Expert Report to the Land Court by Dr Chris Taylor

1. Experts Details & Qualifications

1.1 Name

My name is Dr Chris Taylor.

1.2 Address

My business address is URS Australia Pty Ltd, Level 17, 240 Queen Street, Brisbane, QLD 4000.

1.3 Qualifications

I am an environmental scientist with 12 years postgraduate experience in academic research and consultancy, specialising in atmospheric emissions, preparation of emissions inventories, greenhouse gas (GHG) assessments and climate change. I hold the following qualifications:

(a) MChem in Chemistry from the University of Wales, Swansea, UK; and

(b) PhD in Atmospheric Chemistry and Climate Change from the University of Reading, UK.

Annexure **A** to this report is my curriculum vitae, which sets out my professional qualifications.

2. Instructions

I have been instructed by Allens Arthur Robinson on behalf of Xstrata Coal Queensland Pty Ltd to formulate a report, relating to GHG emissions, in response to the following questions:

(a) With reference to the figures referred to in the EIS, SEIS and Objection of Friends of the Earth Brisbane Co-Op Ltd:

  (i) what will be the GHG emissions produced directly from the mining activities to be conducted at the Wandoan Coal Mine;

  (ii) what will be the "downstream" or scope 3 GHG emissions likely to be produced from the export and ultimate use of the coal; and

  (iii) in respect of (i) and (ii), can you please advise what the GHG emissions will be from the mining activities and from the downstream activities on both an annual basis and on a "life of mine" cycle basis?

(b) What are the estimated total annual GHG emissions for Australia presently? What are the estimated total annual global GHG emissions presently?

(c) What will be the annual emissions produced directly from the Wandoan Coal Mine as a percentage of the estimated total annual Australian and global GHG emissions?

(d) What will the annual emissions produced directly from the Wandoan Coal Mine plus downstream or scope 3 emissions from the mine as a percentage of Australian and global GHG emissions?

(e) What are the current estimated total annual GHG emissions from the Queensland coal industry and the Australian coal industry? Further, what are the current estimated total annual GHG emissions from the global coal industry?

(f) What are commonly employed methods used in Australia to quantify scope 1, 2 and 3 GHG emissions for coal mining operations such as Wandoan? What obligations, if any, are associated with scope 1, 2 and 3 emissions as quantified by these methods in Australia?

(g) What actions proposed or conditioned to be undertaken at the Wandoan Coal Mine are relevant to the reduction of GHG emissions from the operations? Are those actions in accordance with the principles of:

(i) "best practice environmental management"; and

(ii) "ecologically sustainable development",

in terms of industry practice for coal mines of this type in Queensland and Australia?

3. Facts and Assumptions

In producing this report, I have relied on the following facts and assumptions:

(a) GHG emissions for the Project were calculated by URS in 2008 and reported in the Wandoan Coal Project Environmental Impact Statement ("the EIS") Volume 1, Chapter 14 (Xstrata, 2008) and accompanying Technical Report (Wandoan Coal Project Greenhouse Gas Assessment, November 2008, URS reference 42626098) and Supplementary Environmental Impact Statement ("the SEIS") (Xstrata, 2009) Volume 1, Chapter 14. The author of the Technical Report was Sarah Clarke of URS and the reviewer was Greg Loftus of URS. The data presented in the EIS have not been disputed in the Objection of Friends of the Earth Brisbane Co-Op Ltd. I have, therefore, assumed that the calculations were carried out correctly following the stated methodology and have not recalculated the emissions inventory.

(b) The emissions inventory was carried out using emission factors in the National Greenhouse Accounts (NGA) Factors available at the time (Department of Climate Change 2008a). I have reviewed changes to these factors in the most recent version of this guidance (Department of Climate Change and Energy Efficiency, 2010) and found that no significant changes have been made to the emission factors used in the study.

(c) In reviewing the EIS and Technical Report, I identified a number of typographical errors in the EIS. These appear to have occurred when transferring data in the Technical Report to tables in the EIS. The typographical errors in the EIS are minor and do not affect the conclusions of the EIS. However, to ensure clarity, the data presented in the Technical Report have been used to prepare this report. I have confirmed that the data presented in the Technical Report are correct by

comparing the figures presented with the original calculations performed by URS using a spreadsheet inventory model.

(d) The following documents are referenced in this report:

(i) Xstrata (2008) Wandoan Coal Project Environmental Impact Statement;

(ii) Xstrata (2009) Wandoan Coal Project Supplementary Environmental Impact Statement;

(iii) Department of Climate Change (2008a) National Greenhouse Accounts (NGA) Factors;

(iv) Department of Climate Change (2008b) National Greenhouse and Energy Reporting Guidelines;

(v) Department of Climate Change and Energy Efficiency (2010) National Greenhouse Accounts (NGA) Factors;

(vi) Intergovernmental Panel on Climate Change (2007) Climate Change 2007: Synthesis Report;

(vii) World Business Council for Sustainable Development and World Resources Institute (2004) The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard;

(viii) Department of Climate Change and Energy Efficiency (2011a) Australian National Greenhouse Gas Inventory Accounting for the Kyoto Protocol December Quarter 2010;

(ix) Department of Climate Change and Energy Efficiency (2011b) State and Territory Greenhouse Gas Inventories 2009;

(x) Department of Climate Change and Energy Efficiency (2011c) National Inventory by Economic Sector;

(xi) Aecom (2009) East Lake Electrical Infrastructure EIS Greenhouse Gas Emissions;

(xii) Katestone (2010) Air Quality and Greenhouse Gas Assessment of the Stage 2 Middlemount Coal Project;

(xiii) SKM (2010) Connors River Dam and Pipelines EIS – GHG Assessment;

(xiv) New Hope Coal Australia (2009) New Acland Coal Mine Expansion Project;

(xv) Katestone (2006) Air Quality Assessment of the Proposed Roseby Copper Project;

(xvi) Australia Pacific LNG (2010) The Australia Pacific LNG Project EIS;

(xvii) International Energy Agency (2010) CO_2 Emissions from Fuel Combustion Highlights;

(xviii) Queensland Government (2009) Bowen Basin Coal Growth Project: Daunia Mine – Coordinator General's evaluation report on the environmental impact statement;

(xix) Queensland Government (2010a) Wandoan Coal Project Coordinator-General's evaluation report on the environmental impact statement;

(xx) Queensland Government (2010b) Bowen Basin Coal Growth Project: Cavel Ridge Mine – Coordinator General's evaluation report on the environmental impact statement;

(xxi) Queensland Government (2007) Assessment Report under the Environmental Protection Act 1994 on the Environmental Impact Statement for the Carborough Downs Mine Expansion Project proposed by Carborough Downs Joint Venture;

(xxii) Queensland Government (2006) Assessment Report under the Environmental Protection Act 1994 on the Environmental Impact Statement for the Sonoma Coal Project proposed by QCoal Pty Ltd; and

(xxiii) Washpool Coal (2011) Environmental Impact Statement.

4. Opinion and Findings

4.1 Introduction

The Wandoan Coal Project (referred to as the Project) will comprise an open cut coal mine and supporting infrastructure, producing around 30 million tonnes of Run of Mine (ROM) coal per annum (Xstrata, 2008).

4.2 Accounting for Greenhouse Gas Emissions

A project such as the Wandoan Coal Mine produces a range of GHGs, including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Each gas has a different effect on climate because of its radiative properties and lifetime in the atmosphere. In order to understand emissions, it is standard practice to use the concept of carbon dioxide equivalent (CO_2-e) emissions. The Intergovernmental Panel on Climate Change (IPCC) defines this concept in its 2007 Synthesis Report (IPCC, 2007) as follows:

"CO_2-equivalent emission is the amount of CO_2 emission that would cause the same time-integrated radiative forcing, over a given time horizon, as an emitted amount of a longlived GHG or a mixture of GHGs. The equivalent CO_2 emission is obtained by multiplying the emission of a GHG by its Global Warming Potential (GWP) for the given time horizon."

Each gas has a unique Global Warming Potential, which indicates its ability to warm the climate relative to CO_2 over a specified period (typically 100 years).

4.3 Greenhouse Gas Inventory Methodologies

Calculation of a GHG emissions inventory for a project such as the Wandoan Coal Mine is usually carried out using a bottom-up or activity based approach. This type of inventory requires detailed information on project emissions sources, such as equipment used and fuel type, and activity data, such as distance travelled, number of trips and fuel consumption rates. This information is combined with an emissions factor to convert estimates of energy use or fuel consumption into pollutant emission rates.

There are several international guidelines for the preparation of GHG emissions inventories, but the most commonly used is the Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard ("the GHG Protocol") (World Business Council for Sustainable Development and World Resources Institute, 2004). This document sets out a framework for the development of GHG inventories, describing key concepts, principles and guidance on accounting and reporting. It does not set out detailed emission factors for specific industries or activities.

Similarly, there are numerous sources of emission factors available for various industrial activities and processes. Standard practice in Australia for GHG inventories is to use the factors and methods in the National Greenhouse Accounts (NGA) Factors. This approach is confirmed by the National Greenhouse and Energy Reporting (Measurement) Determination 2008 (as amended), which describes a *"default method"* derived from the NGA methods.

To confirm that this represents standard practice, I have reviewed a number of recently published GHG assessments for major projects. These were:

- Katestone (2006) Air Quality Assessment of the Proposed Roseby Copper Project
- New Hope Coal Australia (2009) New Acland Coal Mine Expansion Project
- Aecom (2009) East Lake Electrical Infrastructure EIS Greenhouse Gas Emissions
- Katestone (2010) Air Quality and Greenhouse Gas Assessment of the Stage 2 Middlemount Coal Project
- SKM (2010) Connors River Dam and Pipelines EIS – GHG Assessment
- Australia Pacific LNG (2010) The Australia Pacific LNG Project EIS Volume 4 Chapter 14

Of these, only the study presented in Australia Pacific LNG (2010) is based on emission factors other than the NGA factors, instead drawing on well-known data from the American Petroleum Institute and US Environmental Protection Agency.

The emissions inventory for the Wandoan EIS followed the GHG Protocol and used factors from NGA (2008). I consider this to be an appropriate methodology, following current standard practice for major projects in Australia, including mining projects.

4.4 Scope of Greenhouse Gas Inventories

The GHG Protocol defines direct and indirect emissions as follows:

- Direct GHG emissions are emissions from sources that are owned or controlled by the company.
- Indirect GHG emissions are emissions that are a consequence of the activities of the company but occur at sources owned or controlled by another company.

The GHG Protocol further categorizes these direct and indirect emissions into three broad scopes:

(a) Scope 1: direct GHG emissions

"Direct GHG emissions occur from sources that are owned or controlled by the company, for example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc."

(b) Scope 2: Indirect GHG emissions

"Scope 2 accounts for GHG emissions from the generation of purchased electricity consumed by the company."

(c) Scope 3: Other indirect emissions

"Scope 3 emissions are a consequence of the activities of the company, but occur from sources not owned or controlled by the company. Some examples of scope 3 activities are extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services."

Under the GHG Protocol, Scope 3 emissions are an optional reporting category. Scope 3 emissions of one organisation would be reported by other organisations as their Scope 1 or Scope 2 emissions. For example, the emissions from a power station burning the coal extracted from the Wandoan mine would be reported as Scope 1 emissions by the power station operator and as Scope 2 emissions by the user of the electricity produced. This approach is followed to avoid double counting of emissions. Emissions are allocated to the organisation responsible for the emissions rather than other organisations in the supply chain (such as the coal producer and end user) that do not have control over that emission source.

4.5 National Greenhouse and Energy Reporting

Under the National Greenhouse and Energy Reporting (NGER) Act 2007, corporations meeting specified thresholds are required to report their GHG emissions, energy production and energy consumption.

The NGER Act 2007 follows the terminology and definitions of the GHG Protocol in terms of its definition of emissions Scope.

Under the National Greenhouse and Energy Reporting Regulation 2008 *"Emissions of greenhouse gas, in relation to a facility, means the release of greenhouse gas into the atmosphere as a direct result of 1 of the following:*

(a) an activity, or series of activities (including ancillary activities) that constitute the facility (scope 1 emissions);

(b) 1 or more activities that generate electricity, heating, cooling or steam that is consumed by the facility but that do not form part of the facility (scope 2 emissions)."

The National Greenhouse and Energy Reporting Guidelines (Department of Climate Change, 2008b) confirm that *"Scope 3 emissions, ... are not defined in the NGER legislation because reporting them is not mandatory..."*

4.6 Project Greenhouse Gas Emissions

As noted above, the emissions inventory for the Project's mine was prepared by URS using emission factors in the National Greenhouse Accounts (NGA) Factors available at the time

(Department of Climate Change, 2008a). The emissions inventory has not been recalculated, but the data are repeated here for clarity.

Emissions from mining activity (Scope 1 and Scope 2) were calculated by URS for three scenarios, each considering a different option for the source of electricity used. Project design and predicted activity data were provided to URS by Xstrata.

The GHG inventory for Scope 1 and Scope 2 emissions included the following:

- Fugitive emissions of Coal Seam Gas (CSG) from the open cut mining of coal (Scope 1);
- Fuel consumption in vehicles and plant (Scope 1);
- Use of explosives (Scope 1); and
- Power requirements from onsite diesel generators during the construction phase (Scope 1).

Potential power generation options considered were:

- On-site power generation via coal seam gas power station (Energy Supply Option 1, Scope 1);
- Partial on-site generation, balance grid purchased electricity (Energy Supply Option 2, Scope 1 and Scope 2); and
- 100 percent grid purchased electricity (Energy Supply Option 3, Scope 2).

The scenario with the greatest GHG emissions, referred to as the worst-case, is Energy Supply Option 3 (100 percent grid purchased electricity). The total GHG emissions for this scenario were calculated to be 589,838 tonnes of CO_2-e per year or 17,695,141 tonnes of CO_2-e over the assumed 30 year production life of the mine. When construction emissions of 50,969 tonnes of CO_2-e are included, the life of mine Scope 1 and Scope 2 emissions increase to 17,746,110 tonnes of CO_2-e.

4.7 Downstream Greenhouse Gas Emissions

Downstream, or Scope 3, emissions were calculated for transport of product coal by rail to the port and then by ship to Asia and South America, and also for end-use electricity production. The total GHG emissions for Scope 3 sources were calculated to be 44,032,039 tonnes of CO_2-e per year or 1,320,961,156 tonnes of CO_2-e over the assumed 30 year life of the mine.

Combustion of the product coal accounts for more than 99% of Scope 3 emissions.

The total emissions for Scope 1, Scope 2 and Scope 3 emissions (referred to in the EIS as full fuel cycle emissions) are 44,621,877 tonnes of CO_2-e per year or 1,338,656,297 tonnes of CO_2-e over the assumed 30 year production life of the mine. When construction emissions of 50,969 tonnes of CO_2-e are included, the life of mine Scope 1, Scope 2 and Scope 3 emissions increase to 1,338,707,266 tonnes of CO_2-e.

Notably, the equivalent data presented in the EIS referred to the full lifecycle of the mine, including the construction period, which has no Scope 3 emissions associated with it. Here, only the 30 year production life data are considered unless otherwise noted. As a

result, the annual average figures presented in this report are greater as emissions are averaged over a shorter period. I consider this to be a conservative approach as it is the annual average data that are compared to various emissions benchmarks in the sections below to evaluate the magnitude of emissions from the Project.

4.8 Context of Project Emissions

(a) Global GHG Emissions

The Project EIS (Xstrata, 2008) and SEIS (Xstrata, 2009) reported the global GHG emissions data from the United Nations Framework Convention on Climate Change (UNFCCC) including the contribution for land use, land use change and forestry (LULUCF).

The UNFCCC reports annually on emissions from parties included in Annex I to the Convention. This includes Australia. Data for non-Annex I counties are published for the year 1994 or closest year available.

Combining the latest data from this source (available from http://unfccc.int) gives an estimate of current annual global GHG emissions including LULUCF at 30,645 $MtCO_2$-e.

Similar data from the International Energy Agency (IEA, 2010) estimates global emissions for 2008 at 29,381 $MtCO_2$-e. This inventory is prepared following a different methodology so should not be expected to give exactly the same result. Considering the uncertainties inherent in such calculations, these studies are in good agreement.

Using the data from UNFCCC, the annual emissions from the Project Mine (Scope 1 and Scope 2) for Energy Supply Option 3 are equivalent to 0.0019% of annual global GHG emissions.

Similarly, the annual emissions from the Project Mine (Scope 1 and Scope 2) Energy Supply Option 3 plus downstream emissions (Scope 3) are equivalent to 0.15% of annual global GHG emissions.

(b) Australian GHG Emissions

The Project EIS (Xstrata, 2008) and SEIS (Xstrata, 2009) reported the Australian GHG emissions data from the National Greenhouse Gas Inventory. The latest report from this source (Department of Climate Change and Energy Efficiency, 2011a) estimates Australian emissions at 543 $MtCO_2$-e for 2010.

Using this figure, the annual emissions from the Project Mine (Scope 1 and Scope 2) Energy Supply Option 3 are equivalent to 0.11% of Australian annual GHG emissions.

I have been asked to consider Scope 3 emissions associated with the Project as a percentage of Australian GHG emissions. However, I consider it would not be appropriate to do so. Emissions from coal combustion are expected to be generated in other countries, so would be allocated to those countries' GHG emissions inventory for the purposes of UNFCCC accounting and would not form part of Australia's inventory.

(c) Coal Mining Industry Emissions

The Project EIS (Xstrata, 2008) and SEIS (Xstrata, 2009) reported the GHG emissions data from the National Greenhouse Gas Inventory for the energy sector in Australia and Queensland. This includes but is not limited to the mining industry. However, it was used

as a proxy for the mining industry as more specific categories of data were not readily available.

The latest report (Department of Climate Change and Energy Efficiency, 2011a) presents an estimate of 417.4 $MtCO_2$-e for the entire Australian energy sector in 2009. The equivalent figure for Queensland in 2009 is 97.3 $MtCO_2$-e (Department of Climate Change and Energy Efficiency, 2011b).

Additional data are now available on the breakdown of emissions by economic sector (Department of Climate Change and Energy Efficiency, 2011c). This provides a specific figure for coal mining in Australia of 31.8 $MtCO_2$-e in 2009. I consider that this figure is the most appropriate for setting the context of the Project in terms of emissions from coal mining.

The annual emissions from the Project Mine (Scope 1 and Scope 2) Energy Supply Option 3 are equivalent to 1.9% of Australian annual coal mining emissions. Once again, it would not be appropriate to consider Scope 3 emissions associated with the Project as a percentage of coal mining emissions as they would not form part of this inventory.

Data for global emissions from coal mining are not readily available.

(d) Summary

The data presented above is summarised in the following table:

Emissions Inventory	Annual Emissions ($MtCO_2$-e)	Contribution of Wandoan Project annual emissions	
		Scope 1 + Scope 2	Scope 1 + Scope 2 + Scope 3
Global	30,645	0.0019%	0.15%
Australia	543	0.11%	N/A
Australia Coal Mining	31.8	1.9%	N/A

4.9 Greenhouse Gas Abatement Measures

(a) Project Commitments

(i) Environmental Impact Statement and Supplementary Environmental Impact Statement

A number of commitments were made in the Project EIS and SEIS with regards to the minimization (or abatement) of GHG emissions. These are summarised in Chapter 28 of the SEIS as follows:

(A) Equipment Purchase and Energy Efficiency

- An energy efficiency audit will be undertaken, where appropriate, during the detailed design phase.
- The use of high efficiency electrical motors throughout the mine site and the use of variable speed drive pumps with high efficiency linings at the coal handling and

preparation plant will be considered and implemented where practicable as part of an energy efficiency audit.

- Installing light-sensitive switches on lighting equipment and energy efficiency lightbulbs throughout the Project operations and Wandoan community will be investigated and implemented where practicable.
- Installation of energy saving devices will be undertaken within the MIA buildings and accommodation facilities, where practicable.
- In developing the accommodation facilities, the WJV will endeavour to use leading industry practice in terms of sustainability and energy efficiency, including design maximising air flow, shading and beneficial landscaping, use of energy efficient (eg. Solar) hotwater systems, water saving devices and energy efficiency lighting.
- The WJV will investigate, and implement where practicable, roof-mounted solar hot water systems associated with the accommodation facilities as part of the detailed design process.
- The WJV is investigating renewable energy sources for components of the Project (such as the mine accommodation facilities). This may include on site solar generation.

(B) Preventative maintenance

- Regular monitoring of electrical load on the draglines and the swing distance will be undertaken to improve dragline performance and efficient use of energy.
- Undertaking electrical calibration checks on the draglines as per the manufacturer's instructions.
- A program of bucket inspection and repair will be adopted to prevent the likelihood of poorly maintained dragline buckets reducing the efficiency of each dragline load through increasing the amount of electricity required to move a tonne of Wandoan Coal Project overburden.
- Regular monitoring of the compressed air circuit so that leaks are repaired in a timely manner, to maximise the operating efficiency of the compressor.

(C) Mine planning

- Haul truck scheduling, routing and idling times will be optimised to minimise the amount of diesel consumed.
- Pit access ramps will be designed to limit the amount of effort required for fully-laden trucks to climb.
- Haul roads will be compacted to reduce rolling resistance.
- The location of ROM and overburden dumps will be optimised to limit the amount of distance haul trucks need to cover while fully laden.
- The above measures will be incorporated into a Greenhouse Gas Reduction management plan.

(ii) Coordinator-General's Report

The Coordinator-General's report (Queensland Government, 2010) imposes a condition that requires the proponent to *"develop and implement a Greenhouse Gas Reduction Management Plan in relation to the Scope 1 and Scope 2 emissions of the project."* This plan must include the proponent's policy on GHG emissions, annual monitoring from the construction and operation phases of the Project, an Energy Management Plan and a Fugitive Gas Management Plan.

This plan must be submitted to the authority administering the Environmental Authority prior to commencement of construction activities and be reviewed and submitted annually and made public on request.

(iii) Commonwealth Approval

The Project gained conditional environmental approval from the Commonwealth Department of Sustainability, Environment, Water, Population and Communities in March 2011. The approval included a condition that the development must be carried out in accordance with the EIS, SEIS and Coordinator-General's report and Approval Conditions.

(b) Industry Practice

In order to establish whether these conditions are consistent with best practice environmental management and ecologically sustainable development in terms of industry practice, I have reviewed the commitments made by the following similar developments in Queensland and Australia:

- Bowen Basin Coal Growth Project: Daunia Coal Mine Development (Queensland Government, 2009)
- Bowen Basin Coal Growth Project: Caval Ridge Coal Mine Project (Queensland Government, 2010b)
- Carborough Downs Mine Expansion Project (Queensland Government, 2007)
- Sonoma Coal Project (Queensland Government, 2006)
- New Acland Coal Mine Stage 3 Expansion Project (New Hope Coal Australia, 2009)
- Washpool Coal Mine Project (Washpool Coal, 2011)
- Middlemount Coal Project (Katestone, 2010)

In addition to the EIS for each project, the Coordinator-General's reports for the Caval Ridge Coal Mine (Queensland Government, 2010b) and Daunia Coal Mine (Queensland Government, 2009) were reviewed.

Each of these projects proposes similar commitments to those required of the Wandoan Project. In accordance with internationally accepted GHG accounting principles, none of the projects reviewed proposed to take action regarding Scope 3 emissions.

In Queensland and Australia, best practice environmental management and ecologically sustainable development in the case of GHG emissions from a coal mine is achieved through management of Scope 1 and Scope 2 emissions, including measures such as

energy efficiency and control of fugitive emissions. These issues have been considered and balanced appropriately in the conditions imposed in the Coordinator-General's Report for the Wandoan Project.

5. Summary of Opinion and Findings

This report describes my opinion and findings in relation to the Wandoan Coal Project. In forming my opinion on this Project I have relied on data presented in the Project EIS and SEIS, documents relating to formal approval of the Project, published technical guidance documents and reports relating to other similar projects.

GHG emissions are categorized in the GHG Protocol as Scope 1, Scope 2 or Scope 3. Scope 1 emissions are direct emissions from sources owned or controlled by the organization. Scope 2 emissions are indirect emissions from the generation of electricity consumed by the organization. Scope 3 emissions are indirect emissions occur as a consequence of the organization's activities, but are not owned or controlled by the organization.

Under the GHG Protocol and Australia's National Greenhouse and Energy Reporting legislation, companies are required to report Scope 1 and Scope 2 emissions, but not Scope 3 emissions. Companies do not have operational control over Scope 3 emissions.

The GHG inventory for the Project was prepared by URS following the framework of the GHG Protocol using data from the proponent and the National Greenhouse Accounts.

The approach followed by URS and reported in the EIS and SEIS is consistent with industry practice for similar projects. As required by the EIS Terms of Reference, the emissions inventory included calculations of Scope 1, Scope 2 and Scope 3 emissions.

A number of energy supply options were considered. Of these, the scenario with the greatest GHG emissions, referred to as the worst-case, is Energy Supply Option 3 (100 percent grid purchased electricity).

The total GHG emissions for the Project Mine (Scope 1 and Scope 2) Energy Supply Option 3 were calculated to be 589,838 tonnes of CO_2-e per year or 17,695,141 tonnes of CO_2-e over the assumed 30 year life of the mine. The annual emissions equate to 0.0019% of annual global GHG emissions, 0.11% of Australian annual GHG emissions, or 1.9% of Australian annual coal mining emissions.

The total GHG emissions for the Project Mine (Scope 1 and Scope 2) Energy Supply Option 3 plus Scope 3 emissions were calculated to be 44,621,877 tonnes of CO_2-e per year or 1,338,656,297 tonnes of CO_2-e over the assumed 30 year life of the mine. The annual emissions equate to 0.15% of annual global GHG emissions.

These comparisons are conservative. The annual average emissions from the Project would be lower if they were calculated over the 32 year life of mine (including construction) rather than the 30 year production life. Similarly, the comparisons with national and international emissions have been made on the basis of current emissions. Taking into account forecast increases in global emissions over the life of the mine would result in a lower calculated percentage over the life of the mine.

It would be inappropriate to consider Scope 3 emissions associated with the Project as a proportion of Australia emissions. Emissions from Wandoan coal combustion are expected to be generated in other countries, so would be allocated to those countries' GHG emissions inventory for the purposes of UNFCCC accounting. It would also be inappropriate to compare life of mine emissions with annual Australian or global emissions as it would not be comparing like with like.

Whether the Project proceeds or not would have a negligible impact on global emissions as annual Scope 1 and Scope 2 emissions from the Project Mine are equivalent to just 0.0019% of annual global GHG emissions. Including Scope 3 emissions, almost all of which are the responsibility of the power sector, this figure rises to only 0.15%.

A number of commitments were made in the Project EIS and SEIS. The Coordinator-General's report includes a condition requiring the development to be in accordance with these commitments and other conditions. These requirements relate to the minimization of Scope 1 and Scope 2 emissions. These issues have been considered and balanced appropriately in the conditions imposed in the Coordinator-General's Report for the Wandoan Project.

6. Additional Information Required

I believe that I have had adequate access to the facts of this case and published data in order to form an opinion on the questions I have been asked to consider.

7. Expert's Statement

I confirm the following:

(a) the factual matters stated in this report are, as far as I know, true;

(b) I have made all enquiries that I consider appropriate;

(c) the opinions stated in this report are genuinely held by me;

(d) the report contains reference to all matters I consider significant; and

(e) I understand my duty to the court and have complied with the duty.

Dr Chris Taylor

8 July 2011

Annexure A: Curriculum Vitae for Dr Chris Taylor

Curriculum Vitae

Dr Chris Taylor

Associate Environmental Scientist

Qualifications

Univeristy of Reading, PhD Atmospheric Chemistry and Climate Change, 2002
University of Wales, Swansea, MChem Chemistry, 1999

Areas of Experience

Air Quality and Greenhouse Gases

- Emissions inventories
- Greenhouse Gas assessments
- Climate Change
- Atmospheric dispersion modelling
- Emissions reduction strategies
- Air quality monitoring surveys
- Assessment of dust and odour
- Assessment of nitrogen and acid deposition to ecological sites
- Public hearings and Expert Witness

Career Summary

Chris is an Associate Environmental Scientist and project manager with expertise in air quality, greenhouse gas assessments, climate change and the preparation of Environmental Impact Statements. He has extensive experience in the assessment and modelling of air pollution impacts for a wide range of sectors, including oil and gas, ports and industry across Asia Pacific, Middle East and Europe.

Oil and gas projects have included LNG import terminals in the UK and France, offshore oil and gas production, onshore gas fields and oil refineries.

Port projects have included emissions inventories and modelling studies for major international container ports, oil and bulk terminals and RoRo ferry developments.

Chris has significant experience in the use of complex atmospheric dispersion models TAPM, CALMET/CALPUFF, AUSPLUME, Aermod and ADMS.

Before starting a career in consultancy, Chris undertook research into atmospheric chemistry and climate change at the University of Reading, UK.

Selected Projects

Oil and Gas

Dragon LNG (UK) - Air quality assessment for an application to vary an Environmental Permit for a large new Liquefied Natural Gas (LNG) terminal. Emission sources included submerged combustion vaporisers, gas-fired boiler and flare.

4GAS LNG le Verdon (France) - Air quality impact assessment of a new LNG terminal at le Verdon, France. The assessment included modelling of operational point source emissions and the impact of construction plant and traffic.

South Hook LNG Terminal (UK) – Air quality dispersion modelling of point source emissions, examining alternative site layouts and stack heights for environmental permit application.

Caltex Oil Refinery (QLD) – Air quality modelling to ensure regulatory compliance using TAPM

Oil Refinery Expansion (UK) - Assessment of the impact of emissions to air from a major oil refinery expansion project. Tasks included options assessment and consideration of impacts on ecologically sensitive sites.

Bahrain Petroleum Company Refinery Gas Desulphurisation Project (Bahrain) - Air quality assessment for a US$120 million project to reduce the environmental impact of the BAPCO refinery by installing equipment to treat sour water and gases, including an additional Sulphur Recovery Unit and Tail Gas Treating Unit.

Bahrain Petroleum Company Refinery Lube Base Oil Project (Bahrain) - Dispersion modelling assessment using Aermod to examine the air quality impact of a refinery expansion to produce lube base oil.

Bahrain Petroleum Company Gas Dehydration Unit (Bahrain) - Air pollution and odour assessment of a khuff gas dehydration unit (GDU) following odour complaints, including site inspection and air quality monitoring program. Sources of atmospheric pollution included vents, flares, combustion emissions and fugitive emissions.

Total ABK HSEIA (Abu Dhabi) - TOTAL Abu Al Bukhoosh were required by Abu Dhabi National Oil Company to prepare a Health, Safety and Environmental Impact Assessment (HSEIA) and Control of Major Accident Hazards (COMAH) study for all its existing facilities and associated operations. Responsible for the delivery of the EIA and air quality emissions inventory and AERMOD modelling aspects of this study.

Ports and Terminals

ASEAN Ports Capacity Development (Asia Pacific) – Emissions inventory training and support for ten ports across Thailand, Philippines, Indonesia, Cambodia, Vietnam and Malaysia

Bangkok Port (Thailand) - Rapid assessment of transport issues at Bangkok Port and an emissions inventory for road vehicles, cargo handling equipment, ocean going vessels and harbour craft following US EPA methods. Recommendations were made for traffic and environmental management systems.

Teesport Northern Gateway (UK) - Air quality impact assessment of a major deep sea container port, proposed by PD Teesport. The assessment included an emissions inventory and dispersion modelling of shipping, site plant emissions and the associated road and rail freight traffic.

Cairnryan Ferry Terminal EIA - Air quality assessment of a major expansion to a passenger ferry terminal, including modelling of ship and road traffic emissions using ADMS. Additional work included representing the client at a public consultation meeting and local Council hearing and acting as Expert Witness at Public Local Inquiry.

Port Wirral EIA (UK) - Air quality aspects of the EIA for a new dry bulk and coal import terminal on the Manchester Ship Canal, including consideration of dust control and impacts of road traffic

Thamesport Quay Extension EIA (UK) - Responsible for the air quality aspects of an EIA for a quay extension at the Thamesport container terminal. Key issues for stakeholders were deposition of pollutants at nearby Site of Special Scientific Interest and emissions from construction and operational traffic.

Oikos Storage Ltd new oil jetty (UK) - Oikos import A1 jet fuel, which is then distributed by pipeline. In response to increasing demand there was a need to upgrade the jetty facilities to accommodate vessels of up to 100,000 DWT. The project included concept design and outline costings for various upgrade options, walkover and diving inspections of existing structures, desk-based geotechnical investigation and advice on the environmental constraints and consents required for the new structure.

Oldbury Nuclear Power Station Marine Offloading Facility (UK) - Environmental options appraisal for a new marine facility to support the construction of a new nuclear power station, working with colleagues developing concept designs, construction programme and costing. Constraints mapping, impact identification, development of mitigation and consultation with stakeholders.

Other Projects

Ivanhoe Molybdenum-Rhenium Project (QLD) – Air quality aspects of a revised Environmental Management Plan, including detailed dispersion modelling of the proposed operation.

Milford Power Gas-Fired Power Station EIA (UK) - Air quality and greenhouse gas assessments for CCGT power station, including options for a 1600MW or 2000MW plant. The air quality assessment considered stack emissions, road traffic and construction dust. A number of plant and stack design options were assessed. Issues included the effects on public health and the deposition of pollutants on sensitive habitats.

Mersey Tidal Power (UK) - sustainability scoping report and carbon lifecycle assessment for a major tidal power scheme on the Mersey Estuary.

Stanton under Bardon Air Quality Monitoring (UK) - Air quality monitoring programme for a site intended for use as a waste management facility. Managed tendering process for a continuous monitoring station for nitrogen dioxide particulates (PM_{10} and $PM_{2.5}$) and heavy metals.

Ramat Hovav Wastewater Lagoons (Israel) - Wastewater from the Ramat Hovav industrial area will be discharged to evaporation lagoons. The issue of odour nuisance as a result of the evaporation of VOCs was raised as a concern. Responsible for the dispersion modelling of the lagoon emissions in order to specify suitable effluent discharge limits.

International Paint (UK) - Dispersion modelling assessment to support an Environmental Permit application for a wet paint and polymer plant. Emission sources included a gas-fired boiler, hot-oil boiler and a number of stacks and vents emitting a range of VOCs. Health and odour impacts were assessed.

Bahrain International Investment Park (Bahrain) - Air quality monitoring campaign and large-scale modelling study for the Hidd industrial area of Bahrain to determine the suitability of a new Investment Park for clean industry. Local sources include iron, steel and aluminium production, existing and proposed power stations, ready-mix cement, other industry and road traffic. The methodology was agreed in consultation with the General Directorate for Environment and Wildlife Protection (GDEWP).

Biodiesel Production Facility (UK) - Responsible for the EIA and Environmental Statement, including technical delivery of the air quality and odour aspects, for a new biodiesel and glycerine production facility.

Professional History

2011 – Present, Associate Environmental Scientist, URS

2008 – 2011, Principal Environmental Specialist, URS Scott Wilson, UK

2004 – 2008, Senior Environmental Consultant, Haskoning, UK

2003 – 2004, Environmental Consultant, RPS, UK

2002, Post-Doctoral Research Assistant, University of Reading, UK