Borough Council of
King's Lynn &
West Norfolk

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Air Quality Monitoring at King's Lynn Bus Station Taxi Rank

1 Introduction

Following concerns raised by some licensed hackney carriage drivers, members from the Environmental Quality Team have carried out additional air quality monitoring to assess air quality levels at the undercover taxi rank location on the ground floor of the Old Cattle Market (Sainsbury's) Car Park**.**

2 Background

The Borough Council has for several years monitored levels of Nitrogen Dioxide (NO_2) around the bus station in King's Lynn as part of its ongoing statutory duty to review and assess air quality across the Borough. Monitoring at the bus station follows the statutory guidance for a location where members of the public may stay for up to one hour adjacent to a source of NO_2. Therefore the relevant air quality objective is the one hour short term objective (200 ug/m^3), rather than the annual mean objective (40 ug/m^3). These levels are reported annually in the Borough Council's air quality report and no exceedances of the one hour objective have been monitored.

When the taxi rank moved to its current location an additional NO_2 diffusion tube was place in January 2015 at the head of the new rank. The previous monitoring location at Bay 5 has now been relocated to under the new canopy area at the bus station. These results are available on the Borough Council's webpage. The current results at either location show that levels are below the air quality standards for NO_2.

3 Additional Monitoring

Following the concerns being raised by the taxi trade, additional air quality monitoring has taken place at the new taxi rank. Discussion with the taxi trade indicated the Tuesday's and Friday's were the most suitable days to carry out the monitoring. The first round of monitoring

took place in August/September 2015 and a second round of monitoring took place in December 2015 so any season difference could be identified.

The Council have used a short term method of monitoring called Dräger tubes which sample the air for a few minutes only. This gives a better idea of what people would be exposed to when waiting or moving about in the taxi rank area. A hand pump is used to draw air through the Dräger tube a specified number of times over a given time period. The tube will indicate the level of that pollutant at that moment in time. In August 2015 measurements were taken in this way for Nitrogen Dioxide, Carbon Monoxide, Benzene and Sulphur Dioxide. In December 2015 measurements were taken in this way for Carbon Monoxide, Benzene and Sulphur Dioxide.

During the first round of monitoring concerns were raised that levels were only being monitored at the head of the taxi rank (Location 1) so an additional monitoring point (Location 2) located at the centre of the taxi rank was also used. Both of these monitoring locations were used in December.

A different form of Dräger tube was used to measure the levels over an 8 hour period for three pollutants; Carbon Monoxide, Carbon Dioxide and Sulphur Dioxide. This again was repeated at both locations in August/September and December.

The monitoring results are shown in the Appendix.

Conclusions

The monitoring data using Diffusion Tubes shown in Table 1 and indicates that there are no exceedances of either the annual mean objective or short term objective for Nitrogen Dioxide. It should be noted that levels inside the new taxi rank are consistently below the levels that were monitored previously externally at the bus station bay 5. These levels indicate that there is no impact on human health.

The short term Dräger tubes results are shown in Tables 2 and 3. These results indicate that the levels were at background or limit of detection. The only exception to this was during the monitoring in August 2015 when a vehicle started its engine and pulled away during a measurement and a small amount of Carbon Monoxide was detected. Both the measurements taken in August 2015 and December 2015 indicate that there is no impact on human health.

The long term passive Dräger tubes results are shown in Tables 4 and 5. Both rounds of monitoring found the levels of Carbon Monoxide and Sulphur Dioxide to be either at background or limit of detection levels. Low levels of Carbon Dioxide were measured during both rounds of monitoring and these were well below the long term workplace exposure limit of 5000ppm. These results from long term monitoring indicate that there is no impact on human health.

Appendix - Monitoring Results

Table 1 - NO_2 Diffusion Tubes Results (All results are in ug/m^3)												
	January 2015	February 2015	March 2015	April 2015	May 2015	June 2015	July 2015	August 2015	September 2015	October 2015	November 2015	December 2015
New Taxi Rank	39	35	31	29	26	29	33	31	30	30	34	30
Bus Station Canopy	56	50	*	*	*	*	35	Missing	36	42	36	36
*suspended – tube was removed whilst construction work was completed												
	January 2014	February 2014	March 2014	April 2014	May 2014	June 2014	July 2014	August 2014	September 2014	October 2014	November 2014	December 2014
Bay 5**	79	45	50	44	50	37	40	54	41	53	61	53
** Bay 5: these results are from 2014 before tube was relocated in January 2015. These results are to compare external and internal levels.												
NO_2 short term objective is 200 ug/m^3 not to be exceeded more than 18 times in any year. This equates to an annual mean of 60 ug/m^3 or more. The above results do not indicate a breach of the air quality standard for NO_2.												

Table 2 – Short Term Dräger Tubes Results - **August 2015**

Date	Time	Location	Duration	Pollutant	Result	Notes
17.08.2015	15:00 hrs	1	4 mins	NO2	<2 ug/m3	Location 1 at top of taxi rank
17.08.2015	15:00 hrs	1	4 mins	CO	<2 mg/m3	
17.08.2015	15:00 hrs	1	8 mins	Benzene	<2 ug/m3	
18.08.2015	10.20 hrs	1	4 mins	NO2	<2 ug/m3	
18.08.2015	10.20 hrs	1	4 mins	CO	<2 mg/m3	
18.08.2015	10.20 hrs	1	8 mins	Benzene	<2 ug/m3	
18.08.2015	12.50 hrs	1	4 mins	NO2	<2 ug/m3	
18.08.2015	12.50 hrs	1	4 mins	CO	<2 mg/m3	
18.08.2015	12.50 hrs	2	4 mins	NO2	<2 ug/m3	Location 2 in middle of taxi rank
18.08.2015	12.50 hrs	2	4 mins	CO	5 mg/m3	Adjacent parked car started engine and pulled away during measurement
21.08.2015	12.11 hrs	1	4 mins	NO2	<2 ug/m3	
21.08.2015	12.11 hrs	1	4 mins	CO	<2 mg/m3	
21.08.2015	12.11 hrs	1	8 mins	Benzene	<2 ug/m3	
21.08.2015	12.30 hrs	2	4 mins	NO2	<2 ug/m3	
21.08.2015	12.30 hrs	2	4 mins	CO	<2 mg/m3	
21.08.2015	12.30 hrs	2	8 mins	Benzene	<2 ug/m3	
21.08.2015	15:40 hrs	1	4 mins	NO2	<2 ug/m3	
21.08.2015	15:40 hrs	1	4 mins	CO	<2 mg/m3	
21.08.2015	15:40 hrs	1	8 mins	Benzene	<2 ug/m3	
21.08.2015	15.55 hrs	2	4 mins	NO2	<2 ug/m3	
21.08.2015	15.55 hrs	2	4 mins	CO	<2 mg/m3	
21.08.2015	15.55 hrs	2	8 mins	Benzene	<2 ug/m3	
25.08.2015	10.30 hrs	1	6 mins	SO2	<1 mg/m3	
25.08.2015	10.30 hrs	1	4 mins	CO	<2 mg/m3	
25.08.2015	10.30 hrs	1	8 mins	Benzene	<2 ug/m3	
25.08.2015	10.30 hrs	2	6 mins	SO2	<1 mg/m3	
25.08.2015	10.30 hrs	2	4 mins	CO	<2 mg/m3	
25.08.2015	10.30 hrs	2	8 mins	Benzene	<2 ug/m3	
25.08.2015	13.30 hrs	2	6 mins	SO2	<1 mg/m3	
25.08.2015	13.30 hrs	2	4 mins	CO	<2 mg/m3	

Notes: The above results do not indicate a breach of the air quality standards
Location 1 is at the head of the taxi rank.
Location 2 is adjacent to position 4 on the taxi rank.

Table 3 – Short Term Dräger Tubes Results - **December 2015**						
Date	Time	Location	Duration	Pollutant	Result	Notes
18.12.2015	11:34 hrs	1	4 mins	CO	<2 mg/m3	Four taxis in rank with engines running
18.12.2015	11:40 hrs	1	6 mins	SO2	<1 mg/m3	Adjacent car started engine and reversed out of space
18.12.2015	11:48 hrs	1	8 mins	Benzene	<2 ug/m3	Two taxis left rank, car parked in adjacent empty space
18.12.2015	11:56 hrs	2	4 mins	CO	<2 mg/m3	Three taxis in rank
18.12.2015	12:01 hrs	2	6 mins	SO2	<1 mg/m3	Four taxis arrive at rank, seven on rank in total
18.12.2015	12:10 hrs	2	8 mins	Benzene	<2 ug/m3	Taxi arrives, eight on rank in total
18.12.2015	15:24 hrs	1	4 mins	CO	<2 mg/m3	No taxis in rank, adjacent car starts engine and leaves space
18.12.2015	15:30 hrs	1	6 mins	SO2	<1 mg/m3	No taxis in rank
18.12.2015	15:37 hrs	1	8 mins	Benzene	<2 ug/m3	No taxis in rank
18.12.2015	15:45 hrs	2	4 mins	CO	<2 mg/m3	No taxis in rank, taxi arrived and departed straight away
18.12.2015	15:50 hrs	2	6 mins	SO2	<1 mg/m3	No taxis in rank although taxi arrived and departed straight away
18.12.2015	16:00 hrs	2	8 mins	Benzene	<2 ug/m3	No taxis in rank, two cars start engines and leave adjacent spaces, one car arrives in adjacent space

Notes: The above results do not indicate a breach of the air quality standards
Location 1 is at the head of the taxi rank.
Location 2 is adjacent to position 4 on the taxi rank.

Table 4 – Long Term Dräeger Passive Tubes Results – **August/September 2015**

Date	Location	Time out	Time in	Duration	Pollutant	Result (ppm)	Notes
25.08.2015	1	09:00	15:00	6	SO2	0	0= below limit of detection
25.08.2015	1	09:00	15:00	6	CO2	667	
25.08.2015	1	09:00	15:00	6	CO	0	
28.08.2015	1	09:00	15:30	6.5	SO2	0	
28.08.2015	1	09:00	15:30	6.5	CO2	538	
28.08.2015	1	09:00	15:30	6.5	CO	0	
18.08.2015	1	07:55	15:55	8	SO2	0	
18.08.2015	1	07:55	15:55	8	CO2	500	
18.08.2015	1	07:55	15:55	8	CO	0	
18.08.2015	2	07:55	15:55	8	SO2	0	
18.08.2015	2	07:55	15:55	8	CO2	438	
18.08.2015	2	07:55	15:55	8	CO	0	
22.09.2015	1	08:00	16:00	8	SO2	0	
22.09.2015	1	08:00	16:00	8	CO2	438	
22.09.2015	1	08:00	16:00	8	CO	0	
22.09.2015	2	08:00	16:00	8	SO2	0	
22.09.2015	2	08:00	16:00	8	CO2	625	
22.09.2015	2	08:00	16:00	8	CO	0	

25.09.2015	1	08:00	16:00	8	SO2	0	
25.09.2015	1	08:00	16:00	8	CO2	500	
25.09.2015	1	08:00	16:00	8	CO	0	
25.09.2015	2	08:00	16:00	8	SO2	0	
25.09.2015	2	08:00	16:00	8	CO2	500	
25.09.2015	2	08:00	16:00	8	CO	0	
29.09.2015	1	08:00	16:00	8	SO2	0	
29.09.2015	1	08:00	16:00	8	CO2	562	
29.09.2015	1	08:00	16:00	8	CO	0	
29.09.2015	2	08:00	16:00	8	SO2	0	
29.09.2015	2	08:00	16:00	8	CO2	562	
29.09.2015	2	08:00	16:00	8	CO	0	

Notes:
The above results do not indicate a breach of the air quality standards
Location 1 is at the head of the taxi rank.
Location 2 is adjacent to position 4 on the taxi rank.
Workplace exposure limit for CO_2 is 5000ppm (8 hour time weighted average)

Table 5 – Long Term Dräeger Passive Tubes Results – **December 2015**

Date	Location	Time out	Time in	Duration	Pollutant	Result (ppm/hr)	Notes
18.12.2015	1	08:15	16:05	7hrs 45mins	SO2	0	0= below limit of detection
18.12.2015	1	08:15	16:05	7hrs 50mins	CO	0	
18.12.2015	1	08:30	16:05	7hrs 35mins	CO2	396	
18.12.2015	2	08:20	16:05	7hrs 45mins	SO2	0	
18.12.2015	2	08:20	16:05	7hrs 45mins	CO	0	
18.12.2015	2	08:20	16:05	7hrs 45mins	CO2	387	

Notes:
The above results do not indicate a breach of the air quality standards
Location 1 is at the head of the taxi rank.
Location 2 is adjacent to position 4 on the taxi rank.
Workplace exposure limit for CO_2 is 5000ppm (8 hour time weighted average)