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104 Market Street
Wollongong NSW 2500
Australia

CRINGILA PUBLIC SCHOOL MONTHLY SUBSURFACE GAS MONITORING REPORT – AUGUST 2019

August 2019
J153825-03

NSW Department of Education

Cringila Public School

35 Sheffield Street,
Cringila NSW 2502

C107471:TO/RC

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Cringila PS Monthly Subsurface Gas Monitoring Report – August 2019

NSW Department of Education

Cringila Public School

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1 INTRODUCTION

This report summarises the findings of the August 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 23rd August 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 25th 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
17/08/2019	15.5	17.5	0	S	13	SE	20	1019.6	1019.2
18/08/2019	17	18.9	0	NNW	20	NE	26	1019.4	1012.1
19/08/2019	13	14.3	0	W	28	W	48	1014.9	1015.5
20/08/2019	13.3	17.5	0	W	39	W	39	1021.9	1017.5
21/08/2019	16.7	19.8	0	W	26	WSW	54	1014.6	1011.3
22/08/2019	17.5	14.6	0	W	22	S	35	1011.2	1016.1
23/08/2019	12.4	15.6	0	W	15	NE	17	1027.8	1023.5

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

- Temperatures during the week prior, and on the morning of monitoring were mild, and were observed to increase throughout the day;
- No rainfall was recorded throughout the week prior to monitoring;
- High wind speeds (>10km/h) were recorded on all mornings and afternoons of the week prior to, and including, the day of monitoring; and
- Barometric pressure was observed to fluctuate over the week prior to monitoring, peaking on the day of monitoring (23/8/2019).

3 FIELDWORK METHODOLOGY

Fieldwork was undertaken on 23rd August 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_4) - (%v/v): Maximum and stable concentrations;
- Carbon Dioxide (CO_2) - (%v/v): Maximum and stable concentrations;
- Oxygen (O_2) - (%v/v): Minimum and stable concentrations;
- Carbon Monoxide (CO) - (ppm): Maximum concentration;
- Hydrogen Sulphide (H_2S) - (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**.

Table 2: Threshold Levels for Hazardous Gases

Analyte	Threshold level reference	Unit	Threshold Level	Comments
CH_4	NSW EPA 2016 (1)	% (volume/volume)	1.0	The threshold level for further investigation and corrective action
CO_2			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_4 or CO_2 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.

Table 3: GSV and CS and Characterising Landfill Gas Risk (NSW EPA 2012)

Gas Screening Value Threshold (L/hr)	Characteristic Gas Situation	Risk Classification	Additional Factors
<0.07	**1**	Very low risk	Typically, CH_4 <1% v/v and/or CO_2 <5% v/v, otherwise consider increase to Situation 2[1]
<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.**

Table 4: Threshold Levels for Service Pits

Analyte	Threshold level reference	Unit	Threshold Level	Comments
CH_4	NSW EPA 2016 (1)	% (volume/volume)	1.0	The threshold level for further investigation and corrective action
CO_2			1.5	
CO_2	Safe Work Australia HSIS (2)	ppm	TWA (3): 5000 STEL (4): 30,000	Work Place Exposure Standards - Only applicable to service pits to assess risks for utility workers
H_2S	Safe Work Australia HSIS (2)	ppm	TWA: 10 STEL: 15	

[1] 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 [2]	ppm	TWA: 30	- Not applicable for ground gas

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_4 was detected in monitoring wells GG1, GG2 and GG6, at a level below the adopted NSW EPA (2016) Guideline.

CO_2 concentrations were detected in exceedance of the adopted NSW EPA (2016) threshold in wells GG2, GG3, GG4, GG6 and GG9.

Measured flow rates recorded in all subsurface monitoring wells were consistently 0.0L/hr.

CO was detected in subsurface monitoring wells GG6, GG7, GG8 and GG9. H_2S was not detected in any of the subsurface monitoring wells. O_2 concentrations ranged between 12.5%v/v (GG8) and 20.8%v/v (GG7).

Subsurface monitoring well GG5 was not accessible at the time of inspection.

5.2 Characteristic Gas Situation

GSVs calculated for CH_4 and CO_2 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	23/8/2019	11:45	0.03	0.0	0.2	0.1	0.00	0.3	0.3	0.00	20.6	0	0	79.2	1022
GG2	23/8/2019	11:35	0.00	0.0	0.2	0.1	0.00	2.1	1.9	0.00	19.4	0	0	78.6	1022
GG3	23/8/2019	12:00	0.02	0.0	0.0	0.0	0.00	2.9	2.9	0.00	18.5	0	0	78.5	1020
GG4	23/8/2019	11:55	0.02	0.0	0.0	0.0	0.00	7.7	7.7	0.00	14.6	0	0	77.6	1021
GG5	23/8/2019	INACCESIBLE													
GG6	23/8/2019	12:15	0.07	0.0	0.1	0.0	0.00	1.7	1.5	0.00	20	2	0	78.5	1021
GG7	23/8/2019	12:20	0.05	0.0	0.0	0.0	0.00	0.8	0.8	0.00	20.8	1	0	78.5	1021
GG8	23/8/2019	12:30	-3.06	0.0	0.0	0.0	0.00	0.6	0.5	0.00	12.5	3	0	85.3	1020
GG9	23/8/2019	12:40	0.03	0.0	0.0	0.0	0.00	8.3	8.3	0.00	13.6	1	0	78	1020

Hazardous Ground Gas Guideline Criteria

	Denotes Characteristic Gas Situation of 1 (NSW EPA (2012), *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases*)
	Denotes Characteristic Gas Situation of 2 (NSW EPA (2012), *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases*)
	Denotes Characteristic Gas Situation of 3 (NSW EPA (2012), *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases*)
	Elevated above the 1% volume criteria for CH_4 and 1.5% for CO_2 presented in the NSW EPA *Solid Waste Landfill Guidelines (2016)*

5.3 Service Pits

A total of 12 service pits were 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_4 were identified in any of the accessible service pits across the school. A low concentration of CO_2 was detected within all service pits; however, the CO_2 concentrations recorded were below the threshold levels specified in the NSW EPA (2016) Guideline. Concentrations of CO and H_2S were not detected in service pits during the July 2019 monitoring round - these detections remain below the Work Place Exposure Standard (Safe Work Australia, 2013).

Due to operational/access constraints, service pits P2, P3 and P9 were not accessible during the August monitoring round.

Table 6: Service Pit Gas Results

Service Pit		CH_4 (%v/v)	CO_2 (%v/v)	O_2 (%v/v)	CO (ppm)	H_2S (ppm)
P1	(1m above pit)	0.0	0.1	21.1	0.0	0.0
	(within pit)	0.0	0.1	21.1	0.0	0.0
P2	(1m above pit)	Inaccessible				
	(within pit)					
P3	(1m above pit)	0.0	0.1	21.1	0.0	0.0
	(within pit)	Inaccessible				
P4	(1m above pit)	0.0	0.1	21.1	0.0	0.0
	(within pit)	0.0	0.1	21.1	0.0	0.0
P5	(1m above pit)	0.0	0.1	21.2	0.0	0.0
	(within pit)	0.0	0.1	21.2	0.0	0.0
P6	(1m above pit)	0.0	0.1	21.2	0.0	0.0
	(within pit)	0.0	0.1	21.2	0.0	0.0
P7	(1m above pit)	0.0	0.1	21.1	0.0	0.0
	(within pit)	0.0	0.1	21.1	0.0	0.0
P8	(1m above pit)	0.0	0.1	21.2	0.0	0.0
	(within pit)	0.0	0.1	21.2	0.0	0.0
P9	(1m above pit)	0.0	0.1	20.8	0.0	0.0
	(within pit)	Inaccessible				
P10	(1m above pit)	0.0	0.1	20.8	0.0	0.0
	(within pit)	0.0	0.1	20.8	0.0	0.0
P11	(1m above pit)	0.0	0.1	20.9	0.0	0.0
	(within pit)	0.0	0.1	21.0	0.0	0.0
P12	(1m above pit)	0.0	0.1	21.0	0.0	0.0
	(within pit)	0.0	0.1	21.0	0.0	0.0

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 August 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_2 and CH_4 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

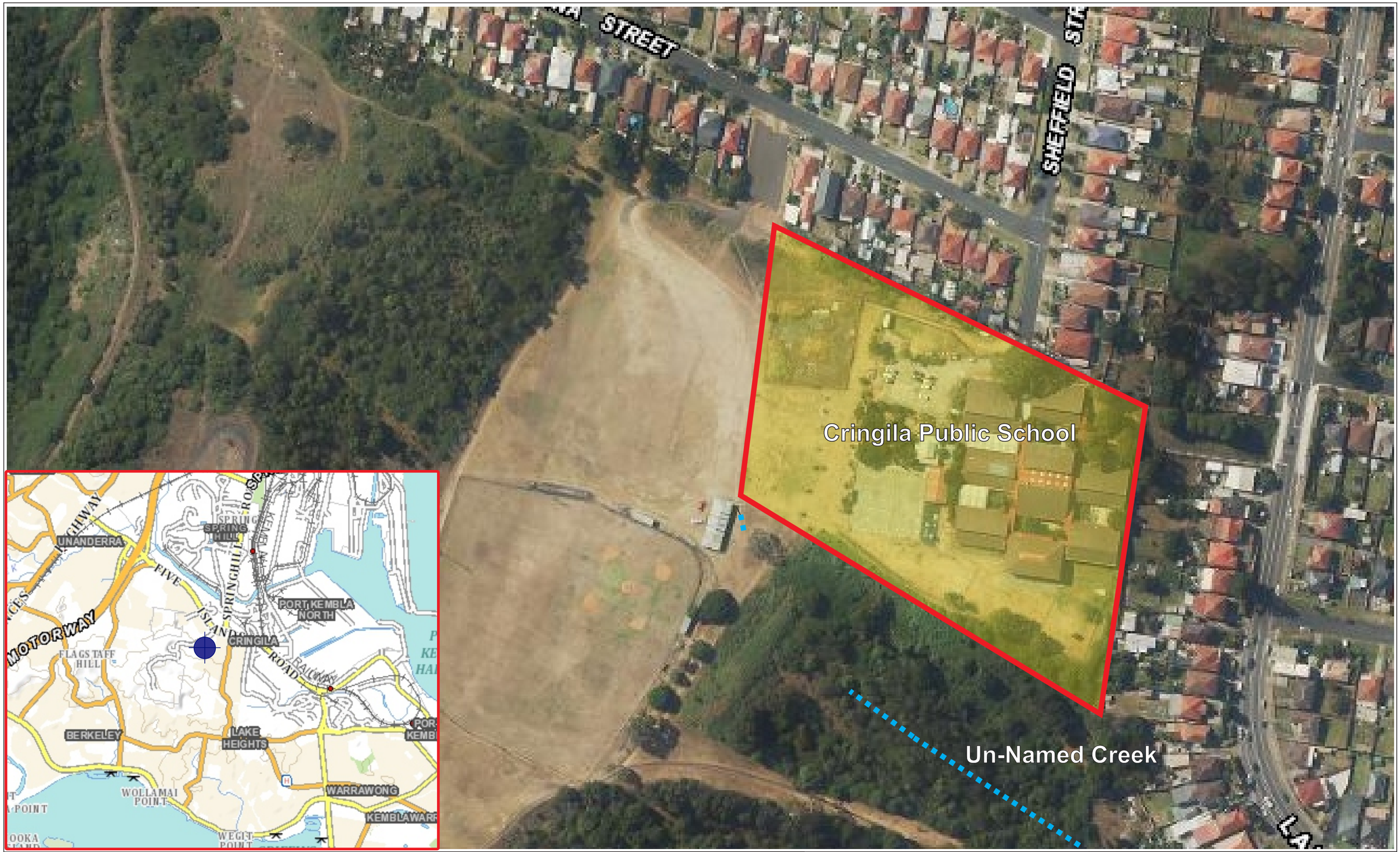
Results of this monitoring round indicate the site is Very Low Risk. No unacceptable risk to human health and/or environment was identified during the August 2019 monitoring round.

Cringila PS Monthly Subsurface Gas Monitoring Report – August 2019

NSW Department of Education

Cringila Public School

Appendix A: Figures



Legend:

- Site Boundary
- Drainage

Metres
0 10 20 30 80

GREENCAP
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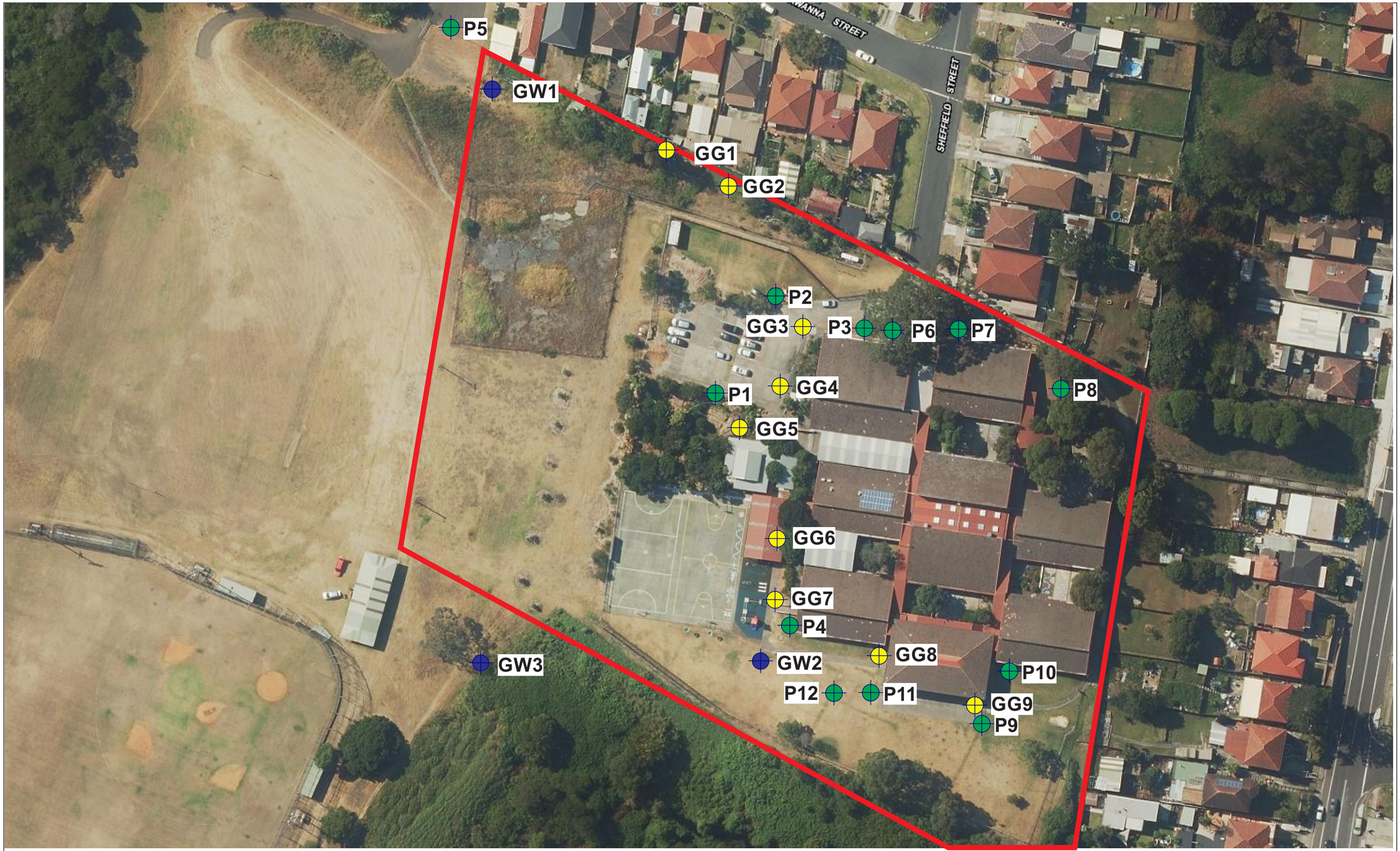
Level 2, 11-17 Khartoum Road
North Ryde, NSW 2113
Ph: 02-9889-1800
Fx: 02-9889-1811

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				



Legend:

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

Metres

0 10 20 30 80

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North Ryde, NSW 2113
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Project Description:	Monthly Monitoring Report - Cringila Public School				
Address:	Cringila Public School				
Prepared:	AMW	Reviewed:	MB	Date:	19/06/2018
Figure 2	Groundwater Well, Gas Well and Service Pit Locations				

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Cringila Public School

Appendix B: Calibration Certificates

Gas Calibration Certificate

airmet
Air-Met Scientific Pty Ltd
1300 137 067

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

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

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	59.9% CH4
CO2		40% CO2	NATA	SY244	39.8% CO2
CO		100ppm CO	NATA	SY277	99ppm CO
H2S		25ppm H2S	NATA	SY277	24ppm H2S

Calibrated by: **Sen Philip**

Calibration date: **21/08/2019**

Next calibration due: **17/02/2020**