



Contractor



Forth Crossing Bridge Constructors

HOCHTIEF Solutions
 American Bridge International
 DRAGADOS
 Morrison Construction

Project

FORTH REPLACEMENT CROSSING

Document title

**AIR QUALITY MONITORING REPORT
 APRIL 2014**

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1. INTRODUCTION

- 1.1.** Air quality monitoring is being undertaken by FCBC during the construction of the Forth Replacement Crossing and the associated road network. This report details the air quality monitoring that is currently being undertaken across the site and presents the monitoring results for April 2014.
- 1.2.** Air quality monitoring during this period has been undertaken in accordance with the Code of Construction Practice (CoCP) and the Dust and Air Pollution Management Plan (DAPMP) contained within the Environmental Management Plan (EMP).

2. MONITORING EQUIPMENT AND LOCATIONS

2.1. Air quality is being monitored on site using both automatic light scatter dust meters and Frisbee gauge dust deposition monitoring. Thirteen Frisbee gauges are set up at sensitive locations across the site to measure dust deposition rates (Figure 1). Seven automatic light scatter meters have also been installed at various sensitive locations to measure real time particulate matter (PM₁₀) concentrations and the Total Suspended Particle (TSP) concentrations (Figure 2). These meters are calibrated annually. Table 1 lists the air quality monitoring equipment present at each monitoring location. The installation of the air quality monitoring equipment was not simultaneous across the site, installation dates are also given in Table 1.

2.2. Light scatter type monitoring equipment have been selected as a site monitoring tool to create a live network which assesses the levels of fugitive particulate matter, principally airborne dust. These monitors require less space, maintenance and power than other real time monitors such as a Tapered Element Oscillating Microbalance (TEOM) which is used and designed to measure particulate levels to exceedingly high standards, including measuring long-term compliance to statutory limits. Light scatter meters are more practicable to deploy. However, the meters do generally record levels higher than those measured by the TEOM. The meters can also be affected by atmospheric moisture content which further increases reported levels. Accordingly, any elevations of statutory limits should be treated as precautionary exceedances. The monitors are reliable for on-site monitoring and the establishment of action thresholds to ensure unforeseen activities generating significant dust are identified and suitably controlled. Light scatter meters are becoming the construction and waste industries norm for particulate dust monitoring.

2.3. In association with air quality monitoring across the site, weather conditions (temperature and relative humidity) are also continually measured by the light scatter meters at Inchgarvie Lodge and Clufflat Brae. Weather stations, located at the sound level meters at Echline and Linn Mill which are adjacent to the light scatter meters at these monitoring locations, also continually record weather data, including temperature, relative humidity, wind speed and wind direction.

2.4. In addition to the fixed monitoring equipment used at sensitive locations across the site, a daily dust log for both the North and South sites has been kept by the FCBC Environmental Department. This daily dust inspection is used to identify any dust occurring as a result of construction works and any actions required. This log also records the weather conditions at the time of the inspection.

2.5. Frequent environmental site inspections are also undertaken by members of the FCBC Environmental Department. These inspections include a dust check to assess the following:

- dust levels on site;
- suppression/dampening down; and
- transportation of materials.

In relation to these inspections, the FCBC Environmental Department register any environmental issues using a QMT (Quality Management Tool). Any issues relating to air quality can therefore be noted and closed out appropriately.



Figure 1: Example of an Installed Frisbee Gauge Meter



Figure 2: Example of an installed Automatic Light Scatter Dust Meter

Table 1: Air Quality Monitoring Locations

Ref:	Monitoring Location	Monitoring Equipment	Installation Date	Construction Activities in April
M1	Whinny Hill	Frisbee	21/03/12	<ul style="list-style-type: none"> Excavation for working platform Rock breaking
		Automatic light scatter meter	16/02/12	
M7	Butlaw Fisheries	Frisbee	05/10/11	<ul style="list-style-type: none"> Marine works Assembling and fixing rebar and formwork works at Piers S6 & S5 Concrete pouring at piers S6 & S5
M8	Barracks West	Frisbee	31/08/11	<ul style="list-style-type: none"> Marine works Assembling and fixing rebar and formwork works at Piers S6 & S5 Concrete pouring at piers S6 & S5
M9	Barracks East	Frisbee	31/08/11	
M10	Inchgarvie Lodge	Frisbee	22/08/11	<ul style="list-style-type: none"> Launch - Install plates and strands to props, king post works and structural steel works Assembling and fixing rebar and formwork works at Piers S6 & S5 Inchgarvie Lodge wall construction
		Automatic light scatter meter	17/10/11	
M11	Linn Mill	Frisbee	22/08/11	<ul style="list-style-type: none"> Launch - Install plates and strands to props, king post works and structural steel works Launch Operations
		Automatic light scatter meter	06/12/11	
M12	Clufflat	Frisbee	29/08/11	<ul style="list-style-type: none"> Launch - Install plates and strands to props, king post works and structural steel works Launch Operations
M13	Clufflat Brae	Frisbee	21/09/11	
		Automatic light scatter meter	24/10/11	
M14	Springfield	Frisbee	15/08/11	<ul style="list-style-type: none"> Launch - Install plates and strands to props, king post works and structural steel works Launch Operations
M15	Echline	Frisbee	16/08/11	<ul style="list-style-type: none"> Launch – install plates to props, king post works and structural steel works Launch Operations Gyratory – concrete finishing, formwork, parapet concrete pours and associated work Scottish Gas diversion work and pipe laying
		Automatic light scatter meter	10/11/11	

M16	Scotstoun	Frisbee	07/09/11	<ul style="list-style-type: none"> • Utilities works • Brash removal
		Automatic light scatter meter	14/02/12	
M17	Dundas Home Farm	Frisbee	29/08/11	<ul style="list-style-type: none"> • Enviro barrier construction
		Automatic light scatter meter	23/02/12	
M18	Newton	Frisbee	22/08/11	<ul style="list-style-type: none"> • None
		TEOM	23/05/12	

3. AIR QUALITY MONITORING RESULTS

3.1. Automatic Light Scatter Dust Meter Monitoring Results

3.1.1. Light scatter results for April 2014 have been presented in a monthly chart; this can be found in Appendix A. Results show that the PM₁₀ levels were below threshold levels throughout the month with the exception of four periods. All monitors showed an increase during 2nd - 4th, 16th - 17th, 21st - 23rd and 26th - 28th April. On each of these occasions a number of monitors exceeded the review level. All monitors with the exception of Inchgarvie Lodge exceeded the review level on one or more days during April. All 7 monitors follow the same general pattern throughout the month.

3.1.2. It was noted that foggy conditions occurred during the periods in question starting 2nd, 21st and 26th April which can affect the meter readings (see section 2.2). Ground conditions during these periods were damp or wet throughout. One of the periods of raised levels also occurred during a weekend with limited works activity occurring on site (26th-28th). The fact that all 7 monitors showed the same pattern would suggest that a regional event affected the levels across the whole area rather than the increases being related to works activities in one specific area affecting only a few monitors. The PM₁₀ results have also been compared to the daily mean results obtained from the TEOM air quality monitoring stations located in Newton, Rosyth, and Broxburn, and from the TEOM FDMS stations located at Queensferry Road. The same increases in levels during these periods can be seen in this TEOM data,

confirming that the increases were likely to be caused by a regional event rather than localised works activities.

- 3.1.3.** The period of the 16th – 17th April saw a rise above the review level of the Echline, Inchgarvie Lodge and Clufflat monitors. During this period there were mechanical issues with the bowser located on the South Network which is used to dampen bare ground on site for dust suppression. Issues were also experienced relating to the access of water from the Forth Estuary and SUDs ponds on site. As a result dust suppression measures for the gyratory area adjacent to the A904 were compromised. This combined with the earthworks and heavy vehicle movements that were taking place in the area resulted in increased levels of dust directly upwind of the three monitors in question. Inspections by members of the Environmental Department confirmed the high levels of dust around the gyratory area. The Whinny Hill and Scotstoun monitors also showed increased levels, although these remained below the review level. After reviewing the works taking place at Scotstoun and Whinny Hill it was concluded that no works that may give rise to dust were taking place. This suggests that background levels were raised in general across site during this period. However it is believed that due to the failure of the mitigation methods noted above the increase at Echline, Inchgarvie Lodge and Clufflat was caused by FCBC activities.
- 3.1.4.** As a result of the issues experienced with the mitigation methods during the 16th - 17th April a review of the procedures for dust suppression was undertaken for the area of the gyratory and the wider South Networks region. A new hydrant was installed to guarantee access to water in the case that abstraction from the estuary or SUDs ponds is not possible. Furthermore a review of dust suppression and works activities for the coming months was undertaken to reduce the likelihood of such an incident occurring again. FCBC's Environmental Department have also installed an extra Frisbee gauge adjacent to the A904 (Echline Corner) to monitor dust levels in the area and is conducting regular inspections at this location to ensure construction activities are not causing increased levels of dust. The additional monitor will remain in

place over the summer and its location and necessity will be reviewed on a monthly basis.

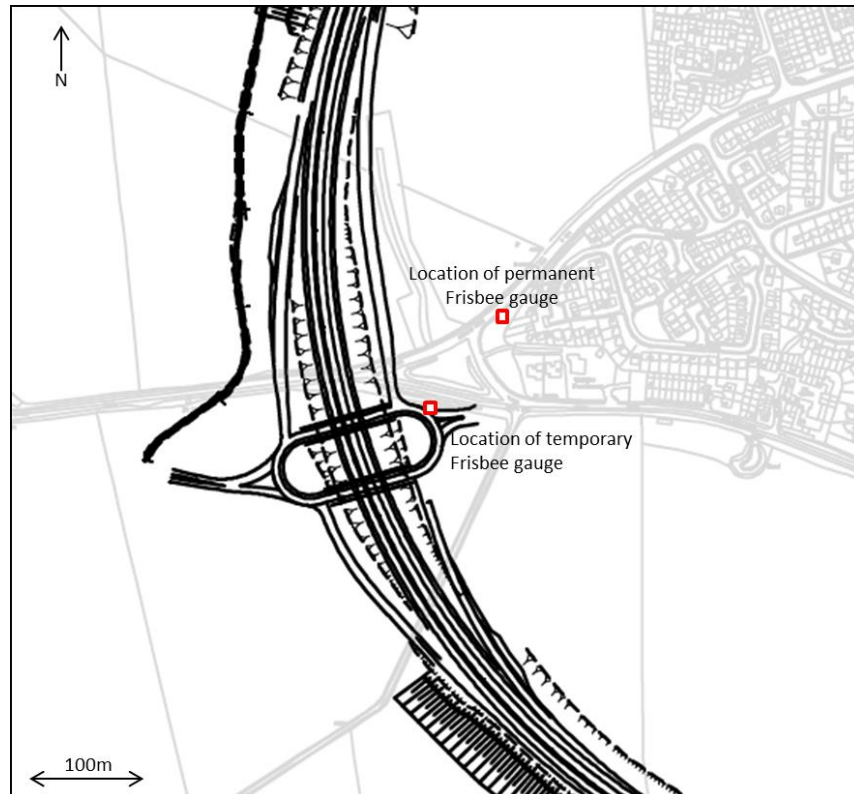


Figure 3: Location of additional temporary Frisbee gauge (Echline Corner)

- 3.1.5.** With regards to the exceedance of the review level for Scotsoun for the 18th April, a further review into works undertaken in the vicinity took place. No construction activities that would be likely to give rise to dust took place in the area on this date. A review of the data for the day was also conducted, looking at a breakdown of the levels throughout the day. Consistently low readings were seen throughout the day until after 8:00pm. For the five minute period ending 07:59pm an extremely high reading was observed ($6447\mu\text{g}/\text{m}^3$). During the hours of work readings were generally in the range of those seen across the rest of the site ($20\text{-}40\mu\text{g}/\text{m}^3$). This indicates that the exceedance at this location was not related to FCBC construction works.

3.2. Total Suspended Particles

3.2.1. The TSP results for April 2014 have been presented in a monthly chart; this can be found in Appendix B. The TSP levels at monitoring locations during April were found to be low and all within the threshold level. All locations were mostly found to follow a similar pattern across the site, demonstrating that, in general, the levels were influenced by regional changes in TSP levels, rather than construction works. During the period discussed in 3.1.3 the Inchgarvie Lodge, Clufflat Brae and Echline monitors see an increase similar to those seen in the PM₁₀ data though they never exceed the review level. Although a general increase can be observed at other locations on this day, the results together with the site observations would support the conclusions drawn in 3.1.3 that the increased levels are largely the result of localised construction activities rather than by a regional event.

3.2.2. The only other elevated reading that occurred during April was at Scotstoun on the 18th. Similar to the PM₁₀ levels for this location on that date, an extremely high reading (9593 µg/m³) was observed for the 5 minute period ending 07:59pm. The readings during working hours were in line with other locations, indicating that the increase was not related to FCBC construction works.

3.3. Frisbee Dust Deposition Results

3.3.1. The Frisbee dust deposition results for April 2014 have been presented in a chart and can be found in Appendix C. Frisbee dust deposition results were collected fortnightly, and the results averaged over this fortnight period to give a daily dust deposition rate. Three collections were made in April, on the 2nd, 16th and 30th. The next collection will take place on the 14th May 2014.

3.3.2. The site action level for the dust deposition rate has been set at 250 mg/m²/day. Exceedances of this level are treated as a potential incident and a review of the works in the vicinity of the site is instigated. A lower, site review level has been set at 140 mg/m²/day. Where concentrations exceed the lower

review threshold the site works are reviewed to ensure good practice is implemented; it is essentially a warning that additional controls may be required.

3.3.3. During April there were three exceedances of the site review level (see Table 4) and two exceedances of the action level. With the exception of the locations where exceedances occurred, Frisbee results from monitoring locations across site were generally found to be low. It should also be noted that after a minor alteration in location and some maintenance to the Barracks West Frisbee, the problems experienced at this location in March have been rectified.

Table 4: Exceedances of the dust deposition thresholds

Fortnight ending	Threshold Exceeded	Monitoring Location	Considerations	Weather conditions during period
02/04/2014	Action	Newton	Monitor blown over – likely erroneous result. No dust generating construction activities in the area	Low winds/ Generally damp
16/04/2014	Review	Newton	Monitor blown over – likely erroneous result. No dust generating construction activities in the area	Low winds/ Generally damp
30/04/2014	Action	Echline	Dust incident occurred at gyratory 16 th & 17 th April	Low winds/ Generally damp
	Review	Echline Corner	Dust incident occurred at gyratory 16 th & 17 th April	
	Review	Barracks East	No dust generating construction activities in the area	

3.3.4. For each of the exceedances of the review or action level, a review of the works in each of the areas, weather conditions, and the mitigation measures in

place was undertaken. Other considerations were also made, such as where the gauge is located. Where available, the Frisbee results were also considered alongside the particulate matter data for the same period.

- 3.3.5.** During the fortnight ending 2th April the Newton Frisbee registered levels above the action level followed by an exceedance of the review level during the fortnight ending 16th April. For these collections, the Frisbee was found to be blown over and resting against the adjacent fence, likely leading to contamination of the samples and erroneous results. After the collection on the 16th April the Frisbee was changed to a different gauge and has had regular checks to ensure that it remained upright. No issues have been experienced since the change. A review of works was undertaken and it was found that no FCBC construction activities took place in the area. A TEOM monitor is also located adjacent to the Frisbee which indicates low particulate matter levels during the period in question. The final Frisbee collection of the month indicates much lower dust deposition with levels below the review threshold. After a thorough review it was concluded that the high results at Newton cannot be explained by FCBC construction activities undertaken during this period and are likely to be due to the Frisbee blowing over. This has now been addressed.
- 3.3.6.** During the fortnight concluding the 30th April, Echline and Echline Corner Frisbees experienced levels above the Action and Review levels respectively. As outlined in section 3.1.3 the period of the 16th-17th saw increased levels of particulate matter believed to be due to construction activities and as a consequence increased inspections were conducted during this period. Having conducted increased inspections in the area over the fortnight in question and comparing the results obtained for the relevant TSP, PM₁₀ and TEOM data it was concluded that the levels observed at these gauges are a result of the issues experienced during the 16th-17th April. The actions to ensure this does not occur again are outlined in section 3.1.4.
- 3.3.7.** Following ongoing issues with unexplained elevated results the Barracks East Frisbee was moved at the beginning of the period covered by the 2nd April collection to an alternative location in the same vicinity.

3.3.8. During the fortnight ending 30th April the Barracks East Frisbee registered levels above the review level. A review of works was undertaken and it was found that no construction activities that would be likely to give rise to dust took place in the area. Activities taking place in the area were checked for dust during inspection on the 23rd and 29th April. Work in the barracks area around Pier S6 and S5 has predominantly been rebar work and activities related to concrete pours. Vehicle movements in the area were minimal due to the closed nature of the work going on and material being tracked out of the compound was negligible. There are also minimal exposed areas of ground in the vicinity that could generate dust. Other indicators such as TSP and Frisbee data were very low for the period at the nearest meter (Inchgarvie Lodge). After a thorough review it was concluded that the results cannot be explained by FCBC construction activities undertaken during this period. However, due to issues in this location in the past and the levels observed FCBC's Environmental Department will conduct increased inspections in the vicinity to ensure construction activities are not causing these results.

3.4. Daily Dust Log and Environmental Inspections

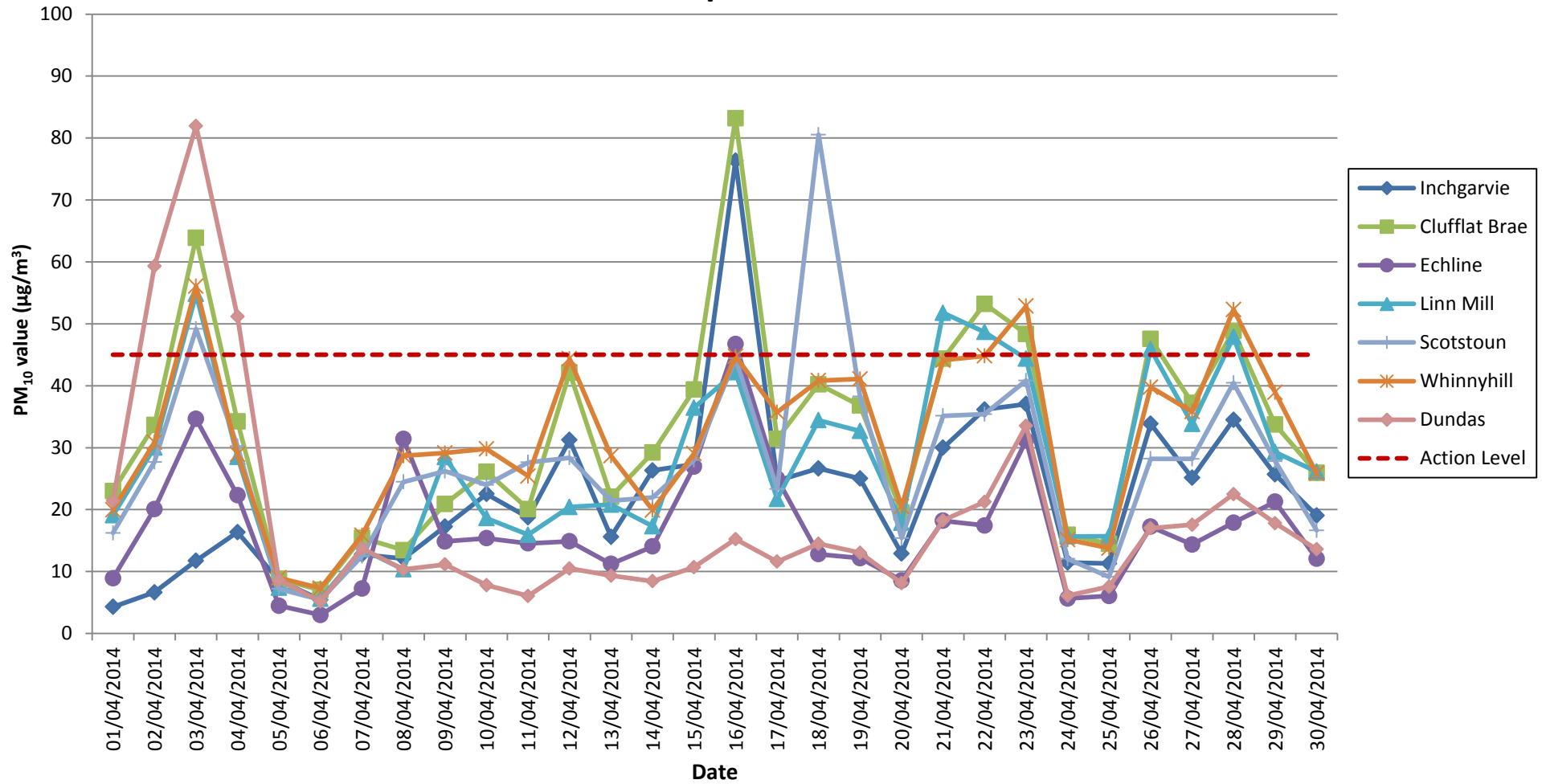
- 3.4.1.** A summary of the daily dust log for April can be found in Appendix D. During April dust was noted on site (16th – 17th) in the Queensferry Gyratory area. This instance is outlined in sections 3.1.3 and 3.1.4.
- 3.4.2.** During this period full environmental inspections were also undertaken across the site and covered areas where works were being undertaken. In April, dust was noted during an inspection on the 16th April as reported above.

APPENDIX A: LIGHT SCATTER METER RESULTS

Air Quality Monitoring

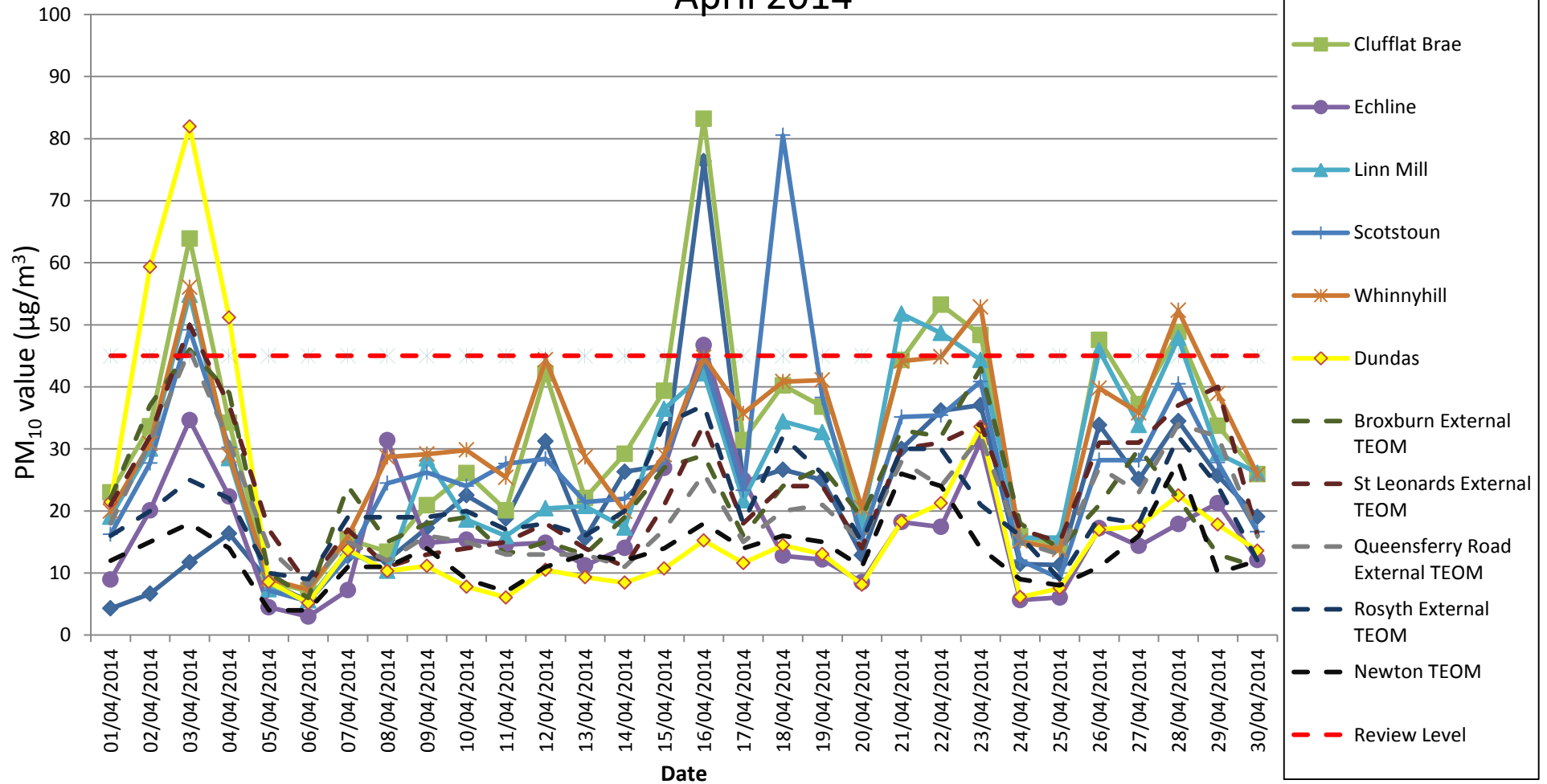
Particulate Matter (PM10) Results for all Monitoring Locations

April 2014



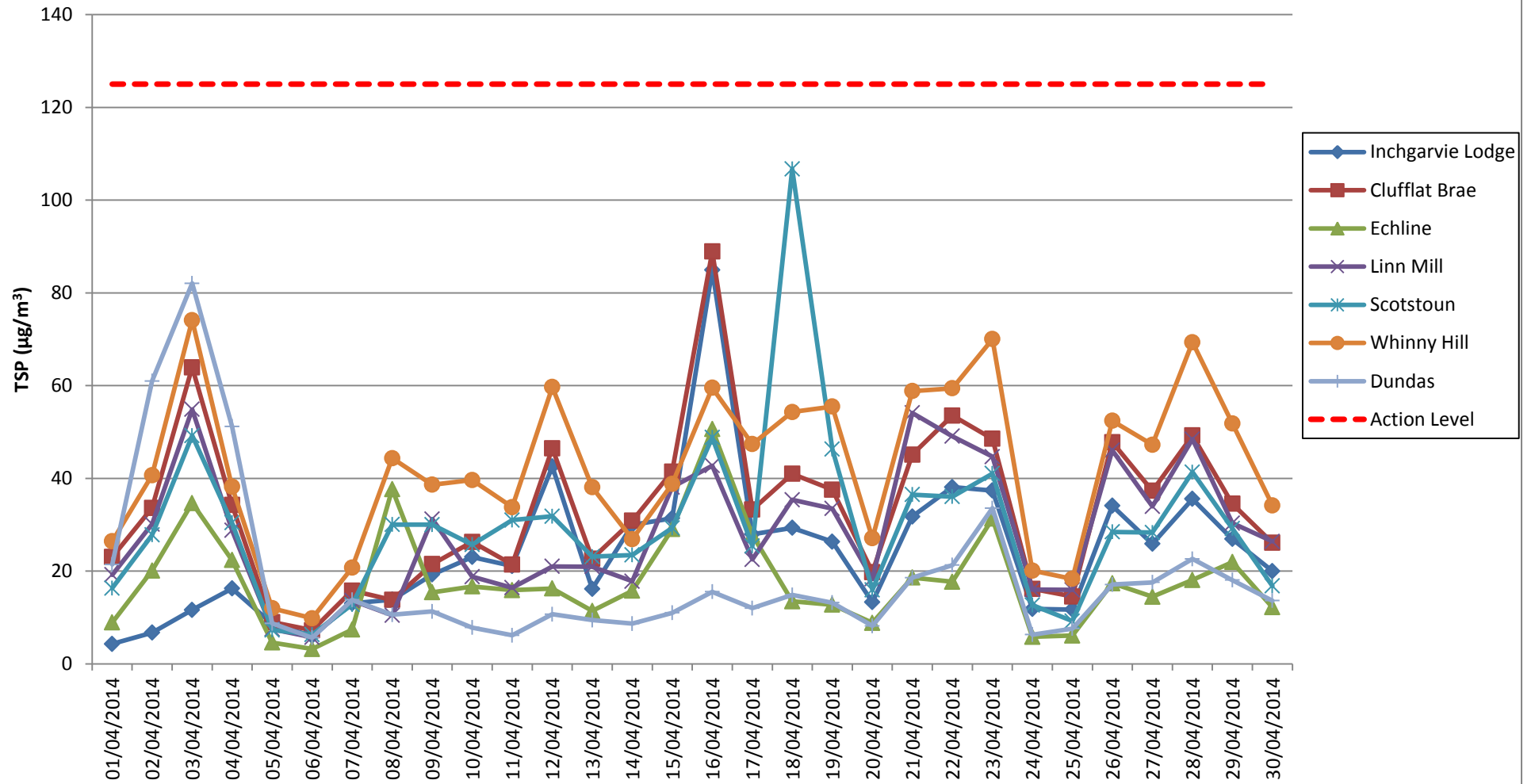
Air Quality Monitoring: Particulate Matter (PM10) Results for all Monitoring Locations, including TEOM data

April 2014



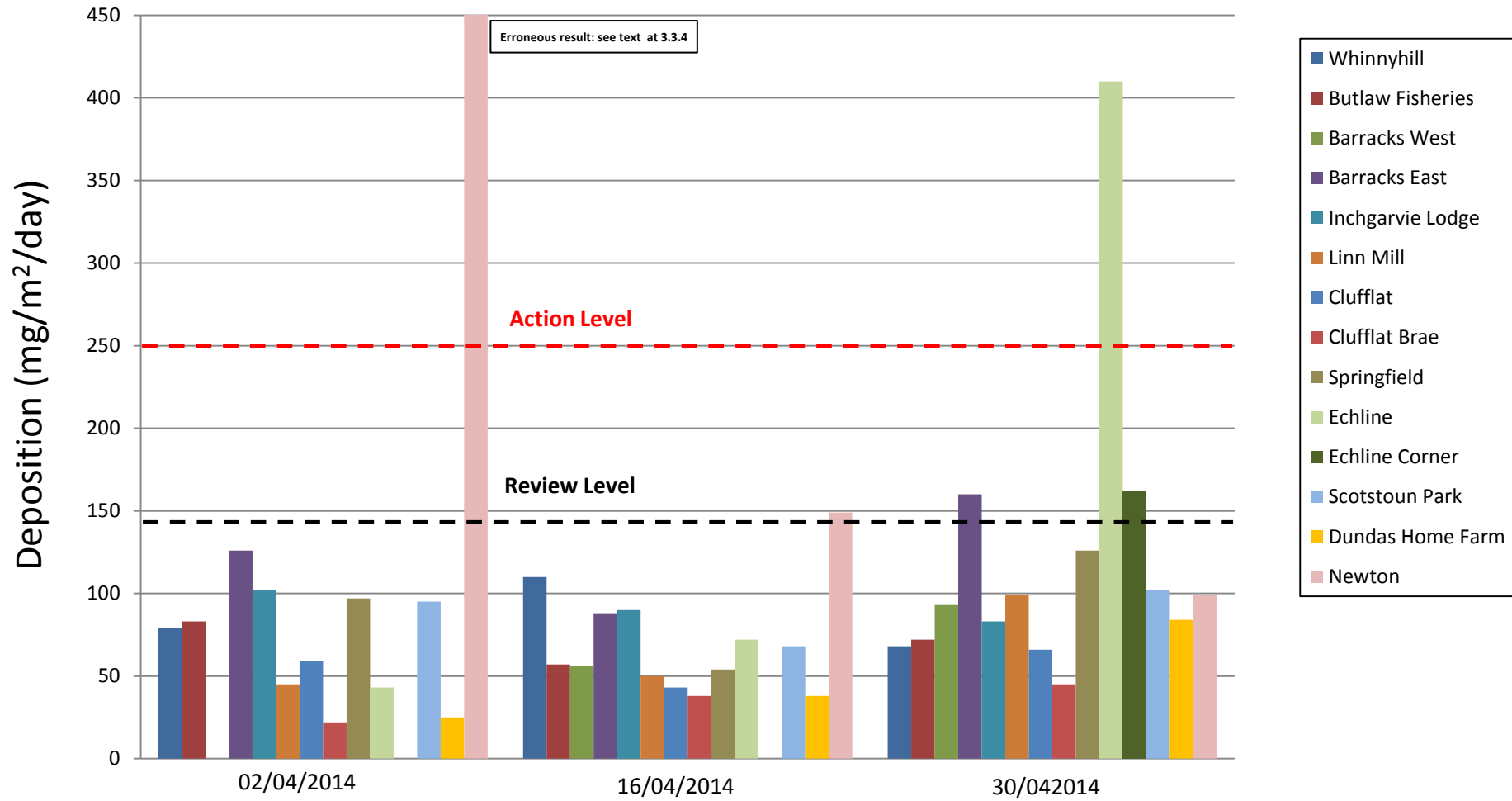
APPENDIX B: TOTAL SUSPENDED PARTICLES

Total Suspended Particles (TSP) Results April 2014



APPENDIX C: FRISBEE GAUGE RESULTS

Frisbee Dust Deposition Results: April 2014



APPENDIX D: DAILY DUST LOG

Daily Dust Log - North - April 2014

DATE	LOCATION	WIND	WIND DIRECTION	GROUND SURFACE	VISIBLE DUST	DUST DUE TO WORKS (if applicable)	CAUSES OF DUST (if applicable)	COMMENTS AND ACTIONS
01/04/2014	N	LIGHT	NNE	DAMP	N			
02/04/2014	N	LIGHT	NE	DAMP	N			Fog
03/04/2014	N	LIGHT	NE	WET	N			Fog
04/04/2014	N	LIGHT	NNE	DAMP	N			Fog
05/04/2014	N	LIGHT	S		N			
06/04/2014	N	MEDIUM	SW		N			
07/04/2014	N	LIGHT	WSW	DAMP	N			
08/04/2014	N	MEDIUM	SW	DAMP	N			
09/04/2014	N	MEDIUM	SW	DAMP	N			
10/04/2014	N	LIGHT	SW	DAMP	N			
11/04/2014	N	LIGHT	SW	DAMP	N			
12/04/2014	N	STRONG	SW		N			
13/04/2014	N	STRONG	SW		N			
14/04/2014	N	LIGHT	WSW	DRY	N			
15/04/2014	N	LIGHT	S	DRY	N			
16/04/2014	N	LIGHT	SSW	DRY	Y			
17/04/2014	N	MEDIUM	SW	DRY	N			
18/04/2014	N	LIGHT	NE	DAMP	N			
19/04/2014	N	LIGHT	NE		N			
20/04/2014	N	LIGHT	ENE		N			
21/04/2014	N	LIGHT	NE	DRY	N			Fog
22/04/2014	N	LIGHT	NNE	DAMP	N			Fog
23/04/2014	N	LIGHT	NNW	WET	N			Fog
24/04/2014	N	LIGHT	NW	DAMP	N			
25/04/2014	N	LIGHT	NW	DAMP	N			
26/04/2014	N	MEDIUM	NW		N			Fog
27/04/2014	N	LIGHT	N		N			Fog
28/04/2014	N	LIGHT	NE	DAMP	N			Fog
29/04/2014	N	LIGHT	NNE	DAMP	N			
30/04/2014	N	LIGHT	NNE	WET	N			

Daily Dust Log - South - April 2014

DATE	LOCATION	WIND	WIND DIRECTION	GROUND SURFACE	VISIBLE DUST	DUST DUE TO WORKS (if applicable)	CAUSES OF DUST (if applicable)	COMMENTS AND ACTIONS
01/04/2014	S	LIGHT	NNE	DAMP	N			
02/04/2014	S	LIGHT	NE	DAMP	N			Fog
03/04/2014	S	LIGHT	NE	WET	N			Fog
04/04/2014	S	MEDIUM	NNE	DAMP	N			Fog
05/04/2014	S	LIGHT	S		N			
06/04/2014	S	LIGHT	SW		N			
07/04/2014	S	MEDIUM	WSW	DAMP	N			
08/04/2014	S	MEDIUM	SW	DAMP	N			
09/04/2014	S	LIGHT	SW	DAMP	N			
10/04/2014	S	LIGHT	SW	DAMP	N			
11/04/2014	S	LIGHT	SW	DAMP	N			
12/04/2014	S	LIGHT	SW		N			
13/04/2014	S	LIGHT	SW		N			
14/04/2014	S	MEDIUM	WSW	DRY	N			
15/04/2014	S	STRONG	S	DRY	N			
16/04/2014	S	STRONG	SSW	DRY	Y			Dust issues (Queensferry Gyratory)
17/04/2014	S	STRONG	SW	DRY	N			Dust issues (Queensferry Gyratory)
18/04/2014	S	MEDIUM	NE	DAMP	N			
19/04/2014	S	STRONG	NE		N			
20/04/2014	S	STRONG	ENE		N			
21/04/2014	S	MEDIUM	NE	DAMP	N			Fog
22/04/2014	S	MEDIUM	NNE	DAMP	N			Fog
23/04/2014	S	LIGHT	NNW	WET	N			Fog
24/04/2014	S	LIGHT	NW	DAMP	N			
25/04/2014	S	LIGHT	NW	DAMP	N			
26/04/2014	S	LIGHT	NW		N			Fog
27/04/2014	S	LIGHT	N		N			Fog
28/04/2014	S	LIGHT	NE	DAMP	N			Fog
29/04/2014	S	LIGHT	NNE	DAMP	N			
30/04/2014	S	LIGHT	NNE	WET	N			