



Contractor



Forth Crossing Bridge Constructors

HOCHTIEF Solutions
 American Bridge International
 DRAGADOS
 Morrison Construction

Project

FORTH REPLACEMENT CROSSING

Document title

**AIR QUALITY MONITORING REPORT
 SEPTEMBER 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 September 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 Quality Management Plan (DAQMP) 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, including the date it was installed.
- 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 September
M1	Whinny Hill	Frisbee	21/03/12	• Earthworks
		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 S1&4 • Concrete pouring at Piers S1&4 • Repair and removal of formwork platforms • Excavation at Pier S2
M8	Barracks West	Frisbee	31/08/11	<ul style="list-style-type: none"> • Marine works • Assembling and fixing rebar and formwork works at Piers S1&4 • Concrete pouring at Piers S1&4 • Repair and removal of formwork platforms • Excavation at Pier S2
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 S1&4 • Concrete pouring at Piers S1&4 • Repair and removal of formwork platforms • Excavation at Pier S2 • Brickwork cladding to Inchgarvie Lodge wall
		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 • Brickwork cladding to Inchgarvie Lodge wall
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 • Excavation and haulage from

				mainline north of A904 to Dundas area
M15	Echline	Frisbee	16/08/11	<ul style="list-style-type: none"> • Launch – Element joints and welding • Launch Operations • Paving, kerbing, surfacing, drainage and earthworks adjacent to A904 • Painting, surfacing and concrete finishing at gyratory • Line marking
		Automatic light scatter meter	10/11/11	
M16	Scotstoun	Frisbee	07/09/11	<ul style="list-style-type: none"> • Filling embankments and sheet piling at B800 • Concrete pours and rebar work • Utility works
		Automatic light scatter meter	14/02/12	
M17	Dundas Home Farm	Frisbee	29/08/11	<ul style="list-style-type: none"> • Haulage of excavated materials from Echline • Construction of road formation from Dundas to Queensferry gyratory
		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 September 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 two periods. All monitors registered values over the threshold on the 12th and/or 13th September and Inchgarvie registered levels above the threshold on the 26th September. All the monitors follow the same general pattern throughout the month.

3.1.2. It was noted that foggy conditions occurred on 4th-5th, 10th-13th and 26th September. All monitors saw increases in PM₁₀ levels during these dates. For

the exceedances of the action level, a review of the works in each of the areas, weather conditions, and the mitigation measures in place was undertaken. The fact that all seven 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. In this case it is concluded that fog caused all the exceedances (see section 2.2) as the dates coincide and all monitors show increases at these times.

- 3.1.3.** 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 and St Leonards, Edinburgh (an urban background site). The TEOM at Newton was installed by West Lothian Council, facilitated by FCBC, during May 2012. The comparison between the light scatter and TEOM results demonstrates that both sets of results generally follow the same pattern at similar levels, indicating that the pattern observed throughout September was largely driven by regional changes in air quality.

3.2. Total Suspended Particles

- 3.2.1.** The TSP results for September 2014 have been presented in a monthly chart; this can be found in Appendix B. The TSP levels at monitoring locations during September were found to be low and all within the threshold level. All locations across the site were mostly found to follow a similar pattern, 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 September 2014 have been presented in a chart and can be found in Appendix C. This includes an additional Frisbee (Echline Corner) currently located south of the A904 in proximity to the Echline monitor. This temporary Frisbee is used to provide additional information and its results are presented alongside the 13 permanent monitors. 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 September, on the 3rd and 17th. The next collection will take place on the 1st October 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 September there were two exceedances of the site review level and two exceedance of action level (see Table 2).

Table 2: Exceedances of the dust deposition thresholds

Fortnight ending	Threshold Exceeded	Monitoring Location	Considerations	Weather conditions during period
03/09/2014	Action	Inchgarvie	Brickwork cladding in immediate proximity	Low winds/ Generally dry
	Review	Echline Corner	No dust generating construction activities in close proximity. Dust generating activities near A904 being mitigated.	
17/09/2014	Action	Springfield	No dust generating construction activities in close proximity. Dust generating activities near A904 being mitigated.	Low winds/ Generally dry

	Review	Scotstoun	No dust generating construction activities in close proximity.	
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- 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 gauge results were also considered alongside the particulate matter data for the same period.
- 3.3.5.** With regards to the exceedance of the action level at Inchgarvie Lodge for the fortnight concluding 3rd September, a review into works undertaken in the vicinity was carried out. Brickwork cladding was taking place on the newly installed wall to the rear of Inchgarvie Lodge, in immediate proximity to the gauge (within 10m). It should be noted that site works do not usually occur at this location and the wall construction is a short-term activity. This means that during this period the gauge was essentially within the construction site. A review of the works in the area, weather conditions, and the mitigation measures in place was undertaken. Considering all the factors, the proximity of the work is believed to be responsible for the exceedance. Three other gauges (Clufflat, Clufflat Brae & Barracks East) are located within 150m of the Inchgarvie Lodge gauge, all of which registered low readings during the same period. It is concluded that while brickwork cladding activities caused the exceedance at the Inchgarvie Frisbee gauge, mitigation was in place which limited the increase in dust to the immediate area and prevented it from migrating off site. Work on the wall concluded during the next period and a return to low dust deposition levels was observed.
- 3.3.6.** During the period ending 3rd September the Echline Corner Frisbee registered levels above the review level. This is an additional temporary Frisbee that was put in place after a dust incident during April. It has been positioned within the construction site and provides information regarding dust levels generated on-site. 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. The Echline gauge, which is located within 200m from the Echline Corner Frisbee gauge, registered very low levels during the same period suggesting that the levels of dust at source on site were above review level but mitigation has prevented dust migrating off-site.

3.3.7. With regards to the exceedance of the action level at Springfield for the fortnight concluding 17th September, a review into works undertaken in the vicinity was carried out. However, during the period in question no construction activities that would be likely to give rise to dust took place in close proximity to the area. The excavations being undertaken to the north of the A904 are located 500m to the south-west. Four other Frisbee gauges are situated within 500m of the Springfield Frisbee (Clufflat, Clufflat Brae, Echline and Inchgarvie Lodge), all of which showed very low levels during this period. These factors would indicate that the exceedance at this location was not related to FCBC works. Similar construction activities were ongoing throughout the entire month and low levels of dust deposition were measured for the previous period at all monitors within proximity of the work with the exception of Inchgarvie (see section 3.3.6) , further suggesting that the exceedance was not related to FCBC construction factors. However, considering the elevated levels in consecutive months FCBC will continue to conduct increased inspections in the vicinity.

3.3.8. With regard to the exceedance of the review level at Scotstoun for the fortnight concluding 17th September, a further review into works undertaken in the vicinity took place. However, during the period in question no construction activities that would be likely to give rise to dust took place in proximity to the meter. The Scotstoun light scatter meter registered levels well below the action level for both TSP and PM₁₀ during this period, with one exception (see section 3.1.2). Activities in the area were monitored more closely during September due to elevated levels during August. No construction related incidents were noted in the area during September. These factors would indicate that the exceedance at this location was not related to FCBC works. However,

considering the elevated levels FCBC will continue to conduct increased inspections in the vicinity to ensure adequate dust suppression measures are in place if required.

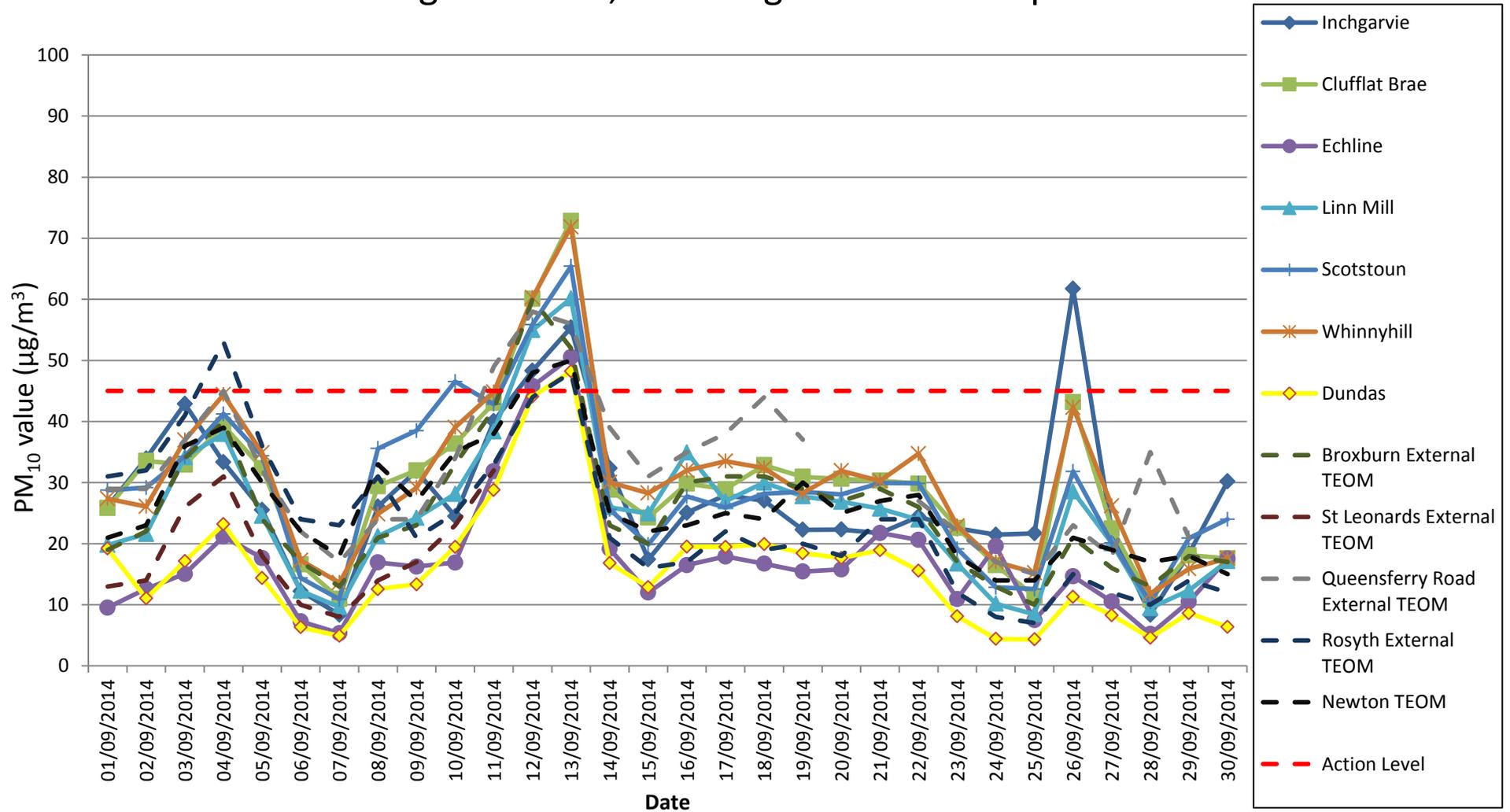
3.4. Daily Dust Log and Environmental Inspections

- 3.4.1.** A summary of the daily dust log for September can be found in Appendix D. During September no instances of dust relating to FCBC works 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 September, 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, including TEOM data September 2014

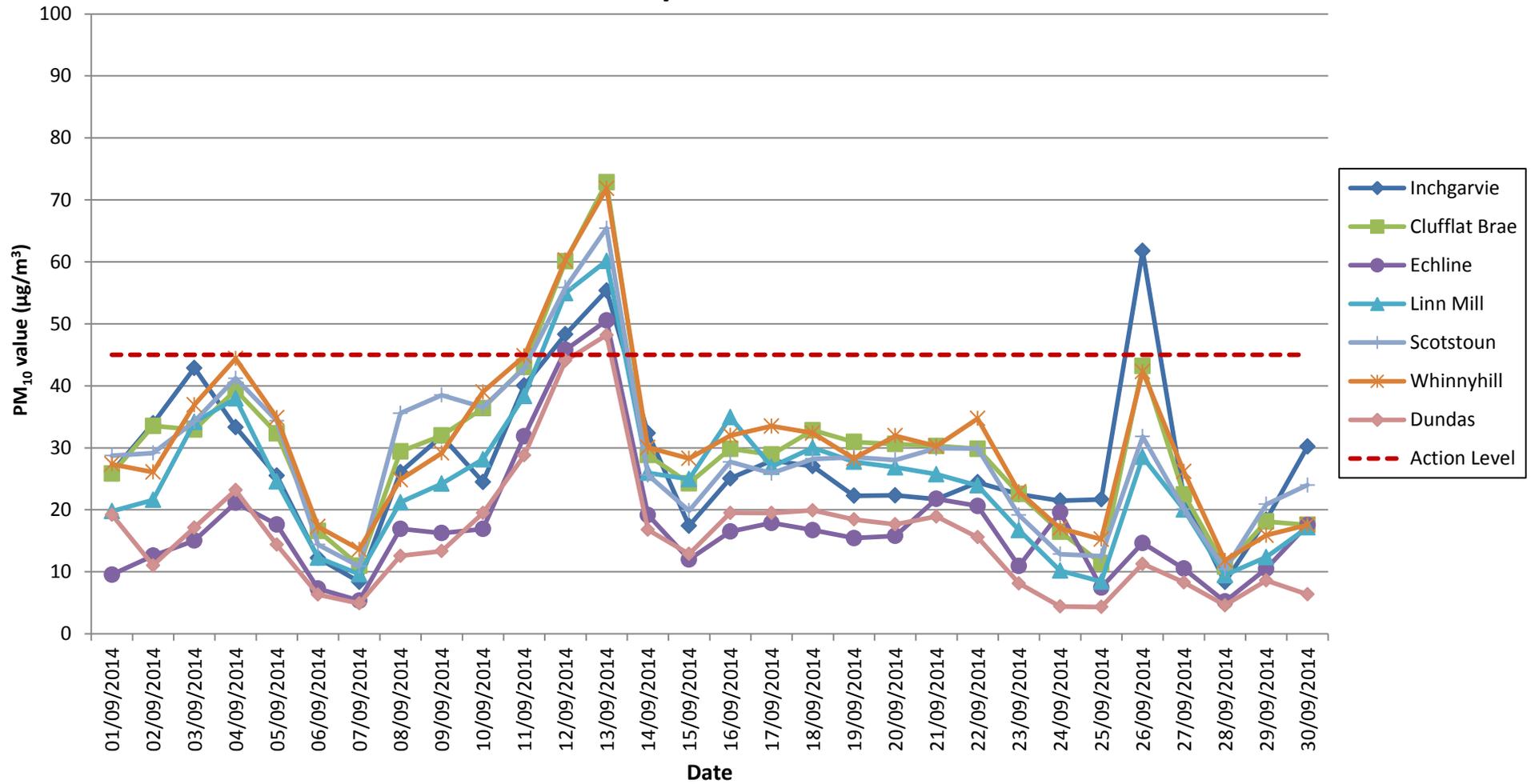


Note: TEOM data missing from scottish air quality for 12-30 September for St. Leonards and the 19-20 September for Queensferry Road.

Air Quality Monitoring

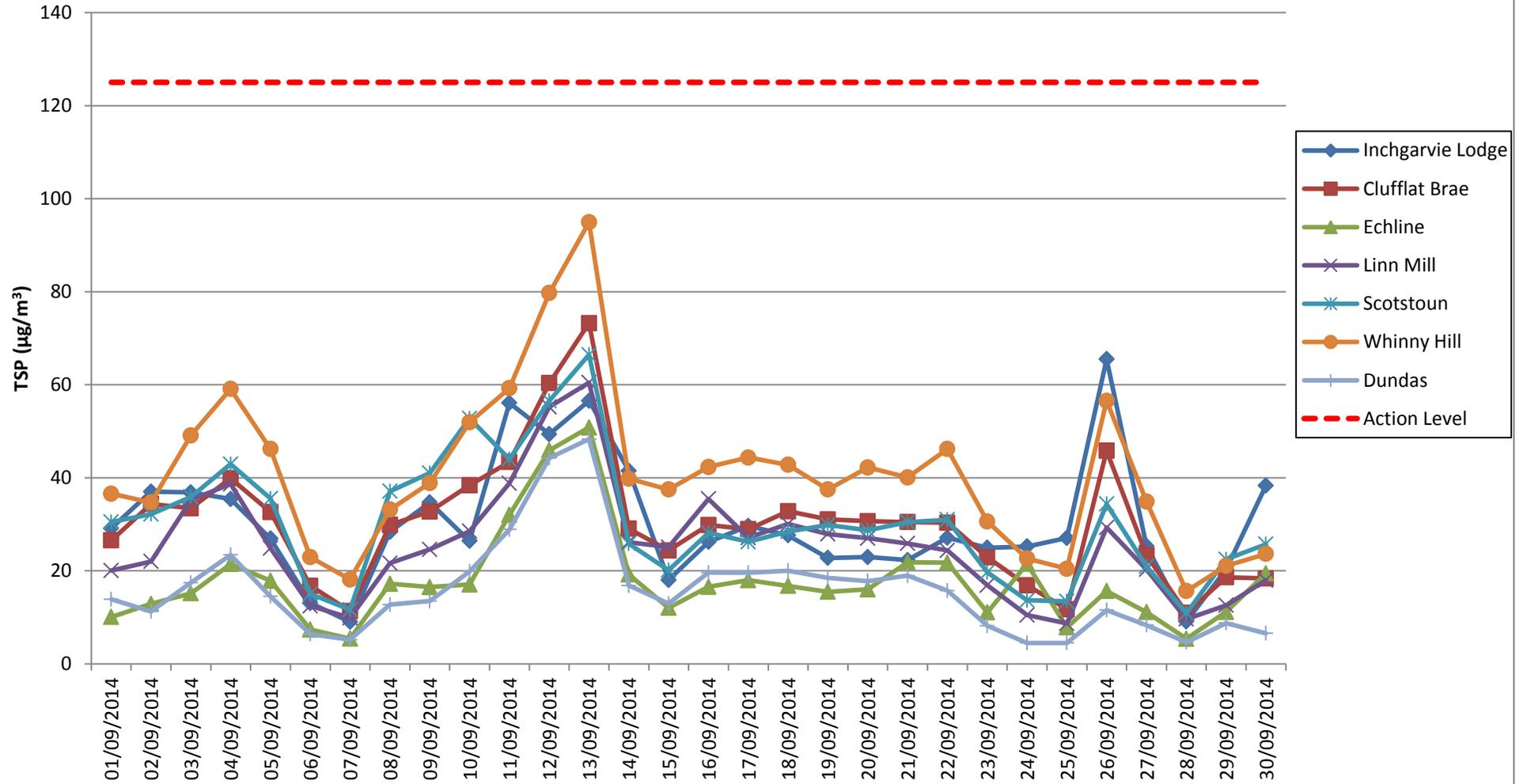
Particulate Matter (PM10) Results for all Monitoring Locations

September 2014



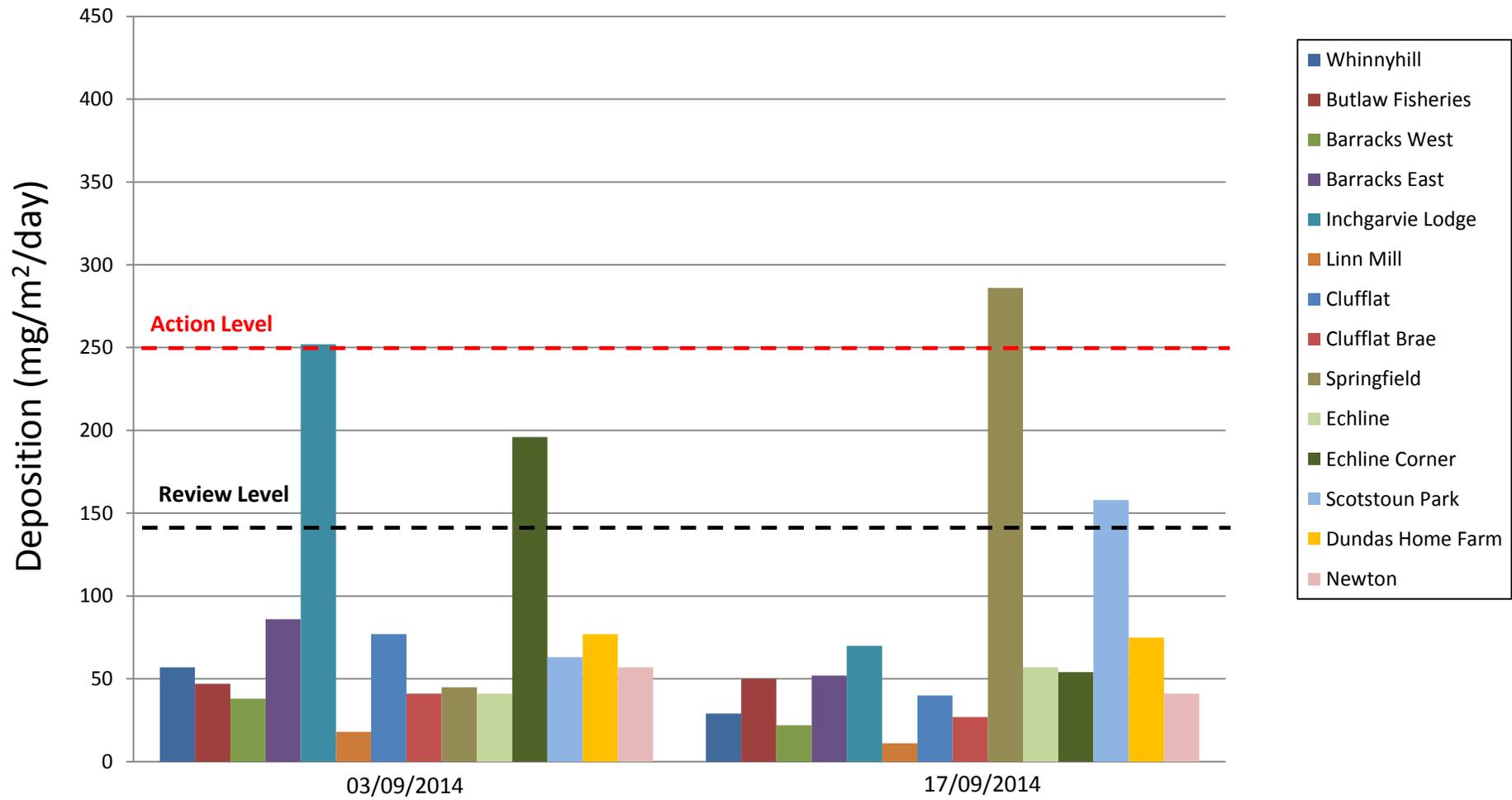
APPENDIX B: TOTAL SUSPENDED PARTICLES

Total Suspended Particles (TSP) Results September 2014



APPENDIX C: FRISBEE GAUGE RESULTS

Frisbee Dust Deposition Results: September 2014



APPENDIX D: DAILY DUST LOG

Daily Dust Log - North - September 2014

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

Daily Dust Log - South - September 2014

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