Luton Borough Council

Indoor Air Quality Plan

Kestrel Way SEND School

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RSK GENERAL NOTES

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Title: Indoor Air Quality Plan: Kestrel Way SEND School

Client: Luton Borough Council

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1 INTRODUCTION

RSK Environment Ltd (RSK) was appointed by Luton Borough Council to prepare an Indoor Air Quality Plan (IAQP) for the construction of a New SEND School which is located at Kestrel Way, Luton, LU4 0UD. Figure 1 shows the proposed site layout.

The proposed development involves the removal of the existing radio mast and erection of a new build SEND school which will also include a 6/8 bed respite resource centre. The proposed building will extend to a maximum of two stories and provide space for 112 children, there will be 14 classrooms and additional specialist rooms. The building will be 3300sqm, an external play area will be located to the rear of the site with parking and drop-off facilities to the front.

The report has been prepared in relation to the 'Prerequisite – Indoor Air Quality Plan', found under section Hea 02 of the Building Research Establishment Environmental Assessment Method (BREEAM) New Construction 2018 guidance, and Guidance Note – GN06, March 2018 and applies to all building areas (excluding Area F). A summary of the BREEAM guidance is included in Appendix B.

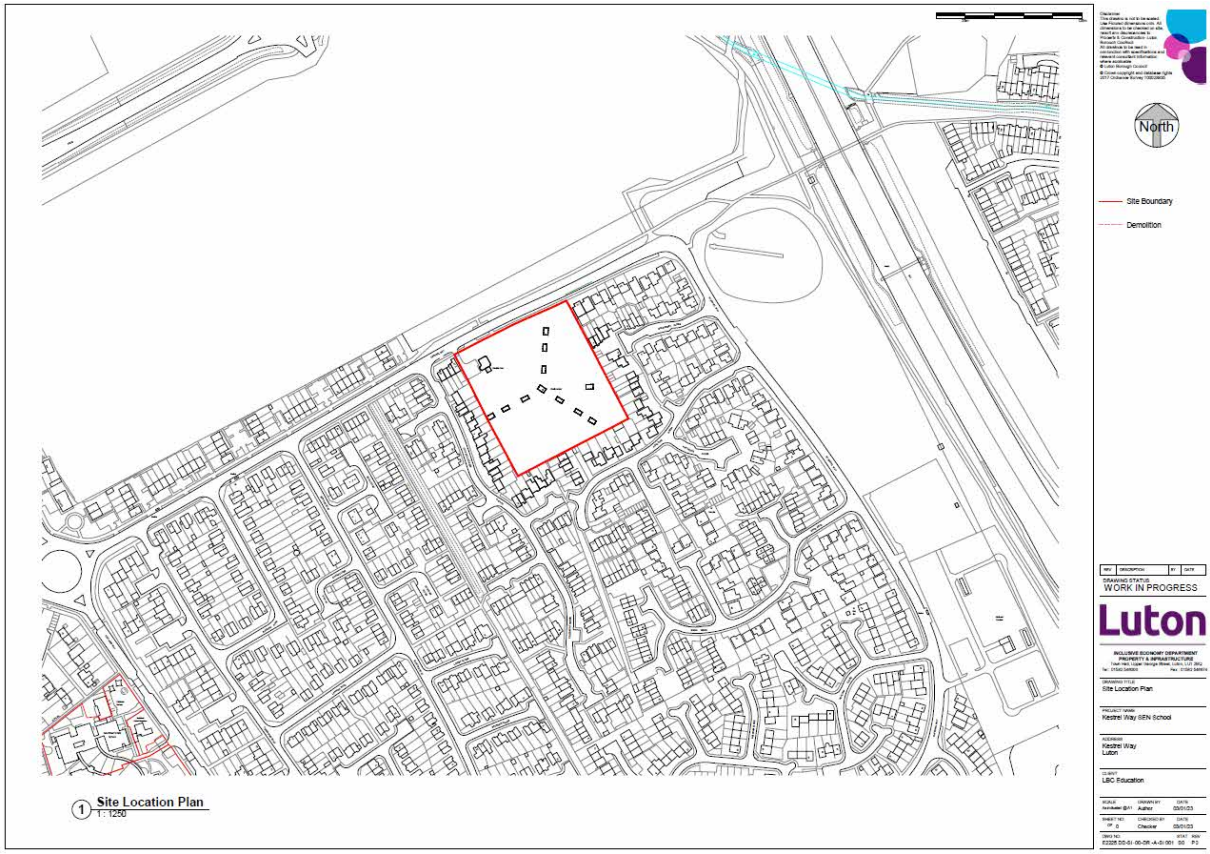
The proposed floor plans are shown in Appendix B.

This IAQP includes consideration of the following:

a. Removal of contaminant sources;
b. Dilution and control of contaminant sources;
c. Procedures for pre-occupancy flush-out;
d. Third party testing and analysis; and
e. Maintaining indoor air quality in use.

The recommendations made in this assessment have been informed by a review of likely ambient air quality, specifications and plans and correspondence with the client.

Figure 1: Proposed Site Layout



2 AMBIENT AIR QUALITY CHARACTERISATION

2.1 Ambient Air Quality at the Site

Indoor air quality is related to ambient air quality, which can be strongly related to location.

Existing or baseline air quality refers to the concentrations of relevant substances that are already present in ambient air. These substances are emitted by various sources, including road traffic, industrial, domestic, agricultural and natural sources. Baseline air quality data employed in this study have been obtained from monitoring stations maintained by LBC and from the LAQM Support website operated by the Department for Environment, Food and Rural Affairs (Defra).

2.1.1 Emission Sources and Key Air Pollutants

The application site is bounded to the east, west, and south by existing residential properties, and to the north by Kestrel Way road. It is therefore likely that transport emissions from local traffic will be the main source of pollutants at the site.

The principal pollutants relevant to this assessment are considered to be NO_2, PM_{10} and $PM_{2.5}$, generally regarded as the most significant air pollutants released by vehicular combustion processes, or subsequently generated by vehicle emissions in the atmosphere through chemical reactions.

The development site is located within the administrative area of Luton Borough Council (LBC). LBC has declared three Air Quality Management Areas (AQMAs), due to the exceedance of the annual mean nitrogen dioxide (NO_2) objective. The nearest AQMA is Luton AQMA No.2 - Gilderdale Road which is 400m away from the proposed development and Luton AQMA No.1 - Withy Close Road which is 500m away from the proposed development. Therefore, the proposed development is not located within but is located close to and may impact an AQMA.

2.1.2 Baseline Monitoring Data

A review of the monitoring data available from the Luton Borough Council (LBC) 2021 Annual Status Report suggests that NO_2, PM_{10}, $PM_{2.5}$ levels monitored within the borough using an automatic monitoring sites and NO_2 levels monitored using a non-automatic monitoring sites. LBC undertook automatic (continuous) monitoring of nitrogen dioxide, PM_{10} and $PM_{2.5}$ at one site during 2020 (LN60 / HB007 – Dunstable Road East). Located within AQMA No.3, this analyser is co-located with diffusion tubes LN61, LN62 and LN63. In addition to the monitoring undertaken by Luton Borough Council during 2020:

London Luton Airport Operations Ltd. (LLAOL) continuously monitored PM_{10} at its site within the airport (LA08 / HB006)

Defra continuously monitored nitrogen dioxide at its Luton A505 Roadside AURN site (CM2 / LUTR)

London Luton Airport Ltd. (LLAL) continuously monitored multiple species including nitrogen dioxide, PM10 and PM2.5 at its new air quality monitoring station in Wigmore Valley Park (LA001)

LBC undertook non- automatic (i.e. passive) monitoring of NO_2 at 51 sites during 2020. In addition to this, LLAOL undertook similar monitoring at 19 sites and LLAL deployed NO_2 diffusion tubes at a further 11 locations (one of which moved during the course of the year).

The closest monitoring location to the proposed development is LN82 which is designated as a suburban location. The main source of pollution in the proximity of the site is expected to be the M1 motorway, the site is approximately 250m from the M1 whereas tube LN82 is approximately 25m from the M1. LN82 is therefore not considered to be entirely representative of the site despite both being suburban locations. However as LN82 has recorded NO_2 concentration well below the air quality objective and it is therefore considered likely for NO_2 concentration at site to also be well below the annual mean NO_2 objective.

There were four NO_2 diffusion tubes and no automatic monitoring station within 1 km of the proposed development site. The NO_2 annual mean concentrations for years 2016 to 2020 for this monitoring site can be found in Table 2.1. No exceedances were recorded between 2016 and 2020, at any monitoring station within 1 km. Figure 2.1 shows the selected Non-Automatic Monitoring Locations.

The LAQM TG.22 notes that research indicates that the annual mean NO_2 concentrations tend to be greater than 60µg/m^3 for an exceedance of the hourly mean NO_2 AQS to be likely. Based on the monitoring data presented, it is considered highly unlikely that the annual or hourly-mean NO_2 AQSs would be exceeded at the proposed development site.

Table 2.1: 2016-2020 Annual Average Measured NO_2 Concentrations at the Selected Non-Automatic Monitoring Locations

Site ID	Location	Site type	Approximate Distance from Site (km)	Annual Mean NO_2 Concentrations (µg/m^3)				
				2016	2017	2018	2019	2020
LN18	Copperfields	Roadside	0.9	28.5	24.4	23.9	22.1	16.9
LN81	Bank Close	Suburban	0.8	-	38.1	31.6	30.8	21.8
LN82	11 Withy Close	Suburban	0.5	-	32.3	27.0	27.6	20.9

Site ID	Location	Site type	Approximate Distance from Site (km)	Annual Mean NO_2 Concentrations ($\mu g/m^3$)				
				2016	2017	2018	2019	2020
LN83	b/h 9 Copperfields	Suburban	1.0	-	24.5	24.5	22.5	16.3
Air Quality Objective				**40 ($\mu g/m^3$)**				

**Air quality objective exceeded values are marked in Bold*

Figure 2.1: Selected Non-Automatic Monitoring Locations

2.2 LAQM Background Data

Table 2.3 reproduces the Defra estimated annual average background NO_2, PM_{10} and $PM_{2.5}$ concentrations at the proposed development site for 2023, 2024 and 2025 the anticipated opening year of the proposed development.

Estimated background concentrations do not exceed the annual average air quality objectives for human health for NO_2, PM_{10} or $PM_{2.5}$. As background concentrations are

predicted to fall with time, background concentrations in future years would not be expected to exceed their respective annual mean standards after the proposed development opening year.

It should also be noted that the Defra website states that *'The projections in the 2018 background maps are based on assumptions which were current before the Covid-19 outbreak in the UK. In consequence these maps do not reflect short or longer term impacts on emissions in 2020 and beyond resulting from behavioural change during national or local lockdowns'.*

Table 2.3: Defra LAQM Estimated Annual Average NO_2, PM_{10} and $PM_{2.5}$ Concentrations at the Proposed Development Site (2023, 2024 and 2025, from 2018 base map)

Assessment Year	Estimated Annual Average Pollutant Concentrations Derived from the LAQM Support Website		
	Annual Average NO_2 ($\mu g/m^3$)	Annual Average PM_{10} ($\mu g/m^3$)	Annual Average $PM_{2.5}$ ($\mu g/m^3$)
2023	15.2	17.3	11.0
2024	14.4	17.1	10.8
2025	13.8	17.0	10.7
Air Quality Standard	**40**	**40**	**20***

Notes: Presented concentrations for 1km^2 grid centred on 504324, 224146; approximate centre of development site is 504500, 224500; *Target objective only.

3 IMPROVING INTERNAL AIR QUALITY

3.1 Removal of Contaminant Sources

3.1.1 Building Location and Development Configuration

Indoor air quality will be affected by the external ambient air quality, the ways in which external air is allowed to mix with internal air, and the distance between sources of pollution and receptors potentially sensitive to pollution.

The site is situated in an area where air quality has been estimated as below the NO_2 and PM_{10} annual mean AQSs and therefore, it is considered unlikely that the proposed development will introduce receptors likely to be impacted by elevated concentrations of these pollutants. Filters have therefore not been recommended to be fitted on the air handling system.

3.1.2 Emissions from Building Materials

Building and fit-out materials can be a significant source of volatile organic compounds (VOC) and formaldehyde, which may adversely affect indoor air quality and the wellbeing of occupants. Potential sources of VOC and formaldehyde should be removed from the building by the specification of low VOC materials, wherever practicable. It is also recommended that products containing the lowest VOC and formaldehyde content should be considered where possible.

Credits are available under BREEAM Hea02 for the specification of certain classes of products with low VOC and formaldehyde content. It is recommended that products and finishes with low formaldehyde, VOC and/or heavy metal emissions (as specified in the BREEAM guidance) are chosen when the development will be fitted out, which would assist in improving internal air quality, particularly during the initial phases of the development opening.

Although some paints and internal finishes listed in the building specification comply with the performance and testing standards, further information would be required to ensure that the other products comply with the relevant criteria. It is recommended that this is sought to confirm that the products have low formaldehyde, VOC and/or heavy metal emissions (as specified in the BREEAM guidance), which would assist in improving internal air quality, particularly during the initial phases of the development opening.

3.2 Dilution and Control of Contaminant Sources

As the building nears completion, the generation of dust and other air pollutants during the remaining construction activities should be minimised, to reduce the quantity of pollutants present in the building at ‘handover’ and the start of the occupation phase. The following measures are recommended as far as reasonably practicable:

Mitigation measures such as water-based dust suppression mechanisms may be used to limit fugitive dust emissions from construction activities, however in this case care should be taken not to cause moisture ingress or damp conditions in the building;

Ventilation systems and ductwork should be checked and cleaned appropriately prior to or during commissioning;

Electric tools and equipment or bottled gas should be used in place of petrol and diesel-emitting equipment wherever practicable;

Exhausts from plant or equipment should be kept away from air intakes as far as practicable;

Wet and waste materials should be covered, sealed and removed from the building;

Walk-off mats should be provided to reduce the tracking of pollutants and dust into buildings;

Overshoes should be worn inside buildings approaching completion to prevent the 'track-in' of mud and dust;

Dust movement within the buildings should be minimised and any visible dust should be cleaned up;

Completed areas should be isolated from active construction as far as practicable;

Any paint used should be allowed to dry for at least 48 hours before carpets are installed in the painted area;

Any sealants should be applied before any carpets are installed;

The following measures should be implemented to minimise dust accumulation on material surfaces and the absorption of other pollutants by absorbent materials:

- Materials should be wrapped and stored properly;
- Highly absorbent materials like carpeting should be covered and sealed;
- Porous materials should be stored indoors and wrapped;
- Timber, unless stored indoors, should be covered with a waterproof coating and stored off ground away from standing water; and
- If condensation forms on cold materials, care should be taken not to expose it to dust or particulates.

Measures to mitigate water ingress, such as temporary water barriers, should be used as appropriate; and

Tidy working and good housekeeping should be encouraged.

The plan should be reviewed subject to any significant material changes in the design plans or work practices.

3.2.1 Protection of Air Handling Systems During Construction

Any openings to air handling equipment and ductwork not in active use should be sealed using a reasonably airtight covering.

Construction work generating air pollution should be avoided where ductwork or air handling equipment is being installed.

Following an overheating analysis of the proposed building, it may be necessary to include mechanical cooling measures. Due to the varying and specific requirements of the building users (Kestrel Way School will be a Special Educational Needs School), it is necessary to have a regulated and controllable environment. Natural ventilation alone may not be sufficient to meet the requirements of the building users. Therefore, a more detailed overheating analysis will be undertaken at the detailed design stage, once a contractor is appointed, so that Part L of the building regulations will be met, as well as the needs of the building users.

The components on the supply and return air flow side, such as return vents, ducts and shafts and transfer ducts, should be protected during construction works. If inspections indicate that protection is required on the supply side, coarse filters covering supply outlets should be used to prevent the distribution of particulates (and potentially NO_x) into the building.

If other measures fail, duct cleaning should be undertaken. Any cleaning should be undertaken by experienced personnel following best practice guidance. Any cleaning which is undertaken whilst construction works are still underway should be logged, and the duct work should be sealed once cleaning is complete.

3.3 Procedures for Pre-Occupancy Flush Out

Following the completion of construction and fit-out activities but before handover of the building and its occupation by users, it is recommended that the building be thoroughly cleaned and purged or 'flushed out' to reduce concentrations of pollutants emitted from construction activities or materials.

There is no widely recognised best practice for pre-occupancy flush out in the UK, but flushing out is typically carried out for a minimum of 7 days. Flushing out should be conducted in consultation with the M&E engineer, by operating the mechanical air supply and extraction system continuously (24 hours per day) with 100% outdoor air supplied (i.e. no recirculation).

Normal air temperature and humidity shall be maintained in the building during flush out. In naturally ventilated areas (including areas served by the natural ventilation system), doors, windows and breathing building openings or stacks should be left open so far as reasonably practicable, for several days.

3.4 Third Party Indoor Air Testing and Analysis

Methods

It is understood that the credit for third party testing and analysis is targeted and therefore, it is recommended that concentrations of formaldehyde and total volatile organic

compounds ('T-VOC') in indoor air are tested post construction but pre-occupancy. Any testing would be carried out by competent persons, according to the following methods:

EN ISO 16000-6: 2011 - VOCs in air by active sampling; and

BS EN ISO 16000-3: 2011 - formaldehyde and other carbonyls in air by active sampling.

Paints and finishes should be allowed to dry, and ventilation and heating systems operated, for at least 12 to 24 hours prior to testing.

Reporting

The results of the sampling will be compared with World Health Organisation (WHO) and Building Regulation Approved Document F criteria, as follows:

Formaldehyde: 100µg/m^3, averaged over 30 minutes; and

Total VOC: 300µg/m^3, averaged over 8 hours.

Sampling Strategy

Airborne concentrations of VOCs and formaldehyde should be sampled in representative occupiable room, for example with similar internal finishes and the same type of ventilation system, as these two factors will likely dominate internal concentrations of formaldehyde and VOCs.

Tests will be undertaken in representative habitable or occupiable rooms. An occupiable room can be defined as a room in a building other than a dwelling that is occupied by people, such as an office, workroom, classroom or hotel bedroom, but not a bathroom, sanitary accommodation, utility room or rooms or spaces used solely or principally for circulation, building services plant or storage purposes. A habitable room can be defined as a room used for dwelling purposes but which is not solely a kitchen, utility room, bathroom, cellar or sanitary accommodation.

It is understood that the development comprises a new SEND school which consist of Ground floor and First floor. The building includes reception area, teaching room, computer lab and various areas.

Based on the latest available design drawings, it is proposed that airborne concentrations of VOC and formaldehyde are sampled at the following locations:

- Entrance/reception;
- Computer lab;
- Soft Play room;
- Teaching room
- Staff room
- Kitchen
- Family interview room

- Medical treatment room
- Hall/Multifunction room

Many rooms will have similar internal finishes and the same type of ventilation system. Therefore, it is considered sufficient if the 9 locations identified above are sampled across the building.

Alternative locations which serve broadly the same function, which are ventilated by the same or similar means, and to which the same or similar internal finishes would also be acceptable.

Post-Testing Flush

Where the results of air quality testing (if undertaken) indicate that results for formaldehyde and VOC exceed the criteria reproduced from the BREEAM guidance above, the suggested method is that the building should be 'flushed out' or purged, as per the procedure described in Section 3.3.

3.5 Maintaining Indoor Air Quality in Use

The usage patterns of the building occupants have the potential to affect indoor air quality in the building.

The main building system will be run via an Air Handling Unit (AHU) with the intake and extract at roof level. It is recommended that all materials comply with the relevant BREEAM product performance and testing standards for low emissions. CO2 detectors expected to be provided only to localised rooms where there is a risk, like plant room, kitchens etc.

Domestic space & water heating be provided by using an ASHP (electric) at ground level and gas boiler as a back-up, within the plant room.

It is also recommended that ductwork is inspected regularly and cleaned as appropriate during the operational phase of the development in accordance with established standards.

Regular housekeeping and cleaning are recommended to control levels of deposited dust and prevent resuspension.

It is recommended that the building is operated to a documented management system to ensure that maintenance is carried out appropriately and in a timely manner. All relevant documentation should be available on site. Maintenance and cleaning of the ventilation systems should be included in this management system.

Where further redecoration or refurbishment is planned, it is recommended that all materials comply with the relevant BREEAM product performance and testing standards for low emissions, which are outlined in Appendix B of this report.

Domestic water systems may interact with indoor air quality in terms of the potential for bioaerosol, particularly of the *Legionella* bacterium, the causative agent of legionelloses including legionnaires' disease. Any domestic water systems serving the building should be designed, operated and maintained by competent persons, and a legionellosis risk assessment should be prepared.

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4 CONCLUSIONS

RSK was commissioned to prepare a IAQP for a New SEND School which is located at Kestrel Way, Luton, in fulfilment of the requirement under section Hea 02 of the BREEAM 2018 guidance.

The IAQP includes consideration of the following content specified under Hea02, namely:

a. Removal of contaminant sources;
b. Dilution and control of contaminant sources;
c. Procedures for pre-occupancy flushout;
d. Third party testing and analysis; and
e. Maintaining indoor air quality in use.

The recommendations made in this assessment regarding these five points have been informed by a review of baseline air quality, building specifications and plans, as well as correspondence with the client.

Although some paints and internal finishes listed in the building specification comply with the performance and testing standards, further information would be required to ensure that the other products comply with the relevant criteria. It is recommended that this is sought to confirm that the products have low formaldehyde, VOC and/or heavy metal emissions (as specified in the BREEAM guidance), which would assist in improving internal air quality, particularly during the initial phases of the development opening.

This IAQP includes recommendations to promote and maintain good indoor air quality, including:

Minimising dust generation during construction and protecting ductwork used in the mechanical ventilation system from sources of dust and pollution;

Using paints and internal finishes complying with the performance and testing standards specified in the BREEAM guidance prior to occupation. (At this stage, detailed information on the paints and internal finishes is not available. Further information would be required to demonstrate compliance of the specified products with the performance and testing standards);

Undertaking testing of indoor air quality at the sampling locations identified in accordance with the VOC and formaldehyde testing standards specified in the BREEAM guidance and the procedures outlined in this report;

Where concentrations are found to be elevated in the testing, undertaking ‘flushing out’ prior to occupation of the building; and

Undertaking regular housekeeping to control levels of dust and preventing dust resuspension.

5 REFERENCES

BREEAM UK New Construction: Non Domestic Buildings SD5078-3.0: 2018, BRE. 2018.

BREEAM Guidance Note: GN06: Indoor Air Quality Plans, 2018. BRE, 2018.

Luton Borough Council, 2021. Air Quality Annual Status Report.

Department for Environment, Food and Rural Affairs, 2018. UK-AIR Air Information Resource. [online] Available at: http://uk-air.defra.gov.uk [Accessed September 2021].

APPENDIX A – PROPOSED SITE LAYOUT

Ground floor

First Floor


Support Rooms
Teaching Rooms
Proposed Floor Areas:
Gross Internal Area:
Ground Floor = 1637 sq m
First Floor = 1363 sq m
School Total = 3000 sq m
Respite Total = 604 sq m
Gross External Area
Ground Floor = 1739 sq m
First Floor = 1455 sq m
School Total = 3194 sq m
Respite Total = 647
MAIN ENTRANCE
Flat Roof above Hydrotherapy Pool
Flat Roof above Main Multi function Room
Flat Roof above Respite
canopy
TENDER
Luton

APPENDIX B – BREEAM GUIDANCE SUMMARY

This Appendix summarises the BREEAM criteria for Indoor Air Quality (found in section Hea 02) against which the assessment in section 3 has been undertaken. There are four credits available, as follows:

a) Prerequisite – Provision of Indoor Air Quality Plan;
b) Ventilation (one credit);
c) Emissions from construction products (up to two credits); and
d) Post-construction indoor air quality measurement (one credit).

The requirements for each of these credits have been replicated below.

Prerequisite – Indoor Air Quality Plan:

1. A site-specific indoor air quality plan has been produced and implemented in accordance with the guidance in Guidance Note GN06. The objective of the plan is to facilitate a process that leads to design, specification and installation decisions and actions that minimise indoor air pollution during occupation of the building. The indoor air quality plan must consider the following:

    1.a Removal of contaminant sources

    1.b Dilution and control of contaminant sources:

        1.b.i Where present, consideration is given to the air quality requirements of specialist areas such as laboratories

    1.c Procedures for pre-occupancy flush out

    1.d Third party testing and analysis

    1.e Maintaining good indoor air quality in-use.

One credit - Ventilation:

2. The building has been designed to minimise the indoor concentration and recirculation of pollutants in the building as follows:

   2.a Provide fresh air into the building in accordance with the criteria of the relevant standard for ventilation

   2.b Ventilation pathways are designed to minimise the ingress and build-up of air pollutants inside the building (see Methodology on page 95)

   2.c Where present, HVAC systems must incorporate suitable filtration to minimise external air pollution, as defined in BS EN16798-3:2017(45) . The specified filters should achieve supply air classification of at least SUP 2.

   2.d Areas of the building subject to large and unpredictable or variable occupancy patterns have carbon dioxide (CO_2) or air quality sensors specified and:

   2.d.i In mechanically ventilated buildings or spaces: sensors are linked to the mechanical ventilation system and provide demand-controlled ventilation to the space 2.d.ii In naturally ventilated buildings or spaces: sensors either have the ability to alert the building owner or manager when CO_2 levels exceed the recommended set point, or are linked to controls with the ability to adjust the quantity of fresh air, i.e. automatic opening windows or roof vents

   2.e For naturally ventilated or mixed mode buildings, the design demonstrates that the ventilation strategy provides adequate crossflow of air to maintain the required thermal comfort conditions and ventilation rates in accordance withCIBSEAM10

Up to two credits – Volatile organic compound (VOC) emission levels (products):

3. Three out of the five product types meet the emission limits, testing requirements and any additional requirements listed in Table 5.11. Where wood-based products are not one of three selected product types, all wood-based products used for internal fixtures and fittings must be tested and classified as formaldehyde E1 class as a minimum.

Two credits

4. All of the product types listed meet the emission limits, testing requirements and any additional requirements listed in Table 5.11.

One credit – Volatile organic compound (VOC) emission levels (post construction):

5. The formaldehyde concentration level is measured post construction (but pre-occupancy) and is found to be less than or equal to 100µg/m^3 averaged over 30 minutes (WHO guidelines for indoor air quality: Selected pollutants, 2010).
6. The formaldehyde sampling and analysis is performed in accordance with ISO 16000-2 and ISO 16000-3.
7. The total volatile organic compound (TVOC) concentration level is measured post construction (but pre-occupancy) and does not exceed 500µg/m^3 over 8 hours.
8. The TVOC sampling and analysis is performed in accordance with ISO 16000-5 and ISO 16000-6 or ISO 16017-1.
9. Where levels are found to exceed the limits, the project team confirms the measures that have, or will be taken, in accordance with the IAQ plan, to reduce the TVOS and formaldehyde levels to within the above limits.
10. The measured concentration levels of formaldehyde (µg/m³) and TVOC (µg/m³) are reported, via the BREEAM Assessment Scoring and Reporting Tool.

Decorations and Finishes Criteria

The decorations and finishes criteria specified in Tables 5.11-5.12 of the BREEAM 2018 guidance are presented below.

Table A.1: Emission Criteria by Product Type (Table 5.11 of the guidance)

Emission limit*			Testing requirement	Additional requirements
Formaldehyde	Total volatile organic compounds (TVOC)	Category 1A and 1B carcinogens		
Interior paints and coatings				
≤ 0.06 mg/m³	≤ 1.0 mg/m³	≤ 0.001 mg/m³	EN 16402 [3] or ISO 16000-9 [4] or EN 16516 [5] or CDPH Standard Method v1.1 [6]	Meet TVOC content limits (See Table 5.13) Paints used in wet areas (e.g. bathrooms, kitchens, utility rooms) should protect against mould growth (See Methodology).
Wood-based products(including wood flooring)				
≤ 0.06 mg/m³ (Non-MDF) ≤ 0.08 mg/m³(MDF)	≤ 1.0 mg/m³	≤ 0.001 mg/m³	ISO 16000-9 or EN 16516 or CDPH Standard Method v1.1 or EN 717-1 (formaldehyde emissions only) [7]	N/A
Flooring materials (including floor levelling compounds and resin flooring)				
≤ 0.06 mg/m³	≤ 1.0 mg/m³	≤ 0.001 mg/m³	ISO 10580[8] or ISO 16000-9 or EN 16516 or CDPH Standard Method v1.1	N/A
Ceiling, wall, and acoustic and thermal insulation materials				
≤ 0.06 mg/m³	≤ 1.0 mg/m³	≤ 0.001 mg/m³	ISO 16000-9 or EN 16516 or CDPH Standard Method v1.1	N/A
Interior adhesives and sealants (including flooring adhesives)				
≤ 0.06 mg/m³	≤ 1.0 mg/m³	≤ 0.001 mg/m³	EN 13999 (Parts 1-4) [9][10][11][12] or ISO 16000-9 or EN 16516 or CDPH Standard Method v1.1	N/A

Note: One credit: Three out of the five product types meet the emission limits, testing requirements and any additional requirements listed in Table 5.11. Where wood-based products are not one of three selected product types, all wood-based products used for internal fixtures and fittings must be tested and classified as formaldehyde E1 class as a minimum.

Two Credits: All of the product types listed meet the emission limits, testing requirements and any additional requirements listed in Table 5.11.

Table A.2: Exemplary level emission criteria by product type (Table 5.12 of the guidance)

Formaldehyde	Total volatile organic compounds (TVOC)#	Total semi-volatile organic compounds (TSVOC)	Category 1A and 1B carcinogens	Testing requirement
Interior paints and coatings				
≤ 0.01 mg/m³	≤ 0.3 mg/m³	≤ 0.1 mg/m³	≤ 0.001 mg/m³	EN 16402 or ISO 16000-9 or EN 16516 or CDPH Standard Method v1.1
Additional requirements				
Meet VOC content limits (Table 5.10). Paints used in wet areas (e.g. bathrooms, kitchens, utility rooms) should protect against mould growth (see Methodology).				
Wood-based products including wood flooring				
≤ 0.02 mg/m³	≤ 0.3 mg/m³	≤ 0.1 mg/m³	≤ 0.001 mg/m³	ISO 16000-9 or EN 16516 or CDPH Standard Method v1.1 or EN 717-1 (formaldehyde emissions only)
Flooring materials (including floor levelling compounds and resin flooring)				
≤ 0.01 mg/m³	≤ 0.3 mg/m³	≤ 0.1 mg/m³	≤ 0.001 mg/m³	ISO 10580 or ISO 16000-9 or EN 16516 or CDPH Standard Method v1.1
Ceiling, wall, and acoustic and thermal insulation materials				
≤ 0.01 mg/m³	≤ 0.3 mg/m³	≤ 0.1 mg/m³	≤ 0.001 mg/m³	ISO 10580 or ISO 16000-9 or EN 16516 or CDPH Standard Method v1.1
Interior adhesives and sealants (including flooring adhesives)				
≤ 0.01 mg/m³	≤ 0.3 mg/m³	≤ 0.1 mg/m³	≤ 0.001 mg/m³	EN 13999 (Parts 1-4) or ISO 16000-9 or EN 16516 or CDPH Standard Method v1.1

The emission limits in this table apply to the finished product, i.e. after any coating or other treatment process has been applied.
* Compliance with emission limits shall be demonstrated after 28 days in an emission test chamber or earlier as stipulated by the relevant testing requirements standard. The emission rate obtained from the chamber test method must be extrapolated to predict what the concentration would be in the air of the theoretical model or reference room (as detailed in the respective testing standard) and this extrapolated concentration compared with the emission limit in this table.
# Where test results for a product exceed the TVOC emission limit, compliance with the above requirements can still be achieved where the test results demonstrate an R-value ≤ 1 after 28 days.

Note: Minimising sources of air pollution - Emissions from construction products

To achieve one exemplary performance credit:

One credit

Three of the product types listed meet the emission limits, testing requirements and any additional requirements listed in Table 5.12. Where wood-based products are not one of the three selected product types, all wood-based products used for internal fixtures and fittings must be tested and classified as formaldehyde E1 class as a minimum.

APPENDIX C – COMPARISON OF INTERNAL FINISHES TO PERFORMANCE AND TESTING STANDARDS

This Appendix has reviewed the paints and finishes to be used within the buildings against the performance and testing standards referenced in Table 5.11 of the BREEAM guidance. The specifications for internal decoration and finishing materials for the building were supplied by Chris Peters Associates Ltd and Jason gale from the project design & delivery team. The 'Finishes Schedule' document comprising of the floor, wall, ceiling, skirting and paint finishes etc, and the specified materials compared with the criteria set out in Table 5.11 of the BREEAM 2018 manual. The criteria in Table 5.11 have been reproduced in Appendix B above.

Tables B.2 to B.5 summarise information which RSK were able to identify at the time of writing in relation to whether the products comply with the BREEAM requirements. Where not listed, the product has not been reviewed and in those instances, it is recommended that the product is reviewed against the relevant BREEAM performance and testing standard to confirm compliance, with products swapped if necessary.

Interior Paints and Coatings

Decorative paints and varnishes are subject to performance requirements relating to their VOC and formaldehyde content and emissions. It must also be confirmed that the product is fungal and algal resistant in wet areas. Additional requirements vary depending on the purpose and location of where the paint will be used, as presented in Table B.1 below.

Table B.1: VOC content limit values for paints and varnishes

Product category	Product subcategory	Free TVOC content of ready to use product (g/l)	Testing requirements
A	Interior matt walls and ceilings (gloss <25@60°)	10	ISO 11890-226 or ISO 1789527
B	Interior glossy walls and ceilings (gloss >25@60°)	40	
C	Interior trim and cladding paints for wood and metal	90	

Product category	Product subcategory	Free TVOC content of ready to use product (g/l)	Testing requirements
D	Interior trim varnishes and woodstains, including opaque woodstains	65	or Calculation based on ingredients and raw materials
E	Interior minimal build woodstains	50	
F	Primers	15	
G	Binding primers	15	
H	One pack performance coatings	100	
I	Two pack reactive performance coatings for specific end use such as floors	80	
J	Multi-coloured coatings	80	
K	Decorative effect coatings	80	

The information of the specified paints and their compliance with the requirements are presented in Table B.2.

Table B.2: Compliance of the specified paints with BREEAM requirements

Locations where product used	Specified product	Specified Manufacturer	Formaldehyde (≤ 0.06 mg/m³)	TVOC (≤ 1.0 mg/m³)	Category 1A and 1B carcinogens (≤ 0.001 mg/m³)	Additional requirements: Interior matt walls (10g/l)
Internal walls	vinyl silk	Dulux	Information unavailable at the time of writing the	Information unavailable at the time of writing the report.	Information unavailable at the time of writing the	Ready mixed: 2g/l VOC Tinted: 8g/l VOC
Timber finishes	Eggshell	Dulux	Information unavailable at the time of writing the	Information unavailable at the time of writing the	Information unavailable at the time of writing the	Ready mixed: 17g/l Tinted colour: 22g/l
Hydrothery pool area	Specialised paint – but information is unknown	Unknown	Information unavailable at the time of writing the report.	Information unavailable at the time of writing the report.	Information unavailable at the time of writing the report.	Information unavailable at the time of writing the report.

Table B2 shows that complete information about the VOCs and formaldehyde concentrations of the some paints proposed for the development was not fully available. As per Table B2, the Dulux paint does meet the additional requirements for TVOC content outlined in Table 5.13 in the BREEAM 2018 guidance (reproduced in B.1 above) if ready mixed. It is recommended that further information is sought to confirm that the products have low VOC emissions, which would assist in improving internal air quality, particularly during the initial phases of the development opening.

Wood-based Products

Wood panels, timber structures and wood flooring are subject to the performance requirement relating to their VOC and formaldehyde content.

Table B.3: Compliance of the specified Wood-based Products with BREEAM requirements

Locations	Specified product	Specific manufacturer	Formaldehyde (≤ 0.06 mg/m³ non-MDF, ≤ 0.08 mg/m³ MDF)	VOC (≤ 1.0 mg/m³)	Category 1A and 1B carcinogens (≤ 0.001 mg/m³)
Whole building Internal doors	FD30 internal doors	Ahmarra	No information was available at the time of writing the report.	No information was available at the time of writing the report.	No information was available at the time of writing the report.
Various	Timber cladding	Ecoscape	No information was available at the time of writing the report.	No information was available at the time of writing the report.	No information was available at the time of writing the report.
Various	Thermowood	Millworks	No information was available at the time of writing the report.	No information was available at the time of writing the report.	No information was available at the time of writing the report.
Changing areas	Changing benches	Ampwire	No information was available at the time of writing the report.	No information was available at the time of writing the report.	No information was available at the time of writing the report.

Flooring Materials

Flooring materials (e.g. vinyl, linoleum, cork, rubber, carpet, laminated wood flooring) are subject to the performance requirement relating to their VOC and formaldehyde content. The materials specified by the client were assessed against the testing and performance standards, and the findings are presented in Table B.4 below.

Table B.4: Compliance of the flooring materials with BREEAM requirements

Locations	Specified product	Specified Manufacturer	Formaldehyde (≤ 0.06 mg/m³)	VOC (≤ 1.0 mg/m³)	Category 1A and 1B carcinogens (≤ 0.001 mg/m³)
Various	Suprema/wood-comfort	Altro	No formaldehyde or formaldehyde contain materials used in manufacturing	Tested against and meets requirements of AgBB Health-related Evaluation Procedure for VOC & SVOC from Building Products and FloorScore certification in accordance with SCSEC-10.2- 2007 "Indoor Air Quality Performance" and Collaborative for CHPS criteria and California 01350 Specification	No carcinogen or carcinogen contain materials used in manufacturing
Offices	Gradus Bodega	Gradus	No formaldehyde or formaldehyde contain materials used in manufacturing	Tested against and meets requirements of AgBB Health-related Evaluation Procedure for VOC & SVOC from Building Products and FloorScore certification in accordance with SCSEC-10.2- 2007 "Indoor Air Quality Performance" and Collaborative for CHPS criteria and California 01350 Specification	No carcinogen or carcinogen contain materials used in manufacturing

It can be seen from Table B.4 that products testing values meet the BREEAM criteria It is recommended that this is sought to confirm that the products have no VOC emissions, which would assist in improving internal air quality, particularly during the initial phases of the development opening.

Ceiling, Wall and Acoustics and Thermal Insulation Materials

Suspended ceiling tiles, wall coverings and acoustics and thermal insulation materials are subject to the performance requirement relating to their VOC and formaldehyde content. The compliance of the suspended ceiling tiles with the BREEAM requirements are presented in Table B.5 below.

Table B.5: Compliance of the suspended ceiling tiles with BREEAM requirements

Locations	Specified product	Specific manufacturer	Formaldehyde (≤ 0.06 mg/m³)	VOC (≤ 1.0 mg/m³)	Category 1A and 1B carcinogens (≤ 0.001 mg/m³)
Whole development	Perla OP 0.95	Zentia	No information was available at the time of writing the report.	Product complies with Indoor Air Comfort Requirements – Meaning compliant with VOC requirements on Low emitting products of VOC Label, AgBB/ ABG and royal decree (Belgium)	No information was available at the time of writing the report.

It can be seen from Table B.5 that there is not enough information available relating to the formaldehyde and VOC emissions of the proposed ceiling tiles. Although the manufacturers' website states that *"Zentia ceiling products achieve low or very low VOC and formaldehyde emission levels"*, no specific information is available. It is recommended that this information is sought to confirm that the products have low formaldehyde emissions, which would assist in improving internal air quality, particularly during the initial phases of the development opening.

Interior Adhesives and Sealants

Details of any specific flooring adhesives to be utilised in the development were not recorded within the information made available to RSK. Further information would be required to ensure that the products comply with the relevant criteria. It is recommended that this is sought to confirm that the products have low formaldehyde emissions, which would assist in improving internal air quality, particularly during the initial phases of the development opening