REPORT ON AMBIENT AIR QUALITY MONITORING CONDUCTED IN WINDSOR CASTLE BUFF BAY
March 31-1 June 2012

Prepared by:
National Environment and Planning Agency
March 2012

LIST OF ACRONYMS

- AQHI- Air Quality Health Index
- AQI -Air Quality Index
- JAAQS-Jamaica Ambient Air Quality Standards
- MET- meteorological
- MOH - Ministry of Health
- NEPA - National Environment and Planning Agency
- NO_2 - Nitrogen Dioxide
- PAPs-Priority Air Pollutants
- PM_{10} - Particulate Matter less than 10 microns
- $PM_{2.5}$ -Particulate Matter less than 2.5 microns
- POPs - Persistent Organic Pollutants
- SO_2 -Sulphur Dioxide
- TSP - Total Suspended Particulate Matter
- Ug/M^3 – Micrograms per meter cube
- m/s – meters per second
- USEPA - United States Environment Protection Agency
- VOC - Volatile Organic Compounds
- WHO-World Health Organization

EXECUTIVE SUMMARY

Ambient air quality monitoring exercise was conducted in response to the air pollution incident, resulting from a fire at the Buff Bay Waste Disposal facility during the period March 31 to June 1 2012. The monitoring exercise was conducted by the National Environment and Planning Agency. The report provides an outline of the monitoring site that was used to assess the impact of the Buff Bay waste disposal site's emissions from the fire, the site location and the pollutants that were tested.
The detailed results for all the monitoring exercise are provided both graphically and in tabular form and a comparison is made with the Jamaica Ambient Air Quality Standards and the World Health Organization Standards. Each graph is analyzed and the important points highlighted.

The general conclusion based on the results of the monitoring exercise is that the subject fire at the Buff Bay Solid Waste Disposal Site created a negative impact on the ambient air quality in Windsor Castle and other communities such a Dover and Epsom along the North Coast to the West of the disposal site. The VOC and PM_{10} data collected indicated that these pollutants were present in the atmosphere. The sample collected showed that PM_{10} had levels above the reference background concentration of 20ug/m^3. However the samples did indicate that both PM_{10} and VOCs were within the 24 hour ambient air quality standard. The basis of the conclusion is as follows:

1. The data showed ambient air quality with respect to benzene, toluene and other organics on the USEPA TO15 list to be within the WHO 24 hour standard 1 June 2012.

2. Based on the data gathered during the fire no exceedance of the National Ambient Air Quality Standard for PM_{10} 24 Hour averaging was recorded for Friday, 1 June 2012. The recorded average for PM_{10} was 24ug/m^3.

3. VOC Samples collected and analyzed showed no exccedance of the World Health Organization Standards for 24 hour averaging period for any VOC measured. Only five organics recorded detectable concentrations above 0.2ug/m^3. Benzene recorded the highest concentrations at 4.7ug/m^3.

It should be noted that these conclusions are based on one sample taken at a specific location. The period of the reported smoke nuisance from the fire did not last for an extended period after sampling commenced so more sampling was not possible to determine impact. The reported and recorded fire event was only for a day and a half.

BACKGROUND

On Thursday the 31st May 2012 the National Environment and Planning Agency received a report from the NSWMA that the Buff Bay Disposal Site was on fire. The Agency contacted the National Solid Waste Authority for further information and they confirmed sections of the site were on fire and they had started to use material to cover the area and contacted the fire department for support. The Agency immediately contacted Ministry of Health for support to conduct air quality monitoring in the area. The services of a local consultant were also used to enhance the monitoring capabilities of the Agency. No previous air quality sampling was done for that specific area of the island and so no existing or background information was available. On the 1st June 2012 the Agency deployed PM_{10} and VOC sampler in the community of Windsor Castle which was observed as the most heavily impacted.

SAMPLING

Locations

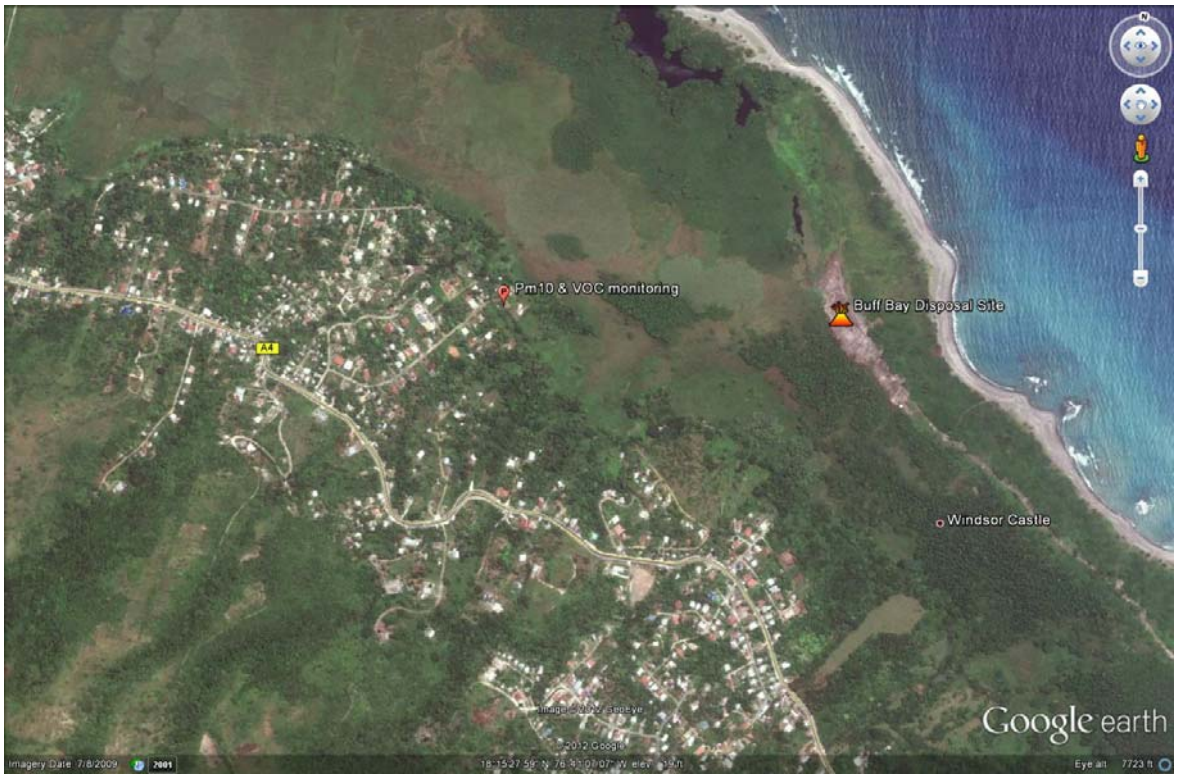
The site chosen were based on observed heaviest impact zone, known general wind direction from disposal site and availability of host for equipment. The site used is shown in Table 1 and Map 1below:

Table 1: Showing Site Location

SITE LOCATIONS	BASIS FOR SELECTION
1. Winsor Castle	Temporary Response Monitoring Site

Thirty five (33) pollutants were assessed during the period (Appendix I).

Map1: Showing sample location



PRESENTATION OF RESULTS

The data was manipulated and presented in the form of graphs and tables. The graphs will represent data gathered over the subject monitoring period i.e. 1 June 2012 while the tables will indicate the data gathered daily for the sampled location for each pollutant.

Figure 2: Showing PM10 Data recorded at Windsor Castle on 1 June 2012

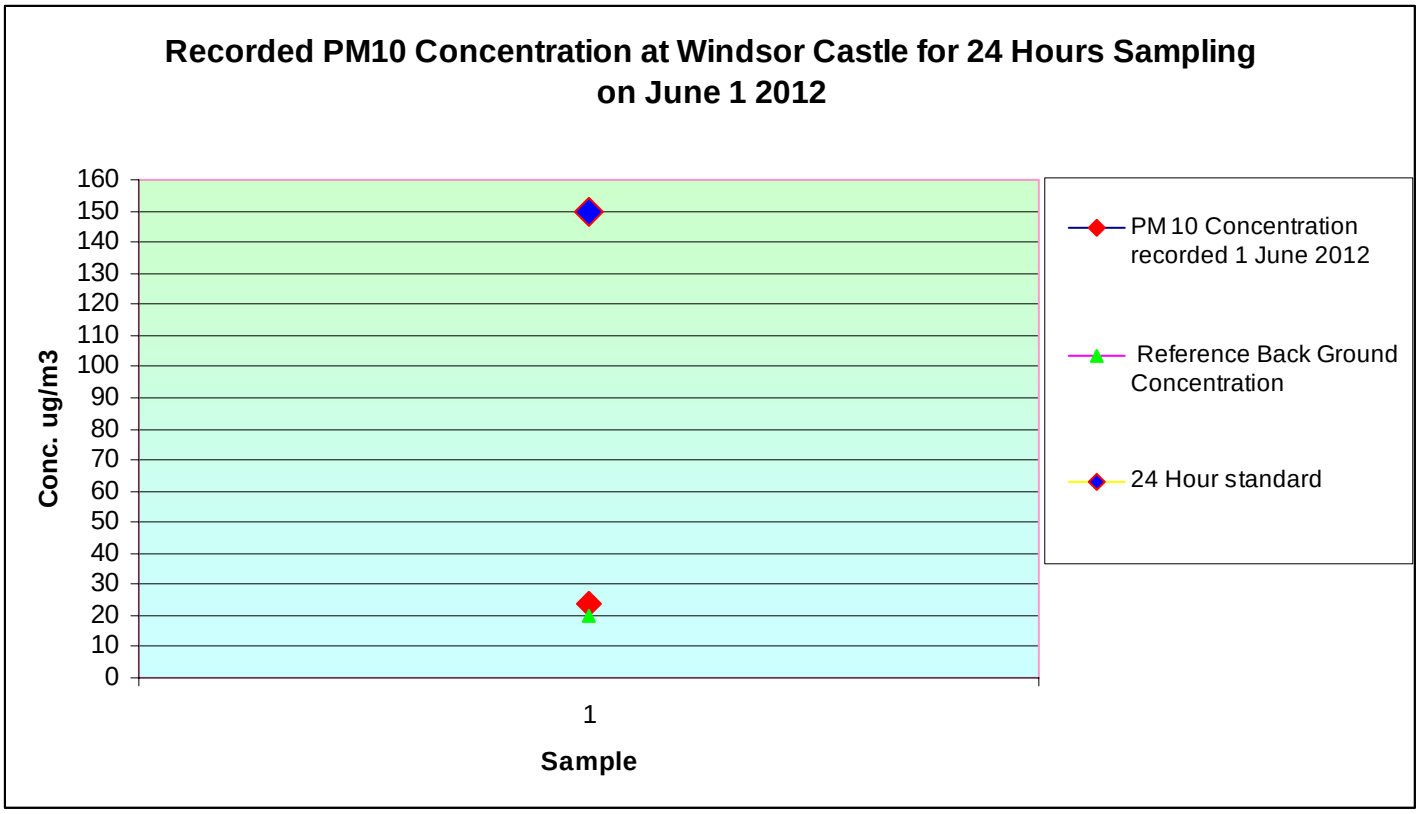


Table 2: Showing 24 hour average PM_{10} (ug/m^3) measured on 1 June 2012

	Windsor Castle (conc. ug/m3)
Friday 1st June 2012 Concentration recorded	24
Back ground Concentration from reference	20
JAAQS 24 Hour concentration	150

Figure 2: Results of the VOC concentrations from monitoring in Windsor Castle 1 June 2012

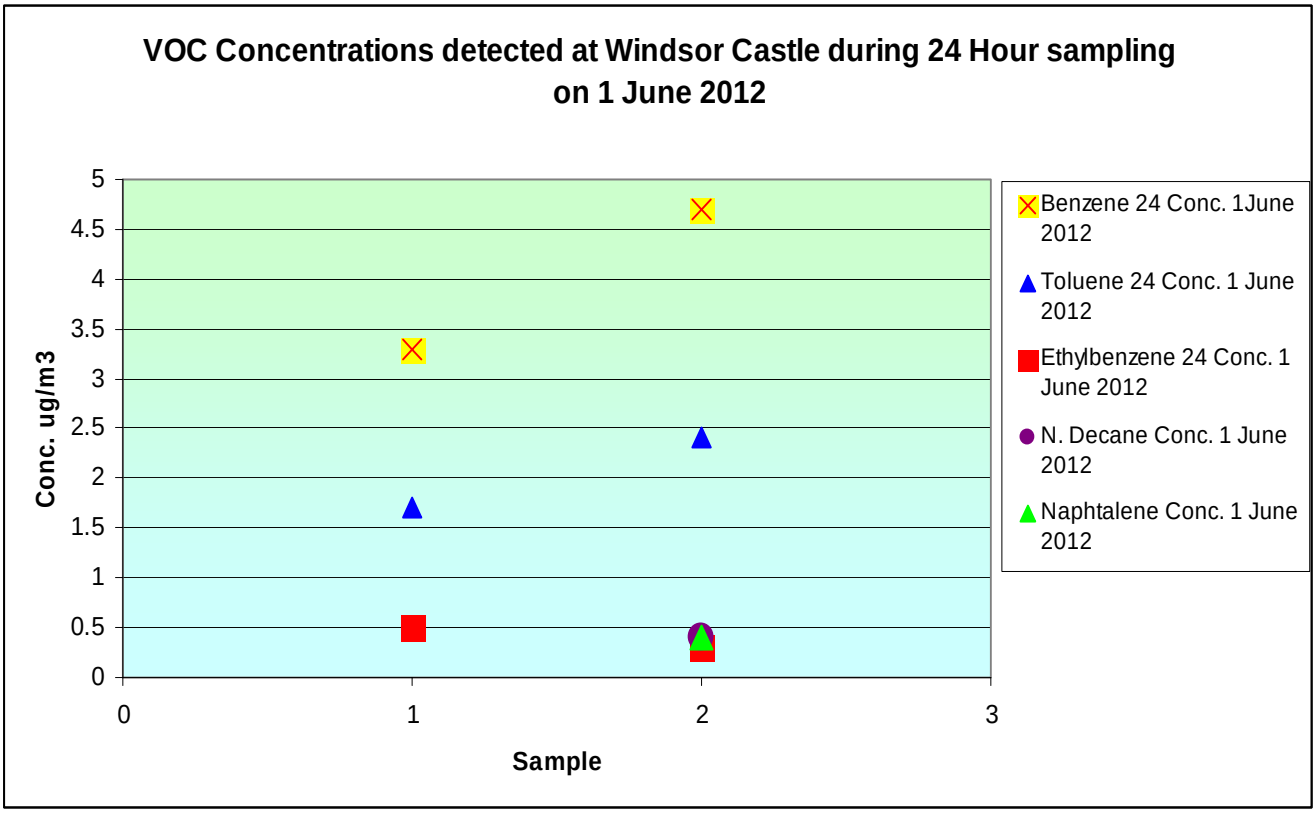


Table 2: Showing 24Hour recorded conc. On 1 June 2012 (all readings in ug/m^3)

SAMPLE ANALYSIS REPORT

Project Number:	J12027			Report #	J12027-2	PSD VOC
Report Date:	June 12, 2012					
Analysis Date:	June 8, 2012					
Sample received Date	June 5-7, 2012					
Analytical Method:	Gas Chromatography/ Mass Spectrometry (GC/MS)					
Sample Type:	PSD					
RESULTS	Unit :				µg/m3	
Sample I.D.	CAS #	Lab Blank	W/Blank	W1	W2	
Dichloromethane	*75-09-2*	<0.2	<0.2	<0.2	<0.2	
Hexane	*110-54-3*	<0.2	<0.2	<0.2	<0.2	
Chloroform	*67663*	<0.2	<0.2	<0.2	<0.2	
1,2-Dichloroethane	*107-06-2*	<0.2	<0.2	<0.2	<0.2	
Benzene	*71432*	<0.2	<0.2	3.3	4.7	
Trichloroethylene	*79-01-6*	<0.2	<0.2	<0.2	<0.2	
Toluene	*108-88-3*	<0.2	<0.2	1.7	2.4	
Tetrachloroethylene	*127184*	<0.2	<0.2	<0.2	<0.2	
Ethylbenzene	*100414*	<0.2	<0.2	0.5	0.3	
(m+p)-Xylene	*108383 / 106423*	<0.2	<0.2	<0.2	<0.2	
o-Xylene	*95476*	<0.2	<0.2	<0.2	<0.2	
Styrene	*100425*	<0.2	<0.2	<0.2	<0.2	
Cumene	*98828*	<0.2	<0.2	<0.2	<0.2	
a-Pinene	*80-56-8*	<0.2	<0.2	<0.2	<0.2	
1,1,2,2-Tetrchloroethane	*79345*	<0.2	<0.2	<0.2	<0.2	
n-Decane	*124-18-5*	<0.2	<0.2	<0.2	0.4	
1,3,5-Trimethylbenzene	*108-67-8*	<0.2	<0.2	<0.2	<0.2	
1,2,4-Trimethylbenzene	*95-63-6*	<0.2	<0.2	<0.2	<0.2	
Pentachloroethane	*76-01-7*	<0.2	<0.2	<0.2	<0.2	
d-Limonene	*5989-27-5*	<0.2	<0.2	<0.2	<0.2	
p-Cymene	*99876*	<0.2	<0.2	<0.2	<0.2	
1,3-Dichlorobenzene	*541-73-1*	<0.2	<0.2	<0.2	<0.2	
1,4-Dichlorobenzene	*106467*	<0.2	<0.2	<0.2	<0.2	
Hexachloroethane	*67-72-1*	<0.2	<0.2	<0.2	<0.2	
1,2,4-Trichlorobenzene	*120821*	<0.2	<0.2	<0.2	0.2	
Naphthalene	*91203*	<0.2	<0.2	<0.2	0.4	

ANALYSIS OF FINDINGS

The analysis focused on the PM_{10} and VOC data as the results showed that ambient air quality with respect to PM_{10}, within 1km radius of the site within the JAAQS, Benzene, Toluene, ethylbenzene, n-Decane as well as Naphthalene were detected in the air but at low concentrations. However continuous exposure to Benzene at these low concentrations would exceed the Jamaica National Standard of 1 ug/m^3 for annual average exposure to benzene

PM Data Analysis

The 24 hour Standard of 150ug/m^3 for PM_{10} was not exceeded on Friday 1 June 2012 at the Windsor Castle site. The value recorded was 24ug/m^3. The data revealed that based on the reference background concentration of 20 g/m^3 the site was impacted very minimal but negatively (Table 1 & Figure 1).

VOC

VOC was sampled at the monitoring station located at the Windsor Castle. , Toluene, ethylbenzene, n-Decane as well as Naphthalene were detected in the air but at low concentrations. Benzene showed the highest recorded at 4.7ug/m^3. Continued exposure at these levels would lead to the annual exposure limit of 1ug/m^3 being exceeded. From literature the cancer risk for exposure of levels of benzene at these levels is 1 in 100,000

SO_2 and NO_2

No sampling of either pollutant was done because of unavailability of mobile sampling equipment.

CATEGORIZATION OF RISK

A full categorization of risk was possible as only one sample was taken.

CONCLUSION

The general conclusion based on the results of the monitoring exercise is that the subject fire at the Buff Bay Solid Waste Disposal Site created a negative impact on the ambient air quality in Windsor Castle and other communities such a Dover and Epsom along the North Coast to the West of the disposal site. The VOC and PM_{10} data collected indicated that these pollutants were present in the atmosphere. The sample collected showed that P10 had levels above the reference background concentration of 20ug/m^3. However the samples did indicate that both PM_{10} and VOCs were within the 24 hour ambient air quality standard. The basis of the conclusion is as follows:

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LIMITATIONS OF RESPONSE MONITORING PROGRAMME

1. NEPA has no permanent monitoring stations in the Buff Bay area.

2. NEPA response monitoring arrived 1 day after fire had start and missed the most intense period of the fire because of lack of appropriate response monitoring

3. Mini-Vol Devices used for response had a four day turn around time for results.

RECOMMENDATIONS

1. The NSWMA should improve its management at all solid waste disposal sites inclusive of the Buff Bay Solid Waste Disposal Site to prevent the reoccurrence of major fires.

2. The monitoring at all PM_{10} response sites established during this event, should to continue for at least 1 year.

3. Permanent air monitoring sites should be installed by the NSWMA, around the Buff Bay Solid Waste Disposal Site based on modeled air dispersion data for worse-case fire event

4. New PM_{10} and $PM_{2.5}$ monitoring devices should be procured by the NRCA for deployment in all parish locations.

5. Monitoring equipment should be procured and further deployed for the sampling of additional pollutants especially those in the category of POPs.

6. A dispersion model should be done using the best data available for similar events in order to obtain a more accurate estimate of the zones of greatest impact. Monitoring devices should also be deployed in those zones.

APPENDICES

Appendix I

LIST OF AIR POLLUTANTS ANALYZED ON 1JUNE 2012

CRITERIA AIR POLLUTANTS

1. Particulate Matter less than 10 microns

VOLATILE ORGANICS

2. Dichloromethane
3. Hexane
4. Chloroform
5. 1,2-Dichloroethane
6. Benzene
7. Trichloroethylene
8. Toluene
9. Tetrachloroethylene
10. Ethylbenzene
11. (m+p)-Xylene
12. o-Xylene
13. Styrene
14. Cumene
15. a-Pinene
16. 1,1,2,2-Tetrchloroethane
17. n-Decane
18. 1,3,5-Trimethylbenzene
19. 1,2,4-Trimethylbenzene
20. Pentachloroethane
21. d-Limonene
22. p-Cymene
23. 1,3-Dichlorobenzene
24. 1,4-Dichlorobenzene
25. Hexachloroethane
26. 1,2,4-Trichlorobenzene
27. Naphthalene
28. 1-Butanol
29. Benzene, chloro-
30. Benzene, butyl-
31. Caprolactam
32. Biphenyl
33. Diphenyl ether

Appendix II

Comparative Ambient Air Quality Standards/Guidelines

Parameter	Averaging time	USA Standard	Canadian Standard	WHO guideline	Jamaican Standard
PM_{10}	Annual 24hrs	n.a. 150µg/m^3	n.a. 150 µg/m^3	20 µg/m^3 50 µg/m^3	50 µg/m^3 150 µg/m^3
SO_2	Annual 24hrs 1hr	78 µg/m^3 366 g/m^3 n.a.	60 µg/m^3 300 µg/m^3 900 µg/m^3	 20 µg/m^3 	60 µg/m^3 280 µg/m^3 700 µg/m^3
NO_2	Annual 24hrs 1hr	100 µg/m^3 n.a. n.a.	100 µg/m^3 n.a. 400 µg/m^3	40 µg/m^3 n.a. 200 µg/m^3	100 µg/m^3 n.a. 400 µg/m^3
VOC	1hr	n/a	n/a	(1-17) µg/m^3	n/a

Appendix III
ESTIMATED COST

NEPA's ESTIMATED COST OF MONITORING EXERCISE FEB 6-13 2012					
EQUIPMENT		QTY	Unit Cost ($US)	EXR ($JA)	Sum TOT (JA$)
	Mini- Volume Sampler	1	3500	87	304,500
	3M passive VOC samplers	3		1320	3,960.00
	Analysis GC/MS	3		14080	42,240.00
	Courier Service +handling VOC samples	1		8945	8945
	Quartz filter Paper	1	10	87	870
	Desiccators	2	200	87	34,800
	Analytical Balance	1	5000	87	435,000
LABOUR		QTY	HOURS	RATE ($JA)/hr	
	Level 6 Officer	1	16	727	11,632
	Level 7 Officer	1	16	878	14,048
TRAVELLING		QTY	DISTANCE (KM)	RATE ($JA)/Km	
	Buff Bay	2	150	30	600
TOTAL ESTIMATED COST OF RESPONSE MONITORING					$847,650