COWAL GOLD OPERATIONS

AIR QUALITY MANAGEMENT PLAN

June 2023

Revision Status Register

Section/Page/ Annexure	Revision Number	Amendment/Addition	Distribution	DPE Approval Date
All	DMP01-R (August 2003) Document No.685106	Original	EPA, NPWS, DoP	August 2003
Addendum	AD-DMP-A (July 2007) Document No. 685108	Addendum to reflect additional dust monitoring sites and additional dust mitigation measures	EPA, NPWS, DoP	August 2007
Addendum	AD-DMP-A (December 2008) Document No. 685109	Addendum to reflect removal of dust monitoring site DG2	EPA, NPWS, DoP	25 February 2009
All	AQMP-C (February 2015) Document No. 655690	Revised to reflect Development Consent as modified on 22 July 2014.	EPA, DPE	18 February 2016
All	AQMP-D (June 2022)	Revised to reflect outcomes of Mod16 and EIS assessment for the Underground Development Project as approved on 30 Sep 2021	EPA, DPE	13 February 2023
All	AQMP-E (June 2023)	Minor revision to reflect SSD 10367 Mod 1.	EPA, DPE	6 December 2023

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1 INTRODUCTION

1.1 PREAMBLE

The Cowal Gold Operations (CGO) is located approximately 38 kilometres (km) north-east of West Wyalong in New South Wales (NSW) (Figure 1). Evolution Mining (Cowal) Pty Limited (Evolution) is the owner and operator of the CGO. All mining activity occurs within Mining Lease (ML) 1535 and ML 1791.

Development Consent no. 14/98 (DA 14/98) for the CGO (including the Bland Creek Palaeochannel Borefield water supply pipeline) was granted by the Minister for Urban Affairs and Planning under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 26 February 1999. Development Consent (DA 2011/64) for the operation of the Eastern Saline Borefield was granted by the Forbes Shire Council on 20 December 2010.

More recently, Evolution sought approval from the NSW Government for proposed underground mining via a State-significant Development application No. 10367 and a related modification to DA 14/98 for the *Cowal Gold Operations Underground Development Project Modification No.16* (herein referred to as Mod 16). Approval for these were granted on 30 September 2021. Collectively, these applications related to the surface (Mod 16) and underground (SSD 10367) components of the Underground Development Project (the Project). SSD 10367 was modified on 7 November 2022, to reflect minor changes in the underground mining method, through Mod 1 (Optimisation Modification).

DA 14/98 generally allows:

- Mining operations until 2040.
- Ore processing at a rate of 9.8 Mtpa.
- Tailings and waste rock emplacement on site.
- Operation of a range of ancillary mining infrastructure.

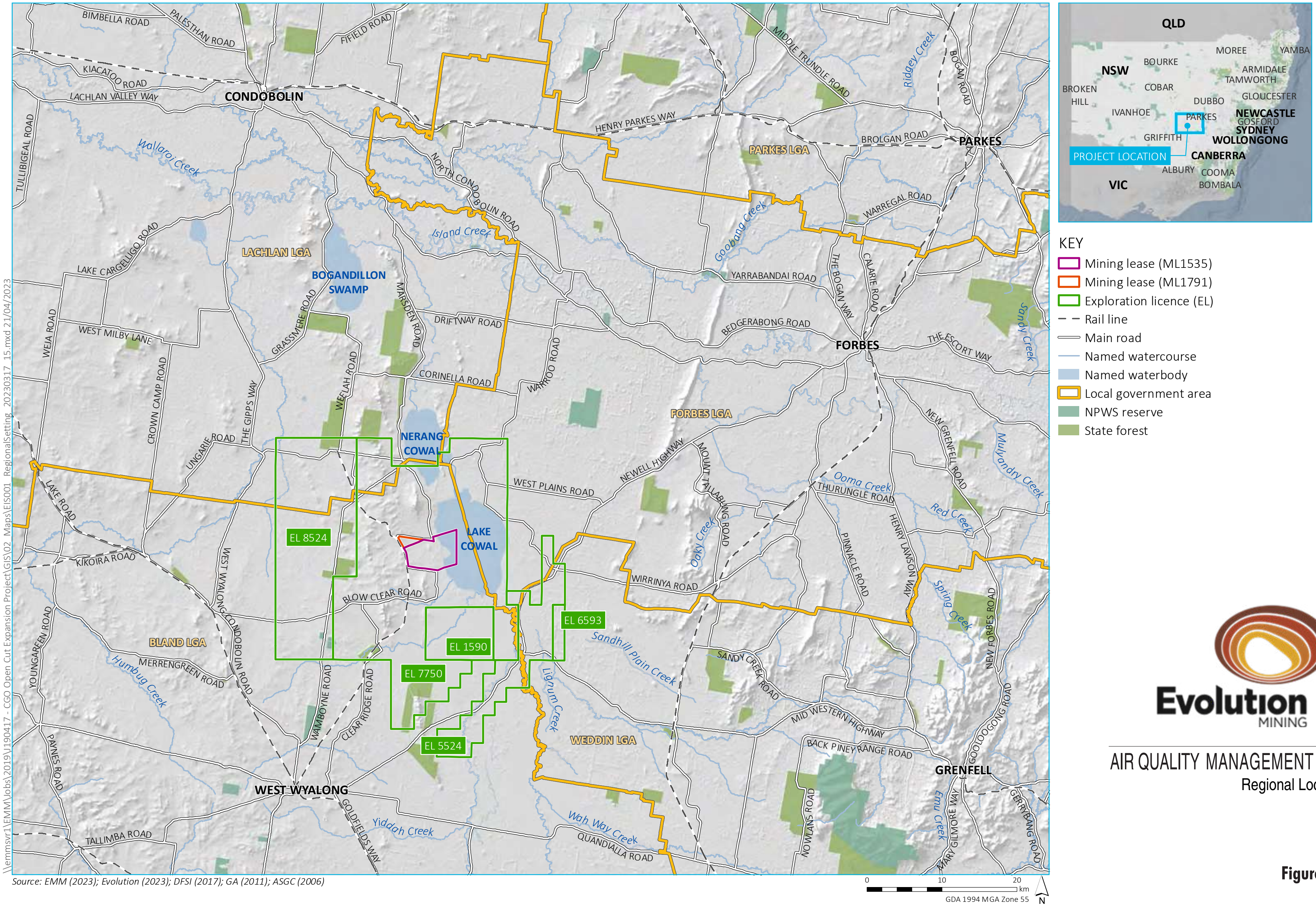
SSD 10367 generally allows:

- Underground stope mining until 2040.
- Backfilling the stopes with cemented paste made from tailings.
- Development of ancillary infrastructure including a box-cut to the underground mine and a paste fill plant.

The general arrangement of the approved CGO is shown in Figure 2.

A copy of the CGO's approved development consents (DA 14/98 and SSD 10367) are available on Evolution's website (www.evolutionmining.com.au).

This revised Air Quality Management Plan (AQMP) has been prepared to reflect the DA 14/98 condition 6.1(c) and SSD 10367 as approved on 30 September 2021 and 7 November 2022, and supersedes all former revisions of the AQMP. As required by DA 14/98 condition 6.1(c)(i), the EPA was consulted during the preparation of this plan.



Source: EMM (2023); Evolution (2023); DFSI (2017); GA (2011); ASGC (2006)

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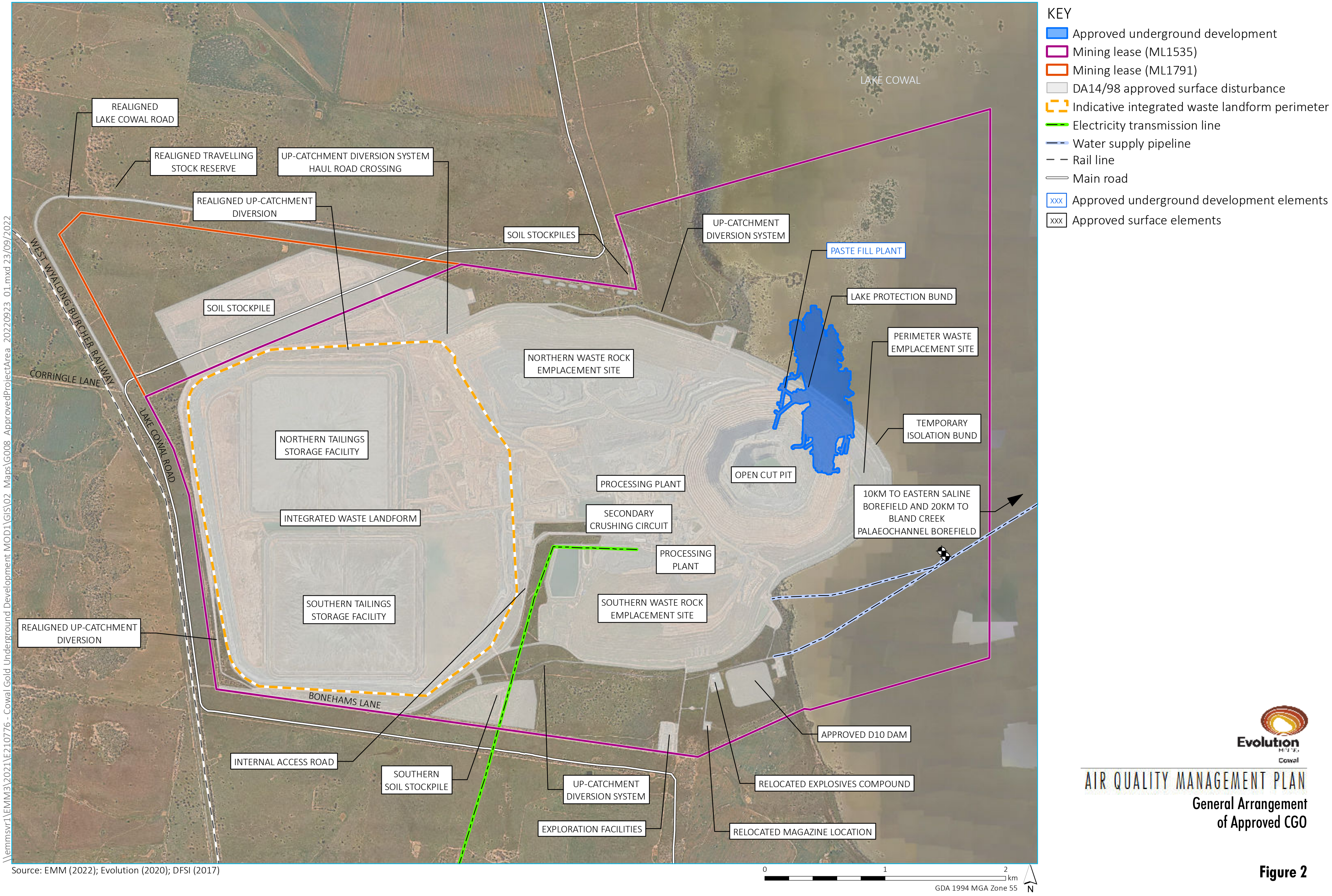
Evolution MINING

AIR QUALITY MANAGEMENT PLAN

Regional Location

Figure 1



Source: EMM (2022); Evolution (2020); DFSI (2017)

AIR QUALITY MANAGEMENT PLAN

General Arrangement of Approved CGO

Figure 2

1.2 OBJECTIVE

The primary objective of this AQMP is to ensure that CGO achieves compliance with the various conditions of consent relating to air quality set through:

- operating conditions within the DA 14/98;
- conditions on Environment Protection Licence (EPL) No. 11912;
- conditions on ML 1535 and 1791.

1.3 SCOPE

To achieve regulatory compliance for air quality, this AQMP identifies the relevant regulatory criteria, establishes background air quality for gases and particulates, the sources of emissions for each, a monitoring regime and systems to measure and report the results of this management system. This document includes:

Section 1: Introduction
Section 2: Statutory requirements relating to air quality emissions from the CGO.
Section 3: Air quality impact assessment criteria and other relevant air quality emissions criteria defined in the Development Consent.
Section 4: Baseline and existing air quality monitoring results to date.
Section 5: Potential dust generation and greenhouse gas sources for which management measures are proposed.
Section 6: Air quality monitoring program for the CGO.
Section 7: Air quality management measures.
Section 8: Air quality assessment procedure that will be implemented to minimise dust emissions from day-to-day activities.
Section 9: Consultation and complaints.
Section 10: Auditing and review
Section 11: Reporting.
Section 12: References.
Section 13: Glossary.
Appendix

2 STATUTORY REQUIREMENTS

2.1 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

2.1.1 DA 14/98

The primary focus of this AQMP is the requirements of DA 14/98 condition 6.1(c) outlined in Table 1 below.

Table 1
DA14/98 Conditions Relevant to this AQMP

<table>
<tr><th>Development Consent Condition</th><th>Section</th></tr>
<tr><td>

6.1 Air Management

(a) Impact Assessment Criteria

The Applicant shall ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated from the Cowal Gold Operations do not cause exceedances of the criteria listed in Tables 3, 4 and 5 at any residence on privately-owned land.

Table 3: Long term impact assessment criteria for particulate matter

<table>
<tr><th>Pollutant</th><th>Averaging Period</th><th>[d] Criterion</th></tr>
<tr><td>Total suspended particulate (TSP) matter</td><td>Annual</td><td>[a] 90 $\mu g/m^3$</td></tr>
<tr><td>Particulate matter <10 µm (PM_{10})</td><td>Annual</td><td>[a] 25 $\mu g/m^3$</td></tr>
<tr><td>Particulate matter <2.5 µm ($PM_{2.5}$)</td><td>Annual</td><td>[a] 8 $\mu g/m^3$</td></tr>
</table>

Table 4: Short term impact assessment criterion for particulate matter

<table>
<tr><th>Pollutant</th><th>Averaging Period</th><th>[d] Criterion</th></tr>
<tr><td>Particulate matter <10 µm (PM_{10})</td><td>24 hour</td><td>[a] 50 $\mu g/m^3$</td></tr>
<tr><td>Particulate matter <2.5 µm ($PM_{2.5}$)</td><td>24 hour</td><td>[a] 25 $\mu g/m^3$</td></tr>
</table>

Table 5: Long term impact assessment criteria for deposited dust

<table>
<tr><th>Pollutant</th><th>Averaging period</th><th>Maximum increase in deposited dust level</th><th>Maximum total deposited dust level</th></tr>
<tr><td>[c] Deposited dust</td><td>Annual</td><td>[b] 2 g/m^2/month</td><td>[a] 4 g/m^2/month</td></tr>
</table>

Notes to Tables 3-5:

[a] *Cumulative impact (i.e. incremental increase in concentrations due to the Cowal Gold Operations plus background concentrations due to all other sources).*

[b] *Incremental impact (i.e. incremental increase in concentrations due to the Cowal Gold Operations on its own).*

[c] *Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter – Deposited Matter - Gravimetric Method.*

[d] *Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Planning Secretary.*

</td><td>Section 3</td></tr>
<tr><td>

(b) Operating Conditions

The Applicant shall:

(i) implement best management practice to minimise the off-site odour, fume, spontaneous combustion and dust emissions of the Cowal Gold Operations;

</td><td>Section 7.1</td></tr>
<tr><td>*(ii) implement all reasonable and feasible measures to minimise the release of greenhouse gas emissions from the Cowal Gold Operations;*</td><td>Section 7.2</td></tr>
<tr><td>*(iii) minimise any visible off-site air pollution generated by the Cowal Gold Operations;*</td><td>Section 7.1</td></tr>
<tr><td>*(iv) minimise the surface disturbance on the Cowal Gold Operations;*</td><td>Sections 7.3 and 7.4</td></tr>
<tr><td>*(v) minimise the air quality impacts of the Cowal Gold Operations during adverse meteorological conditions and extraordinary events (see Note d) above under Tables 3-5); and*</td><td>Section 7.1</td></tr>
</table>

Table 1 (cont'd)
Development Consent Conditions Relevant to this AQMP

(vi) carry out regular monitoring to determine whether there is compliance with the relevant conditions of this consent, *to the satisfaction of the Planning Secretary.*	Section 6
(c) Air Quality Management Plan *The Applicant shall prepare and implement an Air Quality Management Plan for the Cowal Gold Operations to the satisfaction of the Planning Secretary. This plan must:*	This AQMP
(i) be prepared in consultation with the EPA;	Section 1.1
(ii) describe the measures that would be implemented to ensure compliance with the relevant air quality criteria and operating conditions of this consent:	Sections 6 to 8
(iii) include an air quality monitoring program that: • *evaluates and reports on the:* – *the effectiveness of the air quality management system;* – *compliance with the air quality criteria;* – *compliance with the air quality operating conditions; and*	Sections 6 and 11
• *defines what constitutes an air quality incident and includes a protocol for identifying and notifying the Department and relevant stakeholders of any air quality incidents.*	Section 11

In addition to the above, the following DA14/98 conditions are also relevant:

- Condition 8.1(b) outlines the notification requirements for affected landowners in the event of an exceedance of the air quality impact assessment criteria. This condition is addressed in Section 11.2.
- Condition 8.2 outlines the independent review process in the event that a landowner of privately-owned land considers the CGO to be exceeding the air quality impact assessment criteria. This condition is reproduced in full and discussed in Section 10.2.
- Condition 2.4(b) details the requirements for progressive (and interim) rehabilitation of the site to minimise the area exposed for dust generation. This condition is addressed in Section 7.5
- Condition 9.1(d) establishes the requirements for a CEMCC and is reproduced in full and addressed in Section 9.1.
- Conditions 9.1(b) and 9.1(c) establish the reporting and review requirements for this AQMP and are discussed in Section 11.
- Conditions 9.3(a) and (b) detail the notification requirements for an air quality incident and a non-compliance with DA14/98. These conditions are addressed in Section 11.2.
- Condition 9.4(a)(v) outlines the requirements for complaints register. This condition is reproduced in full and discussed in Section 8.2.

It should also be noted that SSD 10367 contains a number of conditions that generally duplicate conditions within DA14/98 e.g., annual review, independent audit, notifications and access to information. These are noted in each section where they are relevant.

2.2 PROTECTION OF THE ENVIRONMENT OPERATIONS ACT 1997

Cowal Gold Operations has also been granted an environment protection licence (EPL no. 11912) under Section 58(5) of the *Protection of the Environment Operations Act* 1997 (POEO Act).

Condition O3 of the EPL 11912 requires that activities at the CGO must be carried out in a manner that minimises the generation, or emissions from the premises, of wind-blown or traffic generated dust. The requirements of condition O3 are consistent with DA14/98 condition 6.1(b).

Condition M2.2 outlines the pollutants/parameters and the frequency of their monitoring while condition P1.1 defines the location of the monitoring stations. A detailed description of the CGO's air quality monitoring program is provided in Section 6. As required by Section 129 of the Protection of the Environment Operations Act 1997, the emission of offensive odours from the CGO is not permitted.

Condition R1 of the EPL outlines the Annual Return reporting requirements. This condition is addressed in Section 9.7.

Section 124 of the POEO Act makes it an offence to operate any plant (other than domestic plant) at those premises in such a manner as to cause air pollution from those premises if the air pollution is caused by the occupier's failure to maintain the plant in an efficient condition, or to operate the plant in a proper and efficient manner.

Section 129 of the POEO Act states that the occupier of a premises must not cause or permit the emission of any offensive odour.

Also relevant to this AQMP, under section 148 of the POEO Act, duties are imposed on employers and employees to notify the EPA (or local council) where a pollution incident causes or threatens material harm to the environment.

The obligations under the POEO Act described above are relevant to the requirements of the CGO's EPL detailed in Section 2.2.

2.3 MINING ACT 1992

2.3.1 Conditions of Authority ML 1535

The Department of Resources and Geoscience (DRG) (within the DPE) administers the Conditions of Authority for ML 1535 under the *Mining Act 1992*. These include requirements relating to the management of soil erosion and air pollution (condition 14) and the reporting of air quality monitoring results within the Annual Review) (condition 26). Condition 14 is quoted below, and condition 26 is addressed in Section 9.7.

> ***Prevention of Soil Erosion and Pollution***
>
> *14. Operations must be carried out in a manner that does not cause or aggravate air pollution, water pollution (including sedimentation) or soil contamination or erosion, unless otherwise authorised by a relevant approval, and in accordance with an accepted Mining operation Plan. For the purpose of this condition, water shall be taken to be include any watercourse, waterbody or groundwaters. The lease holder must observe and perform any instruction given by the director general.*

2.3.2 Conditions of Authority ML 1791

There are no Conditions of Authority on this mining lease directly related to the protection of air quality. Nevertheless, in a practical sense, given the direct physical and management linkages with ML1535, Evolution manages air quality on ML1791 in the same manner using the same air quality criteria.

2.4 OTHER RELEVANT LEGISLATION

National Greenhouse and Energy Reporting Act, 2007

Evolution currently reports annual greenhouse gas (GHG) emission and energy consumption from the CGO to the federal government in accordance with the requirements of the National Greenhouse and

Energy Reporting (NGER) Scheme legislated under the *National Greenhouse and Energy Reporting Act, 2007.*

Three ‘scopes’ of emissions are relevant to CGO activities (Pacific Environment Limited [PEL], 2018):

- Scope 1 emissions - those emissions that occur from sources that are owned or controlled by the reporting entity, such as the emissions resulting from the transportation of materials, products, waste and employees;
- Scope 2 emissions - indirect emissions that account for GHG emissions from the generation of purchased energy products by the entity, such as purchased electricity; and
- Scope 3 emissions - those emissions that are a consequence of the activities of an entity, but which arise from sources not owned or controlled by that entity, such as emissions associated with the extraction, processing and transport of fuels.

The sources and associated scopes of GHG emissions at the CGO are discussed in detail in Section 5.2.

3 AIR QUALITY CRITERIA

As set out in Section 2, air quality criteria for regulatory compliance are primarily defined in the Development Consent and EPL conditions. The Development Consent and EPL conditions also require the management, monitoring and reporting of dust deposition and particulate matter emissions from the CGO.

In accordance with DA14/98 condition 6.1(a), all reasonable and feasible avoidance and mitigation measures are applied so that particulate matter emissions generated by the CGO do not cause exceedances of the criteria in Tables 2, 3 and 4 at any residence on privately-owned land. Particulate matter and deposited dust emissions are defined as:

- **TSP** (total suspended particulate) – refers to all suspended particles in the air. In practice, the upper size range is typically 30 micrometres (µm) – 50 µm (PEL, 2018);
- **PM_{10}** – refers to all particles with equivalent aerodynamic diameters of less than 10 µm, that is, all particles that behave aerodynamically in the same way as spherical particles with diameters less than 10 µm and with a unit density (PEL, 2018);
- **$PM_{2.5}$** – refers to all particles with equivalent aerodynamic diameters of less than 2.5 µm, that is, all particles that behave aerodynamically in the same way as spherical particles with diameters less than 2.5 µm and with a unit density (PEL, 2018); and
- **dust deposition** (deposited matter) – this term describes any particulate matter that falls out from suspension in the atmosphere. This measurement is usually expressed in units of mass per area per time (e.g. grams per square metre per month [g/m^2/month]).

Further detail on applicable criteria for these aspects of air quality is provided below.

3.1 DUST DEPOSITION

Table 2 details the long-term impact assessment criteria for deposited dust for any residence on privately-owned land as required by DA14/98 condition 6.1(a).

Table 2
Long-term Impact Assessment Criteria for Deposited Dust

Pollutant	Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Deposited dust [a]	Annual	2 g/m^2/month [b]	4 g/m^2/month [a, c]

[a] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: *Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method.*

[b] Incremental impact (i.e. incremental increase in concentrations due to the Cowal Gold Operations on its own).

[c] Total impact (i.e. incremental increase in concentrations due to the Cowal Gold Operations plus background concentrations due to all other sources).

These criteria reflect the impact assessment criteria described in the EPA's (2016) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* guideline. It is notable that, given the maximum allowable dust deposition capped at 4 g/m^2/month, the greater the background level, the lower the allowable emissions from the CGO.

3.2 PARTICULATE MATTER

Tables 3 and 4 detail the long–term and short-term impact assessment criteria for TSP and particulate matter less than 10 µm (i.e. PM_{10}) for any residence on privately-owned land as required under DA14/98 condition 6.1(a) respectively.

Table 3
Long-term Impact Assessment Criteria for Particulate Matter

Pollutant	**Averaging Period**	**Criterion** [a]
Total suspended particulate (TSP) matter	Annual	90 µg/m³ [b]
Particulate matter < 10 µm (PM_{10})	Annual	25 µg/m³ [b]
Particulate matter < 2.5 µm ($PM_{2.5}$)	Annual	8 µg/m³ [b]

[a] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Planning Secretary of the DPE.

[b] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).

Mg/m³ = micrograms per cubic metre

Table 4
Short-term Impact Assessment Criteria for Particulate Matter

Pollutant	**Averaging Period**	**Criterion** [a]
Particulate matter < 10 µm (PM_{10})	24 hour	50 µg/m³ [b]
Particulate matter < 2.5 µm ($PM_{2.5}$)	24 hour	25 µg/m³ [b]

[a] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Planning Secretary of the DPE.

[b] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).

µg/m³ = micrograms per cubic metre

The short and long-term criteria above are consistent with the impact assessment criteria described in the EPA's (2016) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* guideline.

4 EXISTING AIR QUALITY

4.1 BASELINE DUST MONITORING

4.1.1 Dust Deposition

Baseline dust deposition was monitored for one year (1993-1994) prior to the submission of the *Cowal Gold Project Environmental Impact Statement* (EIS) (North Limited, 1998) at the locations shown on Figure 3. The mean deposition rates at each sampling site are summarised in Table 5.

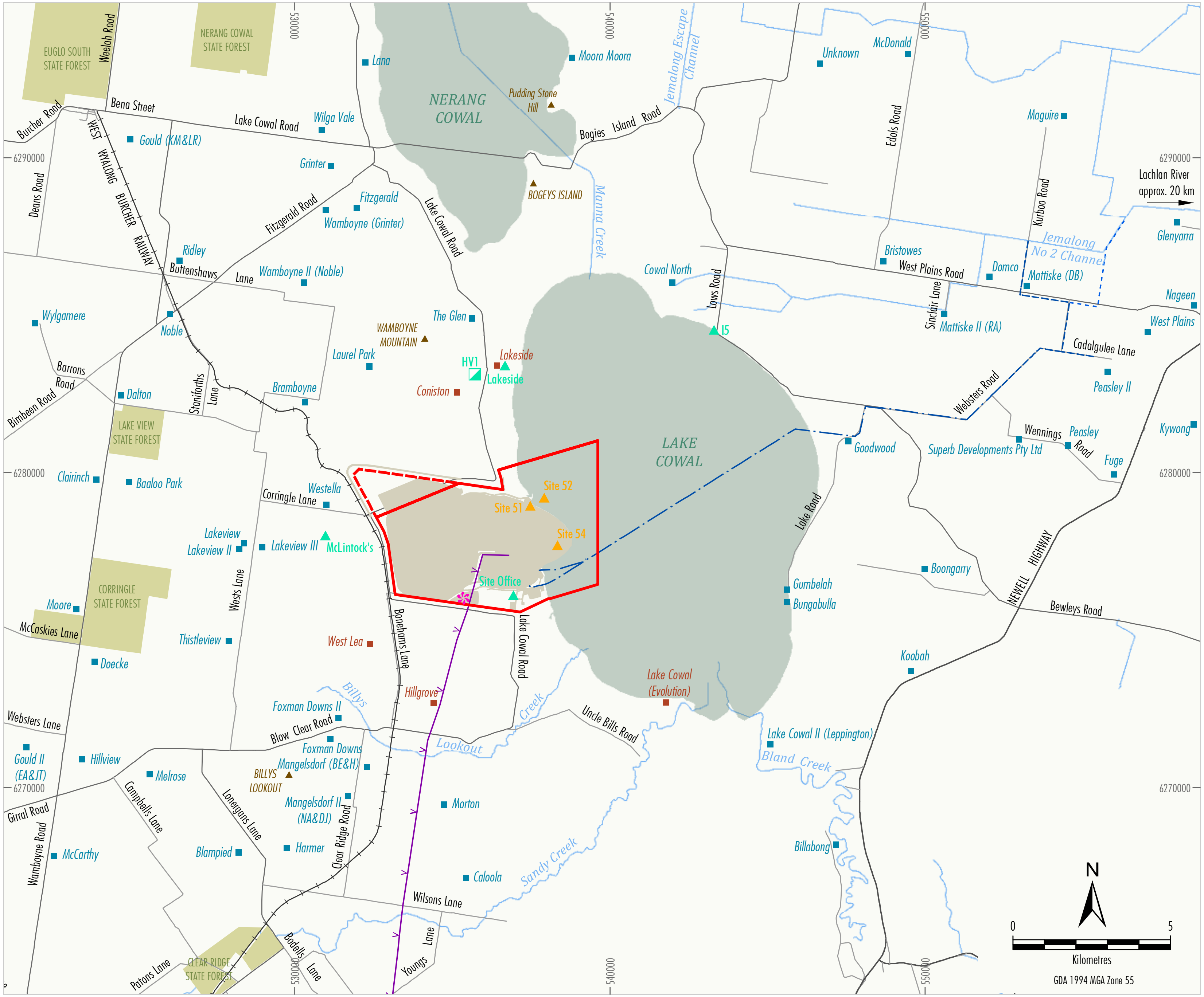
Table 5
Baseline Mean Annual Dust Deposition Rates
(November 1993 to November 1994)

Site (Figure 3)	Mean (g/m^2/month)	Number of Measurements
51	1.61	11
52	1.37	13
54	0.99	13

Source: North Limited (1998)

4.1.2 TSP/PM_{10}/$PM_{2.5}$

No baseline monitoring of TSP, PM_{10} or $PM_{2.5}$ was undertaken prior to the granting of DA14/98. Given the consistently recorded low levels of dust deposition, the concentrations of TSP and PM_{10} are expected to be correspondingly low (Pavel Zib and Associates, 1997).



LEGEND

🟥	Mining Lease Boundary (ML1535)
⬚	Mining Lease Boundary (ML1791)
▨	Approximate Extent of Approved Surface Development
■	Company-owned Dwelling
■	Privately-owned Dwelling
▨	State Forest
┼	Railway
>	Electricity Transmission Line Mine Water Supply
-·-	Pipeline Bland Creek Palaeochannel Borefield
✻	CGO Meteorological Station
▲	Dust Deposition Gauge
◪	TSP High Volume Sampler
▲	Pre-operations Dust Monitoring Site

Source: Evolution (2018); © NSW Department of Finance, Services & Innovation (2017)

Evolution MINING Cowal

AIR QUALITY MANAGEMENT PLAN

Location of Baseline (1993 -1994) and Pre-operations (1999 - 2003) Dust Monitoring Sites

Figure 3

5 SOURCES OF EMISSIONS

5.1 PARTICULATES AND GASES

5.1.1 Substances Considered

As required by DA14/098, particulate matter and deposited dust are considered in this AQMP and includes:

- TSP;
- PM_{10};
- $PM_{12.5}$; and
- deposited dust.

Since September 2021, DA14/98 now includes criteria for particulate matter with equivalent aerodynamic diameters of less than 2.5 μm ($PM_{2.5}$) and has, for the first time, been included in this AQMP. The management measures described in Section 7 remain relevant for the minimisation and control of all dust, including $PM_{2.5}$, PM_{10} and TSP.

5.1.2 Sources of Dust and Particulate Matter

Potential dust emission sources from mining operations include (Pavel Zib and Associates, 1997):

- areas disturbed by mining activities, including waste emplacement areas and other portions of the mine site exposed to wind;
- waste rock handling and stockpiling activities (including loading and unloading, spreading and shaping of waste);
- movement of vehicles on unsealed roads for general mining activities;
- topsoil stripping and stockpiling;
- drilling and blasting; and
- crushing, screening, transport and preparation of ore.

Other key potential dust emission sources include operational emissions generated from construction of the IWL and topsoil stripping and stockpiling activities within ML 1535 and ML 1791.

Other sources of anthropogenic and naturally occurring particulate matter emissions that affect air quality in the region, but are not associated with CGO activities include:

- agricultural activities;
- vehicle movement on local roads;
- bushfires; and
- dust storms.

5.2 GREENHOUSE GASES

Emissions of carbon dioxide (CO_2) and methane (CH_4) have been identified by PEL (2018) as the most significant GHGs relevant to the CGO. These gases are formed and released during the combustion of fuels used on-site (PEL, 2018).

Sources of GHG emissions associated with CGO activities include (PEL, 2018):

- fuel consumption during mining operations (e.g. diesel, unleaded petrol and LPG) (scope 1);

- explosives consumption during mining operations (e.g. ammonium nitrate fuel oil) (scope 1);
- indirect emissions associated with on-site electricity use (scope 2);
- indirect emissions associated with the production and transport of fuels (scope 3); and
- indirect emissions associated with electricity lost in transmission and distribution networks (scope 3).

6 AIR QUALITY MONITORING PROGRAM

The air quality monitoring programme for the CGO is used to assess compliance with DA14/98 and EPL 11912 and to review the effectiveness of air quality management measures. The CGO's air quality monitoring programme uses a network of dust deposition gauges within and surrounding the CGO (Section 6.2). The location of all monitoring sites (dust deposition and TSP) has been developed in consultation with the EPA.

It is the responsibility of the Sustainability Manager (or delegate) to implement the monitoring programme and to ensure monitoring is conducted in accordance with applicable standards and guidelines described in Sections 6.2 and 6.3.

An air quality monitoring report is prepared annually by a suitably qualified specialist and includes analysis of the air quality monitoring programme results, a compliance review and any recommended measures to improve the air quality management at the CGO. The results of the air quality monitoring report are provided in the CGO's Annual Review.

6.1 METEOROLOGY

As required by DA14/98 condition 6.2 and EPL Condition M4, a meteorological station has been installed at the CGO to provide data to be used for predicting air quality impacts. The automated meteorological station is currently located near the southern boundary of ML 1535, west of the exploration facilities (Figure 4). The station records rainfall, wind speed, wind direction, temperature, sigma theta and solar radiation as required by EPL Condition M4. In conjunction with the air quality monitoring results, meteorological data (in particular, wind speed, wind direction and rainfall) is used to manage air quality emissions (Sections 7 and 8) and in the review of air quality management practices.

6.2 ONGOING AIR QUALITY MONITORING

6.2.1 Dust Deposition

Dust deposition monitoring has been conducted at seven sites (Figure 3) since 1999 in a continuation of the baseline monitoring undertaken prior to the issued Development Consent (Section 4.1.1). In addition to the three baseline sites (51, 52 and 54), monitoring has also been conducted at the monitoring sites of Lakeside, McLintock, Site I5 and the Site Office (Figure 3).

The CGO's ongoing dust deposition monitoring programme is further discussed in Section 6.2.

6.2.2 TSP/PM_{10}/$PM_{2.5}$

TSP monitoring has occurred since May 2004 at High Volume Air Sampler (HVAS) site HV1 (Figure 3). HV1 is located approximately 3 km to the north of the CGO (near the Coniston dwelling) and measures the contribution from a range of particulate matter sources, including traffic on unsealed roads, agricultural activities and dust sources associated with the existing CGO (PEL, 2018).

PM_{10} data has been inferred from the daily TSP monitoring data by assuming that 40% of the TSP is PM_{10} (PEL, 2018). This method for measurement of PM_{10} results is consistent with the NSW Minerals Council's (2000) *Technical Paper – Particulate Matter and Mining Interim Report*. The continuation of TSP monitoring is discussed in Section 6.3. A second HVAS unit has been deployed at HV1 since March 2023 to monitor $PM_{2.5}$ directly.

6.2.3 Dust Deposition Monitoring Stations

Table 6 lists the network of 12 stations where dust deposition is monitored in the vicinity of the CGO (Figure 4). The sites are located:

- proximal to relevant privately-owned residences;

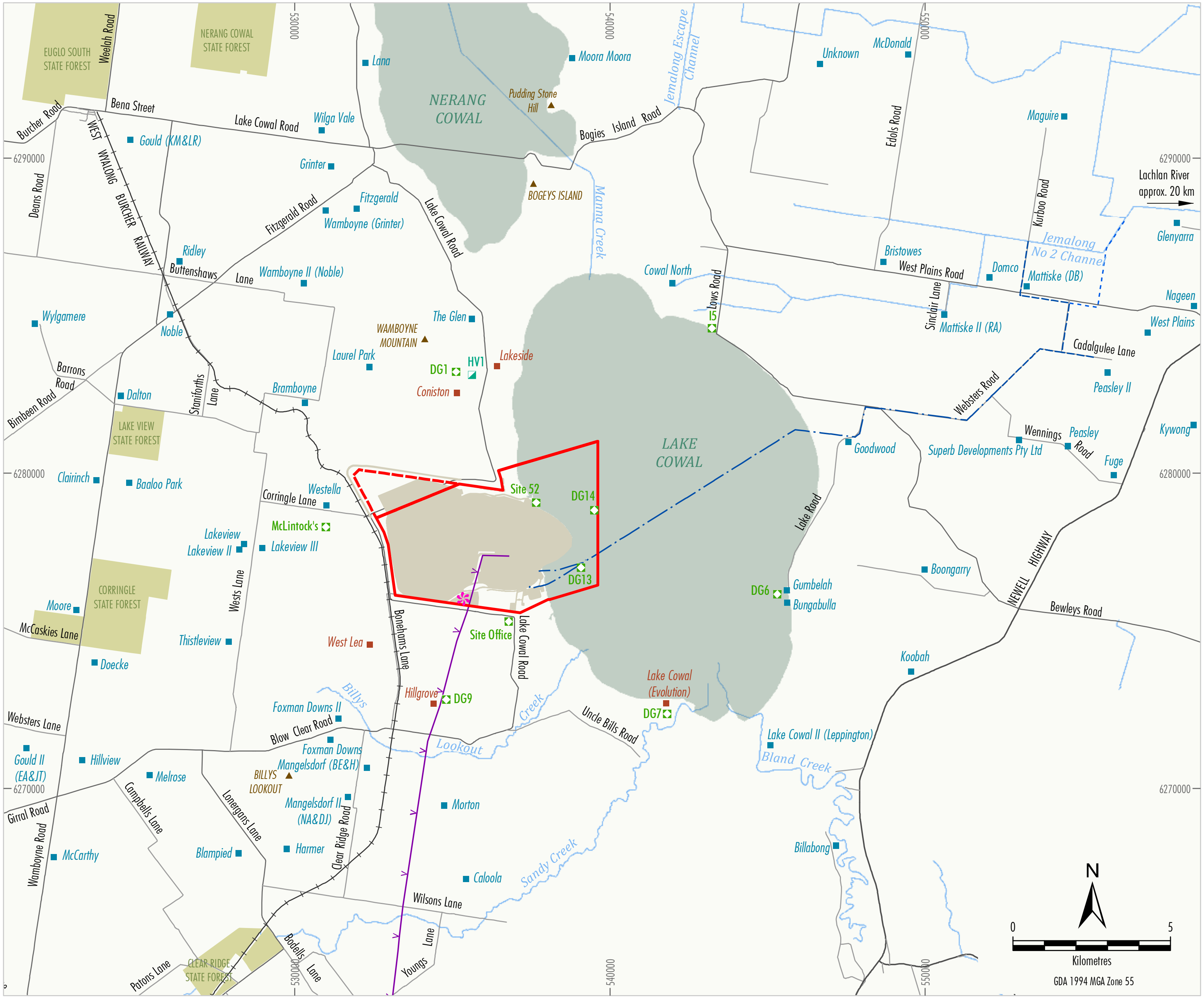
- proximal to key infrastructure components of the CGO (i.e. tailings storage facilities [TSFs]/IWL and waste rock emplacements [WREs]);
- in consideration of prevailing meteorological conditions experienced at the CGO; and
- in consideration of baseline and/or historic dust monitoring locations.

Table 6
Dust Monitoring Sites

Dust Gauge (Figure 4)	Site Location Description
DG1	Coniston residence
DG6	Gumbelah residence
DG7	Lake Cowal residence
DG9	Hillgrove residence
DG13	General monitoring site (proximal to WREs)
DG 14	General monitoring site (ML 1535 eastern boundary within Lake Cowal)
McLintock's	General monitoring site (proximal to residences generally west of the CGO)
Site Office	General monitoring site
Site 52	Continuation of baseline monitoring prior to Development Consent
I5	General monitoring site (north-east of CGO)

Dust deposition monitoring continues at Site 52, which is the only EIS baseline monitoring site not located directly within CGO infrastructure disturbance areas.

Dust deposition monitoring will continue for the life of the mine consistent with EPA guidelines (currently the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales, 2007)* which sets out the methods to be used for sampling and analysing air pollutants in NSW for statutory purposes (Appendix A).



Source: Evolution (2018); © NSW Department of Finance, Services & Innovation (2017)

AIR QUALITY MANAGEMENT PLAN

Air Quality Monitoring Sites

Figure 4

The siting of individual dust monitoring sites has been undertaken in accordance with Australian/New Zealand Standard (AS/NZS) 3580.1.1 – *Methods for sampling and analysis of ambient air – Guide to siting air monitoring equipment* which sets out the process for selection of monitoring sites and positioning the sampling units, and AS/NZS 3580.10.1 - *Methods for sampling and analysis of ambient air – Determination of particulate matter – Deposited matter – Gravimetric method.* For dust gauges, Sections 7 and 8 of AS/NZS 3580.1.1 and Section 7 of AS/NZS 3580.10.1 requires:

- Sampling sites should not be affected by extraneous local emissions.
- Ground level sampling sites (sample inlet less than five metres above ground level) are generally preferable in low or scarcely built-up areas.
- The sampling inlet is to be located at least 5 metres (m) from the source.
- There should be unrestricted airflow of 360 degrees (º) around the sampling site.
- There should be a minimum clear sky angle of 120º above the sampling inlet.
- The height of the funnel aperture above ground level shall be approximately 2 m (±0.2 m) and the funnel aperture plane should be horizontal.
- Located at least 10 m from dripline of trees.
- In general, the period of exposure shall be 30 (±2) days.

All collection and analysis of dust gauge samples is conducted in accordance with AS/NZS 3580.10.1 which sets out the principles, reagents, apparatus, sampling procedures, results calculations and precision, test report format and diagrams of sampling equipment for dust deposition monitoring.

Dust deposition samples is analysed monthly for ash content, combustible matter and insoluble solids. The dust deposition results are compared with the criteria presented in Section 3. All dust deposition monitoring results is reported in the Annual Review (Section 14).

6.2.4 High Volume Sampling for Total Suspended Pariculates

The TSP monitoring site (HV1) is located proximal to the ‘Coniston’ residence to the north of the CGO and has been sighted in consideration of prevailing meteorological monitored conditions at the CGO (Figure 4). The location and selection of a single TSP monitor was agreed with the EPA prior to construction of the CGO (EPA personal communication, 5 June 2003).

TSP is monitored in accordance with procedures within the EPA’s (2007) *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* guideline (Appendix A). TSP will continue to be monitored for the life of the mine unless otherwise agreed by the Planning Secretary of the DPE. The siting of the high-volume sampler monitoring unit has been undertaken in accordance with AS /NZS 3580.1.1 and has been fenced to exclude stock. For TSP high volume samplers, Sections 7 and 8 of AS/NZS 3580.1.1 relevantly require that:

- Sampling sites should not be affected by extraneous local emissions.
- Ground level sampling sites (sampling inlet less than five metres above ground level) are generally preferable in low or scarcely built-up areas.
- There should be unrestricted airflow of 180º around the sampling inlet with no obstruction between the major source and the sampling inlet.
- There should be a minimum clear sky angle of 120º above the sampling inlet.
- The sampling inlet shall be 1 to 5 m above the ground surface.

- Sampler located at least 20 m from trees.
- Located at least 50 m from roads.

TSP is measured to assess fluctuations in particulate matter concentrations on a seven-day cycle (i.e. a 24-hour sample is collected every seven days). All sample collection and analysis are conducted in accordance with AS/NZS 3580.9.3 – *Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – Total suspended particulate matter (TSP) – High volume sampler gravimetric method.* AS/NZS 3580.9.3 sets out the principles, apparatus, calibration, procedures, results calculations and accuracy, test report format and diagrams of sampling equipment for TSP high volume samplers.

The TSP results is compared with the criteria presented in Section 3, and monitoring results is reported in the Annual Review (Section 9.7).

In addition to the dust deposition and TSP monitoring programmes, visual assessments of dust generating activities is periodically conducted by the Sustainability Manager or delegate to identify the major dust generating activities on-site (Section 8).

6.2.5 Lake Cowal Surface Water and Sediment Monitoring Program

In addition to the dust monitoring programme outlined above, surface water and sediment quality monitoring in Lake Cowal is undertaken to assess potential impacts of CGO activities on lake waters.

The CGO's surface water and sediment monitoring programme are described in detail in the Water Management Plan, including locations, frequency and parameters/analytes of surface water and sediment monitoring within Lake Cowal and its associated watercourse inflow sites.

The surface water and sediment monitoring data are reported in the Annual Review and reviewed and revised annually as part of the Annual Review process. Should analysis of surface water and sediment monitoring data and data from the dust gauge network indicate adverse effects of dust on surface water or sediment quality within Lake Cowal, additional dust suppression and control measures is implemented in accordance with the procedures detailed in Section 8.

7 AIR QUALITY MANAGEMENT MEASURES

7.1 SCOPE OF AIR QUALITY MANAGEMENT

The primary objective of dust control at the CGO is to limit air quality emissions to within defined levels for air quality criteria detailed in Section 3.

In accordance with DA14/98 condition 6.1(b)(i), Evolution implements best management practice to minimise the off-site dust, odour and fume emissions from the CGO. No carbonaceous material or pyritic rock occurs in the CGO open pit or in the waste rock emplacements. As a result, spontaneous combustion is unlikely to occur at the CGO and is not considered in this AQMP. Odour and fume emissions associated with blasting activities at the CGO are addressed within the CGO's Blast Management Plan (BMP).

7.2 MANAGEMENT MEASURES

The air quality management measures outlined in this section are applied to minimise emissions from the following key sources:

- general mining activities; and
- exposed areas (via wind erosion).

Tables 7 and 8 list the air quality management measures that are used to minimise dust emissions from the above sources and to minimise the air quality impacts during adverse meteorological conditions and extraordinary events (consistent with the requirements of DA14/98 condition 6.1(b)(v)). These measures are considered to be consistent with best management practice.

Table 7
Management Measures for Mining and Construction Generated Dust Sources

Source	Management Measure
Haul Roads	• All roads and trafficked areas (including key haul roads for IWL construction) are watered and/or treated with an alternative dust suppressant (using water trucks or other methods) and regularly maintained (using graders) to minimise the generation of dust. • Routes are clearly marked. • Obsolete roads will be ripped and re-vegetated.
Minor Roads	• Development of minor roads (including topsoil stockpile access roads) is limited and the locations of these is clearly defined and within approved surface disturbance areas. • Regularly used minor roads are watered and/or treated with an alternative dust suppressant (using water trucks or other methods) and regularly maintained. • Obsolete minor roads will be ripped and re-vegetated.
Materials Handling	• Prevention of truck overloading to reduce spillage during ore loading/unloading and hauling. • A water spray dust suppression system is used at the primary and secondary crusher bins during truck dumping of raw ore. • Freefall height during ore/waste stockpiling is limited.

Table 7 (cont'd)
Management Measures for Mining and Construction Generated Dust Sources

Source	Management Measure
	•
Soil Stripping and Stockpiling	• Soil stripping is limited to areas required for mining operations and soil stockpiles is located within approved surface disturbance areas. • All soil stripping and soil stockpile construction is undertaken in accordance with the measures and procedures in the CGO's Soil Stripping Management Plan.
Drilling	• Dust aprons are lowered during drilling for collection of fine dust. • Water injection or dust suppression sprays are used when high levels of dust are being generated.
Blasting	• Fine material collected during drilling is used for blast stemming. • Adequate stemming is used at all times. • Blasting will only occur following an assessment of weather conditions by the Sustainability Manager (or delegate) to ensure that wind speed and direction will not result in excess dust emissions from the site towards adjacent residences (refer to the Blast Management Plan for further information).
Equipment Maintenance	• Emissions from mobile equipment exhausts is minimised by the implementation of a maintenance programme to service equipment in accordance with the equipment manufacturer specifications.

Table 8
Management Measures for Exposed Area Dust Sources

Source	Management Measure
General Areas Disturbed by Mining	• Only the minimum area necessary for mining will be disturbed. • Exposed areas are reshaped, topsoiled and revegetated as soon as practicable in accordance with DA14/98 condition 2.4(b), to minimise the generation of wind erosion dust.
Waste Emplacement Areas	• Exposed active work areas on waste emplacement surfaces are watered to suppress dust where practicable. • Rehabilitation (i.e. reshaping, topsoil placement and revegetation) of waste emplacement areas is conducted progressively, as soon as practicable following completion of landform, in accordance with DA14/98 condition 2.4(b).
Tailings Storage Facilities/IWL	• During non-operational periods, dust suppression measures are undertaken to minimise dust emissions from dry exposed areas on the surface of the tailing's storage facilities/IWL.
Soil Stockpiles	• All soil stockpiles will be managed in accordance with the measures described in the CGO's Soil Stripping Management Plan. • Long-term soil stockpiles will be revegetated with a cover crop to minimise wind erosion dust.
Material Handling and Ore Stockpiles	• Prevention of truck overloading to reduce spillage during ore loading/unloading and hauling. • The surface of all stockpiles will be sufficiently treated to minimise dust emissions. Such treatment may include application of a dust suppressant, regular dust suppression watering or establishment of vegetation on longer term stockpiles (e.g. the low-grade ore stockpile).

7.3 MODIFICATION STRATEGIES

Additional measures to minimise dust emissions involving measures to modify mining operations may be implemented based on the results of the compliance assessment (Section 9.1). The Sustainability Manager in co-operation with the Mining Manager may adopt a range of modifications to the mining operation. Typical modifications that may be adopted are outlined in Table 9, however, additional modification measures may also be adopted as required.

Table 9
Modifications to Dust Generating Activities

Project Component	Modification
General Exposed Areas	Increased watering of exposed surfaces via water trucks or other methods as required.
Ancillary Activities	Temporary cessation of ancillary or non-essential on-site dust generating activities (e.g. soil stripping).

Modification measures would usually be implemented in conjunction with relevant general air quality control and management measures described in Tables 7 and 8.

Dust Control Equipment
Table 10 presents the equipment that will be used to minimise dust generation at the CGO.

Table 10
Dust Control Equipment

Equipment Type	Typical Control Area
Water (or Dust Suppressant) trucks	Haul roads and exposed trafficked surfaces and all exposed areas.
Water sprays	Ore crushers, product conveyors and conveyor feed points on stockpiles.
Dust Collection Systems	Drill rigs.

An additional management measure that has been adopted for the CGO is the use of a baghouse and associated collection hood/ducting to filter off-gas emissions (i.e. to remove dust particles) from the gold room Doré melt furnace. Particulate material collected by the baghouse will be returned to the melt furnace periodically (SNC Lavalin, 2003). This control method reduces the potential for any minor environmental emissions from the gold smelting process and maximises the retention of gold product.

Suitable rates of application of dust suppression water (or other material) will be determined on an ongoing basis through on-site experience and will be largely related to soil types, variability in mine traffic volumes and meteorological conditions (for example, higher watering rates will be applied on hot, dry, windy days when large numbers of vehicles are trafficking massive-structured soil types than on wet days). Specific application rates are not prescribed in this AQMP due to the potentially high day to day variability in weather conditions. In addition, a review of suitable measures to minimise dust from dry tailings storage facility/IWL surfaces will be undertaken based on available relevant literature, site experience and specialist input (if required). It will be the responsibility of the Mining Manager and Sustainability Manager to assess and implement suitable mitigation measures and rates of water application to minimise dust emissions from trafficked and unsealed or exposed areas.

7.4 SOIL STOCKPILE SURFACE TREATMENT

Evolution treats all soil stockpiles (e.g. apply dust suppression and/or revegetate) as necessary to minimise windblown dust emissions (Table 8). Specific dust suppression activities are determined by the Sustainability Manager in consultation with the Mining Manager.

Measures to control wind-borne dust and sediment runoff from soil stockpiles include the following:

- stripping and placement of soil stockpiles at appropriate moisture conditions whenever possible;
- construction of soil stockpiles of appropriate height and batter angles;
- the application of seed, fertiliser, water or mulch to promote rapid revegetation cover and as a consequence, erosion control;
- application of soil ameliorants (e.g. gypsum or lime) to improve soil structure and reduce erosion potential; and
- minimisation of runoff to stockpile areas.

7.5 REHABILITATION

Further to the above controls, rehabilitation works at the CGO are undertaken progressively as soon as reasonably practicable following disturbance activities or once a landform has been constructed to its final design, in accordance with DA14/98 condition 2.4(b). Rehabilitation is undertaken in accordance with the CGO's Rehabilitation Management Plan (RMP) or the Mining Operations Plan (MOP).

The general principles of the CGO's rehabilitation programme include (Evolution, 2018):

- The rehabilitation of landforms is to be progressive and conducted in accordance with approved plans.
- Final landforms are to be stable in the long-term and include native and/or endemic vegetation characteristic of remnant vegetation within the surrounding landscape.
- Native and/or endemic groundcover, understorey, tree seeds are to be used in the rehabilitation programme.
- Rehabilitation concepts are to be flexible to allow for adjustments, based on investigations and trials, to improve the programme.
- The annual rehabilitation programme and budget is to be prepared by a site team incorporating senior management representatives.

The rehabilitation objectives for the CGO's rehabilitation programme include (Evolution, 2018):

- The water quality of Lake Cowal is not detrimentally affected by the CGO landforms.
- Revegetating CGO landforms with selected native and/or endemic vegetation that are suited to the physiographic and hydrological features of each landform, and which expand on the areas of remnant endemic vegetation in the surrounding landscape.
- Designing final landforms so that they are stable and include revegetation growth materials that are suited to the landform and support self-sustaining vegetation.
- The placement (wherever possible) of soils on final landforms to enable the progressive establishment of vegetation.
- The expansion of habitat opportunities for wetland and terrestrial fauna species. This includes the design and implementation of rehabilitation works at the New Lake Foreshore in a manner consistent with the *NSW Wetlands Policy* (Department of Environment, Climate Change and Water [DECCW], 2010).
- The selection of revegetation species in accordance with accepted principles of long-term sustainability (e.g. genotypic variation, vegetation succession, water/drought tolerances).

- Grazing of land within ML 1535 and ML 1791 to be excluded during operations and during rehabilitation of the site. At lease relinquishment, rehabilitated final landforms are excluded from grazing, with some areas suitable for grazing surrounding the rehabilitated final landforms.

The CGO's rehabilitation concepts and measures are described in detail in the RMP, with rehabilitation planning and scheduling outlined in the MOP.

Interim rehabilitation measures that are implemented to minimise the area exposed for dust generation include the establishment of a cover crop on newly completed landforms/areas and on long-term soil stockpiles. Rock mulch is also applied as soon as practicable following the completion of shaping of the waste rock emplacement and tailings storage facility/IWL batters to minimise the potential for windblown dust from the surface, in accordance with the rehabilitation concepts described in the RMP.

Furthermore, following landform re-profiling works and rock mulch and topsoil application, native pasture hay (or straw hay) may be applied on northern and western facing landform slopes (as these aspects are subject to prevailing conditions), to assist with stabilising and minimise the loss topsoil resources.

It is the responsibility of the Sustainability Manager in co-operation with the Mining Manager to meet the CGO's statutory requirements relevant to rehabilitation.

7.6 GREENHOUSE GAS EMISSIONS

In accordance with DA14/98 condition 6.1(b)(ii), Evolution has implemented a range of measures to minimise the release of GHG emissions from the site. They include:

- Regular maintenance of plant and equipment to minimise fuel consumption.
- Efficient mine planning (e.g. minimising rehandling and haulage of materials) to minimise fuel consumption.
- Consideration of energy efficiency in the plant and equipment selection phase.
- Implementation of a biodiversity offset program.

Evolution currently reports annual GHG emission and energy consumption from the CGO to the Federal government in accordance with the requirements of the National Greenhouse Gas and Energy Reporting System (NGERS) and National Pollutant Inventory (NPI). GHG emissions from the CGO are also reported annually on Evolution's website (www.evolutionmining.com.au).

8 AIR QUALITY ASSESSMENT PROCEDURE

The assessment procedure outlined in this section is implemented to minimise dust emissions from day-to-day activities.

The procedure includes the following phases which are described further below:

1. Source identification.
2. Management decision.
3. Implementation.
4. Review.

Source Identification

The first phase of the air quality assessment procedure involves review of the planned mining activities and their potential for dust generation. The following will be considered:

- the activities and types of equipment that will be used;
- the timing of the activity;
- the location of the activity (in relation to surrounding topography and land use);
- the recent weather conditions, including wind, rain and temperature (Section 6.1) and weather forecasts; and
- the environmental conditions, including lake water levels and season.

Accordingly, if hourly average wind speeds on-site are greater than 5.6 metres per second (m/s) (20 kilometres per hour [km/hr]) from the south and general environmental conditions are conducive to dust generation (e.g. hot and dry), the Sustainability Manager or delegate will review dust generation levels on-site and assess if it is necessary to implement the management strategy phase.

Management Decision

The management decision phase decides which dust management and/or modification measures will be used to minimise dust emissions, based on the results of the Source Identification phase. Potential air quality management and modification measures are presented in Section 7.

Implementation

This phase sees the implementation of the measures selected in the management decision phase. The timing for implementation of some management or modification measures will be dependent on the mine production and progression.

Review

The Sustainability Manager (or delegate) and Mining Manager will regularly review the effectiveness of dust control measures using visual assessment of dust generation at source (e.g. dust generation levels behind vehicles on haul roads) as well as review of general environmental and meteorological conditions and any results that may be available from the dust monitoring programme (Section 6). If required, the Sustainability Manager or Mining Manager will return to the management decision phase of the procedure to implement further control measures as necessary.

The Sustainability Manager (or delegate) will also note any trends in the monitoring data and respond to any complaints from private landholders or the community related to dust or air quality issues that may emerge in regard to particular operating scenarios or meteorological conditions.

9 CONSULTATION AND COMPLAINTS

9.1 COMMUNITY CONSULTATION

A Community Environmental Monitoring and Consultative Committee (CEMCC) has been established for the CGO in accordance with DA14/98 condition 9.1(d):

> ***9.1 Environmental Management***
>
> *(d) Community Environmental Monitoring and Consultative Committee*
>
> *(i) The Applicant shall establish and operate a Community Environmental Monitoring and Consultative Committee (CEMCC) for the Cowal Gold Operations to the satisfaction of the Planning Secretary. This CEMCC must:*
>
> - *be comprised of an independent chair and at least 2 representatives of the Applicant, 1 representative of BSC, 1 representative of the Lake Cowal Environmental Trust (but not a Trust representative of the Applicant), 4 community representatives (including one member of the Lake Cowal Landholders Association);*
> - *be operated in general accordance with the Department's Community Consultative Committee Guidelines: State Significant Projects (2019 or its latest version); and*
> - *monitor compliance with conditions of this consent and other matters relevant to the operation of the Cowal Gold Operations during the term of the consent.*
>
> *Note: The CEMCC is an advisory committee. The Department and other relevant agencies are responsible for ensuring that the Applicant complies with this consent.*
>
> *(ii) The Applicant shall establish a trust fund to be managed by the Chair of the CEMCC to facilitate the functioning of the CEMCC and pay $2000 per annum to the fund for the duration of gold processing operations. The annual payment shall be indexed according to the Consumer Price Index (CPI) at the time of payment. The first payment shall be made by the date of the first Committee meeting. The Applicant shall also contribute to the Trust Fund reasonable funds for payment of the independent Chairperson, to the satisfaction of the Planning Secretary.*

As required, the CEMCC is comprised of:

- four community representatives (including one member of the Lake Cowal Landholders Association);
- one representative of the Lake Cowal Foundation;
- one representative of the Wiradjuri Condobolin Corporation;
- one representative of the Bland Shire Council, Forbes Shire Council and Lachlan Shire Council;
- an independent chairperson; and
- two representatives of Evolution.

The CEMCC will continue to provide opportunities for members of the community to attend CEMCC meetings to discuss specific issues relevant to them. This is achieved by landholders making a request to the CEMCC regarding a particular issue, or by the landowner registering a complaint in the complaints register. Landowners who register complaints may be invited to join in discussion of the issue at the next CEMCC meeting.

The CEMCC meets quarterly and CEMCC meeting minutes are provided on Evolution's website (www.evolutionmining.com.au).

9.2 COMPLAINTS REGISTER

A complaints register is maintained by the Sustainability Manager (or delegate) in accordance with EPL condition M5.1 and SSD 10367 condition C14.

Information recorded in the complaints register with respect to each complaint will include:

- date of complaint;
- the method by which the complaint was made;
- any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that fact;
- nature of complaint;
- the action(s) taken by Evolution in relation to the complaint, including any follow-up contact with the complainant; and
- if no action was taken by Evolution, the reasons why no action was taken.

An initial response is provided to the complainant within 24 hours. Preliminary investigations into the complaint will commence within 48 hours of complaint receipt.

A summary of the complaints register is displayed on the Evolution website in accordance with Development Consent Condition 9.4(a)(v) and is updated on a monthly basis.

9.3 DISPUTE RESOLUTION

In the event that dispute resolution is necessary or where air quality emission levels are subsequently demonstrated to be below the relevant criteria (Section 3), the resolution process is one of informed discussion involving the complainant and Evolution. Evolution may also refer the dispute (with the complainant’s agreement) to the CGO’s CEMCC for mediation (Section 12). In the event that the complainant is still dissatisfied, the matter may be referred to the DPE for consideration of further measures. Every effort is made to ensure that concerns are addressed in a manner that results in a mutually acceptable outcome.

10 AUDITING AND REVIEW

10.1 INDEPENDENT ENVIRONMENTAL AUDIT

An Independent Environmental Audit is conducted in accordance with DA14/98 condition 9.2 and may include air quality related issues:

> ***9.2 Independent Auditing and Review***
>
> *(a)* *Independent Environmental Audit*
>
> *(i) By the end of July 2016, and every 3 years thereafter, unless the Planning Secretary directs otherwise, the Applicant shall commission and pay the full cost of an Independent Environmental Audit of the Cowal Gold Operations. This audit must:*
>
> - *be prepared in accordance with the* Independent Audit Post Approval Requirements *(2020 or as amended from time to time);*
> - *be led and conducted by a suitably qualified, experienced and independent team of experts (including ecology and rehabilitation experts, and in field's specified by the Planning Secretary) whose appointment has been endorsed by the Secretary;*
> - *be carried out in consultation with the relevant agencies, BSC and the CEMCC;*
> - *assess whether the development complies with the relevant requirements in this consent, and any strategy, plan or program required under this consent; and*
> - *recommend appropriate measures or actions to improve the environmental performance of the development and any strategy, plan or program required under this consent.*

In accordance with the recommendations from the Independent Monitoring Panel's *Third Annual Report of the Independent Monitoring Panel for the Cowal Gold Project (October 2007)*, Evolution continues to conduct Independent Environmental Audit's annually, instead of triennially as defined in DA14/98 condition 9.2(a)(i).

10.2 INDEPENDENT REVIEW PROCESS

In accordance with DA14/98 condition 8.2, the following independent review process is undertaken in the event that an owner of privately-owned land considers the CGO to be exceeding the air quality impact assessment criteria (Section 3) (or any other criteria defined in the Development Consent).

> ***8.2 Independent Review***
>
> *If an owner of privately-owned land considers the development to be exceeding the criteria in this consent, then he/she may ask the Secretary in writing for an independent review of the impacts of the development on his/her land.*
>
> *If the Secretary is satisfied that an independent review is warranted, then within 2 months of the Secretary's decision, the Applicant shall:*
>
> *(a) commission a suitably qualified, experienced and independent expert, whose appointment has been approved by the Secretary, to:*
>
> - *consult with the landowner to determine his/her concerns;*
> - *conduct monitoring to determine whether the development is complying with the relevant impact assessment criteria in condition 6 of this consent; and*
> - *if the development is not complying with these criteria, then:*
>   - *determine if more than one mine or development is responsible for the exceedance, and if so the relative share of each mine or development regarding the impact on the land; and*

  - *identify the measures that could be implemented to ensure compliance with the relevant criteria; and*

(b) give the Secretary and landowner a copy of the independent review.

10.3 REVIEW OF THIS PLAN

In accordance with Condition 9.1(c) of the DA14/98 and Condition C5 of SSD 10367, this AQMP is reviewed, within three months of the submission of:

- an Annual Review under Condition 9.1(b);
- an incident report under Condition 9.3(a);
- an audit under Condition 9.2(a);
- an Annual State of the Environment Report under Condition 9.2(b);
- the approval of any modification to the conditions of the Development Consent; or
- any direction of the Planning Secretary under Condition 1.1(c).

SSD 10367 Condition C5 also flags '…notification of a change in development phase under condition A5…' as a trigger to review strategies, plans and programs required under that consent.

Where this review leads to revisions of the AQMP, then within six weeks of the review, the revised AQMP is submitted for the approval of the Planning Secretary of the DPE (unless otherwise agreed with the Secretary). The revision status of this AQMP is indicated on the title page of each copy.

This AQMP is made publicly available on Evolution's website (www.evolutionmining.com.au), in accordance with Condition 9.4(a)(iii) of DA14/98 and SSD Condition C14. A hard copy of the AQMP is also kept at the CGO.

11 REPORTING

11.1 PROTOCOLS FOR COMPLIANCE ASSESSMENT AND NOTIFICATION

The results of the air quality monitoring programme are assessed against the air quality impact assessment criteria identified in Section 3.

In the event of an exceedance of the air quality impact assessment criteria (Section 3), an assessment is conducted to determine:

- Location of the exceedance.
- Possible reasons for the exceedance (e.g. can the exceedance be attributed directly to the CGO). This will include consideration of (but not be limited to):
  - meteorological factors;
  - exclusion of the combustible fractions of the dust samples;
  - CGO mining activities at the approximate time of the exceedance; and
  - other potential factors (including agricultural activities that may have occurred at the approximate time of the exceedance).

If this assessment determines that the exceedance is likely due to CGO's activities, the Sustainability Manager will determine appropriate mitigation strategies and/or management measures to be implemented in consultation with the Mining Manager.

In accordance with DA14/98 condition 9.3(a), Evolution will notify the DPE (and any other relevant agencies) in writing via the Major Projects website within seven days after becoming aware of any non-compliance with the DA conditions. Evolution will provide in writing to the DPE a detailed report of the non-compliance which identifies, the development application number for the CGO, delegated contact person for enquiries related to the incident, the DA condition with which the CGO is non-compliant, the date and approximate time of which Evolution became aware of the non-compliance, the way in which the CGO does not comply and the reason for the non-compliance including but not limited to, how the exceedance was detected. Evolution will also provide details around any immediate actions which have been or will be taken, to address the non-compliance.

CGO's incident Reporting and Investigation Procedure (CGO-OHS-PRO-0006) details requirements for reporting incidents including:

- a summary of the incident,
- outcomes of an incident investigation, including identification of the cause of the incident,
- details of the corrective and preventative actions that have been or will be, implemented to address the incident and prevent recurrence; and
- details of any communication with other stakeholders regarding the incident. N

In addition, as required by DA14/98 condition 8.1(b)(ii), as soon as practicable after verification of a non-compliance with the relevant air quality criteria (as determined by the compliance assessment protocol), Evolution will provide a copy of the NSW Health fact sheet entitled "Mine Dust and You" to the affected landowners and/or existing tenants of the land.

As described in Section 6, an air quality monitoring report is prepared annually by a suitably qualified specialist. This report will include analysis of the air quality monitoring programme results, a compliance assessment (as described above) and any recommended measures to improve the air quality management at the CGO.

As described in Section 11, the air quality monitoring programme results and annual report findings are reported in the Annual Review.

11.2 INCIDENT NOTIFICATION PROTOCOL

In accordance with the DA14/98 condition 9.3(a) and Appendix 8, SSD 10367 Appendix 5 and Section 148 of the POEO Act, Evolution will notify the DPE, the EPA, all other relevant agencies and any affected landholder immediately after becoming aware of an air quality incident that has caused, or threatens to cause, material harm to the environment. Evolution will immediately implement the management or modification strategies (Section 7) necessary to minimise air quality emissions.

In accordance with DA14/98 condition 9.3(a) and condition R2.2 of the EPL, Evolution will provide written details of the air quality incident to the DPE via the Major Projects website and the EPA within 7 days of the incident, including details of measures taken or proposed to be taken to prevent or mitigate recurrence of the incident.

It is the responsibility of the Sustainability Manager (or delegate) in consultation with the General Manager and Mining Manager (or delegate) to implement the procedures above.

11.3 ANNUAL REVIEW

The Annual Review is prepared in accordance with the requirements of DA14/98 condition 9.1(b) and is submitted to the DPE by the end of March each year, or as otherwise agreed with the Planning Secretary of the DPE:

> ***9.1 Environmental Management***
>
> *b) <u>Annual Review</u>*
>
> *By the end of March each year, or as otherwise agreed with the Planning Secretary, the Applicant shall review the environmental performance of the development to the satisfaction of the Planning Secretary. This review must:*
>
> *(i) describe the development that was carried out in the previous calendar year, and the development that is proposed to be carried out over the next year;*
>
> *(ii) include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, which includes a comparison of these results against the:*
>
> - *the relevant statutory requirements, limits or performance measures/criteria;*
> - *the monitoring results of previous years; and*
> - *the relevant predictions in the EIS;*
>
> *(iii) identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;*
>
> *(iv) identify any trends in the monitoring data over the life of the development,*
>
> *(v) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and*
>
> *(vi) describe what measures will be implemented over the next year to improve the environmental performance of the development.*

The Annual Review also addresses the Annual Environmental Management Report requirements of Condition 26 of the Conditions of Authority for ML 1535 and ML 1791. The requirements of Condition 26 are:

> ***Annual Environmental Management Report (AEMR)***
>
> *26. (1) Within 12 months of the commencement of mining operations and thereafter annually or, at such other times as may be allowed by the Director-General, the lease holder must lodge an Annual Environmental Management Report (AEMR) with the Director-General.*
>
> *(2) The AEMR must be prepared in accordance with the Director-General's guidelines current at the time of reporting and contain a review and forecast of performance for the preceding and ensuing twelve months in terms of:*
>
> *(a) the accepted Mining Operations Plan;*
>
> *(b) development consent requirements and conditions;*
>
> *(c) Environment Protection Authority and Department of Land and Water Conservation licences and approvals;*
>
> *(d) any other statutory environmental requirements;*
>
> *(e) details of any variations to environmental approvals applicable to the lease area; and*
>
> *(f) where relevant, progress towards final rehabilitation objectives.*
>
> *…*

The Annual Review will report on the following air quality related issues:

- annual average dust deposition results (plotted in g/m^2/month) and comparison to the air quality impact assessment criteria (Section 3);
- TSP monitoring results and comparison to the air quality impact assessment criteria (Section 3);
- measures employed to minimise air quality emissions;
- dust-related complaints and management measures undertaken in the event of a non-compliance with the air quality impact assessment criteria;
- review of the performance of dust management measures and/or modification strategies and the air quality monitoring programme;
- interpretation and discussion of the air quality monitoring programme results and any recommended management measures provided by a suitably qualified person; and
- any CEMCC decisions relating to air quality issues.

11.4 ANNUAL RETURN

In accordance with Condition R1 of EPL 11912, Evolution will prepare an Annual Return for submission to the EPA, which reports on compliance with the conditions of the EPL. Air quality monitoring data collected in accordance with the EPL is made publicly available on Evolution's website.

12 REFERENCES

Department of Trade and Investment, Regional Infrastructure and Services – Division of Resources and Energy (2013) ESG3: Mining Operations Plan (MOP) Guidelines, September 2013 (ESG3).

Evolution Mining (Cowal) Limited (2018) Cowal Gold Operations Processing Rate Modification Environmental Assessment.

Hydro Engineering and Consulting Pty Ltd (2018) Cowal Gold Operations Processing Rate Modification Surface Water Assessment.

North Limited (1998) Cowal Gold Project Environmental Impact Statement. Prepared by Resource Strategies Pty Ltd.

NSW Department of Environment, Climate Change and Water (2010) NSW Wetlands Policy.

NSW Environment Protection Authority (2007) Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales.

NSW Environment Protection Authority (2016) Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.

Pacific Environment Limited (2018) Cowal Gold Operations Processing Rate Modification – Air Quality and Greenhouse Gas Assessment. Report prepared for Evolution Mining (Cowal) Pty Limited.

Pavel Zib and Associates (1997) Assessment of Air Quality for the Proposed Cowal Gold Project at Lake Cowal, NSW. Report prepared for North Limited.

SNC Lavalin (2003) Cowal Gold Project 6 MTPA Development Plan.

13 GLOSSARY

AR	annual review
AQMP	Air Quality Management Plan
AS/NZS	Australian/New Zealand Standard
BMP	Blast Management Plan
CEMCC	Community Environmental Monitoring and Consultative Committee
CGO	Cowal Gold Operations
CH_4	methane
CO_2	carbon dioxide
DA 14/98	Development Consent no. 14/98 for the CGO including the Bland Creek Palaeochannel Bore field water supply pipeline.
DA 2011/64	Development Consent no. 2011/64 for the operation of the Eastern Saline Borefield
DG	dust gauge
DPE	NSW Department of Planning and Environment
DRG	Department of Resources and Geoscience (within the NSW Department of Planning and Environment)
EIS	*Cowal Gold Project Environmental Impact Statement* (North Limited, 1998)
EP&A Act	NSW *Environment Planning and Assessment Act, 1979*
EPA	Environment Protection Authority
EPL	environment protection licence
Evolution	Evolution Mining (Cowal) Pty Limited
GHG	greenhouse gases
HVAS	high-volume air sampler
IMP	Independent Monitoring Panel
IWL	integrated waste landform
km	kilometre
km/hr	kilometres per hour
m/s	metres per second
ML	mining lease

MOP	mining operations plan
NGER	National Greenhouse and Energy Reporting, required under the *National Greenhouse and Energy Reporting Act, 2007*
NSW	New South Wales
OEH	Office of Environment and Heritage
PM_{10}	particles with equivalent aerodynamic diameters of less than 10 µm
$PM_{2.5}$	particles with equivalent aerodynamic diameters of less than 2.5 µm
POEO Act	NSW *Protection of the Environment Operations Act, 1997*
RMP	Rehabilitation Management Plan
SSD	State-significant Development
SWGMBMP	Surface Water, Groundwater, Meteorological and Biological Monitoring Programme
TSF	tailings storage facility
TSP	total suspended particulates
WRE	waste rock emplacement
$µg/m^3$	micrograms per cubic metre
µm	micrometres

APPENDIX A

APPROVED METHODS FOR THE SAMPLING AND ANALYSIS OF AIR POLLUTANTS IN NEW SOUTH WALES

Approved Methods

for the Sampling and Analysis of Air Pollutants in New South Wales

Department of **Environment and Conservation** NSW

About this publication

Prepared by the NSW Environment Protection Authority (EPA), which is part of the Department of Environment and Conservation NSW (DEC).

For technical inquiries about this document, contact DEC's Ecotoxicology and Environmental Contaminants Section.

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Published by:
Department of Environment and Conservation NSW
59–61 Goulburn Street
PO Box A290
Sydney South 1232
Ph: (02) 9995 5000 (switchboard)
Ph: 131 555 (environment information and publications requests)
Ph: 1300 361 967 (national parks information and publications requests)
Fax: (02) 9995 5999
TTY: (02) 9211 4723
Email: info@environment.nsw.gov.au
Website: www.environment.nsw.gov.au

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Appendix IX: Other approved method 9 – ‘Coarse’ particulates

Appendix X: Test method sources

1. Introduction

Purpose of methods

This document lists the methods to be used for the sampling and analysis of air pollutants in New South Wales for statutory purposes. The document covers:

- pollutant emissions from stationary sources
- pollutant emissions from motor vehicles
- components in and properties of petroleum products
- pollutants in ambient air.

Relevant legislation

This document is referred to in:

- the Protection of the Environment Operations (Clean Air) Regulation 2002, Part 4 Emission of Air Impurities from Activities and Plant
- the Protection of the Environment Operations (Clean Air) Regulation 2002, Part 5 Motor Vehicles and Motor Vehicle Fuels
- the Protection of the Environment Operations (General) Regulation 1998.

It may also be referred to in conditions attached to statutory instruments, such as licences or notices, issued under environment protection legislation, as defined in the *Protection of the Environment Operations Act 1997*.

Industry has an obligation to ensure compliance with limits specified in the Protection of the Environment Operations (Clean Air) Regulation 2002, Part 4 Emission of Air Impurities from Activities and Plant and Part 5 Motor Vehicles and Motor Vehicle Fuels, and certain statutory instruments. All monitoring to show compliance must be done in one of three ways:

- in accordance with the methods specified in this document
- in accordance with the methods specified in the relevant statutory instrument
- if no method is specified in either this document or the statutory instrument, in a manner approved by the EPA in writing before any tests are conducted.

Exceptional circumstances

In exceptional circumstances, the EPA may approve the use of alternative methods to those provided here. An application for approval of a test method (TM), continuous emissions monitoring method (CEM), other approved method (OM) or ambient monitoring method (AM) as an equivalent alternative to a method in this document (the ‘approved method’) must be made in writing to the Chief Scientist, Environment Protection Authority.

The application must:

- demonstrate that there are exceptional circumstances that justify the use of a method other than the approved method
- give comprehensive technical details of the alternative method for which approval is sought
- show that the alternative method is scientifically sound

- show that the alternative method would produce results comparable to those produced by the approved method. This involves establishing method equivalency, by following the procedure outlined in USEPA Method 301, including the optional sections where appropriate.

The EPA will not approve an alternative to a specified TM, CEM, OM or AM unless it is satisfied that the application for approval gives adequate details of the proposed alternative method as listed above.

Any other method, which has been approved by the EPA in accordance with the approval procedures set out above as an equivalent alternative to a TM, CEM, OM or AM of a particular number in this document, is prescribed as an approved method of that same number.

2. Sample collection and handling

Stationary source monitoring

Collect, handle and preserve samples according to the relevant test method. Collect them at the locations determined in accordance with the relevant regulation or specified in the statutory instrument, as the case may be. If the regulation does not provide for determination of the locations or if no locations are specified in the instrument, collect them from locations where they are representative of the total or known portion of the source emissions.

Whenever a United States Environmental Protection Agency (USEPA) test method refers to USEPA (2000) Method 1, Standards Association of Australia, AS 4323.1-1995 must be substituted, except under approved circumstances. Whenever a USEPA test method refers to USEPA (2000) Method 5, AS 4323.2-1995 must be substituted, except under approved circumstances. Approved circumstances are defined in the following section.

Approved circumstances

The following table defines the approved circumstances for the use of AS 4323.1-1995, USEPA (2000) Method 1, AS 4323.2-1995 and USEPA (2000) Method 5.

	TM-1		**TM-15**	
Group	**AS 4323.1-1995**	**USEPA (2000) Method 1**	**AS 4323.2-1995**	**USEPA (2000) Method 5**
1, 2, 3, 4 and A	Under all circumstances	Under all circumstances	Under all circumstances	Under all circumstances
5 and B	Under all circumstances	Under exceptional circumstances	Under all circumstances	Under exceptional circumstances
6 and C	Under all circumstances	Under no circumstances	Under all circumstances	Under no circumstances

Note: Group, in relation to any activity or plant, means the Group to which the activity or plant belongs pursuant to its classification prescribed in the Protection of the Environment Operations (Clean Air) Regulation 2002, Part 4 Emission of Air Impurities from Activities and Plant, Division 2 and Division 3.

Ambient air monitoring

When siting ambient air monitoring equipment, follow AS 2922-1987. Monitoring sites are classified into three types: peak, neighbourhood or background. When selecting a monitoring site, you need to consider many parameters, including, locality, terrain, meteorology, emission sources, possible chemical or physical interference, availability of services and site security. Try to co-locate meteorological monitoring equipment and ambient air monitoring equipment unless site-representative meteorological data are available from another nearby meteorological monitoring site.

3. Methods for sampling and analysis

Analyses should be carried out by a laboratory accredited to perform them by an independent accreditation body acceptable to the EPA, such as the National Association of Testing Authorities (NATA).

Methods approved by the EPA for specific analytes and parameters are listed in Tables 1 to 3. In most cases, standard methods are referenced, with additional guidance or clarification given if needed. Where there is no suitable published method, a complete description of the approved method is given. Refer to Appendix X: Test method sources for the organisations that publish the approved methods.

Refer to Appendix I: Definitions and generic procedures that apply to stationary source monitoring and reporting.

Table 1: Methods for the sampling and analysis of air pollutants from stationary sources in NSW

A. Test methods (TM) prescribed for the purposes of the Protection of the Environment Operations (Clean Air) Regulation 2002, Part 4 Emission of Air Impurities from Activities and Plant

Method no.	Parameter measured	Method
TM-1	Selection of sampling positions	AS 4323.1-1995 or USEPA (2000) Method 1 under approved circumstances
TM-2	Velocity or volumetric flow rate or temperature or pressure of stack gases	USEPA (2000) Method 2 or 2C or USEPA (1999) Method 2F or 2G or 2H (as appropriate)
TM-3	Sulfuric acid mist (H_2SO_4) or sulfur trioxide (SO_3)	USEPA (2000) Method 8 (for sampling and analysis) or APHA (1998) Method 4110B (for analysis only if interference from fluorides, free ammonia and/or dimethyl aniline has been demonstrated to the satisfaction of the Chief Scientist) (as appropriate)
TM-4	Sulfur dioxide (SO_2)	USEPA (2000) Method 6 or 6A or 6B or USEPA (1996) Method 6C or ISO (1989) Method 7934 or ISO (1992) Method 7935 or ISO (1993) Method 10396 or ISO (1998) Method 11632 (as appropriate)
TM-5	Hydrogen sulfide (H_2S)	USEPA (2000) Method 11 or USEPA (2000) Method 15 or USEPA (2000) Method 16 or Environment Canada (1992) Reference Method EPS1/RM/6 (as appropriate)
TM-6	Sulfur (S) in petroleum products	ASTM (2002) D4294-02 or ASTM (1998) D2622-98 or ASTM (2000) D129-00 (as appropriate)
TM-7	Chlorine (Cl_2)	USEPA (2000) 26A
TM-8	Hydrogen chloride (HCl)	USEPA (2000) 26A
TM-9	Fluorine (F_2) or any compound containing fluorine, except where emitted by a primary aluminium	USEPA (2000) Method 13A or 13B (as appropriate)

Method no.	Parameter measured	Method
	smelter while manufacturing aluminium from alumina	
TM-10	Hydrogen fluoride (HF) emitted by a primary aluminium smelter while manufacturing aluminium from alumina	USEPA (2000) Method 14 or USEPA (1997) Method 14A (as appropriate)
TM-11	Nitrogen dioxide (NO_2) or nitric oxide (NO)	USEPA (2000) Method 7 or 7A or 7B or 7C or 7D or USEPA (1990) Method 7E or USEPA (1996) Method 20 or ISO (1993) Method 10396 (as appropriate). NO_x analysers may be substituted in Method 7E provided the performance specifications of the method are met. Both NO and NO_x must be directly measured.
TM-12	Type 1 substances (elements antimony (Sb), arsenic (As), cadmium (Cd), lead (Pb) or mercury (Hg) or any compound containing one or more of those elements)	USEPA (2000) Method 29 or USEPA (2000) Method 102 (for mercury only in hydrogen rich streams) (as appropriate)
TM-13	Type 2 substances (elements beryllium (Be), chromium (Cr), cobalt (Co), manganese (Mn), nickel (Ni), selenium (Se), tin (Sn) or vanadium (V) or any compound containing one or more of those elements)	USEPA (2000) Method 29 (Analysis for tin and vanadium to be done by Inductively Coupled Argon Plasma Emission Spectroscopy (ICAP) as defined in USEPA Method 29) or USEPA (1986) Method 7910 (for vanadium only) or USEPA (1986) Method 7911 (for vanadium only) (as appropriate)
TM-14	Cadmium (Cd) or mercury (Hg) or any compound containing one or more of those elements	USEPA (2000) Method 29 or USEPA (2000) Method 102 (for mercury only in hydrogen rich streams) (as appropriate)
TM-15	Solid particles (Total)	AS 4323.2-1995 or USEPA (2000) Method 5 under approved circumstances
TM-16	Smoke (if determining whether a specified Ringelmann standard has been exceeded)	AS 3543-1989
TM-18	Dioxins or furans	USEPA (1995) Method 23 (Duration of sampling must be between 6 and 16 hours. Several discrete samples may be taken such that the total sampling time is within the specified range but sampling time for each point must comply with TM-15)
TM-19	Volatile organic liquids: total mass of unburnt organic vapours, displaced by the transfer of volatile organic liquids from vapour disposal units	Appendix II: Test method 19
TM-20	Volatile organic liquids: total mass of unrecovered organic vapours, displaced by the transfer of volatile organic liquids from vapour recovery units	Appendix III: Test method 20

Method no.	Parameter measured	Method
TM-21	Volatile organic liquids: calculation of vapour pressure	Appendix IV: Test method 21
TM-22	Moisture content in stack gases	USEPA (2000) Method 4
TM-23	Dry gas density or molecular weight of stack gases	USEPA (2000) Method 3
TM-24	Carbon dioxide (CO_2) in stack gases	USEPA (1990) Method 3A
TM-25	Oxygen (O_2) in stack gases	USEPA (1990) Method 3A
TM-32 (formerly OM-1)	Carbon monoxide (CO)	USEPA (1996) Method 10
TM-33	Total reduced sulfides (TRS)	USEPA (2000) Method 16A or 16B (as appropriate)
TM-34 (formerly OM-2)	Volatile organic compounds	USEPA (2000) Method 18 or USEPA (2000) Method 25 or 25A or 25B or 25C or 25D or 25E (as appropriate)
TM-35	Methanol	USEPA (1997) Method 308
TM-37	Smoke (if determining whether standard for emission of smoke from flares has been exceeded)	USEPA (2000) Method 22
TM-38	Combination of air impurities from two or more sources	Appendix VIII: Test method 38

B. Continuous emission monitoring methods (CEM) prescribed for the purposes of the Protection of the Environment Operations (Clean Air) Regulation 2002, Part 4 Emission of Air Impurities from Activities and Plant

Method no.	Parameter measured	Method
CEM-1	Smoke (if detemining whether a specified standard of concentration of opacity has been exceeded)	USEPA (2000) Performance Specification 1
CEM-2	Sulfur dioxide (SO_2) or nitrogen dioxide (NO_2) or nitric oxide (NO)	USEPA (2000) Performance Specification 2
CEM-3	Oxygen (O_2) or carbon dioxide (CO_2) in stack gases	USEPA (2000) Performance Specification 3
CEM-4	Carbon monoxide (CO)	USEPA (2000) Performance Specification 4
CEM-5	Total reduced sulfides (TRS)	USEPA (2000) Performance Specification 5
CEM-6	Velocity or volumetric flow rate of stack gases	USEPA (2000) Performance Specification 6
CEM-7	Hydrogen sulfide (H_2S)	USEPA (2000) Performance Specification 7
CEM-8	Volatile organic compounds or methanol	USEPA (2000) Performance Specification 8

Method no.	Parameter measured	Method
CEM-9	Volatile organic compounds or methanol	USEPA (2000) Performance Specification 9
CEM-10	Volatile organic compounds or methanol	USEPA (2000) Performance Specification 15

C. Other approved methods (OM)

Method no.	Parameter measured	Method
OM-3	Total or hexavalent chromium emissions from decorative and hard chromium electroplating and anodising operations	USEPA (2000) Method 306
OM-4	Total and hexavalent chromium emissions	California EPA Air Resources Board (1997) Method 425 or USEPA (1996) Method 0061 (as appropriate). (Method 0061 is validated for determination of hexavalent chromium from hazardous waste incinerators, municipal waste incinerators, municipal waste combustors and sewage sludge incinerators)
OM-5	'Fine' particulates (PM_{10})	USEPA (1997) Method 201 or 201A (as appropriate)
OM-6	Polycyclic aromatic hydrocarbons (PAHs)	California EPA Air Resources Board (1997) Method 429
OM-7	Odour sampling from point sources or odour analysis using dynamic olfactometry	AS 4323.3-2001
OM-8	Odour sampling from diffuse sources	USEPA (1986) EPA/600/8-8E/008
OM-9	'Coarse' particulates	Appendix IX: Other approved method 9

Note: Any other method, which has been approved by the EPA in accordance with the exceptional circumstances set out in this document as an equivalent alternative to a test method of a particular number in this document, is prescribed as a test method of that same number.

Table 2: Methods for the sampling and analysis of air pollutants from mobile sources and motor vehicle fuels in NSW

A. Test methods (TM) prescribed for the purposes of the Protection of the Environment Operations (Clean Air) Regulation 2002, Part 5 Motor Vehicles and Motor Vehicle Fuels

Method no.	Parameter measured	Method
TM-26	Exhaust and evaporative emissions from spark-ignition motor vehicles	Federal Office of Road Safety ADR 37/00 (1989) or ADR 37/01 (1995) (as appropriate). Refer to Appendix V: Test method 26 for additional guidance
TM-27	Lead concentration in leaded and	Appendix VI: Test method 27

Method no.	Parameter measured	Method
	unleaded petrol	
TM-28	Phosphorus concentration in unleaded petrol	ASTM (1994) D3231-94
TM-29	Research octane number of unleaded petrol	ASTM (1997) D2699-97
TM-30	Motor octane number of unleaded petrol	ASTM (1997) D2700-97
TM-31	Observation procedure for excessive air impurities: visible emissions	Appendix VII: Test method 31

Note: Any other method, which has been approved by the EPA in accordance with the exceptional circumstances set out in this document as an equivalent alternative to a test method of a particular number in this document, is prescribed as a test method of that same number.

Table 3: Methods for the sampling and analysis of ambient air pollutants in NSW

A. General methods for ambient air monitoring (AM)

Method no.	Parameter measured	Method
AM-1	Guide for the siting of sampling units	AS 2922-1987
AM-2	Guide for measurement of horizontal wind for air quality applications	AS 2923-1987
AM-3	Preparation of reference test atmospheres	AS 3580.2.1-1990 or AS 3580.2.2-1990 (as appropriate)
AM-4	Meteorological monitoring guidance for regulatory modelling applications	USEPA (2000) EPA 454/R-99-005

B. Specific methods for ambient air monitoring (AM)

Method no.	Parameter measured	Method
AM-5	Acid gases	AS 3580.3.1-1990
AM-6	Carbon monoxide	AS 3580.7.1-1992
AM-7	Fluorides – automated, double paper tape sampling method	AS 3580.13.1-1993
AM-8	Fluorides – manual, double filter paper sampling method	AS 3580.13.2-1991
AM-9	Fluorides –sodium acetate coated tube absorption method	AS 3580.13.3-1993
AM-10	Hydrogen sulfide	AS 3580.8.1-1990
AM-11	Lead – particulate collection by high-volume sampler	AS 2800-1985

Method no.	Parameter measured	Method
AM-12	Nitrogen oxides	AS 3580.5.1-1993
AM-13	Ozone	AS 3580.6.1-1990
AM-14	Particulate matter – suspended matter – filter paper soiling method	AS 2724.2-1987
AM-15	Particulate matter – TSP – high-volume sampler method	AS 2724.3-1984
AM-16	Particulate matter – light scattering – integrating nephelometer method	AS 2724.4-1987
AM-17	Particulate matter – impinged matter – directional dust gauge method	AS 2724.5-1987
AM-18	Particulate matter – PM_{10} – high-volume sampler with size-selective inlet	AS 3580.9.6-1990
AM-19	Particulates – deposited matter – gravimetric method	AS 3580.10.1-1991
AM-20	Sulfur dioxide	AS 3580.4.1-1990
AM-21	Volatile organic compounds	AS 3580.11.1-1993
AM-22	Particulate matter – PM_{10} – TEOM	AS 3580.9.8-2001

Note: Any other method, which has been approved by the EPA in accordance with the exceptional circumstances set out in this document as an equivalent alternative to a test method of a particular number in this document, is prescribed as a test method of that same number

4. Analytical report

Stationary source monitoring

The results of any monitoring required by a statutory instrument must be provided as a summary report signed by the licence holder or, where there is no licence, by the person required to provide the report. The report must contain at least the following information for each air contaminant, unless the statutory instrument states otherwise:

- name and address of reporting organisation or individual
- date of issue of the report
- date, time and place of measurements
- identification of source tested
- the test method used and details of any deviation from that method
- details of source or process operating conditions during sampling and a statement about the representativeness of the sample taken
- location of sampling plane, with respect to the nearest upstream and downstream flow disturbances
- number of sampling points
- period of sampling (start and end times)
- average stack gas velocity in metres per second
- average stack gas temperature in kelvins
- contaminant molecular weight or density in kilograms per cubic metre
- water content of stack gas, expressed as a percentage by volume
- stack gas volumetric flow rate on a dry basis under standard conditions, in cubic metres per second
- concentration of contaminant on a dry basis under standard conditions, in grams per cubic metre
- mass emission rate of contaminant on a dry basis under standard conditions, in grams per second
- details of sample preservation, if applicable
- any factors that may have affected the monitoring results
- the precision of the results (using AS 2706 as a guide)
- details of the most recent calibration of each instrument used to take measurements.

If an air contaminant cannot be detected, results must not be quoted as zero but as less than the method's limit of detection.

All volumes and concentrations are normally reported as dry at a temperature of 0°C and at an absolute pressure of 101.3 kilopascals (kPa). The EPA's monitoring requirements may also specify a reference gas level to which the result must be corrected.

Ambient air monitoring

The results of any monitoring required by a statutory instrument must be provided as a summary report signed by the licence holder or, where there is no licence, by the person required to provide the report. The report must contain at least the following information for each air contaminant, unless the statutory instrument states otherwise:

- name and address of reporting organisation or individual
- date of issue of the report
- the test method used and details of any deviation from that method
- period of monitoring (start and end dates and percentage of time the instruments were on-line)
- location of monitoring points (normal address and Australian Map Grid reference, height above nominal ground level, and a description of the terrain features)
- the air pollutants measured, the monitoring instruments used, and a description of the air sampling system
- maximum hourly average concentration, daily average concentration, and appropriate longer-term averages
- appropriate statistical information to describe the variability and range of the concentrations
- any factors that may have affected the monitoring results
- the precision of the results (using AS 2706 as a guide)
- details of the most recent calibration of each instrument used to take measurements.

5. References

American Public Health Association

APHA 1998, **Method 4110B** – Determination of anions by ion chromatography: Ion chromotography with chemical suppression of eluent conductivity, Standard Methods for the Examination of Water and Wastewater, 20th Edition.

American Society for Testing and Materials

ASTM 1994, **D3231-94**: Standard test method for phosphorus in gasoline, American Society for Testing and Materials, West Conshohocken, PA.

ASTM 2000, **D129-00**: Standard test method for sulfur in petroleum products (general bomb method), American Society for Testing and Materials, West Conshohocken, PA.

ASTM 1997, **D2699-97**: Standard test method for research octane number of spark-ignition engine fuel, American Society for Testing and Materials, West Conshohocken, PA.

ASTM 1997, **D2700-97**: Standard test method for motor octane number of spark-ignition engine fuel, American Society for Testing and Materials, West Conshohocken, PA.

ASTM 1997, **D3237-97**: Standard test method for lead in gasoline by atomic absorption spectroscopy, American Society for Testing and Materials, West Conshohocken, PA.

ASTM 1998, **D2622-98**: Test method for sulfur in petroleum products (X-ray spectrographic method), American Society for Testing and Materials, West Conshohocken, PA.

ASTM 2002, **D4294-02**: Standard test method for sulfur in petroleum products by energy-dispersive X-ray fluorescence spectroscopy, American Society for Testing and Materials, West Conshohocken, PA.

California Environmental Protection Agency Air Resources Board

California Environmental Protection Agency Air Resources Board 1997, **Method 425**: Determination of total chromium emissions from stationary sources, Sacramento, CA.

California Environmental Protection Agency Air Resources Board 1997, **Method 429**: Polycyclic aromatic hydrocarbon (PAH) emissions from stationary sources, Sacramento, CA.

Environment Canada

Environment Canada 1992, **Reference Method EPS1/RM/6**: Reference method for source testing – Measurement of releases of Total Reduced Sulphur (TRS) compounds from pulp and paper operations.

Federal Office of Road Safety

Federal Office of Road Safety 1989, **Australian Design Rule 37/00**: Emission control for light vehicles, Canberra.

Federal Office of Road Safety 1995, **Australian Design Rule 37/01**: Emission control for light vehicles, Canberra.

International Standard Organisation

International Standard Organisation, **ISO (1989) Method 7934**: Stationary source emissions – Determination of mass concentration of sulphur dioxide – Hydrogen peroxide/barium perchlorate/thorin method.

International Standard Organisation, **ISO (1992) Method 7935**: Stationary source emissions – Determination of the mass concentration of sulphur dioxide – Performance characteristics of automated measuring methods.

International Standard Organisation, **ISO (1993) Method 10396**: Stationary source emissions – Sampling for the automated determination of gas concentrations.

International Standard Organisation, **ISO (1998) Method 11632**: Stationary source emissions – Determination of mass concentration of sulphur dioxide – Ion chromatography method.

Standards Association of Australia 1984–89

Standards Association of Australia 1984, **AS 2724.3–1984**: Particulate matter – determination of total suspended particulates (TSP) – high volume sampler gravimetric method, Homebush, NSW.

Standards Association of Australia 1985, **AS 2800–1985**: Particulate lead – high volume sampler gravimetric collection – flame atomic absorption spectrometric method, Homebush, NSW.

Standards Association of Australia 1987, **AS 2724.2–1987**: Particulate matter – determination of suspended matter expressed as equivalent black smoke by filter paper soiling, Homebush, NSW.

Standards Association of Australia 1987, **AS 2724.4–1987**: Particulate matter – determination of light scattering – integrating nephelometer method, Homebush, NSW.

Standards Association of Australia 1987, **AS 2724.5–1987**: Particulate matter – determination of impinged matter expressed as directional dirtiness, background dirtiness and/or area dirtiness (directional dust gauge method), Homebush, NSW.

Standards Association of Australia 1987, **AS 2922–1987**: Guide for the siting of sampling units, Homebush, NSW.

Standards Association of Australia 1987, **AS 2923–1987**: Guide for measurement of horizontal wind for air quality applications, Homebush, NSW.

Standards Association of Australia 1989, **AS 3543–1989**: Use of standard Ringelmann and Australian Standard miniature smoke charts, Homebush, NSW.

Standards Association of Australia 1990

Standards Association of Australia 1990, **AS 1876–1990**: Petrol (gasoline) for motor vehicles, Homebush, NSW.

Standards Association of Australia 1990, **AS 3580.2.1–1990**: Preparation of reference test atmospheres – permeation tube method, Homebush, NSW.

Standards Association of Australia 1990, **AS 3580.2.2–1990**: Preparation of reference test atmospheres – compressed gas method, Homebush, NSW.

Standards Association of Australia 1990, **AS 3580.3.1–1990**: Acid gases – titrimetric method, Homebush, NSW.

Standards Association of Australia 1990, **AS 3580.4.1–1990**: Sulfur dioxide – direct reading instrumental method, Homebush, NSW.

Standards Association of Australia 1990, **AS 3580.6.1–1990**: Ozone – direct-reading instrumental method, Homebush, NSW.

Standards Association of Australia 1990, **AS 3580.8.1–1990**: Hydrogen sulfide – automatic intermittent sampling – gas chromatographic method, Homebush, NSW.

Standards Association of Australia 1990, **AS 3580.9.6–1990**: Suspended particulate matter – PM_{10} high volume sampler with size-selective inlet – gravimetric method, Homebush, NSW.

Standards Association of Australia 1991–99

Standards Association of Australia 1991, **AS 3580.10.1–1991**: Particulates – deposited matter – gravimetric method, Homebush, NSW.

Standards Association of Australia 1991, **AS 3580.13.2–1991**: Fluorides – gaseous and acid-soluble particulate fluorides – manual, double filter paper sampling Homebush, NSW.

Standards Association of Australia 1992, **AS 3580.7.1–1992**: Carbon monoxide – direct-reading instrumental method, Homebush, NSW.

Standards Association of Australia 1993, **AS 3580.5.1–1993**: Oxides of nitrogen – chemiluminescence method, Homebush, NSW.

Standards Association of Australia.1993, **AS 3580.11.1–1993**: Volatile organic compounds – methane and non-methane volatile organic compounds – direct-reading instrumental method, Homebush, NSW.

Standards Association of Australia 1993, **AS 3580.13.1–1993**: Fluorides – gaseous and acid-soluble particulate fluorides – automated, double paper tape sampling, Homebush, NSW.

Standards Association of Australia 1993, **AS 3580.13.3–1993**: Fluorides – total gaseous and acid-soluble airborne particulate fluoride – sodium acetate coated tube absorption, Homebush, NSW.

Standards Association of Australia 1995, **AS 4323.1–1995**: Stationary source emission method 1 – selection of sampling positions, Homebush, NSW.

Standards Association of Australia 1995, **AS 4323.2–1995**: Stationary source emissions method 2 – determination of total particulate matter – isokinetic manual sampling – gravimetric method, Homebush, NSW.

Standards Association of Australia 1998, **AS 3570–1998**: Automotive diesel fuel, Homebush, NSW.

Standards Association of Australia 2000-01

Standards Association of Australia 2001, **AS 3580.9.8–2001**: Method for sampling and analysis of ambient air – Determination of suspended particulate matter – PM_{10} continuous direct mass method using a tapered element oscillating microbalance analyser, Homebush, NSW.

Standards Association of Australia 2001, **AS 4323.3–2001**: Stationary source emissions – method 3 – determination of odour concentration by dynamic olfactometry, Homebush, NSW.

United States Environmental Protection Agency 1986

US Environmental Protection Agency 1986, Measurement of gaseous emission rates from land surfaces using an emission isolation flux chamber, user's guide. **EPA/600/8-8E/008**, February 1986.

United States Environmental Protection Agency 2000

US Environmental Protection Agency 2000, Meteorological monitoring guidance for regulatory modelling applications, Office of Air Quality Planning and Standards, Research Triangle Park, NC. **EPA 454/R-99-005**.

USEPA Method 0061

US Environmental Protection Agency 1996, **Method 0061**: Determination of hexavalent chromium emissions from stationary sources (Revision 0, December, 1996), Test methods for evaluating solid waste, 3rd edition, 1986 (SW-846), Office of Solid Waste and Emergency Response, Washington, DC.

USEPA Method 102

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 102**: Determination of particulate and gaseous mercury emissions from chlor-alkali plants (hydrogen streams), Washington, DC.

USEPA Method 201

US Environmental Protection Agency 1997, Code of Federal Regulations, Title 40, Part 51, Appendix M, **Method 201**: Determination of PM_{10} emissions (exhaust gas recycle procedure), Washington, DC.

US Environmental Protection Agency 1997, Code of Federal Regulations, Title 40, Part 51, Appendix M, **Method 201A**: Determination of PM_{10} emissions (constant sampling rate procedure), Washington, DC.

USEPA Method 301

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 301**: Field validation of pollutant measurement methods from various waste media, Washington, DC.

USEPA Method 306

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 63, Appendix A, **Method 306**: Determination of chromium emissions from decorative and hard chromium electroplating and anodizing operations, Washington, DC.

USEPA Method 308

US Environmental Protection Agency 1997, Code of Federal Regulations, Title 40, Part 63, Appendix A, **Method 308**: Procedure for determination of methanol emissions from stationary sources, Washington, DC.

USEPA Methods 7910–7911

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 7910**: Vanadium (atomic absorption, direct aspiration) , Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A. **Method 7911**: Vanadium (atomic absorption, furnace technique), Washington, DC.

USEPA Methods 1–9

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 1**: Sample and velocity traverses for stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 2**: Determination of stack gas velocity and volumetric flow rate (type S pitot tube), Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 2C**: Determination of stack gas velocity and volumetric flow rate from small stacks or ducts (standard pitot tube), Washington, DC.

US Environmental Protection Agency 1999, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 2F**: Determination of stack gas velocity and volumetric flow rate with three-dimensional probes, Washington, DC.

US Environmental Protection Agency 1999, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 2G**: Determination of stack gas velocity and volumetric flow rate with two-dimensional probes, Washington, DC.

US Environmental Protection Agency 1999, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 2H**: Determination of stack gas velocity taking into account velocity decay rate near the stack wall, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 3**: Gas analysis for the determination of dry molecular weight, Washington, DC.

US Environmental Protection Agency 1990, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 3A**: Determination of oxygen and carbon dioxide concentrations in emissions from stationary sources (instrumental analyzer procedure), Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 4**: Determination of moisture content in stack gases, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 5**: Determination of particulate emissions from stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 6**: Determination of sulfur dioxide emissions from stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 6A**: Determination of sulfur dioxide, moisture, and carbon dioxide emissions from fossil-fuel combustion sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 6B**: Determination of sulfur dioxide and carbon dioxide daily average emissions from fossil-fuel combustion sources, Washington, DC.

US Environmental Protection Agency 1996, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 6C**: Determination of sulfur dioxide emissions from stationary sources (instrumental analyzer procedure), Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 7**: Determination of nitrogen oxide emissions from stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 7A**: Determination of nitrogen oxide emissions from stationary sources (ion chromatographic method), Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 7B**: Determination of nitrogen oxide emissions from stationary sources (ultraviolet spectrophotometry), Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 7C**: Determination of nitrogen oxide emissions from stationary sources (alkaline-permanganate/colorimetric method), Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 7D**: Determination of nitrogen oxide emissions from stationary sources (alkaline-permanganate/ion chromatographic method), Washington, DC.

US Environmental Protection Agency 1990, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 7E**: Determination of nitrogen oxide emissions from stationary sources (instrumental analyzer procedure), Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 8**: Determination of sulfuric acid mist and sulfur dioxide emissions from stationary sources, Washington, DC.

USEPA Methods 10–19

US Environmental Protection Agency 1996, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 10**: Determination of carbon monoxide emissions from stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 11**: Determination of hydrogen sulfide content of fuel gas streams in petroleum refineries, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 13A**: Determination of total fluoride emissions from stationary sources (SPADNS zirconium lake method), Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 13B**: Determination of total fluoride emissions from stationary sources (specific ion electrode method), Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 14**: Determination of fluoride emissions from roof monitors for primary aluminum plants, Washington, DC.

US Environmental Protection Agency 1997, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 14A**: Determination of total fluoride emissions from selected sources at primary aluminum production facilities, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 15**: Determination of hydrogen sulfide, carbonyl sulfide and carbon disulfide emissions from stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 16**: Semicontinuous determination of sulfur emissions from stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 16A**: Determination of total reduced sulfur emissions from stationary sources (impinger technique), Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 16B**: Determination of total reduced sulfur emissions from stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 18**: Measurement of gaseous organic compound emissions by gas chromatography, Washington, DC.

USEPA Methods 20–29

US Environmental Protection Agency 1996, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 20**: Determination of nitrogen oxides, sulfur dioxide and oxygen emissions from stationary gas turbines, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 22**: Visual determination of fugitive emissions from material sources and smoke emissions from flares, Washington, DC.

US Environmental Protection Agency 1995, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 23**: Determination of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans from stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 25**: Determination of total gaseous non-methane organic emissions as carbon, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 25A**: Determination of total gaseous organic concentrations using a flame ionization analyser, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 25B**: Determination of total gaseous organic concentrations using a nondispersive infrared analyser, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 25C**: Determination of non-methane organic compounds (NMOC) in MSW landfill gases, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 25D**: Determination of the volatile organic concentration of waste samples, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 25E**: Determination of vapor phase organic concentration in waste samples, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 26**: Determination of hydrogen chloride emissions from stationary sources – isokinetic method, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 26A**: Determination of hydrogen halide and halogen emissions from stationary sources – isokinetic method, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix A, **Method 29**: Determination of metal emissions from stationary sources, Washington, DC.

USEPA Performance Specifications 1–9 & 15

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix B, **Performance Specification 1 –** Specifications and test procedures for opacity continuous emission monitoring systems in stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix B, **Performance Specification 2 –** Specifications and test procedures for SO_2 and NO_x continuous emission monitoring systems in stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix B, **Performance Specification 3 –** Specifications and test procedures for O_2 and CO_2 continuous emission monitoring systems in stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix B, **Performance Specification 4 –** Specifications and test procedures for CO continuous emission monitoring systems in stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix B, **Performance Specification 5 –** Specifications and test procedures for TRS continuous emission monitoring systems in stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix B, **Performance Specification 6 –** Specifications and test procedures for flow rate continuous emission monitoring systems in stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix B, **Performance Specification 7 –** Specifications and test procedures for H_2S continuous emission monitoring systems in stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix B, **Performance Specification 8 –** Specifications and test procedures for VOC continuous emission monitoring systems in stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix B, **Performance Specification 9 –** Specifications and test procedures for gas chromatographic continuous emission monitoring systems in stationary sources, Washington, DC.

US Environmental Protection Agency 2000, Code of Federal Regulations, Title 40, Part 60, Appendix B, **Performance Specification 15 –** Performance specification for extractive FTIR continuous emission monitoring systems in stationary sources, Washington, DC.

Appendix I:
Definitions and generic procedures that apply to stationary source monitoring and reporting

Cubic metre (m^3)

In this document a cubic metre (m^3) refers to the volume of dry gas that occupies 1 m^3 at a temperature of 0°C (273 K) and at an absolute pressure equivalent to 1 atmosphere (101.3 kPa)

Measuring concentrations and volumes in gases

When reporting concentrations of pollutants in gases for comparison with emission standards or with limits in regulations, licences, approvals, statutory notices, guidelines, codes of practice or environmental management plans, you must use the following conversions. However, where any of these conversions are part of the test method used to determine the concentration, they do not need to be repeated for reporting.

The test method for a pollutant gives the volume of gas sampled at the test conditions (i.e. moisture, temperature, pressure, oxygen and carbon dioxide, etc.) at the sample point, V_a.

Adjustment to reference conditions

1. Dry basis

Calculate the volume of dry gas at sample point conditions (V_b):

$$V_b = V_a \times (100 - MC) \div 100$$

2. Standard temperature

Calculate the volume of dry gas at standard temperature (273 K) (V_c):

$$V_c = V_b \times 273 \div (273 + \text{gas meter temperature in °C})$$

3. Standard pressure

Calculate the volume of dry gas at standard pressure (101.3 kPa) (V_d):

$$V_d = V_c \times (\text{gas meter pressure in kPa}) \div 101.3$$

4. Determine concentration as dry basis, standard temperature and standard pressure

Divide the measured mass of pollutant (M_a) by V_d to determine the concentration (C_a):

$$C_a = M_a \div V_d$$

5. Oxygen

For adjustment to an oxygen reference, the adjusted concentration of a pollutant, C_b, is determined by:

$$C_b = C_a \times (21 - \text{reference oxygen concentration as volume \%}) \div (21 - \text{measured oxygen concentration as volume \%})$$

where:

C_a = the measured concentration of the pollutant, reported at the standard reference conditions

6. Carbon dioxide

For adjustment to a carbon dioxide reference, the adjusted concentration of a pollutant, C_c, is determined by:

$C_c = C_a \times 12 \div$ measured carbon dioxide concentration as volume %

where:

C_a = the measured concentration of the pollutant, reported at the standard reference conditions

7. Nitrogen dioxide

Oxides of nitrogen (NO_x) from combustion of fossil fuels consist predominantly of nitric oxide (NO) and nitrogen dioxide (NO_2). Oxides of nitrogen concentrations are converted to equivalent NO_2 as follows:

Equivalent NO_2 = calculated NO_2 + (measured NO $\times 46 \div 30$)

where:

calculated NO_2 = measured NO_x – measured NO

46 = molecular weight of NO_2

30 = molecular weight of NO

Both NO and NO_x must be measured directly.

Conversion from volume- to mass-based units of concentration

Equation 1: Ideal gas law

The physical state of gaseous air pollutants at environmental concentrations may be described by the ideal gas law, as follows:

$P \times V = n \times R \times T$

where:

P = absolute pressure of gas (atm)

V = volume of gas (L)

N = number of moles of gas (mol)

R = universal gas constant (L.atm/mol.K)

T = absolute temperature (K)

Equation 2

The number of moles (n) may be calculated from the mass of a pollutant (m) and its molecular weight (MW) as follows:

$n = m/MW$

Equation 3

Substituting Equation 2 into Equation 1 and rearranging terms yields:

$V = m \times R \times T/P \times MW$

Equation 4

Parts per million (ppm) refers to the volume of pollutant (V) per million volumes of air (A):

$ppm = V/A \times 10^6$

Equation 5: Conversion from volume-to mass-based units of concentration

Substituting Equation 3 into Equation 4 yields:

$$ppm = \frac{m}{A}\frac{R \times T}{P \times MW \times 10^6}$$

Using the appropriate values for the variables in Equation 5, a conversion from volume to mass based units of concentration for carbon monoxide may be derived as shown below:

T = 298.15 K (25 °C)

P = 1 atm

MW = 28 g/mol

R = 0.08205 L.atm/mol.K

$$ppm = \frac{m(g) \times 10^3 (mg/g)}{A(l)} \times \frac{0.08205 (L.atm/mol.K) \times 298.15 (K)}{1(atm) \times 28 (g/mol) \times 10^6}$$

1 ppm = 1.15 mg/m^3

1 mg/m^3 = 0.873 ppm

Conversions at 273 K and 1 atmosphere

C (mg/m^3) = C (ppm) × (MW/22.4)

C (ppm) = C (mg/m^3) × (22.4/MW)

where:

C = concentration

MW = molecular weight

22.4 = the volume of one litre of air at 1 atmosphere and 273 K

Volatile organic compounds

Calculation of VOC as n-propane equivalent on a mass basis

VOC as n-propane equivalent is the sum of the concentrations of each individual VOC species which are measured by a GC, or a similar method, and corrected to VOC as n-propane equivalent.

If speciated gaseous non-methane organics (SGNMO) have been measured using TM-34 (USEPA (2000) Method 18), use the following procedure to convert the concentration of each individual VOC species to VOC as n-propane equivalent:

$$C_{VOC} = \sum_{i=1}^{N} \left(C_i \div MW_i \times 44 \right)$$

where:

C_{VOC} = the calculated concentration of VOC as n-propane equivalent in mg/m^3 (dry, 273 K, 101.3 kPa)

C_i = the measured concentration of each individual VOC species in mg/m^3 (dry, 273 K, 101.3 kPa)

MW_i = the molecular weight of each individual VOC species in g/mol

44 = the molecular weight of n-propane in g/mol

Calculation of TOC equivalent on a mass basis

Total organic carbon (TOC) equivalent is the sum of the concentrations of each individual VOC species which are measured by a GC, or a similar method, and corrected to TOC equivalent.

If speciated gaseous non-methane organics (SGNMO) have been measured using TM-34 (USEPA (2000) Method 18), use the following procedure to convert the concentration of each individual VOC species to TOC equivalent:

$$C_{TOC} = \sum_{i=1}^{N} \left((C_i \div MW_i) \times (K_i \times 12) \right)$$

where:

C_{TOC} = the calculated concentration of TOC in mg/m^3 (dry, 273 K, 101.3 kPa)

C_i = the measured concentration of each individual VOC species in mg/m^3 (dry, 273 K, 101.3 kPa)

MW_i = the molecular weight of each individual VOC species in g/mol

K_i = the carbon correction factor (number of carbons in the molecule) for each species

Conversion of total VOC as n-propane equivalent to TOC equivalent on a volume basis

TOC equivalent is a measure of the amount of gaseous or vapour phase organic carbon which is measured by a FID, or similar method, and expressed as TOC equivalent.

If total gaseous non-methane organics (TGNMO) have been measured using TM-34 (USEPA (2000) Method 25 or 25A or 25B or 25C or 25D or 25E), use the following procedure to convert VOC as n-propane equivalent (or other calibrating gas) to total organic carbon (TOC) equivalent and vice versa:

$$C_{TOC} = K \times C_{VOC}$$

where:

C_{TOC} = the calculated concentration of TOC as carbon equivalent in ppmv

C_{VOC} = the measured concentration of VOC as n-propane equivalent (or other calibrating gas) in ppmv

K = the carbon equivalent correction factor (This is the number of carbons in the molecule and has a value of 3 if n-propane is used as the calibrating gas. An appropriate carbon equivalent correction factor should be selected if a calibrating gas other than n-propane is used.)

Conversion of TOC equivalent on a volume basis to TOC equivalent on a mass basis

$$C_{TOC}\ (mg/m^3) = C_{TOC}\ (ppm) \times (12/22.4)$$

where:

C_{TOC} = the concentration of TOC as total organic carbon equivalent

12 = the molecular weight of carbon

22.4 = the volume of one litre of air at 1 atmosphere and 273 K

Appendix II:
Test method 19 – Determination of total mass of unburnt organic vapours from vapour disposal units

Sampling

Draw the exhaust gases through a 316 stainless steel probe to a sample line of PTFE or 316 stainless steel held at a temperature of at least 105°C.

Pass the exhaust gases to a device capable of reducing the moisture content of the gases to a dew point of less than 3°C. Filter the sample gases to remove entrained particles.

Analysis

Pass the conditioned sample gases to the following two analysers.

Hydrocarbon analyser (flame ionisation detector type)

Set the analyser to zero with air that has a hydrocarbon concentration of less than 10 ppm by volume of propane. Calibrate it with a gas of known propane concentration to give a deflection of between 20% and 90% of full scale on the range being used.

The average of the indicated concentration of hydrocarbons in the conditioned sample gases must lie between 30% and 90% of full-scale deflection of the analyser. The combined effects of carbon dioxide and carbon monoxide in the gases must not affect the reading by more than 2% of full-scale deflection. The deviation from linear response of the analyser must not exceed 2.5% of full-scale deflection.

Carbon dioxide analyser (non-dispersive infrared type)

Set the analyser to zero with nitrogen that has a carbon dioxide concentration of less than 0.05% by volume. Calibrate it with a gas of known carbon dioxide concentration to give a deflection of between 20% and 90% of full scale on the range being used.

The analyser must have a full-scale range for carbon dioxide concentration lying between 0% and 14% and 0% and 20% by volume. The deviation from linear response of the analyser must not exceed 2.5% of full-scale deflection.

Calculation of mass of unburnt organic vapours

The mass of unburnt organic vapours in each cubic metre of the exhaust gases is equal to:

$$C \div (42.3 \times L) \text{ grams}$$

where:

C = the average concentration of hydrocarbons measured as equivalent propane in ppm over the test period
42.3 = a conversion factor
L = the average concentration of carbon dioxide content expressed as a percentage of sample gases

Appendix III:
Test method 20 – Determination of total mass of unrecovered organic vapours from vapour recovery units

Sampling

Draw the exhaust gases through a sample line of PTFE or 316 stainless steel construction. Pass them to a hydrocarbon analyser (flame ionisation detector type).

Analysis

Set the analyser to zero with air that has a hydrocarbon concentration of less than 10 ppm by volume of propane. Calibrate the analyser with a gas of known propane concentration to give a deflection of between 20% and 90% of full scale on the range being used.

The average of the indicated concentration of hydrocarbons in the exhaust gases must lie between 30% and 90% of full-scale deflection of the analyser. The combined effects of carbon dioxide and carbon monoxide in the gases must not affect the reading by more than 2% of full-scale deflection. The deviation from linear response of the analyser shall not exceed 2.5% of full-scale deflection.

Calculation of mass of unrecovered organic vapours

The mass of unrecovered organic vapours emitted for each litre of organic liquid is:

$$(318 \times C \times A \times M \times P \times V) \div (L \times T) \text{ milligrams}$$

where:

C = the average concentration of hydrocarbons expressed as equivalent propane in ppm over the test period

A = the cross-sectional area of the exhaust duct at the plane where the measurements are made in m^2

M = the total time for organic liquid to pass into the tank or out of the industrial plant in minutes

P = the atmospheric pressure in kPa

V = the average exhaust gas velocity in metres per second

L = the volume of organic liquid passing into the tank or out of the industrial plant in litres

T = the average exhaust gas temperature in kelvins (273 + temperature in °C)

318 = a conversion factor

Appendix IV:
Test method 21 – Calculation of vapour pressure

A volatile organic liquid for which the Reid vapour pressure may be ascertained shall be deemed to have a vapour pressure exceeding 75 kilopascals if the maximum bulk storage temperature of the liquid is greater than the temperature specified in Column 2 of the table below corresponding to the Reid vapour pressure of the liquid specified in Column 1.

Where the Reid vapour pressure of the liquid lies between two adjacent values specified in Column 1 of the table, the corresponding temperature may be calculated as though a linear relationship existed between the Reid vapour pressure and the temperature at and between those two values.

Where the Reid vapour pressure of the liquid lies outside the values specified in Column 1 of the table or cannot be determined, the vapour pressure of the liquid shall be calculated by such methods as the EPA may determine.

Column 1 Reid vapour pressure (kPa)	Column 2 Temperature (°C)
50	49
60	43
70	38
80	33
90	29
100	26

Appendix V:
Test method 26 – Exhaust and evaporative emissions from spark-ignition motor vehicles

Testing must be carried out in accordance with the test procedures appropriate for the category of vehicle being tested and its date of manufacture specified in ADR 37/00 or ADR 37/01, *Emission Control for Light Vehicles*. Special conditions apply, as detailed below.

A reference here to components applies only to those components related to the emission performance of the motor vehicle being tested.

1. Compliance testing of new petrol-powered light vehicles

- Test the vehicle in the condition in which it is presented for testing (no tuning or special stabilisation distance run-in) unless the manufacturer or its agent requests special preparations to be made before testing.
- In evaporative emissions testing of a vehicle less than 56 days after it was manufactured, the Clean Air (Motor Vehicles and Motor Vehicle Fuels) Regulation 1997 allows for 1 to 3 g of hydrocarbon emissions emanating from sources other than the fuel system of the vehicle.

2. Compliance testing of in-service petrol-powered light vehicles up to five years old or with 80,000 km accumulated

- The engine of the vehicle must be tuned to the manufacturer’s specifications.
- Where components originally fitted to the vehicle have been removed, disabled or tampered with, they must be replaced or repaired before testing.
- Components that are faulty or broken through normal use of the vehicle must not be replaced or repaired before testing.
- Components whose performance has deteriorated through normal use must not be replaced before testing.

3. Compliance testing of in-service dual-fuel (petrol/LPG) light vehicles up to five years old or with 80,000 km accumulated, operating on liquefied petroleum gas (LPG)

- All conditions in 2 (above) apply.
- Do not conduct the evaporative emission testing procedure.
- Do not apply any heat source to the vehicle’s LPG storage container(s) during testing.
- Use LPG consisting of 50% butane and 50% propane. If this is not available, use commercially available LPG.

4. Compliance testing of in-service dual-fuel (petrol/LPG) light vehicles up to five years old or with 80,000 km accumulated, operating on petrol

- All conditions in 2 (above) apply.
- Do not apply any heat source to the vehicle’s LPG storage container(s) during testing.

5. Compliance testing of in-service dual-fuel (petrol/CNG) light vehicles up to five years old or with 80,000 km accumulated, operating on compressed natural gas (CNG)

- All conditions in 2 (above) apply.
- Do not conduct the evaporative emission testing procedure.
- Do not apply any heat source to the vehicle's CNG storage container(s) during testing.
- Use commercially available CNG for this test.

6. Compliance testing of in-service dual-fuel (petrol/CNG) light vehicles up to five years old or with 80,000 km accumulated, operating on petrol

- All conditions in 2 (above) apply.
- Do not apply any heat source to the vehicle's CNG storage container(s) during testing.

Appendix VI:
Test method 27 – Lead concentration in leaded and unleaded petrol

The lead in all petrol must be determined with this test method. The method was developed by the EPA from the standard test methods AS 1876-1990 *Petrol (Gasoline) for Motor Vehicles* and ASTM D3237-97 *Standard Test Method for Lead in Gasoline by Atomic Absorption Spectrometry.*

Applicability

This method is independent of the lead alkyl type and should be used to sample from bowsers, tanks, delivery tanks, tank vehicles, motor vehicles and pipelines.

Principle

The petrol sample is diluted with methyl isobutyl ketone, and the alkyl lead compounds are stabilised by reaction with iodine and a quaternary ammonium salt. The lead content of the sample is determined by atomic absorption flame spectrophotometry at 283 nm. Standards prepared from reagent-grade lead chloride are used for calibration.

Range

Lead concentrations in the range 0.005 to 1 g/L can be determined. Higher lead concentrations require dilution with iso-octane before analysis.

Sampling and storage

Containers for samples

Sampling containers must be metal cans with welded side seams and a minimum capacity of 250 mL. Each container must have an opening at the top of 30 to 50 mm in diameter. The top must be sealed with a vapour-tight screw cap.

Number of samples

Take two samples of the petrol to be tested and analyse the lead content of each. If requested, leave a third sealed sample with the owner or the person in charge.

Sampling from a bowser

Pour the petrol directly from the nozzle of the bowser hose into the top opening of the sample container. Fill the container to near capacity.

Sampling from other sources

Take a representative sample. Pour it into a sample container for transport.

Storage

Store samples at 0° to 8°C. Bring them to room temperature before analysis.

Cleaning procedures

Rinse the sampling containers with acetone (propanone) or iso-octane. Dry them in a drying cabinet at 40°C or higher.

Reagents

- MIBK: methyl isobutyl ketone (4-methyl-2-pentanone) (AR grade).
- Iodine solution: Dissolve 3.0 g AR grade iodine in AR grade toluene and dilute to 100 mL with the toluene. Store in a brown glass bottle.
- Aliquat 336: Tricapryl methyl ammonium chloride.
- 10% Aliquat 336/MIBK solution: Dilute 100 mL of Aliquat 336 to 1 L with MIBK.
- 1% Aliquat 336/MIBK Solution: Dilute 10 mL of Aliquat 336 to 1 L with MIBK.
- Lead chloride: At least 99% pure.
- Stock lead solution (2000 mg/L): Dry lead chloride at 105° ± 5°C for 3 hours. Dissolve 0.6711 g in about 200 mL of 10% Aliquat 336/MIBK solution. Dilute to the mark in 250 mL volumetric flask with 10% Aliquot 336/MIBK solution. Mix well and store in a brown glass bottle.
- Intermediate stock lead solution (100 mg/L): Transfer accurately by pipette 5 mL of stock lead solution to a 100 mL volumetric flask. Dilute to the mark with 10% Aliquat 336/MIBK solution. Mix well and store in a brown glass bottle.
- Iso-octane: 2,2,4-trimethylpentane (AR grade).
- Nitric acid (1+1): Mix equal volumes of concentrated AR grade nitric acid and distilled water.
- Acetone (AR grade).

Maximum storage periods for reagents:

- Iodine solution – 30 days
- 10% Aliquat 336/MIBK – 30 days
- 1% Aliquat 336/MIBK – 30 days
- Stock lead solution – 30 days
- Standard lead solution – 1 day

Grades of reagents other than those indicated may be used with two privisos:

- The reagent is of high enough purity to permit its use without lessening the accuracy of the determination.
- The same source of reagent is used for all standards and blanks.

Analysis

General

Glassware must be de-leaded by rinsing with dilute nitric acid (1+1) and then rinsed with distilled water. Wash the glassware with acetone and dry it at 50° ± 5°C.

Preparation of working standards (2, 5, 10, 20 mg/L)

Transfer accurately by pipette 1.0, 2.5, 5.0 and 10.0 mL of the intermediate stock lead solution (100 mg/L) to four 50 mL volumetric flasks. Adjust the volume of each to 10 mL by adding 1% Aliquat/MIBK solution and add 10 mL of iso-octane. Add 0.1 mL of iodine solution, mix well and allow to react for at least 1 minute. Dilute to volume with MIBK and mix.

Preparation of the blank

To a 50 mL volumetric flask add 30 mL of MIBK then 10 mL of iso-octane. Add 0.1 mL of iodine solution, mix well and allow to react for at least 1 minute. Add 5 mL of 1% Aliquat/MIBK solution and mix. Dilute to volume with MIBK and mix.

Preparation of sample

- For petrol with a lead concentration of < 0.1 g/L: To a 50 mL volumetric flask containing 30 mL of MIBK and 10 mL of petrol sample, add 0.1 mL of iodine solution. Mix well and allow to react for at least 1 minute. Add 5 mL of 1% Aliquat/MIBK solution. Dilute to volume with MIBK and mix.
- For petrol with a lead concentration of 0.1–1 g/L: To a 50 mL volumetric flask add 30 mL of MIBK. Add 1–5 mL of petrol sample and enough iso-octane to yield a final sample volume of 10 mL. Add 0.1 mL of iodide solution, mix well and allow to react for at least 1 minute. Add 5 mL of 1% Aliquat/MIBK solution. Dilute to volume with MIBK and mix.
- For petrol with a lead concentration of > 1 g/L, dilute with iso-octane before analysis.

Preparation of the atomic absorption spectrophotometer

Optimise the instrument for lead at 283.3 nm. Using the blank, adjust the gas mixture (acetylene/air) and aspiration rate to obtain an oxidising lean, blue flame. Aspirate the 20 mg/L lead working standard and adjust the instrument to achieve maximum response.

Standardisation and analysis

Aspirate the reagent blank and adjust the instrument to zero. Measure the absorbances of the 2, 5, 10 and 20 mg/L lead working standards. Aspirate the samples and record the absorbance values. Aspirate the blank between each sample measurement.

For instruments without a direct concentration readout, prepare a calibration curve by plotting the absorbance of the working standards against their concentrations (mg/L) on linear graph paper.

Calculations

Read the lead concentration in g/L directly from the instrument readout or calculate it by referring to the appropriate calibration curve:

$$\text{Lead concentration in petrol sample (g/L)} = (C \times V_1) \div (V_2 \times 1000)$$

where:

C = lead concentration (mg/L) of sample (as read from graph or instrument readout)

V_1 = final volume (50 mL)

V_2 = volume of sample petrol (mL)

Appendix VII:
Test method 31 – Observation procedure for excessive air impurities: visible emissions

When an observer is determining if a vehicle is being used in breach of the clause limiting visible emissions, the following principles apply:

- The observer must be satisfied that the vehicle generating the visible emissions is correctly identified.
- The observer must be satisfied that the emissions are visible not just because of heat or the condensation of water vapour.
- The emissions must be continuously visible for more than 10 seconds.

The following details of the observation must be recorded:

- Length of time in seconds that the visible emissions were observed.
- Registration number of the motor vehicle under observation.
- Type of motor vehicle under observation.
- Colour and darkness, in the opinion of the observer, of the air impurities emitted.
- Location, date and approximate time of day that the observation was made.

In the case of observation of digital imagery produced by an Approved Vehicle Emission Recording System (AVERS):

When an observer of digital imagery produced by an AVERS is determining if a vehicle is being used in breach of the clause limiting visible emissions, the following principles apply:

- The observer must be satisfied that the vehicle generating the visible emissions is correctly identified.
- The observer must be satisfied that the visible emissions are visible not just because of heat or the condensation of water vapour.
- The emissions must be continuously visible on any digital video imagery produced by the AVERS for more than 10 seconds.

The following details of the observation must be recorded:

- Length of time in seconds that the visible emissions were observed.
- Registration number of the motor vehicle depicted in the digital imagery.
- Type of motor vehicle depicted in the digital imagery.
- Colour and darkness, in the opinion of the observer, of the air impurities which, by reference to the digital imagery, were emitted.
- Location, date and approximate time of day that the digital imagery was created.

For the purposes of this Test Method 31 the following is an Approved Vehicle Emission Recording Systems:

The hardware and software components of the system known as the Vehicle Emission Enforcement System operated by the Roads and Traffic Authority of NSW and installed to record digital imagery of vehicles emitting visible emissions in the M5 East Tunnel, Earlwood and to enable subsequent viewing of that imagery.

Appendix VIII:
Test method 38 – Combination of air impurities from two or more sources

A combined source is a discharge point that combines discharge streams from two or more emission units, prior to discharge to the atmosphere. The procedure for calculating the alternative standard of concentration for a combined source is detailed in the following equation.

$$C_T = \frac{C_1 \cdot q_1 + C_2 \cdot q_2 + \dots + C_N \cdot q_N}{q_1 + q_2 + \dots + q_N}$$

where:

C_T = the alternative standard of concentration for the combined source

C_1, C_2, C_N = the standards of concentration that are applicable to each of *N* emission units

q_1, q_2, q_N = the volumetric flow rates of each of *N* emission units

Appendix IX:
Other approved method 9 – 'Coarse' particulates

To determine 'coarse' particulates:

- determine solid particles (total) using TM-15
- **simultaneously** determine 'fine' particulates (PM_{10}) using OM-5, then
- subtract the result of OM-5 ('fine' particulates (PM_{10})) from the result of TM-15 (solid particles (total)) to determine 'coarse' particulates.

Sampling and analysis for solid particles (total) and 'fine' particulates (PM_{10}) must be carried out simultaneously using TM-15 and OM-5 respectively, to ensure the influence of process variations do not affect the results.

Appendix X:
Test method sources

Australian Standard test methods

Available for purchase from:

Standards Australia
1 The Crescent
Homebush NSW 2140
(PO Box 1055, Strathfield NSW 2135)
Phone: 1300 65 46 46
Fax: 1300 65 49 49
Email: sales@standards.com.au
Website: www.standards.com.au

American Public Health Association test methods

Standard Methods for the Examination of Water and Wastewater, 20th Edition is available for purchase from:

Australian Water Association
PO Box 388
Artarmon NSW 1570
Phone: (02) 9413 1288
Fax: (02) 9413 1047
Email: bookshop@awa.asn.au
Website: www.awa.asn.au

American Society for Testing and Materials test methods

Available from Standards Australia (see above) or direct from:

American Society for Testing and Materials
100 Barr Harbor Drive
West Conshohocken PA 19428-2959, USA
Phone: 0011 1 610 832 9500
Fax: 0015 1 610 832 9500
Website: www.astm.org/index.html#

United States Environmental Protection Agency test methods

Available from:

USEPA
National Service Center for Environmental Publications
PO Box 42419
Cincinatti OH 45242, USA
Phone: 0011 1 513 489 8190
Fax: 0015 1 513 489 8695
Website: www.epa.gov/ttn/emc/ or www.epa.gov/ (for on-line ordering)
USEPA Method 0061: www.epa.gov/epaoswer/hazwaste/test/0061.pdf
SW-846 series: www.epa.gov/epaoswer/hazwaste/test/main.htm

California Environmental Protection Agency Air Resources Board

Available from:

Office of Communications
2020 L Street
Sacramento CA 95814, USA
Phone: 0011 1 916 322 2990
Fax: 0015 1 916 445 5025
Website: www.arb.ca.gov/testmeth/vol3/vol3.htm

Australian Design Rules test methods

The Federal Office of Road Safety publishes Australian Design Rules for motor vehicles. ADR 37/00 or 37/01 Emission Control for Light Vehicles is available from:

Federal Office of Road Safety
15 Mort Street
Canberra ACT 2600
(PO Box 594, Canberra ACT 2601)
Phone: (02) 6274 7111
Fax: (02) 6274 7922
Website: www.atsb.gov.au/fors/contact.htm

International Standard Organisation test methods

The International Standard Organisation test methods are available from:

International Organisation for Standardisation
Case Postale 56
CH-1211 Geneva 20
Switzerland

ISO catalogue information is available at www.iso.ch or from Standards Australia as detailed above.

Environment Canada test methods

The Environment Canada test methods are available from:

Environment Protection Publications
Technology Development Branch
Conservation and Protection
Environment Canada
Ontario K1A OH3
Email: epspubs@ec.gc.ca
Website: www.ec.gc.ca/publications.cfm