



Contractor



Forth Crossing Bridge Constructors

HOCHTIEF Solutions
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 Morrison Construction

Project

FORTH REPLACEMENT CROSSING

Document title

AIR QUALITY MONITORING REPORT
AUGUST 2013

01	23/09/13	Missing appendix added	ESE	NAM	NAM
00	09/09/13	First Revision	ESE	NAM	NAM
Rev	Rev. Date	Purpose of revision	Made	Checked	Reviewed

Document number

REP-00134-01

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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 August 2013.

- 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). 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, thus 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 hold an environmental actions register where any environmental issues, including those relating to air quality, can 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 August
M1	Whinny Hill	Frisbee	21/03/12	Band drain works at King Malcolm Drive Excavation and breaking rock at Castlandhill Road and haulage to Ferrytoll
		Automatic light scatter meter	16/02/12	
M7	Butlaw Fisheries	Frisbee	05/10/11	Marine works Society Road works
M8	Barracks West	Frisbee	31/08/11	Marine works Society Road works Scaffolding works, rebar, formwork and concrete pours at S7/S8
M9	Barracks East	Frisbee	31/08/11	Marine works Society Road works Scaffolding works, rebar, formwork and concrete pours at S7/S8
M10	Inchgarvie Lodge	Frisbee	22/08/11	Launch –fixing steel and erecting formwork, concrete pours, backfilling and assembly of stillages Scaffolding works, rebar, formwork and concrete pours at S7/S8 Society road works
		Automatic light scatter meter	17/10/11	
M11	Linn Mill	Frisbee	22/08/11	Launch –fixing steel and erecting formwork, concrete pours, backfilling and assembly of stillages Scaffolding works, rebar, formwork and concrete pours at S7/S8 Pier trials area works Society road works
		Automatic light scatter meter	06/12/11	

M12	Clufflat	Frisbee	29/08/11	Launch –fixing steel and erecting formwork, concrete pours, backfilling and assembly of stillages Scaffolding works, rebar, formwork and concrete pours at S7/S8 Pier trials area works Society road works
M13	Clufflat Brae	Frisbee	21/09/11	
		Automatic light scatter meter	24/10/11	
M14	Springfield	Frisbee	15/08/11	Launch –fixing steel and erecting formwork, concrete pours, backfilling and assembly of stillages Loading tippers with clay for transport to Dundas Pier trials area works Gyratory – structures
M15	Echline	Frisbee	16/08/11	Launch –fixing steel and erecting formwork, concrete pours, backfilling and assembly of stillages Loading tippers with clay for transport to Dundas Bulk excavation for mainline Structures works at gyratory
		Automatic light scatter meter	10/11/11	
M16	Scotstoun	Frisbee	07/09/11	Bus link works
		Automatic light scatter meter	14/02/12	
M17	Dundas Home Farm	Frisbee	29/08/11	Utilities works Environmental bund works Excavation works for mainline
		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 August 2013 have been presented in a monthly chart; this can be found in Appendix A. Results show that the PM₁₀ levels were largely below threshold levels and generally followed the same pattern across the site. During August there were 6 days on which exceedances of the threshold occurred. These exceedances primarily occurred at Dundas, with exceedances of the threshold also occurring at both Whinny Hill and Inchgarvie Lodge, in addition to Dundas, on 31 August. However, no August exceedances are thought to be related to construction works.

3.1.2. Table 2 lists the locations at which the exceedances occurred. The dust log (section 3.4 and Appendix D) provides further details with regard to the conditions and the actions taken as a result of each exceedance, where applicable.

Table 2: Exceedances of the PM10 threshold

Date	Monitoring Location	Notable conditions
20/08/13	Dundas	Hazy conditions. Showers. Windy.
22/08/13	Dundas	Foggy
23/08/13	Dundas	Rain showers
25/08/13	Dundas	Foggy
26/08/13	Dundas	No works on this date (Sunday). Weather records note foggy conditions
31/08/13	Dundas Whinny Hill Inchgarvie	Limited works at these locations on this date (Saturday). Regional pattern.

3.1.3. The results at Dundas are not considered to be related to construction. The meter at Dundas is particularly sensitive to foggy, misty and hazy conditions (see 2.2). Foggy or hazy conditions were observed and recorded on 20, 22, 25 and 26 August, with high humidity levels recorded at the light scatter meter located at Clufflat on

these dates, in addition to nearby weather stations noting foggy or hazy conditions. With regard to the exceedance on 23 August, the high levels which resulted in the exceedance were noted during the early afternoon, during which time rain showers were noted in the area and no dust was observed when the alerts triggered an investigation.

- 3.1.4.** The exceedances at Dundas, Whinny Hill and Inchgarvie on 31 August are thought to have been due to regionally high levels of particulate matter. Limited works were undertaken on this date due to it being a Saturday and, therefore, given the pattern observed across site it is thought that regional changes in particulate matter levels affected the results (see paragraph 3.1.6 for comparison with local TEOM results).
- 3.1.5.** Throughout August, the environmental department were notified by trigger alerts where any exceedances of the threshold levels occurred. Where necessary, there was close liaison with the works manager and section head of the south networks area to ensure that mitigation was in place. This ensured that no exceedances of the 24 hour threshold occurred as a result of construction during August.
- 3.1.6.** The PM₁₀ results have also been compared to the daily mean results obtained from the TEOM air quality monitoring stations located in Newton, Rosyth, Broxburn, 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. Apart from the exceedances noted above, 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 August was largely driven by regional changes in air quality. An exception to this was noted at Scotstoun and Dundas during the first two weeks of July, although the levels recorded were below the action level. It should also be noted that on 31 August, when a rise in the levels was noted at Dundas, Whinny Hill and Inchgarvie, an increase in particulate matter

levels was also observed at the two closest, non-urban, TEOM monitoring sites; Newton and Rosyth. This, therefore, indicates that the exceedances at the on-site monitoring locations were related to regional changes in particular matter, rather than localised events occurring as a result of construction activities.

3.2. Total Suspended Particles

3.2.1. The TSP results for August 2013 have been presented in a monthly chart; this can be found in Appendix B. The TSP levels at monitoring locations during August were generally low and all within the threshold level, with the exception of 22, 25 and 26 August at Dundas. These exceedances were related to foggy conditions (Table 3), as discussed in relation to the high PM₁₀ levels noted above (see 3.1). No exceedances were, therefore, found to occur as a result of construction activities. 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.

Table 3: Exceedances of the TSP threshold

Date	Monitoring Location	Notable conditions
22/08/13	Dundas	Foggy conditions
25/08/13	Dundas	Foggy conditions
26/08/13	Dundas	Foggy conditions

3.3. Frisbee Dust Deposition Results

3.3.1. The Frisbee dust deposition results for August 2013 have been presented in charts and can be found in Appendix C. To present results, all the monitoring locations have been grouped, based on locality, into the following:

- **Group 1:** M7 Butlaw Fisheries, M8 Barracks West, M9 Barracks East, M10 Inchgarvie Lodge and M11 Linn Mill;
- **Group 2:** M12 Clufflat, M13 Clufflat Brae, M14 Springfield and M15 Echline;

- **Group 3:** M16 Scotstoun Park and M17 Dundas Home Farm;
- **Group 4:** M18 Newton; and
- **Group 5:** M1 Whinny Hill.

3.3.2. Frisbee dust data 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 August; 7 and 21 July.

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

3.3.4. During August there were three exceedances of the site review level and one exceedance of the site action level (see Table 4). With the exception of the locations where exceedances occurred, Frisbee results from monitoring locations across site were generally found to be low. It should be noted, however, that, whilst the results are within threshold levels, the dust levels for Newton are likely to have been affected by on-going building works at the property which are immediately adjacent to the Frisbee gauge.

Table 4: Exceedances of the dust deposition thresholds

Fortnight ending	Threshold Exceeded	Monitoring Location	Notable conditions at time of collection
07/08/13	Review	Barracks West	None
		Echline	None
	Action	Barracks East	Frisbee had been knocked resulting in incorrect set up. Located in vehicle turning area which becomes muddy when wet
21/08/13	Review	Barracks East	Located in vehicle turning area which becomes muddy when wet

- 3.3.5.** Following the exceedance of the site review level at Echline, a review of works in the area and the mitigation measures in place was undertaken. The Frisbee result was also considered alongside the particulate matter data for the same period; all particulate matter levels were low and within the threshold levels. The on-going use of the bowser for dampening down was deemed sufficient mitigation. Additional mitigation measures were not considered necessary as daily site observations did not indicate a dust problem at this location. Results for the following period (7 to 21 August) were found to be lower, demonstrating that the mitigation measures in place were satisfactory.
- 3.3.6.** The exceedance of the action threshold for the period ending 7 August and the exceedance of the review threshold for the period ending 21 August at Barracks East are thought to have been caused by vehicles turning immediately adjacent to the Frisbee gauge. During wet weather, or when the area is dampened down, the area becomes muddy and this splashes onto the Frisbee gauge, elevating the results for this location. With regard to the exceedance of the action level, it is thought that this was further elevated as the tripod had been knocked, causing an incorrect set up of the gauge and resulting in the loss of some of the sample at time of collection. However, it should also be noted that the on-going works at Society Road may have also partially influenced the result.
- 3.3.7.** The works at Society Road may have also elevated the results for Barracks West, causing the exceedance of the review level at this location. As a result, mitigation measures in this location were reviewed and it was ensured that the bowser was available to dampen down at this location as required. The results from nearby monitors, located closer to residential properties, indicated only low levels of dust deposition for this period.

3.4. Daily Dust Log and Environmental Inspections

3.4.1. A summary of the daily dust log for August can be found in Appendix D. Dust was noted in the southern areas of site on four occasions. Vehicle movements were largely noted to be the cause of dust on site, with strong winds also found to be blowing dust on site. On one occasion, excavation works associated with the south network mainline were found to be causing dust. However, this was very localised and the dust was not observed to be leaving the site boundary. In each instance, measures to dampen down the works areas as far as reasonably practicable were employed, notably the use of the bowser to dampen down the tracks and excavation areas. Furthermore, the road sweeper was also in operation as required.

3.4.2. During this period full environmental inspections were also undertaken weekly across the site and covered areas where works were being undertaken. In August there was one instance of dust noted during these inspections (Table 4). This was immediately actioned, with the bowser being called to the area of site. During the remainder of the inspection the bowser was observed sufficiently dampening down the area.

Table 4: Extract from Environmental Actions Register

Date	Inspection by	Location	Issue identified	Due date	Date actioned	Actioned by	Actions
14/08/13	ESE	Dundas	Very high dust levels due to construction of environmental bund at this location, largely due to associated vehicle movements	14 – Aug	14 – Aug	ESE	ESE spoke to operative on site immediately and bowser was sent to area. Bowser observed before ESE left site. Environmental team to reiterate importance of bowser movements in areas where dust is rising from site due to vehicle movements



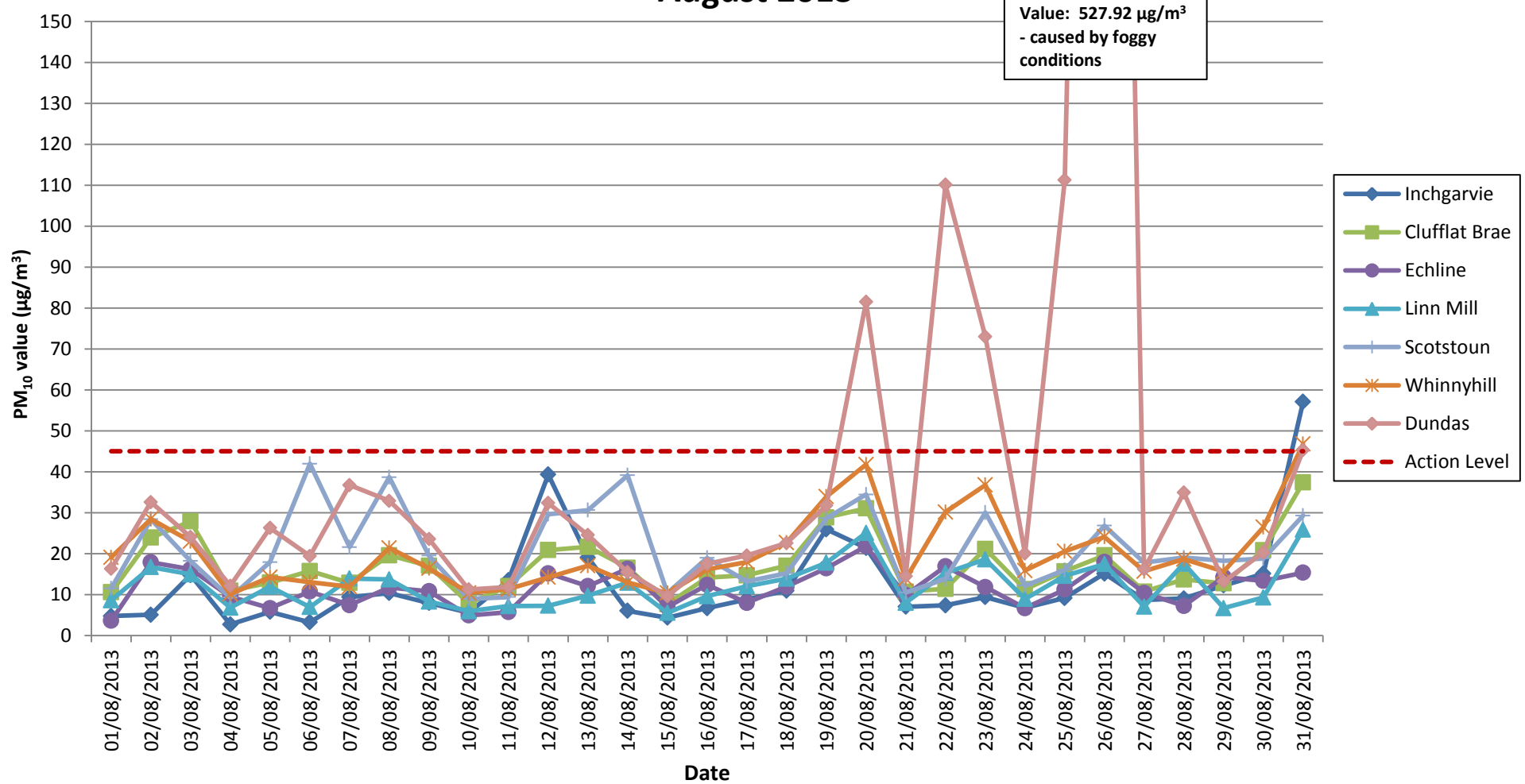
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APPENDIX A: LIGHT SCATTER METER RESULTS

Air Quality Monitoring

Particulate Matter (PM10) Results for all Monitoring Locations

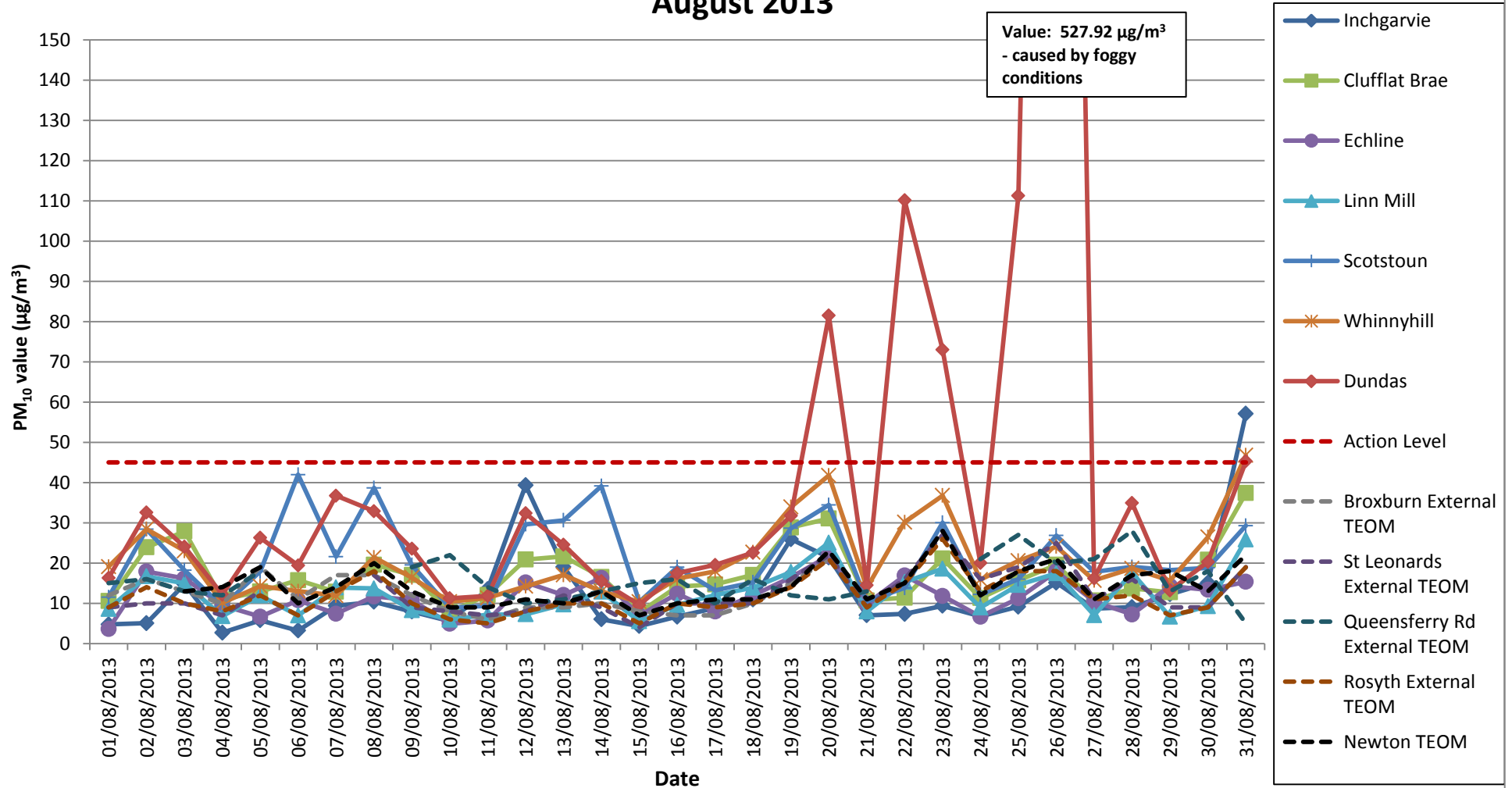
August 2013



Note: Please refer to section 3 of the Air Quality Monitoring Report: August 2013

Air Quality Monitoring

Particulate Matter (PM10) Results for all Monitoring Locations with TEOM results August 2013



Note: Please refer to section 3 of the Air Quality Monitoring Report: August 2013

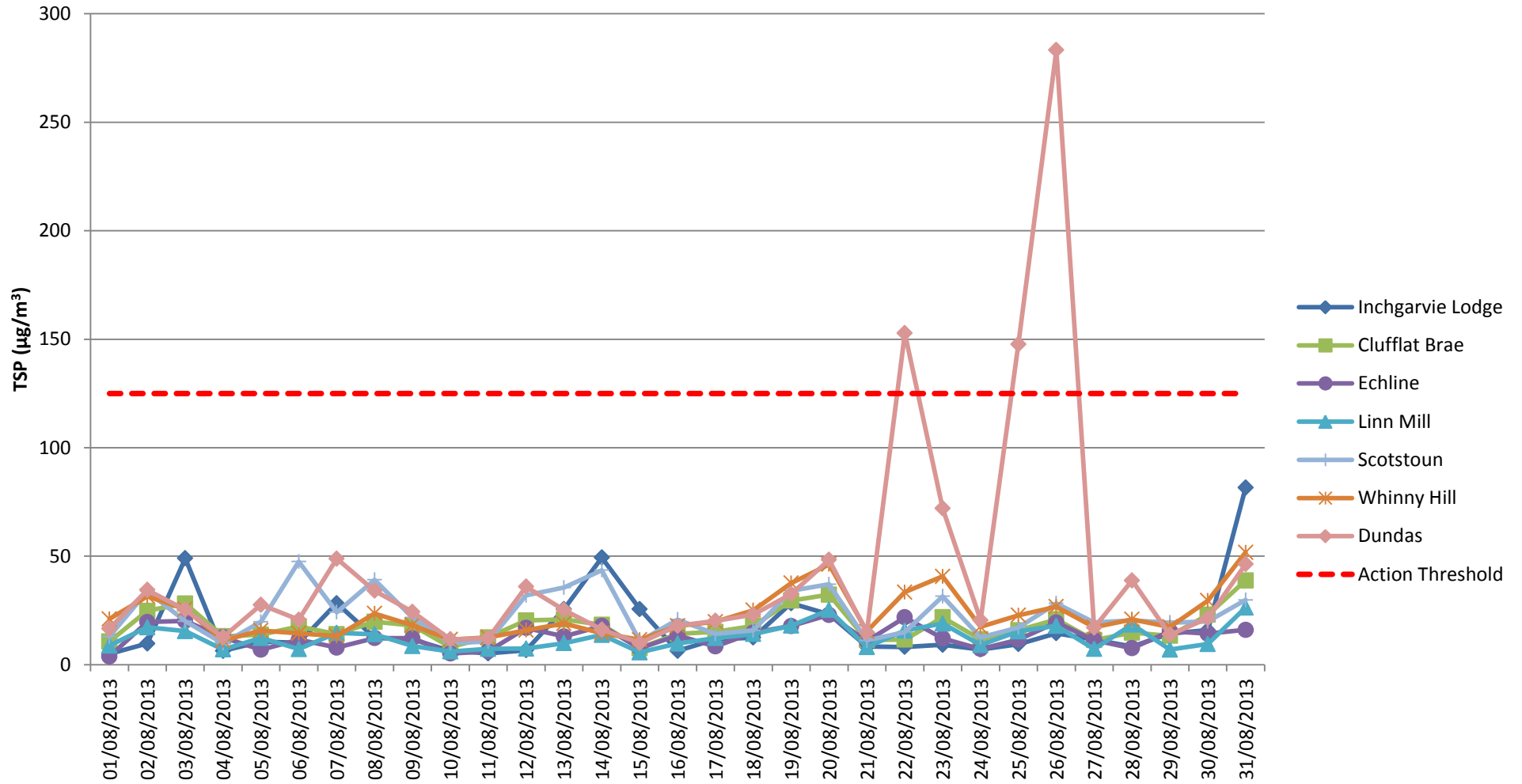


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APPENDIX B: TOTAL SUSPENDED PARTICLES

Total Suspended Particles (TSP) Results

August 2013

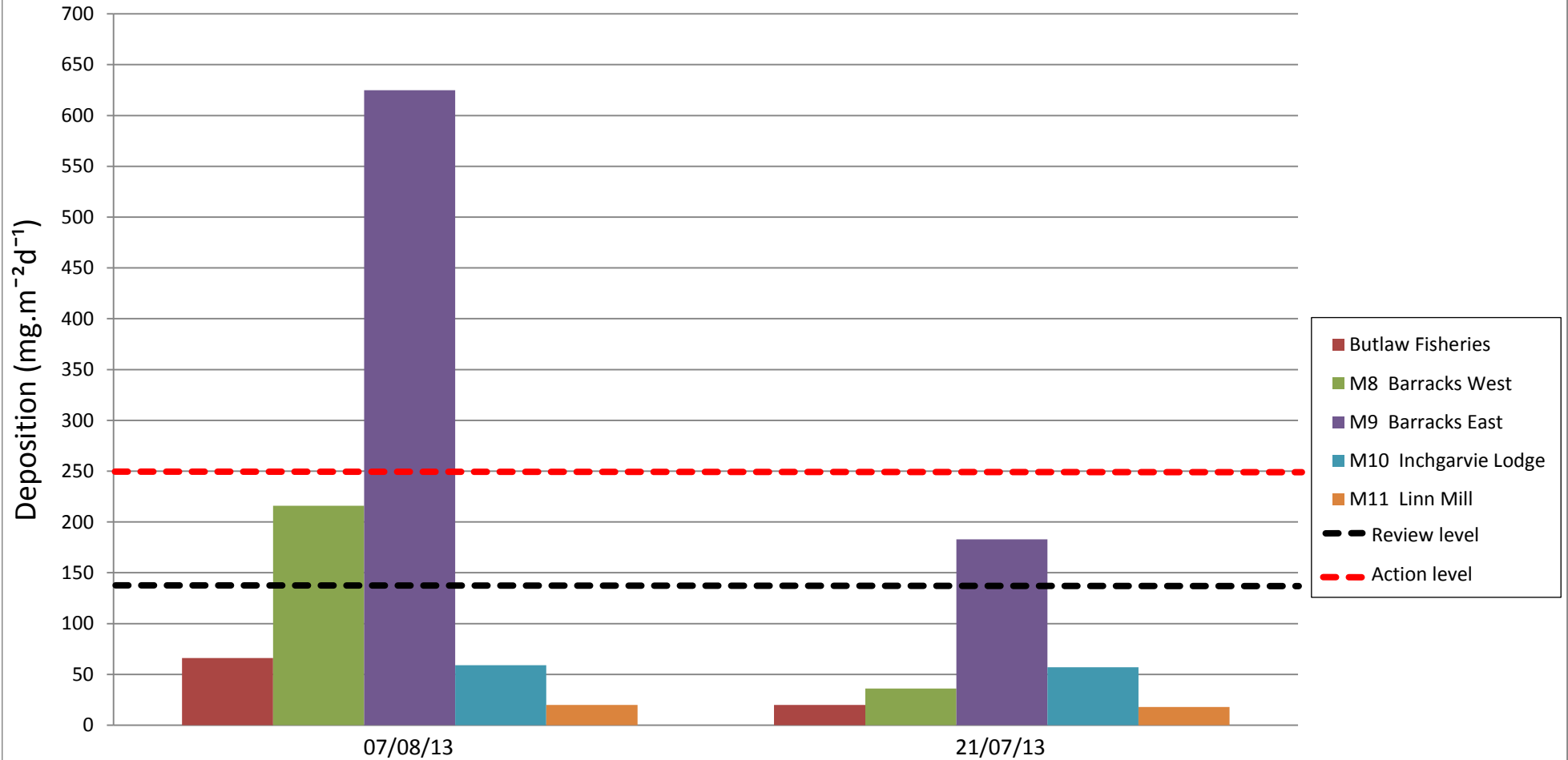




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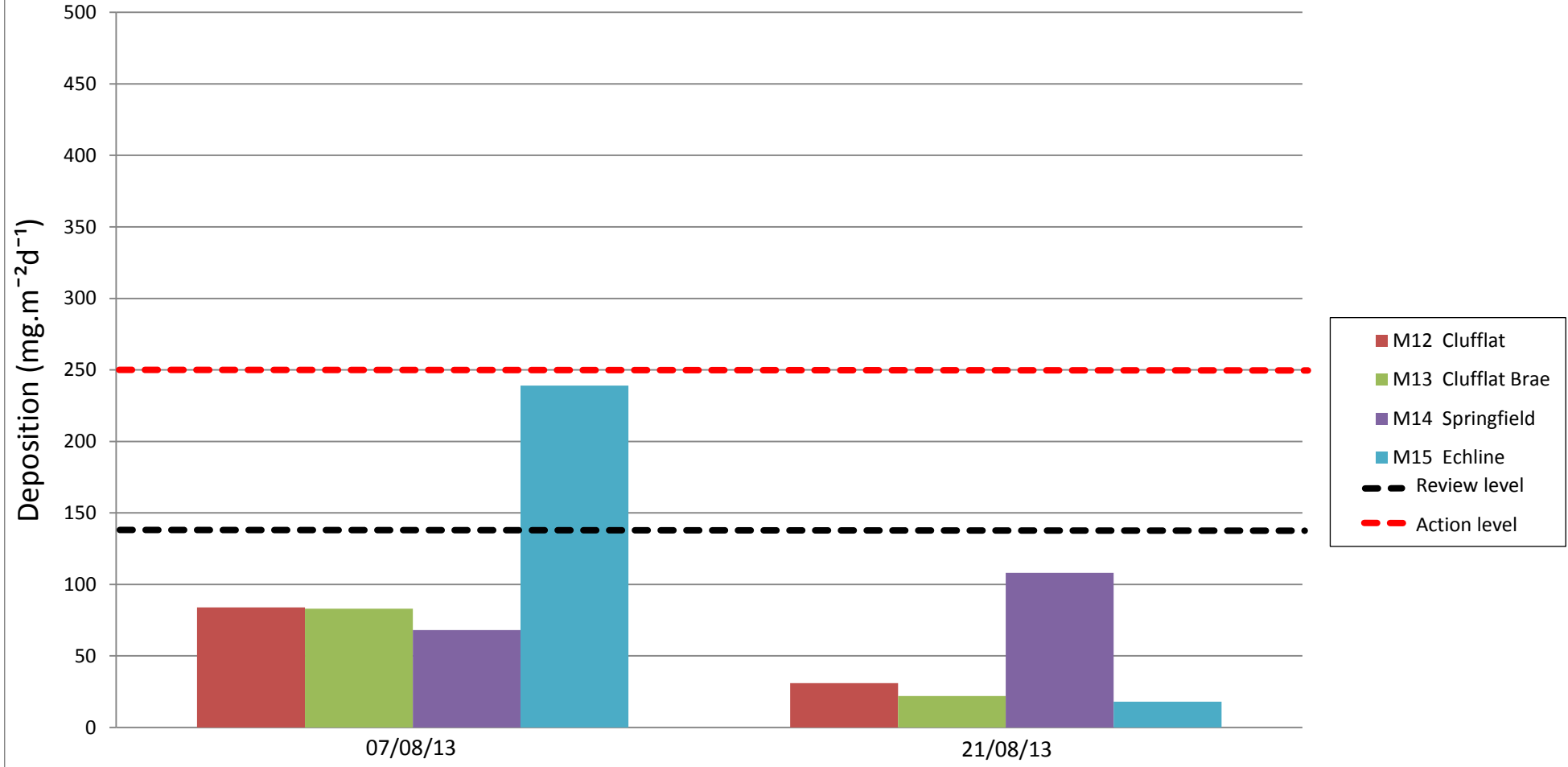
APPENDIX C: FRISBEE GAUGE RESULTS

Frisbee Dust Deposition Results: Group 1
Locations: M7 Butlaw Fisheries, M8 Barracks West, M9 Barracks East, M10 Inchgarvie Lodge and M11 Linn Mill



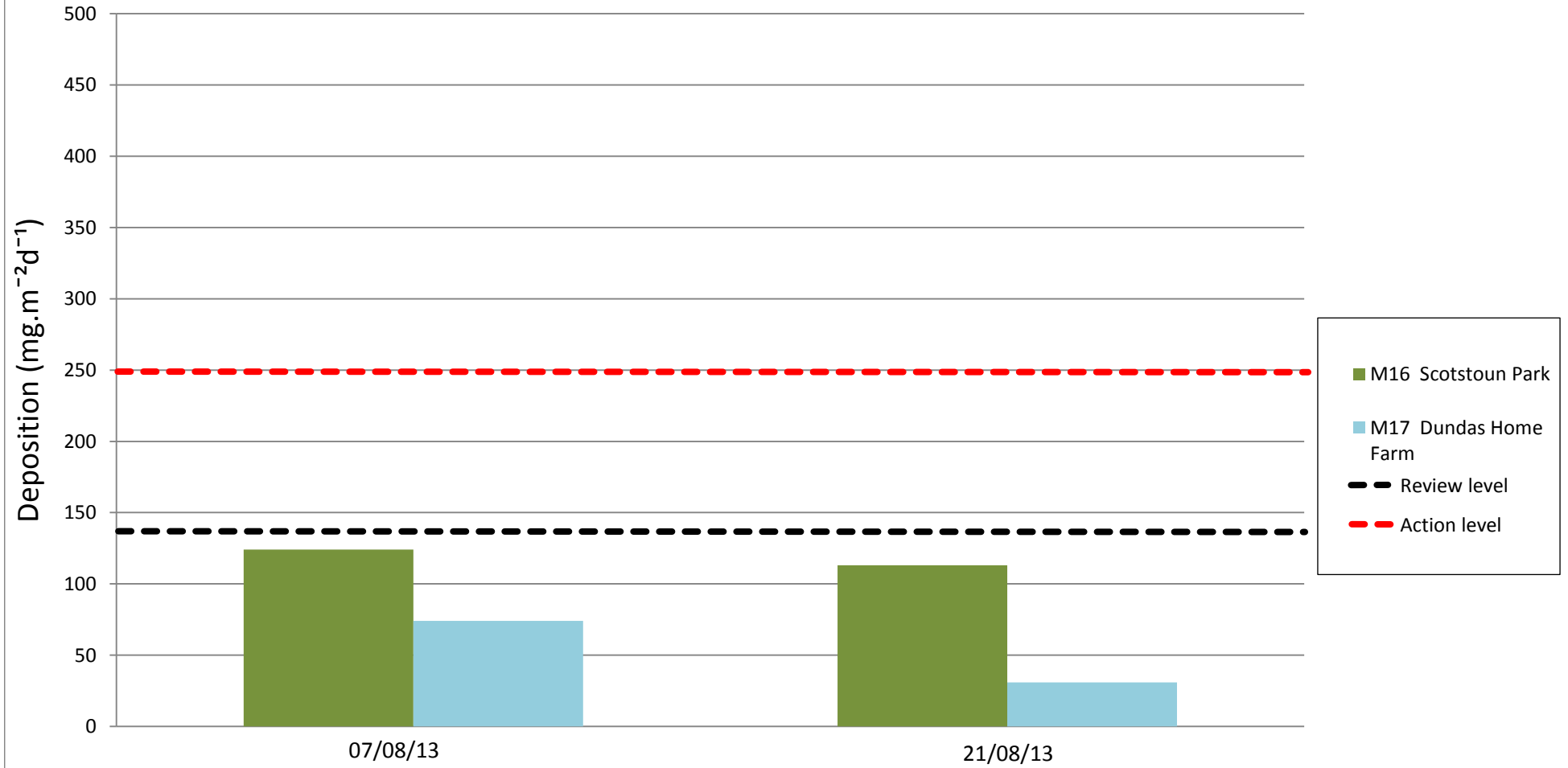
Frisbee Dust Deposition Results: Group 2

Locations: M12 Clufflat, M13 Clufflat Brae, M14 Springfield and M15 Echline



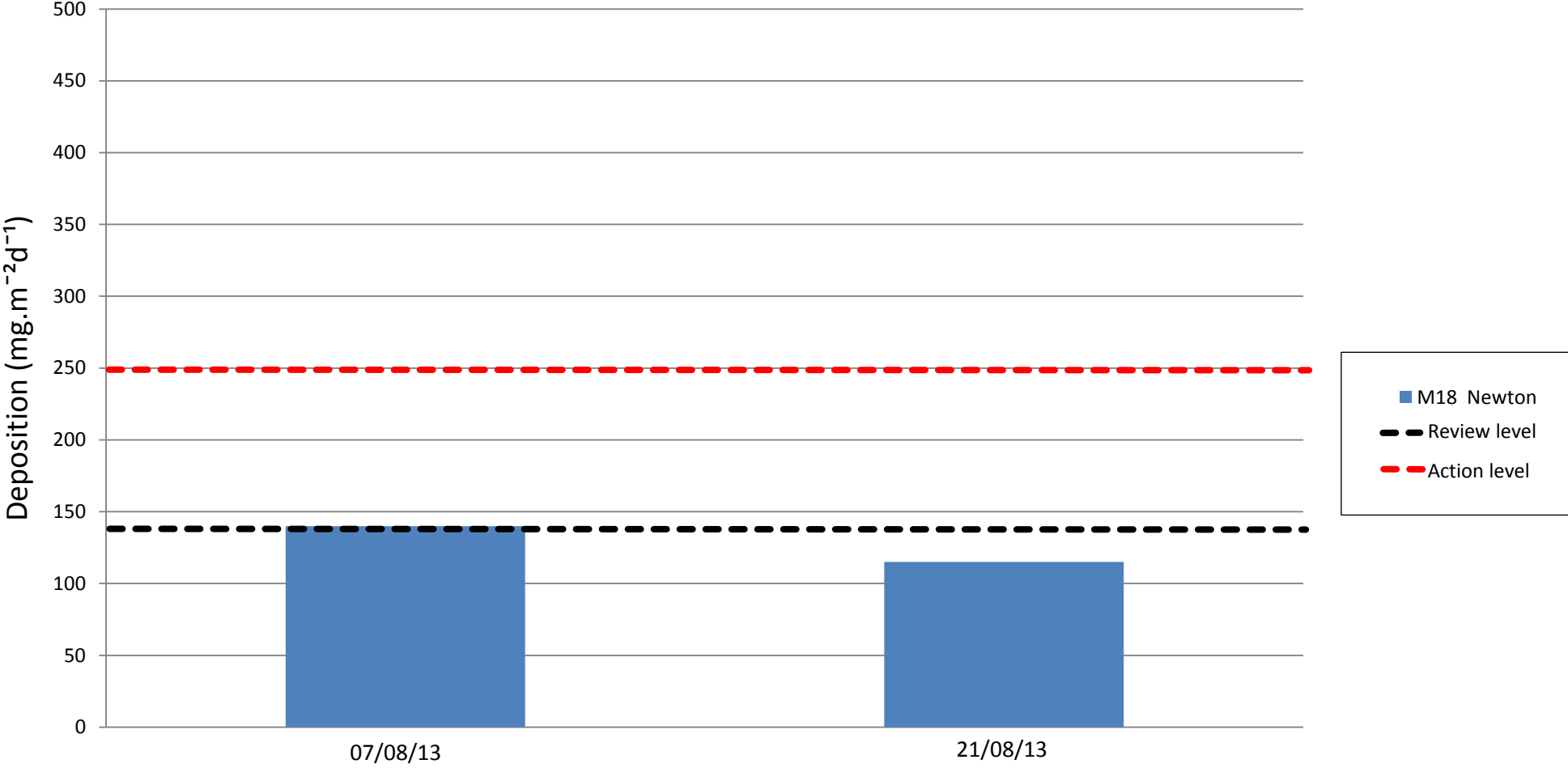
Frisbee Dust Deposition Results: Group 3

Locations: M16 Scotstoun Park and M17 Dundas Home Farm



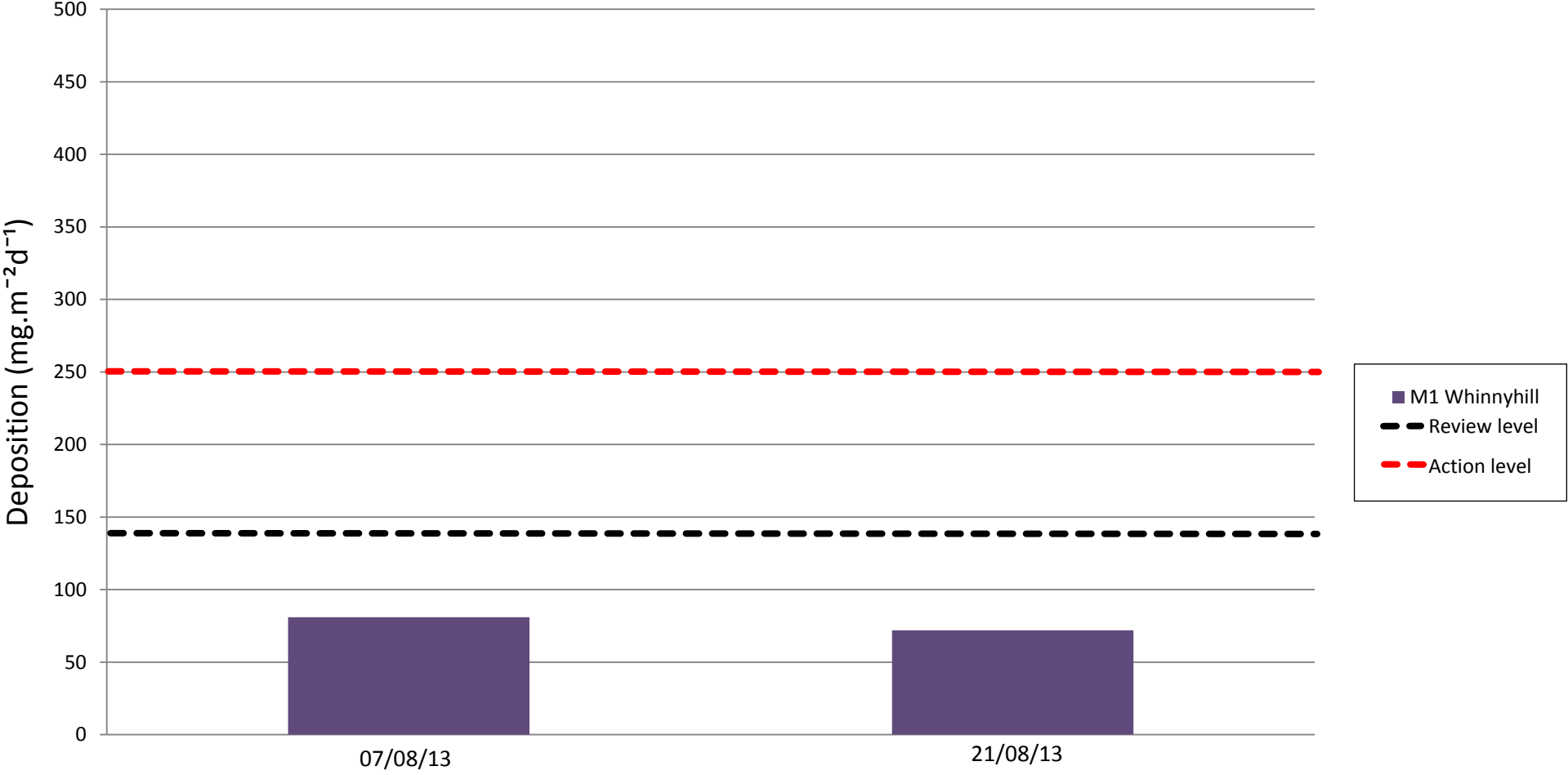
Frisbee Dust Deposition Results: Group 4

Locations: M18 Newton



Frisbee Dust Deposition Results: Group 5

Locations: M1 Whinny Hill





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APPENDIX D: DAILY DUST LOG

Daily Dust Log - South - August 2013

DATE	LOCATION	WIND	WIND DIRECTION	GROUND SURFACE	VISIBLE DUST	DUST DUE TO WORKS (if applicable)	CAUSES OF DUST (if applicable)	COMMENTS AND ACTIONS
01/08/2013	S	MEDIUM	NE	WET	N			
02/08/2013	S	MEDIUM	SSE	DAMP	N			
03/08/2013								
04/08/2013								
05/08/2013	S	LIGHT	WSW	DRY	N			
06/08/2013	S	LIGHT	SW	DRY	N			
07/08/2013	S	LIGHT	WSW	DRY	Y	Y	movement of vehicles	Dust observed due to vehicle movements on haul tracks. Little to no wind so dust not observed blowing off site. Bowser operating in area.
08/08/2013	S	LIGHT	WSW	DRY	N			
09/08/2013	S	LIGHT	WSW	DRY	Y	Y	movement of vehicles	Dust due to vehcile movements at site access 6 - bowser and road sweeper operating in area.
10/08/2013								
11/08/2013								
12/08/2013	S	MEDIUM	WSW	DAMP	N			
13/08/2013	S	MEDIUM	WSW	DRY	N			
14/08/2013	S	LIGHT	S	DRY	Y	Y	movement of vehicles, dust blown, excavation works	Dust observed at Dundas due to vehicle movements associated with embankment works at this location. Bowser attended during inspection to dampen down the area. Some wind blown dust also observed. Very slight dust observed arising from excavation works at Queensferry gyratory - this was limited to the work area and was not seen to be leaving site.
15/08/2013	S	MEDIUM	SSW	WET	N			
16/08/2013	S	MEDIUM	SW	DRY	N			
17/08/2013								
18/08/2013								
19/08/2013	S	STRONG	SW	DRY	Y	Y	Wind blown dust	Hazy conditions. Strong winds. Dust observed blowing due to stong winds in the area around the south abutment. Bowser in operation in this area.
20/08/2013	S	MEDIUM	SSW	DAMP	N			
21/08/2013	S	LIGHT	S	DAMP	N			
22/08/2013	S	LIGHT	ENE	DAMP	N			Foggy
23/08/2013	S	LIGHT	NE	DAMP	N			
24/08/2013								
25/08/2013								
26/08/2013	S	LIGHT	ENE	DAMP	N			Foggy
27/08/2013	S	LIGHT	WSW	DRY	N			
28/08/2013	S	MEDIUM	NE	DRY	N			

29/08/2013	S	MEDIUM	SW	DRY	N			
30/08/2013	S	STRONG	SW	DRY	N			
31/08/2013								