Submission to NSW Dept of Planning & Infrastructure

Opposing PWCS T4 Coal Loader

2 May, 2012

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Summary

- As public health professionals, we regard the Port Waratah Coal Services Terminal 4 development as a significant threat to public health.

- When the Port of Newcastle reaches the planned 331 Mtpa in coal exports, coal train movements from the Port of Newcastle to Muswellbrook and beyond will triple, with **108,000 coal train pass-bys per year (one every 4.9 minutes)** in some townships. This increase poses **health risks for residents living alongside the rail corridor from exposure to fugitive coal dust, diesel engine exhaust and train noise**. T4 will contribute 39,344 of these annual train pass-bys.

- Significantly, the EA has not modeled the **cumulative impact** of adding fugitive coal dust and other pollutants into the air surrounding the rail corridor. For T4 bound trains it gives PM10 estimates from loaded coal trains up to **only 20 m** beside the tracks (a projected additional up to 13 ug/m3, 24 hours). Exposures for residents up to 300 m away should be modeled.

- The EA **fails to assess baseline air quality along the rail corridor** and how it will be affected by all train movements when the port is operating at 331Mtpa. **Emissions modeling and actual measurement are essential to report the cumulative impact of this continuous flow of trains in terms of PM10, PM2.5, diesel combustion pollution, and concentrations of Ultra Fine Particles**. Modeling should include both the residual coal dust in unloaded wagons, as well as coal dust accumulated around the tracks over time that becomes airborne by the passage of trains.

- By 2020, residents near rail lines will be exposed to **an almost continuous intrusion of train noise and vibration.** Round the clock movements will include 135 nightly pass-bys (32 added by T4) when most residents are trying to sleep (between 11pm and 7am). Sleep is a biological necessity and disturbed sleep from intrusive noise has adverse

health impacts, especially among children, the chronically ill and elderly, pregnant women, people under stress and shift workers.

- The EA states that rail noise increases at night will push the **60dBA level impact zone from 320 m to 370 m from the tracks.** This will increase significantly the number of residents exposed to noise disturbance. In 2009 the European standard for night noise was set at 40dBA.

- The proponents state that T4 operations, with 120Mtpa of coal loaded onto 1,379 vessels annually at five berths, will achieve acceptable levels of dust emissions (PM10 & PM2.5) for surrounding residents. **Critical flaws in dust modeling** cast serious doubt on these predictions as they are based on assumptions about weather conditions, the accuracy of other projects' emissions estimates, and fidelity of implementing 'world best practice' dust mitigation control operations, continuously, without fail.

- The EA **does not provide a Health Impact Assessment** whereby population profiles of affected residents near the Kooragang site and rail corridor are defined and potential health impacts, especially on vulnerable groups (children, those in aged care facilities, people with existing respiratory and cardiovascular morbidity) assessed. Many of the local areas affected by the T4 include low income and elderly residents, who are most disadvantaged in terms of health status and who are most vulnerable to the added impacts of air and noise pollution.

- The EA air quality modeling is inadequate to protect the public's health because it **fails to include risk information about short-term exposures to particulates**, which, over a period of even a few hours, can trigger cardiovascular-related mortality and morbidity, as well as adverse respiratory events. Even 15 minutes of exposure to diesel exhaust at 300ug/m3 produces significant cardiac ECG changes in susceptible people. Peaks of this magnitude can frequently be hidden within a 24 hour average of less than 50ug/m3.

- T4 provides the necessary conditions for burning 120Mtpa of black coal, producing **298.6 million tonnes of CO_2 or 55% of Australia's current CO_2 emissions**, and almost twice NSW's total emissions. In global terms, 298.6 mt of CO_2 is about 60% of the CO_2 that was added to the atmosphere globally in 2010 beyond the 2009 levels. This is a significant contribution to the **health damaging effects of global warming**, in Australia and overseas, produced through greenhouse gases.

- Australian Academy of Technological Sciences and Engineering estimates that the monetary costs of damages to health due to the pollution from coal-fired power stations in Australia is $2.6 billion per annum, or $13/MWh. The T4 coal is destined to be burned in foreign countries and we are concerned that this health burden will fall on the population of those countries. The 120mt of T4 coal when burned will create costs associated with pollution damage to human health of $11.7 billion.

I. Introduction

As a group of Newcastle public health professionals, who teach medical and public health students, conduct public health research, and, in some cases, provide direct clinical care, we oppose the proposed Port Waratah Coal Services Terminal 4 development based on its significant threat to public health.

Our review of the proposal from a health perspective has identified 5 critical flaws in the EA that merit the project's rejection. These are:

- unsafe assumptions underlying air quality monitoring;
- failure to provide a Health Impact Assessment of vulnerable populations;
- failure to consider cumulative impacts of increased pollution from coal wagons and diesel locomotives on populations living near the rail corridor;
- failure to consider research linking short term particulate exposures and morbidity/mortality; and ,
- neglect of the adverse health outcomes associated with global warming contributed, in part, by mining, transporting, and burning coal.

II. Unsafe assumptions of the EA air quality modeling.

The EA assumed in its modeling of air quality associated with site operations that: 2010 meteorological conditions will prevail into the future; that an array of world best practice dust suppression practices will be followed without fail; and that the environmental assessment data from 5 approved future developments and expansions are accurate.

First, meteorological analyses used by Hunter councils (Blackmore & Goodwin, 2008, 2009) have found that the projected frequency of weather patterns responsible for extreme storm events along the NSW coast are likely to increase, suggesting a higher probability of an east coast low formation during autumn/winter. Projected increases in the synoptic pattern linked to high maximum temperatures during summer and autumn are likely to result in an increased frequency of extreme heat days in both coastal and central zones by 2020. Such extreme weather events, ironically brought on in part by CO2 from burning coal, would potentially exacerbate pollutants escaping from the site, leading to more days exceeding air standards than estimated based on 2010. Adding the turbulence of future weather patterns to the modeling is essential. In particular, higher temperatures with predominantly westerly winds, drying the air and blowing dust, will pose greater risk of higher particulate levels.

Second, air quality monitoring was based on presumed dust suppression practices at the site that proponents stated will (or should) be implemented during operations (Table 12.10, pg 242, Chpt 12). A reasonable person who has lived near an industrial site will be highly skeptical that all of the 8 dust measure systems listed on page 242 will be implemented with fidelity on all occasions without fail. Despite the best intentions of managers, breaches do occur, and can lead to spikes in pollution. This recently occurred with ammonia releases from Orica reaching residential areas of Mayfield, leading to people being overcome by fumes (Sydney Morning Herald, 3/1/12).

Moreover, it would be difficult to estimate accurately, across all those suppression measures, how much each contributes individually (or collectively) to a reduction in particulates escaping into neighbouring areas. Table 39 (pg. 72) in the Air Quality Assessment presents the estimated control efficiencies for 6 dust suppression techniques, which range from 25% to 85% efficiency. With all these measures operating, the site still produces **0.8 tonne of TSP per day**. Should they not suppress dust as predicted there could be up to **2 tonnes of TSP per day** emitted from that site. Wind erosion of the stockpiles is 50% even with dust suppression, indicating that the stockpiles should be enclosed. More realistic particulate concentrations should be presented, based on real vs ideal suppression possibilities, in order for a proper assessment of the project to be made.

Third, the cumulative concentration of air pollution is based on taking into consideration the EA data from five other approved development sites. Given the goal of all EA applicants is to

minimise the estimated level of their predicted pollution contribution (as above), or to argue that they will reliably apply pollution control procedures, it can be concluded that this T4 EA underestimates significantly what the actual pollution levels will be when all these sites are operational. One of the proponents included in the five sites is Orica. The findings of the NSW Parliamentary Inquiry on the Kooragang Island Orica chemical leak stated that the approach by the company was grossly inadequate to address the potential impact of the leak and that there was an inadequate response by the company to the incident.
http://www.parliament.nsw.gov.au/Prod/parlment/committee.nsf/0/2aaffe5684a88ac6ca2579ac007c4430/$FILE/120223%20Orica%20Report.pdf

It is therefore difficult to trust in the information on projected pollution levels promised by these operators.

III. Missing Health Impact Assessment

Appendix D acknowledges the (deep and long held) concerns of Hunter residents about the health risks from air pollution associated with coal mining, transport and burning. It is widely recognized that these industries have imposed a risk to human and environmental health that is unparalleled elsewhere in NSW if not Australia (Higginbotham, et al 2010). NSW Health has recently responded to community sensitivities on this issue with a series of health reports and by setting up of the air quality monitor network in the Upper Hunter. This response recognizes that mining-affected residents of the Hunter expect, and will energetically pursue, a trustworthy health impact study associated with developments such as the T4. Consequently, the bar has been raised in terms of what is acceptable EA practice from the community's viewpoint. Air quality modeling alone is not sufficient. **A proper best practice Heath Impact Assessment, that includes equity aspects, is required** as an essential component of the EA. Doctors for the Environment Australia (DEA) has argued strongly for adoption of the 2001 Health Impact Assessment guidelines under which development proponents "explicitly address potential impacts on human health."

http://dea.org.au/images/uploads/submissions/MDB_CSG_Senate_submission_June_2011.pdf

Australian experts in this field (e.g., Harris and Harris-Roxas, 2010), have long engaged with government stakeholders showing how to add assessment of human health in project EAs. An appropriately designed Health Impact Assessment of T4 will undertake the following: a) Set up a steering committee involving health experts, community stakeholders, and project personnel; b) develop a population profile of affected residents (both around the site and all along the rail corridor; c) collect information on potential health impacts affecting vulnerable groups such as children, the elderly, pregnant women, people in aged care facilities, schools, as well a profile of those with pre-existing morbidity; d) critically assess the information and prioritise health impacts; e) develop recommendations for project proposal modification.

The current EA gives only general census data about Newcastle LGA. This is wholly inadequate for anticipating health impacts on nearby vulnerable residents, based on their demographic and current health status profile. Many of the local areas affected by the T4 include low income and elderly residents, who are most disadvantaged in terms of health status and who are most vulnerable to the added impacts of air and noise pollution. This entire dimension of understanding of the project's impact is left out and that is unacceptable to best practice and community expectations.

IV. Significant increase in Uncovered Coal Wagons Along Rail Corridor

The EA downplays the significant adverse health risks from fugitive dust emissions, diesel engine exhaust (DEE) and noise caused by the sharp increase in train movements along the rail corridor from Muswellbrook to the Port.

It fails to put the modeled emissions (an additional 13 ug/m3, 24-hour PM10 concentrations from uncovered wagons) into a cumulative emissions context. The EA does not give PM2.5 estimates or combustion-related emission concentrations from the diesel locomotives.

Moreover, dust from residual coal in unloaded wagons making the return trip to the mine sites were not included, nor the return trip diesel exhaust.

These are significant omissions. Based on each train carrying a maximum of 6,100t of coal (as per EA Air Quality Assessment pg 192), and the port capacity achieving over 330Mtpa by 2022, then many **residents living in proximity to the rail corridor can expect at least 108,000 coal train movements past their houses per year** (i.e., 54,000 round trips) with T4 trains contributing 39,344 of these total pass-bys.

Oddly, the EA states that T4 will require 92 daily train movements or 33,580 per year (32 of these each night). This figure, shown in Table 47, pg 60 (Noise & Vibration Impact Assessment), appears to significantly underestimate the movements and should be explained. Table 47 shows 254 daily coal train pass-bys in areas close to Newcastle (92,710 per year). With the addition of passenger and freight trains, it states there will be **388 daily** train movements (i.e., approximately 140,000 per year). **Community consultation by all the affected townships and LGAs about this proposed burden on environmental health must be carried out** prior to a determination of the T4 EA.

(A) Poor air quality.

Further emissions modeling or actual field measurements must also be carried out to report the cumulative impact of this continuous flow of all train movements in terms of PM10, PM2.5, diesel combustion pollution, and concentrations of Ultra Fine Particles. Modeling should include both the residual coal dust in empty wagons, as well as coal dust accumulated around the tracks over time that becomes airborne by the passage of trains. The 'uncovered' wagon estimates are most appropriate to anticipate risk.

The combined diesel combustion (plus un-combusted diesel) and dust emissions could generate unacceptable concentrations in some areas and during certain weather conditions. Diesel engine exhaust (DEE) is classified as a probable human carcinogen. In Great Britain, DEE was the sixth most important occupational carcinogen, contributing 8.1% of the deaths and 5.9% of the cancer registrations (Rushton, 2010). Rushton (2012) reviewed recent DEE studies, noting a sharp rise in cancer risk at lower levels of diesel exhaust; background levels as little as of 1–2 µg/m3 were still likely to carry a small excess risk. Substantial proportions of the population exposed at these low levels, would thus contribute to the burden of cancer from DEE. He argues that reduction of DEE in the general environment, not just occupational control measures, is becoming increasingly important and is essential if the health of large numbers of people is not to be compromised.

Australian air quality authority Lidia Morawska (2010) has voiced considerable concern about diesel engine exhaust along Sydney's highest polluting motorways. In the M-5 tunnel, for example, hourly heavy diesel vehicle (HDV) traffic volume was a very good determinant of health damaging Ultra Fine Particle concentrations (Knibbs, 2009). She warned that the levels of ultrafine particulate matter were so high that motorists suffering asthma, chronic pulmonary disease or influenza would feel its effects ''immediately or very soon after'. ''Even in a healthy person, with none of those conditions, chronic exposure in the form of using the tunnel daily for a year or two could lead to respiratory problems.''). http://www.smh.com.au/national/m5-east-pollution-harming-asthmatics-20090827-f183.html#ixzz1sI6anIna

Morawska's research raises the question of what Ultra Fine Particle concentrations will arise with the ultra heavy diesel locomotives operating at high frequencies along the rail corridor?

Furthermore, as described above, a Health Impact Assessment on the populations exposed to these emissions along the track corridor must be performed. Figure 1F in the Air Quality Appendix (pg. 193) indicates that residents up to 150 m from the rail line are expected to have a continuous inflow of some TSP concentrations. But, we also expect those living further away will be exposed to PM2.5 emissions and smaller particulates. Morawska (2010) has found that "in terms of their number concentration, exposure to airborne particles is significantly increased within the first 100 meters from the road, compared to average urban exposure levels, and usually decreases to the urban background level at distances greater than 300 m from the road."

We need information on how many residents are within the range of particulate exposures coming from these trains based on Morawska's (2010) criterion of 300 m not the 20 m suggested by the EA. We need to understand the exposed population's age and social status, the profile of illnesses in these areas and so forth. Of particular concern are those with existing respiratory illnesses (especially children) and cardiovascular disease. NSW HNE Health data for areas affected by coal mining and power generation show higher rates (compared to State averages) of hospital attendance for respiratory conditions, including asthma, cardiovascular disease and deaths from all causes and cardiovascular disease (NSW Health, May 2010). The Upper Hunter Air Quality Monitoring data show that the existing ambient air quality of several of the townships along coal freight lines can be poor. For example, 24-hour standard exceedances were recorded in 2011 for PM10 in Singleton and PM2.5 in Muswellbrook (Dalton, et al 2011), and the poor air quality in Camberwell is well documented.

(B) Physical and Mental health impact of noise.

Of considerable importance is establishing the adverse health impacts on residents exposed to an increased (almost continuous) frequency of intrusive **train noise and vibration.** The increased frequency of trains means that there will be round the clock movements. The EA expects, for example, 135 nightly pass-bys (32 added by T4) when most residents are trying to sleep (between 11pm and 7am) (Table 47, Noise Assessment). The health impact of the night time cumulative intrusion of noise in particular must be assessed.

World Health Organization Europe (2009) recently reviewed night time noise impacts and set a new nighttime **standard of 40dBA** to protect the public from adverse health effects of night noise, particularly vulnerable groups such as children, the chronically ill and the elderly, but also, pregnant women, people under stress and shift workers.

The scientific review concluded that:

• Sleep is a biological necessity and disturbed sleep is associated with a number of adverse impacts on health. The review found sufficient evidence:

1. for biological effects of noise during sleep: increase in heart rate, arousals, sleep stage changes and awakening;
2. that night noise exposure causes self-reported sleep disturbance, increase in medicine use, increase in body movements and (environmental) insomnia;
3. Environmental insomnia leads to further consequences for health and wellbeing.

• Less conclusive evidence was found that:

1. disturbed sleep causes fatigue, accidents and reduced performance;
2. noise at night causes hormone level changes and clinical conditions such as cardiovascular illness, depression and other mental illness. A plausible biological model is available with sufficient evidence for the elements of the causal chain (WHO Europe, 2009).

The EA acknowledges that rail noise will increase by 1.5dBA during Stage 3 operations, and that this will add to rail noise levels that currently exceed OEH trigger levels and EPL goals at houses less than 130m to tracks (daytime 65dBA) and less than 370 m from tracks (nighttime 60dBA). The project impact during nighttime (LAeq(9hour)) will increase trigger levels and goals by up to 50m (60 dBA levels move from 320 m to 370 m from tracks).

It is critical to identify the number of houses within the 370 m nighttime noise impact zone and assess the population's vulnerability. If the 2009 European standards for nighttime noise were adopted **(40dBA),** there would be far more houses in the night noise disturbance zone. This is a major public health issue that must be mitigated with sound barriers all along the residential areas exposed.

The list of towns and suburbs through which these trains pass is substantial, with many residents living within 200 m of the tracks. These include: Warrabrook, Sandgate, Hexham, Tarro, Beresfield, Thornton, Metford, East Maitland, South Maitland, Maitland, Telarah, Rutherford, Allandale, Greta, Branxton, Belford, Whittingham, Singleton, Darlington, Singleton Heights, Camberwell, Muswellbrook, Aberdeen, Scone, Murrurundi and all the way to Narrabri.

In addition, trains servicing the Carrington Coal Loader pass adjacent to the University of Newcastle, Callaghan, then through densely populated urban areas of Waratah, Mayfield, and Tighes Hill. Each of these townships is a stakeholder in the decision about the sharply increased train traffic. Indeed, a proposed $66m retirement and aged-care complex at Shortland Waters golf course was just announced. The map shows it borders the rail line to Carrington and lies within 400 m of the line to Kooragang coal dumps.

The particulate impacts of these pass-by and noise level increases need to be fully understood and analysed by health authorities before the project can be further considered. Community and LGA consultation that fully explains this issue is essential. The EA listed figure of 100 houses only being affected is implausible, and the magnitude of impact presented in the EA is inconsistent with both the available data and the current scientific literature.

V. Inadequacy of Air Quality Standards

Through the transportation and loading of 120mtpa of coal, T4 will impose additional unwelcomed health risks from particulates, combustion gases, and noise on residents living near the port and railway lines. Residents shouldering an excess burden of environmental ill health should have a significant say in the final decision. If this does not occur, then by definition, the government has imposed environmental injustice on these citizens, which is intolerable in a society valuing democracy and fairness.

(A) Literature Review

A key question is whether air quality standards adequately protect the Newcastle urban and Hunter township communities from the impacts of T4 operations, particularly residents more vulnerable to the effects of increased pollution due to their age, existing health status, economic circumstances, housing conditions, and proximity to the rail and port. The EA concludes that current standards are adequate because coal dust (referred to obliquely as 'particles derived from mechanical attrition processes') is less toxic than combustion-related particulates found in urban areas, which agencies used as the basis for setting PM10 limits. The EA also concludes that particle size may be more important than composition in determining health effects, implying that coal dust, which is larger, will have less effect on health than any particulates that are smaller.

We found the literature cited in the EA review did not justify these conclusions. Both types of particulates are toxic but may produce a different disease pattern (David Shearman, personal communication, 23 April, 2012). The review was at best superficial and distorted the findings of several studies that were cited. For example, the EA cites the National Institute for Occupational Safety and Health (NIOSH, 2010) literature review to support the point that coal dust does not cause cancer. Yet, the NIOSH report notes that “Lung cancer has been suspected to arise in coal miners because of their exposure to crystalline silica dust, which is a Group I carcinogen (p. 25). Thompson et al (2007), cited in the EA, state that ‘coalmine dust….[is a] mixed dust that includes silicates and small concentrations of crystalline silica…the toxicity of coal lies between that of titanium and silica” (p145). Moreover, NIOSH (2010), while noting conflicting findings linking coal dust and lung cancer, did find a recent British coal mining study which included cumulative crystalline silica dust exposures. This study, by Miller & MacCalman, (2010) found evidence of an association between increased risks of lung cancer and increased quartz exposure, particularly at a lag of 15 years. (It is worth noting that NIOSH (2010) reported a rising prevalence of Coal Workers’ Pneumoconiosis (CWP). Younger workers are developing CWP, which may be caused, in part, by increases in crystalline silica exposure. This increase is occurring despite the Coal Mine Health and Safety Act.

Second, the EA referes to a study by Hendryx & Ahern (2008) linking health survey data on 16,400 West Virginia residents with proximity to coal production. This study found an effect on COPD, cardiopulmonary and lung disease, among others. The EA dismisses the value of this study by repeating a list of criticisms written by Entech (2010) on behalf of Scottish Coal. The EA misses an opportunity to explore the value of Hendryx & Ahern’s body of work in this field and to describe the trends in their population-based approach to linking proximity to coal production with mortality and morbidity. Hendryx & Ahern’s initial survey was a “screening test to examine whether coal mining poses a health risk for adults living near the mining sites." They followed up this study with further research examining elevated lung cancer mortality in Appalachian coal mining areas; elevated mortality from heart, respiratory, and kidney disease in these areas; and, most recently, the association between mountaintop mining and birth defects among live births in central Appalachia, 1996–2003 (Hendryx, 2009; Hendryx, O'Donnell, & Horn, 2008; Ahern & Hendryx, et al., 2011). Interestingly, NIOSH (2010) found that Hendryx & Ahern's study area was a 'hot spot' for re-emergence of Coal Workers' Pneumoconiosis.

One further example of the distortions evident in the EA literature citation is the statement (p. 199) that Thompson et al's (2007) "key outcome" was their recommendation to adopt a 24-hour maximum PM10 criterion of 70 ug/m3 at Port Hedland because the mining dust is less hazardous than combustion derived pollution in urban areas. A close reading of the Thompson et al. document suggests that they would have recommended a more stringent level had the local dust been from coal mining. Significantly, their "most important" recommendation was that "reliable, valid data should be collected in order to inform future decisions." This was warranted because, "In the absence of informative data, it is difficult to reach a conclusion regarding an Air Quality Standard that would be appropriate for the Port Hedland community (p146)." The "interim" standard of 70 ug/m3, appeared to have been very reluctantly made, and was based on the standard suggested by a 2005 US EPA Clean Air Science Advisory Committee for the USA.

(B) Short term Pollution Effects Must be Considered

We believe current standards, and the modeling approach adopted for this EA, are inadequate to protect the public's health because they fail to include risk information about short-term exposures to particulates, which, over a period of even a few hours, can trigger CVD-related mortality and nonfatal events including MIs, heart failure, arrhythmias, strokes, and adverse respiratory events. Experimental work has demonstrated that even 15 minutes of exposure to diesel exhaust at 300ug/m3 produces significant cardiac ECG changes in susceptible people.

Peaks of this magnitude can frequently be hidden within a daily mean of less than 50ug/m3 (Mills, 2007).

Experimental, clinical, and population data demonstrate the necessity of considering short-term exposures in planning decisions, and informing the public of air quality hazards on a continuous monitoring basis, rather than 24 hour averages which mask possible pollution spikes. Such an approach is supported by research findings showing that, in terms of the relationship between particulate concentrations and adverse health endpoints: a) there is no threshold in response; b) the response is linear; c) despite the differences in particle composition, the response is similar over different geographic settings (Morawska, 2010, citing Pope & Dockery, 2006). Moreover, Pope & Dockery's (2006) comprehensive review found that numerous researchers using various methods, consistently observe adverse mortality associations with short-term elevations in ambient particulates.

Other research supporting the significance of considering short-term exposures includes McCreanor et al (2007) who found clinical effects of traffic-related pollutants among persons with asthma. Asthmatic adults walking for only 2 hrs along a street in the center of London had a significant decrease in lung function as opposed to walking in a nearby park. In Darwin, Johnson et al (2006) examined the relationship between particulates generated by deliberately lit vegetation fires and daily respiratory health in 251 adults and children with asthma over a 7-month period. PM10 ranged from 2.6 - 43.3 ug/m3 and was significantly associated with onset of asthma symptoms, commencing oral steroid medication, the mean daily symptom count and the mean daily dose of reliever medication. The importance of this study was that there was only 1 exceedence of the 50ug/m^3 PM10 standard during the study period. It documented significant adverse health effects well below the accepted air quality standard for PM10 particulates. (See also Morawska's statements above about the M5 tunnel.)

Weinmayr et al. (2010) completed a meta-analysis of the short-term effects of PM10 on respiratory health among children with asthma (mean 24 hour average for PM10 ranged from

11- <100ug/m3). Across 36 studies in the analysis, they found clear evidence of effects of PM10 on the occurrence of asthma symptom episodes, and to a lesser extent on cough and PEF, and conclude that there is a need to protect asthmatic children with strict air quality standards for PM10.

Complementing the respiratory studies is the 2010 Scientific Statement from the American Heart Association reviewing new evidence linking short term PM2.5 exposure with cardiovascular disease (AHA, 2010). They conclude that short-term exposure to PM2.5 over a period of a few hours to weeks can trigger CVD-related mortality and nonfatal events among susceptible individuals (including women and obese). The PM2.5 concentration—cardiovascular risk relationships for short-term exposures appear to be linear (monotonic), extending below 15 ug/m3, **without a discernable 'safe' threshold.** Thus, public health benefits would accrue from lowering the PM2.5 concentrations even below the present day USA standards. Many potential biological mechanisms exist whereby PM2.5 exposure could exacerbate existing CVDs and trigger acute events over the short term. They conclude that the evidence is consistent with a causal relationship between PM2.5 exposure and CVD morbidity and mortality.

In sum, health effects occur even at exposure levels below current air quality guidelines, and for many pollutants, it is unclear whether a safe threshold exists. The burden of disease is proportional to the level of exposure. These findings appear the same in all communities studied throughout the world (Shearman & Selvey, 2012; and http://dea.org.au/images/general/DEA_Air_Pollution_Policy_03-12.pdf).

VI. Cost of Global Warming from Burning 120mtpa of Coal

The EA report obscures the impact of Scope 3 GHG emissions by placing it in the context of expected 2030 global emissions. From the EA, readers would not understand that burning 120mtpa of black coal, which produces 298.6 million tones of CO_2, is actually about 55% of Australia's current CO_2 emissions (550mt), will be 37% of Australia's projected CO_2 emissions in 2030, and is almost twice NSW's total CO_2 emissions (161mt in 2009). In terms of today's decision-making, this project alone will export about half of our current CO_2 GHG burden to other countries. Ironically, given global warming is a planetary problem, combustion of this coal will boomerang to affected Australia, which is especially vulnerable to global warming effects, as described below.

(A) Health Costs (Externalities).

Economists and public health experts have collaborated to estimate the monetary costs of public health damages due to coal mining and combustion (i.e. externalities). More broadly, however, Yale University economists have estimated air pollution damage from different USA industries (Muller, et al. 2011). Solid waste combustion, sewage treatment, stone quarrying, marinas, and oil and coal-fired power plants have air pollution damages larger than the monetary value they add to the general economy. The largest industrial contributor to external costs is coal-fired electric generation, whose damages range from 0.8 to 5.6 times the economic value added by the industry (Muller, et al. 2011). In other words, the public health costs of treating disease caused by coal-fired electricity is between 0.8 and 5.6 times the value of the electricity that is produced. Similarly, a group coordinated by Harvard Medical School estimated the public health burden in mining communities and from air pollution from combustion to be $75 billion and $188 billion respectively in the USA (Epstein, et al., 2011).

The Australian Academy of Technological Sciences and Engineering (ATSE, 2009) estimated that the total health damage cost from coal-fired power station emissions in Australia is about $A2.6 billion per annum based on a figure of $13/MWh. Researchers found that the ExternE methodology for estimating health damage costs of emissions in Europe is applicable to Australian power stations, and that reasonable relative cost estimates result when the methodology is used to scale down health damage in proportion to Australia's lower population density. A senior Sydney University political economist independently reviewed the ATSE modeling, along with the two American studies, and concluded: "The estimates of externalities provided by Muller, et.al., and Epstein, et.al., are generally accepted within academic debate and probably err on the conservative. The ATSE report does this in effect." (Dr. Stuart Rosewarne, personal communication, 22 April, 2012).

If the figure of $13/MWh is applied to burning 120mtpa from T4, the adverse public health impost of this combustion would be <u>$11.7 billion dollars per annum in Australia</u> (assuming 1 tonne black coal generates 7.5MWh; thus, T4 exports produce 900 million MWh x $13/MWh). Japan, Korea and China are the likely combustion locations for the exported coal. Their higher population densities would increase levels of health damage, while their health care systems costs are likely to be both more expensive (Japan) and less expensive (Korea, China) than ours. On balance, therefore, these health damage costs may well be applicable.

(B) Health Impacts

The World Health Organization also regards climate change as one of the greatest threats to public health, as it will affect a number of the basic determinants of health (clean air and water, food security, levels of disease vectors, etc), especially in countries with lower incomes. Current estimates for global annual deaths attributable to climate change are 300,000 to 400,000 (DEA, 2011). As with increased particulate concentrations, it is the elderly, the very young, the pregnant, the poor and the chronically ill who are most vulnerable to the impacts of global warming.

Haines et al. (2006) describe the pathways by which climate variability and change produce a range of adverse health effects, including heat stress, storm injuries, enhanced air pollution illnesses, vector-borne infectious diseases and diarrhoeal diseases. Most critically, extremes of temperature and rainfall (e.g., heat waves, floods, drought) will have direct immediate effects on mortality. Biodiversity and the ecosystem goods and services that we rely on for human health will be detrimentally affected. Sea level rise, flooding and environmental degradation will lead to population displacement and more environmental refugees (Haines, et al., 2006). In particular, interruption of food security will directly and indirectly lead to increased mortality in developing countries.

CSIRO (2011) describes future Australian climate scenarios. The best estimate of annual average warming by 2030 (above 1990 temperatures) is around 1.0ºC across Australia, with warming of 0.7–0.9ºC in coastal areas and 1–1.2ºC inland. By 2070 warming is expected to be between 2.2ºC and 5ºC. Recent emission observations by the US Department of Energy confirm that the 2007 IPCC worst-case emission trajectories have been exceeded (http://cdiac.ornl.gov/trends/emis/perlim_2009_2010_estimates.html).

Drying is likely in southern areas of Australia, especially in winter, and in southern and eastern areas in spring, due to a contraction in the rainfall belt towards the higher latitudes of the southern hemisphere. Changes in summer tropical rainfall in northern Australia remain highly uncertain. Intense rainfall events in most locations will become more extreme, driven by a warmer, wetter atmosphere. The combination of drying and increased evaporation means soil moisture is likely to decline over much of southern Australia. An increase in fire-weather risk is likely with warmer and drier conditions (CSIRO, 2011).

For Australia, heat waves are likely to have a major impact on human health (CSIRO, 2011). Heat-related deaths for people aged over 65 in six of Australia’s largest cities are likely to increase from around 1100 per year at present to around 2300–2500 by 2020 and 4300–6300 by 2050 (allowing for demographic change). During a 2-week heat wave in early 2009, 374 heat-related deaths were recorded in Victoria. While most attention is focused on extreme heat events, there is also the chronic effect of increased heat loads, which is exacerbated in urban environments by the urban heat island effect.

Australia can expect an increase in disease due to the spread of insect vectors, with 0.6 to 1.4 million more people exposed to dengue fever by 2050, as well as a rise in waterborne and food-borne diseases. Higher temperatures are likely to cause an increase in the concentrations of volatile organic compounds (VOCs) and ozone in the atmosphere. An analysis of future climate found that under a relatively high emission scenario, increased ozone pollution is projected to cause a 40% increase in the projected number of hospital admissions by the period 2020–2030, relative to 1996–2005, and a 200% increase by the period 2050–2060 (CSIRO, 2011). The T4 EA did not provide any estimates of ozone pollution.

In 2010, the world released about 512 million tonnes more carbon into the air than it did in 2009, an increase of 6 per cent http://cdiac.ornl.gov/trends/emis/perlim_2009_2010_estimates.html).

In this context, T4's annual 298.6 mt of CO2 would be equivalent to about 60% of the CO2 that was added to the atmosphere globally in 2010 (beyond the 2009 levels).

In summary, while T4 will not directly combust the 120mtpa of black coal, it will create the **necessary conditions** for doing so, and is therefore directly causally linked to consequent adverse health conditions, and their costs, affecting Australia and other nations.

VII. References

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