killing substances) may be linked with an increased risk of NHL. A number of recent human studies have been conducted that evaluated non-occupationally exposed individuals, serum PCB levels, and the occurrence of NHL among participants in the studies. These studies suggest that there may be an association between PCBs, as measured in the serum of the participants, and certain more common sub-types of NHL, particularly diffuse large cell lymphoma (Engel at al. 2007).

Prior treatment for cancer can increase an individual's risk of developing NHL. Some chemotherapy drugs used to treat other cancers may increase the risk of developing leukemia or NHL many years later. Patients treated with radiation therapy for some other cancers, such as Hodgkin disease, have a slightly increased risk of developing NHL later in life. This risk is greater for patients treated with both radiation therapy and chemotherapy (ACS 2009d).

Among the eight residents of CT 6515 diagnosed with NHL during 1997-2001, the average age at diagnosis was 58, which is slightly younger than the national average reported by the ACS as being in the 60s. Three of the 8 individuals (38%) were over the age of 65 when they were diagnosed with NHL; the ACS reports that about half of all individuals are above 65 when they are diagnosed with NHL. The age pattern at diagnosis of individuals in this census tract with NHL approximates that of the national population.

Seven of the 8 diagnoses (88%) were B-cell lymphomas, the predominant type of NHL in the U.S. population. Based on the occupational information provided by the MCR, one of the

eight individuals diagnosed with NHL in CT 6515 may have been exposed to benzene in an occupational setting. In addition, one of the eight residents of CT 6515 diagnosed with NHL during 1997-2001 had a previous cancer diagnosis reported to the MCR. It is not known, however, whether this individual may have been treated with chemotherapeutic drugs or received radiation therapy for their previous cancer.

It is important to note that although the incidence of NHL was elevated during the 1997-2001 time period in census tract 6515, it occurred either about as expected or less frequently than expected during the other four time periods evaluated. Therefore, no long-term trend was noted in the incidence of NHL in this census tract.

V. DISCUSSION

Forty-five individuals, 43 of whom are current or former residents of the PSWS neighborhood and three individuals who are/were not residents but reportedly had spent a significant amount of time at the PSWS, chose to have their blood serum tested for PCBs. The majority of these individuals have serum PCB levels within the typical variation for their respective age groups in the U.S. population. Given the small numbers of participants, the MDPH/BEH cannot speak conclusively about PCB serum levels for those who were not actually tested.

For the city of New Bedford as a whole, cancer incidence data spanning the 25-year time period showed the following:

- With a few exceptions, no consistent trends in the incidence rates emerged over time. Lung cancer incidence in New Bedford males was somewhat elevated in the time period covering 1987-1996 and it was statistically significantly elevated in the last two time periods evaluated (1997-2001 and 2002-2006). Among those males whose smoking history was reported to the MCR, 97% were current or former smokers at the time of their diagnosis. Smoking, therefore, appears to have played a role in the incidence of lung cancer among New Bedford males. The incidence of lung cancer among New Bedford females was consistently lower than expected over the 25-year time period.

- The incidence of biliary tract cancer in New Bedford females was statistically significantly elevated during the 1987-1991 time period. Incidence rates for this type of cancer, however, fluctuated over the 25-year period with no consistent trend noted.
- For both gallbladder and liver/IBD cancers, statistically significant elevations occurred in each cancer type in one time period. However, a consistent trend was not seen in either cancer type over the 25-year time period with rates fluctuating over time.
- The incidence of colorectal cancer was statistically significantly lower than expected during the first two time periods. It was elevated in the subsequent three time periods, however, it was not statistically significantly elevated.
- The incidence of four types of cancer – breast, NHL, melanoma, and lung cancer in females – was lower than expected throughout the entire time period. For most time periods, it was statistically significantly lower than expected for breast and lung cancer as well as melanoma. The incidence of bladder cancer was either lower than expected or about as expected throughout the entire time period.

MDPH reviewed cancer staging information for women diagnosed with breast cancer in New Bedford for the ten-year period 1996-2005, the most recent time period for which consistent staging methods have been used. (Breast cancer staging methods before 1996 are different from those used after 1996.) Staging describes the extent of spread of an individual's cancer. From a public health perspective, earlier breast cancer staging reflects to some extent that women are being screened early and regularly for breast cancer whereas distant staging may reflect a lack of access to early screening. In New Bedford, more women are being diagnosed with distant stage breast cancer (7%) compared to the state (4%); this difference is statistically significant and may indicate a lack of access to early screening for this disease among women in New Bedford.

For CT 6510.02, where the Parker Street Waste Site is located, the incidence of the majority of the nine cancer types was about as expected during the five time periods evaluated, constituting a 25-year span. Although breast cancer incidence was somewhat elevated (although not statistically significantly elevated) during 1992-1996, with 27 diagnoses observed versus 19 expected, in the time periods before (1982-1991) and after (1997-2006), the rate of breast cancer

was below expected. Similarly, in the last two time periods, although elevations were noted in lung and bronchus cancer in females, these elevations were not statistically significant and did not represent long-term trends. Elevations in bladder cancer in males (during 1992-1996) and colorectal cancer in females (2002-2006) occurred in a single time period but did not occur in the surrounding time periods. During the five time periods, no statistically significant elevations occurred and no consistent trends were seen in the incidence of any particular type of cancer in CT 6510.02. It is important to note that the incidence of liver cancer, the type of cancer with the strongest association with exposure to PCBs, was close to expected over the 25-year period with six diagnoses reported in CT 6510.02 compared to approximately five expected. For the other five types of cancer for which there is some evidence of a link with exposure to PCBs – biliary tract, NHL, colorectal, melanoma, and breast cancer – the incidence of these cancer types over the 25-year period was below the expected rate. After liver cancer, the medical/epidemiological literature is strongest with respect to showing a possible association between these types of cancer and exposure to PCBs.

For CT 6515, which contains the southern most area of the PSWS, the incidence of the cancer types evaluated was approximately as expected for each of the five time periods evaluated with the exception of colorectal cancer and non-Hodgkin lymphoma. Although both colorectal cancer and non-Hodgkin lymphoma were statistically significantly elevated in one time period, these elevations did not persist over time and did not represent a consistent pattern. Except for the 1997-2001 time period, when eight diagnoses of NHL were observed compared to approximately three expected, the incidence of NHL was as expected or less than expected throughout the other time periods. With the exception of the most current time period, the incidence of colorectal cancer was approximately as expected throughout the other time periods.

For CT 6509, the incidence of the nine types of cancer was approximately as expected for each of the five time periods evaluated.

For CT 6510.01, with one exception, the incidence of the cancer types evaluated was approximately as expected for the five time periods. Colorectal cancer incidence was statistically significantly elevated for males and females combined during the middle time period

of 1992-1996. However, this elevation did not occur in the earlier time periods nor did it persist in subsequent time periods.

For CT 6511, the incidence of the nine types of cancer was approximately as expected for each of the five time periods evaluated. The incidence of breast cancer was statistically significantly lower than expected during the last two time periods evaluated. With the exception of breast cancer, no other consistent trends emerged in other cancer types.

VI. CONCLUSIONS

Serum PCB testing conducted by BEH showed that the majority of participants who currently live or previously lived within the five CTs, as well as the three non-resident participants that reported spending a significant amount of time at the PSWS, have serum PCB levels within the 95th percentile of serum PCB levels available from the national NHANES data. Three of the 45 participants had whole weight and/or lipid-adjusted results that exceeded the NHANES 95th percentile. Thus, serum PCB results for 42 of the 45 participants are within the typical variation seen in the U.S. population and the serum PCB concentrations for three of the 45 participants are above the typical range.

Serum levels of PCBs reflect accumulated exposure and studies have shown that concentrations of PCBs in serum generally increase with age (Miller, 1991; U.S. CDC, 2009). Consistent with national patterns, serum concentrations of PCBs in participants generally increased with age but were within typical concentrations for the U.S. population for each age group evaluated. There was no consistent pattern of increasing serum PCB levels with increasing years of residence in the neighborhood around the PSWS, suggesting that location of residence was not a primary predictor of serum PCB levels. Finally, the PCB congener patterns for each age group evaluated are consistent with what is typically seen in the U.S. population, suggestive of dietary sources.

The Parker Street Waste Site is located in CT 6510.02, extending into CT 6515 on its southerly boundary. For both of these census tracts, the incidence of liver cancer, the type of cancer with the strongest association with exposure to PCBs, was approximately the same as the

expected rate, with a difference of one between the number of observed and expected diagnoses for the 25-year time period. For both census tracts, the incidence of the majority of cancer types was approximately as expected and no consistent trends were seen in the incidence of any particular type of cancer over the 25-year span. Therefore, for the two census tracts in closest proximity to the Parker Street Waste Site, the incidence rates of those types of cancer possibly associated with exposure to PCBs appear to be approximately as expected based on comparisons to the cancer experience of Massachusetts as a whole. It is important to point out that a review of cancer incidence data, as was conducted in this report, applies to the population at large. This type of analysis cannot be used to determine the cause of cancer in an individual. It is used as a screening-level evaluation to assess whether further study is warranted.

For the other three census tracts surrounding the Parker Street Waste Site, the incidence of the majority of cancer types evaluated was approximately as expected for each of the five time periods evaluated. No unusual or consistent trends emerged in the three census tracts.

When cancer incidence rates for the City of New Bedford as a whole were examined, some elevations were noted, particularly in lung cancer in males. Lung cancer incidence in males was elevated in males primarily between 1997 and 2006. Based on smoking history information reported to the Massachusetts Cancer Registry, it appears that smoking played some role in the incidence of this cancer in New Bedford males.

VII. RECOMMENDATIONS

To address what may be inadequate early screening for particular types of cancer in New Bedford – notably, breast and colorectal cancers – MDPH recommends that the New Bedford Health Department work with the MDPH Comprehensive Cancer Prevention and Control Program to increase awareness in New Bedford of the importance of early screening for cancer. Most colorectal cancers are preventable with routine screening tests and, when detected early, are almost always treatable. Similarly, when breast cancer is found at an early stage, the chance of a cure is much better. Screenings, such as mammograms, can help find breast cancer early.

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FIGURES

Figure 1: EPA Parker Street Waste Site Boundaries

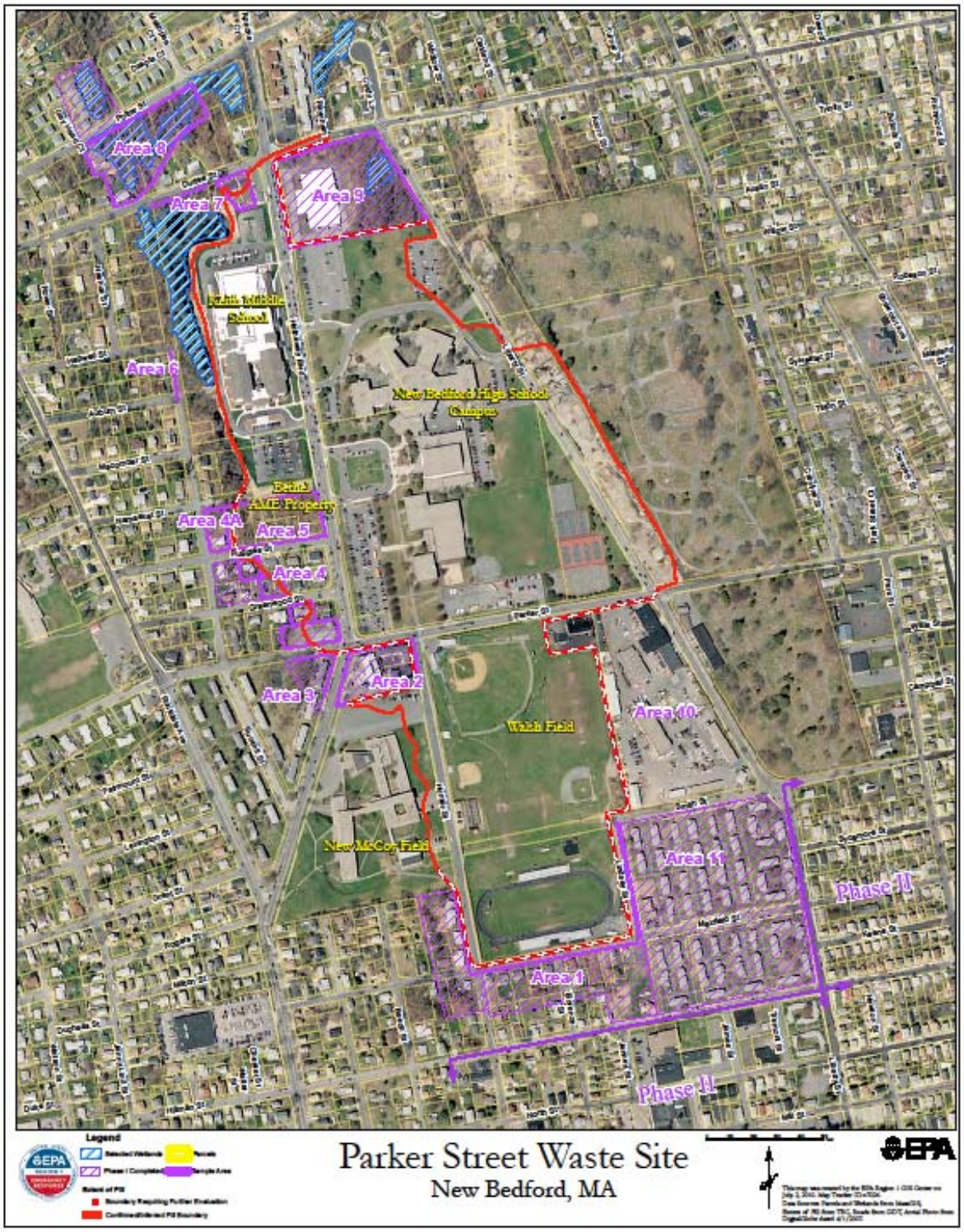
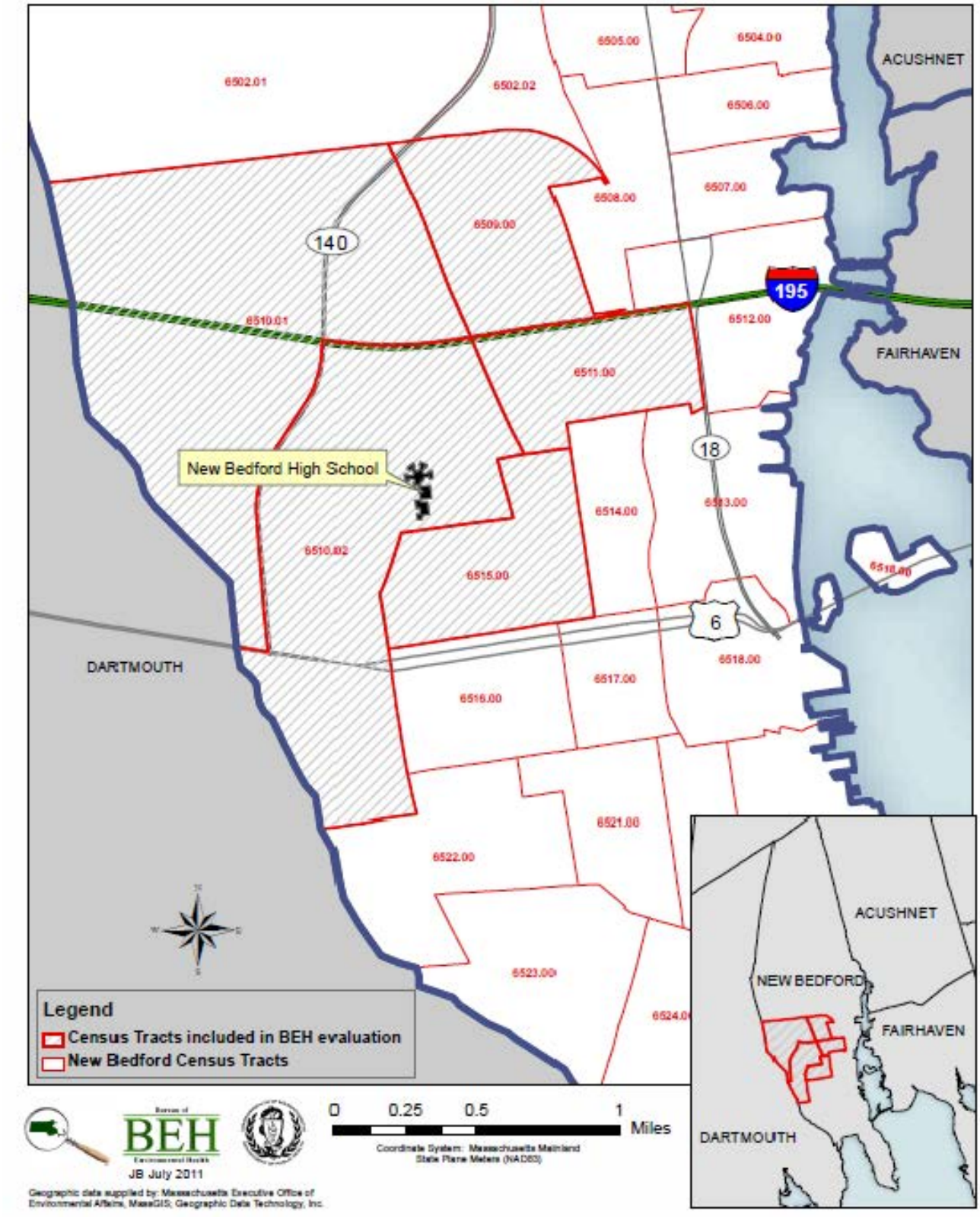


Figure 2: Location of New Bedford High School, Keith Middle School, and the Former Keith Middle School, New Bedford, Massachusetts

Figure 3: Location of Census Tracts, New Bedford, Massachusetts



TABLES

Table 1: Summary of Median Serum PCB Concentrations (Whole Weight)

	New Bedford Residents Median (ppb) [1]	NHANES Median/50th Percentile (ppb)	NHANES 95th Percentile (ppb)
Participants 40-59 yo (n=21)	1.642 (ND to 4.904)	0.927 (0.840, 1.058)	2.780 (2.307, 3.663)
Participants 60+ yo (n=20)	2.455 (1.276 to 7.742)	1.805 (1.694, 1.874)	5.123 (4.131, 6.556)

Notes:
yo = years old
n = number of participants
ppb = parts per billion
NHANES = National Health and Nutrition Examination Survey
The total of the 15 most frequently detected PCB congeners is presented.

The 95% confidence intervals (CI) for the NHANES median and 95th percentile values for each age group are presented in parentheses. The 95% CI is the range of estimated values that has a 95% probability of including the true 50th or 95th percentile value for the population.

1. The median concentration for the two participants between 12 and 19 years of age and the two participants between 20 and 39 years of age are not presented because no PCB congeners were detected in samples collected from the four participants in these age groups.

Table 2: Summary of Median Serum PCB Concentrations (Lipid-Adjusted)

	New Bedford Residents Median (ppb) [1]	NHANES Median/50th Percentile (ppb)	NHANES 95th Percentile (ppb)
Participants 40-59 yo (n=21)	239.9 (ND to 823.9)	145.3 (128.7, 157.9)	402.2 (325.1, 540.2)
Participants 60+ yo (n=20)	360.3 (154.6 to 906.1)	276.0 (251.2, 295.4)	769.4 (600.0, 1026.5)

Notes:

yo = years old

n = number of participants

ppb = parts per billion

NHANES = National Health and Nutrition Examination Survey

The total of the 15 most frequently detected PCB congeners is presented.

The 95% confidence intervals (CI) for the NHANES median and 95th percentile values for each age group are presented in parentheses. The 95% CI is the range of estimated values that has a 95% probability of including the true 50th or 95th percentile value for the population.

1. The median concentration for the two participants between 12 and 19 years of age and the two participants between 20 and 39 years of age are not presented because no PCB congeners were detected in samples collected from the four participants in these age groups.

Table 3: Number of Individuals Currently or Previously Residing within the Five Census Tracts by Years of Residency and Age [1]

Age (years)	3-25 Years of Residence (less than or equal to the 50th percentile)	26-63 Years of Residence (greater than the 50th percentile)	Total
12-19	1	0	1
20-39	1	1	2
40-59	11	8	19
60+	8	12	20
Total	21	21	42

1. Three of the 45 participants in this evaluation did not report currently or previously living in the five census tracts surrounding the PSWS and are not included in this table.

Table 4: Geometric Mean and Range of Serum PCB Concentrations (ppb; Whole Weight) by Years of Residency in the Five Census Tracts Surrounding the PSWS[1,2]

Age Group	3-25 Years of Residence	26-63 Years of Residence
Participants[3] 40-59 yo (n=11, 7)	1.813 (1.112 to 4.904)	1.675 (0.944 to 2.432)
Participants 60+ yo (n=8, 12)	2.306 (1.493 to 4.871)	2.619 (1.276 to 7.742)

Notes:
yo = years old
n = number of participants
ppb = parts per billion
NHANES = National Health and Nutrition Examination Survey
The total of the 15 most frequently detected PCB congeners is presented.

1. Three of the 45 participants in this evaluation did not report currently or previously living in the five census tracts surrounding the PSWS and are not included in this table.

2. Geometric means for the participants in the 12-19 and 20-39 year age groups are not presented in this table because no PCB congeners were detected in samples collected from participants in these age groups.

3. One participant out of 19 between the ages of 40 and 59 years of age was not included in the geometric mean calculations because no PCB congeners were detected in this participant's sample.

Table 5: Geometric Mean and Range of Serum PCB Concentrations (ppb; Lipid-Adjusted) by Years of Residency in the Five Census Tracts Surrounding the PSWS[1,2]

Age Group	3-25 Years of Residence	26-63 Years of Residence
Participants[3] 40-59 yo (n=11, 7)	306.9 (179.6 to 823.9)	238.3 (166.8 to 362.1)
Participants 60+ yo (n=8, 12)	309.7 (190.5 to 687.0)	374.5 (154.6 to 906.1)

Notes:
yo = years old
n = number of participants
ppb = parts per billion
NHANES = National Health and Nutrition Examination Survey
The total of the 15 most frequently detected PCB congeners is presented.

1. Three of the 45 participants in this evaluation did not report currently or previously living in the five census tracts surrounding the PSWS and are not included in this table.

2. Geometric means for the participants in the 12-19 and 20-39 year age groups are not presented in this table because no PCB congeners were detected in samples collected from participants in these age groups.

3. One participant out of 19 between the ages of 40 and 59 years of age was not included in the geometric mean calculations because no PCB congeners were detected in this participant's sample.

TABLE 6A
Cancer Incidence
New Bedford, Massachusetts
1982-1986

Cancer Type	Total					Males					Females				
	Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI	
Other Biliary Tract	4	9.2	NC	NC --	NC	2	3.9	NC	NC --	NC	2	5.3	NC	NC --	NC
Bladder	112	111.1	101	83 --	121	78	78.6	99	78 --	124	34	32.5	105	72 --	146
Breast	275	375.4	73 *	65 --	82	1	2.1	NC	NC --	NC	274	373.3	73 *	65 --	83
Colon/Rectum	355	417.5	85 *	76 --	94	149	197.3	76 *	64 --	89	206	220.1	94	81 --	107
Gallbladder	6	8.2	73	27 --	160	1	2.4	NC	NC --	NC	5	5.8	86	28 --	201
Liver / IBD	11	11.9	93	46 --	166	5	7.6	66	21 --	155	6	4.3	139	51 --	302
Lung/Bronchus	273	354.5	77 *	68 --	87	200	225.4	89	77 --	102	73	129.1	57 *	44 --	71
Melanoma	21	51.4	41 *	25 --	62	17	26.2	65	38 --	104	4	25.2	NC	NC --	NC
Non-Hodgkin Lymphoma	57	74.6	76 *	58 --	99	28	35.8	78	52 --	113	29	38.8	75	50 --	107

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 6B
Cancer Incidence
New Bedford, Massachusetts
1987-1991

Cancer Type	Total					Males					Females				
	Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI	
Other Biliary Tract	15	9.0	166	93	274	5	4.3	115	37	269	10	4.7	214 *	102	393
Bladder	77	107.2	72 *	57	90	64	76.1	84	65	107	13	31.1	42 *	22	71
Breast	362	425.7	85 *	77	94	4	2.7	NC	NC	NC	358	423	85 *	76	94
Colon/Rectum	360	402.9	89 *	80	99	176	195.6	90	77	104	184	207.3	89	76	103
Gallbladder	17	8.1	211 *	123	338	2	2.2	NC	NC	NC	15	5.9	255 *	142	420
Liver / IBD	6	14.2	42 *	15	92	4	9.5	NC	NC	NC	2	4.7	NC	NC	NC
Lung/Bronchus	364	378.3	96	87	107	244	224.5	109	95	123	120	153.8	78 *	65	93
Melanoma	28	57.8	48 *	32	70	15	30.2	50 *	28	82	13	27.6	47 *	25	81
Non-Hodgkin Lymphoma	81	89	91	72	113	39	43.4	90	64	123	42	45.5	92	66	125

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 6C
Cancer Incidence
New Bedford, Massachusetts
1992-1996

Cancer Type	Total					Males					Females				
	Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI	
Other Biliary Tract	10	7.3	138	66 --	254	5	3.7	137	44 --	319	5	3.6	139	45 --	325
Bladder	91	95.1	96	77 --	117	66	67	98	76 --	125	25	28.1	89	58 --	131
Breast	396	412.7	96	87 --	106	1	3.5	NC	NC --	NC	395	409.2	97	87 --	107
Colon/Rectum	377	356	106	95 --	117	173	170.2	102	87 --	118	204	185.8	110	95 --	126
Gallbladder	9	7.3	124	56 --	235	1	1.8	NC	NC --	NC	8	5.5	146	63 --	288
Liver / IBD	20	17.5	114	70 --	176	9	11.7	77	35 --	146	11	5.8	188	94 --	337
Lung/Bronchus	341	378.3	90	81 --	100	226	208.1	109	95 --	124	115	170.2	68 *	56 --	81
Melanoma	27	66.1	41 *	27 --	59	15	35.8	42 *	23 --	69	12	30.3	40 *	20 --	69
Non-Hodgkin Lymphoma	91	100.4	91	73 --	111	44	49.9	88	64 --	118	47	50.6	93	68 --	124

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 6D
Cancer Incidence
New Bedford, Massachusetts
1997-2001

Cancer Type	Total					Males					Females				
	Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI	
Other Biliary Tract	6	7.7	78	29	170	2	3.8	NC	NC	NC	4	3.8	NC	NC	NC
Bladder	77	88.8	87	68	108	55	61.8	89	67	116	22	27	81	51	123
Breast	365	427.3	85 *	77	95	3	2.7	NC	NC	NC	362	424.6	85 *	77	95
Colon/Rectum	365	351.4	104	93	115	182	163.1	112	96	129	183	188.2	97	84	112
Gallbladder	8	7.5	107	46	211	4	2.1	NC	NC	NC	4	5.4	NC	NC	NC
Liver / IBD	36	26.2	138	96	190	24	17.7	136	87	202	12	8.5	142	73	248
Lung/Bronchus	396	405.9	98	88	108	246	206.4	119 *	105	135	150	199.5	75 *	64	88
Melanoma	44	88.2	50 *	36	67	28	47.5	59 *	39	85	16	40.7	39 *	22	64
Non-Hodgkin Lymphoma	81	105.9	76 *	61	95	31	51.4	60 *	41	86	50	54.5	92	68	121

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 6E
Cancer Incidence
New Bedford, Massachusetts
2002-2006

Cancer Type	Total						Males						Females					
	Obs	Exp	SIR		95% CI		Obs	Exp	SIR		95% CI		Obs	Exp	SIR		95% CI	
Other Biliary Tract	12	10.6	113		58	197	4	5.5	NC		NC	NC	8	5.1	157		68	310
Bladder	58	67.1	86		66	112	43	46.2	93		67	125	15	20.9	72		40	118
Breast	313	391.0	80	*	71	89	3	3.2	NC		NC	NC	310	387.7	80	*	71	89
Colon/Rectum	313	308.1	102		91	113	143	144.8	99		83	116	170	163.3	104		89	121
Gallbladder	10	6.7	148		71	272	2	1.9	NC		NC	NC	8	4.9	164		71	323
Liver / IBD	47	32.3	145	*	107	193	37	22.8	163	*	114	224	10	9.6	105		50	193
Lung/Bronchus	430	400.9	107		97	118	227	192.3	118	*	103	134	203	208.6	97		84	112
Melanoma	53	118	45	*	34	59	27	62.5	43	*	28	63	26	55.5	47	*	31	69
Non-Hodgkin Lymphoma	97	110.7	88		71	107	51	54.3	94		70	123	46	56.4	82		60	109

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 7A
Cancer Incidence
Census Tract 6510.02, New Bedford, Massachusetts
1982-1986

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	0	0.4	NC	NC -- NC	0	0.2	NC	NC -- NC	0	0.2	NC	NC -- NC
Bladder	5	5	99	32 -- 231	3	3.6	NC	NC -- NC	2	1.4	NC	NC -- NC
Breast	8	16.1	50 *	21 -- 98	0	0.1	NC	NC -- NC	8	16	50 *	22 -- 98
Colon/Rectum	14	19	74	40 -- 124	5	9.1	55	18 -- 128	9	9.9	91	42 -- 173
Gallbladder	0	0.3	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.2	NC	NC -- NC
Liver / IBD	1	0.5	NC	NC -- NC	0	0.3	NC	NC -- NC	1	0.2	NC	NC -- NC
Lung/Bronchus	12	15.5	77	40 -- 135	7	10.2	69	28 -- 142	5	5.4	93	30 -- 217
Melanoma	2	2.2	NC	NC -- NC	1	1.1	NC	NC -- NC	1	1.1	NC	NC -- NC
Non-Hodgkin Lymphoma	2	3.3	NC	NC -- NC	2	1.6	NC	NC -- NC	0	1.7	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 7B
Cancer Incidence
Census Tract 6510.02, New Bedford, Massachusetts
1987-1991

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	0	0.4	NC	NC -- NC	0	0.2	NC	NC -- NC	0	0.2	NC	NC -- NC
Bladder	2	5.1	NC	NC -- NC	2	3.6	NC	NC -- NC	0	1.5	NC	NC -- NC
Breast	17	18.9	90	52 -- 144	0	0.1	NC	NC -- NC	17	18.8	91	53 -- 145
Colon/Rectum	17	19.3	88	51 -- 141	8	9.4	85	37 -- 168	9	9.9	91	41 -- 172
Gallbladder	2	0.4	NC	NC -- NC	0	0.1	NC	NC -- NC	2	0.3	NC	NC -- NC
Liver / IBD	0	0.7	NC	NC -- NC	0	0.4	NC	NC -- NC	0	0.2	NC	NC -- NC
Lung/Bronchus	11	17.1	64	32 -- 115	7	10.5	67	27 -- 138	4	6.6	NC	NC -- NC
Melanoma	1	2.6	NC	NC -- NC	1	1.4	NC	NC -- NC	0	1.2	NC	NC -- NC
Non-Hodgkin Lymphoma	1	4.1	NC	NC -- NC	1	2	NC	NC -- NC	0	2.1	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 7C
Cancer Incidence
Census Tract 6510.02, New Bedford, Massachusetts
1992-1996

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	1	0.3	NC	NC -- NC	1	0.2	NC	NC -- NC	0	0.2	NC	NC -- NC
Bladder	8	4.4	183	79 -- 361	6	3	198	72 -- 431	2	1.3	NC	NC -- NC
Breast	27	18.7	144	95 -- 210	0	0.2	NC	NC -- NC	27	18.5	146	96 -- 212
Colon/Rectum	11	16.6	66	33 -- 119	6	7.6	79	29 -- 171	5	9	56	18 -- 130
Gallbladder	0	0.4	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.3	NC	NC -- NC
Liver / IBD	1	0.8	NC	NC -- NC	0	0.5	NC	NC -- NC	1	0.3	NC	NC -- NC
Lung/Bronchus	15	16.8	89	50 -- 147	11	9.2	120	60 -- 214	4	7.6	NC	NC -- NC
Melanoma	1	2.9	NC	NC -- NC	1	1.6	NC	NC -- NC	0	1.4	NC	NC -- NC
Non-Hodgkin Lymphoma	6	4.5	133	49 -- 290	3	2.2	NC	NC -- NC	3	2.4	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 7D
Cancer Incidence
Census Tract 6510.02, New Bedford, Massachusetts
1997-2001

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	0	0.3	NC	NC -- NC	0	0.2	NC	NC -- NC	0	0.2	NC	NC -- NC
Bladder	1	3.8	NC	NC -- NC	0	2.6	NC	NC -- NC	1	1.3	NC	NC -- NC
Breast	14	19.6	72	39 -- 120	0	0.1	NC	NC -- NC	14	19.4	72	39 -- 121
Colon/Rectum	11	15.7	70	35 -- 125	8	6.7	119	51 -- 235	3	9	NC	NC -- NC
Gallbladder	0	0.4	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.3	NC	NC -- NC
Liver / IBD	2	1.1	NC	NC -- NC	1	0.7	NC	NC -- NC	1	0.4	NC	NC -- NC
Lung/Bronchus	21	17.6	119	74 -- 182	8	8.4	96	41 -- 188	13	9.3	140	75 -- 240
Melanoma	3	3.7	NC	NC -- NC	1	1.9	NC	NC -- NC	2	1.8	NC	NC -- NC
Non-Hodgkin Lymphoma	3	4.6	NC	NC -- NC	1	2.1	NC	NC -- NC	2	2.5	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 7E
Cancer Incidence
Census Tract 6510.02, New Bedford, Massachusetts
2002-2006

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	0	0.5	NC	NC -- NC	0	0.2	NC	NC -- NC	0	0.2	NC	NC -- NC
Bladder	1	2.9	NC	NC -- NC	1	1.9	NC	NC -- NC	0	1	NC	NC -- NC
Breast	15	18.1	83	46 -- 137	0	0.1	NC	NC -- NC	15	18.0	83	47 -- 138
Colon/Rectum	18	13.8	130	77 -- 206	5	5.9	85	27 -- 198	13	7.9	164	87 -- 280
Gallbladder	0	0.3	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.2	NC	NC -- NC
Liver / IBD	2	1.4	NC	NC -- NC	2	0.9	NC	NC -- NC	0	0.5	NC	NC -- NC
Lung/Bronchus	18	17.6	102	60 -- 161	6	7.8	77	28 -- 168	12	9.9	122	63 -- 213
Melanoma	4	5	NC	NC -- NC	2	2.5	NC	NC -- NC	2	2.5	NC	NC -- NC
Non-Hodgkin Lymphoma	6	4.9	123	45 -- 268	3	2.2	NC	NC -- NC	3	2.7	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 8A
Cancer Incidence
Census Tract 6509, New Bedford, Massachusetts
1982-1986

Cancer Type	Total					Males					Females				
	Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI	
Other Biliary Tract	0	0.2	NC	NC	NC	0	0.1	NC	NC	NC	0	0.1	NC	NC	NC
Bladder	2	2.9	NC	NC	NC	0	2.0	NC	NC	NC	2	0.9	NC	NC	NC
Breast	7	10.2	69	28	141	0	0.1	NC	NC	NC	7	10.1	69	28	142
Colon/Rectum	5	10.9	46	15	107	5	5.1	99	32	230	0	5.8	NC	NC	NC
Gallbladder	0	0.2	NC	NC	NC	0	0.1	NC	NC	NC	0	0.2	NC	NC	NC
Liver / IBD	0	0.3	NC	NC	NC	0	0.2	NC	NC	NC	0	0.1	NC	NC	NC
Lung/Bronchus	9	9.3	97	44	184	7	5.8	120	48	248	2	3.5	NC	NC	NC
Melanoma	0	1.4	NC	NC	NC	0	0.7	NC	NC	NC	0	0.7	NC	NC	NC
Non-Hodgkins Lymphoma	2	2.0	NC	NC	NC	2	0.9	NC	NC	NC	0	1.1	NC	NC	NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 8B
Cancer Incidence
Census Tract 6509, New Bedford, Massachusetts
1987-1991

Cancer Type	Total					Males					Females				
	Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI	
Other Biliary Tract	0	0.2	NC	NC	NC	0	0.1	NC	NC	NC	0	0.1	NC	NC	NC
Bladder	0	2.7	NC	NC	NC	0	2.0	NC	NC	NC	0	0.7	NC	NC	NC
Breast	4	11.1	NC	NC	NC	0	0.1	NC	NC	NC	4	11.0	NC	NC	NC
Colon/Rectum	7	9.9	70	28	145	3	5.1	NC	NC	NC	4	4.9	NC	NC	NC
Gallbladder	0	0.2	NC	NC	NC	0	0.1	NC	NC	NC	0	0.1	NC	NC	NC
Liver / IBD	0	0.4	NC	NC	NC	0	0.2	NC	NC	NC	0	0.1	NC	NC	NC
Lung/Bronchus	11	9.8	113	56	201	7	5.8	121	48	248	4	4.0	NC	NC	NC
Melanoma	2	1.6	NC	NC	NC	2	0.8	NC	NC	NC	0	0.8	NC	NC	NC
Non-Hodgkin Lymphoma	4	2.3	NC	NC	NC	4	1.1	NC	NC	NC	0	1.1	NC	NC	NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 8C
Cancer Incidence
Census Tract 6509, New Bedford, Massachusetts
1992-1996

Cancer Type	Total					Males					Females				
	Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI	
Other Biliary Tract	0	0.2	NC	NC	NC	0	0.1	NC	NC	NC	0	0.1	NC	NC	NC
Bladder	1	2.3	NC	NC	NC	0	1.7	NC	NC	NC	1	0.6	NC	NC	NC
Breast	8	10.3	77	33	153	0	0.1	NC	NC	NC	8	10.2	78	34	154
Colon/Rectum	6	8.3	72	26	157	1	4.2	NC	NC	NC	5	4.1	122	39	285
Gallbladder	0	0.2	NC	NC	NC	0	0.0	NC	NC	NC	0	0.1	NC	NC	NC
Liver / IBD	0	0.4	NC	NC	NC	0	0.3	NC	NC	NC	0	0.1	NC	NC	NC
Lung/Bronchus	12	9.2	130	67	227	7	5.1	136	55	281	5	4.1	122	39	284
Melanoma	2	1.7	NC	NC	NC	1	0.9	NC	NC	NC	1	0.8	NC	NC	NC
Non-Hodgkin Lymphoma	2	2.5	NC	NC	NC	0	1.3	NC	NC	NC	2	1.2	NC	NC	NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 8D
Cancer Incidence
Census Tract 6509, New Bedford, Massachusetts
1997-2001

Cancer Type	Total					Males					Females				
	Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI	
Other Biliary Tract	0	0.2	NC	NC	NC	0	0.1	NC	NC	NC	0	0.1	NC	NC	NC
Bladder	1	2.0	NC	NC	NC	0	1.5	NC	NC	NC	1	0.6	NC	NC	NC
Breast	4	10.2	NC	NC	NC	0	0.1	NC	NC	NC	4	10.1	NC	NC	NC
Colon/Rectum	9	7.8	116	53	220	4	3.8	NC	NC	NC	5	3.9	127	41	297
Gallbladder	0	0.2	NC	NC	NC	0	0.0	NC	NC	NC	0	0.1	NC	NC	NC
Liver / IBD	1	0.6	NC	NC	NC	1	0.4	NC	NC	NC	0	0.2	NC	NC	NC
Lung/Bronchus	10	9.2	108	52	199	5	4.8	104	33	242	5	4.4	113	37	264
Melanoma	1	2.2	NC	NC	NC	1	1.1	NC	NC	NC	0	1.0	NC	NC	NC
Non-Hodgkin Lymphoma	1	2.5	NC	NC	NC	0	1.2	NC	NC	NC	1	1.3	NC	NC	NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 8E
Cancer Incidence
Census Tract 6509, New Bedford, Massachusetts
2002-2006

Cancer Type	Total					Males					Females				
	Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI		Obs	Exp	SIR	95% CI	
Other Biliary Tract	0	0.2	NC	NC	NC	0	0.1	NC	NC	NC	0	0.1	NC	NC	NC
Bladder	1	1.4	NC	NC	NC	1	1.0	NC	NC	NC	0	0.4	NC	NC	NC
Breast	5	9.3	54	17	125	0	0.1	NC	NC	NC	5	9.3	54	17	126
Colon/Rectum	8	6.6	122	52	239	3	3.2	NC	NC	NC	5	3.4	148	48	346
Gallbladder	0	0.2	NC	NC	NC	0	0.0	NC	NC	NC	0	0.1	NC	NC	NC
Liver / IBD	2	0.7	NC	NC	NC	2	0.5	NC	NC	NC	0	0.2	NC	NC	NC
Lung/Bronchus	12	8.6	139	72	243	7	4.2	166	67	343	5	4.4	113	36	263
Melanoma	0	2.8	NC	NC	NC	0	1.4	NC	NC	NC	0	1.4	NC	NC	NC
Non-Hodgkin Lymphoma	3	2.5	NC	NC	NC	3	1.2	NC	NC	NC	0	1.2	NC	NC	NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 9A
Cancer Incidence
Census Tract 6510.01, New Bedford, Massachusetts
1982-1986

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	0	0.3	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.2	NC	NC -- NC
Bladder	4	4.1	NC	NC -- NC	4	2.8	NC	NC -- NC	0	1.3	NC	NC -- NC
Breast	15	13.8	109	61 -- 179	0	0.1	NC	NC -- NC	15	13.7	109	61 -- 180
Colon/Rectum	14	15.8	89	49 -- 149	6	7.1	85	31 -- 184	8	8.7	92	40 -- 182
Gallbladder	0	0.3	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.2	NC	NC -- NC
Liver / IBD	0	0.4	NC	NC -- NC	0	0.3	NC	NC -- NC	0	0.2	NC	NC -- NC
Lung/Bronchus	7	12.8	55	22 -- 113	3	8	NC	NC -- NC	4	4.8	NC	NC -- NC
Melanoma	3	1.7	NC	NC -- NC	3	0.8	NC	NC -- NC	0	0.9	NC	NC -- NC
Non-Hodgkin Lymphoma	3	2.6	NC	NC -- NC	0	1.2	NC	NC -- NC	3	1.4	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 9B
Cancer Incidence
Census Tract 6510.01, New Bedford, Massachusetts
1987-1991

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	0	0.4	NC	NC -- NC	0	0.2	NC	NC -- NC	0	0.2	NC	NC -- NC
Bladder	2	4.8	NC	NC -- NC	1	3.3	NC	NC -- NC	1	1.5	NC	NC -- NC
Breast	12	18.7	64	33 -- 112	0	0.1	NC	NC -- NC	12	18.6	65	33 -- 113
Colon/Rectum	17	18.7	91	53 -- 145	6	8.5	70	26 -- 153	11	10.2	108	54 -- 193
Gallbladder	0	0.4	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.3	NC	NC -- NC
Liver / IBD	1	0.6	NC	NC -- NC	1	0.4	NC	NC -- NC	0	0.2	NC	NC -- NC
Lung/Bronchus	18	16.5	109	65 -- 172	11	9.5	116	58 -- 208	7	7	99	40 -- 205
Melanoma	1	2.2	NC	NC -- NC	0	1.1	NC	NC -- NC	1	1.1	NC	NC -- NC
Non-Hodgkin Lymphoma	1	3.7	NC	NC -- NC	1	1.6	NC	NC -- NC	0	2.1	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 9C
Cancer Incidence
Census Tract 6510.01, New Bedford, Massachusetts
1992-1996

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	0	0.3	NC	NC -- NC	0	0.2	NC	NC -- NC	0	0.2	NC	NC -- NC
Bladder	2	4.6	NC	NC -- NC	1	3.1	NC	NC -- NC	1	1.5	NC	NC -- NC
Breast	20	19.1	105	64 -- 162	0	0.2	NC	NC -- NC	20	18.9	106	64 -- 163
Colon/Rectum	28	18	156	* 104 -- 225	12	7.9	152	78 -- 265	16	10	159	91 -- 259
Gallbladder	1	0.4	NC	NC -- NC	0	0.1	NC	NC -- NC	1	0.3	NC	NC -- NC
Liver / IBD	0	0.8	NC	NC -- NC	0	0.5	NC	NC -- NC	0	0.3	NC	NC -- NC
Lung/Bronchus	20	17.6	114	69 -- 176	10	9.2	108	52 -- 199	10	8.4	120	57 -- 220
Melanoma	1	2.7	NC	NC -- NC	1	1.4	NC	NC -- NC	0	1.3	NC	NC -- NC
Non-Hodgkin Lymphoma	6	4.5	134	49 -- 292	3	2	NC	NC -- NC	3	2.5	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 9D
Cancer Incidence
Census Tract 6510.01, New Bedford, Massachusetts
1997-2001

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	1	0.4	NC	NC -- NC	0	0.2	NC	NC -- NC	1	0.2	NC	NC -- NC
Bladder	3	4.6	NC	NC -- NC	3	3.1	NC	NC -- NC	0	1.6	NC	NC -- NC
Breast	20	20.1	99	61 -- 153	1	0.1	NC	NC -- NC	19	20	95	57 -- 148
Colon/Rectum	22	18.7	118	74 -- 178	11	7.8	140	70 -- 251	11	10.9	101	50 -- 181
Gallbladder	0	0.4	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.3	NC	NC -- NC
Liver / IBD	0	1.2	NC	NC -- NC	0	0.7	NC	NC -- NC	0	0.5	NC	NC -- NC
Lung/Bronchus	18	19.9	90	53 -- 143	8	9.5	84	36 -- 165	10	10.4	96	46 -- 177
Melanoma	3	3.7	NC	NC -- NC	3	1.9	NC	NC -- NC	0	1.8	NC	NC -- NC
Non-Hodgkin Lymphoma	4	5	NC	NC -- NC	3	2.2	NC	NC -- NC	1	2.8	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 9E
Cancer Incidence
Census Tract 6510.01, New Bedford, Massachusetts
2002-2006

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	3	0.5	NC	NC -- NC	0	0.2	NC	NC -- NC	3	0.3	NC	NC -- NC
Bladder	3	3.5	NC	NC -- NC	2	2.3	NC	NC -- NC	1	1.2	NC	NC -- NC
Breast	16	17.7	90	52 -- 147	0	0.2	NC	NC -- NC	16	17.5	91	52 -- 148
Colon/Rectum	11	16	69	34 -- 123	7	6.7	104	42 -- 214	4	9.2	NC	NC -- NC
Gallbladder	1	0.3	NC	NC -- NC	0	0.1	NC	NC -- NC	1	0.3	NC	NC -- NC
Liver / IBD	3	1.4	NC	NC -- NC	2	0.9	NC	NC -- NC	1	0.5	NC	NC -- NC
Lung/Bronchus	25	19.9	126	81 -- 186	11	8.9	123	61 -- 220	14	10.9	128	70 -- 215
Melanoma	2	4.9	NC	NC -- NC	1	2.6	NC	NC -- NC	1	2.3	NC	NC -- NC
Non-Hodgkin Lymphoma	7	5.2	134	54 -- 275	3	2.3	NC	NC -- NC	4	2.9	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 10A
Cancer Incidence
Census Tract 6511, New Bedford, Massachusetts
1982-1986

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	0	0.3	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.2	NC	NC -- NC
Bladder	5	3.9	127	41 -- 296	4	2.8	NC	NC -- NC	1	1.1	NC	NC -- NC
Breast	9	13.8	65	30 -- 124	0	0.1	NC	NC -- NC	9	13.7	66	30 -- 125
Colon/Rectum	10	14.7	68	33 -- 125	4	7.1	NC	NC -- NC	6	7.6	79	29 -- 172
Gallbladder	0	0.3	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.2	NC	NC -- NC
Liver / IBD	0	0.4	NC	NC -- NC	0	0.3	NC	NC -- NC	0	0.2	NC	NC -- NC
Lung/Bronchus	13	12.9	101	54 -- 172	8	8.1	98	42 -- 194	5	4.8	105	34 -- 244
Melanoma	0	2	NC	NC -- NC	0	1	NC	NC -- NC	0	1	NC	NC -- NC
Non-Hodgkin Lymphoma	1	2.7	NC	NC -- NC	0	1.3	NC	NC -- NC	1	1.4	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 10B
Cancer Incidence
Census Tract 6511, New Bedford, Massachusetts
1987-1991

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	0	0.3	NC	NC -- NC	0	0.2	NC	NC -- NC	0	0.2	NC	NC -- NC
Bladder	2	3.7	NC	NC -- NC	2	2.6	NC	NC -- NC	0	1.1	NC	NC -- NC
Breast	9	15.9	57	26 -- 108	0	0.1	NC	NC -- NC	9	15.8	57	26 -- 108
Colon/Rectum	18	14.1	128	76 -- 202	6	6.7	90	33 -- 196	12	7.4	163	84 -- 284
Gallbladder	1	0.3	NC	NC -- NC	0	0.1	NC	NC -- NC	1	0.2	NC	NC -- NC
Liver / IBD	1	0.5	NC	NC -- NC	1	0.3	NC	NC -- NC	0	0.2	NC	NC -- NC
Lung/Bronchus	14	13.6	103	56 -- 173	7	7.8	90	36 -- 186	7	5.8	120	48 -- 248
Melanoma	1	2.2	NC	NC -- NC	1	1.1	NC	NC -- NC	0	1.1	NC	NC -- NC
Non-Hodgkin Lymphoma	2	3.3	NC	NC -- NC	0	1.6	NC	NC -- NC	2	1.7	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 10C
Cancer Incidence
Census Tract 6511, New Bedford, Massachusetts
1992-1996

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	0	0.2	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.1	NC	NC -- NC
Bladder	3	3.2	NC	NC -- NC	3	2.3	NC	NC -- NC	0	1	NC	NC -- NC
Breast	16	15.2	105	60 -- 171	0	0.1	NC	NC -- NC	16	15	106	61 -- 173
Colon/Rectum	11	12.2	90	45 -- 162	4	5.8	NC	NC -- NC	7	6.4	110	44 -- 227
Gallbladder	1	0.2	NC	NC -- NC	0	0.1	NC	NC -- NC	1	0.2	NC	NC -- NC
Liver / IBD	1	0.6	NC	NC -- NC	0	0.4	NC	NC -- NC	1	0.2	NC	NC -- NC
Lung/Bronchus	20	13.5	148	91 -- 229	12	7.2	167	86 -- 291	8	6.3	127	55 -- 251
Melanoma	1	2.5	NC	NC -- NC	0	1.3	NC	NC -- NC	1	1.2	NC	NC -- NC
Non-Hodgkin Lymphoma	5	3.7	137	44 -- 319	4	1.8	NC	NC -- NC	1	1.8	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 10D
Cancer Incidence
Census Tract 6511, New Bedford, Massachusetts
1997-2001

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	0	0.2	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.1	NC	NC -- NC
Bladder	1	3	NC	NC -- NC	0	2.1	NC	NC -- NC	1	0.9	NC	NC -- NC
Breast	7	15.4	45 *	18 -- 94	0	0.1	NC	NC -- NC	7	15.3	46 *	18 -- 94
Colon/Rectum	16	11.7	137	78 -- 223	7	5.7	124	50 -- 255	9	6	150	68 -- 284
Gallbladder	0	0.2	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.2	NC	NC -- NC
Liver / IBD	4	0.9	NC	NC -- NC	2	0.6	NC	NC -- NC	2	0.3	NC	NC -- NC
Lung/Bronchus	17	14.1	120	70 -- 193	9	7.3	124	57 -- 235	8	6.9	117	50 -- 230
Melanoma	1	3.3	NC	NC -- NC	0	1.7	NC	NC -- NC	1	1.5	NC	NC -- NC
Non-Hodgkin Lymphoma	1	3.7	NC	NC -- NC	1	1.9	NC	NC -- NC	0	1.9	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 10E
Cancer Incidence
Census Tract 6511, New Bedford, Massachusetts
2002-2006

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	0	0.4	NC	NC -- NC	0	0.2	NC	NC -- NC	0	0.2	NC	NC -- NC
Bladder	4	2.3	NC	NC -- NC	4	1.6	NC	NC -- NC	0	0.7	NC	NC -- NC
Breast	6	14.8	41 *	15 -- 88	0	0.1	NC	NC -- NC	6	14.7	41 *	15 -- 89
Colon/Rectum	11	10.7	103	51 -- 185	5	5.3	95	31 -- 222	6	5.4	111	41 -- 242
Gallbladder	1	0.2	NC	NC -- NC	0	0.1	NC	NC -- NC	1	0.2	NC	NC -- NC
Liver / IBD	1	1.2	NC	NC -- NC	0	0.9	NC	NC -- NC	1	0.3	NC	NC -- NC
Lung/Bronchus	8	14.2	56	24 -- 111	6	6.9	86	31 -- 188	2	7.3	NC	NC -- NC
Melanoma	2	4.5	NC	NC -- NC	0	2.4	NC	NC -- NC	2	2.2	NC	NC -- NC
Non-Hodgkin Lymphoma	2	4.0	NC	NC -- NC	1	2.1	NC	NC -- NC	1	2.0	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 11A
Cancer Incidence
Census Tract 6515, New Bedford, Massachusetts
1982-1986

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	0	0.3	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.1	NC	NC -- NC
Bladder	2	3.1	NC	NC -- NC	2	2.2	NC	NC -- NC	0	0.9	NC	NC -- NC
Breast	16	10.8	147	85 -- 241	0	0.1	NC	NC -- NC	16	10.7	149	85 -- 242
Colon/Rectum	10	11.7	86	41 -- 158	3	5.5	NC	NC -- NC	7	6.2	114	46 -- 234
Gallbladder	0	0.2	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.2	NC	NC -- NC
Liver / IBD	0	0.3	NC	NC -- NC	0	0.2	NC	NC -- NC	0	0.1	NC	NC -- NC
Lung/Bronchus	6	9.7	62	23 -- 135	5	6.2	81	26 -- 190	1	3.5	NC	NC -- NC
Melanoma	1	1.5	NC	NC -- NC	1	0.7	NC	NC -- NC	0	0.8	NC	NC -- NC
Non-Hodgkin Lymphoma	0	2.1	NC	NC -- NC	0	1.0	NC	NC -- NC	0	1.1	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 11B
Cancer Incidence
Census Tract 6515, New Bedford, Massachusetts
1987-1991

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	1	0.2	NC	NC -- NC	0	0.1	NC	NC -- NC	1	0.1	NC	NC -- NC
Bladder	1	3.0	NC	NC -- NC	1	2.2	NC	NC -- NC	0	0.8	NC	NC -- NC
Breast	7	11.8	59	24 -- 122	0	0.1	NC	NC -- NC	7	11.8	60	24 -- 123
Colon/Rectum	14	11.0	128	70 -- 214	8	5.6	142	61 -- 280	6	5.3	113	42 -- 245
Gallbladder	1	0.2	NC	NC -- NC	0	0.1	NC	NC -- NC	1	0.1	NC	NC -- NC
Liver / IBD	0	0.4	NC	NC -- NC	0	0.3	NC	NC -- NC	0	0.1	NC	NC -- NC
Lung/Bronchus	9	10.2	88	40 -- 167	5	6.3	79	26 -- 185	4	3.9	NC	NC -- NC
Melanoma	0	1.7	NC	NC -- NC	0	0.9	NC	NC -- NC	0	0.8	NC	NC -- NC
Non-Hodgkin Lymphoma	3	2.5	NC	NC -- NC	1	1.3	NC	NC -- NC	2	1.2	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 11C
Cancer Incidence
Census Tract 6515, New Bedford, Massachusetts
1992-1996

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	1	0.2	NC	NC -- NC	0	0.1	NC	NC -- NC	1	0.1	NC	NC -- NC
Bladder	2	2.5	NC	NC -- NC	1	1.8	NC	NC -- NC	1	0.7	NC	NC -- NC
Breast	9	11.5	78	36 -- 148	0	0.1	NC	NC -- NC	9	11.4	79	36 -- 149
Colon/Rectum	10	9.3	108	52 -- 198	4	4.7	NC	NC -- NC	6	4.6	131	48 -- 286
Gallbladder	0	0.2	NC	NC -- NC	0	0.0	NC	NC -- NC	0	0.1	NC	NC -- NC
Liver / IBD	1	0.5	NC	NC -- NC	1	0.3	NC	NC -- NC	0	0.1	NC	NC -- NC
Lung/Bronchus	10	10.1	99	47 -- 182	5	5.7	87	28 -- 203	5	4.3	115	37 -- 269
Melanoma	0	1.9	NC	NC -- NC	0	1.0	NC	NC -- NC	0	0.9	NC	NC -- NC
Non-Hodgkin Lymphoma	1	2.8	NC	NC -- NC	1	1.5	NC	NC -- NC	0	1.3	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 11D
Cancer Incidence
Census Tract 6515, New Bedford, Massachusetts
1997-2001

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	0	0.2	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.1	NC	NC -- NC
Bladder	2	2.2	NC	NC -- NC	1	1.6	NC	NC -- NC	1	0.6	NC	NC -- NC
Breast	12	12.0	100	51 -- 174	0	0.1	NC	NC -- NC	12	12.0	100	52 -- 175
Colon/Rectum	10	8.7	114	55 -- 210	6	4.2	142	52 -- 308	4	4.5	NC	NC -- NC
Gallbladder	0	0.2	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.1	NC	NC -- NC
Liver / IBD	2	0.7	NC	NC -- NC	2	0.5	NC	NC -- NC	0	0.2	NC	NC -- NC
Lung/Bronchus	11	10.6	104	52 -- 186	7	5.4	129	52 -- 266	4	5.2	NC	NC -- NC
Melanoma	1	2.5	NC	NC -- NC	1	1.3	NC	NC -- NC	0	1.2	NC	NC -- NC
Non-Hodgkin Lymphoma	8	2.8	283 *	122 -- 559	4	1.4	NC	NC -- NC	4	1.4	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

TABLE 11E
Cancer Incidence
Census Tract 6515, New Bedford, Massachusetts
2002-2006

Cancer Type	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Other Biliary Tract	0	0.3	NC	NC -- NC	0	0.1	NC	NC -- NC	0	0.1	NC	NC -- NC
Bladder	2	1.7	NC	NC -- NC	1	1.2	NC	NC -- NC	1	0.5	NC	NC -- NC
Breast	11	11.8	93	47 -- 167	0	0.1	NC	NC -- NC	11	11.7	94	47 -- 169
Colon/Rectum	15	8.1	184 *	103 -- 304	6	4.0	152	55 -- 330	9	4.2	215	98 -- 408
Gallbladder	1	0.2	NC	NC -- NC	0	0.0	NC	NC -- NC	1	0.1	NC	NC -- NC
Liver / IBD	1	0.9	NC	NC -- NC	1	0.7	NC	NC -- NC	0	0.3	NC	NC -- NC
Lung/Bronchus	10	10.9	92	44 -- 168	8	5.2	153	66 -- 301	2	5.7	NC	NC -- NC
Melanoma	1	3.5	NC	NC -- NC	1	1.8	NC	NC -- NC	0	1.7	NC	NC -- NC
Non-Hodgkin Lymphoma	2	3.1	NC	NC -- NC	2	1.5	NC	NC -- NC	0	1.5	NC	NC -- NC

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Data Source: Massachusetts Cancer Registry, Bureau of Health Information, Statistics, Research and Evaluation, Massachusetts Department of Public Health.

APPENDICES

Appendix A

New Bedford Blood Serum PCB Testing Program: PCB Serum Analysis Consent Forms

The Commonwealth of Massachusetts
Executive Office of Health and Human Services
Department of Public Health
Bureau of Environmental Health
250 Washington Street, Boston, MA 02108-4619
Phone: 617-624-5757 Fax: 617-624-5777
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SECRETARY

JOHN AUERBACH
COMMISSIONER

AN EVALUATION OF POTENTIAL PCB EXPOSURE AT NEW BEDFORD HIGH SCHOOL, KEITH MIDDLE SCHOOL AND SURROUNDING NEIGHBORHOOD, NEW BEDFORD, MA

ADULT CONSENT FORM FOR PARTICIPANT INTERVIEW

Purpose: The Massachusetts Department of Public Health (MDPH) is offering to administer an exposure assessment questionnaire to school administration, faculty and staff as well as to surrounding residents of the New Bedford High School and Keith Middle School who are concerned about exposure to polychlorinated biphenyls (PCBs). PCB blood serum testing will be offered to individuals who are determined to have the greatest potential for exposure to PCBs by virtue of working in the schools and/or living in the surrounding neighborhood. The serum PCB results will allow MDPH to assess the magnitude of PCB exposure among participants and to address the concerns of the community. You have requested to participate in this effort.

Procedure: Your participation in the interview stage of this evaluation is voluntary and you may withdraw at any time. If you participate in the interview stage of this evaluation, you will be asked to give approximately 45 minutes of your time to respond to an interview by the Massachusetts Department of Public Health. Interviewers will ask questions regarding your residential history, occupational history, affiliation with the two schools, dietary consumption and personal contact information. These questions will be used to identify individuals with the greatest potential for exposure to PCBs.

Risks: There are no risks involved in participating in the interview stage of this evaluation.

Benefits: There are no direct benefits to you for participating in the interview phase of this evaluation other than learning more about your opportunities for exposure to PCBs. Your participation may lead to your being contacted to provide a blood sample for serum PCB analysis. Only individuals identified through this interview as having the greatest potential for exposure to PCBs by virtue of working in the schools and/or living in the surrounding neighborhood will be contacted to participate in the measurement of serum PCB levels in the blood.

Alternatives: This evaluation is being conducted by the Massachusetts Department of Public Health as a public health service to the community of New Bedford, MA. You may choose not to participate in this evaluation.

Payment for Participation: You will not receive payment for your time or participation in this evaluation.

No Additional Costs: There will be no financial charge to you for your participation in this evaluation.

Confidentiality: Every effort will be made to maintain participant confidentiality. The Commissioner of the Massachusetts Department of Public Health has approved this study under the provisions outlined in M.G.L. c. 111, s. 24A, which protects the confidentiality of all information collected as part of this evaluation. Under the provisions of that statute, the Department and all of its employees and agents involved in the *Evaluation of Potential PCB Exposure at New Bedford High School, Keith Middle School, and Surrounding Neighborhood, New Bedford, MA* are prohibited from releasing any individually identifying information provided by you. 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 you provide. Your information will be assigned a random identification number and all personally identifying data will be kept in locked storage files.

I have read the description of this evaluation or have had it explained to me. I have been informed of the risks and benefits involved and all of my questions have been answered to my satisfaction. I will receive a copy of this consent form.

I understand that I am free to withdraw this consent and discontinue participation in this evaluation at any time.

I voluntarily consent to participate in the interview phase of the *Evaluation of Potential PCB Exposure at New Bedford High School, Keith Middle School, and Surrounding Neighborhood, New Bedford, MA* with the Massachusetts Department of Public Health.

Signature of Participant	Print Name	Date

In addition, I agree to be re-contacted if I am selected to participate in the PCB blood serum testing phase of this evaluation.

Yes ☐ No ☐ Initial _____

Signature of Interviewer	Print Name	Date

The Commonwealth of Massachusetts
Executive Office of Health and Human Services
Department of Public Health
Bureau of Environmental Health
250 Washington Street, Boston, MA 02108-4619
Phone: 617-624-5757 Fax: 617-624-5777
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AN EVALUATION OF POTENTIAL PCB EXPOSURE AT NEW BEDFORD HIGH SCHOOL, KEITH MIDDLE SCHOOL AND SURROUNDING NEIGHBORHOOD, NEW BEDFORD, MA

ADULT CONSENT FORM FOR SERUM PCB ANALYSIS

Purpose: The Massachusetts Department of Public Health (MDPH) is offering polychlorinated biphenyl (PCB) serum testing as a public service to select school administration, faculty and staff as well as to surrounding residents of the New Bedford High School and Keith Middle School. Blood testing for serum PCB analysis is being offered to select individuals, identified in the interview stage of the evaluation, who are determined to have the greatest potential for exposure to PCBs by virtue of working in the schools and/or living in the surrounding neighborhood. Blood testing for serum PCB analysis is also being offered as a public service to other participants interviewed. The serum PCB results will allow MDPH to assess the magnitude of PCB exposure among study participants, which may help guide future activities at the two school sites as well as to address the concerns of the community. You have requested to participate in this effort.

Procedure: Your participation in the blood testing phase of this evaluation is voluntary and you may withdraw at any time. If you participate in this stage of the evaluation, a blood sample will be taken to determine the level of PCBs in your blood. The blood will be taken from a vein in your arm and will require the use of a hypodermic needle and vacutainer. Approximately 20 ml of blood will be drawn. Your blood sample will be tested for PCBs and lipids. PCB results are reported on a lipid-adjusted basis because PCBs tend to concentrate in lipid (fatty) tissue. The sample will be destroyed after the analysis and quality control measures are completed. MDPH staff will administer a short questionnaire (approximately 5 to 10 minutes) at the time of the blood draw. The purpose of the questionnaire is to collect important information that may be associated with an individual's PCB exposure and that may help with the interpretation of the results.

Risks: The blood collection procedure usually involves little pain or discomfort, but occasionally some discomfort may occur after the blood sample is obtained. Other risks, while unlikely, will be explained by the staff from Favorite Healthcare Staffing, Inc., who will be taking the blood samples.

ADULT CONSENT FORM FOR SERUM PCB ANALYSIS

Benefits: By participating in the blood serum testing stage of this evaluation, you will be notified of the results of your PCB blood test after all laboratory testing and quality control measures have been completed. If your test results indicate you have elevated serum PCBs, you understand there is no medical treatment to reduce your current PCB levels. MDPH will however offer to counsel you on behaviors to reduce your risk of future exposure.

Alternatives: This evaluation is being conducted by the Massachusetts Department of Public Health as a public health service to the community of New Bedford, MA. You may choose not to participate in this evaluation.

Payment for Participation: You will not receive payment for your time or participation in this evaluation.

No Additional Costs: There will be no financial charge to you for the blood collection and serum PCB analysis.

Confidentiality: Every effort will be made to maintain participant confidentiality. The Commissioner of the Massachusetts Department of Public Health has approved this study under the provisions outlined in M.G.L. c. 111, s. 24A, which protects the confidentiality of all information collected as part of this evaluation. Under the provisions of that statute, the Department and all of its employees and agents involved in the *Evaluation of Potential PCB Exposure at New Bedford High School, Keith Middle School, and Surrounding Neighborhood, New Bedford, MA* are prohibited from releasing any individually identifying information provided by you. 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 you provide. Your information will be assigned a random identification number and all personally identifying data will be kept in locked storage files.

ADULT CONSENT FORM FOR SERUM PCB ANALYSIS

I have read the description of this evaluation or have had it explained to me. I have been informed of the risks and benefits involved and all of my questions have been answered to my satisfaction. I will receive a copy of this consent form.

I understand that I am free to withdraw this consent and discontinue participation in this evaluation at any time.

I voluntarily consent to participate in the PCB blood serum testing phase of the *Evaluation of Potential PCB Exposure at New Bedford High School, Keith Middle School, and Surrounding Neighborhood, New Bedford, MA* with the Massachusetts Department of Public Health.

Signature of Participant	Print Name	Date

Signature of Interviewer	Print Name	Date

Appendix B

New Bedford Blood Serum PCB Testing Program: Questions & Answers

The Commonwealth of Massachusetts
Executive Office of Health and Human Services
Department of Public Health
Bureau of Environmental Health
250 Washington Street, Boston, MA 02108-4619
Phone: 617-624-5757 Fax: 617-624-5777
TTY: 617-624-5286

Questions and Answers

New Bedford Blood Serum PCB Testing Program
New Bedford High School/ Keith Middle School and Neighborhood Surrounding the Schools

1. Who will analyze my blood sample for PCBs?

The Environmental Chemistry Lab at the Massachusetts Department of Public Health's (MDPH) William A. Hinton State Laboratory Institute will analyze the samples for PCBs and MDPH's Lemuel Shattuck Hospital will analyze the samples for lipids. Lipid adjustment is important because PCBs tend to concentrate in lipid (fatty) tissue.

2. When will I obtain the results of my blood test for PCBs?

Once blood sample results have been analyzed, those who gave blood samples will be sent individual letters with only their own serum PCB results. According to the State Laboratory Institute, all of the analyses will be completed by December 2009. However, MDPH will be reviewing results as they are analyzed and if an individual's serum PCB level raises any immediate health concerns, they will be contacted immediately. A final report summarizing the results of all blood samples analyzed will be prepared; however, it will not identify any individual's results.

3. How will the blood test results be evaluated?

Your results will be compared to Centers for Disease Control (CDC) National Health and Nutrition Examination Survey (NHANES) biomonitoring data for the civilian U.S. population for the period 2003-2004. NHANES is a nationally representative survey and these data provide health professionals with a reference range so that they can determine if any specific individuals have been exposed to higher levels of PCBs than the general U.S. population. Most people in the U.S. have low but detectable levels of PCBs in their serum due to diet or the general environment.

4. If I have questions, who should I contact?

You can call the MDPH Bureau of Environmental Health, Community Assessment Program at 617-624-5757 if you have additional questions.

Appendix C

ICD Codes for Selected Cancer Types

ICD CODES FOR SELECTED CANCER TYPES IN THIS REPORT

Cancer Site / Type	ICD-O-3[5]	
	Primary Site Codes	**Histology Type Codes[6]**
Other Biliary Tract	C24.0 – C24.9	all except 9590 - 9989
Urinary Bladder	C67.0 - C67.9	all except 9590 - 9989
Breast	C50.0 - C50.9	all except 9590 - 9989
Colon/Rectum	C18.0 - C18.9, C19.9, C20.9, C26.0	all except 9590 - 9989
Gallbladder	C23.9	all except 9590 - 9989
Liver and Intrahepatic Bile Ducts	C22.0, C22.1	all except 9590 - 9989
Lung/Bronchus	C34.0 - C34.9	all except 9590 - 9989
Melanoma of Skin	C44.0 - C44.9	includes 8720 - 8790
Non-Hodgkin Lymphoma	C00.0 - C80.9 all sites except C42.0, C42.1, C42.4	includes 9590 - 9595, 9670 – 9729 includes 9823, 9827

[5] *International Classification of Diseases for Oncology, 3d Ed.* (2) (includes codes added since publication)

[6] Only invasive cancers (those with invasive behaviors) are included in this report.