

TEST REPORT: 7191018171-CHM11-CYT

Date: 03 NOV 2011

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SUBJECT

Indoor air quality assessment was conducted for German European School Association(Singapore)

CLIENT

German European School Association(Singapore)
72 Bukit Tinggi Road
Singapore 289760

Attn: Mr Carlos Ong

TEST DATE

12 Oct 2011

SAMPLING LOCATIONS

The indoor air quality monitoring was conducted at the air conditioned areas. The sampling locations are labelled as '1' and '2'.

Sampling Point	Sampling Location
1	Class Room K111
2	Class Room K112



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METHODS OF TEST

Grab samples were collected and tested for parameters as given in the Guidelines for Good Indoor Air Quality in Office Premises:

I. Specific Indoor Air Contaminants:

Carbon dioxide (CO₂), ppm

The carbon dioxide content was monitored by means of an Indoor Air Quality Monitor. Instant readings were recorded and the average was reported.

Carbon monoxide (CO), ppm

The concentration of carbon monoxide was determined by means of a Tetra Multigas Monitor with CO Sensor. Instant readings were recorded and the average was reported.

Formaldehyde (HCHO), ppm

The concentration of formaldehyde was determined by means of a Formaldemeter 400. Instant readings were recorded and the average was reported.

Ozone (O₃), ppm

The concentration of Ozone in air was measured by means of an Eco Sensor Ozone Monitor. Instant readings were recorded and the average was reported.

II. Specific Classes of Contaminants:

Suspended particulate matter, µg/m³

The respirable suspended particulate was measured by means of a Grimm Portable Monitor at 10 µm size.

Volatile organic compounds (TVOCs), ppm

The total volatile organic compounds were determined by means of a Portable Photo-ionization Detection System with a 10.6eV lamp.

Total bacterial and fungal counts, cfu/m³

The indoor air was sampled by means of a Bio-test RCS Centrifugal Air Sampler at a sampling volume of 160 litres. The agar strips were incubated and the amount of colony forming units was determined.

III. Specific Physical Parameters:

Relative Humidity and Temperature

The relative humidity and the air temperature were measured by means of a QUESTemp 32 Thermal Environment Monitor.

Air movement

The air velocity was measured by means of an anemometer.

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RESULTS

Test parameter		(Point 1) Class Room K111	(Point 2) Class Room K112	Guideline Values
Time of measurement	Hr	1008	1022	-
Temperature,	°C	26.5	26.3	22.5 – 25.5 °C
Relative humidity,	%	71	66	≤ 70
Average air velocity,	m/s	0.07	0.07	≤ 0.25
Carbon monoxide,	ppm	< 1.0	< 1.0	9 ⁺
Carbon dioxide,	ppm	475	400	1,000 ⁺
Ozone,	ppm	< 0.01	< 0.01	0.05 ⁺
Total volatile organic compounds,	ppm	< 0.1	< 0.1	3
Suspended particulate matter,	µg/m ³	11	9	150
Formaldehyde,	ppm	0.01	0.03	0.1 ⁺
Total bacterial counts, (TSA, 35°C 48 hours)	cfu/m ³	190	210	500
Total fungal counts, (RBA, 25°C 5 days)	cfu/m ³	69	50	500

Note:

- Bold** - indicates not within guideline value
- TSA - Tryptone Soya Agar
- RBA - Rose Bengal agar
- < - Less than
- + - Denotes guideline values for 8-hr averaging time. The results for these parameters were obtained based on instantaneous measurement. Therefore the results are not strictly comparable to guideline values and should be used as an estimate only.



CONCLUSION

Generally, most of the results were within the acceptable values of Guidelines for Good Indoor Air Quality in Office Premises. The parameters where the values were not within the range or exceeded the acceptable values are highlighted below.

Air Temperature and relative humidity

The air temperature tested at Class Room K111 (Point 1) and Class Room K112 (Point 2) were found to be 26.5°C and 26.3°C, which is not within the acceptable range of 22.5° C to 25.5° C for air-conditioned office.

The relative humidity measured at Class Room K111 (Point 1) had exceeded the guideline value of $\leq 70\%$.

Air temperature and relative humidity are considered as thermal environmental factors. They are not air pollutants and have no direct health concerns. However, these factors can affect an occupant's perception of the environment. When the temperature is below 21°C or higher than 27°C, it could cause some discomfort among occupants.

Huang

Yh

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APPENDIX 1

GUIDELINES FOR GOOD INDOOR AIR QUALITY IN OFFICE PREMISES

Table 1 - Guideline maximum concentrations for specific indoor air contaminants

Parameter	Averaging time	Limit for acceptable indoor air quality
Carbon dioxide, ppm	8 hours	1000
Carbon monoxide, ppm	8 hours	9
Formaldehyde, ppm	8 hours	0.1
Ozone, ppm	8 hours	0.05

Note: The guidelines specified have a wide margin of safety such that even if they are exceeded occasionally, toxic effects are unlikely to occur.

Table 2 - Recommended maximum concentrations for specific classes of contaminants

Parameter	Limit for acceptable indoor air quality
Suspended particulate matter, $\mu\text{g}/\text{m}^3$	150
Volatile organic compounds, ppm	3
Total bacterial count, CFU/m^3	500
Total fungal count, CFU/m^3	500

Table 3 - Guideline values for specific physical parameters

Parameter	Range for acceptable indoor air quality
Air temperature, $^{\circ}\text{C}$	22.5 - 25.5
Relative humidity, %	≤ 70
Air movement *, m/s	≤ 0.25

* At workstation within occupied zone

APPENDIX 2

SOME COMMON INDOOR AIR CONTAMINANTS

1. Carbon dioxide

Carbon dioxide is present in the unpolluted atmosphere at a concentration of about 0.03% but since about 5% of the air we breathe out are carbon dioxide, the level increases in inadequately ventilation occupied rooms. The level of carbon dioxide is therefore often used to assess the efficiency of ventilation. Outside sources include vehicle exhaust fumes or other exhausts.

2. Carbon monoxide

Any process of combustion can produce carbon monoxide, including cooking and tobacco smoking. A major source of carbon monoxide is vehicle exhaust.

3. Formaldehyde

Formaldehyde is a colourless gas with a pungent odour. It is found in hundreds of different products, including insulation material, ceiling tiles, particle board, plywood, office furniture, carpet glues, various plastic, synthetic fibres in rugs, upholstery and other textiles, pesticides, paint and paper. Levels of emission increase with temperature.

4. Ozone

Ozone is naturally present in the air since it is produced from oxygen by ultraviolet radiation. However, it can also be produced by electrical discharges and is emitted by some items of electrical equipment such as photocopiers and electrostatic precipitator devices used to clean the air by removing dust.

5. Suspended particulate matter

Respirable particles, released from incomplete combustion, can deposit in the respiratory tract or lungs depending upon the size of the particles. Indoor air particulate may come from outdoor or indoor sources. Respirable particulate (10 micrometers and smaller) are those that can penetrate into the lungs.

6. Volatile organic compounds

Volatile organic compounds are found in tobacco smoke, solvents, inks, glues, paints, room deodorizers, photocopier toners and other organic products used in offices. Furnishings such as carpets and furniture also emit volatile organic compounds.

7. Biological contaminants

Biological contaminants include bacteria, fungi, viruses, algae, insect parts, and dust, which may result in allergenic or pathogenic reactions. There are many sources for these pollutants: pollens from outdoors, viruses and bacteria from humans, hair and skin flakes from household pets, etc.

Many biological pollutants can multiply in standing water, in cooling towers, in water-damaged ceilings, walls, and carpets. Biological pollutants may be distributed through HVAC system.

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