Indoor Air Quality Assessment

Site: Thame Town Council, Thame, Oxfordshire

Prepared for: Rosie Collins
Administration Officer
Thame Town Council
Town Hall
High St
Thame
OX9 3DP

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Written by:

Alex Susanu AFOH
Occupational Hygiene Consultant

Reviewed by:

Mike Robertson LFOH
Occupational Hygiene Director

T: 01274 738668
E: alexsusanu@envirocare.org

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Executive Summary

Mrs Rosie Collins instructed Envirocare to undertake to undertake an Indoor Air Quality Assessment at the Thame Town Council. The site visit was undertaken on 10th December 2021 by Alex Susanu of Envirocare.

The assessment was undertaken in accordance with the Workplace (Health, Safety and Welfare) Regulations 2002 with the accompanying Approved Code of Practice (ACOP) and the Management of Health and Safety at Work Regulations 2002. These regulations place a duty on an employer to provide a reasonable working environment for people in the workplace in terms of ventilation (fresh air), temperature, freedom from injurious or obnoxious fumes and general cleanliness of furniture, furnishings and fittings.

Indoor air quality parameters have been compared to those stated in relevant publications including those summarised in the CIBSE publication K17, 'Indoor air quality and ventilation'.

Assessment Findings

- Temperatures were within the CIBSE guidelines for thermal comfort at the ground floor but below the guidelines at the 1st and 2nd floor.
- Relative humidity levels were within the guidelines for comfort at the 1st and 2nd floor but below the guidelines at the ground floor
- Indoor levels of Carbon Dioxide, based on BS EN 13779, were within the IDA2 and IDA3 classifications which indicate a medium to moderate indoor air quality and below the CIBSE guidance of 1000 ppm.
- The results of the survey revealed that Carbon Monoxide, VOCs, Oxides of Nitrogen and Sulphur Dioxides were not detected during the site visit.
- The results of the spot measurements revealed that airborne particulates were detected at low concentrations and should not be considered significant.

Recommendations

- The humidity levels at the ground floor should be increased. CIBSE Guide A, chapter 1 recommends that relative humidity should be maintained between 40% to 70%. This could be achieved by introducing air humidifiers in the areas affected by low humidity.

- Air movement inside the offices should be increased to prevent the build up of Carbon Dioxide that can appear during high levels of occupancy. This can be achieved by installing a mechanical ventilation system or by opening the windows when possible. CIBSE guidance states that if a supply rate of 10 litres per occupant per second of fresh air is maintained, then CO_2 concentrations should stabilise at below 1000 ppm.

- Undertake further monitoring when there are higher levels of occupancy and during summer months when windows may be open.

- Introducing plants within office areas often has a beneficial effect on air quality.

The results of the monitoring exercise are discussed in Section 5, with recommendations given in Section 7.

1.0 Introduction

Thame Town Council is the parish authority for Thame, which has a team of 16 councillors and 16 members of staff.

Mrs Rosie Collins instructed Envirocare to undertake to undertake an Indoor Air Quality Assessment at the Thame Town Council. The site visit was undertaken on 10th December 2021 by Alex Susanu of Envirocare.

The purpose of the IAQ survey was to measure the following parameters:

- Carbon Dioxide (CO_2) concentrations
- Carbon Monoxide (CO) concentrations
- Airborne Particulates
- Volatile Organic Compounds
- Oxides of Nitrogen
- Temperature
- Relative Humidity
- Air Movement/ Volumetric Flows

2.0 Methodology

The assessment was undertaken in accordance with the Workplace (Health, Safety and Welfare) Regulations 2002 with the accompanying Approved Code of Practice (ACOP) and the Management of Health and Safety at Work Regulations 2002.

These regulations place a duty on an employer to provide a reasonable working environment for people in the workplace in terms of ventilation (fresh air), temperature, freedom from injurious or obnoxious fumes and general cleanliness of furniture, furnishings, and fittings.

The following devices were used to determine the background concentrations for the monitored substances and parameters.

Table 2.1 Sampling Methods specific to this project

Substance / Parameter	Sampling Method
Carbon Dioxide, Carbon Monoxide Temperature and Relative Humidity	TSI Airflow IAQ-Calc 7515 Indoor Air Quality Meter
Volatile Organic Compounds, Oxides of Nitrogen and Sulphur Dioxides	MultiRAE Lite real-time instrument reading
Airborne Particulates	Casella CEL-71x Microdust Pro real-time dust monitor
Air Movement	TSI Hotwire Anenometer

3.0 Indoor Air Quality (IAQ) Standards

3.1 Carbon Dioxide

The carbon dioxide emitted by occupants and/or appliances can provide an indication of the ventilation rate in a space. In a sedentary occupied zone, a concentration of 800 to 1000 ppm typically represents a ventilation rate of about 10 l/s per person. It is for this reason that carbon dioxide monitoring is increasingly being integrated into ventilation control systems.

Carbon dioxide is often used as an indicator for evaluating ventilation effectiveness. Both ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers) and CIBSE (Chartered Institute of Building Services Engineers) recommend that in order to ensure that there is acceptable dilution of airborne pollutants originating from human occupancy, a ventilation supply rate of 10 litres per second per occupant is maintained. If this supply rate is achieved, it has been shown that for normal occupancy densities, carbon dioxide concentrations will stabilise at below 1000 ppm (0.10%). If the measured concentration of carbon dioxide is less than 0.10%, it can be assumed that at least 10 litres per occupant is being supplied.

Based on BS EN 13779, indoor levels of CO_2 (ppm) are categorised below. For general office environments with moderate to high occupancy levels, CO_2 levels within the IDA1 and IDA2 ranges indicate effective ventilation.

Table 3.1: Categorisation of CO_2 levels

Indoor air quality classification	Indoor CO_2 level above level of outdoor air in ppm
IDA1 (High)	≤400
IDA2 (Medium)	400 - 600
IDA3 (Moderate)	600 - 1000
IDA4 (Low)	>1000

3.2 Temperature, Relative Humidity & Air Movement

Table 3.2 CIBSE approximate thermal comfort variables and their effects on Indoor Air Quality (Offices)

CIBSE Guide A, chapter 1(9) gives recommended internal conditions for a variety of room types (i.e dry resultant temperatures (winter and summer), relative humidities, lighting levels and noise ratings).

Variable	Value		Effect on IAQ of exceeding these values
	Winter	Summer	
Dry resultant Temperature (T_{dr},°C)	21-23	22-24	Increasing T_{dr} may increase release of VOCs, possible reduction in IAQ
Relative humidity (%)	40-70	40-70	As above. High values may result in condensation; mould formation
Local air speeds (m/s)	~ 0.1	~ 0.3	Increasing air speeds may improve IAQ but increase the risk of discomfort (ducted air supply; cooling)

Source: CIBSE Guide A, Chapter 1 & CIBSE KS17

3.2.1 Temperature

Thermal comfort is achieved when a person feels neither too hot nor too cold; in other words thermal 'well-being' is neutral with respect to the surrounding environment. The defining variable which governs a thermal comfort level is the dry resultant temperature. This is usually based on the average of air and mean radiant temperature, where the mean radiant temperature is approximately equivalent to the area weighted average fabric surface temperature. It may be measured by recording the temperature at the centre of a blackened sphere and the local air velocity. Source: CIBSE 'KS17'.

Ambient temperature should reach 16°C within an hour of starting work and, although there are no legal maximum limits, should be maintained at a "comfortable" level (13-30°C) depending on activity level of the operative. Temperature levels should not fluctuate greatly and there should not be a large difference (greater than 3°C) between head-height and ground level temperatures.

Thermal comfort guidelines are complex; however, CIBSE advise that comfort should be provided where air temperatures are maintained between 21°C - 23°C (Winter) and 22°C – 24°C (Summer).

3.2.2 Relative Humidity

CIBSE Guide A, chapter 1 recommends that relative humidity should be maintained between 40% to 70%.

Extremely low relative humidity can lead to dryness and irritation of the skin, eyes, throat and mucous membranes. Conversely, high relative humidity may promote the accumulation and growth of microbial pathogens, including bacteria, dust mites and mould, which can lead to odours and cause respiratory irritation and allergies in sensitive individuals. Additionally, higher humidity levels can lead to increased off-gassing: an increase in relative humidity of 35% can increase the emissions of formaldehyde by a factor of 1.8–2.6. Buildings are required to provide humidification when relative humidity is low and dehumidification when relative humidity is high. This feature is dependent on local climate conditions and expected humidity. Source: CIBSE 'KS17'.

3.2.3 Air Movement

For comfortable conditions to be maintained within occupied spaces, variables such as local air speed must be kept between specified limits. Increasing the ventilation rate usually improves indoor air quality but may cause the local air speed to increase and potentially bring about discomfort (if the supply air temperature is significantly greater or lower than local air temperatures in the occupied zone). Modifying a ventilation system to improve air distribution may also increase local air speeds, thus adversely affecting comfort. Source: CIBSE 'KS17'.

CIBSE Guide A, Chapter 1 recommends that air movement should lie between 0.1m/s during the winter and 0.3 m/s during the summer.

3.3 Sick Building Syndrome

Sick Building Syndrome (SBS) is an imprecise term used to describe those buildings in which there is a prevalence of a range of symptoms causing discomfort and a sense of being unwell rather than a distinct illness. There is a particularly high incidence in certain types of buildings, especially offices which are sealed and mechanically ventilated or air-conditioned. SBS is a complex phenomenon, and although several potential contributory factors have been suggested, much of the evidence is circumstantial, and no single underlying cause has been found. It is probable the cause is multi-factorial. Clinically diagnosed illnesses which can readily be attributed to a particular cause, such as humidifier fever, Legionnaires' Disease, or exposure to a toxic agent in the workplace environment are not usually regarded as SBS.

The range of symptoms which can be experienced include:

- eye, nose, and throat irritation
- sensation of dry mucous membranes and skin
- hoarseness, wheezing, coughs and frequent respiratory infections
- skin rash and itching
- headaches and mental fatigue
- nausea and dizziness.

These symptoms may occur singly or in combination with each other. The symptoms generally increase in severity over the working shift and diminish on leaving the building at the end of the working day. There is also a tendency for an increase in severity of symptoms through the working week.

No single cause has been identified for SBS, although many contributory factors have been suggested, and many causes are inter-related. SBS may result from the simultaneous combination of a number of factors. Suggested contributory factors include:

- inadequate ventilation
- thermal discomfort
- low humidity
- air pollution including airborne organic matter
- low morale and general dissatisfaction with working conditions

It has been suggested that certain features of the workplace environment might contribute to SBS including high temperatures, low relative humidity, inadequate ventilation, insufficient fresh air supply, poor lighting and a lack of negatively charged ions.

Airborne pollutants such as chemicals, dusts, fibres and microbiological contaminants may have a directly toxic, pathogenic or irritant effect on occupants; they may also have allergenic effects. The pattern of occurrence effectively eliminates infection as a mechanism.

Chemical pollutants could originate from the building occupants, eg respiratory carbon dioxide or tobacco smoke. The building, fabric and furnishings may produce airborne contaminants by "offgassing", the gradual releasing of gases and vapours from building materials and furniture, eg formaldehyde from certain types of board. Office machinery and equipment may also be a possible source.

Although the potential range of pollutants in offices and similar environments is enormous, levels have generally been found to be minute, in parts per billion compared with currently established occupational-exposure standards quoted in parts per million. Techniques considerably more sensitive and expensive than normal occupational hygiene practice would be required to measure such pollutants. There is no firm evidence to link SBS with specific airborne pollutants.

There is a lack of evidence correlating the incidence of SBS to a cause, or group of causes. Some researchers have suggested that SBS symptoms are an expression of dissatisfaction with the workplace environment, that SBS is not a physical reaction, but a stress response to unsatisfactory workplace conditions. Any investigation of a "sick building" should include identification, if possible, of any aspect of the workplace environment which produces dissatisfaction. Most buildings will be associated with some staff dissatisfaction, most commonly with respect to thermal comfort. One set of workplace conditions will not completely satisfy all the individual wishes of the workforce.

3.4 Workplace Exposure Limits

Workplace Exposure Limits (WELs) are UK occupational exposure limits which have been set in order to help protect the health of workers. Where a substance has been assigned a Workplace Exposure Limit, these have been obtained from EH40/2005 (Fourth Edition, 2020).

WELs are concentrations of hazardous substances in the air, averaged over a specified period of, time, referred to as a time-weighted average (TWA). Two time periods are generally used:

- long-term (8 hours); and
- short-term (15 minutes).

It should be noted that where a WEL or STEL has been obtained from EH40/2005 it is legally binding as it has been approved by the Health and Safety Executive and is subject to the requirement of the COSHH Regulations 2002 (as amended). The Control of Substances Hazardous to Health Regulations 2002 impose requirements on employers to prevent or control exposure to hazardous substances.

The contaminants monitored for in this report have WELs as shown in Table A.

Table A Site Specific Workplace Exposure Limits

Substance	Workplace Exposure Limits				Comments
	WEL (8 Hr TWA)		STEL (15 Mins)		
	ppm	mg/m³	ppm	mg/m³	
Inhalable Dust	-	10	-	-	-
Carbon Monoxide (CO)	20	23	100	117	BMGV
Carbon Dioxide (CO_2)	5000	9150	15000	27400	-
Nitrogen Monoxide (NO)	0.5	0.96	1	1.91	-
Nitrogen Dioxide (NO_2)	2	2.5	-	-	-
Sulphur Dioxide (SO_2)	0.5	1.3	1	2.7	-
Total VOCs	-	525[1]	-	-	-

WEL Workplace Exposure Limit
TWA Time Weighted Average
mg/m³ milligrams per cubic metre
Sen capable of causing occupational asthma
Carc capable of causing cancer and/or heritable genetic damage
STEL Short Term Exposure Limit
ppm parts per million
Sk can be absorbed through the skin
BGMV Biological Guidance Monitoring Value

[1] There is no UK WEL for VOC's therefore a figure of 525 mg/m³ has been given for guidance purposes which has been derived from Stoddard's reagent.

4.0 Site Observations

Thame Town Hall is a municipal building in the High Street, Thame, Oxfordshire. Thame Town Council is the parish authority for Thame, which has a team of 16 councillors and 16 members of staff. The town hall, which is the meeting place of Thame Town Council, is a Grade II listed building, built at the end of the 18th century from red bricks.

The building is comprised of three floors. The ground floor consisted in a reception office, an open plan office called the Central office and four individual offices. The first floor known as the Upper Chamber, is used as the council chamber. Second floor consisted in a small office and meeting room.

During the site visit 7 members of staff were present in the offices. The offices were occupied by one or two persons during the site visits. It should be noted that because of the Covid pandemic restrictions some of employees were working from home.

The assessment was undertaken after some of the employees had headaches, dry itchy skin or sore eyes. The employees used to be based in the central office, located on the ground floor.

It was reported that the members of staff who presented the symptoms were relocated to the 2nd floor or started working from home and these stopped to appear so often.

An indoor CO_2 monitor was installed on the wall in the Central office area and this was indicating 750 – 800 ppm.

The building was not equipped with a mechanical ventilation system. The windows could be opened to provide fresh air supply; however, it was reported that the windows are kept closed to prevent traffic fumes from the bus stop located just outside the building on the Central office side from entering the offices.

5.0 IAQ Monitoring Results & Discussion

5.1 Carbon Dioxide, Carbon Monoxide Monitoring Results

Table 5.1: Summary Table of Carbon Dioxide and Carbon Monoxide Measurements

Location	Carbon Dioxide (ppm)	CIBSE Carbon Dioxide Guidance (ppm)	Carbon Monoxide (ppm)	Carbon Monoxide EH40 WEL (ppm)
Ground floor - Reception	760 – 861	<1000	0.0	20
Ground floor – Printer room	714 – 776		0.0	
Ground floor – Central office	707 – 780		0.0	
Ground floor – Finance office	697 – 791		0.0	
Ground floor – Kitchen	744 – 870		0.0	
Ground floor – Outside kitchen	775 -789		0.0	
Ground floor – Cassie's and Andrea's office	790 -923		0.0	
Ground floor – Rosie's office	868 - 845		0.0	
Ground floor – Meeting room	743 – 866		0.0	
1st floor – Next to staircase	500 – 530		0.0	
1st floor – Middle of hall	489 – 521		0.0	
1st floor – By front door	495 – 516		0.0	
2nd floor – Office	728 - 686		0.0	
Outside – front of building	402		0.0	

The results of the survey detailed in the table above indicate all concentrations of carbon dioxide (CO_2) were below those recommended by CIBSE.

Based on BS EN 13779, the indoor levels of carbon dioxide were within the IDA2 and IDA3 classifications which indicate a moderate to medium indoor air quality.

The results also indicate that carbon monoxide (CO) was not detected during the site visit.

It should be noted that there were only two workers present in the premises at the time of sampling, this is below normal occupancy levels. Following the return of employees back into the work area, carbon dioxide concentrations may rise in all areas of the office due to occupancy.

5.2 Airborne Particulates

Table 5.2: Summary Table of Airborne Particulates Measurements

Location	Airborne particulates (mg/m^3)	Inhalable Dust EH40 WEL (mg/m^3)
Ground floor - Reception	0.01 - 0.03	10
Ground floor – Printer room	0.01 - 0.012	
Ground floor – Central office	0.01 - 0.02	
Ground floor – Finance office	0.02 - 0.03	
Ground floor – Kitchen	0.02	
Ground floor – Outside kitchen	0.02	
Ground floor – Cassie's and Andrea's office	0.01 - 0.02	
Ground floor – Rosie's office	0.02 - 0.03	
Ground floor – Meeting room	0.01 - 0.02	
1st floor – Next to staircase	0.003 – 0.02	
1st floor – Middle of hall	0.01 – 0.02	
1st floor – By front door	0.01 – 0.02	
2nd floor – Office	0.014 - 0.03	

The results of the survey as detailed in the above summary table revealed that Airborne Particulates were detected at low concentrations during the site visit.

5.3 Volatile Organic Compounds, Oxides of Nitrogen and Sulphur Dioxides

Table 5.3: Summary Table of Volatile Organic Compounds, Oxides of Nitrogen and Sulphur Dioxides Measurements

Location	VOCs (ppm)	NOx (ppm)	NO_2 (ppm)	SO_2 (ppm)
Ground floor - Reception	<0.1	<0.1	<0.1	<0.1
Ground floor – Printer room	<0.1	<0.1	<0.1	<0.1
Ground floor – Central office	<0.1	<0.1	<0.1	<0.1
Ground floor – Finance office	<0.1	<0.1	<0.1	<0.1
Ground floor – Kitchen	<0.1	<0.1	<0.1	<0.1
Ground floor – Outside kitchen	<0.1	<0.1	<0.1	<0.1
Ground floor – Cassie's and Andrea's office	<0.1	<0.1	<0.1	<0.1
Ground floor – Rosie's office	<0.1	<0.1	<0.1	<0.1
Ground floor – Meeting room	<0.1	<0.1	<0.1	<0.1
1st floor – Next to staircase	<0.1	<0.1	<0.1	<0.1
1st floor – Middle of hall	<0.1	<0.1	<0.1	<0.1
1st floor – By front door	<0.1	<0.1	<0.1	<0.1
2nd floor – Office	<0.1	<0.1	<0.1	<0.1

The results of the survey as detailed in the above summary table revealed that Volatile Organic Compounds, Oxides of Nitrogen and Sulphur Dioxides were not detected during the site visit.

5.4 Temperature & Relative Humidity

Table 5.4: Summary Table of Temperature and Humidity Measurements

Location	Temp °C	CIBSE Temperature Guidance °C	Relative humidity %	CIBSE Relative Humidity Guidance %
Ground floor - Reception	22	**21 - 23**	35.5 – 41	**40 - 70**
Ground floor – Printer room	22 -24		34.5 – 38	
Ground floor – Central office	22 – 23		34.2 - 35	
Ground floor – Finance office	21 – 23		36 – 36.3	
Ground floor – Kitchen	21 – 23		39.7 – 39.2	
Ground floor – Outside kitchen	22 – 23		37.7 – 37	
Ground floor – Cassie's and Andrea's office	21 - 23		38.8 – 38	
Ground floor – Rosie's office	21 – 23		36.7 – 36	
Ground floor – Meeting room	22 – 24		34.6 – 35.4	
1st floor – Next to staircase	12.4 – 16.6		49.1 – 40.9	
1st floor – Middle of hall	12.4 - 16.3		48.7 – 40.9	
1st floor – By front door	12.4 – 16		48.5 – 41.6	
2nd floor – Office	18.8 – 18.4		41.5 – 42.3	

5.4.1 Thermal Comfort

The results of the survey as detailed in the above summary table showed temperatures levels to be within the CIBSE guidelines for thermal comfort at the ground floor.

The measured temperature at the 1st and 2nd floor were below the CIBSE guidelines for thermal comfort.

5.4.2 Humidity

The results of the survey as detailed in the above summary table showed humidity levels to be below the CIBSE guidelines for thermal comfort at the ground floor.

The measured relative humidity at 1st and 2nd floor were within the CIBSE guidelines for thermal comfort.

It should be noted that the 1st floor is used not used as office space and during the visit the windows were open.

Based on the results of the survey, it is considered that thermal comfort and is not being achieved in the areas where readings were taken. However, it should be noted that increasing the temperature will decrease relative humidity and decreasing the temperature will increase the relative humidity.

5.5 Air Movement

Table 5.5: Summary Table of Air Movement

Location	Air movement m/s	CIBSE Guidance m/s
Ground floor - Reception	0.01	**0.1**
Ground floor – Printer room	0.01	
Ground floor – Central office	0.02	
Ground floor – Finance office	0.01	
Ground floor – Kitchen	0.01	
Ground floor – Outside kitchen	0.01	
Ground floor – Cassie's and Andrea's office	0.01	
Ground floor – Rosie's office	0.01	
Ground floor – Meeting room	0.01	
1st floor – Next to staircase	0.01	
1st floor – Middle of hall	0.02	
1st floor – By front door	0.01	
2nd floor – Office	0.01	

The results of the survey as detailed in the above summary table showed temperatures levels to be below the CIBSE guidelines for air movement at all the monitored locations.

Based on the results of the survey, it is considered that fresh air supply rates are below recommended levels and that they are insufficient to prevent build-up of hazardous levels of airborne substances such as carbon dioxide in the workplace.

6.0 Conclusions

6.1 Indoor Air Quality Assessment

- Temperatures were within the CIBSE guidelines for thermal comfort at the ground floor but below the guidelines at the 1st and 2nd floor.
- Relative humidity levels were within the guidelines for comfort at the 1st and 2nd floor but below the guidelines at the ground floor.
- Indoor levels of Carbon Dioxide, based on BS EN 13779, were within the IDA2 and IDA3 classifications which indicate a medium to moderate indoor air quality and below the CIBSE guidance of 1000 ppm.
- The results of the survey revealed that Carbon Monoxide, VOCs, Oxides of Nitrogen and Sulphur Dioxides were not detected during the site visit.
- The results of the spot measurements revealed that airborne particulates were detected at low concentrations and should not be considered significant.

6.2 Increased Occupancy

There were only seven members of staff present in the premises at the time of the assessment, this is below normal occupancy levels. Following the return of greater numbers of employees back into the work area, carbon dioxide concentrations and heat gain may rise in all areas of the office due to worker occupancy.

7.0 Recommendations

- The humidity levels at the ground floor should be increased. CIBSE Guide A, chapter 1 recommends that relative humidity should be maintained between 40% - 70%. This could be achieved by introducing air humidifiers in the areas affected by low humidity

- Long term monitoring for hazardous substances associated with exhaust fumes should be considered inside the offices and outside to determine if any pollutants from the bus stop linger around the building windows or infiltrate when the windows are open.

- Air movement inside the offices should be increased to prevent the build up of Carbon Dioxide that can appear during high levels of occupancy. This can be achieved by installing a mechanical ventilation system or by opening the windows when possible. CIBSE guidance states that if a supply rate of 10 litres per occupant per second of fresh air is maintained, then CO_2 concentrations should stabilise at below 1000 ppm.

- Undertake further monitoring when there are higher levels of occupancy and during summer months when windows may be open.

- Introducing plants within office areas often has a beneficial effect on air quality. Plants absorb carbon dioxide, and also other airborne pollutants such as volatile organic compounds (VOCs). Plants help to maintain humidity levels, reducing the risk of adverse health effects such as dry, itchy eyes resulting from working in low humidity conditions. Suitable plants include:

    - Ficus benjamina, weeping fig
    - Philodendron, sweetheart plant
    - Green spider plant or variegated spider plant
    - Dracaena marginata, dragon tree
    - Dracaena fragrans 'Massangeana', corn plant
    - Golden pathos
    - Chinese evergreen
    - Philodendron selloum
    - Sansevieria, snake plant
    - Spathiphyllum, peace lilly

Appendix 1 - References

I. CIBSE Knowledge Series: KS17 'Indoor air quality and ventilation' (2011)

II. CIBSE Guide A: 'Environmental Design' (2006)

III. BRE Group 'Ensuring good indoor air quality in buildings'

IV. BS EN 13779:2007; Ventilation for non-residential buildings. Performance requirements for ventilation and room-conditioning systems.

V. HSE publication 'How to deal with sick building syndrome (SBS)'

VI. https://www.nhs.uk/conditions/sick-building-syndrome/