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104 Market Street  
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Australia

CRINGILA PUBLIC SCHOOL  
MONTHLY SUBSURFACE GAS  
MONITORING REPORT  
– NOVEMBER 2019

J153825-03

NSW Department  
of Education  
Cringila Public School

35 Sheffield Street,  
Cringila NSW 2502


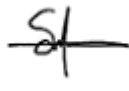
C107471:TO

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# Cringila PS Monthly Subsurface Gas Monitoring Report – November 2019

NSW Department of Education

Cringila Public School

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## 1 INTRODUCTION

This report summarises the findings of the November 2019 monthly round of subsurface gas monitoring carried out at Cringila Public School, located at 35 Sheffield Street, Cringila NSW (refer **Figure 1** in **Appendix A** for site layout).

The works were undertaken on 26<sup>th</sup> November 2019. The work forms part of an ongoing monitoring program prepared for the site in response to a Clean-Up Notice issued to the site (Notice No. 1557944, dated 25<sup>th</sup> October 2017). Works are undertaken in conjunction with weekly near-surface temperature monitoring and ambient air quality monitoring for the purpose of assessing subsurface gas risk associated with combusting coal fill processes identified within the north western hotspot area within the school grounds.

## 2 CLIMATIC CONDITIONS

Daily meteorological data obtained from the Albion Park Weather (Wollongong Airport) (station 068241) was collected prior to and during the monitoring round to provide meteorological data and to assist in accounting for changes in gas concentrations between monitoring events.

The weather station is situated approximately 14km south of the site. **Table 1** below summarises the meteorological variation experienced in the vicinity of the site leading up to and during the monitoring event.

**Table 1: Weather Observations – Albion Park** (station 068241)

Date	Temperature		Rainfall	Wind Parameters				Barometric Pressure	
	9am	3pm		9am		3pm		9am	3pm
	°C	°C	mm	Direction	Speed (km/hr)	Direction	Speed (km/hr)	hPa	hPa
20/11/2019	19.8	22.1	0	E	7	NE	20	1018.3	1016.2
21/11/2019	25.1	24.6	0	N	19	ENE	31	1014.9	1010.4
22/11/2019	23.6	21.9	0	S	24	ESE	17	1013.2	1013.1
23/11/2019	20.1	22.6	0	ESE	7	NE	17	1015.8	1013.2
24/11/2019	20	20.8	0	S	15	E	13	1020.3	1016.7
25/11/2019	21.3	22.7	0	N	11	ENE	15	1012	1007
26/11/2019	26.6	36.1	5	NNW	7	NW	48	1002.5	995.3

The weather observations (as demonstrated in **Table 1** above) indicate the following:

- Temperatures during the week prior, and on the morning of monitoring were warm to hot, and were generally observed to increase throughout the day;
- No rainfall was recorded during the week prior to monitoring, with a small amount of rainfall recorded on the day of monitoring;
- High wind speeds (>10km/h) were recorded on all mornings and afternoons of the week prior to and day of monitoring. Morning wind speeds consistently higher than afternoon wind speeds; and

- Barometric pressure was observed to fluctuate over the week prior to monitoring, with the day of monitoring being the low point of the week.

### 3 FIELDWORK METHODOLOGY

Fieldwork was undertaken on 26th November 2019. Monitoring was carried out using a calibrated GA5000 Landfill Gas Meter (calibration certificates are provided in **Appendix B**).

#### 3.1 Subsurface Gas Wells

The monitoring ports of the GA5000 were fitted to the X-cap of each of the 9 (GG1 to GG9) subsurface monitoring wells. Subsurface gas and flow rate were recorded as well as concentrations of the following Hazardous Gases (refer to **Figure 2 of Appendix A** for monitoring locations);

- Methane (CH<sub>4</sub>) - (%v/v): Maximum and stable concentrations;
- Carbon Dioxide (CO<sub>2</sub>) - (%v/v): Maximum and stable concentrations;
- Oxygen (O<sub>2</sub>) - (%v/v): Minimum and stable concentrations;
- Carbon Monoxide (CO) - (ppm): Maximum concentration;
- Hydrogen Sulphide (H<sub>2</sub>S) - (ppm): Maximum concentration;
- Relative pressure (mbar);
- Atmospheric pressure (mbar);
- Balance (v/v%); and
- Flow rate (L/hr): stabilised concentration (within subsurface gas monitoring wells only).

#### 3.2 Service Pits

Service pits were assessed by inserting the GA5000 nozzle into the pits with the sampling tube inserted at least 30 cm below the cover grate for a minimum of 30 seconds. The locations of service pits monitored (P1 to P12) are presented in **Figure 2 of Appendix A**.

### 4 ASSESSMENT CRITERIA

#### 4.1 Criteria for Ground Gases

Criteria for ground gases in gas monitoring wells is selected based on the threshold levels presented in *Solid Waste Landfills Guideline* (NSW EPA 2016) and presented below in **Table 2**.

Analyte	Threshold level reference	Unit	Threshold Level	Comments
CH <sub>4</sub>	NSW EPA 2016 <sup>(1)</sup>	% (volume/volume)	1.0	The threshold level for further investigation and corrective action
CO <sub>2</sub>			1.5	

**Note:**

1. The threshold levels for further investigation and corrective action are detection of methane at concentrations above 1% (volume/volume) carbon dioxide at concentrations of 1.5% (volume/volume) above established natural background levels.

When the above-mentioned levels are exceeded, further characterisation of the obtained values through the calculation of Gas Screening Values (GSV) will be required. Both on-site and off-site risk associated with

subsurface landfill gas is further characterised through the calculation of the GSV. Using both the total concentration and flow rate, the level of risk associated with any identified subsurface gas concentrations at each of these locations can be assessed. The method of deriving a GSV and associated landfill gas risk has been adopted by the calculations below specified in the Modified Wilson and Card classification *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (NSW EPA 2012).

GSV refer to the concentrations of CH<sub>4</sub> or CO<sub>2</sub> gas measured in a monitoring well multiplied by the measured borehole flow rate.

**Table 3** below presents a summary of the Modified Wilson and Card classification used to calculate GSV and Characteristic Situation (CS) as well as the risk classification in accordance with the Guideline.

Gas Screening Value Threshold (L/hr)	Characteristic Gas Situation	Risk Classification	Additional Factors
<0.07	1	Very low risk	Typically, CH <sub>4</sub> <1% v/v and/or CO <sub>2</sub> <5% v/v, otherwise consider increase to Situation 2 <sup>1</sup>
<0.7	2	Low risk	Borehole flow rate not to exceed 70L/hr otherwise consider increase to Situation 3
<3.5	3	Moderate risk	-
<15	4	Moderate to high risk	Consider need for Level 3 risk assessment
<70	5	High risk	Level 3 risk assessment required
>70	6	Very high risk	

Applicable Gas criteria for service pits is presented below in **Table 4**.

Analyte	Threshold level reference	Unit	Threshold Level	Comments
CH <sub>4</sub>	NSW EPA 2016 <sup>(1)</sup>	% (volume/volume)	1.0	The threshold level for further investigation and corrective action
CO <sub>2</sub>			1.5	
CO <sub>2</sub>	Safe Work Australia HSIS <sup>(2)</sup>	ppm	TWA <sup>(3)</sup> : 5000 STEL <sup>(4)</sup> : 30,000	Work Place Exposure Standards
H <sub>2</sub> S	Safe Work Australia HSIS <sup>(2)</sup>	ppm	TWA: 10 STEL: 15	- Only applicable to service pits to assess risks for utility workers

<sup>1</sup> This was discussed in the scope of the Phase 2 Environmental Site Assessment (Greencap 2018), as indoor monitoring at School Building is regularly undertaken and results obtained so far did not indicate any gas intrusion, GSV values obtained during this monitoring program that are less than 0.07 will be considered as Very Low Risk.

CO	Safe Work Australia HSIS <sup>(2)</sup>	ppm	TWA: 30	- Not applicable for ground gas
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## 5 MONITORING RESULTS

### 5.1 Subsurface Gas Well Monitoring

A summary of the subsurface gas well results is presented below in **Table 5: Subsurface Gas Results**.

CH<sub>4</sub> was detected in monitoring well GG5 at a level below the adopted NSW EPA (2016) Guideline.

CO<sub>2</sub> concentrations were detected in exceedance of the adopted NSW EPA (2016) threshold in wells GG3, GG4, GG5, GG6 and GG7.

Measured flow rates recorded in nearly all subsurface monitoring wells were 0.0L/hr, with the exception of the 0.1L/hr measured in GG4.

CO was detected at low levels in wells GG1 and GG2. H<sub>2</sub>S was not detected in any of the subsurface monitoring wells. O<sub>2</sub> concentrations ranged between 13.4%v/v (GG6) and 19.8%v/v (GG1).

Due to access constraints, wells GG8 and GG9 were not accessible during the November monitoring round.

### 5.2 Characteristic Gas Situation

GSVs calculated for CH<sub>4</sub> and CO<sub>2</sub> in each of the monitored wells indicated a Characteristic Gas Situation of CS1 "Very Low Risk" according to the Modified Wilson and Card classification method presented in **Table 3**.



**Table 5: Subsurface Gas Results**

Well ID	Monitoring Date	Time	Relative Pressure (mb)	Stable Flow Rate (L/hr)	Methane		Gas Screening Value	Carbon Dioxide		Gas Screening Value	Oxygen (%v/v)	Carbon Monoxide (ppm)	Hydrogen Sulfide (ppm)	Balance (%)	Barometric Pressure (mBar)
					Peak (%v/v)	Stable (%v/v)		Peak (%v/v)	Stable (%v/v)						
GG1	26/11/2019	11:06	0.50	0.0	0.0	0.0	0.00	0.2	0.2	0.00	19.8	4	0	80.1	996
GG2	26/11/2019	10:56	0.09	0.0	0.0	0.0	0.00	0.0	0.0	0.00	17.3	4	0	79.8	996
GG3	26/11/2019	9:53	0.02	0.0	0.0	0.0	0.00	5.1	5.1	0.00	15.1	0	0	79.8	997
GG5	26/11/2019	9:46	-1.41	0.0	0.1	0.1	0.00	2.7	1.5	0.00	14	0	0	84.6	997
GG4	26/11/2019	10:03	0.05	0.1	0.0	0.0	0.00	5.0	5.0	0.00	16.4	0	0	78.6	997
GG6	26/11/2019	10:10	0.00	0.0	0.0	0.0	0.00	4.6	4.5	0.00	13.4	0	0	82.1	997
GG7	26/11/2019	10:22	0.05	0.0	0.0	0.0	0.00	2.7	2.7	0.00	14.1	0	0	83.2	997
GG8	INACCESSIBLE														
GG9	INACCESSIBLE														

**Hazardous Ground Gas Guideline Criteria**

	Denotes Characteristic Gas Situation of 1 (NSW EPA (2012), <i>Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases</i> )
	Denotes Characteristic Gas Situation of 2 (NSW EPA (2012), <i>Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases</i> )
	Denotes Characteristic Gas Situation of 3 (NSW EPA (2012), <i>Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases</i> )
	Elevated above the 1% volume criteria for CH <sub>4</sub> and 1.5% for CO <sub>2</sub> presented in the NSW EPA <i>Solid Waste Landfill Guidelines (2016)</i>

### 5.3 Service Pits

A total of 12 service pits are monitored in the field for potential accumulated or venting gases. Gas readings were taken from within the service pits, as well as above the service pits (approximately 1m directly above). A summary of gas results from within and above service pits is presented in **Table 6** below.

No detectable concentrations of CH<sub>4</sub> were identified in any of the accessible service pits across the school. A low concentration of CO<sub>2</sub> was detected within or above a number of service pits; however, the CO<sub>2</sub> concentrations recorded were below the threshold levels specified in the NSW EPA (2016) Guideline. Concentrations of CO were detected in and above all service pits, likely due to high levels of smoke haze in the region on the date of monitoring. Concentrations of H<sub>2</sub>S were not detected in any pits.

Due to access constraints, service pits P2, P9, P10, P11 and P12 were not accessible during the November monitoring round.

**Table 6: Service Pit Gas Results**

Service Pit		CH <sub>4</sub> (%v/v)	CO <sub>2</sub> (%v/v)	O <sub>2</sub> (%v/v)	CO (ppm)	H <sub>2</sub> S (ppm)
P1	(1m above pit)	0.0	0.0	20.4	0.0	0.0
	(within pit)	0.0	0.0	20.4	1.0	0.0
P2	(1m above pit)	Inaccessible				
	(within pit)					
P3	(1m above pit)	0.0	0.0	20.3	1.0	0.0
	(within pit)	0.0	0.0	20.2	2.0	0.0
P4	(1m above pit)	0.0	0.1	20.4	0.0	0.0
	(within pit)	0.0	0.1	20.3	0.0	0.0
P5	(1m above pit)	0.0	0.0	21.0	2.0	0.0
	(within pit)	0.0	0.1	20.7	1.0	0.0
P6	(1m above pit)	0.0	0.0	20.3	2.0	0.0
	(within pit)	0.0	0.0	20.3	2.0	0.0
P7	(1m above pit)	0.0	0.0	20.3	2.0	0.0
	(within pit)	0.0	0.1	20.2	2.0	0.0
P8	(1m above pit)	0.0	0.0	20.3	2.0	0.0
	(within pit)	0.0	0.0	20.2	2.0	0.0
P9	(1m above pit)	Inaccessible				
	(within pit)					
P10	(1m above pit)	Inaccessible				
	(within pit)					
P11	(1m above pit)	Inaccessible				
	(within pit)					
P12	(1m above pit)	Inaccessible				
	(within pit)					

## 6 MONTHLY SITE INSPECTION CHECKLIST

During the monthly subsurface gas monitoring round, a monthly site inspection checklist is also compiled. Refer to the **Monthly Site Inspection Checklist** for the month of November 2019 for details.

## 7 FINDINGS

The main findings of this subsurface gas monitoring round can be summarised as follows:

- All monitoring wells had a GSV of 1 (Very Low Risk). Therefore, detections of CO<sub>2</sub> and CH<sub>4</sub> are not considered to pose a risk to site users or nearby receptors.
- Results have indicated that gas emissions from service pits were below relevant criteria and indicative of background concentrations.

## 8 CONCLUSIONS

Results of this monitoring round indicate the site is Very Low Risk. No unacceptable risk to human health and/or environment was identified during the November 2019 monitoring round.

# Cringila PS Monthly Subsurface Gas Monitoring Report – November 2019

NSW Department of Education

Cringila Public School

Appendix A: Figures



**Legend:**

- Site Boundary
- Drainage

Metres

0 10 20 30 40 50 60 70 80

▲

**GRENCAP**  
*Going Further in Managing Risk*

Client Name:		Department of Education		
Client Number:		C107471	Project Number: J155958	
Project Description: Monthly Monitoring Report- Cringila Public School				
Address:		Cringila Public School		
Prepared:	AMW	Reviewed:	MB	Date: 19/06/2018
Figure 1		Site Location and Regional Context		

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**Legend:**

- Site Boundary
- Groundwater Monitoring Well
- Ground Gas Monitoring Well
- Service Pit Location

Metres

0 10 20 30 40 50 60 70 80

▲

		Client Name: Department of Education	
		Client Number: C107471	Project Number: J155958-01
Level 2, 11-17 Khartoum Road North Ryde, NSW 2113 Ph: 02-9889-1800 Fx: 02-9889-1811		Project Description: Monthly Monitoring Report - Cringila Public School	
Address: Cringila Public School		Prepared: AMW	Reviewed: MB
Figure G: Groundwater Well, Gas Well and Service Pit Locations		Date: 19/06/2018	

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# Cringila PS Monthly Subsurface Gas Monitoring Report – November 2019

NSW Department of Education

Cringila Public School

Appendix B: Calibration Certificates

## Gas Calibration Certificate



Instrument **GA5000**  
 Serial No. **G505858**  
 Sensors **CH4, CO2, O2, CO, H2S**

Air-Met Scientific Pty Ltd  
 1300 137 067

Item	Test	Pass	Comments
<b>Battery</b>	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
	Recharge OK?	✓	
<b>Switch/keypad</b>	Operation	✓	
<b>Display</b>	Intensity	✓	
	Operation (segments)	✓	
<b>Grill Filter</b>	Condition	✓	
	Seal	✓	
<b>Pump</b>	Operation	✓	
	Filter	✓	
	Flow	✓	
	Valves, Diaphragm	✓	
<b>PCB</b>	Condition	✓	
<b>Connectors</b>	Condition	✓	
<b>Sensor</b>	O2	✓	
	CH4	✓	
	CO2	✓	
	CO	✓	
	H2S	✓	
<b>Alarms</b>	Beeper	✓	
	Settings	✓	
<b>Software</b>	Version		
<b>Datalogger</b>	Operation		
<b>Download</b>	Operation		
<b>Other tests:</b>			

### Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Diffusion mode  Aspirated mode

Sensor	Serial no	Calibration gas and concentration	Certified	Gas bottle No	Instrument Reading
O2		20.9% Vol O2		Fresh Air	20.9% O2
CH4		60% CH4	NATA	SY244	59.8% CH4
CO2		40% CO2	NATA	SY244	39.7% CO2
CO		100ppm CO	NATA	SY277	97ppm CO
H2S		25ppm H2S	NATA	SY277	23ppm H2S

Calibrated by: \_\_\_\_\_

Sen Philip

Calibration date: 25/10/2019

Next calibration due: 22/04/2020