



EnviroNgaka CC

- environmental control & management systems
- process engineering support & optimisation
- project management

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AUGUST 2009

IAQMP Report - Section 3.2:

Ambient Air Monitoring Results Report

Site

**ASSMANG Manganese – Cato Ridge Works
Cato Ridge, KwaZulu-Natal**

PREPARED FOR:

ASSMANG Manganese – Cato Ridge Works
Cato Ridge, KwaZulu-Natal

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For and on Behalf of ENVIRONGAKA CC

**August-08
to
July-09**

Update / Report Date:
Reference:
Method:

**6-Oct-09
ENVN_ASD-AAQ_Assmang_Report-Aug2009
Refer: Appendix A - Method**

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INTERNAL DOCUMENT - CONFIDENTIAL

Compiled By: JG Potgieter
Approved By: JG Potgieter

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Ambient Air Monitoring Results Report

3.2-1 List of Contents

Section	Description	Page #
3.2-1	Contents	2
3.2-2	Introduction	3
3.2-3	PM ₁₀ & PM _{2.5} Monitoring	4
3.2-4	SO ₂ , NO ₂ & Benzene Monitoring	6
	Appendix A - Method	8

3.2-2 Ambient Monitoring

Introduction

- (1) Ambient Air Monitoring was implemented at locations to assess the impact / contribution of Assmang-CRW on the surrounding ambient air quality;
- (2) Screening dispersion modelling exercises indicated that the primary sources impact mainly from East to South, with the secondary sources impacting to from West to North;
- (3) The following pages provide the results from the ambient air monitoring;
- (4) The results were used to compare with modeling results in order to improve the model;

Sampling Locations: Passive Sampling of SO₂, NO₂, BTEX gasses, PM₁₀ & PM_{2.5}
 Site
ASSMANG Manganese – Cato Ridge Works
 Cato Ridge, KwaZulu-Natal



Key	Reference	Description	Sampling Positioning interpretation Relative to Site		Purpose / Reason
			"Onsite"	"Offsite"	
14	4SE	Metallica		X	Passive: SO ₂ , NO ₂ , Benzene; PM ₁₀ ; PM _{2.5}
18	6SW	SW fence (Candy filter plant direction)		X	Passive: SO ₂ , NO ₂ , Benzene;
21	2NE	Bass Beams		X	PM ₁₀

3.2-3 PM₁₀ & PM_{2.5} Monitoring

(a) Location: Metallica

- (1) PM₁₀ sampling has been conducted for 431 days at Metallica since 28 June 2008;
- (2) PM_{2.5} sampling has been conducted for 230 days at Metallica since 15 January 2009;
- (3) The annual average concentration measured is 30.77 µg/m³ from 1 September 2008 to 30 August 2009, against a proposed South African annual average ambient air guideline of 40 µg/m³;
- (4) The proposed South African 24 hour average ambient air guideline value of 75 µg/m³ has been exceeded 5 times in the period 28 June to 11 September 2008. Since 11 September 2008 this was exceeded 5 times: once during the period of 23 to 26 May 2009 and 4 times in July 2009. The number of allowable exceedances per annum is 4 times per annum;
- (5) No South African ambient air guideline currently exists for PM_{2.5};

Refer Figure 1.a below

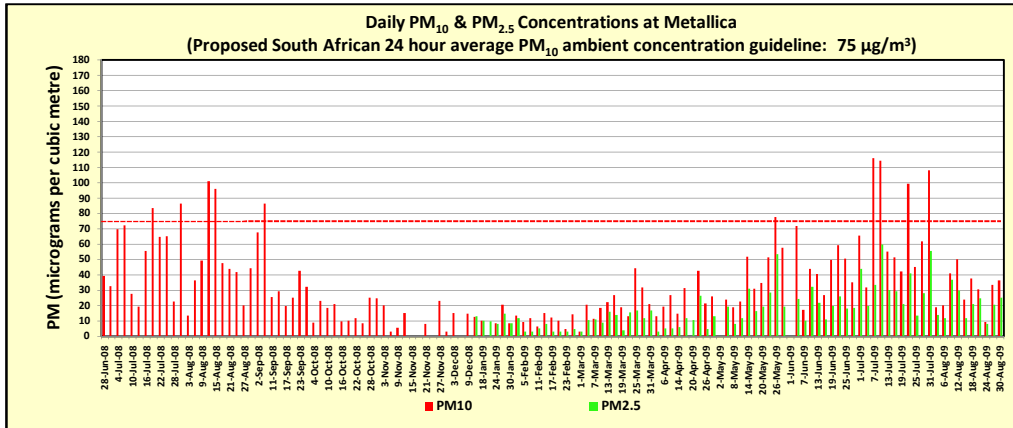


Figure 1.a: Daily PM₁₀ & PM_{2.5} Concentrations at Metallica

- (6) Figure 1.b below provides an indication of the rolling average 24 hour average ambient PM₁₀ concentrations for the period referred to above;
- (7) A downward trend in the ambient concentrations is evident since September 2008, which could be attributed to a number of parameters such as a reduction in the extent of uncontrolled emissions and seasonal meteorological changes. The increase since May 2009 could be attributed to windblown dust as a result of the predominant seasonal NW winds;
- (8) NOTE: "0" (zero) values are as a result of no readings due to samples not collected for access reasons;

Refer Figure 1.b below

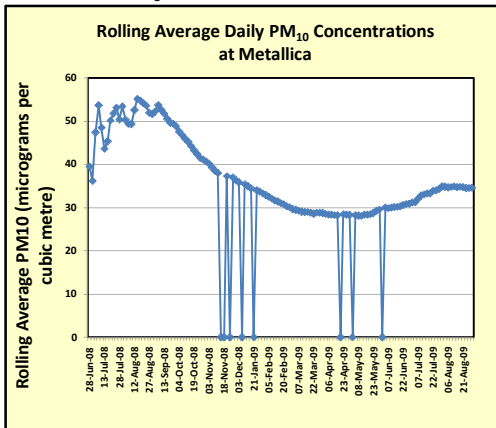


Figure 1.b: Rolling Average Daily PM₁₀ Concentrations at Metallica

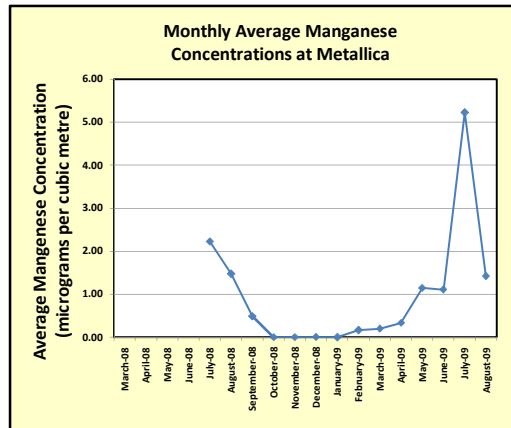


Figure 1.c: Monthly Average Manganese Concentrations at Metallica

- (9) Figure 1.c above provides an indication of the manganese content in the ambient air at the location, based on metal speciation of the PM₁₀ samples collected during the sampling period;
- (10) "0" (zero) values refer to analyses where the Mn content analysed was lower than the blank sample;

- (11) The World Health Organization's proposed annual ambient air guideline for Mn is 0.15 µg/m³. A downward trend was visible, attributable to the reasons stated earlier, but on average the annual WHO guideline is exceeded. Seasonal meteorological changes with windblown dust could play a significant role. For July 2009, the sampled Mn concentration was very high at a monthly average of 5.22 µg/m³;

(b) Location: Bass Beams

- (1) PM₁₀ sampling has been conducted for 431 days at Bass Beams since 28 June 2008;
- (2) PM_{2.5} sampling is not conducted at this location;
- (3) The annual average concentration measured is 25.99 µg/m³ from 1 September 2008 to 30 August 2009, against a proposed South African annual average ambient air guideline of 40 µg/m³;
- (4) The proposed South African 24 hour average ambient air guideline value of 75 µg/m³ has been exceeded 5 times in the period 28 June to 11 September 2008. Since 11 September 2008 the 24 hour average ambient air guideline has been exceeded 5 times, twice in June 2009 and three times in July 2009. The number of allowable exceedances per annum is 4 times per annum;

Refer Figure 2.a below

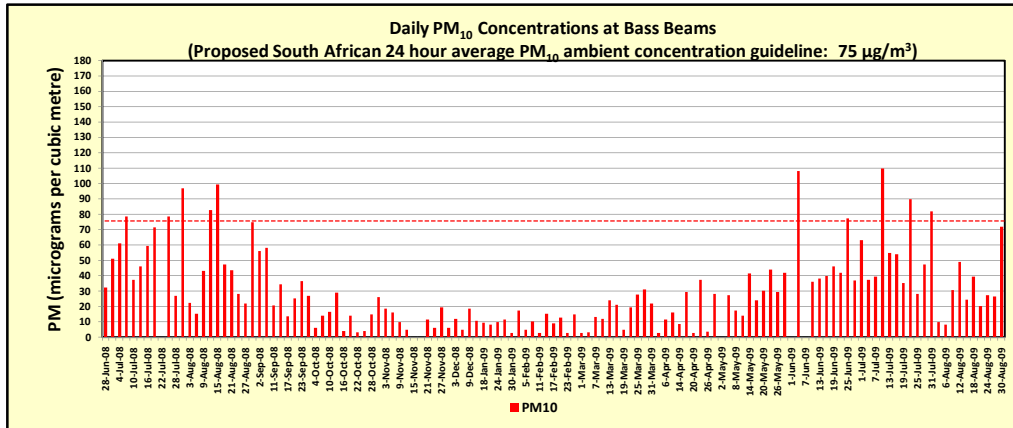


Figure 2.a: Daily PM₁₀ Concentrations at Bass Beams

- (6) Figure 2.b below provides an indication of the rolling average 24 hour average ambient PM₁₀ concentrations for the period referred to above;
- (7) A downward trend in the ambient concentrations is evident since September 2008, which could be attributed to a number of parameters such as a reduction in the extent of uncontrolled emissions and seasonal meteorological changes. The increase since May 2009 could be attributed to windblown dust as a result of the predominant seasonal NW winds;
- (8) NOTE: "0" (zero) values are as a result of no readings due to samples not collected for access reasons;

Refer Figure 2.b below

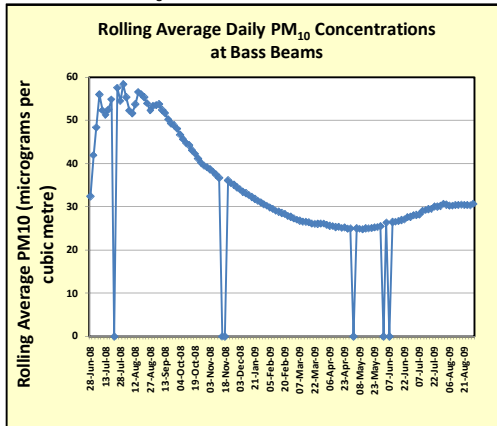


Figure 2.b: Rolling Average Daily PM₁₀ Concentrations at Bass Beams

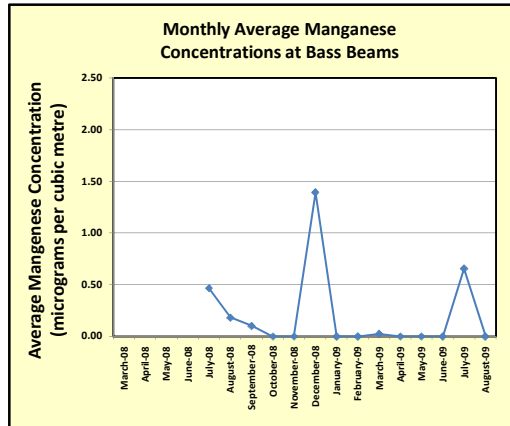


Figure 2.c: Monthly Average Manganese Concentrations at Bass Beams

- (9) Figure 2.c above provides an indication of the manganese content in the ambient air at the location, based on metal speciation of the PM₁₀ samples collected during the sampling period;
- (10) "0" (zero) values refer to analyses where the Mn content analysed was lower than the blank sample;
- (11) The World Health Organization's proposed annual ambient air guideline for Mn is 0.15 µg/m³. A downward trend is visible, but on average the annual WHO guideline is exceeded due to the two high readings in December 2008 & July 2009;

3.2-4 SO₂, NO₂ & Benzene Monitoring

(a) Location: Metallica

- (1) SO₂, NO₂ and Benzene sampling has been conducted at Metallica by means of passive sampling;
- (2) Sampling was conducted from March 2008 till August 2008 and again from December 2008 to date;
- (3) The results provided are monthly average concentrations;

Refer Figures 3.a, 3.b & 3.c below

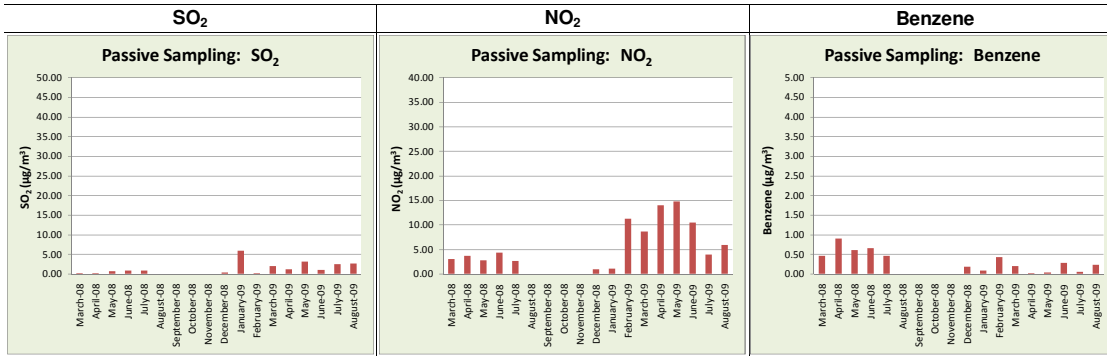


Figure 3.a: Monthly Average SO₂ Concentrations at Metallica

Figure 3.b: Monthly Average NO₂ Concentrations at Metallica

Figure 3.c: Monthly Average Benzene Concentrations at Metallica

Comments			Comments			Comments		
<u>(1) Proposed South African Ambient Air Guidelines</u>			<u>(1) Proposed South African Ambient Air Guidelines</u>			<u>(1) Proposed South African Ambient Air Guidelines</u>		
Period	Ambient Air Concentration (µg/m ³)	Allowable number of Exceedances per annum	Period	Ambient Air Concentration (µg/m ³)	Allowable number of Exceedances per annum	Period	Ambient Air Concentration (µg/m ³)	Allowable number of Exceedances per annum
1 hour average:	350	88	1 hour average:	200	88	1 hour average:	no guideline	no guideline
24 hour average:	125	4	24 hour average:	no guideline	no guideline	24 hour average:	no guideline	no guideline
Annual Average:	50	0	Annual Average:	40	0	Annual Average:	5	0
<u>(2) Results</u>			<u>(2) Results</u>			<u>(2) Results</u>		
Period	Ambient Air Concentration (µg/m ³)	Number of Exceedances per annum	Period	Ambient Air Concentration (µg/m ³)	Number of Exceedances per annum	Period	Ambient Air Concentration (µg/m ³)	Number of Exceedances per annum
1 hour average:	not measured (see Note below)	not measured (see Note below)	1 hour average:	not measured (see Note below)	not measured (see Note below)	1 hour average:	not applicable	not applicable
24 hour average:	not measured (see Note below)	not measured (see Note below)	24 hour average:	not measured (see Note below)	not measured (see Note below)	24 hour average:	not applicable	not applicable
Annual Average:	2.11	0	Annual Average:	7.93	0	Annual Average:	0.17	0
<u>(3) Notes:</u>			<u>(3) Notes:</u>			<u>(3) Notes:</u>		
(i) It is planned to install a continuous ambient air monitoring station to assess 1 hour and 24 hour average concentrations;			(i) It is planned to install a continuous ambient air monitoring station to assess 1 hour and 24 hour average concentrations;			(i) Average concentrations are well below the proposed South African ambient air guideline;		
(ii) Average concentrations are well below the proposed South African ambient air guideline;			(ii) Average concentrations are well below the proposed South African ambient air guideline;					

(b) Location: South West Fence line (Candy Plant)

- (1) SO₂, NO₂ and Benzene sampling has been conducted at the South West fence by means of passive sampling;
- (2) Sampling was conducted from March 2008 till August 2008 and again from December 2008 to date;
- (3) The results provided are monthly average concentrations;

Refer Figures 4.a, 4.b & 4.c below

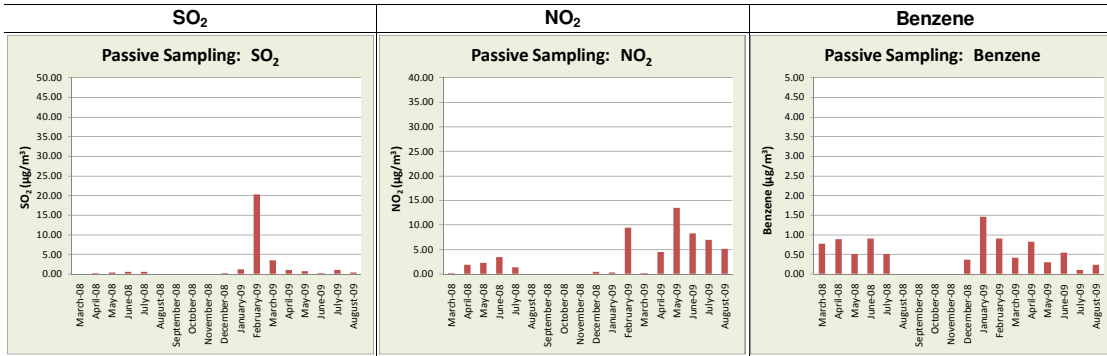


Figure 4.a: Monthly Average SO₂ Concentrations at South West fence

Figure 4.b: Monthly Average NO₂ Concentrations at South West fence

Figure 4.c: Monthly Average Benzene Concentrations at South West fence

Comments			Comments			Comments		
<u>(1) Proposed South African Ambient Air Guidelines</u>			<u>(1) Proposed South African Ambient Air Guidelines</u>			<u>(1) Proposed South African Ambient Air Guidelines</u>		
Period	Ambient Air Concentration (µg/m ³)	Allowable number of Exceedances per annum	Period	Ambient Air Concentration (µg/m ³)	Allowable number of Exceedances per annum	Period	Ambient Air Concentration (µg/m ³)	Allowable number of Exceedances per annum
1 hour average:	350	88	1 hour average:	200	88	1 hour average:	no guideline	no guideline
24 hour average:	125	4	24 hour average:	no guideline	no guideline	24 hour average:	no guideline	no guideline
Annual Average:	50	0	Annual Average:	40	0	Annual Average:	5	0
<u>(2) Results</u>			<u>(2) Results</u>			<u>(2) Results</u>		
Period	Ambient Air Concentration (µg/m ³)	Number of Exceedances per annum	Period	Ambient Air Concentration (µg/m ³)	Number of Exceedances per annum	Period	Ambient Air Concentration (µg/m ³)	Number of Exceedances per annum
1 hour average:	not measured (see Note below)	not measured (see Note below)	1 hour average:	not measured (see Note below)	not measured (see Note below)	1 hour average:	not applicable	not applicable
24 hour average:	not measured (see Note below)	not measured (see Note below)	24 hour average:	not measured (see Note below)	not measured (see Note below)	24 hour average:	not applicable	not applicable
Annual Average:	3.17	0	Annual Average:	5.41	0	Annual Average:	0.57	0
<u>(3) Notes:</u>			<u>(3) Notes:</u>			<u>(3) Notes:</u>		
(i) It is planned to install a continuous ambient air monitoring station to assess 1 hour and 24 hour average concentrations;			(i) It is planned to install a continuous ambient air monitoring station to assess 1 hour and 24 hour average concentrations;			(i) Average concentrations are well below the proposed South African ambient air guideline;		
(ii) Average concentrations are well below the proposed South African ambient air guideline;			(ii) Average concentrations are well below the proposed South African ambient air guideline;					

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Emissions and Ambient Air Quality Test Methods: Assmang Manganese – Cato Ridge Works

Prepared for
EnviroNgaka
AS0405
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TABLE OF CONTENTS

Description	Page
1 INTRODUCTION	4
2 METHODOLOGIES	5
2.1 Ambient Monitoring	5
2.1.1 Dust Deposition ("Dust Fallout")	5
2.1.2 Fine Suspended Inhalable Particulate Matter (PM ₁₀)	5
2.1.3 Sulphur Dioxide and Nitrogen Dioxide	6
2.1.4 Volatile Organic Compounds (VOCs)	7
2.2 Emission Testing	7

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1 INTRODUCTION

ECOSERV were requested to provide an overview of the ambient air quality and emissions test methods applied to Assmang Manganese – Cato Ridge Works projects. An overview of the reference test methods is provided in Section 2 below.

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2 METHODOLOGIES

2.1 Ambient Monitoring

2.1.1 Dust Deposition ("Dust Fallout")

The reference method stipulated in Section 4.8.6 of SANS 1929:2005 Edition 1.1 is *ASTM D1739, or any other method which can be demonstrated to give equivalent results*. ASTM D1739 98 (Reapproved 2004) is the standard test method for the Collection and Measurement of Dustfall (Settleable Particulate Matter) and which is adopted by ECOSERV.

Containers of a standard size and shape are prepared and sealed in a laboratory and exposed at specific sites so that particulate matter can settle into them for periods of approximately 30 days. The containers are then closed and returned to the ECOSERV laboratory in Westville where the masses of water insoluble components of the material collected are determined. The laboratory is not accredited for the analysis performed. The results are reported in units of milligrams per square metre per day ($\text{mg}/\text{m}^2/\text{day}$) and compared to the SANS evaluation criteria.

2.1.2 Fine Suspended Inhalable Particulate Matter (PM_{10})

The reference method for the measurement of PM_{10} concentrations as stipulated in Section 4.4.5 of SANS 1929:2005 Edition 1.1 is EN 12341, *or any other method which can be demonstrated to give equivalent results*.

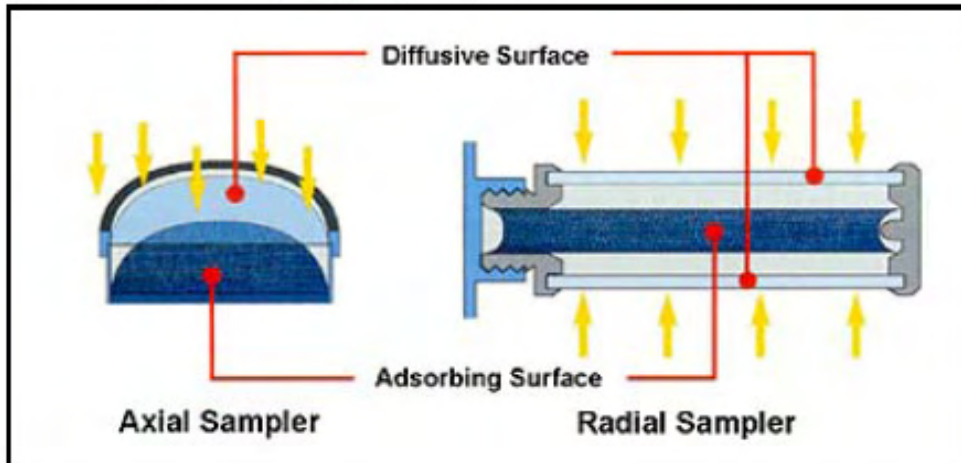
ECOSERV uses MiniVol™ Tactical Air Samplers (TAS). Although the low flow sampling technology was developed jointly with the US EPA, the sampler is not a reference method sampler. Air samples are drawn through a particle size separator and then through a filter medium at a constant flow rate of 5 litres per minute. The sampling duration and flow rate are used to calculate the sample volume which is typically 7.2 m^3 for a 24 hour sampling duration. Filters are weighed in triplicate under controlled temperature and humidity conditions before and after sampling to determine the mass of PM_{10} collected. Gravimetric analysis is performed by the ECOSERV laboratory in Westville and is not accredited for this method of analysis.

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2.1.3 Sulphur Dioxide and Nitrogen Dioxide

Sulphur dioxide (SO₂) and nitrogen dioxide (NO₂) concentrations are measured using Radiello[®] passive (diffusive) samplers, Method F1. This passive sampling methodology has been developed, validated and used extensively in Europe and other countries. A triethanolamine (TEA) impregnated cartridge is sealed behind a microporous diffusion barrier that allows ambient air to diffuse through and come into contact with the cartridge. Sulphur dioxide is adsorbed onto the cartridge as sulphite and sulphate ions, and nitrogen dioxide is adsorbed as nitrite ions. Figure 1 below shows the diffusion principle used in the passive sampling method.

Figure 1: The passive sampling principle of operation



After exposure, the cartridges are labelled, sealed and submitted to an external laboratory for analyses using ion chromatography (IC). The laboratory used by ECOSERV is not accredited for this method of analysis. The concentrations of SO₂ and NO₂ are calculated using the mass of ionic species detected on each cartridge, the sampling duration and the pollutant-specific diffusion factors. At least one unexposed cartridge is also submitted for analysis. This serves as a check on possible contamination or degradation of the batch of cartridges used, and also as an analysis blank for which minor contributions are subtracted from the sample results.

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2.1.4 Volatile Organic Compounds (VOCs)

SANS 1929:2005 Edition 1.1 does not stipulate a specific method for the measurement of volatile organic compounds. ECOSERV performs measurements using the standard Radiello passive sampling Method E1. VOCs are adsorbed onto charcoal impregnated sample tubes and analysed using thermal desorption by an external laboratory. The laboratory used by ECOSERV is SANAS accredited (TO 361) for this method of analysis.

2.2 Emission Testing

Table 2.2.1 provides a summary of the emission test methods applied by ECOSERV.

Table 2.2.1: US EPA Test Methods applied during Assmang Manganese's emissions assessments

US EPA Method	Purpose
1	Sample and velocity traverses for stationary sources
2	Determination of stack gas velocity and volumetric flow rate
3	Gas analysis for carbon dioxide, oxygen, excess air, and dry molecular weight
4	Determination of moisture content in stack gases
5	Determination of particulate matter emissions from stationary sources
7e	Determination of nitrogen oxide emissions from stationary sources
0010	Determination of PAH emissions from stationary sources
26a	Determination of hydrogen halides from stationary sources
29	Determination of metal emissions from stationary sources

N.B. Methods 1 to 4 are prerequisites for Methods 5, 26a, 0010 and 29.

Gravimetric analysis of the stack filters for the determination of particulate matter emissions is performed by the ECOSERV laboratory in Westville which is not accredited for this method of analysis. External laboratories which are not accredited are sub-contracted to perform the specialised sample analyses for US EPA Methods 0010, 26A and 29.