AIR POLLUTION IN WINCHESTER
A Survey 2013
Report to Network for Clean Air / Clean Air UK

1. Summary

Winchester Friends of the Earth (WinFoE) carried out an air quality survey in the town centre in the summer 2013. It was provided with the equipment for this survey, as part of Citizen Science project, by Network for Clean Air (http://www.cleanairuk.org/).

Diffusion tubes designed to measure Nitrogen Dioxide (NO_2) levels were placed around the city of Winchester for a month. The tubes were analysed by a laboratory, which returned results giving equivalent annual mean NO_2 levels.

Winchester has a known pollution problem. Levels of NO_2 in the centre have been stubbornly above thresholds permitted by both EU and UK legislation. Because the District and County Councils for Winchester have shown no disposition to do anything about the problem, WinFoE and the Winchester Green Party took the step of making a formal complaint to the European Commission at the end of 2012. This complaint is ongoing and has been amalgamated with other complaints in the South East of England and awaits the outcome of a reference to the European Court of Justice by the UK Supreme Court, before proceeding further.

This project adds to existing community involvement in air pollution surveys. A local school carried out its own survey near its premises in 2010-11, with the assistance of the technical officer on the Council.

Our survey sought to complement existing Council surveys, with some similar sampling locations and some placements filling gaps in our knowledge. Largely our data agreed with the pattern of previous surveys, adding weight (and coverage) to the clearly demonstrated problem for residents of the area. The biggest discrepancy was with the school project data. Our survey showed a relatively low level near the school, whereas the previous project had shown levels around the EU permitted threshold. As the car park next to the school is a somewhat open area we have surmised that month-long survey may be susceptible to unusual prevailing wind conditions, but we are unable to demonstrate this and the discrepancy remains unexplained.

Since Winchester Councils (apart from the technical officer) appear unwilling to take the problem of air pollution seriously and indeed are perversely adopting policies and measures that can only worsen it, WinFoE intends to go back to the European Commission with further and better particulars on the nature of the problem and the lack of progress in addressing it. This survey will contribute to the information we provide the Commission.

2. Background

2.1 *General*

2.1.1 Winchester Friends of the Earth (WinFoE) has been involved in pressing for sustainable environmental policies in Winchester for at least 37 years, to a large extent, but not entirely concerned with transport policy and its environmental effects. The Winchester branch of the Green Party (WinGP) has also been active in recent years in Winchester, pressing for policies that will encourage and permit true local sustainability.

2.1.2 Air pollution in Winchester has been a significant cause for concern. Winchester City Council has been taking air quality measurements since 2003, when exceedances of EU Directive thresholds in both PM_{10} particulates and NO_2 necessitated the declaration of an Air Quality Management Area (AQMA).

2.1.3 The street pattern in central Winchester is essentially mediæval. Because the narrow streets make it difficult to accommodate higher traffic levels, the local authority many years ago opted for one-way systems, rather than seek to limit the amount of traffic in the City centre. The one-way circulatory system essentially results in significantly more vehicle-km within the city centre than would be the case with simple in-out radial access. The main (as distinct from background) all-year monitoring station is in a busy part of the centre, by St George's Street. Diffusion tubes distributed around the town are also regularly monitored.

2.1.4 There may be geographical factors of importance here, because this area lies essentially in the main river valley of Winchester, with significant uphill gradients of downland immediately to the east of and a long upward gradient to the west. Diffusion tube results, however, do also indicate other areas of concern besides the city centre, even on higher ground to the west (Romsey Road).

2.1.5 Winchester is a largely bypassed town and is not or need not be affected by significant through traffic. Air pollution in Winchester is not imposed by matters beyond the control of local authorities (Winchester City District Council and Hampshire County Council); traffic in Winchester is of the authorities' own making.

2.1.6 The *Network for Clean Air* inspires action by people and communities to improve air quality in their locality (to EU/WHO air quality standards) thus promoting better health and tackling global warming. The Network for Clean Air promotes the exchange of skills, experience, knowledge and mutual support by groups and individuals to this end.

2.1.7 Network for Clean Air / Clean Air UK (NCA) have a project, *Community Clean Air Campaigning*, which sets out to support environmental campaigning: against Silver Town Road tunnel in East London, City Airport/ London; in Winchester and Oxford through sampling air quality by community groups. This project aims to build participation in environmental campaigning by people who oppose road building, more road traffic and flights. The project will measure air pollution – mostly traffic pollution - using low cost

kits (Nitrogen Dioxide diffusion tubes) which are easy to use but sufficiently accurate to also be used by local authorities and Government to measure pollution.

2.1.8 NCA provided 25 diffusion tubes to Winchester Friends of the Earth, which were deployed in late June 2013.

2.2 *European Complaint*

2.2.1 WinFoE and WinGP are joint complainants under the provisions of the EC Ambient Air Quality Directive (Annex XI) for mean annual NO_2 concentrations, for persistent failure to take action to meet the strictures of the Directive.

2.2.2 We submitted the complaint in November 2012; it was accepted for consideration in February 2013 under reference number CHAP(2012)03464. In a communication in December 2013 the Commission has indicated that it will be amalgamating our complaint with others in the SE region of the UK and is awaiting the outcome of the European Court of Justice consideration following the successful action of Client Earth v. UK Government in the UK Supreme Court.[1]

2.2.3 Since making our complaint the local authorities, far from taking any action towards meeting their obligations, have been taking more and more measures in the direction of increasing road traffic through the most affected areas.

3. Existing Data

3.1 *The Bottom Line*

3.1.1 There are strict limits for air pollutants laid out by both EU and UK law. Winchester fails to meet the annual mean NO_2 target in the centre of Winchester (and spot measurements elsewhere, e.g. on Romsey Road, also indicate a likely problem with this measure). It appears that this is not a target that will be reachable merely with the passing of time, through car technology improvement (as PM_{10}[2] appears to have been).

3.1.2 Even if the PM_{10} levels are below the required threshold, they are not declining and remain high enough to be computable as health risks. Quantification of health effects is hard to come by in unambiguous form. In a study cited by the DoH[3] a quantitative life expectancy change is computed for $PM_{2.5}$ and compared with other risks, specifically motor vehicle accidents and passive smoking.

3.1.3 The study shows that a $10\mu gm^{-3}$ drop in $PM_{2.5}$ buys 220 days of additional life expectancy, compared with 56 days if all UK motor vehicle accidents were eliminated and 75 days if

[1] See http://www.clientearth.org/201305012170/news/press-releases/supreme-court-rules-uk-government-is-breaking-air-pollution-laws-2170

[2] We are acutely aware that air pollution from sub-10µm particulates is increasingly being seen as a major health issue, but, as far as we know, neither the EU nor the UK have yet acknowledged this research or defined appropriate target levels.

[3] *Comparing estimated risks for air pollution with risks for other health effects;* BG Miller and JF Hurley, *Institute of Occupational Medicine* Research Report TM/06/01; March 2006

passive smoking were got rid of. We do not know how PM_{10} exposure compares or how much of $PM_{2.5}$ exists within the PM_{10} measure in Winchester. If the statistics for PM10 and PM2.5 were similar then we could determine a life expectancy cost for Winchester.

3.1.4 The most recent data for Winchester (2012) of 35µgm^{-3} would imply a reduction in life expectancy of more than 1½ years. The assumption of PM_{10} and $PM_{2.5}$ equivalence may be poor and not many people in Winchester will be subject to this level of pollution all the time (fall-off is rapid away from road edges), but this ought to be a warning that we do not take particulate pollution seriously enough.

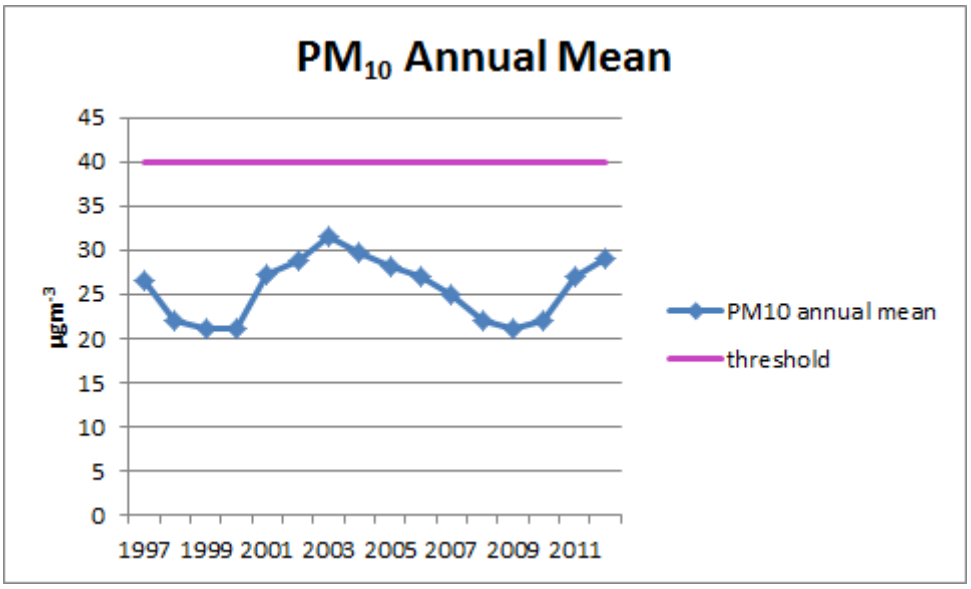


Figure 1 Particulate levels in central Winchester

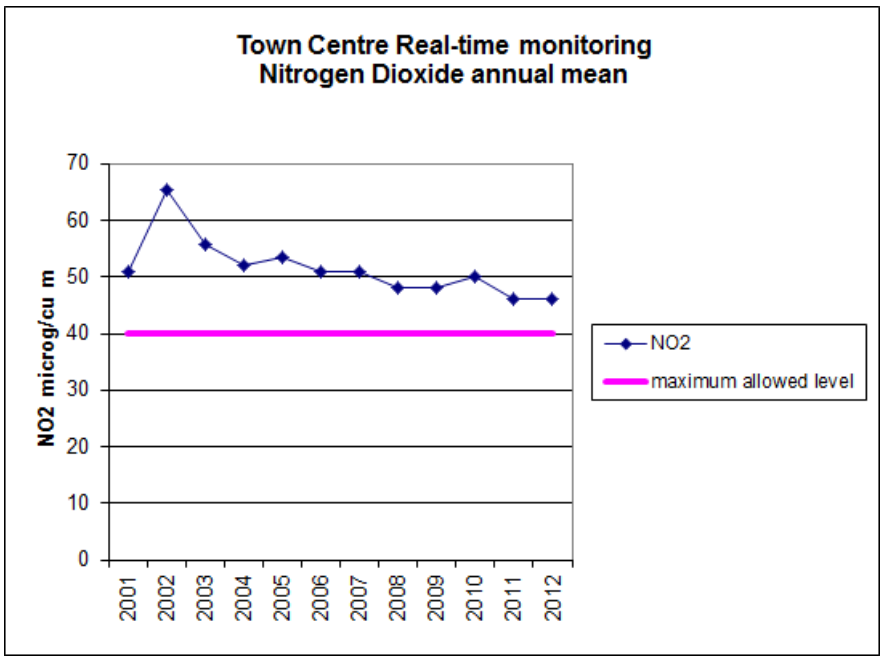


Figure 2 Continuing NO_2 failure

3.1.5 Almost since the declaration of the AQMA in 2003, and certainly since the publication of the Air Quality Action Plan (AQAP) in 2006, there has been little significant diminution in the annual mean NO_2 concentration, and there are several diffusion tube hotspots which are consistently close to 50% above threshold.

3.2 *Details*

Figure 3 Diffusion tube sites

3.2.1 In Figure 3 we show the location of diffusion tubes deployed by the City Council in its last report period. These appear as blue circles or ellipses. The permanent monitoring station (from which the data in **Figure 2** is obtained) is also located at blue circle 6. It is clear that most measurements are within the central area bounded by the railway on the west and the river on the east, though there are points of pollution concern outside this.

3.2.2 There is a central circulatory system roughly around a figure-of-eight configuration. We show this central area at greater resolution in Figure 4 below.

3.2.3 One would expect St George's Street to be a main candidate for a pollution hotspot. It is a narrow canyon street in the Itchen river plain, carries two lanes of traffic accessing or leaving the city centre as well as east-west traffic movements. There are only three east-

Figure 4 Diffusion tube locations in central area

west routes, one of which is off-map to the south of Figure 3[4] and can be regarded as a peripheral route. Regional or trunk east-west movements are only sensibly achieved in normal travel hours by routes that avoid Winchester. The complementary road to St George's Street (carrying traffic west to east) is North Walls. This generally has a more open aspect with lower building heights and does not have pollution levels as high as those pertaining in St George's Street. On the other hand, unlike the largely

[4] The southern road crossing the river shown in Figure 3 is in fact a gated road.

commercial/shopping nature of St George's St., it is dominated by terraced housing, often very close to the road, so that the pollution will have more effect on residents there[5].

3.2.4 It turns out, however, that the highest pollution levels are not confined to St. George's Street, but hotspots also occur in Jewry Street and especially and consistently in Romsey Road west of the circulatory system.

3.2.5 In Figures 2-3 we show the locations (as red circles and ellipses) of the diffusion tubes placed for this project.

4. The Project

4.1 *Method*

4.1.1 25 diffusion tubes were provided by NCA. The tubes were of clear plastic and were provided with a fixed (top) end cap and a removable (bottom) end cap. Each tube came provided with a simple plastic grip with a self-adhesive pad and a long cable tie that could secure the holder to most sizes of vertical poles forming normal street furniture.

4.1.2 The tubes were placed at about 7ft above ground level. After placement the bottom caps were removed. Time and placement of tubes was recorded. All tubes were placed in a single day (21st June). The location was photographed as a record (see Appendix 1). There were two non-standard placements. One (No. 3 – see Appendix) was on the outside of a basement window, to compare with an additional tube on a street-post outside. Another was placed in a multi-storey car park. While one would expect pollution at such a site, it was thought worth testing because part of the car park is a work area (several offices, but

[5] St George's St. does have some housing however.

also a car valeting area). A tube was placed, with permission obtained from the staff, in the car valeting area, attached to a ceiling-hung pipe.

4.1.3 After 1 month the tubes were collected, examined visually and recapped. Time and date of collection were recorded. The visual examination was to determine whether any significant impeding of the tube had taken place. Several were found with traces of spider web, but none of these seemed to be significantly blocked. Four tubes were missing at the time of collection.

4.1.4 Tubes were sent to the issuing laboratory, Environmental Scientifics Group, for analysis. Results were returned in the form of a spreadsheet with a computation of the raw equivalent annual mean NO_2 exposure, together with a bias-correction (see discussion in §5 below).

4.2 *Community Involvement*

4.2.1 There is a primary school, St Bede's, which backs on to a car park[6] next to one of the busiest roads, North Walls. Parents and children have been concerned about the levels of pollution in the vicinity of the school and on the approaches to it.

4.2.2 St Bede's ran an air quality monitoring project in 2011. This is reported on the school website: http://www.stbedewinchester.co.uk/eco.asp, from which the following is extracted:

> *The eco team at St Bede School is working on an Air Quality Monitoring Project with the help of Winchester City Council. Winchester is falling short of the government approved level for air quality in certain areas of the city and we therefore decided to do our own study in the school and the immediate area. A local company, Gradko generously donated diffusion tubes to measure the levels of NO2 (nitrogen dioxide) in the air. This gas is a pollutant that affects our ability to uptake oxygen and is a trigger for asthma (although not a cause). NO2 is generated when something is burned and therefore combustion engines (cars) are the biggest source. The tubes have been positioned by the eco team at three locations; the school, St Peter's car park and Winnall Nature Reserve for a month at a time at each location. Gradko is also processing the results free of charge. According to Winchester City Council the annual mean level of NO2 permissible in the UK is 40 µg/m³ (micrograms per cubic metre). The results:*
>
> *Nature Reserve:* *23µg/m³*
> *School:* *33µg/m³*
> *Car Park:* *39µg/m³*
>
> *These results are in line with the results of the city council's own monitors (of which there are 30 around the city). Obviously the car park level is nearing the acceptable limit of NO2 and as a school we need to raise the profile of this problem. There are many ways in which the eco team together with the whole school can do this.*

[6] Ironically this car park was itself a primary school that moved to the edge of Winchester. The City Council turned it into a car park in the early 1980s, promising that it would only be temporary while a major multi-storey car park was built. The promise has never been kept.

4.2.3 The project involved the children in many ways including a poetry competition, of which the winning entry by Emma Bardsley, entitled *Air Pollution*, was:

The car called out "Let's go for a race"
"No way", I said, "You'll ruin this place"

The plane said "Come with me, I'm a flying ace"
"No way", I said, "You'll ruin this place"

The lorry coughed, "Pick me, I've got space"
"No way", I said, "You'll ruin this place"

The motorbike offered, "A game of chase?"
"No way", I said, "You'll ruin this place"

My bicycle shouted "Come check out my pace"
"Good choice", I cried, "You won't leave a trace".

4.2.4 At the time of the submission of the European Complaint (see §2.2) WinFoE and WinGP joined with parents and children from St Bede's School in a demonstration in the St Peter's car park.

4.2.5 Edward (11) who had been involved in the school project also helped with this project. He said:

The problem with air pollution that comes from cars and lorries, is that we can't see it. It is very bad for our health but we can't see it as we breathe it in. I have done an air quality project with diffusion tubes at my school which is quite near a busy road. The good thing about diffusion tubes is that they capture the nitrogen dioxide which is one of the chemicals in fumes so we can measure how dirty the air is. We put some diffusion tubes near our school and found that the air is very dirty - which worries me when we are out at playtime. Now we are doing a similar experiment with Winchester Green Party and I would like to see what the results are this time round. Whenever I walk past a stationary car that has its engine running I think to myself I wish they would turn it off, so I don't breathe in nasty things.

5. Results

5.1.1 Data was provided by NCA in both raw form converted to an annual mean measure and a bias-corrected form. We are not clear about how the bias factor is calculated, since it would seem to be a function of place and time. The bias factor employed by NCA does not compare well with the biases used by WCC in its analyses.

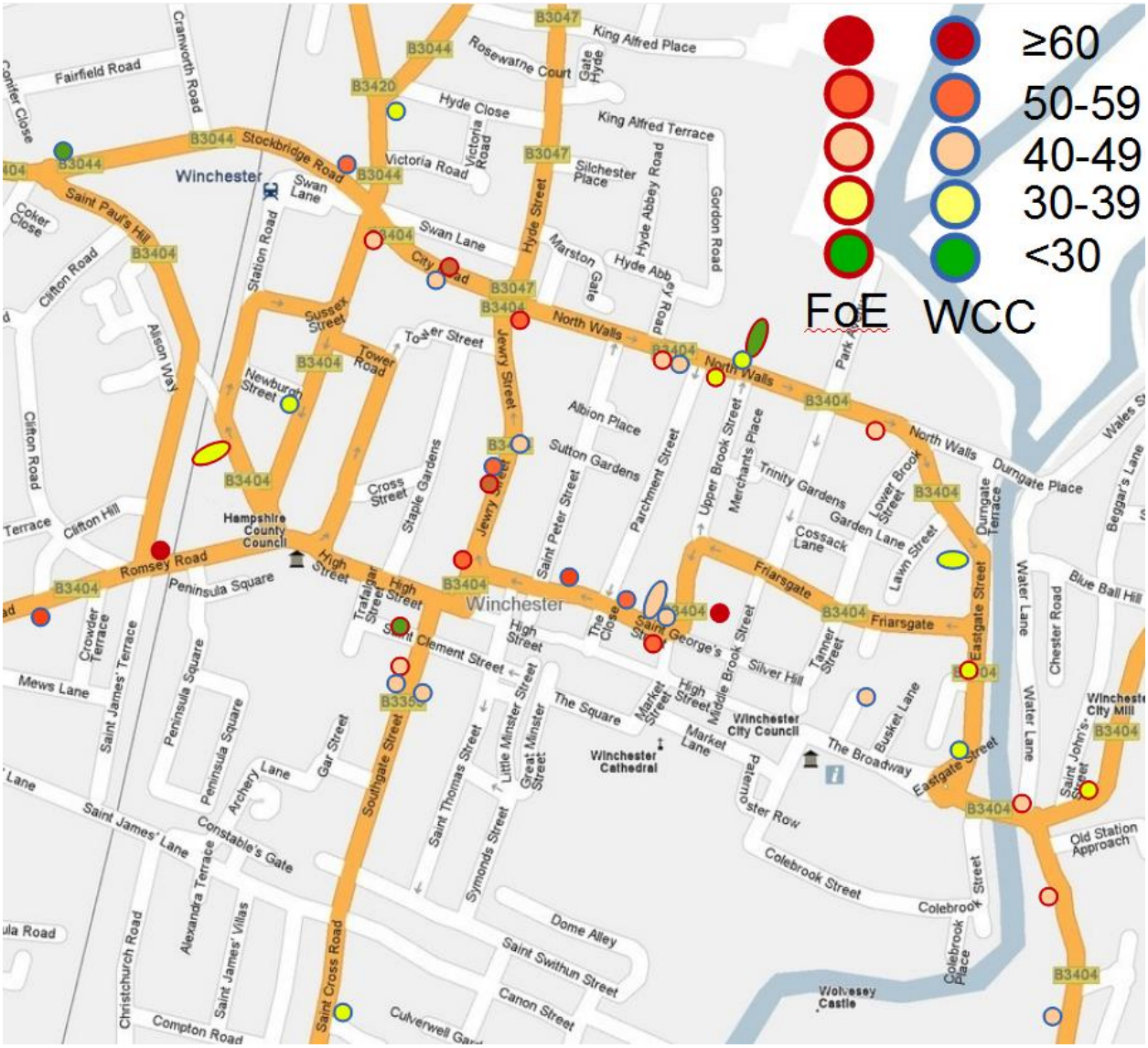
5.1.2 Since our main purpose is to supplement existing data with data for sites not previously measured by WCC, we have calculated a bias factor that appears best to reconcile previous WCC data to our own. To do this we compared a subset of locations that closely match those of WCC data[7] (see Figure 4) and found the mean ratio between our project raw data and that of the most recent WCC data (2010). We argue that **Figure 2**suggests 2013 data is unlikely to be significantly different from 2010 data. This ratio we call B-Bias.

5.1.3 Another ratio could be computed. We note that the 4 diffusion tubes (WC6-9) placed by the automatic station in 2010 show an average 45.8 μgm^{-3}, whereas the automatic station itself shows 50 μgm^{-3} for 2010. This suggests that diffusion tubes are biased down from the more accurate automatic station by about 8.3%. We call the bias represented by this factor together with the B-Bias, the C-Bias.

Sample Number	Site	Date and Time ON	Date and Time OFF	Exposure Time (Hours)	Total µg	raw data $\mu g\ m^{-3}$	Comments	bbias: using average bias of comparison WC2010 FoE diff tubes	cbias:using average bias of comparison WC2010 FoE * bias of automatic and colocated WC
WINCH/13A/NA1S1	Upper High Street 1 - Post	21/06/2013 10:30	22/07/2013 18:20	752	2	39		36	42
WINCH/13A/NA1S2	Romsey Road	21/06/2013 10:50	22/07/2013 18:25	752	3	64		60	70
WINCH/13A/NA1S3	Upper High Street 2 - Window	21/06/2013 16:05	23/07/2013 10:35	763	2	37		35	41
WINCH/13A/NA1S4	St Clement Street	21/06/2013 15:45	22/07/2013 20:05	748	1	23		21	25
WINCH/13A/NA1S5	Southgate Street	21/06/2013 15:50	22/07/2013 20:00	748	2	43		40	47
WINCH/13A/NA1S6	Gladstone Street						Missing		
WINCH/13A/NA1S7	Stockbridge Road East	21/06/2013 11:05	22/07/2013 18:30	751	3	57		53	62
WINCH/13A/NA1S8	Stockbridge Road Mid						Missing		
WINCH/13A/NA1S9	City Road (Carfax)	21/06/2013 11:15	22/07/2013 18:40	751	2	46	Spider's Web	43	50
WINCH/13A/NA1S10	Jewry Street (Delunn)	21/06/2013 11:20	22/07/2013 18:45	751	3	55		51	59
WINCH/13A/NA1S11	North Walls (Austen)						Missing		
WINCH/13A/NA1S12	North Walls (Picture Shop)	21/06/2013 11:30	22/07/2013 18:50	751	2	45		41	49
WINCH/13A/NA1S13	North Walls (Near Café)	21/06/2013 11:30	22/07/2013 19:20	752	2	40		37	44
WINCH/13A/NA1S14	St Peters Car Park By School	21/06/2013 11:35	22/07/2013 19:10	752	1	16		15	18
WINCH/13A/NA1S15	St Peters Car Park Island	21/06/2013 11:35	22/07/2013 19:15	752	1	14	Spider's Web	13	15
WINCH/13A/NA1S16	North Walls (SE)	21/06/2013 11:40	22/07/2013 19:25	752	3	51		48	56
WINCH/13A/NA1S17	Eastgate street	21/06/2013 11:50	22/07/2013 19:35	752	2	37	Spider's Web	34	40
WINCH/13A/NA1S18	Chesil Theatre	21/06/2013 11:55	22/07/2013 19:40	752	2	44	Spider's Web	40	47
WINCH/13A/NA1S19	SGS (McDonalds)	21/06/2013 12:20	22/07/2013 19:50	752	3	55		51	60
WINCH/13A/NA1S20	SGS (Royal Oak)						Missing		
WINCH/13A/NA1S21	Jewry Street (Greens)	21/06/2013 12:25	22/07/2013 19:55	752	3	55		51	60
WINCH/13A/NA1S22	Jewry Street (Multiyork)	21/06/2013 12:25	22/07/2013 19:58	752	3	62		57	67
WINCH/13A/NA1S23	Brooks Car Park Wash	21/06/2013 12:15	22/07/2013 10:05	742	4	74		68	80
WINCH/13A/NA1S24	Morn Hill	21/06/2013 12:05	22/07/2013 19:43	752	2	38		35	42
WINCH/13A/NA1S25	Water Lane Corner	21/06/2013 12:05	22/07/2013 19:45	752	3	50	Spider's Web	46	55

5.1.4 Conservatively we choose the B-Bias. We plot the results:

[7] Locations (FoE:WC)=(19:mean6-9); (22:13); (12:18); (5:mean14-15); (9:17)



5.1.5 The general picture is very similar to the WCC results and the new data tends to fill in some previously unsurveyed locations. The majority of problems occur on the main roads in the central circulatory system. There are specific locations of interest

5.1.6 Romsey Road: This is the highest street result and is consistent with previous WCC results further along this road. The result is slightly surprising since this road is not so obviously canyoned as other roads and it is uphill and out of the river valley, so one would expect more exposure to dispersing winds. It may be that the slope of the road results in more engine revving. Our result, however, is for the north side of the road which is the downhill side. The WCC results are from the south side and further west, but show similarly high values.

5.1.7 Upper High Street: The site chosen is the address of the author of this report. It has the convenience of a basement window and a street sign pole outside. This allows both a normal tube siting and the ability to check how pollution levels apply at an actual residence boundary. The basement window is by a ventilation grid, so that pollution levels can be deemed to be experienced within the basement itself, an inhabited sitting room.

5.1.8 At 36 µgm^{-3}, the pollution level at the signpost comes close to but does not exceed the allowed threshold. The window-mounted sample showed a very similar 35 µgm^{-3}. Our understanding hitherto was that pollution levels have a very sharp drop-off away from the source of the pollution. The pole is about 2.5m from the carriageway by virtue of a line of parked cars (low turnover – i.e. probably little contribution from the parking cars), whilst the window is a further 1.6m from the carriageway. Perhaps the fact that the window location is about 2.1m below the pole offsets the fall-off with distance from road (presumably NO_2 is around 50% heavier than air).

5.1.9 Since Winchester has a fair number of occupied basements, including basement flats, it seems unwise to presume that the prevailing level of pollution in streets is not substantially experienced within residential properties.

5.1.10 St. Peter's Car Park: levels observed here were surprisingly low. Certainly the tubes were placed perhaps 50m away from a road, but it is a car park and the result for the post alongside the St Bede's School fence, at a (corrected) 15 µgm$^{-3,}$ seems very much at odds with the figures of 33 and 39 µgm^{-3} found in the school project for very close locations (see §4.2.2). Unfortunately we have no WCC data for a third source. We do have data on car park use and there appears to be no significant difference in the occupancy of St Peter's car park between the school project date and the current survey date.

5.1.11 It is possible that there were significant differences in wind conditions between the 2011 school project survey and our survey. Because the car park is a wide-open space off the canyon of North Walls, emissions from North Walls traffic may or may not cross that space according to the prevailing wind direction at the time of survey. Any northerly winds would blow from the school towards North Walls.

5.1.12 There is a website that gives historical wind direction data for Winchester. The January 2011 data suggests a north-easterly predominance of the wind (and hence an expectation that pollution levels would be lower), though it is not clear that the directions given are standard meteorological convention. Weather data for the period of this survey have not yet appeared on the website. But if January 2011 weather data is right there is no easy explanation of the discrepancies in air pollution measures between 2011 and 2013.

5.1.13 Brooks Multi-storey Car Park: The pollution level here is seriously high (nearly 50% above the EU permitted threshold on our most conservative allowance for bias). This is public space, though we assume most public will spend very little time in it. Nevertheless there are people working in this area and specifically the sample we placed (with permission of one of the people working there) was located in the work space of an enterprise that cleans people's cars. We need to make sure that the management of this space are aware of the conditions their staff are exposed to.

6. Future Action

6.1.1 Winchester has an air pollution problem. Our results simply reinforce this view. In spite of the fact that the technical officer on the Council is carrying out good work in monitoring the problem there is no willingness on the part of Councillors or higher executive officers to address the problem. Indeed, in recent months, the Council have been progressively adopting policies which seem almost perversely designed to worsen the problem.

6.1.2 It is clear that the problem must arise from road traffic. The Council has consistently taken measures that can only increase the levels of road traffic in central Winchester and indeed the town is now close to gridlock throughout the working day. Council developments, strategies and policies in the pipeline are all encouraging additional traffic.

6.1.3 WinFoE and WinGP are proposing to go back to the EC in the next month with further and better particulars, especially drawing attention to the continuing perverse Council behaviour in this matter.

6.1.4 The discrepancy in observations for the St Bede's School area remains unresolved and is somewhat worrying. We should consider undertaking further surveys here.

Appendix 1 The tube locations

1. Upper High Street

2. Romsey Road

3. Upper High Street (Window)

4. St. Clement's St.

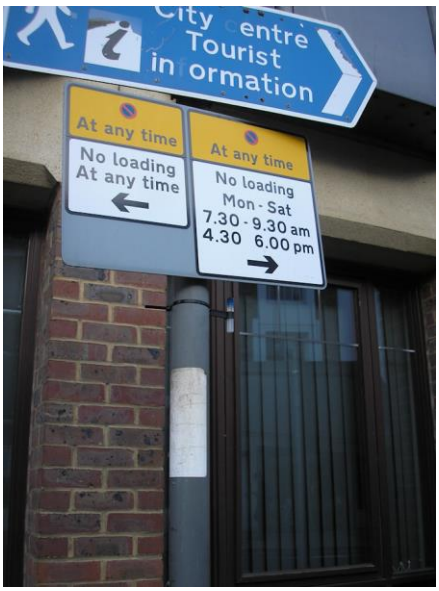
5. Southgate Street

6. Gladstone Street

7. Stockbridge Road East

8. Stockbridge Rd/ Cranworth

9. Carfax



10. Jewry/North Walls de Lunn

11. North Walls Austen House

12. North Walls opp Hyde Abbey Rd

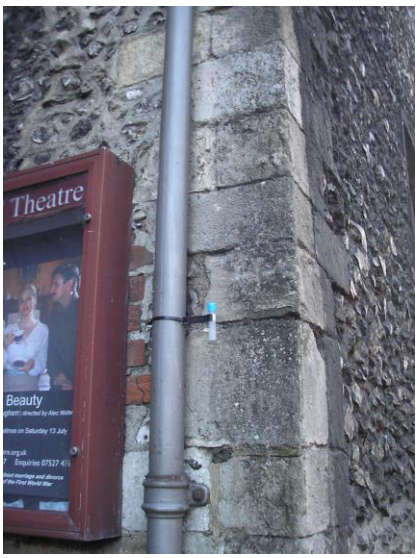
13. North Walls by Parchment St

16. North Walls SE

14. St Bedes School

17. Eastgate Street

15. St Peter's Car Park



18. Chesil Theatre

19. Macdonalds St Georges St

22. Jewry St Multiyork

23. Brooks Car Park car wash – no picture

20. Royal Oak SGS

24. Morn Hill

21. Jewry St Greens

25. Water Lane