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Follow-up Report: Evaluation of Hodgkin's Disease and Non-Hodgkin's Lymphoma Incidence in Stoughton Census Tracts 4563 and 4564.01, MA, 1995-2000

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Follow-up Report: Evaluation of Hodgkin's Disease and Non-Hodgkin's Lymphoma Incidence in Stoughton Census Tracts 4563 and 4564.01, MA, 1995-2000

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I. INTRODUCTION/BACKGROUND

In June of 1999, the Community Assessment Program (CAP) of the Massachusetts Department of Public Health (MDPH), Center for Environmental Health (CEH) completed an assessment of cancer incidence in census tracts 4563 and 4564.01 in Stoughton, Massachusetts (MDPH 1999) (see Appendix A). The CEH conducted this assessment in response to a request by Representative Louis Kafka and the Stoughton Citizens' Association. The report evaluated the incidence of eleven cancer types, including cancers of the bladder, brain, breast, kidney, liver, lung, pancreas, and stomach as well as leukemia, Hodgkin's disease, and non-Hodgkin's lymphoma (NHL), during the time period 1982-1994 in the town of Stoughton overall and in smaller geographic areas within the town (i.e., census tracts) (see Figure 1). The MDPH report specifically addressed cancer incidence in the Canton Street area of Stoughton in proximity to several sites of environmental concern, including census tracts (CTs) 4563 and 4564.01 (refer to Figure 2).

The results of that assessment indicated that for the town of Stoughton, the majority of cancer types reviewed occurred approximately as often as or less often than expected based on statewide incidence rates for the time period 1982-1994. Similar trends were observed in CT 4563 and no cancer types displayed statistically significant elevations in incidence in this census tract. However, in CT 4564.01, statistically significant elevations were observed in the incidence of Hodgkin's disease and NHL. Although the incidence of these two cancer types was statistically elevated in CT 4564.01, no specific geographic patterns of cancer diagnoses were apparent in this census tract or anywhere else in the town of Stoughton (MDPH 1999).

To further address community concerns about the possible relationship between cancer and environmental exposures in the Canton Street area, the 1999 MDPH assessment considered available environmental sampling data from investigations conducted by the Massachusetts Department of Environmental Protection (MDEP) and several private environmental consulting firms. In summary, these data revealed groundwater contamination by volatile organic compounds at three sites: Arc-Les Corporation at 1490 Central Street (HMM 1994a, Earth Tech 1995); Brookfield Engineering at 240 Cushing Street (Fuss & O'Neil 1998); and F.C Phillips, Inc. at 473 Washington Street (H&A 1986, 1987) (see Figure 2). During the excavation of

several underground storage tanks at another Ark-Les Facility at 53 Evans Drive, contaminated soil was discovered (HMM 1994b). Furthermore, releases of gasoline and other petroleum products have been documented at the site of Environmental Compliance Corporation (formerly Jet-Line Services) at 441 Canton Street (Phoenix 1998).

Review of environmental sampling data, the operational history of the facilities, and the location of several other nearby facilities with suspected releases of hazardous substances indicated that the approximate area that appeared to be most affected by environmental contamination from these sites is the area within CT 4563 bordered by Canton, Central, and Washington Streets (MDEP 1998) (see Figure 2). Qualitative examination of the geographic distribution of cancer diagnoses revealed no specific pattern in this area and none of the residences of individuals diagnosed with either NHL or Hodgkin's disease between 1982 and 1994 were located within this area (MDPH 1999).

The results of the 1999 assessment did not suggest that the environment was likely to be playing a primary role in the pattern of cancer incidence in CTs 4563 and 4564.01. At that time, however, MDEP was continuing environmental investigations and it was not possible to determine the full nature and extent of contamination in the area. For this reason, the MDPH recommended continued surveillance of cancer in Stoughton. In addition, the MDPH agreed to evaluate the pattern of cancer incidence in CTs 4563 and 4564.01 in relation to additional environmental data.

The purpose of the current report is to update cancer incidence analyses for the town of Stoughton and CTs 4563 and 4564.01 for the years 1995-2000, the most recent time period for which complete data are available. The cancer types reviewed in this report include Hodgkin's disease and NHL because they displayed statistically significant elevations in incidence during the earlier time period, 1982-1994, and because the scientific literature suggests that environmental factors (e.g., exposure to chemicals) may be associated with their development. In addition, the CAP reviewed more recent environmental sampling data available from the MDEP for groundwater in Stoughton.

II. METHODS FOR EVALUATING CANCER INCIDENCE

To determine whether an atypical pattern of cancer in Stoughton CTs 4563 and 4564.01 exists, the CAP reviewed Massachusetts Cancer Registry (MCR) data files for residents of Stoughton who had been diagnosed with Hodgkin's disease or NHL during 1995-2000. [Coding for cancer types in this report follows the International Classification of Diseases for Oncology (ICD-O) system. See Appendix B for the incidence coding definitions used in this report for these cancer types.] The MCR, a division within the MDPH Center for Health Information, Statistics, Research and Evaluation, is a population based surveillance system that has been monitoring cancer incidence in the Commonwealth since 1982. All new diagnoses of cancer among Massachusetts residents are required by law to be reported to the MCR within six months of the date of diagnosis (M.G.L. c.111. s 111b). This information is kept in a confidential database. Data are collected on a daily basis and are reviewed for accuracy and completeness on an annual basis. This process corrects misclassification of data (e.g., city/town misassignment) and deletes duplicate case reports. Once these steps are finished, the data for that year are considered "complete." At the time of this investigation, complete data records include diagnoses that occurred from 1/1/1982 – 12/31/2000. Due to the volume of information received by the MCR, the large number of reporting facilities, and the six-month period between diagnosis and required reporting, the most current registry data that are complete will inherently be a minimum of two years prior to the current date. The 6-year period from 1995-2000 constitutes the time period for which the most recent and complete cancer incidence data were available from the MCR at the time of this investigation.[1]

In order to determine whether cancer incidence in a community is occurring at a higher or lower rate than expected, a statistic called the standardized incidence ratio (SIR) is calculated using data from the MCR. More specifically, an SIR is the number of observed cancer cases in a town (or census tract) divided by the number of expected cases based on the population of the town

[1] The data summarized here are drawn from data entered on MCR computer files before July 29, 2004. The numbers presented may differ slightly from those published in previous or future reports, reflecting late reported cases, address corrections, or other changes based on subsequent details from reporting facilities.

(or census tract) and the state's cancer rates.[2] An SIR greater than 100 indicates that more cancer cases occurred than expected; an SIR less than 100 means that fewer cases occurred than expected. For example, an SIR of 150 is interpreted as 50 percent more cases than expected; an SIR of 90 indicates 10 percent fewer cases than expected. When an SIR is statistically significant, as indicated in the table by an asterisk symbol (*), there is less than a 5% chance that the observed number of cases is due to chance alone. SIRs and 95% confidence intervals (CIs), statistics used to help interpret the SIR, are not calculated when the observed number of cases is less than five. A more detailed explanation of SIRs and 95% CIs is provided in Appendix C.

Because accurate age group and gender specific population data are required to calculate SIRs, the census tract (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 2,500 and 8,000 persons and are designed to be homogenous with respect to population characteristics. According to the U.S. Census, the town of Stoughton is subdivided into six census tracts (i.e., CTs 4561.01, 4561.02, 4562, 4563, 4564.01, and 4564.02) (U.S. DOC 2000). The town boundaries and census tract locations for Stoughton are illustrated in Figure 1. SIRs were calculated for Hodgkin's disease and NHL for the town of Stoughton as a whole and for CTs 4563 and 4564.01.

In addition to calculating SIRs, place of residence at the time of diagnosis was mapped for each individual diagnosed with either of these cancer types in Stoughton using a computerized geographic information system (GIS) (ESRI 2002). This allowed assignment of census tract location for each case as well as a qualitative evaluation of the spatial distribution of diagnoses at a smaller geographic level (i.e., neighborhoods). Cases for which census tract designation was not possible due to inadequate address information were included in the town totals for Stoughton. The geographic pattern was determined using a qualitative evaluation of the point pattern of individuals diagnosed with cancer to assess any possible concentrations of cases. For confidentiality reasons, maps of the location of individuals diagnosed with cancer cannot be

[2] 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 here.

provided here. However, a summary of this evaluation with any notable findings is presented in this report.

III. RESULTS

A. Review of Environmental Data

The primary geographic area of environmental concern was identified in the original health assessment to be a neighborhood in CT 4563 defined by the boundaries of Canton, Central, and Washington Streets. Prior to 1999, several private wells in the Canton Street neighborhood showed evidence of volatile organic compound (VOC) contamination; however, the extent of this contamination remained uncertain because relatively few groundwater samples had been collected. In order to determine the extent of groundwater contamination at known sites of environmental concern and to identify any new areas that may be impacted by groundwater contamination, the MDEP and U.S. Environmental Protection Agency (EPA) undertook a townwide groundwater sampling survey of private wells between March 1998 and January 2000 (MDEP 1999). Approximately half of the samples were drinking water wells and half were irrigation wells. The majority of drinking water wells were chosen at random for inclusion in the groundwater survey; the remaining drinking water wells, and all of the irrigation wells, were selected because of their proximity to known or suspected hazardous waste sites. After the initial sampling, the MDEP expanded this water quality survey by sampling additional drinking water, irrigation, and monitoring wells in the town of Stoughton.

Results of these sampling activities indicate that groundwater contamination of VOCs is not restricted to the area bounded by Canton, Central, and Washington Streets. Additionally, groundwater contamination exists in CT 4564.01. The recent sampling results showed that the compounds most frequently detected above drinking water standards were tetrachloroethylene (PCE) and trichloroethylene (TCE). Considering all types of sampling, detected PCE levels were generally highest in the central areas of CTs 4563 and 4564.01 and detected TCE levels were generally highest in some central and eastern regions of the study area. As a result of the more recent sampling, MDEP informed individual homeowners of their contaminant levels and took steps to eliminate/reduce exposure opportunities for area residents (MDEP 2004).

B. Cancer Incidence Analyses

1. Hodgkin's disease

Table 1 summarizes the results of cancer incidence analyses previously conducted for Hodgkin's disease during 1982-1994 in the town of Stoughton and the two census tracts of concern (i.e., CTs 4563 and 4564.01) (MDPH 1999). Townwide, Hodgkin's disease occurred as expected during this time period (13 diagnoses observed vs. 13.2 expected, SIR = 99). However, a statistically significant elevation was observed in the incidence of this cancer type in CT 4564.01 (5 diagnoses observed vs. 1.5 expected, SIR = 337, 95% CI = 109-786). There was one diagnosis of Hodgkin's disease in CT 4563 compared to 4.3 expected.

Table 1: Hodgkin's disease incidence in Stoughton, MA and selected census tracts: 1982-1994

	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Town total	13	13.2	99	52-169	7	7.1	99	39-203	6	6.1	99	93-119
CT 4563	1	4.3	NC	NC	1	2.0	NC	NC	0	2.4	NC	NC
CT 4564.01	5	1.5	337*	109-786	1	0.8	NC	NC	4	0.7	NC	NC

Notes: Obs = observed; Exp = expected; 95% CI = 95% confidence interval; NC = not calculated; * = statistical significance

Review of more recent data for the time period 1995-2000 revealed an elevation in the incidence of Hodgkin's disease for the town of Stoughton as a whole (9 diagnoses observed vs. 5.7 expected, SIR = 158). This elevation was primarily the result of a statistically significant elevation in the incidence of this cancer type among males in the town (8 diagnoses observed vs. 3.1 expected, SIR = 258, 95% CI = 111-509). One female was diagnosed with Hodgkin's disease in Stoughton during this time period compared to 2.6 diagnoses expected.

SIRs were not calculated for Hodgkin's disease in Stoughton CTs 4563 and 4564.01 for 1995-2000 due to the small number of observed diagnoses (i.e., less than five); however, expected numbers were calculated to determine whether excess numbers of diagnoses occurred. In CT 4563, three diagnoses of Hodgkin's disease were observed during the time period 1995-2000 compared to about 1.5 expected. In CT 4564.01, Hodgkin's disease was statistically

significantly elevated during the earlier time period 1982-1994, but occurred about as expected during 1995-2000 (one diagnosis vs. 0.6 expected). See Table 2 for a summary of these data.

Table 2: Hodgkin's disease incidence in Stoughton, MA and selected census tracts: 1995-2000

	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Town total	9	5.7	158	72-300	8	3.1	258*	111-509	1	2.6	NC	NC
CT 4563	3	1.5	NC	NC	2	0.8	NC	NC	1	0.7	NC	NC
CT 4564.01	1	0.6	NC	NC	1	0.3	NC	NC	0	0.3	NC	NC

Notes: Obs = observed; Exp = expected; 95% CI = 95% confidence interval; NC = not calculated; * = statistical significance

2. Non-Hodgkin's lymphoma

Table 3 summarizes the results of cancer incidence analyses previously conducted for NHL during 1982-1994 in the town of Stoughton and the two census tracts of concern (i.e., CTs 4563 and 4564.01) (MDPH 1999). NHL occurred slightly more often than expected in the town as a whole during this time period (56 diagnoses observed vs. 52.6 expected, SIR = 106), but the observed elevation was not statistically significant. While residents in CT 4563 experienced NHL about as expected during 1982-1994 (16 diagnoses observed vs. 16.4 expected, SIR = 98), a statistically significant elevation in the incidence of NHL was noted in CT 4564.01 (16 diagnoses observed vs. 5.6 expected, SIR = 285, 95% CI = 163-463). Both males and females in this census tract experienced increased rates of NHL; however, the elevation among males reached the level of statistical significance.

Table 3: NHL incidence in Stoughton, MA and selected census tracts: 1982-1994

	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Town total	56	52.6	106	80-138	27	27.6	98	64-142	29	25.0	116	78-167
CT 4563	16	16.4	98	56-159	5	8.2	61	20-142	11	8.1	135	67-242
CT 4564.01	16	5.6	285*	163-463	10	3.1	326*	156-599	6	2.5	236	86-514

Notes: Obs = observed; Exp = expected; 95% CI = 95% confidence interval; NC = not calculated; * = statistical significance

During 1995-2000, NHL occurred more often than expected in the town of Stoughton as a whole (45 diagnoses observed vs. 34.4 expected, SIR = 131); however, the elevation was not statistically significant (95% CI = 95-175). Both males and females experienced elevations in the incidence of this cancer type. Specifically, 26 males townwide were diagnosed with NHL compared to 17.7 expected (SIR = 147, 95% CI = 96-215) and 19 females were diagnosed compared to 16.7 expected (SIR = 114, 95% CI = 68-178).

NHL incidence trends in Stoughton CT 4563 were somewhat similar to trends in the town as a whole. Among males and females combined, 13 diagnoses were observed compared to 10 expected (SIR = 130) during 1995-2000. This elevation was not statistically significant. In contrast to the statistically significant elevation in NHL incidence in CT 4564.01 observed during 1982-1994, NHL occurred about as expected in this CT during 1995-2000. Specifically, four individuals were diagnosed with this disease compared to 3.5 expected. See Table 4 for a summary of these data.

Table 4: NHL incidence in Stoughton, MA and selected census tracts: 1995-2000

	Total				Males				Females			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
Town total	45	34.4	131	95-175	26	17.7	147	96-215	19	16.7	114	68-178
CT 4563	13	10.0	130	69-222	7	4.9	143	57-295	6	5.2	116	43-253
CT 4564.01	4	3.5	NC	NC	1	1.9	NC	NC	3	1.6	NC	NC

Notes: Obs = observed; Exp = expected; 95% CI = 95% confidence interval; NC = not calculated; * = statistical significance

C. Geographic Distribution

A review of the geographic pattern of individuals diagnosed with Hodgkin's disease or NHL in Stoughton during 1995-2000 revealed no apparent spatial concentrations at the neighborhood level that are not likely attributed to factors such as higher population density (e.g., the presence of multi-unit housing complexes in and around the center of town). That is, no atypical patterns with respect to place of residence emerged. Despite a statistically significant elevation in the incidence of Hodgkin's disease among males in Stoughton, the distribution of individuals diagnosed with this cancer type seemed to coincide closely with the pattern of population in the

town. Finally, there were no apparent concentrations of diagnoses (of either Hodgkin's disease or NHL) in neighborhoods within Stoughton CTs 4563 and 4564.01 or in relation to sites of environmental concern.

When diagnoses of Hodgkin's disease and NHL for the earlier time period, 1982-1994, were included in the geographic distribution analysis with new information, similar trends were observed. That is, for individuals diagnosed with either of these cancer types during 1982-2000, no unusual spatial concentrations of diagnoses were observed in Stoughton CTs 4563 and 4564.01 or in relation to facilities with suspected releases of hazardous materials or known areas of groundwater contamination.

IV. DISCUSSION AND CONCLUSIONS

Previous cancer incidence analyses for the time period 1982-1994 revealed that Hodgkin's disease and NHL occurred about as often as expected in the town as a whole. However, statistically significant elevations were noted for both Hodgkin's disease and NHL in CT 4564.01 during this time period (MDPH 1999). Analysis of data for the time period 1995-2000 suggests different trends in incidence for more recent years. In the town of Stoughton as a whole, Hodgkin's disease and NHL occurred more often than expected during 1995-2000. These elevations, however, were not statistically significant. A statistically significant elevation was observed in the incidence of Hodgkin's disease among males in the town as a whole. In Stoughton CTs 4563 and 4564.01, the incidence of Hodgkin's disease and NHL was about as expected during 1995-2000. The recent data suggests that the elevations observed previously in this area of Stoughton have not persisted. Based on the review of cancer incidence data and environmental information summarized in this report, it does not appear that an atypical pattern of Hodgkin's disease or NHL is occurring in any one area of either of Stoughton CTs 4563 or 4564.01. There were no spatial patterns of disease within either census tract or near sites of environmental concern that would suggest a common factor (environmental or non-environmental) related to the incidence of these cancer types among residents in the area. Appendix C of this report includes information about risk factors for the development of Hodgkin's disease and NHL.

The MDPH does not recommend any further evaluation of cancer incidence in Stoughton at this time but will continue to monitor the incidence of all cancer types in the town through city/town cancer incidence reports published by the Massachusetts Cancer Registry.

V. REFERENCES

Earth Tech. 1995. Limited groundwater and surface water quality study, Arc-Les Corporation, 1490 Central Street, Stoughton, Massachusetts. Concord, MA: Earth Tech.

Environmental Systems Research Institute (ESRI). 2002. ArcGIS, Arcview license, ver. 8.3, Redlands, California.

Fuss & O'Neil. 1998. IRA Status Report, Brookfield Engineering Laboratory, Inc., 240 Cushing Street, Stoughton, Massachusetts. Manchester, CT: Fuss & O'Neil, Inc.

H&A. 1986. Report on Site Assessment, 473 Washington Street, Stoughton, Massachusetts. Cambridge, MA: Haley and Aldrich, Inc.

H&A. 1987. Report on Phase II Site Assessment for F.C. Phillips, Inc., Stoughton, Massachusetts. Cambridge, MA: Haley and Aldrich, Inc.

HMM. 1994a. Transition Site Classification Review, Ark-Les Corporation, 1490 Central Street, Stoughton, MA. Concord, MA: HMM Associates, Inc.

HMM. 1994b. LSP Evaluation Opinion Transmittal Form and RAO Statement, Ark-Les Corporation, 53 Evans Drive, Stoughton, Massachusetts. Concord, MA: HMM Associates, Inc.

Massachusetts Department of Environmental Protection (MDEP). 1998. Personal communication with Gerard Martin, Chief, Site Management & Permits Section, Bureau of Waste Site Cleanup, Massachusetts Department of Environmental Protection, Southeast Regional Office, Lakeville, MA. November 20th, 1998.

Massachusetts Department of Environmental Protection (MDEP). 1999. Personal communication with Gerard Martin, Chief, Site Management & Permits Section, Bureau of Waste Site Cleanup, Massachusetts Department of Environmental Protection, Southeast Regional Office, Lakeville, MA. June 8th, 1999.

Massachusetts Department of Environmental Protection (MDEP). 2004. Personal communication with James Kenny, Environmental Analyst, Bureau of Waste Site Cleanup, Massachusetts Department of Environmental Protection, Southeast Regional Office, Lakeville, MA. December 7, 2004.

Massachusetts Department of Public Health (MDPH). 1999. Assessment of Cancer Incidence in Census Tracts, 4563.00 and 4564.01 in Stoughton, Massachusetts 1982-1994. June 1999.

Phoenix. 1998. Assessment and Monitoring Summary Report, Environmental Compliance Corporation, 441 Canton Street, Stoughton, Massachusetts. Bedford, MA: Phoenix Environmental Services, Inc.

U.S. Department of Commerce (U.S. DOC). 2000. Census of Population: General Population Characteristics, Massachusetts. U.S. Department of Commerce, Washington, DC: US Government Printing Office.

APPENDIX A

Assessment of Cancer Incidence in Census Tracts 4563 and 4564.01 in Stoughton, Massachusetts: 1982-1994

June 1999

APPENDIX B

Cancer Incidence Coding Definitions

APPENDIX C

Explanation of a Standardized Incidence Ratio and 95% Confidence Interval

APPENDIX D

Risk Factor Information for Selected Cancer Types