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HEALTH & SAFETY LABORATORY

HSL Occupational Hygiene Section Site Visit Report

Measurement of VOC's and thermal comfort parameters at the Terminal Building, City Airport. London

Report Number	OH/LET/2009/FSA/101
Job Number	PH01000 A2040
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Persons seen	Alan Sharman Health & Safety Manager
Date of visit	26/06/09
HSL/HSE staff present	Vincent Sandys HSL John Crookes HSE FOD
Date of report	September 2009
Report distribution	John Crookes Karen Parkinson (FOD OH) OH Section archive
Report approval	Chris Keen

1. Introduction

The subject of this report is a visit made to City Airport, Hartmann Road, London, E16 2PX.

HSL was requested to visit this site and monitor the air quality in the international arrivals area located inside the terminal building. This request was made following complaints from members of staff that fumes from the aeroplanes using the airport are entering the terminal building and causing respiratory irritation.

The work was carried out by Vincent Sandys (HSL Senior Scientist) on the 26th June 2009.

2. Site Description.

London City is a small airport made up of one runway, the apron and two terminals. One of these terminals handles passengers using small executive aircraft while the other handles domestic and international flights. The number of air movements (take offs & landings) at the airport is approximately 80,000 per year.

The area of the airport where staff have made complaints, is the "airside" international arrivals building, and it is this that the remainder of the report will focus on.

Airside international arrivals is the part of the airport where passengers pass through border control, collect luggage and then pass through customs to enter the main terminal building. When an aircraft lands it is allocated a stand where the passengers alight and the aircraft is then unloaded/loaded and serviced. Prior to coming to rest and switching of the engines, the aircraft turn through almost 180 degrees so that the back of the aircraft faces the terminal building.

Passengers then transfer to border control and the baggage is transported to the carousel loading point outside the building. The aircraft stands are approximately 15-20 metres from the terminal buildings. HSL was informed that leaving engines idling while the aircraft is stationary is kept to a minimum. It wasn't possible to determine how long or often engines are left idling.

Inside the arrivals area there are staff that man the border control and customs, the numbers vary depending on passenger throughput. In addition to this there is a baggage enquiries desk staffed by up to 5 people and a small bureau de change staffed by one person.

3. Controls

The only area where ventilation equipment was noted in place to control the working environment was the baggage enquiries desk. For cooling there is a ceiling mounted air-conditioning unit that could be switched on by employees as required. This was used periodically on the day of the visit. In addition to this there are wall mounted Dimplex heaters that were not used on the day of the visit.

The doors that lead from the terminal building to the apron are kept closed as much as possible and any gaps sealed.

4. Methodology

4.1 General Strategy

Three sampling stations were chosen, two inside the terminal building close to manned workstations and one outside the building.

Station one was located on top of the cupboards behind the baggage enquiries desk, station two was placed on a pedestal in the border control area and station three on top of a drinks machine close to the area where the baggage carousel is loaded outside the terminal building.

At stations one and two, volatile organic compounds (VOC's), carbon monoxide (CO), carbon dioxide (CO_2), temperature and humidity were monitored throughout the visit. At station three only VOC's were sampled as a comparison to the internal samples.

Temperature and humidity were also measured in the bureau de change along side measuring equipment used by the airport safety team.

Air movement was assessed at station one and two.

4.2 Air sampling for VOC's

Static air samples were taken using a combined tenax and chromosorb 106 metal sorbent tube aspirated at 50ml/min. Samples were analysed by the Organic Measurement team, part of Analytical Sciences HSL Buxton, using gas chromatography with mass selective detection (GC/MS).

Sequential samples were taken at three locations throughout the duration of the visit. Full sample details can be found in table 1.

4.3 Carbon dioxide (CO_2) & Carbon monoxide (CO)

Carbon dioxide in air was monitored using both Anachem Anagas CD98 and Rae Systems MultiRae direct reading gas analysing instruments. These were set to log data continuously throughout the sampling visit. The MultiRae was also used to monitor levels of carbon monoxide.

4.4 Air temperature and humidity.

Air temperature and humidity were measured using Tinytag data loggers fitted with internal temperature and humidity sensors. These were placed at three locations and left for the duration of the visit.

4.5. Air movement.

Air velocity was measured at station one and station two using a TSI VelociCalc Plus anemometer. Air velocity was measured in the vicinity of the other monitoring equipment in a number of different orientations. In addition to this a number of readings were taken at station one while the air-conditioning unit was operating.

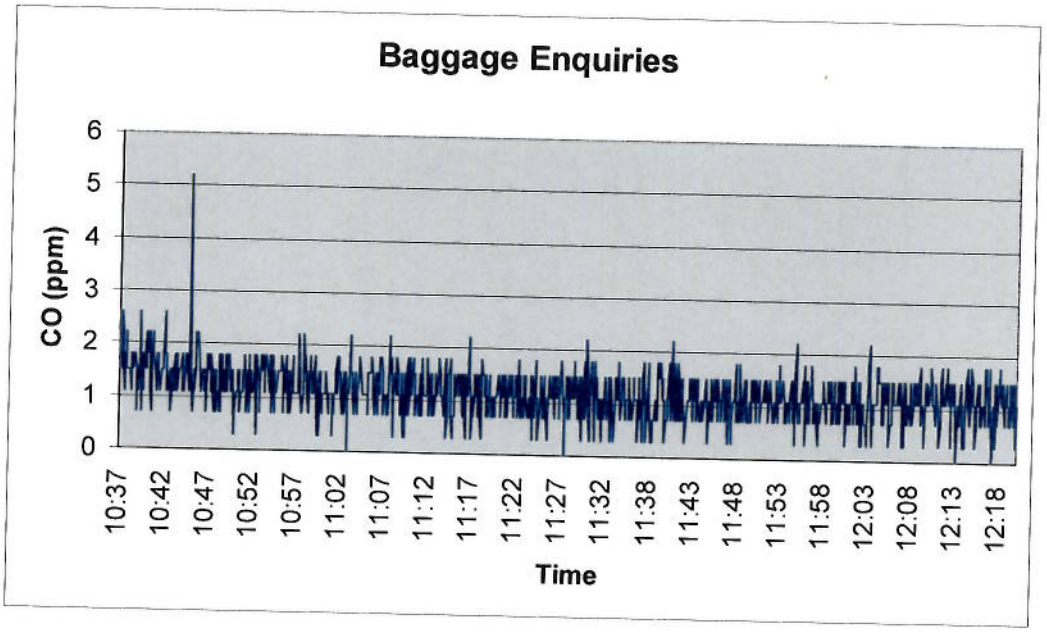
The reported results are the average of ten separate readings.

5 Results

5.1 Table 1. VOC's

Sample No.	Description	4C Alkanes (ppb)	Ethanol (ppb)	Acetone (ppb)	Benzene (ppb)	Toluene (ppb)	Ethylbenzene Xylene all isomers (ppb)	n-Alkanes nC7-nC14 (ppb)	Nonanal (ppb)	Decanal (ppb)	All other hydrocarbons (ppb)
04453/09	Station one. Baggage enquiries. 10:29-12:09	26.2	4.8	3.8	<0.4	0.7	<0.4	1.9	<0.6	<1.7	7.6
04454/09	Station two. Border control 10:31-12:11	64.6	44.4	12.4	0.8	1.6	<0.4	2.6	<0.6	<1.7	21.8
04455/09	Station three. Outside terminal 11:05-12:16	30.2	10.9	6.4	0.7	0.5	<0.4	1.3	<0.6	<1.7	8.8
04456/09	Station one. Baggage enquiries. 12:20-13:24	79.9	196.1	5.9	0.6	2.4	0.8	3.3	<0.6	<1.7	19.9
04457/09	Station two. Border control 12:13-13:27	208.4	68.1	9.1	2.7	1.6	1.9	2.4	<0.6	<1.7	51.2
04458/09	Station three. Outside terminal 12:30-13:31	<7.8	6.0	7.7	1.2	0.7	<0.4	1.5	<0.6	2.0	17.5
04459/09	Station one. Baggage enquiries. 13:35-14:57	231.8	56.4	4.5	0.9	1.0	<0.4	1.7	<0.6	<1.7	36.9
04460/09	Station two. Border control 13:28-14:52	52.9	45.4	5.2	0.5	1.6	0.5	1.5	<0.6	<1.7	13.4
04461/09	Station three. Outside terminal 13:32-14:56	<7.8	<1.4	<1.0	<0.4	0.5	<0.4	<0.9	<0.6	<1.7	<6.7
04462/09	Station one. Baggage enquiries. 14:49-15:53	267.5	34.3	2.8	0.4	1.0	0.8	2.3	1.4	3.4	39.5
04463/09	Station two. Border control 14:53-15:52	93.1	186.1	<1.0	10.7	2.1	0.9	2.5	4.2	4.0	32.0
04464/09	Station three. Outside terminal 14:57-16:02	40.3	<1.4	12.4	<0.4	0.6	<0.4	1.0	0.7	3.6	27.7

5.2 Rae Systems MultiRae Carbon dioxide (CO_2) & Carbon monoxide (CO) Station one.



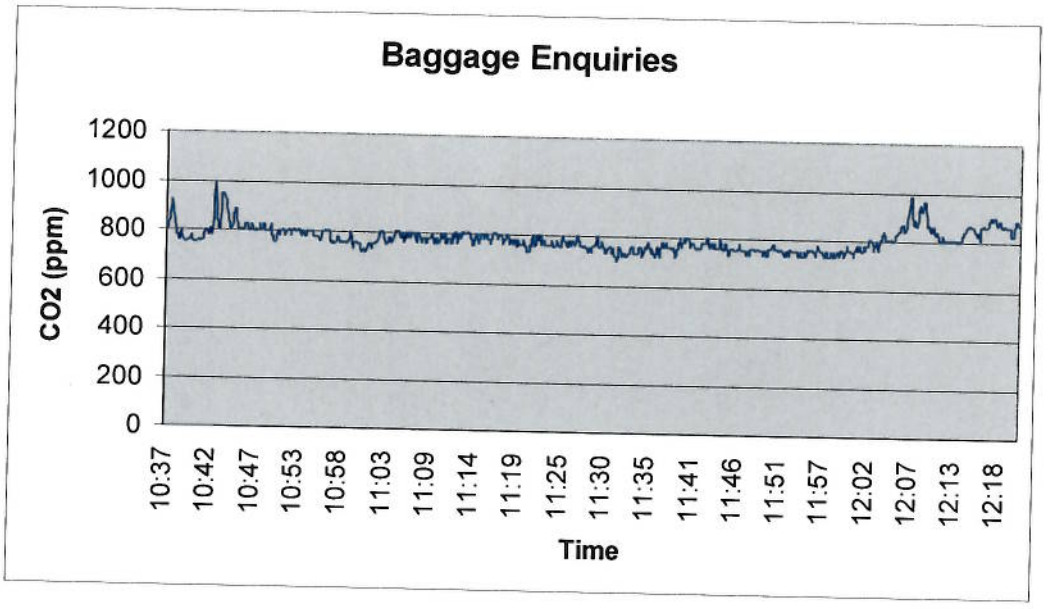
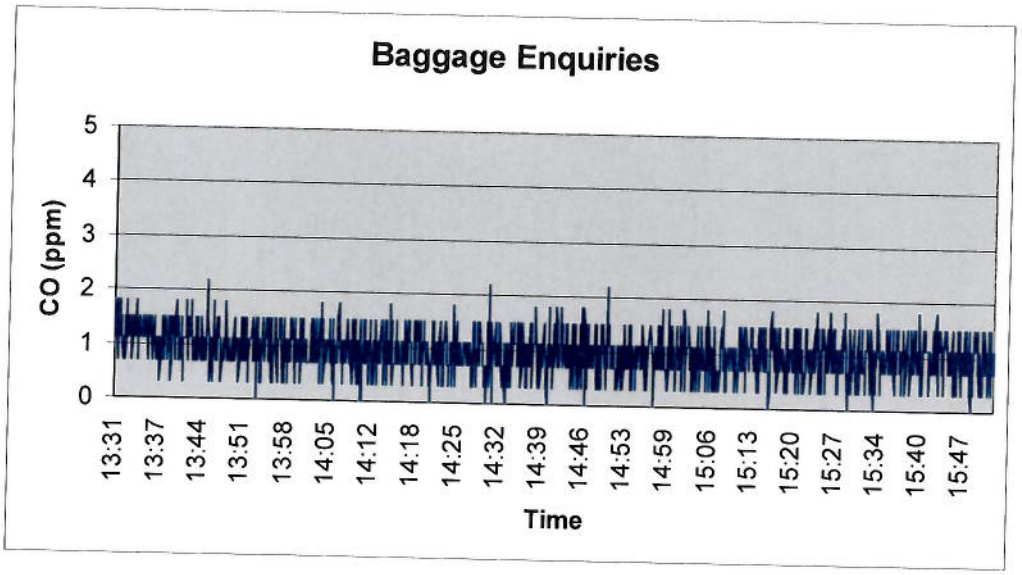


Table 2. Data summary

Baggage enquiries	CO (ppm)	CO2 (ppm)
Average	1.2	787
Maximum	5.2	1000
Minimum	0.0	700



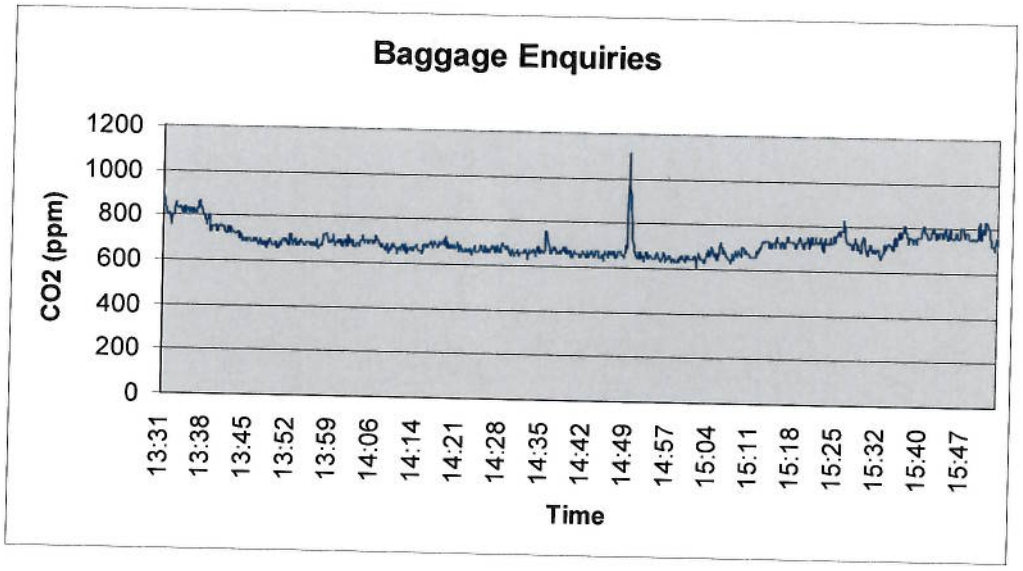
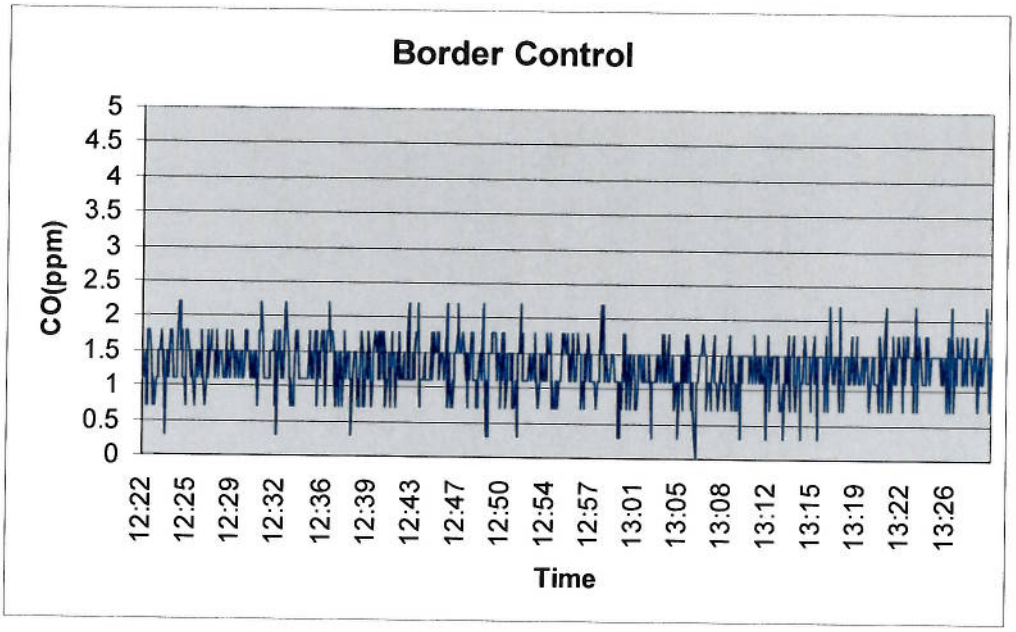


Table 3. Data summary

Baggage enquiries	CO (ppm)	CO2 (ppm)
Average	1.0	704
Maximum	2.2	1110
Minimum	0	610

Station 2



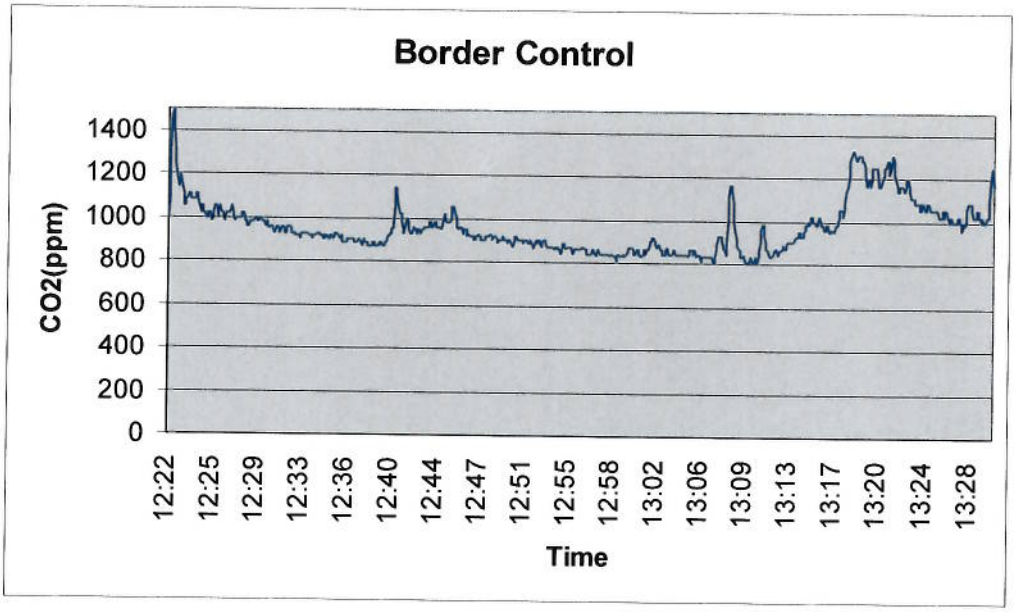


Table 4. Data summary

Border control	CO (ppm)	CO2 (ppm)
Average	1.3	961
Maximum	2.2	1500
Minimum	0.0	800

5.3 Anachem Anagas Carbon Dioxide.

Station 2.

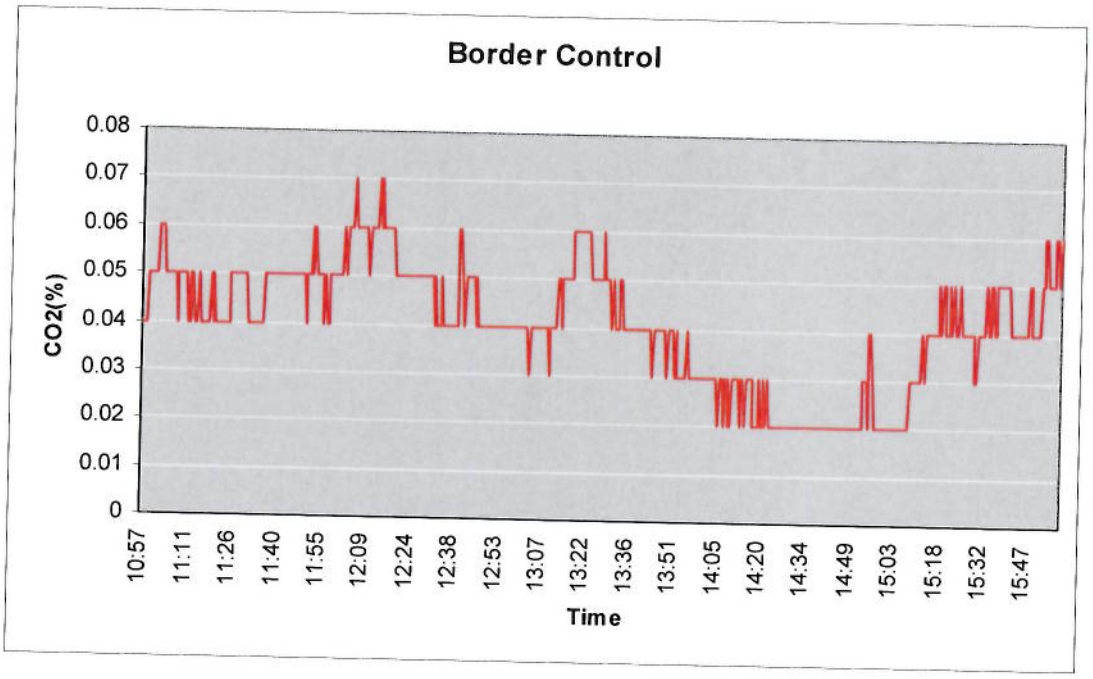


Table 5. Data Summary

Border control	CO2 (%)
Average	0.04
Maximum	0.07
Minimum	0.02

An Anachem carbon dioxide meter was also placed at the baggage enquires desk. The results logged were predominately zero; this indicates that the instrument had malfunctioned during the sampling period.

The guide below is intended to link the data shown in previous graphs where it has been recorded as parts per million, and this chart where data was recorded as percentage.

	CO_2 (%)	CO_2 (ppm)
Atmospheric (normal level)	0.03 - 0.04	300-400
Long term Exposure Limit	0.5	5000

5.4 Temperature and humidity.

Station 1

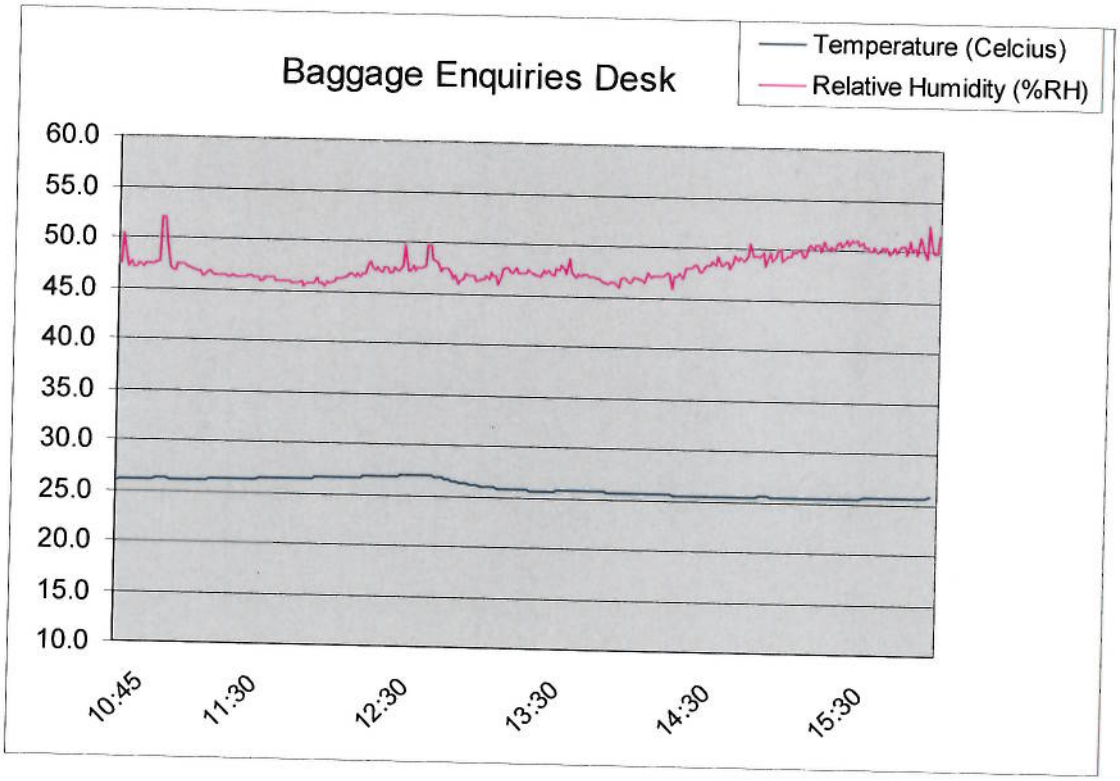


Table 6. Data Summary

Baggage enquiries	Temperature (°C)	Humidity (%RH)
Average	26	47.7
Maximum	26.9	52.5
Minimum	25.4	45.5

Station 2

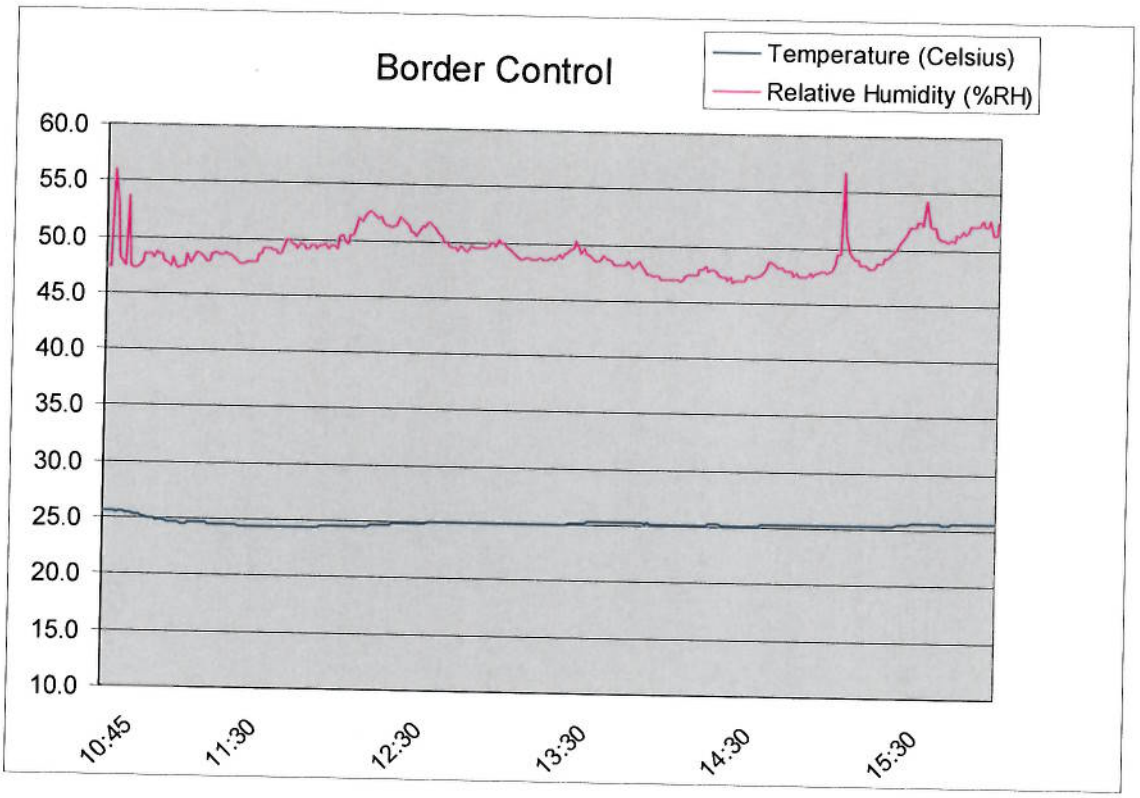


Table 7. Data Summary

Border control	Temperature (°C)	Humidity (%RH)
Average	25.1	49.2
Maximum	25.7	56.7
Minimum	24.4	46.8

Station 3

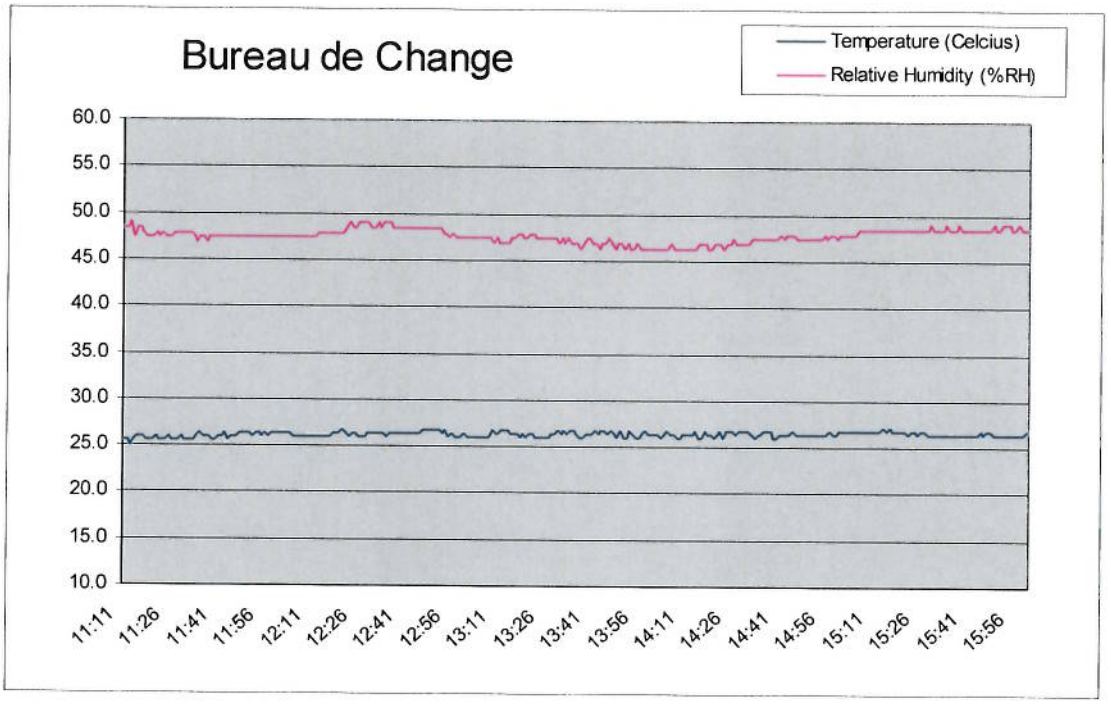


Table 8. Data Summary

Bureau de Change	Temperature (°C)	Humidity (%RH)
Average	26.2	47.6
Maximum	27.1	49.0
Minimum	25.1	46.3

5.5 Air Movement

Table 9.

Location	Average air velocity (m/s)
Baggage enquiries (Station 1). By sampling equipment. 10:40 am	0.05
Border control (Station 2) 10:50 am	0.04
Baggage enquiries (Station 1) By sampling equipment. Air conditioning on.	0.12
Baggage enquiries (Station 1). Middle seating position. Air conditioning on.	0.04
Baggage enquires (Station 1) At exit of air-conditioning unit. Air conditioning on.	2-4
Baggage enquiries (Station 1) Right hand end. Looking from front of desk. Air conditioning on.	0.12
Baggage enquiries (Station 1) Left hand end. Looking from front of desk. Air conditioning on.	0.05

6. Observations.

The airport safety team regularly monitor the working environment throughout the airport using a Rae Systems IAQRAE Air Quality Monitor. This instrument continuously monitors for CO, VOC's, CO2, humidity and temperature. On the day of the visit this was being used in the bureau de change in international arrivals. When inspected this was reading as follows:

Table 10 – Data from Rae Systems IAQRAE Air Quality Monitor

CO (ppm)	VOC's (ppm)	CO2 (ppm)	Temperature (°C)	Humidity (%RH)
0	0.3	700	24	41

These results are broadly similar to the levels detected by HSL during this visit.

The fuel used by the airport is all JET A1 kerosene produced to an internationally standardised specification. The carbon number distribution is typically between about 8 and 16.

In addition to aircraft engines, diesel powered vehicles that service the aircraft while they are on the stand are also potential sources of VOC's and other contaminants. This vehicle traffic is quite high with vehicles passing in close proximity to the terminal buildings.

The weather conditions on the day of the visit were very hot and sunny with very little wind.

7. VOC results discussion.

All VOC sample results were less than 400ppb for total VOC's. In most cases the results were considerably lower than this figure.

One of the blank samples showed higher than expected levels of VOC's (~200ppb total VOC's). The reason for this is unclear so it was disregarded when blank correcting the samples. The three remaining blanks gave total VOC levels of ~ 30ppb. This may mean that the actual results maybe be slightly lower than those reported. Even though the large results spread on the blank tubes will effect the confidence levels applied to the results the fact remains that the levels of VOC's detected were very low when compared to assigned workplace exposure limits for the compounds detected.