

Trial Burning at Bishopton – 11th June 2009

Air Quality Monitoring: Result Summary

Introduction

Enviros Consulting was commissioned by BAE Systems Ltd to undertake air quality monitoring during the trial burning of two buildings at the Bishopton site on the 11th June 2009.

The monitoring was undertaken using two Turnkey Osiris samplers. The Osiris sampler is a real time portable monitor that is capable of measuring fine particles in a range of fractions as fine as PM₁. This instrument is widely used by local authorities and organisations to monitor long term particulate levels in ambient air, and has been successfully used during trial decontamination burns at the Bishopton and Chorley sites. The Osiris uses a light diffraction technology to measure three different particle size fractions (PM₁₀, PM_{2.5} and PM₁) and Total Suspended Particulates (TSP), with a detection limit of 0.01µg/m³. The Osiris has a low sample volume of around 600 cc per minute, and has the benefits of real time logging and display.

The monitor was set to record concentrations of SP, PM₁₀, PM_{2.5} and PM₁ every minute.

Monitoring Locations

The monitors were set up to monitor background concentrations prior to the buildings being burnt. Both monitors were running for one hour or more. The first monitor was located close to the building façade, with the second located between 150 – 200 metres downwind of the building.

The predominant wind direction appeared to be north-easterly prior to the background monitoring for Trial Burn 1, therefore the monitors were located to the south-west of the building. However prior to the first trial burn, it was agreed that the wind direction had changed to westerly and the monitors were relocated accordingly.

The predominant wind direction during the background monitoring for Trial Burn 2 was north-easterly and the monitors were located accordingly. The monitors remained in this location throughout the burn, however it was noted that the wind backed from north-westerly to westerly during the course of the burn.

Following the completion of Trial Burn 2, the monitors were located close to the site gate at Station Road, to determine the concentrations close to receptors following burning on site. The location of all monitors will be provided in a subsequent report.

Air Quality Guidelines

The concentrations monitored were compared to the relevant air quality objectives and guidelines within the Air Quality Strategy for England, Ireland and Scotland¹, which lists the National Air Quality Objectives, limits and target values for the protection of human health. For the purposes of this assessment all concentrations will be compared to the relative Scotland guideline, where applicable.

¹ The UK Government and Devolved Administrations, (2007). *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (The Air Quality Strategy)*, TSO (The Stationary Office), London.

Table 1 Air Quality Guidelines (Scotland)

Pollutant	Applies	Year to be achieved	Averaging Period	Frequency	Criterion Value
Fine particulate matter (PM ₁₀)	UK	2004	24 Hour mean	Not to be exceeded more than 35 times a year.	50.0µg/m ³
	UK	2004	Annual Mean	-	18.0µg/m ³
Particulate (PM _{2.5})	UK	2020	Annual mean	-	12.0µg/m ³

Results

The results of the sampling are presented in Table 2 and 3. The results are also presented in Graphs 1 – 8.

Table 2 Summary of particulate results from monitor TN2127

Test	Reference	Average Concentration (µg/m ³)			
		PM ₁	PM _{2.5}	PM ₁₀	Total Particles
1	Background	0.3	0.7	3.5	6.3
2	28/165	0.7	1.5	7.2	16.3
3	43/302G	0.5	2.3	37.4	83.5
4	Site Office at Station Road	0.5	1.5	6.9	13.4
Objectives (µg/m³)		-	12.0	18.0	-

These results are from monitor TN 2127; that was located 150 – 200 metres downwind from the trial buildings. The average concentrations during Test 2 indicate that the levels meet the Scottish air quality objectives at 150 – 200 metres from the burn but at this distance in Test 3, the objectives are exceeded, even for the relatively short period of the burn. As expected the baseline concentrations were the lowest and although slightly higher, the concentrations at the site office were similar to the baseline levels.

The concentrations appeared to be higher during the second burn for the majority of size fractions. During this phase of the monitoring, it appeared that this burn generated darker smoke for a longer period than the first burn. The operator's initial views of reasons for this have been discussed separately with Renfrewshire Council.

The second monitor was located adjacent to the building façade and the results from this location are provided in Table 3.

Table 3 Summary of particulate results from monitor TN 2300

Test	Reference	Average Concentration ($\mu\text{g}/\text{m}^3$)			
		PM ₁	PM _{2.5}	PM ₁₀	Total Particles
1	Background	0.1	0.4	6.5	14.7
2	28/165	4.3	10.5	33.1	60.2
3	43/302G	10.3	19.3	112.7	190.7
4	Site Office at Station Road	0.1	0.7	5.9	11.2
Objectives ($\mu\text{g}/\text{m}^3$)		-	12.0	18.0	-

This instrument was located adjacent to the trial buildings (>5metres). The results from monitor TN 2300 were significantly higher than TN 2127 for Tests 2 and 3, reflecting the proximity of the monitor to the burn. The background concentrations are slightly higher and the results from Test 4 are slightly lower. The average concentrations for Test 2 were within the air quality objective for PM_{2.5} but exceeded the objective for PM₁₀; during Test 3 the concentrations were above the Air Quality Objective levels for the relatively short period of the burn. This supports the use of an exclusion zone such that burns are not carried out in the near vicinity of sensitive premises. As expected the baseline concentrations were relatively low. The concentrations at the site office were slightly lower but similar to the baseline levels.

Similar to TN 2127, the concentrations during the second burn were higher for the majority of size fractions.

The concentrations detected at TN 2300 were significantly higher than those detected at TN 2127, indicating that the level of particulates decreased with distance from the source, as would be expected.

Figures 1 through 8 present the real time data for the duration of the one hour tests and a short summary is provided with each.

Test 1 (Background)

Figures 1 and 2 both indicate relatively low background concentrations < 20 $\mu\text{g}/\text{m}^3$ for all pollutants over the background monitoring period. Both monitors recorded relatively high concentrations (TN2127 – 64 $\mu\text{g}/\text{m}^3$ and TN2300 – 235 $\mu\text{g}/\text{m}^3$) at the start of the monitoring period but at different times (09:32 and 09:44 respectively). Nothing specific was noted on site which could have resulted in these high levels.

Figure 1 Test 1 – TN 2127

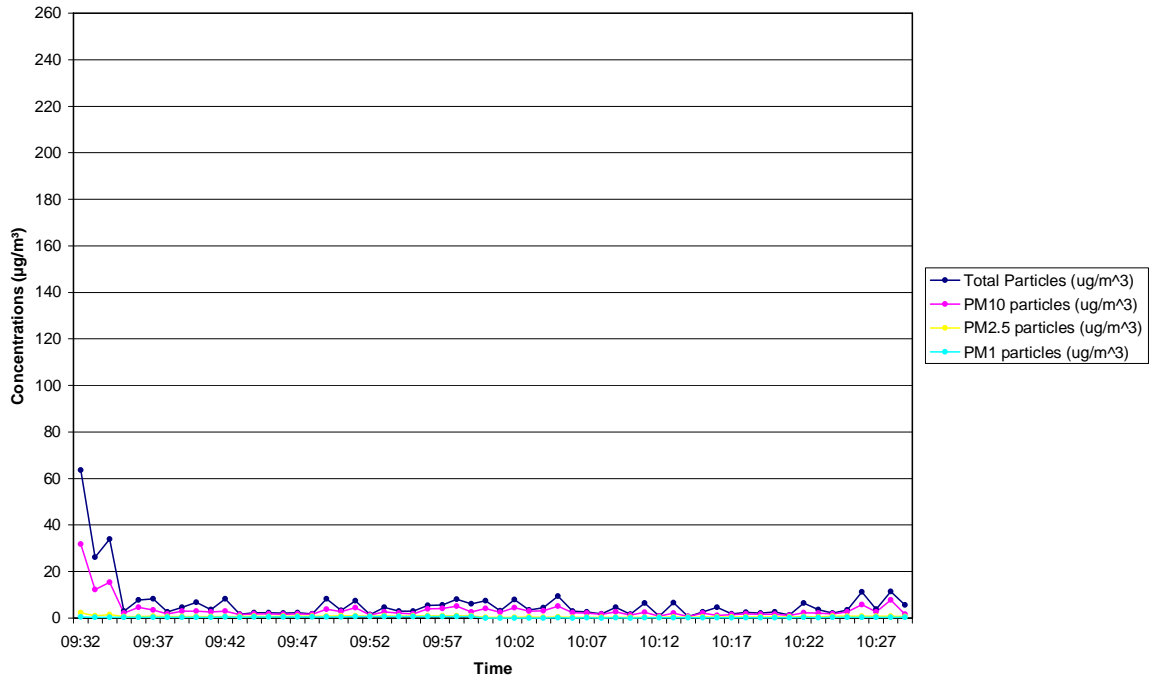
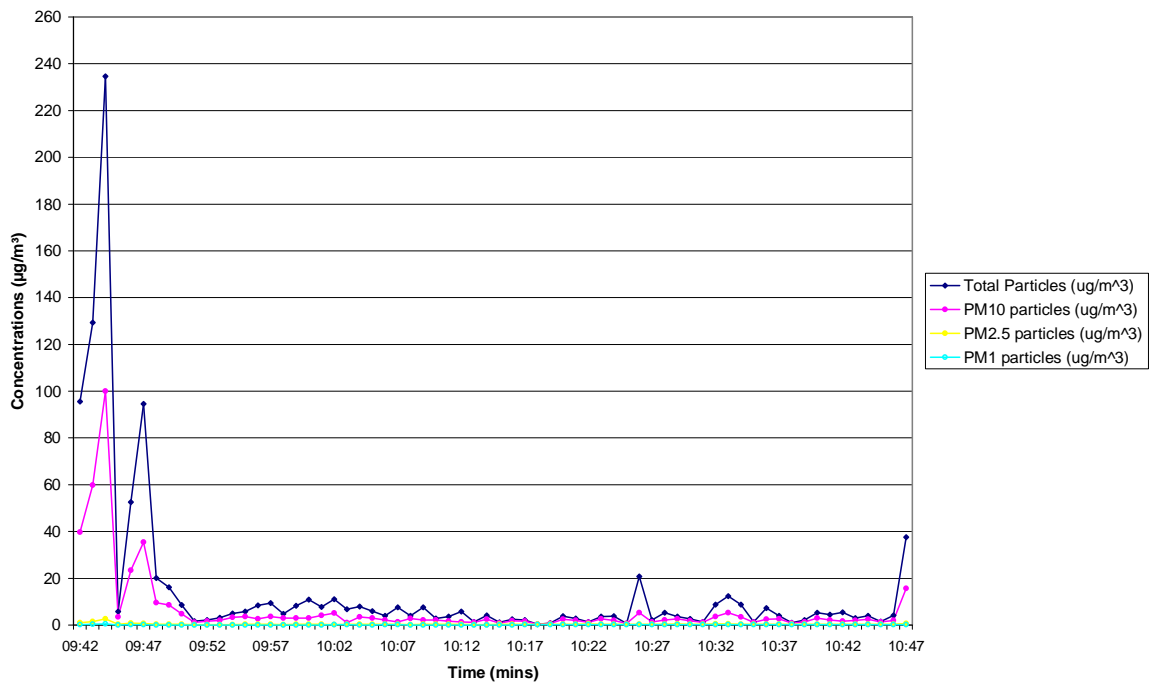


Figure 2 Test 1 – TN 2300



Test 2: Building 28/165 burn

Figure 3 and 4 show that levels taken at the building façade are significantly higher than those recorded further downwind. The monitors show peaks at the same time and the monitor downwind recorded lower levels of particulates.

Figure 3 Test 2 – TN 2127

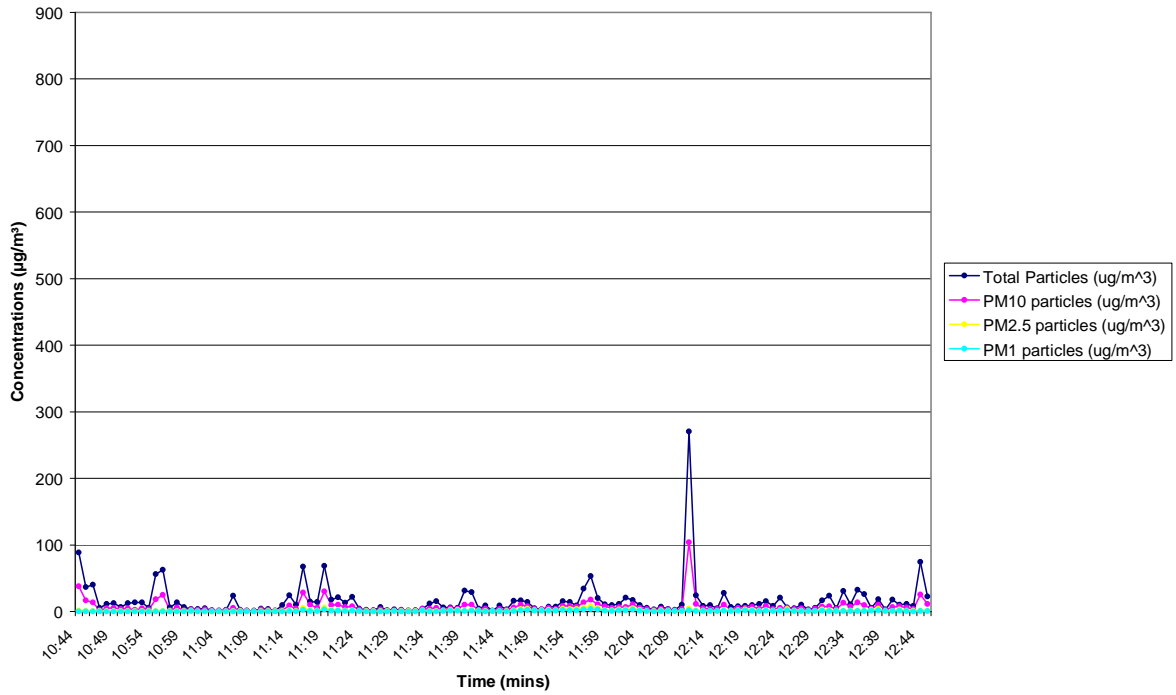
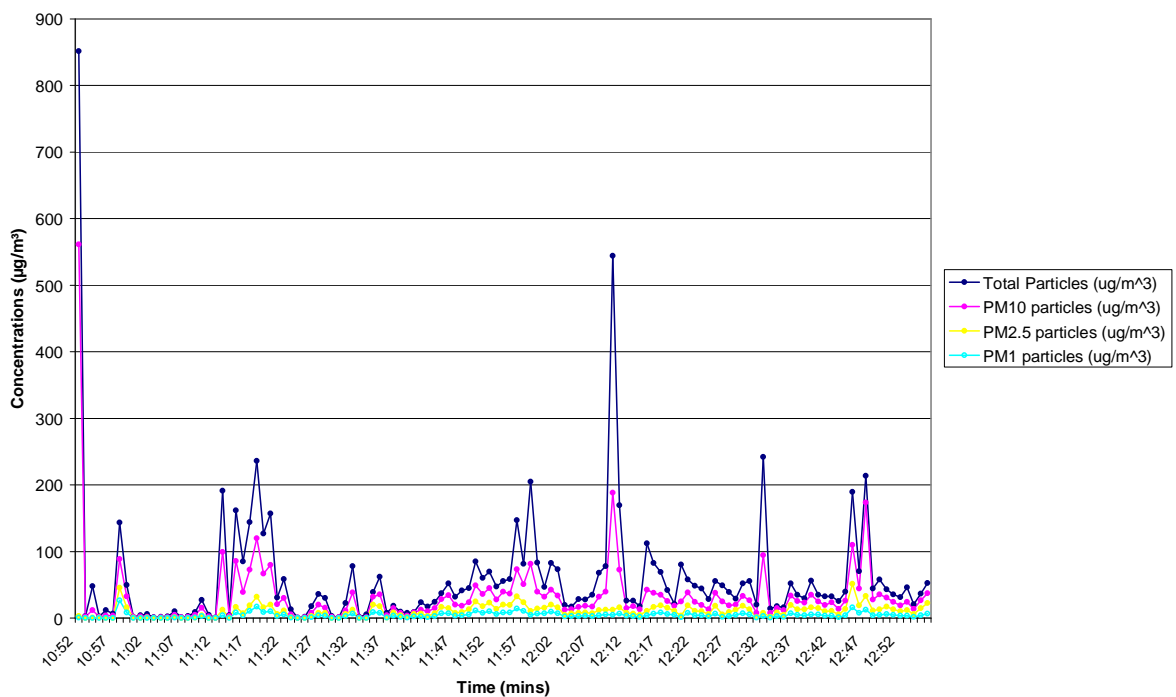


Figure 4 Test 2 – TN 2300



Test 3: Building 43/302G Burn

Figure 5 and 6 demonstrate that the levels during Test 3 were significantly higher than those recorded during Test 2, before and after the burn was started. During Test 3, the smoke from the building was more visible and black smoke was more prominent. During this monitoring period, fine particulates (PM_{2.5} and PM₁) increased during the period 14:11 to 14:28 at the monitor located at the building façade. This correlates with the time that the building was set alight and observations that TN2300 was located within the downwind plume immediately after ignition.

Figure 5 Test 3 – TN 2127

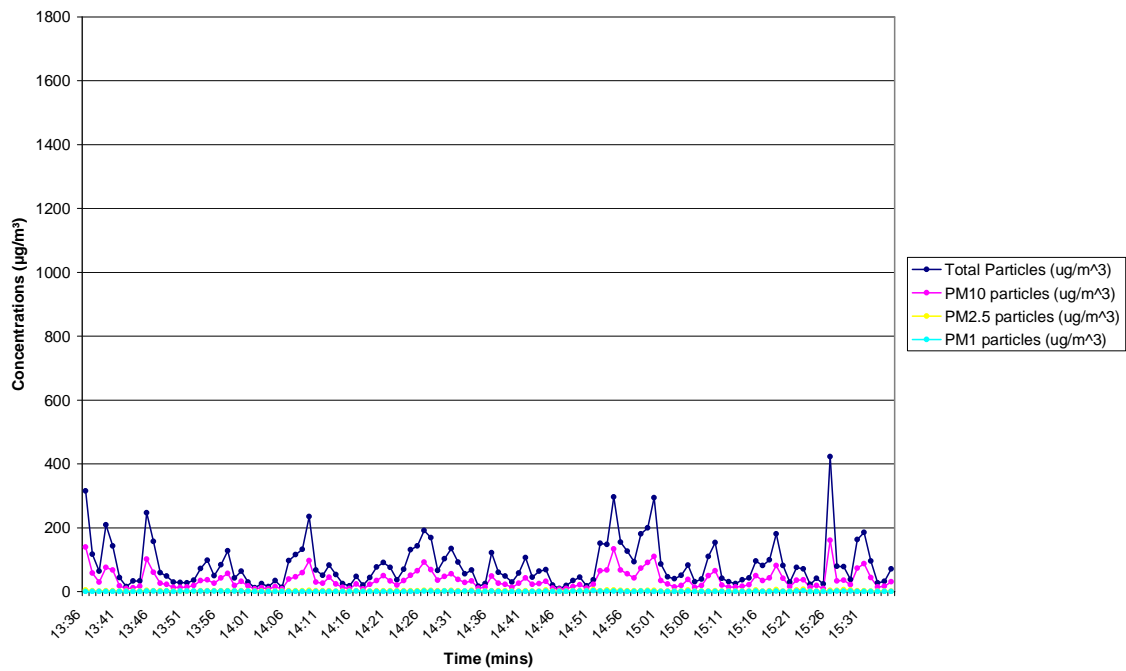
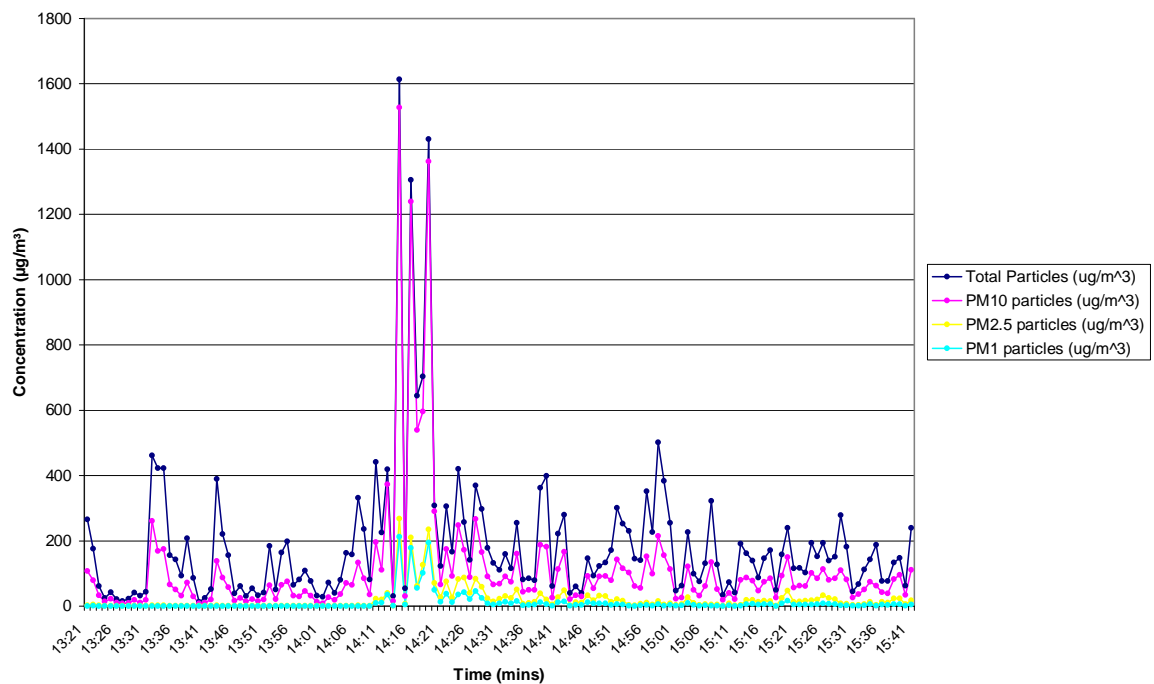


Figure 6 Test 3 – TN 2300



Test 4: Site office

Figure 7 and 8 demonstrate that the levels during Test 4 were comparable to those monitored during Test 1. During Test 4, the monitors recorded similar levels of particulates, although TN 2127 recorded slightly higher levels throughout. At the start and end of the monitoring period, a peak in concentrations was recorded. These results indicate that the levels at the site boundary after completion of the burn programme were not significantly affected by the trial burning carried out previously, as would be expected.

Figure 7 Test 4 – TN 2127

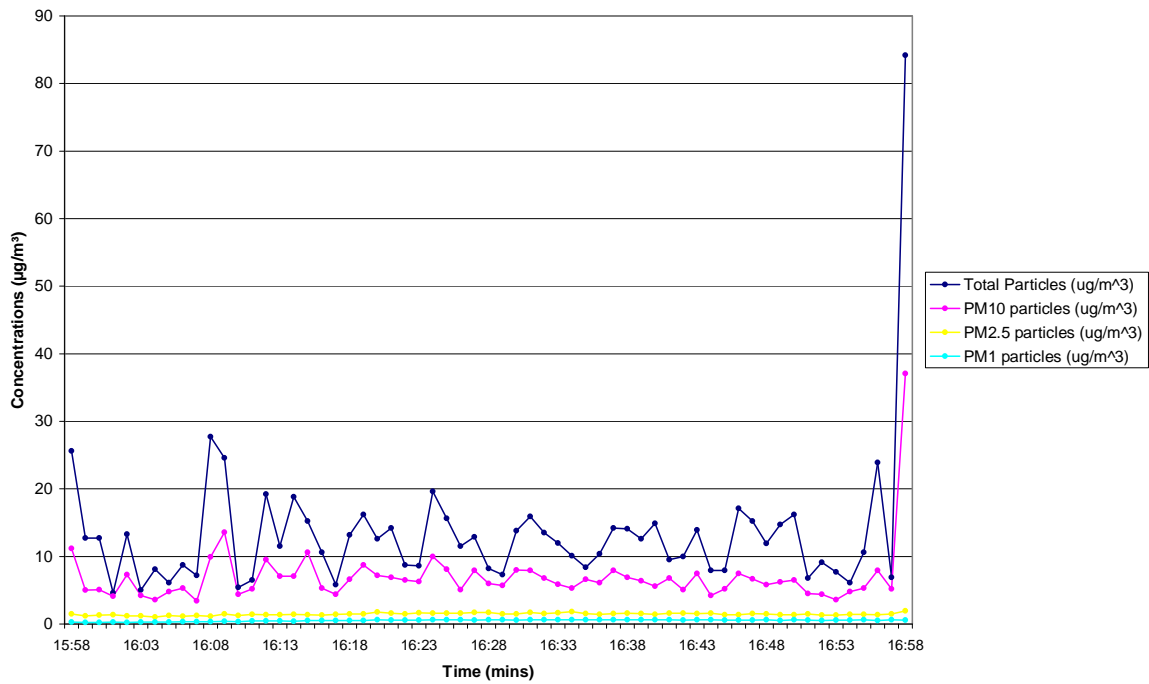


Figure 8 Test 4 – TN 2300

