



Contractor



Forth Crossing Bridge Constructors

HOCHTIEF Solutions
 American Bridge International
 DRAGADOS
 Morrison Construction

Project

FORTH REPLACEMENT CROSSING

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AIR QUALITY MONITORING REPORT MAY 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 May 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, 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 provides a visual record of the weather conditions at the time of the inspection, including conditions that can affect readings, such as fog.

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 May
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 – Element joints and welding 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 – Element joints and welding Launch Operations
		Automatic light scatter meter	06/12/11	
M12	Clufflat	Frisbee	29/08/11	<ul style="list-style-type: none"> Launch – Element joints and welding 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 – Element joints and welding Launch Operations
M15	Echline	Frisbee	16/08/11	<ul style="list-style-type: none"> Launch – Element joints and welding Launch Operations Install lighting columns and duct crossings Gyratory: Concrete finishing & waterproofing 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"> Sheet piling at south pier and

		Automatic light scatter meter	14/02/12	abutment • Utility works
M17	Dundas Home Farm	Frisbee	29/08/11	• Noise barrier construction
		Automatic light scatter meter	23/02/12	
M18	Newton	Frisbee	22/08/11	• 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 May 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 one day. Linn Mill, Whinny Hill and Inchgarvie monitors all exceed the review level on the 19th May.

3.1.2. It was noted that fog occurred during 19th and 20th May which can affect the meter readings (see section 2.2). Ground conditions during these periods were damp or wet throughout. The fact that all 7 monitors showed increased levels during this period 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, Edinburgh. The same increases in levels during this period 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.

3.2. Total Suspended Particles

3.2.1. The TSP results for May 2014 have been presented in a monthly chart; this can be found in Appendix B. The TSP levels at monitoring locations during May 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.

3.3. Frisbee Dust Deposition Results

3.3.1. The Frisbee dust deposition results for May 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. Two collections were made in May, on the 14th and 28th. The next collection will take place on the 11th June 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 May there were three exceedances of the site review level (see Table 4) and four exceedances of the action level. With the exception of the locations where exceedances occurred, Frisbee results from monitoring locations across site were generally low, although showing higher levels than previously observed during 2014 at some locations.

Table 2: Exceedances of the dust deposition thresholds

Fortnight ending	Threshold Exceeded	Monitoring Location	Considerations	Weather conditions during period
14/05/2014	Review	Whinnyhill	Some dust generating construction activities in the area	Low winds/ Generally damp
	Action	Echline	Dust generating activities in the area being mitigated. Monitor may be affected by nearby vegetation and tree pollen.	
28/05/2014	Review	Barracks East	No dust generating construction activities in the area	Low winds/ Generally damp
		Springfield	Sample bottle found empty when collected leading to erroneous result. No dust generating construction activities in the area	
	Action	Echline	Dust generating activities in the area being mitigated. Monitor may be affected by nearby vegetation and tree pollen.	
		Echline Corner	Dust generating activities in area being mitigated. Monitor located within construction site adjacent to activities and A904.	
		Inchgarvie Lodge	Sample bottle found away from gauge and empty – leading to erroneous result. 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 28th May the Inchgarvie Frisbee registered levels above the action level. For this collection, the Frisbee collection bottle was found away from the Frisbee and on its side, likely leading to contamination of the sample and erroneous results. A review of works was undertaken and it was found that no FCBC construction activities took place in the area that were likely to create dust. A light scatter dust monitor is also located at this location. This monitor indicates low particulate matter levels for both PM₁₀ and TSP during the period in question with the exception of one day when fog occurred (section 3.1.2). After a thorough review it was concluded that the high results at Inchgarvie cannot be explained by FCBC construction activities undertaken during this period and are likely to be due to sample disturbance and contamination. This bottle has subsequently been replaced and checked to ensure it is not an ongoing issue.
- 3.3.6.** During the fortnight ending 28th May the Springfield Frisbee registered levels above the review level. For this collection the Frisbee collection bottle was found in place but empty. All other collection bottles that were found in place were approximately one third full. This suggests that at some point the bottle was overturned and the sample lost with possible contamination of the sample bottle occurring. A review of works was undertaken and it was found that no FCBC construction activities took place in the area that were likely to create dust. A light scatter dust monitor is located approximately 150 metres from this location (Clufflat). This monitor indicates low particulate matter levels for both PM₁₀ and TSP during the period in question with the exception of one day when fog occurred (section 3.1.2). After a thorough review it was concluded that the high results at Springfield cannot be explained by FCBC construction activities undertaken during this period and are likely due to the Frisbee collection bottle being found empty and contaminated.

- 3.3.7.** With regard to the exceedance of the review level at Whinnyhill for the period ending 14th May, whilst construction activities cannot be excluded from considerations, a review of the works at this location, the PM₁₀ data and the weather conditions during this period demonstrate that the impact of construction activities on the dust levels at these receptors is likely to have been minimal. Increased inspections have been implemented in the area to ensure any dust generating construction activities are being adequately mitigated.
- 3.3.8.** The exceedance of the review level at Barracks East for the period ending 28th May also initiated a further review into works undertaken in the vicinity. However, during the period in question no construction activities that would be likely to give rise to dust took place in the area, indicating that the exceedance at this location was not related to construction works. The area adjacent to the Frisbee has been closed for access to vehicles in June. Proximity to turning cars has been identified previously as a potential cause for high levels. The results for June and July will help to identify if this has been affecting levels.
- 3.3.9.** During both two week periods the Echline Frisbee registered levels above the action level. A review of the works was undertaken and it was found that although construction activities that could give rise to dust took place in the area during this period, mitigation was in place to prevent dust migrating off-site. Due to the dust incident in April, increased inspections have taken place in the area during May. These inspections not only included identifying dust emissions but also checked the procedures in place to suppress any dust. Inspections were carried out specifically on days where dust was more likely to be an issue (no/low rainfall and dry ground conditions). Live PM₁₀ and TSP levels were also monitored very closely during these days. PM₁₀ and TSP data has been retrospectively interrogated closely for these periods due to the elevated Frisbee results. The automatic light scatter dust monitor for Echline is positioned adjacent to the Frisbee (<1m away). TSP and PM₁₀ levels throughout these periods are low. The automatic light scatter dust monitors were recently calibrated (9th & 10th April 2014) and registered the dust incident that occurred during the 16th & 17th April 2014 indicating that the monitor is

functioning correctly. It is possible that the position of the gauge near to mature trees has resulted in some small vegetation particles affecting the results. Elevated Frisbee levels were also noted at this location during May 2013 with similarly low TSP and PM₁₀. There has been a focus on completion of the works in closest proximity to this monitoring location in order to limit the potential for dust emissions in the area. After a thorough review it was concluded that FCBC construction activities are likely to have contributed to the exceedances. However, in taking account of weather and ground conditions throughout May, in addition to the TSP and PM₁₀ levels recorded, it is considered other factors may also have contributed to the exceedance. Due to the nature of the work and sensitivity of the area, the extra precautions put in place to mitigate dust, including inspections, are continuing until work in the area has been completed.

3.3.10. During the fortnight ending 28th May the Echline Corner Frisbee registered levels above the action level. This is an additional temporary Frisbee that was put in place after the dust incident during April. It has been positioned within the construction site and provides information regarding dust levels generated on-site. As mentioned in 3.3.9 a thorough review was conducted into the results observed in this area during May. The result obtained for the Echline Corner Frisbee during the period ending the 28th May was exceptionally high. Following review and analysis it is concluded that construction activity was responsible for the high levels. However, the location is also directly adjacent to the A904 and so can also be affected by dust from the public road (Figure 3). It should be noted that this monitor can provide an indication of levels of dust at source and the levels recorded do not necessarily represent levels of dust migrating off-site. The exceedance at Echline during the first two weeks of May is not supported by a high dust result at the site, as the result at Echline Corner during this time was relatively low.

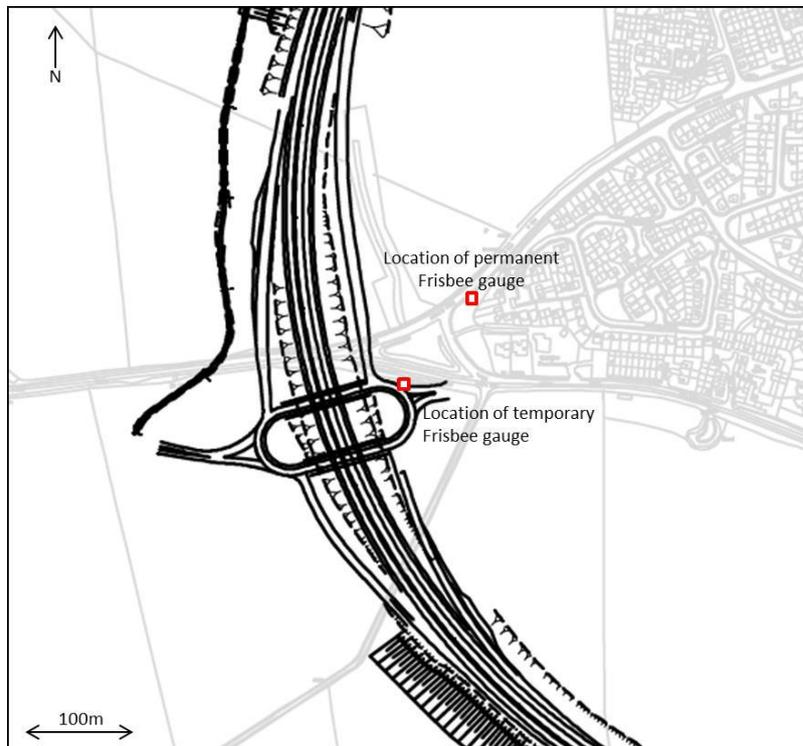


Figure 3: Location of additional temporary Frisbee gauge (Echline Corner)

3.4. Daily Dust Log and Environmental Inspections

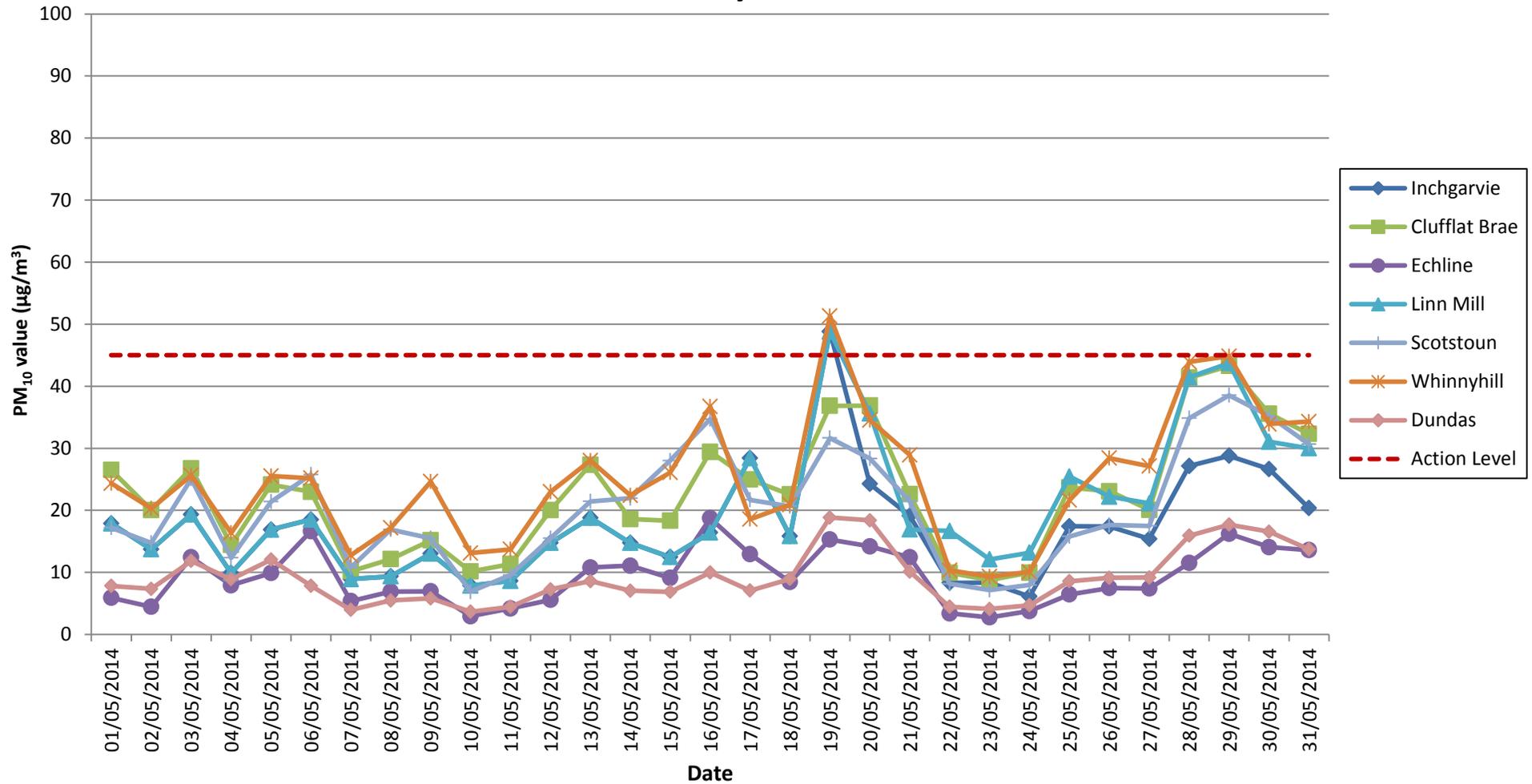
- 3.4.1.** A summary of the daily dust log for March can be found in Appendix D. During this period no instances of dust were noted on site.
- 3.4.2.** During this period full environmental inspections were also undertaken across the site and covered areas where works were being undertaken. In May, no instances of dust were noted during inspections.

APPENDIX A: LIGHT SCATTER METER RESULTS

Air Quality Monitoring

Particulate Matter (PM10) Results for all Monitoring Locations

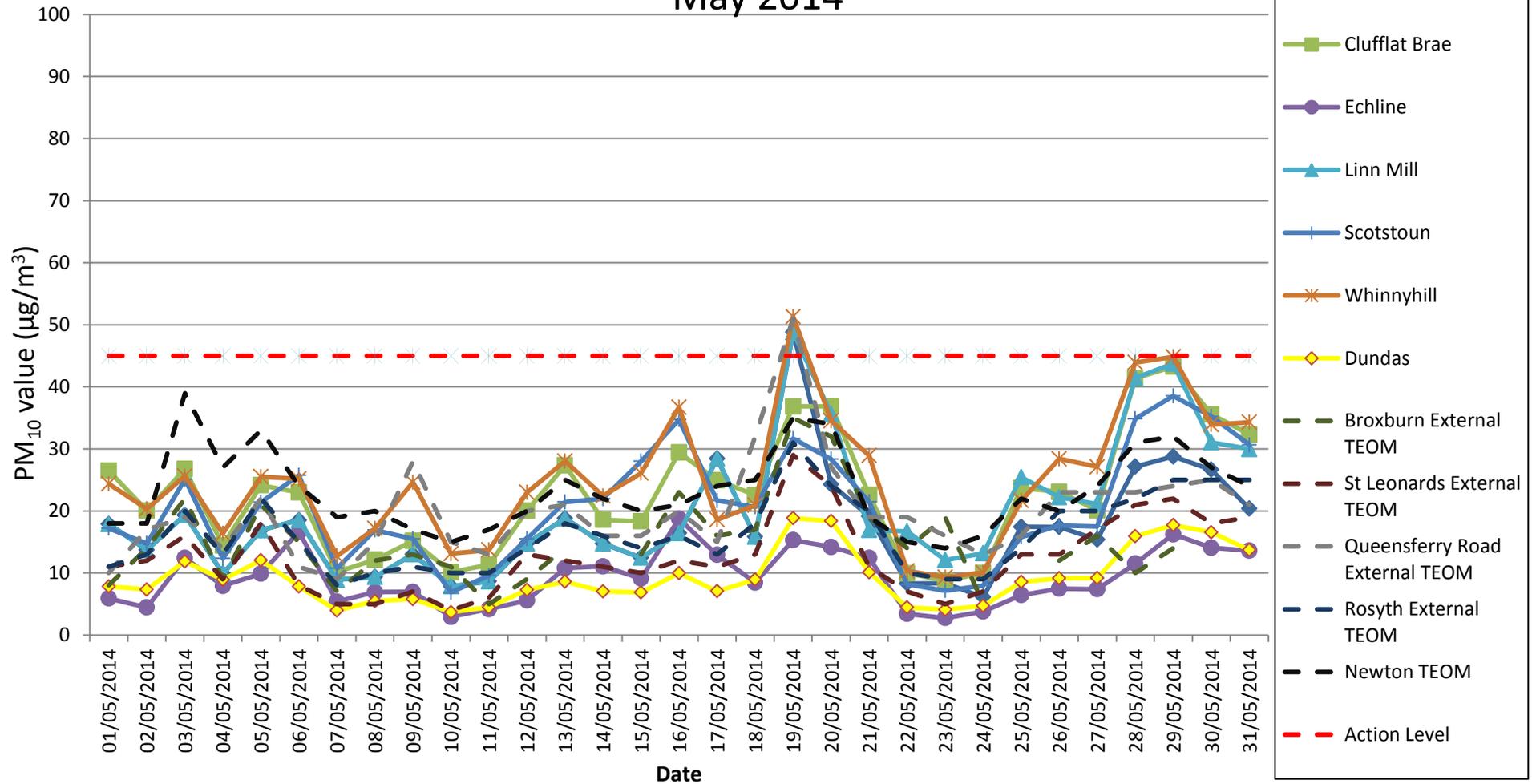
May 2014



Note: The Clufflat monitor defaulted to a value of 99998 for a five minute period on the 31/05/2014. This erroneous value was removed for calculations for the above figure.

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

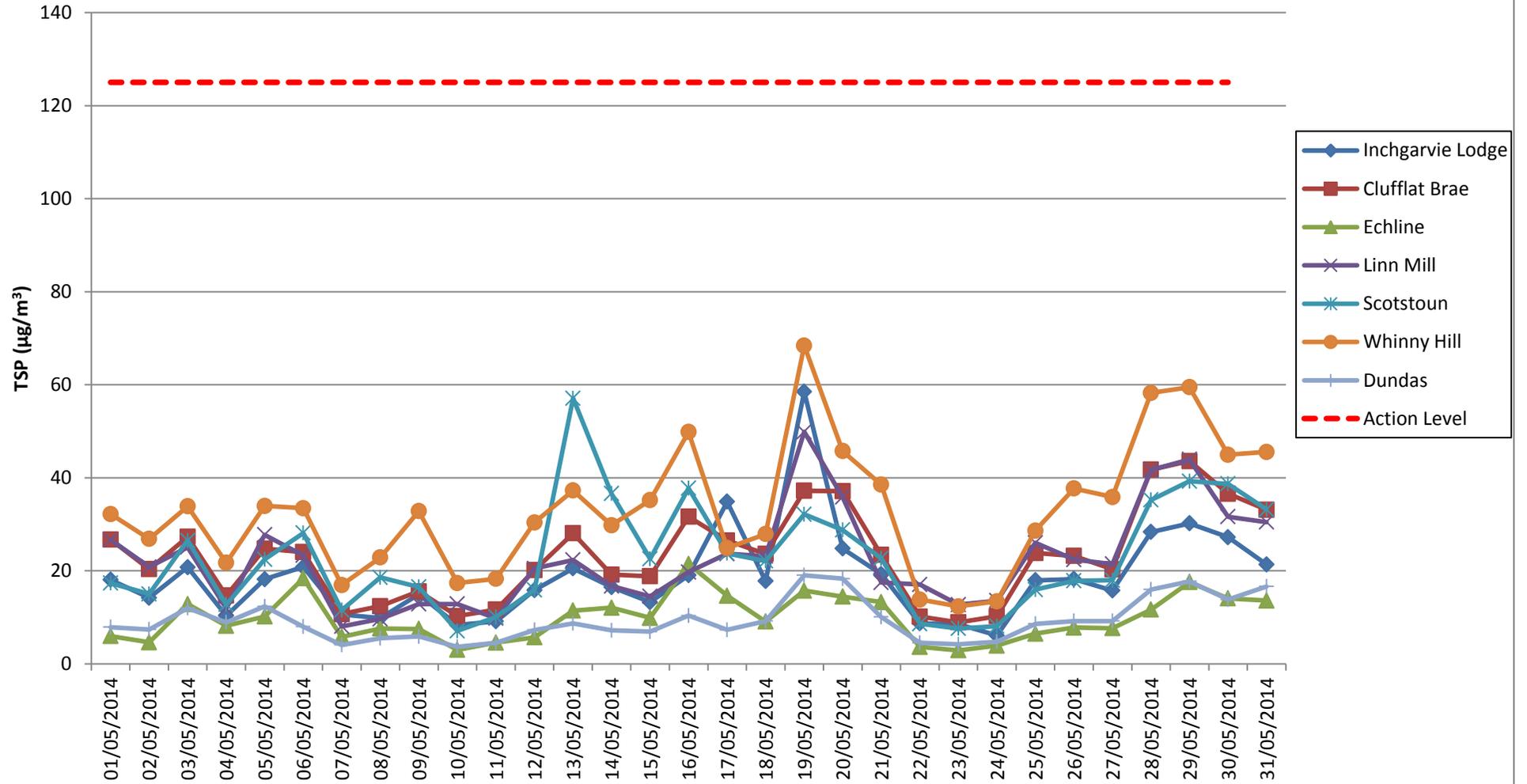
May 2014



Note: The Clufflat monitor defaulted to a value of 99998 for a five minute period on the 31/05/2014. This erroneous value was removed for calculations for the above figure.

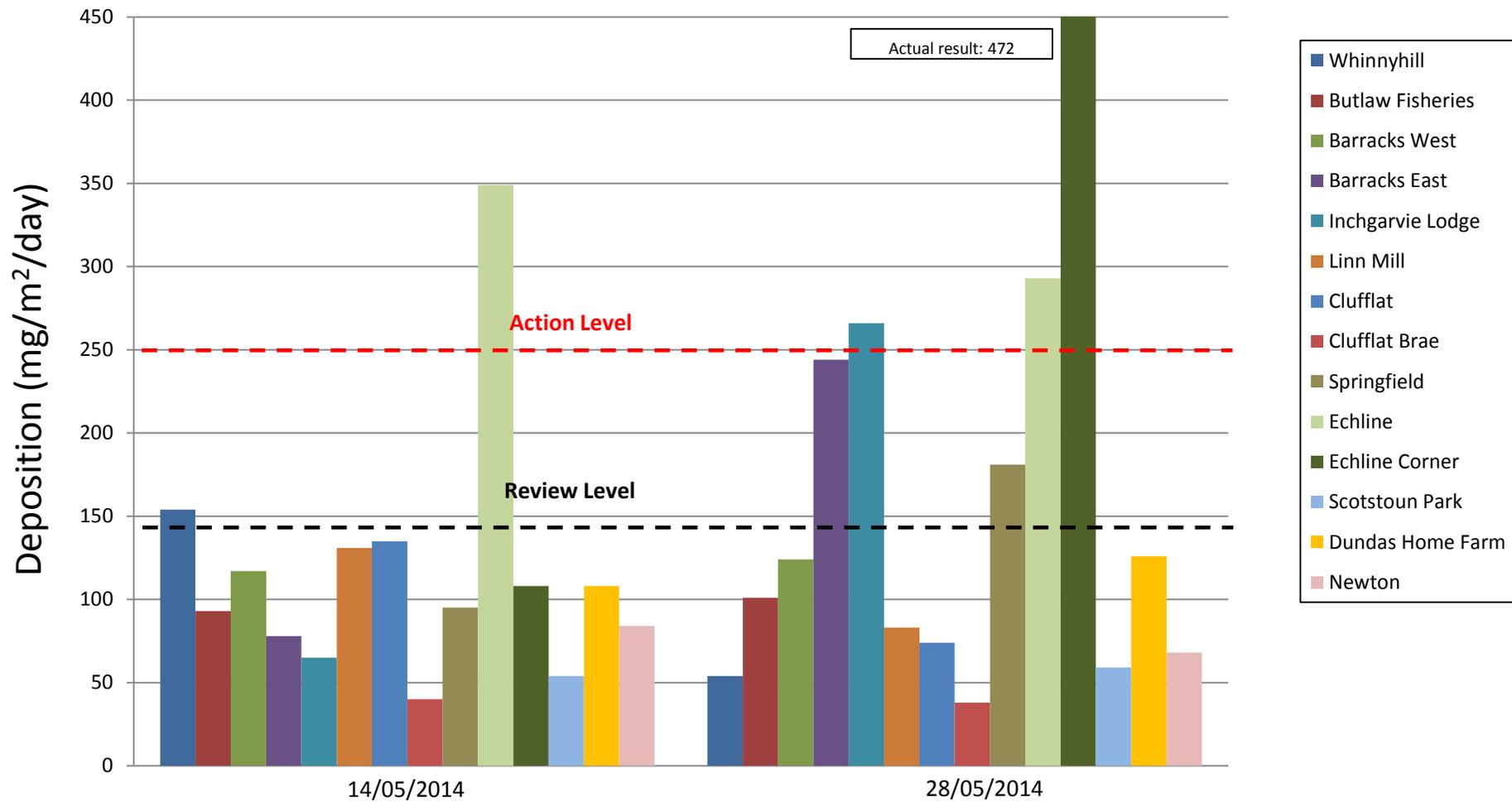
APPENDIX B: TOTAL SUSPENDED PARTICLES

Total Suspended Particles (TSP) Results May 2014



APPENDIX C: FRISBEE GAUGE RESULTS

Frisbee Dust Deposition Results: May 2014



Note: 28/05/2014 results for Inchgarvie and Springfield represent erroneous values as sample bottle found empty and/or away from gauge.

APPENDIX D: DAILY DUST LOG

Daily Dust Log - North - May 2014

DATE	LOCATION	WIND	WIND DIRECTION	GROUND SURFACE	VISIBLE DUST	DUST DUE TO WORKS (if applicable)	CAUSES OF DUST (if applicable)	COMMENTS AND ACTIONS
01/05/2014	N	MEDIUM	NE	WET	N			
02/05/2014	N	LIGHT	ENE	DAMP	N			
03/05/2014	N	LIGHT	SSW		N			
04/05/2014	N	LIGHT	S		N			
05/05/2014	N	LIGHT	SE	DAMP	N			
06/05/2014	N	MEDIUM	SW	DAMP	N			
07/05/2014	N	MEDIUM	SW	DAMP	N			
08/05/2014	N	LIGHT	WSW	DAMP	N			
09/05/2014	N	MEDIUM	SW	DAMP	N			
10/05/2014	N	LIGHT	ENE		N			
11/05/2014	N	LIGHT	W		N			
12/05/2014	N	LIGHT	ENE	WET	N			
13/05/2014	N	LIGHT	WSW	DAMP	N			
14/05/2014	N	LIGHT	SW	DAMP	N			
15/05/2014	N	MEDIUM	SW	DAMP	N			
16/05/2014	N	MEDIUM	SW	DAMP	N			
17/05/2014	N	MEDIUM	S		N			
18/05/2014	N	LIGHT	S		N			
19/05/2014	N	LIGHT	NE	DAMP	N			FOG
20/05/2014	N	LIGHT	NE	WET	N			FOG
21/05/2014	N	LIGHT	SW	WET	N			
22/05/2014	N	LIGHT	NE	DAMP	N			
23/05/2014	N	LIGHT	ENE	DAMP	N			
24/05/2014	N	LIGHT	NE		N			
25/05/2014	N	LIGHT	NNE		N			
26/05/2014	N	LIGHT	NE	WET	N			
27/05/2014	N	LIGHT	ENE	WET	N			
28/05/2014	N	LIGHT	NNE	WET	N			FOG
29/05/2014	N	LIGHT	NE	WET	N			FOG
30/05/2014	N	LIGHT	N	DAMP	N			
31/05/2014	N	LIGHT	WSW		N			

Daily Dust Log - South - May 2014

DATE	LOCATION	WIND	WIND DIRECTION	GROUND SURFACE	VISIBLE DUST	DUST DUE TO WORKS (if applicable)	CAUSES OF DUST (if applicable)	COMMENTS AND ACTIONS
01/05/2014	S	MEDIUM	NE	WET	N			
02/05/2014	S	LIGHT	ENE	DAMP	N			
03/05/2014	S	LIGHT	SSW		N			
04/05/2014	S	LIGHT	S		N			
05/05/2014	S	LIGHT	SE	DAMP	N			
06/05/2014	S	MEDIUM	SW	DAMP	N			
07/05/2014	S	MEDIUM	SW	DAMP	N			
08/05/2014	S	LIGHT	WSW	DAMP	N			
09/05/2014	S	MEDIUM	SW	DAMP	N			
10/05/2014	S	LIGHT	ENE		N			
11/05/2014	S	LIGHT	W		N			
12/05/2014	S	LIGHT	ENE	WET	N			
13/05/2014	S	LIGHT	WSW	DAMP	N			
14/05/2014	S	LIGHT	SW	DAMP	N			
15/05/2014	S	MEDIUM	SW	DAMP	N			
16/05/2014	S	MEDIUM	SW	DAMP	N			
17/05/2014	S	MEDIUM	S		N			
18/05/2014	S	LIGHT	S		N			
19/05/2014	S	LIGHT	NE	DAMP	N			FOG
20/05/2014	S	LIGHT	NE	WET	N			FOG
21/05/2014	S	LIGHT	SW	WET	N			
22/05/2014	S	LIGHT	NE	DAMP	N			
23/05/2014	S	LIGHT	ENE	DAMP	N			
24/05/2014	S	LIGHT	NE		N			
25/05/2014	S	LIGHT	NNE		N			
26/05/2014	S	LIGHT	NE	WET	N			
27/05/2014	S	LIGHT	ENE	WET	N			
28/05/2014	S	LIGHT	NNE	WET	N			FOG
29/05/2014	S	LIGHT	NE	WET	N			FOG
30/05/2014	S	LIGHT	N	DAMP	N			
31/05/2014	S	LIGHT	WSW		N			