Cancer Incidence among Residents of Census Tract 903.02 Riverside, Montgomery County, Ohio

Valley Pike Volatile Organic Compounds (VOC) Site

1996 -2012

Public Health – Dayton & Montgomery County
Epidemiology Department

FINAL REPORT (REVISED)
FEBRUARY 2016

INTRODUCTION

A. Background

An assessment of the burden of cancer among residents of Census Tract (CT) 903.02 in Riverside, Montgomery County, Ohio was conducted by the Epidemiology Department within Public Health - Dayton & Montgomery County (PHDMC) in response to a request from the PHDMC Environmental Health Division in March 2015. The Environmental Health Division has been working with the Agency for Toxic Substance and Disease Registry (ASTDR) and the U.S. Environmental Protection Agency (U.S. EPA) to conduct a vapor intrusion investigation within homes located in the Valley Pike Volatile Organic Compounds (VOC) Site in Riverside, Ohio. This is a residential neighborhood within CT 903.02.

During a site inspection at Mullins Rubber Products (MRP) in November of 2010, Ohio Environmental Protection Agency (Ohio EPA) noted tetrachloroethylene (PCE) and trichloroethylene (TCE) groundwater contamination. Subsequent inspections found PCE and TCE in both shallow and deep aquifers on the perimeter of MRP and in groundwater underlying a residential area boarding MRP to the west and southwest. In May of 2013, Ohio EPA officially expressed their concerns regarding the risk to human health from indoor air exposure to TCE and PCE contaminated groundwater. The Health Assessment Section of the Ohio Department of Health (ODH), under a Cooperative Agreement with the ASTDR, provided health-based guidance to include sub-slab and indoor air screening levels, cancer risks, and noncancerous health risks for PCE and TCE.[1,2]

Initial sampling of groundwater and soil gas within the residential area and sub-slab and indoor air within residential property indicated the contaminants were entering the homes in this area. Based on these preliminary findings, it was determined that a completed pathway of exposure has been established in this neighborhood. A completed pathway of exposure is said to exist when sampling data finds that residents are being exposed to and inhaling air containing contaminants of concern exceeding health-based standards.

Tretrachloroethylene (PCE) is considered "likely to be carcinogenic to humans by all routes of exposure" by the Environmental Protection Agency (EPA)[3] and "probably carcinogenic to humans" by the International Agency for Research on Cancer (IARC).[4] Long-term exposure to PCE might lead to a higher risk of bladder cancer, multiple myeloma, or non-Hodgkin lymphoma. There is strong evidence of cancer risk in animals, but the evidence in humans is limited.[5] Strong evidence supports that long-term exposure to trichloroethlyene (TCE) can cause kidney cancer in humans and some evidence that it can cause liver cancer and non-Hodgkin lymphoma in humans.[6] Both the EPA and IARC have classified TCE as "carcinogenic to humans."[7,4] Chronic exposure to PCE and TCE in contaminated drinking water have been associated with increased levels of leukemia.[8,9]

With a completed pathway of exposure identified and a vapor intrusion investigation underway, PHDMC believed it was important to also conduct a cancer investigation. This assessment included all cancer cases diagnosed among residents of CT 903.02 from 1996-2012 as these years represent the most accurate and complete cancer incidence data available for Ohio.

B. Objectives

There are four primary objectives for this cancer assessment:

1. To determine the number of cancer cases diagnosed among residents of CT 903.02 by site/type of cancer and demographic characteristics for the years 1996-2012
2. To compare the number of cancer cases diagnosed among residents of CT 903.02, by site/type of cancer to the number of expected cases based on national incidence rates;
3. To compare the number of cancer cases diagnosed among residents of CT 903.02 by site/type of cancer to the number of expected cases based on Ohio and Montgomery County incidence rates; and
4. To make recommendations for further action, if necessary.

METHODS

A. Study Population

The study population was defined as residents of U.S. Census 2010 CTs 903.02, Montgomery County, Ohio (Figure 1).[10] Within this census tract, a vapor intrusion investigation is being conducted in a residential area encompassing 545 properties located to the south of Mullins Rubber Products (2949 Valley Pike, Dayton, OH 45404). The 2010 U.S. Census population count for this census tract was 6,296 with the following demographics: 49 percent male (3,074 residents); 51 percent female (3,222 residents); 85 percent White (5,351 residents); 8 percent Black (503 residents); and 3 percent Asian (203 residents).[11] The population counts by age group, sex, and gender are presented in Table 1.

A "case" was defined as a person diagnosed with invasive cancer while living as aresident of the census tract within the area of study from 1996 to 2012. Cancer cases were identified through the Ohio Cancer Incidence Surveillance System (OCISS).[12] All cancer cases diagnosed among Ohio residents since January 1, 1992, with the exception of basal and squamous cell carcinoma of the skin and cervical cancer *in situ*, are required to be reported to the OCISS.

B. National Comparison Data

The incidence of cancer within the study population was compared to national cancer incidence rates from the Surveillance Epidemiology and End Results (SEER) Program of the National Cancer Institute.[13] Data were available from SEER 13 region for the entire study period and were therefore used for comparison. The SEER 13 registries are Atlanta, Connecticut, Detroit, Hawaii, Iowa, New Mexico, San Francisco-Oakland, Seattle-Puget Sound, Utah, Los Angeles, San Jose-Monterey, rural Georgia, and the Alaska Native Tumor Registry.

C. Analyses

Cancer cases were grouped by site/type into 23 categories based on the International Classification of Diseases for Oncology, Third Edition (ICD-O-3) used by the SEER Program (Table 3).[14] These cases will hereafter be referred to as "observed" cases.

The number of cases expected to have been diagnosed from 1996-2012 in CT 903.02 were calculated using the national background cancer incidence rates from the SEER 13 region, generated using SEER*Stat software.[15] These cases will hereafter be referred to as "expected" cases. The age-specific SEER rates per 100,000 were multiplied by the age-specific population counts of the study area to generate expected numbers for all cancer sites/types combined and for each individual cancer site/type. Additionally, expected numbers of cancer cases were generated using 1996-2012 Ohio and Montgomery County age-specific rates for comparison.[6]

The observed and expected numbers for each cancer site/type were compared using the Standardized Incidence Ratio (SIR), where:

SIR = Observed cases / Expected cases

A SIR greater than one indicates more observed cases than expected, and a SIR less than one indicates fewer observed cases than expected. Statistical significance (hereafter referred to as significance) of the test statistic was determined by calculating 95% confidence intervals (CIs) based on the Poisson distribution using Fisher's Exact Test.[16] If the confidence interval for a given SIR did not include 1.0, the difference between the observed and expected numbers was significant. In other words, the probability that the observed number of cases was significantly greater than the expected due to chance alone was less than five times out of 100 (p-value < 0.05).

RESULTS

As shown in Table 2, a total of 495 invasive cancer cases were diagnosed and reported from 1996-2012 among residents of CT 903.02. There were an equal number of cases diagnosed between men (242 cases, 49 percent) and women (253 cases, 51 percent). The majority of cases were diagnosed among Whites (475 cases, 96 percent). This is representative of the demographics of the study area (Table 1). The greatest incidence of cancer cases occurred among residents age 65 to 74 (147 cases, 30 percent) and 55 to 64 (104 cases, 21 percent). The number of cases diagnosed per year from 1996-2012 did not increase or decrease throughout the time period, but showed some small fluctuations. Over the 17 year time period, the average number of invasive cancer cases was 29.1 per year.

The most common cancer site/type in the study area from 1996-2012 was lung and bronchus cancer (132 cases, 27 percent) followed by breast cancer in females (60 cases, 12 percent), prostate cancer (48 cases, 10 percent), and colon and rectum cancer (40 cases, 8 percent). These cancer sites/types are also the most common in Ohio and the United States.[17] The number and percent of invasive cancer cases among residents of CT 903.02 by site/type are presented in Table 3.

Comparison to total SEER population

The observed (O) number of cases was compared to the number of expected (E) cases for all sites/types of cancer combined and for each specific site/type of cancer (Table 4). For all cancer sites/types combined, the 495 observed cases in the study area was not significantly higher than the 482.48 expected cases at the 95% confidence level (SIR= 1.03; 95% CI= 0.94-1.12). The

comparison of observed to expected for each specific site/type was significantly higher than expected for lung and bronchus cancer (O=132; E=59.92; SIR=2.20; 95% CI=1.84-2.61) and non-Hodgkin lymphoma (O=31; E=20.40; SIR=1.52; 95% CI=1.03-2.16).

In addition to non-Hodgkin lymphoma, TCE and PCE exposure has been associated with bladder cancer, kidney and renal cancer, liver cancer, leukemia, and multiple myeloma. Observed cases of bladder cancer (O=16, E=20.14), multiple myeloma cases (O=6, E=6.18), and kidney and renal pelvis cancer (O=13, E=14.06) in the study area were less than the expected number of cases. Although the number of liver and intrahepatic bile duct cancer (O=9; E=7.90; SIR=1.14; 95% CI=0.52-1.97) and leukemia (O=17, E=13.34; SIR=1.27; 95% CI=0.74-2.04) were higher than the expected count, the number of cases was within the expected range (i.e., the confidence interval included one, which indicates no significant difference between the observed and expected).

Comparison to Ohio and Montgomery County

For additional comparisons, the observed numbers of lung and bronchus cancer and non-Hodgkin lymphoma cases were compared to the expected number of these cancers in Montgomery County and the state of Ohio. Expected numbers of cases were generated using 1996-2012 age-specific rates for Ohio and Montgomery County (Table 5). The number of lung and bronchus cases (O=132) in CT 903.02 was significantly higher than the expected number cases in both Montgomery County (E=84.08; SIR 1.57; 95% CI 1.31-1.86) and the state of Ohio (E=78.25; SIR 1.69; 95% CI 1.41-2.00). Similarly, the number of observed cases of non-Hodgkin lymphoma (O=31) was significantly higher than the expected number of cases in Montgomery County (E=19.80; SIR 1.57; 95% CI 1.06-2.22) and in Ohio (E=19.90; SIR 1.66; 95% CI 1.14-2.33).

Lung and Bronchus Cancer and Non-Hodgkin Lymphoma

To further analyze the observed cases of non-Hodgkin lymphoma and lung and bronchus cancer in the CT 903.02, Table 6 presents the demographic characteristics of these cases.

Lung and bronchus cancer

Of the 132 lung and bronchus cancer cases reported from 1996 to 2012, more cases were diagnosed among males (76 cases, 58 percent) than females (56 cases, 42 percent). All but three of the cases were diagnosed in White residents (129 cases, 98 percent). The remaining three were diagnosed in Black residents (2 percent). This is representative of the population demographics (Table 1). The highest percentage of cases occurred in the 65 to 74 year old age group (44 cases, 37 percent) and the 55 to 64 year old age group (34 cases, 28 percent). The average age at diagnosis was 64.9. Table 7 presents the tobacco history of cancer patients for all sites/types and for lung and bronchus cancers from 1996 to 2008. The majority of those diagnosed with lung and bronchus cancer used tobacco (58 percent) or were former smokers (18 percent). Tobacco history was unknown or unreported for 21 percent of the cases; thus, the prevalence of tobacco use in the area is likely to be even higher.

Non-Hodgkin lymphoma

A total of 31 cases of non-Hodgkin lymphoma were reported from 1996 to 2012. There were more males (22 cases, 71 percent) diagnosed than females (9 cases, 29 percent). One case

occurred in a Black resident (1 case, 3 percent). The other cases occurred in White residents (30 cases, 97 percent). The majority of cases were diagnosed between the ages of 75 to 84 years (8 cases, 24 percent). The average age at diagnosis was 65.1.

DISCUSSION

This assessment of the community's cancer burden is a complex task due to the small size of the study population and the instability in case counts over time. The number of cancer cases included in this assessment may be slightly underestimated due to incomplete case reporting to the OCISS. The estimated completeness of reporting for Montgomery County the years 1996-2012 is 94 percent which suggests that case reporting for CT 903.02 is reasonably complete for this time period.

The use of SEER population for generating expected numbers of cases is a standard practice for community assessments. The SEER national background rates are based on relatively complete reports of large number of cases from a large population that are relatively stable and are convenient to use for such analyses. Although the SEER data are collected for a national sample consisting of six states; six metropolitan areas; and one rural area, they may not be similar to the study area in terms of race, socioeconomic status, access to care, and other factors. In light of this, the study population was also compared to the state of Ohio and Montgomery County.

Community cancer assessments are also difficult due to inaccurate classification of the primary residence. A residence is classified by the address at diagnosis, which may not be the person's primary residence throughout their lifetime. History of residence is not collected by the OCISS and thus cannot be accounted for in this assessment. Individuals who worked at the Mullins Rubber Products but lived outside the study area were also not identified in this assessment.

Adding to the complexity of cancer assessments is the fact that, each cancer site/type differs in respect to risk factors, latency, course of disease, and probability of survival. The cancer sites/types found to be significantly higher than expected in CT 903.02 are lung and bronchus cancer and non-Hodgkin lymphoma.

Lung and bronchus cancer – The primary risk factor for lung and bronchus cancer is tobacco smoking (cigarette, cigar, and pipe smoking). Ninety percent of lung and bronchus cancer are caused by smoking. Other risk factors include secondhand smoke, family history, and environmental exposures to radon, air pollution, asbestos, and arsenic.[18]

Non-Hodgkin lymphoma- There are three main types of blood cancers; leukemia, lymphoma, and myeloma. Lymphomas account for about half of the blood cancers that occur each year. Lymphomas affect specialized white blood cells, lymphocytes, which work with other cells in the immune system to fight infections. As cancerous lymphocytes cells multiply, they collect in the lymph nodes and impair the immune system.[19] Lymphomas are divided into two categories: non-Hodgkin lymphoma and Hodgkin lymphoma. Approximately 85 percent of all malignant lymphomas are non-Hodgkin lymphomas. There are several distant subtypes of non-Hodgkin lymphoma and a patient's treatment and prognosis varies depending on the characteristics of their subtype.[20]

While there is no known single cause of non-Hodgkin lymphoma, there are several risk factors that may contribute to a person's risk of developing non-Hodgkin lymphoma. Risk factors include:[21]

- Age - more common in people older than 60 years of age
- Sex - more common in men compared to women
- Race - more common in Whites compared to Blacks and Asians
- Previous exposure to radiation or some chemotherapy drugs
- Exposure to chemicals such as pesticides, fertilizers, or organic solvents
- Use of immunosuppressant drugs following organ transplant surgery
- Infections such as human immunodeficiency virus (HIV), Epstein-Barr virus, Helicobacter pylori (H. pylori) and Human T-lymphottropic virus
- Autoimmune disease such as Sjögren's syndrome, lupus, or rheumatoid arthritis
- Inherited immune deficiency syndromes such as Louis-Barr syndrome and Wiskott-Aldrich syndrome

CONCLUSION

The assessment of cancer among residents of CT 903.02 revealed higher than expected number of lung and bronchus cancer and non-Hodgkin lymphoma. Not only is smoking tobacco the primary cause of lung and bronchus cancer, it also can cause cancer in a number of other body organs to include the larynx, mouth, throat, esophagus, colon and rectum, bladder, kidney, pancreas, cervix and stomach.[22] By making healthier lifestyle choices, the risk of developing lung and bronchus cancer can be lowered.

Although non-Hodgkin lymphoma is related to the chemicals of concern, there are other risk factors attributed to the occurrence of non-Hodgkin lymphoma. Therefore, it is not possible to determine if this particular exposure is associated with these cancer cases. Additionally, the number of cases of non-Hodgkin lymphoma cases reported during the study period is small which increases the likelihood that these results could have occurred by chance alone.

The exact cause of each case of cancer cannot be determined from this assessment due to the lack of case information on each patient's history of environmental exposures, length of residence within the census tract, their health behaviors, and other cancer-related risk factors, but PHDMC will continue to monitor non-Hodgkin lymphoma incidence rates in CT 903.02. Additionally, a contractor with U.S. EPA will complete the sampling of residences and the installation of vapor abatement systems in the structures that require them.

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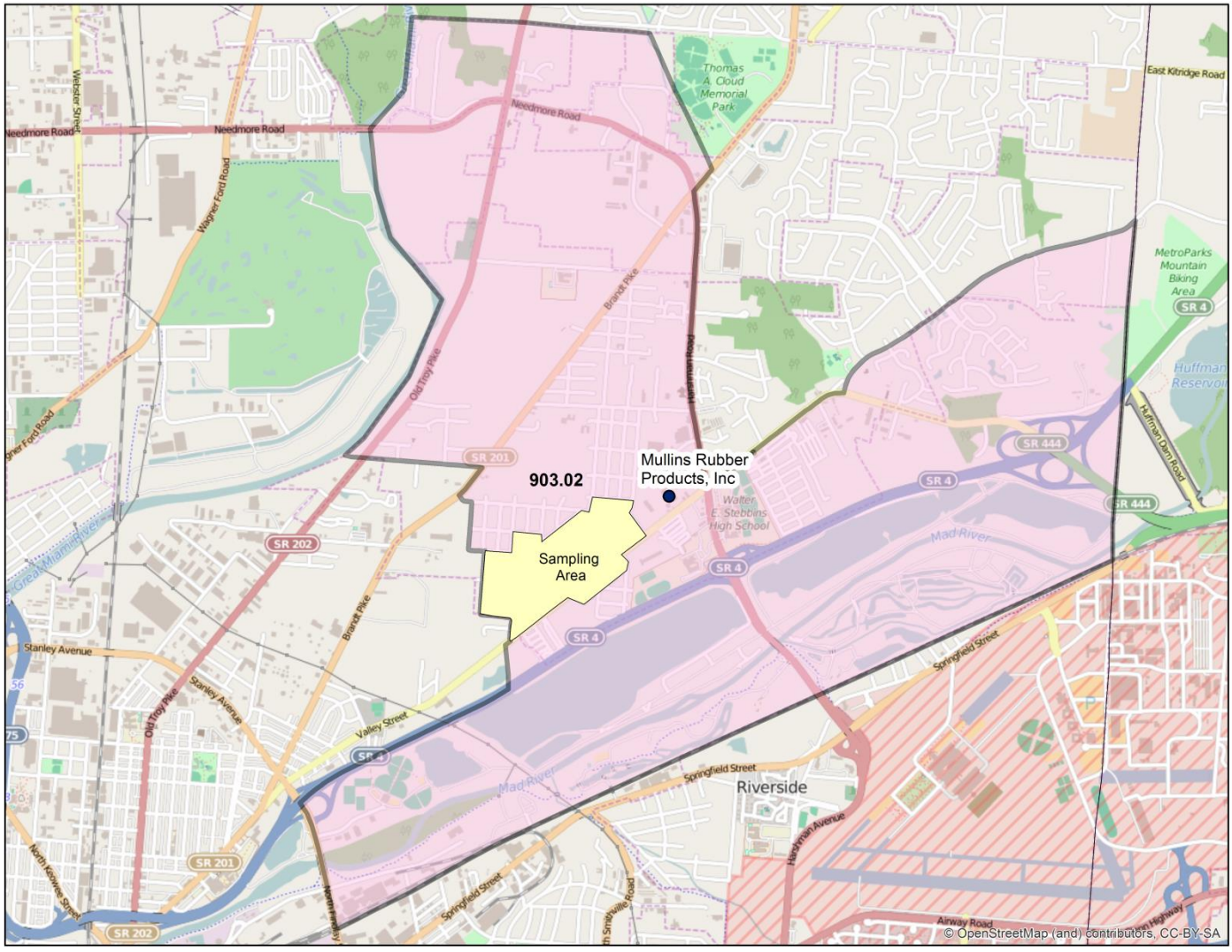
Figure 1. Map of Study Area (Census Tract 903.02) in Riverside, Montgomery County as defined by the U.S. Census Bureau, 2010[1]



[1]Source: Census 2010 TIGER/Line Files, U.S. Census Bureau-Washington D.C.

Table 1. Demographics of CT 903.02[1]

Demographic Characteristics	Number	Percent
Population	6,296	
Sex		
Male	3,074	49%
Female	3,222	51%
Race		
White	5,351	85%
Black	503	8%
Asian	203	3%
Other Race	239	4%
Age		
Under 5	437	7%
5 to 14	887	14%
15 to 19	479	8%
20 to 24	378	6%
25 to 34	815	13%
35 to 44	906	14%
45 to 54	877	14%
55 to 64	765	12%
65 to 74	450	7%
75 to 84	227	4%
85+	75	1%

[1] Source: U.S. Census, 2010

Table 2. Number and Percent Invasive Cancer Cases, by Sex, Race, Age Group, and Year of Diagnosis, among Residents of CT 903.02, 1996-2012[1]

Demographic Characteristics	Cases	Percent
Total	495	100%
Sex		
Male	242	49%
Female	253	51%
Race		
White	475	96%
Black	10	2%
Other/Unknown	10	2%
Age		
Under 5	1	0%
5 to 14	2	0%
15 to 19	1	0%
20 to 24	5	1%
25 to 34	6	1%
35 to 44	30	6%
45 to 54	75	15%
55 to 64	104	21%
65 to 74	147	30%
75 to 84	95	19%
85+	29	6%
Year of Diagnosis		
1996	36	7%
1997	30	6%
1998	24	5%
1999	26	5%
2000	18	4%
2001	25	5%
2002	24	5%
2003	26	5%
2004	22	4%
2005	36	7%
2006	39	8%
2007	29	6%
2008	37	7%
2009	27	5%
2010	30	6%
2011	26	5%
2012	40	8%

[1] Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, April 2015

Table 3. Number and Percent Invasive Cancer Cases by Site/Type among Residents of CT 903.02, 1996-2012[1]

Cancer Site/Type	Cases	Percent
All Cancer Sites/Types	495	100%
Lung and Bronchus	132	27%
Breast (female)	60	12%
Prostate	48	10%
Colon and Rectum	40	8%
Other Sites/Types[2]	34	7%
Non-Hodgkin Lymphoma	31	6%
Melanoma of Skin	19	4%
Leukemia	17	3%
Bladder	16	3%
Oral Cavity and Pharynx	13	3%
Kidney and Renal Pelvis	13	3%
Pancreas	11	2%
Uterus	10	2%
Liver and Intrahepatic Bile Duct	9	2%
Multiple Myeloma	6	1%
Ovary	6	1%
Brain and Other CNS[3]	6	1%
Cervix	6	1%
Stomach	5	1%
Thyroid	4	1%
Esophagus	4	1%
Larynx	3	1%
Hodgkin Lymphoma	2	0%
Testis	0	0%

[1] Source: Ohio Cancer Incidence Surveillance, Ohio Department of Health, April 2015
[2] Other Sites/Types consists of the following cancers: unspecified (16 cases), vagina (3 cases), urinary tract (2 cases), anus (2 cases), bone marrow (2 cases), biliary tract (1 case), gall bladder (1 case), connective tissue (1 case), nasal cavity (1 case), genital tract - female (1 case), pelvis (1 case), vulva (1 case) and adrenal gland (1 case)
[3] CNS = Central Nervous System

Table 4. Number of Observed and Expected Invasive Cancer Cases, Standardized Incidence Ratios (SIR) and 95% Confidence Intervals (CI), by Cancer Site/Type, among Residents of CT 903.02, 1996-2012[1,2,3]

Cancer Site/Type	Observed Cases	Expected Cases	SIR	95% CI
All Sites/Types	497	482.48	1.03	(0.94, 1.12)
Lung and Bronchus	132	59.92	2.20	(1.84, 2.61)*
Breast (female)	60	70.06	0.86	(0.65, 1.10)
Prostate	48	70.03	0.69	(0.51, 0.91)
Colon and Rectum	40	47.87	0.84	(0.60, 1.14)
Other Sites/Types	34	NA	NA	NA
Non-Hodgkin Lymphoma	31	20.40	1.52	(1.03, 2.16)*
Melanoma of Skin	19	20.03	0.95	(0.57, 1.48)
Leukemia	17	13.34	1.27	(0.74, 2.04)
Bladder	16	20.14	0.79	(0.45, 1.29)
Oral Cavity and Pharynx	13	14.06	0.92	(0.49, 1.58)
Kidney and Renal Pelvis	13	11.34	1.15	(0.61, 1.96)
Pancreas	11	11.76	0.94	(0.47, 1.67)
Uterus	10	13.97	0.72	(0.34, 1.32)
Liver and Intrahepatic Bile Duct	9	7.90	1.14	(0.52, 2.16)
Multiple Myeloma	6	6.73	0.89	(0.33, 1.97)
Ovary	6	4.26	1.41	(0.52, 3.07)
Brain and Other CNS[4]	6	6.18	0.97	(0.36, 2.11)
Cervix	6	7.17	0.84	(0.31, 1.82)
Stomach	5	8.39	0.60	(0.22, 1.39)
Thyroid	4	4.60	0.87	(0.24, 2.23)
Esophagus	4	11.03	0.36	(0.10, 0.93)
Larynx	3	3.57	0.84	(0.17, 2.46)
Hodgkin Lymphoma	2	2.85	0.70	(0.08, 2.54)
Testis	0	NA	NA	NA

[1]Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, April 2015.
[2]Expected numbers of cases were calculated using the Surveillance, Epidemiology and End Results (SEER) Program U.S. age-specific cancer incidence rates for 1996-2012, SEER 13 Registries public-use data file, National Cancer Institute, 2015.
[3] 95% confidence intervals were calculated based on a Poisson distribution using Fisher's Exact Test.
[4] CNS = Central Nervous System
[*] A significantly higher than expected number of cancer cases were diagnosed during this time period.

Table 5. Number of Observed and Expected Invasive Cancer Cases, Standardized Incidence Ratios (SIR) and 95% Confidence Intervals (CI) Generated Using SEER, Ohio, and Montgomery Rates, among Residents of CT 903.02, 1996-2012[1,2,3]

Cancer Sites/Types	Region Used to Generate Expected	Observed Cases	Expected Cases	SIR	95% CI
Lung and Bronchus	SEER	132	59.92	2.20	(1.84, 2.61)*
	Montgomery County	132	84.08	1.57	(1.31, 1.86)*
	Ohio	132	78.25	1.69	(1.41, 2.00)*
Non-Hodgkin Lymphoma	SEER	31	20.40	1.52	(1.03, 2.16)*
	Montgomery County	31	19.80	1.56	(1.06, 2.21)*
	Ohio	31	19.90	1.57	(1.06, 2.22)*

[1]Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, April 2015.
[2]Expected numbers of cases were calculated using the Surveillance, Epidemiology and End Results (SEER) Program U.S. age-specific cancer incidence rates for 1996-2012, SEER 13 Registries public-use data file, National Cancer Institute, 2015; Ohio and Montgomery – Ohio Cancer Incidence Surveillance System age-specific incidence rates for 1996-2012, Ohio Department of Health, April 2015.
[3] 95% confidence intervals were calculated based on a Poisson distribution using Fisher's Exact Test.
[*] A significantly higher than expected number of cancer cases were diagnosed during this time period.

Table 6. Number and Percent of Non-Hodgkin Lymphoma and Lung and Bronchus Cancer Cases, by Sex, Race, Age Group, and Year of Diagnosis, among Residents of CT 903.02, 1996-2012[1]

Demographic Characteristics	Non-Hodgkin Lymphoma		Lung and Bronchus	
	Cases	Percent	Cases	Percent
Total	31		132	
Sex				
Male	22	71%	76	58%
Female	9	29%	56	42%
Race				
White	30	97%	129	98%
Black	1	3%	3	2%
Other/Unknown	0	0%	0	0%
Age				
Under 5	0	0%	0	0%
5 to 14	1	3%	0	0%
15 to 19	0	0%	0	0%
20 to 24	0	0%	0	0%
25 to 34	0	0%	0	0%
35 to 44	2	6%	8	7%
45 to 54	5	16%	17	15%
55 to 64	7	23%	31	28%
65 to 74	4	13%	41	37%
75 to 84	8	26%	21	19%
85+	4	13%	5	4%
Average Age	65.1		64.9	
Year of Diagnosis				
1996	1	3%	11	9%
1997	1	3%	10	8%
1998	2	6%	7	6%
1999	2	6%	2	2%
2000	2	6%	7	6%
2001	4	13%	7	6%
2002	0	0%	5	4%
2003	3	10%	10	8%
2004	1	3%	5	4%
2005	2	6%	8	7%
2006	2	6%	7	6%
2007	4	13%	5	4%
2008	2	6%	9	8%
2009	1	3%	8	7%
2010	0	0%	13	11%
2011	1	3%	6	5%
2012	3	10%	12	10%

[1] Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, March 2015

Table 7. Percent of All Cancer Sites/Types and Lung and Bronchus Cancer Cases by Tobacco History among Residents of CT 903.02, 1996-2008[1]

Tobacco[2] History	All Cancer Sites/Types	Lung and Bronchus
Never Used Tobacco	20%	3%
Currently Use Tobacco	39%	58%
Previously Used Tobacco	14%	18%
Unknown/Blank	27%	21%

[1]Source: Ohio Cancer Incidence Surveillance System, Ohio Department of Health, March 2015.
[2]Tobacco Use includes cigarettes, cigars, pipes, snuff, and chewless, and smokeless tobacco

TECHNICAL NOTES

Invasive Cancer

Only invasive cancers were included in the calculation of incidence rates in this document; cancers whose behavior was classified as benign or as a carcinoma in situ were excluded. Cancer that has spread beyond the layer of tissue in which the malignant tumor developed and begins growing into the surrounding, health tissue is considered invasive. Invasive cancers are diagnosed at the localized, regional, distant and unstaged/missing stages.

Age-adjusted Rate

An age-adjusted rate is a weighted average of age-specific (crude) rates, where the weights represent the age distribution of a standard population (direct adjustment). The incidence rates presented in this report were standardized to the age distribution of the 2000 U.S. Standard Population. Under the direct method, the population was first divided into 19 five-year age groups, i.e., <1, 1-4, 5-9, 10-14, 15-19...85+, and the age-specific rate was calculated for each age group. Each age-specific rate was then multiplied by the U.S. Standard Population proportion for the respective age group. A rate represents the number of newly diagnosed cases per 100,000 persons during a specified time period (e.g., 1996-2012).

Census Data

The 1996-2012 rates were calculated using the population counts of CT 903.02 from the 2000 and 2010 decennial Census (U.S. Census Bureau). Population counts from the decennial Census conducted closest to the time period of the study were used in rate calculation. Specifically, the population count for the 2000 Census was used for the years 1996 through 2005 and 2010 population counts were used for the years 2006 through 2012. The overall population for the 17 years (1996-2012) of this study was derived using 10 years of population data from the 2000 Census and 7 years of population data from the 2010 Census.