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TEST REPORT No. NOV22174.1

**AIR EMISSIONS MONITORING OF
CEMENT MILL 1, 2 & 3 EXHAUST
STACKS AT MORGAN CEMENT
INTERNATIONAL IN PORT KEMBLA**

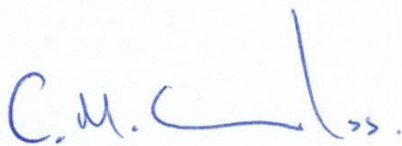
DATE OF TESTING: 22ND NOVEMBER 2022

ACCREDITATION:



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EXECUTIVE SUMMARY

Airlabs Environmental Pty Ltd was commissioned by Morgan Cement International Pty Ltd to monitor air emissions from the Cement Mill 1, 2 & 3 Exhaust Stacks at the Port Kembla plant to ensure compliance with the site's operating licence. All sampling was conducted by Airlabs Environmental on the 22nd November 2022.

Analysis was undertaken by Airlabs Environmental and the National Measurement Institute (NMI) in accordance with our scope of NATA accreditation. Unless otherwise indicated, the methods cited in this report have been performed without deviation.

The following results comparison table shows that the concentrations of all analytes were below the limits set by the NSW EPA (refer to Environment Protection License No. 12643, issued on 6th September 2016).

Table 1: Results Summary – Cement Mill 1, 2 & 3 Exhaust Stacks

Parameter	Concentration (mg/m ³)	NSW EPA Limit (mg/m ³)	Emission Rate (g/min)
Cement Mill 1 Exhaust Stack			
Total Solid Particles	< 1	20	< 1
PM ₁₀ Particles	< 1	N/A	< 1
Type 1 & 2 substances [▫]	0.062	1.0	0.025
Cement Mill 2 Exhaust Stack			
Total Solid Particles	< 1	20	< 0.4
PM ₁₀ Particles	< 1	N/A	< 0.4
Type 1 & 2 substances [▫]	0.0022	1.0	0.00077
Cement Mill 3 Exhaust Stack			
Total Solid Particles	< 1	20	< 1
PM ₁₀ Particles	< 1	N/A	< 1
Type 1 & 2 substances [▫]	0.0014	1.0	0.0019

[▫] Type 1 & 2 substances include As, Be, Cd, Cr, Co, Hg, Mn, Ni, Pb, Sb, Se, Sn, V & their compounds

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INTRODUCTION

Airlabs Environmental Pty Ltd was commissioned by Morgan Cement International Pty Ltd to conduct air emissions testing of the Cement Mill 1, 2 & 3 Exhaust Stacks at the Port Kembla plant. All sampling was conducted on the 22nd November 2022 for the following parameters:

- Gas velocity and volume flow rate
- Temperature
- Concentration of water vapour (moisture content)
- Concentration of oxygen & carbon dioxide
- Dry molecular weight and dry gas density
- Concentration and mass emission rate of:
 - Total solid particles;
 - PM₁₀ (Particulate matter with a nominal aerodynamic diameter ≤ 10 µm);
 - Type 1 & 2 substances ^b

DEFINITIONS

Table 2: Terms and definitions

US EPA	United States Environmental Protection Agency.
NSW EPA	New South Wales Environment Protection Authority.
NMI	National Measurement Institute (Australian Government), North Ryde, NSW.
K	Absolute temperature in Kelvin (°C + 273).
mB	Pressure in millibars.
STP	Standard temperature and pressure (273K and 101.3 kPa).
m ³	Actual gas volume in cubic metres at stack conditions.
Nm ³	Gas volume in dry cubic metres at STP.
<	Less than. The value stated is the limit of detection.
g	Grams.
mg	Milligrams (10 ⁻³ grams).
µg	Micrograms (10 ⁻⁶ grams).
ng	Nanograms (10 ⁻⁹ grams).
min	Minute.
N/A	Not applicable.
PM ₁₀	Particulate matter with a nominal aerodynamic diameter ≤ 10 µm.

QUALITY STATEMENT

Airlabs Environmental is committed to providing the highest quality data to all our clients, as reflected in our ISO 17025 (NATA) accreditation. This requires strict adherence to, and continuous improvement of, all our processes and test work. Our goal is to exceed the QA/QC requirements as set by our clients and appropriate governmental entities and to ensure that all data generated is scientifically valid and defensible.

Airlabs Environmental is NATA accredited for all sampling undertaken for this project. Analysis was undertaken by the National Measurement Institute (NATA Accreditation No. 198) and Airlabs Environmental in accordance with our scope of accreditation.

^b Type 1 & 2 substances include As, Be, Cd, Cr, Co, Hg, Mn, Ni, Pb, Sb, Se, Sn, V & their compounds

TEST METHODS

All sampling was undertaken by Airlabs Environmental. Airlabs Environmental is NATA accredited for all sampling undertaken for this project (NATA Accredited Laboratory No. 15463). Analysis was undertaken by Airlabs Environmental and the National Measurement Institute (NMI, NATA Accreditation No. 198) in accordance with our scope of accreditation. Specific details of the test methods used are available upon request.

Table 2: Summary of Test Methods

Test Parameter	Test Method	Method Detection Limit	Estimated Measurement Uncertainty	NATA Accredited	
				Sampling	Analysis
Sample plane criteria	NSW EPA TM-1	N/A	N/A	✓	N/A
Gas velocity	NSW EPA TM-2	3 m/s	± 13%	✓	✓
Temperature	NSW EPA TM-2	273K (0°C)	± 2.6%	✓	✓
Moisture content	NSW EPA TM-22	0.2%	± 12.2%	✓	✓
Oxygen & carbon dioxide	NSW EPA TM-24 & TM-25	0.1%	± 6.0%	✓	✓
Dry molecular weight & gas density	NSW EPA TM-23	N/A	± 13.1%	✓	✓
Total solid particles	NSW EPA TM-15	1 mg/Nm ³	± 7%	✓	✓
PM ₁₀	NSW EPA TM-5	1 mg/Nm ³	± 12.2%	✓	✓
Type 1 & 2 substances and their compounds	NSW EPA TM-12, 13 & 14	0.05 mg/Nm ³ (total metals)	± 29.1%	✓	✓ ¹

¹. Analysis of Type 1 & 2 substances and their compounds was performed on the various sample components by NMI, with results included in their Report No. RN1375510

DEVIATIONS & INFLUENCING FACTORS

There were no deviations from the test methods and no significant influencing factors were recorded.

It must be noted that these results are accurate for the air emissions at the time of testing and may not reflect long term trends. Variations in factors such as raw material composition, plant processes, operating conditions and maintenance of plant may influence future test results.

SAMPLING LOCATIONS



Figure 1: Cement Mill 1, 2 & 3 Exhaust Stack locations at Gate 7 Foreshore Rd, Port Kembla, NSW

SUITABILITY OF SAMPLING PLANE

Section 4.1 in AS4323.1-1995 'Stationary Source Emissions, Method 1: Selection of Sampling Provisions' states that, in the absence of cyclonic flow activity, ideal sampling plane conditions are found to exist at the positions given in Table 4 below.

Table 3: Criteria for the Selection of Sampling Planes

Type of flow disturbance	Minimum distance upstream from disturbance, diameters (D)	Minimum distance downstream from disturbance, diameters (D)
Bend, connection, junction, direction change	>2D	>6D
Louvre, butterfly damper (partially closed or closed)	>3D	>6D
Axial fan	>3D	>8D (see Note)
Centrifugal fan	>3D	>6D

NOTE: The plane should be selected as far as practicable from a fan. Flow straighteners may be required to ensure the position chosen meets the check criteria listed in Items (a) to (f) below.

Section 4.1 of AS 4323.1-1995 (Ideal Sampling Positions) states that the location of the sampling plane shall be such that it meets the following criteria:

- (a) The gas flow is basically in the same direction at all points along each sampling traverse.
- (b) The gas velocity at all sampling points is greater than 3 m/s.
- (c) The gas flow profile at the sampling plane shall be steady, evenly distributed and not have a cyclonic component which exceeds an angle of 15° to the duct axis, when measured near the periphery of a circular sampling plane.
- (d) The temperature difference between adjacent points of the survey along each sampling traverse is less than 10% of the absolute temperature, and the temperature at any point differs by less than 10% from the mean.
- (e) The ratio of the highest to lowest pitot pressure difference shall not exceed 9:1 and the ratio of highest to lowest gas velocities shall not exceed 3:1. For isokinetic testing with the use of impingers, the gas velocity ratio across the sampling plane should not exceed 1.6:1.
- (f) The gas temperature at the sampling plane should preferably be above the dewpoint.

The sampling plane locations for the Cement Mill 1, 2 & 3 Exhaust Stacks did not satisfy the requirements of AS 4323.1-1995 Section 4.1 Criteria for Selection of Sampling Planes due to insufficient distance between the sampling plane and the upstream and/or downstream disturbances, and as such the sampling locations for the stacks are considered non-ideal. The gas characteristics for the Cement Mill 1, 2 & 3 Exhaust Stacks satisfied the requirements of AS 4323.1-1995 Section 4.1 (a) - (f). The sampling plane details and required number of sampling points are given in the tables below.

SUITABILITY OF SAMPLING PLANE Continued

Table 4: Sampling Plane Details for the Cement Mill 1 Exhaust Stack

Parameter	
Stack Shape	Circular
Stack Diameter (m) at Sampling Plane	0.850
Direction of Discharge to Air	Vertical
Type of Flow Disturbance	Bend
Sampling Plane Distance Downstream from Disturbance	4D (<6D)
Type of Flow Disturbance	Butterfly Damper
Sampling Plane Distance Upstream from Disturbance	1D (<2D)
Compliance with AS 4232.1 Section 4.1 Criteria for Selection of Sampling Planes	No
Required No. and Orientation of Access Holes	2 at 90°
Available No. and Orientation of Access Holes	2 at 90°
Compliance with AS 4232.1 Section 6 Sampling Access Holes	Yes
Standard No. of Sampling Points per Traverse	6
Number of Traverses	2
Correction Factor	1.265
Corrected No. of Sampling Points per Traverse	8
Total No. of Sampling Points	16
Gas Flow Direction is Consistent at all Points	Yes
Minimum Velocity at any Sample Point (m/s)	13 (>3)
Stratified Gas Flow	No
Cyclonic Gas Flow	No (<15°)
Absolute Temperature Difference (K)	1 (<10%)
Pitot Pressure Difference	1.8:1 (<9:1)
Gas Velocity Difference (Isokinetic)	1.3:1 (<1.6:1)
Gas Temperature above Dew Point	Yes
Compliance with AS 4232.1 Section 4.1 (a)-(f)	Yes



Figure 2: Cement Mill 1 Exhaust Stack sampling location

SUITABILITY OF SAMPLING PLANE Continued

Table 5: Sampling Plane Details for the Cement Mill 2 Exhaust Stack

Parameter	
Stack Shape	Circular
Stack Diameter (m) at Sampling Plane	0.850
Direction of Discharge to Air	Vertical
Type of Flow Disturbance	Bend
Sampling Plane Distance Downstream from Disturbance	4D (<6D)
Type of Flow Disturbance	Butterfly Damper
Sampling Plane Distance Upstream from Disturbance	1D (<2D)
Compliance with AS 4232.1 Section 4.1 Criteria for Selection of Sampling Planes	No
Required No. and Orientation of Access Holes	2 at 90°
Available No. and Orientation of Access Holes	2 at 90°
Compliance with AS 4232.1 Section 6 Sampling Access Holes	Yes
Standard No. of Sampling Points per Traverse	6
Number of Traverses	2
Correction Factor	1.265
Corrected No. of Sampling Points per Traverse	8
Total No. of Sampling Points	16
Gas Flow Direction is Consistent at all Points	Yes
Minimum Velocity at any Sample Point (m/s)	11 (>3)
Stratified Gas Flow	No
Cyclonic Gas Flow	No (<15°)
Absolute Temperature Difference (K)	5 (<10%)
Pitot Pressure Difference	1.7:1 (<9:1)
Gas Velocity Difference (Isokinetic)	1.3:1 (<1.6:1)
Gas Temperature above Dew Point	Yes
Compliance with AS 4232.1 Section 4.1 (a)-(f)	Yes

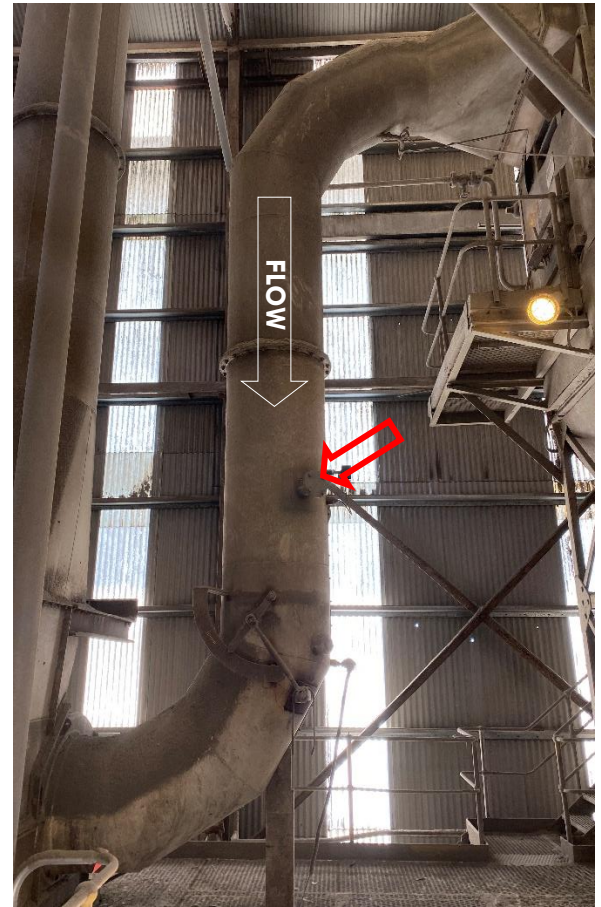


Figure 3: Cement Mill 2 Exhaust Stack sampling location

SUITABILITY OF SAMPLING PLANE Continued

Table 6: Sampling Plane Details for the Cement Mill 3 Exhaust Stack

Parameter	
Stack Shape	Rectangular
Stack Dimensions (m) at Sampling Plane	1.77 x 0.800
Direction of Discharge to Air	Horizontal
Type of Flow Disturbance	Centrifugal Fan
Sampling Plane Distance Downstream from Disturbance	3.4D (<6D)
Type of Flow Disturbance	Stack Exit
Sampling Plane Distance Upstream from Disturbance	4.9D (>2D)
Compliance with AS 4232.1 Section 4.1 Criteria for Selection of Sampling Planes	No
Required No. and Orientation of Access Holes	4 (long side)
Available No. and Orientation of Access Holes	3 (long side)
Compliance with AS 4232.1 Section 6 Sampling Access Holes	No
Standard No. of Sampling Points per Traverse	2
Number of Traverses	4
Correction Factor	1.15
Corrected No. of Sampling Points per Traverse	3
Total No. of Sampling Points	12
Gas Flow Direction is Consistent at all Points	Yes
Minimum Velocity at any Sample Point (m/s)	17 (>3)
Stratified Gas Flow	No
Cyclonic Gas Flow	No (<15°)
Absolute Temperature Difference (K)	2 (<10%)
Pitot Pressure Difference	2.0:1 (<9:1)
Gas Velocity Difference (Isokinetic)	1.4:1 (<1.6:1)
Gas Temperature above Dew Point	Yes
Compliance with AS 4232.1 Section 4.1 (a)-(f)	Yes

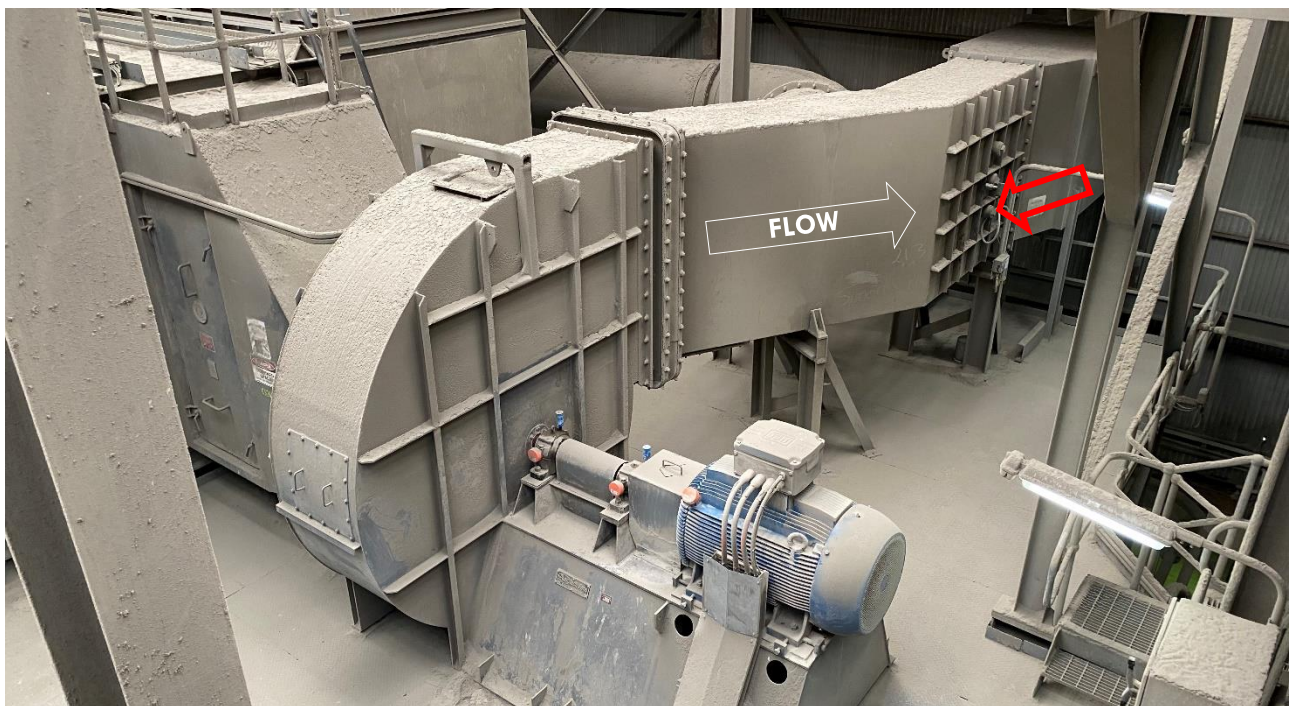


Figure 4: Cement Mill 3 Exhaust Stack sampling location

RESULTS – Cement Mill 1 Exhaust Stack

Company	Morgan Cement International Pty Ltd
Site	Foreshore Rd, Port Kembla
Source Tested	Cement Mill 1 Exhaust Stack
Operating Conditions	Normal
Date of Tests	22 nd November 2022
Sampling Period	12:25 – 14:25 (120 minutes per test)
Testing Officers	P. Collins & P.K. Collins
Sampling Position	Two 110 mm flanges in a circular metal duct

Table 7: Cement Mill 1 Exhaust Stack - Gas flow conditions

Sampling Conditions	
Stack diameter at sampling plane (m)	0.85
Average stack gas temperature (K)	339 (66°C)
Average barometric pressure (mB)	1011.1
Average static pressure (mB)	-24.4
Average stack pressure (mB)	986.7
Average moisture content (%v/v)	0.65
Average oxygen concentration, dry basis (%v/v)	20.9
Average carbon dioxide concentration, dry basis (%v/v)	0.040
Dry molecular weight of stack gas (g/g mole)	28.84
Wet molecular weight of stack gas (g/g mole)	28.77
Dry gas density of stack gas (kg/m ³)	1.287
Wet gas density of stack gas (kg/m ³)	1.284
Average velocity at sampling plane (m/s)	15.5
Actual gas flow rate (m ³ /min)	529
Gas flow rate at STP, dry (Nm ³ /min)	413

RESULTS – Cement Mill 1 Exhaust Stack continued

Table 8: Cement Mill 1 Exhaust Stack - Summary of test results

Parameter	Sampling Period	Concentration (mg/m ³)	NSW EPA Limit (mg/m ³)	Emission Rate (g/min)
Total Solid Particles	13:21 – 14:21	< 1	20	< 1
PM ₁₀ Particles		< 1	N/A	< 1
Type 1 & 2 substances ^c	12:25 – 14:25	0.062	1.0	0.025

Table 9: Cement Mill 1 Exhaust Stack – Type 1 & 2 substances and their compounds

Metal	Concentration (mg/Nm ³)	Emission Rate (g/min)
Type 1 substances and their compounds		
Antimony (Sb) & its compounds	< 0.0002	< 0.00008
Arsenic (As) & its compounds	< 0.0002	< 0.00008
Cadmium (Cd) & its compounds	< 0.00004	< 0.00002
Lead (Pb) & its compounds	0.00032	0.00013
Mercury (Hg) & its compounds	0.000040	0.000017
Type 2 substances and their compounds		
Beryllium (Be) & its compounds	< 0.0002	< 0.00008
Chromium (Cr) & its compounds	0.00049	0.00020
Cobalt (Co) & its compounds	< 0.0002	< 0.00008
Manganese (Mn) & its compounds	0.0035	0.0014
Nickel (Ni) & its compounds	0.00038	0.00016
Selenium (Se) & its compounds	< 0.0002	< 0.00008
Tin (Sn) & its compounds	< 0.0002	< 0.00008
Vanadium (V) & its compounds	< 0.0002	< 0.00008
TOTAL TYPE 1 & 2 SUBSTANCES AND THEIR COMPOUNDS	0.062	0.025

^c Type 1 & 2 substances include As, Be, Cd, Cr, Co, Hg, Mn, Ni, Pb, Sb, Se, Sn, V & their compounds

RESULTS – Cement Mill 2 Exhaust Stack

Company	Morgan Cement International Pty Ltd
Site	Foreshore Rd, Port Kembla
Source Tested	Cement Mill 2 Exhaust Stack
Operating Conditions	Normal
Date of Tests	22 nd November 2022
Sampling Period	09:50 – 12:01 (120 minutes per test)
Testing Officers	P. Collins & P.K. Collins
Sampling Position	Two 110 mm flanges in a circular metal duct

Table 10: Cement Mill 2 Exhaust Stack - Gas flow conditions

Sampling Conditions	
Stack diameter at sampling plane (m)	0.85
Average stack gas temperature (K)	339 (66°C)
Average barometric pressure (mB)	1012.1
Average static pressure (mB)	-18.4
Average stack pressure (mB)	993.7
Average moisture content (%v/v)	0.52
Average oxygen concentration, dry basis (%v/v)	20.9
Average carbon dioxide concentration, dry basis (%v/v)	0.040
Dry molecular weight of stack gas (g/g mole)	28.84
Wet molecular weight of stack gas (g/g mole)	28.79
Dry gas density of stack gas (kg/m ³)	1.287
Wet gas density of stack gas (kg/m ³)	1.285
Average velocity at sampling plane (m/s)	13.1
Actual gas flow rate (m ³ /min)	445
Gas flow rate at STP, dry (Nm ³ /min)	350

RESULTS – Cement Mill 2 Exhaust Stack continued

Table 11: Cement Mill 2 Exhaust Stack - Summary of test results

Parameter	Sampling Period	Concentration (mg/m ³)	NSW EPA Limit (mg/m ³)	Emission Rate (g/min)
Total Solid Particles	11:01 – 12:01	< 1	20	< 0.4
PM ₁₀ Particles		< 1	N/A	< 0.4
Type 1 & 2 substances ^d	09:50 – 11:50	0.0022	1.0	0.00077

Table 12: Cement Mill 2 Exhaust Stack – Type 1 & 2 substances and their compounds

Metal	Concentration (mg/Nm ³)	Emission Rate (g/min)
Type 1 substances and their compounds		
Antimony (Sb) & its compounds	< 0.0002	< 0.00007
Arsenic (As) & its compounds	< 0.0002	< 0.00007
Cadmium (Cd) & its compounds	< 0.00004	< 0.00001
Lead (Pb) & its compounds	0.00049	0.00017
Mercury (Hg) & its compounds	< 0.00004	< 0.00001
Type 2 substances and their compounds		
Beryllium (Be) & its compounds	< 0.0002	< 0.00007
Chromium (Cr) & its compounds	0.00046	0.00016
Cobalt (Co) & its compounds	< 0.0002	< 0.00007
Manganese (Mn) & its compounds	0.0010	0.00035
Nickel (Ni) & its compounds	0.00024	0.000084
Selenium (Se) & its compounds	< 0.0002	< 0.00007
Tin (Sn) & its compounds	< 0.0002	< 0.00007
Vanadium (V) & its compounds	< 0.0002	< 0.00007
TOTAL TYPE 1 & 2 SUBSTANCES AND THEIR COMPOUNDS	0.0022	0.00077

^d Type 1 & 2 substances include As, Be, Cd, Cr, Co, Hg, Mn, Ni, Pb, Sb, Se, Sn, V & their compounds

RESULTS – Cement Mill 3 Exhaust Stack

Company	Morgan Cement International Pty Ltd
Site	Foreshore Rd, Port Kembla
Source Tested	Cement Mill 3 Exhaust Stack
Operating Conditions	Normal
Date of Tests	22 nd November 2022
Sampling Period	14:55 – 16:55 (120 minutes per test)
Testing Officers	P. Collins & P.K. Collins
Sampling Position	Three 4" sockets in a rectangular metal duct

Table 13: Cement Mill 3 Exhaust Stack - Gas flow conditions

Sampling Conditions	
Stack dimensions at sampling plane (m)	1.77 x 0.800
Average stack gas temperature (K)	355 (82°C)
Average barometric pressure (mB)	1011.1
Average static pressure (mB)	1.79
Average stack pressure (mB)	1012.9
Average moisture content (%v/v)	0.72
Average oxygen concentration, dry basis (%v/v)	20.9
Average carbon dioxide concentration, dry basis (%v/v)	0.040
Dry molecular weight of stack gas (g/g mole)	28.84
Wet molecular weight of stack gas (g/g mole)	28.76
Dry gas density of stack gas (kg/m ³)	1.287
Wet gas density of stack gas (kg/m ³)	1.284
Average velocity at sampling plane (m/s)	21.3
Actual gas flow rate (m ³ /min)	1,810
Gas flow rate at STP, dry (Nm ³ /min)	1,380

RESULTS – Cement Mill 3 Exhaust Stack continued

Table 14: Cement Mill 3 Exhaust Stack - Summary of test results

Parameter	Sampling Period	Concentration (mg/m ³)	NSW EPA Limit (mg/m ³)	Emission Rate (g/min)
Total Solid Particles	15:54 – 16:54	< 1	20	< 1
PM ₁₀ Particles		< 1	N/A	< 1
Type 1 & 2 substances ^e	14:55 – 16:55	0.0014	1.0	0.0019

Table 15: Cement Mill 3 Exhaust Stack – Type 1 & 2 substances and their compounds

Metal	Concentration (mg/Nm ³)	Emission Rate (g/min)
Type 1 substances and their compounds		
Antimony (Sb) & its compounds	< 0.0001	< 0.0002
Arsenic (As) & its compounds	< 0.0001	< 0.0002
Cadmium (Cd) & its compounds	< 0.00003	< 0.00004
Lead (Pb) & its compounds	0.00032	0.00044
Mercury (Hg) & its compounds	< 0.00003	< 0.00004
Type 2 substances and their compounds		
Beryllium (Be) & its compounds	< 0.0001	< 0.0002
Chromium (Cr) & its compounds	0.00018	0.00025
Cobalt (Co) & its compounds	< 0.0001	< 0.0002
Manganese (Mn) & its compounds	0.00090	0.0012
Nickel (Ni) & its compounds	< 0.0001	< 0.0002
Selenium (Se) & its compounds	< 0.0001	< 0.0002
Tin (Sn) & its compounds	< 0.0001	< 0.0002
Vanadium (V) & its compounds	< 0.0001	< 0.0002
TOTAL TYPE 1 & 2 SUBSTANCES AND THEIR COMPOUNDS	0.0014	0.0019

END OF REPORT

^e Type 1 & 2 substances include As, Be, Cd, Cr, Co, Hg, Mn, Ni, Pb, Sb, Se, Sn, V & their compounds