

Running Title: Environmental Injustice and Air Pollution in the Hunter

Environmental Injustice and Air Pollution in Coal Affected Communities,
Hunter Valley, Australia

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Abstract

The authors describe environmental injustice from air pollution in the Upper Hunter, Australia and analyse the inaction of state authorities in addressing residents' health concerns. Obstacles blocking public air monitoring and a health study include: the interdependence of state government and corporations in reaping the economic benefits of coal production; lack of political will and regulatory inertia; and study design and measurement issues. We analyse mining and coal-related air pollution in Bourdieu's (1989) terms as a social field; residents, civil society and local government groups struggle with corporations and government over the burden of imposed health risk caused by air pollution.

Keywords: Environmental Injustice,

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I. Introduction

The Upper Hunter Region of New South Wales, in southeast Australia (approximately 18,320 sq kms) takes its name from the Hunter River that winds from the mountains of the Great Dividing Range through the Hunter Valley past small townships, farms, horse studs and vineyards. The river flows into the sea at the port of Newcastle - the world's largest black coal exporting port. The Upper Hunter is the site for three power stations and thirty-six coal mines, and a major source of industry profits and state revenue from the mining, combustion and export of coal. Rural Upper Hunter residents are exposed to industrial air pollution concentrations rivalling any region of Australia. Since 2003, community groups, Greens Party parliamentarians, health professionals, and local government councillors have called for a study to investigate the cumulative health impacts of air pollution in this area. To date no such study has been planned.

This paper reviews the evidence for air pollution in the Upper Hunter and analyses the inaction of state authorities in addressing residents' health concerns. We identify obstacles blocking efforts to undertake more rigorous air monitoring and a health study, including the interdependence of state government and corporations in reaping the economic benefits of coal production and export, lack of political will and regulatory inertia, as well as study design and measurement issues. We analyse mining and coal-related air pollution in Pierre Bourdieu's terms (Bourdieu 1989; Wacquant 1989) as a social field in which residents, civil society and local government groups struggle with corporations, and state government over the burden of imposed health risk caused by air pollution.

II. Environmental Injustice and Health Inequity

Environmental injustice is a contested concept with a range of definitions being utilized (Bullard & Johnson 2000; Schlosberg 2004; Sze & London 2008). Sze and London (2008) state that environmental injustice can be explained in terms of two inter-linked facets. Distributive environmental injustice occurs when certain groups are disproportionately affected by environmental hazards. Procedural injustice explains the inequitable distribution of hazards in terms of underlying socio-cultural and political factors, including the burden of risk imposed on socially disadvantaged groups, and lack of public participation in decision-making processes. Environmental justice advocates call for policies that institutionalise public participation and recognise the legitimacy of community or lay knowledge concerning ecosystem and human health (Schlosberg 2004), a stance that would reconfigure positions in social fields of environmental action where community perspectives are currently subordinated to corporate and government domination.

Public health researchers have identified environmental pollution as a major contributor to health inequities (Brulle & Pellow 2006). Howie et al's (2005) review of thirteen Australian studies found adverse health effects of air pollution in major cities, but also identified gaps in knowledge, such as the spatial effects of air pollution, disentangling the health effects of different air pollutants, and assessing the interactive effects of air pollution with other environmental factors (Howie et al 2005, p.32).

Brulle and Pellow (2006) assert that while US studies emphasise community characteristics as determinants of health disparities, there are few that examine the role of exposures to toxic pollution on community health. Braveman (2006) views

these disparities through a structural inequality lens; health inequities are shaped by government policies.

Residents most likely to experience worse health or be exposed to greater health risks include people from disadvantaged social groups (such as poor, racial or ethnic minorities), women, or others discriminated against (Braveman 2006), such as those living close to polluting industries. In south-east Australia, many rural communities may be considered “disadvantaged” in terms of levels of income, access to services and lack of electoral power or other forms of political influence. In the rural Upper Hunter electoral district, most employment is from sheep, beef cattle and grain farming: the median weekly household income is \$200 less than the Australian average (ABS, 2006). In the next section we examine evidence for Upper Hunter residents’ inequitable burden of imposed risk from air pollution from the coal and power industries.

III. Environmental Injustice and Air Pollution in the Upper Hunter

The expansion of coal mining in the Upper Hunter has led to dramatic transformation of the environment, particularly surrounding the major regional towns of Singleton (21,937 residents, ABS 2006) and Muswellbrook (15,236 residents, ABS 2006). The Hunter Coalfield is the largest coal producing area in NSW, with 60 coal seams; most are easily accessible by open-cut mining. Between 1988 and 1999 the area of open cut mining increased dramatically from 320 sq kms to 520 sq kms (Daley 1999); by 2006-7, there were 34 coal mines in the Hunter Region coalfields, with 75% of coal produced by 18 open cut coal mines (Hunter Valley Research Foundation 2009, p.7). Open cut mining involves drilling and blasting followed by draglines, power shovels,

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bucket wheel excavators, loaders, dumpers and conveyor belts removing large amounts of overburden to reach coal deposits. These operations result in massive discharge of fine particulates from overburden material. Further particulate matter is released into the air during excavation, size reduction, waste removal, transportation, loading and stockpiling of coal; and via fugitive emissions from spontaneous combustion of coal. The Upper Hunter also has two of the most polluting power stations in Australia (CARMA: Carbon Monitoring for Action 2007), as well as the smaller Redbank Power Station.

Burden of Exposure

Inhalable particles -- less than or equal to 10 micrometres in diameter (PM₁₀) -- are associated with increased respiratory symptoms, aggravation of asthma, increased hospital admissions and premature death. The risk is highest for the elderly, children, and people with asthma or heart disease. Even more dangerous to human health are PM_{2.5} or “respirable particles” (less than or equal to 2.5 micrometres in diameter) which can penetrate deep into the respiratory system and are associated with increased hospital admissions for heart and lung diseases, and premature death (Department of Environment and Heritage 2002; Pope et al 2009). Between 2005-2007, aerosol sampling in Muswellbrook found PM_{2.5} were between 5-6 µg/m³ (Muswellbrook Shire Council 2006; 2007) (less than the Australian limit of 8µg/m³), although the World Health Organisation advises that there is “no safe level” of fine particle air pollution (see Robinson 2005, p. 213). No public data are available about the composition of dust in the air around Singleton (Hunter New England Health 2003).

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The National Pollutant Inventory (NPI) reports self-monitored PM₁₀ emissions from industrial sources in the Hunter Valley. PM₁₀ emissions from coal mining and electricity generation facilities in the Muswellbrook and Singleton LGAs have been steadily rising: 37,000 tonnes, 2002-3; 40,000 tonnes, 2003-4; 42,000 tonnes, 2004-5; over 50,000 tonnes, 2005-6 & 2006-7; 53,000 tonnes, 2008-9 (NPI 2009). In addition, over 113 tonnes of toxic metals and their compounds (including arsenic, antimony, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, selenium and zinc) were emitted to the air from these electricity generators during 2006-7. Air quality researchers confirm that particulate air pollution [specifically, PM₁₀ and NO_x] has been identified as a major environmental concern in the Upper Hunter (Bridgman et al 2002; Bridgman et al 2005; Metcalf & Bridgman 2005). The inequity of this situation is highlighted by comparing total PM₁₀ emissions for 2007-8 for the Upper Hunter Shires of Singleton (39,000 tonnes) and Muswellbrook (18,000 tonnes), with their neighbouring Lower Hunter areas of Newcastle (920 tonnes) and Maitland (260 tonnes) where there are no power stations and only a few small open cut mines (NPI 2009).

Health Impacts

Exposure to air pollution can make eyes water, irritate nose, mouth and throat, cause or worsen lung diseases like asthma, bronchitis and emphysema and can contribute to premature death of people with heart and lung disease (Pope et al 2004). Even short term exposure to NO₂ can increase respiratory illness, especially in children and asthmatics. Long-term exposure may lower resistance to respiratory infections (USA Environmental Protection Agency 2008). Similarly, SO₂ is intensely irritating to the eyes, nose and throat and aggravates symptoms of asthma and chronic bronchitis

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(Dept. of Environment Water Heritage & the Arts 2009). Prolonged exposure to SO₂ is significantly associated with all-cause cardiopulmonary and lung cancer; and with mortality from 'all other causes' (Pope et al 2002, p.1137). Meta-analyses of air pollution studies globally found considerable evidence linking air pollution with daily mortality and that PM₁₀, CO, NO₂, O₃, and SO₂ are all positively and significantly associated with all-cause mortality (Stieb et al 2002); (see also Dockery & Stone 2007; Halliday et al 1993; Kjellstrom et al 2002; Lewis et al 1998; Miller et al 2007). Australian government scientists estimated that 2400 of the 140,000 Australian deaths each year (2%) are linked to air quality and health issues, a number that would be even greater if "long-term effects of air toxics on cancer are included" (CSIRO 2004).

Community Concern about Air Pollution

In the worst affected areas of the Upper Hunter, concern about air pollution has found expression in complaints to the Environmental Protection Authority (EPA) community hotline. NSW Department of Environment and Climate Change (DECC) figures show that complaints rose by one third from 2002 to 2006, with big rises in air pollution complaints from the Singleton, Muswellbrook and Maitland areas (Herald (editorial) 2007, 13 July). Residents' discomfort about air pollution was also expressed through a NSW Public Health Unit survey finding that air pollution and water pollution were considered to be the top two environmental health problems (Dalton 2003).

The authors' ethnographic research in the Upper Hunter provides further insights into residents' association of air pollution with a range of health problems including asthma, heart disease, pneumoconiosis, respiratory complaints, cancers, skin

complaints, headaches, breathing difficulties and mental health symptoms (stress, anxiety, depression) (Albrecht et al 2007; Connor et al 2004). A common theme is residents' concern about the present and future health implications of the expansion of coal mining and combustion in the Upper Hunter. However, residents' attempts to gain a response from authorities about their health concerns over the past 20 years have largely been ignored. Several of our study respondents, frustrated with the inability to have local views heeded, have successfully stood as Councillors in Local Government elections, which can be seen as an attempt to counter the subordination of residents' knowledge in the social field of mining.

A Singleton Councillor outlined a range of excuses that have been offered for not conducting a health study that appear to have come straight from a "Yes, Minister" script.

Getting authorities to listen is in some ways the easy bit; they nod their heads, smile with empathy and appear personally committed to our cause. But getting them to act is a completely different matter. It's like going on a merry-go-round of platitudes: "Well it's such a complex issue", "It's really a health issue", "A health study...it's not really warranted or something we see happening in the near future", "Who would finance a study", "It's not this department's responsibility", "You need a population of 25,000 or more to warrant a real-time dust monitor" (McBain 2009).

IV. Pressure for a Health Study in the Upper Hunter

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Since 2000, many different groups and organisations have unsuccessfully made representations to members of NSW parliament, the Hunter New England Public Health Unit, and the NSW Environmental Protection Agency (EPA) asking for a study to examine the relationship between industrial emissions in the Upper Hunter and the health status of the population. By contrast, state and local government sponsored projects in other Australian communities are investigating links between air pollution and health. Foremost among these is *The Clean and Healthy Air for Gladstone Project* assessing the impact of air emissions on the ambient air quality in the heavy industrial Gladstone area of southeast Queensland, including the potential contribution of coal dust to adverse health outcomes (Clean and Healthy Air for Gladstone Project 2008). The final health risk assessment report due in 2010 will combine detailed population health status information with 12 months air quality monitoring data to determine whether “pollutants in the air in the Gladstone area present at levels that may cause health problems in the community” (Queensland EPA and Queensland Health 2008).

Similarly, in early 2009 the City of Lake Macquarie in the Lower Hunter region announced plans for its own air pollution study “to boost the amount of public information on the subject” (Cronshaw 2009, 2 Jan, p.3). Like the Upper Hunter, this area has two large power stations. However, coal mining is on a much smaller scale and is mainly conducted underground with a much smaller air pollution burden (1,540 tonnes of PM₁₀ emissions in 2007-8 compared to 53,000 tonnes in the Upper Hunter Shires of Singleton and Muswellbrook (NPI 2009). The population of Lake Macquarie is much larger (>183,000) compared to the Upper Hunter (<40,000), and the current state government MP, whose electorate overlaps with this Local

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Government Area, is an independent and is known as an environmentally sensitive politician. The health study initiative in Lake Macquarie, as well as the Gladstone study, provides another indication of a shift in the structuring of power in the social field of coal mining and health in other regions.

Pressure from Local Government

In the Upper Hunter, the calls for a health study have become more insistent as the pace of new coal mine operations has escalated, with the price of thermal coal rising from a low of US\$38 a tonne in March 2006 (Boreham 2006) to a high of US\$201 in July 2008 at the peak of the commodity price “supercycle” (Petchey 2009). The growing awareness of the key role of coal combustion and production in contributing to greenhouse gas emissions and the worsening threat of global climate change has added force to the requests for greater government and industry accountability for the impacts from coal mining and power generation. Councils that previously welcomed the financial and infrastructure contributions from the coal companies in their local government area are now more reluctant to trade off the long-term benefits of a healthy environment and growth of other rural industries (such as tourism, agriculture, horse breeding) for the short-term benefits of coal mining. The Mayor of Singleton acknowledged, “I’m very worried about the impact mining is having on people’s health, as there is a very high incidence of respiratory problems among residents of the town” (quoted in Lee 2008).

Local councils have expressed concern about the cumulative impacts of coalmining on Upper Hunter residents. In 2005, the Muswellbrook Mayor “agreed that the cumulative effects of the coalmining boom needed to be studied before any new large

projects were approved” (Ray 2005). Two years later, Singleton Council sent three letters to the NSW Planning Minister and the Natural Resources Minister suggesting a round table discussion about the cumulative effects of mining in the Singleton Shire (Sharpe 2007), and a number of letters, submissions and public meetings have followed. Towards the end of 2008, a public meeting at Singleton, supported by the Mayor and several Councillors, again called for a health study and independent, continuous dust monitoring covering the whole of the Upper Hunter (Maguire 2008b). Such pressure from formerly pro-coal local government bodies indicates a small but significant shift in the structuring of social positions in the field of coal mining and thus a potentially more favourable balance for residents.

Following changes to NSW planning legislation in 2005, local Councils no longer have the power to approve coal mines, with the consent authority first passing to the NSW State Planning Department and then to the NSW Planning Minister. The Minister has discretionary powers to define certain mining proposals as “critical infrastructure projects” reducing the ability of communities and local governments to have input into mining developments that are assessed under Part 3A of the Environmental Planning and Assessment Act (EP&A Act) (Johnson 2005). However, local Councils are still able to regulate certain day-to-day operations of mines, such as roads and drainage (Part 4 of the EP&A Act). Local Councils can also exert political influence on the NSW State Government through their peak body, the Local Shires Association, if they oppose the state on politically sensitive issues.

Civil Society Groups

Civil society groups, with less formal institutional power in the social field of mining, often take strong positions on the health threats posed by the coal industry. In 2007, residents' support group Minewatch called for a ban on all new coalmines and extensions to existing mines until a study is conducted into the health impacts of mining in the region. In 2008 more than 100 residents at a public meeting organised by Minewatch resolved unanimously to call on Singleton Council to hold a forum on the health impacts of coalmining (Maguire 2008a). Echoing this concern, respondents to petitions placed in Singleton pharmacies and doctors' surgeries (N=375) all agreed that air quality "is or may be affecting health in their families"; 50% thought that "asthma in their families is the result of poor air quality" (see Singleton Air Quality Working Group 2009, p.24).

Other community organisations have lobbied politicians for a study into the health impacts of silica from blasting at open cut mines. In 2003, a group opposing the Anvil Hill open-cut mine near Muswellbrook wrote to the NSW Premier about the impacts of inhaling "respirable silica dust", including "chronic airway diseases such as emphysema". Two years later, the Anvil Hill group asked the Secretary of the NSW Senate Community Affairs References Committee to look into Government inaction on this issue:

There are no human health related studies looking at the impact of silica in particulate matter on human health in the Upper Hunter ... There are currently no health studies being conducted in the Upper Hunter to establish if there is a link between health issues and the increase in particulate matter (Phelps 2005).

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The pressure for a health study has gained strength as mining has intensified. With media reports highlighting dramatic rises in the price of coal during 2007-8, the expansion of coal mining and the burning of fossil fuels became a potent political issue beyond the Hunter. The amount of media coverage sympathetic to mining opponents, especially in the major regional newspaper, the *Herald*, has increased correspondingly. For example, since 2001 there have been more than 55 prominent articles in the *Herald* and *Singleton Argus*, and well as over 30 letters to the editor of the *Herald*. In addition, there have been at least 12 *Herald* Editorials which included commentary on calls for a health study in the Upper Hunter. These *Herald* editorials have been particularly scathing of State Government inaction.

A government concerned with the well-being of its citizens would not have to be asked to conduct an inquiry into the possible health effects of dust emissions from the Hunter's massive mines (Herald (editorial) 2008b, 2 Aug, p.18).

Media reports have also highlighted National Pollutant Inventory air pollution figures contrasting inequity between the Upper and Lower Hunter, further supporting residents' calls for a health study in the Upper Hunter (Harris 2009).

V. Barriers to a Health Study

Given the widespread calls from residents, civil society groups, local government and the media, why has the State Government failed to instigate a health study in the Upper Hunter? Barriers include marginalising residents concerns, interdependence of

government and the coal industry, and the power to define, regulate and monitor risk relating to industrial air pollution.

Marginalising Residents' Concerns

State government inaction on the health study was barely an issue of public attention outside the Upper Hunter until a few years ago. Residents and civil society groups who protested about air pollution and health risks were marginalised; legitimate knowledge about the health risks of coal dust and power station emissions was credited to industry and government regulatory officials. Mining industry groups, in particular, have sought to discredit residents' complaints. The NSW Minerals Council argued, "It is popular sport among many individuals and groups to blame the mining industry for all sorts of things, and all types of environmental and social ills, without one shred of supporting evidence" (NSW Minerals Council 2008). Regional parliamentarians have also discounted residents' views. The State Labor Minister for the Hunter told a business group in 2006 that "a very vocal and very organised Green movement" was being heard "disproportionately", despite its "ridiculous ideas" in opposing new coal mines in the Upper Hunter. He added that those who believed the Government was irresponsible for not shutting down the coal industry either had "rocks in their head" or no idea of modern economic realities (Kirkwood 2006). A Federal Labor Minister representing an Upper Hunter electorate evoked the spectre of terrorism, suggesting that those protesting plans to develop the Anvil Hill coalmine in the Upper Hunter were part of a "jihad" launched with the intention of closing the entire coal industry down (Shanahan 2006).

The Political Economy of Coal

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A key explanation of the failure to heed residents' health concerns is the historical links between the State government and the coal mining and power generating industries. Following the 2005 corporatisation of the State-owned power generator, Powercoal, Upper Hunter power stations have been operated by corporate entity Macquarie Generation (Hunter Valley Research Foundation 1996). State owned coal mines supplying the power stations were also privatised from 2002. An example of the political economy of coal in the state of NSW is the controversial Anvil Hill mine site which the NSW Government sold to Centennial Coal for \$331 million in 2002 (Anvil Hill Alliance 2006; Wendt 2004). In 2004 a long-term coal supply contract was secured by Centennial with Macquarie Generation to supply coal from the planned Anvil Hill mine to power stations in the Upper Hunter between 2008-2020 (Centennial Coal 2004). Although the focus of protracted community and environmentalist protest, the new mine was approved by the State Government in 2007, and purchased the following year by multinational mine corporation Xstrata.

By early 2008, some State Government officials were trying to ensure that social and environmental issues were given more consideration. In May 2008, a NSW DECC draft document was leaked stating that, whilst the NSW coal industry reaped \$8.5 billion in 2005-6, taxpayers and the community should not have to bear mining's environmental and social costs (Cronshaw 2008). The contribution of the Upper Hunter region to this tally is considerable. Total NSW coal mining royalties to the State Government in the 2008-9 financial year were \$840 million, and the NSW coal industry estimates that this will rise to \$1.3 billion in 2009-10. Most of this \$1.3 billion royalty is generated from just two local government areas, Singleton and Muswellbrook (Muswellbrook Shire Council 2009). Clearly there are economic

incentives for the State Government to allow unabated coal mining expansion in the Upper Hunter. With the prospect of ever larger royalties, the economic motivation *not* to conduct a health study was obvious enough to be commented on in the editorial of the *Herald*:

Cynics in the Hunter have often wondered if the Government – which benefits to the tune of several hundred million dollars a year from coalmining – may not want to examine the subject too closely. Calls for a health study of those affected by the immense dust output of the Hunter mines have been ignored. So have requests for an Upper Hunter office of the Environment Protection Authority...The Government doesn't argue against these calls: it just ignores them and keeps banking its royalty cheques (Herald (editorial) 2008a, 30 May).

Dependence of the State government on coal revenue from the Upper Hunter has contributed to residents' scepticism about the reasons why no health study has been forthcoming. One Singleton health professional stated: "Maybe they don't want to know... What if a study shows there is a problem? What will they do about it?" (Dr Tuan Au cited in Ray 2007, p.4). Whilst carrying the burdens of inequitable distribution of risks from industrial pollution, it is perceived that few of the actual benefits are returned to the area. The Singleton Mayor stated in 2006: "We've lost any power over mining developments, but we have to live with the consequences" (Ray 2006. 29 Sept, p. 4).

The predominance of economic considerations in decisions relating to the Upper Hunter was made explicit in early 2007 when the State government refused to accede

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to a recommendation from an Independent Panel of Experts examining a proposal by the Newcastle Coal Infrastructure Group (NCIG) (owned by coal producers) for a third coal loader for the export terminal at the Port of Newcastle. The Panel called for a levy per tonne of coal exported to be used to set up an “Ethical Trust” to research and compensate the Hunter community. The rationale for refusal was that the “Imposition of such a levy would place the operators of the NCIG facility at a distinct competitive disadvantage, compared to other facilities both within the Hunter and the State as a whole” (Department of Planning 2007, media release, 17 April).

Guy Pearse, speechwriter for the environment minister in a previous Federal Government, placed these decisions in context: a “greenhouse mafia” had captured key ministers by infiltrating deep into the bureaucracy to ensure the Prime Minister and his ministers only heard advice they wanted them to hear. Prominent amongst this group were executives of coal mining companies (Pearse 2009, p.38-40). Greens Party politicians have been among the few parliamentary advocates challenging the major party consensus on the issue of coal mining (e.g., see Strachan 2007; Wendt 2007). This situation reflects an important aspect of environmental injustice outlined by Lloyd-Smith and Bell, that political and resource inequities inhibit access by community members to government decision makers, compared to powerful industry interests (Lloyd-Smith & Bell 2003), and perpetuate the subordinate social position of community groups in social fields related to environment and health effects of corporate activities.

The Social Construction of Risk

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Upper Hunter medical practitioner Tuan Au described how his pleas for a “formal study” into the links between the volume of fine dust emitted by coalmines and respiratory and other problems were met with “strong denials” from NSW government and health officials, doubting that dust from open cut mining was harmful to health (cited in Ray 2007, p.4). A survey by the authors found that the official view and residents’ views contrast sharply. An Environmental Distress Survey, comparing the views of mining impacted (Singleton, N= 106) with non-impacted rural residents (Dungog, N= 97) found that only 4% of Dungog residents expressed “extreme” concern about dust, whereas over half of Singleton respondents (53%) found dust to be an “extreme threat”. Significantly, a far greater percentage of Singleton, compared to Dungog, residents agreed there was “a lot of asthma locally because of air pollution” (65% vs 12%) and that “environmental problems will cause illness to me or my family” (56% vs 19%) (Higginbotham et al 2006).

Risk communication consultants hired by industry promote different understandings of risk. Consultant Peter Sandman advises industry clients that risk has two components: “Call the death rate ‘hazard’; call everything else that the public considers part of risk, collectively, “outrage”” (Minerals Council of Australia 2005). “Outrage” is considered a risk to the company’s reputation and managed by public relations strategies, “not so much to regain trust as to function without it” (Covello & Sandman 2001, p. 166). A NSW Minerals Council director explains how to use industry-sponsored science to counter lay knowledge and deny risk:

- “Community perceptions to air quality do not correlate well with exposure to long term average PM₁₀ concentrations”

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- “Community perceptions also do not appear to correlate well with even quite extreme exposures to dust measured at a particular location”
- “It is likely that it is the visibility of dust clouds that is even more important than actual concentration to which the observer is exposed [for initiating concerns or complaints]”
- “In addition to undertaking best practicable means to control dust, it is desirable to visually screen mining operations as much as possible” (Smith 2004, p.48).

Control of Risk-Analysis Process

Despite the uncertainty of risk analysis, lay assessments are frequently discounted. Air pollution regulations are often formulated on the basis of limited or incomplete data. The NSW Minerals Council acknowledges the difficulties of estimating background concentrations for inclusion in impacts assessments based on dispersion models (NSW Minerals Council Ltd 2005). It can be added that the significant difficulties in accurately measuring Upper Hunter mining emissions, as well as identifying individual pollution sources (including ‘fugitive’ or non-smokestack emissions, bush fires and agriculture), means that published emission factors and equations “are approximate at best” (Metcalf & Bridgman 2005). Given the level of uncertainty in health risk analysis using such data, even with the best of intentions, it is ironic that lay assessments of risk are so vigorously dismissed. Lloyd-Smith and Bell (2003) see this as a means by which those in authority, and the experts they employ, seek to control the risk-analysis process during toxic disputes.

Self-Regulation of Air Quality Monitoring

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The NSW government classified the Upper Hunter as Level One category (pop <25,000) for ambient air quality monitoring (NEPM); consequently, there is no direct requirement for local monitoring of ambient air quality. Instead, monitoring requirements are built into licences for mines and major industry, which do not necessarily have to conform to ambient air quality standards (Metcalf & Bridgman 2005; Metcalfe & Bridgman 2003). Subsequently, air pollution monitoring has become more contentious, with residents arguing that regulatory standards are inadequate or not being policed. Between 2006-2008 the EPA recorded a sharp rise in the number of breaches by NSW coal mining companies. Over an eight year period (2000-2008) there were over 3000 licence breaches, with only 6 cases going to court (Cubby 2008). In the Hunter region alone, 27 coal mines breached their pollution licences 1041 times between 2000-2006. Environmental injustice through procedural inequity arises because decisions relating to the regulation of “licences to pollute” by coal mining are made by the NSW Department of Mineral Resources which, as a NSW Greens Party politician has stated, “has an inherent conflict of interest as both the state’s coal mining regulator and the primary mining advocate in NSW” (Rhiannon 2005, p.8).

Power stations in both the Upper and Lower Hunter are permitted by the NSW DECC to monitor their own air pollution as a requirement of their licences. DECC does not undertake independent audits of the power generators’ emissions; the Regional Manager stated: “Those reports are available to us, the data is publicly available...The bottom line is they’re pretty much always within their licence” (Cronshaw 2009, p.3). Furthermore, many residents identify the failure of monitoring procedures to take account of cumulative impacts. The Environmental Impact Assessments and

subsequent environmental monitoring requirements are geared to the operations of individual mining sites. Expansions to existing mines require even less rigorous assessments. The synergistic effects of mining, power stations and other point sources of air pollution thus remain uncalculated in the prevailing regime of company self-regulation.

Reluctance of Public Environmental Health Officials

Regional public health officials responsible for Hunter environmental health do not support a community-based study of residents' health as a means of assessing the impact of air pollution (Dalton 2003). Their rationale is that it is difficult to prove epidemiologically that local pollutants are causing an increase in disease incidence or mortality, especially in small populations, where excess cancer deaths may be as low as 2 per 10,000 people. In epidemiological studies, large highly exposed populations are used to identify health effects. Internationally, studies of this type combine data from 5, 6 or even several dozen large cities (e.g., Peng et al 2005; Pope et al 2009; Samoli et al 2005). 'Ecological' studies, comparing illness rates across locations, face a series of potential confounders in drawing causal influences; differences may be due to differences in smoking, social status, 'healthy workers', migration patterns, and so forth. Methodologists would not consider the routinely collected hospital separation data reliable for tracking pollution-linked disease incidence; they may reflect access to services or 'rate of activity' within those services. Random sampling to detect 'true prevalence' of illness in the region's population is expensive, and accurately measuring diseases (e.g., detecting asthma using a methacoline spray challenge into the lungs) is difficult. Similarly, measuring patient exposure to pollutants is complicated, whether done through personal monitoring devices or area-wide air

quality readings that need to be well placed, sampled frequently, and measure a range of emissions.

Opinion among Hunter public health officials is that environmental ‘health risk analysis’ is the preferred strategy to ‘protect’ the health of area residents from pollution. This requires a comprehensive network of ambient pollution monitors, including ultra-fine particle monitors (PM_{<2.5}), and comparing local air quality with international data on disease and mortality risk. Emissions of specific chemicals, toxic metals and particulate matter that exceed standards would be pinpointed along with the source points of pollution. Ideally, action would follow to protect the health of the public, and presumably the flora, fauna and waterways. However, under this strategy, the state environment protection authority (DECC) has responsibility for air quality monitoring, and the public health unit does not act until a high risk is detected. Since the Hunter’s environment authority has yet to establish a monitoring scheme, at present there is neither ‘risk analysis’ nor a health study under way. Over and beyond a risk analysis, the whole process of health impact assessment (HIA) should be systematically incorporated into a more cumulative assessment process (health, social, economic, technological and environmental impacts).

VII. Discussion and Conclusion

Health Inequity and the Precautionary Principle

Two key principles underpinning environmental injustice and health activism are cumulative impacts and the precautionary principle (Sze & London 2008, p.1338).

Indeed, the chairman of the 2008 Singleton public meeting that was held to lobby for

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a “health study and improved air quality monitoring” stated: “There is increasing anecdotal evidence of respiratory and other human health problems in the Upper Hunter and we feel it’s time people in authority took community concerns about the cumulative impacts seriously” (Maguire 2008b, 14 Nov, p.30). In common with residents fighting for environmental justice elsewhere in Australia, Upper Hunter residents are critical of authorities’ failure to include synergistic reactions or cumulative impacts in risk assessments. Moreover, authorities invoke technical and methodological barriers to deny residents a health study and adequate monitoring. To redress this situation, Brulle and Pellow argue for a paradigm shift toward use of the precautionary principle, whereby the burden of proof is placed on the pollution producers to show an absence of harm (Brulle & Pellow 2006, p. 115). Eyles and Elliot (2001) argue that, despite gaps in scientific understanding about environment and health links, the public’s health still needs to be protected. Policy makers have a duty to take action in relation to potential environmental risks to human health *before* all the evidence is in (Eyles & Elliott 2001, p.103).

Intergenerational Equity

Previously we have argued that “Human health, as a manifestation of social justice and equity, can also be seen as a major indicator of social sustainability” (Albrecht et al 2008). Inter- and intra-generational health equity concerns arise because of latency of disease onset associated with exposure to environmental hazards. For example, diseases like mesothelioma have long incubation periods. This means that exposure to pollution today might not translate into disease for many years or decades. Thus, the innocent and non-consenting (children and yet to be born) are exposed to a risk that might impact seriously on their life chances and might even kill them.

Procedural, Geographic and Social inequities in Health

In describing environmental injustice in Australia, Lloyd-Smith and Bell note three categories of inequity: 1) “procedural inequity” involving refusal to accept the community as stakeholder or to consider residents’ concerns; 2) “geographic inequity”, where certain areas are burdened by industrial pollution but receive few benefits; and 3) “social inequity” where decisions that result in environmental degradation reflect power arrangements of society generally, so that powerless communities are selected to become “sacrifice zones” (Lloyd-Smith & Bell 2003, p.21). All three dimensions of environmental inequity apply to the Upper Hunter. An obvious example is the NSW State Government decision to site coal-fired power stations away from the Sydney region. A NSW Legislative Council enquiry into the health impacts of air pollution in the Sydney basin concluded that this decision resulted in the concentration of sulphur dioxide from industrial sources declining in the Sydney basin, but “higher concentrations” are recorded in the Hunter region (NSW Legislative Council 2006, p.20).

The residents of the heavily polluted Upper Hunter region face serious obstacles in their quest for rigorous air monitoring and a health study. These include the interdependence of state government and corporations in reaping the economic benefits of coal production and export, lack of political will and regulatory inertia, as well as study design and measurement issues. Residents articulate their embodied experiences of malaise and illness from a disempowered position in the social field of mining and coal-related air pollution. Their experiential knowledge is discounted against dominant positions of industry and government that use state-sponsored

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science and regulatory regimes to deny, minimise or obfuscate the link between dust and disease. We argue that environmental injustice and health inequity in the Upper Hunter has arisen because political economic interests outweigh concerns about long-term damage to the health of this relatively small (<40,000) and electorally insignificant rural population. Governance issues, including decisions relating to the siting, regulation and supervision of coal mining and combustion in the Upper Hunter, have been instrumental in residents' being disproportionately exposed to health risks from air pollution. It is apparent that positions in the field are shifting as residents' pressure gains momentum and resonance in other social fields such as local government, green politics and mass media, while companies are in a more defensive position, not because of local health impacts, but because of the emergent societal concern about coal combustion, climate change and inadequate government policy responses.

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