Evaluation of Lung Cancer Statistics Related to Community Concerns in Seneca County, Towns of Junius, Tyre, Waterloo, Seneca Falls, and Fayette, 1996 to 2021

Prepared by the

Cancer Surveillance Program
Bureau of Cancer Epidemiology
New York State Department of Health

with assistance from staff in
the New York State Cancer Registry
and the Center for Environmental Health

For further information contact:
Scott E. Coley M.S., M.P.H.
Director, Cancer Surveillance Program

June 2026

Introduction

The New York State Department of Health (NYSDOH) conducted a review of lung cancer incidence data in response to a request from the Seneca Falls Town Board and the New York State Department of Environmental Conservation (NYSDEC). The resolution passed by the Seneca Falls Town Board requesting an analysis of lung cancer patterns cited data from NYSDOH indicating elevated lung cancer incidence in northern Seneca Falls and concerns about the Seneca Meadows Landfill (or "Landfill"). The Landfill is located in Waterloo, west of Seneca Falls.

NYSDOH evaluated lung cancer incidence in the towns of Fayette, Junius, Seneca Falls, Tyre, and Waterloo between 1996 and 2021, a period of 26 years. The Seneca Meadows Landfill is located within the evaluation area. NYSDOH evaluated the number of observed lung cancer cases within these areas as compared to what was expected based on lung cancer rates in New York State excluding New York City (NYS excl. NYC) over the same period.

The objective of this report was to provide the public with an overview of the lung cancer data available to NYSDOH as part of the NYS Cancer Registry, for residents living in the towns surrounding the Seneca Meadows Landfill. This type of review cannot prove whether specific exposures may have caused or contributed to health outcomes in a community, nor can it determine the cause of any specific individual's health problem. The relationship between environmental and behavioral factors and risk for specific health outcomes is complex and would require knowledge at the individual level about residential history, past and current individual exposures, and other factors to further explore possible associations. The data available to NYSDOH does not include individual-level exposure histories.

Origin of this Evaluation

The Seneca Falls Town Board sent a request to NYSDEC for review of lung cancer incidence in the area around the Seneca Meadows Landfill on October 3, 2023. The Seneca Falls Town Board's request cited publicly available data sources suggesting an elevation in lung cancer incidence in the area. One of those data sources was the Environmental Facilities and Cancer Mapping (Cancer Mapping) page on the NYSDOH website. (New York State Department of Health, 2018). This web page shows circled areas of the state where the number of site-specific cancer diagnoses during 2011-2015 were higher or lower than expected based on statewide cancer rates (NYS including NYC). On these maps, northern Seneca County is part of one of 24 areas of high lung cancer incidence. Northern Seneca County is also included in an area of low thyroid cancer incidence. Lung cancer incidence in northern Seneca County was also highlighted in local press reporting about the Seneca Meadows Landfill.

Lung Cancer Risk Factors

Lung cancer is the second most common type of cancer and causes more deaths than any other cancer type. Cigarette smoking is the leading cause of lung cancer overall and is known to cause approximately 80 percent of lung cancer cases (Siegel et al., 2024). Given the significance of smoking in lung cancer risk, information about smoking prevalence was important in the design of this study. Additional information about how we considered smoking in this study is available in a later section on Cigarette Smoking Prevalence.

Other recognized risk factors for lung cancer include exposure to radon gas, secondhand smoke, certain metals and organic chemicals, radiation, air pollution, diesel exhaust, and genetic factors (American Cancer Society). Radon is the second leading cause of lung cancer overall and the leading cause of lung cancer among nonsmokers. Information about indoor air testing for radon in Seneca County is limited with relatively few samples reported. Based on the limited information available from the most recent available data (2015-2019), indoor air radon testing results from Seneca County do not appear elevated compared to the rest of the state (NYSDOH, 2026). The available radon testing data does not allow for a more detailed evaluation for the specific census tracts in this evaluation.

Given the existing community concerns related to the landfill, we examined the current state of knowledge related to residence near municipal solid waste landfills and cancer. The studies available from Canada, the United States and Europe are inconsistent and do not demonstrate an overall association or causal connection between living near landfills and cancer. This is due to inconsistent and contradictory findings, as well as a variety of limitations and confounding factors in those studies. Lung cancer rates were not increased in most cases (Vitti et al. 2021; Mataloni et al. 2016; Goodman et al. 2010; Goldberg et al. 1999, NYS DOH 1998). Each landfill has a unique history of waste operations and environmental controls and needs to be evaluated independently. We examine specific aspects of the Seneca Meadows landfill below.

Landfills & Environmental Exposures

Municipal solid waste landfills like Seneca Meadows Landfill are subject to regulations designed to protect human health and minimize adverse environmental impacts. Minimizing the release of site-related chemicals is a primary goal which includes actions to control the gas produced when waste is broken down, as well as the leachate created as water passes through a landfill.

Landfill gas is primarily composed of methane and carbon dioxide, with objectionable odors stemming from chemicals present at much lower concentrations, hydrogen sulfide and ammonia. Other components can include nitrogen, oxygen, hydrogen, and various other gases. Some of these other gases are classified as carcinogens but are only present in trace amounts. The gas collection system present at the Seneca Meadows Landfill is designed to capture and eliminate those gases to the extent possible. In general, the composition and amount of landfill gases depend on the type of waste present in the landfill, the age of the landfill, oxygen content, the amount of moisture, and temperature (NYSDOH 2024).

As noted above, close residential proximity to a landfill has not been shown to be causally connected to lung or other types of cancer. However, depending on local environmental factors, exposure to landfill gas may cause eye, throat, and lung irritation, nausea, headache, nasal blockage, sleeping difficulties, weight loss, chest pain, and aggravation of asthma, though these effects are likely to go away when exposure is stopped (NYSDOH 2024).

Landfill gas is controlled to the extent practicable by the gas collection and control system, as well as monitoring the landfill surface to ensure the landfill cap is well maintained and taking necessary corrective actions. There are also hydrogen sulfide air monitors located around the perimeter of the landfill to detect times when the hydrogen sulfide exceeds the ambient air standard. Since people can smell hydrogen sulfide at very low concentrations, the ambient air standard is set at a level where objectionable off-site odors may be detected rather than where health effects might be expected. Data from the hydrogen sulfide monitors indicate that potential exceedances of the ambient air standard have occurred but are infrequent.

Additional information about area air quality near the landfill was analyzed by NYSDEC during a 2018 Community Air Screen program. As part of this program to better understand toxic air pollutants at the community level, NYSDEC analyzed air samples in the Town of Seneca Falls for volatile organic compounds and formaldehyde. Based on the results of the analysis, NYSDEC did not detect concentrations of any compounds in the area around the Seneca Meadows Landfill that required follow-up testing. Additional details about the Seneca Falls Community Air Screen program will be made available by NYSDEC as part of the Environmental Impact Statement for the Seneca Meadows Landfill permitting process (see below).

Seneca Meadows Landfill History and Controls

Municipal solid waste disposal at the site of what is now the Seneca Meadows Landfill began in 1958 when the landowner came to an agreement with the Towns of Waterloo and Seneca Falls. Regulation of the facility began around 1968 when actions were taken to modernize operations and protect ground and surface water. A permit for the Landfill was issued by NYSDEC in 1981. Seneca Meadows, Inc. (SMI) took over landfill operations in 1983. Active collection of landfill gas began in 1994. An expansion of the Landfill was approved in 2007.

Seneca Meadows Landfill's operations are subject to solid waste management facility permits issued pursuant to 6 NYCRR Parts 360 and 363 and an Air Title V permit issued pursuant to 6 NYCRR Part 201 regulations. These regulations are protective of human health and the environment.. They also meet or exceed federal requirements and are among the most rigorous landfill regulations in the nation.

To ensure protection of air quality, an extensive gas collection system is used to collect gas generated within the Landfill. The gas is primarily methane and carbon dioxide with lesser amounts of hydrogen sulfide and non-methane organic compounds. Most of this recovered gas is sent to a separate facility for energy recovery. Some gas is controlled at the Landfill using highly efficient flares to destroy the contaminants. Flaring at the Landfill typically occurs when

the landfill gas has a low concentration of methane or when the Landfill generates more gas than the energy facility can process. Landfill gas that is not captured can be emitted into the air through the surface of the Landfill. These are referred to as fugitive emissions. Fugitive emissions are minimized using carefully selected cover and capping materials to enhance landfill gas collection and control efficiency. The facility is required to regularly monitor the landfill cap for gas leaks and promptly repair any leaks identified. The facility is required to continuously monitor for hydrogen sulfide in the air at the perimeter of the landfill property to demonstrate compliance with NYSDEC's hydrogen sulfide air quality standard. Air monitoring data can also help identify an increase in fugitive emissions. In addition, the facility is required to complete highly sophisticated and conservative air modeling in accordance with NYSDEC approved protocols for many air contaminants emitted from the site to further demonstrate that the Landfill's operations are protective of public health and the environment.

Seneca Meadows Landfill Permit

Seneca Meadows Landfill is reaching the capacity set by its current operating permit. Seneca Meadows, Inc., which currently manages the Landfill, is pursuing a revised permit to expand operations. The State Environmental Quality Review (SEQR) process is used to identify potential significant environmental impacts as early as possible in the planning, review, and decision-making processes of government agencies. Drafting an Environmental Impact Statement (EIS) is part of the SEQR process when an agency, in this case the Department of Environmental Conservation, determines that an action may have a significant adverse impact on the environment. The EIS process allows agencies, project sponsors, and the public to consider significant adverse environmental impacts, alternatives, and mitigation. NYSDEC requested this lung cancer incidence review as part of the draft Environmental Impact Statement for the Seneca Meadows Landfill Valley Infill Expansion Application (New York State Department of Environmental Conservation, 2024).

Methods

Evaluation Plan

This evaluation was designed to determine whether the number of cases of lung cancer occurring among people residing in northern Seneca County is unusual. According to the latest guidance from CDC, an unusual pattern of cancer is defined as greater than expected number of the same or etiologically-related (in terms of risk factors, causes, or origin) cancer cases that occur within a group of people in a geographic area over a defined period of time (CDC 2022).

The number of actual lung cancer cases diagnosed among residents of the evaluation area (observed cases) was compared to the expected number of cases of lung cancer in the evaluation area, if rates of lung cancer in the evaluation area were similar to the rates in the comparison area.

Data Sources

The cancer case data source is the New York State Cancer Registry. Medical providers who diagnose and treat cancer in New York State are required to report all cancer cases to the New York State Cancer Registry (New York State Department of Health, 2022). Cancer case information comes from hospitals, laboratories, physicians, and other health care facilities in New York, as well as from the New York State and New York City Vital Records death files, and through reciprocal reporting agreements with many other states. The Cancer Registry has been certified as more than 95% complete by the North American Association of Central Cancer Registries. In addition, the Cancer Registry has received gold certification from the Association for data released since 1996, the highest certification given to central cancer registries (North American Association of Central Cancer Registries, 2024).

Residents of the evaluation area who were diagnosed with lung cancer during the evaluation period were identified from the New York State Cancer Registry. These cases were then grouped by age and sex and are referred to as observed cases. Cancer Registry data are recorded by place of residence at the time of diagnosis. Lung cancers that were diagnosed after a person moved away from the area are not available for inclusion.

The number of lung cancers that would be expected in the evaluation area were calculated to determine if the number of residents of the evaluation area diagnosed with lung cancer is different than expected. This calculation accounts for the population size and the age and sex distribution of the evaluation area. The expected number of cases is calculated by multiplying cancer incidence rates, by age and sex, for a reference area, in this case New York State, excluding New York City (NYS excl. NYC), by the estimated population of the study area, by age and sex.

The population of the evaluation area was estimated using data from the United States Census. Census tract population data by race/ethnicity, age group and sex were obtained from the Surveillance, Epidemiology and End Results Program at the National Cancer Institute (NCI Sureviellance, 2022).

Evaluation Area and Time Period

Cancer incidence data from January 1996 through December 2021 were reviewed for lung cancers occurring among residents who lived in the evaluation area (Figure 1) at the time of their diagnosis. The most recent year for which cancer data were verified as complete and accurate at the time of the evaluation was 2021.

Broad assessment of lung cancer incidence from January 1996 through December 2021 was done for each of the seven individual census tracts in the evaluation area.

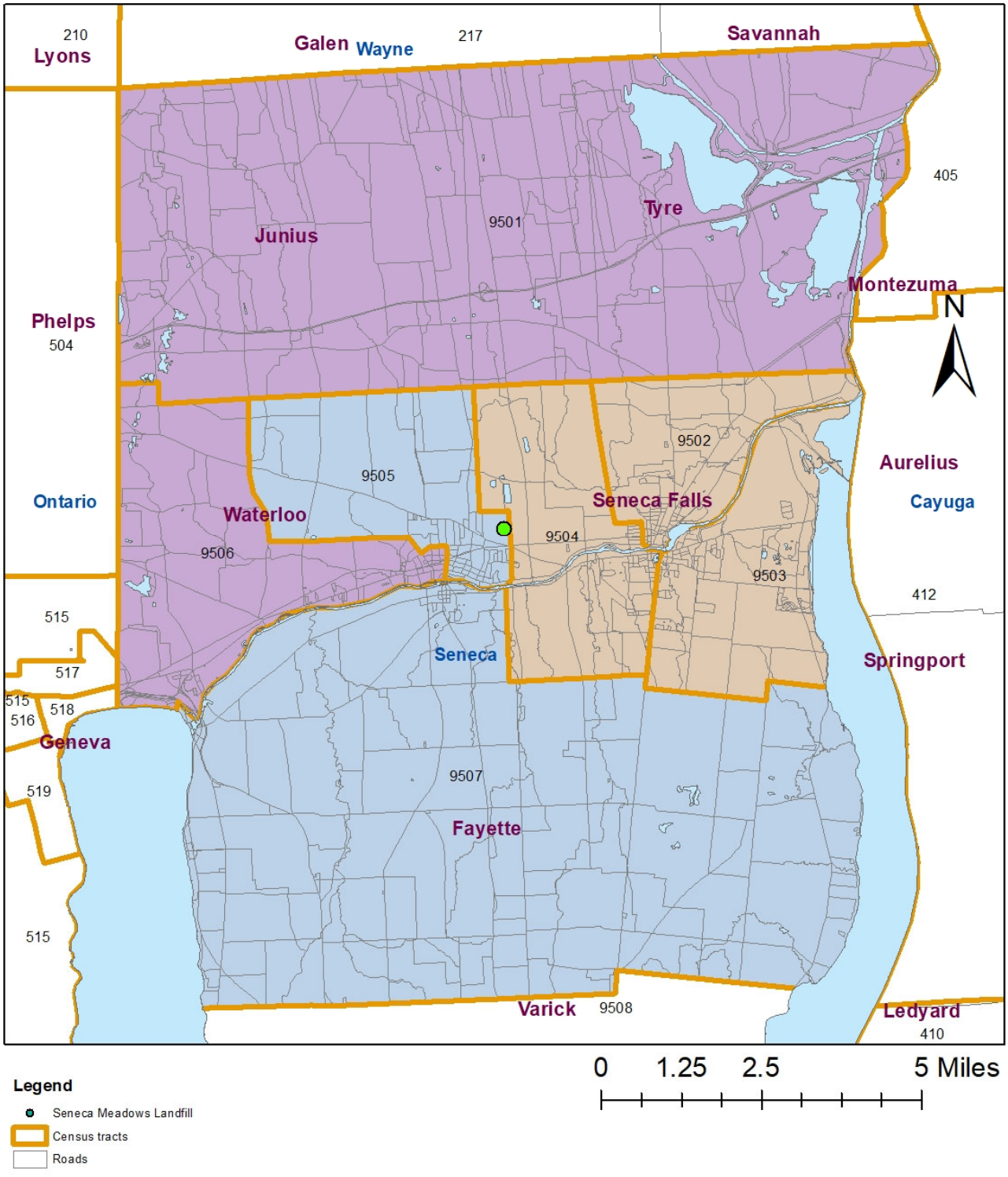
For more detailed analyses of lung cancer incidence by age, sex, and time period, it was necessary to look at groups of census tracts. Previous work done by the Centers for Disease Control and Prevention's Environmental Public Health Tracking (EPHT) Program found that, in general, lung cancer incidence can be displayed in a manner that protects confidentiality and yields stable SIRs for geographic areas with at least 5,000 residents for analysis of incidence by

5-year periods (Ellington et al., 2023). This aggregation was also necessary for analysis by sex and large age group over the entire evaluation period. Because there are thousands of census tracts in NYS, that effort used a spatial aggregation software tool to automate the grouping process, and the grouped census tract data that resulted were used in this evaluation. Three grouped census tract areas were examined separately for this evaluation; census tracts 9505 and 9507 (includes eastern portion of the town of Waterloo and the town of Fayette), census tracts 9502, 9503 and 9504 (Seneca Falls), and census tracts 9501 and 9506 (towns of Junius, Tyre, and western portion of the town of Waterloo). These three areas are all located in Seneca County (Figure 1).

Cigarette Smoking Prevalence Data

Because cigarette smoking is the strongest risk factor for lung cancer, cigarette smoking prevalence data were used to assess the choice for reference population in the calculation of expected lung cancer diagnoses. Information on current smoking prevalence was obtained from the 2016, 2018, and 2021 Behavioral Risk Factor Surveillance System (BRFSS) survey, a telephone survey of the New York State population (New York State Department of Health, 2024). Three survey data sets were combined to allow for a robust local sample within the area of interest. The smallest area at which BRFSS data is available is the ZIP code. Because ZIP codes do not align with census tracts or counties, this analysis includes ZIP codes whose area is at least 50% within the evaluation area; these ZIP codes cover most of the evaluation area: 13065, 13148, and 13165. The following ZIP codes lie mostly outside of the evaluation area and were not included in this analysis: 13146, 14433, 14489, 14532, 14541, and 14556. Statistical testing was used to determine whether potential differences in smoking rates exist in the evaluation area compared with rates in New York City and the rest of New York State.

Figure 1: Map of Study Area Showing 2010 U.S. Census Tracts 9505, 9507 (Fayette, Eastern Waterloo), 9502, 9503, 9504 (Seneca Falls), and 9501, 9506 (Junius, Tyre, Western Waterloo), Seneca County, New York



Statistical Testing

Statistical tests are used to determine whether the difference between the observed number of cases and the expected number might be due to chance. When the difference between the number of cancers observed and the number expected is statistically significant (higher or lower), this means the difference between the observed and expected is not likely due to chance. Non-significant excesses or deficits are considered to represent random variation in observed patterns of disease. Evaluation areas with overlapping confidence intervals are not considered to be significantly different from one another.

We evaluated the probability that chance alone could explain a difference in the observed number of cancer cases compared to the expected number based on the Poisson distribution. Testing results are presented as 95% confidence interval (95% CI) of the Standardized Incidence Ratio (SIR) (Surveillance, Epidemiology, and End Results Program). SIR values greater than 1 indicate that more cancers were observed than expected. If the 95% CI range does not include the value 1, then the study population is significantly different from the comparison or population. Significantly different means there is less than 5% percent chance that the observed difference is the result of random variation in disease occurrence. SIR and confidence intervals were not calculated for observations of fewer than 16 cases. For the smoking prevalence analysis, statistical analyses were calculated using weighted proportions of smokers among survey respondents.

Results

Cigarette Smoking Prevalence

Cigarette smoking is the most significant risk factor for lung cancer, causing an estimated 80 percent of all lung cancer cases. Thus, it is an important risk factor in selecting an appropriate comparison population. Results from the Behavioral Risk Factor Surveillance Survey from 2016, 2018, and 2021 were combined to compare smoking rates in the evaluation area with rates in New York City and the rest of New York State (Table 1). While there is no statistically significant difference between smoking rates in the evaluation area and Statewide or NYS excl. NYC smoking rates, New York City smoking rates are significantly lower than the smoking rates in the evaluation area and NYS excl. NYC. Given the importance of smoking as a

Table 1: Percent Current Smokers, Age 18 and Over
Seneca County Compared with NYS, excl. NYC; NYC; and Statewide

AREA	Percent	95% Confidence Interval
Evaluation area ZIP	17.3	13.1, 21.6
NYS, exclusive of NYC	14.4	13.9, 14.8
NYC	11.1	10.5, 11.7
Statewide	13.0	12.6, 13.3

Source of data: 2016, 2018 and 2021 Behavioral Risk Factor Surveillance System (BRFSS)
* ZIP codes 13065, 13148, and 13165

risk factor for the development of lung cancer, NYS excl. NYC is a more appropriate comparison for lung cancer incidence than Statewide lung cancer rates. Since the evaluation area comprises a large portion of the total county population, using Seneca County alone would not be appropriate. Therefore, a larger comparison area of NYS excl. NYC was selected as the comparison for cancer incidence analyses.

Cancer Incidence

Cases of lung cancer were examined for each individual census tract within the evaluation area for the entire 26-year time period of 1996-2021. This was done for males and females separately. These results are summarized in Table 2.

Among males, there were statistically significant elevations in lung cancer cases among residents of census tract 9504 in the Town of Seneca Falls (49 observed, 36 expected), as well as in census tract 9506 in the Town of Waterloo (71 observed, 47 expected). Among females, there was a statistically significant elevation in lung cancer among residents of census tract 9506 in the Town of Waterloo (61 observed, 42 expected).

To examine the data at a more detailed level by years of diagnosis and age at diagnosis, it was necessary to use the grouped census tract areas (see Evaluation Area and Time Period above). Cases of lung cancer were examined for four five-year time periods (1996-2000, 2001-2005, 2006-2010, 2011-2015), and one six-year time period (2016-2021), for males and females separately, for each of the three evaluation areas. These results are summarized in Table 3.

Among males, there were no statistically significant differences in the numbers of lung cancer cases observed and the numbers of lung cancer cases expected during any of the five time periods, in the three areas that were examined. When looking at the entire time period, 1996-2021, a statistically significant excess number of lung cancer cases was found in census tracts 9501 and 9506 (Junius, Tyre, western Waterloo) (99 observed, 74 expected).

Among females, there were no statistically significant differences in the numbers of lung cancer cases observed and the numbers expected in any of the time periods examined for census tracts 9502, 9503, and 9504 (Seneca Falls). In census tracts 9605 and 9507 (eastern Waterloo, Fayette) there was only one statistically significant excess in the time period 2011-2015 (32 observed, 21 expected). There were fewer than expected numbers of cases in three of the other time periods, none of these were statistically significant, and the observed number was close to the expected number in the 2006-2010 time period. In census tracts 9501 and 9506 (Junius, Tyre, western Waterloo) there was a statistically significant excess in the number of lung cancer cases observed and the number expected in the time periods 2006-2010 (21 observed, 13 expected), and 2016-2021 (28 observed, 16 expected). The observed numbers of lung cancer cases were close to the numbers expected in the other three time periods. When examining the entire time period, 1996-2021, a statistically significant excess was found in census tracts 9501 and 9506 (Junius, Tyre, western Waterloo) (87 observed, 64 expected) but not in the other two areas.

Cases of lung cancer were also examined by age group (less than 65 years, 65 years or older), for the entire time period, 1996-2021, for each of the three areas. These results are summarized

in Table 4. Most age categories among both males and females showed no statistically significant differences. The only statistically significant excesses were found in census tracts 9501 and 9506 (Junius, Tyre, western Waterloo) in males who were diagnosed with lung cancer at age 65 years or older (69 observed, 52 expected) and in females younger than 65 years who were diagnosed with lung cancer (40 observed, 21.6 expected). The number of lung cancers among people at age 45 and younger were close to the expected number. The cases among people under the age of 45 were not concentrated in any one of the evaluation areas and none were observed in people under the age of 20.

Table 2: Observed and Expected Numbers of Lung Cancer[a] Cases by Census Tract
Seneca Meadows Evaluation Area
Seneca County, New York, 1996-2021

AREA AND CENSUS TRACT	MALES		FEMALES	
	Observed[b]	Expected[c]	Observed[b]	Expected[c]
Eastern Waterloo and Fayette				
CT 9505	66	52.7	61	57.1
CT 9507	54	49.7	44	43.0
Seneca Falls				
CT 9502	38	32.7	32	31.7
CT 9503	47	44.4	37	37.5
CT 9504	49*	36.0	37	36.7
Junius, Tyre, and Western Waterloo				
CT 9501	28	26.9	26	21.5
CT 9506	71*	46.9	61*	42.4

[a]Classification of site is based on ICD for Oncology, 3rd Edition.
[b]Data were obtained from the New York State Cancer Registry (database as of November 2023).
[c]Expected numbers are based on standard cancer incidence rates by age and sex for New York State, exclusive of New York City. Standard rates are applied to the 1996-2021 study population, by four five-year time periods and one six-year time period to obtain expected numbers of cases.
Fewer than 16 cases observed. Observations with fewer than 16 cases are not shown and statistical testing is not performed due to statistical stability concerns and to protect patient confidentiality.
*Denotes a statistically significant difference from expected. The probability that this difference is due to chance is less than 5%.

Table 3: Observed and Expected Numbers of Lung Cancer[a] Cases by Time Period
Seneca Meadows Evaluation Area
Census Tracts 9505, 9507 (Eastern Waterloo, Fayette), 9502, 9503, 9504 (Seneca Falls), and 9501, 9506 (Junius, Tyre, Western Waterloo)
Seneca County, New York, 1996-2021

AREA AND TIME PERIOD	MALES		FEMALES	
	Observed[b]	Expected[c]	Observed[b]	Expected[c]
CT 9505 and 9507 - Eastern Waterloo and Fayette				
1996-2000	21	18.4	#	15.7
2001-2005	29	19.9	16	18.5
2006-2010	17	20.6	21	20.1
2011-2015	28	20.3	32*	20.6
2016-2021	25	23.2	23	25.2
TOTAL: 1996-2021	120	102.4	105	100.1
CT 9502, 9503 and 9504 - Seneca Falls				
1996-2000	29	22.4	21	17.9
2001-2005	23	22.7	23	19.7
2006-2010	24	22.4	19	20.9
2011-2015	27	21.4	24	21.2
2016-2021	31	24.3	19	26.2
TOTAL: 1996-2021	134	113.2	106	105.9
CT 9501 and 9506 - Junius, Tyre, and Western Waterloo				
1996-2000	21	14.2	#	10.1
2001-2005	19	14.7	#	11.6
2006-2010	21	14.7	21*	12.8
2011-2015	19	14.2	#	13.1
2016-2021	19	16.1	28*	16.3
TOTAL: 1996-2021	99*	73.8	87*	63.9

[a]Classification of site is based on ICD for Oncology, 3rd Edition.
[b]Data were obtained from the New York State Cancer Registry (database as of November 2023).
[c]Expected numbers are based on standard cancer incidence rates by age and sex for New York State, exclusive of New York City. Standard rates are applied to the 1996-2021 study population, by four five-year time periods and one six-year time period to obtain expected numbers of cases.
Fewer than 16 cases observed. Observations with fewer than 16 cases are not shown and statistical testing is not performed due to statistical stability concerns and to protect patient confidentiality.
*Denotes a statistically significant difference from expected. The probability that this difference is due to chance is less than 5%.

Table 4: Observed and Expected Numbers of Lung Cancer[a] Cases by Broad Age Group
Seneca Meadows Evaluation Area
Census Tracts 9505, 9507 (Eastern Waterloo, Fayette), 9502, 9503, 9504 (Seneca Falls), and 9501, 9506 (Junius, Tyre, Western Waterloo)
Seneca County, New York, 1996-2021

	MALES		FEMALES	
AREA AND BROAD AGE GROUP	Observed[b]	Expected[c]	Observed[b]	Expected[c]
CT 9505 and 9507 - Eastern Waterloo and Fayette				
Less than 65 years	29	27.6	25	26.2
65 years and over	91	74.9	80	73.9
TOTAL: 1996-2021	120	102.4	105	100.1
CT 9502, 9503 and 9504 - Seneca Falls				
Less than 65 years	40	30.4	34	29.5
65 years and over	94	82.8	72	76.4
TOTAL: 1996-2021	134	113.2	106	105.9
CT 9501 and 9506 - Junius, Tyre, and Western Waterloo				
Less than 65 years	30	22.2	40*	21.6
65 years and over	69*	51.6	47	42.2
TOTAL: 1996-2021	99*	73.8	87*	63.9

[a]Classification of site is based on ICD for Oncology, 3rd Edition.
[b]Data were obtained from the New York State Cancer Registry (database as of November 2023).
[c]Expected numbers are based on standard cancer incidence rates by age and sex for New York State, exclusive of New York City. Standard rates are applied to the 1996-2021 study population, by four five-year time periods and one six-year time period to obtain expected numbers of cases.
*Denotes a statistically significant difference from expected. The probability that this difference is due to chance is less than 5%.

Discussion

This evaluation reviewed lung cancer incidence in northern Seneca County, New York, compared with lung cancer incidence in New York State excluding New York City between 1996 and 2021. Our review of lung cancer among residents of individual census tracts during the entire 26-year evaluation time period identified statistically significant elevations among males in census tract 9504 (Seneca Falls), and among males and females in census tract 9506 (western Waterloo). However, to facilitate a more detailed analysis by years of diagnosis and age at diagnosis, it was necessary to use the grouped census tract areas. In our review of 5- and 6-year time periods shown in Table 3, only three statistically significant elevations were observed, all among females. When reviewed by age, only one area, census tracts 9501 and 9506 (Junius, Tyre, western Waterloo), had a statistically significant excess of cancers in females under 65 years of age and in males 65 years and older. Overall, we did not find consistent elevations in incidence over time, sex, or across age groups.

Selecting the comparison population

The selection of a study comparison group has an impact on conclusions. In this analysis, behavioral risk data showed that smoking prevalence in New York City is significantly lower than both in the evaluation area zip codes and in NYS excl. NYC. Therefore, New York City was excluded from the comparison group.

If New York City had been included in the current analysis, the numbers of expected cancers would have been lower. With New York City included, fewer cases would be expected, and more of the statistical analyses may have shown significant differences between the observed numbers of lung cancer diagnoses and what was expected. This would not have been appropriate, given the well-documented and sizable link between smoking and lung cancer. Given that smoking is the most important predictor of lung cancer incidence, including New York City in the comparison group allows smoking rates to influence the analysis when this study is focused on local risk factors other than smoking.

NYSDOH Environmental Facilities and Cancer Mapping

Lung cancer concerns emerged in Seneca Falls, in part, because the town was included in an area highlighted as having a higher lung cancer incidence than expected on the NYSDOH Environmental Facilities and Cancer Mapping (Cancer Mapping) web page (New York State Department of Health, 2018). The Cancer Mapping project uses New York State Cancer Registry data from 2011-2015. This web page shows areas of the state where the site-specific cases for the combined census block groups are at least 50 percent higher or lower than expected. The expected cancer case numbers are based on statewide cancer rates (NYS including NYC). For lung cancer, 24 of these high incidence areas are shown and one of these, LU-H-17, includes Seneca Falls and Waterloo. The LU-H-17 area is roughly 25 miles in diameter and also includes Auburn, Geneva, and Lyons. The Cancer Mapping project also shows 27 areas where lung cancer rates are at least 50 percent below expected, only one of which is outside of the New York City metropolitan area.

There are several important considerations about the Cancer Mapping areas with higher lung cancer incidence. First, the cancer mapping tool is only an exploratory tool. The lung cancer incidence within an area is not uniform and not all areas inside a highlighted circle have elevated lung cancer incidence. It is also important to note that interpretation of spatial patterns must be done cautiously, because numerous personal, community and environmental factors can affect cancer statistics that are not accounted for in such analyses.

Second, the analysis for the Cancer Mapping project used the entire state as a reference group. Because New York City was included in the reference group, with low smoking rates and low lung cancer rates, more and larger areas were shown with elevated lung cancer incidence in the rest of New York State. To address the issue of using an appropriate reference group, similar analyses have been repeated using 2015 to 2019 data with NYS excluding NYC as the reference population. This updated analysis resulted in smaller high incidence areas of lung cancer in this region which does not include any part of Seneca County (Appendix A).

Limitations

There are several limitations associated with this type of health outcomes review. A health outcomes review cannot consider important personal information that may be related to health outcomes, such as medical and family history, dietary and lifestyle choices, and occupational exposures. In addition, NYSDOH lacked information about actual individual-level exposures such as smoking or air quality information for specific addresses. Because the individual-level information is not available, this type of study cannot be used to determine whether a particular risk factor was responsible for observed patterns.

Most cancers begin to develop long before they are diagnosed. The latency period for cancer is defined as the amount of time that elapses between the initial exposure to a cancer-causing substance and the diagnosis of cancer. The latency period for lung cancer is between five and 40 years, but generally 10 years at a minimum. The latency period can vary depending on factors such as the specific cancer-causing substance, dose and duration of the exposure, age at exposure, genetic susceptibility, and other medical conditions. This long latency gives people time to live and work in different places in the period between exposure and the diagnosis of cancer and is one of the reasons it is difficult to determine what causes cancer in humans.

Cancer cases were identified among persons who resided in the evaluation area when their cancers were diagnosed. Former residents of the evaluation area who moved away could not be included in this analysis, and information about how long each patient lived in the evaluation area was not available. Conversely, individuals who have recently moved to the evaluation area would be included in this analysis. Residential migration (the movement of people in and out of the evaluation area) influences the ability to determine if living in the evaluation area increases or decreases an individual's risk of getting cancer.

The BRFSS cigarette smoking data is self-reported and only provides an indication of the proportion of people who reported that they currently smoke. It does not provide insight into health outcomes experienced by any of the BRFSS respondents. Furthermore, former smokers

are also at increased risk of many cancers. The current cigarette smoking prevalence data offered by current survey responses cannot answer questions about past smoking behaviors and may not correlate with historical smoking prevalence among area residents.

Statistical tests identify results that are unlikely to occur by chance alone. However, the tests used in this analysis are expected to yield statistically significant results due to chance alone 5% of the time. Therefore, the more tests we do, the more likely we are to find one or more statistically significant results by chance alone. The approach to interpretation of statistical significance used in this evaluation is consistent with that recommended in CDC guidelines (CDC 2022a). For areas with smaller populations, the lack of statistically significant findings may be because the numbers of cancer cases diagnosed are too small to detect possible differences between the evaluation area and the comparison group. Analyses on smaller populations may also yield results with more statistical variability, as evident in some of these findings where a significant elevation in one time period was not observed in other time periods.

Conclusion

The purpose of this report is to make the rates of lung cancer in the evaluation area available to the public while also reviewing possible environmental factors that have been the source of community questions and concerns. In this regard, we examined the available information about the components of landfill gas, how it is controlled, how it is measured, and the available information on air quality in the area around Seneca Meadows Landfill. We also considered the scientific literature about whether residents near municipal solid waste landfills experience higher cancer rates. Overall, these factors do not point to a greater level of concern about lung cancer in the evaluation area.

The current analysis provides a summary of lung cancer incidence in northern Seneca County in the area around the Seneca Meadows Landfill. The Landfill is located near the border of census tracts 9504 and 9505. In census tract 9505, residents did not show any statistically significant elevations. Male residents of census tract 9504 showed a statistically significant elevation, however such elevation was not observed among female residents of the census tract. The only other statistically significant elevations identified over the complete 26-year time period were among male and female residents of census tract 9506, which is located further away to the west of the landfill.

We provided an analysis of grouped census tracts, to allow for more detailed analysis by age, sex, and time period. One of the three areas, census tracts 9501 and 9506 (Junius, Tyre, and western Waterloo), had a statistically significant elevation in observed lung cancer diagnoses over the 26-year study period among both males and females, while the other two areas, including the town of Seneca Falls, did not. Furthermore, we did not find consistent elevations in incidence over time and across age groups, the areas showing elevated rates are primarily distant from the landfill, and the updated cancer mapping showed that the evaluation area is not elevated relative to NYS (minus NYC) (Appendix A). While the grouped census tract findings do not suggest a consistent pattern of higher lung cancer rates associated with the landfill, it is

important to note that interpretation of these results must be done cautiously because numerous personal, community and environmental factors can affect cancer statistics that are not accounted for in this type of analysis (CDC, 2022).

This review cannot determine why the sporadic lung cancer elevations in individual or grouped census tracts may have occurred, and we note that smoking rates and other environmental, occupational, demographic or lifestyle factors in these particular census tracts are not known. This along with the other uncertainties and limitations described above make conclusions about the causation of lung cancer at a census tract or individual level impossible. Thus, we cannot use the current report to make conclusions about whether lung cancer outcomes for any specific individual were related to their living in this area, or their personal, lifestyle or other environmental risk factors; nor can this review make any conclusion about whether residents of the evaluation area are likely to be diagnosed with lung cancer in the future.

References

American Cancer Society. Lung Cancer Risk Factors. Retrieved October 30, 2024 from https://www.cancer.org/cancer/types/lung-cancer/causes-risks-prevention/risk-factors.html

Centers for Disease Control and Prevention. National Environmental Public Health Tracking Network. Retrieved October, 10, 2024 from https://ephtracking.cdc.gov/

Centers for Disease Control and Prevention, Agency for Toxic Substances and Disease Registry (CDC/ATSDR). (2022). Guidelines for Examining Unusual Patterns of Cancer and Environmental Concerns. https://www.cdc.gov/cancer-environment/php/guidelines/index.html

Centers for Disease Control and Prevention, Agency for Toxic Substances and Disease Registry (CDC/ATSDR). (2022a). Guidelines for Examining Unusual Patterns of Cancer and Environmental Concerns. Appendix A: Statistical Considerations. https://www.cdc.gov/cancer-environment/php/guidelines/statistical-considerations.html

Ellington, T. D., Werner, A. K., Henley, S. J., Paddock, L. E., & Agovino, P. K. (2023). Feasibility of visualizing cancer incidence data at sub-county level: Findings from 21 National Program of Cancer Registries. Spatial and Spatio-temporal Epidemiology, 45, 100564. https://doi.org/10.1016/j.sste.2023.100564

Goldberg MS, Siemiatyck J, DeWar R, Désy M, Riberdy H. Risks of developing cancer relative to living near a municipal solid waste landfill site in Montreal, Quebec, Canada. Arch Environ Health. 1999 Jul-Aug;54(4):291-6. doi: 10.1080/00039899909602488.

Goodman, J. E., Hudson, T. C., & Monteiro, R. J. (2010). Cancer Cluster Investigation in Residents Near a Municipal Landfill. Human and Ecological Risk Assessment: An International Journal, 16(6), 1339–1359. https://doi.org/10.1080/10807039.2010.526504

Mataloni F, Badaloni C, Golini MN, Bolignano A, Bucci S, Sozzi R, Forastiere F, Davoli M, Ancona C. Morbidity and mortality of people who live close to municipal waste landfills: a multisite cohort study. Int J Epidemiol. 2016 Jun;45(3):806-15. doi: 10.1093/ije/dyw052.

National Cancer Institute (NCI), DCCPS, Surveillance Research Program, released February 2022. Populations - Total U.S. (2006-2020), Census Tract Estimates by Race/Origin Controlling to Vintage 2020 <2010 Tract Geographies>, Source: Woods & Poole Economics, Inc. Washington, D.C. Copyright 2022. https://seer.cancer.gov/censustract-pops/

New York State Department of Environmental Conservation. (2024). Final Scoping Document For Draft Environmental Impact Statement Proposed Valley Infill Project To Expand The Seneca Meadows Landfill In The Towns Of Seneca Falls And Waterloo, Seneca County, New York. https://senecameadows.com/wp-content/uploads/2024/04/2024-04-10-SMI-Valley-Infill-Final-Scoping-Document.pdf

New York State Department of Health (1998). Investigation of Cancer Incidence and Residence Near 38 Landfills with Soil Gas Migration Conditions: 1980-1989. New York State Library Call Number: EPI 714-4 INVCI 98-4975.

New York State Department of Health Environmental Facilities and Cancer Map. (July 2018) Retrieved August 23, 2024 from https://www.health.ny.gov/statistics/cancer/environmental_facilities/mapping/

New York State Department of Health (2022). Cancer Reporting. NYS DOH. Retrieved 1/5/2024 from https://www.health.ny.gov/professionals/reportable_conditions/cancer/

New York State Department of Health (February 2024). Behavioral Risk Factor Surveillance System (BRFSS). https://www.health.ny.gov/statistics/brfss/

New York State Department of Health (2024). Important Things To Know About Landfill Gas. https://www.health.ny.gov/environmental/outdoors/air/landfill_gas.htm

New York State Department of Health (2026). Radon in Seneca County. https://apps.health.ny.gov/statistics/environmental/public_health_tracking/tracker/index.html#/radonCountyTable/36099

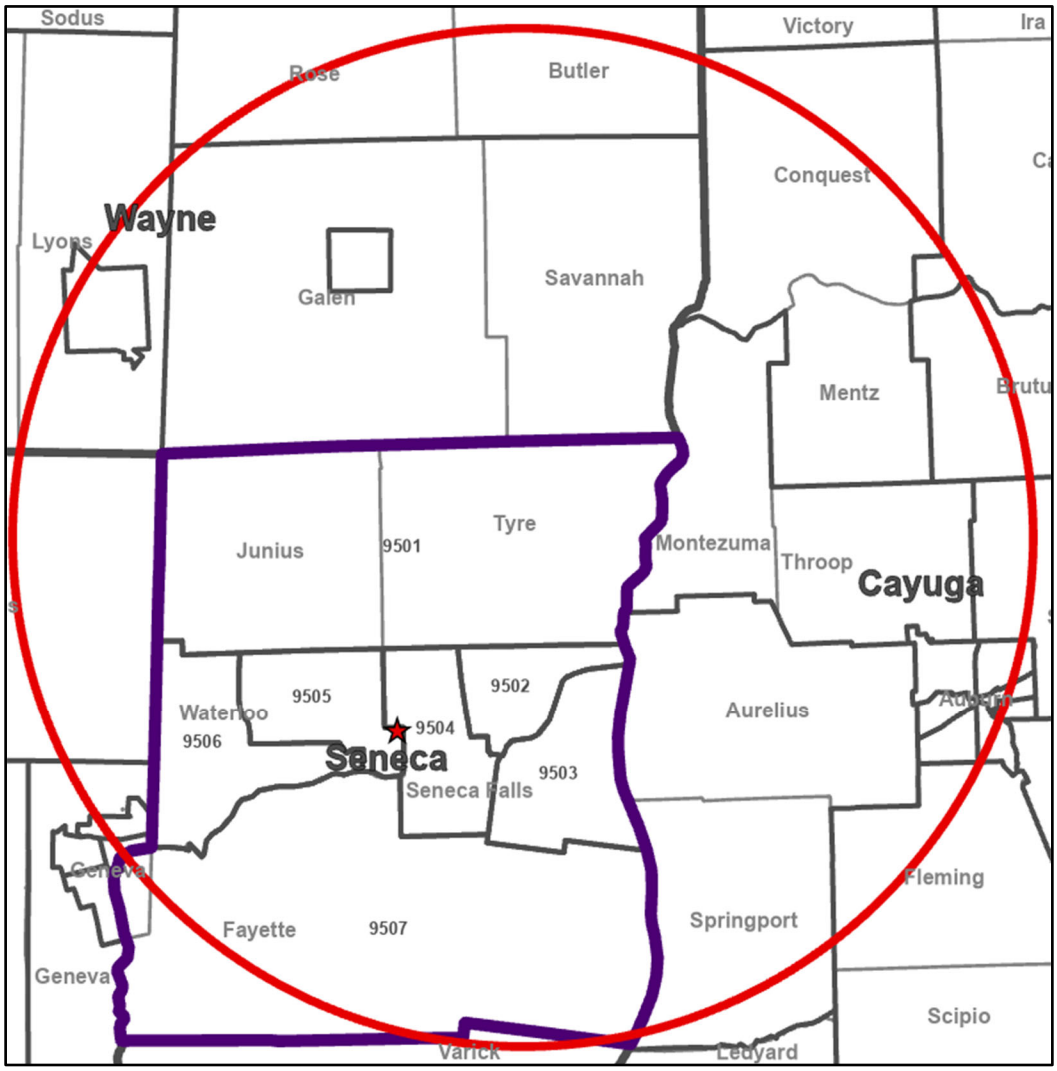
North American Association of Central Cancer Registries, I. (2024). Cancer in North America: 2017-2021. Volume One: Combined Cancer Incidence for the United States, Canada and North America. Appendix D: Data Quality Indicators by Year. I. North American Association of Central Cancer Registries. https://www.naaccr.org/wp-content/uploads/2024/07/Data-Quality-Indicators-by-Year-and-Registry.pdf

Siegel, R. L., Giaquinto, A. N., & Jemal, A. (2024). Cancer statistics, 2024. CA: A Cancer Journal for Clinicians, 74(1), 12-49. https://doi.org/https://doi.org/10.3322/caac.21820

Vinti, G.; Bauza, V.; Clasen, T.; Medlicott, K.; Tudor, T.; Zurbrügg, C.; Vaccari, M. Municipal Solid Waste Management and Adverse Health Outcomes: A Systematic Review. Int. J. Environ. Res. Public Health 2021, 18, 4331.

Appendix A: Cancer Mapping Results, Lung Cancer

Figure A1. Map of Elevated Lung Cancer Incidence Calculated Using New York State as a Reference, 2011-2015



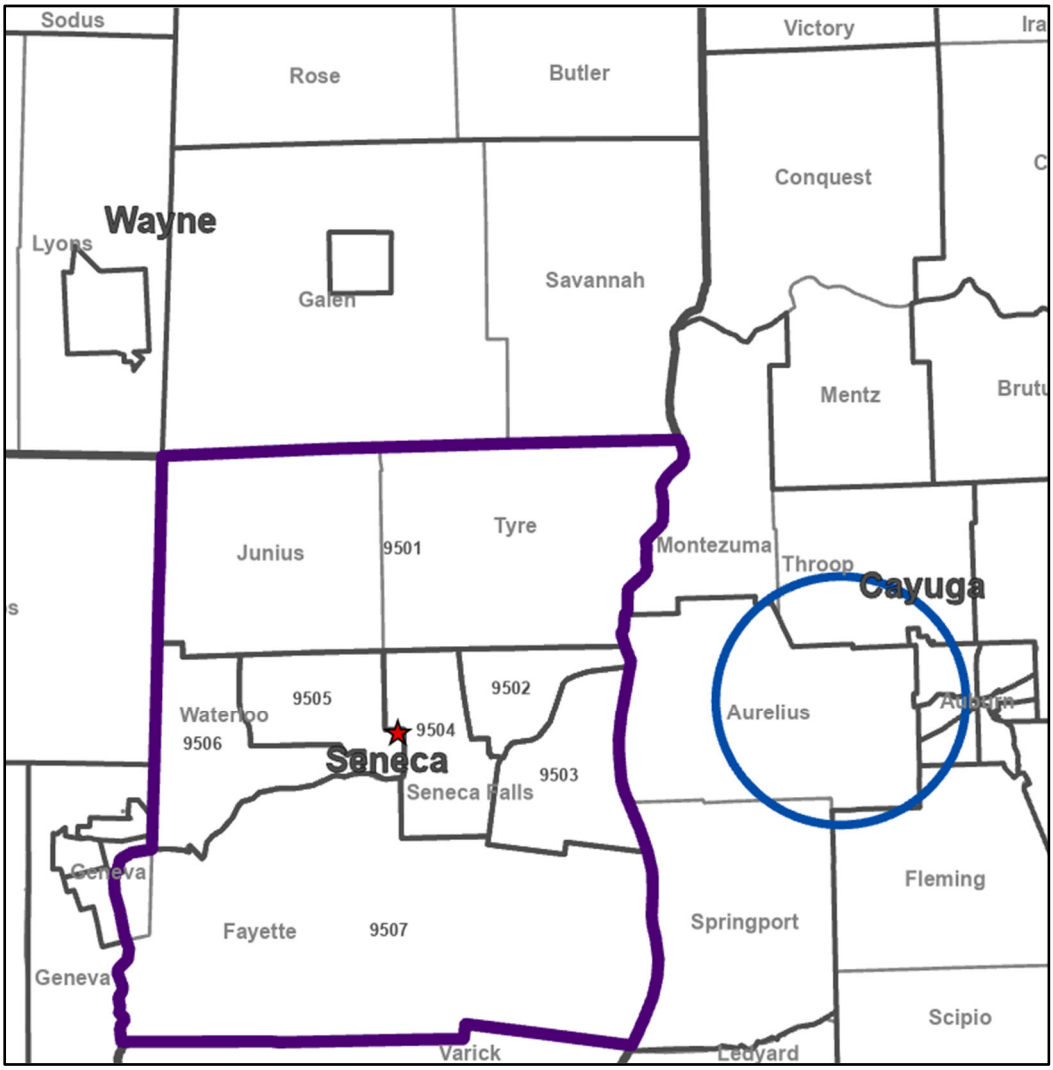
Legend:

Area of elevated lung cancer incidence calculated with New York State including New York City as the reference, 2011-2015

Area included in the current evaluation

Seneca Meadows Landfill

Figure A2. Map of Elevated Lung Cancer Incidence Calculated Using New York State excluding New York City as a Reference, 2015-2019



Legend:

Area of elevated lung cancer incidence calculated with New York State excluding New York City as the reference, 2015-2019

Area included in the current evaluation

Seneca Meadows Landfill