Not relevant

6 Cabinet Notes for Discussion

Not relevant

607 COMMUNICATION STRATEGY ASSOCIATED WITH THE RELEASE OF THE WHYALLA HEALTH IMPACT REPORT (John Hill) - NOTED

Not relevant

607.

MINUTES *forming* **ENCLOSURE** *to:* *07OCE/2995*

TO: THE PREMIER FOR CABINET TO NOTE

RE: COMMUNICATION STRATEGY ASSOCIATED WITH THE RELEASE OF THE WHYALLA HEALTH IMPACT REPORT

1. PROPOSAL

That Cabinet notes:

1.1 That the Whyalla Health Impact Study undertaken by the Department of Health is to be released to the public;

1.2 The Communication Strategy and follow-up activity planned for the public release of the Study.

2. BACKGROUND

2.1 Iron rich red dust emissions from OneSteel's (previously BHP's) pellet plant have caused amenity issues and raised health concerns amongst neighbouring residents for some years.

2.2 Cabinet agreed to regulatory arrangements for OneSteel and provided OneSteel with a new Environmental Authorisation in May 2005. Thereafter, OneSteel's board approved the $375 million Project Magnet which converted the dry, dust producing hematite process to a wet slurry based magnetite process to feed the steelworks. This project will significantly reduce fine dust emissions from the steelworks as the new process uses a slurry process that inherently produces less dust, and all crushing will occur adjacent to the mine and remote from the city. In addition, all export hematite will be transported by a new system which includes new rail trucks, storage shed and enclosed conveyors to the transport barges.

2.3 Onesteel has also agreed to performance based ambient dust standards to be included in the Environmental Authorisation and have previously announced those "community targets" to the Whyalla community. The methodology and targets have been endorsed by the EPA and Department of Health.

2.4 The Department of Health has been involved in assessing potential health impacts of iron ore dust since 2001. Following a meeting between Government and OneSteel in November 2003, the Department of Health was asked to investigate recent literature on dust-related health risks. A "draft-for-discussion" report was produced and provided to relevant stakeholders, including OneSteel, in March 2004. This report indicated

the potential for health impacts associated with the dust and indicated that further analysis would be required after receiving stakeholder feedback.

2.5 Subsequent investigations of cancer registry and hospital separations data indicated some elevated rates of some diseases possibly linked to either inhalation of dust and/or excessive iron intake. Relevant Ministers were apprised of the data and asked the Department of Health to prepare a Cabinet Note.

The Cabinet Note was considered in July 2005 and a senior inter-agency group was established, chaired by the Department of Health Chief Executive, to advise Cabinet on actions.

2.6 The group prepared a Cabinet Submission in October 2005, submitted by the Minister for Health, recommending further investigation in two stages:

- Stage 1 being a refinement of the previous data using in-house expertise and existing data; and
- Stage 2 being an independent formal risk assessment, contingent upon the outcomes of Stage 1.

Cabinet referred this to a Ministerial Working Group. The Working Group sought legal advice on statutory duties, and this indicated that there is a duty to further investigate under section 12A(1)(a) of the *Public and Environmental Health Act 1987* if expert advice considered there was a *potential* health impact. At a subsequent meeting, the Working Group agreed that the Department of Health commence the Stage 1 investigation.

2.7 Cabinet was advised of the findings of the Stage 1 Health Impact Study in July 2007. In summary, the findings of the Study included:

- Cancer registry data shows that compared to other country towns there were 32 more lung cancer cases than expected (95 observed versus 62.8 expected) during the period 1999-2004, mainly in women (ie the lung cancer rate is 51% higher mainly attributable to excess numbers in women rather than men). There is no increase in other cancers. Cancer registry data is the most accurate source of information to identify cancer cases.
- The information source available for non-cancer disease is hospital separations data which shows the number of admissions to hospital for each disease. This shows increased separations for:
  - Chronic Obstructive Pulmonary Disease (COPD)
  - Emphysema
  - Alcoholic liver disease
  - Chronic hepatitis
  - Various anaemias
  - Asthma in children.

It is unclear at this stage if these relate to increased rates of disease in the community (ie more people with the diseases) or to increased hospitalisation rates for those with the disease, (ie each person who has the disease is admitted to hospital more frequently) compared to other geographical regions.

2.8 These changes could not be explained by confounding factors including smoking, alcohol or viral hepatitis.

2.9 The analysis found the highest rates in regions more distant from the plant and did not find higher rates in areas of the city closer to the pellet plant with the highest dust exposure. However, the limitations of the study do not allow a firm conclusion about dose-response.

2.10 The Study was based on available information held by the Department of Health, including cancer registry data and hospital separations data.

This type of study is unable to provide firm conclusions about cause and effect and further study, involving the collection of new data, would be required to determine this conclusively.

2.11 The report's findings were considered by a meeting of Chief Executives or their representatives in April 2007, of the following departments:

- Department of Health
- Department of the Premier and Cabinet
- Primary Industries and Resources (PIRSA)
- Environment Protection Agency (EPA)
- Trade and Economic Development
- Attorney-General's Department
- a representative of the Crown Solicitor also attended.

This group noted:

- that the current evidence was suggestive of a link between the OneSteel dust and possible adverse health effects but was not definitive
- that it had not demonstrated a dose-response or cause-and-effect relationship
- that further research would be required, which would require publicity and substantial expense
- that such a study would take a considerable time to complete and may itself not be able to make definitive findings
- that any findings would only become available after the introduction of project Magnet, expected to greatly reduce iron ore dust pollution.

2.12 The Study report was included in a Cabinet Note submitted to Cabinet in July 2007.

2.13 OneSteel has now implemented Project Magnet. This is expected to significantly reduce the dust levels emitted from the plant. New conditions have been negotiated by PIRSA with OneSteel which will see

fine iron ore dust emission reduced significantly in 2008 and meet EPA and Health 'acceptable levels' by 2011. The three-year transition period allows OneSteel to undertake the removal of crushing facilities and necessary refurbishments to the plant.

2.14 There is likely to be considerable media interest and public concern about potential health effects when the study is released. A communications strategy has been developed by the Department of Health, in conjunction with the EPA and PIRSA.

3. DISCUSSION

3.1 Red iron ore dust has been emitted for many years, first by BHP and now by OneSteel.

3.2 There have been many complaints over many years about the impact of red dust on the nearby community. A number of investigations and reports have been produced over several years, and the matter has caused much media interest, Environment Court proceedings, political commentary and Freedom of Information requests.

The study to be released is the first that identifies specific illnesses and diseases that could potentially be associated with exposure to fine iron ore dust.

3.3 The report that is to be released has been modified from the previous report submitted to Cabinet in July 2007; it has been edited to remove specific names of individuals (replacing names with reference to the Department of Health) and to adjust a table legend that had been mislabelled. A small print run is intended and the document will be made available on the Department of Health website.

3.4 The communication strategy has the following objectives:

- to inform and clarify the findings of the Study for Whyalla residents, former residents, local clinicians and the broader community
- to provide the required and appropriate support to residents, former residents and clinicians seeking further information or action
- to announce the commencement of Project Magnet by OneSteel and the new conditions placed on OneSteel under the Indenture.

3.5 Potential risks that need to be managed following the release of the Study include:

- anxiety of potentially affected community members
- lack of consistent messages about the report and its impacts
- lack of information for media, community, OneSteel, GPs and health services staff
- increased demand on health services and GPs
- delays in accessing GPs and other health services (current waiting times are over one week for GPs)

- impacts on the image of Whyalla and possible implications for future development
- possible claims of Government inaction and delay.

3.6 10 Legal professional privilege

3.7 The communication strategy will ensure that there are key consistent messages to inform all of the products that are to be released into the public domain and will include information on the Study report; advice on interpretation of results; advice on actions taken by Government and OneSteel in relation to Project Magnet; and new emission standards. The information will be distributed via:

- Fact Sheets and questions and answers (Q&As) for public and clinicians
- letter and information package for GPs, including information on possible effects of fine dust exposure and health screening tests to be undertaken
- follow up information about health checks with GPs
- Department of Health support and contact point to be provided in Whyalla including expert advice for community and GPs on health issues
- a 'hotline' with key information for hotline staff
- Department of Health website with information from the Study report, fact sheets and Q&As.

3.8 PIRSA and the EPA are developing Q&As and website content which will be included in the communication package prior to release of the Study report.

3.9 In addition, targeted briefings for hospital and health service staff, GPs, and Whyalla community leaders will be arranged on the morning of the release, and a teleconference for local media immediately following the announcement.

3.10 A copy of material to be released is attached. PIRSA and EPA documentation is being finalised and are not attached to this Cabinet Note.

3.11 Country Health SA is developing a Services Plan for country services including Whyalla. To support the plan, additional health investigation studies to further assess health status in Whyalla are being considered. Such investigations could include a specific Health Monitor Survey, as well as analysis of information generated by voluntary screening tests undertaken by GPs. This work will help identify the health service needs of the Whyalla community and ensure that appropriate prevention and treatment services are in place.

4. RECOMMENDATIONS

That Cabinet notes:

4.1 that the Whyalla Health Impact Study undertaken by the Department of Health is to be released to the public;

4.2 the Communication Strategy and follow-up activity planned for the public release of the Study.

MINISTER FOR HEALTH

Date: 21/11/07

Mayor + Local stakeholders to be briefed

RECEIVED 23 NOV 2007 CABINET OFFICE

In Cabinet

26 NOV 2007

NOTED PREMIER

WHYALLA RED DUST REPORT Q & As

GENERAL

Why did the Department of Health undertake the Whyalla Health Impact study?

There has been public concern about the amenity impact of visible red dust that comes from the ore screening and crushing operations in the nearby steelworks. The purpose of the study was to gain an understanding of whether exposure to red dust might be associated with any health problems. The Health Impact **S**tudy was undertaken using available data sources from the **D**epartment of Health.

What did the study find?

The study found that there are higher than expected numbers of various diseases compared to other country towns. However, a link to red dust emitted from the steelworks could not be demonstrated.

Cancer registry data shows there were 32 more cases of lung cancer between 1999 and 2004 than expected compared to similar towns. This equates to the lung cancer rate being 51% higher than in comparative towns

Hospital admissions data shows increased rates for:

- Chronic Obstructive Pulmonary **D**isease (COP**D**)
- **E**mphysema
- Alcoholic liver disease
- Chronic hepatitis
- Lung cancer
- Various anaemias
- Asthma in children.

Whilst inhalation of iron-rich dust could be associated with these diseases, the report indicates that there is inadequate evidence to confirm dust as the cause.

The analysis did *not* find higher rates in areas of the city closer to the pellet plant (i.e. those areas most affected by the dust) and so a firm conclusion about dust as the cause cannot be made.

Why is there no proven link?

There are a number of areas of uncertainty that have limited the ability to form firm conclusions in this report. The study only looks at cancer registry data and hospital admissions data and did not examine confidential individual patient data. The cancer registry data is very accurate but the hospital admissions data cannot be used to conclude that there is a higher incidence of a particular disease in Whyalla than elsewhere. The reality is that a cause may never be known.

What does it mean for my health?
The limits of the study mean that it is unclear what, if any, are the potential health impacts on individuals. If you have concerns about your health, you should see your General Practitioner, or call the hotline number.

How can I find out if I have any adverse health risks?
Contact your General Practitioner to make an appointment.

Who will pay for my consultation?
The cost will depend on what your General Practitioner usually charges. The SA Department of Health is supporting local doctors with additional nurses to assist.

What happens if the tests detect something out of the ordinary?
The usual follow up tests will occur through the public health system.

What about future problems?
The diseases identified in the Study are all fairly common in the population. We don't know for sure why there is a higher than expected number in Whyalla and so we cannot say what may happen in the future. You should keep in contact with your General Practitioner if you have concerns. The Department of Health will continue to work with doctors to make sure all health supports that may be needed are available.

What if I live close to the steelworks? Am I at greater risk?
The study didn't show that people closest to the steelworks were at greater risk. In fact, higher numbers of lung cancer were seen further from the plant, in a part of Whyalla not heavily affected by dust. This is very difficult to explain but it may mean that the cancers are not associated with the dust but with some other factor. In terms of respiratory and liver diseases, it is not clear from the available data if one part or other of the town is most heavily affected. If you have concerns, talk with your doctor.

What could it be if it isn't dust?
The higher than expected health problems could be related to lifestyle factors like smoking or nutrition, could be related to a large number of local residents who have previously worked in high risk occupations, or could even be a statistical anomaly.

Can I get a blood test to find out if I have been exposed to toxins?
There is no single blood test that will provide you with a clean bill of health. If you have concerns consult your GP. Your GP will decide on the most appropriate tests for you, if any, based on their clinical judgement. The SA Department of Health will assist GPs in the Whyalla area to provide advice.

I worked at the foundry for five years, but left three years ago. Could I still develop lung cancer?
Indications from health checks done regularly on workers at the steelworks show little or no adverse health impact on workers. If you have concerns about your health, you should contact your GP.

I have a two-year old daughter. Is she more at risk of developing asthma?
The study has shown a small but statistically significant increase in hospital admissions for asthma and respiratory infections in children, although once again, the cause is not known. Rates were 23 – 25% higher in Whyalla than in comparable towns.

How many people are affected?
This is impossible to say. From the Cancer registry data, the rate of lung cancer is about 50% higher than expected. In the 5 year period from 1999 to 2004 (the period most closely studied), this equated to 32 extra people, mostly women, and mostly in a part of Whyalla not heavily affected by red dust. For the hospital data, it is difficult to say how many people have been affected because the data are not based on identified individuals.

Why are there higher rates of hepatitis and alcohol liver disease?
We do not know conclusively why there are higher rates of these and other diseases.

How can I make sure I don't get sick in the future?
The SA Department of Health advises all South Australians to look after their own health during their entire lifetime. Given it is not clear what has caused higher than expected health problems found in this study, it pays for everyone to take the best care of their health now and into the future.

QUESTIONS FOR GPs

What sort of tests should be conducted for people who are concerned about their health following the release of this study?
Diagnosis and management of these diseases is no different to usual practice, so for lung disease, spirometry and a chest X Ray might help to show any established disease. Elevated blood iron studies would show any iron excess. Abnormal liver function tests might suggest hepatitis. Other investigations would be as indicated when these tests are abnormal in usual practice.

What do I do if my clinic is over-run with requests for testing?
The SA Department of Health will provide additional practice nurses to assist you in dealing with any extra demand. If required, the SA Department of Health, in consultation with local GPs, can employ a locum doctor in Whyalla to help you deal with any extra demand. It would be up to GPs to decide if the locum is necessary and who to refer to the locum.

What assistance can I get from the SA Department of Health?
The SA Department of Health can provide you with advice about appropriate testing if you have any questions. You can also contact the SA Acting Chief Medical Officer to discuss the issue. Additional Practice Nurses will also be made available at no extra charge to assist GPs in dealing with any extra

demand on their services. If required, the SA Department of Health, in consultation with local GPs, can employ a locum doctor in Whyalla to help you deal with any extra demand. It would be up to GPs to decide who to refer to the locum.

What if I feel that a patient does not need to be tested or will not benefit from testing?
Diagnosis and management of these diseases is no different from usual practice for these illnesses, so, as always, your own clinical judgement is fundamental to diagnosing and treating patients.

What do I do if a patient's test results indicate potential health problems that need further investigation?
Diagnosis and management of these diseases is no different to usual practice for these illnesses, so you should undertake your usual clinical care.

Country Health SA is developing a Health Plan for country services including Whyalla. To support the plan, additional health investigation studies to further assess health status in Whyalla are being considered. Such investigations could include a specific Health Monitor Survey, as well analysis use of information generated by voluntary screening tests undertaken by GPs. This work will help identify the health service needs of the Whyalla community and ensure that appropriate prevention and treatment services are in place.

BACKGROUND Q&As

What is the Government going to do about it?
Health
Country Health SA is developing a Health Plan for country services including Whyalla. To support the plan, the Department of Health with conduct a Health Monitor Survey, as well as analyse information generated by voluntary screening tests undertaken by GPs. This work will help identify the health service needs of the Whyalla community and ensure that appropriate prevention and treatment services are in place.

Why hasn't a study like this been done before?
Previously, there has been little to indicate the red dust has had a negative health impact. It was only some initial investigations by the SA Department of Health that demonstrated there might be any health concerns. These initial investigations raised enough questions for further research by the Department of Health, leading to this report.

Who is to blame / culpable / responsible?
At this stage, we do not know, as the study did not demonstrate what is actually causing the higher than expected rates of disease.

Who is at risk?
Given there is no clear information about the cause of the higher than expected rates of disease, it is impossible to know who is at risk. The SA Department of Health is working with GPs in the local area to ensure that any local residents who are concerned will get the appropriate tests and care.

If I get the tests and there is nothing wrong with me, does that mean my health won't be affected in the future?
The illnesses with increased rates are not unusual in our population and can occur from a variety of causes over a lifetime. This means there is no guarantee that residents who have negative tests now will not be unwell in the future. There is a possibility that the higher than expected numbers of illness we are seeing are a statistical anomaly, which cannot be linked to any environmental factors. You will need to keep an eye on your health the same as anyone in the general population, regardless of any test results now or in the future.

How can you guarantee health safety if it is red dust?
Advice from Primary Industries and Resources SA (PIRSA) indicates that the implementation of Project Magnet by the operators of the steelworks will significantly reduce the red dust in the Whyalla area. Once the dust begins to reduce, any potential health impact from the dust is also likely to reduce.

If I do get sick can I seek compensation?
There is no proven link between the higher than expected adverse health outcomes and the exposure to red dust.

Has the damage to my health already been done?
There is nothing to indicate that a significant number of people in the Whyalla area are unwell. The Health Impact Study only looked at data from people who have attended hospital, not the whole population. If you have concerns you should see your doctor for a health check.

Will there be more health services in Whyalla to cater for any future increase in health problems?
Country Health SA is currently planning for an increase in services in Whyalla at the hospital, as part of the Country Health SA Services Plan. These services will cater for community needs for many years to come, and Country Health SA will consider any further future needs as they arise.

Dear **Whyalla** GP

The SA Department of Health has released a Whyalla Health Impact Study, which was undertaken in response to community concerns about possible health effects of red dust from the nearby steelworks.

The Study found higher than expected numbers of various diseases compared to other country towns. These include respiratory diseases such as lung cancer, emphysema, Chronic Obstructive Pulmonary Disease and asthma as well as diseases of the liver such as chronic hepatitis. The Study was inconclusive about the cause of these higher numbers.

With the study results now in the public domain, it is likely that Whyalla residents may seek medical advice about what, if anything, this study means for them. This may lead to an increase in people attending your clinic looking for advice, testing and reassurance.

Diagnosis and management of any diseases present should be no different to usual practice. For example, for lung disease, spirometry and a chest X-Ray might help to show any established disease, while elevated blood iron studies should show any iron excess and abnormal blood liver function tests might suggest hepatitis. Other investigations would be as indicated if these tests were abnormal, as usual.

The SA Department of Health will provide you with additional Practice Nurses if needed to assist you with additional demand.

If demand for medical services increases significantly, the SA Department of Health can also provide assistance by contracting a locum to help. This will only occur at the request of local GPs, and it will be up to you to decide which patients, if any, you refer to this doctor.

You can contact Acting Chief Medical Officer Professor Paddy Phillips at the SA Department of Health on **8**204 4**0**39 for further advice.

The SA Department of Health will be undertaking a specific Health Monitor Survey, as well analysis use of information generated by voluntary screening tests undertaken by GPs. Country Health SA, which is currently developing the Country Health SA Services Plan, will use this information to identify the health service needs of the Whyalla community and ensure that appropriate prevention and treatment services are in place.

Residents with concerns or wanting more information can be referred to the **Health Call Centre on 1800 xxx xxx or the Department of Health's website** www.health.sa.gov.au/XXXXX

Yours sincerely
A/CMO etc

WHYALLA RED DUST KEY MESSAGES -- HEALTH

- A Whyalla Health Impact Study has been undertaken in response to community concerns about possible health effects of red dust from the nearby steelworks.

- Cancer **R**egistry and hospital separation data show higher than expected rates of various diseases.

- The report does not show cause-and-effect and the reasons for the apparent higher disease rates are not clear.

- Independent experts will now check the report findings and advise on possible further investigations.

- People concerned or in need of further information should call the hotline or see their GP.

The Whyalla Health Impact Study was based on cancer registry data and hospital admission figures.

The study found that there are higher than expected numbers of various diseases compared to other country towns. However, a link to red dust emitted from the steelworks could not be demonstrated.

Cancer registry data shows there were 32 more cases of lung cancer between 1999 and 2004 than expected compared to similar towns. This equates to the lung cancer rate being 51% higher than in comparative towns.

Hospital data shows increased admissions for a number of diseases. These include respiratory diseases such as emphysema, Chronic Obstructive Pulmonary Disease and asthma, and diseases of the liver such as chronic hepatitis.

The findings of the Study are difficult to interpret. Whilst red dust in the eastern part of Whyalla was the trigger for the study, the higher than expected number of lung cancers were mainly associated with women and occurred in parts of Whyalla less affected by red dust.

Country Health SA is developing a Health Plan for country services including Whyalla. To support the plan, the Department of Health will conduct a Health Monitor Survey, as well analysis use of information generated by voluntary screening tests undertaken by GPs. This work will help identify the health service needs of the Whyalla community and ensure that appropriate prevention and treatment services are in place.

Whyalla residents with concerns or wanting more information can call the Health Call Centre on 1800 --- or should go and see their GP. The Department of Health is providing relevant information to local health services and support for GPs.

WHYALLA WEBSITE CONTENT

Whyalla Health Impact Study

There has been public concern about the possible health effects of red dust from the ore screening and crushing operations in the nearby steelworks in Whyalla. The SA Department of Health wanted to gain an understanding of whether exposure to red dust might be associated with any health problems. A Health Impact Study was undertaken using available data sources from the Department of Health.

The Whyalla Health Impact Study looked at cancer registry data and hospital admission figures for Whyalla.

The data showed higher than expected numbers of various diseases compared to other country towns. These include respiratory diseases such as lung cancer, emphysema, Chronic Obstructive Pulmonary Disease and asthma as well as diseases of the liver such as chronic hepatitis.

Whilst inhalation of iron rich dust could be associated with these diseases, the findings of the report are difficult to interpret.

For example the analysis did not find higher rates of disease in areas of the city most affected by dust emissions.

While the cause of the higher than expected health problems may never be known, it is important that the health impacts on the population are addressed. The SA Department of Health will consider undertaking a specific Health Monitor Survey, as well analysis use of information generated by voluntary screening tests undertaken by GPs. Country Health SA, which is currently developing the Country Health SA Services Plan, will use this information to identify the health service needs of the Whyalla community and ensure that appropriate prevention and treatment services are in place.

- link to report
- links to EPA and PIRSA websites
- contact for further information

Communications & Media Action Plan

Project: Whyalla red dust

Health Unit responsible: PH & CC

Background

A Whyalla Health Risk Assessment has been undertaken by the SA Department of Health, in response to community concerns about possible health effects of red dust from the nearby steelworks. The data, from the Cancer Registry and public hospitals' admissions data, has shown people in the Whyalla area have higher than expected numbers of health problems than in other comparable country SA towns (Port Pirie and Port Augusta).

The cause of the higher than expected health problems is not clear because of the limits of the data collection, and advice indicates a long-term health study tracking the health of individuals may not determine a specific cause.

Whyalla has had steelworks nearby for many years, and there has not previously been an assessment of heath risks.

A lobby group of local residents has long campaigned for investigation into the health impacts of steelworks, and has taken a class action (which failed for lack of evidence).

Some sections of the community and media will assume these data demonstrate health impacts from red dust from the steelworks until the recent past.

The current operators of the steelworks have recently implemented Project Magnet to curb dust emissions that impact on the amenity of the area and advice from PIRSA indicates positive results are expected from this program.

Objectives

To inform and clarify the findings of this report for Whyalla residents, former residents, local clinicians and the broader community.

To provide required and appropriate support to residents, former residents and clinicians seeking further information/actions.

Risks/Issues Management

- inability to determine the cause of a higher number of people (in hospital data) from the Whyalla area who have poorer health outcomes than in other comparable country SA towns (Port Pirie and Port Augusta).
- lack of proven link to steelworks
- apparent slow response of government to issue
- potential for litigation
- community fear and/or anger
- negative media coverage at a national level

Budget

A budget of up to $25,000 is required to support a small locally based advertising and communications campaign.

This does not include the cost of any support activities such as clinicians or clinical services.

All activities are currently unfunded and will be covered by PH&CC and or the other government agencies (as negotiated by PH&CC & DH Communications).

COMMS / MEDIA ACTIONS & TASKS	DESCRIPTION / OUTCOMES	TARGET AUDIENCE	DATE	RESPONSIBILITY
Phase – month, year **Objective**				
Develop key messages	For use in all media and communication to ensure consistency of message	Media	DH Drafted	Comms agencies x 3
Draft letters to GPs in Whyalla catchment area	Clarification of issues, what the Government is doing and how GP's may be impacted	GP's serving Whyalla	Drafted	DH Comms
Establish call centre parameters and logistics	National call centre to handle Health calls, referring general enquiries to DH Comms for follow up			National Call Centre CHSA/DH to provide backup/support
Develop call centre scripts	To provide people with basic information and where to follow up			DH Comms in liaison with CHSA/EPA/PIRSA
Web site	Content to be drafted by each agency is to be circulated to all prior to publishing via respective web sites. To include email contact point		DH drafted	Comms agencies x 3 Each website must have links to the other
Hospital and health service staff briefings	Hand outs, Q&A session, locally based contact for further information	Hospital and health service staff	To being as announcement gets underway on day	CHSA with DH Comms support
Information sessions for GPs	As required	Whyalla GPs	Within 48 hours of announcement	DH Public Health/ CHSA w/Comms support

Communication tools for targeting External Stakeholders

DAY ONE -- ANNOUNCEMENT	Description	Timing	Responsibility	Contact details
Phone call to Ral Antic	To inform of announcement	prior to announcement	Paddy Phillips	
Phone call to Whyalla Mayor	To inform of announcement and offer briefing to council	Prior to announcement	PIRSA? Health – Tony?	
Contact Whyalla Economic Board	To inform of announcement and offer briefing to board	Post announcement	PIRSA/EPA Health – Tony?	
Phone call to Whyalla Division of Practice	To inform of announcement and intention to hold briefing for local GPs within 48 hours	Post announcement	Paddy Phillips	
Phone call to A/director of Medicine	To inform of announcement in detail, and to direct Juanita Walker to be part of staff briefing sessions	Prior to announcement	Paddy Phillips	
Phone calls to individual GPs	As above – 15 GPs	Post announcement	Paddy and Juanita	
Contact with OneSteel	Formal briefing by senior officials	One (1) day prior to announcement	PIRSA/EPA/DH	
Contact with local member	To inform of announcement	Prior to announcement	Minister's office	
Briefing session for hospital and health service staff	To outline announcement and provide fact sheets	Following announcement, 3 X sessions to allow for shift changes	Juanita Walker & team	
Fax/email to GPs confirming information sessions	To follow up phone calls, asking GPs to register for one of the sessions	Following phone calls post announcement	Juanita Walker & team (with local admin support contact for registration)	
Book room for GP information sessions	Suitable space available in hospital that will not require forward booking		Juanita Walker & team	
Arrange catering for GP information sessions	Light snacks		Juanita Walker and team	

Communication tools for targeting External Stakeholders

DAY TWO – POST ANNOUNCEMENT	DESCRIPTION	TIMING	RESPONSIBILITY	CONTACT DETAILS
First evening information session for GPs	• Outline information in report • Outline assistance available from CHSA/DH • Discuss tests required • Q&A	PM briefing	Paddy Phillips/ Peter Chapman/ Juanita Walker	
Email local community groups	• outline information in report • offer opportunity to brief • provide follow up contact	Day 2	PIRSA/EPA Comms Health Comms As appropriate	Whyalla Environmental Consultation Group Chronic disease group In Our Hands

WEEK FOLLOWING ANNOUNCEMENT	DESCRIPTION	TIMING	RESPONSIBILITY	CONTACT DETAILS
Practice Nurses briefing	Nurses to be briefed individual in practice clinics	During two weeks following announcement	Juanita Walker & team with DH Comms support as required	
Establish consulting space for locum	Consulting rooms available within hospital	As required	Juanita Walker & team	

Government of South Australia
Department of Health

CONFIDENTIAL

WHYALLA HEALTH IMPACT STUDY

STAGE 1

JANUARY 2007

TABLE OF CONTENTS

Executive summary

1. Purpose and Scope

The purpose of this study is to gain a more detailed understanding of potential health conditions associated with exposure to red dust emitted from the OneSteel plant in Whyalla, using existing data sources in the Department of Health. As such this is an ecological study, capable of further clarifying associations between Whyalla red dust and health effects, but is not able to establish causality. Evidence from the literature that underlies this report is detailed in Dr Edward Maynard's research* 2005.

2. Methodology

The existing data sources analysed in this study were the SA Cancer Registry (1977-2004), Hospital Separations Data (1999/2000 financial year to 2004/2005), SA Health Omnibus (1993-2004), viral hepatitis notifications from CDCB (1994-2005) and Australian Bureau of Statistics Census data. Sex and age adjusted disease rates in Whyalla were compared with Pt. Augusta, Pt. Pirie, Pt. Lincoln, Mt. Gambler and Victor Harbor.

3. Results

There is significantly more lung cancer in Whyalla than the comparison towns, with a ratio of 1.51 (51% increase) and an excess of 32 lung cancers over 5 years. This increased standardised ratio of lung cancers is seen predominately in women, with a ratio of 2.0 (100% increase, double the number expected). Although women have had the increased lung cancer burden in the last five years, both men and women in Whyalla have had a higher than expected incidence of lung cancer when considering the time period from 1977 to 2004. A second analysis comparing the lung cancer rates in Whyalla with the other dusty towns, Pt Pirie and Pt Augusta found a similar but smaller significant excess of lung cancer in Whyalla. There was no association between diagnosis of cancer, (including lung cancer) and location of residence at diagnosis comparing mid to high dust affected zones. The majority of the excess lung cancer was seen in Whyalla Norrie, postcode 5608, which lies on the western half of Whyalla, away from the OneSteel plant in East Whyalla.

Diseases found to be higher (statistically significant) in Whyalla when compared with the comparison towns were:

- Chronic obstructive pulmonary disease
- Asthma
- Chronic hepatitis
- Alcoholic liver disease
- Other anaemias
- Both lung and liver cancer resulted in more hospital separations in Whyalla

*Incomplete research conducted by Dr Edward Maynard 2005

There was an increase in the adjusted ratio of asthma in children under 15 years old and children were more likely to be admitted for respiratory infections in Whyalla than comparison towns.

In examining the factors that were considered to be confounders, Whyalla was not found to be significantly more likely to have increased exposures to smoking or alcohol than the comparison towns. Similarly, Whyalla does not have an excess of Hepatitis A, B or C compared with the comparison towns. As such, these potential confounders are unlikely to explain the overall increased disease burden in Whyalla.

Mortality data demonstrated significantly more deaths in Whyalla from COPD and alcohol related liver disease than the comparison towns. This resulted in an excess 23 deaths from COPD, and an excess of 8 deaths from Alcohol related liver disease.

4. Conclusion

There are a number of areas of uncertainty that have limited the ability to form firm conclusions in this report. There are large information gaps, such as exposure assessment and lack of definitive evidence in the literature regarding the toxicology/bioavailability of iron. In addition, the ecological design of this study is inherently weak and is not able to establish causality.

Despite these limitations, this report has generated a number of hypotheses regarding possible adverse health effects from red dust that warrant further investigation, and a number of factors support further study. Firstly, the diseases found in this study to be of higher incidence in Whyalla are all highly statistically significant. In addition, there is reasonable evidence of biologic plausibility for the diseases found in relation to iron rich dust exposure and lastly, there is indirect evidence of individuals being exposed to red dust. Given that the confounders studied do not explain the increased disease burden, further studies that address the gaps described above would be required to definitively analyse potential health effects from red dust in Whyalla.

1. Purpose and scope

The purpose of this study is to gain a more detailed understanding of potential health conditions associated with exposure to red dust emitted from the OneSteel plant in Whyalla, using existing data sources held by the Department of Health. As such this is an ecological study, capable of further clarifying associations between Whyalla red dust and health effects, but is not able to establish causality (1).

For many years there has been public concern over the visible red dust that comes from the ore screening and crushing operations in the OneSteel plant in Whyalla. In response to this public concern the SA Department of Health has undertaken a series of investigations to explore potential health effects from the red dust. This study continues on from work done by Dr. Edward Maynard* that highlighted potential health issues in Whyalla such as an increased incidence of lung cancer and of Chronic Obstructive Pulmonary Disease (COPD) when compared with other SA rural centres (2).

2. Background

2.1 Whyalla description

Whyalla has been associated with steel production since the mid 1930's. The blast furnace began operations in 1941, and the current pellet plant (previously BHP owned) was established in 1968 to pelletise iron ore. In 2000, 25.7 % of respondents in a representative sample survey reported financial reliance on the OneSteel plant, with a further 10.8% indirectly reliant financially on the plant (3).

In the past, Whyalla shipbuilding works was a major employer in Whyalla. The company closed in 1978 with a consequent population decline.

2.2 Land use

The iron ore used in the OneSteel plant is mined from the nearby Middleback Ranges, and transported into the plant via railway in open rail wagons.

Much of the surrounding land is dedicated to low density sheep farming, with little in the way of crop farming due to the adverse (arid) weather conditions.

2.3 Demography

Whyalla as a community experiences high socio-economic disadvantage relative to much of the population of South Australia, but has a similar demographic profile (4). Figure 1 outlines the Index of Relative Socio-economic Disadvantage (IRSD) by postcode in 2001. This index is a summary indicator of disadvantage, using factors such as income, employment (unemployed, as well as unskilled versus skilled employment) and education. A lower IRSD indicates a lower socio-economic status (5).

*Incomplete research conducted by Dr Edward Maynard 2005

Figure1: Index of relative socio-economic disadvantage (IRSD) by postcode in Whyalla, 2001 (5)

Postcode	IRSD	Population size
5600	1027.39	6857
5608	848.76	14001
5609	1014.11	756

According to the 2001 Census, 21 866 people live in Whyalla, which has reduced steadily from 34 014 in 1976. Children less than 15 years old make up 22.9% (compared with the national 20.7%) and 11.9% are aged 65 and over (compared with 12.6% nationally). Aboriginal and Torres Strait Islanders make up 2.9% of the population, compared with 2.16% nationally.

The proportion of people born in Whyalla who live in Whyalla in 2006, considering those who are 15 years old and over is around 7 out of 10. There is however a net movement of people out of Whyalla. This decline is now small, in that over 2004-2005 there was a net loss of 50 people from Whyalla (4).

2.4 Red dust in Whyalla

The OneSteel plant is located on the eastern side of Whyalla town, adjacent to postcode 5600. From an aerial photo, it can be seen that the red dust covers only a small part of Whyalla town, most of which is concentrated in the few streets adjacent to the plant. An aerial photo demonstrating the red dust in Whyalla in 2002 is in Appendix 1.

3. Work undertaken to date

3.1 Hazard identification

3.1.1. Toxicology

The study by Graham Ohmsen, finalised in October 2004, examined the composition of the red dust in Whyalla (6, 7). His summarised findings are outlined below:

Winds from the direction of OneSteel bring dusts that are:

- at higher dust concentration
- dominated by iron rich materials (up to 76% of deposited dust)
    - the iron is up to 66% haematite and 18% goethite
- dust is up to 7% quartz, up to 25% kaolin (clay), up to 20% calcite and up to 2% talc
- from recently crushed iron ore
- particulate matter with up to 15% below 5 micrometres in diameter and up to 60% particles below 10 micrometres diameter.

Winds from directions other than OneSteel (background) are:

- of lower dust concentration
- dominated by quartz (up to 22%), kaolin (up to 67%), sea salt (up to 100%) and mica (up to 29%)
- low in iron

3.1.2. Epidemiology

Preliminary analysis of Whyalla hospital separations data and SA Cancer Registry data by Dr Ted Maynard indicated higher prevalence than expected of various health conditions when compared with the comparison towns. With the diseases outlined below, the ratio shown in brackets refers to the ratio of observed cases in Whyalla from 1999-2004 to the expected cases over the same period, if Whyalla had the same disease prevalence as the comparison towns for each age and sex profile. For example, a lung cancer ratio of 1.5 means there is 50% more lung cancer measured than expected, or 1.5 times more lung cancer than expected. The diseases that were statistically significant in Dr Maynard's research were:

SA Cancer Registry data 1999-2004

- Lung cancer (1.51, 51% more lung cancer than expected)

Whyalla hospital separations data 1999-2004

- Chronic obstructive pulmonary disease (1.77, 77% more than expected)
- Chronic hepatitis (4.3, 330% more than expected)
- Alcoholic liver disease (1.7, 70% more than expected)
- Other anaemias (1.4, 40% more than expected)

3.2 Exposure Assessment

Exposure assessment involves analysis of hazard locations, identification and analysis of exposed populations as well as identification and analysis of potential exposure pathways (1). There is limited information regarding exposure to red dust in Whyalla.

There is no local information regarding potential important routes of exposure, including the importance of the gastrointestinal (hand mouth) route over the respiratory route. On the basis of work done elsewhere, an assumption was made for this study that the respiratory route is likely to be the most important route of exposure (8). This gap in knowledge limits the effectiveness of any exposure assessment.

Some work has been undertaken to analyse hazard locations by the EPA, as well as the study by Kieron Smith from the Department of Health. The Environment Protection Authority (EPA) has been monitoring concentration of dusts at various sites in Whyalla, including Hummock Hill, Walls Street and Civic Park (9). Figure 2 details the monitoring methods for each of the sites:

Figure 2 EPA monitoring

Site	Date of commencement	Sampling frequency	Purpose
Hummock Hill	1990	One day in 3 (since 2002)	Study of Concentration of dust near plant
Walls Street	2003	Continuous	Industrial compliance site
Civic Park	2001	One day in 3 (since 2002)	Background site

The maximum recommended standard of particulate matter (PM_{10}) exposure is 50µg/m^3 averaged over a 1 day period, with a maximum of 5 exceedences per year (10). The evidence for this standard has been derived predominately from urban ecological epidemiological studies, where a larger proportion of the PM_{10} is finer ($PM_{2.5}$) than in rural environments ($PM_{2.5-10}$). As such there is some debate as to whether this standard is appropriate for rural environments such as in Whyalla, with most of the evidence of negative health effects used for the standard being due to the $PM_{2.5}$ fraction (11). There is, however, an increasing body of evidence that the coarse fraction of PM_{10} also has significant negative health effects and so the Australian particulate matter standard has been used in this report (8, 12). The Walls Street site found that of 357 24-hour averages obtained, 24 exceeded 50µg/m^3 in the 2004-2005 financial year. In comparison, monitoring at Civic Park had no measurements exceeding 50µg/m^3. At Hummock Hill, of the 112 samples taken, 23 exceeded 50µg/m^3 (9). Given that over the 2004-2005 financial year levels of environmental dust in some sites exceeded the maximum recommended standard, exposure to dust in levels higher than recommended for human health occurred.

The study by Kieron Smith in May-June 2005 investigated the amount and composition of airborne and surface dust infiltration at various indoor locations in Whyalla (falling within the densely dust covered zone). Sampling sites were 3 houses and 2 classrooms in the Whyalla Town Primary School. All the locations had high levels of dust, with iron making up between 3 and 15% of the dust samples (13).

Detailed analysis of exposed populations was not possible within the scope of this study. Direct measurement of exposure is ideal in exposure analysis, but was not possible as it involves measurement of either personal monitoring and/or biological markers. It is likely that measuring individual exposures using current personal monitoring technology is not possible, as it is cumbersome, relatively expensive, and has never been applied to a large proportion of a population to accurately measure individual exposures. A possible future option for measuring individual exposures is the use of adapted cohort study designs know as "panel "studies. Panel studies, for example, compare daily symptoms of people with asthma with daily environmental PM monitoring results. Large sample sizes are possible and so adequate data can be gathered and analysed to describe the risk of symptoms per environmental exposure level.

Biological markers can potentially accurately indicate individual biologically significant exposure to toxins, however this is frequently limited by the sensitivity of the tests to analyse low exposure levels (1). There are a number of biological markers that could potentially measure exposure to red dust, including serum iron assessments, chest X-rays and/or pulmonary function tests (PFT). PFT are insensitive to damaged lung tissue, as at least 15-20% of lung tissue needs to be involved in destructive changes before complaints of shortness of breath or impaired function on PFT can be demonstrated (2). This relatively insensitive test is however more sensitive than radiology, as although chest X-rays are able to pick up the presence of iron in the lungs, a ventilatory defect can occur without X-ray changes (2). Blood tests can be used to measure the iron in the blood, and not necessarily accurately reflect iron effects in the lungs. As such, although this information would have added to the exposure assessment, it could not provide definitive exposure results when considering red dust.

Port Hedland study, 2006

The Western Australian Department of Health recently commissioned a study in relation to the potential health affects from respirable dust in Port Hedland. The BHP Billiton Iron Ore processing and loading facility is immediately adjacent to Port Hedland at Nelson Point. Much alike to Eastern Whyalia, Port Hedland is impacted by dust, principally fugitive iron ore from the BHP iron ore facility, with the town experiencing frequent exceedences of the NEPM PM_{10} standard.

Further to the debate on the appropriateness of the PM_{10} NEPM standard being applied to non-urban areas, an extensive literature review was undertaken. The authors recommended that the NEPM standards for exposure to PM_{10} should be revised for non-urban areas to an annual average of $100\mu g/m^3$ per day, with a daily average limit of $<200\mu g/m^3$ (14). This finding was based on the presumption that dusts in rural areas are likely to be less toxic than those in urban areas. This assumption was made in the absence of evidence directly relating to dust exposure and potential health effects in rural areas. As such this finding is opinion based, rather than evidenced based.

An exploratory geographic analysis at the census collection district level of respiratory admissions to hospital from 1993-2004 was also undertaken (15, Appendix 2). The study analysed respiratory, cardiovascular and gastrointestinal admissions in aggregate, with the cardiovascular and gastrointestinal admissions included to aid in the study of confounders. The study found a higher rate of respiratory admissions for all of Port Hedland compared with the rest of WA (1.29, 29% more than expected). There was an increased rate of all three of respiratory, cardiovascular and gastrointestinal admissions, however there was a relatively higher rate of admissions for respiratory illness in the collection districts in the Western part of the township, closer to the BHP plant. The western part of town had rates of respiratory admissions ranging from 1.33 to 6.59. This could not be accounted for by demographic factors including race, or by socio-economic status, although the study did not examine smoking and other risk behaviours.

The study design was ecological and so although the results are indicative of increased respiratory illness in Pt Hedland, there are a number of limitations to the findings. It is not clear if the authors for the issue of counting individuals who were admitted more than once in the study period, nor did they examine admissions for

Port Hedland usual residents out of Port Hedland. It is also unclear which parts of the town are affected by dust, and if this corresponds to the collection district areas that had evidence of higher rates of respiratory admissions.

4. Methods for this study

4.1 Comparison towns for the analysis

The comparison towns for the analysis are Pt Pirie, Pt Augusta, Pt Lincoln, Victor Harbor and Mt Gambier. Comparison towns should be alike to Whyalla in a number of parameters to try and control to some degree the effect of living in Whyalla on health that is separate from the OneSteel plant. Figure 3 below outlines key parameters for comparison:

Figure 3: Comparison towns in the Phase 1 Whyalla study

Town	Size (2001)	Index of relative socio-economic disadvantage*	Accessibility/Remoteness Index of Australia **
Whyalla	21 866	911	Accessible (2.9)
Pt Pirie	3 646	921	Accessible (2.6)
Pt Augusta	13 516	943	Accessible (2.7)
Pt Lincoln	27 306	-	Remote (6.1)
Mt Gambier	23 503	957	Accessible (2.2)
Victor Harbor	11 108	1011	Highly accessible (1.2)

*Lower the number, the higher the social disadvantage (16)

** Accessibility/Remoteness Index of Australia (17)

4.2 Rationale for the diseases chosen for investigation

There were a number of factors that were taken into account when selecting the diseases to be examined. The evidence from the literature supporting the disease selection is outlined in detail in Dr Edward Maynard's research 2005 (2).

4.2.1. Diseases associated with the effects of iron on the body

There are a number of diseases in which the body adversely handles iron leading to iron overload. These diseases include:

- Hereditary Haemochromatosis
- Anaemias such as Thalassaemia, Sideroblastic anaemia and chronic haemolytic anaemias
- Chronic liver disease such as Hepatitis C, Alcoholic cirrhosis, Porphyria cutanea tarda and post portacaval shunting

As these diseases make an individual more susceptible to iron overload, it could be proposed that such individuals would have an increased susceptibility to illness in the setting of high iron exposure and thus would be more likely to have complications from their disease. This may be seen by increased admission rates to hospital.

In addition, iron overload itself can lead to widespread organ fibrosis, in particular:

- Chronic liver disease
- Hepato-cellular carcinoma
- Range of chronic and acute respiratory diseases

Alcohol has an impact on various aspects of the above disease profile in relation to iron overload disorders. Alcohol and iron work synergistically to damage the liver in both primary and secondary Haemochromatosis (iron overload). For example, those with Hereditary Haemochromatosis are more likely to develop cirrhosis when drinking more than 60g of alcohol per day than those who do not. In addition, alcohol consumption itself may lead to altered iron homeostasis which may exacerbate the severity of liver disease and an increased risk of cirrhosis. Alcohol is therefore an important consideration in the study of iron effects on health.

4.2.1. Diseases resulting from exposure to dust

Health outcome studies have shown that particulate matter has a negative health effect on respiratory and cardiovascular disease that can be the result of any biologically or chemically active component of dust, as well as any irritative effect of the dust. In addition, there are "nuisance dust" effects that reduce visibility and increase irritation of eyes, ears, nasal passages and other mucous membranes (18). Although this nuisance effect may be happening in Whyalla due to the red dust, it is not within the scope of this study to examine this, with hospital admissions and available data sets not likely to have any information relating to these issues. There is considerable evidence that people exposed to high levels of particulate matter are at greater risk of developing COPD.

The disease areas that are being investigated in this study in relation to dust effects (and also possibly to the composition of the dust itself) are:

- Chronic obstructive pulmonary disease (bronchitis and emphysema)
- Pneumoconiosis (nodular fibrotic changes)
- Asthma
- Respiratory infections, including pneumonia and infections in children

4.2.2 Cancer

There is limited information about an association between people who work in iron and steel foundries and lung cancer. Although they are associated, there

are problems with confounding (e.g. concurrent exposure to silica and smoking), and delineating any potential synergistic effect between smoking and environmental dust exposure has been difficult. Given this association with lung cancer, but understanding there is uncertainty, lung cancer was included in the study.

4.3 Methods for this analysis

An exploration of the potential health effects of red dust in Whyalla looks at the sources already examined in more depth (SA Cancer Registry and hospital separations data) as well as using different data sets that exist in the Department of Health. The diseases examined are limited to the above outlined disease areas.

4.3.1. Further analysis of preliminary results from hospital separations data and the South Australian Cancer Registry.

From the hospital separations data, 1999/2000 to 2004/2005 financial year:

- Determine the number of individuals with suspected health conditions (looking at Whyalla hospital separations only)
- Examine all SA public hospital data for separations from people living in Whyalla post codes and comparison towns
- Describe the basic demographic features of cases
- Review respiratory infections in children

From Cancer Registry data, 1977 to 2004*

- Further map suspected associated cases, in particular in relation to the One Steel plant (comparing collection districts closer to the plant with those further away)
- Further describe the cancers in question (e.g. histopathology)
- Describe the basic demographic features of cases– age, gender and (occupation if available)
- Increase the length of time of analysis

*some analyses covered period 1999-2004 and are marked as such

4.3.2. Collection and analysis of more detailed information about potential confounding factors:

From Health Omnibus study (randomised sample from SA with annual data collection, surveys 4400 households with approximately 3000 respondents)

- Determine the age and sex adjusted smoking rates in Whyalla compared with towns of comparison (data from 1993 to 2004)
- Determine the age and sex adjusted rate of alcohol abuse as above (data from 1993-1998)
- Determine the age and sex adjusted rate of asthma diagnosis

From Australian Bureau of Statistics data (publications)

- Size of the population, demographic factors – gender, age.

From CDCB

- Notifications of viral hepatitis from Whyalla and comparison towns (1995/1996 to 2005)

4.3.3. Mapping process

In order to analyse data in relation to proximity to OneSteel, Whyalla town was divided into three zones; a densely red dust affected zone, a moderately dust affected zone and a minimally/no dust affected zone. This was done with the use of an aerial photograph of Whyalla taken in 2002, visually determining the different zones according to the amount of red dust seen from the aerial view, within statistical collection district areas. Both the densely covered and moderately covered zones fall within postcode 5600 (Whyalla). A map demarcating the areas is in Appendix 3.

4.3.3. Ethics and confidentiality issues

The report does not identify individuals, and will remain confidential for Cabinet consideration. All data was analysed in a de-identified form. All data sources with identifying information (e.g. SA Cancer Registry, CDCB) were de-identified before being provided for analysis. Hospital unique identifiers have been used but have not been linked with the names of the individuals they belong to.

5. Health outcome data results

5.1 Further analysis of the SA Cancer Registry data

There is significantly more lung cancer in Whyalla than the 5 comparison towns, with a ratio of 1.51 (51% more than expected, $p<0.001$). This translates to an adjusted excess of 32 lung cancers over the five year period from 1999 to 2004 in Whyalla compared with the 5 comparison towns. A second analysis was done comparing the lung cancer rates in Whyalla with the other dusty towns, Ft Pirie and Pt Augusta to explore if the excess was possibly due to crustal dust alone. A similar but smaller significant ($p=0.02$) excess of lung cancer in Whyalla was found, with a ratio of 1.28 (28% more than expected) more lung cancer, leading to 20 excess cases of lung cancer over 1999-2004.

Women were more likely to have lung cancer in Whyalla than the 5 comparison towns, making up 47% of diagnoses compared with 33.9% over the five years from 1999-2004 ($p=0.02$). Although the ratio of lung cancer in Whyalla is 1.5 aggregating men and women, women had a standardised morbidity ratio of 2.0 (100% more than expected), and men of 1.1. The excess lung cancer seen in the 5 years analysed from 1999-2004 in Whyalla is therefore essentially only seen in women.

Figure 4 outlines the change in lung cancer diagnosis by year of diagnosis over time in Whyalla. There has been a steadily increasing crude rate of lung cancer diagnoses over time (significant $p<0.001$), which was not significant when adjusted for age and sex ($p=0.369$). Looking at men and women separately, found that men had a significant decreasing trend in the age adjusted rate of lung cancer over time ($p=0.021$). Conversely, women were found to have had a significant increasing trend in the age adjusted rate of lung cancer, with an increase of 1.38 cases per 100 000 population per year ($p=0.02$). This relationship is demonstrated in figure 5.

Figure 4: Lung cancer diagnoses over time in Whyalla (number of lung cancers observed and age and sex adjusted rates/100 000 population)

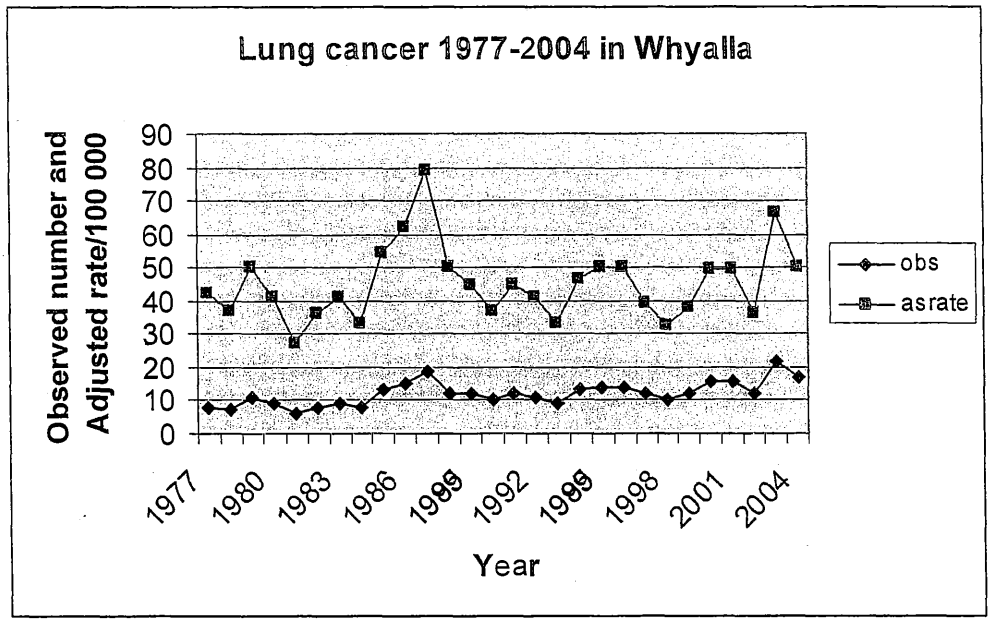


Figure 5: Age adjusted rate of lung cancer/100 000 from 1977-2004 in Whyalla by gender

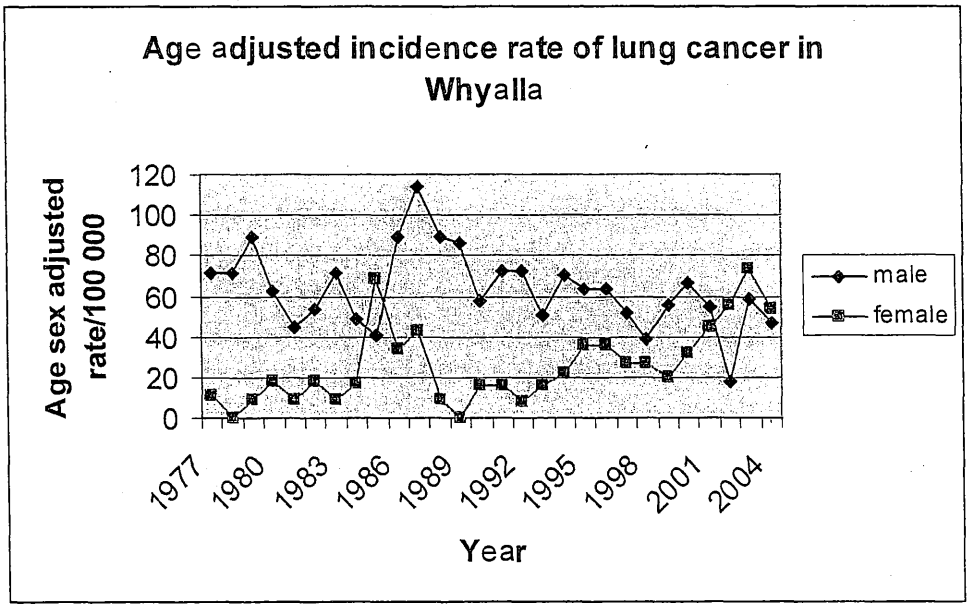


Figure 6 describes the actual lung cancer cases per postcode in Whyalla compared with the expected lung cancer cases (adjusted for population by age). The expected number of cases is displayed for the rest of the state, other metro areas and other country areas from 1977-2004. A higher than expected observed rate of lung cancer is seen across all postcodes, but particularly in postcode 5608, there has been an excess of lung cancer cases in Whyalla for both men and women over the 1977 to

2004 period. Postcode 5608 is Whyalla Norrie, which is situated on the western half of Whyalla, with the postcode closest to the plant being 5600 in Whyalla east.

Figure 6: Lung cancer observed and expected in Whyalla, 1977-2004

Post code	Actual cases Whyalla (observed)		Expected cases					
			State		Metro		Country	
	Male	Female	Male	Female	Male	Female	Male	Female
5600	82	22	72.8	23.8	75.3	24.7	66.1	20.8
5608	135	55	82.1	28.3	84.8	29.2	75.0	25.4
5609	4	3	7.1	2.2	7.4	2.3	6.5	2.0

Although more adenocarcinomas were found as a proportion of the total lung cancers in Whyalla than comparison towns, this was not found to be significant. Overall, there was no significant difference between the distribution of histopathological types between Whyalla and comparison towns. The histopathological profile of the lung cancers is outlined in figure 7:

Figure 7: Histopathology of lung cancers 1999-2004

Histopathology	Whyalla		Comparison Towns	
	Number	% of lung cancers	Number	% of lung cancers
Adenocarcinoma	26	27.4	50	20.7
Squamous Cell Carcinoma	20	21.1	47	19.4
Large cell carcinoma	17	17.9	56	23.1
Small cell carcinoma	18	18.9	34	14.1
Other	14	14.7	55	22.7
Total	95	100	242	100

Age at first diagnosis of lung cancer was compared across the two groups, and it was found that the distribution of the ages at first diagnosis were the same for Whyalla and comparison towns, including the mean, median, 25th centile and 75th centile, and as such no further analysis was undertaken.

Primary liver cancers and bowel cancer were also examined, with no difference in adjusted rates across the comparison towns.

When examining cancers in Whyalla overall, there was no association between diagnosis of cancer and residence at time of diagnosis in the mid to highly dust affected zones. Due to the excess of lung cancers seen, this process was repeated for lung cancers. The geographical distribution of lung cancer in Whyalla in relation to

the OneSteel plant was not associated with either mid or high density dust affected zones when compared with the non-dust affected zone.

Occupation data within the cancer registry could not be analysed as there were problems with apparent misclassification. All people are coded for their occupation at diagnosis, and given most people at cancer diagnosis are elderly, most are coded as pensioners. No information regarding previous occupation is recorded. As such, an excess of people were recorded as pensioners, and there was no data with regards to people who may have worked in the OneSteel plant.

5.2 Further analysis of the hospital separations data

The years of analysis for the hospital data were extended to include 1999/2000 financial year to 2004/2005 financial year (6 year period). Diseases found to be higher (statistically significant) in hospital separations data in Whyalla when compared with the comparison towns are displayed in figure 8. The diagnosis chronic bronchitis which was not significantly higher in Whyalla has been included to demonstrate that the increase in COPD and Emphysema is not due to misclassification bias in Whyalla.

Figure 8: Hospital separations for Whyalla adjusted for age and sex, 1999/2000 to 2004/2005 financial year (*explanatory notes for Figure 8 lie below the table).

Condition	Observed	Expected	Ratio*	SMR lower CI*	SMR upper CI*	Excess no. of cases*	Rate ratio*	SMR p-value*
Rest of D64 Other anaemias	210	146.1	1.44	1.25	1.65	64	1.59	0.0000
Chronic Bronchitis	23	31.5	0.73	0.42	1.07	Nil	0.69	0.1451
Emphysema	23	14.1	1.63	1.12	3.17	9	1.91	0.0363
COPD (excluding emphysema)	814	477.5	1.70	1.59	1.83	326	2.03	0.0000
Alcoholic liver disease	63	39.8	1.58	1.22	2.03	23	1.87	0.0008
Chronic hepatitis, not elsewhere classified	29	6.5	4.44	2.97	6.37	22	37.65	0.0000
Lung Cancer	229	165.4	1.38	1.21	1.58	63	1.52	0.0000
Liver Cancer	20	11.4	1.76	1.07	2.71	8	2.14	0.0262

*Ratio – the number of observed cases to the number of expected cases

*SMR lower CI and SMR upper CI - Ratio of observed to expected disease, adjusted for sex and age, with a 95% chance that the true value lies between the upper and lower confidence intervals
*Excess number of cases – The adjusted number of cases above what was expected
*Rate ratio – age and sex adjusted observed rate divided by the age and sex adjusted expected rate
*Standardised morbidity ratio p value- The probability that the difference in observed to expected disease, adjusted for sex and age, occurred by chance alone.

The data was further analysed specifically with respect to children under 15 years old, due to the physiologic increased vulnerability to inhaled toxins (1). Asthma was considered separately for children under 15 years old, and although it was not significantly different in Whyalla to comparison towns in hospital separations data when all ages were considered, there was an increase in the adjusted ratio of asthma when children were considered separately (ratio of 1.23, $p<0.001$, excess of 54 separations, 23% more than expected). In addition, children were more likely to be admitted for respiratory infections (upper, lower and otitis media) in Whyalla than comparison towns (ratio 1.25, $p<.001$, excess of 140 separations, 25% more than expected).

The admissions to Whyalla hospital were examined for the number of individuals that contributed to the admissions in order to determine if there was a large number of individuals contributing to the excess admissions or a small number. These results are demonstrated in Figure 9.

Figure 9: Whyalla resident's hospital separations 1999/2000 to 2004/2005 financial year

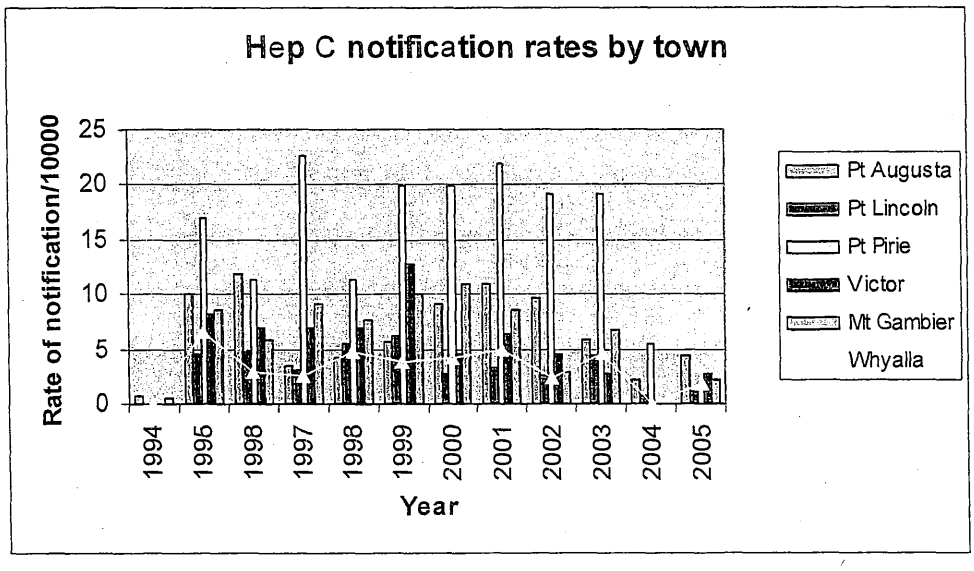
Condition	Admissions to Whyalla Hospital	Persons	Whyalla residents admitted to hospital in SA outside of Whyalla	Expected no. of admissions for SA
Rest of D64 Other anaemias	205	133	5	146
J43 Emphysema	22	22	1	14.1
J44 COPD (excluding emphysema)	793	268	21	477.5
J45 Asthma	253	190	14	319.5
K70 Alcoholic liver disease	56	40	7	39.8
K73 Chronic hepatitis, not elsewhere classified	29	27	0	6.5
Lung Cancer	144	76	85	165.4
Liver Cancer	16	10	4	11.4
Total	1502	745	-	-

To describe the prevalence of asthma in adults who are not necessarily admitted to hospital, age and sex adjusted data from the Health Omnibus study was examined. Adults in Whyalla were more likely (p=0.002) to have a self-reported confirmed diagnosis of asthma than in comparison towns. This increased diagnosis of asthma in Whyalla was still significant (p=0.049) when compared with Port Pirie and Port Augusta.

In examining the factors that were considered to be confounders (smoking, alcohol use and viral hepatitis) Whyalla was not found to be significantly more likely to have increased exposures to the confounding variables than the comparison towns. Specifically there was no significant difference in the adjusted rate of current versus ex-smoker/non smoker in Whyalla compared with the comparison towns. In addition, there was no significant difference in the adjusted rate of intermediate to high and very high alcohol use in Whyalla compared with the comparison towns. Definitions of the alcohol hazardous drinking categories are in Appendix 4.

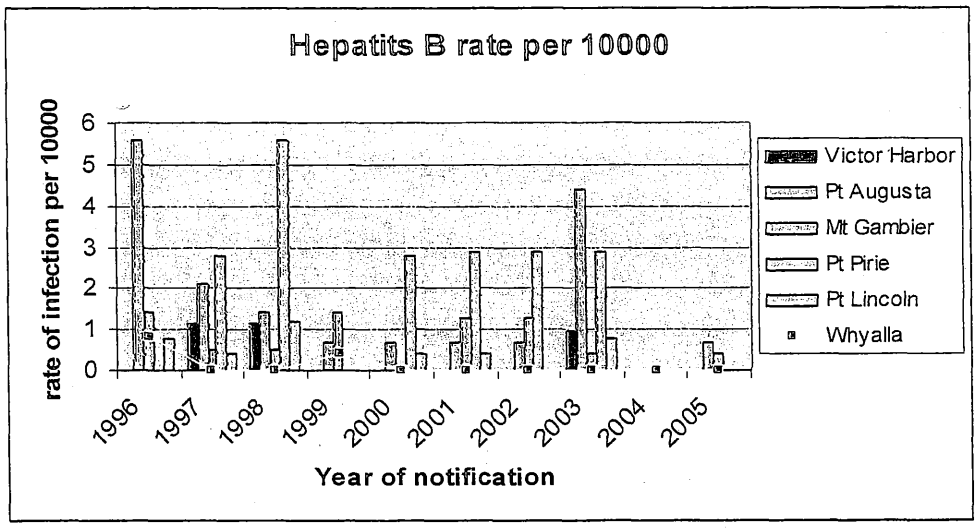
Similarly, Whyalla does not have an excess of Hepatitis C compared with the comparison towns, as demonstrated in Figure 10.

Figure 10: Hepatitis C notifications, Whyalla and Comparison towns



Both Hepatitis A and B have occurred in small numbers across Whyalla and comparison towns, and as such are unlikely to have contributed to the overall chronic liver disease burden. Figure 11 outlines Hepatitis B over time.

Figure 11: Hepatitis B notification rate per 10000



In examining mortality data for Whyalla 1999-2004, there was significantly more deaths in Whyalla from COPD (standardised mortality ratio of 1.86, 86% more than expected, $p<0.001$) and alcohol related liver disease (standardised mortality ratio of 2.27, 127% more than expected, $p=0.009$). This resulted in an excess 23 deaths from COPD, and an excess of 8 deaths from alcohol related liver disease. The standardised mortality ratio for pneumoconiosis was 3.25 (225% more than expected), but given the small numbers (2 in Whyalla, 2 in comparison towns) was not found to be significant.

The hospital separations data could not be analysed in relation to proximity to the OneSteel plant due to the limitation of available data sources. The smallest geographical unit in the available data is postcodes with the postcode adjacent to the plant (5600) covering approximately half of the town.

6. Discussion including limitations in the methodology

The more detailed analysis of Whyalla data has shown further evidence of an increased incidence of lung cancer, and probable increased incidence of COPD, asthma, chronic liver disease including alcohol related chronic liver disease, and asthma and respiratory infections in children. This increased adjusted rate of disease is also reflected in the Whyalla mortality data, that has shown significantly more deaths in Whyalla from COPD and alcohol related liver disease. Factors such as smoking, alcohol intake and viral hepatitis are not significantly different between Whyalla and comparison towns, and as such, these factors do not appear to explain the increase in the above diseases.

Cancer

In this study, a significant increased risk of lung cancer was identified among women with a ratio of 2.0 (100% more than expected) over the five years from 1999-2004, although Figure 5 demonstrates that the excess of observed over expected adjusted rates of lung cancer in Whyalla have occurred in men as well as women (1977-2004).

Women have been experiencing increased rates of lung cancer since 1977, while men have had a reducing lung cancer incidence over the same time period. This in part parallels the state trend for the increased incidence of lung cancer in women and a decline in lung cancer in men, with most of the increase in women occurring in the early 1990s (19). Despite this trend for lung cancer rates in men and women to converge, in 2002 the risk for lung cancer in men in South Australia was 1 in 24, compared with 1 in 42 for women. Although it is possible that the trend for increasing incidence in women has been exaggerated in Whyalla due to the small numbers involved, this finding cannot be further adequately explained with the existing data. Importantly, the smoking rates in Whyalla are no higher than comparison towns and women have traditionally had a reduced rate of smoking compared with men. Women are also less likely to have had industrial occupational exposures and, as such, this rapid increase in lung cancer diagnosis in women warrants further exploration, along with exploration of the overall increase in lung cancers in both men and women.

Postcode 5608 has had the predominance of lung cancers over time in Whyalla, however the data was not able to be analysed to define the time period or year from which the lung cancer incidence is higher than expected. Considering the IRSD data in Figure 1, this suburb does have a lower index of relative disadvantage (lower socio-economic status), which could explain some of the excess lung cancer in this suburb relative to the other suburbs in Whyalla. It does not however explain Whyalla's higher rate of lung cancer compared with the comparison towns, as overall the towns have a comparable socio-economic status to Whyalla. Further analysis beyond the scope of this study is required to explore this result.

In addition, comparing Whyalla with Pt Augusta and Pt Pirie, towns considered to be dusty, found a smaller but still significant increase in lung cancers in Whyalla. This suggests that the excess cancer can not solely be explained by an increased exposure to crustal dust. In order for this increase in lung cancer to be understood further, a more detailed analysis beyond the scope of this study is required.

When analysing many of the diseases in this study, it is important to consider the long latency period required. Latency refers to the length of time between exposure to disease causing agents and the appearance of manifestations of the disease (20). In illnesses such as lung cancer, chronic obstructive pulmonary disease and chronic liver disease, the latency period from exposure to disease can be greater than 20 years. A limitation of this study with regards to latency periods is the ecological study design used to describe the exposure for all people who have had lung cancer in Whyalla from 1999 to 2004, but using smoking data from only 1993-2004. Any exposure to lifestyle risk factors in the present may not clearly define the relationship to such exposures in the past. In addition, due to the constraints of the available data sources, population based statistics have been used to describe the potential for an individual case to have an associated confounder. This has significant limitations, as it is not necessarily the case that population based results are accurate on an individual level, a concept known as ecological bias.

No particular or group of particular lung cancer histopathological subgroups were identified that could account for the increased incidence of lung cancer seen in Whyalla. The numbers in general are small and may have reduced the power of the

statistical tests that were applied, and therefore reduced the ability to find a dominant cancer/group of cancers.

Liver cancer was examined particularly in this study due to the strength of association reported in the literature between iron overload and primary liver cancer. In the cancer registry data there was no difference in the adjusted rate of primary liver cancer in Whyalla compared with the comparison towns. There was however an excess of hospital separations due to liver cancer in Whyalla residents, with 10 people accounting for 16 admissions in Whyalla, when 11.4 admissions were expected. It is likely that the small numbers involved in the cancer registry– 19 across comparison towns and 4 in Whyalla over the 5 year period, has reduced the power of the statistical test to analyse the data.

There are other potential confounders in this study, such as exposure to asbestos and other known environmental respiratory carcinogens that were unable to be controlled for due to the limitations of available data sources. Access to more detailed data, including a full occupational history and community surveys/environmental sampling would be required to analyse this issue further.

Dose-response relationship

There was no association identified between living closer to the OneSteel plant and an increased risk of having any cancer or of lung cancer. This finding is limited by the crude marker of exposure to red dust used in this study, with likely misclassification bias. A more ideal method to demarcate the different zones would involve objective measures of dust density and formal cut-off measures between the zones based on safety data from the literature. Due to limitations in available safety data, this more formal process of analysis has not been effectively undertaken internationally. Consequently, risk assessments have traditionally relied on more crude methods such as used in this study.

Limitations of the dose-response assessment

It might be presumed that if there was a health effect from the red dust, then increasing the dose of exposure by living closer to the OneSteel plant over a longer period of time would be associated with an increased incidence of ill health. Important limitations to this concept are:

- Length of time spent living in Whyalla – no information was available for this study regarding the length of time that cases lived in Whyalla (time of exposure), nor of the number of people who lived in Whyalla for some years and then moved away, becoming unwell out of Whyalla (total exposed population). These cases would have been excluded from this study. Although as described in 2.3 above, a large proportion of people live in Whyalla for long periods of time, this was not examined for individual cases. As such, there is great uncertainty in the completeness and accuracy of the information used in this study with regards to exposure to red dust.
- Working at the OneSteel plant- occupational history is important information that was unavailable. It is presumable that people who worked in the plant may have had high exposure to red dust. If these people did not live within the densely or moderately covered red dust zone, they will have been counted in this study as being at only low risk of exposure. This would have reduced the number of potentially exposed individuals in our analysis, and

consequently reduce the power of this study to detect any significant difference in health outcomes for those exposed to high levels of dust.

- It is also feasible that a number of individuals may not live in the densely covered zone, but spend a large proportion of their time within the zone. Importantly, the Whyalla Primary School falls within the densely covered red dust zone.
- The person's residence was recorded at the time of diagnosis, and did not necessarily reflect their residence during the latency period of the disease.
- Certain vulnerable individuals may have negative health outcomes from exposure to red dust at a low exposure level relative to the general population. The data was not sufficient to enable analysis of this issue in detail.

Hospital separations data

This study identified significantly higher adjusted rates of chronic hepatitis, alcohol related liver disease, COPD, asthma and respiratory infections in children, and other anaemias from hospital separations data in Whyalla. These diseases are biologically plausible in relation to iron rich dust, as described in the literature in Dr Maynard's research.

There was no difference in the prevalence of smoking and high and very high risk alcohol drinking in Whyalla compared with the comparison towns, and no more viral hepatitis. As such, these potential confounders cannot explain the increased incidence of disease as described above.

A key problem with hospital separations data is that unique identifiers are different for the same individuals in different hospitals. As such, it is impossible to determine if individuals are duplicated across different hospitals. Unfortunately the effect of counting individuals more than once could only be removed in the Whyalla hospital separations data, which demonstrated that most of Whyalla residents were admitted to hospital in Whyalla. With illnesses concerned with the liver, there were limited repeat admissions for any individual, strengthening the finding that these illnesses have a higher incidence in Whyalla than the comparison towns. In particular, the diagnosis of "Chronic hepatitis not elsewhere specified" had a ratio of 4.44 (344% more than expected) in Whyalla with all of the 29 admissions admitted to Whyalla hospital, from 27 individuals, when only 6.5 admissions were expected. The data from this table would ideally be compared with similar data from the other towns to understand if the number of admissions, the number of admissions per person, as well as the total number of individuals involved is different for Whyalla when compared with the comparison towns. This would particularly be required for COPD, which in Whyalla accounted for a higher mortality as well as for more admissions than comparison towns.

An additional problem with hospital separations data is that there may be a problem with the accuracy of the clinical diagnosis made, as it has not been standardised to a definition such as would be ideal in an epidemiological study. This was a particular problem with the category "other anaemias" which was found to be significantly higher in Whyalla resident hospital separations data. It is unclear how this may be classified by different hospitals/clinicians, so an analysis of this would require access to clinical records, to better understand what is meant by the category "other anaemias".

Both COPD and alcohol related liver disease have contributed to an increased standardised mortality ratio in Whyalla, adding more evidence to the potential association between red dust and COPD and liver disease associated with alcohol. There is no issue of double counting individuals with mortality data, however it is likely to be incomplete. Over time there has been a net migration out of Whyalla, with the population size having reduced over time (2.3 above). As such, these results may underestimate the true increased mortality from various diseases in Whyalla.

Paediatric analysis

There are a number of physiological and behavioural factors that put children at increased risk from a toxin (1). In relation to this study, children have potentially higher exposure to red dust via the inhalational route, given their higher respiratory rate compared with adults. This study has found a small but statistically increased hospital separation for asthma and respiratory infections. This is evidence for an increased disease burden in a vulnerable group in Whyalla, which is of particular importance given a primary school is in the vicinity of the heavily red dust effected zone.

Comparison with the Port Hedland study

The geographic analysis undertaken in the Port Hedland study enabled a more detailed analysis of the illnesses being studied in relation to the BHP plant than was possible in this study. In the event of future studies, this would be an integral analytical technique to employ to better understand the geographic distribution of illnesses in Whyalla.

Both Port Hedland and Whyalla residents had higher rates of admission for respiratory illnesses. Given the Port Hedland study analysed respiratory diseases in aggregate, it is not possible to make comparisons with the finding in this study of increased rates of COPD or of a range of respiratory illness in children.

The aggregating of gastrointestinal diseases into one category has also limited the ability to compare the finding in the Port Hedland study to the finding in this study of increased risk of liver disease in Whyalla. The intention of including gastro-intestinal diseases in the Port Hedland study was to act as a control for the respiratory illnesses being studied, which was unfortunate given the large amount of evidence in the literature for damaging affects of iron on the liver. In addition, the Pt Hedland study did not examine cancers and so no comparison can be made regarding the increased lung cancer finding in Whyalla.

Nuisance dust affects

The literature suggests that irritation effects to eyes, nose, throat and upper airways could be associated with red dust exposure. The available hospital separations data does not provide information about these potential effects of dust as they generally do not require hospitalisation. Perhaps more importantly, hospital separations data mostly reflects at least moderately severe illnesses, and as such, asthma that may be of a high prevalence in the community but not severe enough to be hospitalised would not be counted. It is likely that this was the case with the asthma analysis, with the data from the Health Omnibus study demonstrating that adults in Whyalla have a higher prevalence of asthma than the comparison towns.

It is likely that the health outcomes analysed in this study were undercounted to some degree. A number of chronic illnesses are sub-clinical in their early stages. In relation to this study, such illnesses include Haemochromatosis, some anaemias and early lung disease. These potentially important illnesses may not have been counted in hospital separations data, but may indicate significant health effects. In addition, there may have been a group of people with chronic illnesses who chose to leave Whyalla to be closer to tertiary care centres and as such would not be counted in Whyalla hospital separations data.

Conclusion

This report has described a number of areas of uncertainty that have limited the forming of firm conclusions. There are large information gaps, such as in exposure assessment and lack of definitive evidence in the literature regarding the toxicology of iron (and less so with dust). In addition, the ecological design of this study is inherently weak and is not able to establish causality.

Despite these limitations, this report has generated a number of hypotheses regarding possible adverse health effects from red dust that warrant further investigation. There are a number of factors that support further study. Firstly, the diseases found in this study to be of higher incidence in Whyalla are all highly statistically significant. In addition, there is reasonable evidence of biologic plausibility for the diseases found in relation to iron rich dust exposure and lastly, there is indirect evidence of environmental exposure to red dust according to the EPA air quality report and Kieron Smith's report. Given that the confounders studied do not explain the increased disease burden, further studies that address the gaps described above would be required to definitively analyse potential health effects from Whyalla red dust.

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Appendix 1

Aerial photo of Whyalla

The OneSteel plant is indicated by the arrow, transparency indicates Whyalla postcodes

Appendix 2

Executive summary: Respiratory Hospitalisations in Port Hedland, 1993-2004: An exploratory geographical analysis

Exploratory Geographical Analysis of Hospital Admissions in the Port Hedland Township

January 2006

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1. Executive Summary

In order to examine the possible impact of high background particulate levels on respiratory disease, the spatial variation in hospital admissions within the town of Port Hedland, Western Australia, over the years 1993 to 2004 was investigated. A descriptive analysis of the population and patients of interest was conducted, followed by an estimation of the risk of being admitted to hospital for respiratory, cardiovascular or digestive diseases as compared to the general Western Australian population, both before and after adjusting for some of the potentially confounding factors. Admissions for cardiovascular and digestive disease were compared with those for respiratory disease to aid the examination of confounders.

The study time frame, small population and the geographic size of the study region limited the ability of this project to examine each of the potentially confounding factors in detail. In addition, behavioural risk factor information such as smoking and lifestyle habits have not been included in the calculation of any risk estimate, and the presence of chronic disease conditions has not been considered. Other potential bias issues associated with remote rural community living may also be present.

The risk of being admitted to hospital across Census Collection Districts (CD) was estimated using a Standardised Rate Ration (SRR) and Bayesian model. The results indicate a geographical variation in the relative risk of respiratory hospitalisation compared to the Western Australian population, ranging from 0.5 (CI: 0.37, 0.64) to 6.59 (CI: 5.55, 7.75) across the Census CDs. This geographical variation was consistent across all 3 disease types investigated.

Table 1: Age, Gender and Race Adjusted Relative Risks of Hospital Admissions in Port Hedland Census Collection Districts 1993-2004

Census Collection District	Respiratory Admissions			Cardiovascular Admissions			Digestive Admissions		
	Relative Risk	2.50%	97.50%	Relative Risk	2.50%	97.50%	Relative Risk	2.50%	97.50%
5010902	1.44	**1.13**	**1.78**	1.20	0.91	1.56	1.03	0.81	1.29
5010903	1.33	**1.09**	**1.62**	2.02	**1.66**	**2.46**	1.34	**1.09**	**1.61**
5010904	2.03	**1.77**	**2.31**	1.81	**1.50**	**2.15**	1.19	**1.01**	**1.39**
5010905	0.91	0.73	1.12	1.08	0.86	1.33	0.93	0.77	1.10
5010906	6.59	**5.55**	**7.75**	5.89	**4.63**	**7.28**	1.31	0.88	1.80
5010908	0.87	0.71	1.03	1.05	0.86	1.26	0.85	**0.72**	**0.99**
5010909	0.50	**0.37**	**0.64**	0.71	**0.54**	**0.90**	0.66	**0.53**	**0.80**
5010910	0.75	**0.62**	**0.90**	0.90	0.74	1.08	0.90	0.77	1.03
5010911	0.57	**0.42**	**0.75**	0.88	0.67	1.12	0.71	**0.56**	**0.87**

bold indicates statistical significance

The hospital admissions modelled during this investigation showed that, although relative risks of respiratory admissions were significantly greater than those expected in the general Western Australian population in 4 of the Census CDs (5010902, 5010903, 5010904, 5010906), this increase is reflected across all disease types investigated in Census CDs 5010903, 5010904 and 5010906. A more significant relative risk in respiratory hospital admissions which is not reflected in cardiovascular and digestive admissions was seen in the most western Census CD of Port Hedland. These higher than expected hospital admissions could not be accounted for by demographic or social and economic factors included in the risk model. It is possible however, that there are other factors such as behavioural (eg smoking, exercise), environmental or occupational exposures influencing the development of this disease, as opposed to the cardiovascular or digestive diseases which cannot be identified within the parameters of this exploratory analysis.

Appendix 3

Map used to demarcate dense, mid and non-dust effected zones.

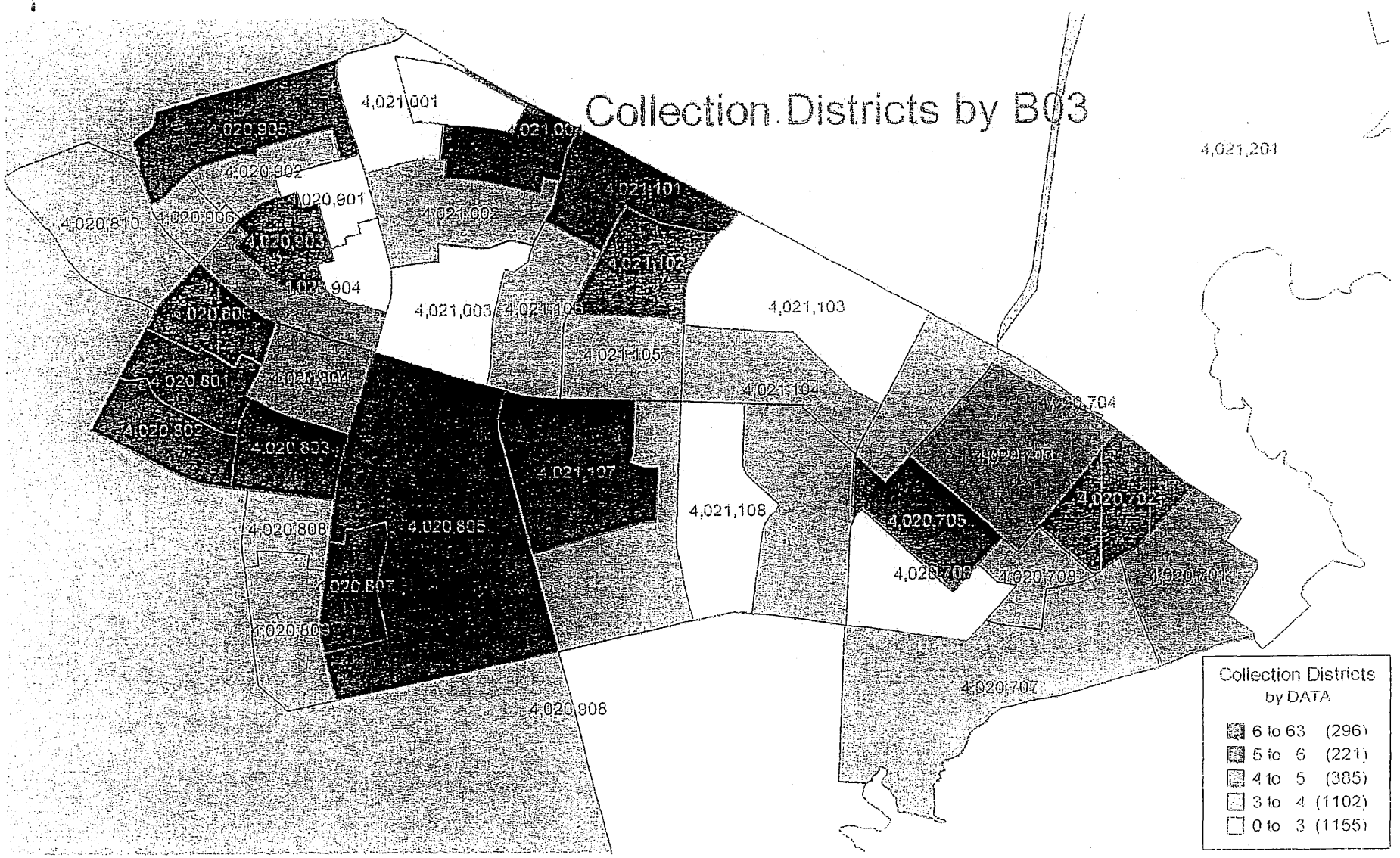
Dense zone collection districts:

- 4020701
- 4020702

Mid zone collection districts

- 4020703
- 4020704
- 4020705
- 4020706
- 4020707
- 4020708

Please refer to the next page for a map of the Collection District areas in Whyalla (ABS census). The transparency indicates H – high dust zone, M – mid dust zone and L – low dust zone


Collection Districts by B03
4,021,001
4,020,905
4,020,902
4,020,901
4,020,810
4,020,906
4,020,903
4,020,904
4,021,002
4,021,101
4,021,102
4,021,201
4,020,805
4,020,801
4,020,802
4,020,803
4,021,003
4,021,106
4,021,105
4,021,103
4,021,104
4,021,107
4,021,108
4,020,704
4,020,705
4,020,702
4,020,709
4,020,708
4,020,701
4,020,808
4,020,805
4,020,807
4,020,809
4,020,908
4,020,707
Collection Districts
by DATA
6 to 63 (296)
5 to 6 (221)
4 to 5 (385)
3 to 4 (1102)
0 to 3 (1155)

Appendix 4

Alcohol hazardous drinking categories

Description	Risk	
	Men	Women
Non-drinkers	None	None
Average daily intake of <3 drinks	None	Low
Average daily intake of **4** drinks or 9-12 drinks in any day	Low	Intermediate
Average daily intake of 5-8 drinks or occasional excess	Intermediate	High
Average daily intake of 9-12 drinks or frequent or great occasional excessive intake	High	Very High
Average daily intake of over 12 drinks	Very high	Very high

Appendix 5

Data tables

Cancers for persons who were resident in Whyalla at the time of diagnosis (postcodes 5600 5608 5609) v defined towns (Pt Pirie, Pt Augusta, Pt Lincoln, Mt Gambier, Victor Harbor) 1999-2004

Lung

whyalla	obs	exp	ratio	smrl95ci	smru95ci	smrprob	rr	l95ci	u95ci	prob	crude	asrate
0.00	242	274.2	0.88	0.78	1.00	0.0518	0.58	0.46	0.75	0.0000	51.64	49.76
1.00	95	62.8	1.51	1.22	1.85	0.0002	1.71	1.34	2.18	0.0000	73.62	85.34

Liver

whyalla	obs	exp	ratio	smrl95ci	smru95ci	smrprob	rr	l95ci	u95ci	prob	crude	asrate
0.00	19	18.7	1.02	0.61	1.59	0.9920	1.09	0.36	4.40	1.0000	4.05	0.04
1.00	4	4.3	0.93	0.38	2.72	0.8526	0.92	0.23	2.76	1.0000	3.10	0.04

Bowel

whyalla	obs	exp	ratio	smrl95ci	smru95ci	smrprob	rr	l95ci	u95ci	prob	crude	asrate
0.00	378	382.0	0.99	0.89	1.10	0.8625	0.95	0.75	1.20	0.6675	80.66	0.78
1.00	92	88.0	1.05	0.84	1.28	0.6940	1.06	0.83	1.33	0.6675	71.29	0.82

Cancers for persons who were resident in Whyalla at the time of diagnosis (postcodes 5600 5608 5609) v defined dusty towns (Pt Pirie, Pt Augusta) 1999-2004

Lung

whyalla	obs	exp	ratio	smrl95ci	smru95ci	smrprob	rr	l95ci	u95ci	prob	crude	asrate
0.00	89	109.8	0.81	0.66	1.01	0.0473	0.63	0.47	0.85	0.0025	50.19	48.69
1.00	95	74.2	1.28	1.04	1.56	0.0229	1.58	1.17	2.13	0.0025	73.62	76.87

Persons usually resident in Whyalla postcodes (5600, 5608, 5609) v defined towns (Pt Lincoln, Pt Pirie, Pt Augusta, Mt Gambier, Victor Harbor)
Six years of data from 1999/2000 financial year to 2004/2005 financial year.

Whyalla	Condition	obs	exp	ratio	smrl95	smru9	smrprob	rr	l95ci	u95ci	prob	crude	asrate
Comparis	Other condition	189,884	196,689.7	0.97	0.96	0.97	0.0000	0.85	0.84	0.86	0.0000	39,663.78	39,264.27
Whyalla	Other condition	57,430	50,624.3	1.13	1.13	1.14	0.0000	1.18	1.16	1.19	0.0000	44,401.66	46,139.29
Comparis	A15,A16 Tuberculosis	2	2.3	0.87	0.26	3.80	0.8082	0.60	0.03	35.40	1.0000	0.42	0.43
Whyalla	A15,A16 Tuberculosis	1	0.7	1.44	0.02	8.04	0.9899	1.67	0.03	32.01	1.0000	0.77	0.71
Comparis	B20-B24 HIV	11	10.7	1.02	0.51	1.83	0.9805	1.11	0.29	6.19	1.0000	2.30	2.36
Whyalla	B20-B24 HIV	3	3.3	0.92	0.33	3.15	0.8147	0.90	0.16	3.41	1.0000	2.32	2.12
Comparis	B18 Chronic Viral Hepatitis	48	46.0	1.04	0.77	1.38	0.8101	1.23	0.63	2.63	0.6613	10.03	10.12
Whyalla	B18 Chronic Viral Hepatitis	11	13.0	0.85	0.48	1.62	0.7120	0.81	0.38	1.59	0.6613	8.50	8.23
Comparis	D55,D58 Haemolytic anaemias	23	19.8	1.16	0.74	1.75	0.5207	3.06	0.75	26.73	0.1595	4.80	4.79
Whyalla	D55,D58 Haemolytic anaemias	2	5.2	0.38	0.11	1.67	0.2087	0.33	0.04	1.32	0.1595	1.55	1.57
Comparis	D64.0 Hereditary sideroblastic anaemia	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
Whyalla	D64.0 Hereditary sideroblastic anaemia	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
Comparis	D64.1 Secondary sideroblastic anaemia due t	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
Whyalla	D64.1 Secondary sideroblastic anaemia due t	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
Comparis	D64.2 Secondary sideroblastic anaemia due t	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
Whyalla	D64.2 Secondary sideroblastic anaemia due t	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
Comparis	D64.3 Other sideroblastic anaemias	69	56.2	1.23	0.95	1.55	0.1094	.	4.13	.	1.0000	14.41	13.92
Whyalla	D64.3 Other sideroblastic anaemias	0	12.8	0.00	0.00	0.44	0.0000	0.00	0.00	0.24	0.0000	0.00	0.00
Comparis	D64.4 Congenital dyserythropoietic anaemia	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
Whyalla	D64.4 Congenital dyserythropoietic anaemia	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
Comparis	Rest of D64 Other anaemias	585	648.9	0.90	0.83	0.98	0.0116	0.63	0.53	0.74	0.0000	122.20	117.86
Whyalla	Rest of D64 Other anaemias	210	146.1	1.44	1.25	1.65	0.0000	1.59	1.36	1.87	0.0000	162.36	187.95
Comparis	D56 Thalassaemia	0	5.0	0.00	0.00	1.12	0.0143	0.00	0.00	0.18	0.0001	0.00	0.00
Whyalla	D56 Thalassaemia	6	1.0	5.76	2.10	12.54	0.0018	.	5.61	.	1.0000	4.64	5.69
Comparis	D46.1 Refractory anaemia with sideroblasts	0	0.8	0.00	0.02	7.04	0.9153	0.00	0.00	10.38	0.4204	0.00	0.00
Whyalla	D46.1 Refractory anaemia with sideroblasts	1	0.2	4.76	0.06	26.47	0.3773	.	0.10	.	1.0000	0.77	0.78
Comparis	Rest of D46 Myelodysplastic syndromes	207	197.4	1.05	0.91	1.20	0.5124	1.33	0.93	1.95	0.1285	43.24	41.91
Whyalla	Rest of D46 Myelodysplastic syndromes	36	45.6	0.79	0.57	1.12	0.1700	0.75	0.51	1.08	0.1285	27.83	31.54
Comparis	E80.0, E80.1 Porphyrias	0	0.8	0.00	0.02	7.09	0.9203	0.00	0.00	10.72	0.4313	0.00	0.00
Whyalla	E80.0, E80.1 Porphyrias	1	0.2	4.64	0.06	25.80	0.3856	.	0.09	.	1.0000	0.77	0.76
Comparis	E83.1 Haemochromatosis	26	24.4	1.06	0.70	1.56	0.8014	1.40	0.53	4.67	0.6597	5.43	5.43
Whyalla	E83.1 Haemochromatosis	5	6.6	0.76	0.33	1.98	0.7139	0.71	0.21	1.89	0.6597	3.87	3.87
Comparis	E83.0 Copper metabolism	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00

whyalla	kids <15	obs	exp	ratio	smrl95ci	smru95ci	smrprob	rr	l95ci	u95ci	prob	crude	asrate
0	Respiratory illness other than asthma	3128	3367.8	0.93	0.90	0.96	0.0000	0.74	0.69	0.79	0.0000	3080.6	3071.4
1	Respiratory illness other than asthma	1190	950.2	1.25	1.18	1.33	0.0000	1.35	1.26	1.44	0.0000	4097.8	4141.2
0	Asthma	754	807.7	0.93	0.87	1.00	0.0590	0.76	0.66	0.87	0.0001	742.6	742.0
1	Asthma	284	230.3	1.23	1.09	1.39	0.0007	1.32	1.15	1.52	0.0001	978.0	980.5

J10-18 J20-22 (lower) J00-06 (upper) and H65-66 (otitis media) J45-46 (asthma)

Death rates for people dying while resident in Whyalla v defined towns (Pt Pirie, Pt Augusta, Pt Lincoln, Mt Gambier, Victor Harbor)

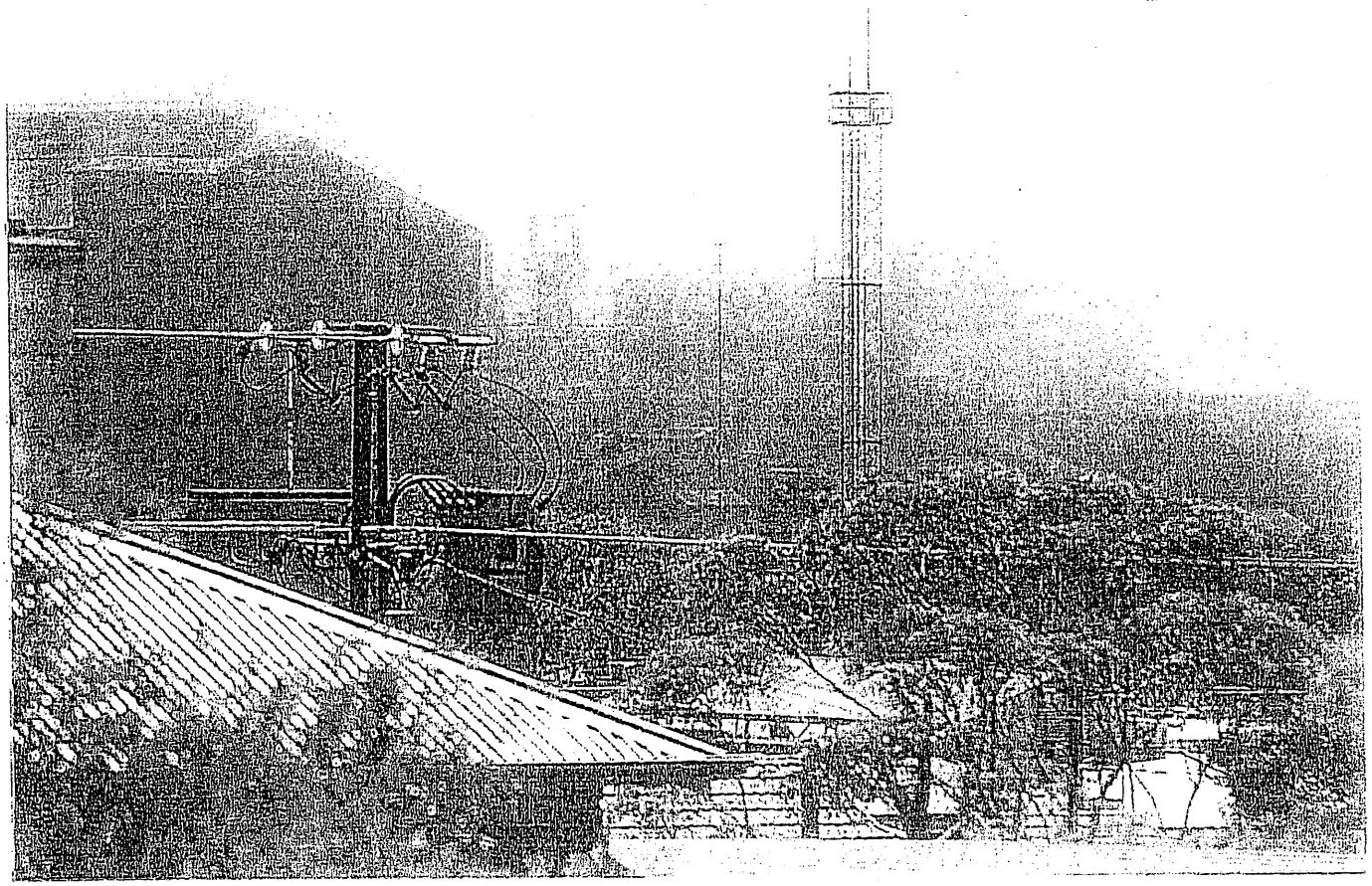
whyalla	conditn	obs	exp	ratio	smrl95ci	smru95ci	smrprob	rr	l95ci	u95ci	prob	crude	asrate
0.00	A15, A16 Tuberculosis	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
1.00	A15, A16 Tuberculosis	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
0.00	B20-B24 HIV	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
1.00	B20-B24 HIV	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
0.00	B18 Chronic Viral Hepatitis	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
1.00	B18 Chronic Viral Hepatitis	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
0.00	D55, D58 Haemolytic anaemias	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
1.00	D55, D58 Haemolytic anaemias	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
0.00	D64.0	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
1.00	D64.0	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
0.00	D64.1	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
1.00	D64.1	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
0.00	D64.2	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
1.00	D64.2	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
0.00	D64.3	1	0.8	1.25	0.02	6.95	0.9050	.	0.01	.	1.0000	0.25	0.25
1.00	D64.3	0	0.2	0.00	0.07	27.94	0.3603	0.00	0.00	156.87	1.0000	0.00	0.00
0.00	D64.4	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
1.00	D64.4	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
0.00	Rest of D64 Other anaemias	3	2.5	1.20	0.24	3.51	0.9081	.	0.08	.	1.0000	0.76	0.71
1.00	Rest of D64 Other anaemias	0	0.5	0.00	0.03	11.08	0.7781	0.00	0.00	12.03	1.0000	0.00	0.00
0.00	D56 Thalassaemia	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
1.00	D56 Thalassaemia	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
0.00	D46.1	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
1.00	D46.1	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
0.00	Rest of D46 Myelodysplastic syndromes	3	2.5	1.19	0.24	3.48	0.9188	.	0.08	.	1.0000	0.76	0.71
1.00	Rest of D46 Myelodysplastic syndromes	0	0.5	0.00	0.03	11.55	0.7526	0.00	0.00	12.66	1.0000	0.00	0.00
0.00	E80.0, E80.1 Porphyrias	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
1.00	E80.0, E80.1 Porphyrias	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
0.00	E83.1 Haemochromatosis	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
1.00	E83.1 Haemochromatosis	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
0.00	E83.0 Copper metabolism	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
1.00	E83.0 Copper metabolism	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
0.00	I81, I85 Portal Vein	1	0.8	1.18	0.02	6.55	0.8618	.	0.00	.	1.0000	0.25	0.23
1.00	I81, I85 Portal Vein	0	0.2	0.00	0.09	36.86	0.2849	0.00	0.00	219.38	1.0000	0.00	0.00

whyalla	conditn	obs	exp	ratio	smri95ci	smru95ci	smrprob	rr	l95ci	u95ci	prob	crude	asrate
0.00	J40-J42 Chronic Bronchitis	3	4.2	0.71	0.26	2.44	0.7902	0.28	0.03	3.41	0.3654	0.76	0.71
1.00	J40-J42 Chronic Bronchitis	2	0.8	2.51	0.28	9.05	0.3769	3.51	0.29	30.65	0.3654	1.86	2.48
0.00	J44 COPD	107	130.1	0.82	0.68	1.00	0.0423	0.44	0.31	0.63	0.0000	26.93	25.56
1.00	J44 COPD	50	26.9	1.86	1.38	2.45	0.0001	2.26	1.58	3.19	0.0000	46.41	57.85
0.00	J45 Asthma	12	10.5	1.14	0.59	1.99	0.7291	2.81	0.42	120.24	0.5239	3.02	2.93
1.00	J45 Asthma	1	2.5	0.41	0.09	2.93	0.5864	0.36	0.01	2.40	0.5239	0.93	1.04
0.00	J60-J65 Pneumoconioses	2	3.4	0.59	0.18	2.59	0.6850	0.18	0.01	2.51	0.2291	0.50	0.47
1.00	J60-J65 Pneumoconioses	2	0.6	3.25	0.37	11.73	0.2531	5.50	0.40	75.68	0.2291	1.86	2.57
0.00	K70	15	22.8	0.66	0.40	1.14	0.1108	0.29	0.13	0.65	0.0022	3.78	3.77
1.00	K70	14	6.2	2.27	1.24	3.81	0.0094	3.46	1.55	7.69	0.0022	12.99	13.05
0.00	K71	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
1.00	K71	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
0.00	K73	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
1.00	K73	0	0.0	.	.	.	.	.	.	.	1.0000	0.00	0.00
0.00	K74	8	7.2	1.11	0.48	2.19	0.8584	2.01	0.27	89.30	0.8664	2.01	1.96
1.00	K74	1	1.8	0.55	0.12	3.99	0.9234	0.50	0.01	3.71	0.8664	0.93	0.99
0.00	Other K70-K76 Chronic Liver	6	6.5	0.93	0.43	2.22	0.9406	0.70	0.13	7.11	0.9317	1.51	1.47
1.00	Other K70-K76 Chronic Liver	2	1.5	1.32	0.15	4.76	0.8905	1.42	0.14	7.97	0.9317	1.86	2.09

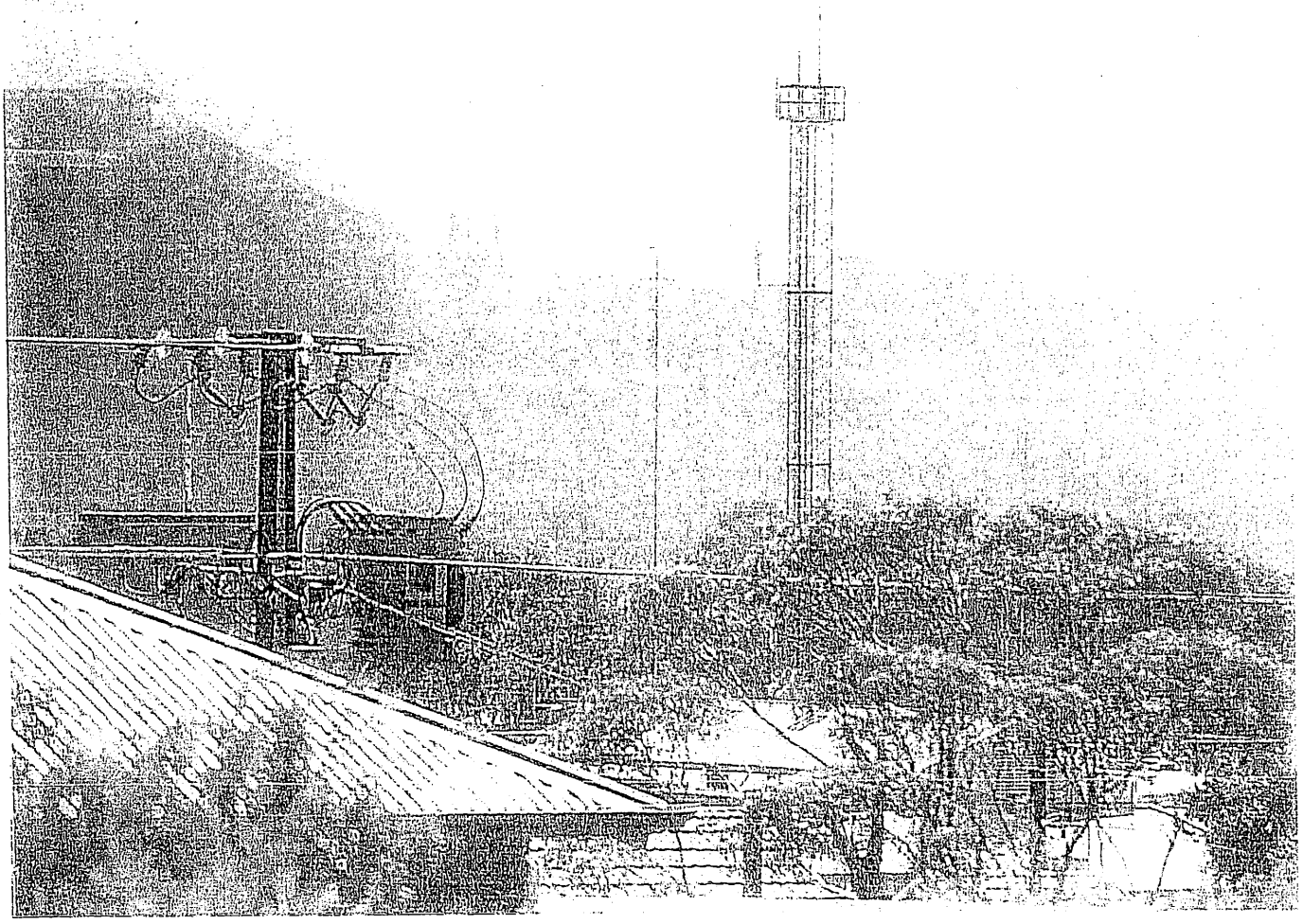
Index of relative socio-economic disadvantage in Whyalla by Collection District

Code	Name	Population	Disadvantage
4020701	4020701	481	1052
4020702	4020702	496	1103
4020703	4020703	832	1070
4020704	4020704	514	971
4020705	4020705	510	965
4020706	4020706	419	879
4020707	4020707	705	1038
4020708	4020708	280	1071
4020801	4020801	655	759
4020802	4020802	682	771
4020803	4020803	714	799
4020804	4020804	720	746
4020805	4020805	841	972
4020806	4020806	697	789
4020807	4020807	775	917
4020808	4020808	412	893
4020809	4020809	537	905
4020810	4020810	756	1014
4020901	4020901	330	797
4020902	4020902	449	746
4020903	4020903	307	704
4020904	4020904	376	776
4020905	4020905	687	1078
4020906	4020906	225	823
4020907	4020907	346	791
4020908	4020908	343	975
4021001	4021001	464	981
4021002	4021002	592	843
4021003	4021003	390	895
4021004	4021004	562	843
4021101	4021101	685	817
4021102	4021102	609	834
4021103	4021103	568	1041
4021104	4021104	607	1031
4021105	4021105	516	878
4021106	4021106	447	841
4021107	4021107	710	824
4021108	4021108	343	1077
4021109	4021109	759	1039
4021110	4021110	273	945
4022201	4022201	47	1051
4022202	4022202	203	748
5600	5600	6857	989
5608	5608	14001	876.84
5609	5609	756	993.13

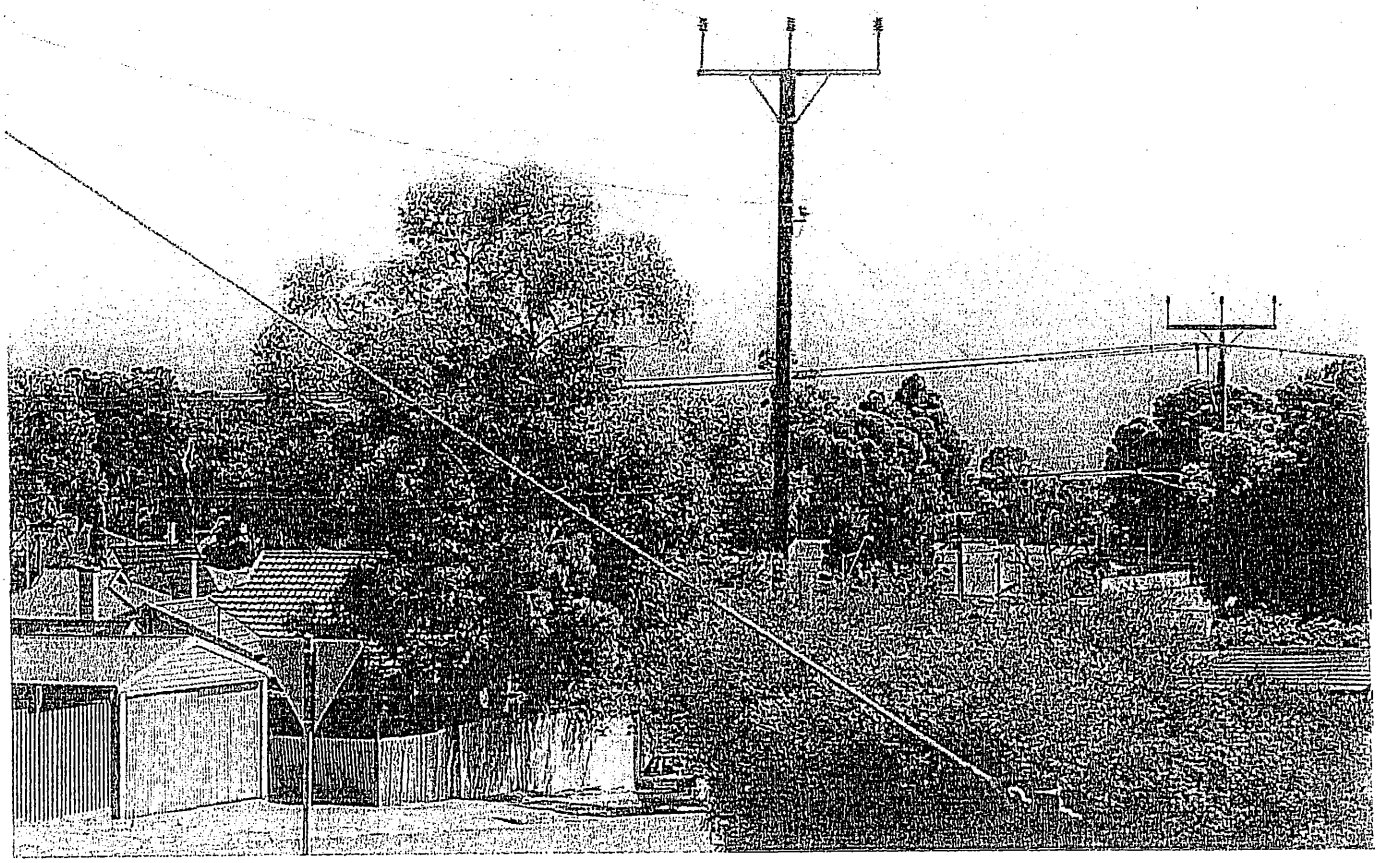
10Jan07 1021hrs wind creates dust bowl.



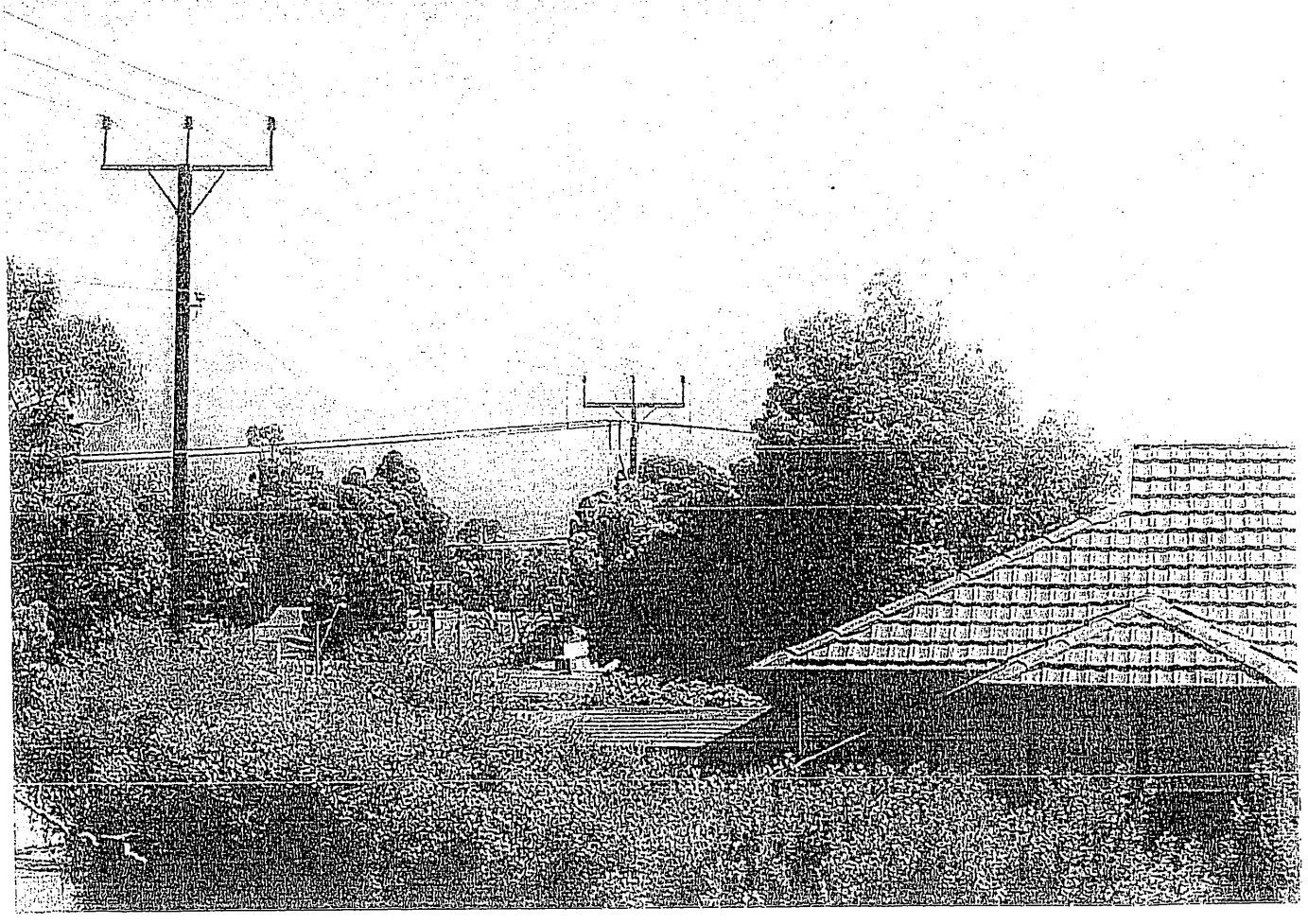
Jan07 1021hrs wind effect on Pellet Plant environs.



Jan07 1020hrs wind hits Blast Furnace area



Jan07 1021hrs coal and coke dust heading for Pellet Plant,NS and Hummock Hill area.



Jan07 photo taken by concerned residents from their Home.