From:	
To:	Community Affairs, Committee (SEN)
Subject:	Questions on notice
Date:	Wednesday, 26 June 2013 5:06:35 PM
Attachments:	Appendix J Connell Hatch.pdf Environmental Assessment Stonewall.pdf GIE-Vital Chemical Bovine Impact -ND v3.1.pdf Ultrafines Letter 21 June 2013.pdf First Response Document.pdf

To the Secretary of the Senate Standing Committees on Community Affairs,

In response to the following questions on notice arising from the Brisbane hearing of the Senate Inquiry into the impacts on health of air quality in Australia, please find attached the documents:

1. Chemical composition of veneer spray – See Attachments 'Environmental Assessment Stonewall', 'First Response Document' and 'GIE-Vital Chemical Bovine Impact'
2. How long does it take for veneer to biodegrade - See Attachment 'Environmental Assessment Stonewall'
3. What is the cost of fitting lids to coal wagons – See Attachment 'Appendix J – Connell Hatch' which was attached to the QRC's original submission
4. Further information on ultrafine particles – See Attachment 'Ultrafines Letter 21 June 2013'

If you have any further questions please do not hesitate to contact QRC at any stage.

Kind regards,

Nicola Garland
Advisor Environment Policy
Queensland Resources Council

Level 13 133 Mary Street
Brisbane Queensland 4000

www.qrc.org.au
Working together for a **shared future**

Simmonds & Bristow
Established 1965 ACN 010 252 418 Pty Ltd

VITAL CHEMICAL PTY LTD

Environmental Assessment of Vital Bon-Matt Stonewall

Document Control

Simmonds & Bristow
Established 1965 ACN 010 252 418 Pty Ltd

Originating Office: 40 Reginald Street Rocklea, Qld 4106	PO Box 3160 Yeronga, Qld 4104	Ph: 07 3710 9100 Fax: 07 3710 9199

Document Number:	1208-100C
Client:	Vital Chemical Pty Ltd
Client Contact:	Albert Xavier

	Name	**Signed**	**Date**
Written by:	Samantha Yeh Process Engineer		13/08/2012
Reviewed by:	Terrence Allen Process Engineer		16/08/2012

Revision History

Rev No.	Date	Author	Page(s)	Description / Revision	Status
0	13/08/2012	SY		Initial Version	Final

Disclaimer

The information contained in this document has been prepared specifically for our client named above and as such its use is limited to the above project. Simmonds and Bristow accept no responsibility to any third party who may use or rely upon this document or the information contained within.

Whilst S&B have made every effort to ensure the accuracy of the information contained within this document it may include typographical errors and may be changed or updated without notice.

Environmental Assessment of Vital Bon-Matt Stonewall
August 2012

TABLE OF CONTENTS

1. PRODUCT

Vital Bon-Matt Stonewall is a water-based copolymer formulated by Vital Chemical Pty Ltd to act as a dust suppressant and erosion/sediment control agent.

The composition of this mixture is proprietary information. The product components have been described by Vital Chemical and are listed below:

- Acrylate Copolymer <60%
- Non-hazardous Ingredients Remainder

These ingredients are determined not to be hazardous (see MSDS for Vital Bon-Matt Stonewall – Vital Chemical Pty Ltd).

2. USE

Vital Bon-Matt Stonewall consists of a copolymer emulsion for use in the coating and binding of dust particles where properties of high water and wind resistance, elasticity and tensile strength are required.

3. WASTE DISPOSAL

Small concentrations of this product should be absorbed using sand, vermiculite or other similar materials and disposed of in an approved municipal landfill. Although these recommendations are considered appropriate for safe disposal, it is necessary to ensure compliance with local regulations which may be more stringent.

Sprayed residues on particulate surfaces are subject to environmental degradation (e.g. by sunlight, hydrolysis and microorganisms) although rates would be variable depending on disposal conditions. Dusts and soils containing residues may be disposed to landfill or stockpiles where carbon oxides and hydrocarbons may be produced during decomposition.

4. ENVIRONMENTAL PROPERTIES AND BEHAVIOUR

Vital Bon-Matt Stonewall is a blend of acrylate copolymer and non-hazardous ingredients. It is non-flammable.

The formulation occurs as a stable white liquid (specific gravity of approximately 1.04) with a slight odour. The pH of the liquid approximately 7.0 – 9.5 (i.e. alkaline).

The slight odour released from this product would be reduced when used in open spaces or well ventilated areas.

Accidental and poorly controlled overspraying may disperse fine aerosols and mists off-site for considerable distances depending upon airborne droplet size in spray and environmental conditions (e.g. strong winds).

The dispersion of the product in water can result in off-site losses of unbound polymers and breakdown products. Water and wind erosion may also transport some polymer bound dust or soil particles off-site from application areas. However, the polymer coatings would tend to strongly bind to particles to reduce erosion potential.

Leaching of polymers and suspending agents through disturbed or sandy soils may occur but the binding nature of this mixture with soil surfaces would inhibit losses to groundwater.

5. ENVIRONMENTAL FATE

Spills can be readily contained by sand and absorbents such as sawdust or inert materials to allow disposal to landfill. Washing down residue from spill site is also recommended.

The primary environmental fate of the copolymer formulation is via degradation into simpler substances. The rate of breakdown, however, varies. By nature of their application, the soil bound polymers are intended to have a low initial rate of breakdown to ensure their efficiency in binding to soil particles

Degradation of residues is accelerated by exposure to strong sunlight, high temperatues, moist conditions and microorganisms.

From current knowledge, there appears to be no undesirable persistence or concentration of these polymers or breakdown products in the environment.

6. ENVIRONMENTAL AND ECOTOXICITY EFFECTS

Copolymers used as dust suppressants are not considered to be hazardous or harmful to the environment. No acute toxicity data, measured as LD_{50} in test animals, are available for this product. The LD_{50} for similar polymers has been reported as >2000 mg/kg which is practically non-toxic for mammals.

Large molecular weight compounds such as polyacrylics are not expected to bioconcentrate in organisms from residues in waters or soils. Ecotoxicity data for the product is unavailable and not considered relevant for the copolymers or suspending agents.

Potential breakdown products such as acrylic acid (monomer) and acrylic esters can readily biodegrade, have a low potential for persistence or bioaccumulation in the environment, and have low to moderate toxicity to aquatic organisms.

If released to waterways, lakes or dams, the biodegradation of dilute concentrations of residues should have little to no impacts on dissolved oxygen levels in receiving waters. Concentrated spills or leaks of formulated or diluted product for application, however, may have the capacity to cause depletion of dissolved oxygen and indirect effects on aquatic life as for discharges of organic matter wastes. The risk of acute and chronic toxicity due to residues in the environment is predicted to be low based on known properties of components, although direct ecotoxicity data on the product is unavailable.

7. ENVIRONMENTAL RISK MANAGEMENT

Potential environmental risks from the spray application of Vital Bon-Matt Stonewall dust suppressant are evaluated as low based on current knowledge and predicted environmental behaviour and fate. However, precautionary measures should be applied through following the MSDS and preventing release of product or residues to sensitive environments such as waterways or wetlands. This includes prevention of spillages and regulated disposal of any wastes.

8. REFERENCES

ANZECC & ARMCANZ (2000). *Australian and New Zealand Water Quality Guidelines for Fresh and Marine Waters.* Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand.

HSDB (2006). Hazardous Substances Databank. http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB. Accessed August 2012.

NPI (2006). The National Pollutant Inventory. www.npi.gov.au. Accessed August 2012.

Applied Australia Pty Ltd
ABN 96 082 810 973

1-9 Nina Link Dandenong South
Victoria 3175 Australia
PO Box 4588 Dandenong South
Victoria 3164 Australia

Tel +61 3 8773 7300
Fax +61 3 8773 7310

APPLIED DMT™

Use Summary

DMT™ is a membrane dust suppressant for coal and mineral ores. DMT™ is added to water at 2 - 4 %v/v and this solution is sprayed on to coal and mineral ore surfaces to suppress dust. The water evaporates, leaving a flexible membrane on the surface.

Hazard Summary

DMT™ is a water-based dust suppressant and contains a water soluble polymer, cellulosic material, wetting agents, pH buffering agents and preservative. The product is classified as Non-Hazardous according to Safe Work Australia (SWA) criteria. It is not a Scheduled Poison according to *Standard for the Uniform Scheduling of Medicines and Poisons No.1* 2010 (SUSMP).

Harmful acute and chronic health effects are not expected as a result of using or handling the DMT™ concentrate, diluted solution or veneered material.

DMT™ is not a skin or respiratory irritant and only has a mild and transient irritant effect on eyes. DMT™ is not hazardous by ingestion.

Independent analysis has stated *"Based on a review of the proprietary formulation the health and environmental hazard classification was assesses and confirmed to be non hazardous."*[1]

Environmental Summary

DMT™ consists of water and organic substances and does not contain petroleum fractions, oil, heavy metals or other material that may impact on the surrounding environment or produce harmful by-products during subsequent processing operations.

Independent analysis has stated *"Practically all ingredients present in the product are readily biodegradable. The product contains a polymer that is not readily biodegradable however it is inherently biodegradable. None of the polymers reviewed are considered to degrade to by-products that are hazardous to humans or the environment."*[1]

Further Information

Further information can be sourced by calling Applied Australia on 03 8773 7300

Graham Astbury (A.D. Clin Lab Tech)
Technical Sales and Project Manager

References

1. John Frangos. (August 2011) Toxikos evaluation DMT

Assessment of Vital Bon-Matt P47-VR1 and Vital Bon-Matt Stonewall with Respect to Hazards to Bovines through Ingestion

Prepared by:
Simon Lewer BSc.
Technical Director

Sydney Office
10 Victory Ave.
Camden, NSW, 2570

Brisbane Office
1 St. Clair Cl.
Parkinson, Qld. 4115

07-3711 2080
Fax: +61-7-3272 4581
admin@gauge.com.au

Background

Vital Chemical manufacture and market chemical products that control dust emission and soil erosion. The Vital Bon-Matt P47-VR1 and Vital Bon-Matt Stonewall are two of these products that are currently being used.

Chemistry

The chemistry of the raw materials disclosed by the manufacturer of the finished product is as follows.

Vital Bon-Matt P47-VR1

Acrylic copolymers (mix of types ranging from 250,000-400,000 Dalton)
Water
The remainder is comprised of non-hazardous components. One non-hazardous component is of the alkyl phenol ethoxylate surfactant type. Isothiazolone biocide compounds are present and a silicone based defoamer.

Vital Bon-Matt Stonewall

Styrene acrylic copolymer of molecular weight of 250,000-400,000 Dalton.
Water
The remainder is comprised of non-hazardous components.
One non-hazardous component is of the alkyl phenol ethoxylate surfactant. Isothiazolone biocide compounds are present as is a silicone based defoamer.

Explanation of Chemical Components

Acrylic Copolymers

Acrylic copolymers are polymeric compounds made from more than one acrylate or acrylic acid monomers.

They are prepared in water and stabilized with surfactants, ie. molecules that are hydrophilic (“water-loving”) in one segment and hydrophobic (“water-hating”) in the other. These copolymers are formed by a reaction that causes as many as 10,000 monomer units to bind together into a polymer chain. As these chains form, they grow into submicron-sized spheres. Within each sphere there are about 300 acrylic copolymer chains.
These spheres are incredibly small. A 200-gram sample of an acrylic emulsion contains tens of millions spheres.
A feature of these polymers is their extremely high molecular weights, which range from 100,000 Daltons to one million Daltons. Because of this, as the water evaporates the polymer spheres coalesce into a tough acrylic film that in the case of the copolymers in the Vital Bon Matt products has good resistance to abrasion and weathering.

Surfactant

Both Vital products contain alkyl phenol ethoxylate surfactants. These compounds are known endocrine disrupters in particular oestrogen mimics. The concentration of the compounds are extremely low in both Vital Bon Matt products that there is an expectation of an insignificant impact on cattle that ingest the Vital Bon Matt products.

Defoamer

Both Vital Bon Matt products contain silicone based defoamer. The silicone compound is polydimethylsiloxane which is a commonly used non-hazardous compound used in industries including the food industry. It is expected to have an insignificant impact on the health of cattle that ingest it in the Vital Bon Matt products due to the large molecular size.

Biocide

Isothiazolones are a common non-hazardous biocide used in industry and in particular cosmetics. It is at an extremely low level in both Vital Bon Matt products. There is no expectation for this biocide will impact on cattle health or accumulate significantly at these extremely low levels.

Application of Vital Bon Matt P47-VR1 and Vital Bon Matt Stonewall

The application rate of Vital Bon-Matt P47-VR1 is 5-10% as a dilution in tap water.

The application rate of Vital Bon-Matt Stonewall is 5-10% as a dilution in tap water.

The Vital Bon Matt products are applied via spraying leaving a thin film of almost entirely acrylic copolymer on the sprayed surface. This film is a product of the evaporation of the water carrier which occurs within minutes of application (dependant on weather conditions).

Upon drying, both products will remain as a virtually waterproof film that is not mobilised by rain or other water washing. The binding action of both products agglomerate soil particles thereby creating weight which resists mobilisation of the product through wind even in very high wind conditions. Therefore if the application of these Vital Bon Matt products is done to allow drying/curing by avoiding rain or other water rinsing, it is expected that these Vital Bon Matt products will only exist in areas where they were applied.

Presentation of the Vital Bon Matt Products to Cattle

In the uncoalesced or dried film form, the polymers in these Vital products will not hydrolyse, undergo thermal or photodegradation or depolymerisation. In the event of cattle ingesting the Vital products either in a wet or dried form (fresh or aged), the polymer compound will enter the animal in its original form.

Impact on Cattle if Vital Bon Matt P47 VR1 and/or Vital Bon Matt Stonewall is Ingested

Both Vital products assessed in this study are expected to have the same impact on cattle through ingestion as the ingredients are extremely similar.
There is no component in either product at the concentrations presented, that would cause injury or acute disease in cattle when ingested. The copolymers will remain intact even in the fermentative environment of the reticulorumen. Microorganisms in the reticulorumen include bacteria, protozoa, fungi, archaea, and viruses. Bacteria, along with protozoa, are the predominant in the rumen. They are categorized into several functional groups, such as fibrolytic, amylolytic, and proteolytic types, which preferentially digest structural carbohydrates, non-structural carbohydrates, and protein, respectively. The enzymes secreted by these microbes have little to no impact on the acrylic copolymers since these polymers do not contain any groups that are targeted by the enzymes.

Sydney Office
10 Victory Ave.
Camden, NSW, 2570

Brisbane Office
1 St. Clair Cl.
Parkinson, Qld. 4115

07-3711 2080
Fax: +61-7-3272 4581
admin@gauge.com.au

Assimilation and Bioaccumulation

The copolymers in both Vital Bon Matt products are not expected to cross biological membranes and bioaccumulate due to their high molecular weight even if ingested before drying(1).

Alkyl phenol ethoxylates(APE) can affect endocrine systems of mammals however the concentration has to be high for an effect to be detected. The effect is weak because nonylphenols are not very close structural mimics of estradiol. Large quantities can induce an affect. The levels of alkyl phenol ethoxylates in the Vital Bon Matt products are far below a level that would create a problem.
An assessment performed by Environment Canada of all commercially relevant alkylphenols and their ethoxylates states that none of the substances met the criteria for persistence or bioaccumulation.

Isothiazolone biocides are not carcinogenic, mutagenic or teratogenic in cattle or in humans(3).
These biocides are not stable in sunlight(3) and breakdown within days in the Vital Bon Matt products as they dry to form a film. At the low levels in the applied solution, the isothiazolone presents a negligible risk to cattle.

The silicone (PDMS) defoamer present in the Vital Bon Matt products do not cross biological membranes due to their large size. Due to this, they also do not bioaccumulate and will pass through a cattle digestive system intact and not absorbed(2). At this low level in the applied solution, the PDMS defoamer presents a negligible risk to cattle.

The APE surfactant, silicone based defoamer and biocides are present in extremely small concentrations applied liquid. Together with their inherently degradable and safe chemistry, they are expected to not affect health of the cattle or be absorbed into the body of cattle that may ingest the Vital Bon Matt products.

Any other Chemistry of Concern

Both Vital Bon Matt P47 VR1 and Vital Bon Matt Stonewall do not contain heavy metals, organochlorines or any chemistries that are classified as hazardous or could break down in the ruminant gastric system to produce hazardous material.

Conclusion

Vital Bon Matt P47 VR1 and Vital Bon Matt Stonewall do not contain chemistries (or break down to chemistries) that is hazardous to cattle upon ingestion in either a wet or dried form. Based on the research evidence available and knowledge of the molecular size of the Vital products, Vital Bon Matt P47 VR1 and Vital Bon Matt Stonewall will not be absorbed by the digestive system of the cattle and therefore not accumulate in any tissue.

Sydney Office
10 Victory Ave.
Camden, NSW, 2570

Brisbane Office
1 St. Clair Cl.
Parkinson, Qld. 4115

07-3711 2080
Fax: +61-7-3272 4581
admin@gauge.com.au

References

(1) Full Public Report, Acrylic Copolymer, National Industrial Chemicals Notification and Assessment Scheme, Oct 1995
(2) An overview of polydimethylsiloxane (PDMS) in the environment, Dow Corning , 1998.
(3) Environmental Fate and Ecotoxicology of Isothiazolone Biocides, Williams and Jacobsen, Rohm and Haas.

Sydney Office
10 Victory Ave.
Camden, NSW, 2570

Brisbane Office
1 St. Clair Cl.
Parkinson, Qld. 4115

07-3711 2080
Fax: +61-7-3272 4581
admin@gauge.com.au

Connell Hatch
ABN 21 646 421 651
433 Boundary Street
Spring Hill
Queensland 4004 Australia

Telephone: +61 7 3135 8444
Facsimile: +61 7 3135 8445
Email: chbne@connellhatch.com
www.connellhatch.com

Wagon Lids Analysis
Environmental Evaluation
Queensland Rail Limited

31 March 2008
Reference H327578-N00-EE00.07
Revision 1

Document Control

Document ID: V:\PROJECTS\QUEENSLAND RAIL\H327578 - COAL TRAIN DUST STUDY\REPORTS\EE\SUPPLEMENTARY REPORTS\FINALS\WAGON LIDS\20080331.WAGONLIDS.REV1.DOC

Rev No	Date	Revision Details	Typist	Author	Verifier	Approver
0	12 March 2008	Draft Report	BB	DJP	SMC	RJH
1	31 March 2008	Final Report	BB	DJP	SMC	RJH

EXPLANATORY STATEMENT

Important Things You Should Know About This Report

Exclusive Use

- This report has been prepared by Connell Hatch at the request of Queensland Rail ("Client") exclusively for the use of its Client.
- The basis of Connell Hatch's engagement by the Client is that Connell Hatch's liability, whether under the law of contract, tort, statute, equity or otherwise, is limited as set out in the terms of the engagement.

Third Parties

- It is not possible to make a proper assessment of this report without a clear understanding of the terms of engagement under which the report has been prepared, including the scope of the instructions and directions given to and the assumptions made by the consultant who has prepared the report.
- The report is a report scoped in accordance with instructions given by or on behalf of Client. The report may not address issues which would need to be addressed with a third party if that party's particular circumstances, requirements and experience with such reports were known and may make assumptions about matters of which a third party is not aware.
- Connell Hatch therefore does not assume responsibility for the use of, or reliance on, the report by any third party and the use of, or reliance on, the report by any third party is at the risk of that party.

Inherent Risk

- A report of this nature is not a certification, warranty or guarantee.

Limited Scope

- The limited scope of Connell Hatch's brief in this matter, including the limited scope of investigation requested by Client, means that the report necessarily concentrates on readily apparent major items.
- Amongst other things, Connell Hatch's brief expressly excludes investigation or advice in relation to the actual or potential presence of pollution, contamination or asbestos, or the actual or potential risk of any incident affecting the safety of operation.

Limits on Investigation and Information

- The extent of investigation required to provide a comprehensive report on the matters the subject of this report would normally be significantly greater than has been carried out to provide this report. Where site inspections have been made, they have been limited in their scope to external visual inspections.
- The report is also based on information provided to Connell Hatch by other parties. The report is provided strictly on the basis that the information that has been provided is accurate, complete and adequate.
- Connell Hatch takes no responsibility and disclaims all liability whatsoever for any loss or damage that the Client may suffer resulting from any conclusions based on information provided to Connell Hatch, except to the extent that Connell Hatch expressly indicates in the report that it has verified the information to its satisfaction.

Limits on Cost Indications

- Since Connell Hatch has no control over the cost of labour, materials, equipment or services furnished by others, or over contractors' methods of determining prices, or over competitive bidding or market conditions, any indication of costs is made on the basis of Connell Hatch's experience and qualifications and represents its best judgment as an experienced and qualified professional consultant, familiar with the relevant industry, but Connell Hatch cannot and does not guarantee that proposals, bids or actual construction costs will not vary from cost indications given.

No Comment on Commercial Feasibility

- The findings, observations and conclusions expressed by Connell Hatch are not, and should not be considered as, an opinion concerning the commercial feasibility of the property or asset.

Legal Documents etc

- The report may contain various remarks about and observations on legal documents and arrangements such as contracts, supply arrangements, leases, licences, permits and authorities. A consulting engineer can make remarks and observations about the technical aspects and implications of those documents and general remarks and observations of a non legal nature about the contents of those documents. However, as a Consulting Engineer, Connell Hatch is not qualified, cannot express and should not be taken as in any way expressing any opinion or conclusion about the legal status, validity, enforceability, effect, completeness or effectiveness of those arrangements or documents or whether what is provided for is effectively provided for. They are matters for legal advice.
- If the reader should become aware of any inaccuracy in or change to any of the facts, findings or assumptions made either in Connell Hatch's report or elsewhere, the reader should inform Connell Hatch so that it can assess its significance and review its comments and recommendations.
- Nothing in this report shall be read or applied so as to purport to exclude, restrict or modify, or have the effect of excluding, restricting or modifying the application of all or any of the provisions of the Trade Practices Act 1974 or any other legislation which by law cannot be excluded, restricted or modified.
- This report, in whole or in part, may only be reproduced or published with the prior written permission of Connell Hatch, and this explanatory statement must accompany every copy of this report.

Contents

Executive summary

The supplementary report presents the particulars of an analysis of wagon lids that was undertaken by Connell Hatch with respect to the Environmental Evaluation commissioned by Queensland Rail Limited. Covering coal wagons with lids has been identified as a mitigation strategy to reduce coal dust emissions from the top of both loaded and unloaded wagons. This report must address two potential variations to the proposed mitigation strategy, retrofitting lids to existing wagons and designing lids into future wagons. Accordingly, for each of the aforementioned, the aim of this report is to:

- Determine the advantages and disadvantages associated with implementing wagon lids
- Consider the impact of lid failures to the industry
- Estimate the capital investment and operational cost associated with wagon lids
- Assess the mitigation strategy for practicability and cost-effectiveness

The outcomes achieved with respect to the aims of this report include:

- The major advantages associated with implementing wagons lids include:
  - 99% reduction in coal dust emissions from the top of wagons, the major coal dust emission source
  - Potential to completely seal the wagons doors
  - Reduction in aerodynamic drag
  - Environmentally friendly solution
- The major disadvantages associated with implementing wagons lids include:
  - Large operating cost (retrofitting only)
  - Modifications to all loading and unloading sites
  - Ramifications of lid failure
- The estimated costs associated with implementing both options are highly dependant upon factors which require a detailed investigation, prior to making an informed judgement. Accordingly, it is considered to be prudent to accept the outcomes of the practicability and cost-effectiveness assessment, which currently show relatively good results, in the absences of such an analysis
- The major concerns with the introduction of any form of lids is the untried nature of these in the coal industry, a harsh environment. The lids proposed as a retrofit are of an experimental nature, hence are not able to be tried with any certainty as to whether they are reliable, safe or effective. The lids which would be incorporated in any design are by definition untried, however QR experience with this style of lids in other industries has proven that these are maintenance intensive, hence cannot be recommended without significant development work being undertaken.
- The final finding of this report is that the implementation of lids to wagons is not to be undertaken at the current time, with further development being warranted prior to any implementation proposal.

Glossary of terms

CQCI
Central Queensland Coal Industry – entire coal supply chain

CQCN
Central Queensland Coal Network – entire rail infrastructure network

EE
Environmental Evaluation

QR
Queensland Rail Limited

QRNA
Queensland Rail Network Access – below rail operator

QRN
Queensland Rail National – above rail operator

1. Introduction

Queensland Rail Limited (QR) has appointed Connell Hatch, John Planner of Introspec Consulting and Katestone Environmental to prepare an Environmental Evaluation (EE) of coal dust emissions engendered from rollingstock in the Central Queensland Coal Industry (CQCI) in response to a Notice issued by the Queensland Environmental Protection Agency (EPA). The deliverables of the report have been stipulated by the Terms of Reference for the project which encompass:

a) *Identify all potential sources of coal dust emissions from QR trains in Central Queensland on land described as rail lines connecting coal mines in the Bowen and Callide Basins with ports at Dalrymple Bay, Hay Point and Gladstone*

b) *Quantify the potential risk of environmental harm posed by each dust source*

c) *Identify the factors and circumstances that contribute to dust emissions and/or impacts from each source. Consideration should be given to (but not limited to) issues such as coal type, coal properties and meteorological conditions.*

d) *Based on the findings from the above, identify locations within QR's Central Queensland operations where proximity of railway lines to communities may give rise to higher risk of environmental harm due to fugitive coal dust*

e) *Identify ways to reduce the risk being caused by coal dust emissions and assess each for practicability, effectiveness and cost, in relation to the mitigation of environmental impacts of fugitive coal dust emissions*

The sources of coal dust emissions that have been identified in the CCQI include emissions from:

- The coal surface of loaded wagons
- Coal leakage from the doors of loaded wagons
- Wind erosion of spilled coal in the rail corridor
- Residual coal in unloaded wagons and leakage of residual coal from the doors
- Parasitic load on sills, shear plates and bogies of wagons

This supplementary report presents the particulars of an analysis of wagon lids that was undertaken with respect to the EE commissioned by QR. Wagon lids have been identified as mitigation strategy for reducing coal dust emissions from the top of loaded and unloaded wagons. There are two potential approaches that could be adopted regarding wagon lids: retrofitting lids to existing wagons or designing lids into wagons. The former is a shorter-term strategy whereas the latter is considered to be a longer-term option, therefore it is imperative that both options are considered exclusively.

In order to assess the practicability and cost-effectiveness, the capital investment and operational costs associated with each option will be determined and then each option will be rated against a set of weighted rating factors.

2. Advantages

There are numerous advantages that would result from the implementation of wagon lids, the most influential of which include:

- 99% reduction in coal dust emissions from the top of loaded and unloaded wagons
- Potential to completely seal the wagons doors
- Reduction in aerodynamic drag
- Environmentally friendly solution

The reduction in aerodynamic drag had been reported to be in the order of 20% based on trials conducted in the US (diesel haul). Due to varying conditions between the US trials and what would be experienced in the CQCI, this figure cannot be applied to the CQCI. Considering that the majority of the network is electrified, the only feasible method of estimating the reduction in aerodynamic drag would be to conduct trials in the CQCI and measure the change in, and cost of, the energy savings.

3. Disadvantages

There are numerous disadvantages that would result from the implementation of wagon lids, the most influential of which include:

- Additional capital expenditure to purchase and install
- Lid failure (discussed in detail in the Section 3.1 Failure)
- Decreased payload due to the weight of the lids
- Modifications required to all loading and unloading stations
- Provisions must be provided for lid maintenance and replacement operations
- Cost of maintenance to lids on wagons

3.1 Failure

3.1.1 Definition

Lid failure is defined as any situation when the wagon lid does not function as it is designed. This definition therefore includes all instances where lids do not open or close as designed, seizes up, collides with other equipment, inhibits the supply chain in any way due to malfunction etc.

3.1.2 Consequences

In a continuous loading situation, the failure of a lid could result in a chute or loading system component colliding with the lid causing damage to both the lid and loading system. Alternatively, the loading system could attempt to load the wagon, damaging the lid, spilling coal and significantly increasing the potential to derail the train. Increased automatic sensing equipment in the control system is required to be implemented in order to avoid either of the aforementioned incidents. Regardless of the potential for damage, if a lid was to fail under any circumstances, the potential resulting scenarios include:

- Stop the train and attempt to fix the lid
  - Delays train
  - Requires trained personnel
  - If the lid cannot be fixed then the wagon will travel around empty until it can be shunted out of the wagon set or replaced
- Leave the wagon unloaded
  - The wagon will travel around empty until it can be shunted out of the wagon set or replaced

A potential problem with leaving damaged lids in service is that if loading and unloading operators are unaware of the failure or particular operations are autonomous, there is the potential for further damage to the lid and surrounding infrastructure, downtime etc if an already failed lid is activated.

Another consideration which would need to be made is how to deal with a failure. Presuming that a failed lid needs replacing, it can either be done immediately, resulting in significant downtime for a particular train and wagon set. Or, the wagon would have to remain in service unloaded until it receives its next three-weekly reliability evaluation. There are many factors which could influence which course of action to take, such as if there were multiple failures in a wagon set, or how close the wagons were to their next reliability evaluation.

4. Costing

4.1 Retrofit

In order to estimate the costs involved with retrofitting lids to the existing fleet, an industry supplier of wagon lids was engaged.

The proposal put forward is a leasing arrangement, which will provide the lids for an operating cost on a time basis. The following indicative cost estimate was provided:

- Capital investment : Nil
- Operational cost : $5.00 - $8.00 per wagon trip

The operating cost presented covers the installation, commissioning of the lids as well as modifications to loading and unloading facilities, ongoing service and maintenance and any staff training. However, there are also many costs and benefits that are not included in the price that could have a marked impact on the estimated operational cost, viz:

- Potential energy savings associated with reduced aerodynamic drag. The only feasible method to estimate this cost would be to perform trials in the CQCI with wagon lids installed on trains to measure the energy savings
- Provisions for additional non-electrified sections of track at central points, with appropriate facilities, access and safety features to perform maintenance operations
- Lost payload due to the weight of each wagon lid. The impact of this would depend highly on the weight of each lid in relation to the accuracy of the weighbridge equipment, reportedly 500 kg. If this was the case, for example, it could be argued that a lid of 250 kg would push the average measurement to the next level
- Costs associated with lid failure
  - Train delays
  - Lost payload
  - Removing trains from service and shunting
  - Damage to infrastructure

All of the aforementioned costs are highly variable and dependant on a range of variables, therefore it considered to be prudent not to attempt to quantify these costs without an in-depth analysis of the full costs and benefits associated with wagon lids, taking into account potential scenarios and operational decisions which would alter the outcomes significantly.

4.2 Design

The capital investment required to design lids into wagons is estimated to be $10000 per wagon. This cost reflects the cost difference between a wagon with a lid and one without. Considering the need for a highly reliable and therefore simplistic design with a minimum of moving parts, this cost difference is considered to be relatively minimal. Extrapolating this cost to a fleet of 7,000 wagons, the estimated capital investment required is in the order of $70 million.

There would be no specific operating cost associated with this type of wagon lid as assessed. Further assessment of the option is required to determine the final cost of the lid in totality.

However, all of the costs which are applicable to the retrofitting option which cannot be accurately estimated are not taken into account. Arguably, a highly reliable wagon lid could be designed as part of the wagon, which might reduce the probability of lid failure, which could reduce some of these costs.

5. Assessment

5.1 Prelude

The practicability and cost-effectiveness of introducing wagon lids is determined by giving a weighted score to predetermined rating factors. The rating system has been developed in order to facilitate a weighted score for each mitigation strategy arising from the EE which has a generic comparable base. This was achieved by developing:

- A set of weighted rating factors which are relevant to the practicability and cost-effectiveness of a mitigation strategy, and
- A rating guide (see Appendix B) pertaining to various aspects of the rating factors which will highlight the differences between the different mitigation strategies

5.2 Retrofit

Table 1 shows that retrofitting lids scores well with respect to the rating factors for cost-effectiveness, scoring 3.6 out of 5, with 5 being the highest. This outcome is achieved because of the estimated 99% reduction in coal dust emissions from the top of the wagons, the primary identified coal dust emissions source as well as the fact that full operating cost of the lids cannot be estimated accurately. Table 2 shows that retrofitting lids scores relatively poorly with respect to the weighted rating factors for practicability, scoring 2.15 out of 5.

This score when compared to other alternatives is not in the acceptable range.

Table 1 – Retrofit Lids Cost-Effectiveness Assessment

Factor	Rating Code	Weighting	Rating
Capital Investment	A	20%	4
Operational Cost	B	40%	2*
Effectiveness	C	40%	5
Total		**100%**	**3.6**

** Does not account for many factors*

Table 2 – Retrofit Lids Practicability Assessment

Factor	Rating Code	Weighting	Rating
Implementation			
Ease	D	8%	3
Time	E	8%	2
Resources	D	8%	5
Capacity Impact	G	35%	2
Maintainability	D	2%	3
Reliability	F	15%	1
Implementation Risk	G	14%	1
Safety	F	5%	2
Environmental	F	5%	4
Total		**100%**	**2.15**

5.3 Design

Table 3 shows that design lids scores acceptably with respect to the rating factors for cost-effectiveness, scoring 3.4 out of 5, with 5 being the highest. This can be associated with the fact that like retrofit lids, this outcome is achieved because of the estimated 99% reduction in coal dust emissions from the top of the wagons, the primary identified coal dust emissions source. Table 4 shows that design lids scores poorly with respect to the weighted rating factors for practicability, scoring 2.32 out of 5.

QR's experience with this style of lid has indicated that the cost of maintenance could be >$10.00 per day per wagon based upon their experience in other industries. This is a significant cost impost when compared to the current maintenance costs.

The combination of these mediocre scores determines that lids are not practical and are not a cost effective mitigation strategy to reduce coal losses from the top of loaded coal wagons during transport in the CQCI.

Table 3 – Design Lids Cost-Effectiveness Assessment

Factor	Rating Code	Weighting	Rating
Capital Investment	A	20%	3
Operational Cost	B	40%	2
Effectiveness	C	40%	5
Total		**100%**	**3.4**

** Does not account for many factors*

Table 4 – Design Lids Practicability Assessment

Factor	Rating Code	Weighting	Rating
Implementation			
Ease	D	8%	5
Time	E	17%	1
Resources	D	8%	5
Capacity Impact	D	40%	2
Maintainability	D	2%	5
Reliability	F	15%	1
Implementation Risk	G	14%	1
Safety	F	5%	2
Environmental	F	5%	5
Total		**100%**	**2.32**

5.4 Comparison

Appendix B contains a complete assessment including both practicability and cost-effectiveness for all of the identified mitigation strategies. Figure 1 highlights the distinct difference between the two lid options as mitigation strategies. There are a few factors which contribute to the differences, mainly:

- Cost (both capital investment and operating cost)
- Operational impact

Designing lids is a cheaper operating cost option because if lids are retrofitted and sourced from another company, they will inherently cost more. There is also therefore less control over the design of the lids, the reliability of the lids, the facilities required to operate and maintain the lids etc.

Potentially the most important difference to consider upfront is the difference in timeframes between the options. Retrofitting lids is estimated to be achieved in 1-5 years, whereas given the design life and cost of building wagons, designing lids into wagons would only be reflected in the industry in the 20-30 year period. Accordingly, retrofitting lids is really a shorter-term solution that could be considered in the interim, with designing in wagon lids to be considered as a long-term migration strategy.

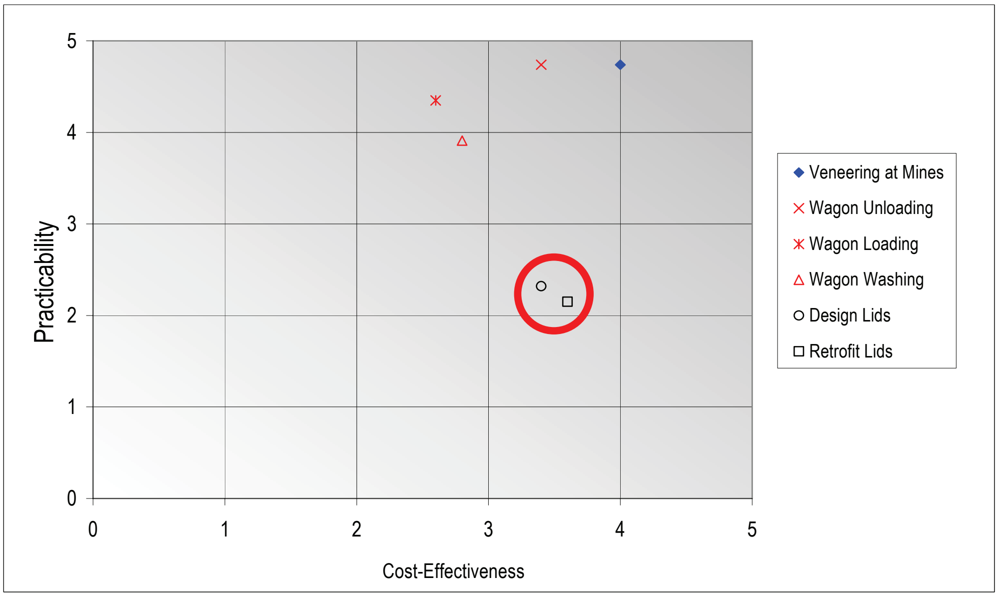


Figure 1 – Mitigation Strategies Assessment Summary

6. Conclusion

An analysis of introducing wagon lids to cover coal wagons in the CQCI has concluded that the major advantages associated with implementing this mitigation strategy would include:

- 99% reduction in coal dust emissions from the top of wagons, the major coal dust emission source
- Potential to completely seal the wagons doors
- Reduction in aerodynamic drag
- Environmentally friendly solution

The major disadvantages associated with implementing wagons lids include:

- Large operating cost (retrofitting only)
- Modifications to all loading and unloading sites
- Ramifications of lid failure

It was acknowledged that there are many potential operational impacts and costs associated with implementing wagon lids that cannot be estimated without a thorough detailed investigation which would need to consider the operational decisions, reliability of lids, facilities at very intricate level of detail. It is therefore considered prudent not to consider wagon lids as a potential mitigation strategy without undertaking the aforementioned course of action.

This initial assessment of wagon lids has indicated that both options are not cost effective, given that both would almost eliminate coal dust emissions from the primary dust source, however without a full comprehension of the costs associated with wagon lids, this result cannot be taken at face value. Both retrofitting and designing lids showed mediocre good scores with respect to practicability, but these scores are highly dependant upon the operational impact and reliability of the lids, wither of which can be accurately estimated without a thorough investigation.

Appendix A

Wagon Lids Fact Sheet

Wagon Lids

Lightweight, automatic fibreglass wagon lids can be installed on train wagons to prevent coal loss during transportation.

"The key factor that contributes to the emission rate of coal dust from wagons is the speed of the air passing over the coal surface." (QR EE Interim Report, Jan 2008)

Capital Investment
Nil

Operational Cost
$5.00 - $8.00*

Major Benefit
Stops coal dust and spillage from the top of rail wagons

Operating devices at either side of loading stations will also be required to open and close the lids prior to and following loading.

Installing lids will provide a highly effective and visible solution to managing coal loss, which will address community, environmental and industry concern.

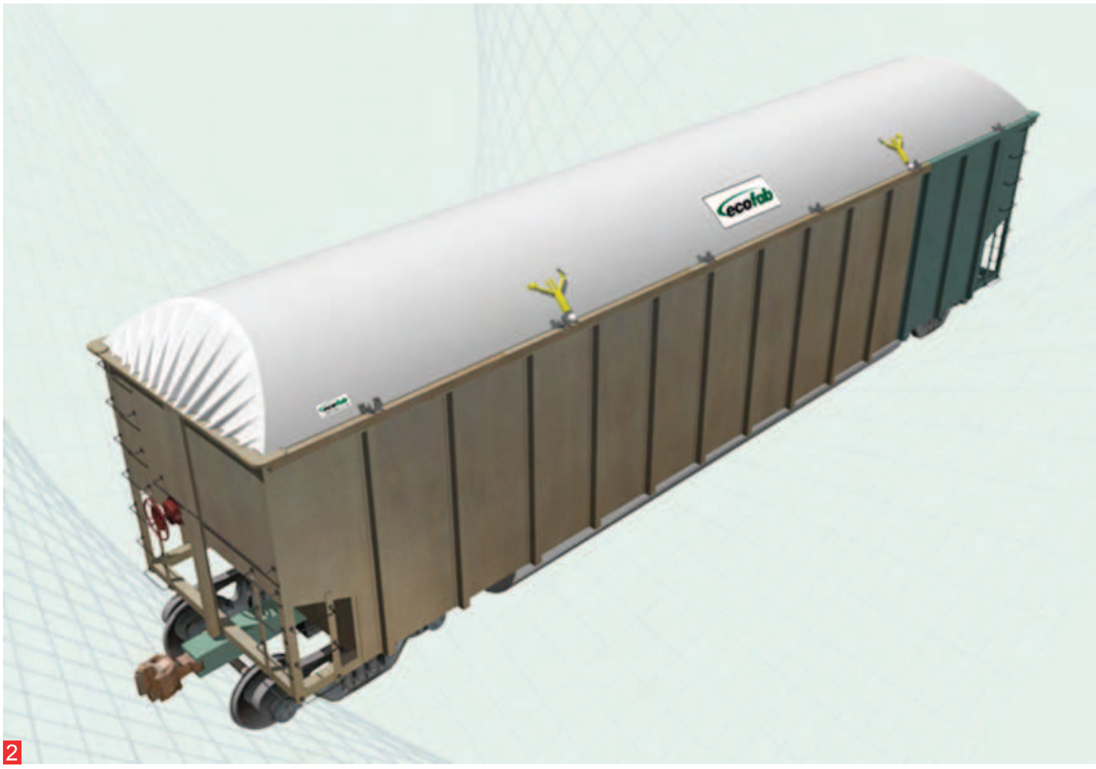
1

Advantages

- Eliminate dust from the top of loaded and empty wagons
- Fuel savings due to reduced aerodynamic drag
- Reduce environmental and community concern

Disadvantages

- Modifications required to all loading systems
- Capacity impacts due to lid failure



2

1. Artist impression © Ecofab 2008
2. Artist impression © Ecofab 2008

* per wagon trip - does not account for lid failure or fuel savings

DRAFT

Connell HATCH
Infrastructure for Industry

Appendix B

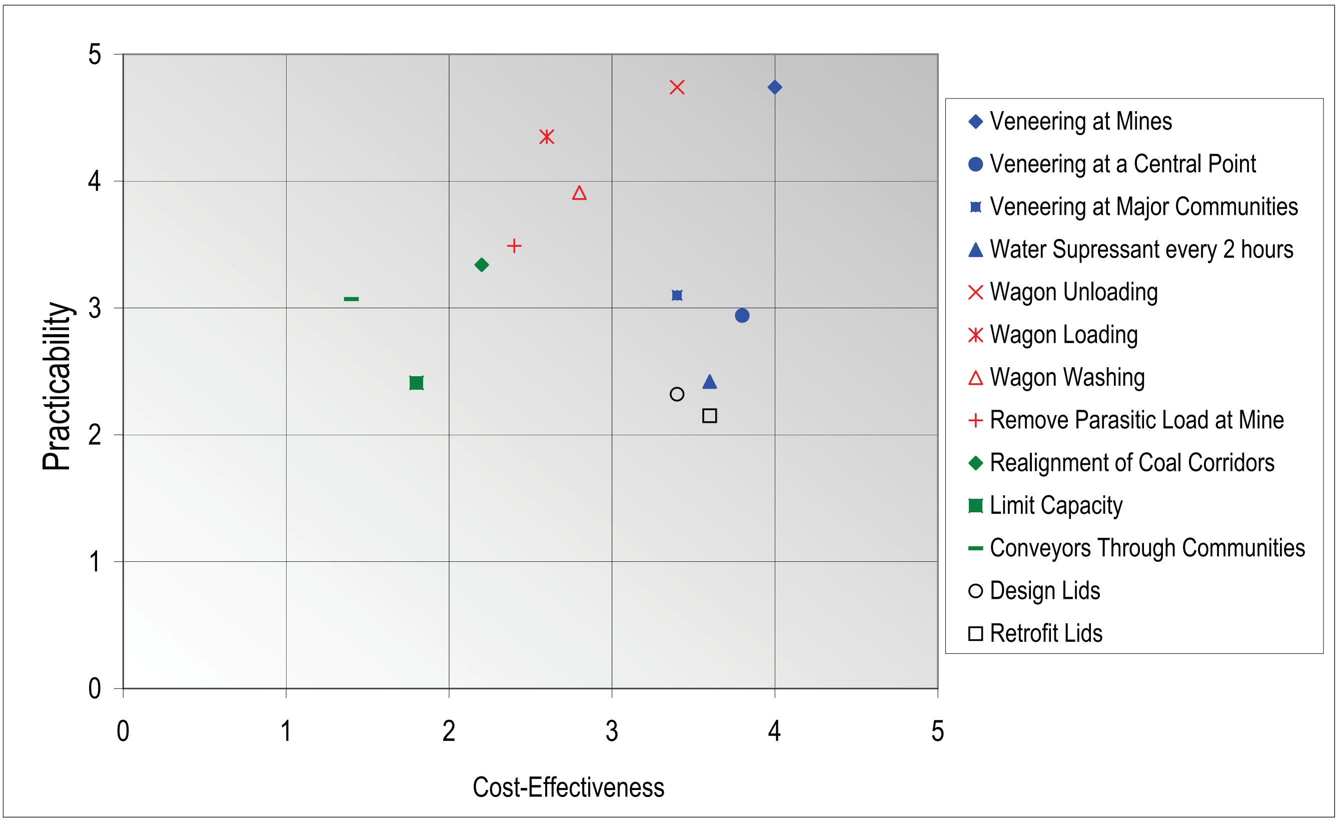
Mitigation Strategies Assessment

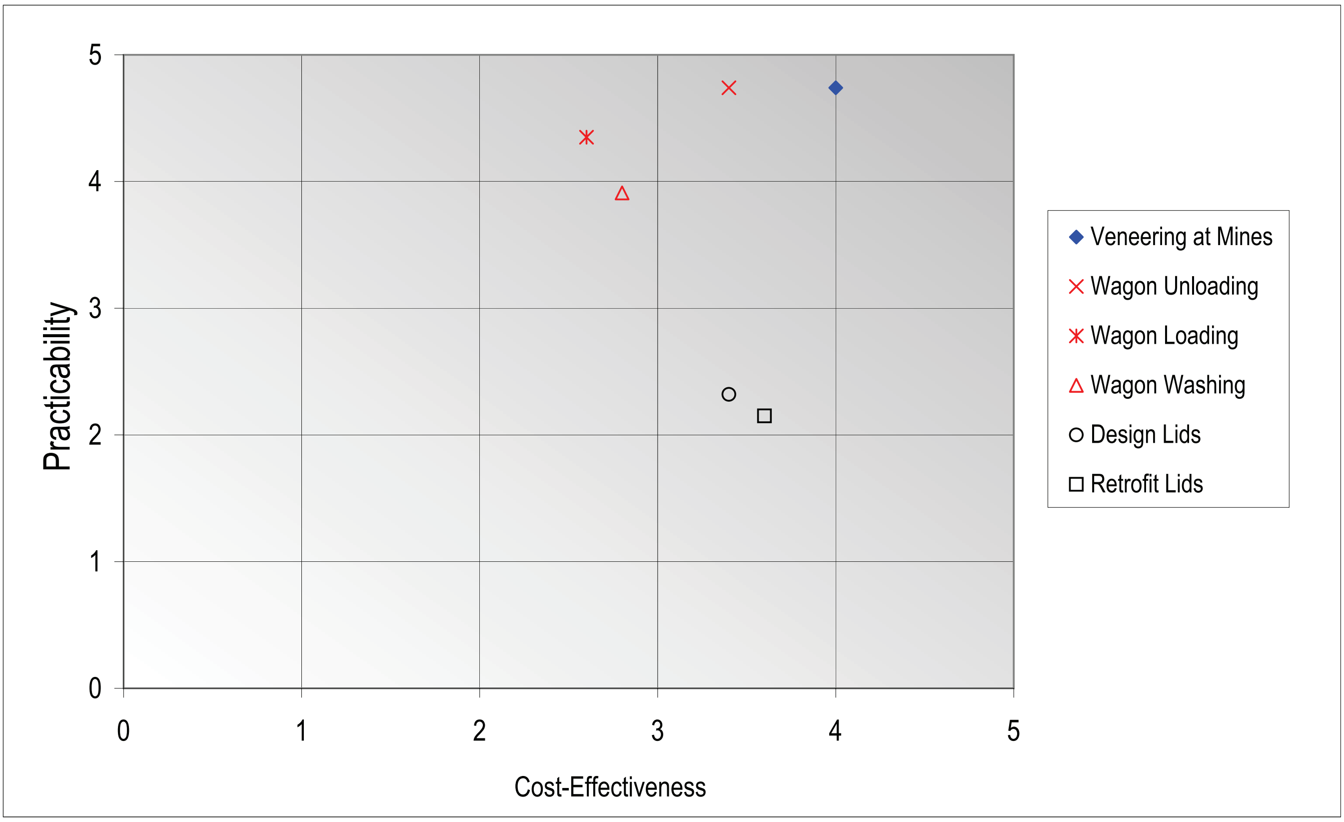
Mitigation Strategies Rating Guide

		Rating Code						
		A	B	C	D	E	F	G
Rating	5	<$1M	<$1	>80%	Very Easy	<1 month	No Impact	Very Low
	4	$1M – $10M	$1 – $5	>60 – 80%	Easy	1-12 months	Low Impact	Low
	3	>$10M - $25M	>$5 – $10	>40 – 60%	Achievable	>1-2 years	Some Impact	Medium
	2	>$25M - $50M	>$10 –$15	20 – 40%	Difficult	>2-5 years	High Impact	High
	1	>$50M	>$15	<20%	Extremely Difficult	>5 years	Untried	Very High

Rating Units

A	industry cost
B	per wagon trip
C	reduction of overall emissions
D	overall assessment
E	implementation timeframe
F	overall assessment
G	overall assessment


Practicability
Cost-Effectiveness
0
1
2
3
4
5
Veneering at Mines
Veneering at a Central Point
Veneering at Major Communities
Water Supressant every 2 hours
Wagon Unloading
Wagon Loading
Wagon Washing
Remove Parasitic Load at Mine
Realignment of Coal Corridors
Limit Capacity
Conveyors Through Communities
Design Lids
Retrofit Lids



Practicability
Cost-Effectiveness
0
1
2
3
4
5
Veneering at Mines
Wagon Unloading
Wagon Loading
Wagon Washing
Design Lids
Retrofit Lids

Client: Queensland Rail Limited
Job Number: H327578-N00-EE00
Project: Environmental Evaluation
Description: Coal Dust Emissions Mitigation Strategies Assessment

Date: 31.03.2008
Revision: 0

Cost-Effectiveness Assessment

	Rating Code	Weighting	Veneering at Mines	Wagon Loading	Wagon Washing	Wagon Unloading	Retrofit Lids	Design Lids	Conveyors Through Communities	Realignment of Coal Corridors	Limit Capacity	Remove Parasitic Load at Mine	Water Supressant every 2 hours	Apply Deflectors to Wagons	Veneering at a Central Point	Veneering at Major Communities
Capital Investment	A	20%	4	1	2	3	4	3	1	1	5	2	4	3	5	5
Operational Cost	B	40%	4	5	4	5	2	2	2	4	1	4	5	5	4	4
Effectiveness	C	40%	4	1	2	2	5	5	1	1	1	1	2	0	3	2
Total:		**100%**	**4**	**2.6**	**2.8**	**3.4**	**3.6**	**3.4**	**1.4**	**2.2**	**1.8**	**2.4**	**3.6**	**2.6**	**3.8**	**3.4**

Practicability Assessment

	Rating Code	Weighting	Veneering at Mines	Wagon Loading	Wagon Washing	Wagon Unloading	Retrofit Lids	Design Lids	Conveyors Through Communities	Realignment of Coal Corridors	Limit Capacity	Remove Parasitic Load at Mine	Water Supressant every 2 hours	Apply Deflectors to Wagons	Veneering at a Central Point	Veneering at Major Communities
Implementation																
Ease	D	8%	5	2	2	4	3	5	1	1	2	3	2	2	3	4
Time	E	8%	4	2	2	4	2	1	1	1	2	3	3	1	4	4
Resources	D	8%	4	5	3	5	5	5	4	2	5	2	1	5	3	4
Capacity Impact	G	35%	5	5	5	5	2	2	3	4	1	4	1	5	1	1
Maintainability	D	2%	5	4	4	5	3	5	4	5	5	4	4	4	4	4
Reliability	F	15%	5	4	4	5	1	1	3	5	4	3	3	5	5	5
Implementation Risk	G	14%	5	5	3	5	1	1	4	3	1	3	4	1	4	4
Safety	F	5%	5	5	5	4	2	2	5	4	5	5	5	5	5	5
Environment	F	5%	3	5	5	4	4	5	4	3	5	5	5	5	3	3
Total:		**100%**	**4.74**	**4.35**	**3.91**	**4.74**	**2.15**	**2.32**	**3.07**	**3.34**	**2.41**	**3.49**	**2.42**	**3.86**	**2.94**	**3.1**

katestone environmental

Expert | Advice | Air

21 June 2013

Attn: Michael Roche
Queensland Resources Council
Level 13
133 Mary Street
Brisbane
Queensland
4000

Re: Brisbane Hearing of the Senate Standing Committee Comments – ultrafine particulates

Dear Michael,

During QRC's appearance at the Brisbane Hearing of the Senate Standing Committee on Community Affairs inquiry into the Impacts on Health of Air Quality in Australia, a question about ultrafine particles was taken on notice. Please find below a response to this question.

The Chair of the Hearing requested that evidence or scientific data on ultrafine particles from coal dust from trains be presented in order to show they are not a component of coal dust from wagons.

A *"Health Impacts of Ultrafine Particles"* study conducted by Professor L. Morawska for the Australian Government Department of the Environment and Heritage (Morawska et al, 2004) provides a detailed description of the sources and characteristics of ultrafine particles. The study states:

> *"Particles in the ultrafine and, more generally, in the submicrometre ranges are generated mainly from combustion, gas to particle conversion, nucleation processes or photochemical processes.......... Particles in supermicrometre size ranges result mainly from mechanical processes."*

The submicrometre range relates to particles less than 1 µm in diameter and the supermicrometre range relates to particles greater than 1µm. Mechanical process that generate supermicrometre particles would include the wind erosion of coal in the wagons of a coal train.

Whilst we are unaware of the having been direct measurements of ultrafine particles from coal wagons, the available evidence suggests that this is not a priority for research.

Ground Floor, 16 Marie St, Milton, QLD.
PO Box 2217, Milton, QLD. 4064, Australia
ABN 92 097 270 276

www.katestone.com.au
Ph +61 7 3369 3699
Fax +61 7 3369 1966

The current research and investigations into coal dust from trains has focused on TSP, PM_{10} and $PM_{2.5}$ as they are the particle size fractions most commonly associated with mechanical disturbance of bulk material handling operations and, therefore associated with coal dust emissions from trains. The majority of ultrafine particle research to date has focused on motor vehicle emissions as this has been shown to be the major source in an urban environment.

Yours sincerely,

Simon Welchman – Director