

APPENDIX A

A-1 Unit conversions

Mass per unit volume: usually $\mu\text{g}/\text{m}^3$. The mass of pollutant is expressed as a ratio to the volume of air. Since the volume of a given parcel of air is depended upon the temperature and pressure at the time sampling, the pollutant concentration expressed in these units, should, strictly speaking, specify the conditions at the time of sampling.

Volume mixing ratio: usually ppm-part per million (10^{-6}); or ppb-part per billion (10^{-9}). This unit expressed the concentration of a pollutant as ratio of its volume if segregated pure, to the volume of the air in which it is contained. Ideal gas behavior is assumed thus the concentration is not depended on temperature and pressure as these affect both the pollutant and air to the same extent. As a consequence of the gas laws, a gas present at a volume mixing ratio of 1 ppm is not only $1 \text{ cm}^3/10^6 \text{ cm}^3$ of polluted air, it is also 1 molecule per 10^6 molecules and has a partial pressure of one millionth of the atmospheric pressure.

Conversion factors

$$\text{ppbv} = \mu\text{g}/\text{m}^3 \times \frac{\text{molecular volume (liters)}}{\text{molecular weight}}$$

Where:

$$\text{molecular volume} = 22.41 \times \frac{T}{273} \times \frac{101.3}{P}$$

T = absolute temperature (K) (Remember that Celcius+273 = Kelvin)

P = atmospheric pressure (kPa) (Remember that 1 atm = 760 mmHg, 1 atm = 101.3 kPa and 1 torr = 133.322 Pa)

Similarly

$$\mu\text{g}/\text{m}^3 = \text{ppbv} \times \frac{\text{molecular weight}}{\text{molecular volume (liters)}}$$

AFFENDIX B

Table B-1 Ozone concentrations and meteorological parameters data in wet season with low concentrations (< 35 ppbv)

Date	Sampling time	O ₃ (AOSD)	O ₃ (Std)	Temp. (°C)	WS (m/s)	WD (Degree)	RH (%)	SR (w/m ²)	NR (w/m ²)	BP (mmHG)	Rain (mm)
6/6/2014	10 – 11	86.4	21.6	30.1	3.3	165.6	63.2	875.8	489.5	728.1	0.0
	11 - 12	101.8	25.2	31.2	3.1	125.7	59.2	819.2	495.8	727.4	0.0
	14 - 15	85.8	19.3	31.5	3.3	217.6	57.5	792.9	104.1	725.4	0.0
	15 - 16	36.7	11.0	27.7	5.2	184.3	70.4	971.8	9.1	725.1	7.3
7/6/2014	10 – 11	49.4	22.9	28.0	1.3	43.8	73.2		253.8	728.0	0.0
	11 - 12	76.9	23.4	29.9	2.7	176.4	62.0	859.2	512.9	727.4	0.0
	14 - 15	77.5	13.7	30.7	4.6	199.9	57.6	793.5	323.3	725.6	0.0
	15 - 16	68.6	15.8	31.1	3.4	189.3	56.6	778.9	213.3	725.4	0.0
13/6/2014	10 – 11	45.1	21.0	28.3	2.3	180.5	68.3	947.1	328.9	725.6	0.3
	11 - 12	43.0	22.0	28.3	2.7	181.3	69.5	963.7	133.8	725.3	0.0
	14 - 15	23.0	15.0	26.2	1.4	329.7	86.6		94.3	723.2	0.0
	15 - 16	34.8	10.0	26.7	1.4	116.4	82.7		-0.2	723.5	1.0
14/6/2014	10 – 11	35.1	24.0								
	11 - 12	42.9	23.0								
	14 - 15	31.1	21.0								
	15 - 16	33.6	21.0	26.8	3.0	217.2	73.0		89.4	725.6	0.0
15/6/2014	10 – 11	36.0	27.0	27.7	3.8	202.9	66.8	921.2	371.6	728.7	0.0
	11 - 12	34.6	26.0	28.0	3.6	214.0	66.7	925.5	348.4	728.1	2.8
	14 - 15	23.5	23.0	28.6	4.2	225.2	63.6	875.6	140.1	726.7	0.0
	15 - 16	14.9	22.0	27.9	3.4	269.5	68.5	943.3	100.2	726.0	0.0

Table B-1 Ozone concentrations and meteorological parameters data in wet season with low concentrations (< 35 ppbv) (cont.)

Date	Sampling time	O ₃ (AOSD)	O ₃ (Std)	Temp. (°C)	WS (m/s)	WD (Degree)	RH (%)	SR (w/m ²)	NR (w/m ²)	BP (mmHG)	Rain (mm)
16/6/2014	10 – 11	26.7	22.0	26.3	2.8	241.7	73.5		355.4	727.4	0.0
	11 - 12	25.2	24.0	27.9	3.5	217.1	68.2	944.5	458.5	727.3	0.0
	14 - 15	23.9	19.0	27.2	3.8	251.5	73.0		208.9	725.3	0.0
	15 - 16	18.4	15.0	27.1	4.3	224.6	72.7		74.3	724.7	0.0
23/6/2014	10 – 11	17.8	21.0	29.0	3.0	220.5	63.3	870.0	209.7	728.4	0.0
	11 - 12	16.2	18.0	30.0	4.1	198.5	58.3	801.8	270.6	728.2	0.0
	14 - 15	16.3	17.0	30.4	3.5	207.0	58.0	802.6	83.6	726.4	0.3
	15 - 16	12.9	16.0	29.7	3.8	308.8	64.7	890.5	63.9	725.8	0.0
25/6/2014	10 – 11	17.2	24.0	26.1	3.8	178.7	80.4		231.2	728.2	0.3
	11 - 12	12.5	12.0	26.2	3.2	143.0	80.7		23.0	726.6	0.0
	14 - 15	11.7	10.0	26.7	2.3	116.3	78.2		6.8	726.6	0.3
26/6/2014	10 – 11	22.2	23.0	28.4	4.1	187.4	64.2	884.1	384.7	732.0	0.0
2/7/2014	10 – 11	21.7	27.0	29.4	2.2	174.4	56.1	777.3	252.9	730.8	0.0
	11 - 12	23.1	30.0	30.9	2.1	175.1	52.1	718.7	413.3	730.5	0.0
	14 - 15	18.5	23.0	31.5	3.4	246.9	50.2	690.8	308.5	728.9	0.3
	15 - 16	21.4	18.0	31.0	4.1	211.8	54.0	748.7	86.1	728.1	0.0
3/7/2014	10 – 11	17.6	20.0	28.4	2.2	239.7	62.7	869.8	209.8	729.3	0.0
	11 - 12	25.0	23.0	29.9	3.2	202.6	57.4	792.2	275.6	728.7	0.0
	14 - 15	19.8	17.0	30.8	3.9	252.7	53.8	740.1	180.9	726.9	0.0
	15 - 16	14.5	11.0	29.9	4.4	245.6	55.0	762.0	33.2	726.2	0.5
22/7/2014	10 – 11	23.0	28.0	26.3	1.2	178.2	71.8	988.3	160.6	729.7	0.0
	11 - 12	25.1	33.0	27.1	1.8	187.0	68.8	946.6	197.9	729.5	0.0
	14 - 15	21.9	20.0	26.8	2.9	234.7	71.2	985.7	168.5	727.4	0.0
	15 - 16	17.2	17.0	25.0	2.6	243.2	80.3		-25.3	726.9	5.3

Table B-1 Ozone concentrations and meteorological parameters data in wet season with low concentrations (< 35 ppbv) (cont.)

Date	Sampling time	O ₃ (new AS)	O ₃ (Std)	Temp. (°C)	WS (m/s)	WD (Degree)	RH (%)	SR (w/m ²)	NR (w/m ²)	BP (mmHG)	Rain (mm)
23/7/2014	10 – 11	16.5	16.0	25.9	1.0	144.4	78.4		43.9	729.2	0.0
	11 - 12	23.5	28.0	27.6	1.7	113.1	71.7	987.2	77.2	728.9	0.0
	14 - 15	19.2	16.0	24.2	1.4	176.0	86.9		39.5	725.8	0.3
	15 - 16	13.6	11.0	26.3	2.2	152.7	74.3		14.2	726.3	0.3
26/7/2014	10 – 11	14.2	22.0	27.1	1.8	216.2	72.4	997.0	35.2	730.9	0.0
	11 - 12	14.9	24.0	28.3	2.2	200.0	66.7	918.0	89.9	730.5	0.0
	14 - 15	23.0	28.0	30.8	3.4	190.9	57.3	794.2	273.5	728.8	0.0
	15 - 16	18.1	24.0	30.2	3.4	197.2	59.0	817.2	95.3	728.0	0.0
27/7/2014	10 – 11	12.9	17.0	24.8	2.5	207.2	84.3		22.0	730.9	0.0
	11 - 12	14.2	21.0	25.9	3.5	195.4	79.7		23.0	730.8	0.0
	14 - 15	16.4	21.0	27.9	2.8	187.8	69.5	963.7	-41.5	728.9	0.0
	15 - 16	16.6	18.0	27.8	1.5	139.8	71.6	993.0	-41.0	728.3	0.0

Table B-2 Ozone concentrations and meteorological parameters data in dry season with medium concentrations (30 - 70 ppbv)

Date	Sampling time	O ₃ (AOSD)	O ₃ (Std)	Temp. (°C)	WS (m/s)	WD (Degree)	RH (%)	SR (w/m ²)	NR (w/m ²)	BP (mmHG)	Rain (mm)
18/11/2014	10 – 11	23.7	50.0	34.5	2.2	130.6	51.1	350.4	247.5	739.2	0.0
	11 - 12	19.3	48.0	34.1	1.6	97.5	52.5	309.5	217.8	738.2	0.0
	14 - 15	24.3	52.0	36.0	2.8	125.1	47.2	135.5	117.3	736.2	0.0
	15 - 16	27.7	51.0	34.7	2.3	158.8	50.0	56.4	19.2	735.9	0.0
19/11/2014	10 – 11	20.8	52.0	34.9	1.6	162.0	48.5	589.9	396.6	738.8	0.0
	11 - 12	31.3	64.0	36.4	2.1	155.1	43.9	559.6	366.8	737.8	0.0
	14 - 15	26.2	56.0	35.2	2.4	122.9	46.9	120.9	91.1	735.2	0.0
	15 - 16	21.2	56.0	32.7	2.3	136.0	49.0	76.0	21.0	735.0	0.0
27/11/2014	10 – 11	19.6	48.0	34.0	1.8	118.6	53.6	587.4	427.7	736.4	0.0
	11 - 12	25.6	54.0	35.9	2.3	120.9	45.4	622.2	421.9	735.4	0.0
	14 - 15	26.1	53.0	35.7	2.1	143.0	41.0	138.0	87.4	733.0	0.0
	15 - 16	23.5	52.0	34.5	1.8	131.1	44.2	52.5	10.2	732.7	0.0
28/11/2014	10 – 11	32.7	39.0	33.3	1.9	194.0	52.3	605.4	447.2	736.6	0.0
	11 - 12	38.6	46.0	35.7	1.8	118.8	45.3	623.2	426.4	735.6	0.0
	14 - 15	51.1	62.0	36.0	1.2	107.5	44.6	140.3	90.3	733.1	0.0
	15 - 16	46.8	64.0	34.8	0.9	168.4	44.9	49.4	9.3	732.8	0.0
29/11/2014	10 – 11	63.6	35.0	33.3	1.8	228.1	45.0	614.8	449.6	736.2	0.0
	11 - 12	65.9	44.0	35.7	1.5	101.5	41.1	628.3	422.0	735.1	0.0
	14 - 15	94.9	71.0	35.9	1.5	124.4	39.5	150.3	89.8	732.5	0.0
	15 - 16	78.8	70.0	34.8	1.1	137.0	41.5	49.6	5.4	732.3	0.0
3/12/2014	10 – 11	42.3	33.0	32.3	1.8	45.9	54.8	567.3	418.4	735.1	0.0
	11 - 12	51.5	50.0	35.3	1.9	95.1	48.5	579.5	394.8	734.6	0.0
	14 - 15	60.8	64.0	35.2	3.2	122.0	51.0	171.0	105.4	732.0	0.0
	15 - 16	48.1	58.0	34.0	2.5	138.6	54.9	54.6	18.4	731.8	0.0

Table B-2 Ozone concentrations and meteorological parameters data in dry season with medium concentrations (30 - 70 ppbv) (cont.)

Date	Sampling time	O ₃ (new AS)	O ₃ (Std)	Temp. (°C)	WS (m/s)	WD (Degree)	RH (%)	SR (w/m ²)	NR (w/m ²)	BP (mmHG)	Rain (mm)
13/12/2014	10 – 11	46.5	39.0	32.8	2.2	118.2	48.1	539.2	400.7	739.6	0.0
	11 - 12	46.1	47.0	34.9	1.8	110.9	43.6	559.5	379.5	738.8	0.2
	14 - 15	53.7	45.0	34.0	2.0	242.0	43.5	140.7	85.6	736.1	0.4
	15 - 16	41.9	47.0	32.3	0.8	216.2	49.7	61.3	21.5	735.8	0.0
14/12/2014	10 – 11	34.6	41.0	32.0	1.9	119.5	55.0	528.6	390.9	738.6	0.0
	11 - 12	39.7	56.0	34.0	2.0	121.1	48.2	547.4	372.2	737.6	0.0
	14 - 15	78.8	68.0	34.3	1.2	142.3	48.5	181.6	129.1	734.6	0.0
	15 - 16	46.5	63.0	32.9	1.0	138.0	52.1	59.1	20.7	734.2	0.0
23/12/2014	10 – 11	36.0	39.0	27.9	2.3	212.5	44.3	546.8	394.4	738.8	0.0
	11 - 12	51.5	47.0	30.8	1.8	164.0	38.1	585.1	375.9	738.0	0.0
	14 - 15	61.0	56.0	31.6	1.8	127.1	37.5	216.4	144.7	735.5	0.0
	15 - 16	45.0	53.0	30.1	1.4	128.4	42.3	67.7	19.2	735.3	0.0
24/12/2014	10 – 11	37.2	34.0	29.4	2.7	77.1	47.4	555.8	403.7	737.8	0.0
	11 - 12	49.0	43.0	32.4	1.5	109.7	38.8	595.1	391.2	736.8	0.0
	14 - 15	54.9	54.0	32.9	1.5	169.2	35.1	219.3	145.1	735.0	0.0
	15 - 16	42.2	54.0	31.2	1.4	196.0	39.3	62.8	14.0	734.8	1.2
25/12/2014	10 – 11	45.4	35.0	29.3	1.8	77.3	51.2	538.1	391.3	737.5	0.0
	11 - 12	49.1	42.0	32.4	1.9	123.8	41.8	581.7	382.6	736.7	0.0
	14 - 15	63.8	63.0	33.5	1.7	137.6	39.2	213.4	143.0	733.7	0.0
	15 - 16	51.9	65.0	32.2	0.8	166.2	43.1	66.9	20.8	733.5	0.0

Table B-3 Ozone concentrations and meteorological parameters data in dry season with high concentrations (> 70 ppbv)

Date	Sampling time	O ₃ (AOSD)	O ₃ (Std)	Temp. (°C)	WS (m/s)	WD (Degree)	RH (%)	SR (w/m ²)	NR (w/m ²)	BP (mmHG)	Rain (mm)
3/3/2015	10 – 11	68.2	83.0	36.8	2.2	132.0	32.6	586.4	353.9	733.7	0.0
	11 - 12	134.5	93.0	39.5	2.6	136.7	28.7	632.8	370.2	732.5	0.0
	14 - 15	137.1	78.0	41.1	2.9	155.1	26.3	428.3	277.2	730.4	0.0
	15 - 16	107.5	76.0	40.4	2.3	151.4	26.7	242.4	146.9	729.5	0.0
10/3/2015	10 – 11	43.6	45.0	35.2	0.5	51.4	37.2	398.1	240.7	735.5	0.0
	11 - 12	65.0	67.0	37.8	1.4	112.3	33.5	461.4	267.6	734.8	0.0
	14 - 15	71.9	63.0	40.3	3.9	138.7	27.3	382.0	259.8	733.0	0.0
	15 - 16	80.4	64.0	40.5	3.6	151.3	24.4	265.8	142.1	732.3	0.0
11/3/2015	10 – 11	40.3	53.0	37.8	1.8	98.6	38.0	481.7	297.2	736.3	0.0
	11 - 12	42.7	78.0	39.4	2.6	133.2	35.2	523.5	303.6	735.4	0.0
	14 - 15	66.9	70.0	41.0	3.9	146.9	29.2	418.3	303.2	733.3	0.0
	15 - 16	61.3	69.0	40.9	3.6	151.9	26.2	292.3	154.8	732.5	0.0
12/3/2015	10 – 11	51.1	58.0	37.0	1.9	117.0	40.6	514.6	312.6	736.1	0.0
	11 - 12	59.7	71.0	39.3	2.2	113.1	34.7	575.6	335.1	735.2	0.0
	14 - 15	79.3	77.0	41.1	3.0	122.7	30.6	411.6	295.3	732.9	0.0
	15 - 16	74.1	68.0	40.7	3.2	140.2	26.2	260.9	140.1	732.0	0.0
13/3/2015	10 – 11	45.9	57.0	38.0	2.2	114.9	33.8	595.3	367.3	735.6	0.0
	11 - 12	58.4	78.0	40.2	2.8	111.0	27.6	639.8	375.4	734.5	0.0
	14 - 15	60.0	74.0	42.0	3.7	148.6	20.7	487.6	341.8	732.3	0.0
	15 - 16	63.4	69.0	41.5	3.7	140.5	19.1	265.5	141.2	731.5	0.0
21/3/2015	10 – 11	46.9	38.0	38.0	1.3	111.7	29.9	507.1	290.8	734.4	0.0
	11 - 12	56.2	88.0	40.5	2.4	108.0	26.1	568.5	315.1	733.6	0.0
	14 - 15	89.1	93.0	42.6	2.7	146.2	19.6	451.2	290.4	731.6	0.0
	15 - 16	81.0	80.0	42.6	2.6	149.2	16.1	275.5	114.6	730.6	0.0

Table B-3 Ozone concentrations and meteorological parameters data in dry season with high concentrations (> 70 ppbv) (cont.)

Date	Sampling time	O ₃ (AOSD)	O ₃ (Std)	Temp. (°C)	WS (m/s)	WD (Degree)	RH (%)	SR (w/m ²)	NR (w/m ²)	BP (mmHG)	Rain (mm)
5/4/2015	11 - 12	77.1	63.0	41.1	1.7	76.5	33.0	619.4	397.7	732.3	0.0
	12 - 13	69.5	69.0	42.6	1.6	52.9	29.8	538.5	373.0	731.5	0.0
	13 - 14	80.7	76.0	42.9	1.4	150.1	28.0	472.1	249.6	730.5	0.0
	14 - 15	72.9	82.0	42.3	1.5	174.8	27.2	293.5	116.9	729.9	0.0
6/4/2015	11 - 12	74.6	60.0	41.9	1.7	85.3	35.7	663.5	436.4	732.6	0.0
	12 - 13	91.3	74.0	43.1	2.5	115.8	33.0	590.1	422.9	731.8	0.0
	13 - 14	105.1	80.0	42.7	2.8	137.9	29.9	523.7	281.6	730.9	0.0
	14 - 15	81.9	68.0	42.3	3.2	141.3	28.7	389.7	127.3	730.2	0.0
7/4/2015	11 - 12	61.8	56.0	44.0	2.5	68.6	24.6	670.8	445.8	733.3	0.0
	12 - 13	69.2	61.0	44.9	2.1	66.1	21.6	601.8	441.8	732.3	0.0
	13 - 14	81.9	73.0	44.4	2.7	130.4	22.7	566.0	298.9	731.3	0.0
	14 - 15	82.9	70.0	43.4	3.1	143.4	22.0	341.7	119.9	730.4	0.0
8/4/2015	11 - 12	51.7	60.0	39.7	3.6	121.4	44.4	550.3	375.6	733.9	0.0
	12 - 13	51.0	64.0	40.2	3.3	129.0	43.3	428.5	296.9	732.9	0.0
	13 - 14	59.1	57.0	40.4	3.4	123.5	43.5	481.9	282.0	731.8	0.0
	14 - 15	61.5	51.0	40.3	2.9	110.8	44.5	357.1	138.6	730.8	0.0

APPENDIX C

The data results of optimum conditions testing for ozone sampling in wet season with low ozone concentrations (< 35 ppbv)

Table C-1 Condition of 1.0% NaNO₂/ 1.0% Na₂CO₃/ 10% ethylene glycol of absorbing solution and 0.5 L/min air flow rate

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
6/6/2014	10 – 11	1	0.125	0.107	0.525	4.066	135.52	69.06	86.44	21.56	301%
		2	0.044	0.026	0.132	1.023	34.10	17.38			
	11 – 12	1	0.129	0.111	0.545	4.216	140.53	71.61	101.75	25.15	305%
		2	0.064	0.046	0.229	1.774	59.14	30.14			
	14 - 15	1	0.125	0.107	0.525	4.066	135.52	69.06	85.80	19.29	345%
		2	0.043	0.025	0.127	0.985	32.85	16.74			
	15 - 16	1	0.059	0.041	0.205	1.586	52.88	26.95	36.67	10.99	234%
		2	0.032	0.014	0.074	0.572	19.07	9.72			
	10 – 11	1	0.086	0.068	0.336	2.601	86.69	44.18	49.43	22.87	116%
		2	0.025	0.007	0.040	0.309	10.31	5.25			
7/6/2014	11 – 12	1	0.102	0.084	0.414	3.202	106.72	54.38	76.87	23.43	228%
		2	0.052	0.034	0.171	1.324	44.12	22.48			
	14 - 15	1	0.109	0.091	0.448	3.465	115.49	58.85	77.50	13.69	466%
		2	0.046	0.028	0.142	1.098	36.60	18.65			
	15 - 16	1	0.106	0.088	0.433	3.352	111.73	56.94	68.57	15.77	335%
		2	0.035	0.017	0.088	0.685	22.83	11.63			
	blank	0.025									
		0.011	0.018								
		0.017									

Table C-2 Condition of 1.0% NaNO₂/ 1.0% Na₂CO₃/ 10% ethylene glycol of absorbing solution and 1.0 L/min air flow rate

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
13/6/2014	10 – 11	1	0.089	0.071	0.36	2.78	46.34	23.61	45.05	21.00	115%
		2	0.082	0.064	0.33	2.52	42.08	21.44			
	11 – 12	1	0.118	0.100	0.50	3.84	63.98	32.60	42.98	22.00	95%
		2	0.046	0.028	0.16	1.22	20.36	10.37			
	14 - 15	1	0.062	0.044	0.23	1.79	29.91	15.24	23.04	15.00	54%
		2	0.038	0.020	0.12	0.92	15.31	7.80			
	15 - 16	1	0.093	0.075	0.38	2.93	48.77	24.85	34.82	10.00	248%
		2	0.045	0.027	0.15	1.17	19.57	9.97			
	10 – 11	1	0.104	0.086	0.43	3.33	55.46	28.26	35.13	24.00	46%
		2	0.035	0.017	0.10	0.81	13.49	6.87			
14/6/2014	11 – 12	1	0.113	0.095	0.47	3.66	60.94	31.05	42.88	23.00	86%
		2	0.051	0.033	0.18	1.39	23.22	11.83			
	14 - 15	1	0.069	0.051	0.26	2.05	34.17	17.41	31.10	21.00	48%
		2	0.057	0.039	0.21	1.61	26.87	13.69			
	15 - 16	1	0.099	0.081	0.41	3.15	52.42	26.71	33.58	21.00	60%
		2	0.035	0.017	0.10	0.81	13.49	6.87			
blank		0.022									
		0.018	0.018								
		0.015									

Table C-3 Condition of 0.5% NaNO₂/ 0.5% Na₂CO₃/ 5% ethylene glycol of absorbing solution and 1.0 L/min air flow rate

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
15/6/2014	10 – 11	1	0.106	0.092	0.46	3.55	59.21	30.17	36.04	27.00	33%
		2	0.028	0.013	0.09	0.69	11.52	5.87			
	11 – 12	1	0.110	0.096	0.48	3.69	61.46	31.32	34.56	26.00	33%
		2	0.019	0.005	0.05	0.38	6.35	3.23			
	14 - 15	1	0.065	0.051	0.27	2.05	34.21	17.43	23.49	23.00	2%
		2	0.029	0.014	0.09	0.71	11.88	6.06			
	15 - 16	1	0.049	0.034	0.19	1.45	24.23	12.35	14.90	22.00	-32%
		2	0.017	0.003	0.04	0.30	5.01	2.55			
	10 – 11	1	0.067	0.053	0.27	2.12	35.37	18.02	26.74	22.00	22%
		2	0.037	0.023	0.13	1.03	17.12	8.72			
16/6/2014	11 – 12	1	0.077	0.062	0.32	2.47	41.15	20.97	25.22	24.00	5%
		2	0.023	0.008	0.06	0.50	8.35	4.26			
	14 - 15	1	0.065	0.050	0.26	2.03	33.84	17.25	23.92	19.00	26%
		2	0.031	0.016	0.10	0.79	13.10	6.68			
	15 - 16	1	0.055	0.040	0.22	1.67	27.82	14.18	18.37	15.00	22%
		2	0.023	0.008	0.06	0.49	8.23	4.20			
blank		0.015									
		0.015	0.014								
		0.014									

Table C-4 Condition of 0.5% NaNO₂/ 0.5% Na₂CO₃/ 5% ethylene glycol of absorbing solution and 1.2 L/min air flow rate (cont.)

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
22/7/2014	10 – 11	1	0.063	0.050	0.32	2.45	34.09	17.37	22.97	28.00	-18%
		2	0.027	0.014	0.10	0.79	10.98	5.60			
	11 – 12	1	0.067	0.055	0.34	2.65	36.82	18.76	25.13	33.00	-24%
		2	0.029	0.016	0.12	0.90	12.50	6.37			
	14 - 15	1	0.068	0.055	0.34	2.66	36.88	18.79	21.93	20.00	10%
		2	0.019	0.006	0.06	0.44	6.16	3.14			
	15 - 16	1	0.046	0.033	0.22	1.68	23.30	11.87	17.21	17.00	1%
		2	0.026	0.013	0.10	0.75	10.47	5.34			
	10 – 11	1	0.039	0.026	0.17	1.34	18.66	9.51	16.46	16.00	3%
		2	0.031	0.018	0.13	0.98	13.65	6.95			
23/7/2014	11 – 12	1	0.062	0.050	0.31	2.42	33.64	17.14	23.45	28.00	-16%
		2	0.029	0.016	0.12	0.89	12.38	6.31			
	14 - 15	1	0.051	0.038	0.24	1.88	26.15	13.33	19.25	16.00	20%
		2	0.028	0.015	0.11	0.84	11.62	5.92			
	15 - 16	1	0.034	0.021	0.14	1.11	15.36	7.83	13.62	11.00	24%
		2	0.027	0.015	0.11	0.82	11.36	5.79			
blank		0.012									
		0.013	0.013								
		0.013									

Table C-5 Condition of 0.5% NaNO₂/ 0.5% Na₂CO₃/ 5% ethylene glycol of absorbing solution and 1.5 L/min air flow rate

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
23/6/2014	10 – 11	1	0.078	0.064	0.33	2.53	28.09	14.31	17.76	21.00	-15%
		2	0.027	0.012	0.08	0.61	6.75	3.44			
	11 – 12	1	0.066	0.051	0.27	2.06	22.85	11.64	16.17	18.00	-10%
		2	0.032	0.017	0.10	0.80	8.87	4.52			
	14 - 15	1	0.069	0.055	0.28	2.19	24.31	12.39	16.31	17.00	-4%
		2	0.029	0.015	0.09	0.69	7.71	3.93			
	15 - 16	1	0.056	0.042	0.22	1.70	18.90	9.63	12.90	16.00	-19%
		2	0.026	0.012	0.07	0.58	6.42	3.27			
	10 – 11	1	0.063	0.049	0.25	1.97	21.94	11.178	14.47	**	-
		2	0.026	0.012	0.08	0.58	6.46	3.293			
25/6/2014	11 – 12	1	0.064	0.050	0.26	2.00	22.23	11.326	17.20	24.00	-28%
		2	0.038	0.024	0.13	1.04	11.54	5.879			
	14 - 15	1	0.059	0.045	0.24	1.83	20.31	10.351	12.48	12.00	4%
		2	0.021	0.006	0.05	0.38	4.17	2.127			
	15 - 16	1	0.050	0.035	0.19	1.47	16.32	8.316	11.65	10.00	17%
		2	0.026	0.012	0.08	0.59	6.54	3.335			
blank		0.015									
		0.015	0.014								
		0.014									

** No data records

Table C-5 Condition of 0.5% NaNO₂/ 0.5% Na₂CO₃/ 5% ethylene glycol of absorbing solution and 1.5 L/min air flow rate (cont.)

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
26/7/2014	10 – 11	1	0.038	0.031	0.20	1.55	17.21	8.77	14.15	22.00	-36%
		2	0.025	0.017	0.12	0.95	10.56	5.38			
	11 – 12	1	0.052	0.045	0.28	2.19	24.37	12.42	14.88	24.00	-358%
		2	0.014	0.006	0.06	0.43	4.82	2.46			
	14 - 15	1	0.067	0.059	0.37	2.87	31.89	16.25	22.98	28.00	-18%
		2	0.030	0.023	0.15	1.19	13.20	6.73			
	15 - 16	1	0.061	0.053	0.33	2.58	28.64	14.59	18.09	24.00	-25%
		2	0.018	0.010	0.08	0.62	6.86	3.49			
	10 – 11	1	0.044	0.036	0.23	1.80	19.96	10.17	12.86	17.00	-20%
		2	0.015	0.007	0.06	0.48	5.28	2.69			
27/7/2014	11 – 12	1	0.046	0.038	0.24	1.89	21.02	10.71	14.23	21.00	-32%
		2	0.018	0.010	0.08	0.62	6.91	3.52			
	14 - 15	1	0.050	0.042	0.27	2.09	23.21	11.83	16.38	21.00	-22%
		2	0.022	0.014	0.10	0.80	8.94	4.55			
	15 - 16	1	0.052	0.045	0.28	2.19	24.37	12.42	16.59	18.00	-8%
		2	0.021	0.013	0.10	0.74	8.18	4.17			
blank		0.007									
		0.009	0.008								
		0.008									

APPENDIX D

The data results of optimum conditions testing for ozone sampling in dry season with medium ozone concentrations (30 – 70 ppbv)

Table D-1 Condition of 1.0% NaNO₂/ 1.0% Na₂CO₃/ 10% ethylene glycol of absorbing solution and 1.2 L/min air flow rate

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
18/11/2014	10 – 11	1	0.044	0.030	0.17	2.61	36.27	18.48	23.72	50.00	-53%
		2	0.030	0.016	0.10	0.74	10.28	5.24			
	11 – 12	1	0.062	0.047	0.26	2.01	27.90	14.22	19.31	48.00	-60%
		2	0.030	0.016	0.09	0.72	10.00	5.10			
	14 - 15	1	0.081	0.067	0.36	2.78	38.67	19.70	24.26	52.00	-53%
		2	0.028	0.014	0.08	0.64	8.94	4.55			
	15 - 16	1	0.098	0.083	0.45	3.46	48.09	24.51	27.69	51.00	-46%
		2	0.023	0.009	0.06	0.45	6.24	3.18			
	10 – 11	1	0.070	0.056	0.30	2.34	32.50	16.56	20.80	52.00	-60%
		2	0.027	0.013	0.08	0.60	8.32	4.24			
19/11/2014	11 – 12	1	0.084	0.070	0.38	2.91	40.35	20.56	31.26	64.00	-51%
		2	0.050	0.035	0.20	1.51	21.00	10.70			
	14 - 15	1	0.082	0.067	0.36	2.81	39.00	19.87	26.23	56.00	-53%
		2	0.034	0.020	0.12	0.90	12.47	6.35			
	15 - 16	1	0.062	0.048	0.26	2.03	28.18	14.36	21.17	56.00	-62%
		2	0.036	0.022	0.12	0.96	13.37	6.81			
blank		0.014									
		0.015	0.014								
		0.014									

Table D-2 Condition of 0.5% NaNO₂/ 0.5% Na₂CO₃/ 5% ethylene glycol of absorbing solution and 1.2 L/min air flow rate

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
27/11/2014	10 – 11	1	0.056	0.042	0.251	1.942	26.97	18.48	19.59	48.00	-59%
		2	0.025	0.011	0.107	0.826	11.47	5.24			
	11 – 12	1	0.068	0.054	0.307	2.378	33.02	14.22	25.63	54.00	-53%
		2	0.037	0.023	0.161	1.244	17.27	5.10			
	14 - 15	1	0.085	0.071	0.386	2.990	41.53	19.70	26.11	53.00	-51%
		2	0.021	0.008	0.090	0.700	9.72	4.55			
	15 - 16	1	0.061	0.047	0.273	2.111	29.32	24.51	23.51	52.00	-55%
		2	0.036	0.022	0.156	1.211	16.82	3.18			
	blank	0.014									
		0.014	0.014								
		0.014									

Table D-3 Condition of 0.5% NaNO₂/ 0.5% Na₂CO₃/ 5% ethylene glycol of absorbing solution and 0.5 L/min air flow rate

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
28/11/2014	10 – 11	1	0.035	0.021	0.154	1.189	39.65	20.20	32.70	39.00	-16%
		2	0.022	0.009	0.095	0.736	24.53	12.50			
	11 – 12	1	0.049	0.035	0.217	1.679	55.97	28.52	38.64	46.00	-16%
		2	0.019	0.005	0.077	0.595	19.84	10.11			
	14 - 15	1	0.070	0.056	0.314	2.432	81.06	41.31	51.05	62.00	-18%
		2	0.018	0.004	0.074	0.574	19.12	9.75			
	15 - 16	1	0.063	0.049	0.282	2.183	72.78	37.09	46.77	64.00	-27%
		2	0.018	0.004	0.074	0.570	19.00	9.68			
	blank	0.014									
		0.014	0.014								
		0.014									

Table D-4 Condition of 0.75% NaNO₂/ 0.75% Na₂CO₃/ 7.5% ethylene glycol of absorbing solution and 0.5 L/min air flow rate

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
3/12/2014	10 – 11	1	0.049	0.034	0.195	1.511	50.36	25.66	42.34	33.00	28%
		2	0.034	0.019	0.127	0.982	32.72	16.67			
	11 – 12	1	0.066	0.051	0.272	2.110	70.32	35.83	51.50	50.00	3%
		2	0.032	0.017	0.119	0.922	30.75	15.67			
	14 - 15	1	0.082	0.067	0.344	2.660	88.65	45.18	60.79	64.00	-5%
		2	0.032	0.017	0.119	0.919	30.63	15.61			
	15 - 16	1	0.060	0.044	0.243	1.883	62.78	31.99	48.07	58.00	-17%
		2	0.033	0.018	0.122	0.947	31.56	16.08			
	blank	0.016									
		0.015	0.015								
		0.015									
13/12/2014	10 – 11	1	0.054	0.036	0.192	1.483	49.43	25.19	46.54	39.00	19%
		2	0.047	0.030	0.162	1.257	41.89	21.35			
	11 – 12	1	0.060	0.043	0.221	1.709	56.97	29.03	46.12	47.00	-2%
		2	0.040	0.023	0.130	1.006	33.53	17.09			
	14 - 15	1	0.073	0.056	0.280	2.165	72.16	36.77	53.68	45.00	19%
		2	0.040	0.023	0.129	0.995	33.18	16.91			
	15 - 16	1	0.045	0.028	0.152	1.175	39.18	37.81	41.93	47.300	-11%
		2	0.019	0.001	0.031	0.243	8.09	4.12			
	blank	0.014									
		0.017	0.017								
		0.021									

Table D-4 Condition of 0.75% NaNO₂/ 0.75% Na₂CO₃/ 7.5% ethylene glycol of absorbing solution and 0.5 L/min air flow rate (cont.)

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
14/12/2014	10 – 11	1	0.055	0.038	0.198	1.532	51.08	26.03	34.59	41.00	-16%
		2	0.026	0.009	0.065	0.504	16.80	8.56			
	11 – 12	1	0.063	0.045	0.232	1.794	59.79	30.47	39.69	56.00	-29%
		2	0.027	0.010	0.070	0.543	18.10	9.22			
	14 - 15	1	0.091	0.074	0.362	2.801	93.36	47.58	78.83	68.00	16%
		2	0.064	0.047	0.238	1.840	61.33	31.25			
	15 - 16	1	0.068	0.050	0.254	1.967	65.57	33.41	46.54	63.00	-26%
		2	0.034	0.016	0.100	0.773	25.76	13.12			
	blank	0.014									
		0.017	0.017								
		0.021									
23/12/2014	10 – 11	1	0.043	0.020	0.140	1.081	36.04	18.36	35.98	39.00	-8%
		2	0.042	0.019	0.134	1.037	34.57	17.62			
	11 – 12	1	0.071	0.049	0.285	2.208	73.61	37.51	51.46	47.00	9%
		2	0.037	0.014	0.106	0.821	27.38	13.95			
	14 - 15	1	0.077	0.054	0.312	2.416	80.54	41.04	61.03	56.00	9%
		2	0.046	0.023	0.152	1.177	39.24	19.99			
	15 - 16	1	0.061	0.038	0.229	1.777	59.22	30.18	45.01	53.00	-15%
		2	0.038	0.015	0.113	0.873	29.11	14.83			
	blank	0.022									
		0.023	0.023								
		0.023									

Table D-4 Condition of 0.75% NaNO₂/ 0.75% Na₂CO₃/ 7.5% ethylene glycol of absorbing solution and 0.5 L/min air flow rate (cont.)

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
24/12/2014	10 – 11	1	0.054	0.031	0.197	1.525	50.83	25.90	37.20	34.00	9%
		2	0.033	0.010	0.086	0.665	22.18	11.30			
	11 – 12	1	0.069	0.046	0.274	2.120	70.68	36.02	49.02	43.00	14%
		2	0.035	0.012	0.099	0.765	25.51	13.00			
	14 - 15	1	0.080	0.057	0.331	2.564	85.47	43.55	54.92	54.00	2%
		2	0.033	0.010	0.086	0.669	22.32	11.37			
	15 - 16	1	0.062	0.039	0.237	1.837	61.22	31.20	42.23	54.00	-22%
		0.032	0.010	0.084	0.649	21.65	11.03	0.032			
	blank	0.022									
		0.023	0.023								
		0.023									
25/12/2014	10 – 11	1	0.068	0.045	0.268	2.076	69.21	35.27	45.42	35.00	30%
		2	0.031	0.008	0.077	0.598	19.92	10.15			
	11 – 12	1	0.063	0.040	0.241	1.865	62.15	31.67	49.09	42.00	17%
		2	0.042	0.019	0.132	1.025	34.17	17.41			
	14 - 15	1	0.085	0.062	0.356	2.756	91.86	46.81	63.75	63.00	1%
		2	0.041	0.018	0.129	0.997	33.24	16.94			
	15 - 16	1	0.063	0.040	0.243	1.885	62.82	32.01	51.94	65.00	-20%
		2	0.045	0.023	0.152	1.173	39.10	19.93			
	blank	0.022									
		0.023	0.023								
		0.023									

Table D-5 Condition of 1.0% NaNO₂/ 1.0% Na₂CO₃/ 10% ethylene glycol of absorbing solution and 0.5 L/min air flow rate

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
29/11/2014	10 – 11	1	0.061	0.044	0.261	2.022	67.40	34.34	63.61	35.00	82%
		2	0.053	0.036	0.223	1.723	57.43	29.27			
	11 – 12	1	0.078	0.061	0.339	2.623	87.44	44.56	65.88	44.00	50%
		2	0.040	0.023	0.162	1.255	41.83	21.32			
	14 - 15	1	0.135	0.118	0.603	4.669	155.62	79.30	94.87	71.00	34%
		2	0.031	0.014	0.118	0.916	30.55	15.57			
	15 - 16	1	0.098	0.081	0.432	3.347	111.57	56.85	78.84	70.00	13%
		2	0.041	0.024	0.167	1.295	43.15	21.99			
	blank	0.017									
		0.017	0.017								
		0.017									

APPENDIX E

The data results of optimum conditions testing for ozone sampling in dry season with high ozone concentrations (> 70 ppbv)

Table E-1 Condition of 0.75% NaNO₂/ 0.75% Na₂CO₃/ 7.5% ethylene glycol of absorbing solution and 0.5 L/min air flow rate

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
13/3/2015	10 – 11	1	0.068	0.040	0.239	1.849	61.65	31.41	45.92	57.00	-19%
		2	0.038	0.010	0.110	0.854	28.46	14.50			
	11 – 12	1	0.105	0.077	0.401	3.108	103.61	52.80	58.41	78.00	-25%
		2	0.023	-0.005	0.043	0.331	11.02	5.62			
	13 - 14	1	0.106	0.078	0.405	3.135	104.51	53.26	60.02	74.00	-19%
		2	0.025	-0.003	0.051	0.398	13.27	6.76			
	14 - 15	1	0.102	0.074	0.390	3.021	100.68	51.31	63.35	69.00	-8%
		2	0.034	0.006	0.092	0.709	23.62	12.04			
	blank	0.028	0.028								
		0.030									
		0.026									

Table E-2 Condition of 1.0% NaNO₂/ 1.0% Na₂CO₃/ 10% ethylene glycol of absorbing solution and 0.5 L/min air flow rate

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
11/3/2015	10 – 11	1	0.073	0.035	0.218	1.691	56.36	28.72	40.30	53.00	-24%
		2	0.043	0.005	0.088	0.682	22.72	11.58			
	11 – 12	1	0.079	0.041	0.244	1.887	62.88	32.05	42.71	78.00	-45%
		2	0.041	0.004	0.081	0.628	20.92	10.66			
	13 - 14	1	0.120	0.083	0.426	3.297	109.91	56.01	66.90	70.00	-4%
		2	0.042	0.004	0.083	0.641	21.37	10.89			
	14 - 15	1	0.125	0.087	0.446	3.449	114.97	58.59	61.34	69.00	-11%
		2	0.028	-0.010	0.021	0.162	5.40	2.75			
	blank	0.039									
		0.029	0.038								
		0.045									

Table E-3 Condition of 1.25% NaNO₂/ 1.25% Na₂CO₃/ 12.5% ethylene glycol of absorbing solution and 0.5 L/min air flow rate

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
12/3/2015	10 – 11	1	0.066	0.035	0.216	1.674	55.80	0.066	51.13	58.00	-12%
		2	0.056	0.025	0.173	1.336	44.55	0.056			
	11 – 12	1	0.100	0.069	0.366	2.835	94.50	0.100	59.68	71.00	-16%
		2	0.036	0.005	0.088	0.678	22.61	0.036			
	13 - 14	1	0.130	0.099	0.499	3.861	128.69	0.130	79.34	77.00	3%
		2	0.040	0.009	0.105	0.810	27.00	0.040			
	14 - 15	1	0.124	0.093	0.469	3.631	121.05	0.124	74.06	68.00	9%
		2	0.038	0.007	0.094	0.729	24.30	0.038			
blank		0.035									
		0.030	0.031								
		0.029									
21/3/2015	10 – 11	1	0.076	0.046	0.283	2.194	73.12	37.26	46.91	**	-
		2	0.033	0.002	0.073	0.568	18.94	9.65			
	11 – 12	1	0.092	0.061	0.359	2.778	92.60	47.19	56.20	88.00	-36%
		2	0.032	0.001	0.069	0.531	17.69	9.01			
	13 - 14	1	0.141	0.111	0.599	4.636	154.52	78.74	89.09	93.00	-4%
		2	0.034	0.003	0.079	0.609	20.31	10.35			
	14 - 15	1	0.123	0.092	0.507	3.928	130.93	66.72	81.01	80.00	1%
		2	0.040	0.009	0.109	0.841	28.05	14.29			
blank		0.031									
		0.031	0.031								
		0.030									

** No data records

Table E-3 Condition of 1.25% NaNO₂/ 1.25% Na₂CO₃/ 12.5% ethylene glycol of absorbing solution and 0.5 L/min air flow rate (cont.)

Date	Time	Stage of filter pack	Peak area ((μ S/cm) x min)	Peak area – blank ((μ S/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μ g)	O ₃ (μ g/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
5/4/2015	10 – 11	1	0.128	0.090	0.436	3.378	112.60	57.38	77.08	63.00	22%
		2	0.068	0.030	0.150	1.160	38.66	19.70			
	11 – 12	1	0.131	0.093	0.453	3.504	116.79	59.51	69.54	69.00	1%
		2	0.052	0.014	0.076	0.590	19.68	10.03			
	12 – 13	1	0.155	0.117	0.569	4.402	146.74	74.78	80.72	76.00	6%
		2	0.046	0.008	0.045	0.350	11.67	5.95			
	13 – 14	1	0.139	0.101	0.491	3.803	126.77	64.60	72.93	82.00	-11%
		2	0.050	0.012	0.063	0.490	16.35	8.33			
	blank	0.041									
		0.032	0.038								
		0.041									
6/4/2015	10 – 11	1	0.150	0.111	0.540	4.184	139.47	71.07	74.63	60.00	24%
		2	0.042	0.004	0.027	0.210	6.98	3.56			
	11 – 12	1	0.170	0.132	0.637	4.931	164.36	83.76	91.33	74.00	23%
		2	0.048	0.010	0.058	0.446	14.87	7.58			
	12 – 13	1	0.192	0.154	0.742	5.748	191.60	97.63	105.09	80.00	31%
		2	0.048	0.010	0.057	0.439	14.62	7.45			
	13 – 14	1	0.154	0.116	0.563	4.358	145.26	74.02	81.85	68.00	20%
		2	0.049	0.011	0.060	0.461	15.36	7.83			
	blank	0.041									
		0.032	0.038								
		0.041									

Table E-3 Condition of 1.25% NaNO₂/ 1.25% Na₂CO₃/ 12.5% ethylene glycol of absorbing solution and 0.5 L/min air flow rate (cont.)

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
7/4/2015	10 – 11	1	0.124	0.086	0.418	3.234	107.79	54.93	61.82	56.00	10%
		2	0.047	0.009	0.052	0.405	13.52	6.89			
	11 – 12	1	0.126	0.088	0.430	3.326	110.87	56.50	69.16	61.00	13%
		2	0.057	0.018	0.096	0.746	24.85	12.66			
	12 – 13	1	0.151	0.113	0.548	4.243	141.44	72.07	81.91	73.00	12%
		2	0.052	0.014	0.075	0.579	19.31	9.84			
	13 – 14	1	0.148	0.110	0.535	4.143	138.11	70.38	82.86	70.00	18%
		2	0.056	0.018	0.095	0.735	24.48	12.48			
	blank	0.041									
		0.032	0.038								
		0.041									
8/4/2015	10 – 11	1	0.106	0.068	0.331	2.561	85.36	43.50	51.71	60.00	-14%
		2	0.049	0.011	0.062	0.483	16.10	8.21			
	11 – 12	1	0.112	0.073	0.359	2.779	92.64	47.21	50.95	64.00	-20%
		2	0.042	0.004	0.028	0.221	7.35	3.75			
	12 – 13	1	0.126	0.088	0.428	3.315	110.51	56.31	59.05	57.00	4%
		2	0.041	0.003	0.021	0.161	5.38	2.74			
	13 – 14	1	0.130	0.092	0.449	3.478	115.93	59.07	61.50	51.00	21%
		2	0.040	0.002	0.018	0.143	4.77	2.43			
	blank	0.041									
		0.032	0.038								
		0.041									

Table E-4 Condition of 1.5% NaNO₂/ 1.5% Na₂CO₃/ 15% ethylene glycol of absorbing solution and 0.5 L/min air flow rate

Date	Time	Stage of filter pack	Peak area ((μS/cm) x min)	Peak area – blank ((μS/cm) x min)	NO ₃ ⁻ (ppm)	O ₃ (μg)	O ₃ (μg/m ³)	O ₃ (ppbv)	total of O ₃ (ppbv)	O ₃ reference (ppbv)	% difference
3/3/2015	10 – 11	1	0.097	0.062	0.335	2.592	86.40	54.93	68.16	83.00	-18%
		2	0.062	0.027	0.184	1.421	47.36	6.89			
	11 – 12	1	0.202	0.167	0.794	6.146	204.85	56.50	134.54	93.00	45%
		2	0.073	0.038	0.229	1.775	59.17	12.66			
	12 – 13	1	0.187	0.152	0.730	5.650	188.32	72.07	137.12	78.00	76%
		2	0.092	0.057	0.313	2.423	80.77	9.84			
	13 – 14	1	0.164	0.129	0.629	4.870	162.33	70.38	107.54	76.00	42%
		2	0.063	0.028	0.189	1.461	48.71	12.48			
	blank	0.041									
		0.032	0.038								
		0.041									
10/3/2015	10 – 11	1	0.068	0.033	0.208	1.610	53.66	43.50	43.62	45.00	-3%
		2	0.048	0.013	0.124	0.958	31.95	8.21			
	11 – 12	1	0.097	0.062	0.337	2.609	86.96	47.21	65.01	67.00	-3%
		2	0.056	0.021	0.157	1.218	40.61	3.75			
	12 – 13	1	0.111	0.076	0.397	3.075	102.48	56.31	71.89	63.00	14%
		2	0.054	0.019	0.150	1.158	38.59	2.74			
	13 – 14	1	0.131	0.096	0.482	3.733	124.42	59.07	80.43	64.00	26%
		2	0.050	0.015	0.129	1.002	33.41	2.43			
	blank	0.027									
		0.039	0.035								
		0.039									

AFFENDIX F

Pair test

Table F-1 Pair test of the optimum condition for ozone sampling in wet season with low concentration (condition of 0.5% NaNO₂/ 0.5% Na₂CO₃/ 5% ethylene glycol of absorbing solution and 1.2 L/min air flow rate)

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Active ozone sampling	20.0956	16	3.56284	0.89071
	Reference	21.1250	16	6.63199	1.65800

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	Active ozone sampling & Reference	16	0.848	0.000

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		95% Confidence Interval of the Difference							
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Active ozone sampling - Reference	-1.02938	4.07267	1.01817	-3.19955	1.14080	-1.011	15	0.328

Table F-2 Pair test of the optimum condition for ozone sampling in dry season with medium concentration (condition of 0.75% NaNO₂/ 0.75% Na₂CO₃/ 7.5% ethylene glycol of absorbing solution and 0.5 L/min air flow rate)

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Active ozone sampling	49.3750	24	10.16307	2.07453
	Reference	49.8333	24	10.46180	2.13551

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	Active ozone sampling & Reference	24	0.633	0.001

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		95% Confidence Interval of the Difference							
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Active ozone sampling - Reference	-0.45833	8.83658	1.80376	-4.18969	3.27303	-0.254	23	0.802

Table F-3 Pair test of the optimum condition for ozone sampling in dry season with high concentration (condition of 1.25% NaNO₂/ 1.25% Na₂CO₃/ 12.5% ethylene glycol of absorbing solution and 0.5 L/min air flow rate)

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Active ozone sampling	72.3478	23	14.09580	2.93918
	Reference	69.5217	23	10.76133	2.24389

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	Active ozone sampling & Reference	23	0.525	0.010

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		95% Confidence Interval of the Difference							
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Active ozone sampling - Reference	2.82609	12.45593	2.59724	-2.56026	8.21244	1.088	22	0.288

AFFENDIX G

Table G-1 Correlation between ozone concentrations and meteorological parameters in wet season with low concentrations (< 35 ppbv)

	AOSD	PCD	Temp.	WS	WD	RH	SR	NR	BP	Rain
AOSD	1	0.848**	0.187	-0.166	-0.215	-0.186	0.407	0.562*	0.563*	-0.292
PCD		1	0.170	-0.376	-0.300	-0.202	0.368	0.658**	0.804**	-0.232
Temp.			1	0.695**	0.370	-0.986**	-0.975**	0.638**	0.314	-0.356
WS				1	0.719**	-0.683**	-0.653*	0.063	-0.362	0.066
WD					1	-0.413	-0.441	0.129	-0.308	0.307
RH						1	1.000**	-0.669**	-0.358	0.341
SR							1	-0.390	0.076	-0.388
NR								1	0.689**	-0.423
BP									1	-0.318
Rain										1

** correlation is significant at the 0.01 level (2-tailed)

* correlation is significant at the 0.05 level (2-tailed)

Table G-2 Correlation between ozone concentrations and meteorological parameters in dry season with medium concentrations (30 – 70 ppbv) (morning period)

	AOSD	PCD	Temp.	WS	WD	RH	SR	NR	BP	Rain
AOSD	1	0.329	0.472	-0.566	-0.098	-0.521	0.702*	-0.243	-0.366	0.101
PCD		1	0.640*	-0.321	0.317	-0.348	0.241	-0.775**	-0.088	0.221
Temp.			1	-0.465	-0.321	0.034	0.264	-0.233	-0.357	0.408
WS				1	0.143	0.162	-0.457	0.278	0.392	-0.188
WD					1	-0.533	-0.025	-0.493	0.479	-0.027
RH						1	-0.674*	0.537	-0.244	-0.174
SR							1	-0.113	-0.476	-0.013
NR								1	-0.275	-0.290
BP									1	0.253
Rain										1

** correlation is significant at the 0.01 level (2-tailed)

* correlation is significant at the 0.05 level (2-tailed)

Table G-3 Correlation between ozone concentrations and meteorological parameters in dry season with medium concentrations (30 – 70 ppbv) (*afternoon period*)

	AOSD	PCD	Temp.	WS	WD	RH	SR	NR	BP	Rain
AOSD	1	0.487	0.586*	0.231	-0.261	-0.086	0.764**	0.802**	-0.064	-0.306
PCD		1	0.358	0.058	-0.715**	0.237	0.182	0.205	-0.642*	-0.324
Temp.			1	0.556	-0.051	0.491	0.357	0.400	-0.524	-0.270
WS				1	-0.290	0.206	0.311	0.298	-0.575	-0.023
WD					1	-0.133	-0.233	-0.233	0.558	0.498
RH						1	-0.508	-0.454	-0.512	-0.278
SR							1	0.996**	0.094	-0.256
NR								1	0.088	-0.285
BP									1	0.221
Rain										1

** correlation is significant at the 0.01 level (2-tailed)

* correlation is significant at the 0.05 level (2-tailed)

Table G-4 Correlation between ozone concentrations and meteorological parameters in dry season with high concentrations (> 70 ppbv) (*morning period*)

	AOSD	PCD	Temp.	WS	WD	RH	SR	NR	BP	Rain
AOSD	1	0.111	0.667*	-0.189	-0.433	-0.278	0.587*	0.738**	-0.703*	.a
PCD		1	-0.055	0.003	0.220	-0.255	-0.152	-0.38	-0.107	.a
Temp.			1	0.054	-0.688*	-0.616*	0.589*	0.840**	-0.787**	.a
WS				1	0.494	0.461	-0.244	-0.020	0.010	.a
WD					1	0.672*	-0.580*	-0.635*	0.554	.a
RH						1	-0.509	-0.396	0.324	.a
SR							1	0.833**	-0.269	.a
NR								1	-0.581*	.a
BP									1	.a
Rain										.a

** correlation is significant at the 0.01 level (2-tailed)

* correlation is significant at the 0.05 level (2-tailed)

a no data record

Table G-5 Correlation between ozone concentrations and meteorological parameters in dry season with high concentrations (> 70 ppbv) (afternoon period)

	AOSD	PCD	Temp.	WS	WD	RH	SR	NR	BP	Rain
AOSD	1	0.701*	0.639*	-0.131	0.303	-0.600*	0.327	0.266	-0.109	. ^a
PCD		1	0.553	-0.448	0.655*	-0.774**	0.071	0.243	-0.037	. ^a
Temp.			1	-0.372	0.451	-0.723**	0.349	0.111	-0.432	. ^a
WS				1	-0.673*	0.247	0.013	0.054	0.521	. ^a
WD					1	-0.613*	-0.344	-0.353	-0.578*	. ^a
RH						1	0.179	0.127	0.173	. ^a
SR							1	0.861**	0.202	. ^a
NR								1	0.591*	. ^a
BP									1	. ^a
Rain										. ^a

** correlation is significant at the 0.01 level (2-tailed)

* correlation is significant at the 0.05 level (2-tailed)

a no data record

AFFENDIX H

Ion Chromatogram

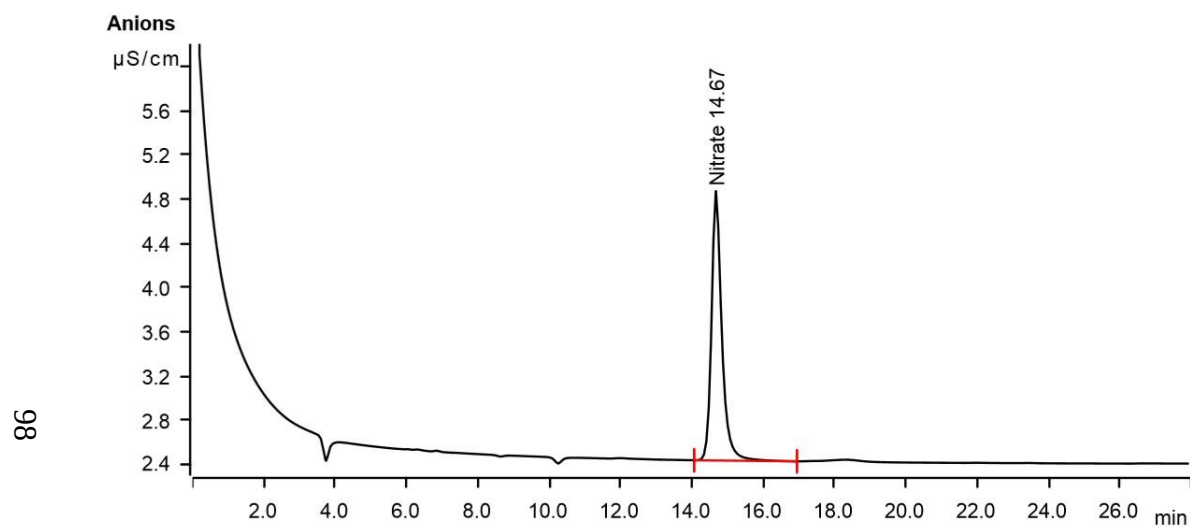


Figure H-1 Ion chromatogram of Nitrate standard

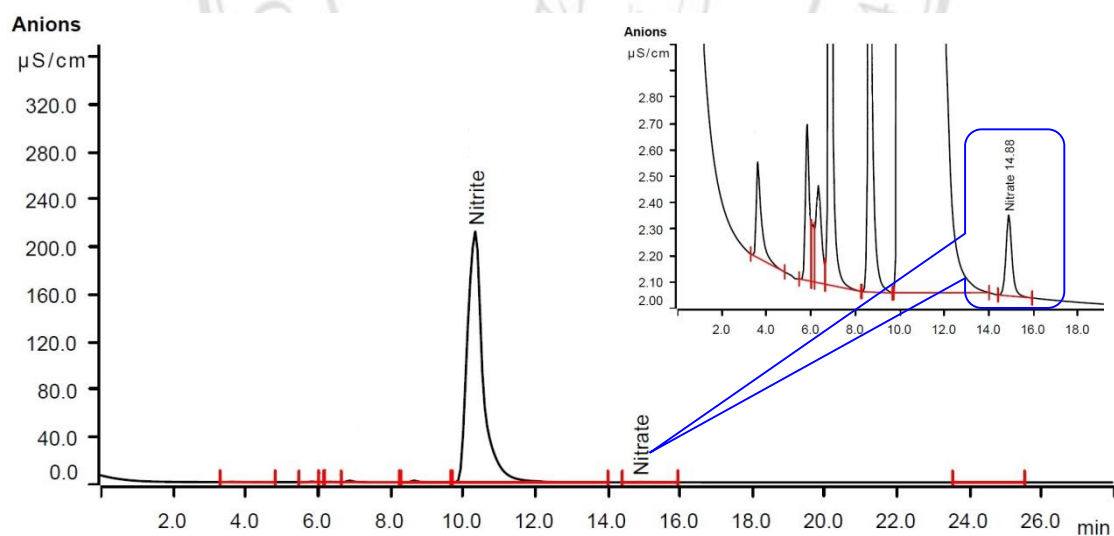


Figure H-2 Ion chromatogram of Nitrite and Nitrate from sample

CURRICULUM VITAE

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