



Contractor



**Forth Crossing** Bridge Constructors

HOCHTIEF Solutions  
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Project

**FORTH REPLACEMENT CROSSING**

Document title

**AIR QUALITY MONITORING REPORT  
 MAY 2013**

00	13/06/13	First Revision	ESE	NAM	NAM
<b>Rev</b>	<b>Rev. Date</b>	<b>Purpose of revision</b>	<b>Made</b>	<b>Checked</b>	<b>Reviewed</b>

Document number

**REP-00117-00**

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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 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 (PM<sub>10</sub>) 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 Meters**



**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	Loading of rock for transport to south side
		Automatic light scatter meter	16/02/12	
M7	Butlaw Fisheries	Frisbee	05/10/11	Pier S6 – cleaning, concreting, fixing rebar and placing formwork Construction of S5 causeway Marine works
M8	Barracks West	Frisbee	31/08/11	Pier S6 – cleaning, concreting, fixing rebar and placing formwork Construction of S5 causeway Marine works
M9	Barracks East	Frisbee	31/08/11	Pier S6 – cleaning, concreting, fixing rebar and placing formwork Construction of S5 causeway Marine works
M10	Inchgarvie Lodge	Frisbee	22/08/11	Excavation of launch South Abutment works Works on launch foundations including concreting Pier trials
		Automatic light scatter meter	17/10/11	
M11	Linn Mill	Frisbee	22/08/11	Excavation of launch South Abutment works Works on launch foundations including concreting Pier trials
		Automatic light scatter meter	06/12/11	

M12	Clufflat	Frisbee	29/08/11	Excavation of launch South Abutment works Works on launch foundations including concreting Pier trials
M13	Clufflat Brae	Frisbee	21/09/11	
		Automatic light scatter meter	24/10/11	
M14	Springfield	Frisbee	15/08/11	Excavation of launch South Abutment works Works on launch foundations including concreting Structure works at gyratory Pier trials
M15	Echline	Frisbee	16/08/11	Excavation of launch Works on launch foundations including concreting Structure works at gyratory Drainage works at A904/U221 U221 paving Bulk excavation for mainline
		Automatic light scatter meter	10/11/11	
M16	Scotstoun	Frisbee	07/09/11	Drainage works Placing rock/clay for embankment
		Automatic light scatter meter	14/02/12	
M17	Dundas Home Farm	Frisbee	29/08/11	Utilities works Fill using clay for road network
		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 2013 have been presented in a monthly chart; this can be found in Appendix A. Results show that the PM<sub>10</sub> levels were largely below threshold levels and generally followed the same pattern across the site, particularly during the first three weeks of May. During May there were eight days on which exceedances of the threshold occurred at four monitoring locations. Table 2 lists the locations at which the exceedances occurred on these dates. 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.

**Table 2: Exceedances of the PM10 threshold**

Date	Monitoring Location	Notable conditions
02/05/13	Scotstoun	Dust blowing on site due to strong winds.
08/05/13	Dundas	Foggy conditions (am)
20/05/13	Scotstoun and Dundas	Fog/haze (am). Road dry at Scotstoun.
22/05/13	Scotstoun	Windy conditions
23/05/13	Scotstoun	Strong winds and gusty showers
27/05/13	Scotstoun and Linn Mill	Very strong winds.
30/05/13	Clufflat Brae	Dry conditions
31/05/13	Scotstoun	Dry road conditions

3.1.2. It is possible that construction works contributed to these exceedances, however, the results on 2, 8, 20, 22 and 27 May show the same trend across site, indicating that the results are generally caused by regional conditions. These dates coincide with days that were affected by notable weather conditions; in particular, 2, 22 and 27 May were affected by strong winds which influenced dust levels. On these dates, dust was also noted blowing in areas outwith the site boundary, including large plumes of dust being generated by agricultural activities in surrounding fields beyond the construction site. Therefore any dust

exceedances on these dates cannot be solely attributed to dust arising from site.

- 3.1.3.** The exceedances at Scotstoun on 23 and 31 May appear to be localised dust events. It is likely that the results for this monitor were affected by dust associated with the adjacent road. Windy conditions at this location on 23 May are also likely to have exacerbated the results, though rain showers were observed on this day, naturally dampening down the area. A road sweeper is in operation at this location which reduces the dust levels. It should also be noted that the monitor at this location is in a position that would result in higher dust levels than at the nearest sensitive receptors. The monitor is located immediately adjacent to the B800 road, whereas the nearest properties are located approximately 100m from the construction site entrance, and 25m from the road, behind a strip of mature trees and shrubs. It should also be noted that during May a dry wheel wash was installed at the site entrance near to Scotstoun.
- 3.1.4.** The exceedance at Clufflat Brae on 30 May also appears to be a localised dust event. Dry conditions were observed on site on this day and therefore it is possible that construction works influenced the results. Appropriate actions were taken in response to the alerts received, including dampening down.
- 3.1.5.** On all occasions where automatic trigger alerts were received within site operating hours, site investigations were undertaken. Where dust was found to be arising from site during inspections, appropriate action was taken in response. A bowser was in use site wide to dampen down, with second and third bowzers also available where conditions required. During conditions where dust was exacerbated by strong winds, FCBC endeavoured to dampen down haulage tracks and excavation areas as far as reasonably practicable.

- 3.1.6.** It should also be noted that the Frisbee results confirm that dust levels across site were generally low throughout the period (see 3.3 Frisbee Dust Deposition Results).
- 3.1.7.** The PM<sub>10</sub> 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. 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 May was largely due to regional changes in air quality, with the exceptions as discussed above. Furthermore, some days on which the same trend was noted between the light scatter meters on site do not correspond with similar increases in the TEOM data, notably 22 and 27 May; these days were both noted to be affected by strong winds.

### **3.2. Total Suspended Particles**

- 3.2.1.** The TSP results for May 2013 have been presented in a monthly chart; this can be found in Appendix B. The TSP levels at monitoring locations during May were generally 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 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. Three collections were made in May, on 1, 15 and 29 May.

**3.3.3.** The site action level for the dust deposition rate has been set at 250 mg/m<sup>2</sup>/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/m<sup>2</sup>/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 May there were two exceedances of the site action level and three exceedances of the site review level (see table 3). Frisbee results from monitoring locations across site were generally found to be low. Frisbee results covering the final two weeks of April will be presented in the May 2013 report as the collection date fell on 1 May 2013.

**Table 3: Exceedances of the PM10 threshold**

Fortnight ending	Threshold Exceeded	Monitoring Location	Notable conditions at time of collection
01/05/13	Action	Barracks East	Vehicles turning immediately adjacent to Frisbee gauge for construction of S5 causeway.
15/05/13			
15/05/13	Review	Scotstoun	Bottle covered in grass cutting. Positioned under trees with presence of some small vegetation particles on disc.
29/05/13	Review	Barracks East	Vehicles turning immediately adjacent to Frisbee gauge for construction of S5 causeway.
29/05/13	Review	Echline	Positioned near to mature trees. Possibly affected by pollen and some small vegetation particles.

**3.3.5.** The exceedances of the action and review thresholds at Barracks East were caused by vehicles turning on a wet surface immediately adjacent to the Frisbee gauge and the deposition of fill material close by for the construction of the S5 causeway. However, this was an entirely localised exceedance as the results at Barracks West (located within 100 meters of Barrack East) show no high results. It should also be noted that there are no sensitive receptors in the vicinity of the Barracks East gauge.

**3.3.6.** With regard to the exceedances at Scotstoun and Echline, an appropriate review of the works in the area, the potential of works to have affected dust levels and any mitigation measures in place was undertaken. However the exceedances are not considered to have been related to construction works.

**3.3.7.** Although the particulate matter results in the Scotstoun area identified the potential of dust from the road to increase dust levels at this monitoring location, the first 2 weeks of May were not largely affected by high particulate matter results at Scotstoun. The positioning of the Frisbee gauge (nearer to the receptors than the PM<sub>10</sub> meter) should generally indicate protection from road dust due to natural protection from trees and increased distance from the road. Rather, it is thought

that the exceedance occurred due to the effects of vegetation on the sample; on collection it was noted that the bottle was covered in grass cuttings and vegetation particles from overhanging trees were noted on the disc.

- 3.3.8.** A review into the exceedance of the Echline threshold also identified non-construction related factors to have been influential on the results. Results of the particulate matter did not highlight any instances of dust at this location. Furthermore, works during this period were not in areas that would give rise to dust at this monitoring location. It is possible, therefore, that the position of the gauge near to trees resulted in some small vegetation particles affecting the results.

#### **3.4. Daily Dust Log and Environmental Inspections**

- 3.4.1.** A summary of the daily dust log for May can be found in Appendix D. Dust was noted in the southern areas of site on seven occasions. Vehicle movements on haulage tracks were largely noted to be the cause of dust on site, with strong winds also found to be blowing dust on site, and on to site from adjacent areas. 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 May one instance of dust was noted during one of these inspections in the south networks area (see table 4). Dust was seen to be rising from site. However, this action was immediately closed out as, whilst undertaking the inspection, the bowser was observed entering this area of site and subsequently dampening down the track earlier noted as giving rise to dust.

**Table 4: Extract from Environmental Actions Register**

Date	Inspection by	Location	Issue identified	Due date	Date actioned	Actioned by	Actions
02/05/2013	ESE	South - U221	Dust was seen blowing from an excavation area to the east of the current U221	02-May	02-May	ESE	ESE reported this immediately following the inspection. It was also reported at the networks meeting. It was confirmed that 2 bowsers were being used on site. One of these was noted entering this area of site as the inspection was finishing. Conditions were exacerbated by very strong winds.

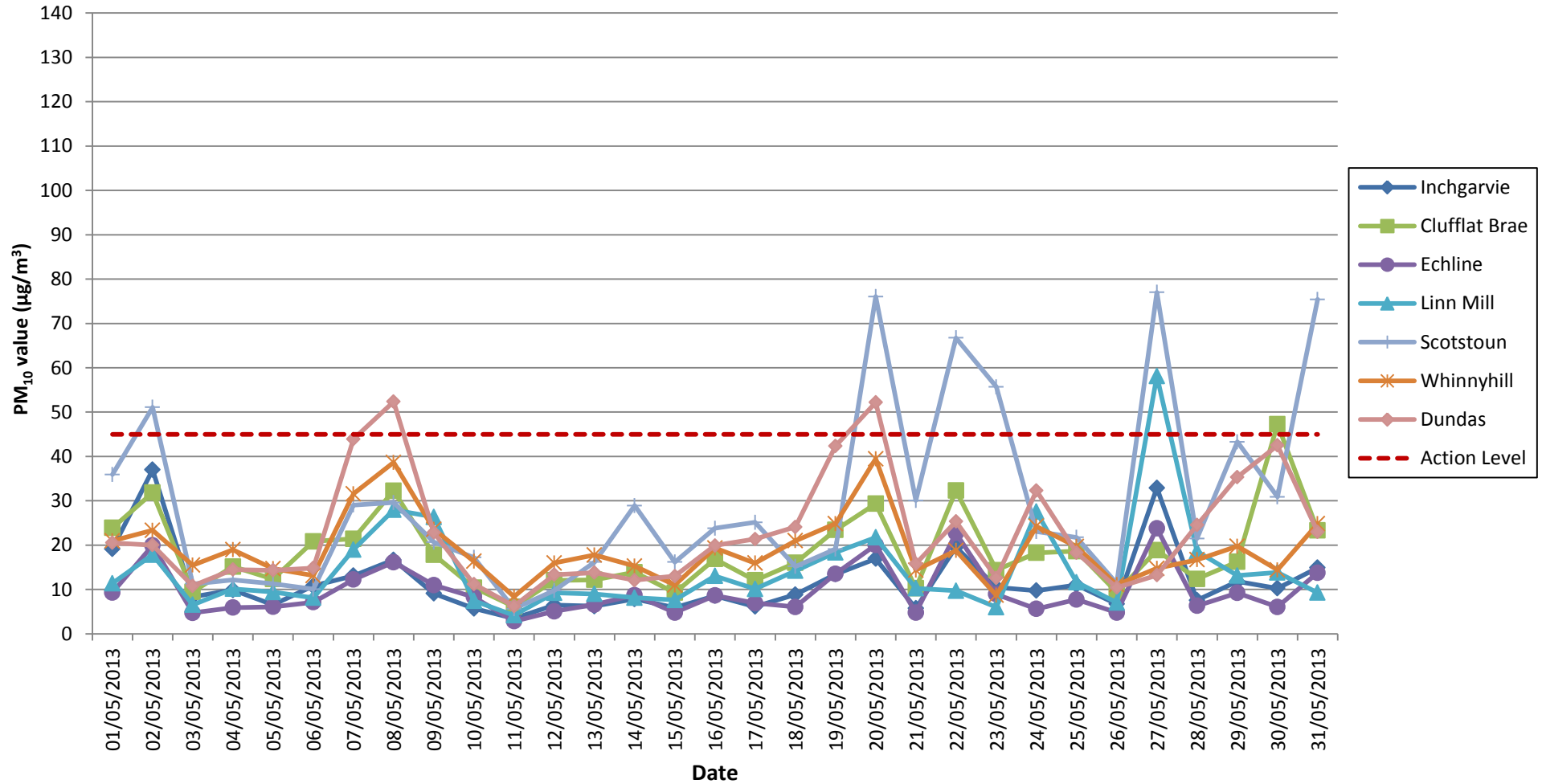


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## **APPENDIX A: LIGHT SCATTER METER RESULTS**

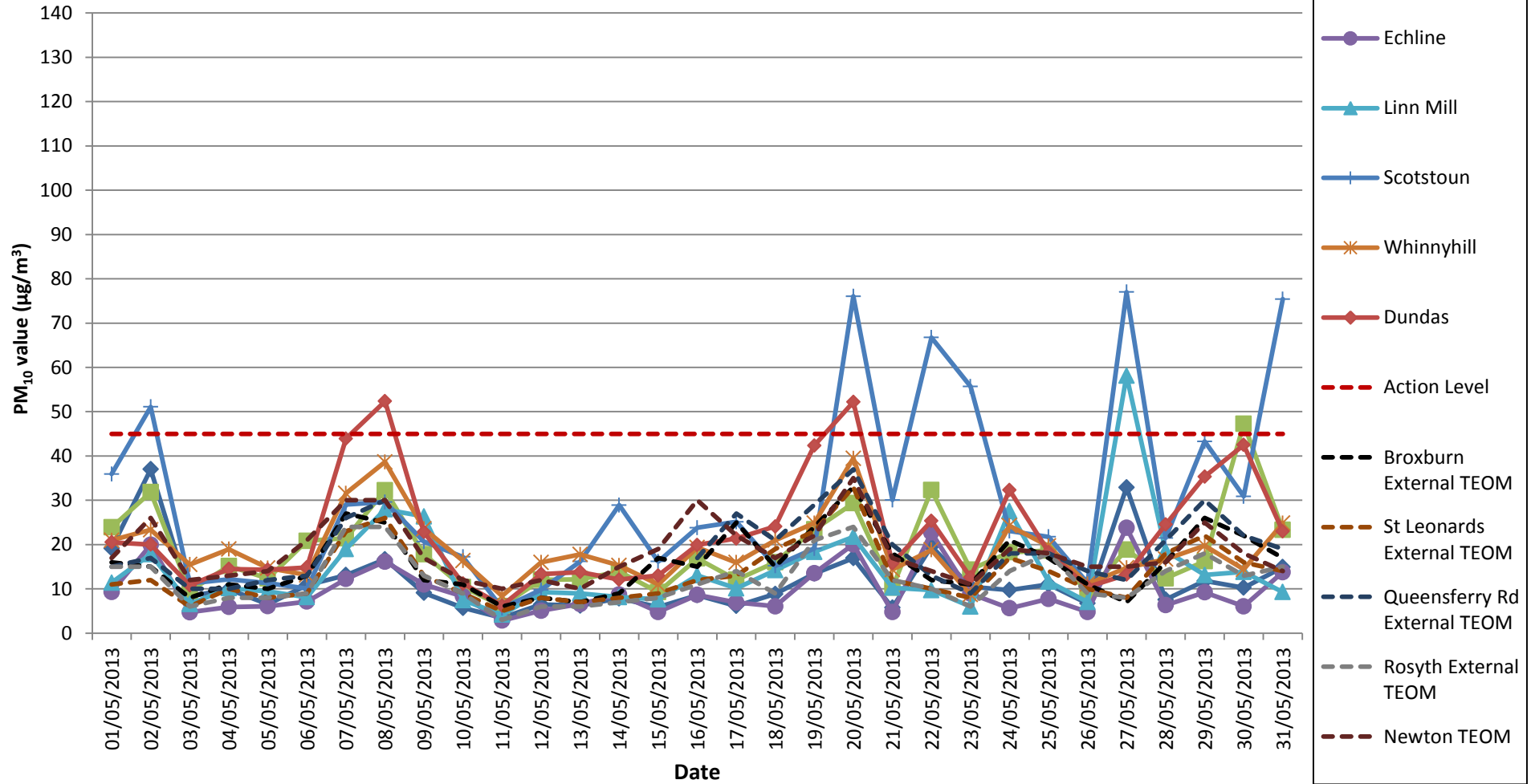


## Air Quality Monitoring Particulate Matter (PM10) Results for all Monitoring Locations May 2013



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

## Air Quality Monitoring Particulate Matter (PM10) Results for all Monitoring Locations May 2013



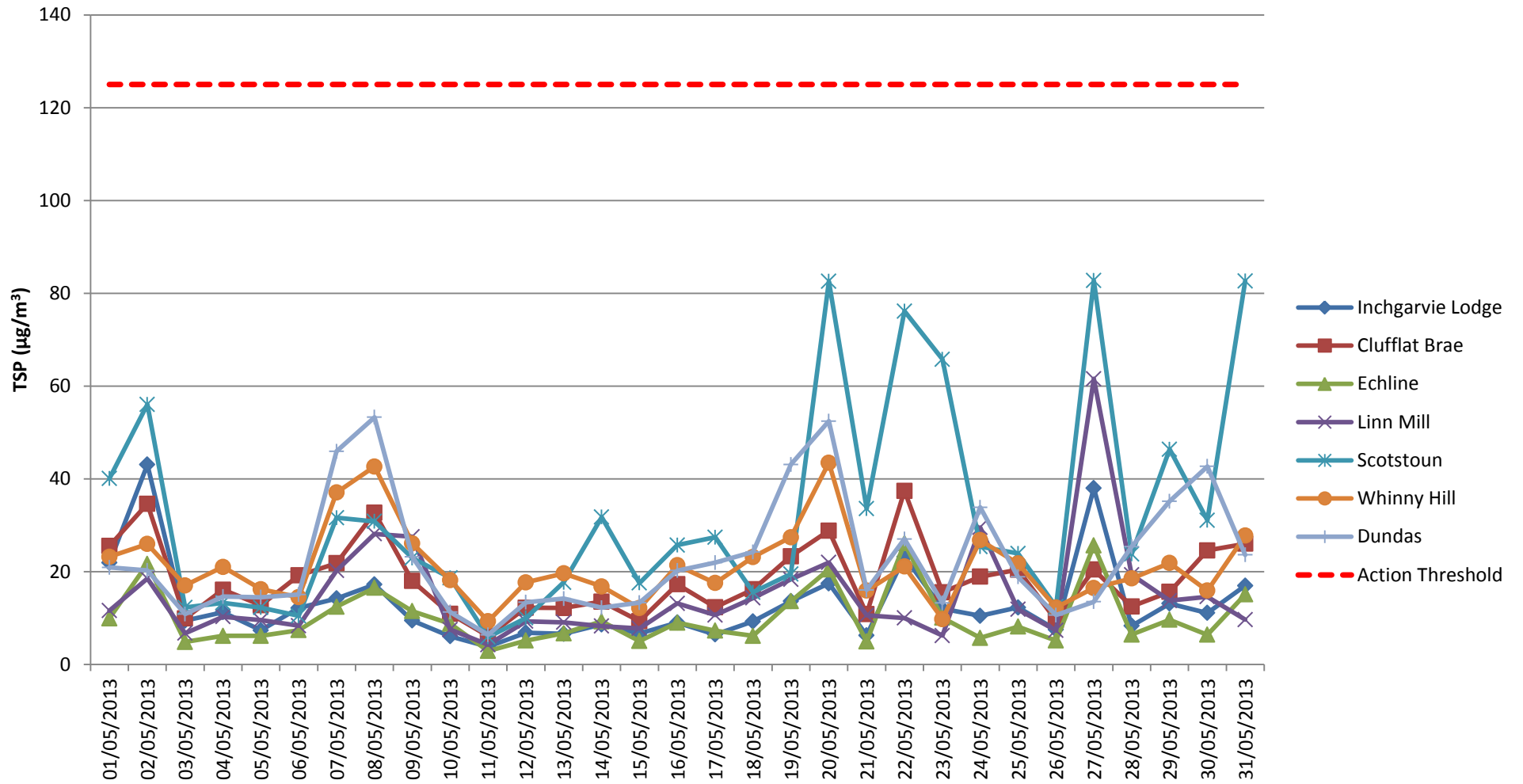
**Note:** Please refer to section 3 of the Air Quality Monitoring Report: May 2013



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## **APPENDIX B: TOTAL SUSPENDED PARTICLES**

# Total Suspended Particles (TSP) Results May 2013

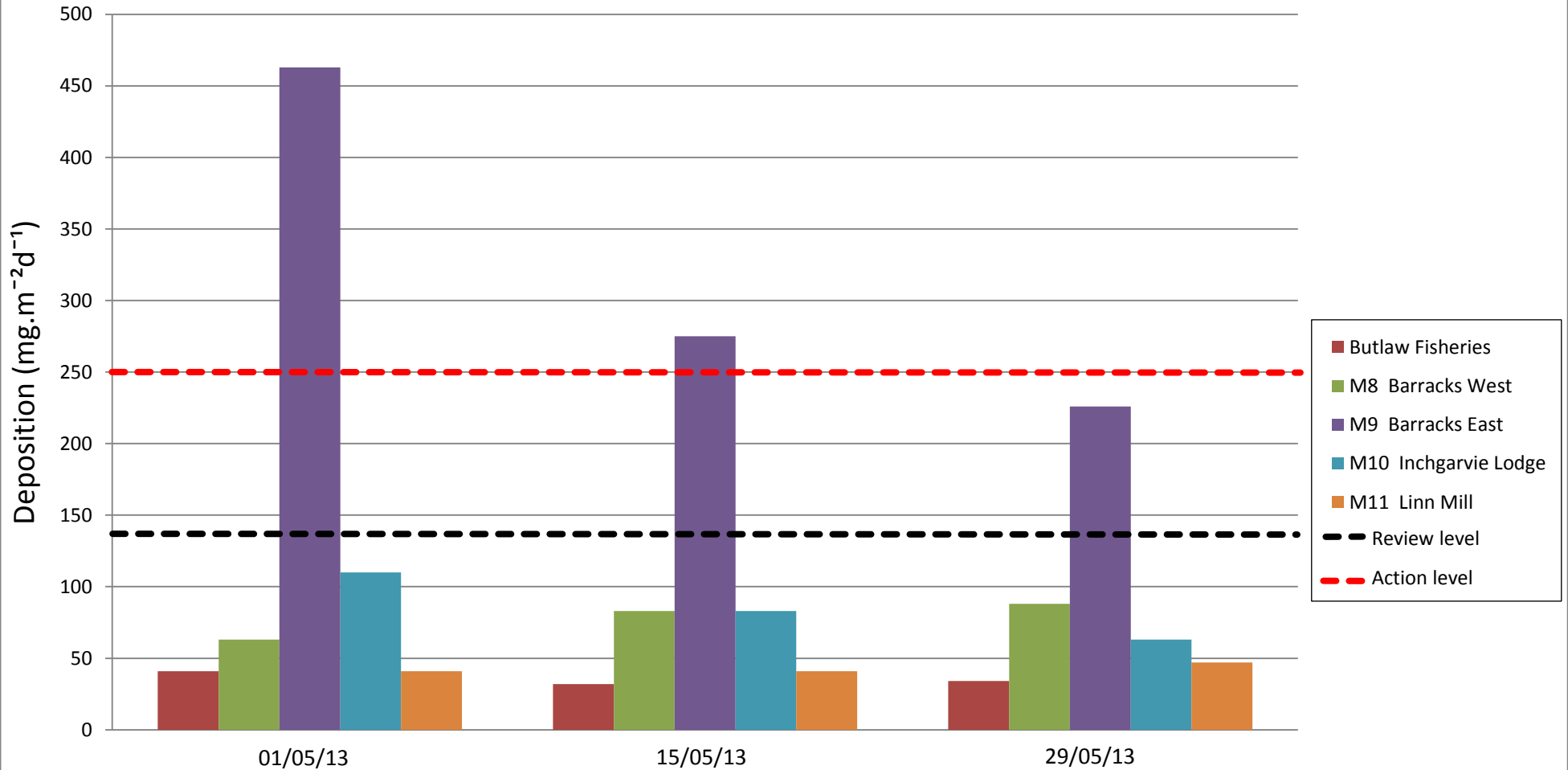




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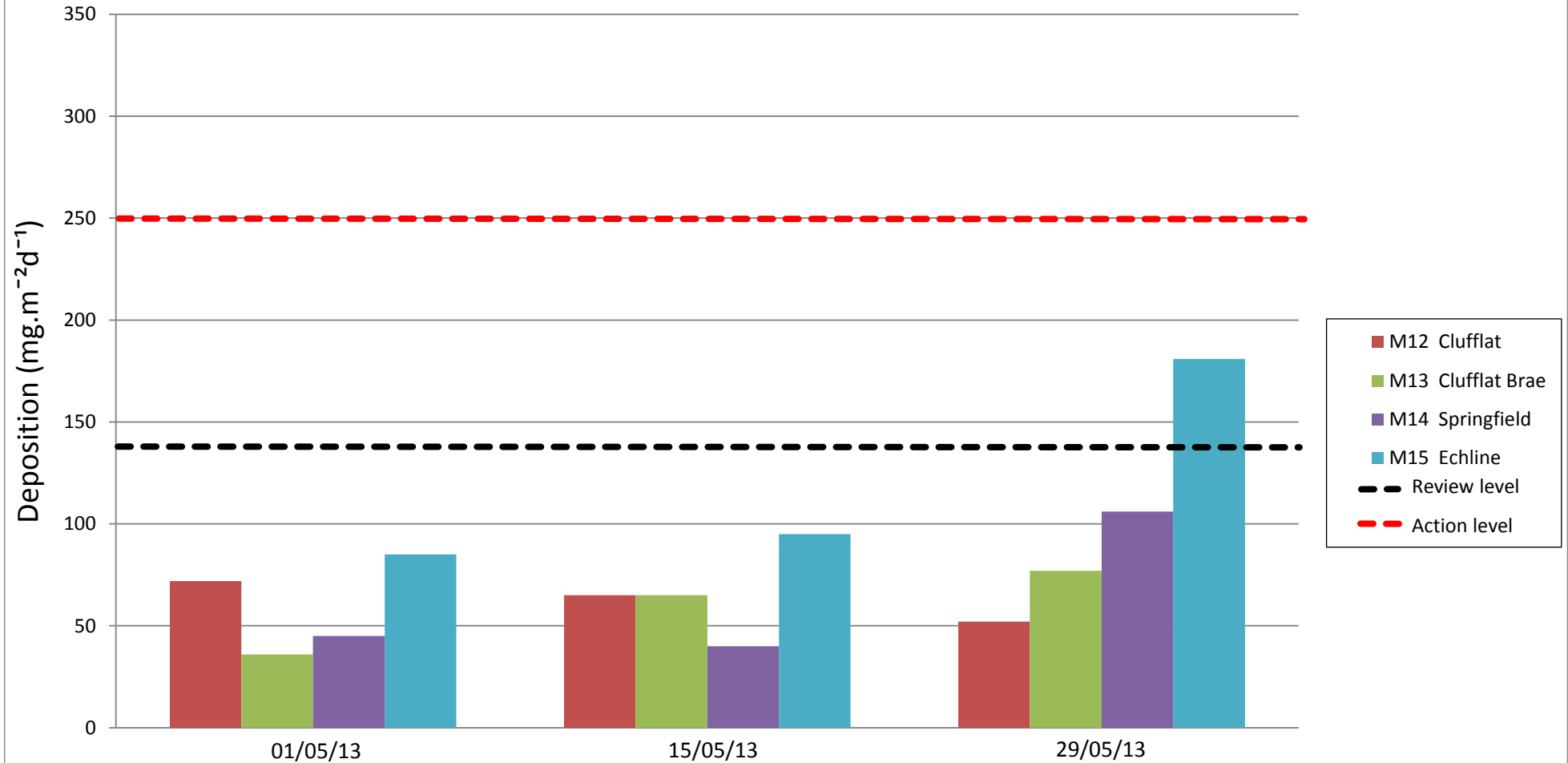
## **APPENDIX C: FRISBEE GAUGE RESULTS**

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



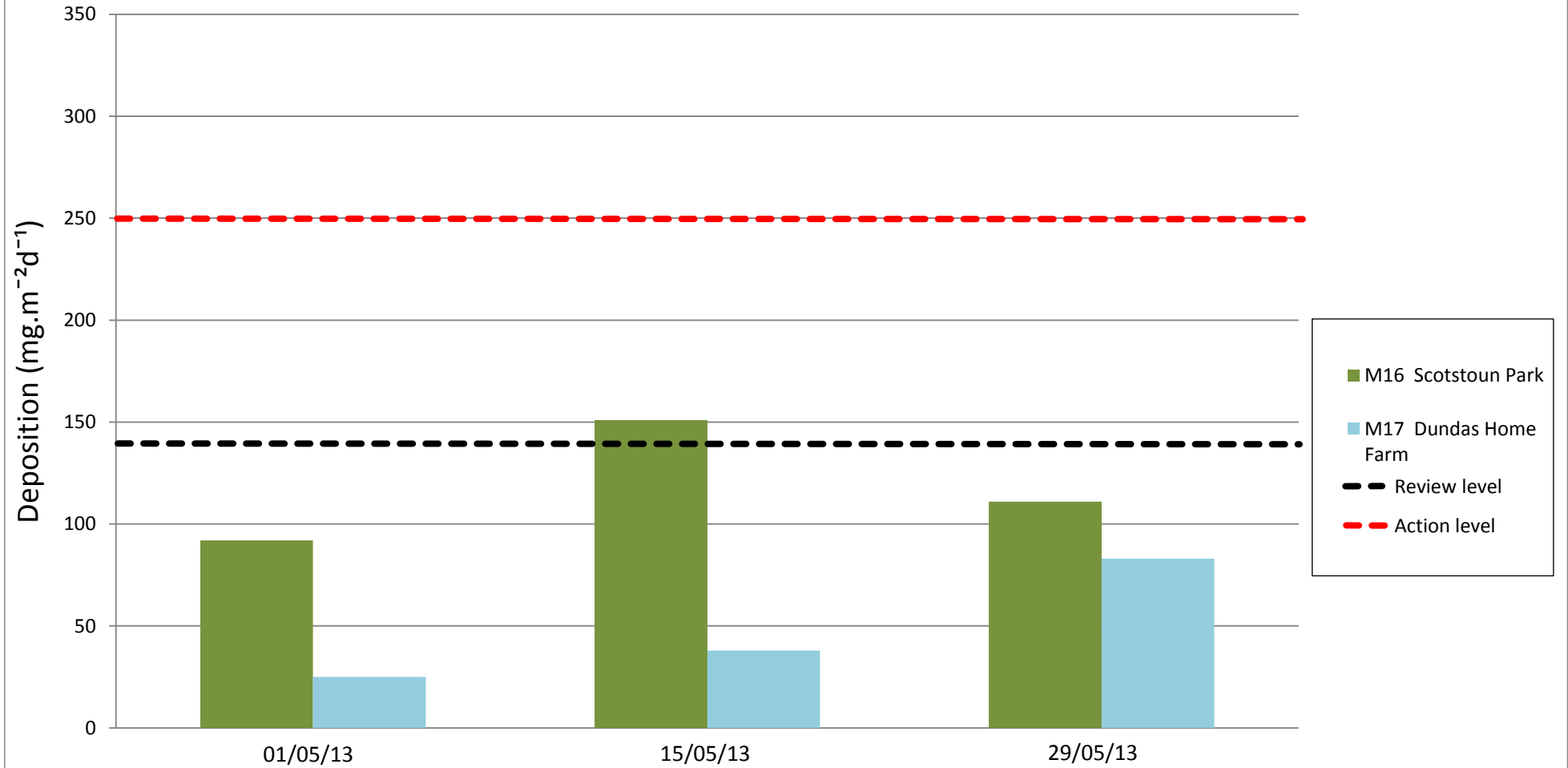
# Frisbee Dust Deposition Results: Group 2

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



### Frisbee Dust Deposition Results: Group 3

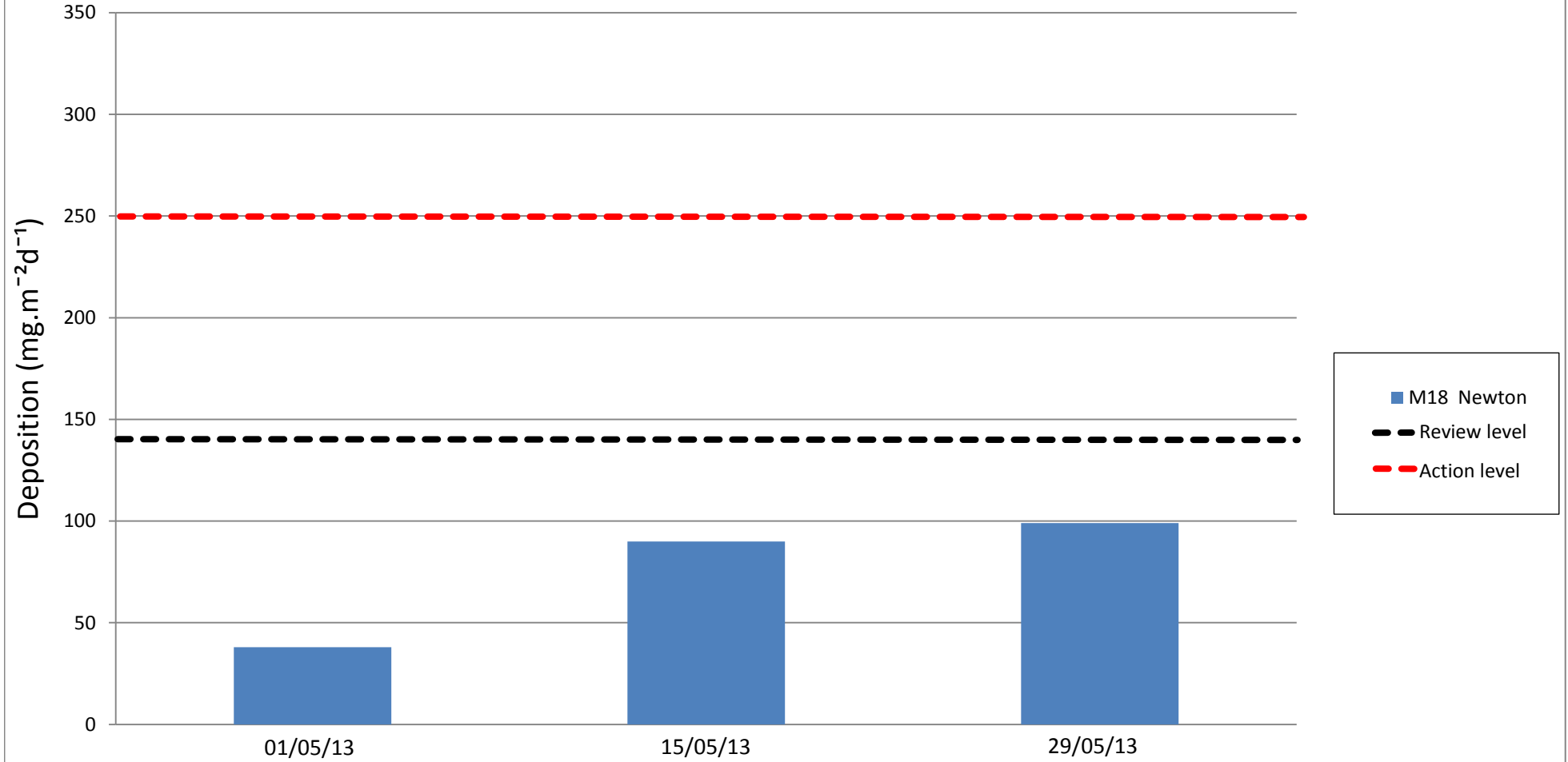
#### Locations: M16 Scotstoun Park and M17 Dundas Home Farm





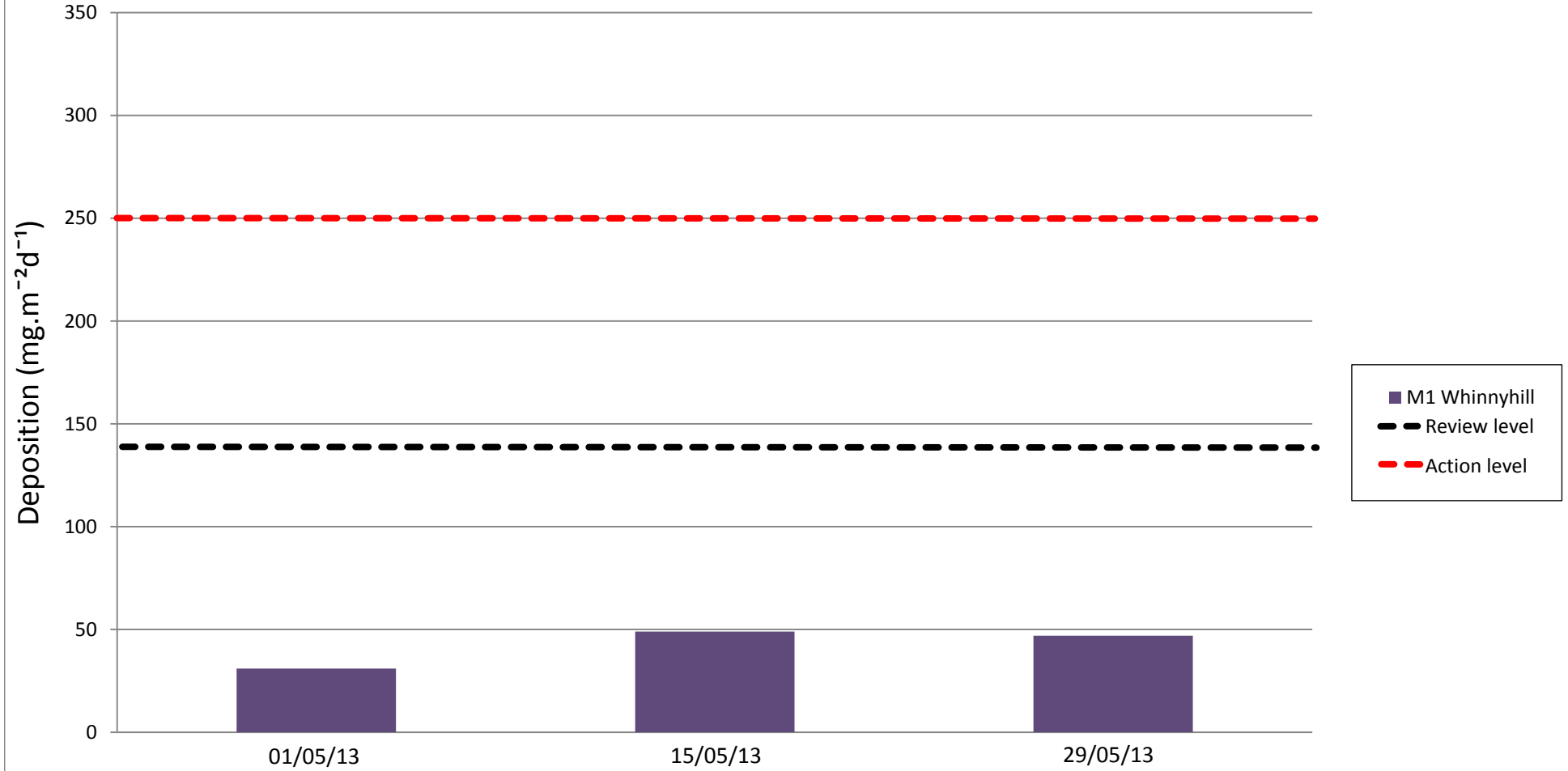
# Frisbee Dust Deposition Results: Group 4

## 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 - North - May 2013

DATE	LOCATION	WIND	WIND DIRECTION	GROUND SURFACE	VISIBLE DUST	DUST DUE TO WORKS (if applicable)	CAUSES OF DUST (if applicable)	OTHER COMMENTS	Actions (if applicable)
01/05/2013	N	MEDIUM	S	DAMP	N				
02/05/2013	N	STRONG	S	DRY	N				
03/05/2013	N	STRONG	SW	DAMP	N				
04/05/2013									
05/05/2013									
06/05/2013	N	LIGHT	ENE	DRY	N				
07/05/2013	N	LIGHT	SE	DRY	N				
08/05/2013	N	MEDIUM	SE	DAMP	N				
09/05/2013	N	MEDIUM	WNW	DRY	N				
10/05/2013	N	STRONG	WSW	WET	N				
11/05/2013	S								
12/05/2013	S								
13/05/2013	N	STRONG	SW	DAMP	N				
14/05/2013	N	LIGHT	NNW	DAMP	N				
15/05/2013	N	LIGHT	W	DAMP	N				
16/05/2013	N	LIGHT	ENE	DRY	N				
17/05/2013	N	LIGHT	WNW	DRY	N				
18/05/2013									
19/05/2013									
20/05/2013	N	LIGHT	ENE	DRY	N				
21/05/2013	N	STRONG	W	DRY	N				
22/05/2013	N	STRONG	WNW	DRY	N				
23/05/2013	N	MEDIUM	ENE	DAMP	N				
24/05/2013	N	LIGHT	WSW	DRY	N				
25/05/2013									
26/05/2013									
27/05/2013	N	STRONG	NE	DRY	N				
28/05/2013	N	NONE	WSW	DRY	N				
29/05/2013	N	LIGHT	ENE	DRY	N				
30/05/2013	N	MEDIUM	WSW	DRY	N				
31/05/2013	N	MEDIUM	WNW	DRY	N				

### Daily Dust Log - South - May 2013

DATE	LOCATION	WIND	WIND DIRECTION	GROUND SURFACE	VISIBLE DUST	DUST DUE TO WORKS (if applicable)	CAUSES OF DUST (if applicable)	OTHER COMMENTS	Actions (if applicable)
01/05/2013	S	MEDIUM	S	DAMP	Y	Y	Vehicles on road	Alerts received for Scotstoun. Caused by dust from road. Roadsweeper observed in area and found to reduce dust.	Roadsweeper in operation
02/05/2013	S	STRONG	S	DRY	Y	Y	Excavations. Wind blown dust	Alerts received. Dust observed on site at excavation area or mainline near to U221. Bowser seen arriving on site during visit. Dust also observed at Scotstoun. Discussions held with site engineers regarding dampening down options.	Bowser in operation
03/05/2013	S	STRONG	SW	DAMP	N				
04/05/2013	S								
05/05/2013	S								
06/05/2013	S	LIGHT	ENE	DRY	N				
07/05/2013	S	LIGHT	SE	DRY	N			Single alerts received for Dundas and Scotstoun. Member of environmental team investigated - no dust noted at time of inspections.	
08/05/2013	S	MEDIUM	SE	DAMP	N			Foggy am - alerts received at Dundas	
09/05/2013	S	MEDIUM	WNW	DRY	N			Alerts received for Scotstoun and Linn Mill. Inspections undertaken - no dust observed at time of inspections.	
10/05/2013	S	STRONG	WSW	WET	N				
11/05/2013	S								
12/05/2013	S								
13/05/2013	S	STRONG	SW	DAMP	N				
14/05/2013	S	LIGHT	NNW	DAMP	N			Alerts received for Scotstoun. No dust observed at monitoring location - likely to be due to proximity to road (B800).	
15/05/2013	S	LIGHT	W	DAMP	N			Single alert received for Scotsoun - no dust observed at monitoring location.	
16/05/2013	S	LIGHT	ENE	DRY	N			Alerts received for Scotstoun. No dust observed at monitoring location - likely to be due to proximity to road (B800).	
17/05/2013	S	LIGHT	WNW	DRY	N				
18/05/2013	S								
19/05/2013	S								
20/05/2013	S	LIGHT	ENE	DRY	N			Hazy/misty am but dry. Heavy rain pm into evening.	
21/05/2013	S	STRONG	W	DRY	Y	Y	Haulage tracks	Alerts received for Scotstoun. Ongoing road sweeping observed. Confirmation that a dry wheel wash was installed at this location over the weekend	Bowser and roadsweeper in operation
22/05/2013	S	STRONG	WNW	DRY	Y	Y	Dust blowing wind around on site	Alerts received. Members of environmental team undertook checks on site. Bowser observed on site and road sweeper observed at Scotstoun. Windy conditions. Showery in afternoon	Bowser and roadsweeper in operation
23/05/2013	S	MEDIUM	ENE	DAMP	N			Alerts received for Scotstoun. No dust observed at monitoring location - alert likely to be due to proximity to road (B800). Gusty showers during the day.	

24/05/2013	S	LIGHT	WSW	DRY	N			Alerts received. Members of environmental team undertook checks on site - no dust observed at time of checks.	
25/05/2013	S								
26/05/2013	S								
27/05/2013	S	STRONG	NE	DRY	Y	Y	Dust blowing wind around on site	Alerts received. Dust observed on site during inspections due to very strong winds. Dust also noted blowing in areas outwith site. Bowser in use across site.	Bowser and roadsweeper in operation
28/05/2013	S	NONE	WSW	DRY	N			Single alert received for Dundas. Confirmed bowser on site. No dust visually noticeable.	
29/05/2013	S	LIGHT	ENE	DRY	N			Alerts received. No dust observed at time of inspection.	
30/05/2013	S	MEDIUM	WSW	DRY	Y	Y	Blowing dust and haulage tracks	Alerts received for Scotstoun, Dundas and Clufflat. Dry conditions with some wind. Evidence of bowser operating on site during checks.	Bowser and roadsweeper in operation
31/05/2013	S	MEDIUM	WNW	DRY	Y	Y	Haulage tracks	Alerts received. Dry conditions around site. Bowser observed in operation during checks.	Bowser and roadsweeper in operation