



NUI MAYNOOTH  
Oifais na hÉireann Mhú Nuú

## DUNSINK LANDFILL

A Study Of The Health Effects Of Living In Close  
Proximity To A Landfill And The Public Perception  
Of Landfills

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Submitted: August 2006

Thesis submitted in partial fulfillment of the requirements of  
the M.A. (Geography of Health), Department of Geography,  
National University of Ireland, Maynooth.

## ABSTRACT

This thesis deals with the adverse health effects caused by living in close proximity to a landfill and the public perception of landfills. The main case study is that of Dunsink Landfill in Finglas, County Dublin. Other landfills focused on are Nantygwyddon Landfill in Rhondda, Wales and Miron Quarry in Montreal, Quebec, Canada.

This thesis examines all forms of continuous illness found in three areas near Dunsink Landfill, not just more serious illnesses such as cancers. These illnesses range from runny noses, coughs and colds to the more serious illnesses of cancers.

Public perception is dealt with by examining two opposing viewpoints of landfills and why these viewpoints have been taken. The opinions of the residents, the North-West Area Manager for Dublin City Council and Dr. Eugene Boyle of the Health Service Executive (HSE) are also taken into account.

A door-to-door survey of three areas in Finglas was used in order to obtain the information needed for the study. This survey included questions relating to health, opinions and own knowledge.

## ACKNOWLEDGEMENTS

There are many people without whom this thesis would not have been completed. I would like to thank them now.

Firstly, I would like to thank my supervisor Dr. Dennis Pringle for his help and guidance with the groundwork of this study.

I would like to thank my friend Ciara Twamley and family members Catherine Rooney and Sandra Ward for their assistance while conducting door-to-door surveys.

I would like to thank the Rooney family and Mary Sinnott for the use of their computer scanners.

A very big thank you to my family and friends for their support. Without it I might never have finished.

And finally, a special thank you to the MA class. Without them I might never have gotten through the year. You kept me going when anyone else would have given up!

# CONTENTS

CHAPTER 1...INTRODUCTION.....	PAGE 1
CHAPTER 2...NANTYGWYDDON LANDFILL.....	PAGE 5
CHAPTER 3...MIRON QUARRY, MONTREAL, QUEBEC.....	PAGE 8
3.1 : 'Low birth weight and preterm births among infants born to women living near a municipal solid waste landfill site in Montreal, Quebec'.....	PAGE 10
3.2 : 'Incidence of cancer among persons living near a municipal solid waste landfill site in Montreal, Quebec'.....	PAGE 12
3.3 : 'Risks of developing cancer relative to living near a solid waste landfill site in Montreal, Quebec'.....	PAGE 13
CHAPTER 4...CHEMICALS EMITTED FROM LANDFILLS.....	PAGE 15
4.1 : Methane.....	PAGE 16
4.2 : Carbon Dioxide.....	PAGE 18
4.3 : Lead.....	PAGE 19
4.4 : Cadmium.....	PAGE 20
4.5 : Arsenic.....	PAGE 21
4.6 : Nickel.....	PAGE 22
4.7 : Benzene.....	PAGE 23
4.8 : Tetrachloroethylene.....	PAGE 24
4.9 : Trichloroethylene.....	PAGE 25
4.10 : Xylene.....	PAGE 27
4.11 : Vinyl Chloride.....	PAGE 28
4.12 : Toluene.....	PAGE 29
CHAPTER 5...SURVEY.....	PAGE 31
5.1: Types Of Illness.....	PAGE 34
5.2 : Results Of Question 3.....	PAGE 35
5.3 : Results Of Question 4.....	PAGE 38
5.4 : Results Of Question 5.....	PAGE 42
5.5 : Results Of Question 6.....	PAGE 43
5.6 : Results Of Question 7.....	PAGE 44

5.7 : Anomalies.....	PAGE 45
CHAPTER 6...PUBLIC PERCEPTION.....	PAGE 49
CHAPTER 7...CONCLUSION.....	PAGE 54

BIBLIOGRAPHY

APPENDIX

APPENDIX A : MAPS

APPENDIX B : AERIAL PHOTOGRAPH

APPENDIX C : SURVEY

# CHAPTER 1

# INTRODUCTION

Two years ago I conducted a study of the gas abstraction site at Dunsink landfill in Finglas, Co. Dublin. (see map a in appendix a) Here, the gas produced by the waste is collected through a network of pipes and converted into electricity. While conducting a door-to-door survey of the residents, they voiced their concerns about the possible adverse health effects which could be caused by living in close proximity to the landfill. It is for this reason that I have decided to conduct a study of the possible adverse health effects of living in close proximity to a landfill and the public perception of landfills, using Dunsink landfill as my main case study.

The landfill was opened over 30 years ago. (Dunsink Landfill gas abstraction site manager) It is unlined as it was not mandatory for landfills to be lined at the time. It was closed to the public in 1994, with the waste reaching up to 30m in parts of it. It has a cap of 20m, which consists of rubble from building sites from Dublin City. (see aerial photograph in appendix B) In 1995, it became the first landfill in Ireland to have a gas abstraction site as it has enough waste to sustain the process.

The aims of this study are:

- 1) To find out what the health threats of a landfill are;
- 2) To ascertain whether or not there is a relationship between living in close proximity to a landfill and ill health; and,
- 3) To find out what the public perception of landfills is.

Each chapter focuses on a different aspect of the study. The content of each chapter is as follows:

**Chapter 2 - Nantygwyddon Landfill:** Chapter two discusses Nantygwyddon Landfill in Rhondda, Wales. Here, the landfill has been linked to the ill health of it's local residents and their offspring.

**Chapter 3 - Mark S. Goldberg:** Chapter three discusses the work of Mark S. Goldberg. He has conducted three separate studies of Miron Quarry Landfill in Montreal, Quebec, Canada. In these studies, he has discussed the possible health effects caused by the landfill.

**Chapter 4 - Chemicals Emitted From Landfills:** Chapter four discusses the main chemicals which are emitted from a landfill, their health effects and how to test for them.

**Chapter 5 – Survey:** Chapter five discusses the information gathered by door-to-door survey of the residents of Finglas. This is the main case study of this study. It includes information on the opinions of the residents regarding the landfill as well as health information.

**Chapter 6 – Public Perception:** Chapter six discusses the public perception of landfills, both local and global.

**Chapter 7 – Conclusions:** Chapter seven discusses the conclusions reached by this study.

# CHAPTER 2

## NANTYGWYDDON LANDFILL

In October 2005 I contacted the CDC about my study. In this email I wrote:

My name is Aoife Drumm and I am a member of the geography department of NUI Maynooth, Ireland. I am currently conducting a study of Dunsink landfill, and unlined landfill in Dublin, and it's effects on the health of the local residents. Do you think it is possible that this site could be a cause of serious health problems such as asthma, birth defects and cancer? Many of the local residents are very concerned about this. (Email to CDC, 11/12/2005)

I received a reply from George R. Prince, in which he stated:

I am not familiar with Dunsink landfill and so cannot answer your questions. The ASDTR deals primarily with "hazardous waste sites", which by their very nature are certain to cause adverse human health effects upon interface. We do however have limited experience with assessing community health in Rhondda, Wales, (Nantygwyddon landfill). (Email from George R. Prince, CDC, 12/12/2005)

He went on to list a number of websites dealing with this landfill and the controversy surrounding it regarding claims that it has had adverse health effects on the local residents.

Nantygwyddon landfill is situated in a narrow valley on a mountaintop. (<http://www.jillevans.net>) The valley is populated by 70,000 people. A third of this population live in villages that are situated within the direct vicinity of the landfill. In September 1988 it was officially opened. It was referred to as a modern "engineered" landfill which would not have any negative effects on the environment. It received the first European grant for a landfill site in the UK. Before construction began, £1.3 million was given to it. It received a second grant of £2.2 million during the construction of the road due to the instability of the mountainside. The first complaints were made in 1992 when residents noted that leachate was bubbling up through the soil in the woodlands below the landfill. Several faults with the site were noted in 1994, including the fact that

the liner could not be found in some areas, the leachate control system did not work, and the stacks built to channel the landfill gas had collapsed. Foul smells were reported to be emanating from the landfill in 1996. These smells occurred at the same time as burning eyes, sore throats and sickness was reported in the local area.

In 1995, waste from Purolite International Ltd was deposited at the landfill. (<http://www.jillevans.net>) In October 1990, this the organic content of filter cake waste of the Purolite waste had been referred to by Her Majesty's Inspector of Pollution as having "the potential to contaminate surface or ground water". The inspector recommended that it should be segregated from organic waste at landfill sites and mixed with inert material. In March 1995, this waste was banned by a neighbouring council from their local landfill due to the smells it created when it mixed household waste. However, this waste was allowed to be deposited at Nantygwyddon landfill. Nearly 30,000 tonnes of Purolite waste was deposited at Nantygwyddon landfill, where it mixed with municipal waste. This resulted in the emission of hydrogen sulphate gases from the landfill, which had a maximum concentration reaching almost 5,000 times higher than that of UK municipal landfill sites. This created a reservoir of sulphate which will take 985 years to dissipate. In 1998, the Environmental Agency commissioned a report which stated that the air above the landfill is prone to contamination by hydrogen sulphide in concentrations in excess of 5,000 parts per billion, exceeding the site's odour threshold by factors of up to 194 million.

In January 1998, a study was conducted in order to ascertain if the landfill was the cause of ill health in the area. (<http://www.jillevans.net>) Health information clinics were set up by Bro Taf Health Authority in communities appearing to be affected by the landfill. Local authority was requested to carry out monitoring of local air quality at the same time. The clinics operated between 20th April and 12th June 1998 but air quality sampling was not carried out by the Councils consultant until July 27<sup>th</sup> of the same year. This sampling was carried out until

August 8th. In January of the following year, 1999, Bro Taf Health Authority published the survey they had carried out of ill health of the residents living in close proximity of the landfill. However, they could not "prove that the higher frequency of symptoms was caused by the landfill site because concurrent monitoring data is not available."

Between 1990 and 1996 statistics recorded in the direct vicinity of the landfill showed that birth defects were twice as high as the national average. (<http://www.jillevans.net>) During this time, gastroschisis cases (a congenital defect where the abdominal wall is not complete so the intestines protrude) were almost ten times higher than expected. Following this in October 1998, a study carried out by EUROHAZCON stated that congenital abnormalities in children whose mothers lived within 3km of landfills were 33% higher than elsewhere

In 2000, Jill Evans, MEP for the area, gave a speech about the landfill in which she referred to article 4 of the EU Waste Framework Directive. (<http://www.jillevans.net>) This article states that:

"Member States shall take the necessary measures to ensure that waste is recovered or disposed of without endangering human health and without using processes or methods which could harm the environment, and in particular:

- without risk to water, air, soil and plants and animals,
- without causing a nuisance through noise or odours,
- without adversely affecting the countryside or places of special interest."

She believes that, in the case of Nantgywyddon landfill, this article has been breached. She has claimed that waste has been disposed of at this landfill in a way that both endangers human health and harms the environment. She has stated that "it is a matter of fact that water, air and soil have been polluted", claiming that there is compelling evidence that the site is damaging human health.

# CHAPTER 3

## MIRON QUARRY, MONTREAL, QUEBEC

In February 2006, I contacted George R. Prince of the CDC about Mark S Goldberg who has completed three studies on the adverse health effects of living in close proximity to a landfill. In this email I wrote:

Mr. Prince,

I contacted you some time ago regarding a study I am currently conducting on Dunsink landfill. I have recently discovered that Mark S Goldberg has conducted similar studies in Montreal, Quebec. Do you know of his work? (Email to George R. Prince, CDC, 20/02/2006)

I received a reply from George R. Prince, in which he stated that:

Mark S Goldberg is associate professor at the Institut National de la Recherche Scientifique, University of Quebec, Laval, Quebec. Dr Goldberg obtained degrees in physics (BSc 1975) and epidemiology and biostatistics (MSc 1985; PhD 1992) from McGill University, Montreal, Quebec. Dr Goldberg is currently researching the short-term effects of air pollution on mortality and identification of susceptible groups. He is part of HEI's team to reanalyze the Harvard Six Cities Study and the American Cancer Society's Cancer Prevention Study-II. His other research interests include investigating occupational risk factors for female breast cancer, and delivery of treatment and other health services for breast cancer. (Email from George R. Prince, CDC, 21/02/2006)

There are three which were studies undertaken by Mark S. Goldberg that relate to this study. They were all collaborations with a group and were all conducted at Miron Quarry municipal waste landfill in Montreal, Quebec. This landfill is the third largest landfill in North America. (Mark S. Goldberg et al, July/August 1999) It has an area of approximately 750,000m<sup>2</sup>, a depth of 50-80m, and in January 1993 it was estimated that it contained approximately thirty-six million tonnes of domestic, commercial, and industrial waste. It was opened in 1968 for the disposal of domestic, commercial, and industrial waste. Like Dunsink landfill, the health and environmental impacts were not considered during it's construction,

leading researchers of studies of this landfill to believe that this may have been a serious oversight as there are approximately 100,000 people now living within 2km of this landfill.

The main environmental problems relating to this landfill include the following:

- the emission of vapors and gases (also known as biogas);
- the amount of toxic chemicals on site; and
- the production of liquids (also known as leachates).

As Montreal does not use groundwater from the area but from other sources, contamination of the groundwater by leachates is not a primary concern. The primary concerns are related to biogas being released into the air and soil. This is produced when organic compounds decompose anaerobically (without oxygen). It is composed mainly of methane and carbon dioxide, the most widely known gases to be emitted from landfills. It is associated with strong smells. Biogas has been collected at this landfill since 1980 through a network of pipes and then burned off. However, this system has continuously operated at a low efficiency and the burning of is incomplete. Studies from other municipal solid waste landfills suggest that the combustion produces many gases which can be harmful to human health, including nitrogen oxides, carbon dioxide, carbon monoxide, sulfur dioxide and hydrochloric acid. It is also possible that dioxins, furans and other volatile organic compounds (VOCs) are released.

### 3.1 : 'Low birth weight and preterm births among infants born to women living near a municipal solid waste landfill site in Montreal, Quebec'

In April 1995, Goldberg published a study of 'low birth weight and preterm births among infants born to women living near a municipal solid waste landfill site in Montreal, Quebec'. (Mark S. Goldberg et al, April 1995) He undertook this study with L. Goulet, H. Riberdy and Y. Bonvalot. Data was used from the Quebec birth registry files and case-controlled analyses were conducted in order to

evaluate the risk of four different conditions of birth. They were low birth weight, very low birth weight, preterm birth and small for gestational age. Low birth weight was defined as less than 2,500g, very low birth weight was defined as less than 1,500g, preterm birth was defined as less than thirty-seven weeks of pregnancy, and small for gestational age was defined as less being in the smallest third for size. Potential exposure to vapors and gases from the waste landfill was defined in terms of selected exposure zones around the waste landfill. Areas without a waste landfill that were used for comparison were selected as they were similar to the exposure zones on a number of key sociodemographic factors. A ninety-five percent confidence interval was used to determine whether or not a relationship exists between close proximity to the waste landfill and the four conditions of birth. The study showed that low birth weight was significantly elevated in the exposure zones close to the waste landfill for the 1,107 exposed cases that were noted. There also appeared to be a relationship between close proximity to the waste landfill and small for gestational age for the 951 exposed cases that were noted. However, the study pointed out that the evidence for a relationship with small for gestational age was not as strong as it was for a relationship with low birth weight. There did not appear to be a relationship between close proximity to the landfill and very low birth weight or preterm birth. The researchers also stated that it was not possible to conclude definitively if low birth weight and small for gestational age are associated with exposure to the vapors and gases emitted from the landfill as it was not possible to evaluate the effects of all of the potentially important confounding factors, and detailed environmental exposure assessments were not available. They also stated that further studies are needed at the waste landfill in Montreal and at other waste landfills in order to either prove or disprove the evidence and conclusions of this study.

### 3.2 : 'Incidence of cancer among persons living near a municipal solid waste landfill site in Montreal, Quebec'

In November and December 1995, he published a study of 'incidence of cancer among persons living near a municipal solid waste landfill site in Montreal, Quebec'. (Mark S. Goldberg et al, November/December 1995) He undertook this study with N. al-Homsi, L. Goulet and H. Riberdy. Data was used from the Quebec Tumor Registry to map incidences of cancer in the study area. However, those being treated outside Quebec were not included as they were not recorded on the Quebec Tumor Registry. Poisson regression analyses were used to evaluate whether or not cancer rates were higher among those living close to the waste landfill than those living further away. A confidence interval of ninety-five percent was used. Areas without a waste landfill that were used for comparison were selected as they were similar to the exposure zones on a number of sociodemographic factors, as had been done in the previous study discussed. In men living close to the waste landfill, elevated risks were observed for six different forms of cancer:

- stomach cancer;
- liver cancer;
- intrahepatic bile ducts cancers;
- trachea cancer;
- bronchus cancer; and,
- lung cancers.

In women living close to the waste landfill, elevated risks were observed for three different forms of cancer:

- stomach cancer;
- cervix uteri cancer; and,
- breast cancer.

As with the previously discussed study, the researchers stated that further studies are needed at the waste landfill studied as well as at other waste landfills in order to either prove or disprove the evidence and conclusions of this study. A further study, which included face-to-face interviews, concluded that there could also be a relationship between living in close proximity to the waste landfill and kidney cancer, pancreatic cancer and non-Hodgkin's lymphomas. However, the researchers stated that the statistical evidence was not persuasive and there was no evidence for an excess of stomach cancer, as there had been in the first study. Again, further studies would need to be undertaken.

### 3.3 : 'Risks of developing cancer relative to living near a solid waste landfill site in Montreal, Quebec'

In July and August 1999, he conducted a study on the 'risks of developing cancer relative to living near a solid waste landfill site in Montreal, Quebec, Canada'. (Mark S. Goldberg et al, July/August 1999) He undertook this study with J. Siemiatyck, R. DeWar, M. Desy and H. Riberdy. This study was conducted in order to determine whether or not men who lived near the Miron Quarry municipal solid waste landfill were at a higher risk of developing cancers than those who lived further away from it. A total of 2,928 men were studied. They were selected from a previously completed population based, interview and cancer case controlled study of men who lived in metropolitan Montreal. As with the previously discussed studies, a ninety-five percent confidence interval was used. Elevated risks for cancers of the pancreas and prostate were found in the exposure zone nearest the waste landfill. Elevated risks for pancreatic cancer and non-Hodgkin's lymphomas were found in a subexposure zone located downwind of the waste landfill. When distance from the landfill was measured, those living within one kilometre of the landfill were found to have higher than expected risks of non-Hodgkin's lymphomas, those living with 1.23km of the landfill were found to have higher than expected risks for pancreatic cancer, those living within 1.5km of the landfill were found to have higher than expected risks for liver

cancer, and those living within two kilometres of the landfill were found to have higher than expected risks for kidney cancer. The researchers concluded that data from this study coincided with a previous study conducted at the same landfill which showed that men who lived near the waste landfill may have been, and may continue to be, at excess risk from non-Hodgkin's lymphomas, as well as cancers of the liver, kidney and pancreas.

# CHAPTER 4

# CHEMICALS EMITTED FROM LANDFILLS

According to the National Institute of Environmental Health Science (NIEHS),

“the primary environmental risks associated with the municipal landfills are due to the leachate and gases produced from the interaction of diverse waste components, rain water, and organic degradation.” (<http://www.niehs.nih.gov>)

According to the US EPA, approximately 50% of the waste in municipal landfill sites is composed of paper products and yard waste, 40% is composed of metals, food waste and plastics, and the final 10% is composed of wood, rubber, leather, textiles and miscellaneous hazardous waste from cleaning products, pesticides, paints and adhesives. (<http://www.niehs.nih.gov>) Other types of waste, including degreasers, oils and solvents, comes from small businesses such as laundrettes, machinery shops and car mechanics. When this waste mixes with rainwater, it produces a solution high in heavy metals and VOCs.

The gas produced by the decomposition of the waste is comprised primarily of methane gas and carbon dioxide. (<http://www.niehs.nih.gov>) Leachate from landfills contains high levels of the heavy metals lead, cadmium, arsenic and nickel. Exposure to these metals can result in blood and bone disorders, kidney damage, decreased mental capacity and neurological damage. Leachate also contains many VOCs, the more widely known being benzene, tetrachloroethylene, trichloroethylene, xylene, vinyl chloride and toluene. Exposure to these VOCs has been associated with cancer, leukemia, liver damage and neurological damage.

## 4.1 Methane

Methane is the most common and widely known gas that is emitted from landfills. It is a colourless, odourless, flammable gas. ([www.dfhs.state.wi.us](http://www.dfhs.state.wi.us)) The chemical formula for methane is CH<sub>4</sub>. (<http://www.wikipedia.org>) It can be used

in homes to fuel water heaters, cookers and clothes dryers. ([www.dfhs.state.wi.us](http://www.dfhs.state.wi.us)) Gas companies add a chemical to it which makes it smell like rotten eggs in order to detect leaks. It can also be smelt when it mixes naturally with hydrogen sulphide. When it can be smelt, its concentrations are at an unsafe level. As it evaporates quickly, most of the methane that ends up in lakes, streams or soil is eventually released into the air. However, methane that is formed underground and moves through the soil can remain unchanged for years.

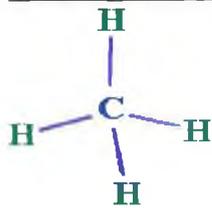
There are 3 ways people can be exposed to methane:

- by inhaling it;
- by ingesting it; and,
- by touching it.

Most exposures to methane occur when it is inhaled. As it is a “simple asphyxiant” it displaces available oxygen. In order to avoid lethal exposures to methane, the minimum oxygen content in the home or workplace should be 18%. As it evaporates quickly, it is not usually found in food or drinking water. However, low levels of exposure can occur when contaminated water is used for drinking or in food preparation. It does not pass readily through the skin, unless it is in its extremely cold liquefied form, when it can cause burns to the skin and eyes.

Immediately or shortly after exposure to oxygen levels of less than 15%, a person may feel dizzy, tired and have a headache. However, the health effects of exposure to methane are unknown. It is rapidly eliminated from the body and, although it can be measured in exhaled breath, urine, blood and other tissues, no reliable method exists to determine the level of exposure.

### Molecule of methane



**Methane**

Source: <http://www.purchon.com/chemistry/images/methane.gif>

## 4.2 Carbon Dioxide

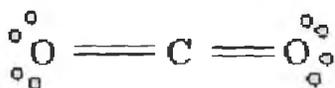
Carbon dioxide is both inhaled and exhaled by humans. (<http://www.wikipedia.org>) However, when it is inhaled in excessive amounts, it can result in unconsciousness or, in extreme cases, death. It is commonly referred to by the scientific formula CO<sub>2</sub>. When it is solid, it is known as dry ice. Carbon dioxide is added to carbonated drinks in order to make them 'fizzy' and by doctors for the removal of warts and verucas.

There are numerous ways to test for its presence. The simplest test is carried out by using a test tube and a lighted splint. A lighted splint is placed into a test tube containing carbon dioxide. As carbon dioxide does not sustain fire, the lighted splint is immediately extinguished. Another simple method is to use a calcium hydroxide solution, which is more commonly known as limewater. When carbon dioxide is mixed with lime water, it turns the lime water a milky colour. In modern laboratories, testing for the presence of carbon dioxide is carried out by using spectroscopic methods. One such method is to use infrared spectroscopy, which is used to measure the amount of carbon dioxide in the atmosphere.

The concentrations of carbon dioxide in fresh air can vary between 0.03% (300 ppm) and 0.06% (600 ppm). There is a concentration of approximately 4.5% of carbon dioxide in exhaled air. It does not become a threat to health until it is inhaled in concentrations greater than 5%. The maximum level considered to be safe for a healthy adult to inhale throughout an eight hour work day is 0.05% (500 ppm).

Inhaling high levels of carbon dioxide can result in headaches, drowsiness or functioning at lower activity levels. Breathing carbon dioxide levels of 5% continuously for more than thirty minutes can result in acute hypercapnia, i.e. when there is too much carbon dioxide in the blood. It can lead to hyperventilation, drowsiness and lung disease. Breathing levels of between 7% and 10% can lead to unconsciousness within minutes.

#### Molecule of carbon dioxide



Source: [http://www.up.ac.za/academic/chem/mol\\_geom/co2\\_2.gif](http://www.up.ac.za/academic/chem/mol_geom/co2_2.gif)

### 4.3 Lead

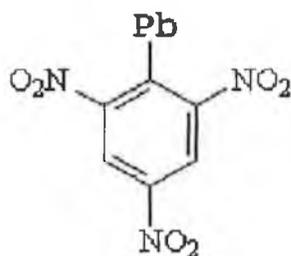
Lead is a soft, dull, heavy metal. (www.wikipedia.org It is a blue-white colour, but when it is exposed to air it tarnishes to a grey colour. The chemical formula for lead is Pb. It is often used in corrosive liquids, such as sulfuric acid, as it is very resistant to corrosion. It has many everyday use, including lead-acid car batteries, as a colouring element, bullets, candle wicks, coolants and as radiation shielding. However, due to its toxicity, its use in paint was banned in the twentieth century. Lead-based paint that is still present in older houses should not be removed by sanding it as this creates a dust which can be easily inhaled. Pencil leads are no longer composed of lead but of graphite, which has been used for the past two centuries.

Lead poisoning can result in blood and brain disorders, as well as damage to nerve connections, which mostly occurs in young children. Long term exposure to lead can result in stomach pains which resemble colic. It can also result in nephropathy, which is damage to the kidneys. It has been hypothesized by some historians that lead poisoning resulted in many Roman Emperors suffering from dementia, as it was used as a wine sweetener at the time. Throughout the seventeenth and eighteenth centuries, people living in Devon suffered from what

became known as 'Devon colic'. This has also been hypothesized to be a result of lead poisoning caused by the use of lead-lined presses when extracting the juice from apples during the production of cider.

Lead poisoning has also been linked to schizophrenia and mental retardation in children. Exposure to lead occurs by inhaling it or ingesting it through contaminated food or water. (<http://www.leadpro.com>) There are two ways of testing for lead outside of a laboratory. One is using a home test kit which can be purchased by anyone. The second is by using x-ray fluorescence (XRF). This uses an x-ray to detect for the presence of lead in paintwork.

#### Molecule of lead



Source: <http://www.powerlabs.org/images/pbpic.gif>

## 4.4 Cadmium

Cadmium is a soft, toxic, rare metal which occurs with zinc ores. (<http://www.wikipedia.org>) It is a blue-white colour. The chemical formula for cadmium is Cd. 75% of the world's cadmium is used in batteries. The remaining 25% is used in pigments, coatings, plating and as a plastic stabilizer. Even though it is known to be toxic to humans, the British Pharmaceutical Codex of 1907 states that it was used as a medical treatment of "enlarged joints, scrofulous glands, and chilblains".

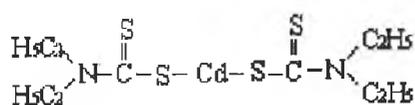
Even at low levels, cadmium is toxic to humans. It obstructs zinc-containing enzymes. Zinc is an important element in the body as a deficiency of zinc can

result in hair loss, skin lesions, diarrhea and, in extreme cases, death. It can also effect memory, sight, smell and taste. Zinc deficiency during pregnancy can cause stunted development of the foetus. Even though cadmium is chemically similar to zinc, it does not replaced it in the body. Other processes it obstructs in the body include processes relating to calcium and magnesium.

When dust containing cadmium is inhaled, it can lead to problems in the kidneys, including renal failure, and respiratory tract, which can lead to death. Ingesting cadmium can result in poisoning, which is immediately evident, and result in kidney and liver damage. Cadmium is also known to be carcinogenic and has been linked to breast cancer. Cadmium poisoning is known to be the cause of the 'itai-itai' disease (Japanese for 'pain-pain'). This has resulted in kidney damage, osteomalacia (rickets in children) and osteoporosis (bone disease).

Testing for exposure to cadmium is carried out by testing the blood, kidneys and liver. (<http://www.disability.vic.gov.au>) Cadmium exposure can also be tested by carrying out tests on the hair and nails, however it is not known how accurate these tests actually are.

#### Molecule of cadmium



Source: <http://pub2.hi2000.com/upload/0502211713284054.gif>

## 4.5 Arsenic

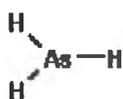
Arsenic is a tin-white colour, becoming a dull grey or black colour when it has tarnished. (<http://www.wikipedia.org>) The chemical formula for arsenic is As. Before it was known to be poisonous, it was used as a green pigment. Today, it has many uses including components of poisons and insecticides, electricity convertors and in bronzing. It became known as 'the *Poison of Kings*' before

tests for its presence were developed as symptoms of arsenic poisoning are hard to determine.

The tests which were developed to detect it are the Marsh test, a sensitive chemical test, and the Reinsch test, which is a more general test but less sensitive than the Marsh test. These tests are carried out on the blood, urine, hair and fingernails. (<http://www.astdr.cdc.gov>) The most reliable test results from recent exposure (within a few days) come from tests on the urine. Testing for exposure over a longer period of time (six to twelve months) is carried out on the hair and fingernails.

Arsenic poisoning through drinking water can result in the disease arsenicosis. (<http://www.wikipedia.org>) The most common forms of arsenicosis are arsenate and arsenite, which are known to be toxic. Arsenic poisoning leads to death by causing multi-organ system failure. Death from arsenic poisoning is determined in post-mortems when mucosa is noted to be a brick red colour. This is caused by severe haemorrhage.

Molecule of arsenic



Source: <http://www.airliquide.com/en/business/products/gases>

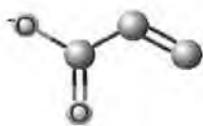
## 4.6 Nickel

Nickel is a silver-white colour. (<http://www.wikipedia.org>) It is hard and malleable. The chemical formula for nickel is Ni. It is used to make coins, in some alloys and as plating for other metals such as brass and iron due to the fact that it is in the atmosphere and is inert to oxidation. Other uses include magnets, stainless steel and green tinting in glass.

Contact exposure to nickel can result in dermatitis, resulting in the fingers, wrists and forearms becoming itchy. (<http://www.weblakes.com>) Long term exposure to nickel can result in allergies, asthma or, in extreme cases, chronic respiratory tract infections. Long term exposure to nickel by inhaling it is also known to increase the risks of developing lung and nasal cancers. Studies carried out on animals have shown that animals that inhaling nickel can have an adverse effect on the immune system, lungs and kidneys.

There are two types of tests used to test for nickel, the Swab Test and the Nickel Release and Wear Test. (<http://www.teg.co.uk>) The second test is carried out in a laboratory and takes ten days to complete. The Swab Test takes less time to complete than the Nickel Release and Wear Test but is not as detailed as it.

Molecule of nickel



Source: <http://smid.blueprint.org/images/630/pc3016630.png>

## 4.7 Benzene

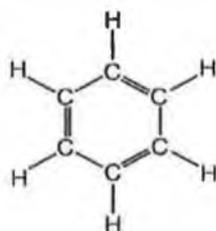
Benzene is a colourless, flammable liquid. (<http://www.wikipedia.org>) It has a sweet smell and is also known as benzol. The chemical formula for benzene is C<sub>6</sub>H<sub>6</sub>. It was once used as an additive petrol. Today, it is used in industrial solvents and in the production of plastics, dyes, synthetic rubber and drugs. It is naturally found in crude oil but is produced from petroleum.

Short term exposure to benzene can result in headaches, drowsiness, loss of coordination, nausea, nose and throat irritation and depression of the immune system

(CNS). Exposure to levels of benzene that reach 20,000 ppm can result in death with five to ten minutes. Women who have inhaled benzene have suffered from irregular menstrual periods and decreased ovary size.

Testing for benzene can be carried out on the breath. (<http://www.ccohs.ca>) However, this can only be done shortly after exposure. Testing on the blood must also be carried out shortly after exposure as benzene is expelled rapidly from the blood. Testing can also be carried out on urine. However, this does not determine the level of exposure.

#### Molecule of benzene



Source: <http://sparror.cubecinema.com/cube/cola/chemistry/figures/benz1.gif>

## 4.8 Tetrachloroethylene

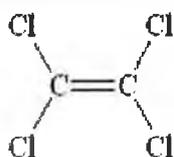
Tetrachloroethylene is a manufactured compound used for dry cleaning, degreasing metals, paint strippers and spot removers. (<http://www.wikipedia.org>) It is also used in the production of other chemicals, such as refrigerants. It is used as a solvent as most organic materials dissolve in it. It is known by other names such as PCE, perc, tetrachloroethene and perchloroethylene. At room temperature, it is a liquid and is non-flammable. It is easily evaporated and has a sharp, sweet smell. When it is evaporated and at a concentration of 1ppm, it can be smelt by most people. The chemical formula for tetrachloroethylene is  $C_2Cl_4$ . In the early twentieth century, it was used for the treatment of hookworm, an intestinal parasite in humans.

Even at low levels, tetrachloroethylene is toxic. It is a central nervous system depressant and inhaling its vapours can result in dizziness, headaches, drowsiness,

confusion, nausea, difficulty speaking and walking, unconsciousness and, in extreme cases, death. Prolonged contact with the skin can result in the fats of the skin being dissolved, causing severe skin irritation. Studies have suggested that there is a link between women exposed to tetrachloroethylene while working in dry cleaning industries and menstrual problems and miscarriages. However, the results of these studies are not conclusive as other factors were taken into account. Studies carried out on animals exposed to high levels of tetrachloroethylene show that it can result in kidney and liver damage. Changes in behaviour were noticed in the offspring of rats that were exposed to high levels of it while pregnant.

Testing for tetrachloroethylene is carried out the same way an alcohol breath-test is carried out. The chemical amount is measured in the breath. As it is stored in body fat and released into the bloodstream slowly, it can be detected for weeks after heavy exposure by testing the breath. Exposure to tetrachloroethylene occurs through ingesting contaminated food and water and through clothes cleaned at a dry cleaners. (<http://www.atsdr.cdc.gov>)

#### Molecule of tetrachloroethylene



Source: [http://www.angelo.edu/faculty/kboudrea/molecule\\_gallery/02\\_alkenes/tetrachloroethylene\\_01.gif](http://www.angelo.edu/faculty/kboudrea/molecule_gallery/02_alkenes/tetrachloroethylene_01.gif)

### 4.9 Trichloroethylene

Like tetrachloroethylene, trichloroethylene is used as an industrial solvent and degreaser, is a non-flammable liquid and is clear with a sweet smell. (<http://www.wikipedia.org>) It is also an effective solvent of most organic materials. In industry, it is also known as TCE, Trike and tri. In medicine, it has been known as trimar and trilene. The chemical formula for trichloroethylene is  $CCl_2$ . It was first used in the 1920s in order to extract vegetable oil from plants. It has

also been used in coffee decaffeination and the preparation of flavouring extracts from spices and hops. In the 1950s, tetrachloroethylene took over its role as a dry cleaning solvent. In the 1970s, its use was banned in the food industry due to its toxicity.

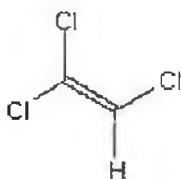
In the 1980s, it was linked with foetal death and considered to be a potential carcinogen. Like tetrachloroethylene, it is a central nervous system depressant when inhaled. Symptoms of inhalation are similar to those of alcohol intoxication. They include headaches, dizziness and confusion. Prolonged exposure can result in unconsciousness and death. High concentrations of trichloroethylene desensitizes the nose to its scent, which can result in unknown inhalation of high concentrations.

Long term effects of exposure in humans are unknown, however studies carried out on animals has resulted in liver cancer in mice. However, rats did not develop liver cancer. Its effects on reproduction yielded similarly inconsistent results. However, studies have shown that there appears to be a relationship between exposure to trichloroethylene and male infertility as it has been shown in some cases to reduce sperm counts. More recent studies have suggested that there is a relationship between exposure and tumor formation, although it is not known how this occurs.

In the 1990s, the EPA began to study how dangerous trichloroethylene is to human health. It came to the conclusion that it is between two and forty times more likely than was previously thought to cause cancer.

Exposure to trichloroethylene occurs by inhaling it, through contact with the skin, through contact with the eyes and ingesting it. (<http://www.astdr.cdc.gov>) Testing for trichloroethylene is carried out through renal-function and liver-function tests as well as testing urine.

## Molecule of trichloroethylene



Source: <http://tnds.glc.org/carol/images/chem/Trichloroethylene.gif>

## 4.10 Xylene

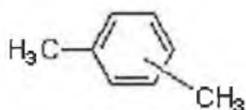
Xylene, like benzene, is produced from petroleum. (<http://www.wikipedia.org>) The chemical formula for xylene is C<sub>8</sub>H<sub>10</sub>. It has many uses in many industries, including the leather, printing and rubber industries. It is also used as a solvent, paint thinner and pesticide.

Xylene affects the brain. (<http://www.ccohs.ca>) High levels of exposure over either short (two weeks or less) or long periods of time (over one year) can lead to many health effects, including dizziness, confusion, headaches and lack of muscle co-ordination. It can also affect balance. Exposure to high levels over a short period of time can result in skin, eye, nose and throat irritation, breathing difficulties and stomach problems. It can also lead to unconsciousness and, at very high levels, death.

Studies of unborn animals have shown that high concentrations of xylene could be a cause of delayed growth and development as well as increased deaths. The mothers have also been adversely affected.

Humans are exposed through occupational hazard, through the soil due to leaking petroleum storage tanks, and drinking contaminated water.

### Molecule of xylene



Source: <http://www.csub.edu/Chemistry/Pictures/molecules/xylene2.gif>

## 4.11 Vinyl Chloride

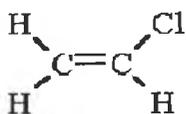
Vinyl chloride is an industrial chemical used in the production of polyvinyl chloride, which is also known as PVC, its polymer. (<http://www.wikipedia.org>) It is a colourless gas at room temperature and has a sweet smell. The chemical formula for vinyl chloride is  $\text{CH}_2$ . It is toxic and is also known as chloroethene. It was once used as an inhaled anaesthetic but this use was abandoned due to its toxicity.

Like tetrachloroethylene and trichloroethylene, it is a central nervous system depressant. Symptoms of exposure, like trichloroethylene, are similar to alcohol intoxication. These include headaches, dizziness and loss of co-ordination. In extreme cases, symptoms may also include hallucination, unconsciousness and respiratory failure, resulting in death. Effects on human reproduction are unknown but studies on animals have shown that it can result in miscarriage and birth defects.

Exposure to vinyl chloride can occur by inhaling it or ingesting it. (<http://www.epa.gov>) Long term exposure has been known to cause skin irritations and Raynaud's syndrome, a painful inflammation in the extremities.

Vinyl chloride is considered to be a human carcinogen. It has been linked to certain liver cancers, mainly hepatocellular carcinoma, a rare malignant cancer of the liver.

### Molecule of vinyl chloride



Source: <http://www.chem.purdue.edu/gchelp/molecules/vincl.gif>

## 4.12 Toluene

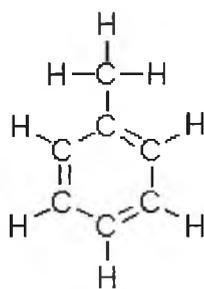
Toluene is a clear liquid that is insoluble in water. (<http://www.wikipedia.org>) It has a sweet smell like that of benzene. It is also known as methylbenzene and phenylmethane. The chemical formula for toluene is C<sub>7</sub>H<sub>8</sub>. It is commonly used as a solvent to dissolve, paint, paint thinners, rubber, printing ink, adhesives, leather tanners, disinfectants, chemical reactants and lacquers. It is also used in petrol as an octane booster.

Inhaling toluene fumes can be intoxicating however, it is not nausea-inducing until it is inhaled in large concentrations. Inhalation of toluene over long periods of time results in irreversible brain damage. As well as inhaling it's fumes, humans can also be exposed to toluene through contact with contaminated soil and drinking contaminated water. Toluene is highly toxic to humans due to the fact that it is insoluble in water, therefore it cannot be excreted through urine, faeces or sweat, so it must be metabolized in order to excrete it. Deliberate inhalation of toluene-containing solvents is often associated with adverse behaviour effects.

Toluene can also cause postural tremors. These are tremors in the limbs when they are outstretched but vanish when the limbs are relaxed.

In order to determine exposure to toluene, tests can be carried out on the blood, urine and liver. (<http://www.astdr.cdc.gov>) An electrocardiogram can also determine exposure.

Molecule of toluene



Source: <http://www.steve.gb.com/images/molecules/arenes/toluene.png>

# CHAPTER 5

## SURVEY

A door-to-door survey (sample survey in appendix c) of three areas in the Finglas area, two situated next to the landfill and one further away, was conducted. 127 houses in total were surveyed. Forty-eight houses were surveyed in Area A, an older area (over thirty years, see maps B and C in appendix A) next to the landfill, forty-six houses were surveyed in Area B, a newer area (less than ten years, see map B in appendix A) next to the landfill, and thirty-three houses were surveyed in Area C, a newer area (approximately ten years, see map C in appendix A) further away from the landfill. These three areas for chosen for two main reasons. They are:

- They allow for comparison between an older and a newer are; and
- They allow for comparison between distance.

There were eight questions included in the survey. Some of these questions had multiple parts, resulting in a total of eighteen questions. The questions included were based on the information required at the time, including length of residency, number of occupants per household, ill health within each household and perception of the landfill. A copy of the survey is included in appendix C. The reasons for including each question are as follows:

- 1) The length of residency should be known in order to ascertain whether or not the environment of their present residence could be a factor of their illness.
- 2) If many people are living in a house, they may all be sick with colds and flus as these are contagious. They may be suffering from them continuously as they may be continuously passed from person to person. Need to know which age groups people are in as the elderly are more likely suffer from repeated ill health. Children are more likely to suffer from frequent colds and runny noses.
- 3) a) Need to know if the illnesses which the residents may be suffering from are continuous and not anomalies or a cold or runny nose in the winter.

- 3) b) Need to know who is sick and what they suffer from. If there are high levels of a particular illness, this may imply evidence of a relationship between the landfill and illness of the local residents.
- 3) c) If there is a family history of any illness, there is unlikely to be a connection to the landfill, unless the family members who also suffer from the illness/illnesses mentioned in 3a also live near the landfill.
- 3) d) Need to know if all illnesses or some illness have a family history. A family history implies no link with the landfill.
- 3) e) If there is a smoker in the household, this could be a cause of any illnesses in the household. Smoking has been associated with breathing problems and cancer.
- 3) f) If the person smoking suffers from ill health, the smoking could be the cause. Non-smokers living with people who smoke can develop illnesses related to smoking through passive smoking.
- 4) a) Ascertain whether or not the residents are concerned about living close to the landfill. This question is asked later in the questionnaire in order to avoid bias in other answers.
- 4) b) Need to know if the residents are concerned for the health or are they worried about something else.
- 5) a) Determine how concerned the residents really are. If they are very concerned, they may have approached a person or organization in order to voice their concerns
- 5) b) Find out who they have approached. Is it just TDs that have been door-to-door or have the residents made an effort? If they have gone out of their way to speak to someone, they are very concerned about the landfill.
- 5) c) Find out why they have not done something about their concerns.
- 6) a) Ascertain if the residents believe the landfill could be cause of ill health. This is below 4a in order to avoid bias. They may be worried about the landfill for other reasons, e.g. house prices or rats.
- 6) b) If the residents believe that landfills could be cause of ill health, find out why they think this.

- 7) a) Find out if there are any landfills which have been associated with ill health
- 7) b) If there are other landfills, find out where they are. Also, to find out how much the residents know about any possible relationship between landfills and ill health.
- 8) Allows the residents to voice any further opinions or concerns they may have.

### 5.1 : Types Of Illness

Of the 127 houses surveyed, only thirty-four of them had anyone suffering from any repeated illness. A total of fifty-five people (adults and children) were reported to suffer from continuous ill health. Of these cases, thirty-two were adults, twenty were children and three were unknown as to whether they were adults or children. Twenty-nine of these people suffered from illnesses that do not have a family history whereas thirty-one of these people suffer from illnesses that do have a family history. Five of them suffer from a combination of illnesses that do and do not have a family history.

Sixteen different types of illnesses were reported, ranging from runny noses, coughs, colds and flus to more serious illnesses such as heart problems and cancers. Five people did not state what type of illness they suffer from. Table 5:1 shows how many times each illness was reported to be suffered from by a resident.

TABLE 5:1 – ILLNESSES AND NUMBER OF SUFFERERS

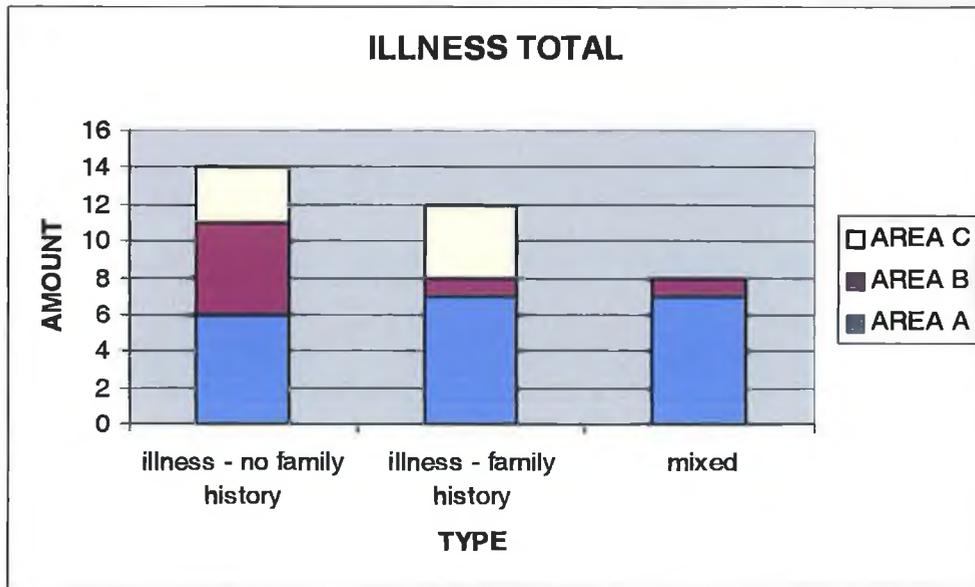
ILLNESS	NUMBER OF SUFFERERS
Runny noses/Coughs/Colds/Flus	6
Sore throats	4
Sinus problems	10
Allergies	5
Exema	1
Diabetes	2

Breathing problems	22
Blood pressure	1
Kidney problems	1
Heart problems	6
Epilepsy	3
Throat and chest infections	3
Parkinson's disease	1
Multiple myeloma	1
Breast cancer	2
Bladder cancer	1
unknown	5

### 5.2 : Results Of Question 3

Table 5:2 shows the total number of houses with illness in each area and if each household has only illnesses that do not have a family history, illnesses that do have a family history, or a combination of illnesses that do and do not have a family history. Illnesses that do not have a family history could possibly be caused by an external factor. Illnesses that do have a family history are unlikely to be caused by an external factor. Households with a combination of illnesses that do and do not have a family history may be caused by a combination of genetics and external causal factors.

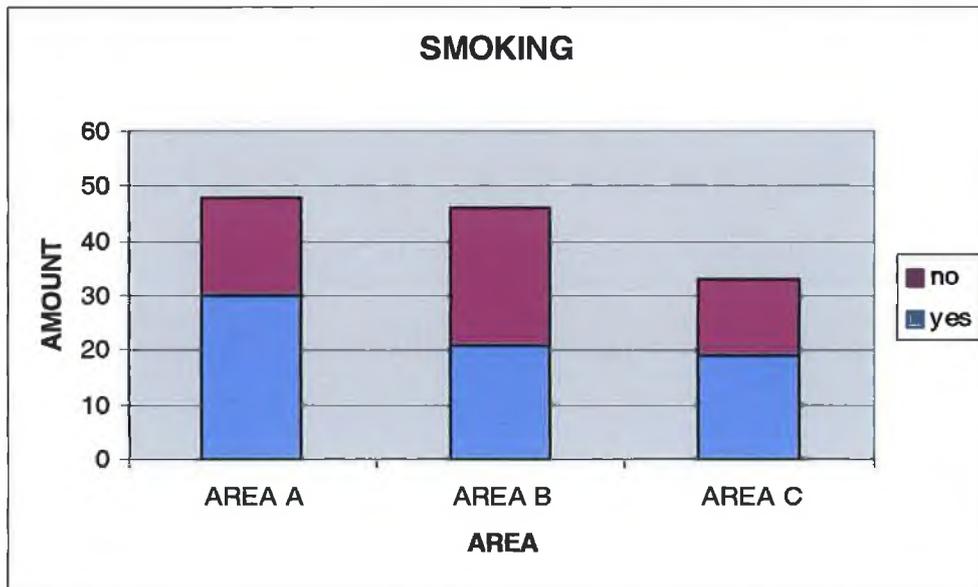
TABLE 5:2 – TOTAL NUMBER OF HOUSEHOLDS WITH ILLNESS



As can be seen from the table, most of the households with continuous illnesses are in Area A. This is most likely due to the fact that the residents of these households have been here much longer than those of Areas B and C. The houses of Area A were built over thirty years ago. The houses of Area B were built eight years ago. The Houses of Area C were built ten years ago.

Table 5:3 shows how many households have residents who do and do not smoke in each area. Thirty households have people who smoke in Area A, twenty-one households in Area B have people who smoke and nineteen houses in Area C have people who smoke.

TABLE 5:3 – TOTAL NUMBER OF HOUSEHOLDS WITH SMOKERS



As can be seen from this table, seventy households in total have people who smoke and fifty-seven do not. However, there does not appear to be a relationship between smoking and illness.

101 households have either illness or smoking or a combination of both. Table 5:4 shows how households are in each of the four categories of illness and smoking; no illness and smoking; illness and no smoking; and, no illness and no smoking. Table 5:4 shows the total in each category for all areas.

TABLE 5:4 – TOTAL ILLNESS AND SMOKING

	illness	no illness
smoking	6	53
no smoking	2	40

In Area A, twelve houses have both illness and a smoker, eight houses have an illness and no smoker. In Area B, all seven houses with an illness have no smoker. In Area C, five houses have an illness and a smoker, two have an illness and no smoker. Tables 5:5a, 5:5b and 5:5c show how many of these

households have an illness that has either no family history, a family history or a combination of both.

TABLE 5:5a – AREA A

	no family history	family history	mixed
smoking&illness	3	3	6
no smoking&illness	3	4	1

TABLE 5:5b – AREA B

	no family history	family history	mixed
smoking&illness	0	0	0
no smoking&illness	5	1	1

TABLE 5:5c – AREA C

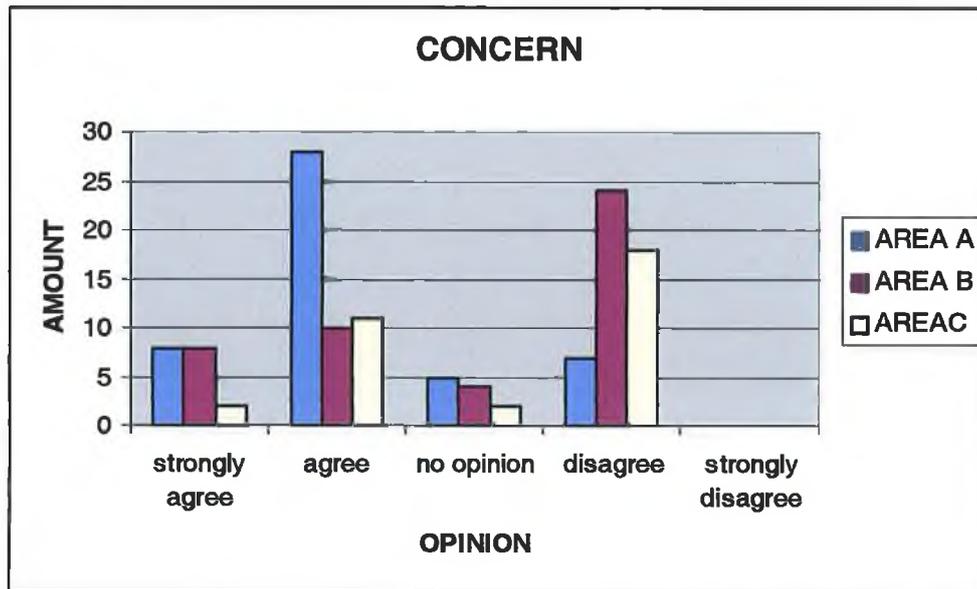
	no family history	family history	mixed
smoking&illness	2	3	0
no smoking&illness	1	1	0

As can be seen from these three tables, there does not appear to be a relationship between smoking and illness, whether it has no family history, a family history or a combination of both. This suggests that smoking is not a causal factor of their illnesses, leading to the supposition that there is another factor to investigate, i.e. the landfill.

### 5.3 – Results Of Question 4

Table 5:6 shows the total number of households for all three areas who are concerned about living close to the landfill. In total, sixty-seven people are concerned about living close to the landfill, forty-nine believe are not concerned about living close to the landfill and eleven have no opinion on this issue.

TABLE 5:6 – TOTAL OPINIONS CONCERN ABOUT LIVING CLOSE TO THE LANDFILL



However, in each individual are, only Area A is concerned overall about living close to the landfill, with 75% either agreeing or strongly agree with the statement that living close to the landfill concerned them. Chart 5:1a shows the overall opinion in percentages of being concerned about living close to the landfill for Area A. Only 15% are not concerned about living close to the landfill while 10% have no opinion on this issue. None of the residents strongly disagreed with the statement that living close to the landfill concerned them.

CHART 5:1a – AREA A OPINION OF CONCERN ABOUT LIVING CLOSE TO THE LANDFILL

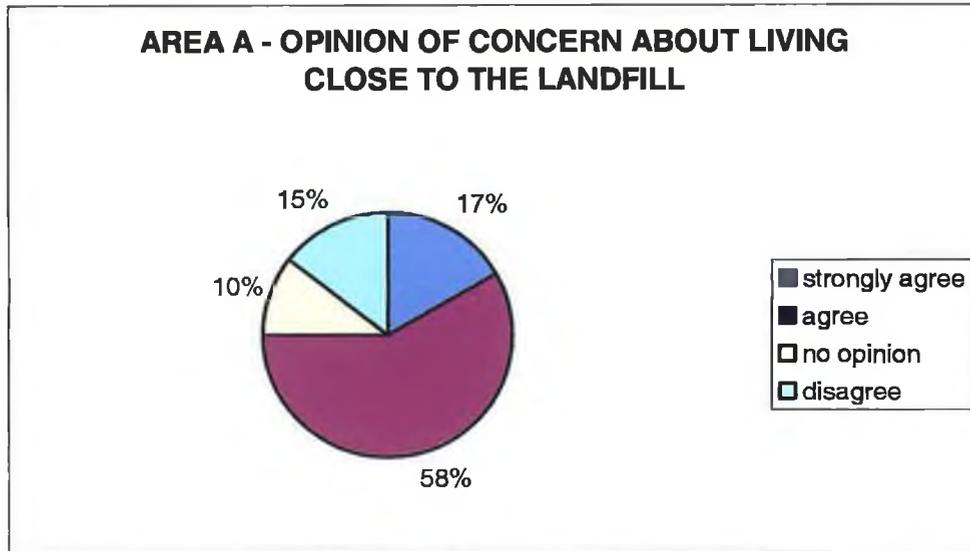
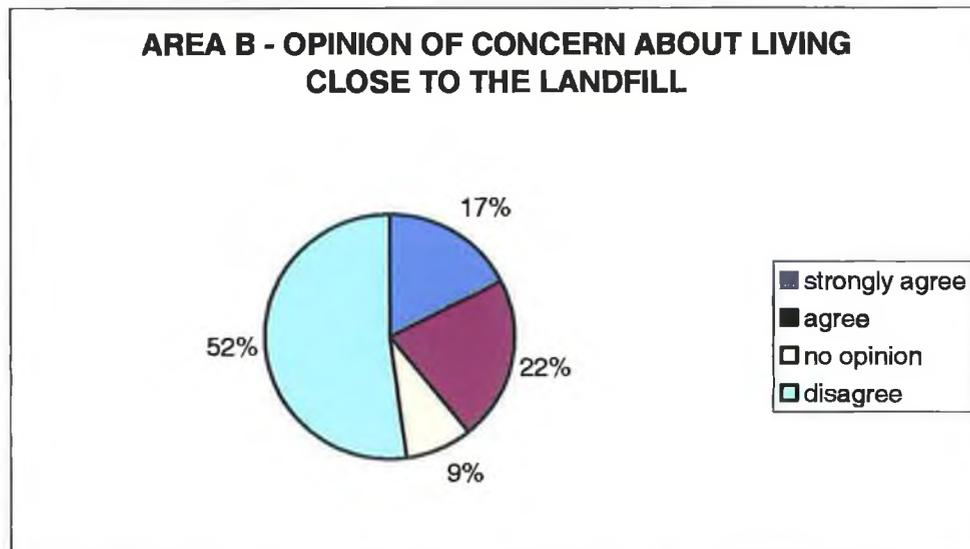


Chart 5:1b shows the opinion in percentages of Area B as to whether or not the residents are concerned about living close to the landfill. In this area, more people disagreed with the statement that living close to the landfill concerned them. As with Area A, no resident strongly disagreed with it.

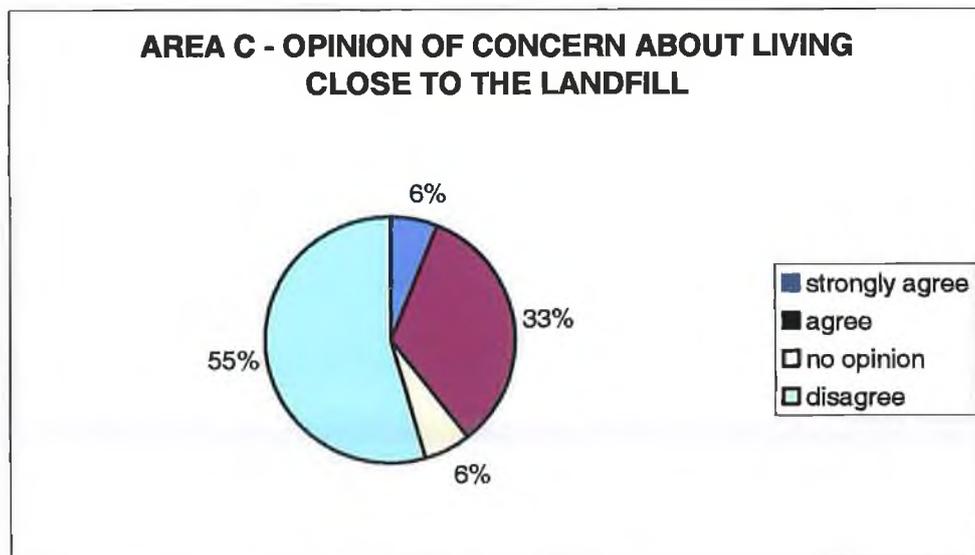
CHART 5:1b – AREA B OPINION OF CONCERN ABOUT LIVING CLOSE TO THE LANDFILL



Overall, only 39% of the residents in Area B are concerned about living close to the landfill. 9% have no opinion on this issue.

In Area C, like Area B, more residents disagreed with the statement that living close to the landfill concerned them. As with Areas A and B, no resident strongly disagreed with it. The totals for each opinion are illustrated in percentages on chart 5:1c.

CHART 5:1c – AREA C OPINION OF CONCERN ABOUT LIVING CLOSE TO THE LANDFILL



Even though Areas B and C disagree with the statement that living close to the landfill concerned them, as more residents took part in the survey in Area A, the overall values for each opinion reflects the opinion of Area A.

There were seven main reasons given for why the residents are concerned about living close to the landfill. Table 5:7 shows each of these reasons and the number of residents who gave each reason. Some residents gave more than one reason.

TABLE 5:7 – REASONS FOR BEING CONCERNED ABOUT LIVING CLOSE TO THE LANDFILL

REASON STATED	AMOUNT
Health	31
Smell	7
Rats	5
Toxins/Toxic	12
Waste	5
Gases	6
Other	24

As can be seen from the table, most of the residents are concerned about their health. Some claim that there is a high level of illness in the areas surrounding the landfill which is caused by the landfill. Other opinions included leachate coming from the landfill and the fact that it's near a residential area. One resident said "who wants to live near a dump?" Of those that are not concerned about the landfill, ten offered a reason as to why they are not concerned. Two said they are not concerned because it is closed, three said that they have never thought about it, three said that they don't care about it and two said that they have never had any problems with it, having lived in their homes for years and not noting any adverse affects.

#### 5.4 – Results Of Question 5

Of the sixty-seven residents who had concerns about living close to the landfill, only twenty-two had approached anyone about their concerns. Forty-five had not approached anyone and one did not say whether or not they had approached anyone about their concerns. Of those who had approached someone about their concerns, eighteen had approached TDs, either as they called door-to-door, by post or on their own time; four had approached Dublin City Council; three had approached their GP; and, one had written letters, but did not say to whom.

Many of the residents in general, whether or not they had approached someone about their concerns, mentioned protests which had been held against the opening of the landfill over thirty years ago. Fourteen different reasons were given by those who had not approached anyone about their concerns as to why they had not. Table 5:8 shows these reasons and the amount of residents who gave them.

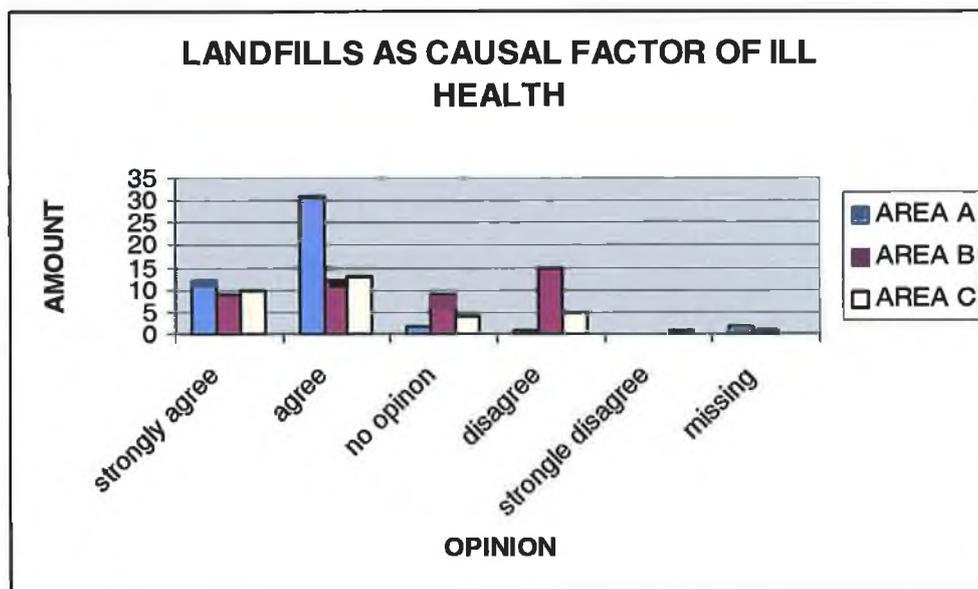
TABLE 5:8 – REASONS FOR NOT APPROACHING SOMEONE ABOUT CONCERNS

REASON	AMOUNT
No time	8
Nothing will be done	1
Work commitments	1
Was at protests	1
Don't know who	4
Don't know	1
Not bothered	3
Not that kind of person	1
Not planning on staying	2
Landfill closed	1
Not here long enough	1
Never thought of it	1
Not a major concern yet	1
missing	19

### 5.5 – Results Of Question 6

Table 5:8 shows the opinions of the residents of each area about whether or not they believe that landfills are a causal factor of ill health.

TABLE 5:9 – LANDFILLS AS CAUSAL FACTOR OF ILL HEALTH



### 5.6 – Results Of Question 7

Of the 127 residents surveyed, only ten of them mentioned another landfill which they believed to be associated with ill health. Ten other landfills were mentioned. Table 5:9 shows which landfills were mentioned and how many times they were mentioned.

TABLE 5:10 – OTHER LANDFILLS BELIEVED TO BE ASSOCIATED WITH ILL HEALTH

LANDFILL	AMOUNT
Swords	3
Ballyogin	2
Ballyally	1
Limerick	1
Finglas (other)	1
Dublin Southside	2
Kildare	1

Naas	1
Ringsend	1
South America (shanty towns)	1

Of these landfills, the only one which appears to have any link with ill health are the landfills in South America with shanty towns built on them. Shanty towns are often built on illegally land belonging to a third party of any material that will provide shelter. (<http://www.answers.com>) They are usually built on the periphery of cities, having no streets, sanitation, electricity or plumbing. They tend to found in Third World countries. They can be found on landfills but landfills may not be a causal factor in the ill health of those who live in them. The lack of hygiene and sanitation, as well as the extreme closeness of those who live in them are more likely to be the real causal factors of ill health in them. Of the other landfills mentioned, there does not appear to be any ill health associated with them and a second landfill site in Finglas could not be found. These landfills are more likely to be landfills that the residents have heard of rather than landfills that have been associated with the ill health of their local residents.

### 5.7 : Anomalies

Of all fifty-five cases, only three appeared to be of any real significance. In Areas A and C. They are comprised of three sisters and two brothers. They grew up in Area A and their parents had lived in Area A for many years. The three sisters and one of the brothers live in Area A and the second brother lives in Area C. The first sister lives with her husband and three children. The second sister lives with her husband and adult son. The third sister lives with her husband, adult daughter and two teenage sons. The first brother lives with his wife. The second brother lives with his wife and two young sons. Within this family, there is a history of asthma, sinus problems and bronchitis.

In the home of the first sister, the two youngest sons both suffer from asthma and the mother suffers from sinus problems. The father also suffers from sinus problems. (His family has also live in Area A for many years.) This family has lived in their home for eleven years but had previously lived in Cardiff Bridge, a nearby estate, where they had noted a smell of gas when the landfill was in use. In this household, both parents smoke, which could be a contributing factor to their illnesses as well as those of their sons, along with a family history of their illnesses.

In the home of the second sister, both mother and son suffer from sinus problems, allergies, and throat and chest infections. The mother stated that she frequently suffers from bronchitis. The father also suffers from allergies and throat and chest infections. They have lived in their home for thirty-two years. In this household the father smokes, which could be a contributing factor to their illnesses. The fact that they all suffer from throat and chest infections could be considered to be evidence of this.

In the home of the third sister, both the mother and one of her teenage sons suffer from sinus problems. They have lived in their home for five years, but had previously lived in Valeview, a nearby estate. When they lived there they had noted a continuous smell emitting from the landfill when it was in use. In this household, no-one smokes.

In the home of the first brother, neither adult suffers from any repeated illnesses. Neither adult smokes.

In the home of the second brother, the mother suffers from kidney problems. There is no history of this in her family. Neither the father or the sons suffer from any repeated illnesses. They have lived in their home for eight years. Neither of the adults smoke in this household.

households, they all differ, which suggests that there are different causal factors rather than just one. As these are the only three cases of any real significance, it suggests that they are anomalies rather than strong evidence that the landfill is a causal factor of ill health.

# CHAPTER 6

## **PUBLIC PERCEPTION**

Throughout this study, it has become clear that it is not the health effects of living in close proximity that is the main problem, it is the public perception of landfills. One of the main concerns is that of the health of those who live in close proximity to landfills.

According to Peter Montague of the Environmental Research Foundation (ERF), landfills have adverse health effects on those living in close proximity to them. (<http://www.garynull.com>) In his paper 'Landfills Are Dangerous', he refers to sixteen different studies of landfills which he states were found to have adverse health effects on their local populations. The first study he cites is one which was conducted by the Department of Health in New York. Here, women were found to be four times more likely to suffer from leukemia and bladder cancer. He also cites the study conducted by Goldberg et al in 1995 entitled 'incidence of cancer among persons living near a municipal solid waste landfill site in Montreal, Quebec'. He states that this study also found that those living near solid waste landfills are at a higher risk of developing cancer, identifying the forms of cancer found to be elevated here, i.e. stomach, liver, prostate and lung cancer in men, cervix and uterus cancer in women. However, he does not state that in study it is concluded that even though there is a higher rate of cancer close to the landfill, more studies need to be conducted at this landfill and others in order to determine whether or not there is a link between landfills and ill health. The other studies he cites and the results they show which lead Montague to believe that landfills are a causal factor of ill health are as follows:

- At Drake Superfund site, Pennsylvania, a study conducted in 1984 found that men living in close proximity to it were more likely to suffer from high rates of bladder cancer. In this study, exposure to the landfill through occupational hazard was not ruled out as the main form of contact with the landfill.
- In north-west Illinois in 1990, a landfill was found to have contaminated a water supply with tetrachloroethylene and trichloroethylene. Those who used

the water supply were found to be at a high risk of developing bladder cancer.

- In 1989, the EPA conducted a study of 593 landfills in 339 counties in the US. The counties with the highest amount of landfills were found to be at greater risk of suffering from bladder, lung, stomach and rectum cancer.
- In Woburn, Massachusetts, a study of children suffering from leukemia was conducted in 1986. A relationship was discovered between their leukemia and drinking water from sources which had been contaminated by a landfill.
- In 1984, a study of Love Canal landfill near Niagara Falls, New York, claimed that children living here were born with abnormally low birth weight. A study in 1985 confirmed this. A further study, which was published in 1989, claimed that children who had lived at least three quarters of their lives near Love Canal landfill were more likely to be shorter than those living further away. However, this landfill has been used to toxic chemicals which would be more likely to have an adverse effect on the local population than general waste, e.g. household waste.
- A study conducted of babies born between 1971 and 1975 in families living near Lipari landfill, New Jersey, were found to have low birth weight. It was during these four years that a large amount of toxic waste is thought to have leaked from the landfill.
- A study of BKK Landfill in Los Angeles County, California, found that those living near it in 1997 found that those who had been living near it when it's use was at it's highest were more likely to have children who had a small birth weight.
- Studies at Nantygwyddon Landfill in Rhondda, Wales, have found that children born to parents living near the landfill are more likely to suffer from birth defects. However, toxic waste has been dumped at this landfill, which is more likely to have an adverse effect on health than other waste, e.g. household waste.

- In San Francisco, a study in 1990 found that children born to parents living near the landfill were one and a half times more likely to suffer from birth defects affecting the heart and circulatory system than those who were born to parents living further away.
- A twelve percent increase of birth defects was found in a study of 590 hazardous landfills in New York State in 1990.
- In 1998, a study of landfills conducted by the London School of Hygiene and Tropical Medicine found that landfills may pose a risk to human health but these risks are unknown.
- In 1991, a community in North Rhine-Westphalia, Germany, reported increased amounts of leukemia near a landfill. However, this is a toxic waste landfill so it is more likely to have an adverse effect on health than landfills which store general waste, e.g. household waste.

Another main concern is that of property values. There are both positive and negative views of this topic. According to the National Solid Wastes Management Association (NSWMA), it is a “common misconception [that] landfills...have a negative effect on property values.” (<http://www.isproductions.net>) It states that academic studies have shown that property values “are not necessarily adversely affected by close proximity to” landfills. Bruce J. Parker, the President and CEO of NSWMA, has stated that close proximity to landfills can have a positive effect. In a paper he wrote entitled ‘Solid Waste Landfills and Residential Property Values’, he claims that landfills can lead to increased property values in seven different ways. (<http://www.pawasteindustries.org>) These are:

- host community fees;
- tax revenues;
- creation of jobs;
- a reliable waste disposal services;
- energy generation; and,

- improvement of infrastructure.

In this paper, he refers to a study which had been conducted while planning the construction of a new landfill. This study had examined other landfills in Texas, coming to the conclusion that property values had not decreased because of the landfills, in some cases actually increasing. He claims that

Generalizations and misinformation about the community impacts of these facilities only exacerbate the problem. The nature of this problem is aptly summarized by the First Law of Garbage, which is: 'Everybody wants it picked up, but nobody wants it put down.' And, the second part of this Law is: 'Nobody wants it put down anywhere near them.'

One resident of Area B of the study of Dunsink landfill believes that if a study of the landfill is conducted, it will devalue the property prices in the areas surrounding the landfill.

When questioned about Dunsink landfill and the concerns that the local residents have regarding their health, the North-West Area Manager for Dublin City Council said that he could not say for definite whether or not Dunsink landfill is a causal factor of ill health in the area as it is not known conclusively whether or not landfills contribute to ill health. Dr. Eugene Boyle of the Health Service Executive (HSE) said that no evidence has been found to prove that landfills are a causal factor of ill health but that does not mean that landfills are not a causal factor of ill health. I have contacted a number of TDs regarding this issue but as of yet have received no response.

# CHAPTER 7

## CONCLUSION

This study set out to find out what the health threats of a landfill are. They range from irritation of the skin to long term illnesses and, in extreme cases, death. The second aim of this study was to ascertain whether or not there is a relationship between living in close proximity to a landfill and ill health. This aim must be refined as in some cases there does appear to be a relationship. At Nantygwyddon Landfill in Rhondda, Wales, there does appear to be a relationship between the landfill and ill health. There also appears to be a relationship at Miron Quarry in Montreal, Quebec between the landfill and ill health. However, toxic waste is known to have been disposed of at these landfills. At Dunsink landfill, there does not appear to be a relationship between the landfill and ill health. Toxic waste is not known to be disposed of here. There is not an above average rate of illness, either of a single illness or collectively. The three cases which stand out are anomalies rather than evidence of a relationship. The relationship appears to be between toxic waste and ill health, not landfills in general and ill health.

Public perception of landfills is both positive and negative. Bruce J. Parker, President and CEO of the National Solid Wastes Management Association (NSWMA) in America, summed up the public perception of landfills aptly when he said:

The First Law of Garbage...is "Everybody wants it picked up, but nobody wants it put down.<sup>2</sup> And, the second part of this Law is... "not in my back yard" syndrome (NIMBY), or "locally unacceptable land use" (LULUs). (Bruce J. Parker, NSWMA)

He has a positive view of landfills. However, his view can be seen to be biased as he is the President and CEO of NSWMA. The negative view of Peter Montague of the ERF can also be seen to be biased as he does not mention the toxic waste known to be disposed of at Miron Quarry in Montreal, Quebec.

As the prevailing winds in Ireland are south-easterly, wind could not transport gases from Dunsink Landfill to Area C. As Area B is in close proximity to the landfill and in the path of the prevailing winds as they blow over the landfill, a high level of illness would be expected to be found here if the landfill was a causal factor of ill health. This is not the case. The residents of Finglas believe that Dunsink Landfill is a causal factor of ill health. However, this is only public perception, not absolute fact.

Through this study it can be concluded that landfills in themselves are not a causal factor of ill health but the waste that is disposed of in them. Therefore, it is the waste that should be of major concern and how it is disposed of, not where it is disposed of.

# BIBLIOGRAPHY

## BIBLIOGRAPHY

ATSDR, "Medical Management Guidelines (MMGs) for Trichloroethylene (Cl<sub>2</sub>C=CHCl)", <http://www.atsdr.cdc.gov/MHMI/mmg19.html>, accessed 25/01/2006

ATSDR, "ToxFAQs for Arsenic", <http://www.atsdr.cdc.gov/tfacts2.html>, accessed 25/01/2006

ATSDR, "ToxFAQs for Tetrachloroethylene", <http://www.atsdr.cdc.gov/tfacts18.html>, accessed 25/01/2006

Canadian Centre for Occupational Health and Safety, "Benzene", [http://www.ccohs.ca/ohanswers/chemicals/chem\\_profiles/benzene/health\\_ben.html](http://www.ccohs.ca/ohanswers/chemicals/chem_profiles/benzene/health_ben.html), accessed 25/01/2006

Canadian Centre for Occupational Health and Safety, "Xylene", [http://www.ccohs.ca/oshanswers/chemicals/chem\\_profiles/xylene/health\\_xyl.html](http://www.ccohs.ca/oshanswers/chemicals/chem_profiles/xylene/health_xyl.html), accessed 25/01/2006

Department of Human Services, "Cadmium", <http://www.disability.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Cadmium?OpenDocument>, accessed 25/01/2006

DHFS, "Methane", <http://www.dhfs.state.wi.us/eh/ChemFS/fs/methane.htm>, accessed 12/10/2005

Evans, J., "Nantygwyddon Speech", <http://www.jillevans.net/spnyg.html>, accessed 17/10/2005

Goldberg, M.S., al-Homsi, N., Goulet, L. and Riberdy, H., "Incidence of cancer among persons living near a municipal solid waste landfill in Montreal, Quebec", *Archives of Environmental Health* 50 (6), 416-425

Goldberg, M.S., Goulet, L., Riberdy, H., and Bonvalot, Y., "Low birth weight and preterm births among infants born to women living near a municipal solid waste landfill site in Montreal, Quebec", *Environmental Res.* 69 (1), 37-50

Goldberg, M.S., Siemiatyck, J., DeWar, R., Desy, M. and Riberdy, H., "Risks of Developing Cancer Relative to Living near a Municipal Solid Waste Landfill Site in Montreal, Quebec, Canada", *Archives of Environmental Health* 54 (4), 291-297

Home Safe Environmental, "Fact Sheets about Lead", <http://www.leadpro.com/factsheet.html>, accessed 25/01/2006

Lakes Environmental, "Nickel and Compunds", [http://www.weblakes.com/toxic/NICKEL\\_AND\\_COMPUNDS.HTML](http://www.weblakes.com/toxic/NICKEL_AND_COMPUNDS.HTML), accessed 25/01/2006

NIEHS, "Waste : Landfill", <http://www.nih.gov/external/faq/landfill.htm>, accessed 21/01/2006

The Electronic Guide, "Nickel Frequently Asked Questions", <http://www.teg.co.uk/nickel/faq.htm>, accessed 25/01/2006

Wikipedia, "Arsenic", <http://www.wikipedia.org/wiki/Arsenic>, accessed 23/01/2006

Wikipedia, "Benzene", <http://www.wikipedia.org/wiki/Benzene>, accessed 23/01/2006

Wikipedia, "Cadmium", <http://www.wikipedia.org/wiki/Cadmium>, accessed 23/01/2006

Wikipedia, "Carbon Dioxide", [http://www.wikipedia.org/wiki/Carbon\\_dioxide](http://www.wikipedia.org/wiki/Carbon_dioxide), accessed 22/01/2006

Wikipedia, "Lead", <http://www.wikipedia.org/wiki/Lead>, accessed 22/01/2006

Wikipedia, "Methane", <http://www.wikipedia.org/wiki/Methane>, accessed 22/01/2006

Wikipedia, "Nickel", <http://www.wikipedia.org/wiki/Nickel>, accessed 23/01/2006

Wikipedia, "Shanty Towns", <http://www.answers.com/shanty%20towns>, accessed 19/05/2006

Wikipedia, "Tetrachloroethylene", <http://www.wikipedia.org/wiki/Tetrachloroethylene>, accessed 23/01/2006

Wikipedia, "Toluene", <http://www.wikipedia.org/wiki/Toluene>, accessed 23/01/2006

Wikipedia, "Trichloroethylene", <http://www.wikipedia.org/wiki/Trichloroethylene>, accessed 23/01/2006

Wikipedia, "Vinyl chloride", [http://www.wikipedia.org/wiki/Vinyl\\_chloride](http://www.wikipedia.org/wiki/Vinyl_chloride), accessed 23/01/2006

Wikipedia, "Xylene", <http://www.wikipedia.org/wiki/Xylene>, accessed 22/01/2006

#### MOLECULE DIAGRAMS

Arsenic, <http://www.airliquide.com/en/business/products/gases>, accessed 16/05/2006

Benzene, <http://sparror.cubecinema.com/cube/cola/chemistry/figures/benz1.gif>, accessed 16/05/2006

Carbon Dioxide, [http://www.up.ac.za/academic/chem/mol\\_geom/co2\\_2.gif](http://www.up.ac.za/academic/chem/mol_geom/co2_2.gif), accessed 16/05/2006

Cadmium, Source: <http://pub2.hi2000.com/upload/0502211713284054.gif>, accessed 16/05/2006

Lead, Source: <http://www.powerlabs.org/images/pbpic.gif>, accessed 16/05/2006

Methane, Source: <http://www.purchon.com/chemistry/images/methane.gif>, accessed 16/05/2006

Nickel, <http://smid.blueprint.org/images/630/pc3016630.png>, accessed 16/05/2006

Tetrachloroethylene, [http://www.angelo.edu/faculty/kboudrea/molecule\\_gallery/02\\_alkenes/tetrachloroethylene\\_01.gif](http://www.angelo.edu/faculty/kboudrea/molecule_gallery/02_alkenes/tetrachloroethylene_01.gif), accessed 16/05/2006

Toluene, <http://www.steve.gb.com/images/molecules/arenes/toluene.png>, accessed 16/05/2006

Trichloroethylene, <http://mds.glc.org/carol/images/chem/Trichloroethylene.gif>, accessed 16/05/2006

Vinyl Chloride, <http://www.chem.purdue.edu/gchelp/molecules/vincl.gif>, accessed 16/05/2006

Xylene, <http://www.csub.edu/Chemistry/Pictures/molecules/xylene2.gif>, accessed 16/05/2006

### MAPS

Bartholomew Mapping Services, "Texaco Map of Ireland", Harper Collins Publishers, 2002

Ordnance Survey Ireland, "Dublin City and District Street Guide", Ordnance Survey Ireland, 2004

AERIAL PHOTOGRAPH

Google Maps, <http://maps.google.com/>, accessed 25/11/2005

# APPENDIX

# APPENDIX A

## MAPS

# MAP A – EAST COAST OF IRELAND



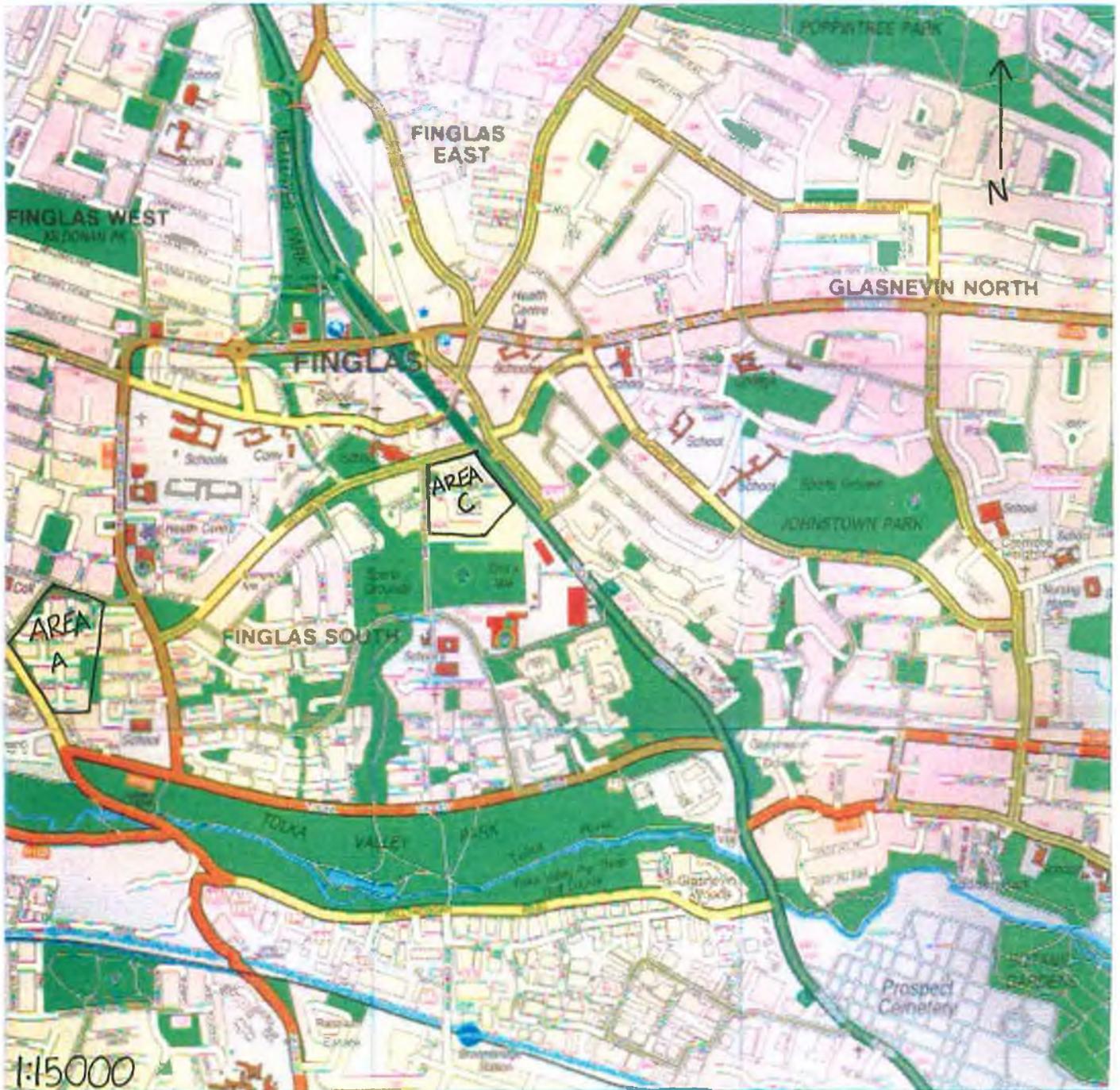
Source : Texaco Map of Ireland

# MAP B – DUNSINK LANDFILL WITH AREAS A AND B



Source : Ordnance Survey Ireland

# MAP C – AREAS A AND C



Source : Ordnance Survey Ireland

APPENDIX B  
AERIAL  
PHOTOGRAPH

AERIAL PHOTOGRAPH OF DUNSINK LANDFILL  
AND AREAS A, B AND C



Source : <http://maps.google.com/>

# APPENDIX C

## QUESTIONNAIRE

1) How long have you lived here? \_\_\_\_\_

2) How many people of each age group live in this house?

0-4     

5-12    

13-18  

19-30  

31-50  

51-65  

66+    

3) A) Do you or anyone in this household repeatedly suffer from ill health?  
(including recurring runny noses and coughs as well as asthma or anything more serious, e.g. cancers)

Yes       No

B) If yes to 3A, who suffers from ill health and what do they suffer from?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

C) If answered 3B, is there a family history of any of these illnesses?

Yes       No

D) If yes to 3C, which illnesses have a family history?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

E) Does anyone in this household smoke?

Yes  No

F) If yes to 3E, who smokes?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4) A) Does living close to a landfill concern you? (Tick the box that most strongly reflects your opinion.)

strongly agree	agree	no opinion	disagree	strongly disagree

B) If agree/strongly agree with 4A, why is this?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

5) A) If agree/strongly agree with 4A, have you approached anyone about your concerns? (e.g. organizations, local council...)

Yes  No

B) If answered yes to 5A, who have you approached?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

C) If answered no to 5A, why not?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

6) A) Do you think landfills could be a factor in ill health? (Tick the box that most strongly reflects your opinion.)

strongly agree	agree	no opinion	disagree	strongly disagree

B) If agree/strongly agree with 6A, why is this?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

7) A) Do you know of any landfills, other than Dunsink, associated with the ill health of its local residents?

Yes  No

B) If answered yes to 7A, where?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

8) Any other comments?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_