GLOUCESTER RESOURCES LTD

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Part 2C: Peer Review of the Air Quality and Health Risk Assessment and Socio-economic and Noise Assessments

Prepared for: R.W. Corkery & Co. Pty Limited
1st Floor, 12 Dangar Road
PO Box 239
BROOKLYN NSW 2083

Tel: (02) 9985 8511
Fax: (02) 9985 8208
Email: brooklyn@rwcorkery.com

On behalf of: Gloucester Resources Limited
Level 37 Riverside Centre
123 Eagle Street
BRISBANE QLD 4000

Tel: (07) 3006 1830
Fax: (07) 3006 1840
Email: gpolwarth@amci.com.au

Prepared by: A. Prof. D. McKenzie
RANDWICK NSW 2031

Email: mckenziedk@gmail.com

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ROCKY HILL COAL PROJECT

GLOUCESTER RESOURCES LIMITED

PEER REVIEW OF HEALTH ASSESSMENT, AIR QUALITY AND HEALTH RISK ASSESSMENT AND SOCIO-ECONOMIC ASSESSMENT

PREPARED BY

ASSOCIATE PROFESSOR DAVID McKENZIE

1. INSTRUCTIONS

1.2 This report has been prepared on behalf of RW Corkery & Co. Pty Ltd to form part of an Environmental Impact Statement for the above project.

1.3 This report has been prepared having regard to Division 2 of Part 31 of the Uniform Civil Procedure Rules 2005 and the Expert Witness Code of Conduct in Schedule 7 of the Uniform Civil Procedure Rules 2005. I have read these provisions and agree to be bound by them.

1.4 In preparing this report I have reviewed the following material:

(a) EIS Executive Summary - RWC;

(b) Health Risk Assessment - Toxikos;

(c) Extracts from the Air Quality Assessment – Pacific Environment Limited;

(d) Extracts from the Socio-economic Assessment - Key Insights;

(e) Noise, vibration and blasting assessment.

1.5 I have been instructed to review the above documents and provide a peer review of the assessments with particular emphasis on any health related issues for the residents of Gloucester with respect to open cut coal mining and the air quality projections contained in the Air Quality Assessments for the Rocky Hill Coal Project.

1.6 I am a Respiratory Physician with 30 years clinical experience and considerable expertise in occupational lung disorders and airborne pollution. I am the Head of the Department of Respiratory and Sleep Medicine at the Prince of Wales Hospital, and the Director of the Cardiac and Respiratory Clinical Stream of the South Eastern Sydney Local Health District. I am also in private practice at the Prince of Wales Private Hospital and it is in the latter capacity that I have prepared this report.

2. BACKGROUND

2.1. Inhalation of suspended particulate matter is a natural phenomenon that has occurred throughout evolution. The healthy lung can remove most forms of foreign matter using the mucus lining the airways and special scavenger cells (macrophages) in the air sacs (alveoli). The potential for inhaled particulates to cause harm depends on the chemical and physical nature of the particles, the concentration of the particles in the air, the percentage of particulate matter which is in the respirable size range of <10μ m in diameter (i.e. small enough to be inhaled into the lung, also known as PM_{10}) and the individual susceptibility of the person inhaling the dust. Many scientific studies are now concentrating on the smaller particles ($PM_{2.5}$) which are inhaled as far as the alveoli in the lungs.

2.2. Most dust that we inhale is harmless and sometimes referred to as "nuisance" dust. Asbestos fibres and very fine particles of crystalline silica, on the other hand, may produce severe fibrotic reactions in the lungs. Silica is contained in quartz, sand and many rocks such as granite. The percentage of silica in coal and the overburden (material above or around the coal seam) varies substantially from site to site but is usually a relatively small fraction. Atmospheric levels of silica have been measured in the vicinity of two mines in the Hunter Valley and the worst case values (0.5 -1.8 $\mu g/m^3$) were well below the environmental standard for an annual average (3.0 $\mu g/m^3$, ACARP Study, C18026, June 2012). Dust we inhale also contains numerous other substances usually in very small quantities. In heavily populated urban areas the air contains particles from the exhaust systems of vehicles, especially diesel trucks and buses and other processes which combust hydrocarbon fuels such as power stations, heavy industries, jet aeroplanes etc. In rural communities, the dust may contain particles from wood fire smoke and dust released from ploughing and the harvesting or processing of various grains such as wheat. There are also small concentrations of pollens and spores of fungi.

2.3. The PM_{10} fraction of airborne dust will therefore vary in composition from place to place depending on the types of industry and the density of vehicular traffic. It also varies with the temperature, humidity, weather (including rain, wind speed and direction), and the time of year. The composition of fine airborne particles collected in an urban area would be different from the particles collected in a rural area because of the relative contribution of exhaust fumes. Motor vehicles are the major source of air pollution in urban areas, contributing to the photochemical smog or haze seen on still days. The urban pollutants most strongly associated with adverse outcomes are "black smoke" or "elemental carbon" which are products of combustion and most strongly associated with diesel traffic. However, the air quality in Australian cities is better than in most other cities of similar size in Europe and the US, particularly in relation to the levels of $PM_{2.5}$.

2.4. Suspended particulates (PM_{10} and $PM_{2.5}$) in a purely rural setting are different from urban pollution and have not been proven to adversely affect health. In rural areas the bulk of airborne particulates are likely to be dust released from farming operations or road works and would include mineral dust, grain dust, pollens and, in winter, smoke from wood fires. It would vary with season, the type of farming and any other variable such as an open cut coal mine, coal fired power station or smelter in the district. There would generally be much lower concentrations of the toxic gases and fumes than found in the petrochemical smog of cities. In other words, the percentage of $PM_{2.5}$ within the PM_{10} range is much lower in rural samples than in urban samples. Air quality criteria for PM_{10} (and $PM_{2.5}$) have been established for urban areas and applied to rural settings. Using the urban criteria for rural areas is regarded as conservative.

2.5. Long-term exposure to excess levels of urban pollution is thought to induce oxidative stress, inflammation, progression of atherosclerosis and, possibly, altered autonomic function of the heart. Very high concentrations of airborne urban pollution are associated with increased cardiovascular and respiratory disease (including exacerbations of asthma) and increased mortality on high pollution days. A small proportion of the population is at risk of adverse outcome from short- and long-term exposure to pollution - that is the elderly, those with cardiopulmonary disease, infants and asthmatics. Most studies conclude that, although a susceptible individual's risk when exposed to air pollution is small, the large populations exposed in cities result in a significant burden of illness.

2.6. High levels of particulates occur with high winds in dry seasons and bush fires. When bushfires occur around Sydney PM_{10} levels can rise to 300-500 $\mu g/m^3$ (i.e. up to 10 times the 24 hr criterion). There is weak evidence for increased admissions to hospital for respiratory complaints during bush fires around Australian cities. During the infamous East Coast dust storm of 23 September 2009 PM_{10} levels in Sydney and Newcastle were variously reported at 2,000 $\mu g/m^3$ and 15,500 $\mu g/m^3$ (the latter presumably an instantaneous peak level). Emergency services reported an increase in complaints of breathing difficulties. Children, elderly and those with heart and lung conditions were advised to remain indoors. I have been unable to find reports of increased admissions to hospital or deaths during the East Coast dust storm.

2.7. Noise intensity decreases with distance from the source according to the inverse square law under ideal conditions. If the sound intensity 100 m away from the source is x, it will be x/4 at 200 m and so on. The pressure wave on the other hand decreases in a power function such that it is halved every time the distance is doubled. The decibel scale which is logarithmic is used to measure noise intensity. Painful noise (e.g. a rock concert or jack hammer) is around 120 dB(A) but levels over 80 dB(A) may damage the inner ear if exposure is prolonged. The likelihood of damage to hearing is a product of intensity and duration of the noise as well as the frequency composition of the sound. A quiet room would be between 33 and 40 dB(A). If the distance from the source is doubled the noise intensity decreases about 6 dB(A). Thus, if a machine was producing noise of 100 dB(A) at 10 m from the source it would be down to approximately 80 dB(A) at 100 m. These calculations assume ideal conditions and do not take into account variations in atmospheric conditions, wind, reflection, etc. so the actual transmission could be greater or less.

2.8. In NSW night-time traffic noise outside residences should be below 55 dB(A) as an average but transient peaks of 65-70 dB(A) may occur (e.g. trucks, motor bikes and sports cars). The noise inside is around 10 dB(A) less than outside. Residences near train lines may be exposed to peaks of 80 dB(A) at night. Aircraft produce noise levels typically in the range of 70-85 dB(A) depending on distance from the airport. The health effects of lower noise intensities are mostly believed to relate to sleep disturbance.

3. AIR QUALITY AND HEALTH RISK ASSESSMENT

The air quality and health risk assessment by Pacific Environment Limited and Toxicos includes an introduction explaining the possible emissions from an open cut coal mine. It is argued that emissions from combustion engines including carbon monoxide, sulphur dioxide and diesel fumes would be relatively low given the number of mining machines and the large area of the site together with the fact that these emissions disperse rapidly and widely. Therefore these emissions are not considered in this report. The main focus of the report is on total suspended particulate matter (TSP), particulate matter with an equivalent aerodynamic diameter of 10 μm or less, particulate matter with an equivalent aerodynamic diameter of 2.5 μm or less and deposited dust emissions. The relevant air quality impact assessment criteria and advisory reporting standards for these particles are listed in detail.

Air-quality monitoring was performed from July 2010 to June 2012 at a number of places around the site. Meteorological data was also collected from a weather station specifically installed for this project. All these observations and measurements appear to have been conducted with appropriate methodology and the results are presented clearly.

Data for dust deposition indicates relatively low levels at all sites tested with an average across all sites less than 1g/m^2/month. The annual average PM_{10} data for the area ranged between 8-10 μg/m^3. Concentrations were slightly higher at the monitor closer to a road and the town of Gloucester which suggested a possible influence from nearby traffic. These values are well below the relevant standard which is 50 μg/m^3. Annual average $PM_{2.5}$ concentrations ranged from 3 to 5 μg/m^3 which is well below the advisory reporting standard of 25 μg/m^3.

The highest 24-hour PM_{10} concentrations for all sites ranged between 10 and 37 $\mu g/m^3$ and no recordings were above the standard of 50 $\mu g/m^3$. There were two occasions when the 24-hour $PM_{2.5}$ concentration at one site were at the advisory reporting standard of 25 $\mu g/m^3$. One of these was possibly related to burning off nearby.

The report also summarised data for air-quality monitoring at the nearby Stratford coal mine. Over a ten-year period the average dust deposition across all sites was 1.0 g/m^2/month. The annual average PM_{10} concentrations across all sites was 11 $\mu g/m^3$. These are both well within the standard.

Predictions based on dispersion modelling were made for four stages of the project up to year 13 (considered to be the worst periods for potential dust emissions) for concentrations of PM_{10} and $PM_{2.5}$. Firstly, the dust emissions for the proposed project were modelled and estimated with contour plots drawn around the site. Then the cumulative concentrations incorporating the background concentration plus any contribution from surrounding mining operations were modelled. The results indicated that two private residences are predicted to experience some exceedances of the 24-hour average PM_{10} levels above the criterion of 50 $\mu g/m^3$ during each year of the project. No privately owned receptors were predicted to experience exceedances of annual average PM_{10}, TSP or dust deposition above the assessment criteria. No receptors were predicted to experience $PM_{2.5}$ concentrations above the advisory reporting standards.

In my opinion, the methodology used in this air quality assessment has been appropriate and applied in a conservative manner. In other words, the conclusion that two receptors would experience some exceedances of the 24 hour at average PM_{10} levels represents a worst-case scenario, and might not be borne out. I agree with the argument that diesel emissions will have a negligible impact on air quality at any private residence.

4. HEALTH RISK ASSESSMENT

The health assessment prepared by Toxikos has used the modelling data from the air quality assessment to derive predicted increases in PM_{10} and $PM_{2.5}$ concentrations. These values were then examined in relation to the medical literature from epidemiological studies that have calculated the risks to health from urban pollution. The authors assert that the health risk assessment is conservative for several reasons. Firstly, the modelling data for dust emissions was designed to incorporate worst-case scenarios. Second, the environmental standards have been set conservatively with safety margins built-in to protect the most vulnerable individuals including the sick and elderly and infants. Third, the health risk assessment calculated the long-term risks based on exposure at the predicted levels for 24 hours per day for each day of the year for 70 years whereas the life of the mine is estimated to be around 20 years. I agree with this assertion (discussed further below).

The authors point out that there is relatively little Australian data on health effects from pollution and particulate matter. They also point out that there is little if any data on the risks associated with particulate matter in rural communities. They provide a brief review of some of the literature which has examined the short-term and long-term effects of PM on a variety of health outcomes. The review is not exhaustive and is not critical but I agree with the general line that has been taken and the conclusions. I also agree with the conclusion to use $PM_{2.5}$ as the metric to assess risks to health from exposure because of clear evidence in the world literature that smaller particles are more harmful than larger particles.

Data from several different studies were used to provide estimates of risks of death or hospitalisation associated with a 10 $\mu g/m^3$ increase in $PM_{2.5}$. These values were then adjusted for the predicted incremental increases in $PM_{2.5}$ as a result of the Rocky Hill Coal Project based on the air quality assessment. Based on these calculations it was estimated that the annual mortality per 100,000 would increase from 658 to 660 (i.e. an increase of 0.002%). The risk from short-term exceedances is even lower and would require a population of 50,000,000 to see a single death.

The authors discuss these calculations in the context of the assumptions that were used and concluded that these estimates of risk are exaggerated. The incremental increase in PM concentration used for the calculation was that at the highest receptor and this level was assumed to apply to the whole population. It was also assumed that the population would be exposed 24 hours a day for 70 years. It is most unlikely that even the residents of the highest receptor would be exposed for 24 hours a day. The modelling data from the air quality assessment gives levels in the open air which are likely to be higher than those in doors. It would also be reasonable to argue that the PM emissions from the mining operation would be less toxic than the petrochemical smog of urban pollution.

Therefore, the authors conclude that the risk to health from the Proposal is within the NEPM guidelines which state that an additional risk of one per 100,000 for adverse health outcomes is sufficiently small to be acceptable. I agree with this conclusion.

Toxikos also calculated the health risks due to $N0_2$. The air quality assessment predictions of $N0_2$ levels from blast emissions at the worst affected receptor are well below the ambient air NEPM of 246 $\mu g/m^3$ (one hour). Because blasting will occur only intermittently the chronic levels of $N0_2$ will be well below the NEPM of 61.5 $\mu g/m^3$ (annual). Therefore it was concluded that health risks from $N0_2$ would be very unlikely. I agree that there would be minimal risk from $N0_2$ emissions for the residents in the vicinity of the site.

5. SOCIO-ECONOMIC ASSESSMENT

The Socio-economic Assessment prepared by Key Insights Pty Ltd includes a survey of residents and interviews with key service providers. It provides a comprehensive analysis of potential benefits and risks to the community with emphasis on the potential loss of amenity to residents. I am not an expert in this field but I could find no obvious errors or omissions in this assessment which seems objective and sympathetic to the concerns of the community and service providers.

The conclusions are relevant and indicate that, by and large, the town's infrastructure would cope with the predicted increase in population with the possible exception of the ambulance service which is stretched at present. There were some concerns about the availability and affordability of housing and rental accommodation while others were concerned that property values near the mine would fall. Residents were concerned about potential health effects, noise and increased traffic and the uncertainty of change. Potential remedies to address some of these concerns were discussed and it was felt that uncertainty about the process and effects of the mine were creating anxiety which would likely ameliorate once a decision was made.

Overall I felt the report was balanced and agree with the findings.

6. NOISE, VIBRATION AND BLASTING ASSESSMENT

The Noise, Vibration and Blasting Assessment described the results of noise monitoring at a number of receptors surrounding the proposal between July 2010 and July 2012. The results show that most of the surrounding area had generally low noise levels except for those receptors near roads which had elevated levels due to traffic noise. Noise modelling was then undertaken to predict the total noise at each receptor in the vicinity at a number of key stages in the construction and operation of the proposal. These time points were chosen because they represent distinct phases of the Proposal and included the period predicted to have maximum noise impacts. The modelling considered numerous meteorological conditions during the day, evening and overnight.

The results indicated that five receptors would have exceedances of 1 to 2 dB(A), three receptors would have exceedances of 3 to 5 dB(A) and four receptors would have exceedances of more than 5 dB(A). Most of the exceedances were levels below 40 dB(A) with only four receptors experiencing levels between 40 and 47 dB(A). None of the receptors was predicted to have night-time levels above the relevant screening criterion of 45 dB(A).

Predictions for blasting indicate that during the early stages of the proposal all blasts would produce pressure waves and ground vibration within criterion levels at all privately owned receptors. In later stages of the proposal, as blasting approaches the closest point to nearby receptors, charge quantities would need to be reduced to satisfy airblast overpressure criteria at all receptors. The effects of blasting would be monitored and changes to the design and charge composition of blasts would ensure that pressure waves are not excessive. No exceedances of vibration criteria were predicted.

Noise from railway activity was not predicted to exceed criteria at any stage in the project.

The assessment also listed a number of noise mitigation and abatement strategies that would be likely to reduce the noise experienced at the receptors to levels below those in the predictions which do not take into account such strategies.

In my opinion the methodologies used in the noise and vibration predictions are appropriate and designed to be conservative. In other words, the actual noise levels experienced are more likely to be below the predicted levels than above them. The predicted levels of noise are generally low and well below those commonly experienced by residents in urban areas.

The noise levels predicted to occur at sensitive receptors in the vicinity of the proposal are well below those that have been reported in the medical literature to be associated with potential health risks. There appear to be minimal health effects with noise levels below 55 dB(A). Frequent occurrences of noise above this level have a weak association with hypertension and cardiovascular disease. The strength of the association is increased for noise levels above 65 dB(A). Most of the medical literature concerning sleep quality and daytime performance showed little adverse effect with noise levels below 40 to 55 dB(A) indoors. None of the sensitive receptors including those in the noise affected zone is predicted to have levels above this range.

7. CONCLUSIONS

After review of the dispersion modelling data for PM_{10} and $PM_{2.5}$ dust levels I conclude that $PM_{2.5}$ levels would be at acceptable levels in the districts and residential areas surrounding the Rocky Hill site throughout the life of the mine even if the PM_{10} values exceeded the criteria at some receptors from time to time. Fumes and gases from diesel exhausts and blasting disperse more rapidly in the atmosphere than particulate matter. These would not exceed criteria levels.

The calculations in the Health Assessment are based on conservative assumptions and interpretation of the worst case scenario in the modelling data. I conclude that the potential risk to health is very small and within acceptable levels.

The noise levels predicted for receptors in the vicinity of the proposal are below those that have been reported in the medical literature to produce adverse health effects. There should be no clinically significant impact on sleep quality or quantity.