REPORT

LOWER HUNTER AIR QUALITY COMMUNITY RESEARCH PROJECT

Prepared for the NSW Environment Protection Authority
59-61 Goulburn St Sydney NSW 2000

November 2014
Macquarie University Research Team

Chief Investigator: Dr Kirsten Davies

Department of Environment and Geography
Faculty of Science and Engineering,
Macquarie University, NSW 2109 Australia
kirsty.davies@mq.edu.au
T: +61 2 9850 8334

The report was prepared by: Dr Kirsten Davies, Ms Alison Jaggard, Dr Pamela Box, Ms Ellie Downing and Ms Danielle Munro.

Acknowledgements
The research team at Macquarie University, together with the EPA, would like to express our sincere gratitude to the people of the Lower Hunter region for your time and knowledge as you contributed to this project. Local citizens of all ages and from a range of sectors participated with such goodwill and with the interests of the health and well-being of your community and environment at heart. We have made every endeavour to accurately reflect your views and thank each of you for your involvement.

We would also like to extend our heartfelt thanks to our dedicated and tireless volunteers: Dr Pamela Box, Ms Ellie Downing, Ms Pamela Morales and Ms Danielle Munro.

Disclaimer
This report was prepared by Macquarie University in good faith exercising all due care and attention, but no representation or warranty, express or implied, is made as to the relevance, accuracy, completeness or fitness for purpose of this document in respect of any particular user’s circumstances. Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect of, their situation. The views expressed within are not necessarily the views of the Environment Protection Authority (EPA) and may not represent EPA policy.

© Copyright State of NSW and the Environment Protection Authority

Cover photo: A Jaggard 2014
List of Acronyms

ANSTO  Australian Nuclear Science and Technology Organisation
ARTC  Australian Rail Track Corporation
COAG  Council of Australian Governments
CSIRO  Commonwealth Scientific and Industrial Research Organisation
DP&I  Department of Planning and Infrastructure
DSEWPAC  Department of Sustainability, Environment, Water, Populations and Communities
NCCCE  Newcastle Community Consultative Committee on the Environment
NEPM  National Environment Protection Measure
OEH  Office of Environment and Heritage
PM  Particulate matter
PRP  Pollution Reduction Program

Definitions

Air quality is the state of the air around us (DSEWPAC 2013, p3). Air quality is compromised by the presence of natural and anthropogenic air pollutants that affect people and ecosystems sometimes far removed from the emission source (CSIRO 2013, p3). COAG (2011) identified air quality as a priority issue of National Significance.

Air pollution  Air pollution refers to the presence in the atmosphere of chemicals, particulates, or biological materials that cause discomfort, disease or death to humans, damage other living organisms such as food crops, or damage the natural or built environments. Examples of air pollutants include particulates, oxides of sulphur and nitrogen, carbon monoxide, volatile organic compounds, toxic metals (such as lead), ground-level ozone, and odours (CSIRO 2013, p3).

Particulate matter (PM) refers to everything in the air that is not a gas. Both solid and liquid particles (vapour). PM is heterogeneous in size and composition. It can be transported long distances and can influence weather and climate. The PM sizes that are of most concern to health are PM$_{10}$ and PM$_{2.5}$ (CSIRO 2013, p4).

Sources of PM$_{10}$ and PM$_{2.5}$

PM$_{10}$ is primarily soil, dust, material from roads, farming, mining, dust storms, pollen, sea salt, mould and spores. PM$_{2.5}$ is primarily from emissions from combustion, such as petrol and diesel vehicles, wood burning, coal burning for power generation, industrial smelters, cement plants, paper mills and steel mills. Smaller particles are inhaled more deeply into the lungs and may enter the bloodstream. Most particles $>$PM$_{10}$ (e.g. PM$_{50}$ “black dust” deposited in the Newcastle area) are filtered by the nose (The Senate Inquiry on the Impacts on Health of Air Quality in Australia, 2013).
Table of Contents

INTRODUCTION ................................................................................................................................................... 10

DESKTOP REVIEW ............................................................................................................................................. 12
Section 1. Working with Communities ......................................................................................................... 12
  BACKGROUND CONCEPTS .......................................................................................................................... 12
  1. Human behaviour ........................................................................................................................................ 12
  2 & 3. Community engagement and participation ................................................................................... 17
  Whole-of-community approach to community engagement and participation ................................ 18
  4. Policy .............................................................................................................................................................. 24
  5. Education ........................................................................................................................................................... 25
EPA Air Quality Actions and Programs .......................................................................................................... 28
  6. Monitoring, reporting and consultation ................................................................................................. 30
  7. Community-based social marketing ........................................................................................................ 33
  8. Risk management ........................................................................................................................................ 34
Section 2. Profile of the Lower Hunter Region ............................................................................................ 46
  Social Profile of the Lower Hunter Region ............................................................................................... 47
  Environmental Profile of the Lower Hunter Region .................................................................................... 49
ABOUT THE PROJECT .......................................................................................................................................... 50
Methods .................................................................................................................................................................. 51
Limitations .............................................................................................................................................................. 52
RESULTS ..................................................................................................................................................................... 54
Demographics ....................................................................................................................................................... 54
Quantitative and Qualitative results ................................................................................................................ 58
DISCUSSION ............................................................................................................................................................. 81
Conclusions and Recommendations ................................................................................................................ 92
REFERENCES ............................................................................................................................................................. 97

**Please note: Appendices have been published as a separate report.**
Executive Summary

The aim of this study was to investigate ways to improve community access to information on, and understanding of, air quality in the Lower Hunter region which consists of the local government areas of Newcastle, Cessnock, Lake Macquarie, Maitland and Port Stephens.

The project involved an extensive search of the literature which included examining national and international studies. It employed Intergenerational Democracy (ID), a method of community engagement developed by Dr Kirsten Davies (2012) that involved the inclusion of children through to the elderly. Through adopting this method the range of divergent views, pertaining to air quality and in particular air pollution, across the community was captured.

This study engaged 395 participants in total, including 210 interviewees and 185 focus group participants. This whole-of-community study revealed the existence of complex and differing perceptions, levels of concern and knowledge pertaining to air quality, environmental protection and the role of the EPA in the Lower Hunter region.

Key Findings

51.4% of the respondents in this study were either ‘not concerned’ or ‘not sure’ about air quality in the region (or provided ‘no response’).

The 48.6% who said they were ‘concerned’ were asked to rank their levels of concern. 47.3% ranked their concern as ‘moderate’ or ‘very severe’. Few people thought it was extremely severe (5.5%). Older people were found to be more concerned about air quality than young people.

The qualitative and quantitative data point towards a community divide in the Lower Hunter regarding those who are concerned about air quality and are more aware of the EPA and those who are not concerned and less, or not, aware of the EPA and its activities.

Responses to previous community interactions with agencies and the provision of information were mixed. 44% of participants described their lack of trust in being provided with ‘the whole picture’ of information while 17.5% believed they had received comprehensive information.

It was found that 66.4% of the community had no previous contact with the EPA or any other authority on air quality, and 65.8% had not sought information about air quality. The study found that 11.2% of respondents believed air quality was adequately monitored and controlled, 36.4% believed it was not, and 37.1% said they were not sure.

Local media was found to be the main source for people to learn about air quality. The local newspapers, radio and television were all cited as key sources of information for all age groups.

Wood smoke and diesel emissions (from vehicles and boats) were identified as factors contributing to poor air quality. Participants were especially concerned about the emissions from trucks and ships. They described their concerns as not only related to air pollution but also the impacts on marine, aquatic and terrestrial ecosystems.

The perceived correlation between local air quality and ill (physical and psychological) health was found to be the predominant concern, with key health concerns including: respiratory illnesses (in particular asthma) and cancer which participants attributed to the effects of PM$_{2.5}$ and smaller.

Linked to this concern was the strong community drive to have train wagons, transporting coal, and
stock piles, covered. There was found to be a community view, expressed by individuals and diverse community groups, that covering of wagons and stock piles will help to improve air quality and human health.

Citizens were generally concerned with the need to protect the environment and ecosystems (aquatic, marine and terrestrial) and were found to be wanting to work in partnership with government agencies (local and state) such as the EPA, industry and business to protect the environment.

The challenges of residential communities interfacing industrial activities were often raised in focus groups and interviews. While citizens recognised the economic benefits (including employment) that industry brings to the region, they were also concerned about quality of life including a healthy environment and the impacts of industry on population growth and tourism. Many expressed their aspirations for the region to transition to ‘clean’ industries, including the use of renewable energy.
Recommendations and Actions:

The following recommendations and actions have been developed based on the findings from this study. It should be noted that their future implementation is subject to their adoption by the community and the EPA, together with the availability of human and financial resources. Therefore neither a timeframe nor a priority listing has been included. Growing and implementing these actions is the joint responsibility of individuals, community groups, business, industry and government agencies as they work together to care for the people and environment of the Lower Hunter region.

**Recommendation 1: Grow community relationships**

Build on existing programs (including those not related to air quality) and assist in growing community relationships with the EPA. Some of the ways this can occur are:

**Action 1a) Strengthen community awareness of the EPA and its activities**

Investigate opportunities to develop a corporate branding and marketing campaign to raise community awareness of the authority’s role as the NSW environmental custodian for communities and ecosystems. In the Lower Hunter region this could include marketing materials distributed locally e.g. attendance and stalls at local events such as: farmers markets, schools, local Lions and Rotary club events, local agricultural shows and local festivals.

**Action 1b) Build closer relationships between EPA senior staff and local communities**

Prioritise opportunities for EPA senior staff at state and local levels to interact directly with communities. This approach will build relationships, strengthening trust and the management of community interactions in future unplanned situations (such as pollution incidents) when the EPA is required to take a reactive role, often at short notice. Building close community relationships is part of a risk management approach that will facilitate localised monitoring and reporting and enable early community alerts surrounding issues of concern.

**Action 1c) Foster relationships with NSW government agencies, universities and local councils**

Facilitate the coordinated approach of: industry, NSW government agencies (EPA, OEH and others), universities, local councils that prioritise the health and well-being of local communities and ecosystems. This can occur through the identification of key issues, discussions surrounding solutions, and the provision transparent and accessible information.

In the Lower Hunter region this role could be facilitated by the Newcastle Community Consultative Committee for the Environment (NCCCE). The community has proposed the reintroduction of community forums on air quality with the EPA and the NCCCE which were run in 2013. The NCCCE received positive feedback on these and it is recommended that the NCCCE and EPA collaborate to continue to run them regularly.

**Recommendation 2: Work with industry and communities to address key community concerns**

Cultivate community and industry partnerships that acknowledge and address key community issues. Some of the ways this can occur are:
Action 2a) Work with the community and their concerns surrounding coal dust

In the Lower Hunter region there is significant level of community concern surrounding the impacts on human (physical and psychological) health and visual amenity of coal dust. There is a ‘public call’ to cover coal train wagons and stock piles as one of the community based solutions to minimising coal dust. The EPA has several initiatives that are currently underway including: 1) Audit and review of coal transport from coal mine to port; 2) Identifying and evaluating the cost of rail system dust mitigation options; 3) Assessment of rail system operator records; 4) Compliance audit on coal train loading and unloading facilities; 5) Diesel emission analysis and control measures; 6) Review of the current regulatory framework for the operational rail sector and 7) Non-road diesel emission strategy.

Following the outcomes of these initiatives, it is recommended that the EPA facilitate discussions with industry on the actions to address community concerns surrounding coal dust. Additionally a targeted coal dust education program may assist to build community knowledge and understanding surrounding coal dust and health.

Action 2b) Refer findings of the report to NSW Department of Health regarding the community concern about the physical and psychological health impacts of air quality issues

Elevated levels of concern surrounding the (perceived and/or actual) impacts of air pollution on the physical and psychological health of community members was identified as an issue.

It is recommended that the EPA refers this issue to the NSW Department of Health for their follow up and works with this department to improve education surrounding the health implications of air pollution.

Action 2c) Work with communities and industry to improve air quality

It is recommended that the EPA work in partnership with industry, agencies, schools and community groups (such as: NCCCE, Greening Australia, Trees in Newcastle¹, Men’s Shed groups, Clean Air Society, CWA, local schools, and councils) to improve air quality including minimising diesel emissions from vehicles and boats. Some of the ways this could occur are: through a reduction of vehicles on the roads and an increase in the use of public transport and increasing native vegetation plantings in the Lower Hunter region to improve amenity and air quality.

Recommendation 3: Develop a whole-of-community, targeted approach to participation, awareness raising and education

Develop projects that prioritise and engage community groups at the interface of industrial and mining activities and in high density urban areas.

Some of the ways this can occur are:

Action 3a) Investigate opportunities for school education programs and air quality

It is recommended that particular emphasis is placed upon future EPA programs that involve the engagement of children, for example in local primary and secondary schools. Children are the future environmental custodians, their participation in projects require the mentorship, advocacy and

¹ Trees in Newcastle (TIN) “…is a local native plant nursery, volunteer and education centre and bush regeneration provider” with a number of employed staff.
involvement of adults, therefore the EPA can maximise the impact and reach of its community based investment in projects through working with local children.

This can be achieved by the EPA establishing partnerships with NSW government agencies, including the NSW Department of Education, NSW Health and the Office of Environment and Heritage, to improve community education and awareness surrounding air quality, in particular working with schools and the curriculum. Education programs can be based on an ecosystem approach, conveying the message of the impact of air pollution on natural systems including terrestrial, aquatic and marine ecosystems.

Examples for the EPA to consider in the development of programs include: the US EPA School Flag Program, and Cleaner Air 4 Primary Schools, which is a part of the Cleaner Air 4 London program. Both programs educate students on air pollution issues, involve them in pollution measuring, and provide information to the wider community.

**Action 3b) Investigate opportunities for emergency response education programs**

In partnership with emergency response agencies, assess how community awareness and education programs, including emergency procedures, can be strengthened to ensure that all community members are aware of protocols in the case of future pollution incidents. Community preparedness can help to minimise risk, protect people and reduce the escalation of some issues in emergency situations, including anxiety. The EPA could work with the NSW State Emergency Services to extend existing programs to educate communities on how to respond to emergency situations linked to air pollution.

**Action 3c) Investigate citizen science initiatives**

Investigate projects surrounding air quality that involve citizen science and are designed to empower communities to improve air quality. Facilitating citizen science initiatives can assist the EPA in: community relationship building, harnessing local resources and expertise and sharing the responsibility of environmental monitoring and management with communities.

Project themes for the Lower Hunter region could include: minimising wood smoke and/or vehicle emissions and ‘greening’ areas to improve air quality. Taking the lead from citizen science projects on air quality in the USA, such as the Kids Clean Air Zones Project\(^2\) in Newark, New Jersey\(^3\).

**Recommendation 4: Develop a whole-of-community communication approach**

Increased communication with the whole community will assist in building trust and mitigating community anxiety. Some of the ways this can occur are:

**Action 4a) Adopt an age based approach to communication**


\(^3\) Newark is a highly industrialised area and has similar community complaints to the Lower Hunter area including numerous industrial pollution sources and asthma and cancer concerns. It is envisaged that a similar study would measure particulate matter from diesel truck exhaust on busy roads close to where community members are engaged in outdoor activities such as high schools or parks. The hypothesis is that diesel truck traffic increases air pollution levels. A control site located in a quiet residential area away from truck traffic would provide baseline comparison. It is envisaged that this would provide the community with information regarding local air quality and the impact of diesel traffic emissions, with the outcomes being suggested as ways to improved local air quality
Develop an aged based approach to communication\textsuperscript{4} that provides accessible and easy to interpret information e.g. Content for local television, including news and weather broadcasts and children’s television shows, newspapers and radio news broadcasts, a simplified website, information for school newsletters, emails, apps, SMS, displays in schools and public spaces. This approach could include air quality forecasting that is widely presented on local television networks and accompanies the weather forecast. A community suggestion was that the EPA provides a trusted senior staff member to present a regular radio spot on air quality as a way to share information and build trust with the community. Indexing and clear explanatory messaging regarding potential health impacts and actions could also accompany the forecasting.

\textbf{Action 4b) Strengthen community trust regarding science communication}

Building ongoing relationships with research institutions and experts will spread the responsibility of communicating the results of scientific studies. To assist this process, the EPA could develop and distribute (including on the EPA web site) a list of community driven research priorities that may attract university researchers, including PhD projects.

\textbf{Action 4c) Deliver timely responses to issues}

When an issue, or potential issue, has been identified, timely communication with the community to inform them that the EPA is aware of the issue and it is being investigated, is critical. This approach will provide reassurance and help to mitigate some levels of community concern. Follow-up with subsequent messaging that provides up-to-date information in accessible language and formats.

\textsuperscript{4} Specific communication preferences by age group can be found in the results section of this report
INTRODUCTION

This study was commissioned by the NSW Environment Protection Authority (EPA) and conducted by a research team from Macquarie University (Sydney, Australia) led by Dr Kirsten Davies. The project commenced in late 2013 and was completed in July 2014. The aim was to examine and understand whole-of-community perceptions and attitudes towards air quality in the Lower Hunter region of New South Wales (NSW) Australia.

The Lower Hunter region has a population of 520,666 (ABS 2013) and is defined as the local government areas of: Newcastle, Cessnock, Lake Macquarie, Maitland and Port Stephens. The region is renowned for its picturesque beaches, lakes and landscape. It is an urban growth centre due to its close proximity 161 km to the north of Sydney, and the range of lifestyle and employment opportunities that are offered. This is a region with a long history of mining and industrial activities, including a large and active transport infrastructure leading in and out of the port located in Newcastle. Communities cohabitate alongside mining and industry resulting in a spectrum of complex and diverse relationships and attitudes. Mining and industrial activities offer employment and economic growth opportunities. Simultaneously the impacts of these activities present ongoing regulatory and community relationship challenges centred on protecting the health of terrestrial and marine ecosystems and local communities.

The project involved an extensive search of the literature which included examining national and international studies. Due to the quantity of literature and additional material, community-related literature has been placed in the main report and scientific literature has been placed in the appendix. The appendix contains scientific literature pertaining to air quality and additional material and data. The Newcastle Community Consultative Committee on the Environment (NCCCE) assisted in guiding the study which aimed to collect whole-of-community views. This was achieved by adopting Intergenerational Democracy (ID), a method of community engagement developed by Dr Davies (2012) that involves the inclusion of children through to the elderly. Through adopting this method the range of divergent views, pertaining to air quality and in particular air pollution, across the community were captured. Citizens rarely heard in studies of this kind, such as school children, participated in this study. Local schools, technical and further education (TAFE) colleges, community groups, local councils, Country Women’s Associations (CWA) and a Men’s Shed group were some of the organisations involved in this study. Qualitative and quantitative social data was collected from these groups through interviews and focus groups. The results were analysed and compared with the literature review. Key findings were explained and recommendations developed to inform and assist the EPA as it continues to work closely with communities into the future.
Desktop Review

SECTION 1 - WORKING WITH COMMUNITIES

SECTION 2- PROFILE OF THE LOWER HUNTER REGION
The desktop review has been divided into two sections:

**Section 1. Working with Communities** – containing background theory, details of EPA actions and programs on air quality, prior community consultations by the EPA, and details of community participation and engagement, including risk perception and citizen science.

**Section 2. Profile of the Lower Hunter Region** - containing geographic, social and environmental summaries of the region.

### Section 1. Working with Communities

**BACKGROUND CONCEPTS**

Environmental issues are increasingly being examined through coupled human and nature systems (CHANS) also referred to as socio-ecological systems (SES) (Liu et al 2007; McConnell at al 2009; Wiek et al 2012). This approach positions people within ecosystems and builds understanding of the consequences of human activities on interconnected webs of life. Striving towards reconnecting people with nature through education, communication and involving them in programs underpins community based approaches to environmental management. In this report we are defining ‘community’ as a group of people within the common geographic boundary and/or a group of people with shared interests and/or values. ‘Community engagement’ is defined as: “a planned process of working collaboratively with identified groups of people, whether they are connected by geographic location, special interest or affiliation, to address issues affecting their well-being” (Centers for Disease Control and Prevention, 1997).

The following components of the literature review examine key aspects of working with communities, outlining aspects of (1) human behaviour, (2) engagement, (3) participation, (4) policy, (5) education, (6) communication, (7) social marketing and (8) risk management. It describes ways in which communities can become more involved in environmental monitoring and management such as through ‘citizen science’ and provides some exemplary case studies.

#### 1. Human behaviour

**UNDERSTANDING BEHAVIOURAL CHANGE**

It is helpful to have an understanding of behavioural change when working with communities.

The complexity of the task of finding a solution to a problem involving human behaviour is introduced via the following problem descriptions. Darnton (2008a) (citing Ackoff 1974 in Chapman 2004) defines two types of problems:

- ‘Difficulties’ are those where there is “agreement about the problem and what constitutes a solution and which are bounded by time and resources” (p. 53).
- ‘Messes’ are “characterised by uncertainty: about what the problem is, how it might be deemed fixed, and how long that might take” (p. 53).

This is similar to the concept of tame and wicked problems introduced by Rittel and Webber (1973):
‘Tame’ problems have a clear, often technical solution and it is clear when the problem has been solved.

‘Wicked’ problems are difficult to define and separate from other problems, they tend to be persistent, they have no technical solution, it is not apparent when they have been solved, they have no right or wrong solution. To improve the situation all stakeholders must engage in an interactive, experimental and deliberative process.

Heifetz et al. (2009) make a distinction between ‘technical problems’ and ‘adaptive challenges’:

- ‘Technical’ problems are those that “have known solutions that can be implemented by current know-how. They can be resolved through the application of authoritative expertise and through the organization’s current structures, procedures, and ways of doing things” (p. 19).

- ‘Adaptive challenges’ “can only be addressed through changes in people’s priorities, beliefs, habits and loyalties” (p. 19).

BEHAVIOURAL PRINCIPLES

The GSR Behaviour Change Knowledge Review (2008) commissioned by the UK Government Social Research Unit (GSR) is a comprehensive review of over 60 behavioural change models and provides a general starting point for research analysts in developing sustainable development strategies, programs and policy initiatives.

The Review incorporates:

- The Reference Report (Darnton 2008a)
- The Practical Guide (Darnton 2008b)

The Practical Guide (Darnton 2008b) provides a summary of behaviour change models and works as a guide for developing interventions that consider individual, group and societal levels. The Practical Guide outlines how behaviour models can be used in the design phase of an intervention to identify factors to be targeted proposing that “interventions can be evaluated in terms of impact on those target variables, as well as in terms of change in the end behaviour itself” (Darnton 2008b p. 21). The Nine Principle framework (Table 1) aims to integrate an understanding of the behaviour and its underlying influences with practical techniques to bring about change (Darnton 2008b). It is important to note that while the nine principles “unfold in a logical sequence, they should not be regarded as discrete steps” and that learning gained in one part of the process may require a return to earlier assumptions (Darnton 2008b, p. 23).
**Table 1: GSR Nine Principle Framework Process Description [Adapted from Darnton 2008b, pp. 23-34]**

<table>
<thead>
<tr>
<th>Principle 1</th>
<th>Identify the audience groups and the target behaviour</th>
<th>If faced with a complex behaviour break it down into its component behaviours and/or adopt a systems thinking approach.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principle 2</td>
<td>Identify relevant behavioural models</td>
<td>Using both individual and societal level models draw up a shortlist of influencing factors</td>
</tr>
<tr>
<td>Principle 3</td>
<td>Select the key influencing factors to work on</td>
<td>Use these to design objectives in a draft strategy for the intervention</td>
</tr>
<tr>
<td>Principle 4</td>
<td>Identify effective intervention techniques</td>
<td>Identify effective intervention techniques which have worked in the past on the influencing factors selected</td>
</tr>
<tr>
<td>Principle 5</td>
<td>Engage the target audience for the intervention</td>
<td>Engage the target audience for the intervention in order to understand the target behaviour and the factors influencing it from their perspective</td>
</tr>
<tr>
<td>Principle 6</td>
<td>Develop a prototype intervention</td>
<td>Develop a prototype intervention based on the learning from working with the actors. Cross-check this against appropriate policy frameworks and assessment tools</td>
</tr>
<tr>
<td>Principle 7</td>
<td>Pilot</td>
<td>Pilot the intervention and monitor continuously</td>
</tr>
<tr>
<td>Principle 8</td>
<td>Evaluate</td>
<td>Evaluate impacts and processes</td>
</tr>
<tr>
<td>Principle 9</td>
<td>Feedback</td>
<td>Gather learning from the evaluation</td>
</tr>
</tbody>
</table>

This approach is based on a ‘learn through doing’ model which requires the intervention be refined in response to ongoing ‘monitoring and evaluation’ (Darnton 2008b). The review advocates that genuine collaboration with the ‘actors’ in the process (i.e. those whose behaviour is to be changed) is critical to the success of the intervention (Darnton 2008b).

**CHANGE AT AN INDIVIDUAL LEVEL**

Fishbein et al. (1992) identified eight factors as prerequisites for human behaviour change, the first three of which they believed were ‘necessary and sufficient for producing any behavior’ (p. 249) (see Table 2)
### Table 2: Eight Factor Behaviour Change Model [Reproduced from Fishbein et. al. 1992 p. 249]

<table>
<thead>
<tr>
<th>Intention</th>
<th>The person forms a strong positive intention, or makes a commitment, to perform the behavior.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental constraints</td>
<td>There are no environmental constraints that make it impossible for the behavior to occur.</td>
</tr>
<tr>
<td>Skill</td>
<td>The person possesses the skills necessary to perform the behavior.</td>
</tr>
<tr>
<td>Outcome expectancies (or attitude)</td>
<td>The person believes that the advantages (benefits, anticipated positive outcomes) of performing the behavior outweigh the disadvantages (costs, anticipated negative outcomes)-in other words, the person has a positive attitude toward performing the behavior.</td>
</tr>
<tr>
<td>Norms</td>
<td>The person perceives more normative pressure to perform the behavior than to not perform the behavior.</td>
</tr>
<tr>
<td>Self-standards</td>
<td>The person perceives that performance of the behavior is more consistent than inconsistent with his or her self-image or that it does not violate personal standards.</td>
</tr>
<tr>
<td>Emotional reactions</td>
<td>The person’s emotional reaction to performing the behavior is more positive than negative.</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>The person perceives that he or she has the capabilities to perform the behavior under a number of different circumstances-in other words, the person has self-efficacy with respect to executing the behavior in question.</td>
</tr>
</tbody>
</table>

### Influences on Behaviour

**Social and cultural aspects of community engagement to motivate environmental action**

The social and cultural aspects that motivate environmental action at individual, group, and community levels are important factors in developing sustainable initiatives. Education programs need to include the significance of place in planning and delivering projects, such as home, work, school, and the environment (physical and virtual space). Hawkins (2006) in *The Ethics of Waste* discussed the significance of subjective experience and the connection between pro-environmental behaviour and everyday practices. Hawkins proposed that environmental issues need to be framed within the relationship between nature and culture.

The idea of a ‘life course pathway’ approach to environmental education with respect to environmental concern and ecological action was proposed by Wells & Lekies (2006). The linkages between childhood learning experiences and adult environmentalism indicated two significant factors: ‘play’ in natural environments or locations; and the role of parents, teachers or significant others (eg community leaders/elders). These factors were seen to foster an interest in the environment through nature experiences.

Keefe’s (1992) research proposed that ethnic identification could be conceptualised as a process that is lifelong and embodies an understanding of oneself in relationship with cultural groups in the larger society (p. 42). He found that place of residence and birthplace were two significant factors in ethnic identity and that length of residence and intergenerational aspects were also significant to acculturation patterns. This linked with later research by Ross (2002) that observed changes in ethno-ecological knowledge, beliefs and behaviour between two generations. The study concluded that there had been a rupture in social context and therefore the cultural identity and practices...
between generations. This shift in worldview impacted on choices and behaviours of the younger generation.

**Education**

Williams & McCrorie (1990) suggested that "providing individuals with relevant information and education regarding environmental issues and the effects of their behaviour upon the environment will result in the formation of a more environmentally aware individual, and one who is prepared to modify his entire behaviour in a pro-environmental direction" (p. 162).

The literature has shown that formal education had a significant influence on environmental attitudes and behaviours. Higher levels of education tended to lead to higher support of environmental protection (Blomquist & Whitehead 1998 cited in Torgler & Garcia-Valinas 2007, p. 538) which was also a finding in the New South Wales Government’s Office of Environment and Heritage *Who Cares about the Environment in 2012?* report (OEH 2012).

**Age**

The importance of age as an influence is supported by research such as that undertaken for the *Who Cares about the Environment in 2012?* report. This research revealed that age was an influencing factor on environmental attitudes, for example, young people (15-24 years) are much less likely to engage in environmental protection activities than older age groups, although younger people were more positive that environmental issues would improve (NSW OEH 2013). Huntley (2006) believes that today’s young people “were born and raised in a global society where consumerism and capitalism are natural conditions” (p.2). Several studies suggest that age can be positively and negatively correlated with environmental protection dependent upon an individual’s life stage (Whitehead 1991; Carson et al. 2000).

This view was identified by Erikson (1964), who described the theory of psychosocial human development suggesting an 8-stage lifecycle from childhood through to old age. His research referred to ‘mutuality’ and ‘generativity’ or the interaction of generations. ‘Mutuality’ reflects the effect of generations on each other, especially among families, and particularly between parents, children and grandchildren. ‘Generativity’ represents a stage during adulthood concerned with care in “establishing and guiding the next generation” (Erikson 1950 p. 267, cited in Slater 2003) and productively contributing to society as an individual (Harder 2002). Extensive additional research supports the positive and negative correlations of age with environmental protection and the significance of an individual’s life stages (Mackay 1997; Huntley 2006; Carson et al. 2000).

Wells et al (2006) highlighted the important role of childhood experiences in influencing adult values and attitudes to environmental issues. These included spending time in natural habitats, having educators who encouraged an interest in nature and active participation in domestic gardening (such as growing and caring for flowers and vegetables). The findings of Wells et al’s (2006) research clearly linked childhood connections with natural environments to pro-environmental attitudes in adulthood.
Gender

According to the *Who Cares about the Environment in 2012?* report (NSW OEH 2013) women were more likely than men to say they often did environmentally friendly things domestically or when shopping, while men were found to be more inclined to be involved with environmental activities external to the home, such as composting or taking chemicals to a council drop-off point. While women were found to have a greater level of concern and took environmentally friendly actions more often, men had greater environmental knowledge but took environmental actions less frequently (NSW OEH 2013). However Zelezny et al. (2000 cited in Torgler & Garcia-Valinas 2007, p. 537) found strong evidence to suggest environmental attitudes did not begin in adulthood, challenging the common belief that gender differences arose due to motherhood and child protection. Torgler & Garcia-Valinas (2007) suggested that caution should be taken when making assumptions regarding gender. They identified, through their literature reviews of research throughout the 1980s, that there were inconsistencies in findings pertaining to gender.

2 & 3. Community engagement and participation

**ENGAGEMENT**

Successful community engagement identifies and involves individuals or groups who have a ‘stake’ in the issue. Stakeholders can be defined as “those who are interested in, concerned about, affected by, have a vested interest in, or are involved in some way with, the issue” (IAP2 2010).

Research has shown that participation and engagement arise when the following elements are present:

- a personal motivation
- a trigger
- resources
- opportunities

People get involved in activities that have personal meaning and value through connecting with the people, interests and issues that are important to them. Having influence, exercising values and beliefs, and being part of something are some of the reasons that motivate people to participate.

Triggers for engagement include:

- emotional reactions, such as anger at a decision
- a response to a threat
- wanting to improve something locally (Involve 2011)

**PARTICIPATION**

The International Association for Public Participation (IAP2 2010) core values for the practice of public participation describe the ethics surrounding community engagement. These are:

1. “Public participation is based on the belief that those who are affected by a decision have a right to be involved in the decision-making process.
2. Public participation includes the promise that the public’s contribution will influence the decision.

3. Public participation promotes sustainable decisions by recognizing and communicating the needs and interests of all participants, including decision makers.

4. Public participation seeks out and facilitates the involvement of those potentially affected by or interested in a decision.

5. Public participation seeks input from participants in designing how they participate.

6. Public participation provides participants with the information they need to participate in a meaningful way.

7. Public participation communicates to participants how their input affected the decision” (IAP2 2010).

Whole-of-community approach to community engagement and participation

A whole-of-community approach to working with communities doesn’t require involving every person rather capturing the views of a representative group which has the attributes of the community.

INTERGENERATIONAL DEMOCRACY

One of the methods of a whole community engagement approach is Intergenerational Democracy (ID), a method of engagement and participation that includes people of all ages (from 8 to 100+ years). It is an age-based method developed by Dr Kirsten Davies to respond to the challenges of engaging diverse communities. Dr Davies believes that there is just one social variable that cuts across all communities, people’s age or phase of life (Davies 2012).

The foundation of ID is embedded in the principles of direct democracy and human rights. ID recognises that there are many quieter but equally legitimate voices, particularly those of children, who are rarely heard in policy and planning forums. Through its age-based methodology ID enables the application of intergenerational equity which is at the heart of environmental sustainability. ID engages, connects and motivates whole communities, from children to the elderly, in planning and managing their sustainable futures.

An intergenerational approach has the capability of aligning human and environmental lifecycles and the capacity to cut through barriers of inequality by recognising life phase as an equalising common thread in communities. It offers a multidimensional approach to understanding issues (for example, the views of an 18 year old may be different to those of an 80 year old), while enabling an increased capacity for behavioural change (for example, activities that would interest a 12 year old could be very different to those that would interest an 18 year old, a 40 year old or a 60 year old).

Secondary factors that require inclusion in this method are: gender, geographic spread, ethnic heritage, socio economic status and level of education. ID can be applied to any policy, planning and programming initiatives that require capturing broad community views, ownership and involvement.
GOVERNMENT AGENCIES AND COMMUNITY TRUST

Key to community engagement is the issue of trust: the public need to consider the source of information trustworthy. Understanding how community members assess information and risk is important in designing appropriate programs to inform and engage the public. The importance of engaging the community in discussions of risk has seen risk perception and related fields move away from seeing a dichotomy between the ‘correct’ officials’ view of risk and ‘incorrect’ public view, to recognising that a range of factors influence public perceptions. Bickerstaff (2004) noted that over time risk perception studies have shifted from identifying and correcting gaps between the objective and ‘correct’ perceptions of officials and the subjective (mis)perceptions of the public in early work to engaging with the various social contexts of individuals and communities. She noted a division between how officials and the public discussed pollution, with officials making more quantitative judgements compared to qualitative judgements from the general public. As research developed and moved beyond psychology, it took into consideration the role of social context, such as peoples’ experience, agency, and knowledge of pollution, in determining how individuals view and respond to pollution. She also noted the importance of trust in the organisation providing any information about pollution, with information from governments often seen as untrustworthy. Her conclusions on trust and agency can be seen in the work of other researchers. When people feel invested in and attached to their place they are more likely to show interest and involvement in local issues (Wakefield et al 2001). Concern about air pollution has increased as publicity of pollution increased. For example, public opinions surveys in the USA found an increase in the number of people concerned about air pollution from 30% in 1965 to 70% in 1970 at the same time as increased publicity about air pollution (Bickerstaff and Walker 2001).

With regard to trust, a study by Charnley and Englebert (2005) reported on the US EPA’s community involvement program known as Superfund, which targets hazardous waste clean-up sites close to places where people live and work. Most people surveyed in the study obtained information about the hazardous waste clean-up sites from the media (e.g. newspapers) while agreeing that newspapers, radio and TV were not good sources of information. This study found the community wanted to be informed and preferred to receive information directly from the US EPA. Community members surveyed who were more informed by the EPA and more involved with the Superfund sites rated the community involvement program and the EPA as better than those who were less informed and involved. Those community members who had received information from the EPA also rated the EPA as being more able to earn community trust (Charnley and Englebert 2005). Providing trusted information to the community may lead to greater acceptance and satisfaction with community environment issues.

Community Consultations carried out by the OEH, EPA and Ipsos

Community opinion about air quality and the EPA has been assessed by a number of avenues including the OEH’s ‘Who Cares About the Environment’ report, the Ipsos EPA Stakeholder survey and workshops run by the EPA with the NCCCE. The findings of these are summarised here.

WHO CARES ABOUT THE ENVIRONMENT IN 2012? (NSW OEH, 2013)

This was social research carried out by the Office of Environment and Heritage (OEH) in 2012.

When asked what are the top two most important environmental issues today? Air pollution and air quality was No. 3 in the top seven Environmental Issues identified (NSW OEH 2013, p5):
1. Water issues (nominated by 18% of people)
2. Mining (17%)
3. Air pollution/air quality (17%)
4. Waste (14%)
5. Forest/bushland/biodiversity (12%)
6. Climate change (12%)
7. Energy/fuel (12%)

Key findings relating to air quality and air pollution were as follows:

- Air quality and air pollution have decreased in importance since 1997 (32%).
- University educated people are more likely to nominate mining as an issue (20% vs 17%).
- Air pollution is more top of mind in Sydney (20% compared with 12% outside of Sydney)

Regarding air pollution/air quality sources, responses were as follows

- 7% nominated motor vehicles, vehicle emissions
- 4% nominated air pollution/air quality
- 2% nominated traffic/congestion
- 1% nominated industrial emissions/waste
- <0.5% nominated air pollution caused by mining
- <0.5% nominated smoking/smokers
- <0.5% nominated smells and odours

The most important issues for NSW government attention now were nominated as follows

- Health (27%)
- Roads and traffic (26%)
- Education (22%)
- Public transport/railway (22%)
- Cost of living (11%)
- Other social issues (7%)
- Environment (6%)

Health was also rated the top issue for NSW government attention in 10 years’ time. 2% of respondents said air pollution was the top Government Issue (a reduction from 4% in 2009). Of these, most said reducing vehicle emissions was top with reducing industrial emissions and reducing air pollution in general making up the rest.

In response to the question, “What is the most important thing the NSW government can do?” education to increase awareness of and engagement in environmental issues was nominated by 9%. Listening to and consulting with people, and putting money or research into environmental issues was nominated by 5% of people.

When asked if over the past three years, had air quality got worse?, fewer people believe air quality has become worse over the past 3 years (19% vs last survey’s 24%). 50% of people think it hasn’t changed in that time and 26% of people think it has improved. Women were more likely than men to believe air quality has become worse (22% vs 15%). People who have high environmental concerns are more likely to view air quality as worse (27% vs 19%). 48% of people say they have often acted to reduce their fuel consumption/vehicle air pollution, often to save money (49%).
OUTCOMES OF FACILITATED WORKSHOP SESSIONS WITH EPA AND NCCCE (APRIL 2013)

This was a workshop on air science, policy and communication. Community was represented by the Newcastle Community Consultative Committee on the Environment (NCCCE)

These questions were asked:

1. How can the EPA better communicate air science and policy to the wider community?
   - That the websites for the public should contain a searchable map.
   - The website should contain an interactive (popup) Q & A section (e.g. What is that black stuff on my window sill? Should I close my windows at night?)
   - An Air App should be developed; what to look for and what action to take.
   - Regular updates should be provided in the newspaper
   - Regular (quarterly) meetings should be held for the public
   - Regular (weekly) slot on the radio should take place with opportunity for questions phoned in.

2. What type of information do community members want?
   - Visual interactive map on EPA website linking all industry and EPA monitoring data in one place.
   - Monthly averages for PM2.5 rather than annual, in monthly Air Quality Report. Monthly averages would be more of value to the community. Monthly report to appear more quickly than currently (sometimes 2 months after event).
   - Display of values to include all units.
   - Archival material to be more easily accessed.

3. How do community members want to receive information?
   - Monitoring data: one-stop-shop including industry info
   - Actions on feedback and complaints is not currently clear and requires reporting back to the community
   - Easy to find and understand maps, social media and SMS service
   - Newspapers and radio. A newspaper Air Watch report.
   - Increased understanding of basic principles so people can interpret
   - Increased public forums (every 6 months)

4. How do community members want to provide feedback?
   - A have your say website, website Q & A section
   - Info on when reviews of industry licence conditions are being undertaken, and community involvement in this

5. What can EPA and NCCCE do to build trust with community regarding local air quality issues?
   - Develop a protocol for engagement
   - More info about the health burden of air quality in EPA info – the cost of pollution
   - More clarification on EPA interaction with community
   - Feedback when complaints occur
   - Good news stories
   - Community opportunity to comment on new industry licences and renewals
   - Web Q and A for education
   - More involvement in EPA research - community and industry input
   - Diverse approach to info delivery and education
Other recommendations included:

- Improved education for public knowledge of air quality issues – how to interpret results
- More public forums
- Have e-copies of public/industry presentations available on website
- Summary of licence conditions, performance and pollution emissions for key polluters in district (e.g. Orica, OneSteel etc.) With info on actions taken by EPA for exceedances and with explanations.
- Acknowledgement of complaints to EPA. Report of actions on complaints to EPA and industry
- Email communication to community groups with reports. Also put these on website.
- Communication with NCCCE and community groups via email, website and direct contact
- Regular meetings with EPA staff to discuss issues, actions etc. Monthly or bi-monthly.
- More information on the contribution of transport to air quality. Is it rail, road or sea, and in particular is it diesel?

**EPA STAKEHOLDER SURVEY (IPSOS, 2013)**

The EPA’s external stakeholders include community and general public, environmental and non-governmental groups, licensees, industry groups, peak bodies and business (manufacturing, mining, agriculture, construction), local governments, NSW government agencies (environment, planning, health, water), federal government, interstate EPAs and agencies. A survey was done of both the EPA’s stakeholders and the general public. (See Appendix 9 for questions used in the survey).

From the general population study:

- Detailed knowledge of the EPA is low. 53% of respondents said they knew nothing about it, although 84% had heard of them. Those who have heard of them had neutral or positive views.
- 43% of the general population surveyed thought they were professional, trustworthy (37%), independent (32%), effective regulator (34%). Those who knew about the EPA were more likely to say that they were professional and effective but less likely to say trustworthy, independent or innovative.
- 38% had contact with EPA through TV, 36% through newspapers
- 59% of respondents would seek info about Air quality and odours from the EPA
- 39% of respondents thought that air quality was a high priority in environmental legislation. 29% said it was an essential priority.
- 41% said air quality was being managed well or very well. 19% said it was managed poorly or very poorly. Those who knew something of the EPA were more likely to say that management of air quality was good or very good (43%). 22% who knew something of the EPA said it was managed poorly or very poorly.

From the stakeholder study:

- 50% were satisfied with EPA and 23% were dissatisfied.
- The EPA was seen as approachable (77%), professional (72%) and trustworthy (68%)  
- Common things that emerged were responsiveness and timeliness – responding appropriately to an issue or enquiry and doing something in a reasonable timeframe.
- A key perception was that health issues worsen over time, so taking too long was detrimental, or seen as not taking things seriously.

Community and environmental stakeholders prioritise the environment. They often felt they were not heard by the EPA. The “common thread tying most environmental stakeholders together” (Ipsos 2013, p7) was that the EPA does not give their concerns enough weight. Industry stakeholders expressed a desire for pragmatic outcomes balanced against environmental and commercial interests.

Many community stakeholders felt that EPA did not willingly share important information. This contributed to lack of trust and they felt the EPA is not clear in terms of objectives, capacity, remit and stance on particular issues. Some asked for greater transparency in accessing raw data and scientific evidence. They also felt the EPA was not clear in its relationship with industry. Many community and environmental stakeholders felt that the EPA is not independent from industry, this being to industry advantage. Senior-staff are felt to be pro-industry and view community stakeholders as adversaries.

Another recurring theme was giving feedback. Many stakeholders reported a frustrating lack of any feedback at all. Stakeholders desire their input into decisions made by the EPA and they want feedback about how their input was used.

All groups requested that the EPA be more proactive in its approach. Suggestions included having a clear stakeholder engagement policy, being clear about the EPA’s role, remit and vision and expectations of stakeholders.

Communications were fine for 69% of all stakeholders. Stakeholders did express a desire for more direct contact including e-newsletters. Most people communicated with the EPA via email (86%) and phone (83%). 71% used the website and some found it hard to use. No strong demand was made for social media.

Consultation between stakeholders and the EPA was requested to be early and wide. An engagement charter clearly outlining the consultation process was suggested and an expectation for feedback (again) about the decision and outcome rationale.

**RECOMMENDATIONS MADE BY IPSOS:**

1. Clearly communicate the EPA’s role
2. Be transparent in all transactions and communications
3. Prompt responses to submissions and enquiries
4. Manage stakeholder expectations around how it responds to submissions and enquiries.
5. Demonstrate how the EPA balances competing stakeholder priorities and evidence in compliance process
6. Communicate the EPA approach to compliance clearly and effectively.
7. Communicate how the EPA ensure appropriate levels of staffing and access to expertise
8. Ensure meaningful consultation with stakeholders, including the development of stakeholder engagement principles.
4. Policy

POLICY AND COMMUNITY

A number of policies have been developed to aid the development of environmental and air quality programs. The New South Wales Environment Protection Agency and Department of Land and Water Conservation produced a document in 2000 entitled *What We Need Is...A Community Education Project* (NSW EPA 2000). The document provides a detailed guide for involving communities in discussing and responding to environmental issues. It also includes discussion of various techniques for community engagement, their strengths and weaknesses, and suggestions on which techniques would suit particular issues and groups. The second half of the publication contains five case studies of environmental issues where community education projects were used. The Victorian EPA has also developed a policy for engaging with the community (Vic EPA, undated), developed to articulate the processes and aims of community engagement. It emphasises working with all stakeholders in government, industry, and the community. In the United States, the US EPA has a memorandum on Early and Meaningful Community Involvement (US EPA 2001, see also Appendix 11), which highlights the need to proactively involve the community in determining how to meet environmental goals. It emphasises that communities need to be engaged from the beginning of the process, and that such community involvement needs to be sustained throughout the process. A similar concept, Community Based Participatory Research (CBPR) Guide for Air Quality Management formed the focus of a Western Australian Department of Environment and Conservation air quality management guide produced in collaboration with the Federal environment department (Department of Environment and Water Resources 2008). The guide provides comprehensive information about what CBPR is, how to identify potential studies and participants, and how to carry out a project. It also identifies four types of stakeholders:

1) Actively Involved: those who seek to be actively engaged in decision-making. These are often known to an agency and include activists and affected community members.

2) Attentives: those who are informed observers and seek to be kept informed. They include community leaders, academics and the media.

3) Browsers: those who will hear about the issue from the media (such as the newspaper) but won’t look into it themselves. They will form their opinions based on what the Actively Involved and Attentives think, and what they hear in the media.

4) General Public: those who have no solid opinion on the issue.

The CBPR Guide for Air Quality Management notes that the different types of stakeholders will often move between ‘types’ (such as a Browser becoming an Attentive) if their need for information is unfulfilled, and that they require different levels of community participation (DEWR 2008).

NSW planning and policy directions and community

Most recently, two New South Wales Government documents have focused on community engagement in planning. The NSW Government has adopted a state plan titled: NSW 2021: A plan to make NSW number one sets the Government’s agenda for change in NSW, that prioritises “consultation with the community to identify local priorities and develop Local and Regional Action Plans.” This plan has 32 strategic goals. Under the heading of ‘strengthen our local environment and communities’ there are specific goals that are relevant to this study as follows:

**Goal 22. Protect our natural environment**

Goal 23. Increase opportunities for people to look after their own neighbourhoods and environments

Goal 24. Make it easier for people to be involved in their communities

Goal 28. Ensure NSW is ready to deal with major emergencies and natural disasters (NSW Government 2013a)

At the time of writing this report a White Paper titled: A new planning system for New South Wales12 which includes a section describing the significance of community participation13. A key directive of this document is “Early and effective community participation in planning is central in the new planning system for NSW. Genuine community participation requires authorities to commit resourcing to planning processes to create a culture that values ideas, knowledge and contributions from all parts of the community. It gives the community opportunities to participate in shaping the future of their areas” (NSW Government 2013b, p.44).

These documents highlight the importance of broad-based community participation in developing effective policies.

All of these policies highlight the need for communities to be informed and involved participants in environmental programs.

5. Education

Education for the whole community is an important aspect of building engagement and capacity towards behaviour that protects the environment. Education programs surrounding air quality can be designed in partnership with existing educational institutions (e.g. primary and secondary school, TAFE, universities) and agencies (e.g. OEH and Environmental Trust, Local Council programs) that offer programs for the broader community. People may judge information about air pollution irrelevant if it does not relate to their personal experience, and knowledge does not always lead to action. In work on the impact of air pollution on commuting decisions in Queensland, while higher levels of education were correlated with greater concern about air pollution, less than 15% of respondents stated that air pollution was a barrier to walking or cycling to work (Badland and Duncan, 2009).

The following Australian and International case studies provide examples of education programs concerned with air quality.

COMMUNITY EDUCATION PROGRAMS

Australia

AirWatch, Western Australia

The Government of Western Australia Department of Environment and Conservation (DEC) ran the school-based AirWatch education program from 1996-2013 (DEC 2013a). Participating schools were provided with resources in line with the school curriculum, scientific equipment hire, and a

professional development session (DEC 2013a). The program aimed to educate young people on air pollution and climate change and to encourage children to actively reduce the energy use of the school (DEC 2013a). In 2009 the DEC AirWatch program was presented with the Clean Air Society of Australia and New Zealand Clean Air Achievement Award (DEC 2013b). While the program has been discontinued, it provides an example of an Australian environmental agency involving young people in air quality discussions.

Li’l Larrikins

In Australia, community education and engagement has been used around natural hazards. The various state and territory SES, the Australian Fire and Emergency Service Agencies Council (AFAC) and the National Emergency Management Program together developed the Li’l Larrikins program, aimed at educating school students about hazard risk and preparedness (Australian Council of State Emergency Services, 2013). The program involved school kits with lessons about natural hazards, videos, and a website. The school kits use a ‘5 E’s’ framework, looking at five phases: engage, explore, explain, elaborate, and evaluate. The program developed 10 short videos on flood, tsunami, emergency preparedness, and cyclone safety to teach children about preparedness and safety. The videos were developed in consultation with a child psychologist and aim to educate children and encourage them to have conversations with their parents. Unfortunately the website is no longer active, and some links are incorrect.

Harden Up

The Harden Up website14 was launched by Green Cross following the 2010-2011 floods and is a Queensland-based hazard education and awareness site (Green Cross Australia, 2014). The site has a focus on natural hazards and climate change, and includes both educational tools and volunteering opportunities. It contains historical information about hazard events in Queensland, as well as links to programs and resources in different locations. One key element of the site is the Harden Up preparedness plans, with the website noting that over 40,000 people have made a plan since the site’s inception. This project works to not only provide the public with information, but also with tools to use in their own hazard preparedness.

Pictorial Community Action Guides

In addition to the children’s Li’l Larrikins program, education on natural hazards has been developed for the wider community. Australian Emergency Management, part of the Federal Attorney-General’s department, has developed short comic strip safety guides for six different hazards: cyclone (Figure 1), earthquake, flood, heatwave, lightning, and severe storm (Australian Emergency Management, undated). The program received the 2013 Australasia Emergency Management Resilience Award for promoting community awareness. The comics provide simple and clear illustrations and basic English instructions to tell people what to do in emergencies. In addition to these comic strips, there are also FloodSafe and StormSafe guides, developed by the NSW SES, Canterbury Council, and NRMA, available in six community languages, and FloodSafe fact sheets and audio in 33 languages (NSW SES, 2012). Tsunami information is also available in ten different languages, to target major immigrant groups (NSW SES, 2011).

14 http://hardenup.org/
**Hong Kong**

**Environmental Exhibition & Resource Centres, Hong Kong**

The Hong Kong Environmental Protection Department operates six Environmental Exhibition & Resource Centres in Hong Kong with the aim to educate the public on environmental issues and to encourage public involvement in environmental protection (GovHK 2013). There are five permanent centres and one mobile centre (GovHK 2013). The centres cater for school or community group visits as well as being open to the general public (GovHK 2013). Each of the centres run different environmental programmes and has interactive exhibitions and games as well as a library and lecture room (GovHK 2013). The centres also distribute resource materials and provide education kits for teachers (GovHK 2013).
EPA Air Quality Actions and Programs

The EPA is committed to actively reducing particle emissions and has implemented a number of plans and programs which are summarised here. It should be noted these also fall under the headings of community engagement and participation.

**NSW AIR EMISSIONS INVENTORY**
This covers the regions of Sydney, Newcastle and Wollongong, known as the Greater Metropolitan Region (GMR\(^{15}\)). It is an inventory of all the substances released into the atmosphere by man-made and natural sources. Emissions are estimated for over 1000 substances including air pollutants such as particulate matter (PM). It allows quantification of particle emissions from the main sources impacting air quality. The EPA updates it every 5 years (2013 will be the most recent). (EPA 2013a, EPA 2013b, EPA 2013c). It does not cover the entire Lower Hunter region.

**DUST STOP PROGRAM**
The Dust Stop Program (2013) is one of the EPA’s recent initiatives implemented throughout coal mines in NSW, which will determine the best approach to reduce dust emissions at each mine, with practical measures implemented through pollution reduction programs. All working coal mines are required, through pollution reduction programs (PRPs) attached to their environment protection licences, to assess their operations against international best practice dust management. Improvements to dust management are identified and reported back to the EPA. The EPA works with industry to implement PRPs for managing dust from haul roads, under adverse weather conditions, for managing stockpiles and monitoring dust. The EPA has also developed and circulated a pictorial dust assessment handbook for mine sites. The handbook is intended to help mining machinery operators assess and reduce their dust emissions. Following reporting and review of procedures by the EPA in 2014, the EPA will further refine regulation of coal dust emissions (EPA 2013b, EPA 2013c).

**THE CLEAN MACHINE PROGRAM**
This intends to reduce diesel exhaust emissions from non-road diesel machinery. The EPA works together with councils and private companies in the construction, maintenance, waste and port industries to develop better worksite practices, obtain cleaner machinery and also works to retrofit existing machines with diesel particle filters. The partners targeted are identified through the Air Emissions Inventory. As of June 2013, 30 organisations had become partners in the program and 20 of these had retrofitted 118 diesel machines. This translated to reductions of approximately 2.6 tonnes of diesel particles per annum (EPA 2013b, EPA 2013c).

**INDUSTRY LEVY CONTRIBUTION TO AIR QUALITY MONITORING NETWORK**
Funding is secured from the coal mines and electricity generators in the Upper Hunter for monitoring and ongoing operation of the air monitoring network. This is in the form of an industry levy which is calculated from the mine and premises’ emissions and the amount of materials moved (EPA 2013b).

\(^{15}\) A map defining the Greater Metropolitan Region is found on the EPA website at http://www.epa.nsw.gov.au/resources/air/figure107335.pdf
WOODSMOKE REDUCTION PROGRAM
Woodsmoke reductions are being undertaken by local councils with support from the EPA in the form of training and resources. Education initiatives for the local community, local enforcement programs for Councils and rebates for residents for removing old heaters are some of the initiatives included in over $1million worth of grants as part of the Woodsmoke Reduction Program in NSW. The Program also works with government and industry on the National Plan for Clean Air and Standards Australia, to recommend tighter wood heater emission limits nationally (EPA 2013a, EPA 2013b, EPA 2013c).

LOWER HUNTER DUST DEPOSITION STUDY – DUE TO COMMENCE 2014
Visible dust deposited locally in the Newcastle area (PM$_{50}$) will be measured over one year, and analysed for composition and sources. This study will also examine the relationship between dust deposition and proximity to the rail corridor in the Lower Hunter region (EPA 2013a). This study was sent out to tender in June 2014 (EPA,2014). The EPA has established a reference group for the study, which comprises eight members: two community representatives, two industry representatives, two independent technical experts and two EPA staff members (EPA 201416).

LOWER HUNTER PARTICLE CHARACTERISATION STUDY
This is to take place at Stockton, Beresfield, Mayfield and Newcastle and has adopted the same protocol as the Upper Hunter particle characterisation study but with a longer timeframe of 18 months (EPA, 2014). It has been through peer-review of the study design and monitoring began in March 2014. This study is in response to community concern, regarding air quality and its relation to the proposed additional coal terminal and the rail corridor in the Lower Hunter region (EPA 2013a).

BEST PRACTICE DIESEL EMISSIONS MANAGEMENT STRATEGY
The EPA is implementing a best practice diesel emissions management strategy for mine sites. It will identify international best practice emissions reductions, for non-road vehicles and mine equipment. It will also assess how well NSW mines meet best practice standards and if they can be retro fitted with pollution control devices. It is also proposed that PRPs attached to environment protection licences will be enforced, as with the Dust Stop Program, to reduce diesel emissions. The EPA also advises the DP&I on air quality assessments for coal mines, recommending conditions when a mine is approved. The EPA has also commenced more stringent enforcement actions such as assessing and auditing coal mines, conducting unannounced inspections and surveillance of operations, and issuing penalty notices or other legal actions when there is a breach (EPA 2013b, EPA 2013c). The EPA held a diesel workshop on 13 June 2014 to introduce emission standards for non-road diesel engine emissions (EPA, 2014).

EPA LOCAL GOVERNMENT AIR QUALITY TOOLKIT
The EPA has also developed the Local Government Air Quality Toolkit. This is a resource for local council officers to assist them in improving local air quality. Training workshops are also held for local councils to assist them in applying the toolkit (EPA 2013b, EPA 2013c).

LET’S CLEAR THE AIR

This was an air education project started in 2009 by the OEH (this project is completed). Its aim was to promote public awareness and understanding of air pollution and its impacts by encouraging the adoption of sustainable behaviours for businesses and individuals to improve air quality in NSW. The Let’s Clear the Air website provided free educational resources and information for the public. It promoted activities such as reducing woodsmoke and encouraging use of sustainable transport. Educational aspects of the program included the Clean Air, Healthy Communities program funding provided by the NSW Environmental Trust. This program aimed to reduce vehicle emissions and reduce the dependency on vehicles for transport, with co-benefits being reduced greenhouse emissions and improved air quality. Initiatives included workshops and grant funding for local councils.

6. Monitoring, reporting and consultation

The EPA is committed to engaging and informing the community. The EPA website offers a range of information available to the public, including information on emissions and their sources, the air quality monitoring network, air quality monitoring data, reports and information on particulate matter and its impacts on health. Hourly updates for local air quality levels are available on the OEH’s air quality monitoring website. SMS and email alerts are available to subscribers to alert them of high pollution days.

The Air Emissions in My Community tool was launched in December 2013, showing data from the Air Emissions Inventory for 2008 Calendar Year including top emission sources for a local area or LGA and geographic comparisons.

The Air Quality Index (Figure 2) was developed by the Office of Environment and Heritage (OEH) in response to the need to improve community awareness and knowledge of air quality. The Air Quality Index calculation was revised and hourly updates released for each monitoring station and region, instead of twice daily. The website was improved with more maps and greater access to historical data. Six air pollution categories instead of three were established, these categories are: very good, good, fair, poor, very poor, and hazardous. An email and SMS subscription service was introduced for the community to receive health alerts and pollution forecasts.
MONITORING AIR QUALITY IN THE LOWER HUNTER REGION

National Environment Protection Measure (NEPM) for air (NSW Office of Environment and Heritage 2014)

The National Environment Protection Measure for Air (NEPM) sets maximum goals or standards for the gaseous pollutants (nitrogen dioxide, sulfur dioxide, carbon monoxide and ozone) and for fine particles (as PM$_{10}$ and PM$_{2.5}$). The NEPM standard for PM$_{10}$ is a 24-hour average of 50 ug/m$^3$ and the PM$_{10}$ goal is that this level is not to be exceeded more than five times per year. The current NEPM advisory reporting standard for PM$_{2.5}$ is a daily average of 25 ug/m$^3$ and an annual average of 8 ug/m$^3$. Currently, there is no goal for PM$_{2.5}$. The NEPM provides guidelines for the measurement and reporting of air quality on a regional basis to provide information on the exposure of the general population in that region to the pollutants noted above.

Lower Hunter - annual exceedences 1993-2013

Air quality has been measured continuously in the Lower Hunter region since 1993 (gaseous pollutant measurements commenced in 1993, PM$_{10}$ in 1994 and PM$_{2.5}$ in 1997) (Figures 3 – 5 below).

Air quality in the lower Hunter is generally good by international standards. While levels of nitrogen dioxide, carbon monoxide and sulfur dioxide in the Lower Hunter have not exceeded national standards during this time, exceedences for ozone and fine particles have been recorded periodically. Levels of ozone and fine particles can be affected by such things as the annual variability of the weather, the location and intensity of emission sources such as transport and industry and significant natural events such as bushfires and dust storms.

Over the last twenty years, notable events were major bushfires (in the summers of 2001-2002 and 2002-2003 and recently in October-November 2013) and the 'red' dust storm in September 2009.

**Figure 3. Days exceeding NEPM standards for PM$_{10}$ in the lower Hunter 1993-2013**

**Figure 4. Days exceeding NEPM advisory reporting standard for PM$_{2.5}$ in the lower Hunter 1993-2013**
COMMUNICATION AND CONSULTATION IN THE LOWER HUNTER REGION

The EPA website also contains links to further information such as NSW Health’s webpages on air quality and health. The EPA holds public forums and workshops with local communities in the Hunter region, including through the NCCCE. The NCCCE meets regularly with a representative from the EPA’s Newcastle office (EPA comm. 2014). The EPA held a workshop with the NCCCE in April 2013 (p16) to discuss how the EPA can better communicate with the community. Additionally, a stakeholder survey was conducted by Ipsos (p18) in 2013. (EPA 2013a, EPA 2013b, EPA 2013c, Ipsos 2013).

Clean Air Forums (organised by the OEH) were held every three years for the public. These forums brought together >200 community representatives including scientists, local government, students, environment and transport advocates to discuss ideas, trends, strategies and technology that can reduce air pollution and carbon emissions. The last one in 2010, focused on technologies to reduce greenhouse gas emissions in the future.

7. Community-based social marketing

The social diversity of contemporary urban communities has influenced the way sustainable development programs are designed, implemented and assessed. The focus on community as a place to promote sustainable development initiatives and foster pro-environmental behaviour is partly in response to the complex local geographies in which we live our daily lives. May (1996) argued that people draw on multiple place identities in the social construction of community. McKenzie-Mohr & Smith (1999) advocated that for community-based programs to foster pro-environmental behaviour they must be multifaceted and incorporate social marketing techniques which involve direct contact with community members. This approach recognised the individual as a social entity and the concept of cultural capital (Bourdieu 1984) as important aspects in understanding why people choose to adopt or reject sustainable activities.

The community-based social marketing approach commences with people’s behaviour and then selects a particular strategy suited to that behaviour. The community-based social marketing model conceptualises two key aspects to understanding behavioural change, the benefits and barriers.
people perceive; and the ratio of benefits and barriers for individuals toward the target behaviour. The inclusion of community-based social marketing techniques into program design acknowledges that barriers which prevent individuals from engaging in sustainable behaviour are activity specific and include both internal and external barriers (McKenzie-Mohr & Williams 1999). A community-based social marketing strategy requires an ongoing evaluation process that is compatible with the dynamic social landscape of urban communities.

The report produced by the World Wildlife Fund United Kingdom (WWF-UK) Weathercocks and Signposts: the environment movement at a crossroads (Crompton 2008) questioned some aspects of the effectiveness of the social marketing approach to behaviour change and the associated 'small-step' program strategy to tackle the environmental challenges facing consumer societies. The report specifically questioned whether an emphasis on green consumption addressed the fundamental problems inherent in consumerism (i.e. underlying motivations) to effect systematic behavioural change. Although, the report does acknowledge that the market segmentation techniques employed in community-based social marketing highlighted the importance of social context. It explained that a range of communication strategies are necessary to work with diverse communities and the importance of human values in determining behavioural choices. The report argued that for programs to inspire pro-environmental behavioural change the initiative needed to engage with the intrinsic motivations and values that underlie decisions.

Where there is a convergence of self-interest and environmental interest small scale programs could employ community-based social marketing to motivate behavioural change. The report recommended that organisations, government and public debate engage with the values that underpin responses to environmental and sustainable development initiatives.

8. Risk management

Effective management of any environmental risk, including air pollution, requires an informed and engaged community.

Academic research has been conducted into public perceptions of risk in general and air pollution in particular. A brief summary of key research and trends is provided here. The key findings in the literature are the role of tangible evidence of pollution in creating concern in individuals, and the role of socio-cultural factors, such as income, gender, and trust, in determining individuals’ attitudes towards pollution. Understanding of public perceptions of risk and pollution is necessary for ensuring that any programs to inform the community about air quality will be accepted and understood.

Research has found higher levels of concern about air pollution when individuals could point to physical evidence of pollutants – sight, smell, and health impacts. One early environmental hazard study, conducted in Los Angeles in the early 1960s and assessing the perceptions of five different hazards – smog, air traffic noise, brush fire, landslide, and flood – found that smog was the hazard most perceived by residents, as they were able to clearly see evidence of it (van Aardsol, Sabagh and Alexander 1964). In Birmingham, UK, one study described the public connecting ‘primary evidence of the climatic factors that promote air quality problems’ in relating weather and smog to health concerns (Bickerstaff and Walker 2001, pg 137).

Comparing perceptions of air pollution in different suburbs in London, Day (2007) found that respondents in areas with more trees and greenery saw the air as cleaner than those with less greenery, even though the actual pollution levels were similar. In another English study, Howel et al
(2003) found that those who lived closer to heavy industry were more likely to say they or someone they knew had a health condition negatively affected by pollution. The study specifically asked about perceived impacts of pollution on health, stating that “The presence of industry nearby, with its influence on the environment and the identity of the neighborhood [sic], frames residents’ views about the links between air pollution and health (pg 170).” Similarly, a report produced by People Science & Policy Ltd for the Department for Environment Food and Rural Affairs (Defra) in the UK noted that sensory perceptions in the form of sight and smell were key to individuals’ assessment of air quality and pollution (People Science & Policy 2006). In Australia, the Australian Coal Association Research Program (ACARP) produced a report into dust concentrations and community response in the Hunter Valley in 1999\(^\text{18}\) (ACARP 1999) (see Scientific Literature Appendix in this report). The researchers conducted weekly repeat interviews with community participants, asking questions about the amount of and nuisance caused by dust. They found that seeing evidence of pollution – either emissions from a mining or other source, or dust around the outside of their home – was important in determining community responses.

**DISASTER PREPAREDNESS**

Community engagement in managing environmental issues has become increasingly important in recent decades. One key early work on community engagement is by Maskrey (1989), looking at hazard programs and preparedness in Peru. Maskrey (1989) argued that planning for and responding to environmental issues would only be effective if it worked from the community level, rather than a top down bureaucratic approach. Further work in the field has emphasised the importance of public consultation and participation, and the need for clear and accessible information (Pearce 2003).

The potential for the internet to be used to increase awareness of environmental hazards has been recognised in recent years. Websites can serve as a database, allowing ‘hot spots’ to be identified and planned around (Dunbar 2007). Social media can also be successfully used to engage the public in preparedness and response. One example from the Queensland floods of 2010-2011 is Queensland Police. Using their @QPSMedia Twitter account and the hashtag #qldfloods, Queensland Police were able to effectively engage with the community, providing information and correcting misinformation, to allow people to protect themselves during the floods, with over 35,000 tweets using the #qldfloods hashtag sent, and Queensland Police widely praised for their social media presence (Bruns et al 2012). Difficulty in finding information and difficulty in understanding terminology used have been identified as barriers to public understanding of air quality (Bailey et al 1999). Having a clear and public source of information enables communities to engage with reliable environmental information. With regards to air quality, it allows individuals to know when pollution is high and, if necessary due to allergies or asthma, to change their behaviour on high pollution days (Shooter and Brimblecombe 2009).

**ENVIRONMENTAL MONITORING AND MANAGEMENT**

While there are barriers and limitations to understanding air quality issues, a number of programs and tools exist that try to provide this information to the public. International and Australian tools and programs were reviewed to understand global best practice in presenting air quality information to the community and in increasing community awareness of air quality. These case studies are summarised here and are arranged by country. In addition to air quality programs, a small selection of natural hazard programs that could inform approaches to air quality information have also been included.

\(^{18}\) Monitoring was conducted at three locations in the Upper Hunter: Camberwell, Singleton Heights, and Warkworth.
The United States Environmental Protection Agency (EPA) AIRNow website and app
AIRNow has been the national data collection method for air quality in the United States since 1998 and is a result of the collaboration between federal, state and local agencies (Dye et al 2004; AIRNow 2013a). It was designed ‘to provide easy access’ to air quality data (Dye et al 2004, p.1). While the program is run by the United States EPA, the branding AIRNow and EnviroFlash is used instead of the EPA logo on all material. AIRNow provides daily forecasts and real-time data updated hourly (AIRNow 2013a). The EnviroFlash program, as part of AIRNow, provides an email and text message subscription service offering either daily forecasts or alerts when levels are high, and utilises Facebook and Twitter (EnviroFlash undated). AIRNow data is also available on commercial weather websites, on CNN and Weather channel television stations and in the USA today newspaper (Dye et al 2004).

The AIRNow website has a strong focus on providing clear information to school aged children through interactive activities. An animated character ‘Coco the chameleon’ is used to teach children aged 7-10 about the health effects of poor air quality through games on the website (AIRNow undated a). There are animated videos and an interactive simulated city ‘Smog City 2’ aimed at children over the age of 11 (AIRNow undated d). The AIRNow website also provides curriculum resources and activity ideas for teachers (AIRNow 2013b). The US EPA AIRNow App has been available since 2011. It provides separate index levels for PM$_{2.5}$ and ozone on a scale from 1-150 and in categories of good, moderate or unhealthy for sensitive groups (see Figure 6). There is corresponding health advice for the category of the air quality level. The app allows the user to search by zip code or use their current location, and is available for both Apple and Android devices (EPA undated).

The United States EPA School Flag program
The EPA School Flag Program is an outreach program designed to increase community awareness and knowledge of the air quality index and to educate the community on the health effects of poor air quality. The program uses the Air Quality Index (AQI) which measures both ozone and particulate matter (PM$_{10}$ and PM$_{2.5}$) at government monitoring sites (Shendell et al 2007). A fax or email is sent to the participating school or community centre (including hospitals and universities) with the forecast and then a colour flag to match the forecast is raised (Shendell 2007). The flags
used correspond with the colour gradient of the AQI scale: green, yellow, orange, red and purple (AirNow Undated b). Participating schools and community centres are provided with flags at no cost and given informative presentations on the program and provided with continuing support (Shendell et al 2007). A report on the program being used in communities with poor air quality in Central California in 2004-06 found the focus of the program to be two-fold: while the program was targeted at educating school children and indirectly informing the broader community, it was also intended to produce local policy reform to reduce exposure to asthma triggers at schools (Shendell et al 2007). There are now over 350 schools participating in the program across the United States (AirNow undated c). The program has been seen as a simple yet effective program for increasing awareness of air quality and changing people’s behaviour on days of poor air quality (Shendell et al 2007).

**Canada**

**Air Quality Health Index, Canada**

The Air Quality Health Index (AQHI) was designed to improve upon the existing Index of the Quality of the Air (IQUA). It was developed following a 2004-05 public opinion survey and involved consultation with stakeholders from the government, industry, non-government organisations and health authorities (Environics Research Group 2005). The AQHI was introduced into four communities in British Columbia in 2005 as a pilot program run jointly between Environment Canada and Health Canada. The program was reviewed before being expanded further in British Columbia in 2006 and then introduced into eastern Canada in 2006-07 (Office of the Auditor General of Canada 2009). It has since become a national index.

The AQHI correlates air pollution to health risk and is presented as a numerical scale from 1-10, in categories of low, moderate, high or extremely high risk to health and by using a colour gradient (see Figure 7) (Environment Canada 2013). The AQHI also presents a health message to correspond with the air quality level and includes suggestions when the general public or people at risk should modify their outdoor activities (Environment Canada 2013).

![Figure 7. AQHI (Environment Canada 2013)](image)

A mobile app presenting the Canadian AQHI has been developed (Apple online store 2013b), however it is not endorsed by Environment Canada. In December 2013 the Government of Alberta released the AQHI App for iPhone, iPad, and Android (see Figure 8) and will release the App for Blackberry in 2014 (Government of Alberta 2013). The App provides hourly updates on air quality for over 20 communities in Alberta (Apple online store 2013a).
Social marketing model used for AQHI, Canada
The success of the AQHI was contributed to by the social marketing model used. The campaign that ran alongside the introduction of the AQHI in British Columbia titled ‘Air Quality – Get to know it’ used printed material distributed to local councils and included brochures, posters and give-away promotional items (Environment Canada 2013; Communication Solutions 2013). The introduction of the AQHI in Toronto was accompanied by the development of educational resources to support air quality being a part of the school curriculum, as well as outreach programs within the community (Office of the Auditor General of Canada 2009). This included providing a “tool kit” which comprised of PowerPoint presentations, newsletter articles and print resources for community organisations to use (Environment Canada 2010). The government also worked with health care providers to target patients at risk from air quality related illnesses, and hosted booths at conferences (Environment Canada 2010). A 2010 evaluation of the AQHI found the Weather Network cable television channel was a particularly valuable way of presenting data, and was the second most common way people receive information on the index after the internet (Environment Canada 2013). The same evaluation showed the need for greater utilisation of local newspapers in providing information on the index and confirmed the need for the use of social media (Environment Canada 2010).

UK
London Air
London Air is a program run by the Environmental Research Group, King’s College London (Environmental Research Group 2014 a). It has three foci, public, policy, and science, with each section containing information and resources geared towards different interest groups. The service has both an app and a Twitter address (@LondonAir) to provide information, as well as a monthly email newsletter. London Air was established with an interest in health and the impact of air pollution on people’s health, and provides information on the levels of five pollutants: NO₂, O₃, PM₁₀, PM₂.₅ and SO₂. The service also provides a banded and colour-coded key to pollution levels to ensure easy reading and simplicity, with their Nowcast map (see Figure 9) providing an hourly...
updated map of pollution levels across greater London. The site also allows users to download data from specific monitoring sites.

![Updated Pollution Map](image)

**Figure 9. London Air App, Nowcast Pollution Map (Environment Research Group 2014a; Google Playstore)**

**airTEXT, London**

The Greater London Authority (GLA) is working with London boroughs to reduce emissions and reduce public exposure to air pollution as part of the Mayor’s Air Quality Strategy (GLA 2013). As part of this policy the GLA funds airTEXT, a service run by the London boroughs of Croydon and Islington (GLA 2013). AirTEXT has provided forecasts for air quality alongside UV, pollen and temperature forecasts for Greater London since 2007 (CERC 2014). The air pollution data is obtained by monitoring levels of ozone, nitrogen dioxide and particulates (PM$_{10}$ and PM$_{2.5}$) (CERC 2014). The data is presented on a scale from 1 to 10 and categorised into low, moderate, high or very high with a responding colour gradient (see figure 4) (CERC 2014). The service allows the user to search by borough and also shows air pollution levels on a map (CERC 2014). The website provides a three day forecast while the mobile app (available for Apple and Android) provides a two day forecast (see Figure 10 and 11) (CERC 2014).

The service also provides alerts through email, text message or voice mail, utilises Facebook and Twitter, and uses a separate account for each borough (CERC 2014). A 2009 study by the University of Brighton showed a substantial increase in public awareness of the impact of air pollution on health from receiving alerts sent through the airTEXT service (Smallbone 2009).
Cleaner Air for London programs

One aim of the London Mayor’s Air Quality Strategy is to raise public awareness of air quality and target groups most at risk of health effects from air pollution (GLA 2013). As part of this the Greater London Authority (GLA) designed a new air quality website, ‘Cleaner Air for London’ (GLA 2013). The website is devoted to providing clear information to the public on air pollution issues in London, the effect air quality has on health, and providing updates on programs underway to support the Mayor’s strategy to reduce emissions (GLA 2014b). The site provides links to London Air (a service where data is collected by Kings College London) and airTEXT for air quality forecasts (GLA 2014b). The ‘Cleaner Air for Businesses’ section of the website encourages businesses to reduce their emissions and to raise community awareness of air pollution by suggesting simple steps a business can take (GLA 2014a)

France

Atmo the giraffe, Airparif France

Airparif is an organisation accredited by the French Ministry of the Environment to monitor the air quality in Paris and the surrounding Ile de France region. Airparif monitors air quality, forecasts pollution episodes, assesses the impact of mitigation measures and informs the authorities, media and citizens. Airparif continuously monitors the air quality and contributes to the assessment of health risks and environmental impacts of air pollutants.
The Atmo Index (Figure 12), which has been in use since 1995, describes the daily air quality not only for the Paris region, but also all major French cities of over 100,000 inhabitants. It uses an illustrated giraffe to show the level of air quality and is numbered 1 to 10 with an associated descriptor (very good to very bad) and colour (green, orange and red). The Index is derived from pollution levels throughout the day from background monitoring stations and the characteristics of the general pollution of the city. It incorporates the major air pollutants: dust, nitrogen dioxide, ozone and sulphur dioxide.

![Atmo Index Diagram](image)

**Figure 12: Atmo the giraffe, his neck constricts as the air pollution index worsens (AirParif 2010)**

**Citizen science**

Another trend has been towards involving community members in monitoring environmental issues. This is part of what is known as citizen science. Citizen science is defined as “projects in which volunteers partner with scientists to answer real-world questions” (Cornell University 2014). As such, citizen science is a form of community engagement and works to create understanding and ownership of scientific research. Sites such as Zooniverse\(^\text{19}\) and SciStarter\(^\text{20}\) provide a platform for scientists and researchers to advertise their projects, and community-members to participate in projects that interest them. There are two ways the public are involved in citizen science projects: either an existing project provides data for the public to analyse, or they provide information about how individuals can collect and analyse data themselves. Citizen science and community engagement tools aim to give the public an avenue for involvement in and understanding of issues that affect their lives. One finding of citizen science and community engagement has been the importance of making any information clear and easily understood by the broader public, including the use of visual aids to explain pollution levels (Smallbone 2010). Environmental and pollution issues are common projects to use citizen science and public participation techniques.

International citizen science programs pertaining to air quality were reviewed to understand global best practice in engaging the public in air quality science, increasing community awareness of air quality and empowering the community to take action.

\(^{19}\) www.zooniverse.org
\(^{20}\) www.scistarter.com
In Australia the concept of Citizen Science has started to emerge lately with a piece published on ‘The Conversation’ website in August 2013 that gives an overview of the field, key players, and successful research that has used this approach (Simpson 2013). Another newly formed association The Clean Air Association of Australia has recently announced a citizen science project entitled: the National Visible Air Project. This project is still in a formative stage but some information can be found on their website\(^1\).

An overview of the citizen science case studies and initiatives are summarised here, and organised by country.

**USA**

**Community Air Screen Program, New York State Department of Environmental Conservation USA**

The Community Air Screen Program began in 2012 and allows community groups and individual citizens to work with the Department of Environmental Conservation in collecting air samples (NY DEC, 2014). The program is funded by the United States Environmental Protection Agency in support of community based programs. It is a limited program with 23 of 42 applications accepted, the majority of those accepted being community groups rather than individuals. The DEC works with the group or individual to determine the best time and location for the sample and then provides the equipment. Each sample is collected for one hour and the participants can use between one and six canisters (each having a capacity of six litres) spread around the neighbourhood. The participants record the date, time, temperature, wind direction and weather when the sample was taken as well as anything which may impact on the sample such as construction or heavy traffic. The sample is returned to the DEC where it is tested in a laboratory for 43 toxic air pollutants. If the results show levels of concern then extra testing will be ordered. The results of each sample are published on the DEC website.

**Next Generation Air Measuring, United States EPA**

Portable technologies could provide more avenues for the public to be involved in pollution monitoring. The United States Environmental Protection Agency has proposed utilising new technology in citizen science projects. The AirCasting Air Monitor is an inexpensive, mobile and easy to use device which allows the public to participate in collecting air quality data (EPA 2014a). Users can record the results on the AirCasting App for smartphones which will then map all of the results. This new technology allows for data to be collected at more sites and close to the source of emissions. As of January 2014 this technology has not been implemented, but the EPA is holding an upcoming webinar on this and other cutting edge pollution monitoring techniques (EPA 2014b). It is still being developed as part of the EPA Citizen Science Toolbox which aims for citizens to be involved in collecting air quality data.

**United States Environmental Protection Agency (Region 2)**

Region 2 of the United States EPA, which covers New York and New Jersey, has introduced a number of citizen science projects to engage with communities concerned about local environmental issues (EPA 2014c). The website provides links to short YouTube videos about particular examples of citizen science projects that have been undertaken\(^2\). One such example is the community of Tonawanda in upstate New York, where citizens concerned about pollution from the more than 50 industrial plants in their neighbourhood campaigned for the EPA to conduct a detailed study of air

\(^1\) [http://caaa.org.au/](http://caaa.org.au/)

\(^2\) The Tonawanda case study can be viewed at [http://www.youtube.com/watch?v=DZKxn1nioNA](http://www.youtube.com/watch?v=DZKxn1nioNA). The US EPA has a YouTube channel which features other community engagement case studies which can be found at [https://www.youtube.com/channel/UClUC_8c_F3aBmwME-dNfvKg](https://www.youtube.com/channel/UClUC_8c_F3aBmwME-dNfvKg) The US EPA Region 2 website contains links to citizen science videos for their region [http://www.epa.gov/region2/citizenscience/](http://www.epa.gov/region2/citizenscience/)
pollution (EPA 2013). The study found levels of six hazardous pollutants exceeded guidelines, including benzene levels 75 times higher than considered safe for health. The study resulted in one major polluter being found guilty of violating pollution and environmental regulations, and led to changes in their operating procedures to reduce benzene emissions.

**Canister Sampling Program, Southwest Ohio Air Quality Agency USA**

The Canister Sampling Program allows an individual citizen to request a canister from the Southwest Ohio Air Quality Agency when they are making a complaint about air quality (SOAQWA 2014). The individual receives the canister with instructions on collecting an air sample. The individual takes the sample for one or 24 hours and they record information such as the time, wind direction and temperature when the sample was taken. An inspector collects the canister and it is then analysed in a laboratory. The results are then used to assist the agency in identifying the air pollutant causing the individual's complaint.

**CitizenAir**

CitizenAir is a US-based website that acts as a message and information board about air quality projects, education, and information in the USA. It is for use by governments, community groups, individuals, environmental organisations, and relevant companies (CitizenAir undated). The site provides links to reports, talks, and articles on air pollution, as well as information about air quality measuring tools. Unfortunately the site appears to be little used.

**The Berkeley Atmospheric CO2 Observation Network (BEACON)**

BEACON is a new project to monitor air quality in the Bay Area of California. The project has set up monitoring equipment at approximately 20 sites, and has also developed a science program for involved and interested schools (University of California, Berkeley 2014). The program involves small-scale experiments on how to monitor emissions, as well as detailed science questions. It also teaches how to recognise what characteristics and differences might influence how much CO$_2$ is found at different sensor sites, including how much vegetation is nearby, if the area is residential, and if the area is industrial. This program is aimed at high school students and is more detailed than the London Cleaner Air 4 Schools program (detailed below), and shows how air quality programs can be aimed at different educational levels.

**UK**

**Cleaner Air 4 Primary Schools**

The London Mayor’s Air Quality Strategy has highlighted children as group vulnerable to air quality issues and as a result is trying to reduce air pollution levels around schools and educate children on air quality (GLA 2013). The ‘Cleaner Air for Schools’ section of the website provides information on air pollution for school-age children. The website has activities and videos teaching children about air pollution, and advice for children on reducing their exposure (GLA 2014c). The Mayor of London and London Sustainability Exchange released an extensive ‘Cleaner Air 4 Primary Schools’ toolkit for teachers with activities and experiments aimed to teach children in grades 3-8 about air quality (GLA 2014c). The Cleaner Air 4 Primary Schools toolkit encourages citizen science in schools by incorporating air quality issues into the National School Curriculum. The toolkit provides teachers with activities for school children in grades 3 to 6 to collect air quality samples and analyse the data. The activities include the use of diffusion tubes to test levels of nitrogen dioxide, ozone badges or test strips to test the concentration of ozone, surface wipes to test for particulate matter and ‘ghost’ wipes to measure heavy metals in the air. Each activity is linked to the curriculum for Science, Geography, Citizenship or English. The toolkit provides complete instructions and supplier details for the required equipment. The activities are simple to do and since the analysis is done by students in school it is designed purely as an educational tool.
Cleaner Air 4 Communities
Building on the success of the Cleaner Air 4 Primary Schools program, the London Sustainability Exchange began ‘Cleaner Air 4 Communities’. The project aims to educate communities about air quality issues in their area and greater London with the hope of influencing local policymaking and planning (LSX undated a). The project, which has worked with communities in Battersea and Merton, trains community members to use air monitoring equipment and identify what the LSX describe as air pollution ‘hot-spots’, and educates individuals on what actions they can take to improve local air quality. As well as air pollution projects, the London Sustainability Exchange has promoted community involvement in monitoring noise pollution on Pepys Estate, Lewisham (LSX undated b). Four resident ambassadors were recruited and trained in the use of noise monitoring equipment which they used to take 385 readings over a seven-week period. This data was analysed to produce GIS noise pollution maps to be utilised to create an action plan to address noise pollution issues.

The Openair Project
The Openair project is run in conjunction with London Air by the Environmental Research Group at King’s College, London, and is an open-source project for the analysis of air pollution data (Environmental Research Group 2014 b). It is supported by both the Natural Environment Research Council and Defra, and makes air pollution data available for analysis. In addition to providing the data, a manual is available describing the various tools and processes available for data analysis (Carslaw 2014). The project aims to allow for deeper analysis of air quality information, with the aim of better identifying pollution sources and allowing comparison to national and international measurements and standards. Openair data has been used by industry, academia, and consultancies, both within and outside the UK. Future opportunities to use this data and the data from other countries will allow for collaboration on air quality initiatives.

Australia
DustWatch Australia
DustWatch Australia23 is a collaborative project on wind erosion in Australia. It is a collaborative effort between universities, the Office of Environment and Heritage, and catchment management authorities. There are two citizen science programs in DustWatch, Community DustWatch and School DustWatch. School DustWatch24 has been developed to work with schools in remote Northern Territory communities, providing science education and monitoring of dust issues in their area. Community DustWatch involves volunteers taking measurements of dust and erosion events which are combined with monitoring data from other stations to give a detailed picture of wind erosion and dust issues across Australia. Both of these programs involve community members in monitoring a pollution issue and working with governments and agencies in education and understanding.

Clean Air Association of Australia
The Clean Air Association of Australia (CAAA) is a newly established not-for-profit group of academics and researchers who aim to work on increasing public awareness of issues around air quality. They are launching a National Visible Air Project, a citizen science project aimed at involving schools and communities in hosting and using air monitoring sites. Individuals, schools, and groups across the country will be able to host a monitoring site and check sensor data, which will be used

24 http://school.dustwatch.edu.au/site.html
for education, awareness, and scientific research. Placing monitoring sensors in schools across the country would help educate communities about air quality issues, as well as monitoring at the local level, allowing identification of local air quality issues. The Association plans to implement test monitors in a small number of schools soon. At the time of writing (June 2014) the CAAA website is still being developed, but brief information about the planned project is available from the website.²⁵

Section 2. Profile of the Lower Hunter Region

The Lower Hunter Region, as defined by the NSW EPA, is made up of the five Local Government Areas (LGA) of Newcastle, Cessnock, Maitland, Port Stephens and Lake Macquarie (Figure 13). The region is located in New South Wales, approximately 160km north of Sydney. Newcastle is the major city in the region and is the second largest urban centre in New South Wales.

![Figure 13: Map of the Lower Hunter Region (NSW Government Department of Planning 2006)]
Social Profile of the Lower Hunter Region

DEMOGRAPHICS

The Australian Bureau of Statistics (ABS) 2011 Census showed the total population of the Lower Hunter Region to be 520,666 (ABS 2013). Table 3 shows the population of each local government area included in the Lower Hunter region. The region is experiencing accelerated growth rates and the NSW Government Department of Planning (2006)26 expects that there will be an extra 160,000 people in the region by 2031.

<table>
<thead>
<tr>
<th>Local Government Area</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Macquarie</td>
<td>189,006</td>
</tr>
<tr>
<td>Newcastle</td>
<td>148,535</td>
</tr>
<tr>
<td>Maitland</td>
<td>67,478</td>
</tr>
<tr>
<td>Port Stephens</td>
<td>64,807</td>
</tr>
<tr>
<td>Cessnock</td>
<td>50,840</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>520,666</strong></td>
</tr>
</tbody>
</table>

Maitland has the youngest population in the region with a median age of 36 and 22% of the population aged 0-14 years old while 12.7% is over the age of 65 (ABS 2013). Newcastle has a median age of 37 and has the lowest percentage of the population aged 0-14 years old in the region at 17% (ABS 2013). Port Stephens has the highest median age at 42 and with 19.3% of the population over 65 years old has the largest percentage of elderly in the region (ABS 2013). With a high percentage of young people leaving the region the percentage of the population over 65 years of age is increasing at a rate faster than the state average (NSW Planning 2006).

The percentage of the population that identify as Aboriginal or Torres Strait Islander is the largest in Cessnock at 4.8% (ABS 2013). In Port Stephens it is 3.6%, in Maitland 3.5%, in Lake Macquarie 3% and in Newcastle 2.6% (ABS 2013). These are all greater than the NSW state average of 2.5% (ABS 2013).

26 This is the most recent data from the Department of Planning and was re-endorsed in 2010. The plan is currently being revised by the Department of Planning.
CULTURAL
There are six Aboriginal peoples in the traditional country of the Hunter Region: Awabakal, Birpai, Gaddhang, Gwaegal, Wonnarua and Worimi. The region features six main indigenous language groups: Awabakal, Birpai, Dainggati, Darkinjung, Gwaegal and Kamilaroi (McDonald et al. 2008). The Hunter region excluding Newcastle (Statistical Division 4) has an indigenous population above the state average, at 3.9% compared to 2.5% for New South Wales and Australia, while Newcastle (Statistical Division 3) has an indigenous population of 2.7% (ABS 2013). The percentage increase in the indigenous population of the Lower Hunter in the years 1996-2006 was 67%, compared to 36% for New South Wales. The indigenous community is also younger than the overall population, with 76% under the age of 40 compared to 51% of the non-indigenous population (McDonald et al. 2008). The Lower Hunter Region has a high percentage of the population born in Australia, compared to the state average, ranging from 82.3% in Newcastle to 87.8% in Cessnock and Maitland (ABS 2013). The most common countries of birth other than Australia are England and New Zealand with approximately 2% and 1% respectively (ABS 2013). The region has a much lower percentage of people with parents born overseas than the state average and 75% of the population report having both parents born in Australia (ABS 2013). The most common ancestry is Australian, English, Irish, Scottish and German (ABS 2013). English is the only language spoken at home for 87.3% of the population in Newcastle and for approximately 93% of the population for the remainder of the region (ABS 2013). Other top languages include German, Italian, Macedonian and Cantonese (ABS 2013). Anglican and Catholic are the predominant religions in the region with ‘no religion’ being the next most common response in the 2011 Census (ABS 2013).

ECONOMIC
There has been an increase in new jobs created in the region which has seen a reduction in unemployment rates (NSW Planning 2006). The number of skilled and professional workers is increasing and the service and knowledge industries have been growing consistently (Maitland City Council 2007; Lake Macquarie City Council 2013). Advances in technology and the automation of equipment have resulted in a decline in the number of people employed by the mining industry (Cessnock City Council 2014). The agricultural industry remains strong and the wine industry is growing along with associated tourism particularly in Cessnock (Cessnock City Council 2014). The main occupations in the region are professionals, technicians and trades workers, and clerical and administrative workers (ABS 2013). Coal mining accounts for 5.3% of employment in Maitland (providing 1,641 jobs) and 8.7% of employment in Cessnock (providing 1,814 jobs) while 5.9% of employment in Port Stephens is from defence (ABS 2013). Other major industries in the region include hospitals, school education and hospitality (ABS 2013).

Maitland has the highest full time employment at 60.1% while Port Stephens has the lowest at 56.1% (ABS 2013). Cessnock and Port Stephens have unemployment rates higher than the state average at 6.5% and 6.2% respectively (ABS 2013). Maitland has the lowest unemployment rate in the region at 5% (ABS 2013).

Maitland is the only LGA in the region with an average household median weekly income above the state average of $1,237 at $1,292 (ABS 2013). The lowest average household median weekly income in the region is $999 in Port Stephens (ABS 2013).
Environmental Profile of the Lower Hunter Region

The Lower Hunter Region is comprised of approximately 430,000 hectares (NSW DECCW 2009). Approximately 60% of the region is native vegetation, most of which is located in the ranges in the south west of the region as much of the valley floor has been cleared for mining, agriculture and development (NSW Planning 2006). The fertile land supports a strong agricultural industry in the region most notably dairy, crops and vegetables (NSW Planning 2006). The area also generates a large wine industry, especially in Cessnock, and is one of the oldest wine producing regions in Australia. The region contains areas of conservation status with ‘green corridors’ targeted for protection from destruction by future development (NSW Planning 2006). There are also important aquifers within the region which supply drinking water to both the Lower Hunter and Central Coast regions (NSW Planning 2006).

There is a significant lake system including Lake Macquarie which is one of the largest saltwater lakes in Australia (NSW DECCW 2009). The Hunter estuary wetlands have been Ramsar-listed and the wetlands at the shores of Lake Macquarie and Port Stephens estuary are also of national significance due to their habitat for migratory birds and endangered species including several species of marine turtles (NSW DECCW 2009). Port Stephens also has the largest mobile sand dune in New South Wales (NSW DECCW 2009).

MINING AND POWER GENERATION

The Hunter region employed 17,232 people in mining in 2011, the majority of this being in coal mining (NSW Minerals Council 2011). There are 3 coal mines in the Cessnock LGA, 9 in the Lake Macquarie LGA and 1 in the Maitland LGA, with none in the Newcastle LGA (EPA, 2014).

Coal from the mostly open-cut mines in the Upper and Lower Hunter valley is transported to the Port of Newcastle by rail. The Port of Newcastle is the biggest coal export port in the world. The Hunter Valley Coal Chain is comprised of 35 mines (across the whole Hunter Valley region), 24 rail load points, and 15,000 loaded rail trips each year, ending at the Port of Newcastle (NSW Minerals Council 2010). Three coal terminals currently operate in Newcastle, two are located at Kooragang Island and one at Carrington. A fourth coal terminal is currently proposed for Kooragang Island.

Origin Energy owns and operates Eraring Power Station, located at the southern end of Lake Macquarie (Origin Energy 2013). Delta Electricity owns and operates Vales Point Power Station located at the southern end of Lake Macquarie and Colongra Power Station near Lake Munmorah (Delta Electricity 2013).
ABOUT THE PROJECT

In late 2013, Macquarie University (Department of Environment and Geography, Faculty of Science and Engineering) was engaged by the NSW Environment Protection Authority (EPA), the Newcastle Community Consultative Committee on the Environment (NCCCE) and the Lower Hunter regional community to investigate information and community perceptions pertaining to air quality for the whole community of this region. The project aims were to analyse and provide recommendations regarding how to:

- Empower local communities to engage in informed discussions on air quality
- Increase community engagement and understanding about air quality issues in the Lower Hunter
- Contribute to community, industry and government initiatives to address air quality issues.
- Improve working relationships between community and government
- Identify solutions and actions to address community concerns

The project tasks included:

- Review information from community workshops and other forums held in 2012 and 2013 in the Hunter
- Conduct further community consultation to identify key community concerns about air quality in the Lower Hunter region.
- Review the Who Cares surveys, information in State of the Environment Reports, and other relevant projects and studies
- Assist the NCCCE and key community representatives to identify topics of interest and concern within the remit of the EPA and consistent with EPA air quality management practices
- Provide recommendations to improve the presentation of information on air quality that meets the requirements of the community.
- Recommend actions to improve community awareness of and access to information on air quality
Methods

This study was designed to capture community perceptions surrounding air quality in the Lower Hunter region of NSW. The collection of qualitative and quantitative social data was attained through interviews and focus groups. Interviewees who agreed to participate but could not attend face-to-face meetings were interviewed over the phone.

The consultation plan was developed based on analysis of previous local community studies to minimise any duplication of effort. Initial discussions with the EPA and the NCCCE also informed the design of the study. Intergenerational Democracy (ID) was the consultation method applied in this project, facilitating the objective of capturing whole-of-community views (Davies 2012).

Information and consultation tools

A consultation tool for interviews and focus groups was developed, refined and trialled (see Appendix 2 and 3) to collect social data. The EPA assisted in the process of refining this tool and approved the final version. The tool included a demographic form and 14 focus group and interview questions that could be responded to in writing or through a verbal interview process.

A letter requesting the consent of school principals was developed, along with a template giving their school’s consent (see Appendix 4).

An information sheet was developed (see Appendix 5) for each interviewee or participant to read prior to their involvement in the study. This study involved the engagement of young people under the age of 18 years. Their engagement required written parental authority (see Appendix 6) prior to the commencement of interviews or focus groups. Young people under the age of 18 were not photographed.

Human Ethics

Prior to the commencement of the data collection process, approval was attained from Macquarie University’s Human Ethics Committee.

An application was also lodged with the NSW State Education Research Approvals Process (SERAP) (see Appendix 7) to obtain approval from the NSW Department of Education to conduct research with students within schools. Approval was granted however the Department requested that three of the questions were not asked of young people and these were deleted from their set of questions.

Recruitment

All community consultation was held during March, April and May 2014. Eight visits were made by the researchers to the Lower Hunter region.

Interviewees and participants were recruited through purposeful selection and ‘snowballing’. Community directories were used to source whole-of-community representation including targeting citizens from age groups as part of the process of implementing ID. These groups included: the Country Women’s Association, Men’s Shed and a community action group. One meeting was held at the beginning and the end of the project with the Newcastle Community Consultative Committee on the Environment (NCCCE). Some interviews were conducted with staff members from the Sydney and Newcastle branches of the EPA and OEH.
Young people were recruited through TAFE colleges and schools. One primary school and one high school were selected from the region to participate in the study. These schools were selected based on their proximity to air quality issues.

**Data collation and analysis**

All focus groups and most interviews were conducted in the region. Some interviews were conducted on the telephone to suit people’s availability. Transcriptions were made of each interview and focus group. These sessions were audio recorded following permission from participants. The audio recordings were only used to check the accuracy of transcriptions and were deleted once final transcriptions were formatted.

The data was collated in Excel spreadsheets and analysed by question, theme and demographic variables (e.g. age and gender). Summaries were written and the findings compared with those from other studies included in the literature review.

The Draft report was presented to the EPA and NCCCE for review and revised following their comments. The final report was placed on the EPA web site and the link sent to participant groups.

**Community Comments**

The Draft Final Report was sent to all groups who participated with a request for comments and suggestions. Comments from five individuals were received and reviewed by the Macquarie University team and the EPA. Comments were summarised (see Appendix 12) and necessary changes and additions resulting from the comments were made to the report.

**Limitations**

This study was limited by time constraints. The project timeframe was seven months from commencement to completion of the draft report. The study required an extensive literature review for the collection of empirical data through community consultation. Delays were incurred through the requirement to attain human ethics approval from Macquarie University prior to conducting the community consultation. These delays were further compounded by the need to also obtain research clearance from the NSW Department of Education’s State Education Research Approvals Process to enable the inclusion of young people under the age of 18 in the study. School holidays at Easter also contributed to delays in including young people. Due to these time delays, the period of data collation, analysis and writing was compacted to a period of three weeks.

A further limitation involved a high proportion of the interviewees also participating in focus groups. As the names of individuals were not captured, it is not possible to determine the exact number that may have participated in both. Another limitation was a data collection error in one of the questions asked of high school students in the 15-19 year old age group. The 1-5 scale for Question 3a was omitted in error.
Results

SECTION 1 - DEMOGRAPHICS

SECTION 2 - QUANTITATIVE AND QUALITATIVE RESULTS
RESULTS
Demographics

The collection of data in this study involved interviews and focus groups. A total of 210 people were interviewed and 185 participated in 11 focus groups. Focus groups were held with: The NCCCE, two local TAFE colleges, one primary school, one high school, a Rotary group, a local council group of senior staff, a Men’s Shed group, a CWA group (that included representatives from branches across the region), a community group and a group of the EPA staff. Interviewees ranged from local academics (including atmospheric scientists), health practitioners, environmentalists, community leaders, industry representatives (including mining) and members of the general community from across the region.

A total of 395 focus group participants and interviewees took part in this study of which 208 (52.7%) were females, 183 (46.3%) were males and four people did not state their gender as male or female (Table 4). Percentages have been rounded to one decimal place.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Interviewees</th>
<th>Focus Group Participants</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>111 (52.8%)</td>
<td>97 (52.4%)</td>
<td>208</td>
<td>52.7%</td>
</tr>
<tr>
<td>Males</td>
<td>97 (46.2%)</td>
<td>86 (46.5%)</td>
<td>183</td>
<td>46.3%</td>
</tr>
<tr>
<td>Other</td>
<td>2 (1.0%)</td>
<td>2 (1.1%)</td>
<td>4</td>
<td>1.0%</td>
</tr>
<tr>
<td>Total</td>
<td>210</td>
<td>185 (in 11 Focus Groups)</td>
<td>395</td>
<td>100%</td>
</tr>
</tbody>
</table>
All age groups were represented with a strong involvement of 132 (33.4%) young people aged 10 - 19 years and 126 (31.9%) were older people aged 60 - 79 years (Table 5). The large number of young people involved in the study can be explained through the participation of local schools and TAFE colleges. The number of older people was attributable to the involvement of Rotary, CWA and Men’s Shed groups.

**Table 5. Age groups of interviewees and focus group participants**

<table>
<thead>
<tr>
<th>Age group in years</th>
<th>Interviewees</th>
<th>Focus Group Participants</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 – 14</td>
<td>34 (16.2%)</td>
<td>32 (17.3%)</td>
<td>66</td>
<td>16.7</td>
</tr>
<tr>
<td>15 – 19</td>
<td>33 (15.7%)</td>
<td>33 (17.8%)</td>
<td>66</td>
<td>16.7</td>
</tr>
<tr>
<td>20 – 29</td>
<td>14 (6.7%)</td>
<td>15 (8.1%)</td>
<td>29</td>
<td>7.3</td>
</tr>
<tr>
<td>30 – 39</td>
<td>12 (5.7%)</td>
<td>12 (6.5%)</td>
<td>24</td>
<td>6.1</td>
</tr>
<tr>
<td>40 - 49</td>
<td>16 (7.6%)</td>
<td>17 (9.2%)</td>
<td>33</td>
<td>8.3</td>
</tr>
<tr>
<td>50 - 59</td>
<td>23 (11.0%)</td>
<td>17 (9.2%)</td>
<td>40</td>
<td>10.1</td>
</tr>
<tr>
<td>60 – 69</td>
<td>40 (19.0%)</td>
<td>28 (15.1%)</td>
<td>68</td>
<td>17.2</td>
</tr>
<tr>
<td>70 – 79</td>
<td>32 (15.2%)</td>
<td>26 (14.1%)</td>
<td>58</td>
<td>14.7</td>
</tr>
<tr>
<td>80+</td>
<td>6 (2.9%)</td>
<td>5 (2.7%)</td>
<td>11</td>
<td>2.8</td>
</tr>
<tr>
<td>No response</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>210</td>
<td>185</td>
<td>395</td>
<td>100%</td>
</tr>
</tbody>
</table>

Most interviewees and participants (344 or 87.1%) were born in Australia while 51 (12.9%) were born elsewhere in countries such as: USA, UK, England, Scotland, Ireland, Nigeria, Uganda, Rwanda, Sierra Leone, Philippines, Indonesia, Netherlands, Austria, New Zealand, Africa (sic) and Germany (Table 6).

**Table 6. Country of birth**

<table>
<thead>
<tr>
<th>Born in Australia</th>
<th>Interviewees</th>
<th>Focus group participants</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>183 (87.1%)</td>
<td>161 (87.0%)</td>
<td>344</td>
<td>87.1%</td>
</tr>
<tr>
<td>No*</td>
<td>27 (12.9%)</td>
<td>24 (12.9%)</td>
<td>51</td>
<td>12.9%</td>
</tr>
<tr>
<td>No response</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>210</td>
<td>185</td>
<td>395</td>
<td>100%</td>
</tr>
</tbody>
</table>

*Countries listed included: USA, UK, England, Scotland, Ireland, Nigeria, Uganda, Rwanda, Sierra Leone, Philippines, Indonesia, Netherlands, Austria, New Zealand, Africa and Germany.*
A total of 16 (4.1%) people identified as being of Aboriginal or Torres Strait Islander descent (Table 7).

**Table 7. Numbers of interviewees and focus group participants identifying as Aboriginal or Torres Strait Islander**

<table>
<thead>
<tr>
<th>Aboriginal or Torres Strait Islander</th>
<th>Interviewees</th>
<th>Focus Group Participants</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>9 (4.3%)</td>
<td>7 (3.8%)</td>
<td>16</td>
<td>4.1%</td>
</tr>
<tr>
<td>No</td>
<td>201 (95.7%)</td>
<td>178 (96.2%)</td>
<td>379</td>
<td>95.9%</td>
</tr>
<tr>
<td>No response</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>210</td>
<td>185</td>
<td>395</td>
<td>100%</td>
</tr>
</tbody>
</table>

The majority (385 or 97.5%) of interviewees and participants resided in the lower Hunter region (Table 8).

**Table 8. Number of interviewees and participants living in the Lower Hunter region**

<table>
<thead>
<tr>
<th>Lives in Lower Hunter region</th>
<th>Interviewees</th>
<th>Focus group Participants</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>205 (97.6%)</td>
<td>180 (97.3%)</td>
<td>385</td>
<td>97.5%</td>
</tr>
<tr>
<td>No</td>
<td>2 (1.0%)</td>
<td>3 (1.6%)</td>
<td>5</td>
<td>1.3%</td>
</tr>
<tr>
<td>Sometimes</td>
<td>1 (0.5%)</td>
<td>1 (0.5%)</td>
<td>2</td>
<td>0.5%</td>
</tr>
<tr>
<td>No response</td>
<td>2 (1.0%)</td>
<td>1 (0.5%)</td>
<td>3</td>
<td>0.7%</td>
</tr>
<tr>
<td>Total</td>
<td>210</td>
<td>185</td>
<td>395</td>
<td>100%</td>
</tr>
</tbody>
</table>

Many of the interviewees and participants (299 or 75.7%) had been residents in the region for more than 10 years (Table 9).

**Table 9. Number of years living in the Lower Hunter region**

<table>
<thead>
<tr>
<th>No. of years in Lower Hunter region</th>
<th>Interviewees</th>
<th>Focus Group Participants</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 year or less</td>
<td>5 (2.4%)</td>
<td>4 (2.2%)</td>
<td>9</td>
<td>2.3%</td>
</tr>
<tr>
<td>1- 5 years</td>
<td>19 (9.1%)</td>
<td>15 (8.1%)</td>
<td>34</td>
<td>8.6%</td>
</tr>
<tr>
<td>6- 10 years</td>
<td>19 (9.1%)</td>
<td>16 (8.6%)</td>
<td>35</td>
<td>8.9%</td>
</tr>
<tr>
<td>More than 10</td>
<td>157 (74.6%)</td>
<td>142 (76.8%)</td>
<td>299</td>
<td>75.7%</td>
</tr>
<tr>
<td>No response/not from Lower Hunter LGA</td>
<td>10 (4.8%)</td>
<td>8 (4.3%)</td>
<td>18</td>
<td>4.5%</td>
</tr>
<tr>
<td>Total</td>
<td>210</td>
<td>185</td>
<td>395</td>
<td>100%</td>
</tr>
</tbody>
</table>
Interviewees and participants place of residence was spread across the five lower Hunter local government areas with the highest representation from Newcastle (189 or 47.8%) and the lowest from Maitland (19 or 4.8%) (Table 10).

**Table 10. Number of interviewees and focus group participants living in the five Lower Hunter Local Government Areas (LGAs)**

<table>
<thead>
<tr>
<th>LGA</th>
<th>Interviewees</th>
<th>Focus Group Participants</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newcastle</td>
<td>102 (48.6%)</td>
<td>87 (47%)</td>
<td>189</td>
<td>47.8%</td>
</tr>
<tr>
<td>Cessnock</td>
<td>26 (12.4%)</td>
<td>26 (14.1%)</td>
<td>52</td>
<td>13.2%</td>
</tr>
<tr>
<td>Lake Macquarie</td>
<td>26 (12.4%)</td>
<td>25 (13.5%)</td>
<td>51</td>
<td>12.9%</td>
</tr>
<tr>
<td>Maitland</td>
<td>11 (5.2%)</td>
<td>8 (4.3%)</td>
<td>19</td>
<td>4.8%</td>
</tr>
<tr>
<td>Port Stephens</td>
<td>40 (19.0%)</td>
<td>33 (17.8%)</td>
<td>73</td>
<td>18.5%</td>
</tr>
<tr>
<td>No response/not from Lower Hunter LGA</td>
<td>5 (2.4%)</td>
<td>6 (3.2%)</td>
<td>11</td>
<td>2.8%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>210</strong></td>
<td><strong>185</strong></td>
<td><strong>395</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Many interviewees and participants were still at school (129 or 32.6%), held a University degree (96 or 24.3%) or post school qualification (101 or 25.6%) (Table 11).

**Table 11. Education level of interviewees and focus group participants**

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Interviewees</th>
<th>Focus Group Participants</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>University degree</td>
<td>50 (23.8%)</td>
<td>46 (24.9%)</td>
<td>96</td>
<td>24.3%</td>
</tr>
<tr>
<td>Post school qualification</td>
<td>55 (26.2%)</td>
<td>46 (24.9%)</td>
<td>101</td>
<td>25.6%</td>
</tr>
<tr>
<td>Year 12</td>
<td>11 (5.2%)</td>
<td>7 (3.8%)</td>
<td>18</td>
<td>4.6%</td>
</tr>
<tr>
<td>Year 10</td>
<td>22 (10.5%)</td>
<td>17.0 (9.2%)</td>
<td>39</td>
<td>9.9%</td>
</tr>
<tr>
<td>Year 9</td>
<td>2 (1.0%)</td>
<td>1 (0.5%)</td>
<td>3</td>
<td>0.8%</td>
</tr>
<tr>
<td>Still at school</td>
<td>65 (31.0%)</td>
<td>64 (34.6%)</td>
<td>129</td>
<td>32.6%</td>
</tr>
<tr>
<td>No response</td>
<td>5 (2.4%)</td>
<td>4 (2.2%)</td>
<td>9</td>
<td>2.3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>210</strong></td>
<td><strong>185</strong></td>
<td><strong>395</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Quantitative and Qualitative results

The following text, tables and graphs report on the interview and focus group results. The quantitative data was obtained from interviews and has been analysed by age group and these results are displayed in age-based graphs. The qualitative data was obtained from both interviews and focus groups.

Question 1. Describing the air quality in the region

Descriptions of air quality ranged from very poor to excellent. People noted some high pollution days across the whole region when the polluted air could be seen visibly as a blanket covering the region. While others, for example those who live at Port Stephens believed the air quality was excellent.

For example, one focus group participant said “It’s really great because I compare with Indonesia where I come from and I’m in heaven here, it’s so clean”. Another remarked that “When I look at the sky at night, the stars, the sky is clearer” while another participant said she had noticed native bird species returning to Newcastle. Some of the Cessnock participants noted that their view over the Hunter Valley from Mount Sugarloaf has been reduced which they believed was due to air pollution, with one participant saying, “I used to be able to see to Singleton from Mt Sugarloaf and now [I can’t]”. Many people noted that it was generally good to average but with some variability depending on the wind, and the proximity to pollution sources such as heavy traffic, mines, coal loaders and the railway line. Participants commented that the air quality was noticeably better the further they were away from the railway line, busy roads and the Newcastle port area. Participants from areas near the coast or lakes, such as Port Stephens, often used positive descriptors such “fresh”, “clear”, “crisp” and “breezy”. Primary school children at Stockton also used these descriptions and added that it was “crispy”, “light”, “unpolluted” and “salty”. Several people mentioned the presence of trees in their area that they believed improved the air quality, such as a high school student who said, “The air where I live is clean and well filtered by the surrounding vegetation” and another high school student who said “…the air is fine as there are a lot of trees”.

A focus group participant described how she thought the air quality was “Generally very good, we are in a leafy suburb and fairly elevated”. Many people mentioned the deposition of black dust on surfaces which they believed to be coal dust, and that concerned them. One participant said of a black film on her windowsill “…if it’s on the house, what are we breathing in?”. Another focus group participant said “You have to shut the house, shut the windows, otherwise you have a film covering everything. There is no bush behind us. If we had more trees and they hadn’t had cut them down, they would filter the dust and we wouldn’t get as much dust as we do now”. Smell was another factor that came up quite frequently with people complaining of abnormal smells in the air of uncertain origins, with one interviewee in Lake Macquarie saying there was often a “…. terrible [smell]… like someone burning tyres off”. Cessnock participants mentioned “The Rutherford Stink” – an industrial area - and “smelly air” at Kurri Kurri. Although the primary school children in Stockton described the air quality as generally good, they reported frequent bad smells in the air from the direction of Orica and Kooragang Island, with the description “disgusting” unanimously agreed upon. They described the frequency of this occurrence as at least once a month to twice a week. They used descriptions such as “rotten”, “really weird”, “like something really, really bad is going on”, “burning eggs”, “something’s died”, and “sewerage”.

In summary the overall impression from the community consultation was that the air quality in the region was regarded as good as it has improved over the years. However, the proximity of the pollutions sources and the level of vegetation in the area were selected as the major contributors to the air quality.
Question 2. Describing health effects related to air quality

Most participants were concerned, at various levels, about the health effects that were perceived to be related to air quality. Levels of concern were high in residents whose homes were located close to areas of industrial, mining and transport activities or who had family or personal experience of health problems related to air quality. Health concerns included respiratory illnesses, in particular asthma, and cancer. One group cited a study that was commissioned by Port Waratah Coal Services that they believed found cancer clusters associated with air quality in the region. They explained that the whole report has never been released to their knowledge and they believed that the original researchers were not permitted to present their findings. Another group spoke of the research of a GP based in Singleton who was reported to be treating a significant group of children with 10% less lung capacity than normal. Several participants described friends and family members suffering from asthma and other respiratory complaints that they believed were exacerbated by the region’s air quality.

Some were very concerned about the very fine particles of PM$_{2.5}$ and smaller, and the lack of knowledge surrounding the health effects of these small particles. One group pointed to international studies that have confirmed correlations between respiratory illness (especially asthma), cancer (especially brain tumours), allergies (especially skin allergies) and air quality. They believed Australia should be conducting more research in the region, examining these potential relationships and in the interim should use international studies as a guide.

Health professionals and some other participants described the psychological distress that is present in the community’s concerns surrounding air quality, seeing patients who were distressed about air quality and health especially concerning the wellbeing of children. The health professionals believed that the media was accountable for perpetuating and exploiting this deep community fear. Likewise, a community member expressed this, “[The] emotional response to perception of air quality does have an adverse effect”. Another said that community concern around air quality “…is in many instances exaggerated by people with a lack of technical expertise generating undue concern…”

Other respondents mentioned how their respiratory problems may simply be part of aging or other factors. For example, a Lake Macquarie resident said, “I have [chronic] bronchitis but I cannot attribute this to the air quality as I was coal miner for 32 years”.

The information captured in the focus groups and interviews suggested that the respiratory illnesses, in particular asthma, and cancer and the effect of PM$_{2.5}$ and smaller were the key health concerns.

---

27 “My daughter in law lived in London for 3 years and had no [problems with her] asthma, she came home to Rutherford [near Maitland] and she is on the puffer constantly now”.

“Over the past 5 years or so I’ve developed a nasal issue, it clogs up and runs down my throat and I have to use a salt spray to clear it…it’s hard to correlate it with the air but…when I go away for a couple of weeks to the country, it is not such a problem. That’s what makes me think it’s the air here.”

28 I think the air quality monitoring the EPA are doing is great… but what about what we don’t know? What about [particles] lower than 2.5? …it seems the smaller the particles the more damage they cause…maybe it is like Maralinga or asbestos? Will we know the damage they cause in 30 years’ time when it is too late?”

29 A health professional said, “Is it ethical to push the fear factor [in the media]? There are people suffering, lying awake at night worrying about their kids’ future.”
Question 3. Concern with issues surrounding air quality in the Lower Hunter region

Interviewees were asked if they were concerned with air quality issues in the Lower Hunter region, with the response options being Yes, No or Not Sure. While 48.6% said that they were concerned, just under half (47.1%) said they were either not concerned (31.9%) or were not sure (15.2%) (Table 12). This data was also analysed by gender, with men feeling slightly more concerned than women (54.6% of men concerned compared with 43.2% of women) about air quality issues in the Lower Hunter.

<table>
<thead>
<tr>
<th>Response</th>
<th>Actual</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>102</td>
<td>48.6%</td>
</tr>
<tr>
<td>No</td>
<td>67</td>
<td>31.9%</td>
</tr>
<tr>
<td>Not sure</td>
<td>32</td>
<td>15.2%</td>
</tr>
<tr>
<td>No response</td>
<td>9</td>
<td>4.3%</td>
</tr>
<tr>
<td>Total</td>
<td>210²⁰</td>
<td>100%</td>
</tr>
</tbody>
</table>

Responses were also analysed by age group and it was found that as people aged they became more concerned about air quality with the 60-69 years age group being the most concerned. It was notable that children aged 10-14 years were not sure and the majority of those aged 15-19 years were not concerned (Figure 14).

This data was also analysed according to Local Government Area (LGA) as seen in Figure 15. Respondents from Port Stephens LGA were the least concerned with air quality in the Lower Hunter with 57.5% (or 23 people) saying they were not concerned. The Maitland LGA were the

²⁰ The smaller sample size for the quantitative data reflects the fact it was derived from interview results
most concerned with 72.7% (or 8 people) saying they were concerned, although it should be noted that Maitland had a small sample size (11 interviewees) (see Appendix 10). Just over half of the Newcastle sample (51% or 52 people) said they were concerned, with 45.1% saying they were not concerned or were not sure (Figure 15). Most of the Cessnock respondents were also concerned (65.4% or 17 people), while 57.7% of Lake Macquarie interviewees said they were concerned with air quality in the Lower Hunter.

![Figure 15. Concern with air quality in the Lower Hunter, by LGA](image)

**Question 3a. Perception of the severity of air quality issues in the Lower Hunter**

Interviewees who responded 'yes' to question three were then asked to rank their perception of the severity of the air quality issue in the Lower Hunter, using a scale of 1 – 5, with 1 being the most severe. Of the concerned respondents, their levels of concern were mostly moderate (47.3%) or very severe (27.3%). It is notable that few people ranked this issue as extremely severe (5.5%) (Table 13). 8.2% of people did not rate their level of concern and 2.7% said they were concerned about air quality in the Lower Hunter but did not think it was severe at all (Table 13).

<table>
<thead>
<tr>
<th>Response on scale of 1-5 (1 being most severe)</th>
<th>Actual</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (extremely severe)</td>
<td>6</td>
<td>5.5%</td>
</tr>
<tr>
<td>2 (very severe)</td>
<td>30</td>
<td>27.3%</td>
</tr>
<tr>
<td>3 (moderate)</td>
<td>52</td>
<td>47.3%</td>
</tr>
<tr>
<td>4 (not very)</td>
<td>10</td>
<td>9.1%</td>
</tr>
<tr>
<td>5 (not at all)</td>
<td>3</td>
<td>2.7%</td>
</tr>
<tr>
<td>No response</td>
<td>9</td>
<td>8.2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>110</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

31 The smaller sample size of this data set reflects the fact that it was a follow on from the preceding question (Question 3) regarding concern about air quality in the Lower Hunter. Only people who said they were concerned were asked to answer this question. There are more responses than the total number who answered 'Yes' to Question 3, due to a small number of respondents answering this question despite not answering 'Yes' to the preceding question.
Responses to this question were examined by age group. It was found that for interviewees aged from 20 to 29 years, air quality was a ‘very severe’ issue for this region. It should be noted there were only a small number of responses to this question in this age group (see Appendix 10). There was a fairly even spread across most age groups describing this issue as a moderate problem (Figure 16). Young people aged 10-14 years described it as ‘moderate’ to ‘not very’ severe.

![Figure 16. Perceived severity of the air quality issue for concerned people in the Lower Hunter, by age group](image)

This data was also analysed by LGA as seen in Figure 17 below. Maitland had a high (50%) proportion of respondents rating the air quality issue as ‘very severe’ although it should be noted that Maitland had a small sample size (11 interviewees). Concerned residents in Port Stephens mostly rated the problem as moderate. There was a fairly even spread for the other response options.

---

32 6 people responded
33 Due to data collection error, the data for the 15-19 year old age category is unavailable for this question.
34 It should be noted this was a small group of 4 respondents
Overall, participants in both focus groups and interviews found this issue to be either very important to them or it was not high on their priorities of concern. People who resided closer to mines (including areas nearing the Upper Hunter), quarries, industry surrounding Newcastle Port, busy roads and the train lines transporting coal were generally concerned about the air quality, as were those who had family in these areas. Those who did not reside close to pollution generating activities were less concerned. This is illustrated by comments such as, “[It’s] good, it is not near any huge cities or condensed housing, [there is] no rail line in the area…minimal dust” and “I feel the air quality is fair at my current address as I live approximately 10-15km from rail tracks. However [the] car traffic on [the] highway I feel impacts on air quality in the area”.

People who were familiar with mining or other local industry either personally or in their family tended to show more concern, as evidenced in the Cessnock group which included a number of former industrial and mining workers. People who had personal or family experience of health problems that can be exacerbated by poor air quality (such as asthma and allergies) were also more concerned about air quality than those who had little experience of such problems. A primary school child described how she had a family member who had asthma that she believed had worsened when she came to stay with them in Stockton. She said “[her] asthma is really, really bad, so when she comes to our house and is outside with us… the pollution makes it a bit worse, she can’t sleep well at night. I think it is more [sic] when she comes here [Stockton]”. Others who were not concerned described how they believed their personal or family’s asthma had either improved or remained unchanged upon moving to the Lower Hunter area. For example one man who said, “My wife is an asthmatic and that was a concern when moving to Stockton but we have enjoyed living there. We were told we were brave moving to Stockton as an asthmatic… my wife seems to be reasonably good despite the pollution”.

**Figure 17. Perceived severity of air quality issues for concerned people in the Lower Hunter region, by LGA**
Question 3b. Community concern pertaining to air quality

The predominant issue of concern surrounding air quality was its perceived correlation with ill health, with many stating they were concerned for the health of future generations. Other concerns included Newcastle being labelled as the ‘dirty city’ due to its industrial activities and pollution. Participants described how on one hand local and state government was promoting the region as a growth centre, a place for families and a great lifestyle including the beaches. On the other hand the government was promoting mining growth. They believed that these two foci were conflicting and that urban growth should be the priority. One primary school child described how he thought property value may be affected by poor air quality, “…maybe you want to sell your house, but nobody wants to buy it because of the air from Orica”. Another primary school child said he believed that increased demand for coal would result in destruction of bushland in the region, “…because they have to make more coal stations …”

The primary school children described their concerns over the perceived environmental effects of air pollution. They spoke of concern about possible harmful effects of poor air quality on local wildlife, native vegetation, rivers and food crops. One child said, “I’m not sure if this is true or not, but it could destroy the ozone layer” while another described how he believed pollution in the air could be brought down with rain and enter aquatic systems and be soaked up by plants and drunk by animals.

Others spoke about how they believed it was exaggerated in the media and that there was little real cause for concern, such as the comment, “Try living in an industrial city in China and see that there is no comparison to our excellent air quality” and another who said “It’s much ado about nothing”.

One group described their vision for the region as a global leader in green industries and renewable energy. They felt this was the direction for the future and that Newcastle should be transitioning in this direction ensuring its long-term economic future. They believed that current activities and any expansion of these was not investing in a sustainable future for the region.

Many people spoke of the need to retain jobs in the area while still addressing the issues of climate change and air pollution. One interviewee said “We are in the process of moving from the coal age to the renewable age. We need to do this without destroying the local economy.” Mining and other industries were often singled out for emphasising economic gains over the negative environmental and social impacts of their activities. One focus group participant said “I know it creates jobs and the men are getting paid well, but at what cost?”

Overall, the impression given by the community consultation is that the perceived correlation between local air quality and ill health is the predominant concern.
Question 3c. Cause (or causes) of this issue

Participants were divided in terms of their levels of knowledge surrounding air quality. Generally citizens who resided around areas directly affected by polluting activities were found to have a higher level of knowledge surrounding air pollution, particulate matter and its sources. They quoted the findings of research reports and appeared to be highly knowledgeable. Many people were aware of the contributions of diesel (vehicle and ship), wood smoke, bushfires and industrial emissions to air pollution. Amongst the causes they identified included red dust from central Australia and ‘general dust’ from mining activities and train movements. Those who had experience and knowledge of mining and transport (such as mine workers and their families) mentioned dust (other than coal dust) from roads, and diesel emissions from trains and vehicles. One focus group participant said “Dust is often from dirt not coal; those mines produce so much dust, dirt dust, not coal dust”. A primary school child said he believed that when the price of coal was higher this could contribute to poorer air quality.

Those who did not reside closely to polluting activities, such as participants in one of the TAFE college focus groups, were found to be less knowledgeable. They had not read reports but did describe mining and industrial activities and car and truck emissions as contributors to poor air quality. A lack of reliable public transport in the region was often cited as a reason why there was so much traffic which contributes to air pollution. One man said “You need a car to live in Newcastle” and a number of people described the extended time needed to get somewhere by local public transport compared to using a private vehicle. Another said of her proximity to a busy road “I feel anxious about traffic exhaust.” A primary school child said that she believed air quality was poorer “when it’s rush hour, because there is more petrol being used”.

Overall, those who had an interest in the issue were well informed about the causes of air pollution, and most community members generally had a good idea of contributing factors. Some community members were lacking in knowledge about air quality and the causes of air pollution.

Question 3d. Changes in air quality at different times of the year

All groups spoke of the correlation between air quality and winds. In particular, they described the link between westerly winds and increased air pollution. Those participants who resided in the Cessnock area linked winds and open cut mines as contributors to dust and poor air quality. Many people mentioned westerly winds and winds coming from the Upper Hunter as being a factor in increasing air pollution levels. One focus group participant in Cessnock said “We know the dust blows hundreds of kilometres but we don’t know where from”. There was general agreement in this Cessnock focus group that the “prevailing winds down the valley” bring dust. A number of participants said the westerly winds were worse in spring and winter. Several mentioned wood smoke in winter and the bushfire season as contributors to poor air quality.
Question 3e. Long-term residents describing any changes they have observed in air quality over their lifetime

Long-term residents described the dramatic improvement in air quality since the closure of BHP in 1999. One long-term resident said, “I remember when I was young, the sky outside in Newcastle was often grey and orange and red and I remember thinking, ‘How can men walk on the moon and we can’t fix air pollution’”. Another said, “We used to get fall out from BHP, ’65. When we got [a] really bad southerly, the bloom that used to sit over Newcastle, you could see it. But now, we have noticed that there isn’t the cloud. It’s really lovely now. It’s gone. [I’m] 100% happy with air quality.” A Cessnock focus group participant said that he thought it was much better than 65 years ago when there were more coal mines in the immediate area and several others in the group agreed. However some people believed that over the past five years the air quality has started to deteriorate again due to increased industrial activities. One interviewee described it thus “…problems like breathing and the dust that lay on furniture et cetera were much worse in the 1960s. It decreased as BHP scaled down and pollution legislation was promulgated, and it’s now increasing again”. One man also said “…pollution has gone down while concerns over air pollution have gone up, especially coal and now coal seam gas”. Some remarked that they thought the activities of Newcastle City Council to green the city through significant plantings in public spaces had also helped to improve the air quality and reduce dust from vacant land. Under -18s were not asked this question.

Question 3f. Why participants believe that air quality has been identified as an issue of community concern

The predominant issue identified was the potential correlation between air quality and community health, for the same reasons as explained by participants at Question 3b above.

Others described it as a public amenity issue, that industry and communities could not coexist and grow in such close proximity. Some identified community concerns from those living in areas along the train line, close to industry, the port or coal mines. Those residing in these locations described how they could not hang out their washing close to a train track transporting coal wagons. People described the need to be constantly washing their houses and furnishings due to air pollutants. One participant said “We have to hold a working bee to go and wash her [resident of Tighes Hill, Newcastle] house down every couple of months, and paths…” While another said “On certain days the amount of residue that is found in the clothes basket (that was clean) is quite heavy, so [that] would indicate the [air] quality is poor”. Others identified prior pollution incidents, such as Orica in 2011, and other issues of health and pollution from mining in the Upper Hunter as raising the awareness of pollution amongst the Lower Hunter community.

Aside from air quality issues raised by shipping in Newcastle port, they were also concerned about the effect it may have on water quality and aquatic ecosystems. The larger topic of environmental pollution in general, particularly water pollution, came up as several participants associated air and water pollution together. One participant described how this affected them, “… on the Hunter River, the river water has changed since the mines have been operating. We used to swim in the river, don’t anymore because you become itchy from the water”. Another woman said, “They say they don’t release anything into the river but I’m sorry, they do. We can see it”.

Some people believed that the local media had artificially raised the level of community concern and that much of the reporting had not been evidence based, with one participant saying “…the media saturates opinions, and constantly informs people of all the things that go wrong…” and another
who said they thought it was of concern “…because I see it on the television…” . A number of respondents said there was little real cause for concern, such as the comment, “[The] media fills people’s heads full of crap. It’s much better now that BHP has gone”.

**Question 4. How people learn about air quality in the Lower Hunter region**

A range of sources were cited regarding how local people learn about air quality in the region. Participants who were highly informed had read current reports and are consistently informed by the OEH monitoring which is accessible through the website.

Those who were less informed learnt about air quality through the local media. The local newspapers, radio and television were all cited by many as key sources of information. Many participants said that their personal observations through sight and smell were very important in their assessment of air quality. For example, one man when asked how he learnt about air quality said “We live and breathe it” and another who said, “I don’t know what that smoky stuff is in the sky, but I know it’s not good”. Others stated that activists, community groups, and word-of-mouth were also a source of information for them. For example one person said they heard about it “…when the locals talk… [and] on the radio and TV”. Several people said they did not know where they would find information and had no need to seek it out. This included comments like this man’s, “It is not an issue for me. If I wanted to know about air quality, I expect there would be websites available”.

Sources most frequently nominated by respondents to receive information about air quality were local newspapers, local television and email. Several people mentioned the importance of having information available in ways other than the internet, as some people do not have computers. A public display in a common area such as a library or community noticeboard was suggested, as was a newsletter as part of a rates notice attachment. Some suggested adopting multiple approaches to broadcast information, so that more people would be reached.

Under 18s frequently nominated their parents, family members, the news, and teachers and the school in general as sources of information about air quality with one primary school child saying “I don’t know who I would ask [about air quality] but I would probably ask mum and dad”. One high school student said that she “…look at forums online to see what others think and know. I would ask my parents and others, I guess”.

**Question 5. Asking participants if they had a query concerning air quality would they know who to contact? If so, which authority would that be?**

Most focus group participants and interviewees nominated the local council as their first contact for any information surrounding air quality. Many had not heard of the EPA nor did they know what acronym stood for, with one young woman saying “… before today I didn’t know about the EPA and I’m 26. It’s not apathy…we just don’t know about it…” More informed participants nominated the EPA as the first agency they would contact and were familiar with the EPA’s roles and responsibilities. Other people said they would conduct a search on the internet to see who to contact, or ask their friends and family.
Question 6. Describing any contact with a Council or government agency about air quality

A small number of people had contacted their local council about air quality. The experiences were varied with neither positive nor negative impressions prevailing. Examples of statements from respondents include, “…I’ve dealt with the local council and our local councillors are good”, while another said “I tried the local council. Useless!” A few people mentioned how they had written to state or federal MPs with little response other than a formulaic letter.

Only a few people had had contact with the EPA and while some were happy, several were unhappy with the response. Some people had positive experiences, such as the man who said, “My experience has usually been positive. When I call the EPA, I ask for a call back and I usually get one. At times I have insisted that something be attended to and it usually is”. Another man from Cessnock said that he “…called the EPA once and they came out straight away and dealt with it”.

Those who had negative experiences with the EPA described their dissatisfaction with the lack of feedback, being passed from person to person, the lack of a timely response and the feeling that their complaints were not taken seriously, for example “… if you do make a complaint…you don’t get any feedback… people don’t see the point of making a complaint [if there is no feedback]… people need a quick response… people like to feel as though they can take action and there will be change…. they want to feel ‘I can do something’.”

Respondents were not asked for the date of their interaction with the agency and as such these statements may refer to the Orica incident before the current EPA was formed. This question was not asked of under-18s.

Question 6b. Level of satisfaction with council or government agency response to air quality query.

Interviewees were asked to rank their level of satisfaction with the response to their query about air quality, using a scale of 1 – 5, with 1 being the best. This question was not asked of under-18s. Most people interviewed (66.4%) had not had any contact with an agency concerning air quality (Table 14). It should be noted that 9.1% did not give a rating even though they indicated they had had contact.

<table>
<thead>
<tr>
<th>Response on a scale of 1-5 (1 being the best)</th>
<th>Actual</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (excellent)</td>
<td>2</td>
<td>1.4%</td>
</tr>
<tr>
<td>2 (very good)</td>
<td>6</td>
<td>4.2%</td>
</tr>
<tr>
<td>3 (neutral)</td>
<td>10</td>
<td>7.0%</td>
</tr>
<tr>
<td>4 (poor)</td>
<td>9</td>
<td>6.3%</td>
</tr>
<tr>
<td>5 (very poor)</td>
<td>8</td>
<td>5.6%</td>
</tr>
<tr>
<td>No contact</td>
<td>95</td>
<td>66.4%</td>
</tr>
<tr>
<td>No response</td>
<td>13</td>
<td>9.1%</td>
</tr>
<tr>
<td>Total</td>
<td>14335</td>
<td>100%</td>
</tr>
</tbody>
</table>

The smaller sample size of this dataset reflects the fact that under-18s were not asked this question. There was one ‘outlying’ 19 year old interviewee who was removed from this dataset.
Of the 48 people who had contact with a Council or government agency, 27.1% of those who had contact gave no response, 35.4% said the response was poor to very poor, and 37.5% said it was neutral to excellent. The data was analysed by age distribution however no discernible pattern was found.

**Question 7. Community perception of the adequacy of air quality monitoring and control in the Lower Hunter**

Interviewees over 18 years of age only, were asked if they believed that air quality is adequately monitored and controlled in the Lower Hunter region, with the response options being Yes, No or Not Sure. 11.2% responded yes, 36.4% responded no they didn’t think air quality was being monitored or controlled adequately and 37.1% were not sure. It should be noted that a reasonable number (15.4%) did not respond to this question (Table 15). These results suggest that the community is not well informed about the adequacy of air quality monitoring.

**TABLE 15. PERCEIVED ADEQUACY OF AIR QUALITY MONITORING AND CONTROL IN THE LOWER HUNTER REGION, FOR OVER 18S ONLY**

<table>
<thead>
<tr>
<th>Response</th>
<th>Actual</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>16</td>
<td>11.2%</td>
</tr>
<tr>
<td>No</td>
<td>52</td>
<td>36.4%</td>
</tr>
<tr>
<td>Not sure</td>
<td>53</td>
<td>37.1%</td>
</tr>
<tr>
<td>No response</td>
<td>22</td>
<td>15.4%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>143</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

The data was analysed by age group and it was found that people under 50 were often not sure, whilst people aged 50-79 years were more likely to believe that it was not adequately monitored and controlled (Figure 18).
Question 8. Community views describing some of the ways that air quality in the Lower Hunter region could be improved

The more informed participants spoke of the opportunities Australia has to employ best practice in all aspects of environmental regulations. They believed that regulatory frameworks and practices could be vastly improved to match or better the standards adopted and implemented by some other developed nations. They described how regulatory improvements would empower the future roles of the EPA to be the environmental protector for communities and the environment.

Participants and interviewees believed that fines imposed on industry pertaining to pollution events were not severe enough to be a disincentive, with one woman describing the fines as “chicken feed” to large industries. They cited the lack of large fines as further evidence of the EPA being ‘on the side of industry’ rather than ‘the side of the community’ and called for heavier fines. They explained that community anxiety surrounding an incident has more impact than a fine. This is because industries employ local people and it is in their best interest to nurture closer relationships.

Many citizens described the dependency of the local community on private vehicle transport. They explained that public transport infrastructure was inadequate, resulting in people needing to use their cars and the emissions were contributing to air pollution. Many people said that reducing the numbers of cars on the road, increasing the reliability and availability of the public transport system and encouraging bicycle use, would all help improve local air quality.

Most groups mentioned the need to cover coal train wagons to assist the improvement of air quality. Some people remarked that they believed it was a media ‘beat-up’ while many others believed it would contribute to significant reductions in air pollution, particularly coal dust. Those who were more concerned pointed to international cases where this is standard practice. Some had read recent studies which showed a lack of evidence to support covering coal wagons; however this appeared to do little to change their views. As one interviewee said, “The coal trains, despite what the reports say, remain an issue”. Participants noted that this issue had been reported on over a long period of time in the local media.

More concerned participants raised the issue of approval processes regarding proposed mining and industrial activities. They believed that individual proposals were assessed on an individual basis rather than their contribution to the cumulative whole. They were interested in scenario planning and projections that examined activities impacting on air quality through an ecosystem approach that includes the aquatic environment. One of the examples they cited was the proposed Terminal 4 development. They explained that the environmental impact of this development was calculated on out of date data and did not include proposals that are in the pipeline for assessment or have recently been approved.

Several people suggested increased plantings of trees and native vegetation in their local area as a way of absorbing and intercepting particulate matter, and to improve the area’s amenity. Phrases like “Plant more trees” were commonly used by these respondents. The primary school children in particular nominated this method frequently, saying “Plant more trees” and “Stop cutting down trees” which they believe would improve air quality.
Question 9. Trusting the information provided is giving the whole picture about air quality in the Lower Hunter region

This data was coded into Yes, No and Not sure responses during data analysis. People mostly responded ‘no’ (44%) or ‘not sure’ (19.6%) to this question, with quite a high number giving no response (18.9%) (Table 16). 17.5% said that they did think the information on air quality in the Lower Hunter was a complete picture (Table 16).

<table>
<thead>
<tr>
<th>Table 16. Trust that information provided on air quality for the Lower Hunter is giving the whole picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Not sure</td>
</tr>
<tr>
<td>No response</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

The data was analysed by age group but no discernible pattern was found. When analysed by Local Government Area it was found that the Maitland and Port Stephens cohorts had the highest proportion of ‘no’ responses, Lake Macquarie had the highest proportion of ‘not sure’ while all other responses were fairly evenly spread (Figure 19).
A number of participants described how it depended on the source of the information, with several saying that the media was providing misinformation and was a biased source. As a Cessnock participant described his mistrust of certain information, “By the media, no [I don’t trust it]. By the EPA, yes [I do trust it]”, while another said of the media “They [the media] only tell us what they think we need to know”. Others said they had heard no information from the EPA or other authorities and thus their only source of information was the news. As a Cessnock participant said, “I only trust the newspaper. You get no information from the EPA. They don’t publish readings or results…”. Those who said they did not trust the information or were not sure often said this was because they believed not all information was given out and things were being withheld from the public. As one adult student said of her trust of the information, “Not if it is provided by mining companies and at times the EPA. The health department and universities appear to have less bias”. Another adult student said, “I think whole truths generally are uglier and could cause public and community out-cry…authorities possibly contain the ‘ugly truths’”. Several people who answered ‘not sure’ said this was because they had either not sought or not heard any information and thus were not well enough informed to comment.

Interviewees and participants who were aware of the EPA’s information described their distrust of the EPA’s reporting explaining that they believed there was a lack of transparency. They believed that the EPA was more invested in their relationships with regulating industries rather than the role of environmental protectors. As one participant said, he believed industry has “…very powerful friends in high places…. the mining industry is huge…they have political connections and can get away with it” and described how he believed it was easier for government bodies to force smaller industries such as a local sawmill to comply with dust suppression than a large mining company who he believed had undue influence. This question was not asked of under 18s.
Question 10. Attaining information about air quality

Interviewees were asked if they had been able to get all the information they had sought in the past about air quality. This question had Yes, No and Not Sure response options. This question was not asked of under-18s. 13.9% of people responded yes, with 20.3% saying no. Many people said they were not sure (37.1%) and a high number of people did not respond (25.9%) (Table 17). Four people responded “NA” or “Not applicable”. It would be reasonable to assume that these ‘not sure’, ‘no response’ and “NA” results could be attributable to these people not seeking out information and therefore could not comment.

Table 17. Whether people had been able to get all the information they sought about air quality in the Lower Hunter, for over 18s

<table>
<thead>
<tr>
<th>Response</th>
<th>Actual</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>20</td>
<td>13.9%</td>
</tr>
<tr>
<td>No</td>
<td>29</td>
<td>20.3%</td>
</tr>
<tr>
<td>Not sure</td>
<td>53</td>
<td>37.1%</td>
</tr>
<tr>
<td>No response</td>
<td>37</td>
<td>25.9%</td>
</tr>
<tr>
<td>People who wrote “NA”</td>
<td>4</td>
<td>2.8%</td>
</tr>
<tr>
<td>Total</td>
<td>143</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The data was analysed by age range (Figure 20) with the highest group of ‘not sure’ responses coming from the 20 - 29-year-olds. The people who are most satisfied with the information they had received were 70 - 79-year-olds.

Figure 20. Whether people had been able to get all the information they sought about air quality in the Lower Hunter, by age, for over 18s

---

36 Four interviewees responded “NA” or “Not applicable” at this question
37 The smaller sample size of this dataset reflects the fact that under 18s were not asked this question. There was one ‘outlying’ 19 year old interviewee who was removed from this dataset.
Question 11. Information community members would like to receive on air quality in the Lower Hunter

Participants were asked to describe the information they would like to receive on air quality in the region. They highlighted the need for a source of information that they could trust. They did not trust the local media because they believed they sensationalised and trivialised issues. One memorable quote from a focus group was that the media was “…more interested in when Lara Bingle breaks a fingernail [than in] the real issues that are not being reported” and others said that the media will take whatever angle is needed to sell papers. It was noted that some local newspaper reporting (e.g. the Newcastle Herald) had improved in recent times and appeared to be doing more research and presenting differing perspectives. They did trust universities and the ABC to provide transparent information and they wanted to trust government and in particular the EPA. Several people expressed distrust in anything related to the government with one man saying “…they [the EPA] report to the government, so we are in trouble there.” Those who were familiar with the EPA requested increased prioritisation of communities and their needs to rebuild the agency as the environmental protector for communities and not industries.

Citizens wanted information that is easy to interpret. While they found the OEH monitoring site to be comprehensive, its level of detail was overwhelming to those who just required a snapshot or information surrounding a pollution incident. Many participants, including several high school students, requested clarity in information on air quality. Phrases such as “how bad it [air quality] really is” and “how bad on a scale of 1 – 10” were common with these respondents. They also requested information showing the Lower Hunter region in comparison with other areas in New South Wales, Australia and the world. One high school student explained it thus, “What is the air quality in popular places in Australia and other countries? …so we [can] recognise what the differences are.”

They requested very prompt responses to communities when a pollution incident occurred, even if that was just to acknowledge the EPA’s awareness of the issue and that an investigation was in progress and report to the community would be issued as quickly as possible. They also expressed a desire for more transparency and honesty in the EPA’s communication, as illustrated by the comment “…it doesn’t matter what the problems are, just put them out there because if you cover up it breeds mistrust and misinformation”.

Participants suggested increased education in primary and secondary schools would be useful and may provide an opportunity for the EPA to work closely with the broader community in a preventative rather than reactive role. A comment that supported this was “…they should be more open, and educate us… we need more education, more of a community face, more trust…” and “…everything starts with children… educate the youth on [air quality] to instil the care factor…”.

A small report with warnings about high pollution in either the newspaper or local television news as an add-on to the weather report was suggested, as one woman said “We have a surf report, why can’t we have an air quality report?” Participants from non-English speaking backgrounds said it should be translated into different languages. A number of participants mentioned that any information they received should include health information and actions to take if air quality was poor, particularly for people who are susceptible to health problems that are exacerbated by poor air quality. As one woman said, “What would we do with it [the information] even if we had an App?” and that the terms used should be basic and easily understood by laypeople.
Question 12. Ways that the community want to receive information about air quality

Interviewees were asked how they preferred to receive information on air quality, with respondents choosing from a list of options. More than one option was allowed. The following responses reflect the number of times the option was chosen, with local television and local newspapers coming out on top closely followed by local radio and emails (Table 18 and Figure 21). People were also given the opportunity to list other modes of communication; responses included flyers or letters in the mail, community noticeboards, EPA awareness days library displays, community forums and national radio.

**Table 18. Preferred options for hearing about air quality, in order of popularity**

<table>
<thead>
<tr>
<th>Information Option</th>
<th>Total number of times this option was selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local TV</td>
<td>123</td>
</tr>
<tr>
<td>Local Newspapers</td>
<td>121</td>
</tr>
<tr>
<td>Local radio</td>
<td>92</td>
</tr>
<tr>
<td>Email</td>
<td>81</td>
</tr>
<tr>
<td>Website</td>
<td>65</td>
</tr>
<tr>
<td>Newsletters</td>
<td>61</td>
</tr>
<tr>
<td>App for smart phones</td>
<td>56</td>
</tr>
<tr>
<td>Social media</td>
<td>48</td>
</tr>
<tr>
<td>SMS</td>
<td>28</td>
</tr>
<tr>
<td>No response</td>
<td>23</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
</tr>
</tbody>
</table>

**Figure 21. Most popular ways that interview respondents nominated for receiving information about air quality**

75
Figure 22 below shows the data by age group. Overall, younger people were more likely to nominate an app or social media as a preferred method of receiving information, whilst older people preferred options like local newspapers and email. Local television and radio were popular with most age groups, as was the local newspaper. An app was fourth most popular with children (10-14 years) and social media was second most popular with older adolescents (15 - 19 years), with local television being the most popular for both age groups. Email was popular with older people (40 – 80+ years) but not as popular as local media (newspaper, TV, radio). SMS messaging was less popular with all age groups. Newsletters were found to be an alternate mode of communication with children (fifth most popular) and 50-69 year olds. As described in the qualitative results school newsletters are important modes of communication between schools and families. In the case of adults it may be that participants were referring to their specific group newsletters (e.g Men’s Shed, CWA).
**Figure 22.** Ways that the community want to receive information about air quality, by age

*‘Other’ included flyers or letters in the mail, community noticeboards, library displays, awareness days, community forums and national radio.*
Question 13. Additional thoughts

The more concerned participants described their perception of a lack of community interaction and leadership by the EPA’s executives. They wanted to have a close, trusting relationship with the EPA but felt there had been much reputation and trust damage that would require considerable effort to restore. These comments applied to all EPA’s executives. Local council staff reiterated the need for nurturing closer relationships with EPA staff. Concerned participants held the NSW Government accountable for the divisions between industries and communities pertaining to air quality. They felt that the EPA was beholden to the government’s drive to generate economic growth through mining and industry in the region. Participants described their extreme concern that the government placed a higher value on economic growth than on the health and well-being of communities. They understood that the EPA was not responsible for planning and legislation determining industrial activities and growth. They believed that the agency, as the regulator, was “stuck between a rock and a hard place” and required autonomy from government.

Others described what they perceive to be a mismatch between reports in the media and their personal experiences of air quality such as the comments, “It’s mostly fine, I’m happy….but I know it’s an issue for some areas and people with breathing problems” and “It’s more of a question - should I be worried?!”. Another said, “Living in Mayfield and being aware that it is an area near the coal train line, I have the perception that the air quality could be bad, but in reality I haven’t noticed anything, I would say the air quality is good”.

Interviewees and participants wanted to see closer connections built between the community and industry. They believed that closer relationships would result in a more harmonious coexistence between industry and communities. They noted that Newcastle has the largest industrial activities of any city in the world. This situation, unsurprisingly, leads to the disharmony that continually reverberates through the city and the region. An example of a strong relationship between industry and the community was cited at Lake Macquarie. Participants explained that the local power station has an active programme of community engagement and transparency. They described how, at any time, local people could come into the General Manager’s office and discuss any issues and would be provided with any data on request. The power station hosts open days and funds community programs. They believed a large key to the success of this relationship was the attitude and approach of the General Manager who had built a reputation of trust and respect within the community. They also cautioned that in the absence of a monitoring station at Lake Macquarie the community was not aware of any emissions issues. A Lake Macquarie participant described how the OEH had said they could not put in an air monitor as it was difficult to identify an ambient air monitor site in the area because there are too many significant pollutant sources for it to qualify as ambient. He said “It’s an odd argument - we can’t find an area without pollution to put the [air monitoring] station, so we can’t put in a pollution monitor, so there is nothing to worry about?” and another said “There is no solid evidence of the concentration of pollution in the city [of Lake Macquarie], and there is no way to get that information.”

The issue of coal dust and the need to cover coal trains was raised with most groups. They cited world’s best practice and believed that NSW should be regulating to cover the trains. Many people simply stated “cover the coal trains” and “cover the coal stockpiles” as methods that would improve air quality. Another said of her concerns about coal dust “…there is an inadequacy of protection from coal dust and it’s not just in Stockton, it’s all of the areas around Newcastle and the Hunter…”

The other issues that were raised were the proposed Terminal 4 (T4) at the port and its privatisation. They believed that the construction of T4 would mean an increase in shipping traffic and an increase in air pollutants from ships’ diesel emissions and increased activities. They were concerned about the lack of control of international ships and their emissions at present and
believed this situation would be exacerbated if the port was privatised. They asked how international and national legislation surrounding these emissions would be implemented and monitored. The example of a ship from Asia recently docking in Newcastle was cited by an industry representative. He explained that they were aware of the issue surrounding the type of diesel this ship was using which has recognised carcinogenic attributes in the particulate emissions. As the ship was received in port their only option was to load it as quickly as possible, double loaders were used, so the ship could depart promptly.
Discussion

INCLUDING CONCLUSION, RECOMMENDATIONS AND ACTIONS
DISCUSSION
The following discussion section summarises the study’s results together with the relevant literature. Discussions are grouped under the project aims with the exception of the final aim to “Identify solutions and actions to address community concerns” which has been addressed in the proceeding conclusions and recommendations section of the report. It should be noted that the aim of this study was to capture whole-of-community perceptions surrounding air quality so they could be understood in more depth with the objective of providing the EPA and Lower Hunter community with this information to guide and build future community based activities.

1. Empower local communities to engage in informed discussions on air quality

To assist the empowerment of the Lower Hunter community to engage in informed discussions on air quality, this research project investigated: levels of knowledge, key issues, communication, education, planning and policy. Literature in each of these following areas has been aligned with the study’s results to add depth to the discussion.

1.1. Participants’ concern, awareness and knowledge of air pollution

Concern
Participant’s concern, awareness and knowledge of air pollution were found to vary significantly. While almost half of interviewees (48.6%) expressed their concern just under half (47.1%) said they were either not concerned (31.9%) or were not sure (15.2%). Levels of concern relating to the (48.6%) of people who said they were concerned, varied from moderate (47.3%) to very severe (27.3%).

Many people said that they believed the air quality to be ‘good’. The air monitoring data over a 20 year period (1993- 2013) reveals that the air quality in the region is ‘good’ by international standards. Notable events were major bushfires and a ‘red’ dust storm (see the air quality reporting information provided by OEH 2014 on p31-33 of this report). It should be noted that this monitoring and reporting provides a regional overview. Participants in this study who resided or worked close to localised emission sources (e.g. near industrial areas) were found to be more likely to be concerned about air quality than those residents who were less affected in their daily lives (e.g. residents of Port Stephens).

Awareness and knowledge

Older and more concerned community members were found to have greater levels of awareness and knowledge. Participants identified correlations between wind, weather conditions and poor air quality. Awareness of the relationship between weather and pollution is not unusual for the general public. A comparable study conducted in Birmingham, UK, described how members of the public connected “primary evidence of the climatic factors that promote air quality problems” with air quality (Bickerstaff & Walker, 2001, p. 137). Participants in this study were also aware of the contribution of vehicle emissions to air pollution, as was found in the Who Cares About The Environment? report of 2012 (NSW OEH 2013).

Those who lived or had connections living close to industrial areas and mines were found to have higher levels of awareness and knowledge, and recognised different types of air pollution. Participants referred to their personal experience as a source of knowledge, particularly in regard to the sight and smell of polluted air. An Australian Coal Association report conducted in 1999 also
found that ‘seeing’ dust was the biggest contributor to concern about poor air quality (ACARP 1999) as did a health study by Dalton (2003). A number of participants suggested planting trees as a way to reduce this visible pollution and to reduce the visibility of pollution sources such as factories, a finding consistent with studies conducted in other locations (Day 2007).

Some participants (often in the 50 – 60s age range) were found to be well-informed and able to quote findings of research reports on air pollution and related issues. They demonstrated their understanding of the contributions of dust, salt, woodsmoke and diesel emissions to air pollution as supported by the findings of the Upper Hunter Particle Characterisation Study (Hibberd et al 2013). These informed respondents can be considered “Attentives” and/or “Actively Involved” as per the profiles of these types of stakeholders in the Community Based Participatory Research Guide for Air Quality Management (DEWR 2008).

In this study, children and young people were found to be less informed about air quality, highlighting the need for education programs targeting young people. Less informed members of the community, of all ages, can be considered “Browsers” and/or “General Public” types of stakeholders, as per the CBPR Guide (DEWR 2008). These stakeholders either have no solid opinion, or will glean their opinion from the media and from “Attentives” and “Actively Involved” members of the community.

A further layer of complexity was found to exist in terms of communities accessing scientific information upon which they based their discussions. Most people cited local media (TV, newspaper and radio) as the source of their information. Overall, younger people were more likely to nominate an app or social media as a preferred method of receiving information, whilst older people preferred options like local newspapers and email. Local television and radio were popular with most age groups, as was the local newspaper. An app was fourth most popular with children (10-14 years) and social media was second most popular with older adolescents (15 - 19 years), with local television being the most popular for both age groups. Email was popular with older people (40 – 80+ years) but not as popular as local media (newspaper, TV, radio). SMS messaging was less popular with all age groups. Newsletters were found to be an alternate mode of communication with children (fifth most popular) and 50-69 year olds. As described in the qualitative results school newsletters are important modes of communication between schools and families. In the case of adults it may be that participants were referring to their specific group newsletters (e.g Men’s Shed, CWA).

1.2. Community perceptions and science

Another phenomenon that impacted on informed community discussions surrounding air quality was the gap between community perceptions and scientific evidence. This gap was demonstrated in this study pertaining to community views surrounding the perceived need to cover or veneer coal train wagons and health issues. To help to explain this gap, studies confirm that direct experiences are more highly valued than scientific evidence (Bickerstaff & Walker 2001). In other words people are more likely to believe their personal experiences than scientific literature.

Bickerstaff (2004) explains that there has been a shift with agencies and their approach to managing community perceptions of issues surrounding air quality. Rather than attempting to correct perceptions by providing scientific evidence, an alternative approach is to engage with communities within their social context to enable a deeper understanding of the social and cultural factors that underpin the issue. To do this, communities need to have involvement in identifying issues that concern them and in deciding how to respond (Maskrey 1989). One important element is to ensure communities are seen as active participants rather than just passive recipients of policy. As previously noted, social media can be used to good effect for this, allowing direct communication
between community members and agencies, allowing each to share important information, as occurred during the 2010-2011 Queensland floods (Bruns et al 2012). Focused programs, such as school education and foreign language resources, are also important for strong community engagement. Finally, it is best to begin working with organised and interested community groups, as engaging with existing interested groups will encourage greater participation (Godschalk et al 2010). Once these relationships have been formed there may be an opportunity to influence perceptions and build trust.

1.3 Key community issues

1.3.1 Coal dust

The health concerns about the effect of coal dust is a long standing issue in this region. Discussions and debates surrounding covering or veneering wagons were often aligned with the lack of community support surrounding the proposed Terminal 4 (T4) at Newcastle port; anti coal mining and support for action to address the impacts of climate change; continued campaigning in the media to mandate the covering of coal wagons.

The Queensland Resources Council recognised the gap between science and community perceptions, when it stated that although there are no demonstrated benefits to health expected from veneering the coal wagons, the industry accepted that there is public concern surrounding coal dust from coal trains (QRC 2013).

It is acknowledged that community concern exists surrounding this issue, including groups that do not have a reputation for environmental lobbying, such as the Country Women’s Association lodging a submission to the government in support of covering coal train wagons (see Appendix 8 and Appendix 1). However, to evaluate the pros and cons of covering coal wagons is beyond the scope of this study.

1.3.2 Health effects related to air quality

In particular parents were concerned about the possible impacts of air pollution on the health of their children. Those residents whose homes were located close to areas of industrial, mining and coal train transport activities, or who had family in these areas, were found to be most concerned about the health impacts of air pollution. This result is validated in other international studies (Howel et al 2003). A number of respondents used anecdotal evidence to support their concerns about the links between poor air quality and poor health, citing friends and family members suffering illness, particularly respiratory illness (Howel et al 2003).

Some participants referenced a study commissioned by Port Waratah Coal Services (PWCS) which they claimed had found increased cancer rates due to air pollution. The report was provided by PWCS (Guest et al 2012). This study was completed in 2012, and three media releases have been provided: two from Port Waratah Coal Services (PWCS 2013 and 2012), and one from Hunter Health (HNELHD 2012). The study found Kooragang Island employees were 1.7 to 2.8 times more likely to be diagnosed with cancer when compared to the NSW population, the Australian population or Carrington terminal employees. The report and the media releases stated that it is unlikely there is a link between cancer rates and the Kooragang facility due to workplace factors, with the expert opinion of reviewers being that the results are most likely due to lifestyle and hereditary factors. The cancers that were more prevalent in the study cohort (melanoma, prostate and bowel) are not linked to occupational or environmental factors. In 2013 PWCS reported back
to staff and the community regarding the implementation of the report’s recommendations. Despite these actions and communications some sections of the community still expressed their health concerns.

Studies have been conducted into health issues in the Hunter region, but their conclusions on any link to air pollution have been mixed. While Toneguzzi et al (1995) and Lewis et al (1998) found higher rates of respiratory illness in primary school children in the Hunter Valley, a more recent study by NSW Health concluded the mortality rate for respiratory illnesses in the Hunter region was not higher than that for NSW overall (NSW Health 2010). The time interval between the studies should be noted, as participants in this study stated that air quality had improved since the time the Toneguzzi and Lewis studies were completed. However, as stated by the World Health Organisation, it is generally accepted in the scientific community that ambient (outdoor) air pollution is a trigger for respiratory illness such as asthma and is linked to cancer and heart disease. For example, a Europe-wide study of lung cancer cases concluded that increased levels of PM$_{10}$ and PM$_{2.5}$ are correlated with higher incidences of cancer (Raaschou-Nielsen et al 2013). Furthermore, few studies have looked specifically at the health of Lower Hunter residents and air quality. Further research into links between cardiorespiratory illness, air quality and airborne allergens (e.g. pollen) in the Lower Hunter region would assist in understanding this complex issue.

1.3.3. Industry and urban growth

Community members expressed their concern surrounding their perceived lack of compatibility between industrial and urban growth. Previous studies have found that, while the Hunter Valley’s identity as a mining and industrial region is strong, younger generations are less likely to see the benefits of industry and mining as outweighing the costs (Evans 2008). Newcastle’s identity as an industrial city, and the complexity of balancing job-creating industries and a healthy city for residents was recognised by many participants. Although understanding that industry provides employment and economic stability, the close interface between industrial and residential areas concerned them. They described the need for government prioritisation of community health and well-being. They perceived government priorities to be focused on economic growth through mining and industry. As a result it was found that there was a level of mistrust surrounding government (Federal and State) generally that flowed on to the EPA.

1.4 Community perceptions and greening the environment

In this study respondents who were concerned about air quality listed tangible evidence as the basis of their concerns, mainly the visibility and odour of air pollution. This was also found in a study by Day (2007) who found those who can point to a physical indicator of pollution are more likely to rate pollution as a concern. They found that the presence of green spaces, trees and other vegetation helped “protect people from the experience of pollution” (Day 2007, p258). As such, one way to improve community perceptions is through reducing those physical indicators. For example, the planting of trees can lead to increased satisfaction with air quality, with communities with more green spaces and vegetation perceiving their air to be cleaner than communities which lack greenery (Day 2007). As well as the perception of cleaner air, trees act as a filter for pollutants. Nowak et al (2013) concluded that trees are beneficial in reducing the amount of PM$_{10}$ and PM$_{2.5}$ in the atmosphere. Planting vegetation to reducing the visibility of pollution sources such as factories may also alleviate community anxiety. Local, visual sources of pollution serve as a reminder of potential pollutants and seeing pollution “causes anxiety” (Bickerstaff and Walker, 2003, p51) and reminds people of the “potential to pollute and contaminate the air” (Bickerstaff and Walker, 2003, p52).

http://www.who.int/mediacentre/factsheets/fs313/en/
Community anxiety around air pollution may be linked to having industrial pollution sources in their line of sight each day at work and as they travel around the region. Vegetation ‘screening’ of these may have positive impacts on the local community’s wellbeing.

1.5 Communication

Interviewees in this study were asked if they had been able to get all the information they had sought in the past about air quality. Over half responded no or not sure and a quarter did not respond to the question at all. This result indicates that a large sector of this study cohort had not previously sought out information on air quality, or had not been able to obtain what they wanted.

Participants desired locally targeted information, favouring local media as their preferred source for the provision of air quality information. However they did not trust the local media to always report without bias. They believed due to the nature of commercial media, that issues were sensationalised making it difficult for them to attain a complete picture of the issue. It was noted that some local newspaper reporting had improved in recent times and appeared to be doing more research and presenting differing perspectives. Participants were found to place more trust in universities and the ABC to provide transparent information.

The need to communicate directly with communities is advocated by McKenzie-Mohr & Williams (1999). Crompton (2008) explains that a range of communication strategies are required to inspire pro-environmental behavioural change. The EPA and OEH provide a range of air quality information to the community. Community members can subscribe to air quality communications via an email and SMS alert system on the OEH website. The OEH’s air quality monitoring website provides detailed information on local air quality levels in the Upper Hunter and Newcastle, updated hourly. The Air Emissions in My Community tool is also available on the EPA website. However, a key point raised in this study, and supported by the NCCCE workshop (2013) findings, was the importance of providing air quality information that is easy to comprehend by the general community. Generally participants who had sought information had found the current OEH website too technical. Other research has highlighted similar issues, with complex terminology, jargon, blocks of text, and complex tables and diagrams nominated as examples of information that was too difficult to understand (Bailey et al 1999, Smallbone 2010). Difficulty in finding information, and difficulty in understanding terminology used, have both been identified as barriers to public understanding of air quality (Bailey et al 1999). Research by Shooter and Brimblecombe also noted that people want information about air quality present with recommended actions they should take on days of high pollution, and they suggested a small report on the television alongside weather information (Shooter & Brimblecombe 2009).

1.6 Education

Concerned participants were interested in increased education for the whole community, with priority given to school education and air quality. Schools as a location for education around air quality have been raised in other studies (People Science & Policy 2006). Internationally a number of projects have been implemented to educate and engage school students on air pollution issues, such as London’s Cleaner Air 4 Primary Schools (GLA 2013) and a range of EPA USA initiatives, such as their Coco the Chameleon character (AIRNow undated a) and School Flag Program (Shendell et al 2007).

Wells & Lekies (2006) highlighted the role of parents, teachers or significant others in environmental education and working with children. In other words education programs involving children can have a multiplier effect of reaching broader sectors of the community. From the perspective of
intergenerational equity, investing in education for future environmental custodians and decision makers is important (Erikson 1964, Wells et al 2006).

In this study children and some adults expressed their desire to learn about the impacts of pollution on whole ecosystems as exemplified by the child who questioned the implications of air pollution on bird life and fish. An ecosystem approach to future EPA education programs is a worthy direction to investigate.

1.7 Policy and planning

In the absence of an adopted policy and strategic position on community relationships, education, engagement, participation and communication, it is difficult for the EPA to respond in a co-ordinated and strategic way to community based issues in the Lower Hunter region.

However the NSW Government has adopted a ten year state plan titled: NSW 2021: A plan to make NSW number one that prioritises community engagement and participation at a local level and can assist in guiding EPA and community relationships in to the future (NSW Government 2013a). The plan includes a dedicated section to ‘strengthen our local environment and communities’ and four state wide goals (22, 23, 24, 28) relate directly to the objectives of this study. Furthermore, at the time of writing this report, a white paper titled A new planning system for New South Wales was under consideration by the NSW Government. This paper includes a section a significant emphasis on local community engagement and participation (NSW Government 2013b).

Valuable lessons can be learnt from the exemplars of the USA EPA (US EPA 2001) and the EPA in Victoria, Australia (Vic EPA, undated) that can inform the development of future policy and strategies. The inclusion of a whole-of-community approach, such as Intergenerational Democracy (Davies 2012), as adopted in this study to assist the EPA as it works in partnership communities. The 2013 Ipsos EPA stakeholder survey also recommended the development of a stakeholder engagement strategy, stating in one of its recommendations that the EPA should have published principles for engagement (Ipsos 2013). This recommendation is also reflected in the comments from participants in this study, who desired clarity about EPA involvement with the public.

2. Increase community engagement and understanding about air quality issues in the Lower Hunter.

To increase community engagement in an issue, it is important to establish levels and areas of concern, identify key participants and design appropriate engagement and participation initiatives at a localised level. Key results from this study are compared with the literature in the following summaries.

2.1 Air quality in the region and levels of community concern

From a NSW state-wide perspective, the OEH’s Who Cares About the Environment in 2012? report identified air pollution and air quality as third in the top seven environmental issues, as identified by 17% of that study’s participants. This represents a drop in state-wide community prioritisation of this issue when measured in 1997 as being of concern to 32% of the state’s population (NSW OEH 2013).

In this study just under half of the participants were either ‘not concerned’ or ‘not sure’ about air quality in the region. Just under half were concerned, with these people mostly rating their level of
concern as moderate or very severe. This is despite the air monitoring data showing the air quality of the Lower Hunter to be generally good with few exceedances of NEPM standards since air monitoring began in 1993, with these exceedances often being attributed to events such as bushfires and dust storms (OEH 2014). A substantial number did not rate their level of concern.

It was notable that a large proportion of children aged 10 - 14 years were ‘not sure’ and the majority of those aged 15 - 19 years were not concerned. This lack of concern by adolescents is consistent with the findings of Huntley (2006) who described the lack of environmental concern of young people.

Many middle aged and elderly participants in this study believed that air quality in the Lower Hunter was good and had improved, particularly since the closure of BHP in 1999. This finding was supported by a study of the air quality in the five years following BHP’s closure which found that the levels of a number of pollutants had indeed decreased, based on measurements from three locations (Sajjadi et al, 2012).

People residing in areas close to train lines where coal is transported, stock piles, mines (including areas nearing the Upper Hunter), or industrial areas, were found to be more concerned about air quality those who resided further afield. This is a finding consistent with other studies, such as Smallbone (2010), which describes the need for an issue to directly touch the lives of individuals, including their values and priorities before they seek information and express their levels of concern. As van Ardsol et al discovered in 1964, Los Angeles residents were most concerned about smog because it was the environmental hazard that was most visible. Work in the ensuing decades has similarly found that communities and community members are most concerned when they can see evidence of air pollution in the form of smog, dust, or respiratory health issues (Bickerstaff and Walker 2001, Howel et al 2003, People Science & Policy 2006). One Australian report in the Upper Hunter also found that seeing dust was the biggest contributor to concern about poor air quality on any given day (ACARP 1999). In comparison, Day (2007) found seeing green vegetation and trees works to reduce community concern about air quality issues.

2.2 Community engagement

People become engaged in activities that have personal meaning and value (IAP2 2010). Triggers for engagement include: emotional reactions (such as anger at a decision), a response to a threat (including a perceived threat) and wanting to improve something locally (Involve 201139). People are more likely to become positively or negatively engaged in an issue that they experience and touches their lives (Wakefield et al 2001). Successful community engagement involves the development of partnerships of trust and meaningful interactions that can result in agreed outcomes. These outcomes must be achievable or the community will become disengaged. Interactions, including education and communication components should be appropriate to the age group (Erikson 1964, Wells et al 2006) and interests of the community (Involve 2011).

Key EPA and OEH initiatives in community engagement are outlined more fully in the section entitled Working with Communities, earlier in this document. These include the Air Emissions in My Community tool, the Air Quality Index and the Clean Air Forums. There are a number of existing programs internationally that provide air quality information to the community. Key to successful programs is clear and easy to use visual guides to show pollution levels in a simple and easily understood manner. Many programs have websites with frequently updated information about pollution levels in easy to read, pictorial formats. With the increase in the use of smartphones, a
number of programs also include a mobile app, such as London Air, the US EPA AIRNow, and Canada’s AQHI. These apps make air quality information available to the public wherever they are. In addition, Twitter is being used to provide air pollution information to the public.

2.3 Community participation

The core principles of community participation describe the need to empower, engage and communicate with citizens (IAP2 2010). Community participation in environmental issues, such as air quality can occur through the development of programs, some of which include the growing trend of citizen science. The NSW EPA has a growing track record of community participation.

Key EPA and OEH initiatives in community participation are outlined more fully in the section entitled Working with Communities, earlier in this document, and are summarised on the EPA website. Some key EPA initiatives in the Lower Hunter include the Newcastle Community Consultative Committee on the Environment and the Rutherford Air Quality Liaison Committee. Both of these were established in order to enable people living in the region to identify important environmental and amenity issues associated with industrial activities in the area.

Agencies such as the USA EPA are placing increased prioritisation on community participation pertaining to environmental management. They cite the many benefits of working with communities that is based on empowering and encouraging communities to take increased local responsibility for managing and monitoring environmental issues. The USA EPA’s 2013 Draft Roadmap for Next Generation Air Modelling also notes the value of citizen science and community participation approaches in building trust and stronger ties with communities, and encouraging interest in and understanding of air quality issues (US EPA 2013). The US EPA see this as a multi-year strategy, involving identifying community concerns, developing and conducting pilot projects, and then expanding successful strategies nationwide.

As noted in the desktop review, citizen science programs use community participation to study and educate about scientific issues. Citizen science aims at using public involvement to increase community understanding of scientific questions (Cornell University 2014). As noted by the examples discussed in the desktop review, air quality monitoring offers opportunities for citizen science programs. Local air quality monitoring sensors have been used as part of citizen science programs in a number of locations, with schools a particular focus. These programs not only provide air quality information, but can be integrated into the science curriculum. Examples such as London’s Cleaner Air 4 Primary Schools (LSX undated) and Berkeley’s BEACON (UC Berkeley 2014) demonstrate how schools can be effectively involved in air quality monitoring. In Australia, the newly formed Clean Air Association of Australia plans to implement a national program of sensors in schools and at other interested locations to provide localised air quality information, as well as involving students in science education (CAAA 2014).

3 Improve working relationships between community and government

The EPA has demonstrated its commitment to a model of continuous improvement through the many programs it offers and plans to have stronger community partnerships in the future. Following summaries discuss ways in which this can occur.

---

3.1 Community, industry and government initiatives to address air quality issues

Newcastle’s identity as an industrial city, and the complexity of balancing job-creating industries, economic growth and a healthy city for residents was understood by participants. They were aware of the employment opportunities created by industry while also being concerned about the liveability and environmental quality of the area. One study conducted in the industrial city of Hamilton, Canada, reported comparable findings, as residents balanced the positive aspects of a strong community and amenities against the negatives of pollution (Elliott et al 1999). As with the Hamilton study, residents of the Lower Hunter described their strong attachment to the region with over three quarters having resided there for 10 years or longer. Attachment to place is important in encouraging involvement in and care about local issues (Wakefield et al 2001). As such, Lower Hunter residents are well-positioned to be engaged in air quality programs.

The recognition that local and state governments need to balance the interests of both industry and residents was found to be relatively well understood. However, both this study and the EPA stakeholder survey (Ipsos 2013) reported a number of participants who felt the EPA valued its relationship with industry above environmental and community interests. This perception made them less likely to trust that the EPA would make the best decisions on air quality issues. Participants saw value in working with both government and industry, but placed the majority of importance on their own personal experience.

Other studies in industrial cities have concluded that working collaboratively with government, industry, and community interests is necessary to properly address air quality issues in such areas (Elliott et al 1999, Howel et al 2003).

3.2 Awareness

Participants often nominated the local council as their first contact for any information about air quality, while many had not heard of the EPA, a finding that was supported by the 2013 Ipsos study. A small cohort of more informed participants nominated the EPA as the first agency they would contact and were familiar with the EPA’s roles and responsibilities. Those who were familiar with the EPA requested increased prioritisation of communities and their need to promote the agency as the environmental protector for communities and not industries.

3.3 Experience with the EPA

Those who had contacted the EPA in the past about air quality described their dissatisfaction with the experience, with a small number of exceptions. Dissatisfied respondents also mentioned that they had been passed from person to person in the EPA with no result when they tried to seek information about a pollution incident, and hadn’t received a response following their complaint.

3.3 Monitoring

Nearly three quarters of people interviewed in this study either disagreed or were not sure that air quality in the region was being adequately monitored and controlled. More people gave no response to this question than people who said they agreed that the air is being monitored adequately. It can be inferred from these results that just over half of respondents in this study did not have any views on air quality monitoring, as they either said they were unsure or gave no response. Respondents under 50 years of age were often not sure regarding the adequacy of air quality monitoring, whilst people in the age range of 50 – 79 years were more likely to believe that it was not adequately monitored and controlled.

Participants who had a view on monitoring usually cited the EPA as the monitoring agency rather than OEH demonstrating the level of community confusion surrounding roles of agencies.
3.4 Risk management

Poor air quality is a risk, with environmental and health impacts. While it does not discuss air quality issues, the National Strategy for Disaster Resilience outlines the need for various stakeholders to be involved in the management of environmental hazards (COAG 2011). The evolution of emergency management from responding to events to managing hazards through awareness, preparedness, and mitigation has involved a move towards engaging and empowering communities to know their risk and take necessary precautions (Tarrant 2006). Similarly, air quality issues involve governments, industry, and community, and all groups need to be aware of their roles and their options for involvement. Perceived problems in managing air quality can also add to distrust of government agencies, as outlined in the trust and reputation section below. Effective risk management needs to identify stakeholders and provide clear roles and responsibilities. To do so, it is necessary to talk to each stakeholder group to identify their concerns and what they see as their own and each other’s roles, and ensure there is no misunderstanding (Box et al 2013). It is important that public participants feel their recommendations and concerns are listened to, as this will make them more likely to accept any decisions made (Pearce 2003). The National Strategy for Disaster Resilience (COAG 2011) noted above should be used as an example for the EPA to build on.

3.5 Community partnerships

Participants in this study described their desire to work in partnership with the EPA towards the collective goal of community and environmental health together with economic sustainability.

3.6 Leadership

It was found that community members and local council representatives wanted to have stronger personal relationships with senior management of the EPA at state and regional levels. They believed these interactions lead to increased trust and improved working relationships.

3.7 Trust and reputation

Closely linked to reputation is community trust. One previous study reported that residents concerned about air pollution in the Hunter Valley felt their complaints to authorities were not taken seriously (Higginbotham et al 2010). This finding was supported by the 2013 Ipsos study, where community stakeholders perceived a lack of willingness by the EPA to share information with the public (Ipsos 2013). A slow response to inquiries following the 2011 Orica leak was highlighted as a specific example of a lack of timely responsiveness from the EPA leading to reputation damage. This is consistent with the conclusion of Bickerstaff (2004), that while the public tend to see governments as having responsibility for air pollution issues, they also lack confidence that these institutions will make decisions in the interests of the community.

Some described their lack of trust regarding these sources providing complete and balanced information and nominated specific campaigns they believed were being promoted in the media, such as the covering of coal train wagons. This is consistent with a 2005 study by Charnley and Engelbert. They found that community members involved in a hazardous waste community clean-up program run by the EPA in the USA received most of their information from the media, such as newspapers, and they wanted to be more informed by the EPA directly. Those who were more directly involved and informed with the Superfund program rated the EPA as better than those were less involved and informed, and rated the EPA at better being able to gain their trust (Charnley & Englebert 2005).
Contributing to the Lower Hunter community’s lack of trust, was the community perception that the EPA was ‘on the side’ of industry rather than being the environmental protector of communities. These perceptions can be explained by the EPA’s regulatory role concerning industry which results in close working relationships.

As a general rule interactions between the EPA and communities occur when there has been a pollution incident or a specific issue. As a result, those people affected by the issue tend to associate the authority with a problem, which does not assist the EPA’s reputation. This relationship could shift through the authority investing in an increased emphasis on working with communities on proactive ventures that will build the EPA’s reputation as one that prioritises community well-being.
Conclusions and Recommendations

This whole-of-community study has revealed the existence of complex and divergent community perceptions, levels of concern and knowledge pertaining to air quality, environmental protection and the role of the EPA in the Lower Hunter region.

In summary, just over half of the participants in this study were either ‘not concerned’ or ‘not sure’ about air quality in the region, or provided ‘no response’ when asked to rank their levels of concern. Just under half were ‘concerned’, ranking the majority of their levels of concern as ‘moderate’ and ‘very severe’. Older people were found to be more concerned than young people. Those who were concerned described their fears surrounding air pollution which included: human (psychological and physical) and environmental health together with aspects of liveability for residents and a growing population centre. The results also indicate around two-thirds of the community sampled had no previous contact with the EPA or any other authority. Both the qualitative and quantitative data indicated that those who were concerned about air quality issues tended to be more aware of the EPA and its activities, and those who are not concerned tended to be less or not aware of the EPA.

This body of evidence highlighted the opportunity for the EPA to grow and prioritise community partnerships that build the authorities reputation and trust within communities. In this time of increasingly engaged communities combined with the decreasing financial and human resources of government authorities, the following recommendations and actions have been developed to recognise the need for strong interagency and community partnerships that share and spread the responsibility of ongoing environmental protection and risk management. This approach is supported by the state plan: NSW 2021: A Plan to Make NSW Number One.

Future community programs and projects benefit by being embedded in policy and strategic planning to ensure a co-ordinated approach for the Authority to work in partnership with communities. At the time of completing this report the EPA was developing its Engagement Guidelines. Implementing an effective engagement model is a key result area of the EPA’s Strategic Plan 2014–17 and recognises the important role stakeholders play in the success of the EPA and its work in improving environmental outcomes. The Engagement Guidelines have been informed by the Ipsos Study (2013), EPA Strategic Plan, EPA policy documents and input from staff. The Guidelines outline the EPA’s purpose of engagement, engagement goals and objectives and guiding principles. They also set clear expectations for stakeholders by outlining when and how they engage, and the parameters of engagement.

Based on the findings of this study, it is proposed that a future Engagement Policy would assist the implementation of the Engagement Guidelines. The policy would be a statement of intent, describing the nature of the relationship between the EPA, the community and other stakeholders (such as those from the Lower Hunter region) as one of working in partnership towards mutually agreed outcomes. It would recognise the increasing trend of the EPA (and comparable agencies across the world) to share the responsibility of environmental management and monitoring with local citizens, industry and business.
Recommendations and actions for the Lower Hunter region

The following recommendations and actions have been developed based on the findings from this study. It should be noted that their future implementation is subject to their adoption by the community and the EPA, together with the availability of human and financial resources. Therefore neither a timeframe nor a priority listing has been included. Growing and implementing these actions is the joint responsibility of individuals, community groups, business, industry and government agencies as they work together to care for the people and environment of the Lower Hunter region.

Recommendation 1: Grow community relationships

Build on existing programs (including those not related to air quality) and assist in growing community relationships with the EPA. Some of the ways this can occur are:

Action 1a) Strengthen community awareness of the EPA and its activities

Investigate opportunities to develop a corporate branding and marketing campaign to raise community awareness of the authority’s role as the NSW environmental custodian for communities and ecosystems. In the Lower Hunter region this could include marketing materials distributed locally e.g. attendance and stalls at local events such as: farmers markets, schools, local Lions and Rotary club events, local agricultural shows and local festivals.

Action 1b) Build closer relationships between EPA senior staff and local communities

Prioritise opportunities for EPA senior staff at state and local levels to interact directly with communities. This approach will build relationships, strengthening trust and the management of community interactions in future unplanned situations (such as pollution incidents) when the EPA is required to take a reactive role, often at short notice. Building close community relationships is part of a risk management approach that will facilitate localised monitoring and reporting and enable early community alerts surrounding issues of concern.

Action 1c) Foster relationships with NSW government agencies, universities and local councils

Facilitate the coordinated approach of: industry, NSW government agencies (EPA, OEH and others), universities, local councils that prioritise the health and well-being of local communities and ecosystems. This can occur through the identification of key issues, discussions surrounding solutions, and the provision transparent and accessible information.

In the Lower Hunter region this role could be facilitated by the Newcastle Community Consultative Committee for the Environment (NCCCE). The community has proposed the reintroduction of community forums on air quality with the EPA and the NCCCE which were run in 2013. The NCCCE received positive feedback on these and it is recommended that the NCCCE and EPA collaborate to continue to run them regularly.
Recommendation 2: Work with industry and communities to address key community concerns

Cultivate community and industry partnerships that acknowledge and address key community issues. Some of the ways this can occur are:

**Action 2a) Work with the community and their concerns surrounding coal dust**

In the Lower Hunter region there is significant level of community concern surrounding the impacts on human (physical and psychological) health and visual amenity of coal dust. There is a ‘public call’ to cover coal train wagons and stock piles as one of the community based solutions to minimising coal dust. The EPA has several initiatives that are currently underway including: 1) Audit and review of coal transport from coal mine to port; 2) Identifying and evaluating the cost of rail system dust mitigation options; 3) Assessment of rail system operator records; 4) Compliance audit on coal train loading and unloading facilities; 5) Diesel emission analysis and control measures; 6) Review of the current regulatory framework for the operational rail sector and 7) Non-road diesel emission strategy.

Following the outcomes of these initiatives, it is recommended that the EPA facilitate discussions with industry on the actions to address community concerns surrounding coal dust. Additionally a targeted coal dust education program may assist to build community knowledge and understanding surrounding coal dust and health.

**Action 2b) Refer findings of the report to NSW Department of Health regarding the community concern about the physical and psychological health impacts of air quality issues**

Elevated levels of concern surrounding the (perceived and/ or actual) impacts of air pollution on the physical and psychological health of community members was identified as an issue.

It is recommended that the EPA refers this issue to the NSW Department of Health for their follow up and works with this department to improve education surrounding the health implications of air pollution.

**Action 2c) Work with communities and industry to improve air quality**

It is recommended that the EPA work in partnership with industry, agencies, schools and community groups (such as: NCCCE, Greening Australia, Trees in Newcastle41, Men’s Shed groups, Clean Air Society, CWA, local schools, and councils) to improve air quality including minimising diesel emissions from vehicles and boats. Some of the ways this could occur are: through a reduction of vehicles on the roads and an increase in the use of public transport and increasing native vegetation plantings in the Lower Hunter region to improve amenity and air quality.

---

41 Trees in Newcastle (TIN) “…is a local native plant nursery, volunteer and education centre and bush regeneration provider” with a number of employed staff.
**Action 3a) Investigate opportunities for school education programs and air quality**

It is recommended that particular emphasis is placed upon future EPA programs that involve the engagement of children, for example in local primary and secondary schools. Children are the future environmental custodians, their participation in projects require the mentorship, advocacy and involvement of adults, therefore the EPA can maximise the impact and reach of its community based investment in projects through working with local children.

This can be achieved by the EPA establishing partnerships with NSW government agencies, including the NSW Department of Education, NSW Health and the Office of Environment and Heritage, to improve community education and awareness surrounding air quality, in particular working with schools and the curriculum. Education programs can be based on an ecosystem approach, conveying the message of the impact of air pollution on natural systems including terrestrial, aquatic and marine ecosystems.

Examples for the EPA to consider in the development of programs include: the US EPA School Flag Program, and Cleaner Air 4 Primary Schools, which is a part of the Cleaner Air 4 London program. Both programs educate students on air pollution issues, involve them in pollution measuring, and provide information to the wider community.

**Action 3b) Investigate opportunities for emergency response education programs**

In partnership with emergency response agencies, assess how community awareness and education programs, including emergency procedures, can be strengthened to ensure that all community members are aware of protocols in the case of future pollution incidents. Community preparedness can help to minimise risk, protect people and reduce the escalation of some issues in emergency situations, including anxiety. The EPA could work with the NSW State Emergency Services to extend existing programs to educate communities on how to respond to emergency situations linked to air pollution.

**Action 3c) Investigate citizen science initiatives**

Investigate projects surrounding air quality that involve citizen science and are designed to empower communities to improve air quality. Facilitating citizen science initiatives can assist the EPA in: community relationship building, harnessing local resources and expertise and sharing the responsibility of environmental monitoring and management with communities.

Project themes for the Lower Hunter region could include: minimising wood smoke and/or vehicle emissions and ‘greening’ areas to improve air quality. Taking the lead from citizen science projects on air quality in the USA, such as the Kids Clean Air Zones Project\(^\text{42}\) in Newark, New Jersey\(^\text{43}\).

\(^{42}\) [http://www.youtube.com/watch?v=Uevr3vjWDt8](http://www.youtube.com/watch?v=Uevr3vjWDt8)

\(^{43}\) Newark is a highly industrialised area and has similar community complaints to the Lower Hunter area including numerous industrial pollution sources and asthma and cancer concerns. It is envisaged that a similar study would measure particulate matter from diesel truck exhaust on busy roads close to where community members are engaged in outdoor activities such as high schools or parks. The hypothesis is that diesel truck traffic increases air pollution levels. A control site located in a quiet residential area away from truck traffic would provide baseline comparison. It is envisaged that this would provide the community with information regarding local air quality and the impact of diesel traffic emissions, with the outcomes being suggested as ways to improved local air quality.
Recommendation 4: Develop a whole-of-community communication approach

Increased communication with the whole community will assist in building trust and mitigating community anxiety. Some of the ways this can occur are:

Action 4a) Adopt an age based approach to communication

Develop an aged based approach to communication that provides accessible and easy to interpret information e.g. Content for local television, including news and weather broadcasts and children’s television shows, newspapers and radio news broadcasts, a simplified website, information for school newsletters, emails, apps, SMS, displays in schools and public spaces. This approach could include air quality forecasting that is widely presented on local television networks and accompanies the weather forecast. A community suggestion was that the EPA provides a trusted senior staff member to present a regular radio spot on air quality as a way to share information and build trust with the community. Indexing and clear explanatory messaging regarding potential health impacts and actions could also accompany the forecasting.

Action 4b) Strengthen community trust regarding science communication

Building ongoing relationships with research institutions and experts will spread the responsibility of communicating the results of scientific studies. To assist this process, the EPA could develop and distribute (including on the EPA web site) a list of community driven research priorities that may attract university researchers, including PhD projects.

Action 4c) Deliver timely responses to issues

When an issue, or potential issue, has been identified, timely communication with the community to inform them that the EPA is aware of the issue and it is being investigated, is critical. This approach will provide reassurance and help to mitigate some levels of community concern. Follow-up with subsequent messaging that provides up-to-date information in accessible language and formats.

Specific communication preferences by age group can be found in the results section of this report
REFERENCES

Apple online store 2013 a, Alberta Air Quality Health Index (online), Available: 

Apple online store 2013 b, AQHI (online), Available: 


Apple Online Store 2013 d, airTEXT (online), Available: 

AIRNow Undated a, Kid’s Air (online) Available: 

AIRNow Undated b, School Flag Program (online), Available: 

AIRNow Undated c, School Flag Program Registered Schools (online), Available: 

AIRNow Undated d, Students (online), Available: 

AIRNow 2013 a, About AIRNow (online), Available: 

AIRNOW 2013 b, Teacher’s Air Quality Resources (online), Available: 


AirParif 2010. Air Quality in the Ile-de-France (Paris, France) region. Available 
http://www.airparif.asso.fr/reglementation/indice-qualite-air-francais (February 17 2014)

Australian Bureau of Statistics (ABS) 2013, 2011 Census Community Profiles (online), Available: 

Australian Coal Association Research Program (ACARP). 1999. Dust in the Hunter Valley – An 
evaluation of concentration distributions, meteorological associations and community response. Prepared by Holmes Air Sciences.

Australian Coal Association Research Program (ACARP). 2008. Assessing the cumulative impacts of 
mining on regional communities: An exploratory study of coal mining in the Muswellbrook area of NSW. Prepared by the University of Queensland.

Australian Council of State Emergency Services, 2013, ‘SES Li’l Larrikins Natural Hazards Children’s 


Bruns, A., Burgess, J. E., Crawford, K. & Shaw, F. 2012. *# qldfloods and@ QPSMedia: Crisis communication on Twitter in the 2011 south east Queensland floods*. ARC Centre of Excellence for Creative Industries and Innovation, Queensland University of Technology, Brisbane, Australia


Cornell Lab of Ornithology 2014, Citizen Science Central (online), Available: <http://www.birds.cornell.edu/citscitoolkit/about/definition> Cornell University (13 June 2014)


International Association for Public Participation (IAP2) 2010, Core Values (online), Available: <http://www.iap2.org.au/about-us/about/core-values> (6 April 2014)

Involve, 2005, People & Participation: How to put citizens at the heart of decision-making, London. www.involve.org.uk; Core Principles for Public Engagement prepared by the National Coalition for Dialogue & Deliberation (NCDD), the International Association for Public Participation (IAP2), the Co-Intelligence Institute, and other leaders in public engagement. http://ncdd.org/


NSW Environment Protection Authority. 2013a. Meeting between EPA and Macquarie University about the EPA’s activities on air quality in the Hunter region. Unpublished document. 17 December 2013, Sydney, NSW.


NSW Government 2013b White Paper: A new planning system for New South Wales 


Smallbone, K. 2010. Individuals’ interpretation of Air Quality Information: customer insight and awareness study, Report for DEFRA/COMEAP. HMSO, UK


