
FACT SHEET

**INVESTIGATION OF CANCER INCIDENCE
NEAR 38 LANDFILLS WITH SOIL GAS
MIGRATION CONDITIONS:
NEW YORK STATE, 1980-1989**

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Prepared by:



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SUMMARY

The New York State Department of Health (DOH) conducted this study to find out if people living near certain landfills had an increased risk of cancer compared to people living elsewhere. The landfills studied were older municipal landfills. Municipal landfills contain household garbage which breaks down, creating methane gas. Previous investigations showed that methane can move away from landfills and carry other chemicals present in the landfill with it.

When this mixture of gases moves away from a landfill through air pockets in soil, people can be exposed in their homes. Previous DOH studies suggested possible health effects near a landfill where chemical exposures had occurred in indoor air. After review of these studies, DOH and the federal Agency for Toxic Substances and Disease Registry (ATSDR) recommended that DOH conduct a larger health study to evaluate possible cancer effects among people living near a group of landfills of this type.

From 245 landfills identified in the state, 38 were selected for the study. The information available for each of the selected landfills showed directly or provided strong evidence that the landfill contents were creating methane gas. Twenty-six landfills had soil gas sampling data. Nine of these had data only on methane levels in soil gas, two had data on other chemicals in soil gas, and fifteen had data for both methane and other chemicals in soil gas. For the 12 other landfills where soil gas was not sampled for methane or specific chemicals, methane or other chemicals were found in ambient air or water within the landfill boundary. By evaluating these data along with information about what was buried in the landfill and what type of soils surrounded it, the researchers concluded that these 12 landfills should be included in the study.

For each of the 38 landfills an area, or ring, around the landfill boundary was identified where people may have been exposed to landfill chemicals through soil gas moving into homes. For twelve of the 38 landfills, soil gas samples had been taken outside the landfill boundaries. From this sampling information, the researchers estimated the migration distances for the other landfills where this type of sampling had not been done. The potential exposure areas, or rings, extended 250 feet from the landfill boundaries for 33 landfills. The other five landfills were given larger rings based on sampling results showing methane in soil at specific distances from the landfills. (For four of these landfills, the ring extended out 500 feet, and for one landfill it extended 1,000 feet.)

The study evaluated cancer incidence among people living in the zip codes containing these 38 landfills. All cases of leukemia, non-Hodgkin's lymphoma, liver, lung, kidney, bladder and brain cancer diagnosed from 1980 to 1989 in these zip codes were located on a map. A random sample of people who did not have these seven cancers were selected as controls. The controls came from the same zip codes and their addresses were located on a map as well. The researchers then looked to see if people with cancer were more likely than people without cancer to live in the rings surrounding the landfills.

The data available for this study were limited. There were no data that measured whether individuals were exposed to landfill chemicals. Only a person's address at the time of diagnosis was used for mapping his or her location. The length of time people lived at their

homes before being diagnosed with cancer was unknown; a person in the study could have just recently moved to the address. This is important because there is a period of years, called latency, between the beginning of the cancer's growth and its later appearance and diagnosis.

For most cancers, the period of latency is thought to be between ten and twenty years. For cancer studies, researchers would like to know where people lived and what they were exposed to at least twenty years before cancer is diagnosed. But this is rarely possible. This study looked back from cancers diagnosed in the 1980's to potential exposures that might have occurred near landfills that were active in the 1960's and 1970's. This type of study cannot prove a direct cause and effect relationship between exposure and disease.

Since the 1960's and 1970's, when individuals in this study may have been exposed to landfill gases, clean-up activities and landfill closings have changed the conditions at New York State's landfills. This study does not provide us with information about health risks related to living near landfills today.

Study Findings:

- ◆ Of the people in the study zip codes diagnosed with any of the seven types of cancer (9,020) over the ten-year period 1980-1989, fewer than one percent (49) lived in the landfill potential exposure areas (rings) at diagnosis. Fewer than one percent of the people without cancer (controls) lived in the rings around the landfill as well.
- ◆ Among the study's 397 women with bladder cancer, six cases (1.51%) lived in the rings when they were diagnosed. Seven of the study's 1,869 controls (0.37%) lived in the rings. This difference in percentages produced an estimate of a four-fold elevation of risk for bladder cancer among women living in the exposure areas.
- ◆ Among the study's 335 females with leukemia, five cases (1.49%) and five of the 1,575 controls (0.32%) lived in the rings around the landfills. This difference produced an estimate that the risk of leukemia for women living inside the rings was about four times higher than for women living outside them.
- ◆ For men living in the rings around the landfills, the risk for leukemia and risk for bladder cancer were not shown to be higher than for men living outside the rings.
- ◆ Risks for the other five types of cancer, non-Hodgkin's lymphoma, liver, lung, kidney and brain, for women and men living in the rings were not shown to be higher than for those living outside the rings.

These findings need to be interpreted carefully in light of the many problems researchers face when studying cancer incidence in communities. First, one such study alone cannot prove a relationship between an exposure and a disease. Several such studies with similar results are usually needed for scientists to agree that there is evidence for an exposure-

disease relationship. In addition, the findings of this particular study cannot be used to draw strong conclusions about cancer risks around these specific landfills because of the data limitations discussed above. These findings do, however, require follow-up.

DOH is currently conducting a review of the medical records for the leukemia and bladder cancer cases who lived in the potential exposure areas near the study's landfills. A follow-up study is planned using a different group of study controls to see if this study's findings can be verified. The study will also be updated, using cancers diagnosed through 1994. To better assess the study hypothesis that hazardous chemicals moved from these landfills through soil gas into residential areas, the follow-up study will include additional review of data that is relevant to past landfill conditions. In addition, sampling will be conducted at selected landfills to assess current conditions.

None of this study's landfills remain open today. All of the study's landfills have been investigated by DOH and New York State Department of Environmental Conservation (DEC). These investigations addressed the potential for human exposures and health problems related to each landfill site. The actions taken to improve conditions at closed landfills depend on specific characteristics at each site. Remedial actions have included installing systems for collecting landfill gas, capping the landfill, collection of leachate (water run-off) from the landfill, intercepting and treating contaminated groundwater plumes, and continued groundwater monitoring and air monitoring of landfill vents.

QUESTIONS AND ANSWERS

1. Why was this study done? Problems with methane and hazardous volatile organic chemicals (VOCs) have been documented at various landfills in New York State. After several small explosions near furnaces in homes close to Port Washington Landfill, air was sampled in a few homes in 1981. Levels of vinyl chloride, benzene, 1,1,1-trichloroethane, and 1,1,2-trichloroethane in these samples were higher than usual (background) levels. Indoor air samples were taken near two other study landfills, and they did not show VOC levels above expected levels.

The situation at Port Washington Landfill led to the joint DOH and ATSDR recommendation that DOH conduct further health studies. Methane migration conditions were known to exist at other landfills. It did not make sense to study landfills one-by-one because the number of people living near any one landfill is too small for a cancer study. So this study combined information about cancers diagnosed in the 1980's in the areas surrounding the 38 landfills in the state that were judged to have had similar soil gas (methane) migration and hazardous VOC conditions in the 1960's and 1970's.

2. How were the landfills selected for the study? The researchers started with 245 municipal landfills that were included or had been considered for inclusion on the New York State Registry of Inactive Hazardous Waste Sites. After examining population data for these sites, 125 were eliminated because they were located in rural areas with too few people nearby (fewer than 300 people living within ½ mile of the landfill boundary). From the 120 sites remaining, 38 landfills were selected based on data showing methane gas or other chemicals in

soil gas or other samples as described on page 1. This fact sheet includes a table showing the 38 landfills listed according to the zip codes that contain them. The table shows each landfill's size, the years it was active, and whether it has a methane collection system.

3. How was the study done? In this type of study, called a case-control study, two groups are selected. The first is a group of people referred to as cases who were diagnosed with any of the seven types of cancer, leukemia, non-Hodgkin's lymphoma, liver, lung, kidney, bladder and brain cancer, from 1980 to 1989. The second is a group of people referred to as controls who were selected from the same population as the cases, but who have not had cancer. For this study, five controls were selected for each case.

The New York State Cancer Registry was used to find every person who lived in the study's zip codes and was diagnosed between 1980 and 1989 with any of the seven cancers as a primary cancer. Leukemia, non-Hodgkin's lymphoma, liver, lung, kidney, bladder and brain cancer were chosen for the study because they have been linked to occupational chemical exposures in scientific studies. The control group was chosen from data from death certificate files maintained by DOH. The controls were a random sample of all non-cancer deaths occurring in the same zip codes as the cases. The DOH files provided needed information about address and date of birth, so that the control group was comparable in age to the cancer case group.

The study researchers looked to see if there was a clear difference between the people with cancer (cases) and without cancer (controls). If such a difference is found, it helps point the researchers toward a possible cause. In this case, the researchers looked to see if the people with cancer were more likely to live in the rings around the landfills than the people without cancer. All the study cases and controls lived in the zip codes containing the landfills. Once each person's exact address was mapped, the researchers could see who lived in the landfill rings, and could estimate whether the percentage of the cases living near the landfills was higher than expected, using the locations of the controls for comparison.

4. What chemicals were considered in the study? The VOCs detected most often at the 19 landfills where VOCs were sampled in soil gas were tetrachloroethene (PCE or perc), trichloroethene (TCE), toluene, 1,1,1-trichloroethane (TCA), benzene, vinyl chloride, xylene, ethylbenzene, methylene chloride, 1,2-dichloroethene and chloroform. These frequently detected chemicals should be considered as general indicators of chemical contamination because the soil gas likely contained other chemicals in addition to those for which it was monitored. This means that even if a cause and effect relationship is suspected, the specific causative agent cannot be identified.

5. How can people be exposed to landfill chemicals? The methane gas which is produced in landfills during the breakdown of household wastes travels through air pockets in soil. The methane carries other chemicals along with it. Buildings create regions of lower air pressure which can draw air and soil gases from the surrounding soil through cracks or other openings in the basement or slab. In this way, people residing near landfills could possibly be exposed to hazardous components of landfill gas.

6. Were the cancer risks analyzed separately for each of the 38 landfills? No, the landfills could not be looked at separately because the number of people living near any one particular landfill was too small to do statistical analysis. For each type of cancer, the study cases and controls from all the zip codes containing the 38 landfill potential exposure areas were combined into one group for the analyses.

7. Were the study subjects contacted and interviewed? The cases and controls in this study were not contacted directly. So the researchers did not have information about each person's smoking habits, occupational exposures, medical history, or other cancer risk factors. A case-control study is designed so that the people in the study all come from the same population. There is no reason to think that the people living in the landfill potential exposure areas would have different smoking habits or occupations from their neighbors living just a little further away from the landfill. The lack of individual information, however, is a limitation of this study. It is possible that personal risk factors that were not identified could have played a role in the findings.

8. Were the study's findings statistically significant? The findings for a four-fold elevation of risk for bladder cancer and leukemia for women living in the rings around the landfills are statistically significant. This means that the statistical tests show that it is very unlikely, but not impossible, that the higher than expected number of cases of these two types of cancer in the landfill rings occurred just by chance. For the seven cancers examined in males and the other five cancers examined in females, there were no statistically significant findings. The statistically significant findings of the study still need to be judged based on the study's methods. The findings need to be interpreted with caution because this study did not have the type of data available that could point directly to a cause and effect relationship.

9. What does this study tell us about cancer incidence and landfills? The study used data from existing records to provide scientists with leads about possible connections between environmental exposures and disease. The study succeeded in combining information about 38 landfills in New York State to look at several different types of cancer among people living very close to specific landfills. The study's data limitations prevent us from drawing strong conclusions from this one study, however.

An important finding of this study is that there were relatively few people, less than one percent of the study population, living in the landfill potential exposure areas. Less than one percent of the cancers identified in this study occurred among people living in the potential exposure areas. Because very few people live close enough to the landfills for exposures to possibly occur, very few cancers can potentially be attributed to this possible risk factor.

10. I have lived for many years near a landfill included in the study. Should I be concerned? This study did not prove that there is a relationship between living very close to the study landfills and female bladder cancer or leukemia. But the study findings do suggest that there may be an increased risk for these cancers for women who lived within 250 feet of the landfills during the 1960's and 1970's. For a woman faced with this possibility it is important to remember that bladder cancer and leukemia are rare cancers in women. While any increased risk would be a concern, these rare cancers are still less likely to occur than

many other more common health problems.

Over an entire lifetime (living 95 or more years), a woman's risk of being diagnosed with bladder cancer is about 1 out of 100, and her risk for leukemia is also about 1 out of 100. This study's estimate of a possible four-fold increase in risk for bladder cancer and leukemia would increase the estimated lifetime risk of being diagnosed with bladder cancer to about 4 out of 100 and the estimated lifetime risk of being diagnosed with leukemia to about 4 out of 100. Over a 95-year-lifetime, a woman's risk of being diagnosed with lung cancer is 5 out of 100 and her risk of being diagnosed with breast cancer is about 12 out of 100.

For cancers which are often curable, such as bladder cancer and leukemia (and breast cancer), the chances of dying from these cancers are smaller than the chances of being diagnosed with them. People often do not realize that heart disease is the biggest health risk women face. About nine times more women die each year from heart disease than from breast cancer. If you are concerned about a possible increased cancer risk, you should discuss it with your physician. Your physician may also call the Environmental Health Informationline at 1-800-458-1158, ext. 6402 to discuss this further with DOH staff.

11. I live near a landfill that was not included in the study. Should I be concerned? Specific conditions must exist for landfill gases to move through the soil and reach residential areas. Of the 245 landfills examined by this study's researchers, only 38 met the study conditions for possible exposures through soil gas migration to residents living nearby. The other 207 landfills did not meet these conditions. This study did not evaluate current conditions at landfills. The cancers investigated in the study occurred in the 1980's. Sites were identified which might have caused exposures in the 1960's and 1970's.

12. What has been done to correct problems at the landfills included in this study? Most of the study landfills (30) began operating before 1970. Many of these older landfills were not lined and capped as they would be if constructed today. By the end of the 1980's only three of the landfills were still operating, and none of the landfills remain open today. Methane collection systems for decreasing methane migration away from the landfills began to be used in the late 1970's. Twenty-two of the study's landfills currently have methane collection systems in place and four more are planned to be constructed in 1998. The landfills in this study have been evaluated as hazardous waste sites by DOH and DEC. A variety of corrective actions, usually including capping the landfill and maintaining methane collection systems, have been taken at the sites.

13. What is the current status of landfills in general in New York State? After New York State (1973) and the federal government (1976) began regulating landfills, existing open dumps were either closed or upgraded to sanitary landfills, which have a clean fill cover placed on top of the solid waste. In 1988 the New York State legislature passed the Solid Waste Management Act which set priorities for solid waste management in New York State. It required New York State communities to develop programs following this ordering of priorities: (1) reducing the generation of waste, (2) reusing and recycling, (3) recovering energy from waste that cannot be recycled, and (4) disposing by land burial or other means approved by DEC.

In 1988, DEC also revised its regulations, known as "Part 360," for constructing, operating and closing non-hazardous landfills. The Part 360 regulations also include rules for monitoring non-hazardous landfill conditions after closure. Since 1988, the number of active landfills accepting municipal solid waste in New York State has decreased from about 240 to 39. The active landfills remaining tend to be large because the rules for building and running landfills are more strict and this makes the larger ones more economical. Many of the remaining landfills are privately owned; others are owned by cities or counties. They are regulated by DEC, Division of Solid and Hazardous Materials. Of the 39 active municipal solid waste landfills, 38 of them are either lined, have perimeter gas migration cutoff trenches, or are located in soils with low permeability. The 39th landfill is a small rural landfill in Hamilton county. This landfill is scheduled to close in 1999 with State assistance provided by the 1996 Clean Water/Clean Air Bond Act in accordance with Part 360, which addresses landfill gas migration.

FOR MORE INFORMATION about this study please contact:

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Investigation of Cancer Incidence and Residence Near
 38 Landfills with Soil Gas Migration Conditions:
 New York State, 1980-1989
 38 Landfills Selected for Inclusion in the Study

Zip Codes	County	Site Number	Site Name	Buffer Width	LF Acres	Methane* Collection	Active Years
10543	Westchester	360021	Mamaroneck Srs.	250	8	P-1996	50-70
10950	Orange	336027	Mayer LF	250	20	None	49-75
10994	Rockland	344006	Nyack LF	250	12	P-TBC1998	51-83
10994,10960	Rockland	344001	Clarkstown Town LF	500	80	A-TBC1998	40-90
11040	Nassau	130008	Denton Ave LF	250	54	P-1975	53-74
11050	Nassau	130025	Port Washington LF	1000	53	A&P-1982	74-83
11542	Nassau	130032	Garvies Point	250	19	None	71-80
11572	Nassau	130023	Oceanside LF	250	181	P-1983	62-88
11722,11788	Suffolk	152084	Watch Hill Sand & Gravel#	250	45	P-1988	60s-80
11722,11788	Suffolk	152002	Blydenburgh LF	500	55	A-1983	27-90
11725	Suffolk	152043	Smithtown LF	250	20	A-1983	10-79
11725	Suffolk	152044	Smithtown Sanitary LF	250	24	A-1984	78-84
11725	Suffolk	152096	Steck & Philbin#	250	5	None	70s-80s
11725,11731	Suffolk	152040	Huntington LF	250	44	A-1982	35-89
11741	Suffolk	152053	Sayville LF	250	30	P-1984	38-85
11742	Suffolk	152010	Holtsville LF	250	74	A-1979	68-74
11754,11787	Suffolk	152097	Star Sand & Gravel	250	3	None	78-85
11767,11780	Suffolk	152042	South Montclair Ave LF	250	20	A-1978	67-70
11791	Nassau	130011	Syosset LF	250	35	P-1981	36-75
11804	Nassau	130001	Old Bethpage LF	500	65	A-1982	58-86
11937	Suffolk	152058	East Hampton LF	250	45	A-TBC1998	60-93
11968	Suffolk	152052	North Sea LF	250	13	P-1988	63-95
12078	Fulton	518001	Gloversville LF	250	80	P-1997	57-89
12144	Rensselaer	442003	Former Rensselaer City LF	250	12	None	57-76
12508	Dutchess	314024	Beacon City LF(inactive)	250	5	None	30-68
12508	Dutchess	314046	Beacon City LF	250	17	P-1993	68-83
12603	Dutchess	314047	Dutchess Sanitation	250	19	A-1994	71-85
13205	Onondaga	734037	Brighton Ave LF	250	35	None	43-78
13215	Onondaga	734009	Tripoli LF	250	75	P-1984	39-85
13492	Oneida	633013	Whitestown Municipal LF	500	30	P-1992	67-91
13748	Broome	704013	Conklin Dump	250	37	P-1994	64-75
14048	Chautauqua	907003	Dunkirk LF	250	27	P-1979	66-78
14101	Cattaraugus	905021	Machias LF	250	7	None	70-80
14120	Niagara	932026	Niagara County Refuse	250	50	P-TBC1998	69-76
14467	Monroe	828037	Henrietta Town Dump	250	19	None	50-65
14534	Monroe	828048	Pittsford Town Dump	250	13	None	33-82
14617	Monroe	828009	Old Rochester/Pattonwood	250	28	None	56-62
14845	Chemung	808011	Horseheads LF	250	25	None	40-73

*This column indicates whether the site has an active (A=Active) or passive (P=Passive) methane collection system and the year the system was installed. TBC indicates that a system is planned to be constructed.
 #For these landfills, dates of operation are estimated from available information.