

**Environment Compliance  
Report  
Compliance audit of coal  
train loading and  
unloading facilities**

## More information

For technical information on the matters discussed in this paper contact EPA's Compliance and Assurance Section on (02) 9995 5000.

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## Executive summary

The NSW EPA conducted a compliance audit program of licenced coal loading and unloading premises between May and December 2014. The focus of the audits was on the loss of coal, in particular the management methods and procedures used to minimise or prevent the loss of coal (in the form of leaks, spills and dust emissions) during rail transport. The EPA audited eleven load-out facilities and four coal terminals representing all major coal fields and coal terminals in NSW.

In relation to coal loading, the audits examined management practices at coal loading facilities that could minimise the main sources of coal dust emissions from loaded coal trains during rail transport. Although the audits found that some coal loading facilities were fully automated and equipped with loading chutes that were designed to achieve a consistent load profile height, shape and distribution, others lacked automation or the chutes were not well maintained.

The profile of the loaded coal wagon refers to the shape of the exposed surface of coal on the top of the wagon. A flat surface with gradually sloping sides sometime called a 'garden bed profile' is the optimum shape to minimise dust emissions during transport. Whilst some facilities audited achieved a good garden bed profile, at the majority of facilities audited the coal profile was generally irregular resulting in a greater exposed surface area and potential for increased dust emissions.

Monitoring to ensure that the wagon doors are firmly closed before the train departs the loading station ensures that coal is not spilled from the bottom of loaded wagons during transit. Although a number of facilities audited had controls in place to detect open wagon doors, the majority of facilities did not have wagon door controls in place.

The audits also examined management practices at coal unloading facilities that could minimise the coal dust emissions from unloaded coal trains during rail transport. All unloading facilities audited were equipped with Closed Circuit Television Cameras (CCTV) to automatically identify large quantities of 'hung up' coal in unloaded wagons and had controls in place to ensure wagon doors were closed after unloading. Coal unloading facilities audited were also equipped with high hopper alarms to identify possible coal overflows preventing coal being transferred into adjacent ballast or building up on the wagon wheels and axles.

A total of 26 non compliances were identified during the audit program. The EPA is requiring the coal loading and unloading facilities audited as part of this program to rectify the non-compliances identified and will be following up to make sure they are complying with their licence requirements.

The EPA recommends that remaining coal loading facilities which were not audited in this program should use this report and individual audit findings to inform their review of processes and procedures in relation to coal loading.

## Introduction to audit program

The NSW Environment Protection Authority (EPA) has completed a compliance audit program examining coal train loading and unloading facilities throughout NSW.

The program focussed on the loss of coal, in particular the management methods and procedures in place to minimise or prevent the loss of coal (in the form of leaks, spills and dust emissions) during rail transport. Compliance audits were undertaken at 11 coal train load-out facilities throughout the Gunnedah, Hunter, Newcastle, Western and Southern coal fields and the four export coal terminals at Newcastle and Port Kembla.

This report summarises the findings of the compliance audits. The audit inspections were undertaken by officers of the EPA between May and July 2014. The procedures for conducting EPA Compliance Audits are detailed in the *Compliance Audit Handbook* (DEC 2006), which can be accessed on the EPA website at <http://www.environment.nsw.gov.au/resources/licensing/cahandbook0613.pdf>.

### Legislative Framework

The main stakeholders involved in the transport of coal by rail for export in NSW are:

- the coal producers who undertake the coal loading process;
- the rolling stock operators (RSOs) who provide and maintain the locomotives and wagons that transport the coal;
- the rail network providers, including the Australian Rail Track Corporation (ARTC) and other entities, that manage the NSW rail network; and
- the port unloading facilities that receive the coal and assemble it into the relevant allocations for shipment.

Currently the EPA licences the coal producers, the port unloading facilities and the rail network provider such as ARTC and John Holland Pty Limited. Under the current licensing framework, the rail network providers are responsible for the environmental performance and impacts of the rail corridor including the rolling stock that are owned and operated by the RSO's, regardless of the nature of the management controls they have on that rolling stock.

Currently the RSOs are not licensed by the EPA. The RSOs are responsible for the certification, maintenance and provision of locomotives and wagons for the transport of the coal by rail.

The EPA is currently reviewing the current regulatory framework for the NSW operational rail sector to determine if there is an alternative regulatory framework that would enable environmental impacts of rail activities on the NSW environment and community to be more effectively regulated.

### Coal loss during rail transport

#### Coal rail network in NSW

Coal from mines in NSW is transported for export to ports in Newcastle and Wollongong. Movement of coal in NSW is either by truck, train or conveyor, with train being the most commonly used means of long distance coal transport.

To facilitate the movement of coal from the mines to export terminals and domestic users, approximately 1,000 km of rail network connects a total of 34 coal train load-out points with receival stations at the export terminals and domestic user facilities (power stations, steel plants and cement plants). The Northern Rail System connects mines in the Gunnedah, Western, Hunter and Newcastle coalfields to the three coal export terminals at the Port of

Newcastle. The Southern Rail System connects mines in the Western and Southern coalfields to the coal export terminal at Port Kembla.

All but a very small amount of the coal shipped through Newcastle is transported by rail, with an average of 61 loaded coal trains using the Northern Rail System each day (Katestone 2014). The volume of coal transported over the Southern Rail System is significantly lower owing to fewer mines and a preference for truck and conveyor transport in the Western and Southern coalfields.

### **Coal loss during rail transport**

Coal loss, in the form of coal dust emissions and leaks and spills of coal, can occur from loaded and unloaded coal trains during their journey in the rail corridors.

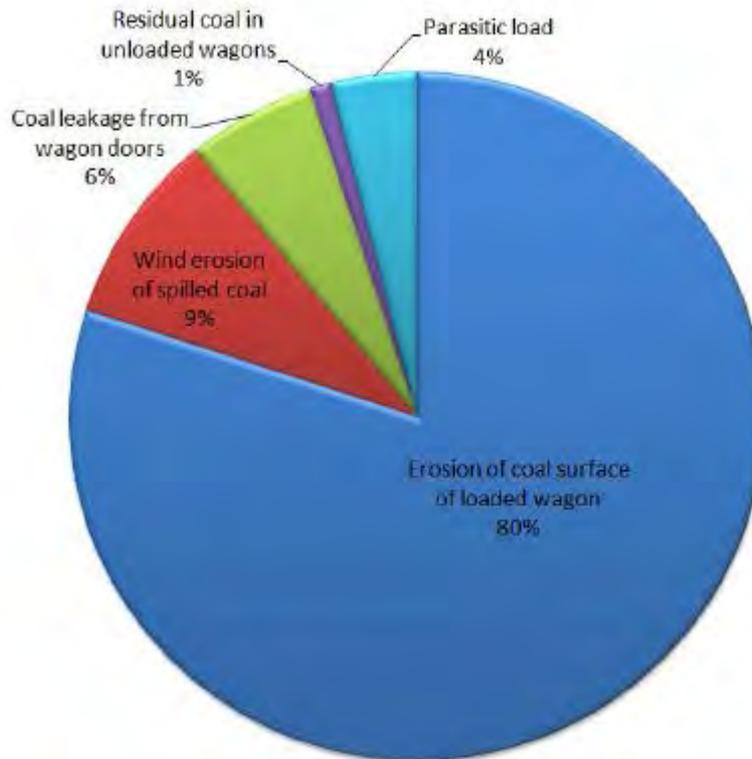
The issue of dust from coal trains has been a major community concern both in Australia and abroad resulting in a number of studies relating to coal train dust being undertaken. Two key studies relevant to the Australian context are:

- Environmental Evaluation of Fugitive Coal Dust Emissions from Coal Trains Goonyella, Blackwater and Moura Coal Rail Systems (Connell Hatch 2008)
- Literature Review of Coal Train Dust Management Practices (Katestone Environmental 2014).

These studies identified the following as potential contributing sources of coal dust emissions from the rail corridor:

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

Figure 1 illustrates the relative contribution of each of these sources as estimated by Connell Hatch (2008). It can be seen that approximately 80% of coal loss was attributable to the surface of loaded coal wagons.



**Figure 1: Estimated relative contribution of coal loss during rail transport (Connell Hatch 2008)**

The factors that have an impact on the likelihood of coal loss occurring during rail transport are dependent on how activities are undertaken at various stages of the process, as follows.

At coal train load-out facilities:

- Ensuring the optimal height, shape and positioning of the load profile.
- Understanding the properties of the loaded coal, including moisture, dustiness and particle size.
- Monitoring of wagon doors.
- Preventing the deposition of parasitic coal on sills, shear plates and bogies of wagons.

At coal unloading facilities:

- Minimising the amount of residual (or 'carry back') coal remaining in wagons after unloading.
- Monitoring of wagon doors.
- Preventing the deposition of parasitic coal on sills, shear plates and bogies of wagons.

As coal trains move through the rail corridor, a number of other factors influence the likelihood of coal dust from the rail corridor, including:

- Frequency of train movements.
- Vibration of the wagons during the journey.
- Transport distance.

Note the rail corridor factors were not considered during the audit program as they do not explicitly relate to activities undertaken at coal train load-out and unloading facilities.

## **Overview of the compliance audit program**

In May 2014 the EPA commenced a compliance audit program of licensed coal loading and unloading facilities aimed at minimising or preventing the loss of coal during rail transport. The focus of the program was on the loss of coal, in particular the management methods and procedures used to minimise or prevent the loss of coal during rail transport.

### **Audit objective**

The objective of the program was to assess the level of compliance at loading and unloading facilities with the requirements of Environment Protection Licences (EPLs) relating to the management of the loss of coal during rail transportation.

A total of 11 coal load out and four coal unloading facilities were audited.

### **Audit scope**

The audits assessed compliance with the 'operating' conditions of the licence with a specific focus on activities undertaken at each premises related to minimising or preventing the loss of coal (in the form of spills, leaks and dust emissions) during rail transport. These activities were:

- Loading of coal into trains or unloading of coal from trains
- Maintenance and operation of plant and equipment.

In relation to temporal scope, these activities were assessed against the audit criteria for the 24 hours prior to the end of the audit inspection. Supporting documentary evidence was collected for the 12 months prior to the end of the audit inspection.

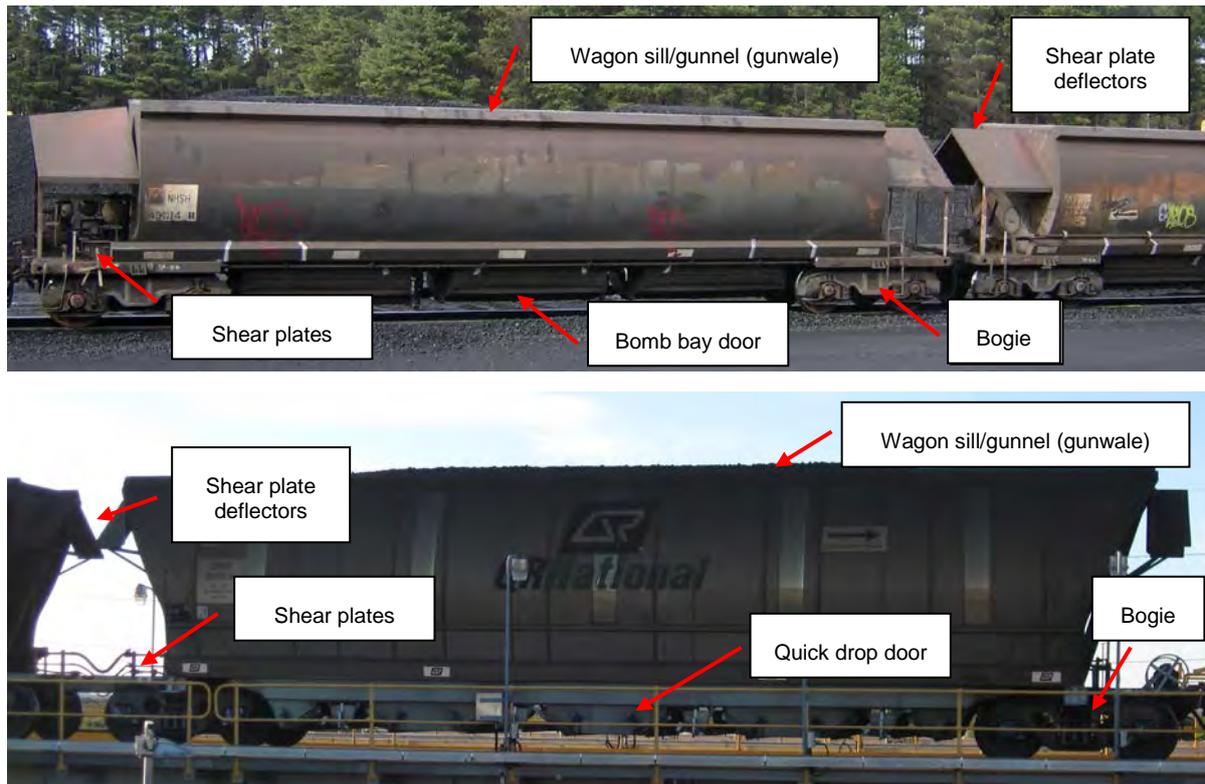
Assessment of compliance was based on information gathered during the audit inspection, information supplied by the licensee and a review of records and documentation relating to the premises

### **Audit criteria, evidence and findings**

The audit criteria, against which compliance was assessed, are the operating conditions of the licence, O1 - 'Activities must be carried out in a competent manner' and O2 - 'Maintenance of plant and equipment'.

The auditors assessed compliance by observing the potential for the spillage of coal or generation of coal dust from the tops, bottoms and exterior of coal train wagons.

- 'Tops of wagons' refers to the surface of the coal for loaded wagons.
- The 'bottoms of wagons' refer to the wagon doors which are located underneath the wagon.
- The 'exterior of wagons' refers to exterior features such as wagon bogies, sills (or 'gunnels/gunwales') and wagon shear plates.



**Components of different wagon types: train wagon with bomb bay doors (top) and kwik drop doors (bottom) (photo: T Greyling (top)/E Howard (bottom))**

Audit evidence was collected for each premises during an audit inspection, which included discussions with relevant staff and observations of operational activities, and a review of relevant documentation and records.

A summary of audit findings of the program are presented below under 'Audit findings'. Individual audit reports are available on the EPA public register at <http://www.epa.nsw.gov.au/prpoeo/>.

## Queensland Visit

In preparation for the audit program, the EPA undertook detailed research to identify management practices at coal loading and unloading facilities to minimise the loss of coal and coal dust emission during rail transport. As part of this initiative officers of the EPA visited central Queensland in July 2014 to gain an insight into dust management practices for coal train loading and unloading.

The EPA officers visited 2 loading facilities in the Bowen Basin area (about 70 km east of Emerald) and observed coal loading operations. The mines visited were the Blackwater coal mine and the Boonal Load out facility. The EPA also visited the Gladstone Ports Corporation and observed the unloading of coal trains at Gladstone Port.

### Coal loading

At both loading facilities, the loading systems were automated and were designed to achieve a consistent garden bed profile, a consistent load profile height, shape and distribution. After the coal was loaded into the wagon, the wagon passed through an overhead sprinkler bar that sprayed a veneer onto the coal surface. In addition at the Boonal loading facility, as

pulverised coal was being loaded, large quantities of water was added to the coal to increase moisture levels.

The loading systems were designed to enable the automatic shutdown of the loading process when any issues are identified. The facilities were also equipped with close circuit video cameras and open door detectors.

### *Coal Unloading*

The EPA officers visited the RG Tanna coal terminal at the port of Gladstone. The coal terminal was equipped with a number of fully enclosed and automated coal dump stations. During coal receipt, the moisture content of coal being unloaded is measured and monitored throughout the unloading activity which is then fed to the system controlling the water sprays at the rail receipt hoppers to allow adjustment of coal moisture levels as coal is transferred to terminal stockpiles.

The terminal is equipped with a high level hopper alarm and automated door open alarm systems that alerts for instances of open wagon doors to reduce the risk of depositing residual coal along rail tracks.

Coal unloading practices are also videoed in order to record the levels of residual coal remaining in empty wagons. If residual coal is detected the terminal is equipped with wagon vibrators to dislodge remnant coal and minimise coal carry-back in coal wagons.

Gladstone Ports Corporation in partnership with CSIRO is examining a laser volumetric profiling system to profile empty wagons to detect carry back coal in unloaded wagons. This system detects coal remaining in wagons after unloading and while the system is designed currently to detect larger lumps of coal, studies are underway to refine the system to detect smaller quantities coal remaining after unloading.

## **Audited premises**

Compliance audits were undertaken at 15 licenced premises which had coal train loading/unloading facilities throughout the Gunnedah, Hunter, Newcastle, Western and Southern coal fields. The selected premises represent 11 load-out facilities and four coal terminals.

Nine of the load-out facilities were mining operations which included open pit or underground coal mines, Coal Handling and Preparation Plants (CHPPs) and train load-out facilities. Two premises were coal train load-out facilities which processed and loaded coal from nearby mining operations. Overall, the audited premises represent one third of the coal train load-out facilities currently operating throughout NSW. The premises are numbered in red in figure 2 and listed in Tables 1 and 2. The scale of activity at the premises' varied, with between 2 million and 17.8 million tonnes of coal loaded into trains on an annual basis.

The following factors were taken into account when selecting the premises to be audited:

- Relative size of the operation (tonnes of coal loaded/unloaded)
- Representation of load-out facilities from all the major NSW coal basins
- Representation of all the NSW coal export terminals
- Operational considerations
- Export focussed operations.

Compliance audits were also undertaken at the four export coal terminals in NSW (refer to Figure 2). Newcastle Port receives coal from the Hunter, Newcastle, Gloucester, Gunnedah and Western coalfields through three coal terminals; one located at Carrington and two at Kooragang Island. Port Kembla, near Wollongong, receives coal from the Southern and Western coalfields through one coal terminal.

**Table 1: Audited unloading facilities**

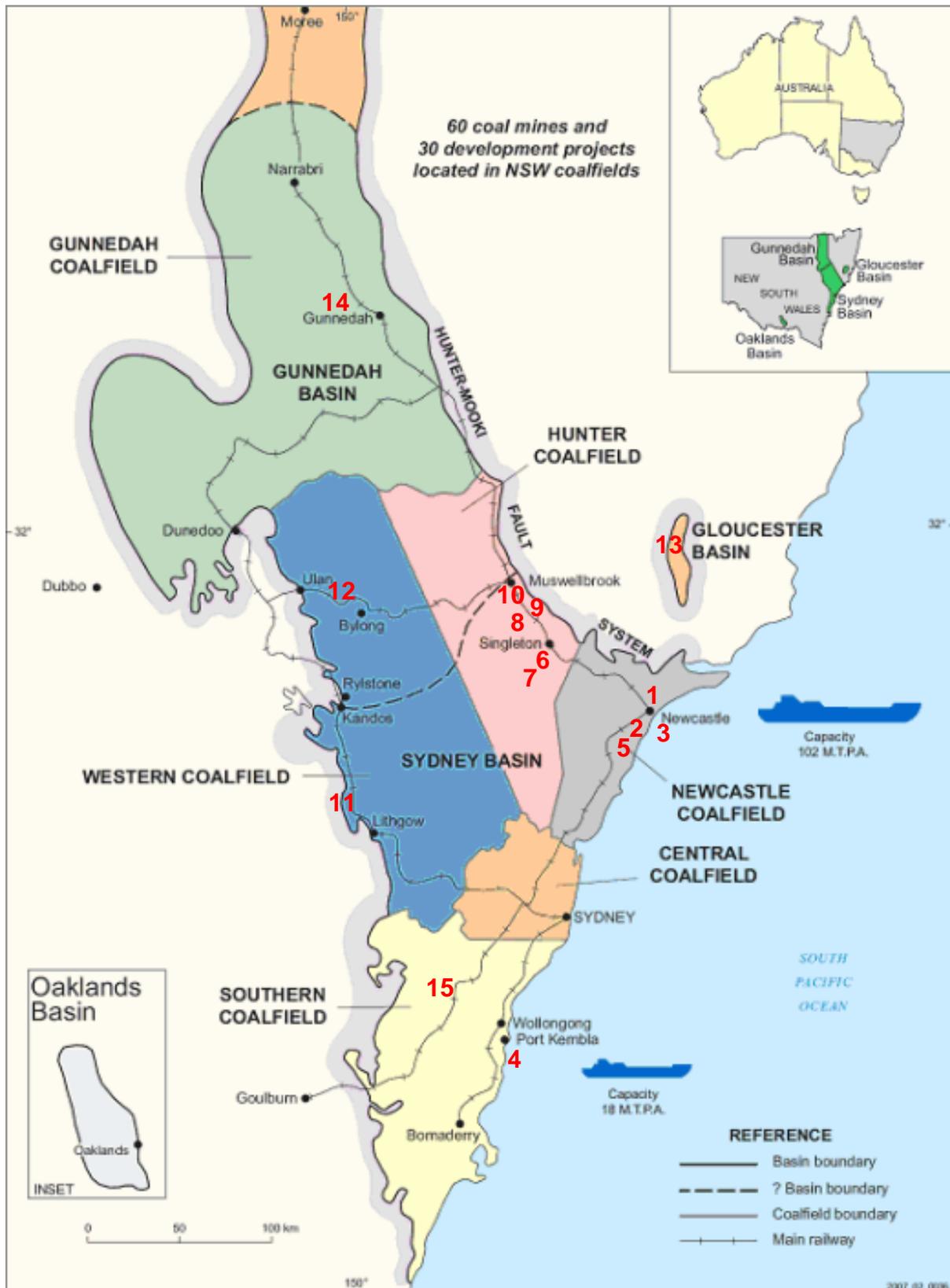
<b>EPL No.*</b>	<b>Licensee</b>	<b>Location</b>	<b>Map Ref. No.</b>
601	Port Waratah Coal Services (PWCS) Ltd (Carrington)	Newcastle	1
1552	Port Waratah Coal Services (PWCS) Ltd (Kooragang)	Newcastle	2
12693	Newcastle Coal Infrastructure Group (NCIG) Pty Ltd	Newcastle	3
1625	Port Kembla Coal Terminal Ltd	Wollongong	4

\*Note: copies of the licences can be accessed through the EPA online public register at: <http://www.epa.nsw.gov.au/prpoeoapp/>.

**Table 2: Audited load-out facilities**

<b>EPL No.*</b>	<b>Licensee</b>	<b>Coalfield</b>	<b>Map Ref. No.</b>
395	Centennial Newstan Pty Ltd	Newcastle	5
24	Mount Thorley Coal Loading Ltd	Hunter	6
563	Bulga Coal Management Pty Ltd	Hunter	7
640	Coal & Allied Operations Pty Ltd (Hunter Valley Operations)	Hunter	8
4460	Xstrata Mount Owen Pty Ltd	Hunter	9
11457	Hunter Valley Energy Coal Pty Ltd (Mt Arthur Coal)	Hunter	10
5129	Ivanhoe Coal Pty Ltd (Lidsdale Siding)	Western	11
12425	Wilpinjong Coal Pty Ltd	Western	12
5161	Stratford Coal Pty Ltd	Gloucester	13
3637	Whitehaven Coal Mining Ltd	Gunnedah	14
1389	Tahmoor Coal Pty Ltd	Southern	15

\*Note: copies of the licences can be accessed through the EPA online public register at: <http://www.epa.nsw.gov.au/prpoeoapp/>.



**Figure 2: NSW Coalfields and licensees included in the audit program (NSW Trade & Investment 2014)**

The audit inspections were conducted over a 9-week period from 15 May 2014 to 11 July 2014. Following the audit inspections, the evidence gathered during the audits was assessed to determine compliance and draft reports were issued to the licensees for comment. The

licensee’s comments and the EPA’s response to the comments were appended to the final compliance audit report for each premises. The reports are available on the EPA’s website at <http://www.epa.nsw.gov.au/prpoeoapp/>

The auditors considered a range of evidence in determining compliance including information gathered on the day of the audit inspection such as observations, photographs and video. Documentation such as management plans, procedures, maintenance records, training and records were also requested from licensees for review after the day of the audit inspection.

The timing of the audit inspections were determined by the arrival of trains at the load-out facilities and coal terminals as the purpose of the audit program was to assess train loading and unloading activities undertaken at these facilities. Due to operational changes and restrictions around the train schedules, the loading at some load-out facilities were observed at night.

### Analysing the risks

Risk assessment of non-compliances was undertaken as part of the audit process to identify the relative significance of any identified non-compliance. The risk assessment involved assessing each non-compliance against two criteria:

- The likelihood of environmental harm occurring
- The level of environmental impact as a result of the non-compliance.

After these assessments were made a prioritisation risk code was assigned to each non compliance identified using the risk analysis matrix identified in Table 3.

**Table 3: Risk analysis matrix**

		Likelihood of Environmental Harm Occurring		
		Certain	Likely	Less Likely
Level of Environmental Impact	High	Code Red	Code Red	Code Orange
	Moderate	Code Red	Code Orange	Code Yellow
	Low	Code Orange	Code Yellow	Code Yellow

Within the risk analysis matrix:

- A **code red** risk assessment denotes that the non-compliance is of considerable environmental significance and therefore must be dealt with as a matter of priority.
- A **code orange** risk assessment denotes that the non-compliance is of environmental significance, however remedying the non-compliance can be given a lower priority than a red risk assessment.
- A **code yellow** risk assessment indicates that the non-compliance could receive a lower priority than a red or orange risk code, but the non-compliance is still important and must be addressed.

The colour code was used as the basis for deciding on the priority of remedial action required by the licensee and the timeframe within which the non-compliance needs to be addressed. This information is presented in the action program alongside the target/action date for the non-compliance to be addressed.

While the risk assessment of non-compliances is used to prioritise actions to be taken, the EPA considers all non-compliances to be important and licensees must ensure that all non-compliances are addressed as soon as possible.

## Audit findings

This section of the report summarises the non-compliances and other issues identified and reported on in the individual compliance audits. Non-compliances are identified as a result of licensees not complying with conditions of their EPL.

### Risk analysis of identified non-compliances

Non-compliances identified during the review were categorised using the risk-analysis matrix illustrated in Table 3. The percentages of non-compliances found in each category during the audit process are shown in Table 4.

**Table 4: Percentage of non-compliances found in each risk category**

Colour code of issue	Code Red	Code Orange	Code Yellow	Total
No. of non-compliances	0	8	18	26
Percentage	0%	31%	69%	100%

### Coal load-out facilities

In relation to coal load out facilities, the assessment of compliance was divided into the following activities relevant to the audit scope, namely:

- Carrying out train loading activities in a manner which minimises or prevents coal spills and dust emissions from the tops of wagons during rail transport
- Carrying out train loading activities in a manner which minimises or prevents leaks and spills of coal from wagon doors during rail transport
- Carrying out train loading activities in a manner which minimises or prevents coal deposition on the exterior of wagons
- Maintenance and operation of plant and equipment.

General audit findings are discussed for each of these activities.

**Activity: Carrying out train loading activities in a manner which minimises or prevents coal spills and dust emissions from the tops of wagons during rail transport**

Coal spills and dust emissions from the tops of loaded wagons have been identified as a significant source of coal dust emissions during rail transport, having a relative contribution in the order of 80% (Connell Hatch 2008i).

There is evidence to indicate a low, flat garden bed profile is preferable for loaded wagons as wagons with a high or irregular load profile can produce more dust (Katestone Environmental 2011, Connell Hatch 2008i, Connell Hatch 2008ii). High or uneven load profiles also increase the likelihood of coal spills from the tops of wagons while they are underway (Connell Hatch 2008iii).



**Loading coal with a low, flat garden bed profile (left) as opposed to an uneven, undulating profile minimises coal losses from the tops of wagons (photo: E Howard (left)/ W Wickremeratne (right))**

### *Stationary loading systems*

Only a minority of load-out facilities still use this approach with only two of the 11 audited premises utilising a stationary loading system. Stationary loading systems use a front end loader to transfer coal from stockpiles into a stationary coal train which is periodically repositioned as the wagons are filled. Under and over-loading, spillage and inconsistent load profiles are common occurrences from stationary loading systems.

The wagons loaded at these premises had irregular and uneven load profiles which were inconsistent between wagons. The load profiles observed at both sites were higher than the wagon sill. These factors increase the likelihood of coal spills and dust emissions during rail transport and resulted in assessments of non-compliance.

Controls used to minimise dust emissions during rail transport observed at these facilities during the audit program included:

- Utilising a front end loader mounted 'gunnel brush' to clean wagon sills (or 'gunnels/gunwales') of residual coal after loading.
- A loading procedure which specified under-loading by weight as a method to maintain low load profiles.
- A water jet to wet the surface of loaded coal (if required) and to remove any coal on the exterior of wagons.

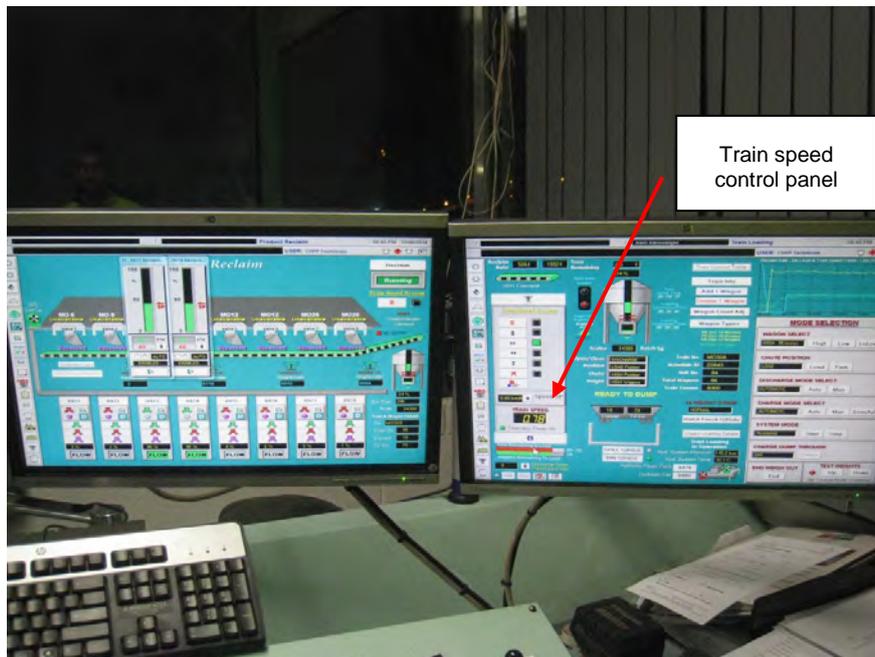


**Stationary loading: Front-end loader for loading of stationary train (top) and spillage of coal over the wagon sill during loading (bottom) (photo: E Howard (top)/ T Greyling (bottom))**

### *Continuous loading systems*

Continuous train loading systems typically use an overhead surge bin and loading chute to periodically load coal into empty wagons as they pass below the chute at a constant speed. The level of automation between systems observed during the audit program varied, with some operating on highly automated processes and others requiring a higher degree of manual operation.

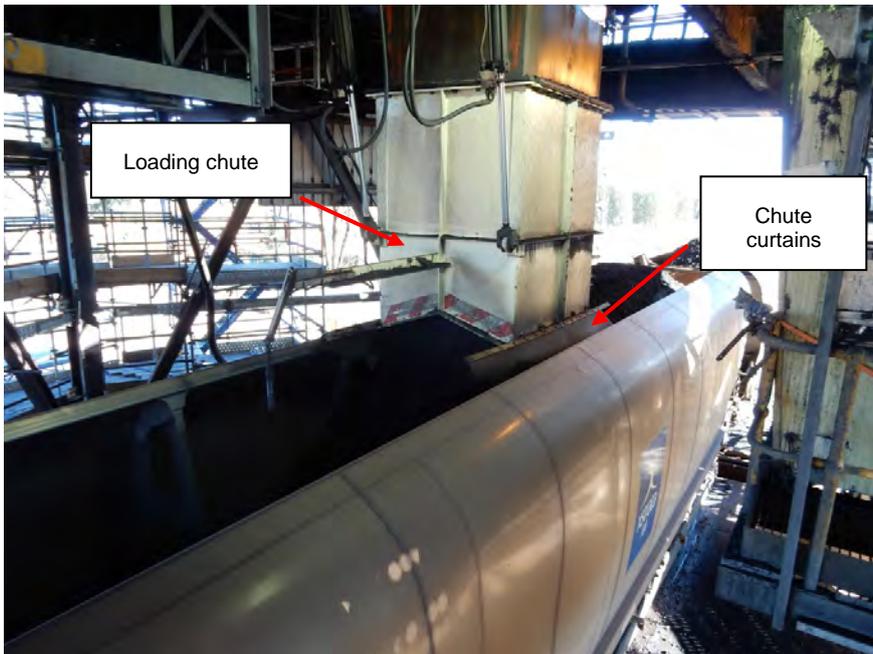
Nine of the audited premises utilised continuous loading systems, with all but one using a telescopic overhead loading chute and the remaining premises using a slide type loading chute.



**Good practice: Fully automated loading at a load-out facility including control of the train speed from the control room (top) is achieved by tracking train movement by means of photoelectric cells (bottom) (photo: M Karam (top)/ T Greyling (bottom))**

While continuous loading systems demonstrated marked improvement in consistency and control over stationary loading systems, the audit program identified several issues which increase the likelihood of coal loss during rail transport and led to assessments of non-compliance:

- Profile heights being above (in some cases substantially above) the sill of the wagon. Several facilities advised during the audit that the load profiles of wagons loaded at their facility were in compliance with the requirements of the Rolling Stock Operator (RSO); however these requirements did not address minimising or preventing coal loss during rail transport and instead focus on safety aspects of coal train loading and transportation.
- Profile shapes not being consistent with a low or garden bed shape. Profiles with steeper sides and sharper angles are more prone to slip failure after loading, increasing the likelihood of coal building up against wagon sills and increases exposure to turbulence from exposure to wind.
- Profiles which are inconsistent along the length of the wagon or not aligned with the centre of the wagon.
- In some instances documented loading procedures were not being followed.
- Only a limited number of sites had considered coal loss during rail transport in their internal risk assessments, training documentation and loading procedures.



**Continuous loading: Conveyor-fed surge bin (top) and retractable loading chute with curtains (bottom) (photo: R Deves (top)/ T Greyling (bottom))**

*Other controls*

Aside from the method used to physically load coal into wagons there are other potential controls which can be used to minimise coal loss from the tops of wagons during rail transport, including:

- Maintaining the moisture content of the coal above the Dust Extinction Moisture (DEM)<sup>1</sup> level
- Applying a suppressant (either water or a veneering agent) to the surface of the loaded coal
- Covering the loaded wagons.

During the audit program it was found that several licensees had undertaken testing to determine the DEM of their coal, with testing generally limited to one of their multiple coal types. Limiting testing to one coal type does not account for the variability between different coal types (including unwashed 'bypass' coal). Despite the knowledge of the DEM of their coal, none of the licensees had controls in place to ensure that the moisture content of the loaded coal was maintained above DEM. Generally, moisture was assessed from samples taken at the Coal Handling and Preparation Plant, at the load-out facility immediately prior to loading or at the port during unloading, and was recorded for product quality purposes. Moisture content was generally not considered as a control to reduce the likelihood of coal dust emissions during rail transport.

Some licensees identified that the moisture content of their coal was inherently high, leading to a target of reducing (rather than maintaining or increasing) moisture content prior to loading for commercial purposes. While high moisture content could form an effective control for reducing the likelihood of dust emissions especially on shorter trips, it was not demonstrated that licensees were utilising this information to inform dust management or that the moisture content of each train load would be maintained at an appropriate level (such as DEM).

One premises was observed to use an automated spray system attached to the loading chute to apply water to the surface of the loaded coal. This system can reduce dust emissions by increasing the moisture content of the coal load surface and also by preventing or minimising coal dust from being deposited on the exterior of wagons.

No premises were observed to apply a veneering agent to the surface of the loaded coal and it was also noted that no coal wagons were covered.

Assessments of Compliance for Activity

10/11 facilities were non-compliant

At 1/11 facilities compliance could not be determined<sup>2</sup>

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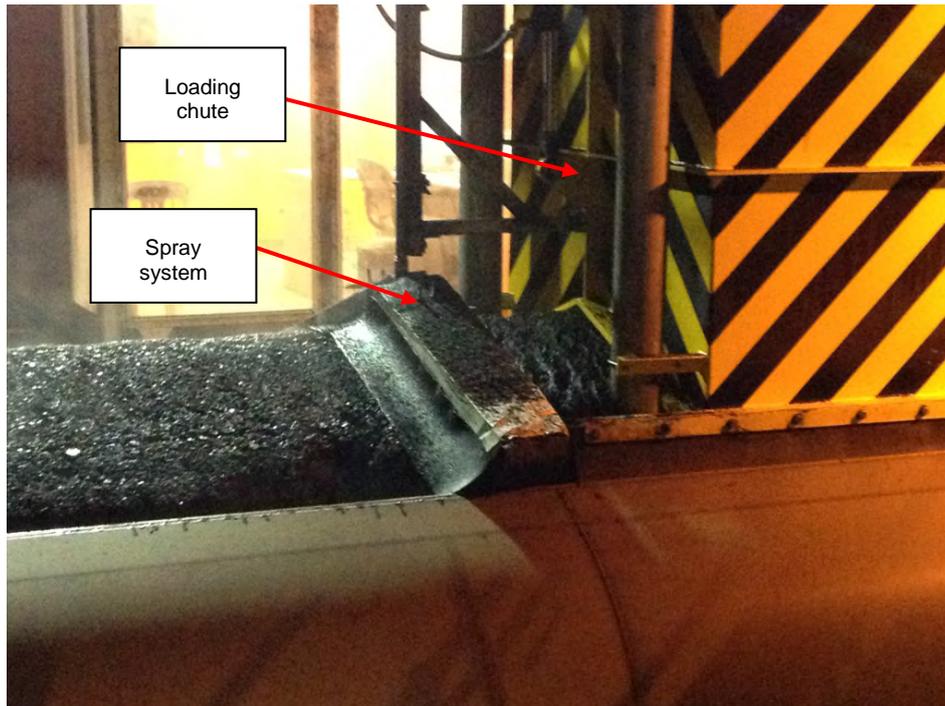
<sup>1</sup> Dust Extinction Moisture (DEM) is the total moisture content of a coal sample at which dust generation is minimised. DEM is determined by use of Australian Standard AS 4156.6—2000 Coal preparation - Part 6: Determination of dust/moisture relationship for coal.

<sup>2</sup> Not determined means that there is insufficient evidence available to assess compliance.

Good practices observed

Although none of the premises received a 'yes' compliance assessment, some good practices were noted:

- Automated loading systems which had a greater capacity to achieve consistent load profile height, shape and distribution.
- Automated spray system attached to loading chute which applied moisture to the load surface, thereby adding surface moisture and minimising dust accumulating on the wagon exterior.



**Automated spray system attached to loading chute to add moisture to the coal surface during the loading process (photo: M Karam)**

**Activity: Carrying out train loading activities in a manner which minimises or prevents leaks and spills of coal from wagon doors during rail transport**

Ensuring wagon doors remain securely closed during the loading process mitigates the likelihood of coal leaking or spilling from the doors during rail transport. Coal leaked or spilled from wagon doors has been shown to be a contributing factor in coal dust emissions during rail transport (Aurecon Hatch 2009) and is estimated to be 8% in relative terms (Connell Hatch 2008iii).

The wagons observed during the audit program were either equipped with kwik drop doors or bomb bay doors. The licensees advised that issues with wagon doors were rare. This was supported by the fact that no coal was observed to leak or spill from wagon doors during the audit inspections. However, the auditees noted a higher prevalence of problems with door closing mechanisms where bomb bay doors were in use. The bomb bay door design appears to be associated with older rolling stock.

During the audit program the EPA noted the contractually delineated roles and responsibilities and statutory restrictions regarding wagons existing between the Rolling Stock Operators (RSOs) and licensees (refer to the 'General observations' section below for

more detail). These roles, responsibilities and restrictions were often cited as a limiting factor on interactions with wagons, including monitoring wagon doors. It was also identified that inspections to ensure wagon doors are securely closed are undertaken by RSO representatives as the trains leave port unloading facilities. However, it remains the licensee's responsibility under their licence to undertake activities in a competent manner. This includes loading wagons in a way which minimises or prevents leaks and spills of coal from wagon doors during rail transport.

Some of the premises audited had adequate controls in place to ensure wagon doors remained securely closed after loading, including:

*Stationary loading systems*

- Visual inspection of wagon doors and sign off by train crew prior to departure from the load-out facility (this was not undertaken by all RSOs)

*Continuous loading systems*

- CCTV camera monitoring wagon doors
- Radar detectors monitoring profile height
- Microwave or radar spill detectors located in rail spill pits under wagons
- Wagon 'door open' detection systems
- Lanyard type derailment devices triggered by faulty or open wagon doors

The effectiveness of the above controls varied, for example, spill detectors contained in rail spill pits have limited capacity to detect spills which may occur outside of the spill pit. Assessments of non-compliance were made when controls to monitor that wagon doors were securely closed were either non-existent or not adequate.

Assessments of Compliance for Activity

4/11 facilities were non-compliant

5/11 facilities were compliant

At 2/11 facilities compliance could not be determined

Good practices observed

- Controls integrated into loading systems to automatically stop the loading process when issues are identified.



**Controls to prevent spillage from the bottom of coal wagons: White markings on door closing mechanism to identify open doors (top) and in-pit spillage sensor at a coal load-out facility (bottom) (photo: L Silk (top)/ T Greyling (bottom))**

**Activity: Carrying out train loading activities in a manner which minimises or prevents coal deposition on the exterior of wagons**

Coal present on the exterior of the wagon, wagon shear plates, sills and bogies is referred to as parasitic coal. Parasitic coal can occur either as fine dust or coarse particles and is a potential source of coal loss during rail transport and is estimated to be 4% in relative terms (Connell Hatch 2008iii).

Some of the premises audited had adequate controls in place to minimise or prevent coal deposition on the exterior of wagons, including:

- Load profiling curtains which prevented coal spilling of wagon sills
- Automated spray system attached to the loading chute
- Partially enclosed loading facility
- Inspection and cleaning of loading facility areas between trains.

Additionally, some licensees undertake inspections for parasitic coal on either incoming or outgoing wagons. One facility, which utilised a stationary loading system, had the capability to remove parasitic coal, using a water jet to remove parasitic coal prior to the departure of the train. Other licensees note the presence of parasitic coal on their internal documentation (and in some instances pass this information to the RSO or port facility) but have no measures in place to remove the coal.

The audit program identified several key issues which increase the likelihood of coal loss during rail transport and led to assessments of non-compliance:

*Stationary loading systems*

- Coal spilling over the sills of the wagons during loading
- Dust generated by loading process

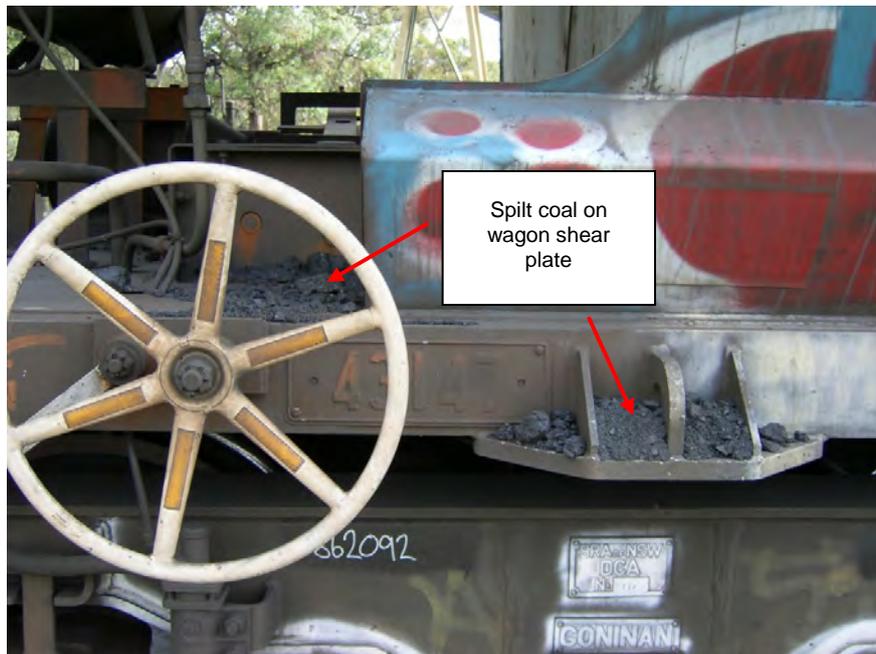
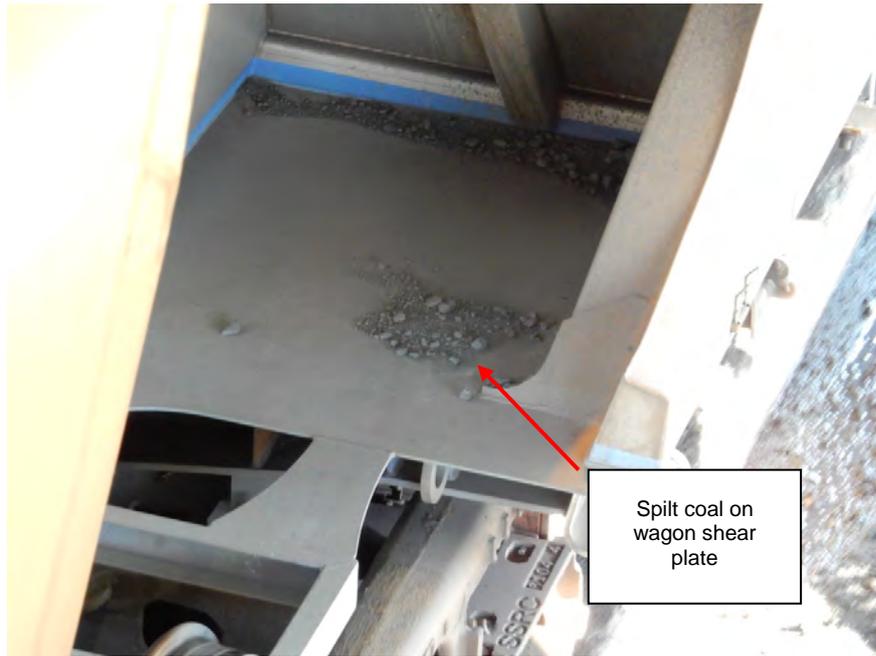
*Continuous loading systems*

- Loading chute and load profiling curtains not being effective at containing coal within the wagon
- Coal leaking from chute onto the exterior of wagons
- Dust generated by the loading process
- Failure to load wagons in accordance with established procedures.



**Worn out or poorly calibrated profiling curtains (top) resulting in coal ‘riding up’ onto wagon sills (bottom) (photo: L Silk (top/bottom))**

Parasitic coal on wagon shear plates was repeatedly observed by the auditors during the audit program, although no instances of it being deposited were observed during the audit inspections. It was apparent that, in some instances, the parasitic coal had been in place on the wagons for enough time to allow significant drying, further increasing dust emission potential.



**Parasitic coal observed on wagon shear plates (photo: R Deves (top)/ W Wickremeratne (bottom))**

Assessments of Compliance for Activity

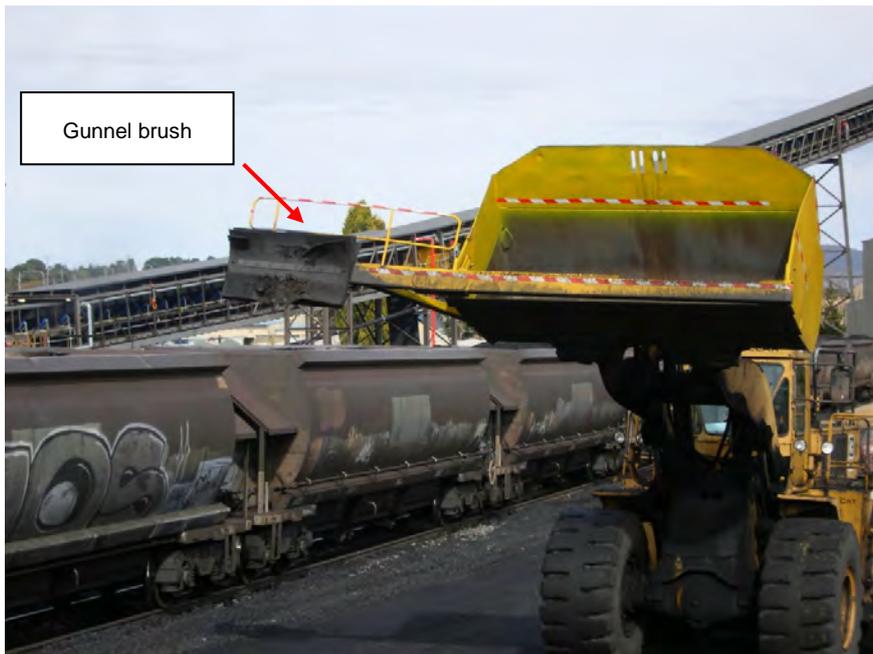
4/11 facilities were non-compliant

6/11 facilities were compliant

At 1/11 facilities compliance could not be determined

Good practices observed

- Effective design and calibration of load profiling curtains to prevent coal building up or spilling over wagon sills.
- Automated spray system attached to loading chute which minimised generation of dust during loading process, thereby adding surface moisture and minimising dust accumulating on the wagon exterior.



**Good practices: removal of coal from wagon gunnels by means of the gunnel brush (top) and use of a water jet to remove coal from wagon exteriors (bottom) (photo: W Wickremeratne (top)/ M Karam (bottom))**

**Activity: Maintenance and operation of plant and equipment**

Most of the audited premises were maintaining plant and equipment used in the loading of coal in a proper and efficient manner, including:

- Coal loading plant and equipment such as conveyors, surge bins, loading chutes and load profiling curtains
- Moisture control equipment such as automatic spray systems
- Monitoring equipment such as CCTV cameras, weighers, line-of-sight indicators and control room displays.

In total three non-compliances were identified for maintenance:

- At one premises it was found that a CCTV camera used to monitor loading had not been operational for an extended period of time
- In two instances it was found that wagons were not being maintained in a proper and efficient manner. This related to excessive gaps along wagon doors and broken or defective shear plate deflectors. It is noted that maintenance of wagons is undertaken by the RSO.

In several instances compliance was not able to be determined due to relevant documentation related to the maintenance of wagons not being made available to the EPA within the audit timeframe.

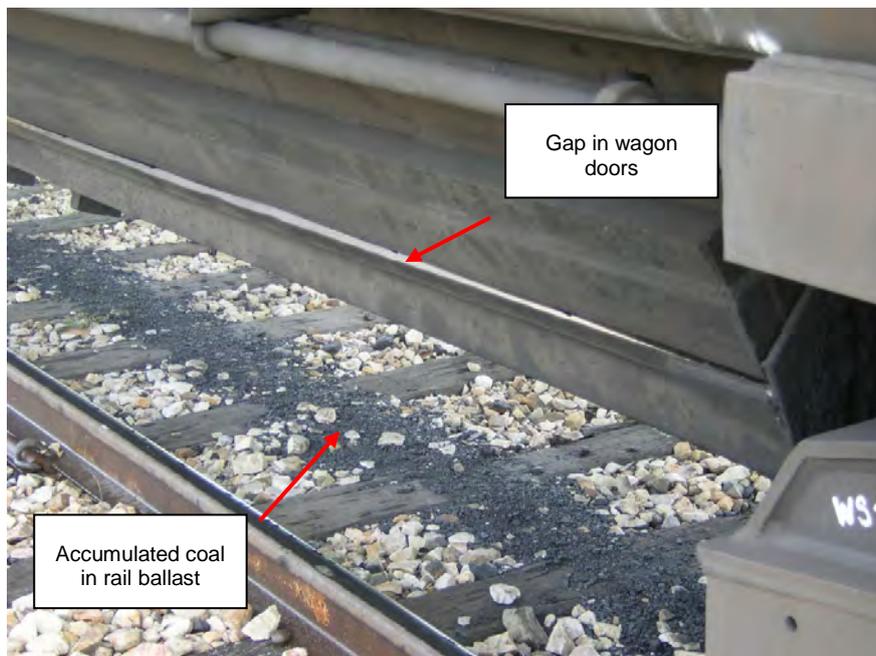
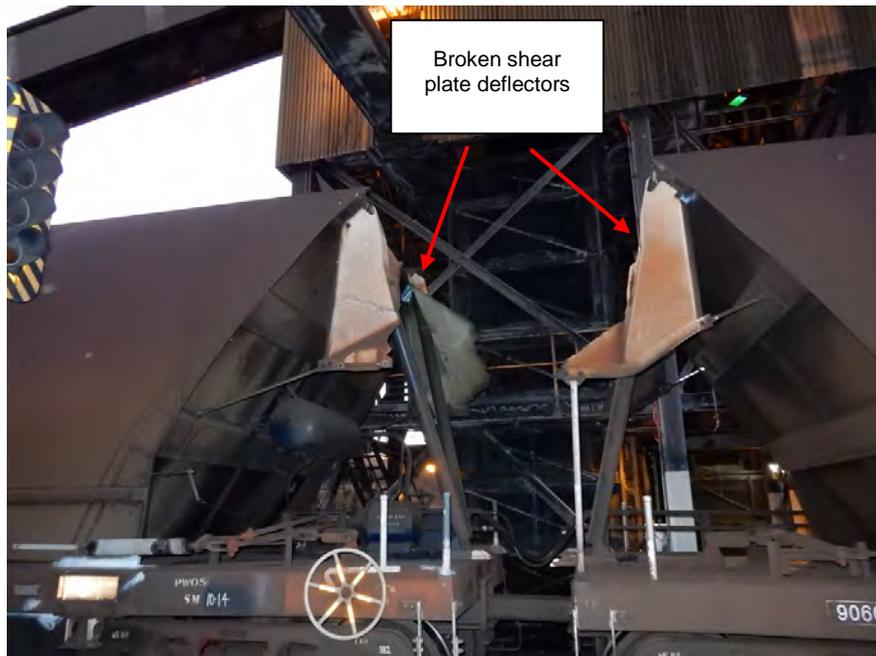
All plant and equipment observed during the audit program was assessed to be operated in a proper and efficient manner.

Assessments of Compliance for Activity

3/11 facilities were non-compliant

5/11 facilities were compliant

At 3/11 facilities compliance could not be determined



**Damaged shear plate deflectors can contribute to coal build-up on shear plates (top) and poorly maintained wagon doors resulting in accumulation of coal in rail ballast (bottom) (photo: R Deves (top)/ W Wickremeratne (bottom))**

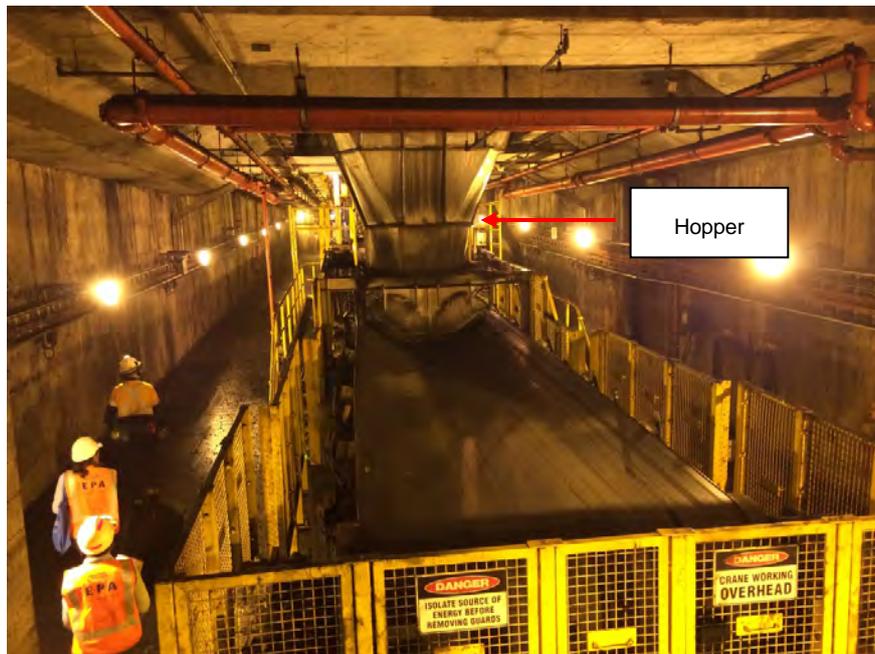
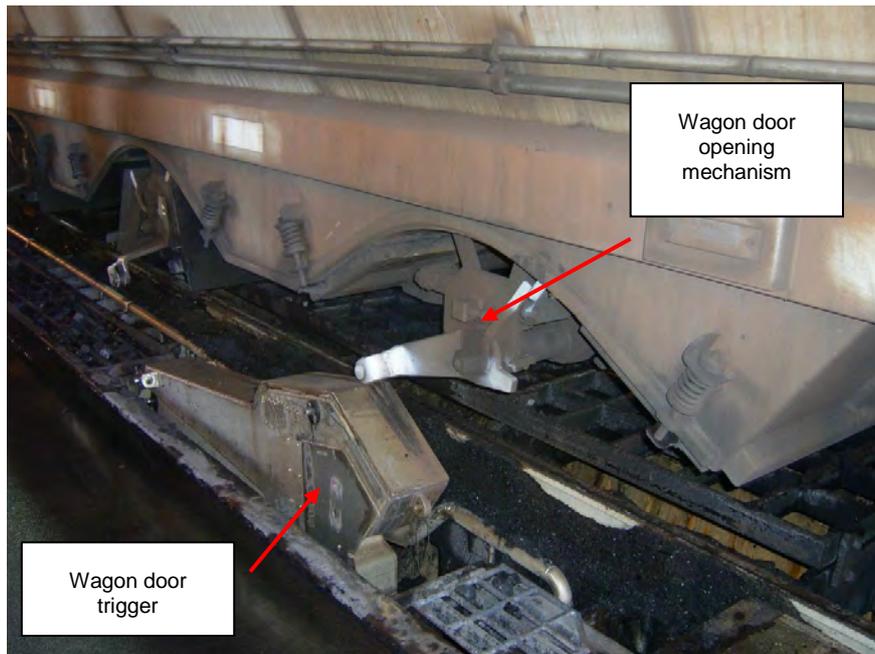
### Coal export terminals (ports)

All of the coal terminals have semi-enclosed rail receival stations which unload bottom dumping wagons. Each terminal is equipped to unload rolling stock with the three types of wagon doors used in NSW – mechanically activated kwik drop doors, electronically activated bomb bay and transverse doors. A summary of the terminals is provided in Table 5.

**Table 5: Summary of NSW coal terminals**

<b>Terminal</b>	<b>Annual throughput of coal (Mt)*</b>	<b>Capacity to unload (trains/day)</b>	<b>Number of rail receival stations</b>
NCIG Kooragang	43 (year ending Dec. 2013)	40	2
Port Kembla	12.3 (financial year ending June 2014) 6.9 by rail	14	1
PWCS Carrington	25 (average)	7	2
PWCS Kooragang	91 (year ending Dec. 2013)	40	4

\*This data was collected in the course of the audit program and presented to licensees for confirmation in the draft compliance audit report for each premises



**Wagon door opening mechanism and trigger (top) to allow discharge of coal from wagons to the receival station hopper below (bottom) (photo: E Howard (top)/ L Silk (bottom))**

In relation to coal unloading facilities, the assessment of compliance was divided into the following activities relevant to the audit scope, namely:

- Carrying out train unloading activities in a manner which minimises or prevents coal dust emissions from the interior of empty wagons during rail transport.
- Carrying out train unloading activities which minimises or prevents leaks and spills of coal from wagon doors during rail transport.
- Carrying out train unloading activities in a manner which minimises or prevents coal deposition on the exterior of wagons.

- Maintenance and operation of plant and equipment.

General audit findings are discussed for each of these activities.

**Activity: Carrying out train unloading activities in a manner which minimises or prevents coal dust emissions from the interior of empty wagons during rail transport.**

Coal remaining in wagons after unloading, referred to as 'carry-back coal', can contribute to dust emissions during rail transport as the coal dust can become entrained in the air currents which develop in empty wagons as the train is underway and can also leak through gaps in wagon doors. Carry-back coal in empty wagons is a potential source of dust emissions and is estimated to be in the order of 1% in relative terms (Connell Hatch 2008i).

Assessment was made through consideration of two aspects:

- Large amounts (in the order of tonnes to tens of tonnes per wagon) of carry-back coal in the form of accumulations of 'hung-up' coal
- Small amounts of carry-back coal in the form of small accumulations of coal (in the order of kilograms to hundreds of kilograms) and fine coal dust residues.

Large amounts (tonnes to tens of tonnes per wagon) of carry-back coal remaining in wagons

All of the coal terminals audited had adequate controls in place to prevent or minimise large amounts of carry-back coal. These controls included:

- CCTV cameras showing footage from the inside of wagons which can be viewed by the operator (at some facilities the RSO examiner can also view this footage). The operator and examiner can stop the train if there is a large amount of coal remaining in the wagon. In cases where the train has exited the receival station, it is reversed back over the bins to remove the coal. The coal can be removed manually by high pressure hose and vibration devices to dislodge 'hung up' coal.
- Telemetry system to monitor train speed to ensure an optimum train speed is maintained for the unloading process. The required speed is communicated between the operator and the locomotive driver through a train speed indicator with radio used as a back-up.
- Training of operators in unloading in relation to processes and controls to minimise or prevent large amounts of carry-back coal.



**Magnetic vibration device to dislodge hung up coal (top) and control room displays showing the interior of unloaded wagons to monitor for potential carry back coal (bottom) (photo: L Silk (top)/ R Deves (bottom))**

One licensee is in the process of developing a laser system which monitors the interior of wagons for unloading issues.

Assessments of Compliance for Activity

4/4 facilities were compliant

Good practices observed

- A highly automated unloading process managed by a control system linked to a network of equipment and sensors.
- Communication between the terminal, the load-out facility and RSO examiner regarding issues encountered with the coal during the unloading process such as coal remaining 'hung up' in the wagon. The load-out facility can subsequently adjust future loads to help prevent carry-back coal occurring.
- Video analytics to automatically detect coal hung up in wagons. Computer software and CCTV cameras automatically identify potential hung up coal without an operator needing to monitor the video. Algorithms are used to detect changes in live and recorded video which produces audible and visual alarms if hung up coal is detected.

Small amounts of carry-back coal in the form of small accumulations (kilograms of coal per wagon) and fine coal particles remaining in wagons

Small amounts of carry back coal and fine coal particles were observed in the coal wagons following unloading of the coal at the coal terminals. There is potential that this coal could be emitted from the empty wagons during rail transport, however the contribution to overall coal dust emissions during rail transport is likely to be relatively minor when compared to other sources (such as the tops of loaded wagons) (Connell Hatch 2008).

In some instances, incoming, empty coal wagons containing small amounts of carry back coal were observed at load-out facilities. This observation, although confirming that small amounts of carry back coal can remain in wagons after unloading, also indicates that some or all of the coal remains in the unloaded wagons during transport back to the load-out facility. Therefore it could not be determined whether carry back coal was being deposited or emitted during rail transport.

The EPA was therefore not able to determine if small accumulations of carry back coal are causing or are likely to cause significant coal dust emissions during rail transport.

Assessments of Compliance for Activity

At 4/4 facilities compliance could not be determined

**Activity: Carrying out train unloading activities which minimises or prevents leaks and spills of coal from wagon doors during rail transport.**

Ensuring wagon doors are properly opened and closed at the port facility mitigates the likelihood of any carry-back coal leaking or spilling from wagon doors during rail transport. Coal leaked or spilled from wagon doors has been shown to be a contributing factor in coal dust emissions during rail transport and is estimated to be 1% in relative terms (Aurecon Hatch 2009).

All of the terminals had adequate controls in place to ensure wagon doors were opened and closed before leaving the facility. These controls included:

- Wagon door triggers for opening and closing wagons with bomb-bay, transverse and kwik-drop doors.
- CCTV cameras to monitor wagon door opening and closing.
- Training of operators to cover processes and controls to manage issues with wagon doors.

- RSO Examiners carrying out post unloading inspections to ensure the wagon doors are closed.
- The ability of the operator and/or RSO examiner to stop trains promptly if an issue is identified and provision for doors to be manually opened and closed.

Assessments of Compliance for Activity

4/4 facilities were compliant

Good practices observed

- A wagon 'door open' detector array being located after the last closing trigger which alerts the operator of partially or fully open wagon doors.
- A wire trigger located on the tracks beyond the rail receipt station to detect open wagon doors if they are not detected by the terminal operator or RSO Examiner. This device is also a spillage detection derailment device.

**Activity: Carrying out train unloading activities which minimises or prevents coal deposition on the exterior of wagons.**

Coal deposited on the exterior of wagons (referred to as 'parasitic coal') is a potential source of dust emissions during rail transport. This coal can be fine particles of dust on wagon surfaces and coarse coal particles and lumps of coal on wagon bogies.

Assessment was made through consideration of two aspects:

- Coarse coal particles and lumps of coal on wagon sills, shear plates and bogies
- Fine coal dust particles on wagon surfaces.

Coarse coal particles and lumps of coal on wagon sills, shear plates and bogies

All of the terminals were minimising or preventing the deposition of coarse coal particles and lumps of coal on wagon bogies. Controls were in place to prevent overfilling of hoppers and subsequent ploughing of coal. These controls included:

- Operator supervision of the unloading process by CCTV camera and direct line of sight.
- Telemetry to ensure the train speed is kept at an optimum for unloading.
- Multiple triggers to ensure load is evenly distributed across hoppers.
- Sensors and detectors to monitor the hopper fill height such as laser detectors and microwave sensor capacity probes. High level sensors can trigger the train to stop to allow the hoppers to draw down.
- Level sensors on the feeder belt and ultrasonic sensors on the conveyors which provide information to help maintain the correct unloading rate.

Although these controls were observed to be effective on the day of the audit inspection, it is noted that:

- Neither the licensees nor RSO examiners have procedures or controls to identify parasitic coal on wagon sills, shear plates and bogies
- The facilities have no procedures or controls in place to remove parasitic coal if it is identified.

Assessments of Compliance for Activity

4/4 facilities were compliant

Good practices observed

- An unloading process that is highly automated with multiple layers of controls to manage hopper fill height and prevent hopper overflowing.

Fine coal dust particles on wagon surfaces

The majority of coal terminals provide satisfactory management controls for the generation of dust during unloading which in turn assists in preventing the generation of parasitic coal. One of the terminals was not minimising or preventing the deposition of fine coal particles on the exterior of wagons.

At this facility it was noted that,

- Controls, such as water sprays on the hoppers, were not being used to minimise dust emissions during the unloading process.

Assessments of Compliance for Activity

1/4 facilities were not compliant

3/4 facilities were compliant

Good practices observed

- One operator has developed a dust risk ranking for the coal received from each load-out facility. This is fed into the control system prior to train unloading which automatically adjusts the operation of the hopper spray bars. In addition, in-line moisture monitoring of the unloaded coal provides real time information to the control system to further adjust the hopper spray system.

**Activity: Maintenance and operation of plant and equipment**

All coal terminals were maintaining plant and equipment used in the unloading of coal in a proper and efficient condition and operating it in a proper and efficient manner. This included:

- Coal unloading plant and equipment such as hoppers, conveyors belts and feeders and wagon door triggers.
- Monitoring equipment such as CCTV cameras, bin level indicators, control room monitors and the train speed indicator.
- Moisture control equipment.

It was noted that the RSO is responsible for maintenance of wagons and provided evidence to determine that they were being maintained.

Assessments of Compliance for Activity

4/4 facilities were compliant

## General observations

### Taking ownership

There are many stakeholders involved in the transport of coal by rail for export in NSW. The main stakeholders are:

- the coal producers and their contractors who undertake the coal loading process
- the rolling stock operators who provide and maintain the locomotives and wagons that transport the coal
- the rail network managers, such as the Australian Rail Track Corporation (ARTC), that manage the NSW rail network
- the port unloading facilities that receive the coal and assemble it into the relevant allocations for shipment.

It was found during the audits that in relation to minimising the likelihood of coal being lost between the coal load-out facilities and the port rail receipt stations, each stakeholder has particular roles and responsibilities. These are outlined in procedures, interface agreements, and other contractual arrangements between the different parties.

#### *Load-out facilities (coal producers)*

Many of the load-out facilities are located at the mine sites or at their associated processing facilities. Licensees managing the load-out facilities are responsible for ensuring that the coal is loaded into wagons according to specifications outlined in procedures provided by the rolling stock operators. These in turn reference requirements specified by the rail network providers, with the main objective being to avoid derailments and safety incidents. For example, there are maximum height and weight specifications for loaded trains carrying freight including coal on the rail network. Coal loading operators are also required to ensure that the coal loaded into wagons is distributed evenly, with no coal on the ends or sides of the wagons. If there is an issue with a train or a wagon while it is on a licensee's premises, such as defective wagon doors, the licensee is not permitted to physically intervene as it is the rolling stock operator's responsibility to address any maintenance or operational issues with the train.

#### *Rolling stock operators*

There are four main rolling stock operators in NSW that transport coal. These are:

- Pacific National
- Aurizon
- Freightliner
- Southern Shorthaul Railroad (SSR).

Rolling stock operators are responsible for the certification, maintenance and provision of locomotives and wagons for the transport of the coal by rail. The rolling stock operators are also responsible for the control of locomotives and wagons during loading and unloading operations.

In particular, it was found during the audits that the rolling stock operators are responsible for checking that wagon doors are closed after unloading at the rail receipt station before the train goes back out onto the rail network. Many load-out facilities were found to rely on the wagon door checks undertaken by the rolling stock operators after coal unloading, with no further checks being undertaken at the load-out facilities to ensure the wagon doors are closed before coal loading.

#### *Rail network providers*

The rail network managers are responsible for the management of the NSW rail network used by the rolling stock operators. The EPA licences the rail network managers such as ARTC and John Holland Pty Limited. Apart from scheduling train movements, the rail network providers also maintain the rail infrastructure. Coal which ends up in the rail ballast or within the rail corridor can erode over time to contribute to dust being generated within the rail corridor.

When trains travel on the network, fine coal particles can become entrained and airborne due to the train movement. As outlined in this report, there are several ways that coal may be lost from a wagon during rail transport (i.e. from the top, from wagon doors or from the exterior of the wagon). Rail network managers are responsible for maintaining the rail corridor including cleaning the ballast from any accumulations of fine coal. The clean-up of a spillage of coal from a coal train is the responsibility of the rail network managers. Rolling stock operators may however also assist in the clean-up.

#### *Port unloading facilities*

The port unloading facilities receive the coal at their rail receival stations. In accordance with arrangements with the rolling stock operators, the port unloading facilities open and close the wagon doors during the unloading process. Like the load-out facilities, the port unloading facilities are not permitted to physically intervene if there is an issue with a wagon door that does not open or close. This is the responsibility of the rolling stock operator.

In relation to ensuring that wagons are fully unloaded and empty as they depart the rail receival station, the port unloading facilities have systems to monitor the unloading process and to detect large amounts of coal remaining in wagons including 'hung up' coal. However, it is noted that through contractual arrangements between the port unloading facilities and the rolling stock operators, it is generally the rolling stock operator's responsibility to intervene in the event of coal being 'hung up' and to ensure that each wagon is completely empty before departure from the facility.

#### **Product quality versus environmental compliance**

During the audits it was found that there is a lack of representative sampling at the coal load-out facilities and the port unloading facilities to determine whether the moisture content of the coal when it leaves the load-out facility is sufficient to minimise the generation of dust during the rail journey, and whether the coal is still sufficiently moist when it reaches its destination (i.e. the port).

The main purpose of moisture monitoring appears to be for product quality rather than dust suppression. Therefore, there is a reliance on the sampling undertaken at the coal terminals as this is at a point in the production process immediately prior to the loading of the ships. However, this method does not provide the load-out facility with the information required to assess whether the loaded coal meets the DEM before the departure of the train. Sampling undertaken at the coal handling and preparation plant does not provide reliable information either due to stockpiling prior to loading when the coal may dry out.

## After the audit

### Follow-up by the EPA

The EPA has required the coal loading and unloading facilities audited as part of this program to rectify any non-compliances identified and will be following up to make sure they are complying with their licence requirements.

In many cases the comments received from licensees as part of the audit process indicated that licensees had already commenced reviews of their processes and procedures to improve performance and address non compliances.

The EPA recommends that remaining coal loading facilities which were not audited in this program should use this report and individual audit findings to inform their review of processes and procedures in relation to coal loading.

## Other EPA initiatives

### Lower Hunter Particle Characterisation Study

The Lower Hunter Particle Characterisation Study was initiated in 2013 to study the composition of airborne particulate matter (PM<sub>2.5</sub> and smaller) in the Lower Hunter region, and the composition of airborne particulate matter (PM<sub>10</sub>) in the vicinity of the Newcastle Port.

The study is being undertaken to provide communities in the Lower Hunter with scientific information about the composition and likely sources of fine particles, invisible to the eye, in their local environment.

The study includes one year of sampling (March 2014 to February 2015) at four sites (Newcastle, Beresfield, Mayfield, Stockton), followed by sample analysis and modelling to identify the sources of air particles. PM<sub>2.5</sub> will be sampled at Newcastle and Beresfield to study air particles characteristic of the broader region, with PM<sub>2.5</sub> and PM<sub>10</sub> sampled at Mayfield and Stockton situated in proximity to the Newcastle Port. Study findings will be released in early 2016.

### Dust Deposition Study

Community groups and individuals have also raised concerns about the levels of visible black dust in the lower Hunter region. The EPA has commissioned a study to examine the quantity, composition and likely sources of deposited dust visible to the eye, in parts of the region, including but not limited to the rail corridor and coal loaders.

To ensure that the views of the community are fully considered, the EPA established a project reference group for the study that includes community members, industry representatives and independent experts.

In August 2014, the EPA sought expressions of interest from residents who live near industries to host dust gauges at their homes for the duration of the study. Twelve sites were identified as being suitable. Monitoring at these sites has commenced and will run for 12 months.

The analysis of the dust samples may point to likely or potential sources of the dust. However, it is beyond the scope of the study to identify specific facilities as the sources of dust. The principle objective of the study is to provide information that increases community knowledge and understanding about dust deposition in the Lower Hunter and is primarily concerned with visible dust, as opposed to fine particles (PM<sub>10</sub> and PM<sub>2.5</sub>) which are the focus of the Lower Hunter Particle Characterisation Study.

The study's findings will be presented to a community forum, hosted by the Newcastle Community Consultative Committee for the Environment.

### Coal Dust Literature Review

Katestone Environmental Pty Ltd was commissioned to undertake a literature review of currently available information relating to the control of fugitive coal dust emissions in the rail corridor (Katestone 2014). The purpose of the project was to provide comprehensive knowledge and information about management practices for fugitive coal dust emissions from trains, with a focus on measures that could be applied in the Hunter Valley rail corridor and other coal rail corridors in NSW. The review can be found on the EPA's website at <http://www.epa.nsw.gov.au/esdsmoky/qovimpro.htm>

The Review considered emission and management practices relating to:

- coal handling (both loading and unloading)

- wind erosion of coal in wagons (both loaded and unloaded wagons)
- coal spillage in the rail corridor (overloading and spillage of parasitic coal from loading and unloading, spillage from top, and door leakage from loaded, and residual coal left in unloaded wagons)

The Review provides a description and evaluation of coal dust management practices; considers the emission reduction effectiveness of practices; and outlines whether they have been adopted or identified in NSW.

#### **Notices issued by the EPA to rail track providers/managers**

On 10 March 2014, the EPA issued notices to the NSW rail network providers/managers – ARTC, John Holland Rail and Sydney Trains – requiring them to provide records and information about how they monitor and manage spilt or fugitive coal in the rail corridor. All three rail network providers/managers complied with the notices and the EPA has assessed the information provided. The information is being used to better inform the EPA's approach to regulating the different stakeholders involved in the NSW coal chain.

## References

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- Katestone Environmental, 2014, 'Literature Review of Coal Train Dust Management Practices', Report to NSW Environment Protection Authority.
- NSW Trade & Investment, NSW coalfields, accessed on 7 Oct 2014: <<http://www.resourcesandenergy.nsw.gov.au/landholders-and-community/geoscience-for-landholders/coalfields>>.

## Glossary

<b>Assessment of Compliance</b>	The specific measures against which compliance is assessed and a component or sub-set of licence conditions.
<b>Audit</b>	A systematic, independent and documented verification process of objectively obtaining and valuating audit evidence to determine whether specified criteria are met.
<b>Audit criteria</b>	The audit criteria are defined requirements against which the auditor compares collected audit evidence. Criteria may include regulatory requirements, standards, guidelines or any other specified requirements.
<b>Audit evidence</b>	Evidence collected for the purpose of assessing compliance including documentary evidence and any evidence collected during an audit inspection of the premises such as auditor's observations, photographs, videos and evidence provided by the licensee during interviews.
<b>Audit inspection</b>	The step in the audit process where auditors visit the licensed premises to conduct meetings, interviews, observation of the operational systems and collect evidence against which compliance will be assessed.
<b>Audit scope</b>	The audit scope defines the extent and boundaries of the audit such as locations, organisational units, activities and processes to be audited, and the time period covered by the audit.
<b>Carry-back coal</b>	Any coal which at the time of unloading is not removed from the bay of the train wagon and therefore travels back to the load-out facility on the return journey. It may constitute a wide particle size distribution from large pieces of coal to fine material.
<b>Coal ploughing</b>	When during unloading of a coal train, coal discharged through the doors underneath the wagons builds up to the extent that the wagon wheels start rolling through ('ploughing') the coal.
<b>Coal terminal</b>	Port infrastructure for the unloading of coal from trains, and its storage and subsequent loading onto ships.
<b>Code blue</b>	A non-compliance for licence conditions that do not have a direct environmental significance, but are still important to the integrity of the regulatory system. These conditions relate to administrative, monitoring and reporting requirements.
<b>Code orange</b>	A non-compliance of environmental significance, however remedying the non-compliance can be given a lower priority than a red risk assessment.
<b>Code red</b>	A non-compliance of considerable environmental significance and therefore must be dealt with as a matter of priority.

<b>Code yellow</b>	A non-compliance which could receive a lower priority than a red or orange risk code, but the non-compliance is still important and must be addressed.
<b>Compliance</b>	There is sufficient and appropriate evidence to demonstrate the particular requirement has been complied with and is within the scope of the audit.
<b>DEM</b>	Dust Extinction Moisture (DEM) is the total moisture content of a coal sample at which dust generation is minimised. DEM is determined by use of Australian Standard AS 4156.6—2000 Coal preparation - Part 6: Determination of dust/moisture relationship for coal.
<b>Environment Protection Licence (EPL)</b>	A licence that authorises the carrying out of scheduled activities or controls pollution arising from non-scheduled activities, being a licence issued under Chapter 3 of the <i>Protection of the Environment Operations Act 1997</i> and in force.
<b>Environmental harm</b>	Includes any direct or indirect alteration of the environment that has the effect of degrading the environment and, without limiting the generality of the above, includes any act or omission that results in pollution.
<b>Facility</b>	Any premises where scheduled or non-scheduled activities is undertaken.
<b>Hung-up coal</b>	Large amounts of residual coal remaining in the train wagons after unloading and caused by particular coal types usually caused by the characteristics of the coal making it stick to the interior of the wagon bay surface.
<b>Licence conditions</b>	Stipulations listed on the Environmental Protection Licence outlining the requirements which the licensee must comply with.
<b>Licensed premises</b>	Any premises where a scheduled activity is undertaken for which the licensee has obtained a licence to do so.
<b>Load-out facility</b>	Infrastructure where coal is received and from which coal trains are loaded. It may be located at a mine site or at dedicated premises.
<b>Loss of coal</b>	Spills, leaks or dust emissions from coal trains.
<b>Monitoring</b>	Monitoring generally means to be aware of the state of a system. The process of monitoring involves data collection, data analysis and interpretation of the data to determine the state of the system and how the system is changing.
<b>Monitoring data</b>	Data collected for the purpose of characterising changes in an event as the result of a direct observation or experiment. The facts are usually numbers that reflect the result of a measurement determined from observations or experiments.
<b>Monitoring frequency</b>	The frequency by which licensees are required to collect samples, as required by their Environmental Protection Licence.

<b>Non-compliance</b>	Clear evidence has been collected to demonstrate the particular requirement has not been complied with and is within the scope of the audit.
<b>Not applicable</b>	The particular requirement is not relevant to the licensee's facilities or operating conditions.
<b>Not determined</b>	Insufficient evidence is available to allow an evidence-based assessment of compliance to be made.
<b>Parasitic coal</b>	Coal which during loading or unloading is unintentionally deposited and subsequently transported on the exterior of train wagons (e.g. on wagons sills, shear plates, bogies and so forth). This coal may be lost from the exterior of the wagon during the journey.
<b>Particulate matter</b>	Solid or liquid particles 10 micrometre or less in diameter (refer to PM <sub>10</sub> and PM <sub>2.5</sub> ).
<b>PM<sub>10</sub></b>	Particles between 10 and 2.5 micrometre in diameter and commonly referred to as 'coarse'.
<b>PM<sub>2.5</sub></b>	Particles less than 2.5 micrometres in diameter and commonly referred to as 'fine'.
<b>Pollution</b>	Means water pollution, air pollution, noise pollution, or land pollution.
<b>Public register</b>	The public register under section 308 of the POEO Act is an online searchable database and contains: <ul style="list-style-type: none"> <li>• environment protection licences</li> <li>• applications for new licences and to transfer or vary existing licences</li> <li>• environment protection and noise control notices</li> <li>• convictions in prosecutions under the POEO Act</li> <li>• results of civil proceedings</li> <li>• licence review information (submissions regarding licence review can be made at any time)</li> <li>• exemptions from the provisions of the POEO Act or regulations</li> <li>• approvals granted under clause 9 of the POEO (Control of Burning) Regulation</li> <li>• approvals granted under clause 7A of the POEO (Clean Air) Regulation.</li> </ul>
<b>Remedial action/Action program</b>	An action or series of actions that the licensee is required to undertake in order to correct an identified non-compliance. It is issued in association with an expected completion date.
<b>Residual coal</b>	Any coal remaining in the train wagon after unloading including large and small particle sizes and large and small amounts of coal.
<b>Risk assessment</b>	A systematic process whereby a potential environmental breach is identified and a rigorous methodology followed to

	determine the level of risk posed were such a breach to occur.
<b>Rolling stock operator</b>	The owner and operator of train locomotives and wagons.
<b>Scheduled activity</b>	An activity listed in Schedule 1 of the <i>Protection of the Environment Operations Act 1997</i> .
<b>Scheduled (premises)</b>	<p>A premises (as defined in the <i>Protection of the Environment Operations Act 1997</i> (POEO Act)) on which an activity listed in Schedule 1 of the POEO Act is carried out. The person or company undertaking the activity is required to hold an Environment Protection Licence to carry out the activity.</p> <p>Premises includes:</p> <ul style="list-style-type: none"><li>• a building or structure or</li><li>• land or a place (whether enclosed or built on or not) or</li><li>• a mobile plant, vehicle, vessel or aircraft.</li></ul>
<b>Wind erosion of coal</b>	Coal particles which have been deposited along railway tracks and that are subsequently eroded to a finer particle size. Fine material may become entrained in the wind movement through the rail corridor.

## Appendix A: List of licensees audited

### Audited load-out facilities

EPL No.*	Licensee	Coalfield
395	Centennial Newstan Pty Ltd	Newcastle
24	Mount Thorley Coal Loading Ltd	Hunter
563	Bulga Coal Management Pty Ltd	Hunter
640	Coal & Allied Operations Pty Ltd (Hunter Valley Operations)	Hunter
4460	Xstrata Mount Owen Pty Ltd	Hunter
11457	Hunter Valley Energy Coal Pty Ltd (Mt Arthur Coal)	Hunter
5129	Ivanhoe Coal Pty Ltd (Lidsdale Siding)	Western
12425	Wilpinjong Coal Pty Ltd	Western
5161	Stratford Coal Pty Ltd	Gloucester
3637	Whitehaven Coal Mining Ltd	Gunnedah
1389	Tahmoor Coal Pty Ltd	Southern

### Audited coal terminals

EPL No.*	Licensee	Location
601	Port Waratah Coal Services Ltd (Carrington)	Hunter
1552	Port Waratah Coal Services Ltd (Kooragang)	Hunter
12693	Newcastle Coal Infrastructure Group Pty Ltd	Hunter
1625	Port Kembla Coal Terminal Ltd	Wollongong

\*Note: copies of the licences can be accessed through the EPA online public register at: <http://www.epa.nsw.gov.au/prpoeoapp/>.

## Appendix B: Links to further information

**Background information about air quality:**

<http://www.epa.nsw.gov.au/aqms/index.htm>

**NSW EPA air pollution initiatives:**

<http://www.epa.nsw.gov.au/esdsmoky/govimpro.htm>

**Minimising particulate pollution from coal mines:**

<http://www.epa.nsw.gov.au/air/coalminingNSW.htm>

**NSW EPA Public Registers:**

<http://www.epa.nsw.gov.au/publicregister/>

**NSW EPA Environment Line**

<http://www.epa.nsw.gov.au/contact/EnvironmentLine.htm>