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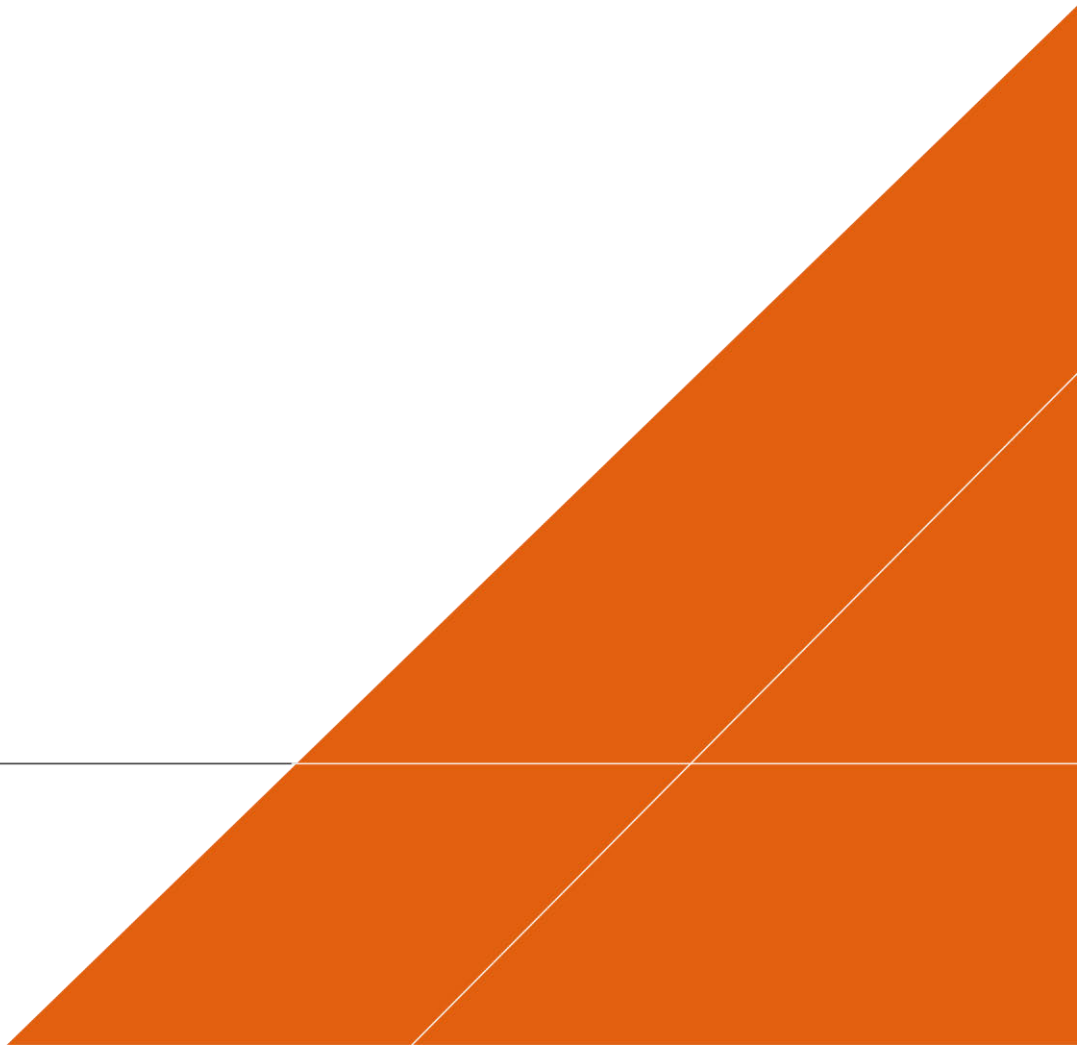
MOOREBANK LOGISTICS PARK – PRECINCT EAST

Best Practice Progress Review 2021

07 JULY 2021



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Revision 001

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REVISIONS

Revision	Date	Description	Prepared by	Approved by
000	01/07/21	First draft for review	[redacted]	K[redacted]
001	07/07/21	Response to TACTICAL and final submission	[redacted]	[redacted]

ACRONYMS AND DEFINITIONS

Term	Explanation
AS	Australian Standard
ARA	Australasian Railway Association
BPR (2017)	MPE Stage 1 (SSD 6766) Best Practice Review (Report #013 September 2017)
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CoA	Condition of Approval
CoP	Code of practice
DAWE	Commonwealth Department of Agriculture, Water and Environment
DPIE	Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
EPA	Environment Protection Authority - Australia
EPL	Environmental Protection License
EU	European Union
Facility	The MPE Concept (MP10_0193), MPE Stage 1 (SSD 6766) and MPE Stage 2 (SSD 7628) Project, including the operation of the IMEX terminal, warehousing and distribution facilities. A rail link is included as part MPE Stage 1 (SSD 6766) and connects the Facility to the SSFL.
FORG	Freight on Rail Group
IMEX	Import-Export Terminal Facility • Truck processing, holding and loading areas - entrance and exit from Moorebank Avenue • Rail loading and container storage areas – installation of four rail sidings with adjacent container storage area serviced by manual handling equipment initially and overhead gantry cranes progressively • Administration facility and associated car parking- light vehicle access from Moorebank Avenue.
IMT	MPE Stage 1 Site including the construction of the following key components together comprising the intermodal terminal (IMT): • Truck processing and loading areas. • Rail loading and container storage areas. • Administration facility and associated car parking • Rail Link.
MLP	Moorebank Logistics Park
MPE	Moorebank Precinct East
MPW	Moorebank Precinct West
NMHC	Non-methane hydrocarbons
NRMM	Non-road mobile machinery
NOx	Oxides of Nitrogen
NO_2	Nitrogen dioxide

Term	Explanation
OAQMP	Operational Air Quality Management Plan
PM	Particulate Matter
Qube	Qube Holdings Limited
RISSB	Rail Industry Safety and Standards Board
SSD	State significant development
SIMTA	Sydney Intermodal Terminal Alliance
THC	Total hydrocarbon
US EPA	United States Environmental Protection Authority

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LIST OF TABLES

1 INTRODUCTION

This Best Practice Progress Review (the Report) has been prepared in accordance with the requirements of the Best Practice Review, 2017 (BPR (2017)) prepared by Arcadis to satisfy the Moorebank Precinct East (MPE) Stage 1 State Significant Development (SSD) 6766 Condition of Consent (CoC) G6.

The BPR (2017) stated that a progress review against the objectives and targets of available best practice on an annual basis (for a notional period of up to 7 years from operation) would be undertaken to ensure that available best practice benchmarks are current, relevant and achievable. This requirement was subsequently included within the Moorebank Logistics Park (MLP) East precinct Operational Air Quality Management Plan (OAQMP).

This Report has been prepared by Arcadis following the first year of MLP operations (May 2020 to May 2021).

1.1 Background

The MLP is an integral component of the Freight, Ports and Transport strategies of both the NSW and Commonwealth governments to help manage the challenges of an expected tripling of freight volumes at Port Botany by 2031. The MLP is operated by the Sydney Intermodal Terminal Alliance (SIMTA). SIMTA is wholly owned by Qube Holdings Limited (Qube).

The MLP aims to streamline the freight logistics supply chain from port to store, deliver savings to businesses and consumers, and help service the rapidly growing demand for imported goods in south-west Sydney. It is located approximately 27 kilometres (km) south-west of the Sydney Central Business District and approximately 26 km west of Port Botany within the Liverpool Local Government Area. The MLP is divided into an East Precinct and a West Precinct, located east and west of Moorebank Avenue.

The MLP East Precinct (Figure 1-1) is currently in operation and includes the Moorebank Intermodal Terminal (IMT) and associated Rail Link, which is the subject of this Report. The MLP West Precinct (SSD 5066 and SSD 7709) and MPE Stage 2 (SSD 7628) are currently under construction and not included in this Report.

1.2 Purpose and structure

This Report has been prepared to satisfy the Best Practice Progress Review for emission technologies for locomotives (Rail Link and IMEX) as identified in Table 4-6 of the MLP – Precinct East OAQMP and Section 4.2.3 of the MPE Stage 1 (SSD 6766) Best Practice Review (Report #013 September 2017 and herein referenced as BPR (2017)).

The BPR (2017), required as part of SSD 6766 CoA G6(a) was approved in 2017 and identified the need to undertake a Best Practice Progress Review annually each year for up to 7 years from commencement of operation.

The purpose of this Report is to:

- Review progress against the objectives and targets of available best practice referenced in the BPR (2017) (Section 2)
- Summarise best practice emission objectives and targets of available best practice to ensure that available best practice benchmarks are current, relevant and achievable (Section 3)
- Provide recommendations on how the Facility will implement available best practice technologies, as they relate to available upgrade / repower options (Section 4).

In accordance with Table 4-6 of the MLP – Precinct East OAQMP, this Best Practice Progress Review will be submitted to the Department of Planning, Industry and Environment (DPIE) and Commonwealth Department of Agriculture, Water and Environment (DAWE) for information.

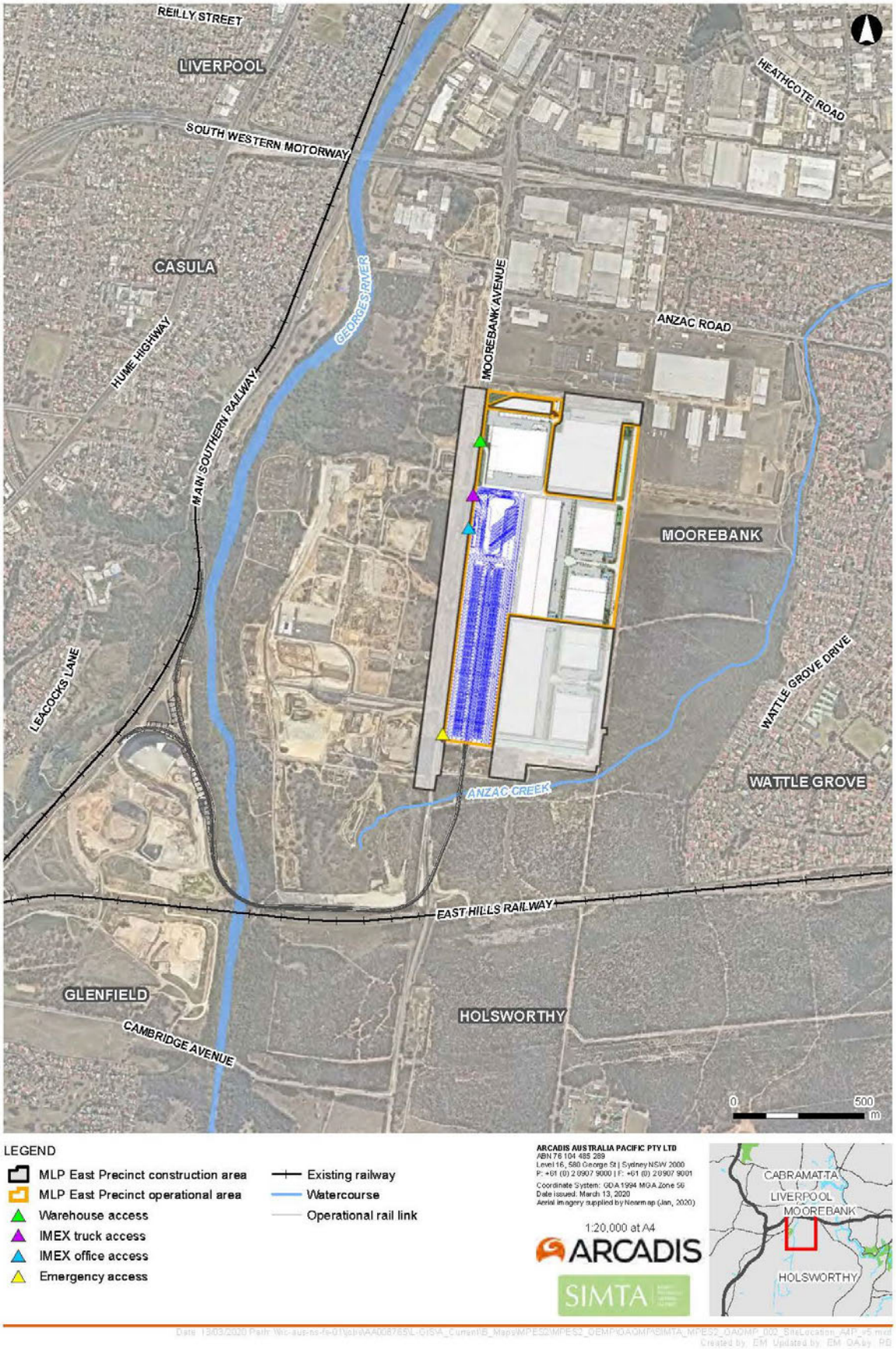

Figure 1-1: MLP Overview

2 BEST PRACTICE REVIEW (BPR, 2017)

Qube is recommended to operate the Facility as a non-discriminatory open access terminal. That means the Import and Export (IMEX) terminal could be accessed by any rail operator within the existing fleet of port shuttle locomotives and wagons used by the industry. Therefore, while Qube cannot directly influence the technology used by the existing fleet, they can impose reasonable and feasible performance benchmarks for air emissions for port shuttle locomotives and wagons that enter the IMEX terminal.

Following consultation with the Environmental Protection Authority (EPA) and Transport for NSW, and based on an understanding of industry best practice, the benchmarks in Table 2-1 were established for the Facility (as per the BPR, 2017 and MLP OAQMP). These benchmarks have been established until such time as an industry standard or guideline has been established, at which time the relevant standard or guideline including associated timeframes would apply. Until such time, Qube would restrict port shuttle locomotives, that do not meet the following air emissions standards from entering the MPE Stage 1, IMEX terminal (Table 2-1).

Table 2-1: Locomotive emission benchmarks

Locomotive type	Standard	Periodic improvements	Ultimate outcome
Existing locomotives	Operate with diesel particulate emissions less than 0.30 grams per kilowatt hour (g/kWh)	Any overhauls of existing locomotives after the commencement of operations of the IMEX terminal would need to comply	All existing locomotives to comply within 7 years of operation of the IMEX terminal
New locomotives	Operate with diesel particulate emissions less than 0.27 g/kWh and oxides of nitrogen (NOx) emissions of less than 7.37 g/kWh.	Any new locomotives ordered after the commencement of operations of the IMEX terminal would need to comply	N/A
New locomotives	Operate with diesel particulate emissions less than 0.13 g/kWh and NOx emissions of less than 7.37 g/kWh.	Any new locomotives ordered after 5 years of the commencement of operations of the IMEX terminal would need to comply	N/A

It is Qube's intention to continuously improve, through benchmarking, the environmental performance of port shuttle locomotives which use the IMEX terminal. This continuous improvement will be based on industry benchmarking to ensure both a non-discriminatory access arrangement and best practice can be achieved. The benchmarking process will provide reasonable time for the rail operator to ensure that their fleet intended to use the IMEX terminal meet the imposed standard that will be set by Qube as the minimum benchmark, from a published date.

The following section provides a summary of the available best practice benchmarks.

3 AVAILABLE TECHNOLOGY AND CURRENT INDUSTRY BENCHMARK

A summary of the available best practice technology and best practice benchmarks are discussed below. The summary has been developed through a desktop analysis of world-wide best practice and is discussed in the context of the previous BPR (2017).

3.1 Air emissions

3.1.1 Rail Industry Safety and Standards Board

The Rail Industry Safety and Standards Board (RISSB) is an accredited Standards Development Organisation in Australia responsible for the development and management of rail industry standards, rules, codes of practice and guidelines. The standards, codes of practice, rules and guidelines published by RISSB form the Australian Code of Practice (CoP).

Since the development of the BPR (2017), RISSB has released the first recommended practices (CoP) for the management and improvement of exhaust emissions of diesel freight locomotives in the Australian railway industry a revised version in November 2018 (Appendix A).

The CoP provides weighted average emission requirements as shown in Table 3-1.

Table 3-1: Weighted average emissions for locomotives (adapted from RISSB, 2018)

Locomotive type	PM Emissions (g/kWh)#	Comment
New locomotives	0.27	
Upgraded locomotives	0.30	USA tier 0+ level^
Pre-owned (imported) locos new*	0.27	
Pre-owned (imported) locos other	0.30	

^This is in reference the 2008 US EPA emissions standards

*a locomotive ordered after the effective date of this CoP including orders for already manufactured but not used new locomotives

To convert g/kWh to g/bhph multiply by 1.341, to convert g/bhph to g/kWh multiply by 0.7457

The CoP does not explicitly state oxides of nitrogen (NOx) or carbon monoxide (CO) targets, however notes "*Consistent with meeting the emission standards for PM specified above, and minimising emissions of GHG, operators should endeavour to minimise emissions of NOx*."

In addition to emission requirements, the CoP identifies that:

- Operators shall undertake upgrades on existing locomotives, which are not capability compliant, by whatever method, as required to meet the requirements, at the first major overhaul after the effective date, and before the due date unless essential components to undertake such an update are not available. The due date is defined as 10 years after the effective date (i.e. December 2028).
- Equivalent or better ways of achieving the required emissions outcomes may be possible. It states that for this reason, compliance with the CoP is not mandatory, providing that any other method used provides an equivalent or improved emissions outcome than is defined in the CoP.
- Improved technology may become available over the review period and that, to remain relevant, it is likely that the CoP will be updated at intervals less than the review period. The review period is four years. The next review and thus is anticipated to be around late 2022.
- Locomotive operators are required to provide annual reporting updates to the reporting organisation (identified as the Australasian Railway Association (ARA) at the time of the CoP release). The CoP requires the number of:
  - New locomotives purchased in the prior calendar year and compliance with the CoP

- Non-compliant locomotives, including those receiving a major overhaul, receiving an upgrade kit, for which no kit was available and reasons why any non-compliant locomotive receiving a major overhaul, and capable of being upgraded did not receive an upgrade.

The release of this RISSB CoP represents a best practice Australian standard that will be subject to ongoing review and updates. Whilst it is noted that this CoP was not established at the time of the BPR (2017), the current locomotive emission benchmarks (Table 2-1) are considered consistent with the CoP standards. Amendments to the CoP will continue to be reviewed annually at the time of future annual best practice reviews.

3.1.2 EPA Environmental Protection Licences – Rolling Stock

The EPA has been working with train rolling stock operators to reduce air impacts on the community. On 5 August 2020, following extensive consultation with stakeholders, the EPA issued new Environmental Protection Licences (EPL) to rolling stock operators (EPA, 2020).

The new licences, inclusive of the MLP environmental protection licence (EPL) (21161):

- Include operating conditions and pollution studies relating to idling
- Require new locomotives in NSW to comply with air emission limits
- Include monitoring and reporting requirements to allow the progress of the rail industry in reducing emissions to be determined over time.

A review of these rolling stock EPLs identified the following key requirements as shown in Table 3-2.

Table 3-2: Rolling Stock EPL Air Emission Requirements

Locomotive type	Requirement
New locomotives	From the date of issue of this licence, any New Locomotive Class that is to be operated on a Licenced Rail Network must comply with the US EPA Tier 2 line-haul cycle weighted average exhaust emission limit for particulate matter (PM) of 0.27g/kWh.
All	The licensee must prepare a report which describes the actions and practices undertaken by the licensee to prevent or minimise noise and air emissions, and impacts on sensitive receivers, from locomotives idling on any Licensed Rail Network. Note: This report may be used to develop a Pollution Reduction Program to further investigate potential improvements to current actions and practices and develop a management plan to minimise the impacts of idling where appropriate and as requested by the EPA

The current locomotive emission benchmarks (Table 2-1) are consistent with these guidelines.

3.1.3 US EPA's tiered emissions standards

The most commonly referenced international emissions standard is the US EPA's tiered emissions standards for new locomotives and re-manufactured locomotives.

Table 3-3 shows the US-EPA emission standards for key pollutants relating to line-haul locomotives as identified in Title 40: Protection of Environment, Part 1033-Control of Emissions from Locomotives.

Table 3-3: US-EPA Tiered Standards for line-haul locomotives

Year of original manufacture	Tier of standards*	PM (g/bhp-hr)	HC (g/hp-hr)	NO_x (g/bhp-hr)	CO (g/bhp-hr)
1973-1992	Tier 0	0.22	1.00	9.5	5.0
1993-2004	Tier 1	0.22	0.55	7.4	2.2
2005-2011	Tier 2	0.10	0.30	5.5	1.5
2012-2014	Tier 3	0.10	0.30	5.5	1.5
2015 or later	Tier 4	0.03	0.14	1.3	1.5

* Refer to US regulations; Title 40: Protection of Environment, Part 1033-Control of Emissions from Locomotives for specific footnotes regarding exceptions, standards and conditions relevant to each Tier.

Transitions to the standards specified in

Table 3-3 are as follows: Tier 0 and 1 standards apply for new locomotives beginning January 1 2010; Tier 2 standards apply for new locomotives beginning January 1 2013; and Tier 3 and 4 standards apply for their respective locomotive engine years e.g. Tier 3 between 2012 and 2014 and Tier 4 in 2015 to current.

A review of the US standards was undertaken during the BPR (2017), as at the time no Australian CoP or best practice standard had been established. As the RISSB CoP is in place and is considered best practice in Australia, the US EPA standards will no longer be reviewed in future progress reviews.

3.1.4 European Standards

In the European Union, emissions of NOx, total hydrocarbon (THC), non-methane hydrocarbons (NMHC), carbon monoxide (CO) and PM are regulated for most vehicle types. The term non-road mobile machinery (NRMM) is a term used in the European emission standards to control emissions of engines that are not used primarily on public roadways. This definition includes off-road vehicles as well as railway vehicles.

European standards for non-road diesel engines harmonise with the US EPA standards, and comprise gradually stringent tiers known as Stage I–V standards. The Stage I/II was part of the 1997 directive (Directive 97/68/EC). It was implemented in two stages with Stage I implemented in 1999 and Stage II implemented between 2001 and 2004. In 2004, the European Parliament adopted Stage III/IV standards. The Stage III standards were further divided into Stage III A and III B were phased in between 2006 and 2013. Stage IV standards are enforced from 2014. Stage V standards are phased-in from 2018 with full enforcement from 2021.

As the RISSB CoP is in place and is considered best practice in Australia, the European standards will no longer be reviewed in future progress reviews.

3.1.5 Emission performance of the existing Australian fleet

A review of the emission performance of the existing Australia fleet is not within the scope of this Report. The most recent detailed review of emissions of the Australian fleet was completed by ENVIRON in 2013 and was summarised in the (BPR, 2017).

3.1.6 Emission control technology for upgrade / repower options in Australia

Options to improve air emissions from in-service locomotives include fleet upgrades, repowering, fuel efficiency improvements and retrofitting of after-treatment systems, which have been previously described in the MPE Stage 1 EIS.

4 FLEET REVIEW

In addition to the above-mentioned air standards, Qube is advised to complete a detailed review of the existing fleet utilising the IMEX terminal and for any other locomotives potentially using the terminal. This review will develop a matrix for the fleet that intend to use the IMEX terminal and compare this fleet to the wider locomotive fleet to identify the implementation of best practice performance and a road map for ongoing review and improvement, in addition to the recommendations identified above.

Locomotives that have been using the IMEX terminal since operation in 2020 include: SQEF, SQEY, CQBY, CQZY, and LQAY. It is noted that the terminal has not been running at full capacity since operation and Qube cannot control all locomotives using the terminal. Under section 3.8 of the RISSB CoP, it is recommended that the operator of locomotives should secure agreements of the owners to comply with the RISSB CoP.

5 CONCLUSION

This Report has been prepared following the first year of MLP operations in accordance with the requirements of the BPR (2017) prepared by Arcadis to satisfy the MPE Stage 1 SSD 6766 CoC G6, and subsequently the MLP East precinct OAQMP.

Qube is advised to operate the MPE Stage 1 Project as a non-discriminatory access terminal. This means the IMEX terminal can be accessed by any rail operator within the existing fleet of port shuttle locomotives used by the industry. On this basis, while Qube cannot directly control the technology used by the existing fleet, they can influence it through imposition of minimum performance expectations for air emissions for port shuttle locomotives that enter the IMEX terminal. These current standards are included in the OQAMP (Table 2-1 of this report). Qube is advised to restrict port shuttle locomotives, that do not meet the air emissions standards from entering the MPE Stage 1, IMEX terminal.

This Report summarises the international and Australian emission standards and best practice technology available to reduce air emissions from locomotives. Since the BPR (2017), RISSB has released a CoP for the management and improvement of exhaust emissions of diesel freight locomotives in the Australian railway industry. This release represents a best practice Australian standard that will be subject to ongoing review and updates. Whilst it is noted that this CoP was not established at the time of the BPR (2017), the current locomotive emission standards (Table 2-1) are considered consistent with the CoP standards.

Amendments to the CoP will continue to be reviewed annually at the time of future annual best practice reviews to ensure that available best practice benchmarks are current, relevant and achievable.

REFERENCES

Arcadis, 2017, *MPE Stage 1 (SSD 14-6766) Best Practice Review*

Environmental Protection Agency (NSW), 2020, *Regulation of railway activities*, Regulation of railway activities (nsw.gov.au)

ENVIRON (2013). Locomotive Emissions Project: Potential Measures to Reduce Emissions from New and In-service Locomotives in NSW and Australia, prepared for NSW EPA by ENVIRON Australian Pty Ltd, March 2013

Transport Policy (2018). *EU Nonroad Emissions*, EU: Nonroad: Emissions | Transport Policy

Rail Industry Safety and Standard Board, 2018, *Code of Practice: Management of Locomotive Exhaust Emissions*

U.S. Code of Federal Regulations (2018), Title 40: Protection of Environment, Part 1033-Control of Emissions from Locomotives, Code of Federal Regulations (govinfo.gov)

APPENDIX A: RISSB CODE OF PRACTICE

Document control

Document identification

Document title	Version	Date
Code of Practice: Management of Locomotive Exhaust Emissions	2.0	16 November 2018

Document history

Publication version	Effective date	Reason for and extent of change(s)
2.0	16/11/2018	Revised
1.0	20/11/2017	First published

Approval

Name	Date
Rail Industry Safety and Standards Board	16 November 2018

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Contents

1 Introduction

1.1 Purpose

This Code of Practice describes recommended practices for the management and improvement of exhaust emissions of diesel freight locomotives in the Australian railway industry.

Diesel locomotives create several emissions with adverse effects on the environment or human health, including diesel particulates (PM), oxides of nitrogen (NOx) and greenhouse gases (GHG).

In the Australian context, PM and GHG emissions are considered higher priority issues than NOx emissions. This Code of Practice seeks to address these Australian environmental considerations through a balanced approach to these competing emissions outcomes. As such this Code of Practice has reflected the broader priorities in addressing locomotive emissions.

It is recognised that equivalent or better ways of achieving the required emissions outcomes may be possible. For this reason, compliance with this Code of Practice is not mandatory, providing that any other method used provides an equivalent or improved emissions outcome than is defined in this Code of Practice.

1.2 Scope

This Code of Practice covers all diesel locomotives used for the haulage of freight in Australia, including both for hire and reward, and those used as part of the production process.

It is not applicable to:

- heritage locomotives not used for any commercial freight tasks;
- locomotives used solely for the haulage of passengers;
- other on-rail diesel engines e.g. those used in track maintenance machinery.

1.3 Definitions

Capability compliant: a locomotive which meets or exceeds the relevant standards in Table 1.

Certification: means a formal statement from a supplier (or where applicable an operator) of the emission level from a locomotive confirming that equipment (either an engine, locomotive, or parts installed for reducing locomotive emissions) has been tested and is compliant with the relevant emission level in this Code of Practice. Certification of one engine as compliant shall be accepted as evidence of compliance by all locomotives similarly engined and configured. ("type testing").

Testing data or certification of an engine or kit undertaken overseas shall be accepted as evidence of performance in Australia unless such use is expressly forbidden by the supplier.

Compliant maintenance: means the configuration, operation and maintenance of components and systems affecting locomotive emissions as directed by the original equipment manufacturer (OEM), or in the case of an upgrade, the kit supplier, or as modified by changes to best practice, so that emissions conform to the certification provided.

Due date: is 10 years after the effective date.

Duty cycle: The amount of time a locomotive spends in each throttle notch setting ("notch").

Effective date: is 1 December 2018 being the first day of the first month falling more than 12 months after the publication of this Code of Practice.

Existing locomotive: a locomotive either ordered for supply to or in service in Australia at the effective date.

FROEPG (Freight Rail Operators' Environmental Policy Group): is a group open to all freight rail operators in Australia and comprising the majority of such operators. It was formed in 2012, with the endorsement of RISSB and the Australasian Railway Association (ARA), with the purpose to address environmental matters resulting from rail freight operations.

Major overhaul: is a scheduled power assembly change out, component change out or other planned maintenance requiring replacement of 75% or more of the pistons and cylinder liners of the engine. A major overhaul will not include unscheduled maintenance to replace these components due to unforeseen failure of engine component(s) prior to scheduled maintenance.

New locomotive: a locomotive ordered after the effective date of this Code of Practice including orders for already manufactured but not used new locomotives.

PM: particulate matter present in the exhaust emissions of diesel locomotives.

Pre-owned locomotive: a locomotive previously operated overseas and ordered after the effective date for importation and use in Australia. If the locomotive previously operated outside Australia was manufactured after 1 January 2010 or had covered less than 50 000 km at the date of importation, it shall be considered a new locomotive for the purposes of this Code of Practice and shall meet the standards required of a new locomotive.

Reporting organisation: means that organisation nominated by the industry which is independent of any operator subject to this Code of Practice, which will publish annual data on the emissions performance of the freight industry as described in Section 2.7 of the Code. At the effective date the reporting body was the Australasian Railway Association (ARA).

Review period: means the maximum period between formal reviews of this Code of Practice commencing from the publication of this Code of Practice. The review period is four years.

Short term: means a period of less than 5 years.

Should: The use of the word 'should' indicates a recommendation.

Technical body: means that organisation nominated by the industry which is independent of any operator subject to this Code of Practice, which prepares and publishes the data on locomotive PM emissions by engine model required in Table 2 of this Code of Practice. FROEPG may by majority vote of the FROEPG members act as the Technical Body if no other body is nominated.

Testing: means the measurement and determination of the weighted average of a locomotive's PM emissions using the processes and methodology outlined in Section 3.1 of this Code of Practice.

Threshold usage: means 50,000 km/annum and is the maximum level of annual locomotive usage, at which the relevant provisions in Section 2.5.c shall apply.

Upgrade kit: means a package of parts generally comprising enhanced pistons, injectors and other components which when fitted to an existing locomotive will reduce PM emission levels to at or below levels specified in this Code of Practice.

Upgraded locomotive: an existing locomotive upgraded after the effective date, to meet the standard below.

Weighted average emissions: The weighted average emissions ("emissions") shall be the emissions of PM g/ kWh developed from the emissions in each notch weighted by the duty cycle. Calculation of weighted average emissions should preferably use the AAR main line duty cycle

2 Improvement by application of mandatory locomotive standards

2.1 Weighted average emissions

Table 1 - Required weighted average emission level line haul duty cycle

Locomotive type	PM Emissions g/kWh	Comment
New Locomotives	0.27	
Upgraded locomotives	0.30	USA tier 0+ level
Pre-owned (imported) locos “new”	0.27	Refer above for definition of a “new“ pre-owned locomotive
Pre-owned (imported) locos other	0.30	

2.2 Purchase of new locomotives

Locomotives ordered after the effective date shall be certified as meeting the requirements in Table 1 having full regard for planned usage, Australian weather conditions, modifications to meet Australian Standards, and other factors deemed likely to affect the level of locomotive emissions.

This requirement shall be waived if the operator provides documented evidence that:

(a) no locomotive with this emission standard meeting the operator’s specific operational and network requirements was commercially available in Australia at the time of purchase; and

(b) the locomotive purchased provides the highest available standard meeting these operational and network requirements.

2.3 Upgrading of existing locomotives

Existing locomotives found to be non-compliant shall be upgraded to meet the requirements in Table 1 in this Code of Practice, generally through fitting of an upgrade kit.

An operator may at their discretion upgrade an existing locomotive through other engine modification works which can be demonstrated to improve emissions sufficiently to satisfy this upgrading requirement, subject to certification.

Operators shall undertake this upgrade on existing locomotives, which are not capability compliant, by whatever method, as required to meet the requirements of Table 1, at the first major overhaul after the effective date, and before the due date unless essential components to undertake such an update are not available.

2.4 Emission /fuel usage optimisation

Changing the engine injection timing and other settings alters the mix of emissions between the three key emission types. Action to reduce fuel usage and emission of GHG may therefore have the effect of increasing emissions of PM and/or NOx.

Operators may alter the engine timing and other settings of their new or upgraded locomotives to optimise fuel usage and GHG emissions, provided that certification of compliance at this new configuration is supplied.

Existing locomotives which have not been upgraded may be similarly optimised without the need to provide evidence from testing.

2.5 Locomotives not compliant by the due date

A non-compliant locomotive which at the due date has not been upgraded to meet the emission levels in Table 1 shall not be in breach of this Code of Practice if:

(a) the locomotive has received a major overhaul prior to the due date, but no parts were available to upgrade its emission standard (as above); or

(b) the locomotive has not received an overhaul, but it will be scrapped within five years after the due date; or

(c) in each year after the due date, the locomotive will not exceed the threshold usage (the operator shall supply data to confirm compliance). If in any 12 consecutive months after the due date the locomotive does exceed the threshold usage, it shall be upgraded to comply with Table 1 of this Code of Practice not later than 12 months after this exceedance.

Operators using this provision should avoid operating these locomotives in or around urban areas or population centres.

2.6 Review of emission standards for new locomotives

It is recognised that over the review period of this Code of Practice that improved technology may become available. It is anticipated that, to remain relevant, it is likely that this Code of Practice will be updated at intervals less than the review period; in particular, the content of Table 1 and Table 2.

2.7 Reporting

Operators shall report to the reporting organisation within two months after the end of each calendar year (or part calendar year in the first year) after the effective date:

(a) the number of new locomotives purchased in the prior calendar year;

(b) of that number, those that meet the standard;

(c) that meet a lesser but best available standard as addressed in Section 2.3.

Operators shall also report at this time the number of non-compliant locomotives:

(a) receiving a major overhaul as defined above;

(b) receiving an upgrade kit;

(c) for which no kit was available; and

(d) reasons why any non-compliant locomotive receiving a major overhaul, and capable of being upgraded did not receive an upgrade.

(e) disposals of locomotives net of any purchase of non-compliant locomotives

The reporting body shall publish this data per operator within four months of the end of each calendar year.

3 General actions to reduce emissions

3.1 Testing

Equipment and the procedures used to measure emissions for certification in Australia shall comply with one or more of US EPA 1065, EC 595 and Regulation 49. The calculation of the weighted average PM emissions shall be undertaken using the weightings in the US EPA line haul duty cycle.

3.2 Certification

Certification of either an engine, locomotive, or parts installed for reducing locomotive emissions shall confirm that it has been tested in accordance with Section 3.1 and is compliant with the relevant emission level in Table 1 of this Code of Practice. Certification of one engine as compliant shall be accepted as evidence of compliance by all locomotives similarly engined and configured. (Type testing).

Certification of capability compliance for new and existing locomotives in the compliant configuration and set up specified by the purchaser and accepted by the supplier shall be satisfied by evidence of certification by the OEM, or for upgraded locomotives, certification by the provider of an emission upgrade kit, and shall be the responsibility of the supplier.

Certification/testing undertaken overseas will be acceptable if meeting either US EPA or EU UIC requirements. However, any Australian testing will take precedence over such overseas information.

If no certification, either from independent sources or local testing, is available for an engine it shall be deemed as non-compliant.

3.3 Maintenance Equipment

The OEM/kit supplier shall provide the information required for compliant maintenance. Variation of the locomotive set-up outside these conditions shall require retesting of the locomotive emission levels.

3.4 Geographic usage

Prior to the due date, no operational restrictions shall be placed on new, existing or upgraded locomotives as a result of this Code of Practice.

After the due date, operators shall take all reasonable steps to minimise human exposure to the use of non-capability compliant locomotives.

3.4.1 Reduction through improved operating practices

Operators should take actions to reduce emissions from in-service use, especially in urban areas or adjacent to centres of population, through steps such as:

(a) running locomotives "dead" when not required for operating conditions;

(b) use of software to optimise engine loadings in multi loco consists;

(c) installing idling management equipment such as engine stop/start or similar systems;

(d) use of crew advisory systems to optimise conservation of momentum; and

(e) crew training.

3.5 Network owners/operators to facilitate emission reduction

Network owners/operators should consider maximising available opportunities to reduce locomotive emissions exacerbated through network conditions. For example, to increase network velocity, reduce delays, and enable conservation of momentum.

3.6 Actions to reduce emissions of NOx

Consistent with meeting the emission standards for PM specified above, and minimising emissions of GHG, operators should endeavour to minimise emissions of NOx.

3.7 Change of ownership

Where either all or part of an operator's fleet, or beneficial control of the operator, is sold, the improvement obligations under this Code of Practice shall continue.

3.8 Locomotive not owned by the operator

Some locomotives are owned by parties other than the operator. This includes locomotives under financing arrangements, and those owned by a customer, who contracts with the operator to provide haulage services to the owner using these locomotives.

Responsibility for compliance of these locomotives with this Code of Practice shall rest with the operator. The operator shall, where necessary, secure any agreements from the Owner needed to allow the Operator to achieve this compliance.

This requirement shall not apply to short term commercial leases of locomotives, or those maintained by the lessor, where responsibility for compliance shall reside with the locomotive owner.

4 Data for determining compliance

Table 2 data below, unless provided by an OEM or testing, provides guidance only for determining compliance of existing locomotives. Operators should establish compliance in accordance with Section 3

Table 2 - Weighted average PM emissions/kWh for engine models operating in the Australian rail freight industry (including non-hire and reward operations)

Engine Model	PM Emissions g/kWh	Source
Alco 12-251C	N/A	No
Alco 12-251CE	N/A	No
Alco 12-251E	N/A	No
Alco 6-251	N/A	No
Alco 6-251B	N/A	No
Cummins QSK19	0.134	O.E.M
Cummins QSK78-18	0.134	O.E.M
EMD 12-567C	N/A	No

Engine Model	PM Emissions g/kWh	Source
EMD 12-645C	N/A	No
EMD 12-645E3B	0.386	O.E.M
EMD 12-645E3C	N/A	No
EMD 12-645F3B	0.389	O.E.M
EMD 12-710-G3B-ES (Upgraded Tier 0+)	<0.268	O.E.M
EMD 12-710G3	0.386	O.E.M
EMD 12-710G3A	0.386	O.E.M
EMD 12-710G3B-EC	N/A	O.E.M[3]
EMD 12-710G3B-ES2	0.386	O.E.M
EMD 12-645E	N/A	O.E.M[3]
EMD 16-567BC	0.386	O.E.M
EMD 16-567C	0.447	O.E.M
EMD 16-645E	0.447	O.E.M
EMD 16-645E3	N/A	O.E.M[3]
EMD 16-645E3B	N/A	O.E.M[3]
EMD 16-645E3C	0.447	O.E.M
EMD 16-645E3C (Tier 0+ kit already fitted)	<0.268	O.E.M
EMD 16-645F3	0.452	O.E.M
EMD 16-645F3B	0.386	O.E.M
EMD 16-710 SLAC (SD90MAC)	N/A	O.E.M[3]
EMD 16-710G3	0.386	O.E.M
EMD 16-710G3A	0.386	O.E.M
EMD 16-710G3A SD60 JWAC	N/A	O.E.M[3]
EMD 16-710G3A (Tier 0+)	<0.268	O.E.M
EMD 16-710G3A-EC	0.366	O.E.M
EMD 16-710G3A-EFI	0.366	O.E.M
EMD 16-710G3B-ES	N/A	No
EMD 16-710G3B SD70M JWAC	N/A	O.E.M[3]
EMD 16-710G3C-ES	N/A	No
EMD 16-710G3C SD75M JWAC	N/A	O.E.M[3]
EMD 16-710G3C-ES2	<0.241	O.E.M
EMD 16-710G3C-T1	0.3	O.E.M

Engine Model	PM Emissions g/kWh	Source
EMD 16-710G3C-T3	<0.107	O.E.M
EMD 20-645E3	0.463	O.E.M
EMD 6-567C	0.389	O.E.M
EMD 8-567C	0.389	O.E.M
EMD 8-645E	0.389	O.E.M
EMD 8-710G3B	N/A	No
EMD 8-710G3B (Tier 0+)	0.10	O.E.M
EMD16-645E3B	0.447	O.E.M
EMD16-710G3A EFI	0.366	O.E.M
English Electric 12CSVT	N/A	No
English Electric 6CSRKT	N/A	No
English Electric 8SRKT	N/A	No
GE 7FDL12 EFI 2800	N/A	O.E.M[1]
GE 7FDL12 MUI	N/A	O.E.M[1]
GE 7FDL16 Dash8 EFI	N/A	O.E.M[1]
GE 7FDL16 Dash8 MUI	N/A	O.E.M[1]
GE 7FDL16-C40ACi-AU	0.134	O.E.M
GE 7FDL16-C44ACi-AU	0.134	O.E.M
GE 7FDL16-Dash9 EFI	0.19	O.E.M
GE 7FDL16-Dash9 NR	0.134	O.E.M
GE EVO12-ES44ACi-AU	0.134	O.E.M
GE EVO12-ES44DCi-AU	0.134	O.E.M
GE P616-PH37ACi-AU	0.134	O.E.M[2]
MTU-20V4000R43	0.134	O.E.M
MTU-20V4000R43L	0.134	O.E.M

Notes:

1. No PM test data is available for these engine types according to Section 3.1 of the RISSB Locomotive Emissions CoP
2. GE P616-PH37ACi-AU PM is an estimate for US EPA LH Duty Cycle based upon EU3a certification test results.
3. Performance varies with specific configuration and some models are compliant; refer to O.E.M or Supplier for details
4. Further data affecting entries in this Table may be issued from time to time

RISSB

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