
**INVESTIGATION OF CANCER INCIDENCE
IN THE AREA OF NEW YORK AIR BRAKE,
JEFFERSON COUNTY, NEW YORK, 1996-2019**

Prepared by the

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

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

For further information contact:

Scott Coley
Director, Cancer Surveillance Program

09/2024

INVESTIGATION OF CANCER INCIDENCE IN THE AREA OF NEW YORK AIR BRAKE, JEFFERSON COUNTY, NEW YORK, 1996-2019

Background

The Cancer Surveillance Program of the New York State Department of Health (NYSDOH), Bureau of Cancer Epidemiology, responds to concerns about cancer in communities throughout New York State. In November 2012, the Cancer Surveillance Program received a request from the Bureau of Environmental and Occupational Epidemiology in the Center for Environmental Health, which is also part of NYSDOH, to conduct a cancer incidence investigation in the area of the New York Air Brake facility, located in the City of Watertown, Jefferson County.

The New York Air Brake facility is in a mixed-use area in the northeast part of Watertown and has been the site of industrial activity for over 100 years. Residents of the surrounding neighborhood have expressed concerns about site-related contaminants impacting off-site properties, including along Kelsey Creek, and via soil-vapor intrusion. Residents have also expressed concerns about a variety of health outcomes, including cancer, neurological and autoimmune diseases, allergies and respiratory irritation, and adverse birth outcomes. NYSDOH conducted this health outcomes review at the request of community members and in response to a reported unusual pattern of disease. Additional background about potential exposures and health outcomes is provided below.

The facility itself is contaminated with chlorinated solvents, volatile organic compounds (VOCs), metals, and PCBs. Off-site contamination has included metals and PCBs found in Kelsey Creek and Oily Creek, and chlorinated solvents found in groundwater.

Past exposures to metals, VOCs and PCBs via dermal contact or incidental ingestion could have occurred in some residential yards adjacent to Kelsey Creek and Oily Creek or from exposure to surface waters and sediments in Kelsey Creek and Oily Creek. These areas were mitigated in 2017-2019.

Past exposures to VOCs via inhalation could have occurred from releases to the ambient air as well as from on-site soil vapor intrusion into facility buildings. Measures are currently in place to control the potential for contact with subsurface soil and groundwater contamination. People are not drinking the contaminated groundwater because the area is served by a public water supply that is not affected by this contamination. Volatile organic compounds in the groundwater may move into the soil vapor (air spaces within the soil), which in turn may move into overlying buildings and affect indoor air quality. This process, which is similar to the movement of radon gas from the subsurface into the air of buildings, is referred to as soil vapor intrusion. Sub slab depressurization systems (systems that ventilate/remove the air beneath the building) have been installed in on-site buildings and one off-site structure to prevent the indoor air quality from being affected by the contamination in soil vapor beneath the buildings. Sampling indicates soil vapor intrusion is not a concern for other off-site buildings. Prior to the sale of the

business in 1991, the US EPA Toxic Release Inventory identified fugitive air emissions of VOCs from the site, specifically trichloroethylene and xylene. In more recent years the Toxic Release Inventory data show small amounts of copper and lead (less than 2 pounds per year), and no VOCs.

Based on available information about environmental contaminants and existing mitigation systems, the general public is not currently being exposed to site related contaminants.

Members of the community reported concerns about cancer and adverse birth outcomes, among other illnesses. A separate report was written about the analysis of adverse birth outcomes diagnosed among area residents. The current review focuses on cancer. This type of review is feasible because NYSDOH collects comprehensive data on cancer diagnoses for the NYS population. While there are other health outcomes of interest, those were not included in this review because statewide data are not available for these conditions.

Methods

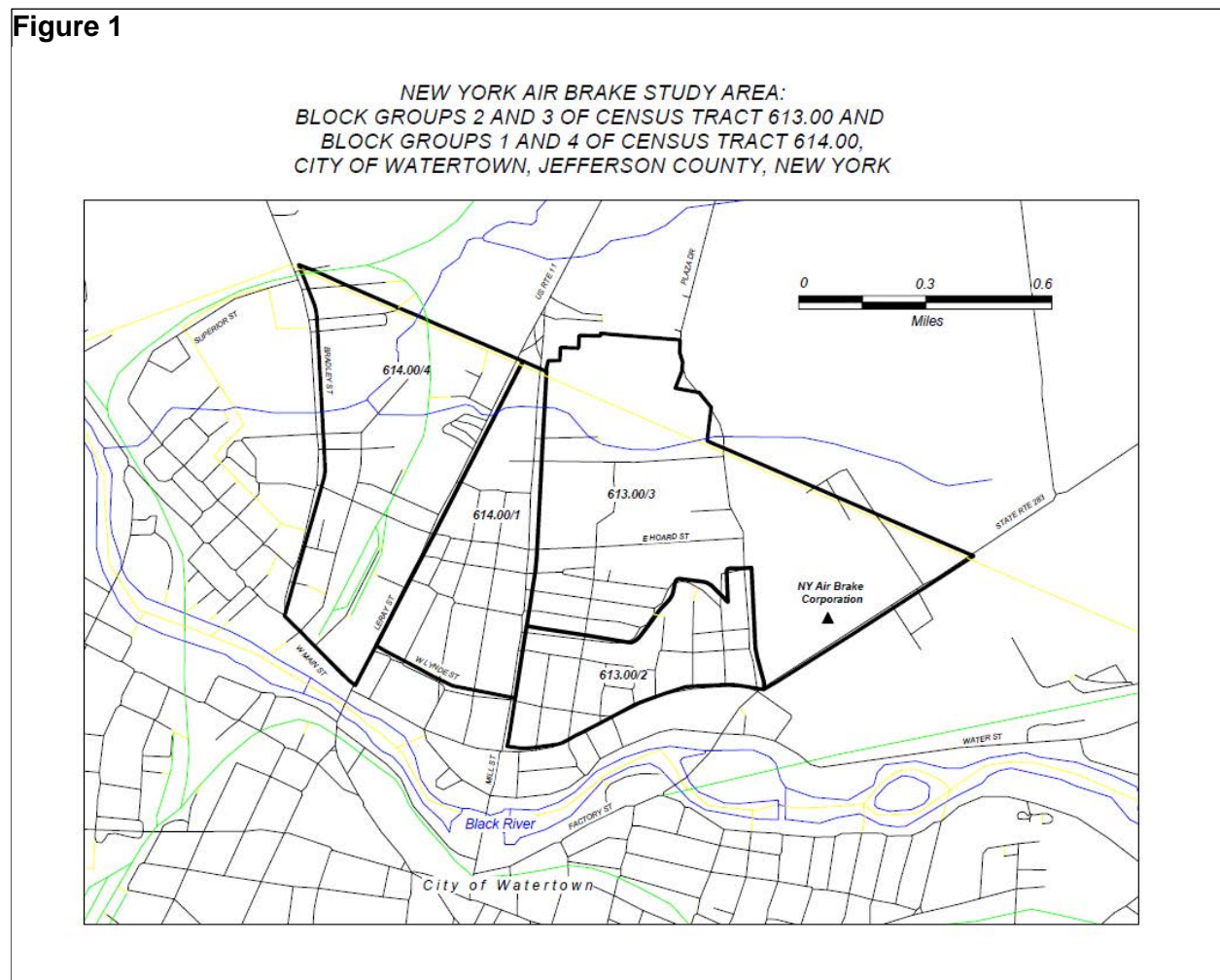
Study Plan. This investigation was designed to determine whether the number of cancer cases arising among people residing in the study area was unusual. In order to do this, the number of cases diagnosed among residents of the study area was compared with the number of cases one would expect to find, if cancer rates in the study area were the same as in similar areas of the state.

Study Area and Time Period. The study area consisted of block groups 2 and 3 of Census Tract 613, and block groups 1 and 4 of Census Tract 614, all located in ZIP Code 13601, Jefferson County (Fig. 1). The time period for the investigation of cancer incidence was selected as 1996 through 2019, the most recent year for which cancer reporting was considered complete and official at the time this report was prepared.

Identification of Observed Cancer Cases. Residents of the study area who were diagnosed with cancer during the time period of the study were identified from the New York State Cancer Registry. As required by New York State law, the Cancer Registry collects information on all individuals diagnosed with cancer in the state. The Registry receives this information from hospitals, laboratories, physician practices, death certificates, and various other sources. Cancer Registry files are continuously updated, and all the information received is combined to reflect the most accurate and complete information available.

Calculation of Expected Cancer Cases. To determine whether the number of observed cases of cancer was unusual, it was necessary to calculate the numbers of cases of cancer that would be expected in the study area. This calculation takes into account the population size and the age and sex distribution in the study area. The number of cancers that would be expected in the study area was calculated by applying cancer incidence rates by age and sex for a reference area to the estimated population of the study area by age and sex. The reference area selected for this investigation was New York State, exclusive of New York City. The population for the study area was estimated using data from the United States Census for 2000 and 2010.

Figure 1



Types of Cancer (Anatomic Sites) Studied. Seventeen of the most common types of cancer were examined among males, including lung, colorectal, prostate, and bladder cancers, and lymphomas and leukemias. Nineteen of the most common types were examined among females. In addition to the sites examined for males (except prostate and testis), cancers of the breast, cervix, ovary, and uterus were examined for females.

Statistical Testing. The probability that chance alone could explain an increase or decrease in the observed number of cancer cases compared to the expected number was evaluated based on the Poisson distribution.¹ If the probability of observing an excess or deficit was 0.025 or less for any cancer site, the result was considered to be statistically significant. Non-significant excesses or deficits were considered to represent random variations in observed patterns of disease.

Results

Observed and Expected Numbers of Cancer Cases by Sex

Table 1 presents observed and expected numbers of cancer cases among all people residing in the study area between 1996 and 2019. A total of 548 cancer cases were reported to the Cancer Registry. For all anatomical sites combined, the total of 281 cancers observed in males was statistically significantly higher than the 238 cases of cancer expected. Among females, the total of 267 cancers was not statistically significantly different from the 255 cases of cancer expected.

The most common types of cancer observed among males included prostate with 67 observed cases (65 cases expected); lung with 52 observed cases (33 cases expected); and colorectal with 34 observed cases (22 cases expected). Fewer than six cases of cancer were

Table 1

Observed and Expected Numbers of Incident Cancer Cases New York Air Brake Study Area Census Tract 613 (Block Groups 2 and 3) and Census Tract 614 (Block Groups 1 and 4) Jefferson County, New York, 1996-2019 New York State exclusive of New York City Standard				
SITES (ICD-O-3) ^a	MALES		FEMALES	
	Observed ^b	Expected ^c	Observed ^b	Expected ^c
All Sites	281*	238	267	255
Oral Cavity / Pharynx	8	7	-- ^d	4
Esophagus	-- ^d	4	-- ^d	1
Stomach	-- ^d	4	0	3
Colorectal	34*	22	35*	24
Liver / Intrahepatic Bile Duct	9*	4	-- ^d	2
Pancreas	8	6	6	7
Larynx	6	3	0	1
Lung / Bronchus	52*	33	47	35
Female Breast			63	73
Cervix uteri			-- ^d	4
Corpus Uterus / Uterus NOS			14	16
Ovary			14*	8
Prostate	67	65		
Testis	-- ^d	3		
Urinary Bladder (including in situ)	23	19	14*	7
Kidney / Renal Pelvis	10	9	11	6
Brain / Other Central Nervous System	-- ^d	4	-- ^d	3
Thyroid	0	3	-- ^{d^}	10
Lymphomas	10	12	12	12
Myeloma	-- ^d	3	-- ^d	3
Leukemias	-- ^d	9	9	7
All Other Sites	33	29	24	30

^a Classification of site is based on International Classification of Diseases for Oncology, 3rd Edition.

^b Data were obtained from the New York State Cancer Registry (database as of November 2021).

^c Expected numbers are estimated 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 total 1996-2019 study population (43,985 males, 48,705 females) to obtain expected numbers of cases.

^d The number of cases is not shown to protect patient confidentiality.

* Denotes a statistically significant difference from expected. The probability that this excess is due to chance is less than 2.5%.

[^] Denotes a statistically significant difference from expected. The probability that this deficit is due to chance is less than 2.5%.

observed for several types of cancer including cancers of the esophagus, stomach, testis, brain/other central nervous system, myeloma, and leukemia. (To protect patient confidentiality, the specific numbers of observed cases are not displayed for cancer sites with fewer than six observed cases.) There were no cases of thyroid cancer among males during the time period of the study. Among all cancer sites examined, a statistically significant excess was found in the number of males with colorectal cancer (34 observed vs. 22 expected), cancer of the liver/intrahepatic bile duct (9 observed vs. 4 expected), and cancer of the lung (52 observed vs. 33 expected). No other individual cancer site showed a statistically significant difference among males.

The most common types of cancer observed among females included breast with 63 observed cases (73 cases expected); lung with 47 observed cases (35 cases expected); and colorectal with 35 observed cases (24 cases expected). Fewer than six cases were observed for several types of cancer including cancers of the oral cavity/pharynx, esophagus, liver/intrahepatic bile duct, cervix, brain/other central nervous system, thyroid, and myeloma. There were no cases of cancers of the stomach, and larynx diagnosed in females during the time period of the study. Among all cancer sites examined, a statistically significant excess was found in the number of females with colorectal cancer (35 observed vs. 24 expected), cancer of the ovary (14 observed vs. 8 expected), and cancer of the urinary bladder (14 observed vs. 7 expected). In addition, there was a statistically significant deficit in the number of females with thyroid cancer. No other individual cancer site showed a statistically significant difference among females.

For pancreatic cancer, which was a specific concern of the residents, the number of cases diagnosed in males in the study area was eight, which was similar to the six cases that was expected. Among females, the number of cases diagnosed was six, and was close to the seven cases expected.

Further Examination of Statistically Elevated Cancer Sites

For cancers with a statistically significant excess, 10-year age groups were also examined (45-54 years, 55-64 years, etc.). The numbers within age groups were mostly less than 6. Therefore, in concordance with our confidentiality policy, results are not presented in a tabular format. Instead, they are summarized in text.

Colorectal Cancer. In the study area, the ages of the males who were diagnosed with colorectal cancer between 1996 and 2019 ranged, in years, from the early-30s to the mid-90s, with an average age of 70 years. Almost 90 percent of the men were over the age of 50 at diagnosis. When 10-year age groups were examined, some of the older age groups had more cases of colorectal cancer than expected, however none had a statistically significant excess.

The ages of the females diagnosed with colorectal cancer ranged, in years, from the late-20s to the early-90s, with an average age of 69 years. Over 90 percent of the women were over the age of 50 at diagnosis. When 10-year age groups were examined, more cases of colorectal cancer were observed than expected in some of the older age groups, but none of these age

groups had a statistically significant excess.

Cancer of the Liver/Intrahepatic Bile Duct. The ages of the males diagnosed with liver cancer ranged from the early-40s to the mid-80s, with an average age of 65. When 10-year age groups were examined, none had a statically significant excess.

Cancer of the Lung. In the study area, the ages of the males who were diagnosed with lung cancer ranged, in years, from the mid-40s to the late-80s, with an average age of 67. When 10-year age groups were examined, there was a statistically significant excess in two of the age groups; 45-54 years (7 observed vs. 3 expected) and 55-64 years (13 observed vs. 7 expected).

Among males in the study area who developed lung cancer between 1996 and 2019, about 94% were identified as either current or former smokers at the time of their diagnosis, and about 4% had an unknown smoking status. According to the New York State Cancer Registry, approximately 82% of males diagnosed with lung cancer between 1996 and 2019 in New York State, exclusive of New York City, were current or former smokers at the time of their diagnosis. New York State, exclusive of New York City, however, had a higher percentage of unknown smoking status (17%).

Cancer of the Ovary. In the study area, the ages of the females who were diagnosed with ovarian cancer ranged from the mid-20s to the early-90s, with an average age of 64. When 10-year age groups were examined, there was a statistically significant excess in the 85+ years age group (fewer than six observed vs. one expected).

Cancer of the Urinary Bladder. The ages of the females in the study area who were diagnosed with bladder cancer ranged, in years, from the mid-40s to the mid-80s, with an average age of 69. Almost 90 percent of them were diagnosed over the age of 55. When 10-year age groups were examined, there was a statistically significant excess in the 65-74 years age group (seven observed, two expected). The total number of males diagnosed with bladder cancer was greater than expected but the excess was not statistically significant.

Among females in the study area who developed bladder cancer, about 70% were identified as either current or former smokers at the time of their diagnosis, and about 14% had an unknown smoking status. According to the New York State Cancer Registry, approximately 51% of females diagnosed with bladder cancer between 1996 and 2019 in New York State, exclusive of New York City, were current or former smokers at the time of their diagnosis. New York State, exclusive of New York City had about the same percentage of unknown smoking status (17%).

Discussion

Cancer Incidence

This study found that the total number of cancers diagnosed among males residing in the

study area was statistically significantly more than expected. Seventy-two percent of this excess is due to the higher-than-expected numbers of observed colorectal and lung cancers. The total number of cancers diagnosed among females was statistically similar to the number expected. Statistically significant excesses were also found in the number of males and females diagnosed with colorectal cancer, in males diagnosed with liver cancer and with lung cancer, and in females diagnosed with ovarian cancer and with bladder cancer.

The incidence of lung cancer is high in the Watertown area. In the time period 2015-2019, the most recent five-year period for which cancer data are available, the incidence rate of lung cancer per 100,000 people for all of Jefferson County was 100.2 for males and 84.8 for females, compared to rates of 69.4 for males and 62.3 for females for New York State, exclusive of New York City. These elevations amount to about 45% for males and 35% for females. For the years 2011-2015, the Environmental Facilities and Cancer Map, a mapping project produced by NYSDOH, shows that much of Jefferson County, including Watertown, as well as parts of St. Lawrence and Lewis Counties, is in an area of elevated lung cancer incidence, not likely to be due to chance.² The higher incidence of lung cancer in the study area may be a reflection of a regional pattern.

General Cancer Information

Cancer is a common disease. One of every two men and one of every three women will develop cancer during his/her lifetime.³ Cancer occurs at all ages, but most often in middle-aged and older people. The number of people diagnosed with cancer is increasing in most communities. Most of this is because more people are living to the older ages, where cancer is more common.

Different cancers have different causes, and there are many factors that affect a person's chance of getting different types of cancer. Personal health habits and lifestyle may contribute to the development of cancer. Scientists have estimated that at least 30% of cancer deaths are due to tobacco.⁴ In addition, between 25-30% of cancer deaths may be due to inadequate physical activity, obesity and an unhealthy diet.⁵ A family history of cancer can also affect someone's risk. Scientists agree that people can get cancer through repeated long-term contact with carcinogens. These include tobacco, sunlight, x-rays, and certain chemicals that may be found in the air, water, food, drugs, and workplace.

Most cancers develop slowly in people. They usually appear between five to 40 years after exposure to a carcinogen. For example, lung cancer may not occur until 30 years after a person starts smoking. This long latency period is one of the reasons it is difficult to determine what causes cancer in humans.

It is important to realize that many cancers can be effectively treated if they are diagnosed at an early stage. Screening for cancers of the breast, cervix, rectum and colon, and lung, for example, helps to identify these diseases before the onset of symptoms and at a time when they are usually the most curable. Many persons could reduce their chances of developing or dying

from cancer by adopting a healthier lifestyle and by visiting their physician for a cancer-related checkup.

Cancer Risk Factors

Colorectal Cancer. Colorectal cancer is one of the most common cancers in US.⁶ It is more likely to occur in people older than 50 years, however, for unknown reasons more people under the age of 50 are being diagnosed with this cancer. Risk factors for this cancer include obesity, an inactive lifestyle, diets high in red and processed meats or low in vegetables and fruits, long-term smoking, and heavy alcohol consumption. Other risk factors include having had intestinal polyps or inflammatory bowel disease, or a family history of colorectal cancer.

Cancer of the Liver/Intrahepatic Bile Duct. Liver cancer is more common in men than in women and in Asian Americans and Pacific Islanders.⁷ The most common risk factor for this cancer is chronic infection with hepatitis B or hepatitis C viruses. Other risk factors include cirrhosis, non-alcoholic fatty liver disease, heavy alcohol use, tobacco use, and obesity.

Cancer of the Lung. Lung cancer is one of the most common cancers in US.⁸ It is more likely to occur in older people; the average age at diagnosis is about 70 years. Men are more likely to be diagnosed with this cancer than females. Smoking is the most common cause, with estimates that it accounts for 80 to 90 percent of all lung cancer cases. Other established risk factors include exposure to radon gas, asbestos exposures in the workplace, exposure to high levels of ionizing radiation such as X-rays, and a history of other lung diseases, such as tuberculosis.

Cancer of the Ovary. The risk for ovarian cancer gets higher with age.⁹ Other risk factors include being overweight or obese, having children later or never having had a full-term pregnancy, taking hormone therapy after menopause, or having a family history of ovarian cancer, breast cancer or colorectal cancer.

Cancer of the Urinary Bladder. Smoking is the most important risk factor for bladder cancer, with estimates that it accounts for up to 50% of all bladder cancer cases.¹⁰ Other risk factors include certain chemicals, such as those used in the dye industry, certain medicines or herbal supplements, arsenic in drinking water, and not drinking enough fluids. Whites are more likely to develop bladder cancer. It is also much more common in men than in women. About 90% of the people diagnosed with this cancer are older than 55 years of age.

Cancer of the Pancreas. Pancreatic cancer was of particular concern to the community, although it was not elevated among either males or females.¹¹ Almost all people who are diagnosed with pancreatic cancer are older than 45 years. The average age at the time of diagnosis is 71 years. Some of the risk factors that increase one's chance of being diagnosed with pancreatic cancer include smoking, being overweight or obese, having exposure to certain chemicals used in the workplace (dry cleaning, metal working), having a family history of pancreatic cancer, having certain inherited genetic syndromes, or having diabetes.

Environmental Considerations

For any substance to have an effect on human health, people have to come into contact with it. This is what is known as exposure. People may be exposed to a chemical substance by breathing it in (inhalation), consuming it in food or water (ingestion), or getting it on their skin (dermal exposure). Even with exposure, not all hazardous substances cause cancer. The risk of developing cancer upon exposure to a cancer-causing substance depends on the amount of the substance people are exposed to, the length of time they are exposed to it, and how often they are exposed to it.

Study Limitations

In drawing conclusions from these data, several aspects of the methodology need to be addressed. First, since there were 38 individual significance tests conducted (17 among males, 19 among females, and one each among males and females overall), it was anticipated that one or two results might appear statistically significant even though the difference between observed and expected events were due entirely to random fluctuations in the data.

The second aspect is the power of the statistical test, that is, the probability that a true departure from the expected number can be detected by significance testing. The power of a significance test varies with the number of expected cases. For example, using the statistical test described above, the probability of detecting a true doubling in cancer incidence over the expected value will be 80% or higher when the expected number is 12 or more. For this investigation, the power of detecting a doubling, if one were present, was sufficient for total cancers in males and females separately and for the most frequently diagnosed cancers in males and females, but low for a majority of the individual cancer sites.

An additional limitation is that migration, movement of people in or out of the study area, could not be taken into account. Cancer cases were identified among persons who resided in the study area when their cancers were diagnosed. Former residents of the study area who moved away prior to being diagnosed with cancer could not be included, while persons who developed cancer shortly after moving into the area were included. According to the 2010 US Census, the percent of people in the study area who were renters was around 43%. This percentage is higher than the 30% of those who are renters in New York State exclusive of New York City. This means people in the study area may move around more frequently and may not have lived in the study area for a long length of time.

Interpretation

This study found that the total number of cancers among males in the study area was statistically significantly elevated. This elevation is due in large part to the excesses in colorectal and lung cancers. The total number of cancers among females was not significantly elevated. There was a statistically significant excess number of cases of colorectal cancer among males,

as well as among females. There were more cases of this cancer diagnosed in most of the 10-year age groups, but none of the age-groups had a statically significant excess. There was a statistically significant excess number of cases of cancer of the liver/intrahepatic bile duct in males, but not in females. The most common risk factor is chronic infection with hepatitis B or hepatitis C viruses. There was a statistically significant excess number of cases of lung cancer among males, but not in females. This excess may be part of an area-wide pattern, possibly related to smoking habits. There was a statistically significant excess number of cases of bladder cancer among females, but not in males. This excess could also possibly be related to smoking habits. There was a statistically significant excess number of cases of ovarian cancer among females. Most of the excess was in the oldest age group, 85 years and older. Pancreatic cancer, which was of concern to community residents, was not elevated in either males or females.

It is important to realize that this study cannot prove cause and effect. For any substance to have an effect on human health, people have to come into contact with it. This type of study cannot determine whether any of the people with cancer had any exposures that were associated with New York Air Brake. Also, most cancers have more than one possible cause, and in this study, it was not possible to identify all other possible causes. Finally, it is not possible to rule out that some of the statistically significant excesses in males and females were due to chance.

References

1. Molina EC. Poisson's Exponential Binomial Limit. Huntington, NY: Robert E. Krieger Co., 1973.
2. New York State Department of Health, Environmental Facilities and Cancer Map. Available at https://apps.health.ny.gov/statistics/cancer/environmental_facilities/mapping/map , accessed June 2022.
3. American Cancer Society. Cancer Facts & Figures 2022. Atlanta: American Cancer Society, 2022.
4. U.S. Department of Health and Human Services. The Health Consequences of Smoking: A Report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2004.
5. Byers T, Nestle M, McTiernan A, et al. American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention: Reducing Risk of Cancer with Healthy Food Choices and Physical Activity. CA Cancer J Clin. Mar-Apr; 52(2):92-119, 2002
6. American Cancer Society. (June 2020). Colorectal Cancer. From American Cancer Society website: <http://www.cancer.org> .
7. American Cancer Society. (April 2019). Liver Cancer. From American Cancer Society website: <http://www.cancer.org> .
8. American Cancer Society. (October 2019). Lung Cancer. From American Cancer Society website: <http://www.cancer.org> .
9. American Cancer Society. (January 2021). Ovarian Cancer. From American Cancer Society website: <http://www.cancer.org> .
10. American Cancer Society. (January 2019). Bladder Cancer. From American Cancer Society website: <http://www.cancer.org> .
11. American Cancer Society. (June 2020). Pancreatic Cancer. From American Cancer Society website: <http://www.cancer.org> .