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DISSEMINATION OF AIR QUALITY INFORMATION IN VICTORIA, AUSTRALIA

An Interactive Qualifying Project Report

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by

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1. **Dissemination**
2. **Environment**
3. **Information**

ABSTRACT

The Victorian Environment Protection Authority (EPA) sponsored this project conducted in Melbourne, Australia. The goal of this project was to determine what air quality information the community values and how to disseminate this information. We conducted surveys and interviews to gain feedback from the general public and special interest groups. We analysed our results and provided the EPA with a list of suggestions. If the EPA implements our suggestions, they will increase awareness and interest in air quality issues.

EXECUTIVE SUMMARY

The Worcester Polytechnic Institute (WPI) requires students to conduct an Interactive Qualifying Project (IQP) that relates societal and technical issues. This degree requirement can be conducted at one of several global project centres around the world as well as on campus. The Victorian Environment Protection Authority (EPA) sponsored our project conducted in Melbourne, Australia D term 2000.

The EPA is a governmental organisation whose main mission is to protect and restore air, land, and water quality in Victoria. The goal of our project was to help the EPA determine what air quality information the community values and the best way to present this information. By providing the EPA with a list of suggestions on how to improve communication with the community, we aimed to increase awareness and interest in air quality issues. An educated and active public will help the EPA achieve its goals of environment protection.

The focus of our research was on the general public and special interest groups. Certain members of the general public are more susceptible to the adverse effects of poor air quality. These high-risk members are often used as a threshold by the Government when setting air quality standards. Our project explored both low and high-risk members of the community.

We conducted background research before our arrival and on-site. Various pollutants were examined, including their sources and health risks. We also explored previous work done in the areas of air quality perceptions and graphical representations. This research was done to aid in the design of the methods and processes used in our project.

To gather information from the general public, we decided to conduct surveys. We conducted a pre-survey to find flaws in our survey design. To reach high-risk individuals, we contacted medical facilities and elderly organisations. Low-risk members of the community were contacted by asking people in various places in the greater Melbourne area.

Special interest groups are non-profit, non-governmental organisations that are interested in and active with environmental issues. We obtained a list of groups from the EPA and found others via the Internet, the Yellow Pages and other special interest

groups contacts. We conducted interviews with members of several special interest groups.

We stored the responses of our survey in a database to allow us to analyse the results. We examined the responses in general and with respect to age, gender and medical conditions. We created charts and graphs to explain our findings. After testing various hypotheses and running several queries against the gathered data, we were able to draw conclusions. These conclusions gave rise to our list of suggestions for the EPA to improve air quality data dissemination to the general public.

The notes from the interviews were summarised and examined for similarities. Many of the interviewees had the same comments and suggestions. These results formed the basis of our suggestions regarding improvement in communication with special interest groups.

We suggested that the EPA focus on today's and tomorrow's air quality information because we found that most people surveyed were interested in current and forecasted conditions as opposed to the recent past. Television, newspaper, and radio are the formats that the general public want used in the communication of air quality information. Surprisingly, the Internet ranked a distant fourth to these three media. Many people we surveyed and interviewed told us they would like to have air quality reported with the weather. We also found that the relationships between the EPA and the media were not very strong, so we suggested that the EPA work to build relationships with the meteorological community. We also suggested that the EPA focus on information related to health effects, sources and how to reduce air pollution because those were the areas of greatest concern amongst the general public. Many of the special interest interviewees and several survey respondents suggested that the EPA associate an action with the problems it presents. After examining how other cities cope with air quality issues, we suggested that the EPA investigate the possibility of providing free public transportation on smog alert days. We also suggested that the EPA increase overall awareness and interest via public displays and increased education in schools.

To help the EPA improve relationships with special interest groups, we provided them with a list of suggestions derived from the results of our interviews. The main suggestion was for the EPA to produce regular bulletins. These bulletins should include information on the air quality levels since the last bulletin. It should also outline the EPA's current projects. Many people we spoke with also indicated

that they would like to be informed of actions taken against polluters. The bulletin should also include a list of current events from both the EPA and special interest groups. Many of the special interest groups were not pleased with the number and location of the EPA's monitoring stations. We suggested that the EPA examine this issue and attempt to increase the effectiveness of their data gathering. The format of the data that the EPA presented in the past to special interest groups was unclear and incomplete at times. We suggested that the EPA work to improve the format and make the data presentation more meaningful. We also found that the EPA provides more data via their web site than any other format, but many special interest groups do not have access to this information. We suggested that the EPA provide all of its data on both the Internet and alternative formats.

By conducting this project, we achieved our goal of helping the EPA disseminate air quality information to the general public and special interest groups. We feel that the work we completed will allow Victorians to better utilise the EPA as a source of air quality information. We hope that the increased communication achieved by implementing our suggestions will help the EPA work with the general public and special interest groups to provide an ecologically sustainable environment both now and in the future.

AUTHORSHIP

All sections of this project and report were contributed to equally by Christine Lawrence, Ian Munger, and Shelton Richards.

Christine Lawrence was responsible for portions of the writing of this project. She created and updated the database as well as conducted general public surveys. She also assisted with interviewing special interest groups.

Ian Munger was responsible for portions of the writing of this project. He worked on contacting and interviewing special interest groups. He also assisted with surveying the general public. He also created population maps with ArcView.

Shelton Richards was responsible for portions of the writing of this project. She played a large part in the data analysis, creation of graphs, and maintenance of the database. She also assisted with surveying the general public and interviewing special interest groups.

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Special thanks to Andy, your interview was great! We wish we had met with you earlier in the project and gotten to know you better. Thanks for teaching us about Australian drivers' point system.

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Last but not least we would like to thank our advisers, Professor Matt Ward and Professor Jonathan Barnett. Thanks so much for the opportunity to complete our project in Australia. The meetings B term were a blast! Matt, thanks for all of your help with our writing. Sorry you couldn't hang out with us in Australia, Jonathan.

Cheers!

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CHAPTER 1: INTRODUCTION

This project was sponsored by the Victorian Environmental Protection Authority (EPA), located in Melbourne, Australia. The goal of the EPA is to protect and restore land, water, and air quality to give Victorians a safer and more ecologically sound environment. They achieve this goal by helping to create and enforce governmental laws regarding environmental protection, monitoring the status of various environmental factors, a system of fines, and educating industry and the general public on restoring and preserving their surroundings.

The focus of this project was in the Air Quality Studies division of the EPA. Members of the Air Quality Studies division are dedicated to gathering, analysing, and reporting information on Victorian air quality. Information pertaining to current air quality is presented on the EPA web site, through the media, and other means. The EPA has stations throughout Victoria that collect measurements on six air quality factors: Ozone, Nitrogen Dioxide, Sulfur Dioxide, Carbon Monoxide, Fine Particulates, and Visibility. The EPA has broken its audience into 4 major groups; industry, academic and research, special interest, and the general public. Each of these target groups has different air quality information interests alongside different presentation needs. The goal of our project was to help the EPA determine what air quality information the general public and special interest groups value and the best way to present this information. The EPA currently had good working relations with industry and academic and research target groups. For that reason these groups were not a focus of our project.

Environmental protection is an area that should be of great importance to society. Without clean air, water and land, the balance of the ecology is compromised. Poor air quality can lead to reduced visibility, vegetation damage, lower property value, and a wide range of health problems, from headaches to lung cancer. Air quality control is an area that needs public support, which can be gained through education and awareness. The EPA wants to give those interested and active in the area the information they need. Also, they feel that giving the community the information they desire in a format they understand will increase awareness and action.

Today there is an overwhelming amount of information available to the public. We explored the best ways to disseminate this information to the groups that are in need. Case studies involving other air quality organisations were explored to gather other methods of information dissemination.

One of the main goals of our project was to determine what information each of the target groups is interested in obtaining. The EPA collects approximately 2 million points of air quality data per year. With this much information available, it is necessary to determine what information the community values.

The second goal of our project was to determine the format of the air quality data that the target groups prefer. Once the data that is of interest is isolated from the rest of the data, it must be presented in an understandable format. There are several ways to present information, and people have various preferences. Our project explored the best ways to present the air quality data so that people can easily understand the information.

The Interactive Qualifying Project (IQP) is a degree requirement first introduced to Worcester Polytechnic Institute (WPI) in 1970 with the goal of integrating science and technology with current social and ethical issues. WPI has project centres all over the world in which students can spend a term working with professionals to explore, research and analyse various issues. Our project, conducted at the Melbourne, Australia project centre, integrates science and technology by combining air quality, a technical, scientific issue, with information collection and distribution, a field that uses social research methods.

CHAPTER 2: LITERATURE REVIEW

This chapter provides the reader with the background information necessary to understand our project. During our Preliminary Qualifying Project (PQP), we spent seven weeks researching information that we needed to utilize our IQP time to the fullest. The research performed in creating this literature review helped us to gain a better understanding of the EPA. Research into pollution and current air quality trends gave us the background knowledge we needed to be able to delve deeper into our project. Exploring previous studies into air quality information presentation helped us understand what has been done and gave us ideas on how to conduct our project.

2.1 Air Pollution

Pollution is defined by the Merriam-Webster dictionary as, "the act of contaminating the environment with man-made waste, poses a serious threat to agriculture, water, air and humans." Numerous sources contribute to air pollution. In order to protect as well as improve the earth's ecological situation, pollution needs to be pinpointed and controlled. Pollution can be broken down into categories based on the area that is affected (i.e. land, water, and air). The focus of our project is on air pollution. Air monitoring stations can be used to isolate sources of air pollution as well as show when the pollution in a certain area is under proper control. By taking measurements of various air quality indicators, the efforts of the EPA, industry, and the general public can be analyzed and its effectiveness examined.

2.1.1 Sources of Air Pollution

Sources of air pollution can be broken down into four major categories: stationary, area-based, mobile, and indoor. Stationary sources are considered anything that remains in a fixed location during operation. Industrial premises are considered a stationary source. Area-based sources are "individual sources which occur over a

wide area but which are too small or numerous to identify as stationary sources" (EPA, 1999). Backyard incinerators are a typical example of this type of source. Sources of pollution that occur when the source is in motion are considered mobile. The predominant mobile sources are automobiles. The main indoor sources consist of gas appliances, wood fires, building materials, and surface coatings. In Victoria, wood stoves are the worst problem of indoor sources causing nearly 70% of fine particle emissions in winter.

One of the main contributors to air pollution today is car emissions. The primary cause of the emission of nitrogen oxides into the air is the combustion of fossil fuels from the internal combustion engines inside cars.

> "The early focus of air quality management was on stationary industrial sources of pollution, but improved control measures, combined with the closure of many heavy industries, means that transport sources, particularly cars and light trucks, are now the principal source of air pollution" (Grant, 1994).

Progress has been made to set standards for car emissions. In most countries, cars must pass annual emissions tests. Emission control has also played a significant role in the production of new cars, which emit far fewer pollutants into the air than older models. Since private motorists are the principal cause of air pollution, an effort should be made to inform them of their role in the environment. Social awareness will often promote a change in behavior and an improvement in air quality.

The EPA has a program that encourages motorists to get frequent tune-ups performed on their cars. By educating the public about the adverse effects that emissions from improperly tuned cars have on air quality, they have significantly reduced air pollution. In addition, the EPA has a program that allows EPA officials to report on cars that smoke for more than 10 seconds. Letters are sent to the car owner alerting them to the problem. If the car is not inspected and problems fixed the owner is fined.

Wood stoves and wood burning devices are a considerable source of fine particle (PM-2.5) emissions in Victoria. During the winter months it comprises up to 70% of the particle pollution found in the air. The main contributors are open fires and older wood stoves. Newer wood heaters that meet the Australian Standard use more wood but are considerably more efficient and produce less particle pollution than open fires. Currently the EPA recommends saving open fires for special

occasions and installing a wood heater that meets the Australian Standard (EPA website, 3/00).

2.1.2 Health Risks

Poor air quality causes serious adverse effects on human health. Three requirements must be met in order for an effect to be classified scientifically as a health risk; an index of pollution should be measured accurately, the effect of the pollution must be measured accurately, and a connection should be made between the two. Those highly susceptible to the health risks associated with air pollution are infants, newborns, the elderly, the frail, and those with chronic diseases of the lungs and heart. There are two types of exposures to air pollution, acute and chronic. Acute exposures occur when the human population is subjected to very high concentrations of toxic air pollutants. The other type, chronic exposure, occurs on a day-to-day level. Today humans are, "subjected continuously to relatively low-level concentrations of various air pollutants with intermittent, periodic, random episodes of relatively high concentrations lasting a few minutes to one day or longer" (Krupa, 1997). In general, air pollution is considered a major cause in the increasing rate of asthma, berylliosis, emphysema, and mesothelioma. Air pollution is also considered a contributing cause of bronchitis and cancer.

> "These hazardous air pollutants can irritate the eyes, nose throat or lungs. Some can exacerbate the symptoms of asthma. Some effect the functioning of organs such as the lungs, kidney, liver, brain and nervous system, and some can affect the human reproductive system" (EPA, 1999).

Air pollutants usually monitored globally are ozone (O3), nitrogen dioxide (NO2), sulfur dioxide (SO2), carbon monoxide (CO), fine particulates (PM10 and PM-2.5), visibility (Airborne particle index), lead (Pb), sulfate (SO4), and particulates (TSP).

One of the more common pollutants is sulfur dioxide. The main issue concerning sulfur dioxide is that it is highly soluble in water. Therefore, it is almost entirely removed in the mouth, throat, and nose. Sulfur dioxide does alters the mechanical function of the upper airway. It causes an increase in nasal flow resistance and a decrease in nasal mucus flow rate. "Exposing strenuously exercising asthmatic

subjects to relatively low levels of S02 (.25 and .5 ppm) produces acute bronchial constriction on inhalation" (Krupa, 1997).

Another pollutant that poses a serious threat to health is carbon monoxide, which joins with hemoglobin in the blood to form carboxyhemoglobin. At a level of 1,000 ppm (parts per million) or higher carbon monoxide is considered highly toxic and can result in death from asphyxiation because it deprives body and brain of oxygen. Exposure to carbon monoxide at a level of several hundred ppm can cause headaches, fatigue, and nausea (Godish, 1997).

2.1.3 Current Regulations and Control

The most current method of trying to control air pollution is attempting to reduce emissions from motor vehicles and stationary sources. In addition, limiting the emission of pollutants from stationary sources is accomplished by setting standards on the amount of pollution emitted from a source. To determine the standards, the members of the community who are sensitive to the air pollutants are used as a threshold. "Although there are no specific ambient standards in Australia for H.A.P. (Hazards Air Pollutants) other than lead, emissions are controlled through various means. For example, specific limits apply to emissions of many toxic metals and other HAPs from new stationary sources" (EPA, 1999). Presently, "National Australian Design Rules (ADRs) set limits on emissions of volatile organic compounds from motor vehicles, thereby limiting emissions of many HAPs from a significant mobile source" (EPA, 1999). Newly produced vehicles are expected to comply with these limits.

The use of Methanol as a new fuel also will lower emissions. Methanol burns cleaner, forming less ozone, and more time passes before it reacts with the atmosphere. "There is approximately 50 per cent less ozone potential per mile compared to conventional gasoline" (Grant, 1994).

During an interview taken from a study in California one state official commented:

> "What's interesting is that it's getting to the point that air pollution (control) ... is going to have to entail some changes in lifestyle and development habits. To enact that type of legislation is not politically favorable; it's

> very easy to say we'll put on some control technology because we want clean air back, but to say we're going to get you out of your car or going to change development patterns, that's no-no in this state" (Grant, 1994).

Informing people about air quality in a relevant and clear manner can increase their awareness about air quality. With increased awareness comes a change in behavior.

2.2 Melbourne Eddy

Researching air pollution in a particular area involves gaining an understanding of meteorological conditions in addition to researching pollutants. Melbourne, Victoria has a unique weather pattern known as the Spillane, or the Melbourne Eddy. The wind patterns generated by the mountains and the sea have a significant impact on Melbourne's air quality. Winds from the north push air through the mountains and into the city, where it picks up various pollutants. This air then circulates over Melbourne, trapping pollution over Port Phillip Bay. The afternoon sea breeze pushes the air pollution from the bay back over the city in the afternoon (EPA website, 4/00).

The EPA has studied the Melbourne Eddy and its effects on the movement of air pollution. When determining an air quality forecast, the EPA must take into account the release of pollutants and the force and direction of the winds (EPA website, 4/00).

FIGURE 2-1: MELBOURNE EDDY

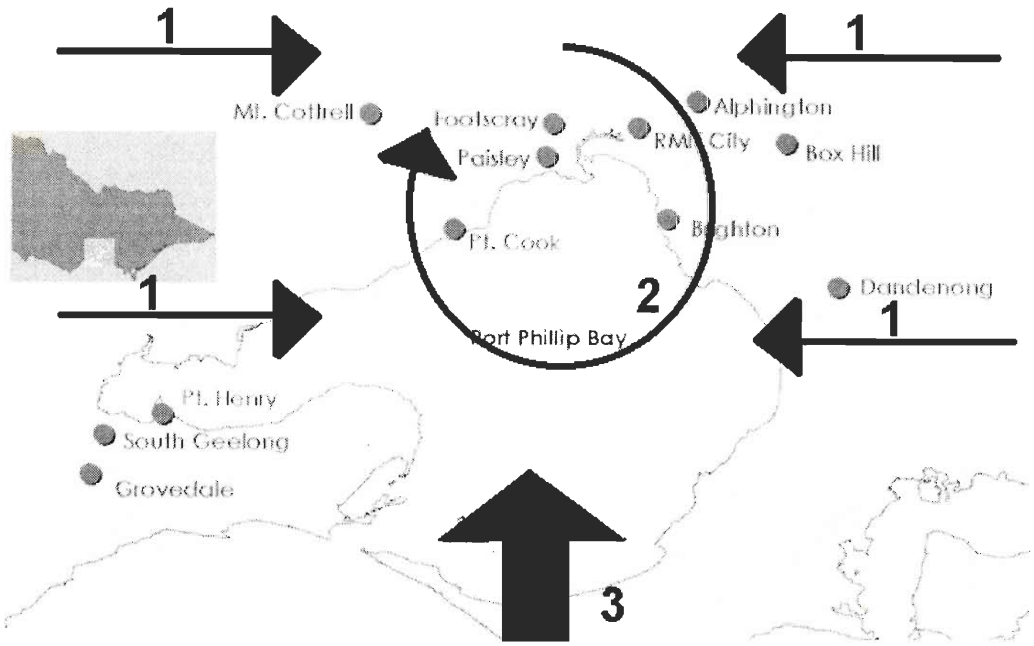


Figure 2-1: Melbourne Eddy: (1) Air enters the Port Philip Bay region from the mountains. (2) This air forms a circular motion that moves air pollution over the bay. (3) Afternoon breeze returns air pollution to the city.

2.3 Interests in Air Quality

Since air quality involves everyone, the community as a whole should work together to tackle the problems air quality presents. Part of this project involved contacting different groups of people particularly concerned with air quality in order to see what types of information they want from the EPA and where they believe further research should be done. Reaching public needs and preferences is important to the EPA. An increase in change of behavior comes with an increase of awareness.

2.3.1 Special Interest Groups

The EPA is interested in the opinion of special interest groups. A special interest group is defined as any official non-profit, non-governmental organization that is interested in and active with environmental issues. Some examples of these

groups located in Australia are the Clean Air Society of Australia and New Zealand, the Armidale Air Quality Group, Smogbusters (Brisbane), Greenfleet, and the Environmental Center of Western Australia.

The Clean Air Society of Australia and New Zealand (CASANZ) is a non-governmental, non-profit organization. When first founded, their goal was to bring together people with an interest in clean air and in the mechanics of air pollution. Now their goal has been expanded to include broader environmental management affairs related to air quality and similar issues. They support the protection of the environment by educating society about environmental issues, especially air quality, including the causes, effects, measurement, legislative aspects, and control of pollution. They use their organization as a tool to gather, as well as distribute, information. They also educate society through lectures, exhibitions, public meetings and conferences. Besides conferences, they also reach society through publications. They collaborate with other organizations that share their interest in air quality and provide scholarships, bursaries, and monetary grants to those studying relevant subjects or disciplines.

The Armidale Air Quality Group is concerned with the increasing problem of air pollution from domestic wood heaters. They offer suggestions for alleviating the problem including alternative ways to heat homes. They provide the community with health risk information and the latest air quality measurements from Armidale.

Another special interest group, Smogbusters, works to inform the public about the health risks associated with poor air quality. Their focus area is the effect of car emissions on humans and the environment. They hope to reduce the amount of car usage and in turn reduce greenhouse emissions.

Greenfleet is an environmental organization located in Victoria. Their campaign's goal is to reduce carbon emission from cars. They raise money to help plant trees that absorb the carbon monoxide emitted from cars.

The Environment Centre of Western Australia (ECWA) is a non-profit non-governmental organization that deals with the needs of the Western Australian Community. The Environment Centre is also interested in raising community awareness on environmental issues and educating the public about changing lifestyles to benefit the environment. "The Environment Centre facilitates and assists community participation and action on environmental issues, and works with other groups to fulfill these aims" (ECWA, 2/1999).

2.3.2 General Public

The opinions of an informed public are very important to the EPA and to the future effectiveness of anti-pollution efforts. Since the public elects members of the government and to some degree influence these politicians, an informed public will generate more action. The general public was therefore an important target for our research. The general public, for the purposes of this project, was considered to be persons who lives in Victoria and are not involved in environmental activism, and not representing industry. We were interested in what information is useful to ordinary people and what they generally understand about air quality. In order to deliver data to them that is useful, we needed to know how much they generally know about air quality as well as determine the best way to reach them.

The general public can be split into two sub groups: high risk and low risk. Members of the high-risk group feel the effect of air pollution more than the average person. Members of the high-risk population are frequently used as a threshold for pollutant standards. Members of the high-risk population include children, the elderly, and those with heart and lung conditions. The effects of air pollution are felt more by these people.

There has been a great deal of focus and research done over the past five years on the effects of air quality on children. A study done in California showed that air pollution might cause some degree of lung damage on young adults. "One of the most compelling air pollution statistics is the fact that children in the Los Angeles Basin suffer a 15 per cent reduction in lung function" (Grant, 1994). Researchers have recently become aware that infants' and children's physiological and chemical processes are different due to the fact they are developing and growing. "As growing developing organisms, children are often exposed to environmental toxins in greater proportions than adults, yet they are unable to protect themselves as easily" (Brown, 1998). Children are more susceptible to the adverse effects of poor air quality because they tend to be outdoors more often and have immature body organs and tissues. These immature body organs and tissues aren't as capable of detoxifying chemicals as adults. It has also been proven that, "children receive greater exposure to environmental pollutants present in air, food and water because they inhale or ingest

more air, food and water as a percentage of their body weight than adults do" (Brown, 1998).

Another group of affected people is the sick. The World Health Organization (WHO) defines health as the state of complete physical, mental and social well being of man; not merely freedom from disease or infirmity (Weisner, 1992). Good health requires a constructive balance between individuals or groups and the environment (Weisner, 1992). It is now recognized that the physical environment is the most important determinant of good health and consequently, protection of the environment and preservation of ecosystems are fundamental in the struggle against human illnesses (Cortese, 1993). Air pollution can increase breathing difficulty for those already experiencing respiratory problems. In addition, those who are sick may have a weakened immune system, making it more difficult to fight of the effects of air pollution.

The elderly are also more likely to experience health effects associated with air pollution. The elderly in general tend to be frailer than the general population. A study done in Montreal showed that there was a direct connection between the level of PM-2.5 and the number of elderly ER visits (Delfino, 1998). The findings of this study prove that, "while air quality standards may protect the respiratory health of the general population, this is not the case for susceptible subgroups such as the elderly" (Delfino, 1998).

Asthmatics also fall into the high-risk population. It has been established in numerous studies that there is a strong relation between long-term outdoor air pollution and asthma. A case study done in Taiwan found, "asthma significantly related to high levels of nitrogen dioxide, ozone, carbon monoxide, airborne dust particles, and total suspended particulate" (Whang, 1999).

As a whole, the community should work together to tackle this problem. Part of this project involved contacting members of both the high-risk and low-risk groups to see what types of information they want from the EPA.

2.3.3 Academic/Research Community

Another important target group in the community is the academic and research population. This portion of the community can inform us on what type of information

would be useful to those involved in environmental research. Samuel Ratick, Associate Professor of Geography and Environmental Science & Policy at Clark University in Worcester, MA, stated that the academic research community would be interested in knowing about any instrument change as well as instrument calibration. He also suggested that the EPA publish a long-term series of information. These last two suggestions combined make it possible to reproduce experiments and a larger amount of data provides more accurate results. Measuring a broader spectrum of pollutants as well as air toxins was another suggestion made by Ratick. The EPA is also interested in what the academic or research community in Australia sees as up and coming issues.

Although this group is important to consider in the dissemination of air quality information, the EPA felt they have adequate knowledge of this group's interests, so they were not a main focus in our project.

2.3.4 Industry

Industry uses air quality data to determine how it is complying with governmental laws and regulations regarding air quality issues. Although industry has a major effect on the pollution of the environment, the EPA felt that they have a good relationship with industry and know what types of information they want as well as how to present it. We did not focus on this group in our project.

2.4 Risk Assessment

Risk assessment is the estimation of the likelihood of adverse effects that may result from exposure to specified health hazards. This estimation can be either qualitative or quantitative. The EPA has the task of calculating air quality risk assessment and communicating it to the public.

2.4.1 Risk Assessment Information Related to Air Quality

The risk associated with air quality varies greatly with location and individual. It can also be measured using a variety of different scales. Certain groups are at higher risk due to factors such as age, health, and level of activity.

To provide risk assessment information for a given pollutant, the EPA determines the percentage of the relevant standard of the pollutant. The relative risk can then be calculated by taking the current concentration, divided by the pollutant standard and multiplying this by 100. These percentages are then classified into different levels, which can be seen in Table 2-1.

TABLE 2-1: AIR QUALITY INDEX

CATEGORY	INDEX RANGE
Very Good	0 – 33
Good	34 – 66
Fair	67 – 99
Poor	100 –149

Source: The EPA Air Quality Index
http://www.epa.vic.gov.au/aq/abindex.htm (March 2000)

The types of ratings vary slightly between different organizations, yet a common technique is to break up the pollutant levels into easy to understand categories. The Pollutant Standards Index (PSI) is used by the United States of America's Environmental Protection Agency (USA EPA). The PSI is calculated from the amount of different pollutants in the air. The scale ranges from 0 to 500. A level less than a 100 is considered good to moderate. This poses little to no threat to the above-mentioned affected people or the general public. The USA EPA reports on the several different types of pollutants including CO, lead and SO2. These reports can

help to define patterns and potential trouble spots. This information can be searched by zip code on the USA EPA's website.

Good and Moderate (0 – 100) levels are deemed healthy for all people. Unhealthy (100 – 200) levels can cause irritation for the extremely susceptible. People with heart and respiration conditions should reduce outdoor physical activity. Vigorous outdoor activity should be reduced by all. A very unhealthy (200-300) level will cause major problems with people suffering from health conditions related to the heart and lungs. General symptoms will also appear in the overall public. Elderly and people with medical conditions should stay indoors. Outdoor vigorous activity should be avoided. Hazardous (above 300) levels can cause death in elderly and unhealthy people. Everyone should stay indoors and avoid physical activity. At extreme levels in the hazardous zone (above 400), windows and doors should be kept shut and physical exertion kept to a minimum.

2.4.2 Communicating Risk Assessment Information to the Public

Communicating risk assessment information to the public can be a complex and sometimes unrewarding task. Information presented to the public can often be misleading or too complex. Percentages and numbers that are hard to understand are often interpreted incorrectly.

To help the public interpret information properly, levels must be presented in a clear and easy to understand format. Breaking things down into good and bad levels and the use of graphs prevent misinterpretation and make data easier to interpret than presenting raw data or charts. The goal is to correctly supply the public with information, but caution should be taken not to oversimplify the information or the public may discredit the source.

While the web offers an easy way to present this information, several problems arise. Many people within the public do not have access to the Internet. Many who have access may not access the EPA's website on a daily basis. Other mediums can be used to communicate this information, such as radio, television and newspapers.

2.5 Dissemination of Complex Information

The dissemination of technical information is an area that has been examined by a variety of people for many years. Compared to other forms of presentation, graphical representations (such as graphs and charts) are often more effective and appealing to the receiver. In addition to being easier to comprehend, representing data using graphs saves time and space. Facts and relationships that might be hidden by use of plain text or raw data can be highlighted and understood more clearly in a chart or graph. It is also easier for people to remember information if they view it in a graphical form (Schmid, 1979).

When the decision is made to disseminate information in a graphical form, there must be careful design and analysis performed to ensure that the resulting chart or graph is viable. The main goal in the design is that the data is fully and accurately represented. The information should also be easy to read and understandable to all readers. The design should be constructed to attract and hold the attention of the readers. In the design of a graphical representation, the preparation time and the audience must be carefully considered to avoid problems (Schmid, 1979).

Edward Tufte, a professor of political science, statistics and computer science, is well known for his graphical presentation research. In his book, *The Visual Display of Quantitative Information*, he explores the requirements of graphical displays. Tufte states, "excellence in statistical graphics consists of complex ideas communicated with clarity, precision, and efficiency" (Tufte, 1983). The viewer should be made to think about the data and should be unaware of the methodology, graphic design, or the technology of the graphic production. The data should be displayed in a coherent manner while still keeping the meaning intact (Tufte, 1983).

Several levels of detail should be represented in the displayed data to satisfy a large audience. The design of the graphical representation should encourage the eye to compare various pieces of data. The purpose or problem that the data is supposed to represent should be clearly defined. There should be a need for the data in the form that it is presented in. When dealing with the special interest groups, we assume that they will be interested in large sets of data. According to Tufte, all large data set should be displayed in a coherent manner. A large amount of numbers should be displayed in a small space (Tufte, 1983).

By generating a graphical representation of data, the goal is to reach 100% of the target audience. Realistically a good graphical representation can be accurately interpreted by 90% of the target population. This percentage should be increased with respect to the importance of the message being portrayed. For example, traffic signs must have a near 100% rate (Berryman, 1990).

Due to the fact that few people have 20/20 vision, information should be presented in an easy to read manner. In printed text, the font should never be smaller than 8 point. For a public display to be read from 100 feet, the font should be at least 3" and to be read from 400 feet, the font should be no less than 12" high. Messages should be simple and easy to read. Public displays that are designed with the intent of the viewer moving (ie. a billboard) should contain only 1 picture and at most 7 words (Berryman, 1990).

In most cultures, including that of Australia, reading flow is from left-to-right, top-to-bottom. This should be considered in the design of a graphical representation. Also, when scanning a document, the human eye has a tendency to focus on the lower left corner (Berryman, 1990).

In his paper entitled "Factors Influencing the Effectiveness of Warnings," Wogalter explains that warnings issued to the public must contain (at minimum) a signal word (such as "danger" or "caution"), a description of the hazard, a description of consequences as a result of the hazard, and directions or instructions on how to reduce the risk of the hazard. Warning messages must attract attention and be understood by everyone exposed to the hazard (Zwaga et al, 1999).

Due to the fact that nearly 6% of males have some form of colour-blindness and about .5% of the population can't detect any change in colour, the use of colours should be avoided or reduced. If colours are necessary, the number of different colours used should be small and the contrast between the colours should be high. By using a reverse contrast (ie. black on white rather than white on black), a design can appear 10% larger (Berryman, 1990).

Rectangular charts are more aesthetically pleasing than square. To determine an appropriate proportion for the rectangle, Breckon suggests making the long side equal to the diagonal of the square that is formed by the shorter side (see Figures 2-2 and 2-3). This aids in making it easier to view and helps keep the diagram visually pleasing if the overall size of the diagram is changed (Breckon, 1985).

FIGURE 2-2: CONSTRUCTING THE AREA FOR A GRAPH OR CHART

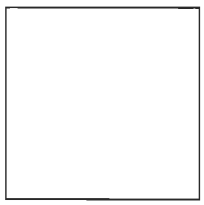
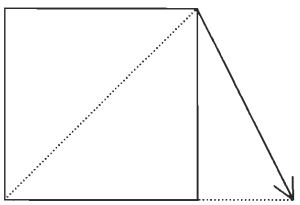
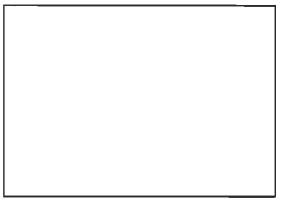
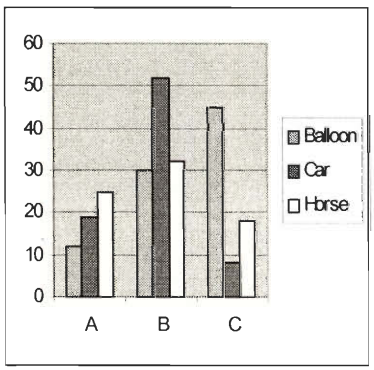
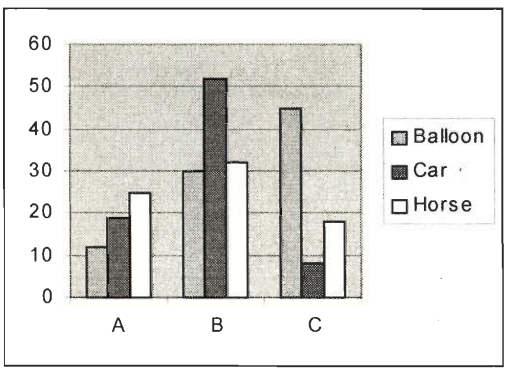
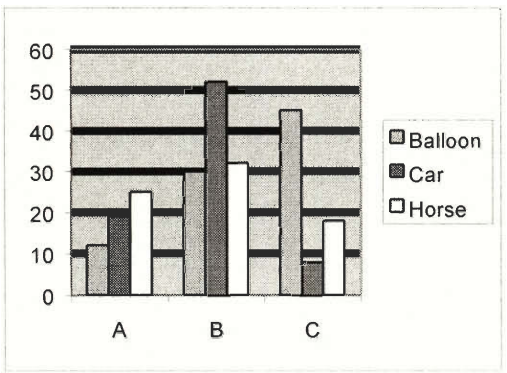
		
(1) Create a Square	(2) Take the length of the diagonal and make it the length of the longer side of the rectangle	(3) Use the original square and the new side to create a rectangle

FIGURE 2-3: SQUARE VERSUS RECTANGULAR AREA FOR CHARTS AND GRAPHS

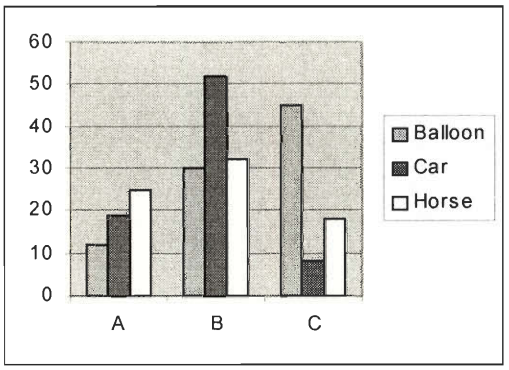
	
Square Area: Not pleasing to the eye	Rectangular Area: Aesthetically pleasing

The lines used in a graph or chart can vary in form and width to help with legibility and to distinguish them from each other. Gridlines are for reference only, so they should be light (see Figure 2-4). Curves used should be clear and easy to reproduce. There should be a title at the top of the diagram that is larger and bolder than other text in the diagram. Labels for horizontal and vertical axis should be the same font (Breckon, 1985).

FIGURE 2-4: GRIDLINES EXAMPLE



Dark Gridlines: Not pleasing to the eye



Light Gridlines: Pleasing to the eye

The size and position of a chart or graph should be such that the reader does not have to adjust when moving between graphic and text. If a full-paged chart is used, the title of the chart should be in the left margin so that the reader rotates the page in a clockwise direction to read the chart (Schmid, 1979).

When generating bar charts, the width of the bars should be uniform and the bars should be evenly spaced. A general rule of thumb is to have the space between the bars equal to half the width of a bar (although this can range from a fourth of the width to the entire width of a bar). It is highly recommended not to leave the bars as outlines, but to fill them in. The colour recommended is black. Stippling and Crosshatching can be used with care and other colours should only be used if necessary. It is also recommended that all bar charts include a scale (Schmid, 1979).

2.6 Case Studies

The following are case studies compiled on public perception of air quality. We used these case studies to help us conduct our project. By reading previous work done in the area of disseminating air quality information, we were able to avoid work that has already been done and analyzed. If a particular method was found effective, we included it as part of our methodology. If there were multiple failed attempts at a particular method, we avoided using it in our project unless we felt we could modify it to increase its effectiveness.

2.6.1 Society for Risk Analysis-Europe

At the 1997 annual meeting of the Society for Risk Analysis-Europe, a report entitled "Perceptions of Risks to Health from Industrial Air Pollution -- A High Priority?" explored how the general public perceives health risks caused by air pollution. The study was conducted in northeast England with an eye towards particular industrial sites (Bush and Moffatt, 1997). The main goal of this study was to gain a better understanding of how the public prioritizes various air quality issues and their relation to other societal issues. Researchers examined public awareness and access to air quality data.

The research included a postal survey of 5000 residents, individual interviews and focus groups. Analysis was performed on socioeconomic status, age, sex, distance from industrial sites, and diseases caused or exacerbated by poor air quality. In addition to this quantitative data, they also encouraged members of the public to express their concerns in an effort to obtain insight into the varying perceptions and their respective causes (Bush and Moffatt, 1997).

2.6.2 Franklin Pierce Law Center

In his paper, "Public Participation in Risk Regulation" Thomas McGarity discusses the issues involved in allowing the public to participate in governmental risk assessment and regulation. Environmental protection has been emerging as one of the greatest issues in our society since the late 1960's. The US government has encouraged the public to play a role (McGarity 1990).

McGarity explains that there are several interpretations of the term "public", including interested individuals, local and national public interest groups, regulated industry and trade associations, and affected labor groups. An interesting representative group of the public is competitors: if an industry has to comply with regulations, they have a vested interest in seeing that their competition is forced to comply (McGarity 1990).

There are several ways to view public participation in risk assessment. On one side, it is necessary to get feedback from the public in order to run a good government. On the other side, resources have to be spent that might be better used

towards a solution. Often a clash of interests can arise in what information should be made public. For example, if a company uses a particular chemical they should inform their consumers, but at the same time they want to hide this information from competitors (McGarity 1990).

The key to successful public interaction is in the communication of information. The government must educate the public in the area of environmental protection. Explanations should be clear and accessible to all members of the community. It is then the responsibility of the public to process this information and provide feedback on the precedence of the various issues. With the knowledge of what areas are most important to the public, the government has to work with industries to provide adequate environmental protection efforts. The industries should work with the government to provide information to the public as to the progress of the protection efforts (McGarity 1990).

2.6.3 Survey of Air Pollution Perceptions

In a telephone survey conducted in September 1999 current public perceptions of air pollution were gathered and analyzed. The survey was conducted on a random sample of 1012 US residents. Factors such as age, race, sex, education level and location were obtained to analyze any differences among various groups (ICR, 1999).

The majority (61%) of those polled believed that the nation's air quality had declined in the past 10 years. 50% of the respondents based their opinion on personal experience, while 25% cited the media as the source. 64% named cars and 36% as industry as the greatest air pollution source. When asked to state the most improved source of pollution, 34% named cars, 20% industry and 24% couldn't name one (ICR, 1999).

2.6.4 Comparative Assessment of Environmental Problems

In 1987, the USA EPA conducted a study to evaluate resources allocated to various environmental issues and determine if the current course of action accurately reflected public opinions. The study encompassed a wide range of environmental issues that were broken down into 31 categories (i.e. air pollutants, toxic waste, pesticides, and greenhouse effect). They also split the risk analysis into four groups: ecological effects, cancer risks, non-cancer health risks, and welfare effects (i.e. property damage, visibility). By analysing each risk independently, equal weight was given to all four risk types (Lee, 1987).

The data was gathered by surveys conducted by the Roper Centre for Public Opinion Research (affiliated with the University of Connecticut) over a two-year period. The questions did not cover all 31 topics and some questions covered several topics. The main method used in writing the questions was to have respondents rank the environmental issues in various contexts (Lee, 1987). The results of this study can be seen in Table 2-2.

One of the main findings of this study was that no issue ranked consistently "high" or "low" for all four-risk types. They found that issues ranked high in one or both of the health risk categories ranked low in ecological and welfare risks and vice versa. Consequently, determining overall priorities was difficult.

In the interest of time and resources, the study did not take into account laws, technologies and costs when ranking the environmental issues. To accurately rank the various issues that face the USA EPA, these factors would have to be included in the analysis.

TABLE 2-2: SUMMARY OF RESULTS

Public Perception of Risk and Ranking	Roper Area	Corresponding USA EPA Environmental Problem Area
High	1. Chemical waste disposal	Haz. waste sites - active (#16)
		Haz. waste sites - inactive (#17)
	2. Water pollution	Direct point source discharged (#9)
		Indirect point source discharges (#10)
		Nonpoint source discharges (#11)
	3. Chemical plant accidents	Accidental releases - toxics (#21)
	4. Air pollution	Criteria air pollutants (#1)
		Hazardous air pollutants (#2)
Moderate	5. Oil tanker spillage	Accidental releases - oil spills (#22)
	6. Exposure on the job	Worker exposure (#31)
	7. Eating pesticide-spread. Food	Pesticide residues on foods (#25)
	8. Pesticides in farming	Application of pesticides (#26)
		Other pesticide risks (#27)
	9. Drinking water	Drinking water (#15)
Lower	10. Indoor air pollution	Indoor air pollution (#5)
	11. Indoor air pollution	Consumer product exposure (#30)
	12. Genetic engineering	Biotechnology (#29)
	13. Strip mining	Mining waste (#20)
	14. Non-nuclear radiation	Radiation - other than radon (#6)
	15. The "greenhouse" effect	CO2 and global warming (#8)

Source: Lee, 1987

This study also concluded that the current programs supported by the USA EPA do not accurately reflect the importance of various risks. Areas found to be of high risk and low USA EPA priority include indoor air pollution, stratospheric ozone depletion, accidental release of toxins, and worker exposures to chemicals. Issues determined to be of medium to low-risk and have high USA EPA effort include hazardous waste sites and releases from storage tanks. It is possible that a particular

issue is considered low risk due to the fact that it has high priority and efforts are made to control it.

It was concluded that, with the exception of water protection, the USA EPA has been more concerned with pollution that affects public health rather than protection of natural habitats and ecosystems.

2.6.5 United Kingdom Case Study

Air quality information in the United Kingdom is disseminated by numerous methods including television, the Internet, telephone help lines, electronic notice boards, statistical digests and media bulletins and forecasts. The environmental protection agency in the UK (UK EPA) was criticized because it didn't explore the needs of the general public.

The purpose of this study was to determine the nature and extent of public air quality requirements. They conducted a pilot social survey of the members of the Middlesex University Alumni. The survey had three main goals: a) to get a basic grasp of the extent of air quality information the public wants; b) to determine what information the public wants and why they want it; and c) to determine what method for receiving the air quality information the public preferred. They were aware of the limitations of the survey but it was only intended to obtain a "snapshot" of public opinion. Those running this study also set up a workshop at Middlesex University to "share experience and practice amongst information providers and interested professionals" (Williams, 1994). The results of this survey can be seen in Table 2-3.

Those who wanted regular access to information were given follow-up questions. They were asked to rank on a 0 to 4 scale, 4 meaning most interested their degree of interest in different types of information. 88% of those asked were interested in the health effects of air pollution. 83% wanted to know how to avoid air pollution. 80% wanted to know how to reduce air pollution. 78% wanted a forecast of tomorrow's air quality. 77% requested to be given the current air quality and the sources of pollution. 73% wanted to know the different types of air pollution and finally 57% wanted to know air quality in previous days, weeks or years.

TABLE 2-3 - RESULTS OF SURVEY

Wanted Air Quality Information	Didn't want Air Quality Information
80 % wanted regular access to air quality information	20% Did not want access to air quality information
Reasons they wanted the information:	**Reasons they didn't want the information**:
56% concerned about families and their own health	Most Stated: They were not effected by air pollution
33% gave no reason	3% not interested or didn't care
15% plan their activities to avoid pollution.	
3% reduce their own contribution to air pollution	

Respondents were also asked by what means they would like to receive air quality information and where they have received it in the past. The results of this question are reproduced in Table 2-4.

The workshop suggested that the information should be 'receiver-friendly' and "should cater for 'interest groups' amongst the public as well as providing broad, general data" (Williams, 1994). Other ideas included a warning system related to the threshold concentrations of pollutants and a place to access detailed information for those who want a greater understanding of air quality over and above local information.

TABLE 2-4 –BY WHAT MEANS RESPONDENTS WOULD LIKE AIR QUALITY INFORMATION

Source	Percentage of respondents who have received air quality information from which source	Percentage of preference for respondents who state source (up to three choices per respondent)
TV	78.3	70.0
Radio	57.3	57.1
Newspapers	50.2	46.2
Environmental pressure groups	16.3	13.8
Teletext	13.8	13.3
Magazine	11.7	1.3
Public information display	10.8	12.7
Local authority	5.6	10.0
Health professional	4.6	3.5
Department of the Environment	4.4	18.7
Local school/ college/ university	4.2	1.3
Internet	2.7	5.4
Exhibition	2.7	1.0
Public information posters	2.3	5.2
Local library	1.5	2.1

Source: Williams, 1994

In conclusion, this study showed that in addition to giving the public the information they wanted, the UK EPA should inform the public of the health effects of air pollution and what they can do about those effects. In addition, an effort should be made to reduce technical jargon while remaining scientifically accurate.

2.6.6 The role that the EPA can play in extending the community's awareness about the environment

Natalie Bishops, a student at Phillips Institute of Technology (PIT), conducted a study in 1989 in association with the EPA to "determine the community's level of awareness of environmental issues and their level of commitment to the environment, as well as their knowledge of EPA's role." The intent of this study was to aggrandise the EPA's role in the community, to identify the information the community wants, and to determine what aspects of the environment interests the community. Also, the study aimed to ascertain what the community understands about the EPA's role and functions. Surveys were used that asked the community about their environmental concerns, actions they have taken to improve the environment, why they refused to change their behaviour, their environmental commitment, and what their motivation to change was. Questions also focused on what the community's information needs are, their knowledge of the EPA and the EPA's role, their opinions of the EPA's effectiveness, and the role of the government in environmental issues.

Focusing on the findings of this study that pertain to our project provided interesting results. The interviewer divided the information the community needs into two separate categories, practical information and factual information. Practical information included the environmental safety of products and what shops sold such products. Information on what to do when there is a smog alert, what is excessive use of energy, and information on burning off rubbish was also desired. Effects of pollutants on our environment, reports on pollution created and discharged alongside the allowable limit, and air quality after an incident are all examples of factual information the community wants.

2.7 Conclusion

We have identified the types of air pollutants monitored by the EPA and how these are reported. Typically an air quality index is calculated and used for reporting the overall quality for a particular time frame. Many sources of air pollution exist, with major contributors from wood stoves, automobiles, and factories. Air pollution

has caused severe effects on human health. The effects on elderly and people with health problems can be more immediate and visible then those without.

Currently a lot of work is being done to improve the quality of Victoria's air. Increased laws on emissions, and public awareness, is a step in the right direction. Several studies have been done within this field and using ideas and findings from these studies we can improve our results.

In this literature review we have laid out where air pollution comes from, who is affected by it, what is currently being done, and studies that have been conducted in the past. From this information we have developed our methodology, which is presented in the next chapter.

CHAPTER 3: METHODOLOGY

This chapter provides the reader with information on the methods and procedures used to conduct our project. The goal of this project was to provide the EPA with a list of ideas on how to better present the community with air quality information. The two target groups of this project were the special interest community and the general public. The general public was subsequently divided into high-risk and low-risk.

This project aimed to determine what air quality data each of the target groups found valuable. In addition, we researched presentation of complex information and asked members of each target group for feedback on various presentation styles.

The results of this study will allow the EPA to better disseminate relevant information to their target groups. The suggestions made will allow messages regarding air quality to reach more people. By creating more awareness among Victorians, the EPA feels more action will take place to help protect and restore air quality.

3.1 Background Research

We performed research to gather background information for our project. We began this work during our Preliminary Qualifying Project (PQP) seven weeks prior to arriving on-site. This background research included gaining a better understanding of the EPA, their overall mission and their expectations of our project. We reviewed various air quality topics to provide us with adequate knowledge of the issues facing the EPA. We examined air pollutants, including sources and health risks. We also read about current regulation and control. We defined and explored the various target groups of the EPA. Risk assessment was examined in both a general sense and as it relates to air quality issues. We also utilised previous work done in graphical representations of complex data and other studies similar to ours. We also examined issues that are unique to residents of the Melbourne area such as the Melbourne Eddy. The background research that we performed for this project is summarised and presented in Chapter 2 of this document.

3.2 On-Site Research

Once in Australia, we spoke with members of the EPA to determine if the background research and initial methodology we produced during our PQP was on target with their vision of the project. After slight modifications, we began contacting members of each of the target groups.

To generate a list of special interest groups, we first spoke with members of the EPA. We then searched on our own to ensure that our list was reasonably complete. We contacted the special interest groups via e-mail and telephone to ask for their help with our project.

The high-risk population was reached via doctors' offices, retirement communities and other organisations. By targeting these locations, we were able to find high-risk individuals in the most time efficient manner. Since there are a wide range issues that classify a person as high-risk, we made sure that we contacted an adequate number of people from each category (e.g., elderly and asthmatics).

The low-risk population members we reached via on-the-street surveying. We travelled to various locations and approached a wide variety of people to ensure that our sample population could be used to represent the target population. We travelled to locations such as Footscray and Richmond because our sponsors had interest in hearing from the residents of areas known to suffer from poor air quality. The other locations were places that gave us wide variety of economic classes, age ranges, and cultures.

3.3 Surveys

An effective method to gather information regarding the use of the EPA as a source of air quality information is through surveying. The population that we were interested in obtaining information from was the entire pool of people that use (or could potentially use) air quality information from the EPA.

3.3.1 Sample Population

If the entire group of people were known and accessible to us, we could have talked to each user and determined their individual needs. Since the pool of users is so large, diverse and constantly changing, we needed to take a sample of users to determine their views and extrapolate this knowledge to the entire population.

The users of EPA information can be broken down into four categories, consisting of special interest groups, industry, the academic and research community, and the general public. Presently the EPA has strong relationships with the academic and research community and industry. The needs of the special interest groups are more involved than those of the general public. More information is needed from the special interest groups than could be obtained through the use of surveying, so interviews were used. For those reasons our surveys focused on the high-risk and low-risk general public groups.

3.3.2 Survey Design

We wanted our survey to be accurate and useful, so we had our advisor and liaison review our survey. We conducted a small pre-survey to iron out any kinks in the original survey. We ensured that our survey did not touch on any areas that were sensitive issues to the EPA. Our pre-survey was conducted at the Southgate Mall. After the subjects had completed the survey, we asked them for comments and suggestions about the survey itself.

Through observation and reviewing the results of the pre-survey, we came across some general conclusions. The main complaint was that the survey was far too long. We had both daily and weekly prototypes in the survey to determine how people prefer to have information presented. To shorten the survey, we eliminated the weekly prototype question. To compensate for this loss, we modified the daily prototype question to allow us to use the results from the daily question to project results for a weekly design layout.

Another issue that arose during our pre-survey involved the ranking questions. We found that approximately half of the people surveyed did not read the directions correctly and completed questions with a tick rather than ranking. In addition,

ranking questions consumed more time than ticking questions, so we changed all of the ranking questions to ask the participant to tick the desired answer.

The original survey asked for people to add comments about the various prototypes. Many respondents left these blank or filled them in with information that was not very useful. To alleviate this problem, we changed the layout of the prototype questions (See Figures 3-1 and 3-2). In the new survey the prototypes are located at the top of the page going across in a row, labelled A, B, and C. Specific questions were asked regarding the prototypes, and tick boxes were provided for A, B and C.

FIGURE 3-1: ORIGINAL SURVEY PROTOTYPE LAYOUT

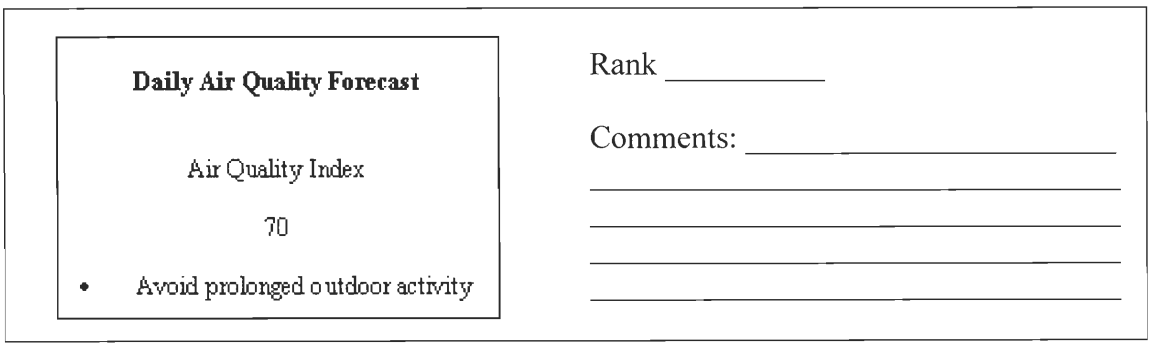
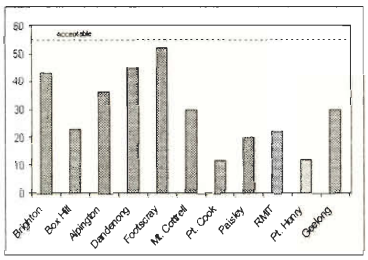


FIGURE 3-2: FINAL SURVEY PROTOTYPE LAYOUT



REGION	STATION	Carbon Monoxide	Ozone	STN. AQI	STN. SUMMARY
EAST	Brighton	26	35	52	GOOD
	Box Hill	5	26	27	VERY GOOD
	Alphington	5	24	46	GOOD
	Dandenong		37	63	GOOD
CITY	RMIT	26	22	22	VERY GOOD
GEELONG	Pt. Henry	26			offline
	Geelong Sth.	6	23	23	VERY GOOD

Daily Air Quality Forecast

Air Quality Index

70

- Avoid prolonged outdoor activity

7. Which figure(s) appeals to you the most for displaying air quality information?

☐ A ☐ B ☐ C

In designing the original survey, we left out several questions that we wanted to ask the general public. Once we found that our survey was too long and we cut more out of the survey, we wanted to compensate for this loss. We added an optional section at the end of the survey that asked people to provide their name and contact information if they were willing to participate in a follow up interview. Time did not allow us to conduct these interviews, but we provided the EPA with a list of those interested and their responses to the survey (not included in this report for privacy). These people are willing to give the EPA time to discuss air quality dissemination issues further. EPA employees or a subsequent IQP group could contact these people to ask questions about their responses and ask other questions that we could not include on our survey.

3.3.3 Conducting Surveys

During the first week of data collection, we did not gather a sufficient number of responses to our survey. Many doctors' offices that we contacted did not want us to leave surveys in their waiting rooms. We located a few places and we dropped off

a box, clipboard, pen and a number of surveys. This method was not as successful as we had hoped. This was most likely due to the fact that the people in the office (i.e. the doctors, nurses or secretaries) had no particular interest in our project and did not encourage patients to fill out the surveys. If surveys were left in the offices of medical facilities that had relationships with the EPA, the number of responses would likely have been higher.

The on-the-street interviews started off with a low yield. We asked people that were either sitting on benches, standing, or walking. We found that many people were not willing to fill out the survey. People were not interested because they didn't have time, did not like surveys, or were not interested in air quality issues. Overall, about 10% of those asked on the street to fill out a survey said yes.

To gain more results, we decided to change our surveying tactics. We began conducting surveys in malls, parks and on public transportation. The malls had roughly the same rate of responses as the streets. The parks had a very high rate (near 100%), but failed to produce a broad age range. The location that worked the best for us was the train system. The rate of success on the trains was about 60%. Many factors influenced how many people would fill out the survey. If the train was too crowded, people did not want to bother with the survey. Since people travelling on the train are committed to staying on the train from point A to point B, they did not seem to mind taking the time to fill out a survey. Another key to getting good results from our surveying time was to bring several clipboards with us. We noticed that in a section of the train, if the first person said no, the rest of the section would more likely say no. Similarly, if the first person asked said yes, the others were more willing to do the same. To use this to our advantage, if a person on the train made eye contact with us, we would ask them first.

3.4 Interviews

For the special interest groups, we wanted more detail than a survey could provide, so we gathered our information through interviews. The interviews allowed us to gain a deeper understanding of the needs of the users. Based on the response to a particular question, subsequent questions were altered to gather information more effectively.

In comparing surveys and interviews, there is also the issue of keeping the subject's interest. With so many surveys in our society today, people sometimes do not give their full attention to their responses. In an interview situation, gathering the data takes longer, but the subject is more likely to be interested in providing useful feedback.

3.5 Target Groups for the EPA in the General Population

The special interest groups, the high-risk public, and the low-risk public were targeted by our project. Through the use of surveys and interviews, we were able to gather feedback on how the EPA currently presents air quality information and obtain suggestions for improvements.

3.5.1 Special Interest Groups

Special interest groups are considered to be any official non-profit, non-governmental organisation that is interested in and active with concerns about a topic, such as the environment. In order to gather their opinions we conducted interviews with representatives of special interest environmental groups located in Victoria. Some examples of these groups are Environment Victoria, the Altona Community Group and AirWatch. We used an interview script to guide the interview, although most of the time the conversation flow would be altered depending on responses. The script can be found in Appendix B.

The special interest groups were located through references made by our sponsors as well as publicly listed sources (i.e. web pages and the Melbourne yellow pages). During the interviews, one person acted as speaker while another acted as scribe. Minutes of each meeting were typed up and can be seen in Appendix E. Analysis of interviews was performed done and the results presented in chapter 4.

3.5.2 Low-Risk Group

The members of the low-risk group are those without health issues complicated by poor air quality and not involved in an environmental group. We gathered the opinions from a wide variety of people. We attempted to gather opinions from a wide variety of post codes and age groups. The low-risk representatives were found at shopping places, plazas, busses, trams, and trains around the city.

3.5.3 High-risk Group

Members of the general public categorised as high-risk (as defined in Section 2.3.2) provide the threshold for government air quality standards. Their needs were used to represent the needs and wants of the general public. The members of the high-risk population were located through doctors' offices and other organisations. Allergy sufferers and those with heart conditions were reached by leaving surveys at allergy and heart specialists' offices.

Our original plan was to reach the elderly through nursing homes and retirement communities. After visiting a nursing home, it was found that the interviewees at nursing homes seemed to have a hard time following the survey and changed topics of conversation frequently. The results obtained from the visit to the nursing home were not adequate to include in our report. We decided that retirement homes would be a better place to survey and interview the elderly population.

At first we planned on surveying parents to reach high-risk children. It was felt that surveying parents might cause unnecessary worry about air quality. After weighing the risks and benefits of surveying parents, it was decided the results would not outweigh the harm.

3.6 Data Storage

We stored the results of the surveys in a Microsoft Access database. A form was created to allow for faster data entry. The use of the database allowed us to easily find relationships between the data through the use of queries. We had some

hypotheses about the results of the surveys and we were able to easily test them against the data in the database. Another advantage to using the database was that we were able to give the EPA all of our raw data in electronic format. If they decide to do further analysis or studies in this area, they will have our data to utilise.

The results obtained from the interviews were summarised in a one to two page write-up. Immediately following an interview, the scribe typed up a list of main ideas from the meeting. All comments and suggestions about how the EPA can better disseminate air quality information were summarised. A list of interview summaries can be found in Appendix E.

3.7 Analysis

After gathering and storing the information from the surveys and interviews, we analysed the results. Because the survey and interviews were different and the needs of the general public varied significantly from those of the special interest groups, no analysis was performed across the two target groups. All analysis was done within the target group.

We discussed the information gathered with employees at the EPA. We shared our hypotheses and experimental design with our sponsor to gain approval and allowed them to add items to be tested.

For the general public surveys, we used Microsoft Access and Excel to generate charts and graphs to reflect our findings. Analysis was performed on the group as a whole. We also analysed the data with respect to age, gender and medical condition. All of this information is included in Appendix D and highlights are presented in Chapter 4.

Unlike the quantitative results obtained from the general public surveys, the special interest group interview results had to be carefully examined. The notes and summaries were read several times and similarities were extracted. The complete summaries are included in Appendix E and highlights provided in Chapter 4.

3.8 Conclusions

From our analysis, we were able to come to conclusions about what the general public and special interest groups want from the EPA regarding air quality data. We were able provide the EPA with a list (see Chapter 5) of suggestions for improvement in their dissemination of air quality information.

We also provided the EPA with the Microsoft Access database for future analysis. The survey (found in Appendix B) was also given to the EPA so that additional data can be entered into the database. The form in the database allows for easy data entry. The queries we used to conduct our analysis are in the database for future use if more data is added.

With the information gathered through our surveys and interviews we were able to draw relevant conclusions that present a clear picture to the EPA as to their users' needs. In addition to providing suggestions, our entire process has been documented in the hope that our methods can be used by other departments within the EPA to help them reach their users more effectively. This chapter has outlined the process we used to obtain the results presented in the next chapter.

CHAPTER 4: DATA ANALYSIS

This chapter provides the reader with the data that we obtained during our project as well as analysis of this data. To help the EPA determine how to better present the community with air quality information, we performed surveys and interviews.

4.1 General Survey Questions

We performed a survey (see Appendix B) of the general public to determine how they prefer to obtain information from the EPA. Our survey asked several questions to conclude what content and presentation styles are preferred by the general public. We also asked demographic information to try to correlate responses with medical condition, gender and age.

4.1.1 Question 1

The goal of Question 1 (Figure 4-1) was to determine the percentage of people interested in air quality. If people are interested in air quality, it is easier to determine what information they want due to the fact that they already have curiosity or interest in the subject.

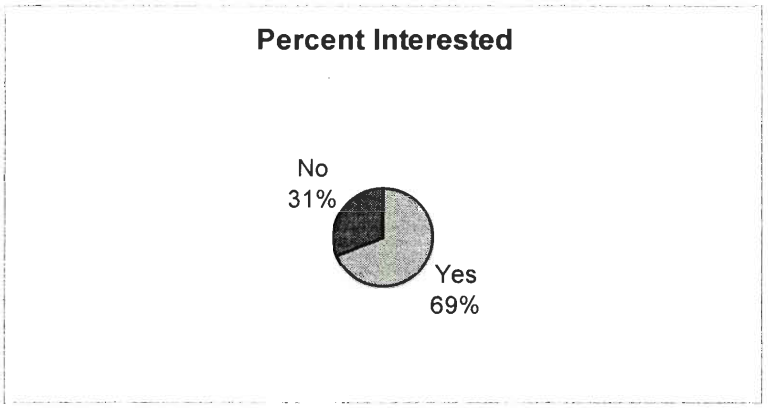
FIGURE 4-1: QUESTION 1

1. Are you interested in obtaining information about air quality?

☐ Yes ☐ No

As seen in Figure 4-2, of the 189 people surveyed, 69% were interesting in obtaining information about air quality.

FIGURE 4-2: QUESTION 1 – OVERALL RESPONSES



The second part of Question 1 (Figures 4-3 and 4-5) gathered information on why or why not people are interested in obtaining information about air quality.

FIGURE 4-3: QUESTION 1A

If no, why would you not want access to information about air quality? Please tick all that apply.

- ☐ I am not overly concerned about the health effects of air quality.
- ☐ I am not very interested in environmental issues.
- ☐ I don't have time.
- ☐ I don't understand what air quality information means.
- ☐ Other: _____

Figure 4-4 describes why participants do not desire access to air quality information. This bar graph proves that most people who do not want air quality information felt that they do not have time to access the information (38%). The second

largest response, 28%, chose other. Some of the reasons listed are just to have knowledge or to compare Melbourne's air quality to other cities. Surprisingly, 25% were not concerned with the health effects of air quality.

FIGURE 4-4: QUESTION 1A – OVERALL RESPONSES

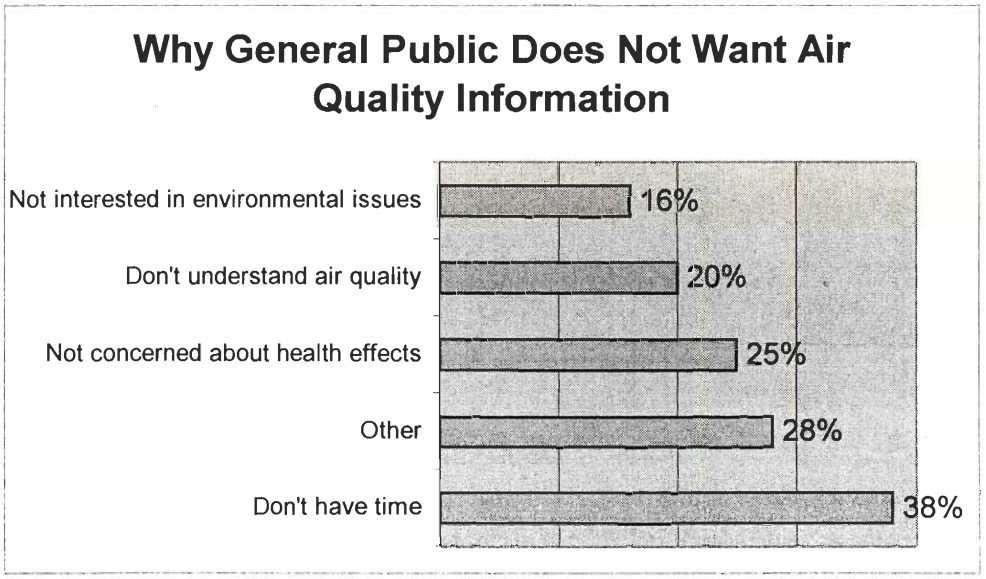


FIGURE 4-5: QUESTION 1B

If yes, why are you interested? Please tick all that apply.

☐ I am concerned about air quality's effect on my health.

☐ I am concerned about air quality's effects on others' health.

☐ I require information to avoid pollution.

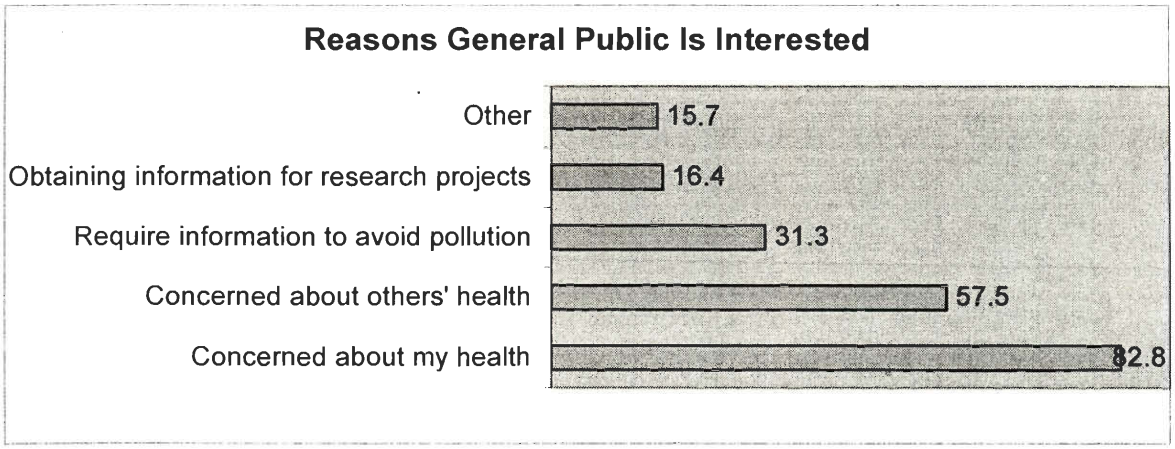
☐ I am interested in obtaining more information for studies and research projects.

☐ Other: _____

The main reason people gave for wanting access to air quality information, as

shown in Figure 4.6, is the fact that they are concerned with air quality's effect on their health. Being concerned about others' health was the second largest reason being selected by 57.5%.

FIGURE 4-6: QUESTION 1B – OVERALL RESPONSES



4.1.2 Question 2

Question 2 (Figure 4-7) asked those being surveyed where they had obtained information on air quality in the past. This question was useful to inform the EPA what methods have previously been effective.

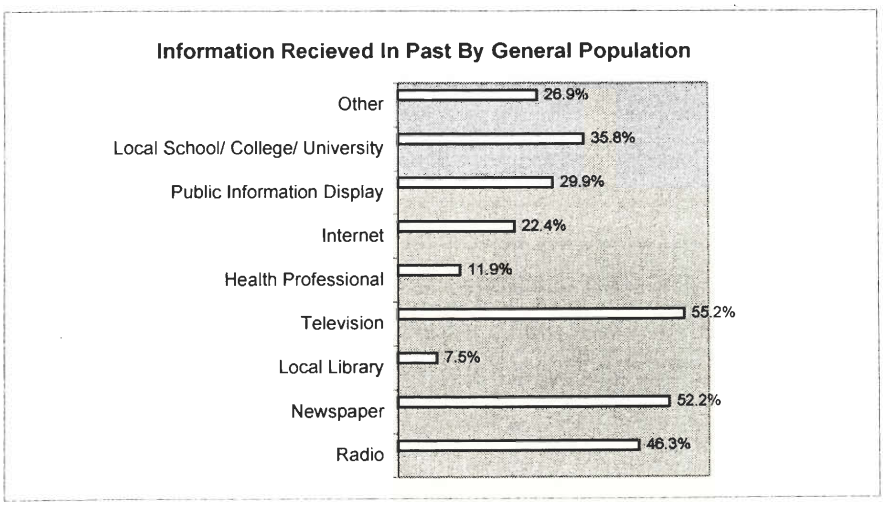
FIGURE 4-7: QUESTION 2

2. Where have you obtained air quality information in the past? Please tick all that apply.

- ☐ Radio
- ☐ Newspaper
- ☐ Local library
- ☐ Television
- ☐ Health professional
- ☐ Internet
- ☐ Public information display
- ☐ Local school/ college/ university
- ☐ Other: _____

The results of Question 2 can be seen in Figure 4-8. The responses show that television, newspaper, and radio were the top three methods used to obtain air quality information in the past. Television was the top choice with 55% of the total population surveyed choosing it. Newspaper was the second highest choice, at 52%. Third highest way that the general public received information in the past was via radio. This was chosen by 46% of those surveyed.

FIGURE 4-8: QUESTION 2 - OVERALL RESPONSES



4.1.3 Question 3

The goal of Question 3 (Figure 4-9) was to determine where people would like to receive information in the future. Different media dictates different layout design and also requires a different amount of time to view the information. A newspaper allows little space but as much as time as needed to read the information. Web pages allow as much time and space as the designer wants. Television, on the other hand, needs to display the message in a fast, clear manner, due to the fact that there are only a few seconds given to the viewer to absorb the information.

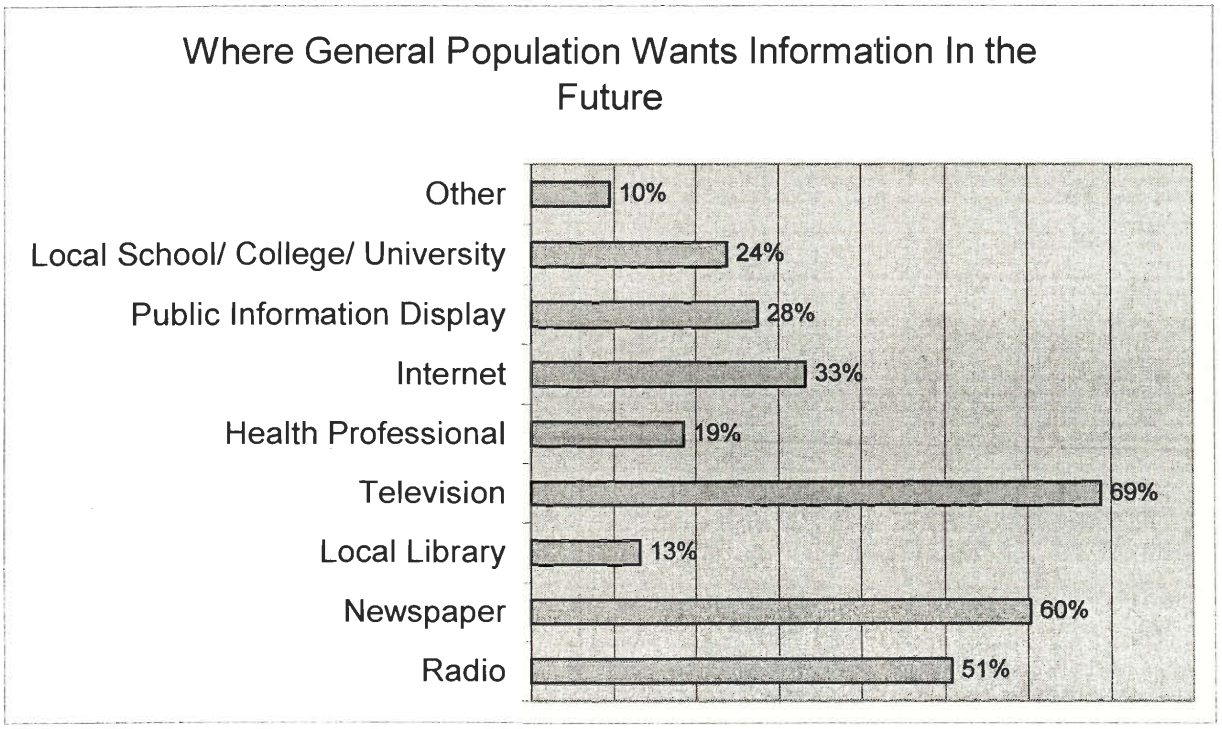
FIGURE 4-9: QUESTION 3

3. Where would you prefer to obtain air quality information in the future? Please tick all that apply.

- ☐ Radio
- ☐ Newspaper
- ☐ Local library
- ☐ Television
- ☐ Health professional
- ☐ Internet
- ☐ Public information display
- ☐ Local school/ college/ university
- ☐ Other:

Figure 4-10 shows the responses for Question 3. 69% of those surveyed chose television as their preferred method to gather air quality information. 60% chose newspaper as their preferred method and 51% chose radio. A distant forth was the 33% that preferred to receive their information in the future via the Internet.

FIGURE 4-10: QUESTION 3 – OVERALL RESPONSES



4.1.4 Question 4

Question 4 (Figure 4-11) aimed to ascertain what general types of information the public would like to access from the EPA. Depending on the interests of the community, the EPA can alter the types of information they provide to the public.

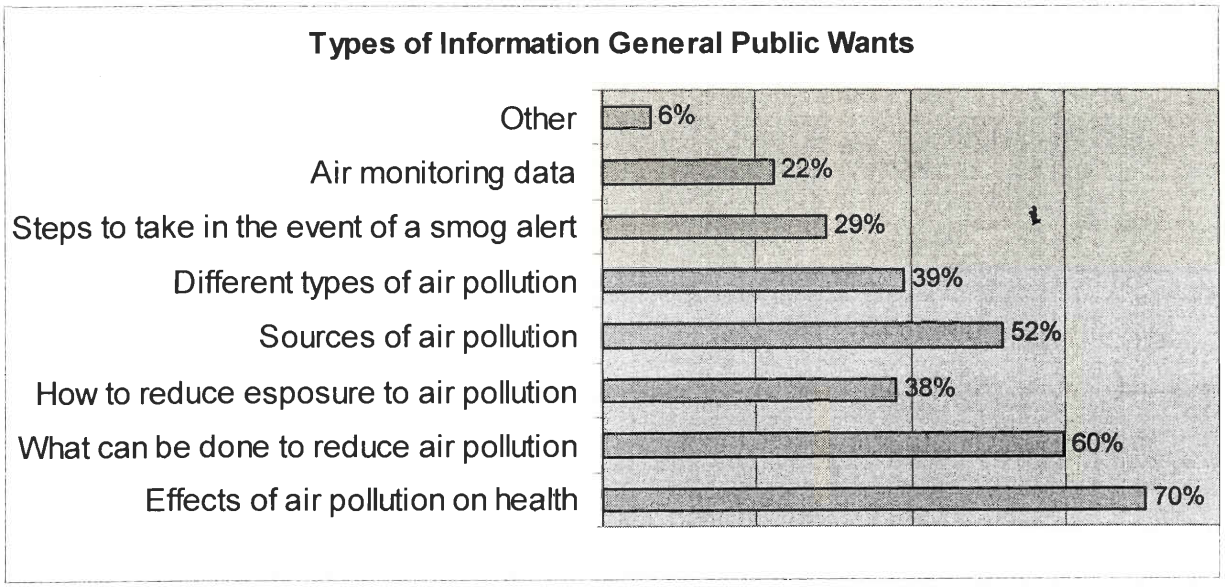
FIGURE 4-11: QUESTION 4

4. What types of general air pollution information would you want to access? Please tick all that apply.

- ☐ Effects of air pollution on health
- ☐ What can be done to reduce air pollution
- ☐ How to reduce exposure to air pollution
- ☐ Sources of air pollution
- ☐ Different types of air pollution
- ☐ Steps to take in the event of a smog alert
- ☐ Air monitoring data
- ☐ Other: _____

Figure 4-12 shows that highest concern was in regards to the effects air pollution has on health, with 70% of those surveyed choosing it. 60% would like to know what could be done to reduce air pollution. 52% would like to know the sources of air pollution.

FIGURE 4-12: QUESTION 4 OVERALL RESPONSES



4.1.5 Question 5

To determine how detailed the respondents would like the air quality information to be, Question 5 was asked (Figure 4-13). The EPA needs to know what time period they should use when presenting air quality information.

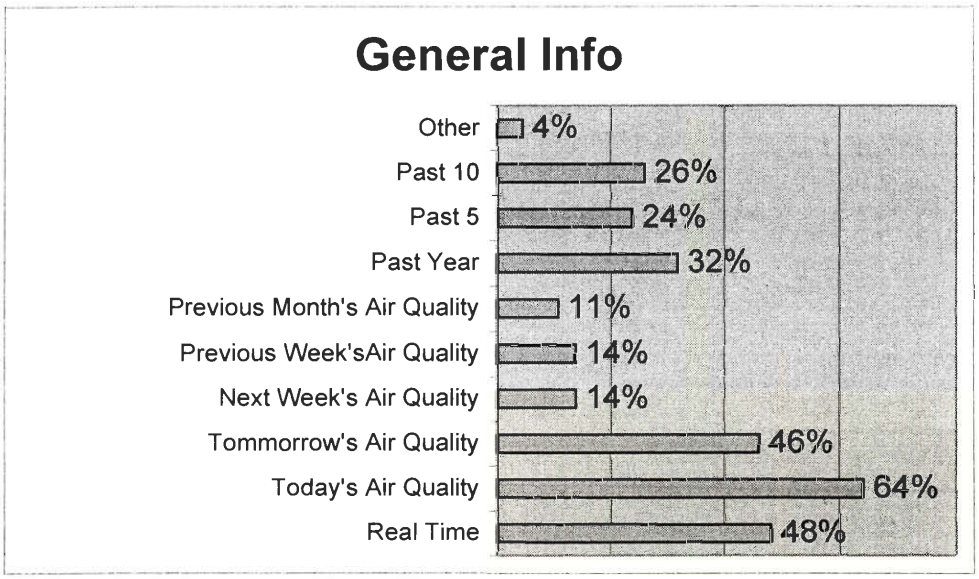
Figure 4-13: Question 5

5. How detailed would you like the air quality information to be? Please tick all that apply.

- ☐ Real time air quality (as it is happening)
- ☐ Today's air quality
- ☐ Tomorrow's air quality prediction
- ☐ Next week's air quality
- ☐ Previous week's air quality
- ☐ Previous Month's air quality
- ☐ Air quality trends over the past year
- ☐ Air quality trends over the past 5 years
- ☐ Air quality trends over the last 10 years.
- ☐ Other: _____

The results of Question 5 are presented in Figure 4-14. The responses show that 64% of those surveyed want access to today's air quality. 48% would like to receive real time (as it is happening) air quality reports. Tomorrow's air quality forecast was desired by 64% of the participants.

FIGURE 4-14: QUESTION 5: OVERALL RESPONSES



4.1.6 Question 6

The goal of Question 6 (Figure 4-15) was to determine the geographic region size at which people want air quality information. The EPA wanted to know at what spatial resolution they should deliver the information they gather.

FIGURE 4-15: QUESTION 6

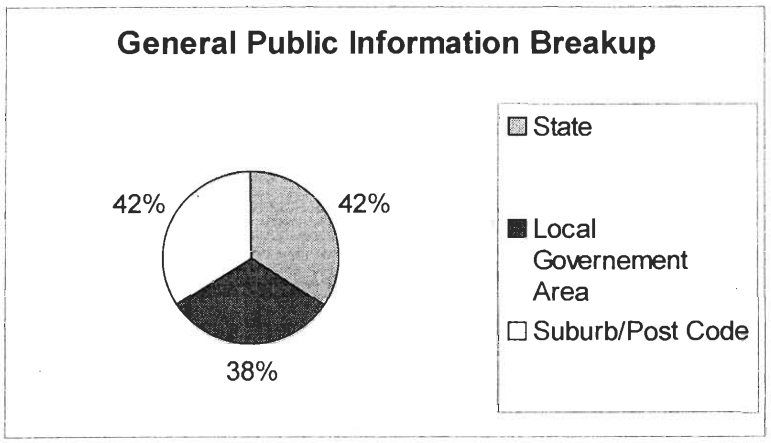
6. How would you like the information broken down?

☐ State
☐ Local Government Area
☐ Suburb/Post code

As shown in Figure 4-16, 42% of those surveyed would like to receive air quality information broken down by post code. State was given the second highest rating

with 42%. Local Government Area was chosen by 38% of those surveyed. The data gathered is inconclusive due to the fact that the results are almost evenly split.

FIGURE 4-16: QUESTION 6 – OVERALL RESPONSES



4.1.7 Question 12

Question 12 (Figure 4-17) asked the survey participants to indicate the pollutants that interest them. The EPA monitors a wide range of pollutants. By determining what pollutants cause the greatest concern among the community, the EPA can increase efforts to report about the pollutants the general public is interested in.

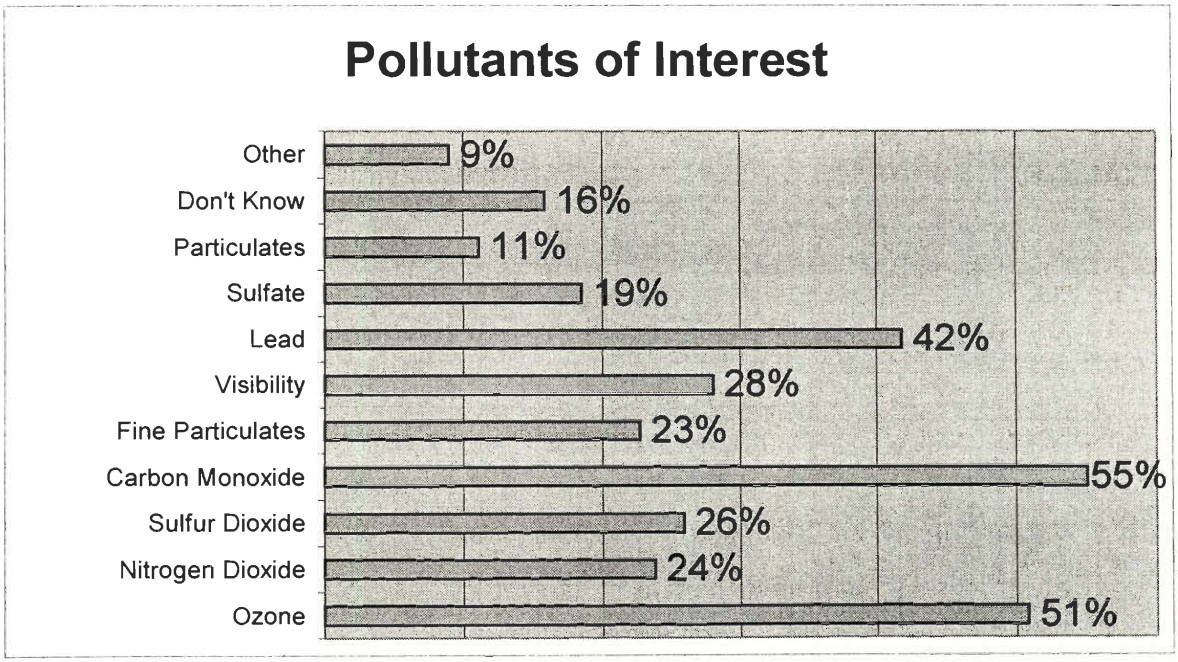
FIGURE 4-17: QUESTION 12

12. What pollutants are you interested in obtaining information about? Please tick all that apply.

- ☐ Ozone (O3)
- ☐ Nitrogen Dioxide (NO2)
- ☐ Sulfur Dioxide (SO2)
- ☐ Carbon Monoxide (CO)
- ☐ Fine Particulates (PM10)
- ☐ Visibility (Airborne particle index)
- ☐ Lead (Pb)
- ☐ Sulfate (SO4)
- ☐ Particulates (TSP)
- ☐ Don't Know
- ☐ Other: _____

As portrayed in Figure 4-18, 55% are interested in obtaining information about carbon monoxide, 51% about ozone, and 42% want information about lead.

Figure 4-18



4.2 Survey Prototype Questions

In our survey, we included a prototype section. We provided three example formats for displaying air quality information. Below the prototypes, we asked 5 questions about the prototypes. The respondents then indicated the prototype(s) that they felt answered the questions. These prototypes can be seen in Appendix C.

4.2.1 Question 7

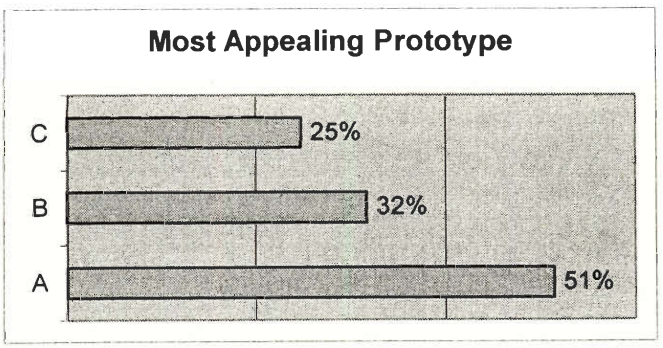
Question 7 (Figure 4-19) asked the user what figure appealed to them the most for displaying information. 51% chose the bar graph (Prototype A) as the most appealing, with the data chart second with 32%.

FIGURE 4-19: QUESTION 7

7. Which figure(s) appeals to you the most for displaying air quality information?

☐ A ☐ B ☐ C

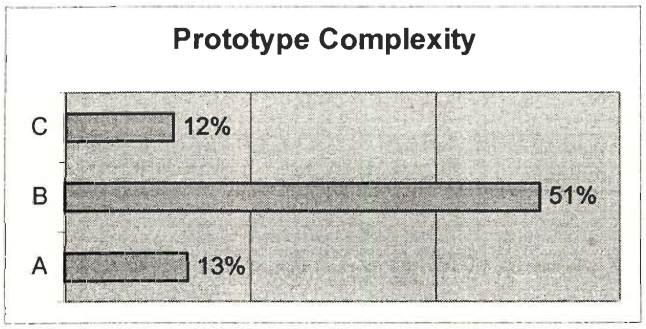
FIGURE 4-20: QUESTION 7 OVERALL RESPONSES



4.2.2 Question 8

Question 8 asked the participant what figures were too complex to understand. 51% of the respondents thought that the data chart (Prototype B) was too complex. Only 12% thought that the overall index (Prototype C) and 13 % the bar chart (prototype A) were too complex. See figure 4-21.

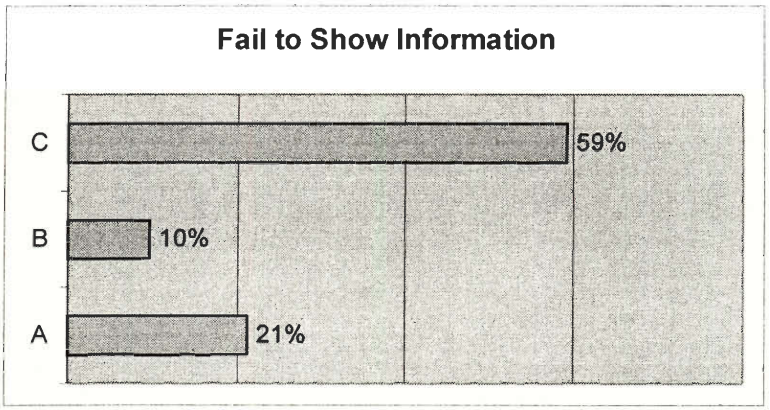
FIGURE 4-21: QUESTION 8 OVERALL RESPONSES



4.2.3 Question 9

Question 9 determined which prototypes the respondents felt fails to show all the information required. 59% of those surveyed stated that the overall index (Prototype C) failed to show all the information required. The bar graph (Prototype A) was chosen by 21% of those surveyed as not displaying all the information required.

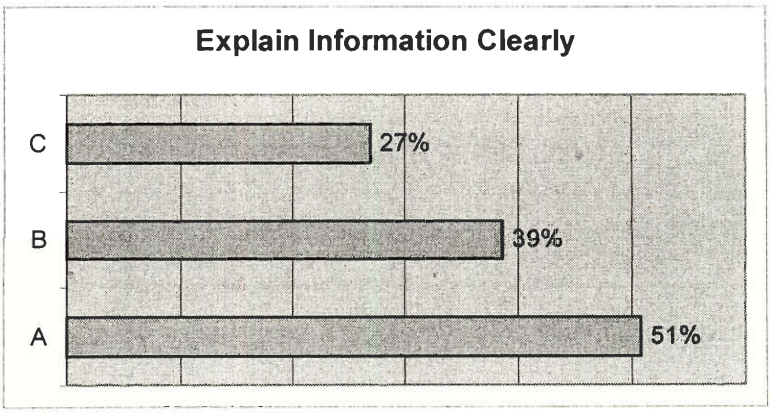
FIGURE 4-22: QUESTION 9 OVERALL RESPONSES



4.2.4 Question 10

Question 10 asked those taking the survey which figures explain the information clearly. As seen in Figure 4-14, 51% of those surveyed thought the bar graph explained the information clearly, while 39% of those surveyed thought the data chart showed the information clearly.

FIGURE 4-23: QUESTION 10 OVERALL RESPONSES



4.2.5 Question 11

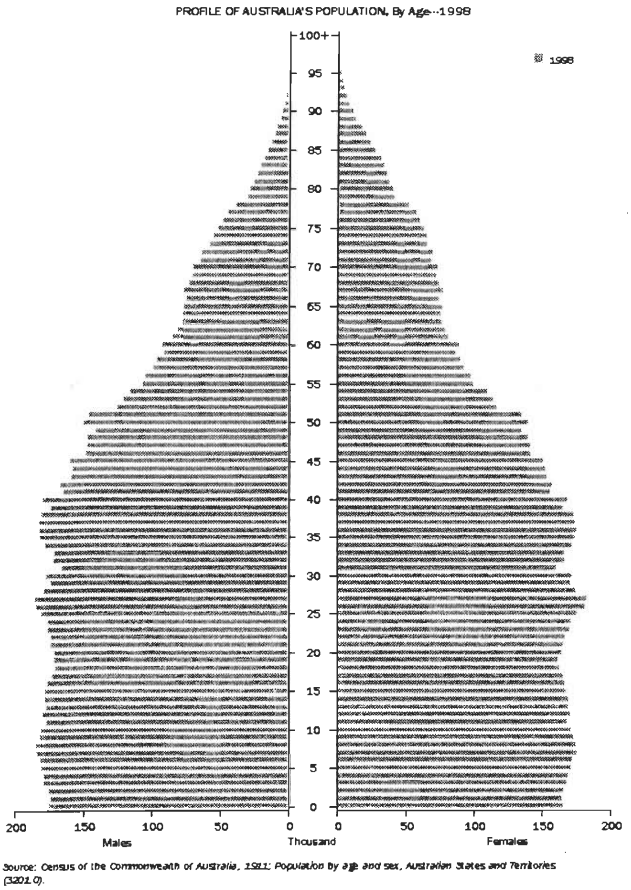
Question 11 was an open-ended question determining what information, if any, the survey taker felt was missing from the prototypes. Some common suggestions were:

- Explanation of y-axis data in plot A
- Map of Melbourne metro area w/ air pollution "footprint" for the day (or tomorrow) taking into account wind direction/movement
- A map perhaps in shades lines or colours
- Diagram C should be more specific as to where the air quality is good/bad
- A prediction for future, tomorrow or next few days

4.3 Respondents by Age Groups

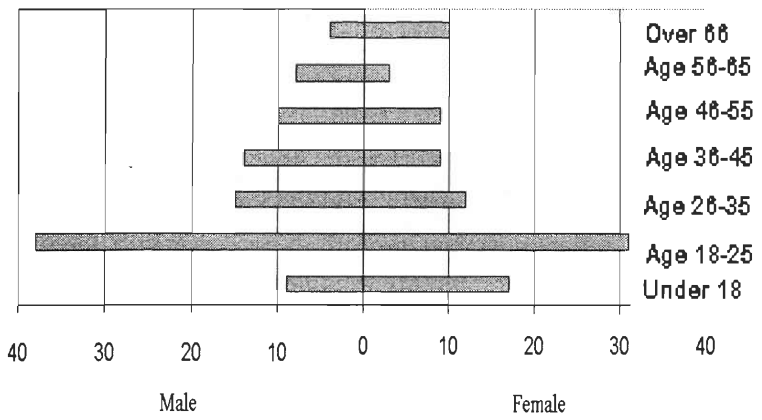
Breaking the respondents down by age showed the survey respondents were generally equally distributed much like the population of Australia. By comparing figure 4-27 and 4-28 it can be seen that the survey is a valid representation of the age break up of the general population. There is a slight over representation of the percentage of respondents from the age 18-25 group, which is due to an eagerness from this age group to complete surveys when approached by project team members.

FIGURE 4-24: PROFILE OF AUSTRALIA'S POPULATION



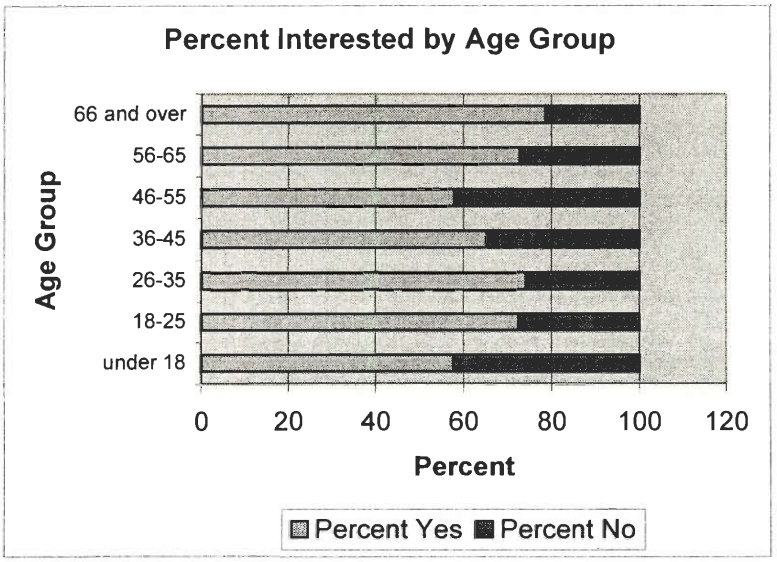
Source: www.ABS.gov.au

FIGURE 4-25: PROFILE OF SURVEYED POPULATION



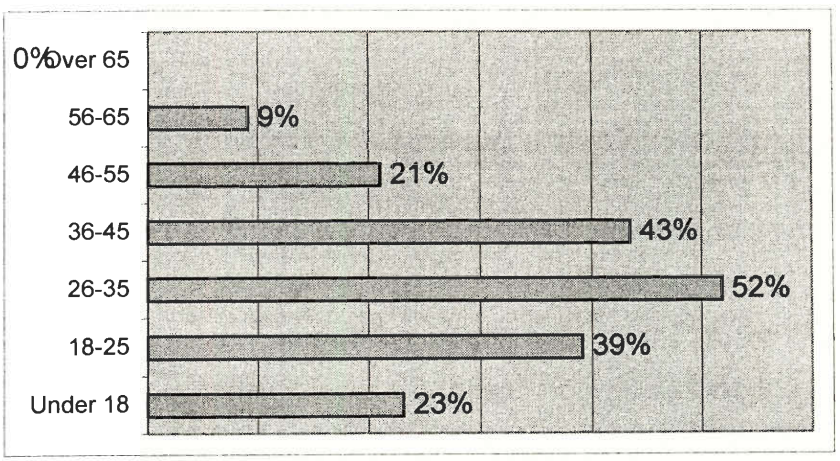
Breaking the responses up by age group would indicate if there were any generation gaps. People of different age groups offer differences in opinions. The result of breaking up the responses to Question 1 by age is shown in Figure 4-26. This shows the percentage of people interested in obtaining air quality information varied by age group; the percentages vary slightly but not significantly.

FIGURE 4-26 – PERCENT INTERESTED BY AGE GROUP



There were no large correlations found between the answers chosen and the age group. One small correlation noticed was that those who preferred to receive information in the future by Internet decreased significantly as the age group increased. This correlation is showed in Figure 4-27.

FIGURE 4-27 AGE WHO WOULD LIKE TO RECEIVE INFORMATION VIA INTERNET



4.4 Dividing Responses By Gender

Breaking the results down by gender will uncover any gender bias that might exist regarding interest in air quality information. Both males and females appeared to have similar levels of interest in air quality information. This is shown in Figure 4-28 and 4-29. There was no significant incident of gender bias located in out results. The results of all questions analysed by age group can be seen in Appendix D.

FIGURE 4-28 PERCENTAGE OF MALES INTERESTED

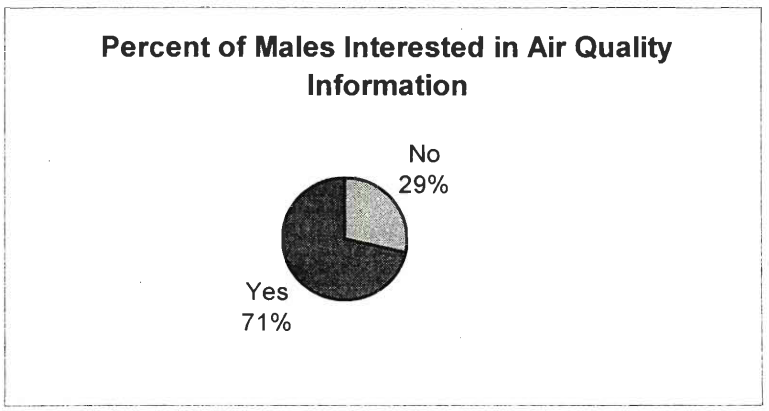
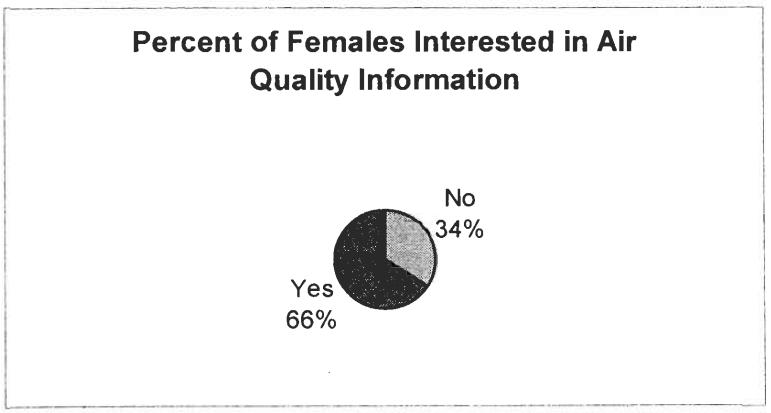


FIGURE 4-29 PERCENTAGE OF FEMALES INTERESTED



4.5 Analysing Responses By Medical Conditions

Breaking the responses down by those with or without medical conditions would tell us if those with medical conditions affected by air quality are more interested in obtaining information than those without specific medical conditions. The responses were broken down into three categories: asthma, allergies, and other. No relations were found between medical condition and types or amount of information wanted. All results of breaking the respondents down by medical condition are located in Appendix D.

To ensure we had surveyed a population that represented the current medical problems found in Victoria, we compared our percentages with those found on the Australian Bureau of Statistics (ABS) web page. Asthma is found in significantly higher precent in children under 15; however, in the respondents' age range, cases of Asthma range from 9% to 17% of the total population. 14% of our respondents had Asthma, which falls on the upper end of the range. A large portion of Australia's population have allergies, including hayfever, ranging from 16% to 26% according to ABS. We found 25% of our respondents suffered from allergies. The precent of the population over 18 that suffers from heart disease is 3.7%; this number rises significantly to 12.7% in the 65 and over category. After targeting several heart clinics, 6% responded that they had a heart condition. These results increase our confidence that our survey was representative of the entire population.

4.6 Geographical Data

To determine if we had correctly surveyed the population surrounding Melbourne, a GIS program was used to map our data. Figure 4-30 shows a map with the postal codes shaded in where surveys were collected. As shown in the figure, a majority of those surveyed lived in central Melbourne and in the south east. This is consistent with the population distribution of Melbourne as shown in Figure 4-30 and Figure 4-31.

FIGURE 4-30 POPULATION DENSITY OF PORT PHILLIP REGION

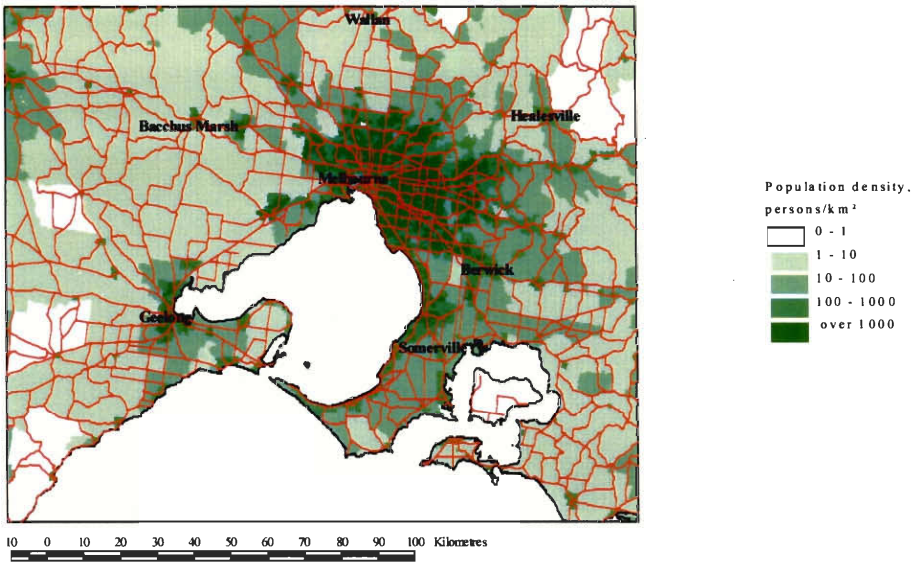


Figure 3:30: This map shows the population density of the Port Phillip Region.

FIGURE 4-31: SURVEY DISTRIBUTION MAP

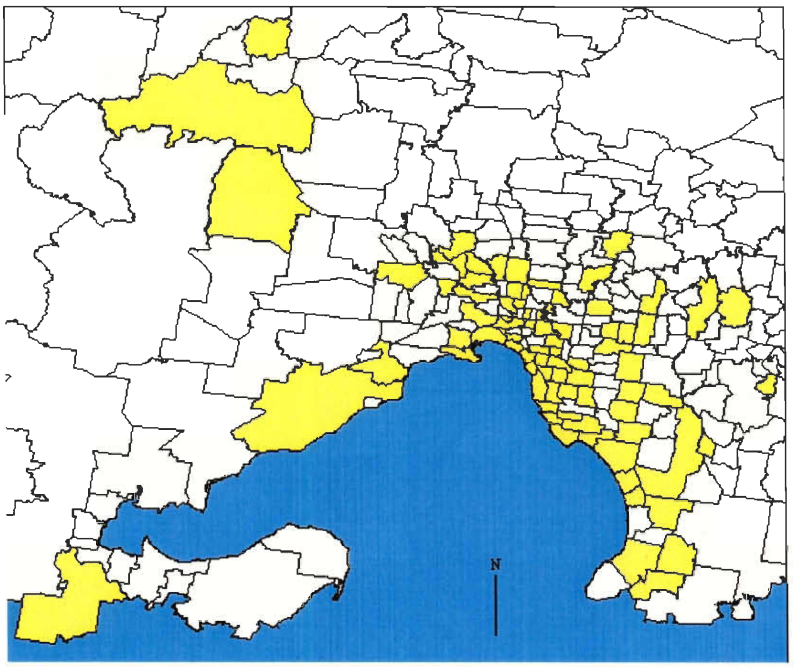


Figure 4-31: The shaded areas of the map are postal codes that surveys were collected from.

We then tried to determine if any correlation exists between peoples' interest in air quality and their postal code. As can be seen in Figure 4-31 there is no noticeable relationship. Several postal codes had only a few responses, so no conclusions can be made about extremely high or low levels.

FIGURE 4-32 AIR QUALITY INTEREST MAP

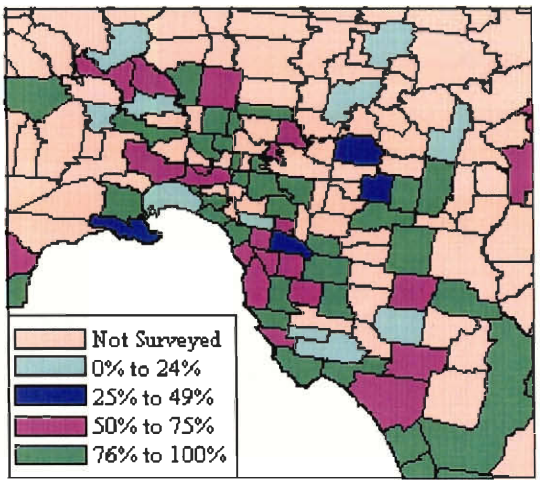


Figure 4-32: This map displays the percent of the population interested in receiving air quality information by postal code.

While no conclusive results could be drawn from the maps about peoples' interest, they were used to determine that the population surveyed represented the general population.

4.7 Special Interest Interviews

As with the general public, each special interest group has its own agenda and opinions on how the EPA should provide its services. In this section we provide reviews of the interviews carried out during our stay in Melbourne. Summaries of most of the interviews can be found in appendix E.

The groups or individuals interviewed were:

Educational Groups

- Margot Finn/ AirWatch

Residential Action Groups

- Ian Wood/ Richmond Action Coalition On Freeways
- Morag Loff/ Stonnington City Air Watch
- Ray McDonnald/ Southbank Residents group
- Nessie Hardy/ Altona Community Group

Governmental Groups

- Gordon Edgar/ City of Melbourne

Watchdog Groups

- Bronwen Machin/ Environment Victoria
- Robin Dyall/ Environment Defenders Office

EPA Employees

- Warwick Hoffmann/ EPA in conjunction with Australian Institute of Urban Studies
- Andy Gash / EPA Information Centre

As seen above these groups were clustered into several different categories, based on their function. These groups are educational groups, residential action groups, watchdog groups, governmental groups, and EPA employees.

4.7.1 Educational Groups

Educational groups are formed to meet a demand for information in the schools and at the local level. These groups typically work with teachers to generate lesson plans and resources to teach air quality and environmental issues. The EPA makes an excellent partner for such groups because of its resources in data collection, scientific knowledge, and industry contacts. The suggestions of these groups can be summarised into the

following points.

- Children have a hard time using websites to complete research.
- Educational materials and supplies are great resources in schools.
- Monitoring information in present format can be confusing.
- The EPA does a great job in lectures and workshops.

4.7.2 Residential Action Groups

Residential action groups are normally created by concerned citizens who feel their surrounding environment is threatened. These groups are typically focused on one area or problem which can sometimes cause them to have very narrow views. Some of the main suggestions of these groups can be summarised by the following points.

- EPA has improved communication over the past several years.
- EPA should increase communication and trust.
- EPA should not make broad, uninformative, and patronising statements, such as "trust me", "it's being looked into" "The effects are minimal."
- Monitoring stations coverage should b increased.
- EPA is helpful and accessible during working hours only.
- Data is sometimes in confusing formats and presentation style.
- Dealing with individuals at the EPA is good, but communicating with the organisation as a whole is difficult.
- Presentations at meetings have improved but make sure to maintain the improvements.
- Reasons for decisions should be provided.

4.7.3 Watchdog Groups

The watchdog groups category contains organisations whose goals are to protect the environment and try to ensure the best possible outcome of planning and legislation. The main points made by these groups can be summarised as follows.

- Reasons for decisions should be provided.
- EPA sides with industry for political favour.
- Data was not released in a timely manner if it was released.
- The EPA did not enforce penalties or law as fully as it should.
- The EPA did not give respect for opinions, even after asking for input.

4.7.4 Governmental Groups

This category contains government-sponsored groups whose primary focus may not be the environment but wishes to work on environmental issues. Many of these groups look to the EPA as a partner with whom to work. Comments from these groups include:

- Working relationship is very good.
- Providing too little information to the newspapers.
- Relying too much on the web to release information.
- Provided information quite useful and meaningful.

4.8 Summary

Combining the results gathered from both the special interest groups and the general public it was determined that it will be necessary for the EPA to present at least two levels of information. Other methods of disseminating large amounts of data to special interest groups should be developed and utilised. Multiple media formats should be used to reach the general public. These simple conclusions, as well as all data presented in this chapter, were pooled together and conclusions and suggestions to the EPA were made. These conclusions and suggestions can be seen in chapter 5.

CHAPTER 5: CONCLUSIONS

This chapter provides the reader with the conclusions derived from our project. Our suggestions to the EPA are detailed in the sections that follow. The goal of our project was to determine what information regarding air quality the general public and special interest groups want from the EPA and how they want this information presented. We generated a list of suggestions that we feel might help the EPA to strengthen their community relationships. If the guidelines that we present are implemented, the EPA will be able to better serve the community, the general public, and special interest groups. This in turn will allow the EPA to better accomplish its task of protecting and restoring Victorian air quality.

5.1 General Public

We conducted surveys in an effort to determine how the general public would prefer to gather air quality information. We complied and analysed the results of our surveys and generated a list of suggestions (see Chapter 4). Our list of suggestions for reaching the general public is as follows:

- Focus on today and tomorrow's air quality
- Use television, newspaper, and radio to reach the general public
- Create and utilise a meteorologist connection
- Present information focused on effects on health, sources and how to reduce air pollution
- Associate action with a problem
- Investigate the possibility of free public transport on smog alert days
- Increase interest in air quality via public displays
- Increase education about air pollution in schools

5.1.1 Focus on Today and Tomorrow Air Quality

The EPA gathers a large number of data points and can generate reports based on different time periods (e.g., daily, weekly). We suggest that the EPA produce daily reports that indicate the current day's air quality and the next day's predicted air quality. The EPA has the technology to predict the air quality at least a day in advance. The EPA provides a daily forecast on their website, but this is not accessible to all users. The newspaper (from which 52% of the respondents have received air quality information in the past), displays air quality information for the previous week. 14% of respondents indicated they would like to view the past week's air quality history. This does not represent a high portion of the population. After further investigation it was noticed that 64% want to receive today's air quality and 46% are interested in tomorrow's air quality. For these reasons it was concluded that the newspapers, as well as other formats, should focus on today's and tomorrow's air quality. The general public is not as interested in knowing about air quality history as they are interested in a forecast because the past does not affect them on a day-to-day basis. 46% of those surveyed would rather receive air quality information predictions so they can plan their day around it.

5.1.2 Use Television, Newspaper, and Radio to Reach the General Public

Based on the results of our survey, the EPA should provide air quality information via television, newspapers and radio. Other methods such as the Internet can be used by the EPA, but should not be relied on to reach a large number of community members. Presently the Internet constitutes most of the EPA's efforts to disseminate information. Though the Internet can be a useful tool for disseminating large amounts of data as well as easy to update, information that is critical to the public should be available in all three forms to ensure a broad audience is reached.

69% of those surveyed prefer to gather their information via television. This tool can be useful if a small forecast about air quality could be stated after the weather report on the news. Improvements can be made to the existing newspaper section about air quality in order to reach the 60% of the population that would prefer to receive information via the newspaper. Discussion of these improvements, such as

providing current and future information rather than past information, is located in section 5.3.2.

5.1.3 Create and Utilise a Meteorologist Connection

Many people that we surveyed and interviewed told us that they would like to have air quality reported with the weather. Although temperature and precipitation are not closely related to air pollution, many people would like to associate them. Just as weather has an effect on making plans, so too air pollution levels can alter the way members of the community might go about their day.

Although the EPA has increased relations with the media, there is still a lack of interest and vital contacts. Andy Gash, head of Media Relations for the EPA, has helped strengthen media relationships since her arrival to the EPA in November of 1999. There is still much work to be done in this area. Currently, the EPA sends data two newspapers, The Age and the Herald Sun, that is then converted into bar charts. The EPA has no impact on the manner in which the charts are generated. In addition, the EPA issues press releases about current air quality topics that often go ignored by members of the press. Ms. Gash suggested that in lieu of giving data directly to the media, the EPA should build relationships with meteorologists. Because the meteorologists already have the attention of the media and the public, and the public wants to hear a daily air quality forecast along with a weather forecast, the EPA should create and utilise connections with the meteorological community.

5.1.4 Information Focused on Effects on Health, Sources and How to Reduce Air Pollution

The general public is interested in obtaining information focused on the health effects, sources, and ways to reduce air pollution. 70% of those surveyed wanted information on the health effects associated with air pollution. 52% are interested in learning the sources of air pollution. 38% are interested in ways to reduce air pollution. This information will increase awareness, reduce misconceptions, and allow them to understand more of the air quality information when it is presented to them. When there is a general awareness about the effects of a problem on the individual,

followed by guidelines for alleviating problem, it reduces the feeling that the problem is far too big to be tackled by the average person.

5.1.5 Associate Action with a Problem

Part of educating the general public on air quality issues involves correcting misconceptions. Associating an action with a problem is one of the ways to go about this. The EPA cannot tell the public that there is a problem without providing them with a solution. It would not benefit air quality to have the general public know about smog alerts if they are unaware of the actions that should be taken. If people are not given an action, they are likely to ignore the situation. Even worse, people could go about handling the problem in an incorrect manner and might exacerbate the problem.

A prime example of how action should be associated with a problem is in the event of a smog alert. Currently, it is just stated that there is a smog alert. Many people do not know how this should impact their schedules. Some people even take a smog alert to mean that they should drive in an attempt to avoid breathing bad air. The EPA has proven that people encounter higher levels of pollutants when driving versus public transportation or walking. The EPA must associate this information along with the smog alert. We suggest that the smog alert be changed to "Melbourne has a smog alert today. Take public transportation to reduce exposure to and generation of air pollution".

5.1.6 Free Public Transport on Smog Alert Days

Another suggestion to the EPA to increase the use of public transportation on heavy pollution (or smog) days is to offer free public transportation. In order for this program to work there needs to be collaboration between the EPA, the Met, and the Department of Transportation. This program is already running in Rhode Island, USA. In Rhode Island there is free public transportation on "Ozone Days" that occur during the summer. The groups associated with this program are the Rhode Island Department of Environmental Management (RIDEM), the Rhode Island Department of Transportation (RIDOT), and the Rhode Island Public Transit Authority (RIPTA).

The goal of this program is to increase the number of Rhode Island citizens using public transportation and reduce the number of Ozone days that occur each summer.

In addition to decreasing the number of cars on the road during these "Ozone Days", this program also introduces community members to public transportation. Some people that do not use the public transportation system on a regular basis might realise that it works well for them and continue to use it in the future.

5.1.7 Increase Interest in Air Quality via Public Displays

28% of those surveyed are interested receiving air quality information via public displays. Although the interest in air quality issues is high, 31% of respondents stated that they are not interested in obtaining air quality information. 38% cited time as a reason.

Public information displays, if done well, can increase interest and awareness in the general public. Many people that we surveyed made comments, either on the survey itself or verbally, that public displays would generate more interest among the community.

We suggest an ad campaign to place posters and other public displays throughout the state of Victoria. Based on our research on graphical design (see Section 2.5) and our interview with Andy Gash (see Appendix E), we suggest the message on the posters be simple, catchy and to the point. We believe one graphic (that incorporates the EPA logo) should be used on all displays. A billboard could be placed on roads with heavy traffic to inform motorists of air quality issues. As mentioned in section 5.1.4, these displays should attempt to provide the viewer with an action. The EPA should inform motorists that they need not rely solely on public transportation. People should be informed that driving only part of the way to work or driving only on certain days can help them reduce the presence of pollutants and reduce their exposure to air pollution.

5.1.8 Increase Education in Schools Regarding Air Pollution

An increase of environmental education in school will also reduce misconceptions held by the community. As the children age they will understand more and be more aware of air quality than those who were not educated on these topics when they were young. This will help to improve concern about air quality in future generations. Another way to increase education in schools regarding air pollution is to increase the awareness in teachers. These teachers can pass along their knowledge to the children. If a campaign was started in school that made children involved and excited about improving air quality, these children would pass their excitement on to their parents, increasing the awareness of the whole family.

5.2 Special Interest Groups

In addition to the general public, the EPA also wanted to know how to better serve special interest groups. To help the EPA, we conducted 11 interviews with members of various special interest groups. We compiled and analysed the results of our interviews (see Chapter 4) and generated a list of suggestions. Our list of suggestions for reaching the special interest groups is as follows:

- Produce bulletins
- Increase monitoring stations
- Provide more meaningful data
- Provide an alternative to the Internet for data release

5.2.1 Bulletins

During the interview process, the interviewees were asked how they received current air quality information. Several of the contacts received information through the newspaper and occasionally via the EPA's web site. Many of them felt that they did not receive a continuous stream of information. When discussing alternative methods of dissemination, the subject of a bulletin or a report that was released on a

frequent basis was mentioned. These bulletins would be targeted at those who have a strong interest in air quality and have vested interest in keeping up to date on EPA news.

After speaking with several groups, we found a number of common things to be desired.

Air quality since the last bulletin

> This information should be presented in a clear, easy to understand way, outlining the number of times pollution levels exceeded the acceptable levels, and developing trends of good or bad air quality.

Current planning projects

> Details of proposed projects that the EPA is currently reviewing and working on should be included. Including this information will help keep groups informed so they are not surprised or angered when these projects are released.

Actions that have been taken against polluters

> When possible, details should be released outlining large fines or action taken against a major polluter. Details of how the pollution is going to be cleaned up, and steps to be taken to prevent it from happening again, should be included in the bulletin.

Current events of local groups working with the EPA

> This would be a great place for the EPA to publish how it is working with other groups towards common goals. A highlight of things completed and plans for the future would help to increase awareness of the EPA actions.

Upcoming events and issues that the EPA is working on

> Community events that the EPA is involved in should be reported. Any progress and actions should be included. Meetings held for public input or special events on environmental days are examples of things that would fall into this category.

While some of this information is available through other sources it is sometimes hard for people with limited time and resources to access all this information. Care should be taken to ensure that these bulletins are released on time and in a professional manner. Failure to do so increases mistrust and a lack of confidence in the EPA.

5.2.2 Increase Monitoring Stations

As shown with the general population there is an increasing concern about local air quality. Several groups were concerned about the number of air monitoring stations and their placement. Many groups requested more collection of "hot spots" and street level monitoring. Programs such as CAAM could be used to support these stations. Reasoning for tower placement and removal should be released to help increase trust.

5.2.3 Provide more meaningful data

While the EPA collects several millions data points a year, they can be relatively meaningless if not interpreted correctly. Even creating a daily index sometimes is not enough to provide people with data they can use.

Several issues arose when discussing how the EPA could better improve the data it collects. All numbers and charts should be compared to a reference of normal and unhealthy levels. When possible also include frequency and range data along with maximum values. Knowing how many times a level went above normal and by how much is a lot more useful than receiving the one maximum reading for the day.

The EPA web page does an excellent job of providing the latest readings from the monitoring stations; however, easy to understand and interpretive trends are lacking. Teachers found it was sometime frustrating to have school age children extract meaningful information from the web. The EPA should create understandable descriptions of the pollutants, and charts that students can relate to their school work. This was very important to AirWatch when trying to incorporate the EPA's work into its own.

5.2.4 Provide an Alternate to the Internet for data release

As the Internet's popularity rises there is an increasing trend to rely heavily on this resource. This, however, can cause problems for some. Certain groups, such as those with limited funds, have no means for accessing the World Wide Web. Often their computers have not been upgraded in several years and they simply don't have the technology. Groups that have the technology often find gathering information on the web a tedious and painful task.

Some concern was expressed that the EPA was dependent on the Web for communication. To help increase the number of people the EPA can reach, alternative methods for all releases should be explored. Examples include fax back systems, mailings, library releases, and informational bulletins. As discussed in 5.4.3 a stronger presence with the media will help to release daily air quality information.

5.3 Specific Format Suggestions

During the course of this project, we did a lot of research into how the EPA can better disseminate air quality information to the community. We examined previous EPA publications and consulted books in the area of graphical design. Using this information, we generated prototypes for our surveys and interviews (See Appendix B).

Our survey indicated that the general public prefers bar graphs for receiving information. As mentioned in chapter 4, people were divided as to how they want the information broken up (ie. state, suburb). We suggest that the EPA provides the air quality data by location of the monitoring stations.

The prototypes we generated for our survey are most conducive to the newspaper, since our survey was printed. If we were able to use other methods in the survey, such as radio and television clips, we would have developed more prototypes and been able to gather feedback on a broader range of presentation media. Due to the fact that different formats have different criteria to be met, this section outlines suggestions for the various communication methods.

5.3.1 Television

The communication method that ranked the highest (69%) among our survey respondents is television. We asked those that mentioned television as a preferred method how they envision the presentation. Almost all said they would like it given with the weather. We suggest that the EPA provide the major television stations daily air quality readings and forecasts. If the meteorologist can present the air quality in a manner similar to temperature or precipitation, it would be very clear to the viewers. The announcement should be verbal (a sentence or two depending on the status) and should also include some sort of graphical indicator. Ideally, all television stations would use similar indicators to make it easier to understand and hopefully make air quality readings more recognisable. The information presented on the television needs to be understood in a very short time span, so it cannot be very detailed or complex.

5.3.2 Newspaper

We determined that the second highest-ranking preferred medium of communication is newspapers. With 60% of the respondents claiming they would be interested in receiving air quality information in the newspaper, the EPA should ensure that the messages they present are in the format the general public desires.

Currently, the previous week's air quality data is presented in the two major local newspapers, The Age and the Herald Weekly Times. The results of our survey indicate that people are more interested in today and tomorrow's air quality than the previous week.

Figures 5-1 and 5-2 are an example of our prototypes. The general population wants today and tomorrow's air quality. Therefore, the prototype for the newspaper format has both today's air quality report and tomorrow's prediction. As discussed in Chapter 4, our data concerning the size by which region the general public would like the data broken down was inconclusive. For that reason the information in the charts is reported by monitoring stations.

FIGURE 5-1 TODAY'S AIR QUALITY

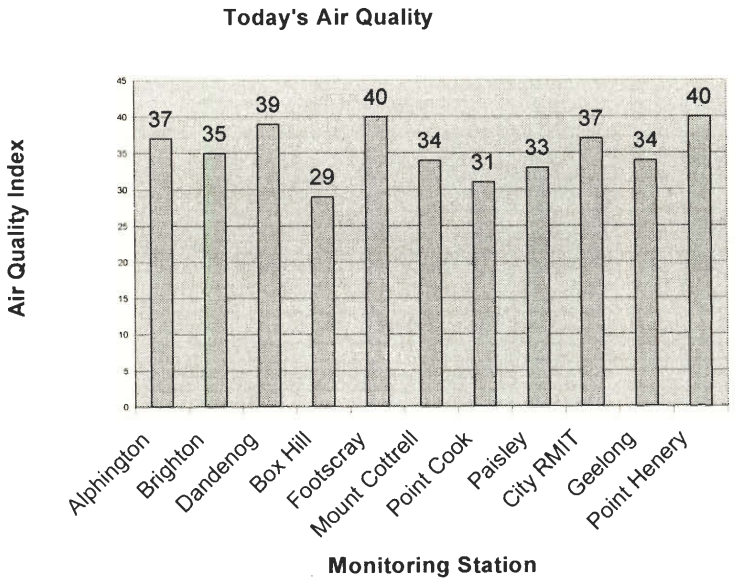
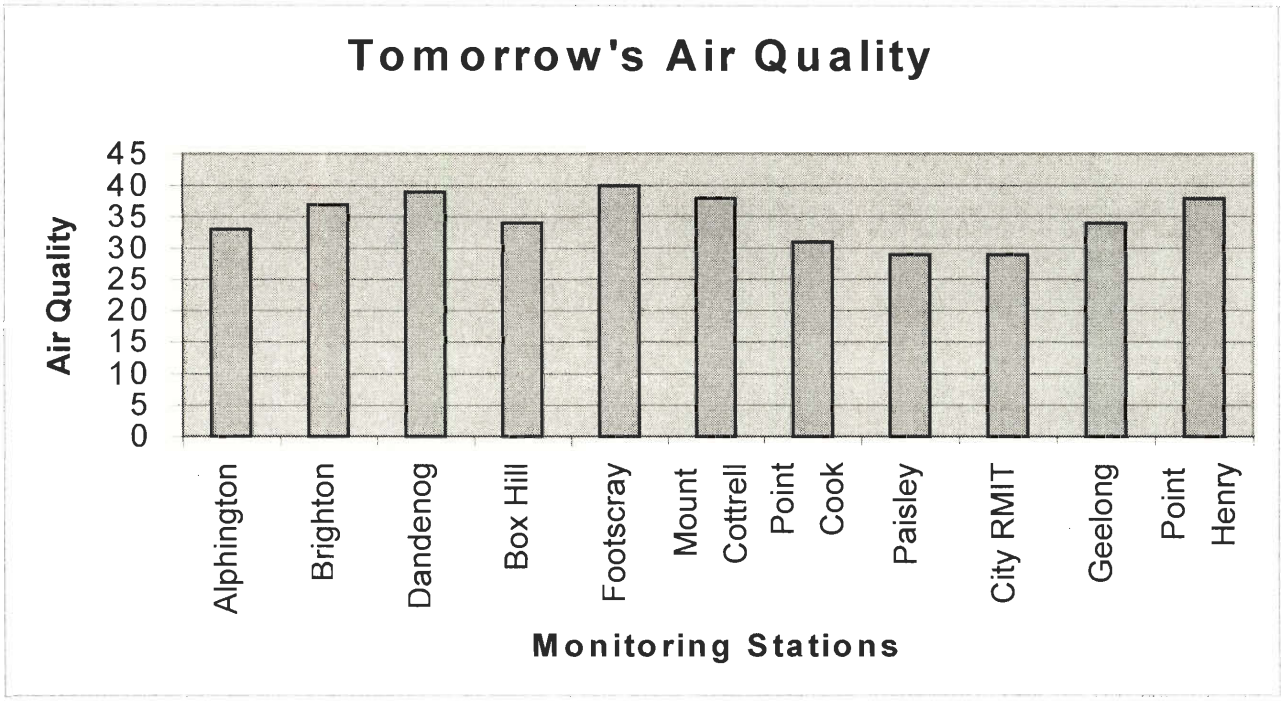


FIGURE 5-2 TOMORROW'S AIR QUALITY



5.3.3 Radio

Since roughly half (51%) of the respondents indicated that they would like to hear air quality information on the radio, we suggest the EPA work on providing radio stations with bulletins that can be read over the radio. The air quality information should be given along with the weather. The message should be clear and to the point.

5.3.4 Internet

Roughly a third of the respondents stated that the Internet would appeal to them as a method of receiving air quality information. Since different users of the website have varying needs, there should be separate links for special interest groups, schools, and the general public. The different sections should contain the appropriate level of information desired by the group.

We suggest that the general public section contain a map with colour-coded areas portraying the air quality index. (See Figure 5-3) The colours would be explained in a key. Alongside the pollution level the key will contain suggestions of what to do at each pollution level. (See Figure 5-4) This view will satisfy those people who prefer an overall picture of the current air quality. Each section of the map could be clicked on to show a detailed description of the pollution levels in each region (See Figure 5-5). This will allow those who desire more information to receive it without causing confusion to other users. Depending on the current air pollutant level, the website could provide a list of suggested actions.

Figure 5-3 Overall Map

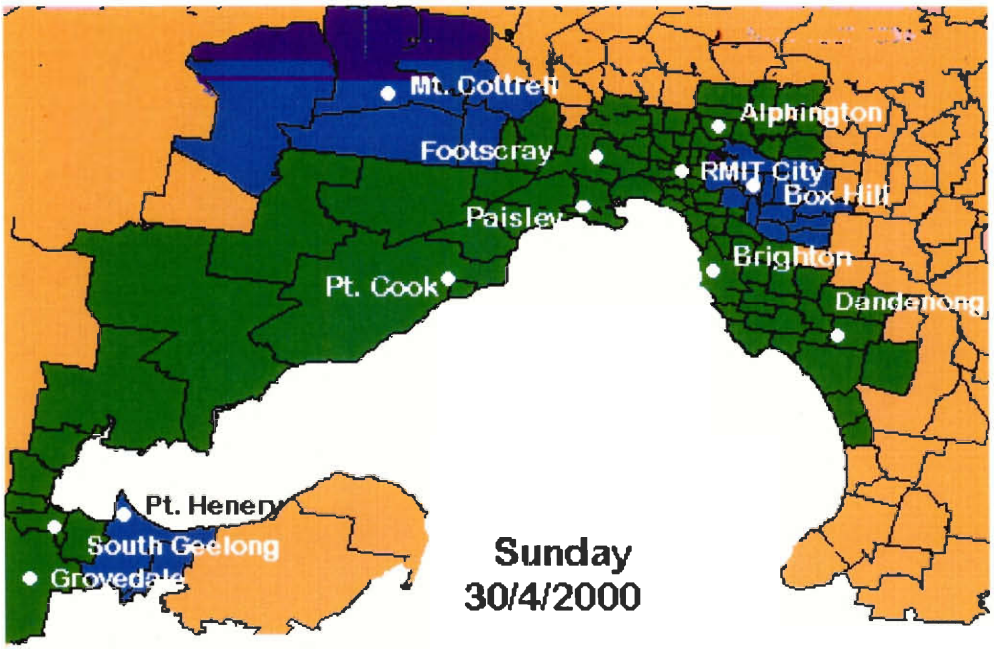
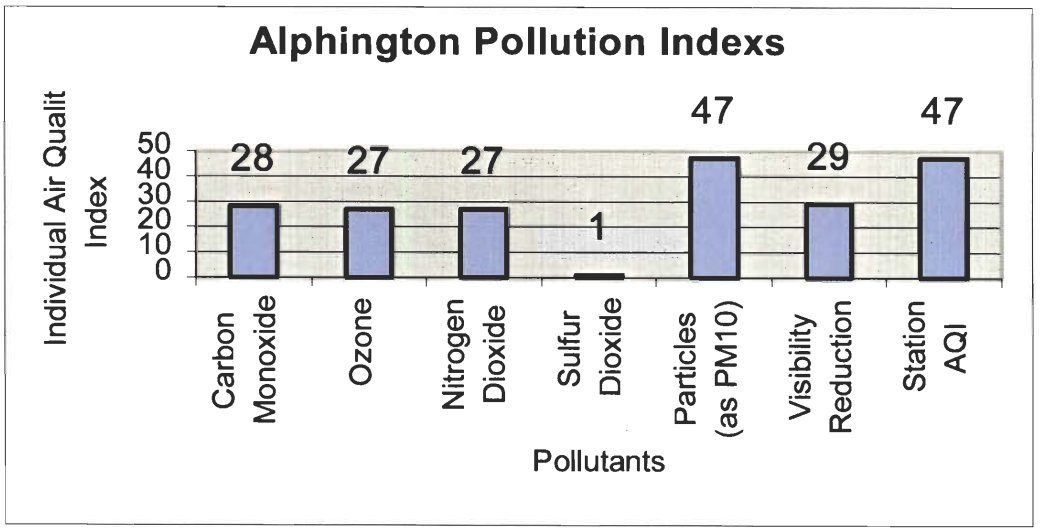


FIGURE 5-4 INDEX KEY

Rating	Pollution Level	Suggestions
Very Good	0-33	Normal activity
Good	34-66	Normal Activity
Fair	67-99	Strenuous Activity should be avoided for those with medical conditions.
Poor	100-149	Strenuous activity should be avoided by all. Take public transportaion when possible.
Very Poor	150	Stay indoors.
	NO Data Available	

FIGURE 5-5 INDIVIDUAL REGION POLLUTANTS



The special interest group area would be for members of the community that want more detailed information. It could provide all data obtained by the EPA. This includes all stations and pollutants. Ideally this information would be updated hourly. Users of this section should be able to view not only the highest-level reached for a

particular time range, but also the frequency at which the various levels were hit. Information should be given that tells the average amount and also maybe indicate how many times each level was hit. Wind direction should be included to attempt to correlate wind shifts with pollution levels.

The school section, used by such programs as AirWatch, should have more user-friendly terminology. This would allow those with a low level of education in the area to be able to understand the web page. It should be fun for children of all ages to use. It should be educational as well as entertaining.

5.4 Future Work

The goal of our project was to determine what air quality information the general public and special interest groups value and the best way to present this information. After analysing our results, we created a list of suggestions for the EPA. We feel these suggestions, if implemented, will help the EPA fully and accurately present air quality information to the community. The goal of our project was achieved, but there are many opportunities to expand this project. Throughout the course of our project, we had several ideas that we wanted to explore, but were unable to in the time we had.

5.4.1 Follow-up interviews

The pre-survey that we conducted indicated that our survey was too long. We had to sacrifice survey content in order to shorten the survey. We added a section to the survey that asked for contact information from those survey respondents that would be interested in participating in a follow-up interview. Due to time constraints, we were unable to conduct these interviews. Many of the people that we surveyed seemed very interested in speaking with us about how the EPA can better serve them. We feel valuable information can be gained by contacting these members of the community.

5.4.2 Iterative design of prototypes

After reviewing the comments about the prototypes and analysing the results of the prototype questions, we would have liked to have redone that section and gained feedback on a new set of prototypes. By applying the results obtained and gaining more feedback, we could have confirmed our thoughts on what the community wants. Repeating this several times would result in a design that is liked by most of the general public. By taking the suggestions that the respondents made, EPA employees or a future IQP team could generate subsequent sets of figures. These could then be included in survey to gain more feedback. When we were first generating our methodology, we discussed using an iterative design of our prototypes. By changing the prototypes, analysis has to be made after each redesign. We were very interested in this idea, but were unable to execute it given the time allotted.

5.4.3 Work on Media Relationships

Relationships between the EPA and various media sources could be enhanced. After speaking with several EPA employees, we realized that the lack of strong media relations has had a negative impact on the EPA's relationship with the community. Andy Gash has done a lot to improve these relationships, but there is still a lot of work to do in this area. We discussed interviewing employees from local television, radio and newspapers, but realized the scope would be better suited for another IQP.

5.4.4 Go Beyond Melbourne

The EPA has the responsibility of protecting and restoring air quality to all Victorians. The surveys and interviews we conducted were only done on residents of the greater Melbourne area because that's where we were located. If the EPA wants to explore more of Victoria than Melbourne, surveys and interviews should be conducted statewide.

5.5 Conclusions

Using the information we gathered during our research, we developed a methodology to determine what air quality information the community desires from the EPA and the best way to present it to them. The results of our surveys and interviews were recorded and analysed. From the conclusions that we drew from our data, we generated a list of suggestions for the EPA. The list of suggestions for the general public will increase the awareness of the community and promote action. The list of suggestions for the special interest groups will help strengthen the relationships that the EPA has with various groups. It will also help restore the EPA's image. If implemented, we feel our suggestions will help the EPA achieve its goal of restoring and protecting Victorian air quality.

APPENDIX A: SPONSOR BACKGROUND INFORMATION

The Victorian Environmental Protection Authority (EPA) is an Australian governmental organization whose main mission is

> "to meet the aspirations of Victorians, now and in the future, for a safe and ecologically sustainable environment through the protection and restoration of air, land and water quality, and the control of unwanted noise."

This agency was established in 1970 as part of an Act by the Victorian Parliament in response to community concern about pollution. The chairman of the EPA is appointed by the government and is assisted by an Executive and the EPA staff. The creation of the EPA marked the first time that all areas of pollution control were brought together in Victoria.

Although this organization is an authority of the Victorian government, it has no control over any of the government sectors. The responsibility of passing environmental laws does not fall on the EPA. The EPA persuades government officials who are in control of the laws and regulations to follow the desires of the community.

The main goals of the authority are presented in the Environment Protection Act of 1970.

> "The Act itself has developed to reflect changing community expectations and concerns about the environment, our growing understanding of it as a complex interrelated system and the availability of evolving technologies and processes for industry and commerce."

The Act follows four principles, the first of which is the precautionary principle that focuses on the point that action is more productive then reaction. This principle promotes research, legislation, and economical solutions to solve possible environmental problems before they cause harm. The second principle, the protection of intergenerational equity, calls for protection of the environment for future generations.

This principle was designed to ensure that the environment would be healthy for years to come. The polluter pays principle is the third principle and its main focus is on punishing the polluters. Under this principle, the EPA and government enforce strict fines on those who contaminate. The hope is that by doing so, Victoria will stay clean at the expense of those who pollute. The final principle is the protection of biodiversity. This principle is similar to the protection of intergenerational equity. Under this principle the environment must be protected for the enjoyment of our children. This principle aims to ensure that polluted water or air doesn't lower the basic quality of life. In conclusion, the Act puts the responsibility in the hands of the community, businesses and individuals.

The EPA also helps deal with environmental problems overseas. The EPA works in cooperation with the Overseas Projects Corporation of Victoria Limited to execute environmental projects. Mainly these two organizations provide consultancy services. EPA's main consultancy services include development of legislation, policy and strategy, air quality management, pollution prevention and cleaner production, institutional strengthening and training courses, corporate systems development, and technical and scientific assessment. The present day approach taken by the EPA "maintains standards of environmental quality through work approvals, licensed inspections, pollution abatement notices and land use planning referrals." They are looking further into controlling pollution in the future by environmental taxes and levies. They are working with the industry rather than in conflict with the private sector.

The EPA is currently running many programs dealing with air quality. Some of these programs are Community Access to Air Monitoring (CAAM), Aircare and Air Quality Management Plan. CAAM, which came about in 1998, is a ground-breaking program in which the Environment Protection Authority and the community join. Together they manage two ambient air quality-monitoring stations located in Alphington and Dandenong. The EPA feels that this program will educate the public on how to improve air quality activities and procedures. AirCare is a joint program between the Royal Automobile Club of Victoria and the EPA. The goal of this program is to increase the awareness amongst the public that regular car servicing and maintenance reduces air pollution. The third program, The Air Quality Management Plan, is attempting to create a plan to improve air quality in the Port Philip Region.

Many regulations exist which involve the EPA. Acting as an intermediary between the government and the community, the EPA has a hand in improving the environment. Their role is a vital one in the Victorian community. With the cooperation of business, people, and the government the EPA is helping to keep the environment sustainable both now and in the future.

APPENDIX B: SURVEY AND INTERVIEW SCRIPT

Air Quality Information Survey

Conducted by the Environment Protection Authority (EPA) of Victoria

These surveys are being conducted as part of a research project about community perceptions of air quality and will be kept confidential. All information gathered will be used only by the Victorian Environment Protection Authority. This information will be used to assist EPA in the development of community information programs about air quality.

1. Are you interested in obtaining information about air quality?

Yes No

If no, why would you not want access to information about air quality? Please tick all that apply.

I am not overly concerned about the health effects of air quality.
I am not very interested in environmental issues.
I don't have time.
I don't understand what air quality information means.
Other: _____

If yes, Why are you interested? Please tick all that apply.

I am concerned about air quality's effect on my health.
I am concerned about air quality's effects on others' health.
I require information to avoid pollution.
I am interested in obtaining more information for studies and research projects.
Other: _____

2. Where have you obtained air quality information in the past? Please tick all that apply.

Radio
Newspaper
Local library
Television
Health professional
Internet
Public information display
Local school/ college/ university
Other: _____

3. Where would you prefer to obtain air quality information in the future? Please tick all that apply.

- ☐ Radio
- ☐ Newspaper
- ☐ Local library
- ☐ Television
- ☐ Health professional
- ☐ Internet
- ☐ Public information display
- ☐ Local school/ college/ university
- ☐ Other: _____

4. What types of general air pollution information would you want to access? Please tick all that apply.

- ☐ Effects of air pollution on health
- ☐ What can be done to reduce air pollution
- ☐ How to reduce exposure to air pollution
- ☐ Sources of air pollution
- ☐ Different types of air pollution
- ☐ Steps to take in the event of a smog alert
- ☐ Air monitoring data
- ☐ Other: _____

5. How detailed would you like the air quality information to be? Please tick all that apply.

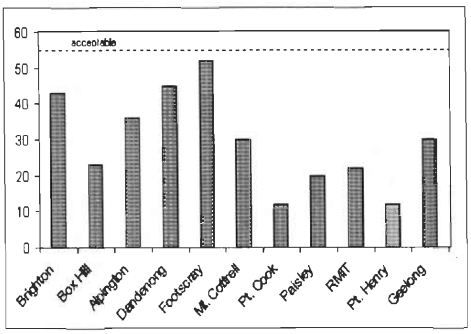
- ☐ Real time air quality (as it is happening)
- ☐ Today's air quality
- ☐ Tomorrow's air quality prediction
- ☐ Next week's air quality
- ☐ Previous week's air quality
- ☐ Previous Month's air quality
- ☐ Air quality trends over the past year
- ☐ Air quality trends over the past 5 years
- ☐ Air quality trends over the last 10 years.
- ☐ Other: _____

6. How would you like the information broken down?

- ☐ State
- ☐ Local Government Area
- ☐ Suburb/Post code

Please consider these three layouts for the following questions.

A



B

REGION	STATION	Carbon Monoxide	Ozone	STN. AQI	STN. SUMMARY
EAST	Brighton	26	35	52	GOOD
	Box Hill	5	26	27	VERY GOOD
	Alphington	5	24	46	GOOD
	Dandenong		37	63	GOOD
CITY	RMIT	26	22	22	VERY GOOD
GEELONG	Pt. Henry	26			offline
	Geelong Sth.	6	23	23	VERY GOOD

C

Daily Air Quality Forecast

Air Quality Index

70

- Avoid prolonged outdoor activity

7. Which figure(s) appeals to you the most for displaying air quality information?

A B C

8. Which figure(s) are too complex to understand? Please tick all that apply.

A B C

9. Which figure(s) fail to show all information needed? Please tick all that apply.

A B C

10. Which figure(s) explain the information clearly? Please tick all that apply.

A B C

11. What would you like to see that is not displayed? _____

_____

_____

_____

_____

12. What pollutants are you interested in obtaining information about? Please tick all that apply.

- ☐ Ozone (O3)
- ☐ Nitrogen Dioxide (NO2)
- ☐ Sulfur Dioxide (SO2)
- ☐ Carbon Monoxide (CO)
- ☐ Fine Particulates (PM10)
- ☐ Visibility (Airborne particle index)
- ☐ Lead (Pb)
- ☐ Sulfate (SO4)
- ☐ Particulates (TSP)
- ☐ Don't Know
- ☐ Other: _____

13. Do you have any of the following medical conditions? Please tick all that apply.

- ☐ Asthma
- ☐ Allergies
- ☐ Angina
- ☐ Heart Condition
- ☐ Lung Disease

Demographic Information:

14. What is your gender?

☐ Male ☐ Female

15. What is your age?

- ☐ Under 18
- ☐ 18-25
- ☐ 26-35
- ☐ 36-45
- ☐ 46-55
- ☐ 56-65
- ☐ 66 and over

16. What is your occupation? _____

17. What is your PostCode? ___ ___ ___ ___

18. Do you have any children? _____

19. If so, what are their ages? _____

20. Optional:
If you would be willing to do a follow up interview please fill out the following info.
Name:_____
Phone Number:_____

Special Interest Group Interview Script

We are students working in conjunction with the EPA, conducting some research into disseminating information that the EPA has to offer. I would like to thank you for letting myself/us interview you today.

Organization _____

Name _____

Title _____

1. What is the main focus of your organization?

2. Who is your target audience?

3. What is your role in the organization?

4. What type of air quality data does your organization deal with or desire?

5. Where have you received air quality data in the past?

6. Where would you prefer to retrieve data in the future?

7. How do you see the EPA helping you and your organization achieve your goals?

8. Do you use any of the resources the Victorian EPA has gathered?

9. If you answered yes to number 8 what kind of resources or data?

10. What types of data would you like now or in the near future?

11. Using the raw data the EPA currently offers what type of interpretations or compiled reports would be useful to you?

12. What do you see as up and coming air quality issues in Victoria?

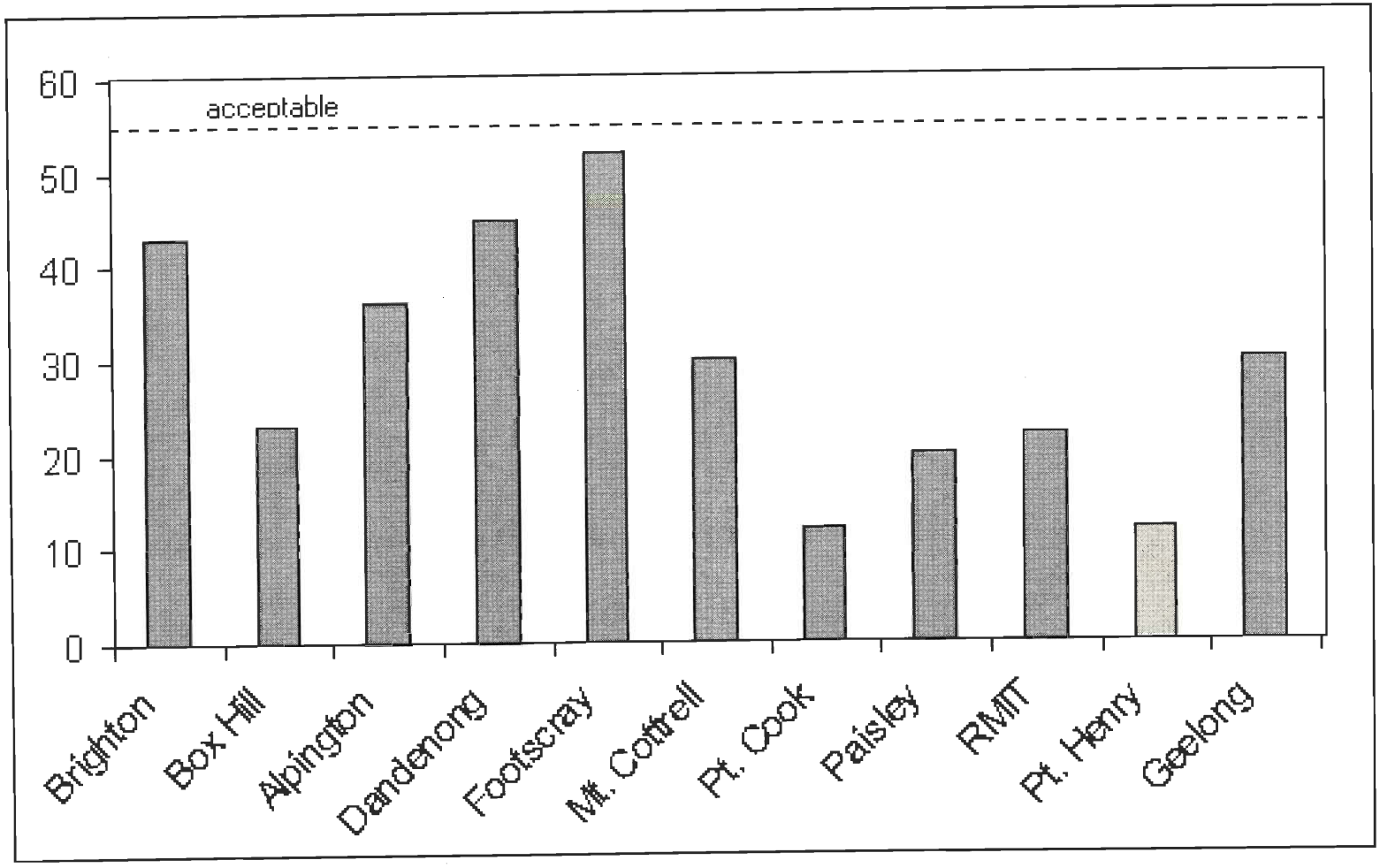
13. How could you improve your relationship with the EPA?

14. Are their any programs or project that you would want to work with the EPA on?

Thank you for you time.

APPENDIX C: SURVEY PROTOTYPES

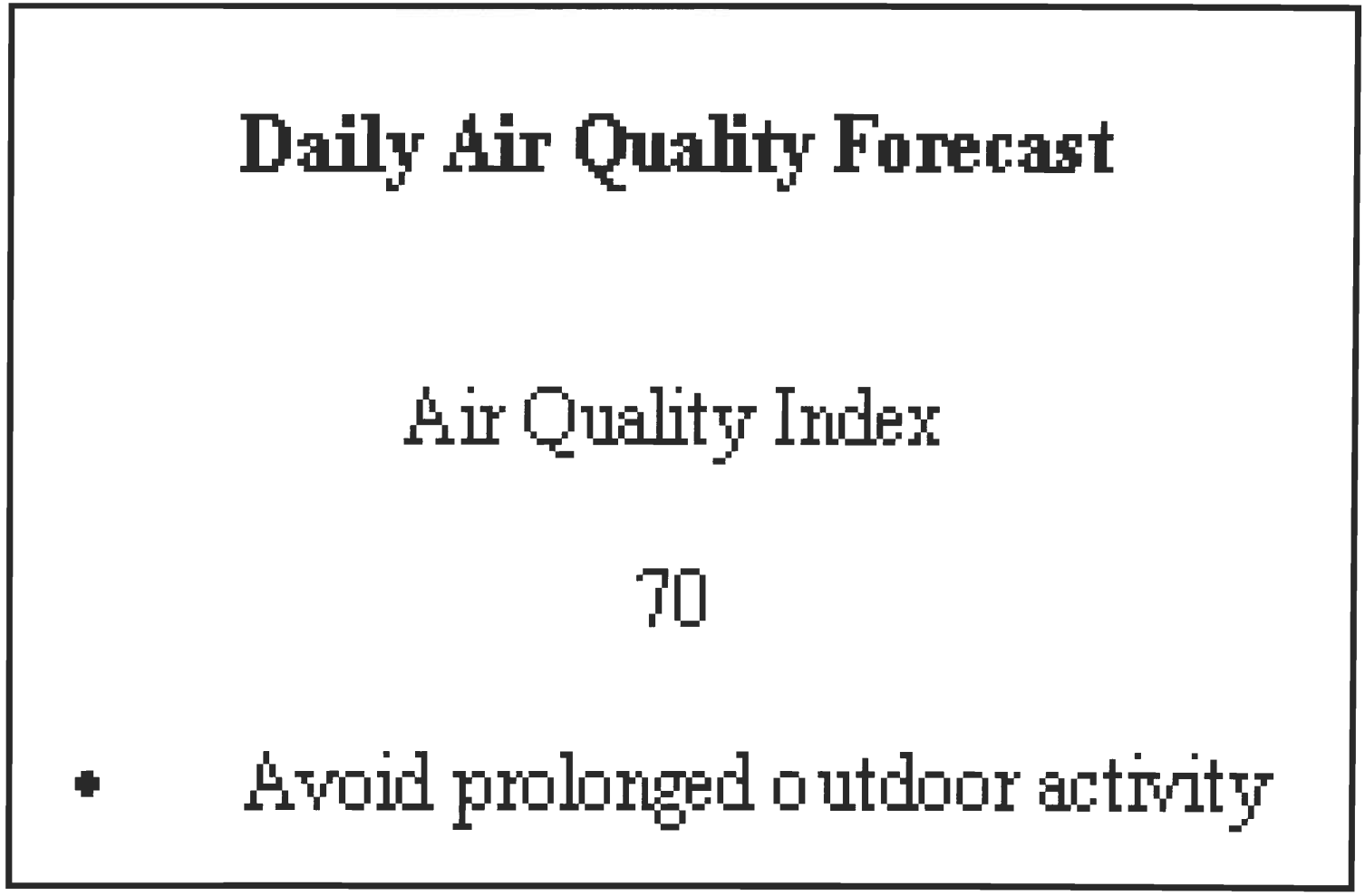
PROTOTYPE A: BAR CHART



PROTOTYPE B: DATA CHART

REGION	STATION	Carbon Monoxide	Ozone	STN. AQI	STN. SUMMARY
EAST	Brighton	26	35	52	GOOD
	Box Hill	5	26	27	VERY GOOD
	Alphington	5	24	46	GOOD
	Dandenong		37	63	GOOD
CITY	RMIT	26	22	22	VERY GOOD
GEELONG	Pt. Henry	26			offline
	Geelong Sth.	6	23	23	VERY GOOD

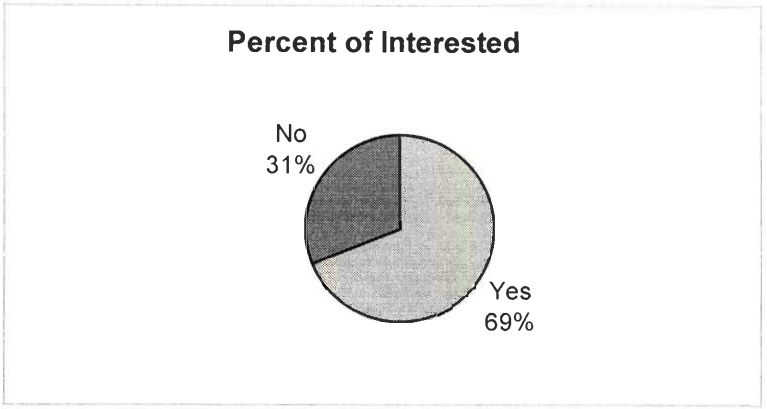
PROTOTYPE C: OVERALL INDEX



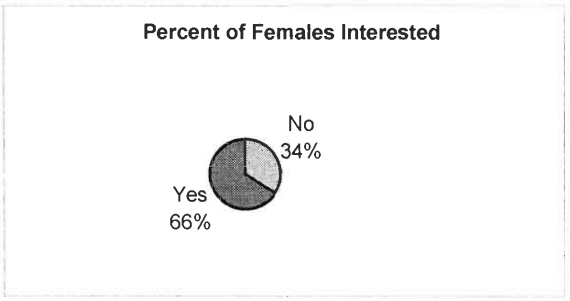
APPENDIX D: SURVEY DATA

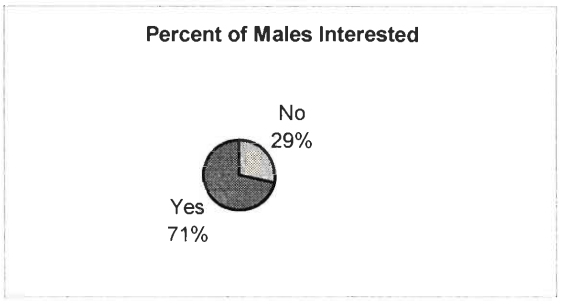
Question 1: Are you interested in obtaining information about air quality?

General Response

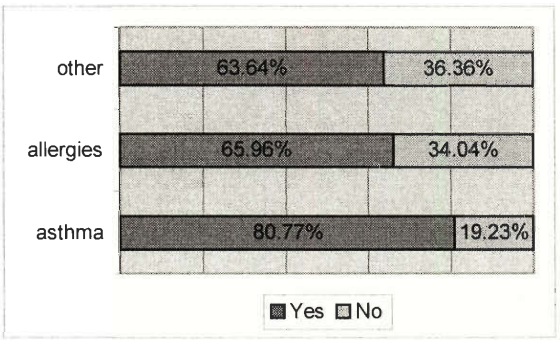


Responses by Gender

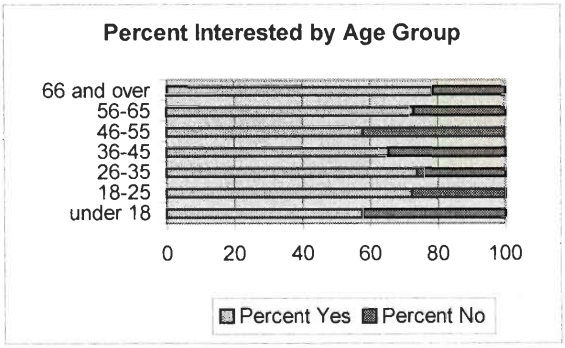




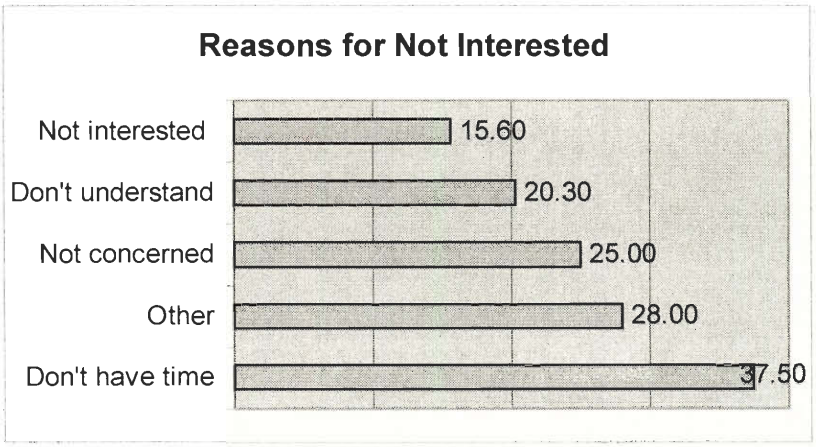
Responses by Medical Conditions



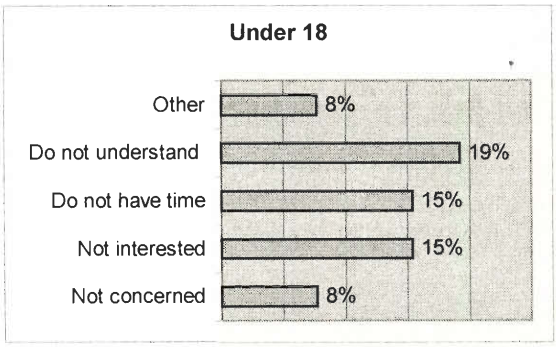
Responses by Age

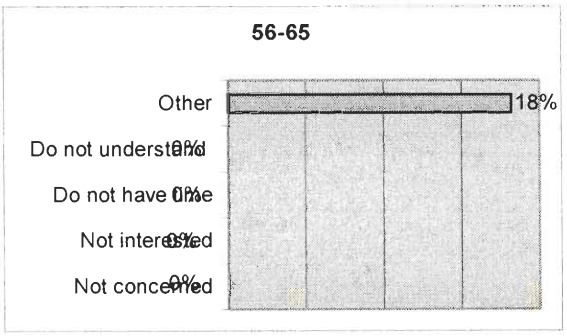


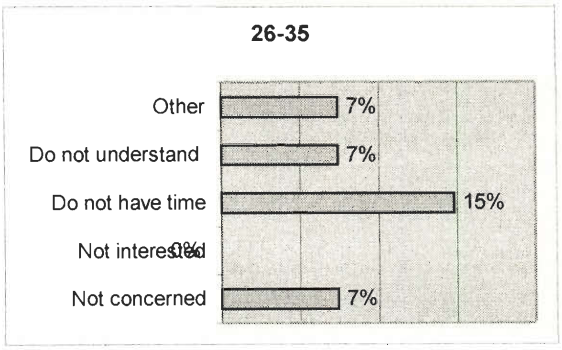
General public responses for not being interested

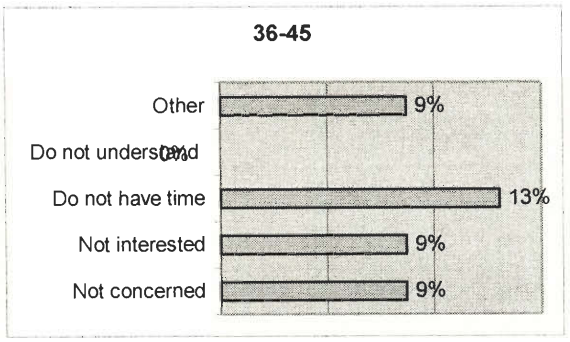


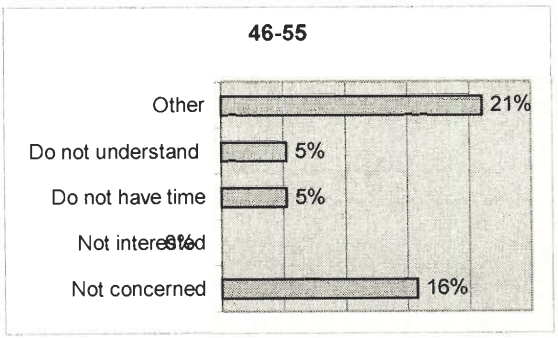
Reasons for not being interested broken down by age

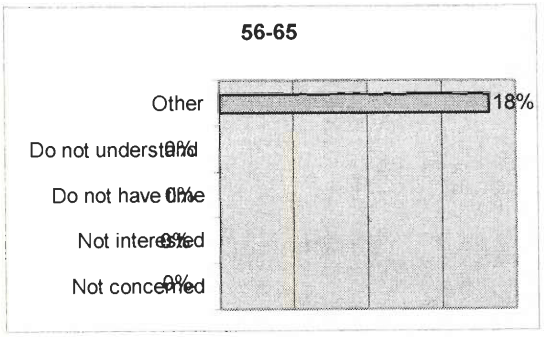


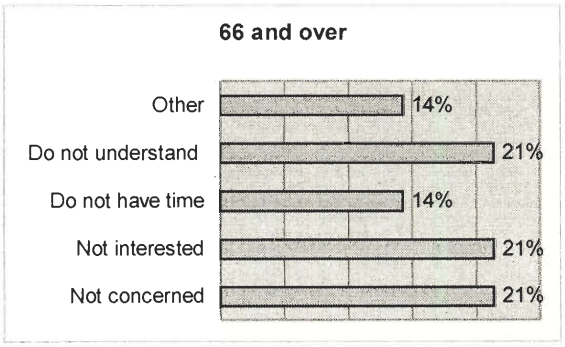




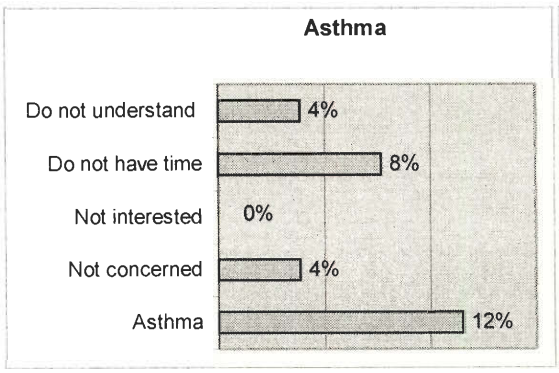


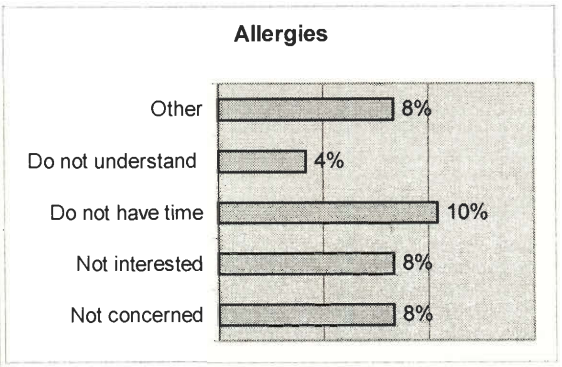


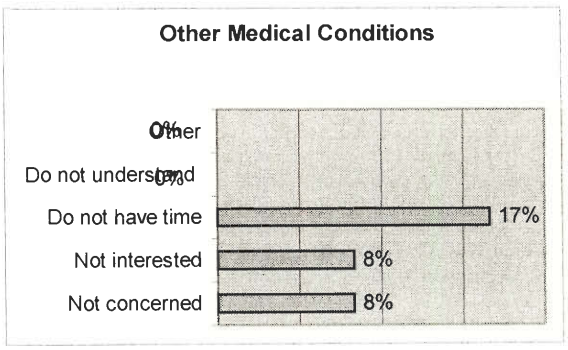




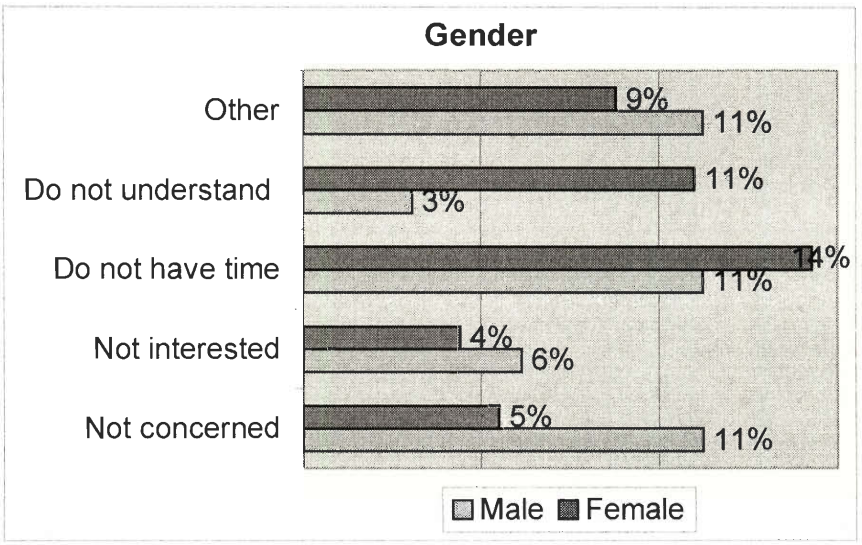
Reasons for not being interested broken down by medical condition



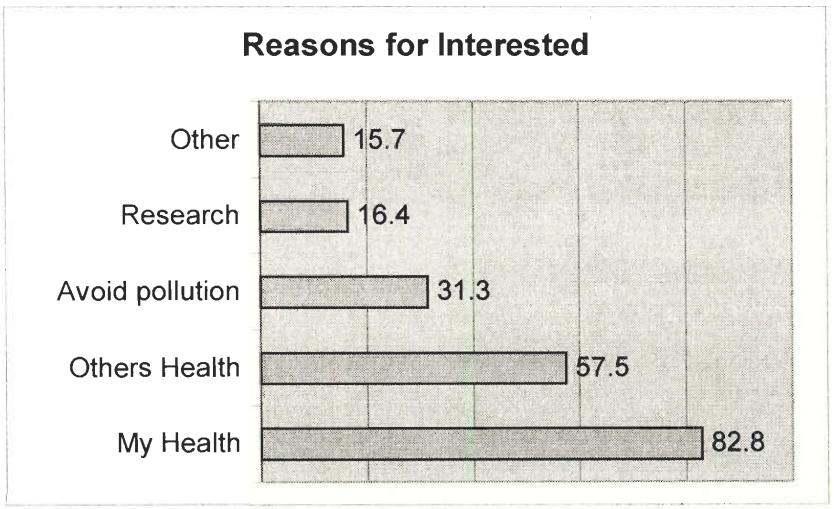




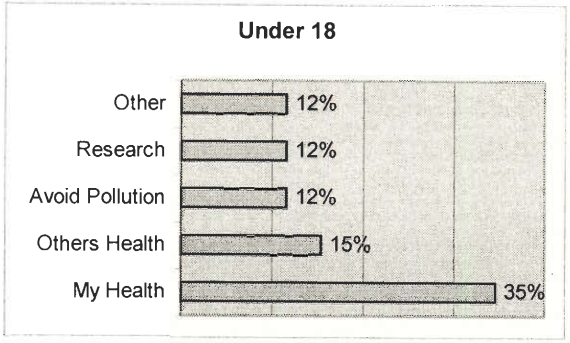
Reasons for not being interested broken down by gender

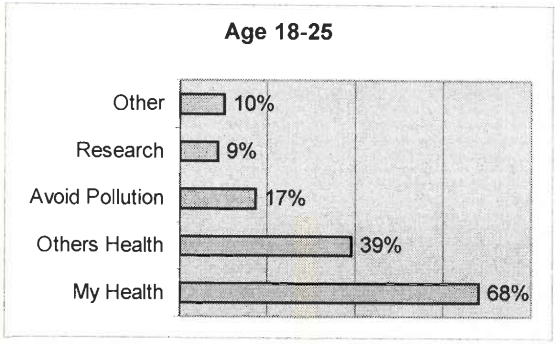


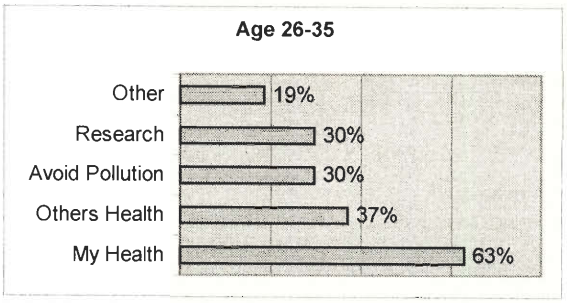
General Public responses for being interested in air quality

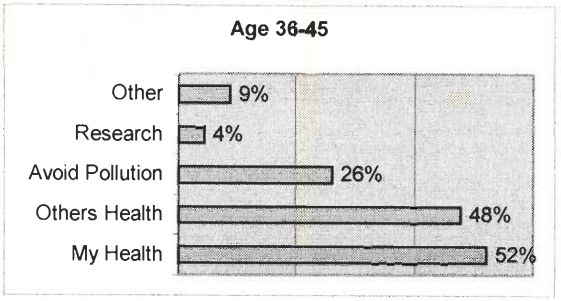


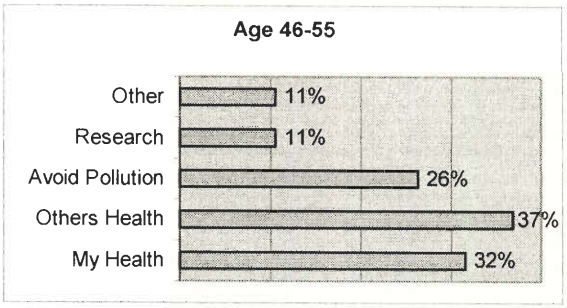
Reasons for being interested broken down by age

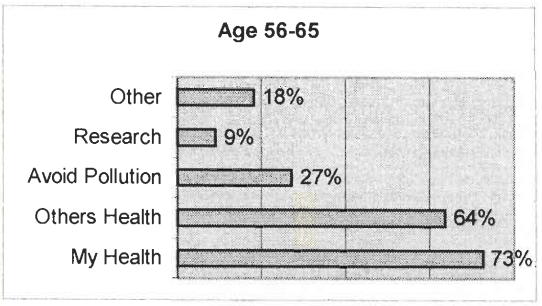


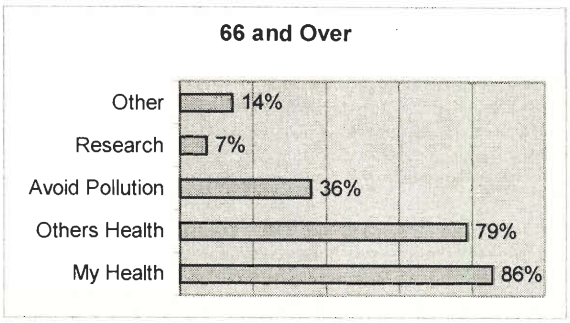




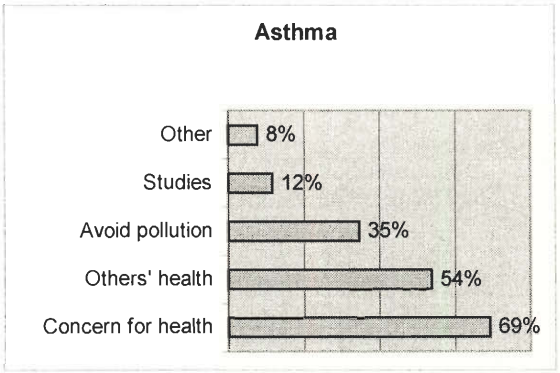


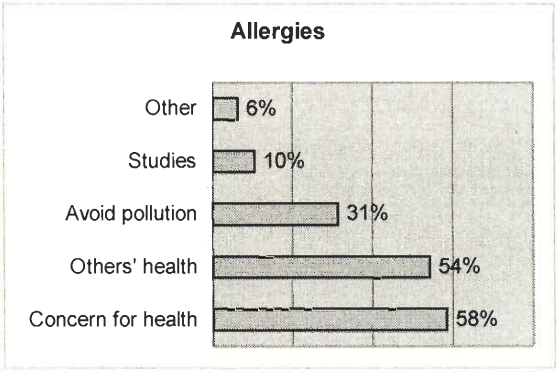


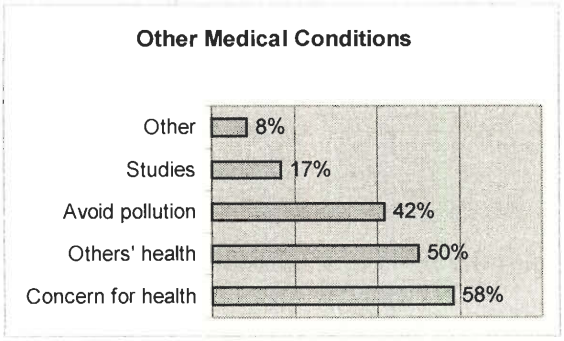




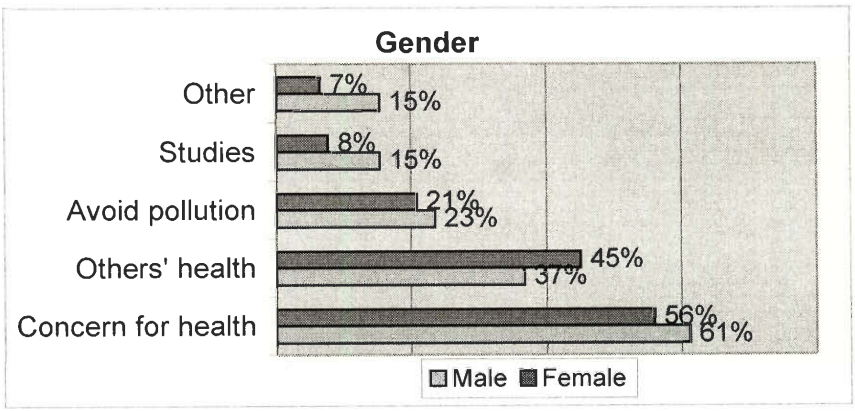
Reasons for being interested broken down by medical condition





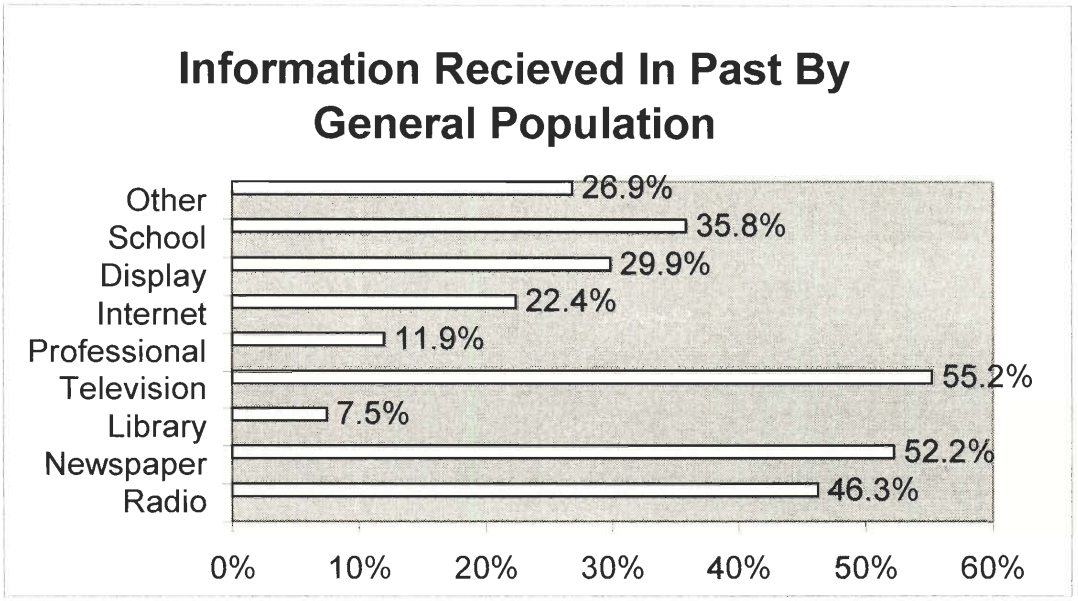


Reasons for being interested broken down by gender

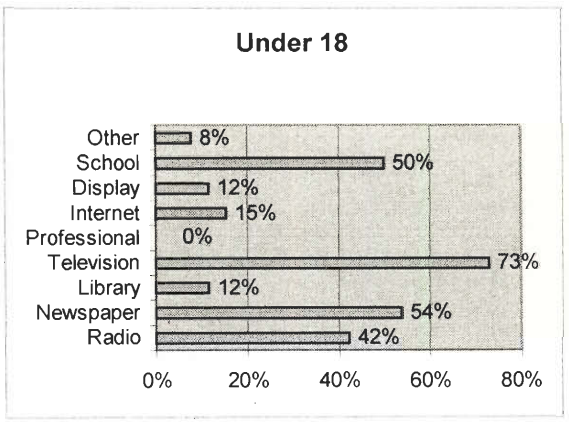


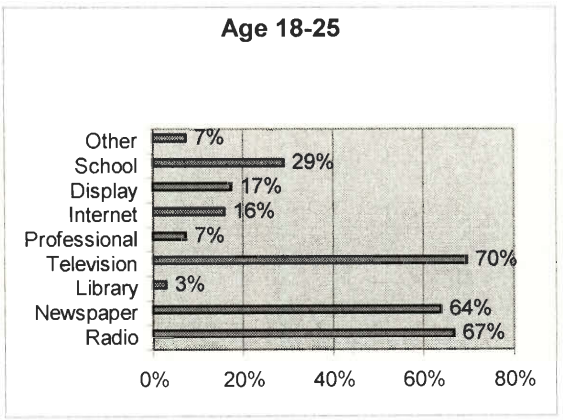
Question 2: Where have you obtained air quality information in the past?

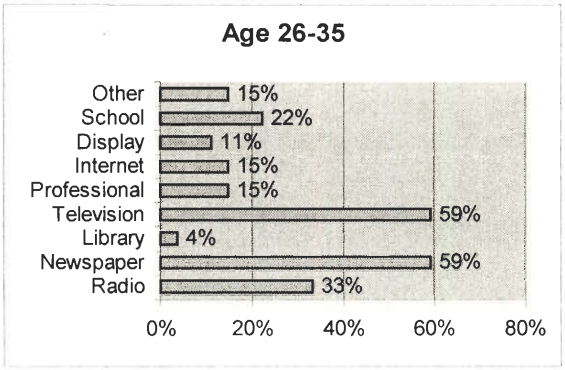
General Responses

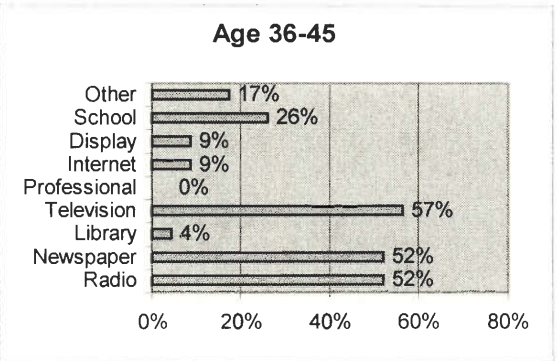


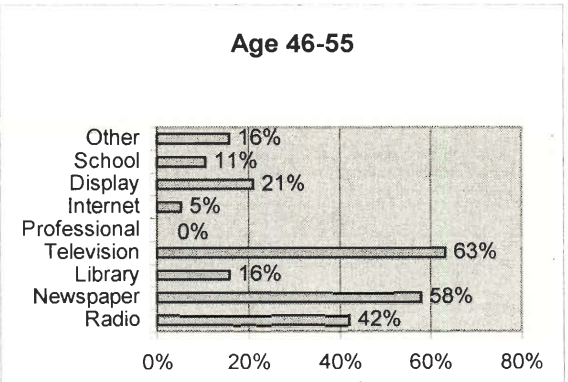
Responses by Age

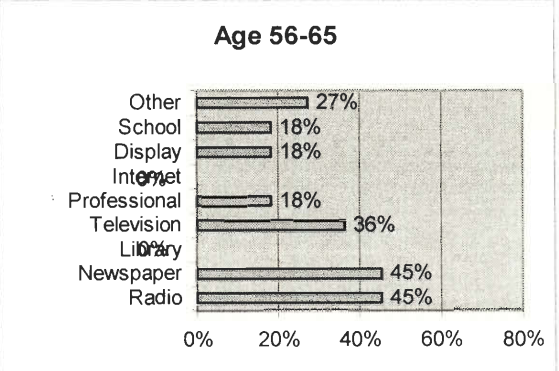


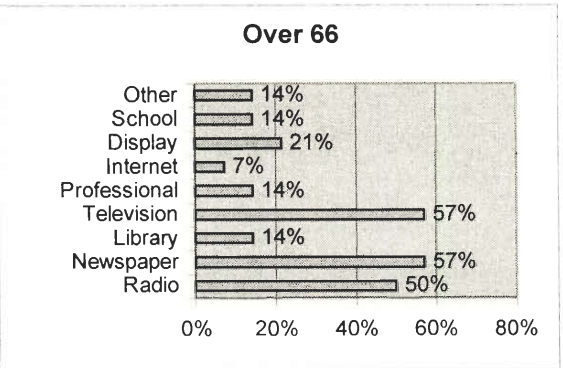




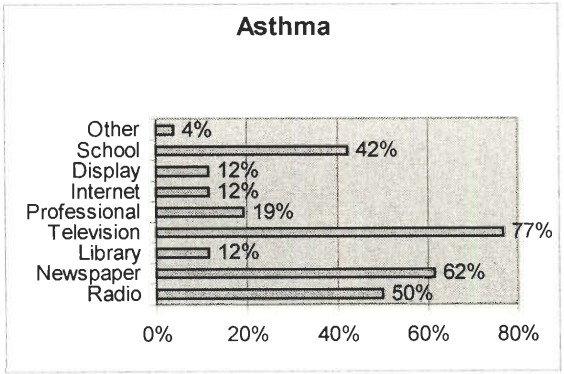


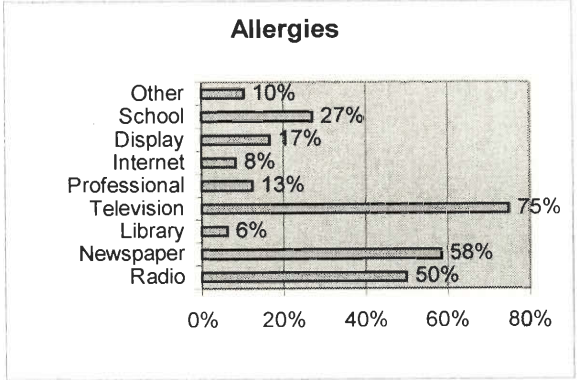


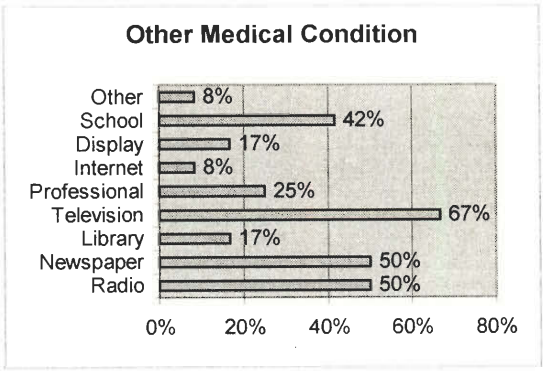




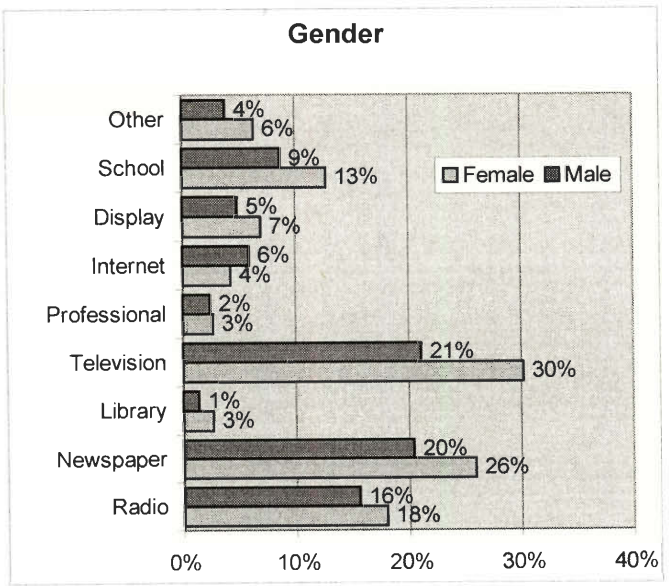
Responses by Medical Condition





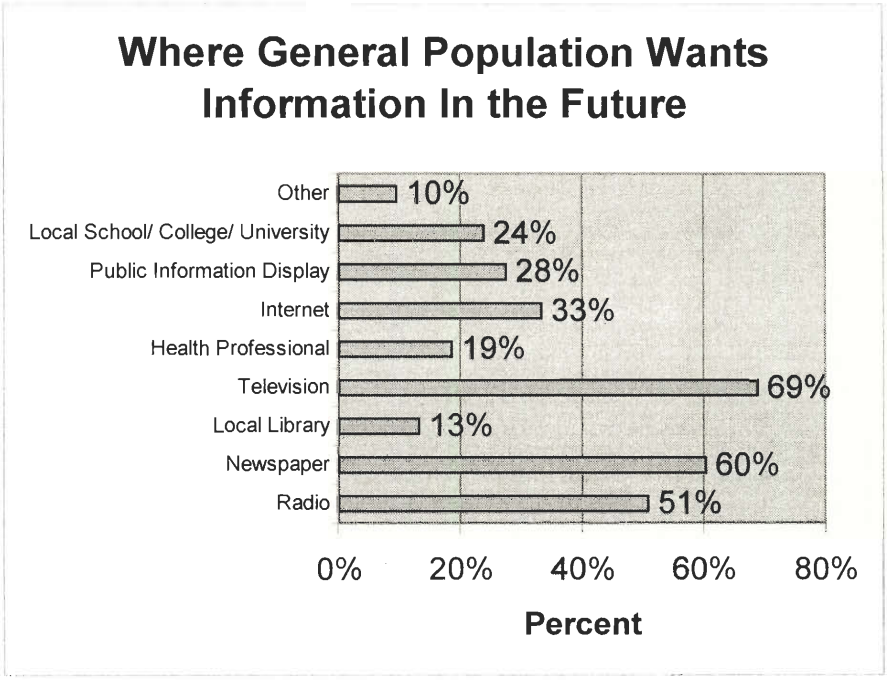


Responses by Gender

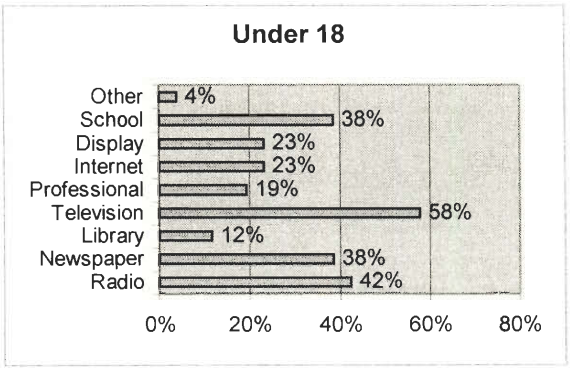


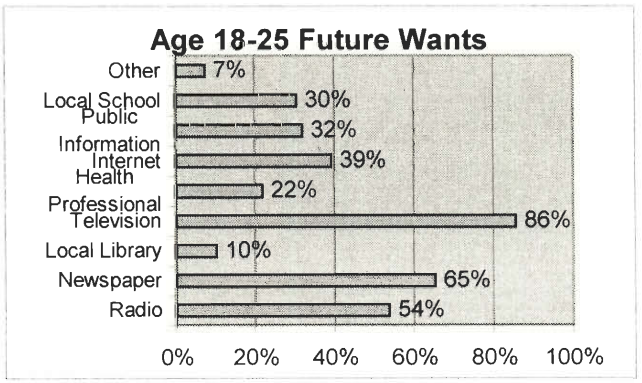
Question 3- Where would you prefer to obtain air quality information in the future?

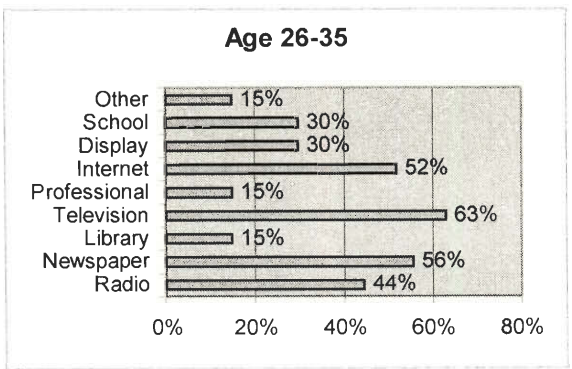
General Response

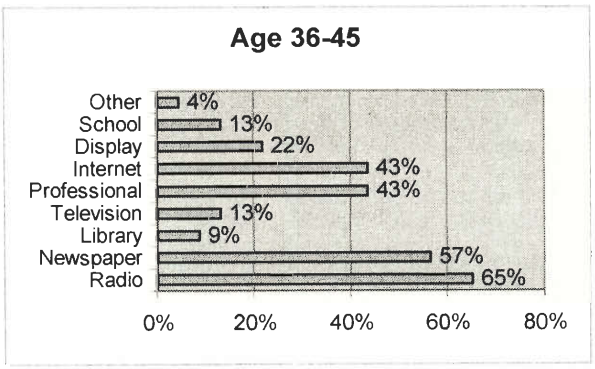


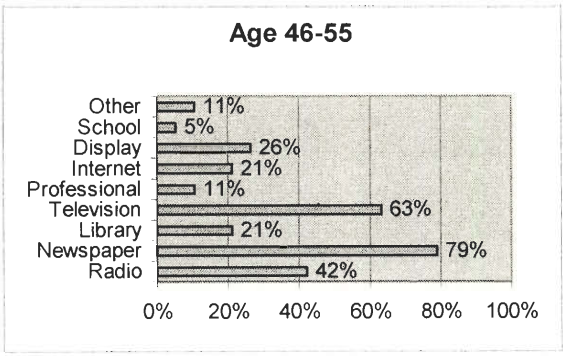
Responses by Age

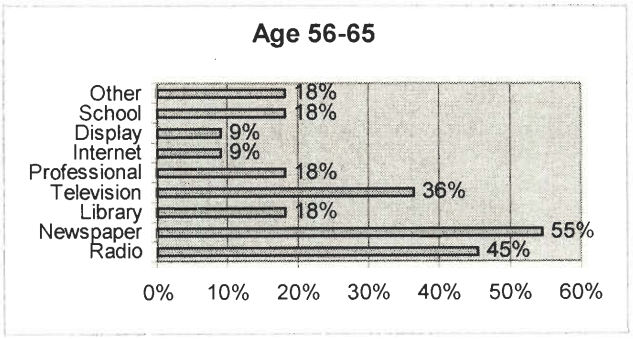


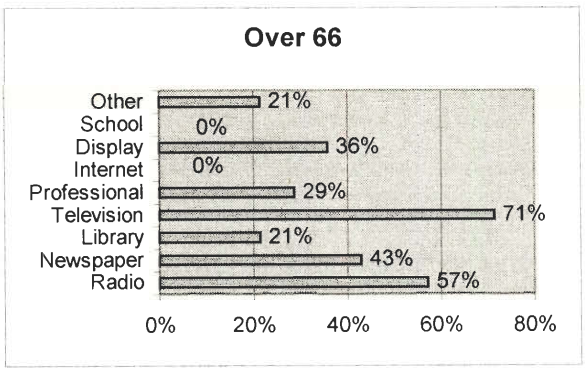




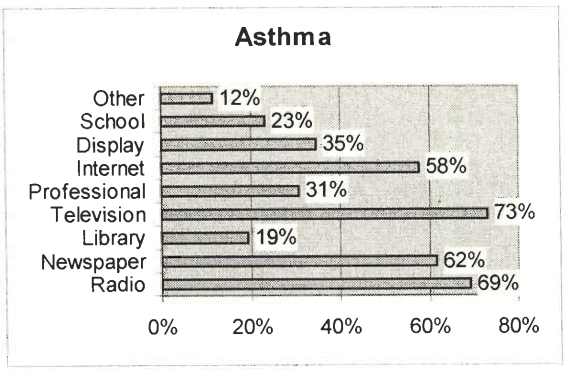


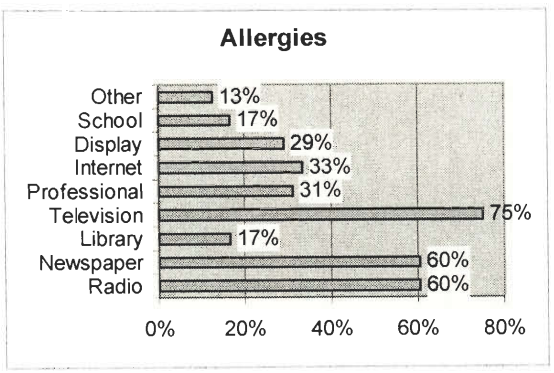


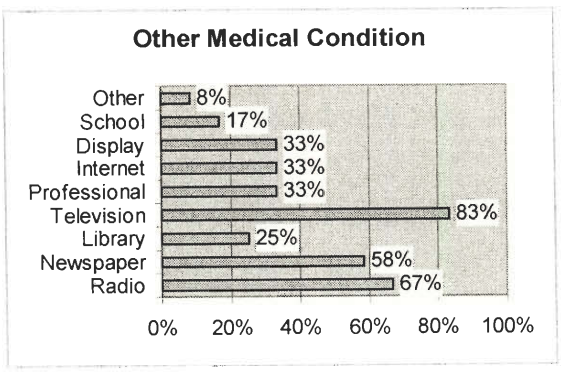




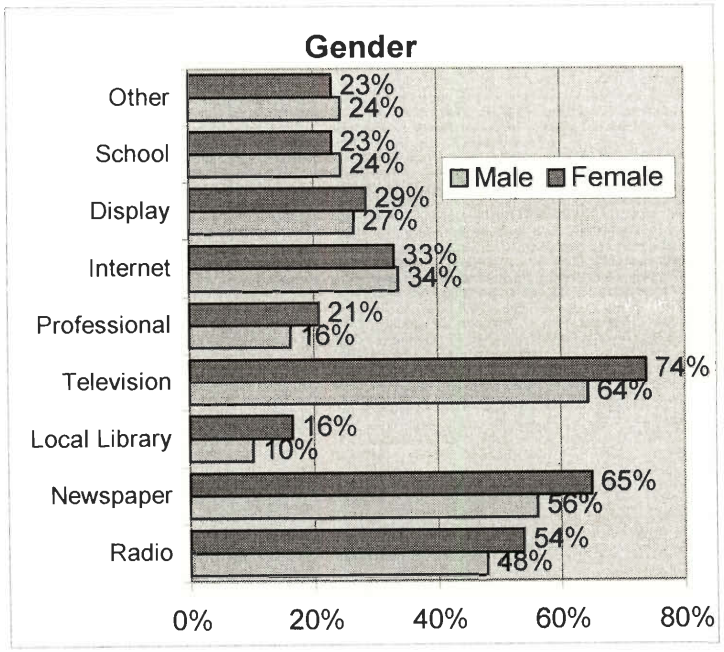
Responses by Medical Conditions



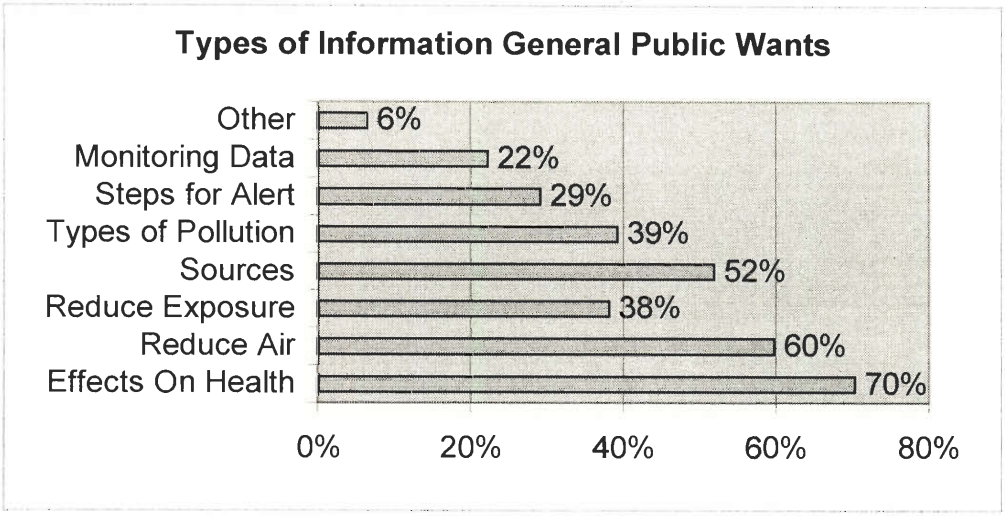




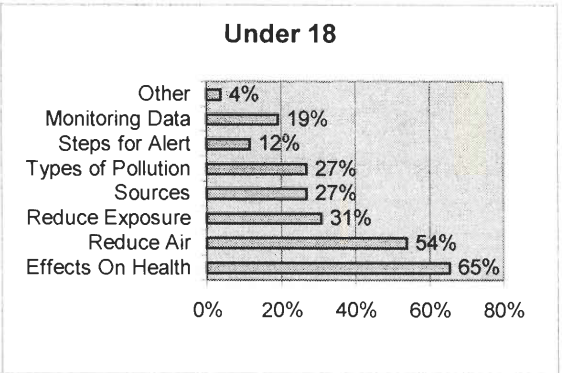
Responses by Gender

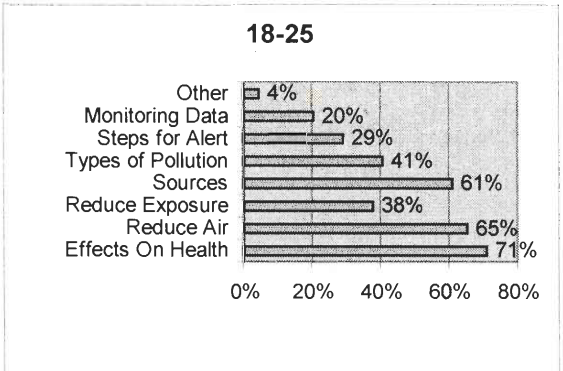


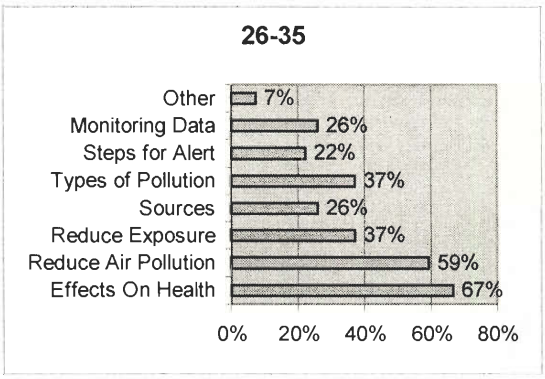
Question 4: What types of general air pollution information would you want to access?

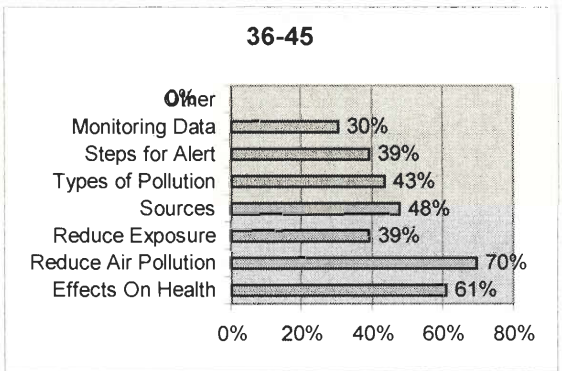


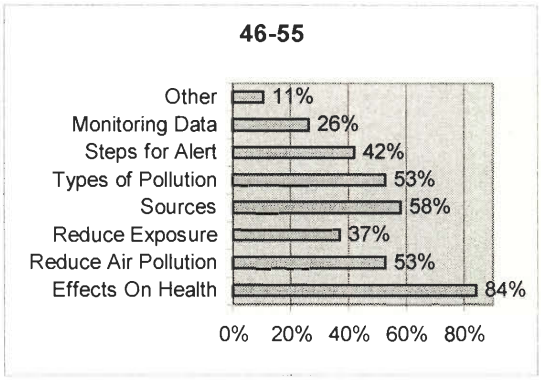
Responses by Age

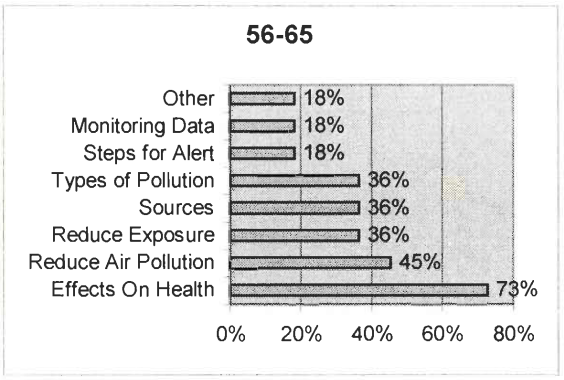


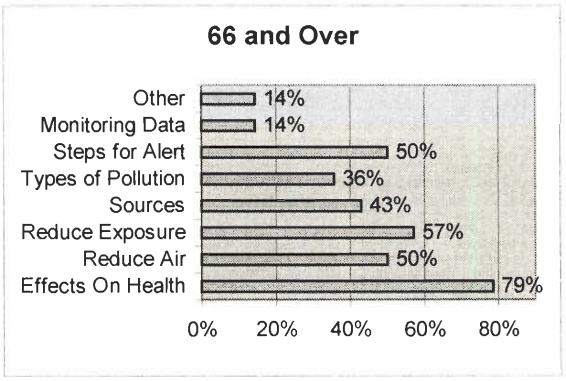




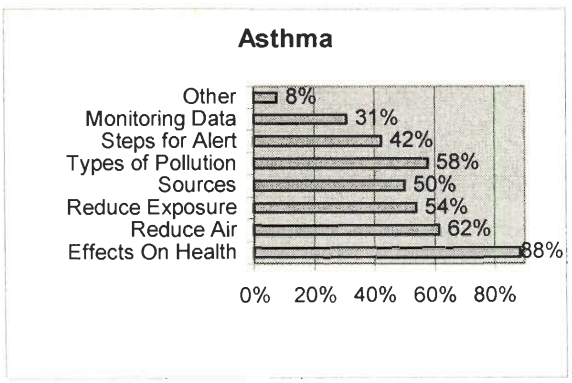


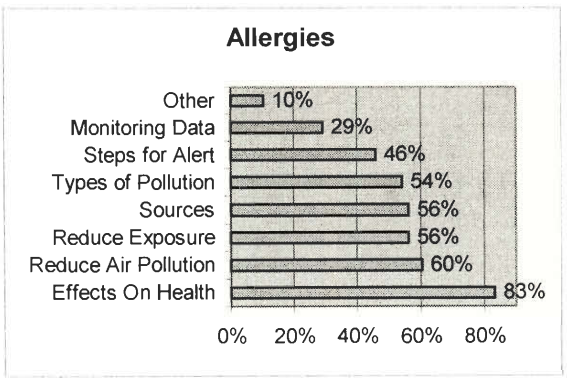


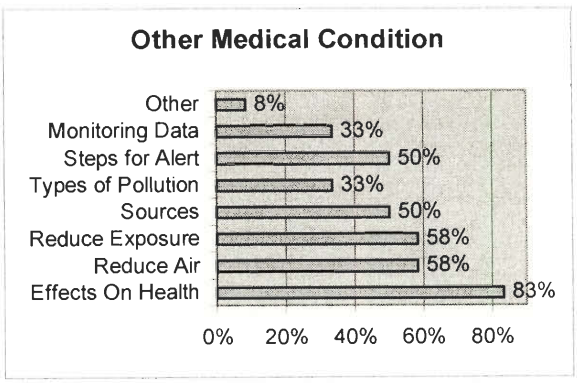




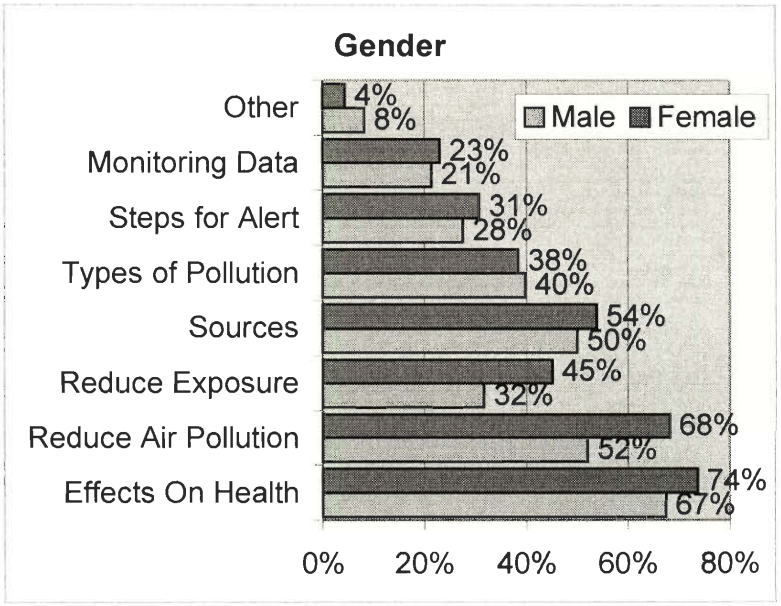
Responses by Medical Condition



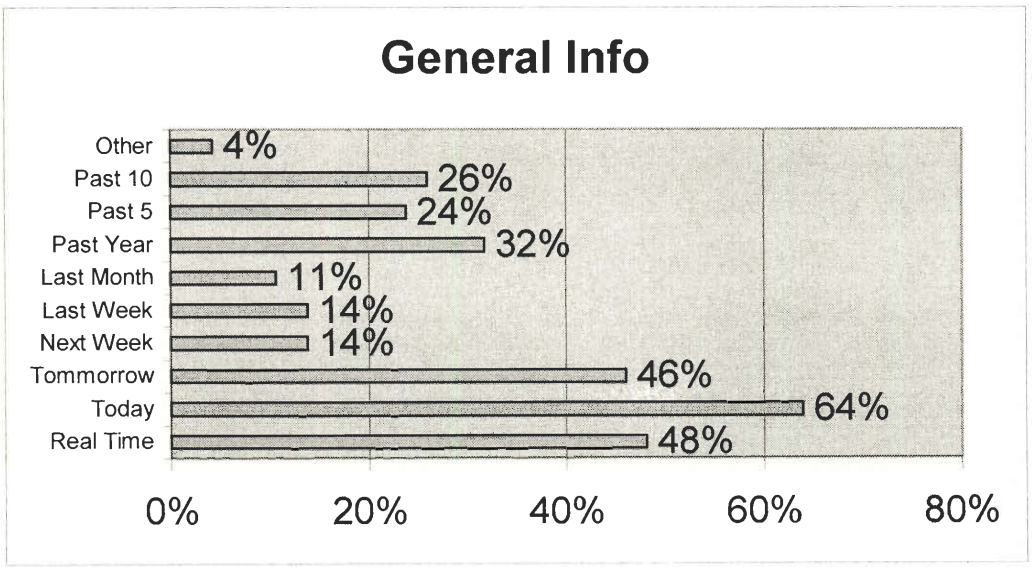




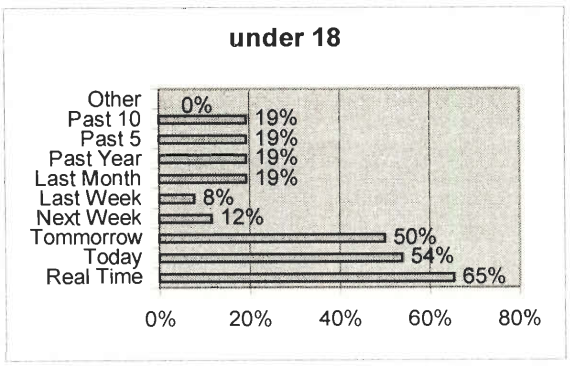
Responses by Gender

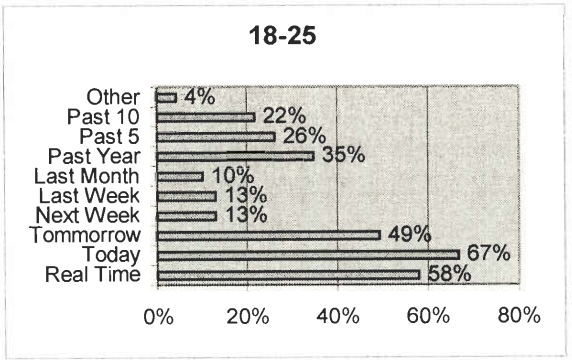


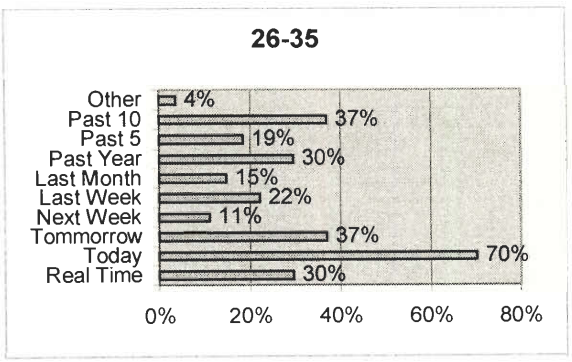
Question 5: How Detailed would you like the air quality information to be?

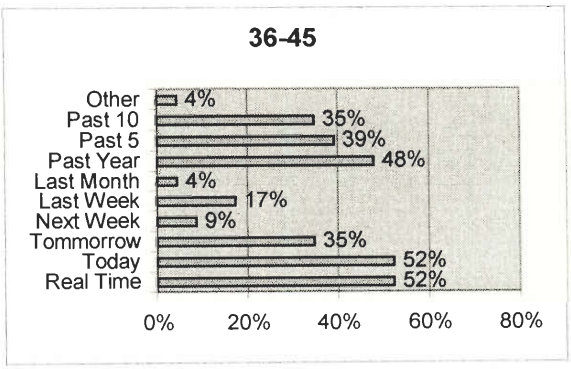


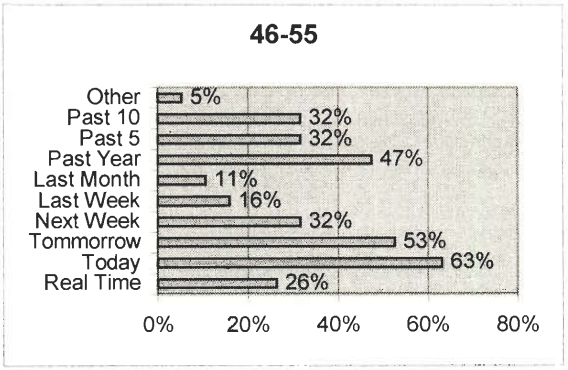
Responses by Age

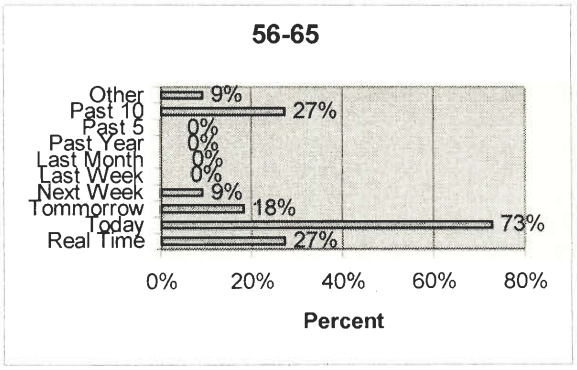


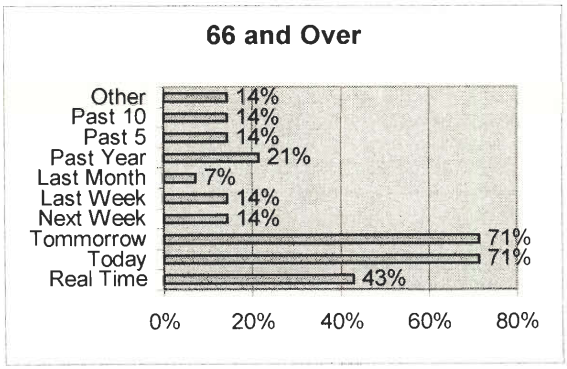




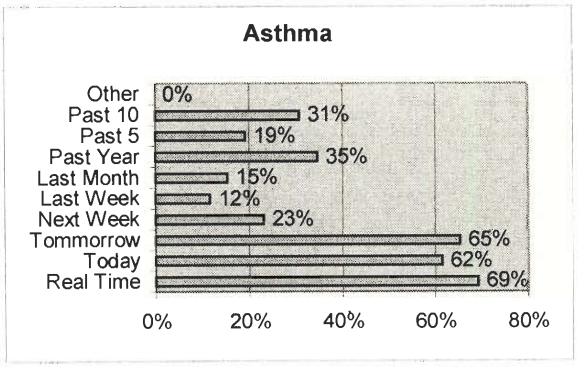


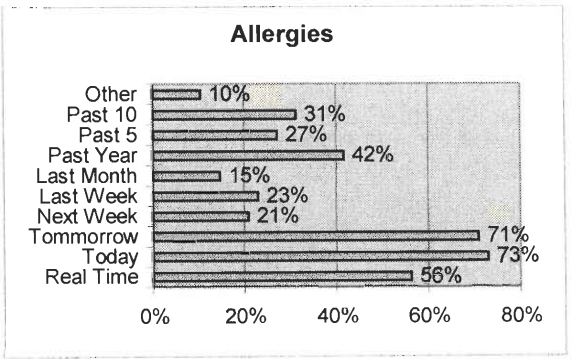


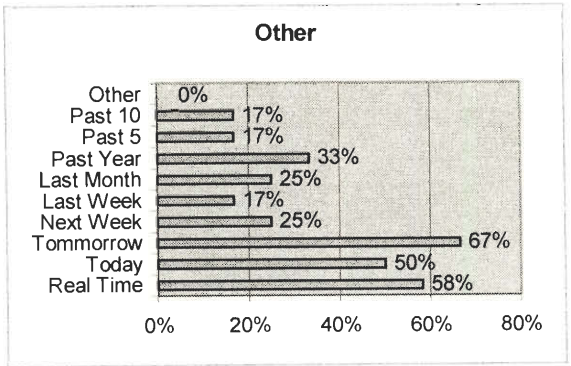




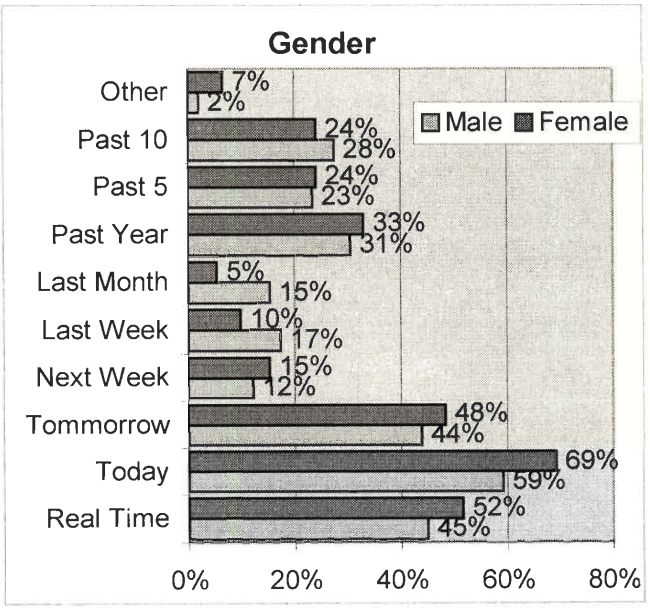
Responses by Medical Condition





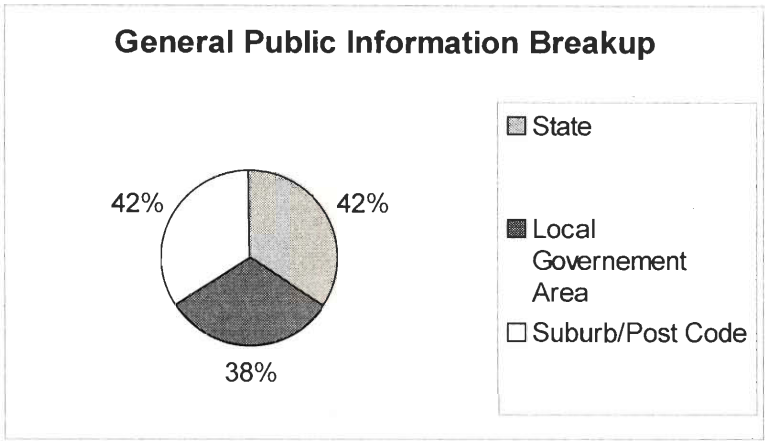


Responses by Gender

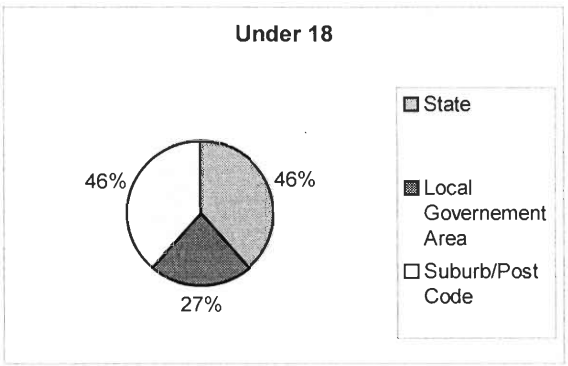


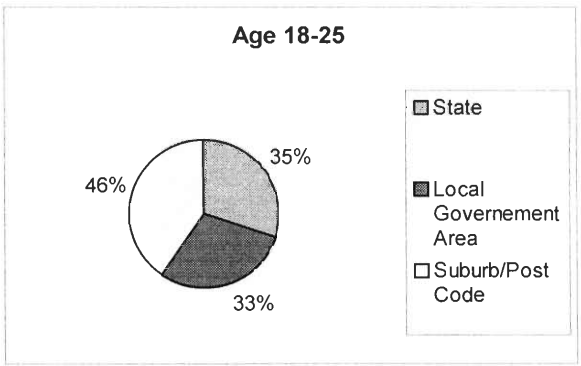
Question 6: How would you like this information broken down?

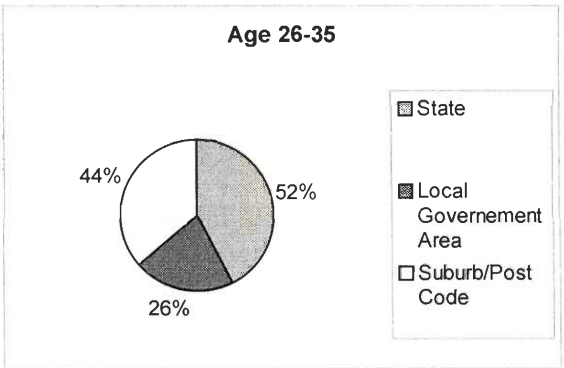
General Response

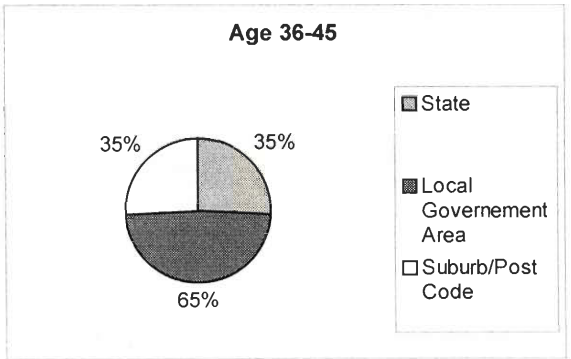


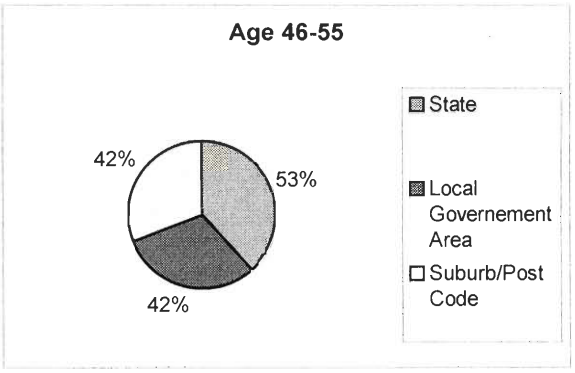
Responses broken down by Age

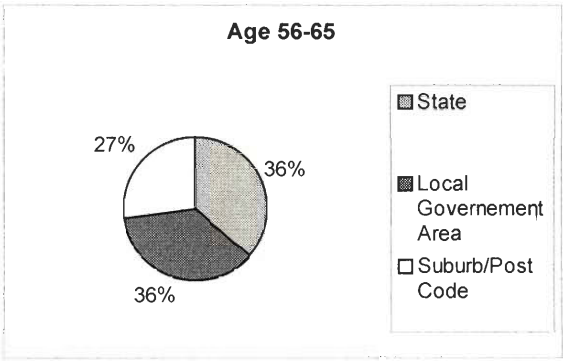


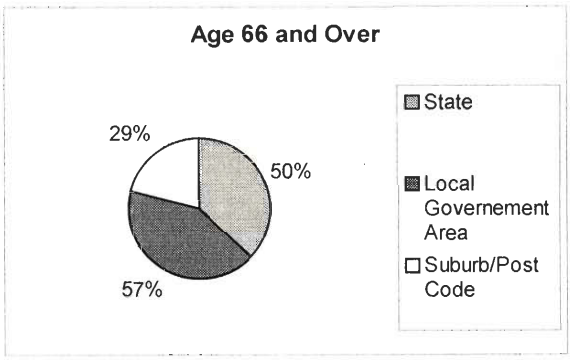




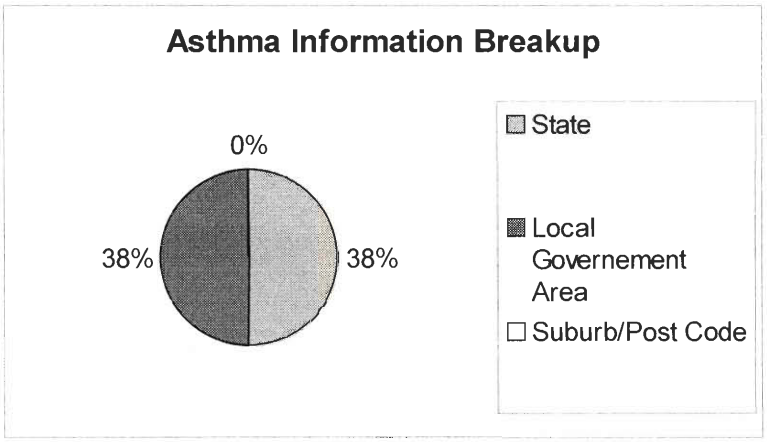


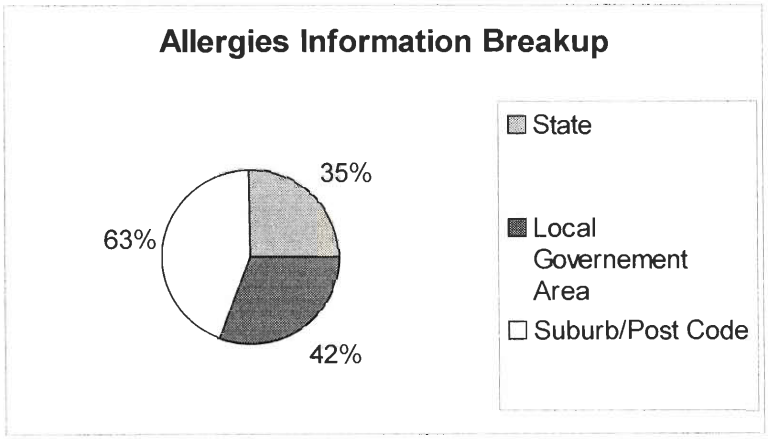

Age 46-55
42%
53%
42%
State
Local Governement Area
Suburb/Post Code

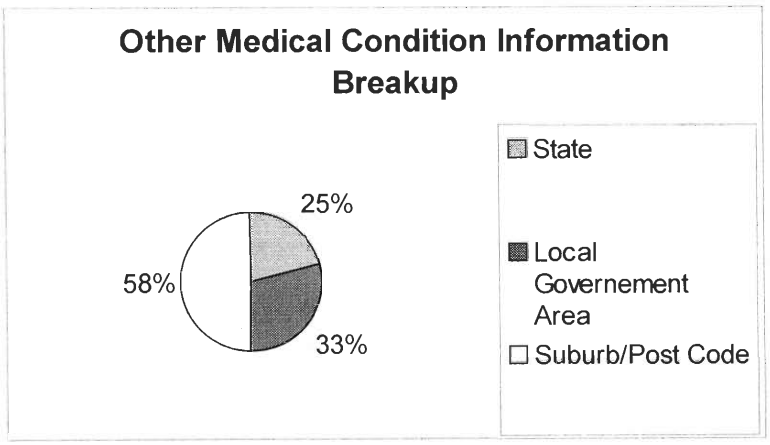

Age 56-65
27%
36%
36%
State
Local Governement Area
Suburb/Post Code


Age 66 and Over
29%
50%
57%
State
Local Governement Area
Suburb/Post Code

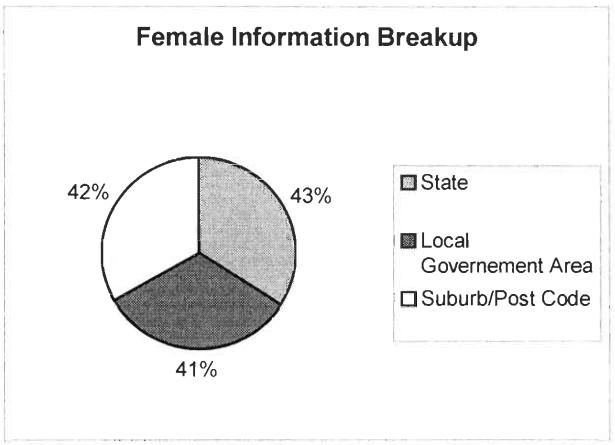
Responses by Medical Condition

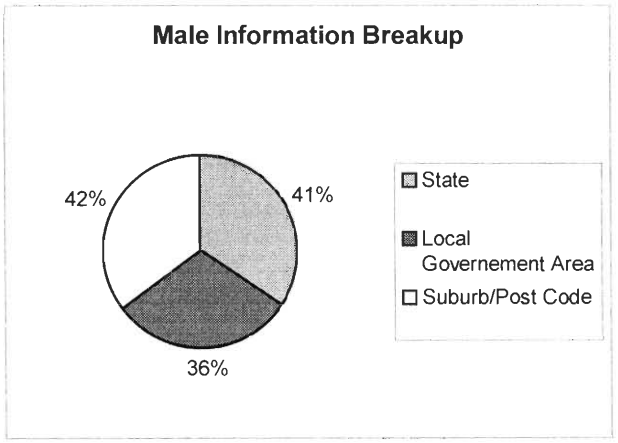






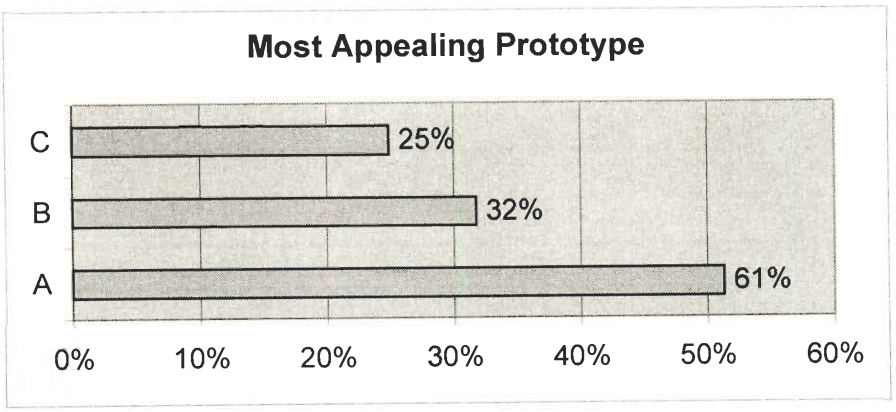
Responses by Gender



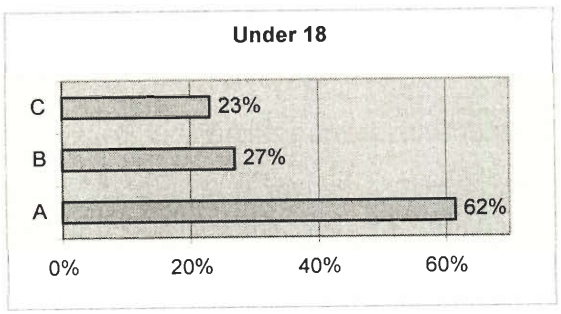


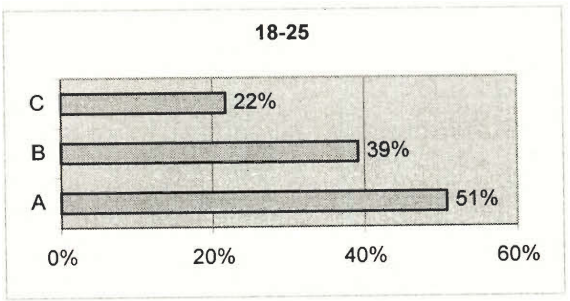
Question 7: Which figure appeals to you the most for displaying air quality information?

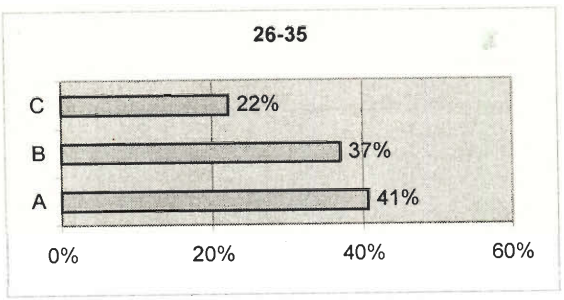
General Response

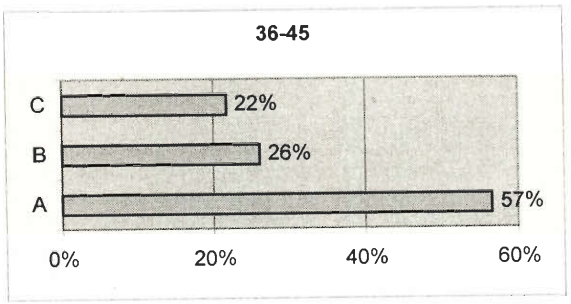


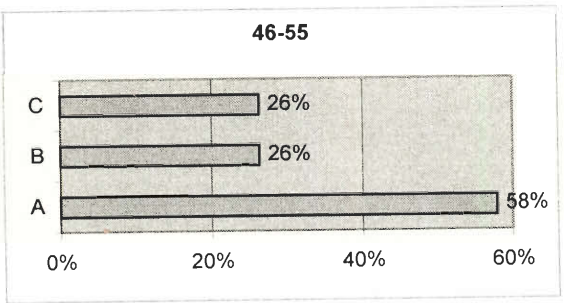
Responses by Age

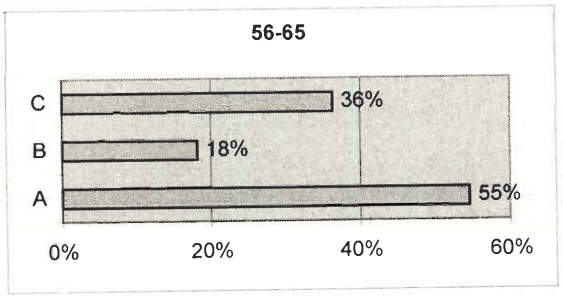


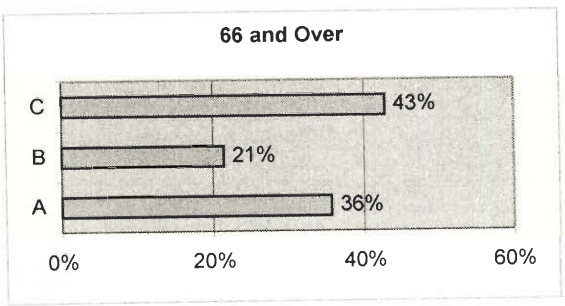




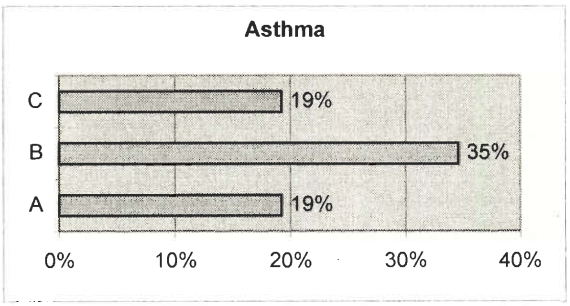


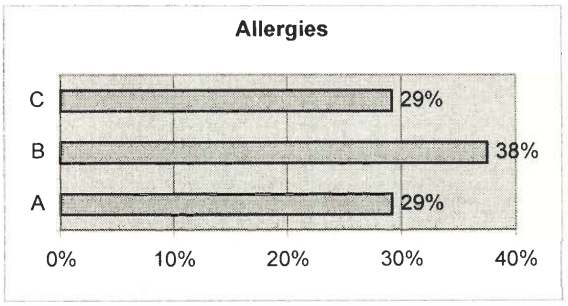


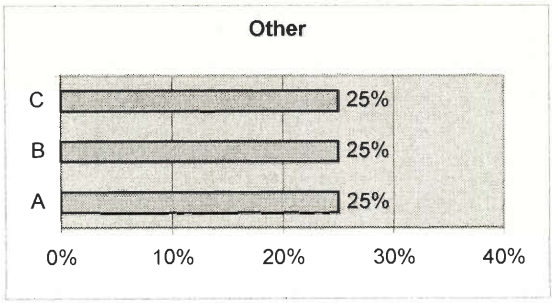




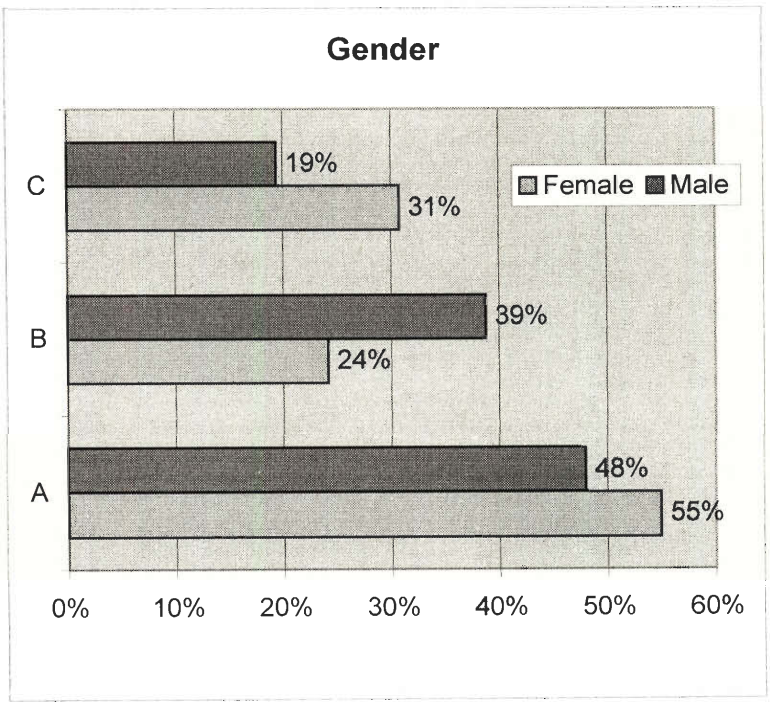
Responses by Medical Condition





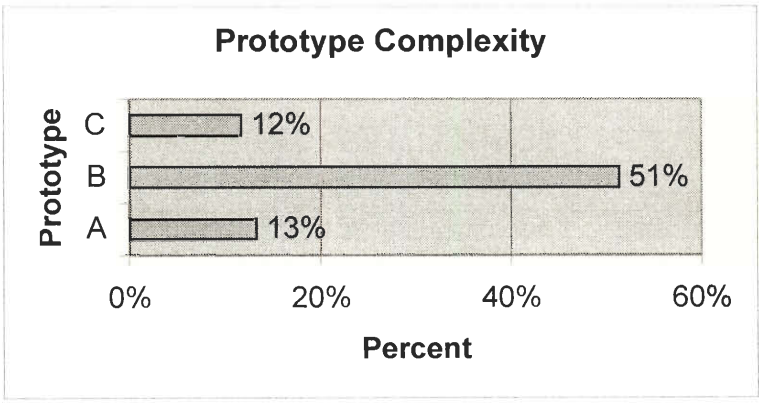


Responses by Gender

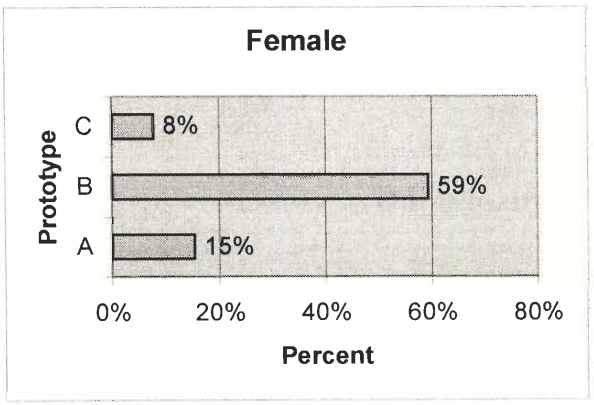


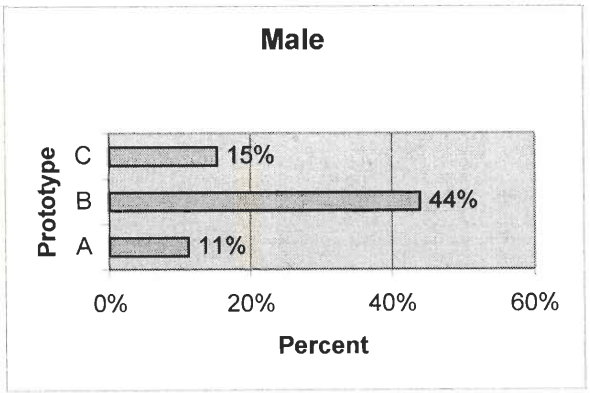
Question 8. Which figure(s) are to complex to understand?

Overall response

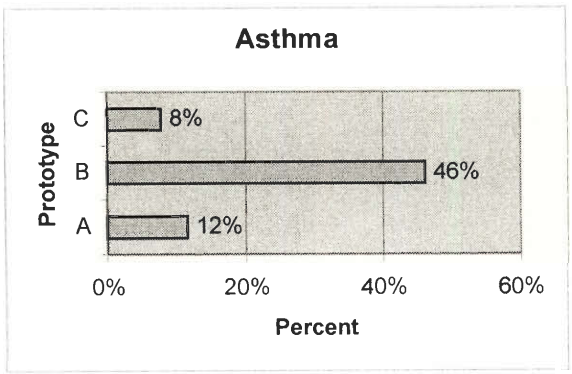


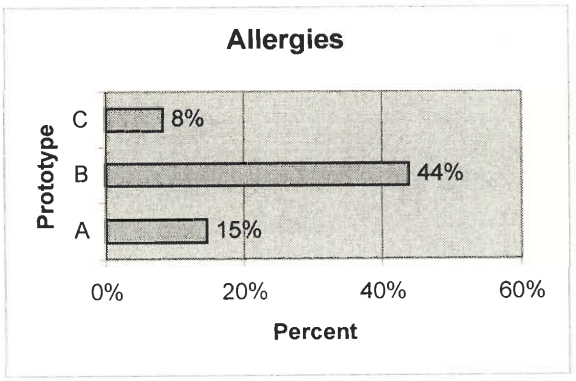
Responses by Gender

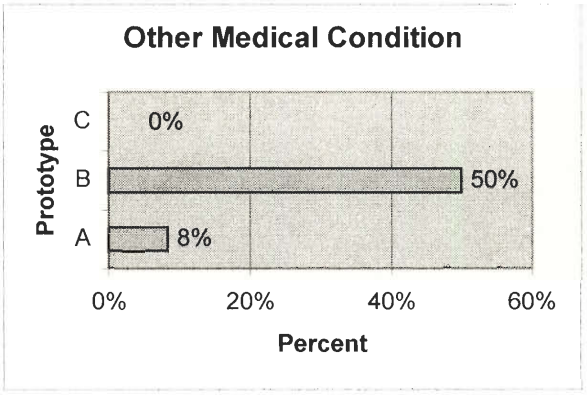


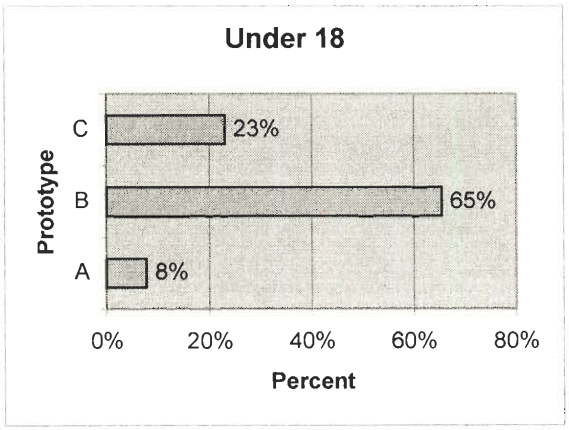


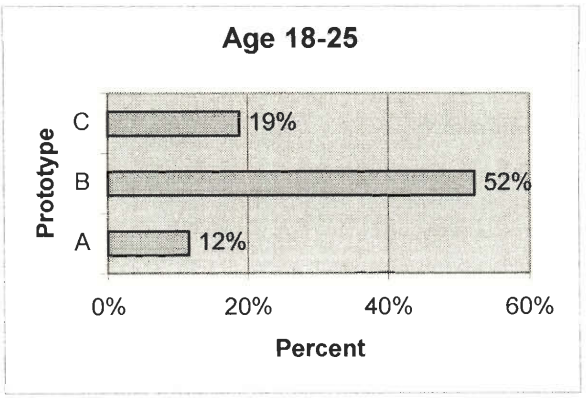
Responses by Medical Conditions






Other Medical Condition
Prototype
C
B
A
0%
50%
8%
0%
20%
40%
60%
Percent


Under 18
Prototype
C
B
A
23%
65%
8%
0%
20%
40%
60%
80%
Percent


Age 18-25
Prototype
C
B
A
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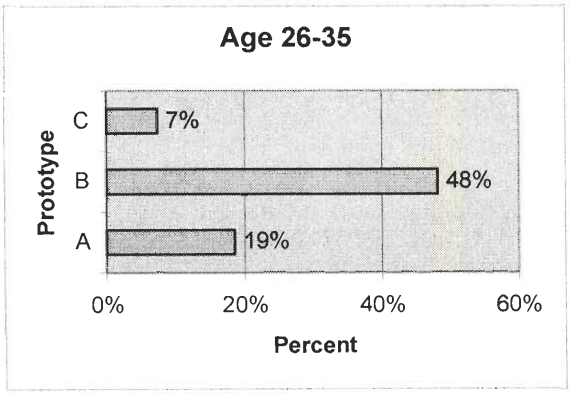
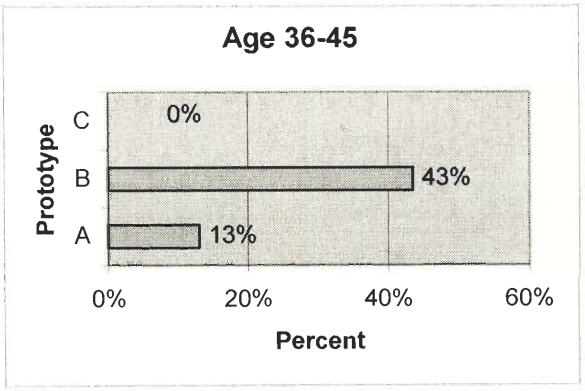
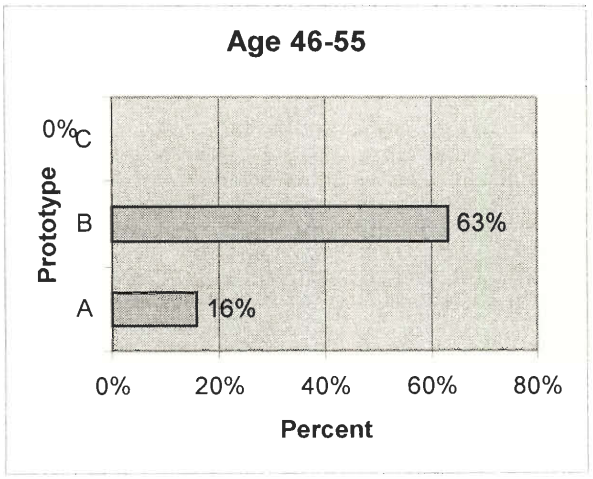
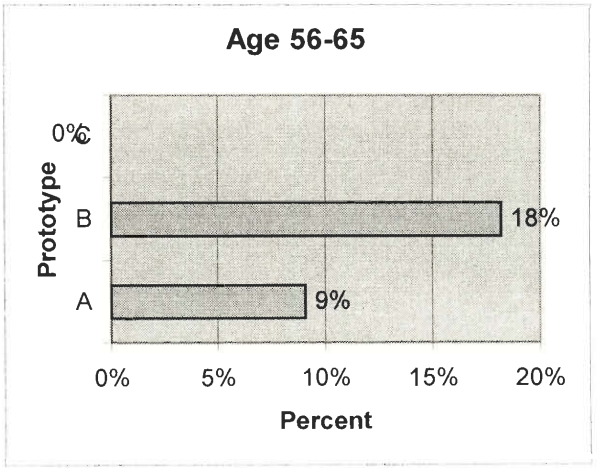
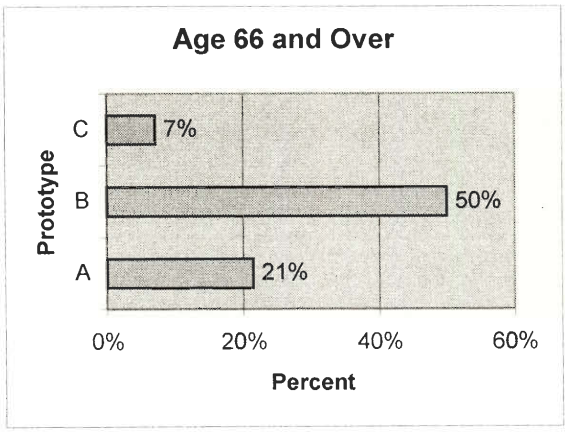
52%
12%
0%
20%
40%
60%
Percent


Age 26-35
Prototype
C
B
A
7%
48%
19%
0%
20%
40%
60%
Percent

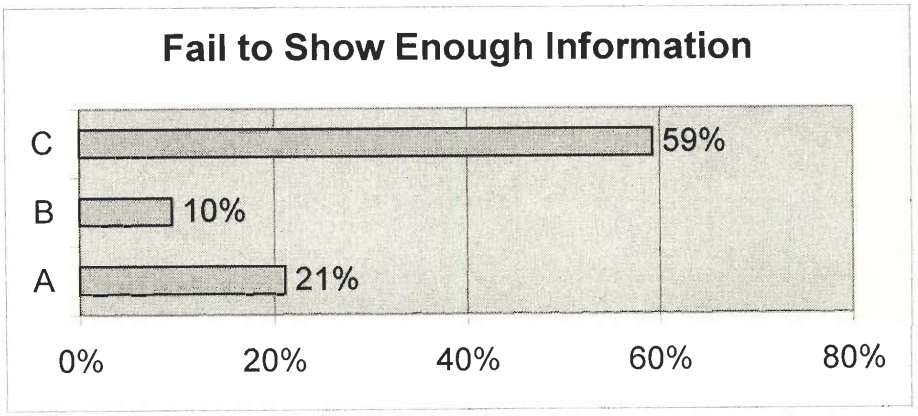

Age 36-45
Prototype
C
B
A
0%
43%
13%
0%
20%
40%
60%
Percent


Age 46-55
0%
C
B
63%
A
16%
Prototype
0%
20%
40%
60%
80%
Percent

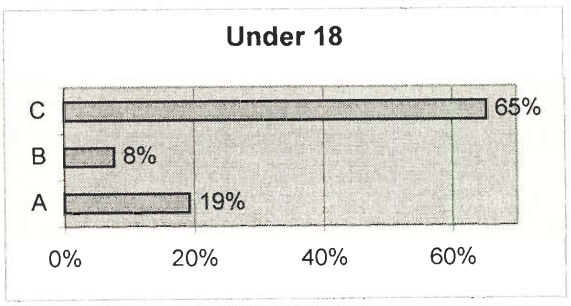

Age 56-65
0%
C
B
18%
A
9%
Prototype
0%
5%
10%
15%
20%
Percent

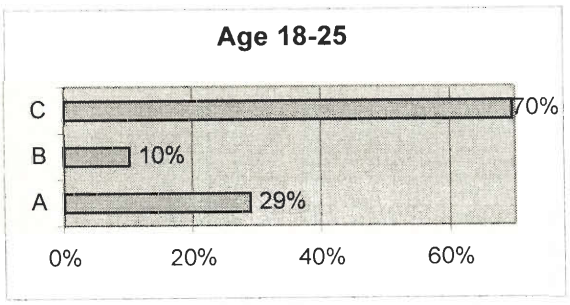

Age 66 and Over
C
7%
B
50%
A
21%
Prototype
0%
20%
40%
60%
Percent

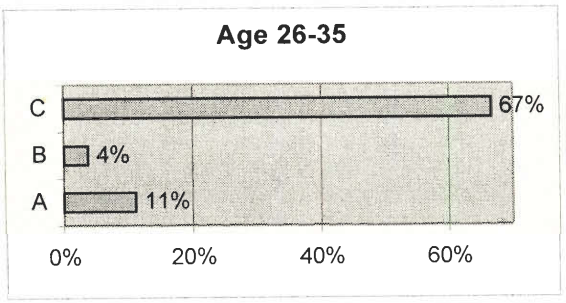
Question 9: Which figures fail to show all information needed?

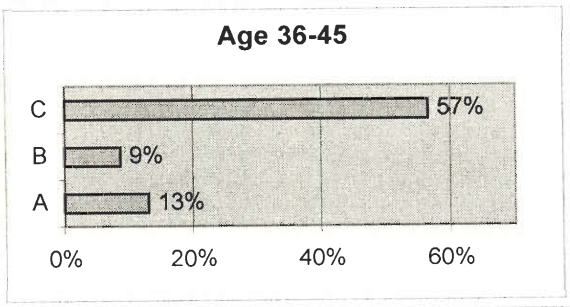


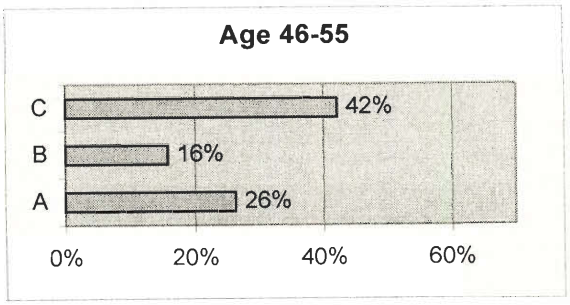
Responses broken down by age

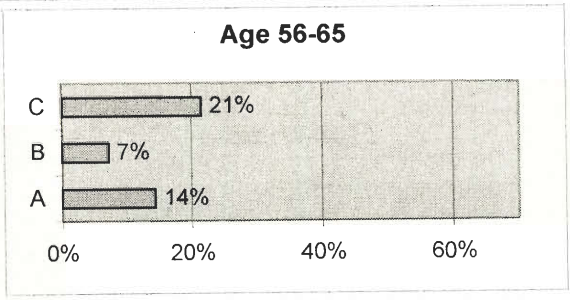


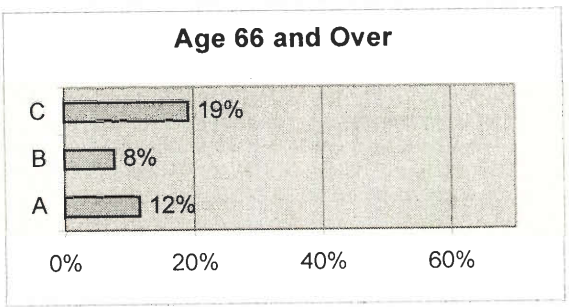




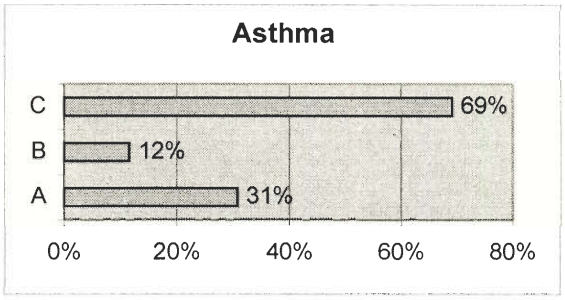


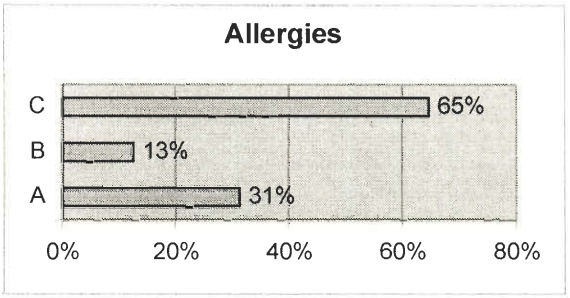


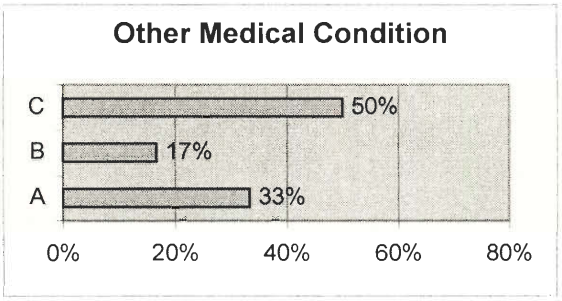




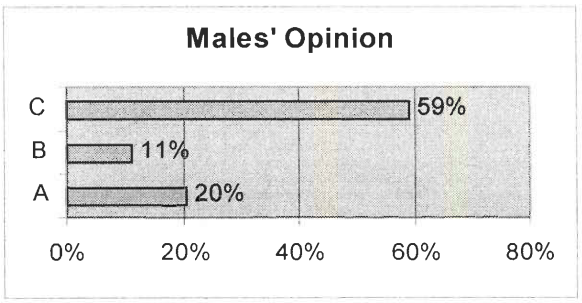
Responses broken down by Medical Conditions

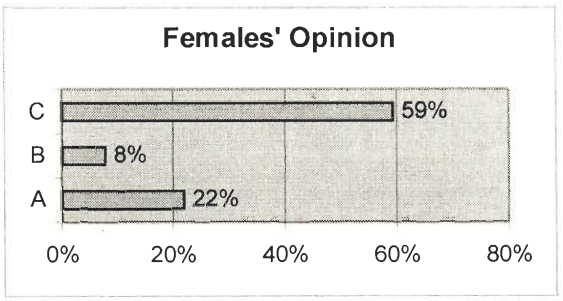




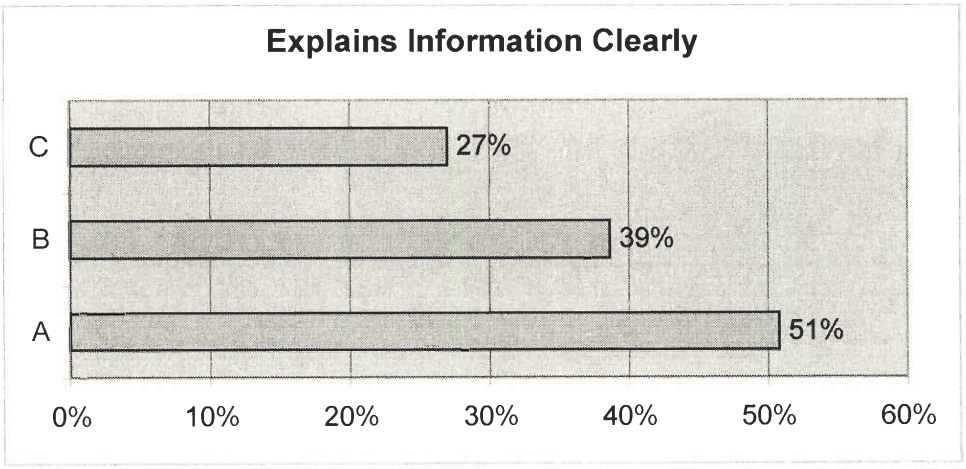


Responses broken down by gender.

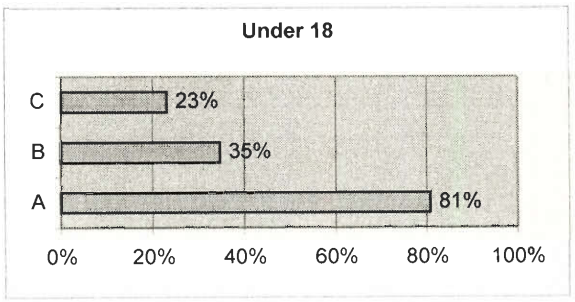


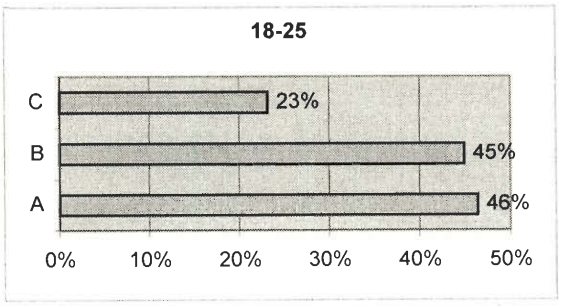


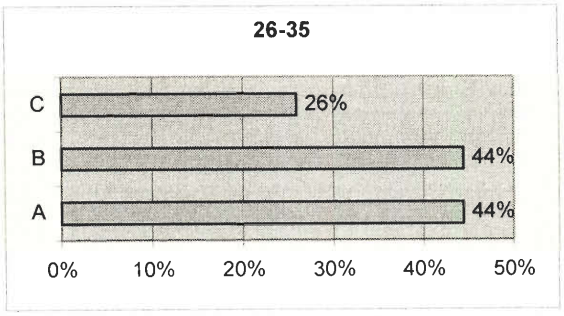
Question 10: Which figure explains the information clearly?

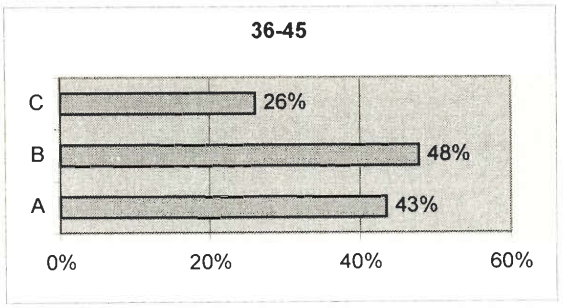


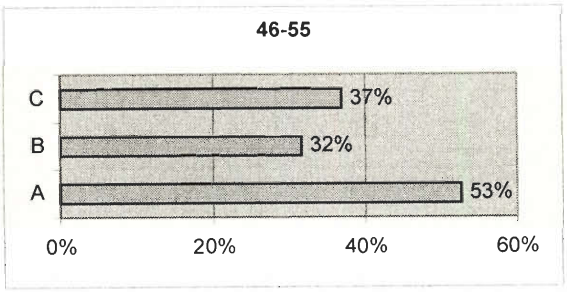
Responses by age

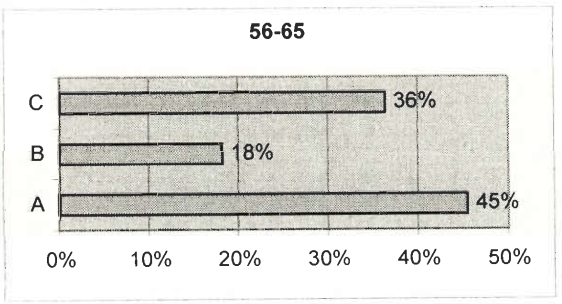


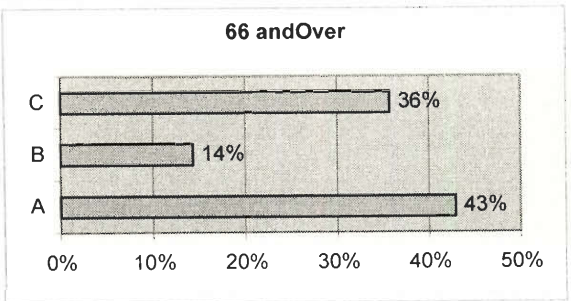




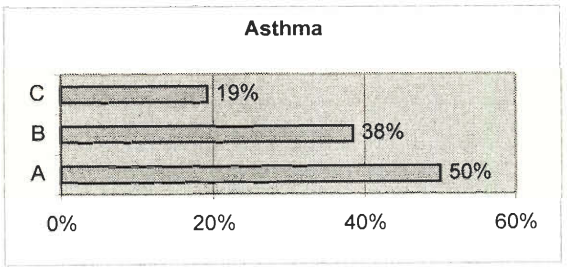


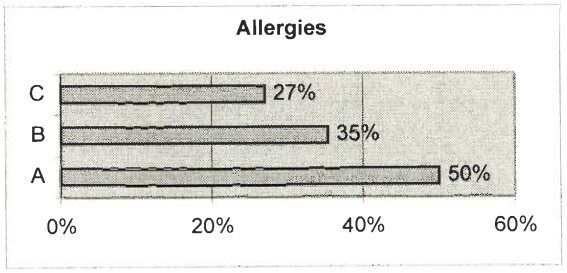


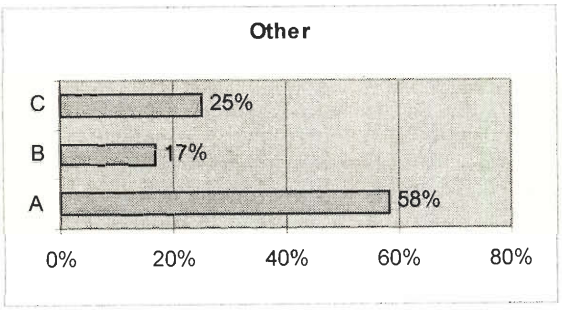




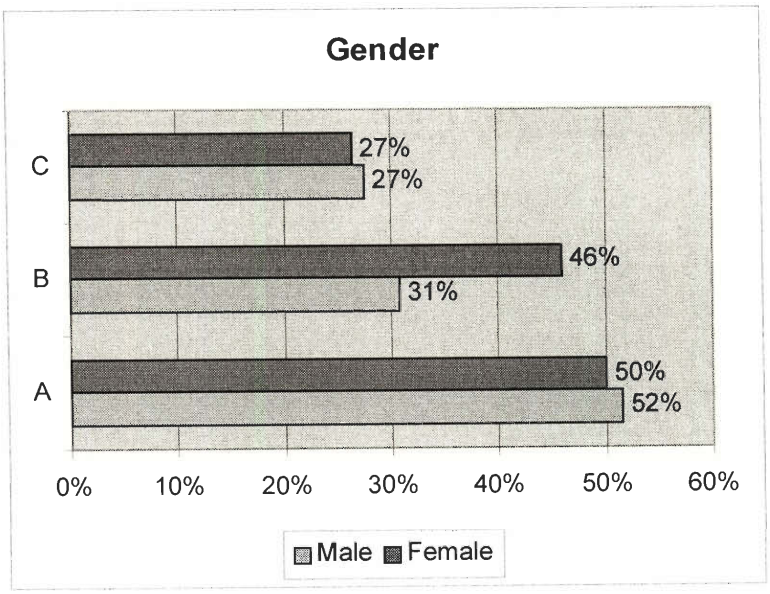
Responses broken down by Medical Conditions





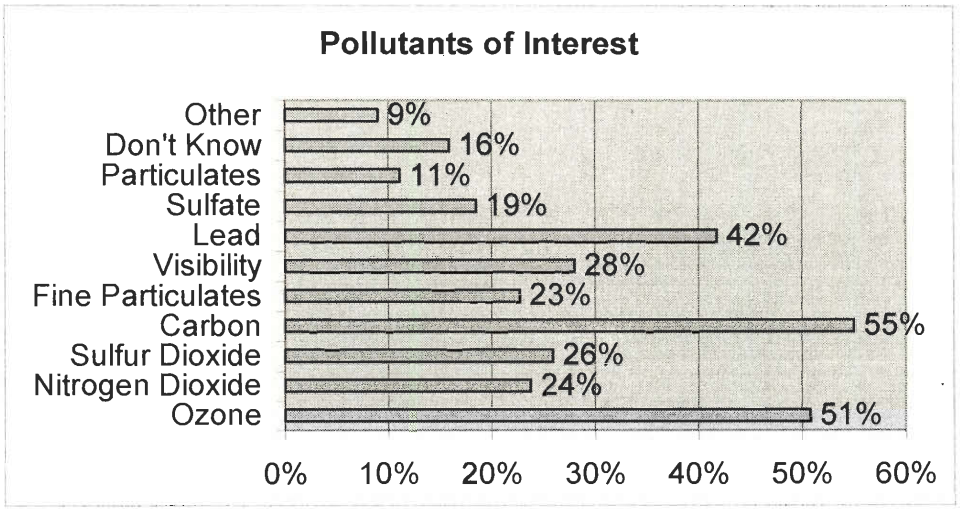


Responses by gender

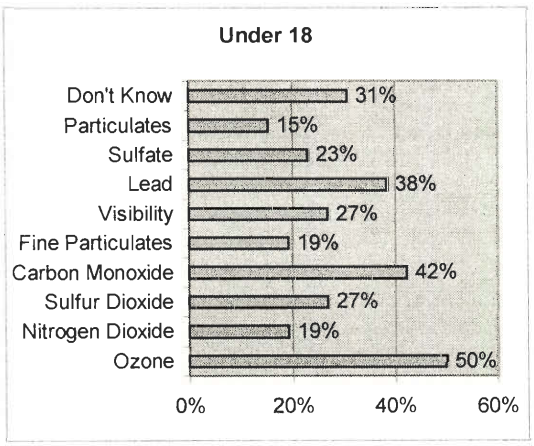


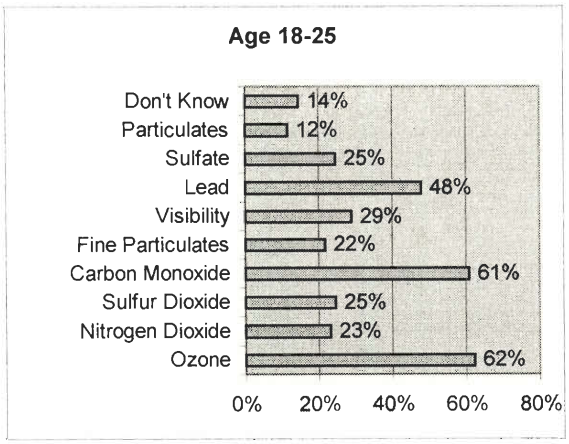
Question 12: What pollutants are you interested in obtaining information about?

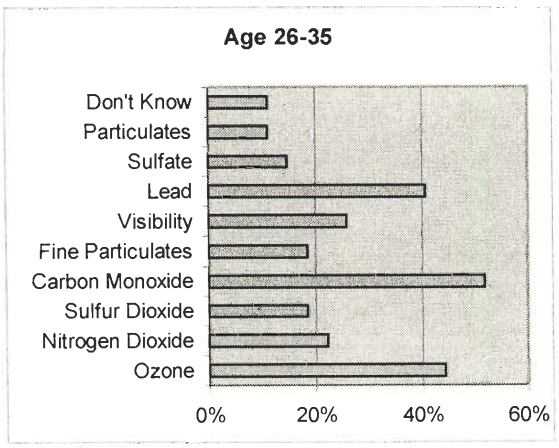
General response

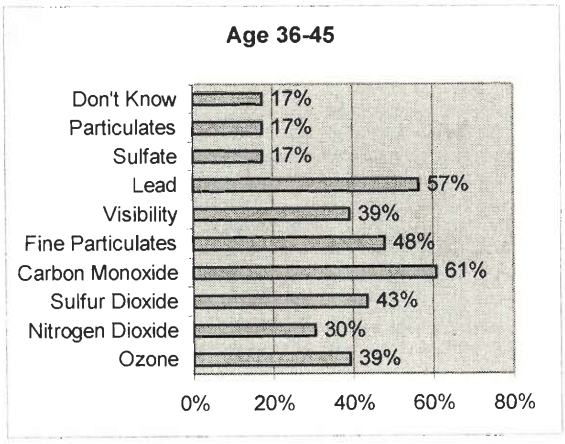


Responses broken down by age

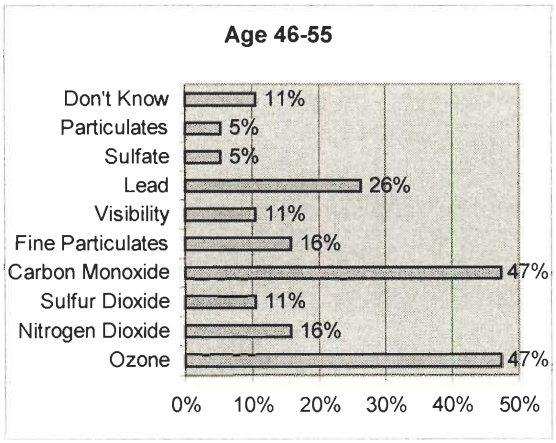


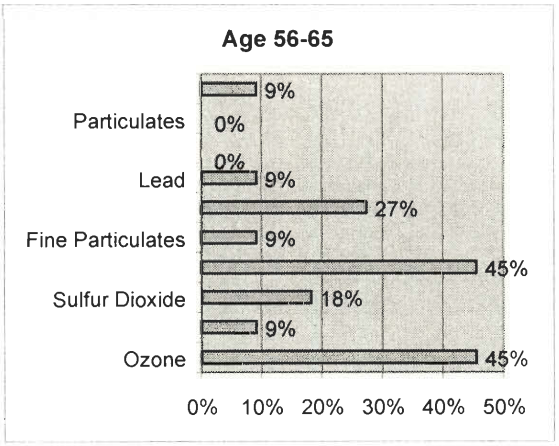


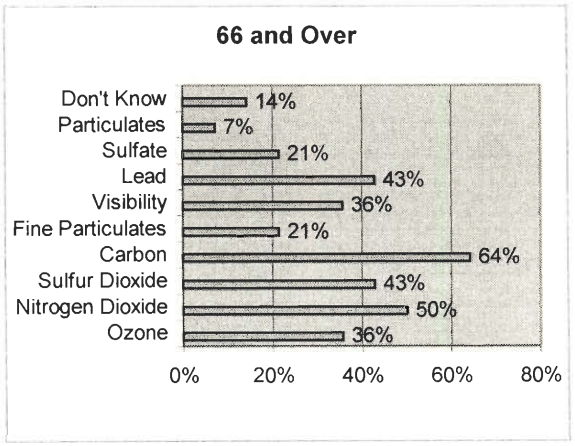




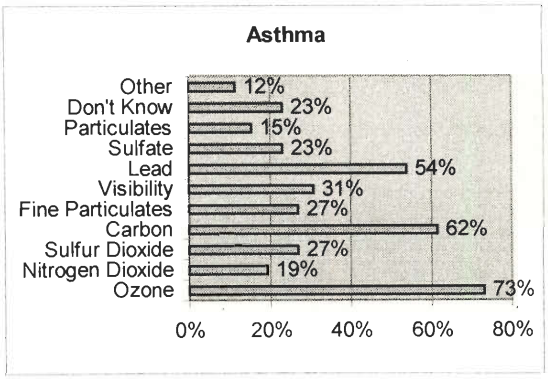
Responses broken down by age

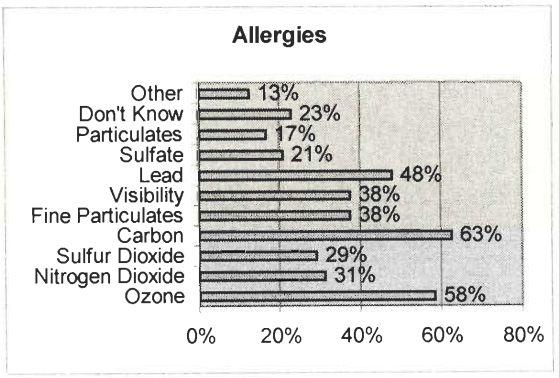


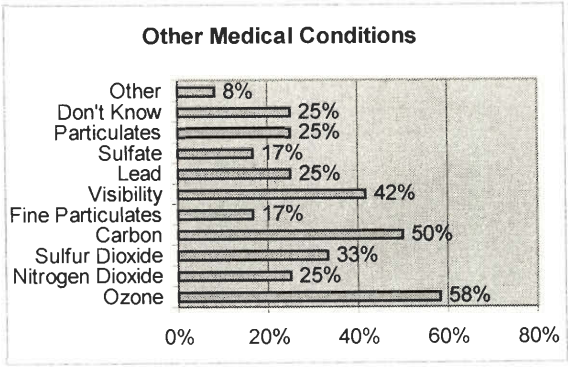




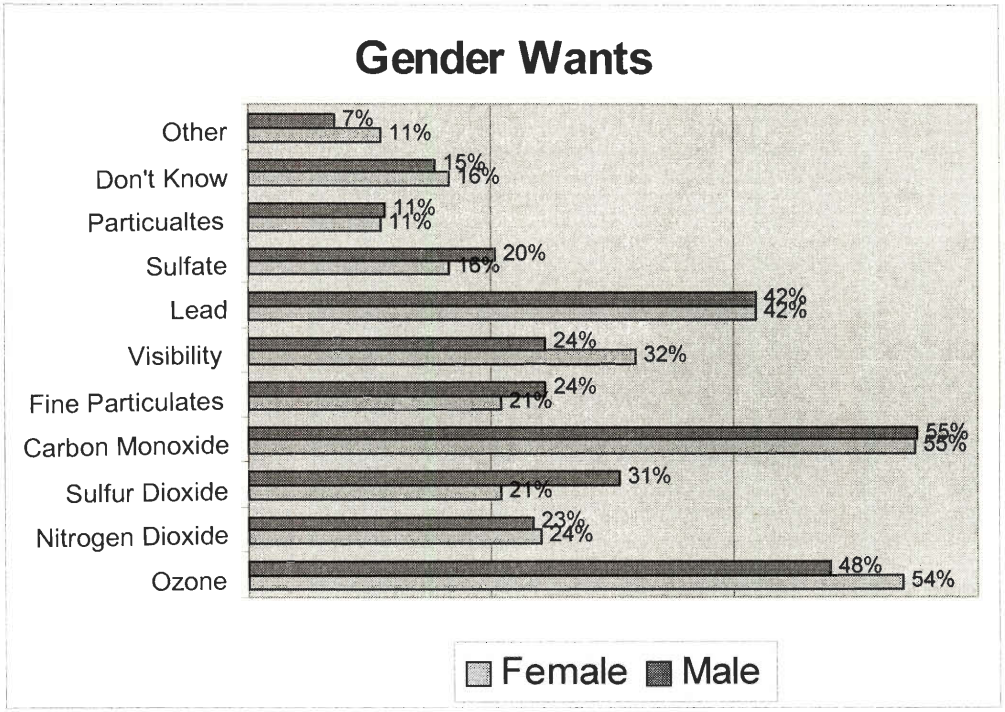
Responses by medical conditions







Response By Gender:



APPENDIX E: INTERVIEW NOTES

Date: 4/19/00
Organisation: Altona Community Group
Contact: Nessie Hardy

The Altona Community Group started out of concerns about the chemical companies that worked in the area. The group was formed when a social club preposed to be built close to an industrial site was opposed by the companies. The area of Altona houses more blue-collar workers and industry than other areas of Melbourne. The industry asked the council to rezone a buffer area around the industrial complex. As concern in the community started to grow the major companies started holding meetings to address the concerns. During this process the EPA was felt to be unhelpful and hard to contact.

As the community became more active their relationship with the EPA improved. They feel the EPA is more helpful and accessible than in the past. One complaint is that contacting them after working hours is hard and frustrating.

The EPA's presentations have recently been very well thought out and more professional. They contain information that is meaningful and follow up on problems from past meetings.

Frustration arises when the EPA makes patronising and broad statements such as, "we will look into it", "the levels aren't that bad", or "it's nothing to worry about". Problems have arisen when complaints have been called into the complaint line. During the next meeting the presenters had the facts and figures wrong about the number and types of complaints. Residents have turned to the hotline set up by the companies to report problems.

It was felt that the EPA sometimes does not focus on the big picture. As an example, City Link produced levels under limits; however filters could be put in place to help reduce pollution. Dealing one-on-one with EPA officials is very helpful and useful, however dealings with the EPA as an organisation are somewhat frustrating. The EPA should be more involved in the planning of major projects and advising on the environmental effects.

Date: 6/4/00
Organisation: Air Watch
Contact: Margot Finn

AirWatch is a joint venture between several organisations focusing on education at the school level. The National Heritage Trust (NHT) funded this program. However, funding will not be continued into next year. AirWatch has approximately 150 eastern schools involved and Finn presented at 40 workshops last year.

AirWatch is mainly interested in education and creating a program for students. AirWatch provides opportunities for schools to monitor their environment. The monitoring can be broken down into two levels. Level 1 monitors social trends and general population habits. The second level allows the schools to monitor their local environment and surrounding air quality. AirWatch sells equipment needed for air monitoring at cost to schools taking part in the program.

Once students collect data, the information can be up-loaded to the AirWatch web page. The data is then graphed and related to other students' data. Problems can arise when schools do not submit data that is correct or on time.

Margot Finn would like to see the EPA provide daily air information that is easy for the students to access. The current format of the web site is not simple enough for teachers and students. The information should be worded clearly and simply, including a list of collected pollutants, their meanings, and quizzes so students can test themselves. Having the EPA provide data to allow the students to compare their results on an interactive website for the students would be a great improvement. The EPA supplying educational material and supplies, such as posters to work with in schools, would be another improvement in the program.

Greg Howarth, an employee of the EPA, works in contact AirWatch. He speaks at workshops, providing the perspective of a scientist. He helps by answering questions about the Melbourne Eddie, types of pollutants, and other scientific data.

Date: 18/4/00
Organisation: Interview with City of Melbourne
Contact: Gordon Edgar

Gordon Edgar works for the City of Melbourne in the Strategic Research Branch. They produce a benchmarking Melbourne status report for the city. This includes performance measures for the city's 6 strategic objectives: Sustainable City, Innovative City, People City, Attractive City, Culturally Vital City and Prosperous City. They work in conjunction with local governments to produce annual Environmental Indicators for Metro Melbourne bulletin aimed at senior local government decision-makers to raise the profile of environmental concerns. The bulletins also help to determine how livable a city Melbourne is. The next bulletin will be released at the end of August.

These bulletins were necessary to help fill the void of information about environmental indicators. Certain environmental and statistics from local companies were hard to access. This project was meant to allow local governments to have easy access to this information.

They have had an increasingly improving relationship with the EPA. Last year they obtained EPA GIS air quality information that was not published in other places. The new EPA representative on the Environmental Indicators Steering Committee seems enthusiastic to be working with them.

The Steering Committee is interested in using official environmental data, not looking to quibble or criticise over issues such as placement of measuring devices.

It was felt that traffic pollution is the biggest environmental issue facing Melbourne and one that will get worse. When the EPA is reporting data, it should be compared to official standards or an acceptability line. Newspapers and publications should be a lot more prominent in any communications strategy and the Internet should not be solely relied on to present information. Perhaps TV news and current affairs programs could be persuaded to present a daily environmental index in the same way they present stock market indices.

Meeting 4/17/00 9:00AM
Organisation: EPA Information Centre
Contact: Andy Gash

Background on Ms. Gash

Ms. Gash has had 30 years experience in the communications industry. She has worked in the private sector with companies involved with newspapers, radio and television. She joined the EPA in November of 1999 and her main goal is to aid the EPA in communicating information to the public. She has done a lot of work to help with the EPA's relations with various media sources.

View on the Internet

The Internet is great, but many people do not have access to it. People might go to a local library to use it, but then they have to download the information and they have no way to print it out. Parents sometimes limit their children's' access to the Internet because of cost and accessing bad content pages. Companies block the use of some sites to employees. Overall the access to the Internet is not very good or the best way to reach the public. Ms. Gash feels that there is a tendency to put too much information on the web. It can be overwhelming to a visitor of the site to be bombarded with all of the information.

Using the Media

The best methods to get the information to people are radio and television (especially morning TV). Putting air quality information with the weather is the best way to get people to see it. FoxTell has a 24 hour weather channel that might be a good option for displaying air quality information, because then people can get the information whenever they want it.

Reliability of the Information

The problem with the current air quality information is that it is not always accurate. The stations are not very reliable and the EPA does little to compensate for a broken station. Also, the newspapers do not generate the bar charts in the way the

EPA likes. The set up is not ideal for showing the information; they often make mistakes and different newspapers display different numerical data. Ms. Gash said that getting bad information (such as that in the current newspapers) is worse than getting no information. If people receive bad information, they will be mislead and if they find out the information is wrong, they will lose trust in the EPA.

The current newspaper segments are bar charts that show the past week's air quality for 3 regions. There is no date to indicate to the reader that the data is from the past. Many people could interpret the current bar charts as representing the upcoming week.

Meteorology

The current relationships between the EPA and the media are good, but not as strong as Ms. Gash would like. There are many press releases the EPA issues that go unnoticed by the media. She suggests that instead of working with the media directly, it should try to levy its relations with the bureau of meteorology. Since most people would like the air quality to be listed with the weather, the EPA might want to provide the meteorologists with data that can be presented along with the weather.

Air Quality Campaign

The main goal of this year's Air Quality Campaign is to increase awareness of air quality issues. This campaign is starting on May 1st. Ms. Gash hopes that our project will be able to aid in this campaign or those of years to come. She feels that having the campaigns associated with a season is a bad idea. Although smog is worst in autumn, people should be aware of it all year.

Newspapers

The current space allotted in the newspapers is adequate. The problem is that the information is from the past and is trying to show too much information. It would be better to have something that says, for both today and tomorrow, what the air quality is for the 3 regions (ie. good, fair, poor). Numbers and bar charts are not good for the newspaper.

Forecasting

The EPA has the technology to issue forecasts, but this information is only on the web. This information needs to be more accessible to others.

Action

She also feels that action should be associated with the air quality information. She would like to see the weekly summary changed to just today and tomorrow. With that extra space, a few words about what can be done could be added. The EPA cannot simply give the public the problems. The EPA has to provide the community with solutions in order to overcome the problems.

Immigrants

Many people who have migrated to Australia over the years, and thus there is a need to get information to those who have English as a second language. Ms. Gash informed us of radios that people can buy that, along with a subscription, broadcast a radio station in their native language. These radio stations talk about a variety of issues. The EPA should consider these radios as a means to target ESL community members.

Radio

The radio is a good method of communicating to those in rural areas. Newspapers and television are not as easily accessible.

Public Transport

We ran our suggestion of free public transport on smog alert days by Ms. Gash. She really liked this idea and wants to learn more about how Rhode Island accomplishes this. Some of this information will be reached via the Rhode Island Public Transit Authority's (RIPTA) web site. Although the public transport is privately held right now, there is a possibility that the government can work with the

Met to come up with a solution. Since only 5-6 smog alerts are issued per year, it is not unreasonable to have public transport free for those days. By having it free, more people will use it on the days when smog is bad. This might also make people realise that the public transportation is very good.

Children

The EPA's website has a children's section that is not very good. It has too much information and is not clear. The Queensland EPA has a much better site. Ms. Gash suggests the Victorian EPA try to model their site after that of the Queensland EPA. She also suggests that the EPA breaks down the educational programs into 3 levels: one for those under 8 years old, one for those between 8 and 14 and one for those 14-18.

Overall

Don't use big words. Keep the message simple and mix different topics of information. Don't always focus on the same thing.

Date: Tuesday April 4, 2000
Organisation: Environment Victoria
Contact: Bronwen Machin

Bronwen Machin works for an organisation named Environment Victoria. Environment Victoria presently employees about 16 to 17 people. Her interaction with the EPA consists of advocating and air cleaning advice. An example of this would be the new City Link smokestack. She also represents all of Victoria in an environment movement, trying to change air quality standards.

She gathers air-monitoring information from the EPA twice daily. This information is received by fax due to the fact that the organisation's computers need to be updated and therefore cannot access the Internet. She feels that most affluent groups are not interested in the Internet either. These groups aim to improve air quality and not interested in the data they could receive. Currently information received consists of reports, air quality data, and annual reports.

To improve relations she would like to receive more hot spot data (e.g., inner city and City Link areas). She would like to receive information for every local government area, but this is impossible due to the fact there is not a station in every local government area. She feels an emissions inventory e.g., measuring Alphington in winter (wood stove), would be useful. Data for Collingwood and Richmond should be done and reported more frequently. It presently comes only every 6 days because of air volume sampling. She feels that new standards of pollutants should be formed, including the standards of pollutants in hot spots. Standards in Victoria for criteria pollutants should be created for peak sites similar to those that exist for ambient air quality. Wind directions should be reported so a correlation can be made between pollution level and wind.

Several suggestions were made to improve fax formats. Data trends over time should be formatted and an annual report should be created faster. The highest pollution level per day should not just be reported but also the number of times certain levels were reached. The final fax format suggestion was to make it clear that the numbers presented are percentages.

Ideas suggested to improve data dissemination to the general public included presenting smog alert information and also the action to fix the problem. Education needs to be done. The EPA should conduct focus groups. They should try to reach the general public through local newspapers. Ideas such as CAAM should be used as

a model for other groups to follow. Also a campaign was mentioned, Heat Your House Week; she offered to be a consultant for the program.

Date: 18/4/00
Organisation: Southbank Residents Group.
Contact: Ray McDonald

The Southbank Residents Group was formed when several residents became upset about the environmental and planing issues that began to impact the neighbourhood. As the new government came into power several changes were made in regards to planning, which upset several residents. There are about 700 people involved with the group with 10 taking an active leadership role.

He was unsure what air quality information the EPA provides. It was believed that the EPA has 3 monitoring stations around Melbourne and that was not a sufficient number to monitor all of Melbourne. He was unsure that the EPA could back up its claim that the air is clean, without sufficient monitoring. He would like to see more stations to monitor specific areas and high pollution areas, such as factories and roads.

Mr. McDonald feels that the EPA tends to patronise the communities and that communication is not enough to build trust with the EPA. Claims that the EPA makes are not explained or backed up. The City Link project has caused some problems and highlighted existing ones, because it is felt that EPA was not on the level all the time and patronised the community.

The liaison committee that the EPA set up to talk about City Link is a start. It was felt that the committee had no real power, and was used just to pacify the upset community members. The new committee involving Translink, the EPA, and concerned groups has potential to show that the roads are within limits. The EPA should use this committee to show that all parties involved keep their promises.

Good communication was reiterated many times. The general feeling was that the EPA presents people with their conclusions and opinions with out providing supporting information. They would ask people to "trust them" to do their job without giving people a reason to trust them.

Issues with where the EPA monitors air pollution were also discussed. It was felt that several places were not monitored because they were known to be high pollution areas, such as Punt Road and the off ramp from the highway. It was felt that the EPA didn't want to measure where the pollution was bad and nothing could be done to improve the pollution in these areas.

He would like to see the EPA provide information to the public through the newspaper on a daily basis in a meaningful way. The newspaper should show what

the level was, the expected level, and what the EPA plans on doing about this rise. This information would best be presented in a graph with a reference line.

Date: 20 April 2000
Organisation: Stonnington Air Watch
Contact: Morag Loh

The main focus of Stonnington Air Watch is to raise the awareness of potential air quality problems and seek solutions to these problems through council, working with scientific bodies, and research through postgraduate students. Stonnington Air Watch's target audience is those who live and work in the city of Stonnington.

In particular the organisation looks at car (vehicular) pollution and is concerned with degreening of Stonnington. They are concerned with the increasing residential development. They feel that there should be an effort made to look into new methods of transportation.

Past air quality data has been received from the EPA and independent scientists. The Stonnington Air Watch has some questions with the methods and results of the EPA.

The Stonnington Air Watch group feels that the EPA, until quite recently, has been unwilling to look at other methodologies and initiate studies which could help to expand the knowledge base in specific localities. They feel that the EPA is "extremely defensive about their own methods and unwilling to support or look for an alternative views which can be explored".

An effort should be made by the EPA to look at local hotspots and local air monitoring. Formats to reach the general public are newspapers, TV, and a website.

They see vehicular, and particularly diesel trucks, as becoming the main air quality issues in Victoria unless alternative fuels and transport methods are looked into. She feels that the EPA should associate the action with the problem. The pollution can be broken up into particulates and gasses. There should be daily bulletins and a public campaign about environmental reports daily. This group has recently begun to have daily dialog with the EPA and has proven to be extremely useful. She thinks contented dialog is important. Issues raised in dialog must be addressed. Also she feels that people should get an answer when they ring the EPA with issues.

She feels that the EPA should learn to listen. If there were dialog with the EPA on some issues they would not have had to go to court. They had dialog via the press and that is far less useful. EPA is there for the environment and the public's health.

EPA should be pro-active in actually meeting with community groups. If they find that they cannot do that, these community groups should be helping them get resources to do it. Become the EPA's support group. They would be willing to campaign to get money for stations. Stonnington Air Watch does understand that the government funds the EPA and that this is a constraint. She would prefer to help the EPA gain more money than be opposing them.

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