Secondary Analysis of Census Tracts with Consistently-Elevated All-Site Cancer Rates in Delaware, 2001-2005, 2002-2006, 2003-2007, 2004-2008 and 2005-2009

In April, 2013, the Delaware Division of Public Health (DPH) released its annual *Cancer Incidence & Mortality (I&M) Report, 2005-2009.* The 2013 I&M report includes updated cancer statistics for the two most recently available five-year time periods, 2004-2008 and 2005-2009. As part of the report, and in accordance with Delaware legislation, DPH calculated both 2004-2008 and 2005-2009 all-site cancer incidence rates for each of Delaware's census tracts. As of the 2010 Census, Delaware was reorganized into 214 census tracts, rather than the 197 tracts in effect as of the Census 2000.

In Delaware, all-site cancer incidence rates measure the overall cancer burden for an area over a five-year time period. Cancer incidence rates are calculated by dividing the total number of cancer cases in an area by the total number of people living in that area and are expressed as the average annual number of new cases diagnosed per year per 100,000 people. Cancer cases diagnosed among Delaware residents during the time period under study are obtained from the Delaware Cancer Registry (DCR). For each time period, the all-site cancer incidence rate for each census tract was compared to the all-site cancer incidence rate for Delaware as a whole.

DPH used standard statistical procedures to determine if the difference between a census tract rate and the state rate reached the threshold of statistical significance. If a census tract rate is significantly different from the state rate, the difference between the rates would be interpreted as statistically significant; i.e. "larger than would be expected by chance alone" or "smaller than would be expected by chance alone." If a census tract rate is not significantly different from the state rate, it is interpreted as "no meaningful difference" between the two rates.

Results for 2004-2008 show that:

- In 11 of Delaware's 214 census tracts, the overall cancer incidence rate was statistically significantly higher than Delaware's average 2004-2008 incidence rate (515.6 per 100,000).
- In 17 census tracts, the overall cancer incidence rate was significantly lower than Delaware's average incidence rate (515.6 per 100,000).

Results for 2005-2009 show that:

- In nine of Delaware's 214 census tracts, the overall cancer incidence rate was statistically significantly higher than Delaware's average 2005-2009 incidence rate (516.0 per 100,000).
- In 16 census tracts, the overall cancer incidence rate was significantly lower than Delaware's average incidence rate (516.0 per 100,000).

Earlier, also in accordance with Delaware legislation, DPH had conducted three analyses on cancer incidence by census tract for time periods 2001-2005, 2002-2006 and 2003-2007. These analyses covered 197 census tracts that had been established by the Census 2000. To calculate incidence rates for each of the census tracts, population data were estimated from projections based on the Census 2000. Results of these three analyses, shown in Table 1, reveal an increasing number of census tracts with significantly elevated overall cancer incidence, beginning with 29 in 2001-2005, 45 in 2002-2006 and increasing to 59 in 2003-2007.

Table 1. Numbers of Census Tracts with Significantly High and Low Cancer Incidence Rates Based on Census 2000 Data, by Time Period

CT 2000	2001–2005	2002–2006	2003–2007
Significantly high	29	45	59
Significantly low	23	22	16

In DPH's March 2012 report on *Analysis of Census Tracts with 2001-2005, 2002-2006 and 2003-2007 Elevated All-Site Cancer Rates*, several possibilities were presented that could account for the increased number of census tracts with significantly elevated all-site cancer incidence rates. These possible causes, which are discussed in detail below, are:

- difficulty in estimating population size for small areas,
- small group analyses,
- improved geocoding capabilities at the DCR and
- trends in completeness of cancer case data collection from hospitals and non-hospital sources at the DCR.

Difficulty in estimating population size for small areas—Although it may seem counter-intuitive, estimating population sizes for very small areas like census tracts is more difficult than estimating population sizes for large areas like counties or states. This is because there are far fewer resources that collect data at the census tract level compared to the county or state levels. Researchers rely on data sources such as vital statistics, tax and school enrollment records that are typically aggregated to the county or state level. This makes it harder for researchers to know exactly how many people live in a particular census tract. For this report census tract populations were projected using estimates from the Delaware Population Consortium (DPC) and the 2000 census.

> "Another problem that complicates studies in community settings arises from inaccurate data on the population at risk in small geographic areas or demographic subgroups. Census data are less accurate for cities or counties than for states. "*The uncertainty is greatest for demographic subgroups of the population during the 10-year interval between national census counts.*"[1]

Thun and Sinks summarize two instances in which breast cancer clusters were identified in the 1990s. When updated population data were released from the 2000 Census, however, rates were re-calculated and it was determined that breast cancer rates in these communities were NOT higher than expected. Specifically, "the alarming increase in incidence reported during the 1990s appears to have been an artifact of inaccurate projections of the underlying population."

Small group analyses— In a small group, such as a census tract, the snapshot changes a lot from year to year. If one case of cancer is diagnosed in a census tract one year and three cases of cancer are diagnosed in the same census tract the next year, the cancer rate for that census tract will change dramatically from one year to the next. These big fluctuations do not typically occur in larger populations. If we compare the cancer rate for a census tract to the cancer rate for the whole state of Delaware for a given time period, it would not be unusual to find the comparison different (perhaps even reversed) the following time period.

Improved geocoding capabilities at the Delaware Cancer Registry (DCR) — For 2001-2005, 96.5% of all cases were successfully assigned to their correct census tract. DPH was able to assign 97.4% of all 2002-2006 cases to their correct census tract and for 2003-2007, the percentage increased to 98.0%. Although improved geocoding is excellent from a data accuracy standpoint, it has the unavoidable potential of

[1] Thun, M. & Sinks, T. (2004). "Understanding Cancer Clusters". Cancer: A Cancer Journal for Clinicians, 54(5), 273–280.

creating a sudden increase in cancer rates. Since the calculation of an incidence rate takes into account the total number of cases diagnosed over a certain time period in a census tract, more cases are included each year. As geocoding abilities improve, increased cancer rates will result. The increase in a cancer rate in a census tract does not necessarily reflect a true increase in cancer burden.

Trends in completeness of cancer case data collection from hospitals and non-hospital sources at the DCR—From 2005 through 2011, the DCR increased its completeness of data collection from various reporting sources, particularly from non-hospital sources such as physician offices, path labs, and ambulatory surgery centers. An increase data from non-hospital data sources could lead to an increase in incidence for types of cancer that are routinely diagnosed or treated outside the hospital setting. From 2005 to the present, the number of physician offices reporting to the DCR has more than doubled. As a result, the number of cases collected solely from non-hospital sources has more than doubled for diagnosis years 2003 to 2009. The most common cancer types diagnosed or treated outside a hospital setting include melanoma, noninvasive bladder tumors, small eye tumors, oral or genital tumors, some prostate and breast tumors, tumors in colorectal polyps, lymphoma, leukemia, multiple myeloma and other bone marrow primaries.

Reanalysis Using Census 2010 Census Tracts and Updated Population Data

Since updated census data were available as of 2010, DPH was able to calculate more accurate census tract population counts for the individual years 2001-2009 by extrapolating between the Census 2000 and Census 2010 population estimates. Therefore, analyses for 2004-2008 and 2005-2009 had the benefit of population estimates that were derived from both the Census 2000 and Census 2010; i.e. without having to project estimates from 2000.

To achieve greater accuracy in determining population sizes for each of the census tracts, and to be able to assess whether or not the increasing number of elevated census tracts was real or an anomaly based on the data, DPH recalculated population estimates for individual years from 2001-2003 based on data that were now available. This recalculation effort required that all cancer cases and population data were in the 2010 census tract configuration. Therefore, cancer cases diagnosed in 2001, 2002 and 2003 were geocoded again, this time to the 2010 census tracts.

Results of the reanalysis of data for the first three time periods, along with results for the newly-released analyses for 2004-2008 and 2005-2009, are in Table 2. Results show a steadier pattern regarding the number of tracts that were high or low. Based on the Census 2010 geocoding and population estimates, there were 15, 10 and 10 census tracts with elevated all-site cancer incidence in 2001-2005, 2002-2006 and 2003-2007, respectively. Earlier results showed census tracts with elevated rates numbering 29, 45 and 59, respectively (Table 1).

Table 2. Numbers of Census Tracts with Significantly High and Low Cancer Incidence Rates Based on Reanalysis Using Census 2010 Data, by Time Period

CT 2010	2001–2005	2002–2006	2003–2007	2004–2008	2005–2009
Significantly high	15	10	10	11	9
Significantly low	13	12	13	17	16

Consistently-Elevated Census Tracts by Time Period

Since cancer case and population data from all five time periods were now all in Census 2010 format, it was possible to examine trends in all-site cancer incidence across all five time periods. To focus the secondary analysis, patterns of elevated all-site cancer were examined by census tract across these time periods to identify areas of potential concern. Shown in Table 3 are census tracts that show a consistent pattern of having an all-site cancer incidence rate that is significantly elevated. Here 'consistent' is defined as a census tract that has a significantly elevated all-site cancer incidence rate in two or more adjacent time periods. There are two census tracts in Kent County, seven in New Castle County and five in Sussex County that show a consistent pattern of elevated all-site cancer incidence across two or more of the five time periods.

None of the census tracts had a significantly elevated incidence rate in all five time periods. There are three tracts that had an elevated rate over four consecutive time periods; two in New Castle County, and one in Sussex County. There are five census tracts that had a significantly elevated incidence rate over three adjacent time periods. In all, there are 40 census tract/time period combinations that were assessed in this secondary analysis.

Table 3. Consistently-Elevated Census Tracts by County and Time Period**

County	Census Tract	2001–2005	2002–2006	2003–2007	2004–2008	2005–2009
Kent	421.00				X	X
	428.00		X		X	X
New Castle	6.02	X	X	X	X	
	139.01	X	X	X	X	
	149.06	X	X			
	156.00			X	X	X
	160.00	X	X	X		
	169.01	X	X	X		
	169.04	X	X	X		
Sussex	501.05			X	X	X
	506.02	X	X			
	513.02	X	X	X	X	
	513.05	X	X			
	517.01			X	X	

** – Two or more adjacent time periods with a significantly elevated incidence rate.

Secondary Analyses on Consistently-Elevated Census Tracts

For the consistently-elevated census tracts, DPH analyzed cancer data for the relevant time periods indicated in Table 3. Therefore, these secondary analyses were limited to the following number of census tracts: nine in 2001-2005, 10 in 2002-2006, nine in 2003-2007, eight in 2004-2008 and four in 2005-2009. DPH anticipated that the secondary analyses would help determine the local need for screening and prevention services. Furthermore, unique patterns could suggest an environmental, occupational or other unusual cause.

Secondary analyses were conducted on the consistently-elevated census tract/time period combinations to examine incidence patterns with respect to five factors that would help identify any areas of concern.

These factors are:

- sex distribution,
- age at diagnosis,
- types of cancers elevated and
- cancers with suspected environmental or chemical etiology.

Sex Distribution of Elevated Cancer Incidence Rates

To determine if the elevated overall cancer rate in a census tract affected males and females differently, age-adjusted all-site cancer incidence rates were calculated separately by sex. Male- and female-specific rates for each census tract were compared to those at the state level. The census tracts fell into one of the following four categories compared to Delaware as a whole:

- All-site cancer incidence rates were significantly elevated for both males and females.
- Only males in the census tract had a significantly elevated all-site cancer incidence rate.
- Only females in the census tract had a significantly elevated all-site cancer incidence rate.
- Neither sex had a significantly elevated overall cancer rate. Rather, minor (non-significant) elevations in the male and female cancer rates produced a significantly-elevated overall cancer rate for both sexes combined.

Results of the comparison of sex-specific rates for the 40 census tract/time period combinations are in Table 4. Only four census tracts (three during 2004-2008 and one in 2005-2009) had a significant excess of all-site cancer in both males and females. In the majority of the 40 census tract/time period combinations (18 or 45.0%), incidence was significantly elevated for males but not for females.

Table 4. Number of Census Tracts with Significant Elevations in All-Site Cancer Incidence by Sex and Time Period

Time Period	Rate Elevated for Both Males & Females	Rate Elevated for Males Only	Rate Elevated for Females Only	Rate not Elevated for Males or Females	TOTAL
2001–2005	0	7	2	0	**9**
2002–2006	0	6	1	3	**10**
2003–2007	0	3	3	3	**9**
2004–2008	3	2	1	2	**8**
2005–2009	1	0	1	2	**4**
TOTAL	**4**	**18**	**8**	**10**	**40**

Age at Diagnosis of Cases in Census Tracts with Elevated Rates

The median age of diagnosis of all cancer cases was 67 during 2001-2005; 66 for 2002-2006, 2003-2007 and 2004-2008; and 65 for 2005-2009. In other words, during a specific time period, half of all Delawareans diagnosed with cancer were younger than the median age at diagnosis and half were older than the median age for that time period. The median age of cases of all cancers combined in each census tract was compared to the median age of all cases of cancer combined at the state level for the same time period. A significantly younger median age at diagnosis in the census tract could suggest a unique exposure, such as from the environment or an occupation. Statistical significance was determined by the "sign test." Of the 40 census tract/time period combinations analyzed:

- Seven census tract/time period combinations (17.5%) had a significantly lower median age at diagnosis than the state's median age at diagnosis.
- One census tract/time period combinations (2.5%) had a significantly higher median age at diagnosis than the state's median age at diagnosis.
- Thirty-two census tract/time period combinations (80.0%) had a median age at diagnosis that did not differ significantly from the state's median age at diagnosis.

Table 5. Comparison of Median Age at Diagnosis in Census Tract with Median Age for Delaware by Time Period

Time Period	Delaware Median Age	Median Age Lower than Delaware's Median Age	Median Age not Different from Delaware's Median Age	Median Age Higher than Delaware's Median Age	TOTAL
2001–2005	65	1	7	1	**9**
2002–2006	66	1	9	0	**10**
2003–2007	66	1	8	0	**9**
2004–2008	66	3	5	0	**8**
2005–2009	67	1	3	0	**4**
TOTAL		**7**	**32**	**1**	**40**

Number of Significantly Elevated Cancer Types within Consistently–Elevated Census Tracts

For each of the census tracts with a significantly elevated all-site cancer incidence rate, incidence rates were calculated for the 24 most-commonly diagnosed cancers. These analyses helped to determine which specific cancers, if any, contributed to the higher-than-expected overall cancer rate. Numbers of cancer types with elevated rates are shown in Table 6 by time period. Results for the 40 census tract/time period combinations are:

- Five census tract/time period combinations (12.5%) did not have any cancer type that was significantly elevated.
- Ten census tract/time period combinations (25.0%) had **one** specific cancer type that was significantly elevated.
- Sixteen census tract/time period combinations (40.0%) had **two** specific cancer types that were significantly elevated.
- Nine census tract/time period combinations (22.5%) had **three** specific cancer types that were significantly elevated.

None of the consistently-elevated census tract/time period combinations had more than three cancer types that were significantly higher than Delaware's incidence rate.

Table 6. Number of Significantly Elevated Cancer Sites in Census Tracts by Time Period

Time Period	0	1	2	3	TOTAL
2001–2005	1	3	3	2	**9**
2002–2006	1	4	4	1	**10**
2003–2007	1	2	4	2	**9**
2004–2008	2	1	1	4	**8**
2005–2009	0	0	4	0	**4**
TOTAL	**5**	**10**	**16**	**9**	**40**

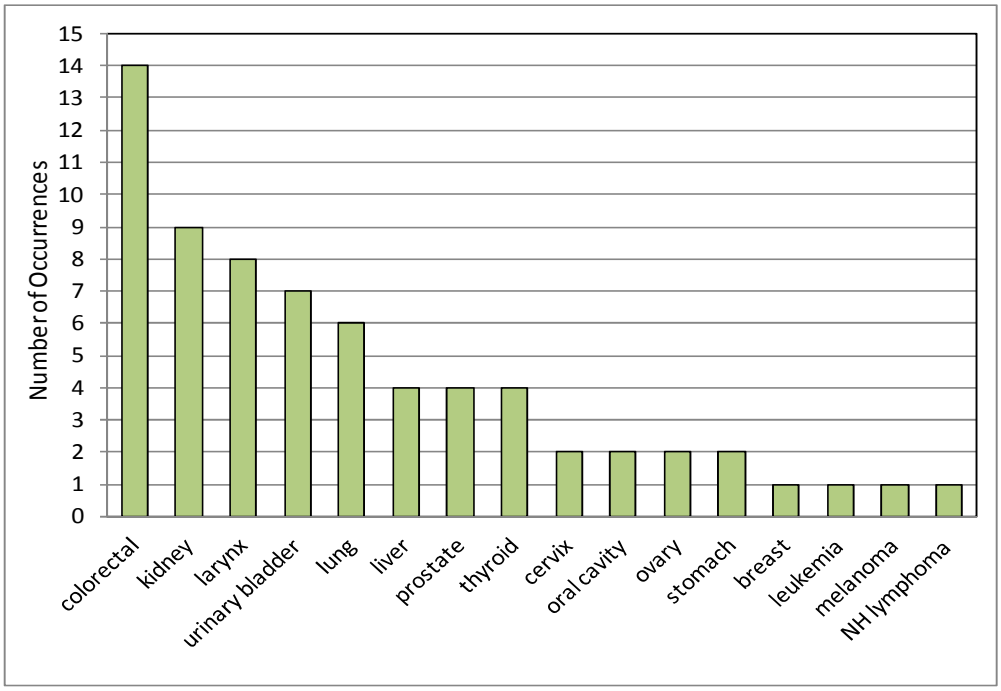
Types of Cancers Elevated within Consistently-Elevated Census Tracts

Cancer is a generic term used to describe more than 100 different diseases. Although 14 of Delaware's 214 census tracts had significantly elevated all-site cancer incidence rates in two or more consecutive time periods, it is important to note that not every cancer type was elevated in any census tract. Rather, the higher-than-expected overall cancer incidence rates were usually attributable to a significant excess of one or more cancer types.

Figure 1 shows the specific cancer types that were most often elevated within the 14 consistently-elevated census tracts in the secondary analysis. Note that the frequencies in Figure 1 sum to more than 40 because, as shown in Table 6, 25 of the 40 census tract/time period combinations had more than one cancer type that was significantly elevated.

The most frequently elevated cancer type is colorectal cancer, which was elevated in 14 census tract/time period combinations; in five for both sexes combined and in nine for males only. The next four most frequently-occurring types are cancers of the kidney (nine times), larynx (8 times), urinary bladder (seven times) and lung (six times). Cancers of the liver, prostate and thyroid were each elevated in four census tract/time period instances. Breast cancer, leukemia, melanoma and non-Hodgkin lymphoma were each elevated in one census tract/time period combination.

Figure 1. Number of Occurrences of Elevated Cancer within Consistently-Elevated Census Tracts by Cancer Type: Delaware, all Time Periods Combined



Cancer sites with environmentally-suspected cause(s).

The Delaware Cancer Consortium identified seven cancer types with substantiated environmental risk factors. These are:

- brain/central nervous system cancer
- Hodgkin lymphoma
- leukemia

- liver cancer
- non–Hodgkin lymphoma
- thyroid cancer
- urinary bladder cancer

It is important to note that while these seven malignancies have been known to be associated with environmental risk factors, they may also be related to modifiable risk factors. For example, in addition to chemical exposures in the manufacturing of dyes, rubber and leather, tobacco use is the primary risk factor for urinary bladder cancer.

Among the 40 occurrences of elevated census tract and time period, results related to these seven cancer types are (Table 6):

- One census tract (9%) had a significantly elevated rate for **two** of the seven cancer types with substantiated environmental risk factors.
- Ten census tract/time period combinations (25.0%) had a significantly elevated rate for **one** of the seven cancer types with substantiated environmental risk factors.
- Three census tract/time period combinations (7.5%) had a significantly elevated rate for **two** of the seven cancer types with substantiated environmental risk factors.
- Twenty–seven census tract/time period combinations (67.5%) did not have a significantly elevated rate for any of the seven cancer types with substantiated environmental risk factors.

Table 6. Census Tracts with Elevations in Environmentally-Linked (E-L) Cancer Types*: Delaware, by Time Period

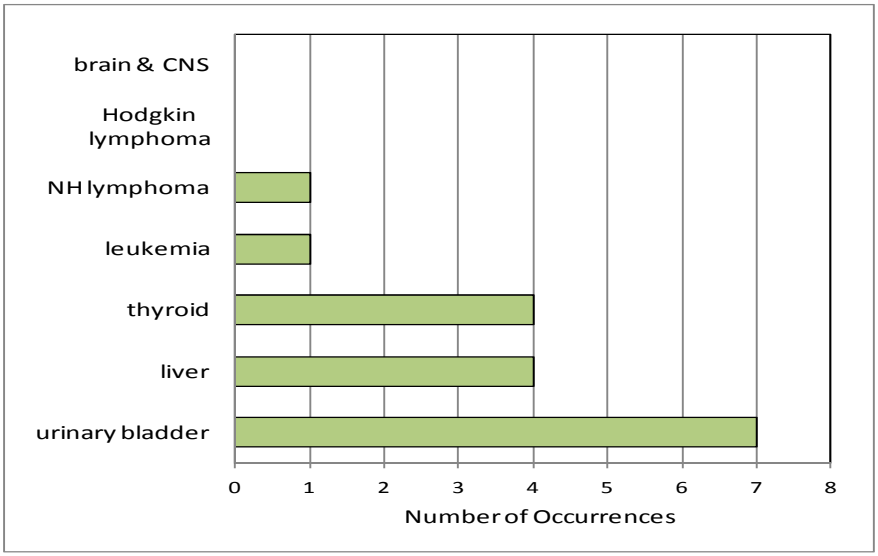
Time Period	No E-L Sites	One E-L Site	Two E-L Sites	Three E-L Sites	TOTAL
2001–2005	7	1	1	0	**9**
2002–2006	7	3	0	0	**10**
2003–2007	5	2	2	0	**9**
2004–2008	7	1	0	0	**8**
2005–2009	1	3	0	0	**4**
TOTAL	**27**	**10**	**3**	**0**	**40**

** – bladder, brain, Hodgkin lymphoma, leukemia, liver, non–Hodgkin lymphoma, thyroid.

Of the seven cancers with environmentally-suspected causes (Figure 2 and Table 7):

- Cancer of the urinary bladder was elevated seven times:
  - among males in five instances: 506.02 (01-05 & 02-06), 513.05 (02-06), 169.04 (03-07), 428.00 (05-09),
  - among females in one instance: 506.02 (01-05) and
  - for both sexes combined in one instance: 169.01 (03-07).
- Liver cancer was elevated four times:
  - among females in: 156.00 (03-07 and 05-09), 160.00 (03-07), 139.01 (04-08).
- Thyroid cancer was elevated four times:
  - among males in 421.00 (05-09) and
  - among females: 513.05 (01-05), 149.06 (02-06), 160.00 (03-07).
- Leukemia was elevated among females in 156.00 (03-07).
- Non-Hodgkin lymphoma was elevated among males in 428.00 (05-09) .
- None of the census tracts had a significantly elevated incidence rate of Hodgkin lymphoma or brain cancer.

Figure 2. Number of Occurrences of Environmentally-Suspected Cancers by Type of Cancer: Delaware, all Time Periods Combined



When a census tract has an elevated rate for a cancer with many risk factors, it is difficult to isolate a single causal factor. Rather, the elevated cancer rate is likely due to a mix of non-modifiable and modifiable risk factors. Adding to the complexity, the interaction of several risk factors may increase a person's cancer risk more than the sum of the individual risk factors. For example, the American Cancer Society (ACS) cites 19 substantiated risk factors for breast cancer alone: 12 of these risk factors are non-modifiable (e.g., age, family history); the remaining seven are modifiable (e.g., lack of exercise, being overweight/obese). The impact of another seven potential breast cancer risk factors is still under scientific review.

While some of the elevated cancer types in these consistently-elevated census tracts were those with environmental risk factors, some other cancer types without these risk factors were also higher compared to the state average. Some of these excesses may simply be statistical aberrations resulting from the very small number of cancer cases in these communities, or, especially when combined with unusual sex and age distributions, there may be underlying occupational or environmental causes. Further investigation of these concerns cannot be conducted with data routinely collected by DPH.

In Table 7 is the summary of analyses of the consistently-elevated census tracts. The table, which includes cancer types that are elevated and gender(s) for which these elevations occur, allows comparison of the elevated cancer types in for each census tract across two or more of the five time periods: 2001–2005, 2002–2006, 2003–2007, 2004–2008 and 2005–2009.

Table 8 lists risk factors associated with each cancer type that was elevated in this report.

The Appendix provides details of the analyses for each of the consistently-elevated census tracts by the time periods in which their all-site cancer rate was elevated. The tables provide cancer-related areas of concern for each cancer type that is listed.

DPH will work with communities to address risk factors for the elevated cancer types and address any concerns. In summary, DPH will:

- Educate residents about findings in this report.
- Seek guidance from the Environment Committee of the Delaware Cancer Consortium regarding the policy implications of this report.
- Ensure awareness of and access to screening and prevention services, including promotion of healthy lifestyles that decrease risk of cancer.
- Address environmental and occupational concerns of residents or other agencies, including exploration of possible known sources of environmental carcinogens.
- Where appropriate, collect and analyze additional information, as feasible.

Table 7. Types of Cancer[2] Elevated in Census Tracts with Consistently-High All–Site Cancer Incidence: Delaware, by Time Period

County	Census Tract	2001–2005	2002–2006	2003–2007	2004–2008	2005–2009
Kent	421.00				None	Kidney – F ***Thyroid – M***
Kent	428.00		Oral cavity – M		Larynx – M ***NH lymphoma-M***	Larynx – All ***Urinary Bladder–M***
New Castle	6.02	Colorectal – M Larynx – M Prostate – M	Larynx – M Lung – All Prostate – M	Colorectal – M Larynx – M	Colorectal – M Larynx – M Prostate – M	
New Castle	139.01	Colorectal– M Ovary – F	Colorectal – M	Breast – F	Kidney – F ***Liver – F*** Lung – M	
New Castle	149.06		Cervix – F ***Thyroid – F***			
New Castle	156.00			***Leukemia – F*** ***Liver – F***	None[3]	Kidney – All ***Liver – F***
New Castle	160.00	None[3]	None[3]	Kidney – F ***Liver – F*** ***Thyroid – F***		
New Castle	169.01	Colorectal – All Stomach – M	Colorectal – M	***Urinary Bladder–All*** Kidney – F		
New Castle	169.04	Colorectal – All Kidney – M	Colorectal – All Larynx – M	***Urinary Bladder–M*** Kidney – All		
Sussex	501.05			Colorectal – All Lung – All Ovary – F	Kidney – All	Breast – F Stomach – M
Sussex	506.02	***Urinary Bladder–M*** ***Urinary Bladder–F*** Lung – M	***Urinary Bladder–M*** Lung – M			
Sussex	513.02	Colorectal – M	Oral cavity – All	Colorectal – M	Colorectal – All Kidney – M Melanoma – All	
Sussex	513.05	***Thyroid – F***	***Urinary Bladder–M*** Lung – M			
Sussex	517.01			None[3]	Colorectal – M Larynx – M Prostate – M	

[2] A cancer type in bold and italics represents one of the seven cancer types considered by the Delaware Cancer Consortium to have environmentally–substantiated risk factors.
[3] "None" = No specific cancer type was significantly elevated in a census tract that had a significantly elevated all-site cancer incidence rate.

Types of Cancer[4] Elevated in Census Tracts with Consistently-High All–Site Cancer Incidence: Delaware, by Time Period and County

Census Tract	NEW CASTLE COUNTY						
	6.02	**139.01**	**149.06**	**156.00**	**160.00**	**169.01**	**169.04**
2001–2005	Colorectal – M Larynx – M Prostate – M	Colorectal– M Ovary – F			None[3]	Colorectal – All Stomach – M	Colorectal – All Kidney – M
2002–2006	Larynx – M Lung – All Prostate – M	Colorectal – M	Cervix – F ***Thyroid – F***		None[3]	Colorectal – M	Colorectal – All Larynx – M
2003–2007	Colorectal – M Larynx – M	Breast – F		***Leukemia – F*** ***Liver – F***	Kidney – F ***Liver – F*** ***Thyroid – F***	***Urinary Bladder–All*** Kidney – F	***Urinary Bladder–M*** Kidney – F
2004–2008	Colorectal – M Larynx – M Prostate – M	Kidney – F ***Liver – F*** Lung – M		None			
2005–2009				Kidney – All ***Liver – F***			

Census Tract	KENT COUNTY		SUSSEX COUNTY				
	421.00	**428.00**	**501.05**	**506.02**	**513.02**	**513.05**	**517.01**
2001–2005				***Urinary Bladder–M*** ***Urinary Bladder–F*** Lung – M	Colorectal – M	***Thyroid – F***	
2002–2006		Oral cavity – M		***Urinary Bladder–M*** Lung – M	Oral cavity – All	***Urinary Bladder–M*** Lung – M	
2003–2007			Colorectal – All Lung – All Ovary – F		Colorectal – M		None[3]
2004–2008	None[3]	Larynx – M ***NH lymphoma-M***	Kidney – All		Colorectal – All Kidney – M Melanoma – All		Colorectal – M Larynx – M Prostate – M
2005–2009	Kidney – F ***Thyroid - M***	Larynx – All ***Urinary Bladder–M***					

[4] A cancer type in bold and italics represents one of the seven cancer types considered by the Delaware Cancer Consortium to have environmentally–substantiated risk factors.

Table 8. Known Risk Factors by Cancer Type[5]

Cancer Type	Known Risk Factors
breast	age – increasing, alcohol abuse, family history, genetic mutations, benign breast conditions, early menarche, hormone therapy, high–fat diet, recent birth control pills, smoking (cigarettes, cigars or pipes), secondhand smoke
colon/rectum	age 50 and older, alcohol abuse, diabetes – type 2, family history, high–fat diet, history of bowel disease, physical inactivity, smoking (cigarettes, cigars or pipes), overweight or obesity
esophagus	age 55 and older, alcohol abuse, chemicals used in dry cleaning, chewing tobacco, combined use of tobacco and alcohol, diet, gastroesophageal reflux disease, gender – male, overweight or obesity, smoking (cigarettes, cigars or pipes),
kidney	advanced kidney disease w long–term dialysis, cigar or cigarette smoking, family history, gender – male, hypertension, certain medications, overweight or obesity, workplace exposures
larynx	alcohol abuse, combined alcohol and tobacco use, diet , gastroesophageal reflux disease, gender – male, genetic syndromes, human papilloma virus, poor nutrition, secondhand smoke, smoking (cigarettes, cigars or pipes),workplace exposure
leukemia	alcohol abuse, blood disorders, chemical exposure, chemotherapy, cigarette smoking, diet, genetic conditions, ionizing radiation, ultraviolet light
liver	alcohol abuse, arsenic in drinking water, cirrhosis of liver, diabetes – type 2, genetics, infection with hepatitis B or hepatitis C virus, obesity, race – Asian American or Pacific Islander, steroids, viral hepatitis, workplace exposures
lung	asbestos, diet low in fruits and vegetables, family history, radiation therapy, radon exposure, secondhand smoke, smoking (cigarettes, cigars or pipes), tuberculosis, workplace exposures
melanoma	excessive ultraviolet light, fair skin, family history, having many moles, history of sunburn before age 20, increasing age, race – Caucasian, weakened immune system
non–Hodgkin lymphoma	autoimmune diseases, certain infections, chemotherapy (alkylating agents), diet high in fat and meats, exposure to benzene race – Caucasian, radiation, weakened immune system
oral cavity	alcohol abuse, diet low in fruits and vegetables, gender – male, genetic syndromes, heavy drinking and smoking, human papilloma virus, poor nutrition, smoking (cigarettes, cigars or pipes), snuff or chewing tobacco, ultraviolet light (lip cancer)
prostate	African American race, age – over 50, diet high in red meat and high–fat dairy, ethnicity – non–Hispanic, family history, gene mutations, inherited DNA changes, obesity, workplace exposures
stomach	age 50 and older, diet low in fruits and vegetables, diet high in smoked foods, and salted fish and meats, ethnicity – Hispanic, family history, gender – male, obesity, infections, race – African American or Pacific Islander, residence (China, Japan, Eastern Europe, South and Central America), smoking (cigarettes, cigars or pipes)
thyroid	age (40 – 50 in women, 60 and older in men), diet low in iodine, gender – female, genetic conditions, lack of iodine, race – Caucasian, radiation – environmental and medical
urinary bladder	age 55 and older, arsenic in drinking water, chemotherapy (alkylating agents), cigarette smoking, ethnicity – Hispanic, family history, gender – male, genetic syndromes, race – Caucasian, radiation therapy to bladder, workplace exposures

[5] Listed in alphabetical order, not by priority or magnitude of impact.

APPENDIX – Characteristics of Census Tracts with Consistently–Elevated All–Site Cancer Rates, by Time Period

Time Period	Census Tract	Ave. # Cases per Year	All–Site Age–Adjusted Cancer Incidence Rates per 100,000[4]				Significantly Elevated Cancer Site(s) & Sex[5]	Median Age at Diagnosis[6]		Areas of Concern
								DE	CT	
2001–05	6.02	24		**All**	**Male**	**Female**	Colorectal – M Larynx – M Prostate – M	67	63	Sex distribution Screening Prevention
			DE	511.4	608.4	442.2				
			CT	***711.1***	***1047.4***	500.0				
2001–05	139.01	17		**All**	**Male**	**Female**	Colorectal – M Ovary – F	67	63	Sex distribution Screening Prevention
			DE	511.4	608.4	442.2				
			CT	***673.8***	766.4	***633.4***				
2001–05	149.06	15		**All**	**Male**	**Female**	Cervix – F	67	***57***	Sex distribution Screening Age distribution Prevention
			DE	511.4	608.4	442.2				
			CT	***663.8***	551.5	***780.5***				
2001–05	160.00	19		**All**	**Male**	**Female**	None[8]	67	64.5	Sex distribution
			DE	511.4	608.4	442.2				
			CT	***684.5***	***830.6***	550.2				
2001–05	169.01	16		**All**	**Male**	**Female**	Colorectal – All Stomach – M	67	65.5	Sex distribution Screening Prevention
			DE	511.4	608.4	442.2				
			CT	***718.0***	***909.8***	555.5				
2001–05	169.04	14		**All**	**Male**	**Female**	Colorectal – All Kidney – M	67	66	Sex distribution Screening Prevention
			DE	511.4	608.4	442.2				
			CT	***713.5***	***938.5***	504.5				
2001–05	506.02	39		**All**	**Male**	**Female**	***Urinary Bladder – M*** ***Urinary Bladder – F*** Lung – M	67	69	Sex distribution Prevention Cancer type Screening
			DE	511.4	608.4	442.2				
			CT	***654.7***	***882.9***	518.2				
2001–05	513.02	23		**All**	**Male**	**Female**	Colorectal – M	67	69	Sex distribution Prevention Screening
			DE	511.4	608.4	442.2				
			CT	***679.4***	***818.8***	591.5				
2001–05	513.05	30		**All**	**Male**	**Female**	***Thyroid – F***	67	71	Sex distribution Cancer type
			DE	511.4	608.4	442.2				
			CT	***661.9***	***804.9***	542.7				
2002–06	6.02	24		**All**	**Male**	**Female**	Larynx – M Lung – All Prostate – M	66	68	Sex distribution Prevention Screening
			DE	512.00	505.0	518.6				
			CT	***740.3***	***1250.4***	423.4				

Time Period	Census Tract	Ave. # Cases per Year	All–Site Age–Adjusted Cancer Incidence Rates per 100,000[4]				Significantly Elevated Cancer Site(s) & Sex[5]	Median Age at Diagnosis[6]		Areas of Concern
								DE	CT	
2002–06	139.01	18		**All**	**Male**	**Female**	Colorectal – M	66	63.5	Screening Prevention
			DE	512.00	505.0	518.6				
			CT	***696.7***	824.4	600.1				
2002–06	149.06	16		**All**	**Male**	**Female**	Cervix – F ***Thyroid – F***	66	***57***	Sex distribution Prevention Screening Cancer type
			DE	512.00	505.0	518.6				
			CT	***713.5***	532.8	***881.3***				
2002–06	160.00	20		**All**	**Male**	**Female**	None[8]	66	65	
			DE	512.00	505.0	518.6				
			CT	***680.9***	774.7	613.0				
2002–06	169.01	16		**All**	**Male**	**Female**	Colorectal – M	66	69	Sex distribution Screening Prevention
			DE	512.00	505.0	518.6				
			CT	***659.7***	***886.9***	450.5				
2002–06	169.04	15		**All**	**Male**	**Female**	Colorectal – All Larynx – M	66	63	Sex distribution Screening Prevention
			DE	512.00	505.0	518.6				
			CT	***678.4***	***857.0***	459.8				
2002–06	428.00	39		**All**	**Male**	**Female**	Oral cavity – M	66	63	Sex distribution Prevention
			DE	512.00	505.0	518.6				
			CT	***629.3***	***786.7***	498.4				
2002–06	506.02	39		**All**	**Male**	**Female**	***Urinary Bladder – M*** Lung – M	66	70	Sex distribution Cancer type Prevention
			DE	512.00	505.0	518.6				
			CT	***633.9***	***780.7***	550.1				
2002–06	513.02	23		**All**	**Male**	**Female**	Oral cavity – All	66	68	Screening Prevention
			DE	512.00	505.0	518.6				
			CT	***653.0***	784.6	563.3				
2002–06	513.05	29		**All**	**Male**	**Female**	***Urinary Bladder – M*** Lung – M	66	71.5	Sex distribution Cancer type Prevention
			DE	512.00	505.0	518.6				
			CT	***627.6***	***798.7***	473.9				
2003–07	6.02	22		**All**	**Male**	**Female**	Colorectal – M Larynx – M	66	68	Sex distribution Screening Prevention
			DE	512.5	609.0	441.7				
			CT	***675.5***	***1073.6***	431.1				

Time Period	Census Tract	Ave. # Cases per Year	All–Site Age–Adjusted Cancer Incidence Rates per 100,000[4]				Significantly Elevated Cancer Site(s) & Sex[5]	Median Age at Diagnosis[6]		Areas of Concern
				All	Male	Female		DE	CT	
2003–07	139.01	18	DE	512.5	609.0	441.7	Breast – F	66	63	Screening
			CT	***662.5***	776.6	575.9				
2003–07	156.00	20		**All**	**Male**	**Female**	***Leukemia – F*** ***Liver – F***	66	62	Sex distribution Cancer type
			DE	512.5	609.0	441.7				
			CT	***708.4***	751.0	***672.0***				
2003–07	160.00	19		**All**	**Male**	**Female**	Kidney – F ***Liver – F*** ***Thyroid – F***	66	65	Sex distribution Prevention Cancer type
			DE	512.5	609.0	441.7				
			CT	***670.5***	683.6	***662.0***				
2003–07	169.01	16		**All**	**Male**	**Female**	***Urinary Bladder – All*** Kidney – F	66	69.5	Sex distribution Cancer type Prevention
			DE	512.5	609.0	441.7				
			CT	***658.1***	***910.6***	411.1				
2003–07	169.04	16		**All**	**Male**	**Female**	***Urinary Bladder – M*** Kidney – All	66	62	Sex distribution Cancer type Prevention
			DE	512.5	609.0	441.7				
			CT	***674.5***	***860.9***	480.0				
2003–07	501.05	30		**All**	**Male**	**Female**	Colorectal – All Lung – All Ovary – F	66	67	Sex distribution Screening Prevention
			DE	512.5	609.0	441.7				
			CT	***641.2***	673.5	***629.0***				
2003–07	513.02	23		**All**	**Male**	**Female**	Colorectal – M	66	68	Screening Prevention
			DE	512.5	609.0	441.7				
			CT	***642.4***	748.5	567.9				
2003–07	517.01	26		**All**	**Male**	**Female**	None[8]	66	67	
			DE	512.5	609.0	441.7				
			CT	***635.0***	729.5	563.8				
2004–08	6.02	21		**All**	**Male**	**Female**	Colorectal – M Larynx – M Prostate – M	66	68	Sex distribution Screening Prevention
			DE	515.1	611.4	443.3				
			CT	***683.4***	***1070.7***	441.9				
2004–08	139.01	18		**All**	**Male**	**Female**	Kidney – F ***Liver – F*** Lung – M	66	62	Cancer type Prevention
			DE	515.1	611.4	443.3				
			CT	***668.6***	755.3	596.4				
2004–08	156.00	19		**All**	**Male**	**Female**	None[8]	66	63	Sex distribution
			DE	515.1	611.4	443.3				
			CT	***697.8***	743.1	***648.2***				

Time Period	Census Tract	Ave. # Cases per Year	All–Site Age–Adjusted Cancer Incidence Rates per 100,000[6]				Significantly Elevated Cancer Site(s) & Sex[7]	Median Age at Diagnosis[8]		Areas of Concern
								DE	CT	
2004–08	421.00	29		**All**	**Male**	**Female**	None[9]	66	66	
			DE	515.1	611.4	443.3				
			CT	***683.0***	***841.8***	***586.1***				
2004–08	428.00	44		**All**	**Male**	**Female**	Larynx – M ***NH lymphoma – M***	66	63.5	Prevention Cancer type
			DE	515.1	611.4	443.3				
			CT	***658.1***	***783.4***	***557.4***				
2004–08	501.05	30		**All**	**Male**	**Female**	Kidney – All	66	66.5	Prevention
			DE	515.1	611.4	443.3				
			CT	***622.4***	700.4	572.6				
2004–08	513.02	25		**All**	**Male**	**Female**	Colorectal – All Kidney – M Melanoma – All	66	68	Sex distribution Screening Prevention
			DE	515.1	611.4	443.3				
			CT	***649.2***	***793.7***	530.2				
2004–08	517.01	28		**All**	**Male**	**Female**	Colorectal – M Larynx – M Prostate – M	66	67	Screening Prevention
			DE	515.1	611.4	443.3				
			CT	***999.7***	***1418.9***	***750.5***				
2005–09	156.00	18		**All**	**Male**	**Female**	Kidney – All **Liver – F**	65	63	Prevention Cancer type
			DE	515.3	608.2	445.2				
			CT	***651.4***	716.7	590.7				
2005–09	421.00	29		**All**	**Male**	**Female**	Kidney – F ***Thyroid – M***	65	66	Sex distribution Prevention Cancer type
			DE	515.3	608.2	445.2				
			CT	***660.7***	751.7	***602.1***				
2005–09	428.00	48		**All**	**Male**	**Female**	***Urinary Bladder – M*** Larynx – All	65	64	Cancer type Prevention
			DE	515.3	608.2	445.2				
			CT	***673.1***	***790.8***	***575.6***				
2005–09	501.05	32		**All**	**Male**	**Female**	Breast – F Stomach – M	65	66	Screening Prevention
			DE	515.3	608.2	445.2				
			CT	***635.5***	741.8	554.6				

[6] Age–adjusted incidence rate in bold and italics indicates that the census tract rate is significantly elevated compared to the state rate.
[7] A cancer type in bold and italics represents one of the seven cancer types considered by the Delaware Cancer Consortium to have environmentally–substantiated risk factors.
[8] A median age at diagnosis in bold and italics indicates that the census tract's median age at diagnosis is significantly lower than that of the state.
[9] "None" = No specific cancer type was significantly elevated.