



Three Kings Quarry
Air Quality Quarterly Report
December - February
2009

In compliance with: Permit 21875, conditions 26 & 27

Compiled By: Sari Eru, Environmental Coordinator

Date: 5 March 2009

Introduction

This report details the air quality monitoring results for Winstone Aggregates Three Kings Quarry for the period Dec – Feb 09

This report is being prepared in accordance with Conditions 26 and 27 of Permit 21875. The conditions state:

“A summary of all monitoring results, including references where applicable to wind and rainfall data, and any remedial actions taken shall be submitted to the Manager at the end of each quarter”.

“A summary of the information recorded shall be submitted to the Manager at the end of each quarter.”

Details of the monitoring undertaken as part of the air permit are described below and actual monitoring results are presented in tables within the report or in the Appendices.

Daily Log

In accordance with Condition 26 (a) – (e) of the air permit a daily log of monitoring results is maintained on site. The log includes information about equipment malfunctions; visible dust emissions, water cart use and all relevant details relating to particulate monitoring.

December 08

Three Kings Quarry Summary monitoring results for the period Dec 08

Date	Day	dally average WS m/sec	dally average WD (degrees)	Dally Rain (mm)	Site TSP mg/m3 office	BAM FH62 mg/m-3 office	Site TSP mg/m3 North Boundary
1/12/2008	Mon	1.988	267.0	3.600		4.9	
2/12/2008	Tue	3.689	149.9	0.400		14.6	
3/12/2008	Wed	1.627	189.8	0.000	40.6	21.8	38.9
4/12/2008	Thur	1.605	132.4	0.000		19.3	
5/12/2008	Fri	2.388	126.4	0.400		15.2	
6/12/2008	Sat	3.491	210.9	0.000	36	16.1	38.6
7/12/2008	Sun	2.091	191.5	0.000		17.1	
8/12/2008	Mon	3.348	123.5	1.800		10.6	
9/12/2008	Tue	3.240	177.7	20.400	11.6	5.9	14.5
10/12/2008	Wed	2.502	195.0	0.400		12.4	
11/12/2008	Thur	3.307	43.6	0.000	34	13.7	34.7
12/12/2008	Fri	2.621	164.5	0.000		n/a	
13/12/2008	Sat	2.708	171.5	0.000		20.4	
14/12/2008	Sun	2.870	123.2	0.400	27.4	15.6	32.2
15/12/2008	Mon	4.841	109.6	5.000		18.2	
16/12/2008	Tue	3.026	288.5	2.200		24.3	
17/12/2008	Wed	5.805	230.8	0.600	76.4	27.2	79.5
18/12/2008	Thur	3.143	138.1	0.000		22.3	
19/12/2008	Fri	2.022	130.1	0.000		22.8	
20/12/2008	Sat	3.275	169.1	2.800	35	17.2	31.4
21/12/2008	Sun	3.614	224.4	1.600		21.4	
22/12/2008	Mon	2.136	173.1	0.000		22.1	
23/12/2008	Tue	2.846	112.8	45.400	23.4	11.9	14.7
24/12/2008	Wed	4.476	190.8	20.400		7.3	
25/12/2008	Thur	2.850	94.8	0.000	31.5	12.4	20.2
26/12/2008	Fri	1.675	206.3	0.000		10.3	
27/12/2008	Sat	1.597	199.1	0.400		12.9	
28/12/2008	Sun	1.607	235.0	0.000		12.5	
29/12/2008	Mon	2.138	106.7	9.200		6.8	
30/12/2008	Tue	2.039	90.0	2.000	21.9	9.9	15.2
31/12/2008	Wed	2.003	112.4	0.000		11.1	

January 09

Three Kings Quarry Summary monitoring results for the period Jan 09

Date	Day	dally average WS m/sec	dally average WD (degrees)	Daily Rain (mm)	Site TSP mg/m3 office	BAM FH62 mg/m-3 office	Site TSP mg/m3 North Boundary
1/01/2009	Thur	1.758	199.74	2.200		14.1	
2/01/2009	Fri	2.248	115.16	7.000	20.4	8	18.9
3/01/2009	Sat	3.318	193.97	8.000		9.8	
4/01/2009	Sun	4.036	194.87	0.000	38.8	14.8	83
5/01/2009	Mon	2.210	136.08	0.000		17.2	
6/01/2009	Tue	2.056	143.26	0.000	45.2	17.3	84.3
7/01/2009	Wed	2.933	120.60	0.000		12.6	
8/01/2009	Thur	2.512	248.45	0.000		18.9	
9/01/2009	Fri	2.183	160.75	0.000		13.7	
10/01/2009	Sat	1.407	205.08	22.800	33.6	16.2	43.9
11/01/2009	Sun	1.922	266.60	15.400		6	
12/01/2009	Mon	2.373	221.13	0.000		8	
13/01/2009	Tue	3.116	158.61	0.000		20.2	
14/01/2009	Wed	2.220	114.61	0.000	49.8	18.7	64.2
15/01/2009	Thur	3.043	119.70	0.000		16.6	
16/01/2009	Fri	4.125	94.21	0.000	81.8	25.2	111.5
17/01/2009	Sat	2.248	221.33	0.000		14.7	
18/01/2009	Sun	3.227	87.83	5.200		13.1	
19/01/2009	Mon	4.566	157.68	1.600		25.6	
20/01/2009	Tue	4.218	158.15	0.400	65.1	21.1	99.8
21/01/2009	Wed	2.972	203.78	0.000		20.5	
22/01/2009	Thur	1.710	236.78	0.000	47.4	19	67.9
23/01/2009	Fri	1.236	151.53	0.000		17.7	
24/01/2009	Sat	2.237	187.88	0.000		12.2	
25/01/2009	Sun	2.988	159.66	0.000		13.3	
26/01/2009	Mon	3.721	189.04	0.000	42.7	13.6	31.2
27/01/2009	Tue	3.578	153.37	0.600		17.7	
28/01/2009	Wed	1.814	196.80	0.000		24	
29/01/2009	Thur	2.295	79.44	0.000	62.3	26.1	137.6
30/01/2009	Fri	3.877	161.91	0.000		20.2	
31/01/2009	Sat	3.945	128.23	0.000		20.4	

Winstone Aggregates Three Kings Quarry
 Quarterly Air quality Report: December – February 09

February 09

Date	Day	dally average WS m/sec	dally average WD (degrees)	Dally Rain (mm)	Site TSP mg/m3 office	BAM FH62 mg/m-3 office	Site TSP mg/m3 North Boundary
1/02/09	Sunday	4.011	134.3	0.000	44.1	14.9	27.9
2/02/09	Monday	2.684	120.7	0.000		25	
3/02/09	Tuesday	2.479	275.3	0.000		-	
4/02/09	Wednesday	1.684	200.4	0.000		-	
5/02/09	Thursday	2.030	205.3	0.000		-	
6/02/09	Friday	2.250	133.7	0.000	31.2	-	
7/02/09	Saturday	2.498	231.0	0.000		-	
8/02/09	Sunday	3.208	257.9	0.000		-	
9/02/09	Monday	1.818	167.6	5.200		-	
10/02/09	Tuesday	1.987	121.8	3.000	23.3	9	27.8
11/02/09	Wednesday	1.213	167.3	0.000		11.1	
12/02/09	Thursday	3.255	314.3	9.000	48.8	15.5	48.2
13/02/09	Friday	4.576	185.3	1.000		21.6	
14/02/09	Saturday	2.134	192.1	12.800	24	13.6	24.4
15/02/09	Sunday	2.229	253.7	0.000		10.8	
16/02/09	Monday	1.390	229.5	0.000		13.7	
17/02/09	Tuesday	2.180	215.5	0.000		20	
18/02/09	Wednesday	1.560	255.5	1.000		16.8	
19/02/09	Thursday	3.257	267.4	0.800		11.5	
20/02/09	Friday	4.054	203.2	56.400		5.5	
21/02/09	Saturday	2.615	243.3	0.200		14.3	
22/02/09	Sunday	1.665	74.5	2.800	45.3	10	26.2
23/02/09	Monday	0.104	96.4	0.600		13.2	
24/02/09	Tuesday	1.819	71.7	0.600	23.8	12.2	29.4
25/02/09	Wednesday	1.889	93.1	0.000		7.3	
26/02/09	Thursday	0.939	169.6	0.000		12	
27/02/09	Friday	2.591	237.2	13.000		8.5	
28/02/09	Saturday	3.886	163.9	28.600		13.9	

**Daily Log Summary for Three Kings Quarry Site for the period
June - Aug 08**

(Condition 27, Air Permit 21875)

- a. No significant visible dust emissions from the quarry (outside the boundary) were recorded during the above period. Visual dust emissions were noted on the 3rd and the 5th of January, rising from the Perrons storage yard along the Northern Boundary.
- b. TSP monitoring was carried as per TSP monitoring procedures documented in the site Air Quality Management Plan. A total of five exceedances were encountered for this period, occurring on the 4th, 6th, 16th, 20th and the 29th of January. An investigation report is attached.
- c. The water cart used 3528L during this period, made up of:

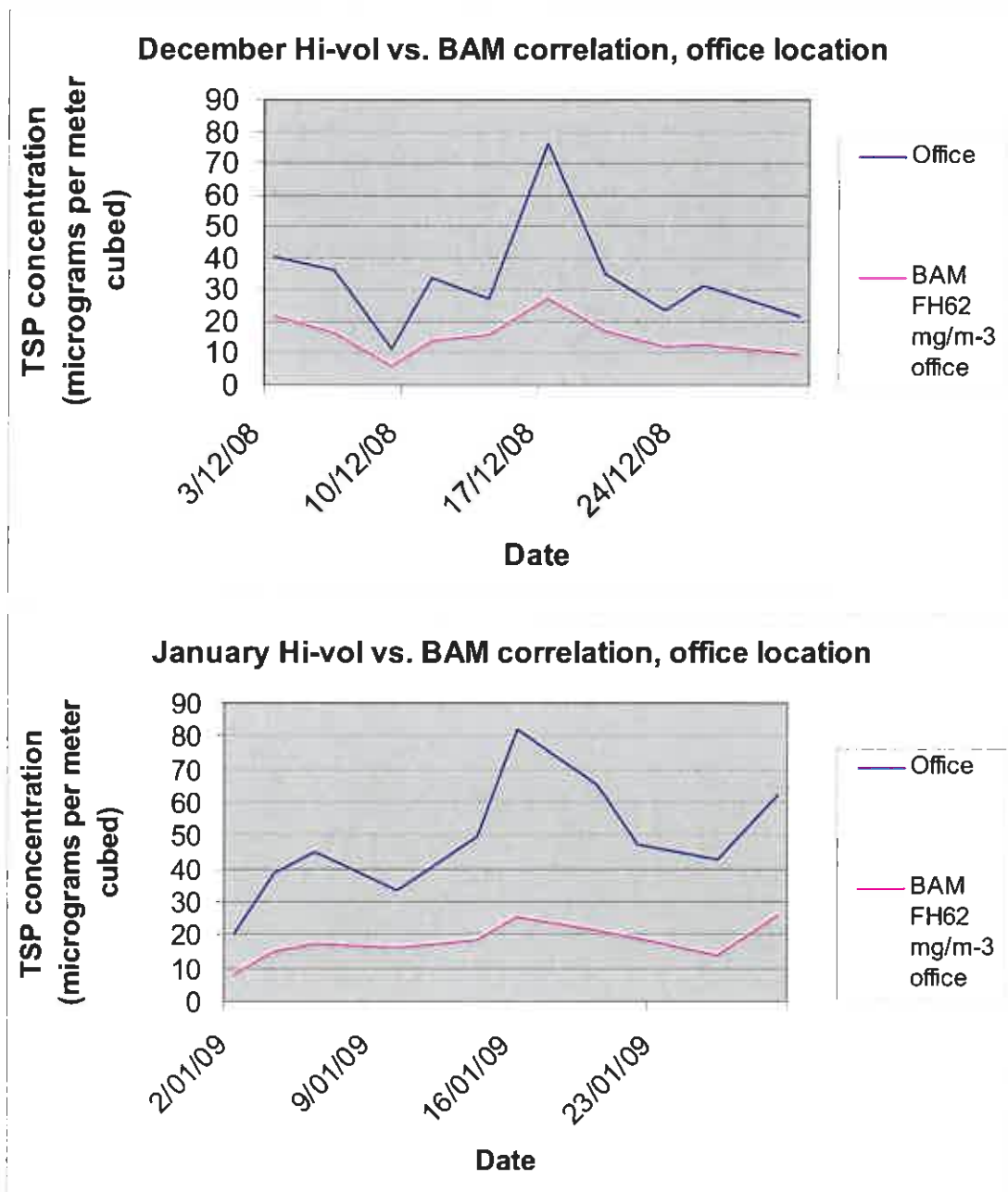
December: 38 loads, 456L
January: 118 loads, 1416L
February: 138 loads, 1656L
- d. The daily log sheet is dated and signed by the person entering the information.

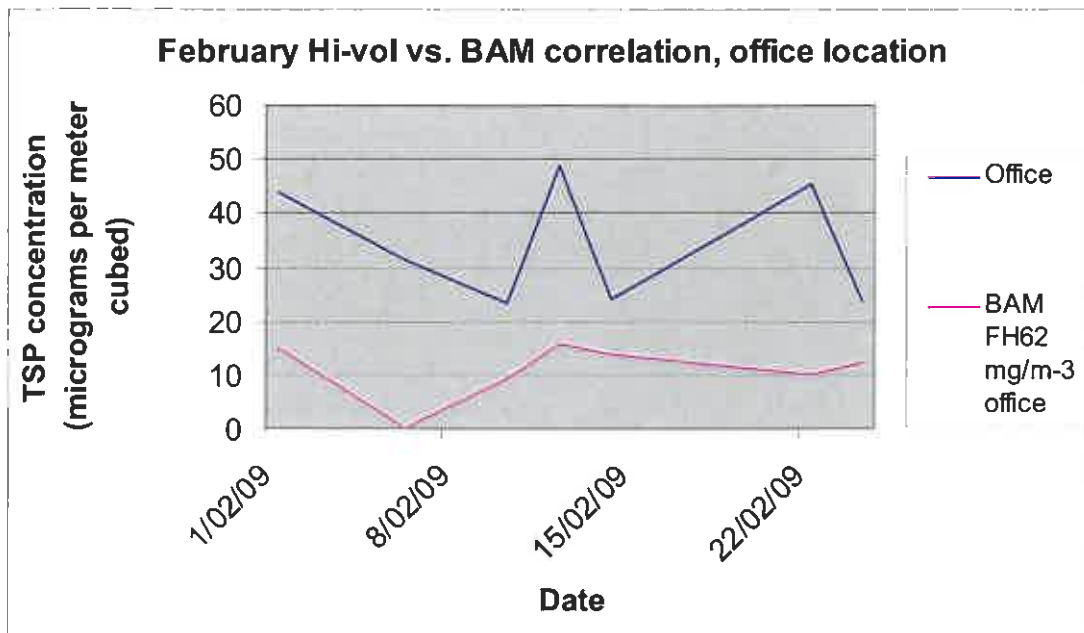
Complaints:

There has been no complaints received for this period.

APPENDIX 1

Hi Vol vs. BAM Graphs to show relationships







13 March 2009

The Manager – Air Quality
Auckland Regional Council
Private Bag 92 012
Auckland 1142

Attention: Gareth Noble

Re: Investigation of TSP Triggers at Three Kings Quarry

Dear Gareth

With regard to condition 20 of the Three Kings Quarry Air Discharge permit, this is to confirm that five results greater than $80\mu\text{g}/\text{m}^3$ as a 24hour average were recorded at the northern boundary Hi-vol TSP sampler, and one at the quarry office Hi-vol during the month of January 2009.

The triggers are as follows:

Sunday	4 January:	Northern Boundary	$83.0\mu\text{g}/\text{m}^3$
Tuesday	6 January:	Northern Boundary	$84.3\mu\text{g}/\text{m}^3$
Friday	16 January:	Northern Boundary	$111.5\mu\text{g}/\text{m}^3$
		Quarry Office	$81.8\mu\text{g}/\text{m}^3$
Tuesday	20 January:	Northern Boundary	$99.8\mu\text{g}/\text{m}^3$
Thursday	29 January:	Northern Boundary	$137.6\mu\text{g}/\text{m}^3$

As required by condition 21 of the Air Discharge Permit, an investigation has been undertaken. This letter details the results and conclusions of the investigation.

Air quality monitoring at Three Kings Quarry consists of:

- Hi-volume TSP air samplers located on the quarry office and the northern boundary.
- A FH62 Beta Attenuation Monitor (BAM) located on the quarry office, run in conjunction with the quarry office Hi-vol sampler.
- A meteorological monitoring station located on the quarry office that records wind speed, wind direction and rainfall on a continuous basis;

- A time lapse video camera located on the roof of the Foodtown supermarket to the south of the quarry that records general quarry operations during daylight hours;
- Visual inspections of air quality carried out by site staff;
- Recording of dust suppression equipment use and malfunctions.

All relevant air quality-monitoring results collected on the day of the exceedances have been summarised in Table 1 below.

Table 1: Exceedance Air Quality Monitoring Results

Date	TSP Quarry Office $\mu\text{g}/\text{m}^3$	BAM Quarry Office 24hr average $\mu\text{g}/\text{m}^3$	TSP Northern Boundary $\mu\text{g}/\text{m}^3$	Daily Rain mm	Daily average wind speed m/sec.	Daily average wind direction degrees	Watercart volume m^3	Sprinklers On/Off	Time Lapse Video On/Off
04.01.09	38.8	14.8	83	0	4.036	213	Nil	On	Yes
06.01.09	45.2	17.3	84.3	0	2.056	215	48	On	Yes
16.01.09	81.8	25.2	111.5	0	4.125	228	24	On	Yes
20.01.09	65.1	21.1	99.8	0.4	4.218	240	Nil	On	Yes
29.01.09	62.3	26.1	137.6	0	2.295	221	36	On	

Please note that the wind directions are taken from Auckland Regional Council weather station at Onehunga (Station No 12326) and the NIWA electronic weather station at Penrose (Station No 22254) as it was found during this investigation that the wind direction monitor at Three Kings Quarry is faulty and needs to be replaced.

Exceedance on 4th January: Northern Boundary TSP Sampler – $83\mu\text{g}/\text{m}^3$

- The wind on the 4th of January 2009 was moderately strong from a south-south westerly direction.
- This event occurred during the Christmas break. No personnel were on site and no activities took place onsite.
- No dust sources from the quarry operational area were observed on the time lapse video.
- The water cart was not used. The sprinklers were in full operation.
- The Hi-vol TSP sampler on the office recorded 38.8 micrograms per cubic metre.
- The BAM recording an average of 14.8 micrograms per cubic meter for the same monitoring period with no 5 minute reading exceeding 30 micrograms per cubic meter.

The wind direction on the date of the exceedance shows winds originating from a south-south westerly direction. As this day was during the Christmas break, no persons were onsite to see any visible dust nor was the water cart in use.

The operator setting the filters on the 3rd of January noted that there were significant visual dust emissions rising from the storage yard on the adjoining property directly to the north of the Northern Boundary Hi-vol sampler. This yard is an unsealed storage area for many boats and other recreational vehicles. As it was holiday time for many, vehicles were being used in this area, creating dust due to their movements on this unsealed area. The wind direction however suggests the dust exceedance to originate from the quarry site. Please note that 8mm of rain fell on the 3rd of January, and this would normally have been sufficient to have suppressed dust on the 4th.

Video surveillance shows no major dust sources arising from the quarry and shows sprinklers were in full operation at the time. No vehicle movements occurred on the site.

Exceedance on 6th January Northern Boundary TSP Sampler – 84.3 $\mu\text{g}/\text{m}^3$

- The wind on the 6th of January 2009 began with light variable winds, with stronger south westerlies recorded in the afternoon.
- No dust sources from the quarry operational area, were observed on the time lapse video. No emissions were seen to leave the site boundary
- Minimal staff were onsite, with no crushing occurring. The site was open for distribution only, and sales were low, 18 loads in total for the day.
- The water cart used 48 cubic meters across the site. The sprinklers were in full operation.
- The TSP sampler on the quarry office recorded 45.2 micrograms per cubic metre.
- The BAM recorded an average of 17.3 micrograms per cubic meter over the same monitoring period with no 5min readings exceeding 60 micrograms per cubic meter for that day.

The wind direction on the date of the exceedance shows light variable winds in the morning, continuing to become stronger in the afternoon. The time lapse video footage showed minimal dust emissions from the site, and sales recorded 18 sales for the entire day. Sprinklers were in full operation.

Few occurrences of dust were seen originating from vehicle movements running along the haul road, and it was an assessment from staff onsite that the water cart was not necessary. It was noted again on this day there were significant dust emissions from the storage yard directly to the north of the northern boundary Hi-vol sampler.

An orange-brown dust was present on the Hi-vol filters collected on the 4th and 6th January.

Exceedance on 16th January Northern Boundary TSP Sampler – 111.5 $\mu\text{g}/\text{m}^3$ and Office TSP Sampler – 81.8 $\mu\text{g}/\text{m}^3$

- The wind on the 16th of January 2009 was a moderately strong south westerly at approximately 4ms^{-1}
- The quarry was fully operational, with both distribution and crushing activities occurring.
- The water cart was used twice, once at 1330hrs and again at 1400hrs. Sprinklers were in full operation.
- The time lapse video recorded visual dust originating from the haul road due to vehicle movements.
- The TSP monitor on the quarry office recorded 81.8 micrograms per cubic metre.
- The BAM recording an average of 25.2 micrograms per cubic meter over the 24hr period with no 5min readings exceeding 80 micrograms per cubic meter.

The wind direction on the 16th of January was from a southwesterly direction. The time lapse video footage showed significant visual dust originating from the haul road due to vehicle movements, and the need for a watercart was missed. The BAM did not produce any alarms as peaks did not reach 80 (consequently the alarm levels have now been reduced).

The Hi-vol filters from both the northern boundary and quarry office contained a coating of dark grey dust.

Site personnel have been advised of these issues, and extra vigilance on water cart use shall be used from here on.

Exceedance on 20th January Northern Boundary TSP Sampler – 99.8 $\mu\text{g}/\text{m}^3$

- The wind on the 20th of January 2009 was again moderately strong, (4.2ms^{-1}) from a west-southwest direction.
- The quarry was fully operational, with both distribution and crushing activities occurring.
- The water cart was not used, and no visual dust emissions were noted by staff.
- Sprinklers were in full operation.
- The time lapse video recorded dust originating from the haul road due to vehicle movements.
- The TSP monitor on the quarry office recorded 65.1 micrograms per cubic metre.
- The BAM recording an average of 21.1 micrograms per cubic meter over the 24hr period with no 5min readings exceeding 54 micrograms per cubic meter.

The wind direction on the 20th of January suggests the dust to be coming from the site, and time lapse video footage again showed significant visual dust originating from the haul road due to vehicle movements.

The Hi-vol filters from both the northern boundary and quarry office contained a coating of dark grey dust.

Exceedance on 29th January Northern Boundary TSP Sampler – 137.6 $\mu\text{g}/\text{m}^3$

- The wind on the 29th of January 2009 was a mild (2ms^{-1}) southwesterly.
- The quarry was fully operational, with both distribution and crushing activities occurring.
- The water cart used 36 cubic meters of water around the site, and no visual dust emissions were noted by staff.
- Sprinklers were in full operation.
- The time lapse video showed the crushing plant to be a significant source of dust.
- The TSP monitor on the quarry office recorded 62.3 micrograms per cubic metre.
- The BAM recording an average of 26.1 micrograms per cubic meter over the 24hr period with no 5min readings exceeding 55 micrograms per cubic meter

Wind direction on the 29th of January was again from a south-westerly direction. The time lapse video footage showed significant visual dust originating from the crushing plant, and the watercart completed only three runs, using 36 cubic meters for the day. Processing trials using the Three Kings crushing plant in a different area of the site took place on this day, and this seems to be the main cause of this exceedance. It has now been decided this area of the site shall not be suitable for further crushing activities.

Summary of Investigations

In the first two cases (4th and 6th January), it has been fairly difficult to accurately assess the cause of these exceedances. These occurrences have highlighted to staff the importance of the water cart particularly under similar weather conditions. Sprinklers located along the Haul roads have been replaced with 360 degree turning heads so that they not only shower the quarry batters, but also the roads. The need for watercart operation was missed, and further suppression methods, such as water additives are now being investigated.

It has been found that the presence of the BAM however has given a false sense of security. The 24-hour averages and 5 minute readings have been significantly less the 80 micrograms per cubic metre. The BAM alert level has now been reduced to 30 micrograms per cubic meter (as measured at a 5 minute interval), so as to alert staff to any possible causes of an exceedance well before its occurrence.

The wind direction monitor on the site weather station was faulty and will be replaced.

No complaints to date have been received by neighbouring properties as a result of these exceedances.

If there are any further queries or comments on this investigation please do not hesitate to contact either myself, or Tony Carpenter, Three Kings Quarry Manager.

Yours faithfully
for Winstone Aggregates

Sari Eru
Site Environmental Coordinator

Cc Tony Carpenter, Quarry Manager – Three Kings Quarry
Bernie Chote, General Manager – Winstone Aggregates