

Coal Dust Management Plan

13 March 2020



Table of Contents

1.0	Introduction	2
2.0	Central Queensland Coal Supply Chain Overview	2
3.0	Coal Dust	4
4.0	Coal Dust Management on the CQCN	5
4.1	Regulatory Background	5
4.2	Measures Implemented by Coal Producers.....	7
4.2.1	Garden Bed Profiling.....	7
4.2.2	Veneering.....	8
4.3	Measures Implemented by Rail Network Manager.....	8
4.3.1	Transfer Facility Licences	8
4.3.2	Opacity Monitoring and Reporting	8
4.3.2	Access Management on the CQCN.....	10
4.3.3	Ballast Management	10
4.4	Measures Implemented by Rail Operators	10
4.5	Measures Implemented by Coal Terminal Managers.....	12
5.0	Summary of Performance	13
6.0	Complaints Management.....	14
7.0	Stakeholder Engagement	14
9.	References.....	15

Coal Dust Management Plan

1.0 Introduction

This Coal Dust Management Plan (**CDMP**) focuses on operations on the Central Queensland Coal Network (**CQCN**) rail corridors undertaken by the Central Queensland Coal Supply Chain. It outlines actions undertaken during train loading processes at mines, transport of coal on the CQCN, and train unloading processes at the ports. This document provides an update to the CDMP originally released in 2010.

The purposes of the CDMP are to:

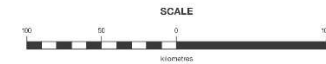
- provide a high-level plan for the Central Queensland coal supply chain to manage coal dust from trains transporting coal on the CQCN;
- inform stakeholders of CQCN coal supply chain practices;
- demonstrate the performance, and associated effectiveness, of the existing management measures which are being implemented across the CQCN because of the commitments outlined in the previous CDMP; and
- outline mechanisms to respond to community concerns.

The Central Queensland Coal Supply Chain recognises the need for industry Best Practice to mitigate coal dust. The CDMP highlights that isolated responses by single entities will not provide the best outcome and that a whole-of-supply chain approach provides the most effective mitigation of coal dust.

2.0 Central Queensland Coal Supply Chain Overview

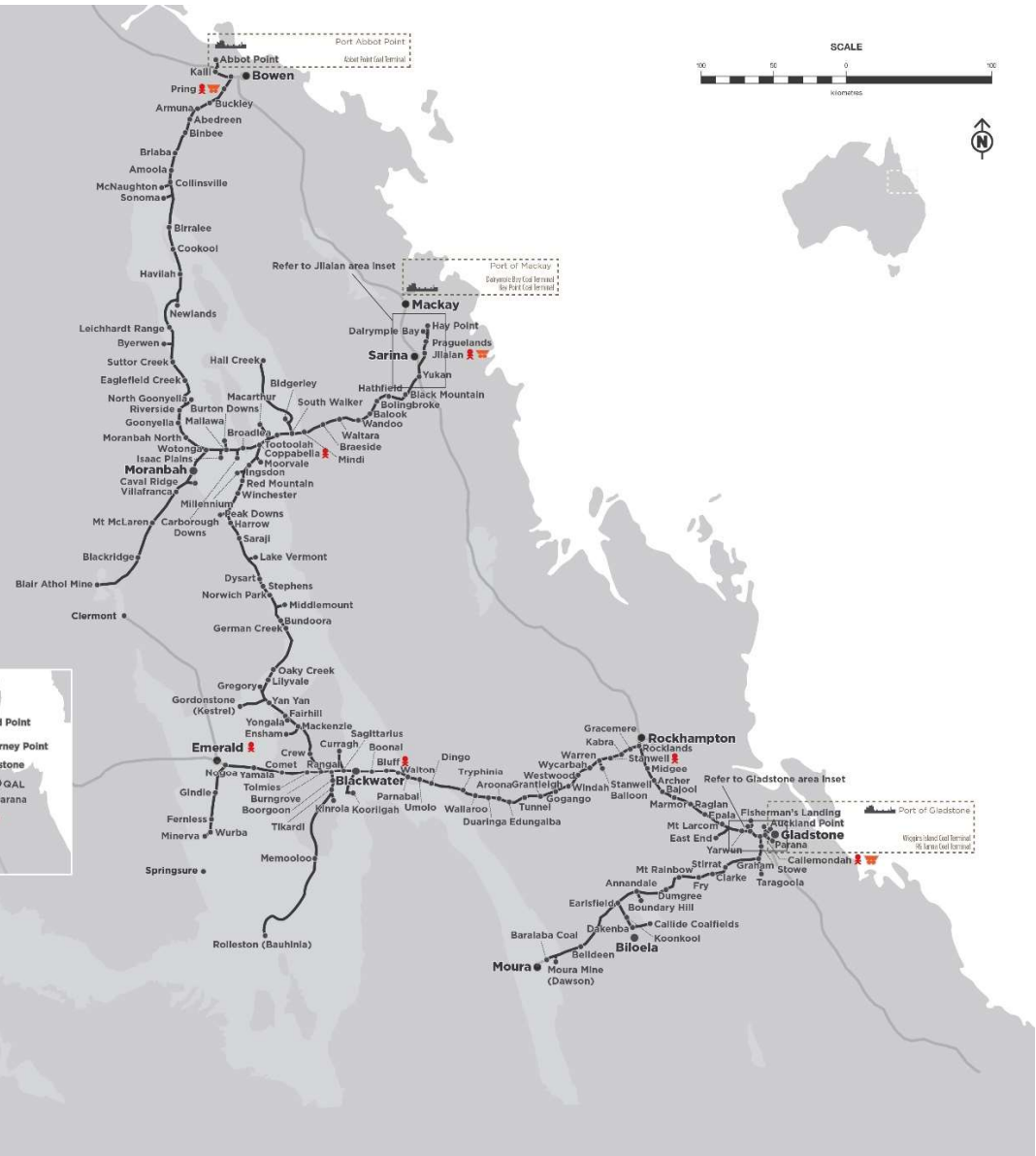
The CQCN is the largest coal rail network in Australia, spanning approximately 2,670km (refer the Network Map). The CQCN connects multiple customers from more than forty mines to five export terminals located at three ports namely: Port of Gladstone (RG Tanna Coal Terminal and Wiggins Island Coal Terminal), Port of Mackay (Dalrymple Bay Coal Terminal and Hay Point Coal Terminal) and Port Abbot Point (Abbot Point Coal Terminal). The CQCN includes four major coal systems (Moura, Blackwater, Goonyella and Newlands) and a connecting link (Goonyella to Abbot Point Expansion). Aurizon Network is the responsible rail network manager for the entire CQCN. Three rail transport operators (Pacific National, BMA Rail and Aurizon) currently operate coal services on the CQCN.

AURIZON Network Map



Legend

- City/town
- Export terminal
- Rollingstock depot
- Train crew depot
- Aurizon Network
- Queensland Rail Network
- Coal basin



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3.0 Coal Dust

Dust is comprised of small particles, often referred to as particulate matter, which originate from a broad range of sources.

In an operational railway setting, visible dust is often created by moving trains, trucks and other machinery. To a stationary observer, there can be noticeable peaks in dust generation when a train arrives due to the air ahead of the train being “pushed” by the train’s movement, which in turn disturbs dust on the ground. This dust can originate from soil, rocks or plants and leaves on the ground (DSITIA, 2013).

Coal which is extracted from a mine can be comprised of coal, rocks, soil and associated loose particulate matter. Prior to transport, coal is generally delivered to a coal handling and preparation plant where it is washed (to remove soil and rock) and crushed in various grades as required by customers. At this stage, much of the loose particulate matter associated with the coal product is also removed, and the residual product is watered (to increase moisture content) prior to transport by train. Dust which remains with the coal product is generally between 50-200 microns (μm) in diameter (which is much greater in size than more commonly known dust groupings, such as PM_{10} and $\text{PM}_{2.5}$, which as the name suggests are $10\mu\text{m}$ and $2.5\mu\text{m}$ in diameter). Connell Hatch (2008) noted that coal dust can be lost during transport due to:

- lift off from the surface of loaded coal wagons;
- leakage from the doors of wagons;
- deposited coal left on sills and wagons; and
- parasitic and/or residual coal on unloaded wagons

Deposited black dust which is observed within proximity to rail corridors on which coal is transported is sometimes believed to be wholly comprised of coal dust. However, scientific investigations (New Hope Group, 2013) have showed that coal is not a major contributor to black dust found around the corridor, and that, instead it can be derived from a range of sources, including soil, soot, black tyre rubber and mould. It is these contributors that are often mistaken for coal dust during observations of roof tops and water tanks on residences adjacent to the corridor. On the Western-Metropolitan Rail System (**WMRS**) in southern Queensland, black dust was shown to contribute only 14.4% of total dust measured near the rail corridor, and, of the total dust captured, only 2% of the sample was comprised of coal dust (DES, 2018). Additional studies, also undertaken on the WMRS, have shown that very little coal travels more than 10 metres beyond the boundaries of the rail corridor (Connell Hatch, 2008).

Dust can take several forms and sizes. For environmental and health purposes, dust is usually described by size. PM_{10} and $\text{PM}_{2.5}$ are microscopic particles, not visible to the naked eye, found in dust and can be generated by a range of things including home fires, lawn mowers, vehicle exhaust, agricultural and bushland burning and salt from the sea air.

Where dust reaches levels where it unreasonably interferes with ecological health, public amenity or safety it is described an “environmental nuisance” pursuant to the *Environmental Protection Act 1994* (Qld) (**EP Act**). Established criteria for outdoor (ambient) air quality have been established by the Commonwealth and Queensland governments which, if met, ensure the wellbeing of both the public and ecological communities. The air quality criteria are summarised in the below table as derived from the following applicable regulations:

- *Environmental Protection (Air) Policy 2008* (Qld)(**EPP Air**);

- Qld Dept. of Environment & Science (14 March 2019) *Guideline: Application requirements for activities with impacts to air (the Guideline)*; and
- *National Environment Protection (Ambient Air Quality) Measure 2016 (Cmth)(AAQ NEPM)*.

Characteristic	Averaging Period	Max. Concentration	Criteria Source
Dust Deposition	30 days	120mg/m ² /day	The Guideline
Total Suspended Solids	1 day	60µg/m ³	The Guideline
	1 year	90µg/m ³	EPP Air
PM ₁₀	1 day	50µg/m ³	EPP Air, AAQ NEPM
	1 year	25µg/m ³	AAQ NEPM
PM _{2.5}	1 day	25µg/m ³	EPP Air, AAQ NEPM
	1 year	8µg/m ³	

4.0 Coal Dust Management on the CQCN

4.1 Regulatory Background

Aurizon Network is responsible for managing the implementation of its CDMP. The CDMP, originally published in 2010, documents how the CQCN coal supply chain reduces, and otherwise manages, coal dust emissions to the air that is caused by coal dust lift-off from wagons.

Development of the CDMP was instigated after the Chief Executive Officer of QR Limited was issued, in 2007, an Environmental Evaluation (**EE**) Notice pursuant to the EP Act by the then Department of Environment and Resource Management (**DERM**) (now Department of Environment and Science (**DES**)). The EE was to identify the sources of nuisance coal dust from trains in the Goonyella, Blackwater and Moura coal rail systems connecting to the Ports of Gladstone and Hay Point. QR Limited submitted the EE on 31 March 2008, and DERM, under s326 of the EP Act accepted this report.

The recommendations from the EE formed the basis for DERM to request a Transitional Environment Program (**TEP**) and for QR Limited to implement the findings of the EE in cooperation with the Central Queensland coal industry. The CDMP, submitted to DERM in February 2010, was a key deliverable of the TEP.

The CDMP requires that profiling and veneering of coal wagons is undertaken at all train load out facilities within the CQCN. Profiling of coal in wagons to a “garden-bed profile” has been found to improve the following:

- reduction of coal dust lift-off from the tops of wagons, estimated as the greatest source of dust emissions, at approximately 80%, on the corridor (Connell Hatch, 2008);
- reduction of coal spillage and fouling of the railway;
- reducing safety risk due to ballast failure
- reducing capacity losses and costs associated with ballast cleaning and maintenance;

- even loading of coal trains; and
- loaded train performance.



Plate 1: Photograph showing a 'garden bed' shape profile

Veneering of coal wagons involves the application of a biodegradable spray onto the surface of loaded coal after profiling. This process minimises environmental impact through reducing dust lift-off by up to 85 percent (Connell Hatch, 2008) and assists in retaining coal moisture. Veneering systems were installed at train load out facilities at all existing mines in the CQCN by mid-2014. All new mines that have a load out facility which connects to the CQCN are required to install this infrastructure.

The conditions of approval for the original TEP required that, aside from development of the CDMP, a subsequent TEP, herein referred to as TEP 2, be developed to implement the appropriate options detailed in the CDMP. Where reasonably practicable it would implement the CDMP's detailed short, medium and long-term strategies to minimise visible coal dust emissions from the dust sources highlighted in the final EE. TEP 2 was developed in April 2010.

The key actions of the TEP 2 were to:

- Collect, review, monitor and report opacity data from the dust monitoring systems monthly to DES and coal producers.
- Develop the project plan for the installation of veneering spray stations at all Central Queensland mines.

- Install veneering spray stations at eleven (11) priority mines by December 2010 to bring the total mines with veneering spray station to fourteen (14) with all Central Queensland mines to have veneering spray stations in place by 2013.
- Establish veneering spray stations at loadout facilities for those members of the coal supply chain that wished to purchase the service from Aurizon Network.
- Negotiate or update all Transfer Facility Licences by mid-2010 for all loading facilities to include coal dust mitigation and profiling measures.
- Plan and work with coal producers to implement loading practices which mitigate slippage and coal dust emissions at eleven (11) mine sites by 2010.
- Develop and trial a wagon cleaning system with an analysis report provided to DES on completion.
- Monitor, review and maintain the complaints system.

In the wake of QR National splitting from Queensland Rail in mid-2010, QR Limited was renamed Aurizon Operations Limited. Aurizon Network became custodian of the CDMP.

TEP 2 was largely closed out in February 2014 with the DES's acceptance of Aurizon Network's progress in implementing the actions of the program. At this time, there were two outstanding actions to be closed out including the execution of all Transfer Facility Licences (TFL) and installation of veneering at all load-out facilities. Final close-out of the outstanding actions of TEP 2 was confirmed in December 2014 by the DEHP.

The coal loss management measures undertaken since closure of the TEP 2 by DEHP in 2014 continue to satisfy the requirements of the TEPs due to ongoing cooperation between Aurizon Network, coal producers, rail operators, terminals, and the DES. The opacity monitoring program, along with extensive management practices adopted by the supply chain, has been demonstrated to be the most suitable measure for understanding coal dust lift off from coal trains and allowing the tracing of any exceedances back to the relevant parties.

4.2 Measures Implemented by Coal Producers

4.2.1 Garden Bed Profiling

Coal Producers have various techniques to load trains ranging from front-end loaders, clamshell loaders and a variety of batch weighing hopper arrangements. Although the type of loading technique has implications for the ability of the mine to control the profile of coal in the wagon, during operation of their wagon loading infrastructure Coal Producers are responsible for ensuring that:

- the height of the load does not exceed a maximum height of 3950mm above rail;
- 100mm freeboard is left around the edge of the wagon; and
- an even top surface is established to create a "garden bed profile".

Uneven loads with multiple peaks have been demonstrated as leading to loads becoming relatively unstable and susceptible to spillage (Connell Hatch, 2008). Wind tunnel testing and modelling has also shown that the uneven surface is subject to higher turbulent intensity and, hence, higher levels of coal dust lift-off. A wagon that has a consistent coal surface (i.e. a "garden bed profile") reduces the potential for such lift-off and improves the effectiveness and application of veneering treatments (Connell Hatch, 2008).

4.2.2 Veneering

Dust suppressants are used as a surface veneer to control coal dust emissions from wagons. When applied, the suppressants bind particulate matter together to provide a surface that is resistant to dust lift-off (Connell Hatch, 2008). The suppressants are applied to the surface of the loaded wagons using a relatively simple spray system installed as part of, or immediately after, the coal loading facility. The water used in the system is either recycled water or grey water, provided it is of sufficient quality to ensure that the spray jets do not clog. The dust suppressant system is either automated or else takes signals from the coal load-out facility, enabling the system to be turned on and off for each wagon as well as recognising and turning off for locomotives. As outlined in Section 4.2.1, the use of load profilers and continuous loading techniques enhance the performance of the suppressants through the establishment of the garden bed profile (Connell Hatch, 2008).

There are a variety of surface veneering products available, with the sourcing and selection of same left to the discretion of the Coal Producers. Surface veneering products are generally applied at a common application rate of one litre per square metre, with the solution strength dependent on the manufacturer's specifications.

4.3 Measures Implemented by Rail Network Manager

4.3.1 Transfer Facility Licences

Aurizon Network, the Rail Network Manager, and Coal Producers on the CQCEN have previously held extensive negotiations relating to the implementation of the TFLs. The TFL is an interface between the Aurizon Network and the Licensee which owns and operates the mine load out. The TFLs incorporate the requirements of TEP 2 (Refer Section 4.1). Under the TFL, Aurizon Network grants the Licensee a licence to use the Transfer Area within the CQCEN to operate Train Load Out facilities in compliance with the terms and conditions set out in this agreement.

TFLs have been executed for all operational mines on the CQCEN since August 2014. Any new mines seeking to construct Train Load Out facilities on the CQCEN are also required to agree to a TFL. Under the provisions of the TFLs all CQCEN coal producers have adopted best practice coal dust mitigation measures, including veneering and profiling, as recommended in the CDMP.

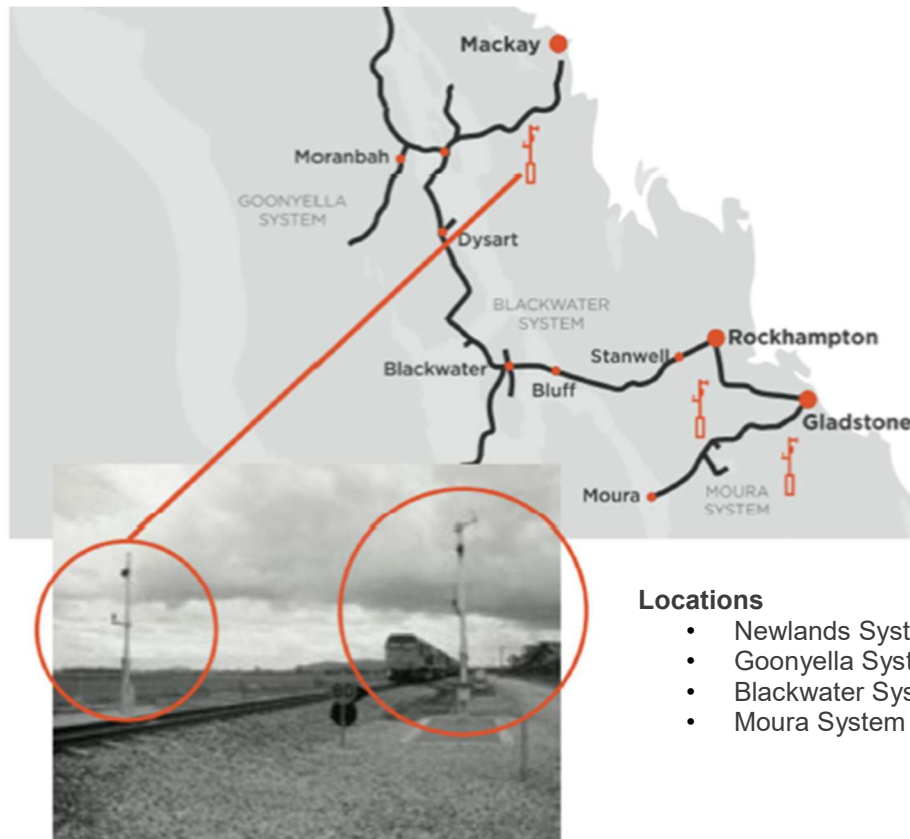
4.3.2 Opacity Monitoring and Reporting

As part of the extensive investigative works undertaken as part of the original TEP and TEP 2, Aurizon Network and DERM agreed that the most effective means of monitoring the coal dust lift off from the top of coal wagons whilst being able to trace potential problems back to a specific part of the supply chain was opacity monitoring. As part of the TEP works, a threshold of 5% opacity was agreed between DERM and Aurizon as the minimum level at which a passing train emits visually noticeable dust. In this regard, the threshold of 5% opacity represents an indicator that requires action to be taken to improve dust management, otherwise referred to as an exceedance in the data provided in the figures below.

Four monitoring stations have been installed on the CQCEN at:

- Buckley on the Newlands System;
- Mindi on the Goonyella System;
- Kalapa on the Blackwater System; and
- Graham on the Moura System.

Stations at Kalapa and Graham respectively replaced older stations at Marmor and Schilling's Lane in 2017-2018 to increase data reliability and improve access for maintenance purposes.



Locations

- Newlands System – Buckley
- Goonyella System – Mindi
- Blackwater System – Kalapa
- Moura System – Graham

Plate 2: Locations of opacity monitoring stations

The opacity monitoring stations are equipped with sensors to measure opacity and meteorological conditions, and to detect the presence of a passing train. The opacity measurements use an indirect method to measure the level of dust present in the atmosphere. The equipment consists of a light source (transmitter) and detector (receiver) mounted on masts either side of the rail corridor such that the light beam is transmitted at a set distance above the top of the train wagons. Dust emitted during a train pass is measured as an obstruction of the light beam between the transmitter and detector.

The parameter that describes the amount of dust emitted by a train is its average opacity. The average opacity for a train is obtained by averaging the opacity readings (after subtracting the background or ambient opacity level) for a three-minute interval, starting when the lead locomotive passes the opacity monitoring station. Three minutes was chosen as it included the average time that a coal train passes the monitoring station (on average approximately two minutes) and the remaining time to record any residual dust which may be present after the train had passed.

Since 2016, monitoring data has been cross referenced to train data supplied by Aurizon Network's Vizirail system to identify the specific train responsible for each opacity measurement. This enables close to a "real time" view of opacity measurements and is a marked improvement from the earlier iteration which was uploaded on a weekly basis. In addition to recording of opacity data, co-located weather stations record wind direction and speed, temperature, relative humidity and rainfall to determine the potential influence of weather on opacity level readings. This data is analysed, validated and subsequently presented on a secure web portal for viewing by stakeholders.

In the event of a validated exceedance of the 5% opacity threshold, Aurizon Network contacts the applicable Coal Producer to investigate potential causes and take appropriate action. Aurizon Network records details relevant to the exceedance and issues the information as part of a monthly report to the Aurizon Board. The exceedance data is also report in Aurizon’s annual Sustainability Report and biannual reports issued to the investment community. Aurizon Network has provided the DES with super-user access to the opacity monitoring online database thus allowing the DES to access opacity monitoring data across the CQCN at any point in time.

Aurizon operates a 24x7 community hotline so that members of the community can contact Aurizon at any point in time about concerns or complaints related to coal dust (Refer Section 6.0). If sufficient details are provided regarding a particular train service (i.e. approximate location and/or time), it is possible to accurately identify the service and its origin. In these instances, the opacity measure is checked, and Aurizon Network contacts the applicable Coal Producer to investigate potential causes and take appropriate action.

4.3.2 Access Management on the CQCN

Aurizon Network requires all Access holders who operate train services on the CQCN to agree to both an overarching Integrated Risk Management Plan and conditions associated with the access undertaking which mandate compliance with the provisions of this CDMP (Refer Section 4.2).

4.3.3 Ballast Management

As part of the ongoing maintenance of the CQCN, Aurizon Network is responsible for completion of ballast cleaning. This involves the mechanical removal of material (e.g. coal fines, degraded ballast rock, sand and dust) contained within the ballast by on track Ballast Cleaning Machines (BCMs). The removal of the material improves availability of track capacity, increases safety by improving the track structure and, by lessening the amount of material in the ballast, the potential for it to be re-entrained by passing rollingstock or for it to migrate onto adjoining properties.

Ballast cleaning is undertaken on all four rail systems on the CQCN on a priority schedule, determined in part by the Percentage Void Contamination (**PVC**) which is a measure of the amount of material in the ballast. The higher the PVC rating, the greater the impact of the material in the ballast and the greater its priority for ballast cleaning.

4.4 Measures Implemented by Rail Operators

Coal Rail Operators are committed to minimising dust from coal trains. They achieve this by:

- reporting any observations of dust on their services to Aurizon Network;
- observing and adhering to train speed limits (max 80km/hr);
- working with other members of the coal supply chain to identify and implement coal dust mitigation initiatives;
- conducting research and development into operational and technological solutions that will assist in the suppression of coal dust from coal trains the CQCN; and
- where practical, implementing operational and technical solutions.

With respect to the third dot above, some Rail Operators have worked to improve their wagon design and have included features which:

- reduce coal loss during loading, unloading, and transit; and

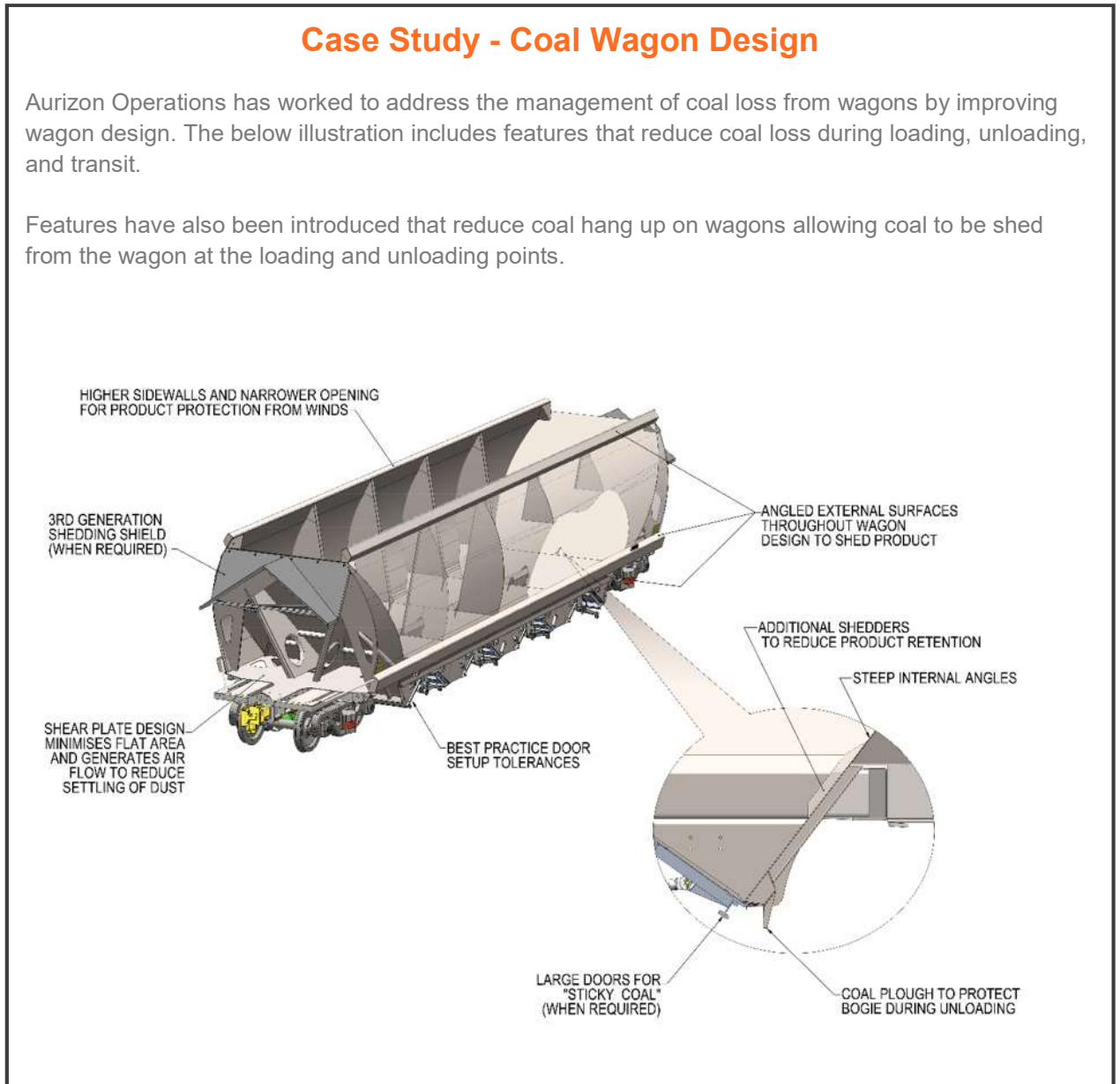
- reduce coal hang up on wagons allowing coal to be shed from the wagon at the loading and unloading points

These activities are in line with the Rail Operators' ongoing commitment to the reduction of coal dust from trains.

Case Study - Coal Wagon Design

Aurizon Operations has worked to address the management of coal loss from wagons by improving wagon design. The below illustration includes features that reduce coal loss during loading, unloading, and transit.

Features have also been introduced that reduce coal hang up on wagons allowing coal to be shed from the wagon at the loading and unloading points.



4.5 Measures Implemented by Coal Terminal Managers

Coal transported on the CQCN is railed to domestic and export terminals in Central Queensland. Domestic terminals include:

- NRG Gladstone Operating Services (Gladstone Power Station);
- Rio Tinto Aluminium Yarwun;
- Queensland Alumina Limited;
- Stanwell Power Station; and
- Cement Australia.

Export terminals include:

- Wiggins Island Coal Export Terminal Pty Ltd (<http://www.wicet.com.au/>);
- Gladstone Port Corporation Limited (RG Tanna Coal Terminal)(<https://www.gpcl.com.au/>);
- Hay Point Coal Terminal (<https://ngbp.com.au/our-ports/hay-point>);
- Dalrymple Bay Coal Terminal (<http://www.dbct.com.au/>);
- Adani Abbot Point Terminal (<https://www.adaniaustralia.com/projects-businesses/abbot-port>).

Both domestic and export coal terminals are committed to reducing coal dust from coal trains by working with other members of the coal supply chain to optimise cleaner coal transport practices, and both focus efforts on mitigating residual and parasitic coal dust sources at the train terminal interface.

It is the responsibility of individual terminals to identify appropriate mitigation methods applicable to its operations which take suitable account of specifications for infrastructure and operational practices. In general terms, the terminals implement the following to reduce residual and parasitic coal dust sources.

1. Training and Communication:
 - a. Internal Training / Environmental Awareness.
 - b. Community Liaison and External Communication.
2. Procedural and Infrastructure:
 - a. Wagon Unloading Practices.
 - b. Hopper Level / Train Speed Indicators.
 - c. Remnant Coal Monitoring.
 - d. Remnant Coal Elimination / Removal - Wagon Interior.
 - e. Remnant Coal Elimination / Removal – Wagon Exterior.

Additional to above, some terminals have also implemented the following specific automated initiatives.

1. LIDAR technology which detects coal hang up in wagons;

2. wagon vibrators; and
3. Wheel washing.

5.0 Summary of Performance

Figure 1 below outlines the trends in exceedances of the 5% opacity figure, agreed with DERM (now DES), in the past six years and the tonnes of coal hauled on the CQCN over the same period. It is evident, that despite record tonnes now being hauled on the CQCN, instances of the 5% opacity figure being exceeded have trended downwards since veneering installation was completed at all train load out facilities. Other visible trends include the impact of seasonal variations (i.e. exceedances increasing in drier and hotter months) and the transition period when veneering responsibilities were transferred from Aurizon Network to coal producers in June 2015. An increase in opacity exceedances in early 2018 was found to be largely attributable to issues with several veneering systems coupled with the low moisture content of older coal stockpiles at some loading points due to an extended dry period. Improvements made to these veneering systems had a noticeable effect, with a demonstrable downward trend of opacity exceedances from mid-2018 onwards.

It is important to note that whilst exceedances do occur, in FY2019, average opacity for each month did not exceed a three-minute average opacity reading of 0.18%. Further, of the approximate 45,000 coal rail services on the CQCN in FY2019, only 48 of these exceeded the 5% opacity threshold.

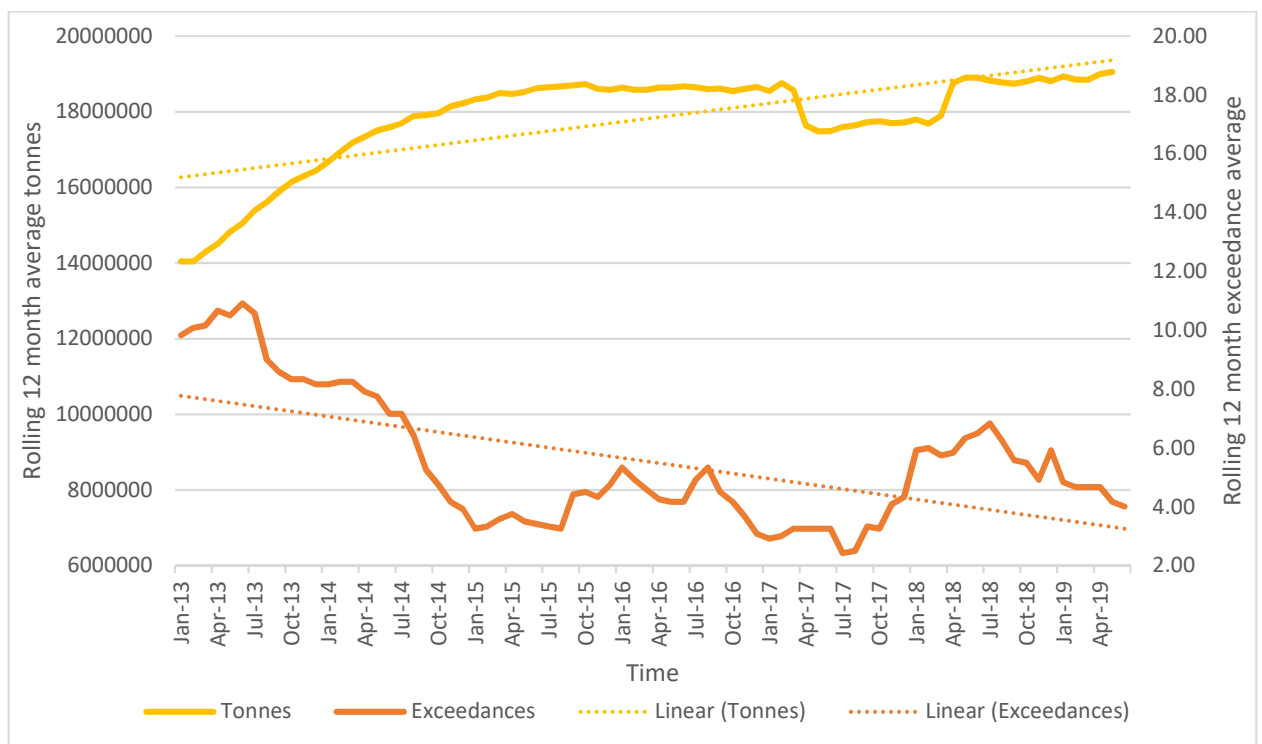
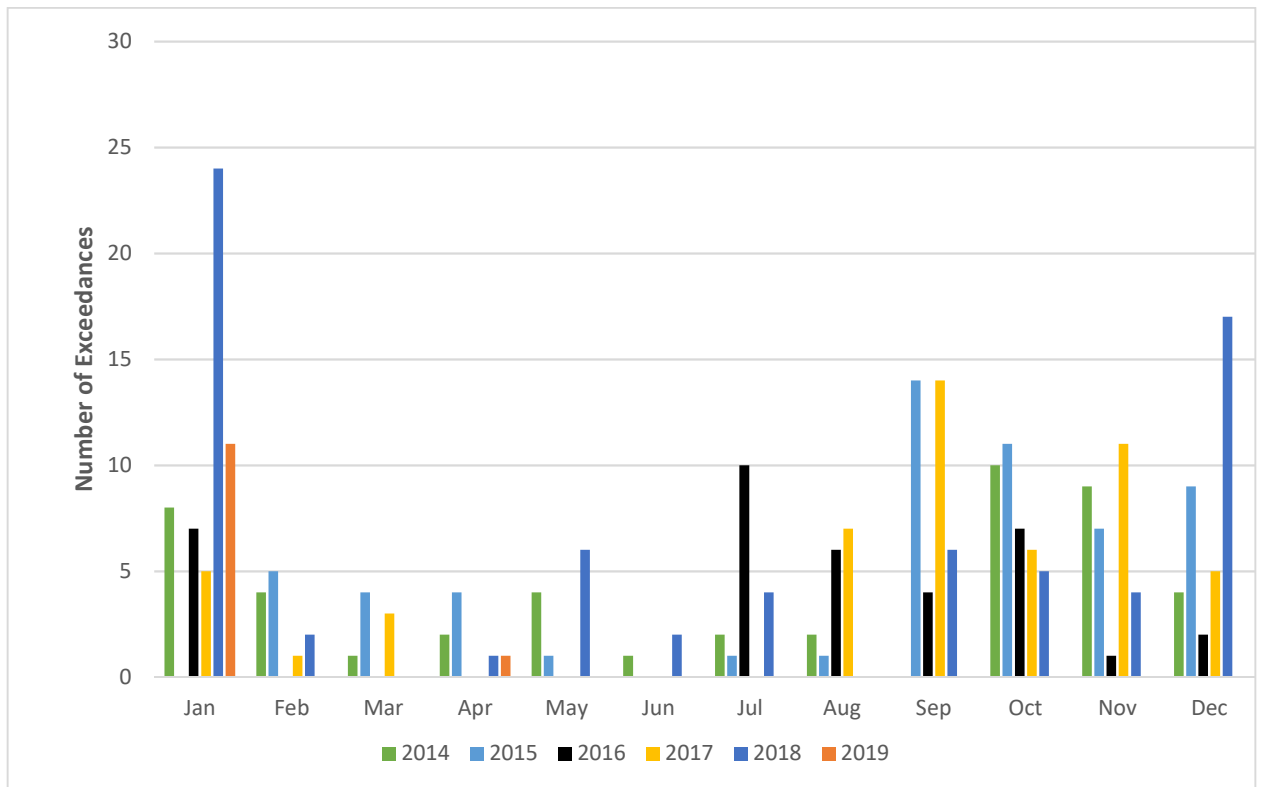


Figure 1 Exceedance vs Tonnage Data January 2013- May 2019

Figure 2 presents the number of monthly opacity exceedances across the CQCN since 2014 and for the first six months of the 2019 calendar year. The six months of data for this period is generally consistent with the trends observed for the same period in previous years; that is, exceedances tend to be more frequent during the warmer months of the year.



6.0 Complaints Management

All complaints from coal dust are encouraged to make contact with Aurizon through our 13 23 32 telephone number, or our email address: community@aurizon.com.au and also through our web page aurizon.com.au.

These are manned 24x7 with a 24-hour turnaround internal notification. There is also a protocol for escalation of urgent matters called in by community members

We aim for a 3 working day response either holding action or resolution. A further 10 days are used in a holding action (matters requiring investigation or resolution time)

All community feedback is recorded in a Daily Log or our Consultation Manager System (CMS) database. Community engagement tracks all feedback and allocates to relevant business areas for response and actions via an accountability matrix. Reports are monthly to Management Leadership Teams and the Executive Leadership Team, while systemic issues are raised in monthly reports

Aurizon's complaints management process protocol and principles are reflective of the AS ISO 10002:2006 Guidelines for Complaints Handling in Organisations.

7.0 Stakeholder Engagement

The members of the CQCN Supply Chain are committed to a transparent process of sharing information with stakeholders in relation to ongoing mitigation and management of coal dust on the CQCN.

Apart from the opacity monitoring and reporting provided, Aurizon Network regularly discusses any coal dust issues or improvements at regular Supply Chain Groups.

9. References

Connell Hatch (2008) Environmental Evaluation of Fugitive Coal Dust Emissions from coal trains Goonyella, Blackwater and Moura Coal Rail Systems, prepared for QR Limited

New Hope Group (2013) Rail Coal Dust Report: characterisation of domestic dust. AMCP Laboratory Emu Place, Laidley.

NSW Office of Environment and Heritage (2012). Lower Hunter Air Quality Monitoring Report 2012.

Queensland Government, Department of Environment and Science (2018) Western-Metropolitan Rail System Coal Dust Monitoring Program, January to December 2017

Queensland Government, Department of Information Technology, Science and Innovation (2017) Western-Metropolitan Rail System Coal Dust Monitoring Program, January to December 2016

Queensland Government, Department of Information Technology, Science, Innovation and the Arts (2013a) Western-Metropolitan Rail Systems Coal Dust Monitoring Program, Pre-veneering monitoring period results

Queensland Government, Department of Science, Information Technology, Innovation and the Arts (2013) Western Metropolitan Rail Systems Coal Dust Monitoring Program March–June 2013.