

Regents Wharf, N1

Overheating Risk Analysis Report

April 2017



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Regent's Wharf, London
Overheating Risk Analysis Report



Client Name: Regent's Wharf Unit Trust

Client Address: 4 Sloane Terrace
London
SW1X 9DQ

Property: Regent's Wharf

Project Reference: 3840

Issue: For Planning Submission

Date: April 2017

Prepared by: SH

Checked by: SEJ

Validated by: SRM



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1.00 INTRODUCTION

1.01 Purpose

This report has been prepared for Regents Wharf Unit Trust for the proposed Regents Wharf development. This document assesses the overheating risk and requirement for active cooling in accordance with the following:

- London Plan Policy 5.9
- Islington Policy DM 7.5
- Islington Environmental Design SPD sections 6.0.24 to 6.0.30

This report demonstrates that the proposed development has maximised passive design measures where feasible and followed the sequential cooling hierarchy stated in the Islington Policy DM 7.5. The report includes details of internal temperature modelling under projected increased future summer temperatures to demonstrate that the risk of overheating and to justify the requirement for active cooling.

The development has been subjected to an overheating analysis as set out in the GLA document "Energy Planning Greater London Authority guidance on preparing energy assessments (March 2016)" to assess the risk of the building overheating. The weather data used for the assessment has been taken from the CIBSE TM49 suite of data as recommended by the GLA energy strategy guidance. The assessment of the overheating criteria is based on the recommendations of the CIBSE Technical Memorandum document TM52 and the 2015 edition of the CIBSE Guide A that was published after TM52.

1.02 Proposed Building

Redevelopment of the site at Regent's Wharf including the demolition of 14, 16 and 18 Regent's Wharf; construction of a seven storey building providing Class B1 office floor A1/A3/B1/D1/D2 space and class floor space at ground floor; refurbishment and extension of 10-12 Regent's Wharf to provide additional Class B1 floor space with ancillary Class A1/A3 restaurant and Class A1/B1/D1 floor space at ground floor and associated hard and soft landscaping.

1.03 Reservation

The thermal model assessment has been prepared for Regents Wharf Unit Trust only, and Watkins Payne Partnership accepts no responsibility for its use by any third parties.



2.00 OVERHEATING RISK ANALYSIS PRINCIPLES

2.01 General

The "Testing for the presence or likelihood of overheating" criteria as set out in TM52 and the subsequent 2015 edition the CIBSE Guide A the overheating analysis shall be undertaken in two separate stages:

Stage	Operating Mode	Overheating Analysis Assessment Method
1	Free running i.e. no mechanical comfort cooling provided	Indoor operative temperature
2	Mechanical comfort cooling	Predicted Mean Vote (PMV) and Predicted Percentage Dissatisfied (PPD)

It should be noted that the base information for naturally ventilated buildings utilised in TM52 is taken from BS EN 15251 which is based purely on office buildings and is assumed to apply to a wider variety of buildings. However as noted in the 2015 edition of CIBSE Guide A "This assumption should be treated with caution and consideration should be given to any specific circumstances in any particular building".

2.02 Software Utilised

The modelling software used to carry out this analysis is a product of Environmental Design Solutions Ltd (EDSL) called TAS, version 9.4. This is a dynamic simulation software which is constructed in accordance with CIBSE AM11. TAS can provide a full dynamic thermal analysis for simple or complex building HVAC systems. Using this software it will be illustrated how the Regents Wharf building performs against the overheating / thermal comfort parameters, as set out in CIBSE TM52 and the subsequent 2015 edition of the CIBSE Guide A for mechanically cooled buildings.

2.03 Overheating Risk Criteria

2.03.01 Free Running Building

The TM52 overheating compliance criteria for a free running building to be regarded as not overheating is that two of the three criteria, set out below need to be met.

The pass / fail limits for the three criteria are summarised below:

Criterion 1	Hours of Exceedance (H_e)	The first criterion sets a limit of 3% for the number of occupied hours that the operative temperature (T_{op}) can exceed T_{max} during a typical non-heating season. T_{max} being exceeded is indicated by $\Delta T > 1K$
Criterion 2	Daily Weighted Exceedance (W_e)	The second criterion deals with the severity of overheating within any one day, which is given in terms of temperature rise and duration and sets a daily limit for acceptability. This is indicated by the weighted exceedance being less than or equal to 6
Criterion 3	Upper Limit Temperature (T_{upp})	The third criterion sets an absolute maximum acceptable temperature for a room. This is indicated by ΔT shall not exceeding 4 K.



Where the following, in the above table are defined as:

Operative temperature (T_{op})	The resultant hourly room air temperature calculated by the dynamic simulation software
Maximum acceptable temperature (T_{max})	T_{max} is calculated for each day from the running mean of the outdoor temperature. In accordance with Category II in BS EN 15251 T_{max} has been set at a maximum acceptable temperature of 3K above the comfort temperature.
Non-heating season	1 st May to 30 th September
Delta T (ΔT)	This is a simple equation where $\Delta T = T_{op} - T_{max}$

2.03.02 Mechanically Comfort Cooled Building

The TM52 overheating compliance criteria for a mechanically cooled building are as set out below in the extract from TM52.

A mechanically cooled building should aim to provide an indoor environment where the PMV index is near to or equal to zero. According to Table 2, it will be considered as overheating if the value of the PMV index is above 0.5 (PPD \geq 10%).

However this criterion has been further refined in the 2015 edition of the CIBSE Guide A. The applicable extract from the 2015 CIBSE Guide A is as follows:

A mechanically cooled building should aim to provide an indoor environment where the PMV index is near to or equal to zero. It will be considered as overheating if the value of the PMV index is above 0.5 (equivalent to a PPD of 10%).

The predicted indoor temperature or values of PMV should not exceed the tabulated values for more than 3% of occupied hours.

For heated and mechanically cooled buildings, the PMV (Predicted Mean Vote) is an index that predicts the mean votes of a large group of persons on the seven-point thermal sensation scale (below) based on the heating balance of the human body. Thermal balance is obtained when the internal heat production in the body is equal to the loss of heat to the environment.

PPD (predicted percentage dissatisfied) is an index that establishes a quantitative prediction of the percentage of thermally dissatisfied people who feel too cool or too warm. For the purposes of ISO 7730, thermally dissatisfied people are those who will feel hot, warm, cooler or cold.

Seven Point Thermal Sensation Scale	
3	Hot
2	Warm
1	Slightly warm
0	Neutral
-1	Slightly cool
-2	Cool
-3	Cold



Based on the ISO 7730 if you fall between 1 and -1 of the thermal sensation scale the occupants of the building are thermally satisfied.

As the PPD (predicted percentage dissatisfied) is an index that establishes a quantitative prediction of the percentage of thermally dissatisfied people who feel too cool or too warm based on the Seven Point Thermal Sensation Scale the PPD results include dissatisfied people who are "slightly cool", "cool" or "cold". From an overheating perspective the occupants whose perception is that they are too cool needs to be discounted when applying the above compliance criteria.

2.04 Design Summer Year (DSY)

The GLA require three CIBSE TM49 DSY to be simulated. The three years are:

- 1976: a year with a prolonged period of sustained warmth.
- 1989: a moderately warm summer (current design year for London).
- 2003: a year with a very intense single warm spell.

Also to take account of the urban heat island effect appropriate for the development each the DSY data is available for three different locations as set out below:

- The Greater London Authority Central Activity Zone (CAZ) and other high density urban areas (e.g. Canary Wharf): London Weather Centre data.
- Lower density urban and suburban areas: London Heathrow Airport data.
- Rural and peri-urban areas around the edge of London: Gatwick Airport data.

The location applicable to the Regents Wharf development is the London Weather Centre.

In addition, as part of the Islington Council Environmental Design SPD it is required to take account of projected weather conditions due to climate change, As such the following DSY's also require simulation:

- Islington 90th percentile – 2030
- Islington 90th percentile – 2050

3.00 Overheating Risk Analysis

3.01 General

In accordance with tenants expectations for office accommodation is proposed that the areas are to be mechanically comfort cooled. Therefore the risk of overheating during occupied hours in these areas is minimised due to the provision of the comfort cooling.

However in line with the applicant's preferred specification the new build office accommodation has the ability to operate in a 'mixed mode' manner as the office areas are provided with individual on/off control of the comfort cooling system and openable windows. The office accommodation can be assumed to have the ability to operate in a 'free running' mode as set out in TM52 albeit with a restricted window opening.

As the office accommodation has openable windows and comfort cooling this overheating risk analysis has been undertaken in two parts. Firstly the initial risk analysis has been run without comfort cooling and secondly a comfort cooled analysis has been simulated. It is



expected that the office accommodation should be capable of operating for significant periods without the need for comfort cooling.

As with all mechanically comfort cooled buildings a slight risk of overheating still does exist if the prevailing ambient conditions are in excess of the design criteria external temperatures.

The applicable accommodation use/designation National Calculation Method (NCM) internal heat gains have been used in this Overheating Risk Analysis.

3.02 Free Running Analysis

The free running analysis has been dynamically simulated and the subsequent associated results calculated for office accommodation in each of the three buildings for each of the three TM49 DSY's in accordance with the recommendations of TM52. The results for each of the sample rooms for each DSY are summarised in the following sub sections of this report.

Using the dynamic software the resultant room air temperature has been calculated for each occupied hour in each room / zone for each of the three TM49 design summer years. The software does not calculate the operative temperature however TM52 accepts that simulated room air temperatures from dynamic modelling software are acceptable for use in place of the operative temperature.

In addition the running mean of the outdoor temperature (T_m) has been calculated from the DSY weather data for the non-heating season, 1st May to 30th September and hence the limiting maximum acceptable temperature (T_{max}) for the assessed rooms has been calculated.

Due to the large amount of analysis data generated for the office areas a typical zone has been selected for each building on the east, south and west façades where applicable. The zones reviewed are as follows (along with the appropriate zone reference from the model):

Building A

- Zone A1 - West (6th – Office_per 5)
- Zone A2 - East (6th – Office_per 1)
- Zone A3 - South (6th – Office_per 10)

Building B

- Zone B1 - South (4th – Office_per 12)

Building C

- Zone C1 - West (5th – Office_per 1)
- Zone C2 - East (5th – Office_per 2)
- Zone C3 - South (4th – SME Office 2)

The occupied hours applied are

- Office Accommodation - 0800 hours to 1800 hours



3.02.01 Free Running Analysis

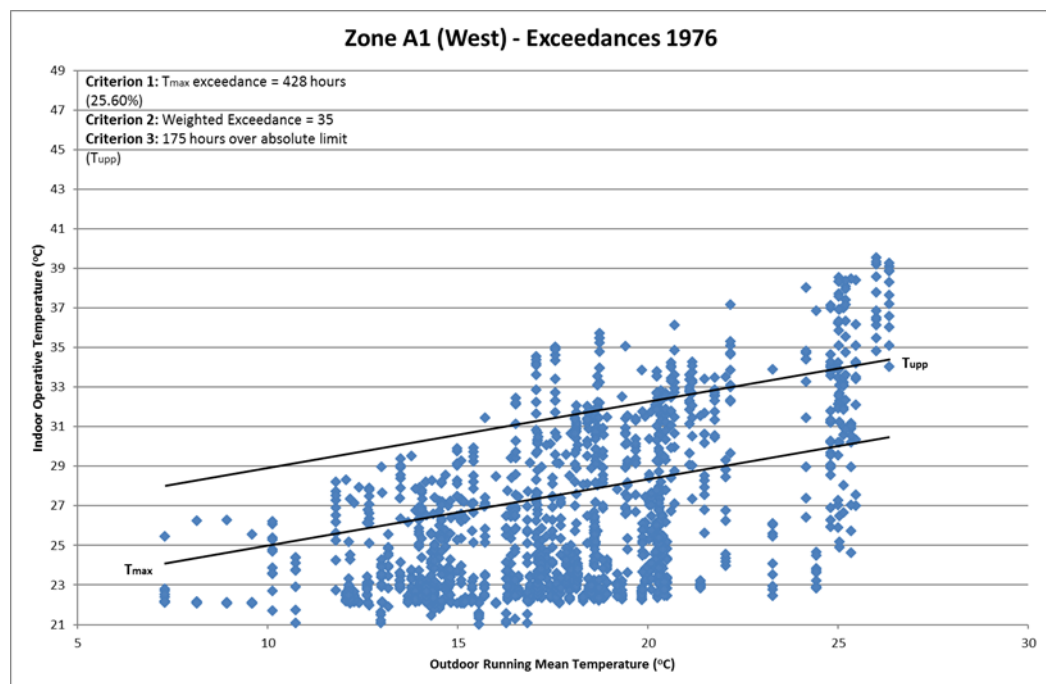
To be regarded as not at risk from overheating two of the three TM52 free running criteria must be met.

3.02.02 Free Running Analysis - TM49 DSY: 1976 LWC

A summary of the dynamic simulation results is as follows:

TM49 DSY: 1976 LWC	
Zone A1 (West)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 25.60% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 180 The calculated W_e is 35 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 175 occupied hours during the assessed summer period.
Summary	None of the 3 criteria has passed The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring.

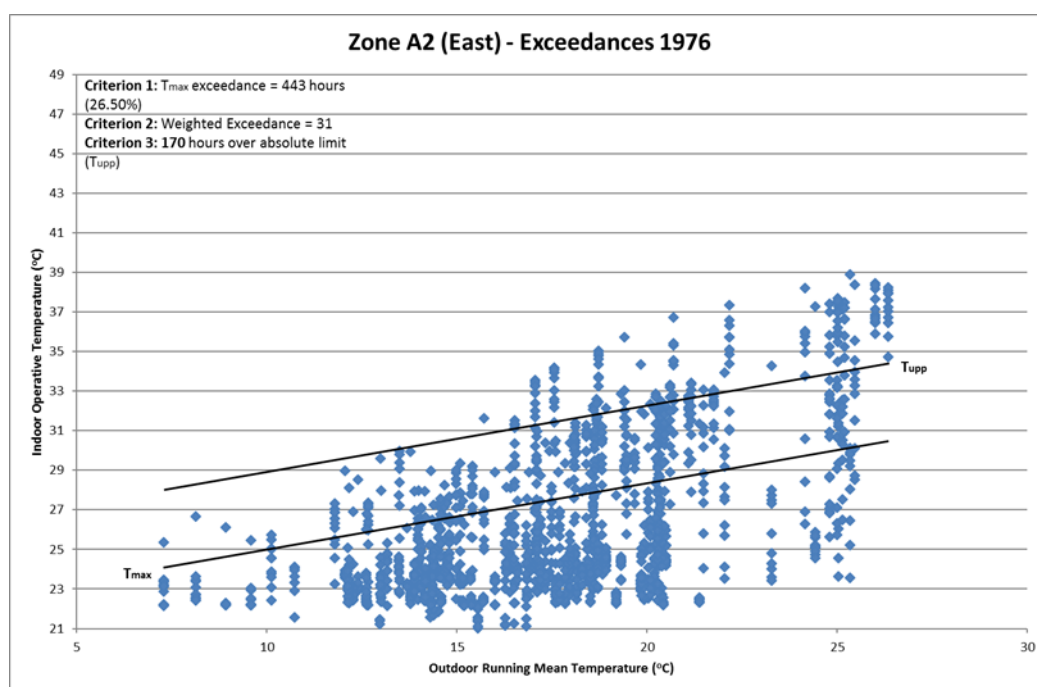
These results are shown graphically below:





TM49 DSY: 1976 LWC	
Zone A2 (East)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 26.50% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 180 The calculated W_e is 31 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 170 occupied hours during the assessed summer period.
Summary	None of the 3 criteria has passed The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring

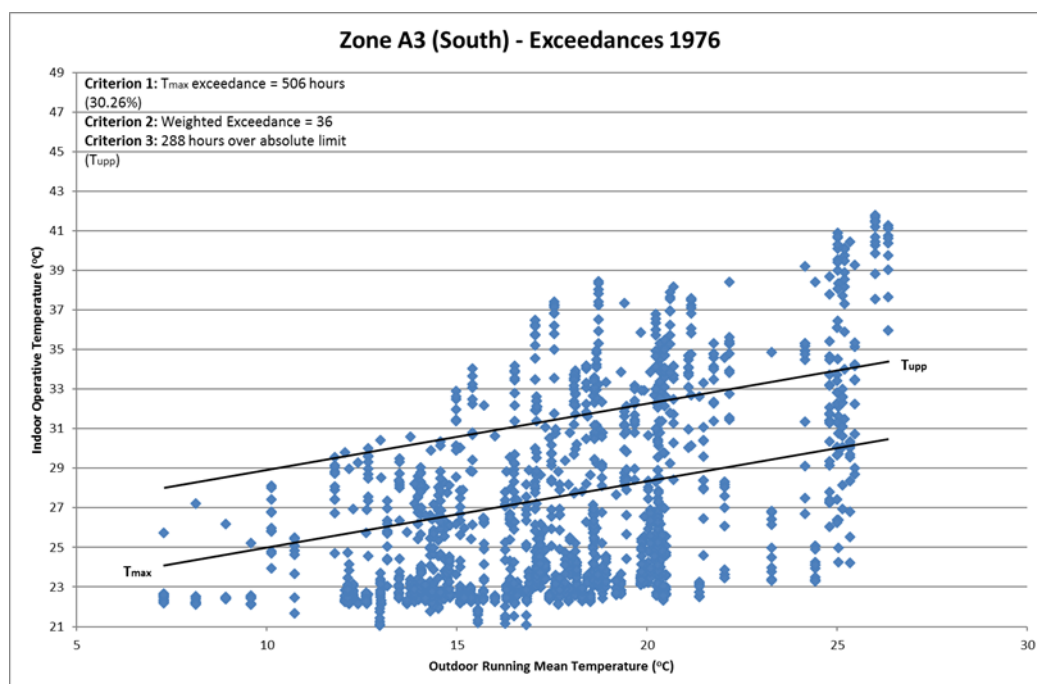
These results are shown graphically below:





TM49 DSY: 1976 LWC	
Zone A3 (South)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 30.26% The limiting value of percentage of occupied hours is 3% hence this criteria is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 180 The calculated W_e is 36 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 288 occupied hours during the assessed summer period.
Summary	None of the 3 criteria has passed The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring

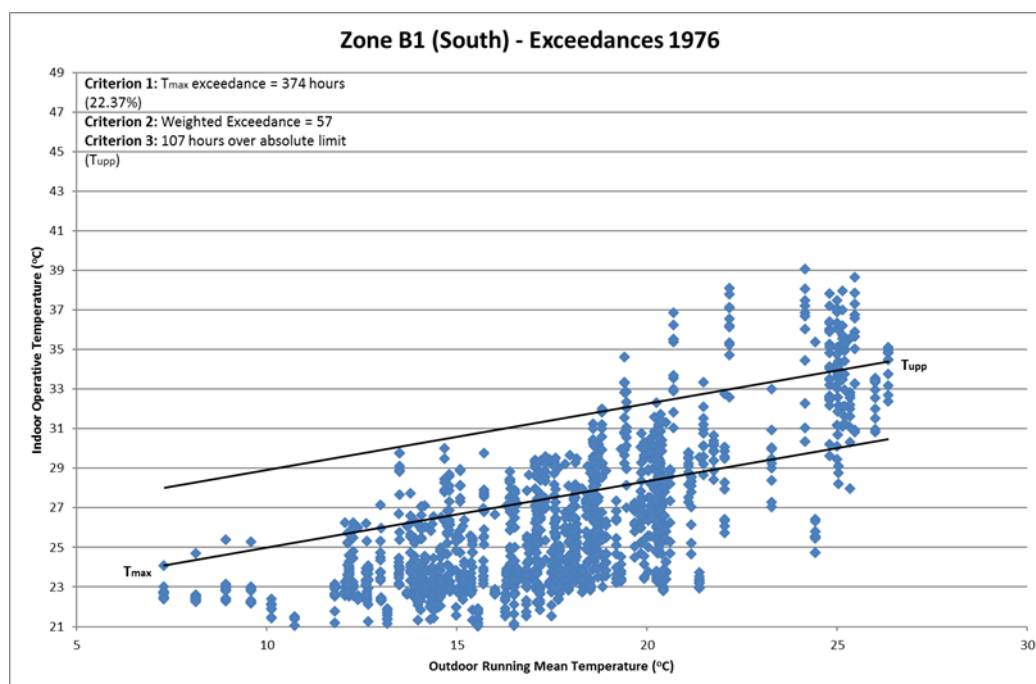
These results are shown graphically below:





TM49 DSY: 1976 LWC	
Zone B1 (South)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 22.37% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 180 The calculated W_e is 57 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 107 occupied hours during the assessed summer period.
Summary	None of the 3 criteria has passed. The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring.

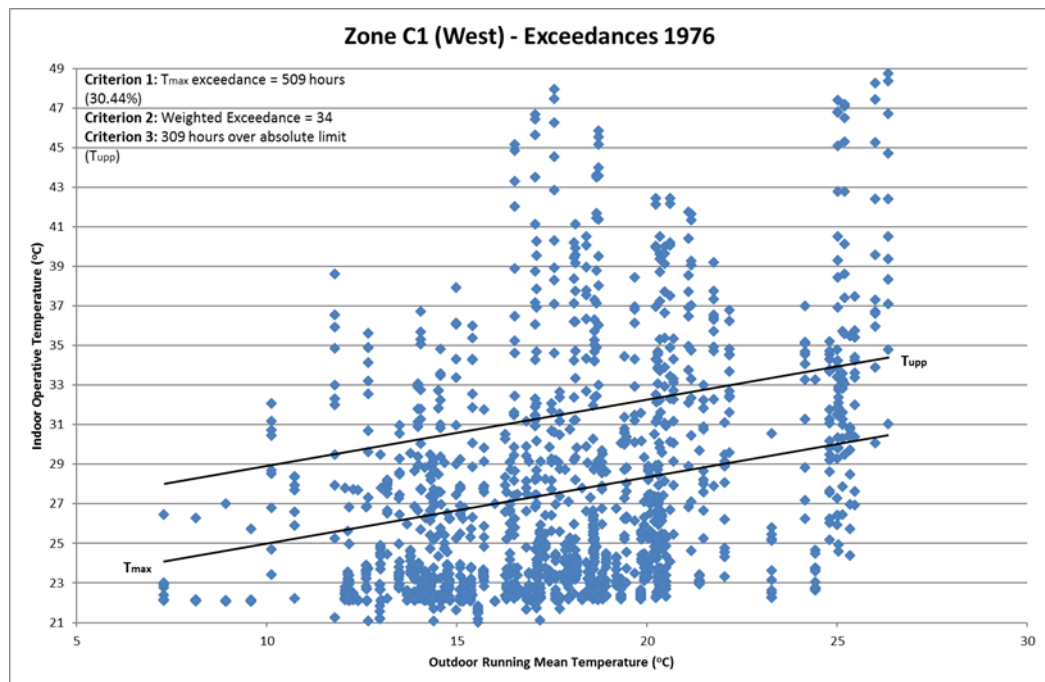
These results are shown graphically below:





TM49 DSY: 1976 LWC	
Zone C1 (West)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 30.44% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 180 The calculated W_e is 34 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 309 occupied hours during the assessed summer period.
Summary	None of the 3 criteria has passed The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring

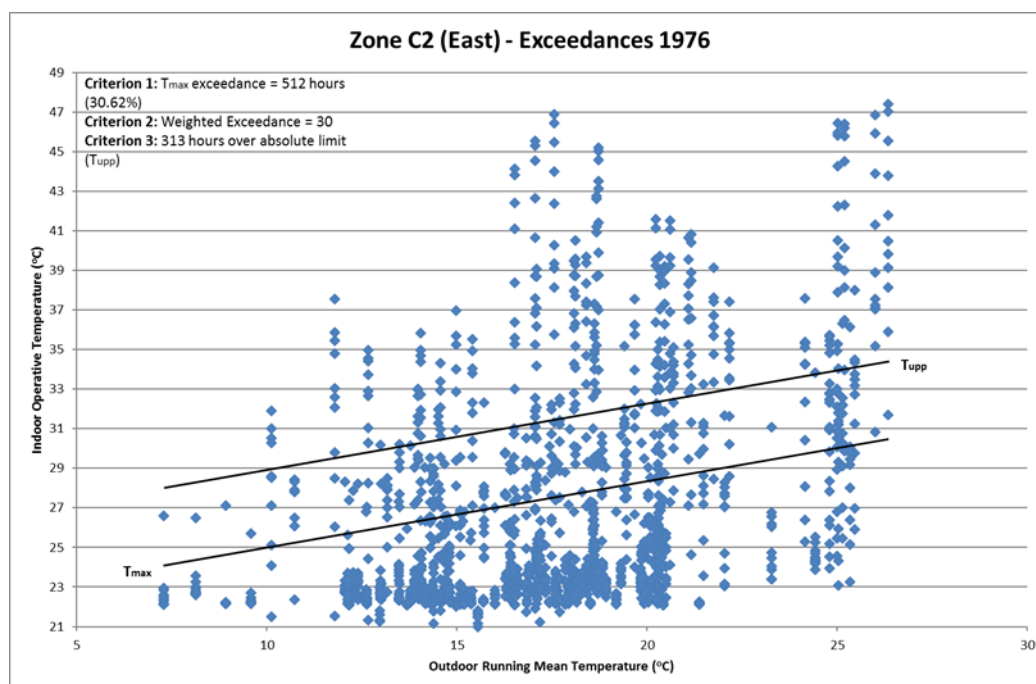
These results are shown graphically below:





TM49 DSY: 1976 LWC	
Zone C2 (East)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 30.62% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 180 The calculated W_e is 30 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 313 occupied hours during the assessed summer period.
Summary	None of the 3 criteria has passed The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring

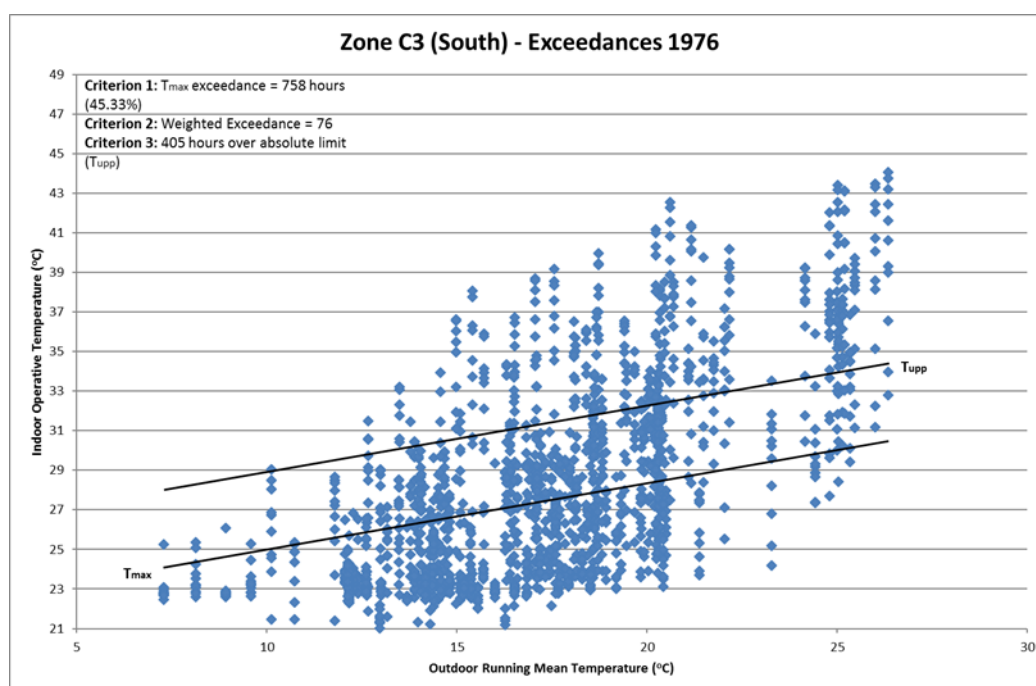
These results are shown graphically below:





TM49 DSY: 1976 LWC	
Zone C3 (South)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 45.33% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 180 The calculated W_e is 76 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 405 occupied hours during the assessed summer period.
Summary	None of the 3 criteria has passed The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring

These results are shown graphically below:



Based on the recommendations of TM52 each of the representative zones from all three buildings are shown to have a risk of overheating when operating in free running mode for the 1976 DSY.

Each zone has been shown to fail all 3 criteria and hence based on the recommendations of TM52 have a predicted risk of overheating during prolonged periods of high external ambient temperature when operating in free running mode for the 1976 DSY.

Therefore, additional measures need to be employed to reduce the predicted risk of overheating. See section 4.00 of this report for further details.

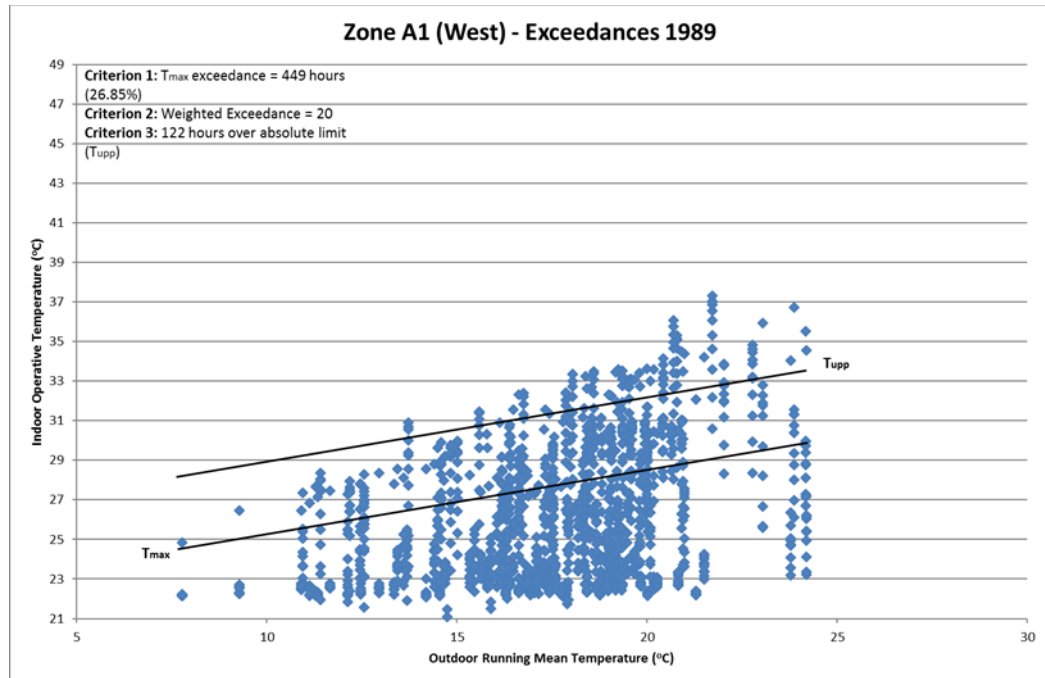


3.02.03 Free Running Analysis - TM49 DSY: 1989 LWC

A summary of the dynamic simulation results is as follows:

TM49 DSY: 1989 LWC	
Zone A1 (West)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 26.85% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 204 The calculated W_e is 20 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 122 occupied hours during the assessed summer period.
Summary	None of the 3 criteria has passed. The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring.

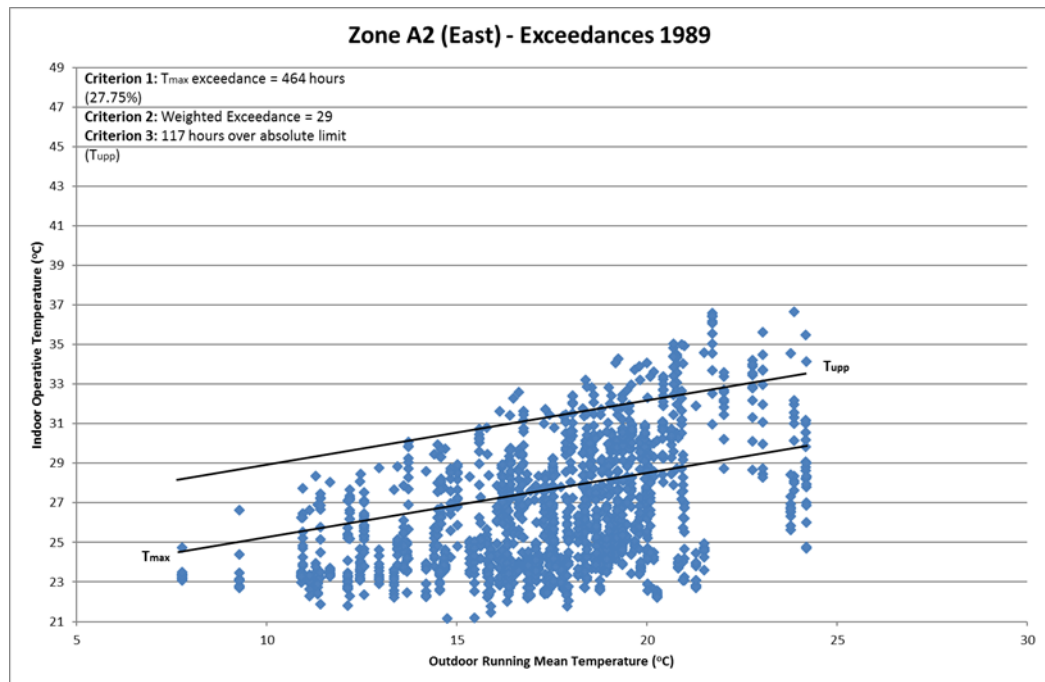
These results are shown graphically below:





TM49 DSY: 1989 LWC	
Zone A2 (East)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 27.75% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 204 The calculated W_e is 29 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 117 occupied hours during the assessed summer period.
Summary	None of the 3 criteria has passed. The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring.

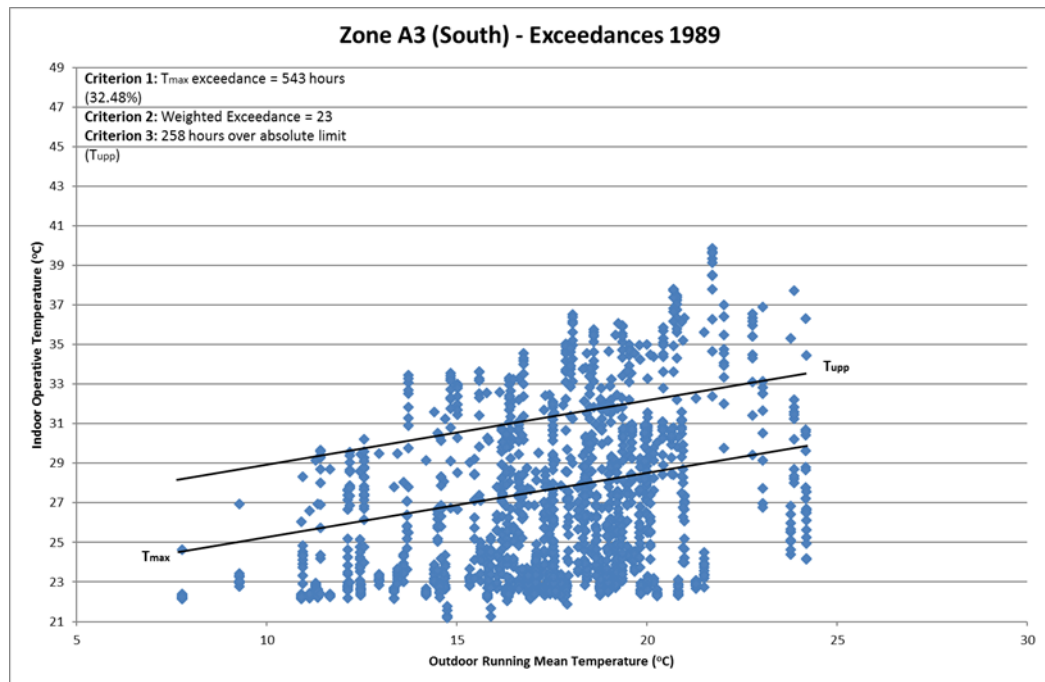
These results are shown graphically below:





TM49 DSY: 1989 LWC	
Zone A3 (South)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 32.48% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 204 The calculated W_e is 23 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 258 occupied hours during the assessed summer period.
Summary	None of the 3 criteria has passed. The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring.

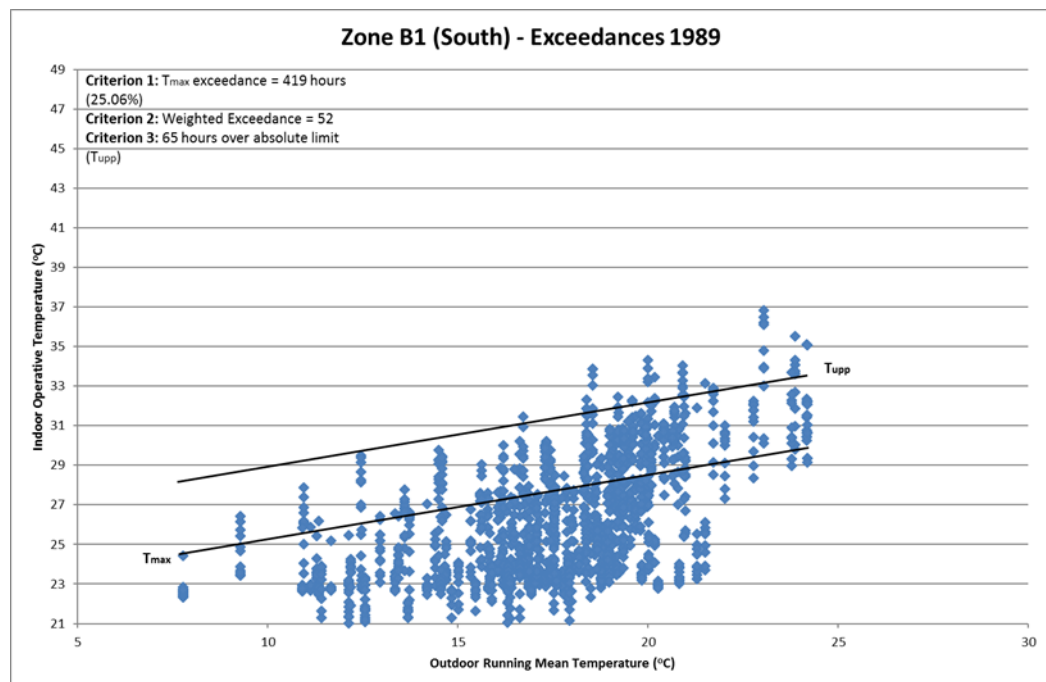
These results are shown graphically below:





TM49 DSY: 1989 LWC	
Zone B1 (South)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 25.06% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 204 The calculated W_e is 52 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 65 occupied hours during the assessed summer period.
Summary	None of the 3 criteria has passed. The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring.

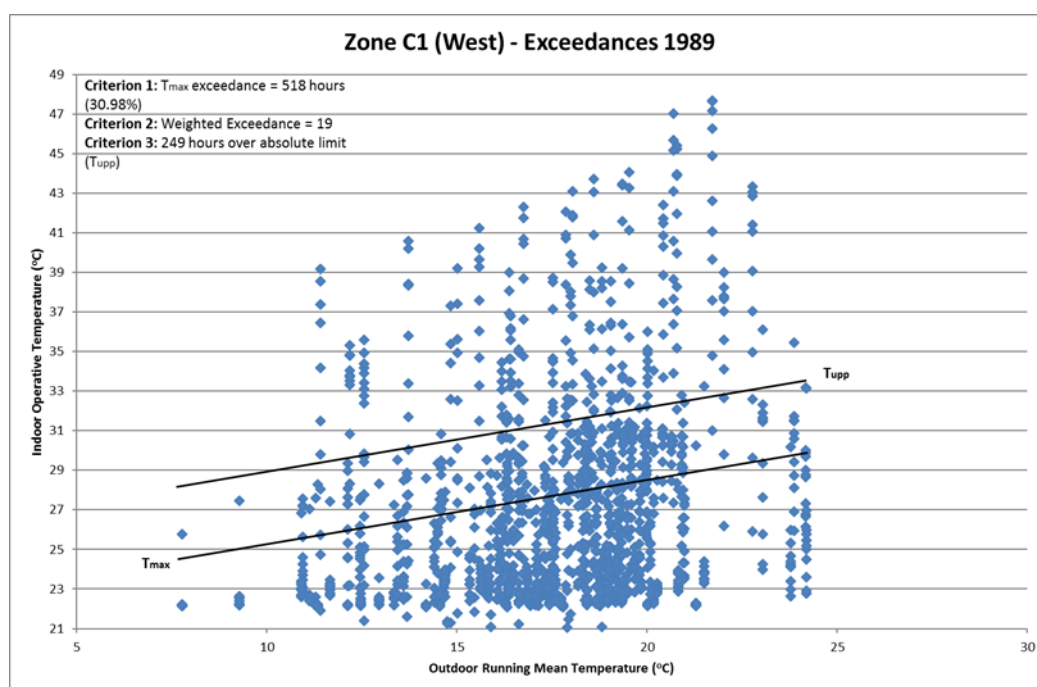
These results are shown graphically below:





TM49 DSY: 1989 LWC	
Zone C1 (West)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 30.98% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 204 The calculated W_e is 19 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 249 occupied hours during the assessed summer period.
Summary	None of the 3 criteria has passed. The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring.

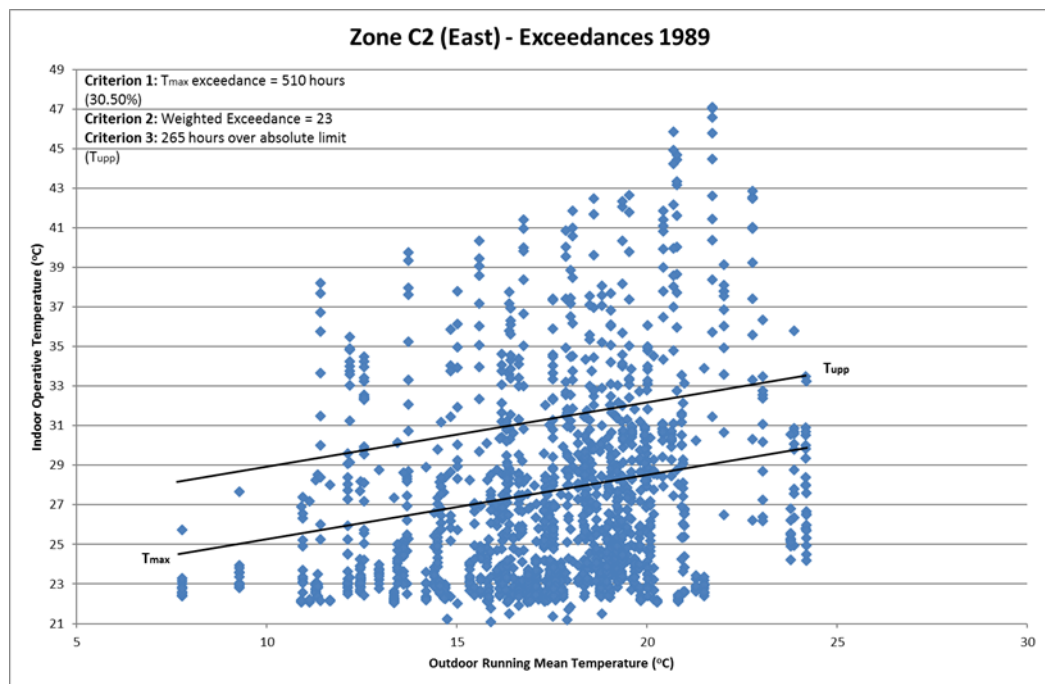
These results are shown graphically below:





TM49 DSY: 1989 LWC	
Zone C2 (East)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 30.50% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 204 The calculated W_e is 23 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 265 occupied hours during the assessed summer period.
Summary	None of the 3 criteria has passed. The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring.

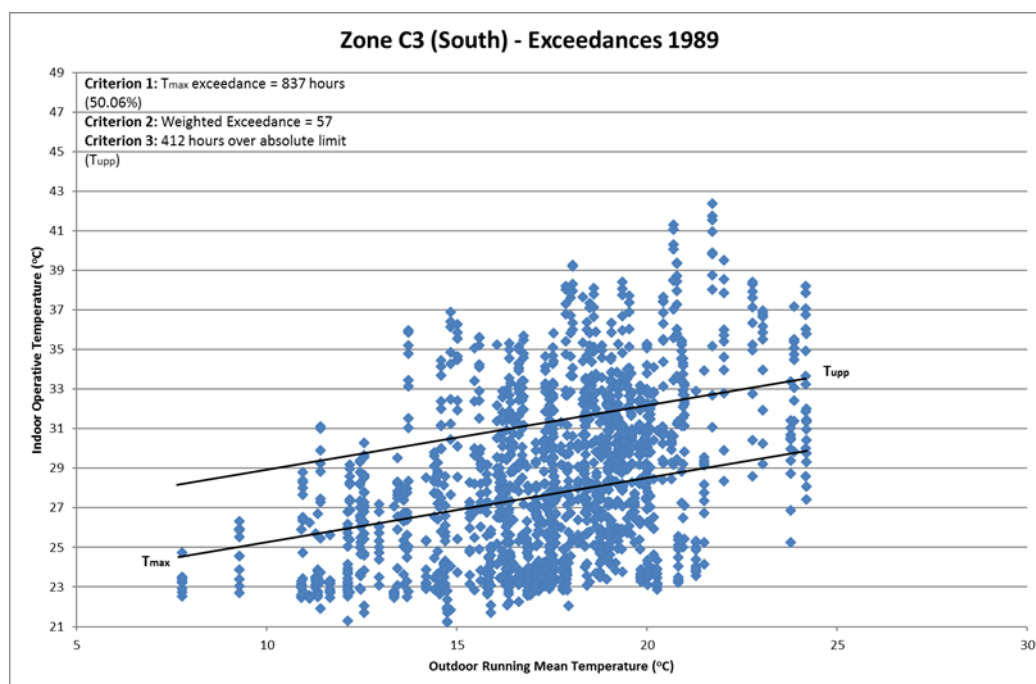
These results are shown graphically below:





TM49 DSY: 1989 LWC	
Zone C3 (South)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 50.06% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 204 The calculated W_e is 57 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 412 occupied hours during the assessed summer period.
Summary	None of the 3 criteria has passed. The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring.

These results are shown graphically below:



Based on the recommendations of TM52 each of the representative zones from all three buildings are shown to have a risk of overheating when operating in free running mode for the 1976 DSY.

Each zone has been shown to fail all 3 criteria and hence based on the recommendations of TM52 have a predicted risk of overheating during prolonged periods of high external ambient temperature when operating in free running mode for the 1976 DSY.



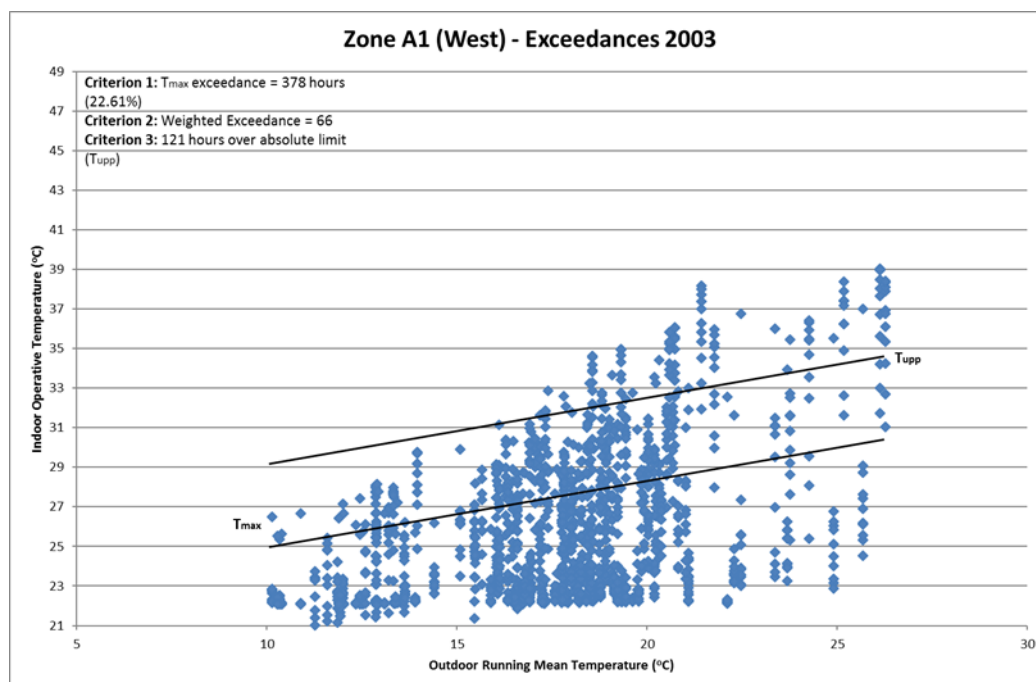
Therefore, additional measures need to be employed to reduce the predicted risk of overheating. See section 4.00 of this report for further details.

3.02.04 Free Running Analysis - TM49 DSY: 2003 LWC

A summary of the dynamic simulation results is as follows:

TM49 DSY: 2003 LWC	
Zone A1 (West)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 22.61% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 222 The calculated W_e is 66 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 121 hours during the assessed summer period.
Summary	None of the 3 criteria has passed. The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring.

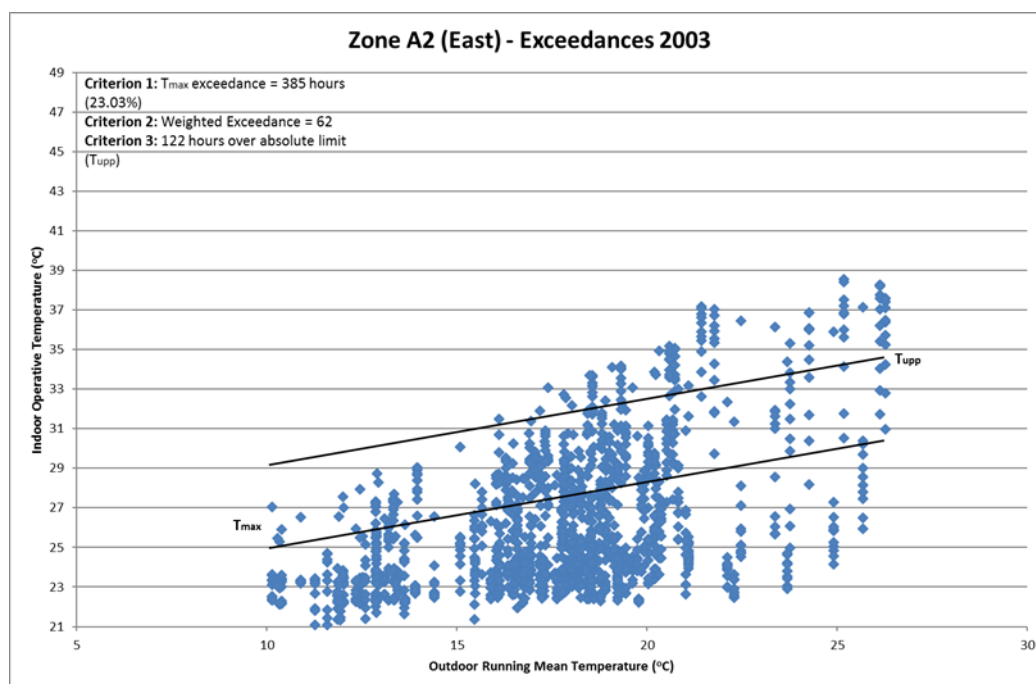
These results are shown graphically below:





TM49 DSY: 2003 LWC	
Zone A2 (East)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 23.03% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 222 The calculated W_e is 62 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 122 hours during the assessed summer period.
Summary	None of the 3 criteria has passed. The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring.

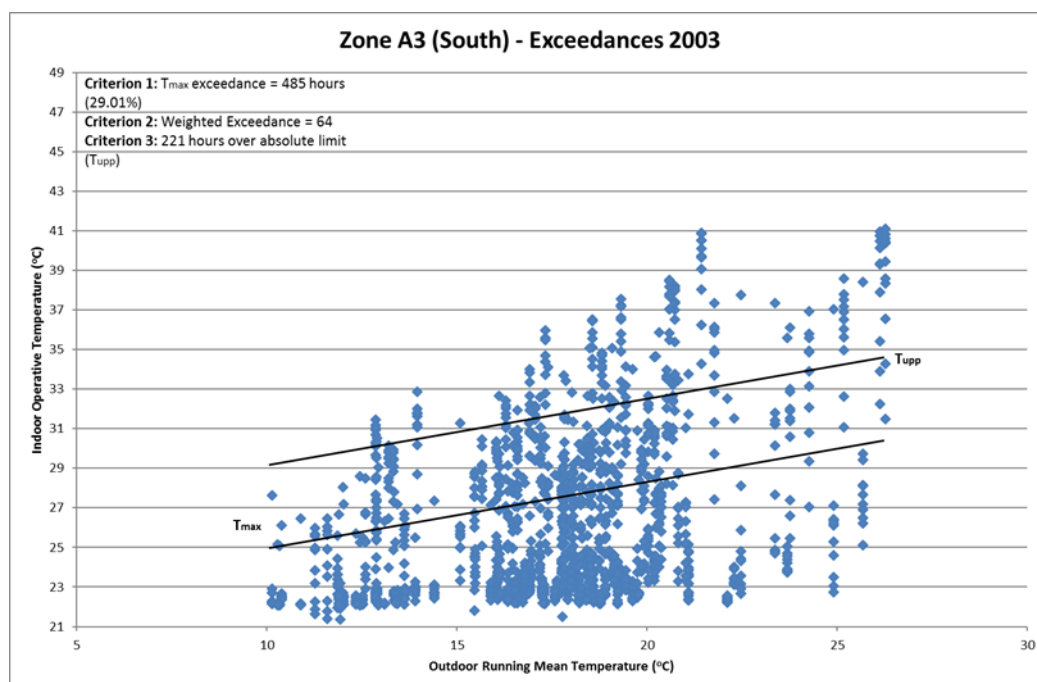
These results are shown graphically below:





TM49 DSY: 2003 LWC	
Zone A3 (South)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 29.01% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 222 The calculated W_e is 64 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 221 hours during the assessed summer period.
Summary	None of the 3 criteria has passed The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring.

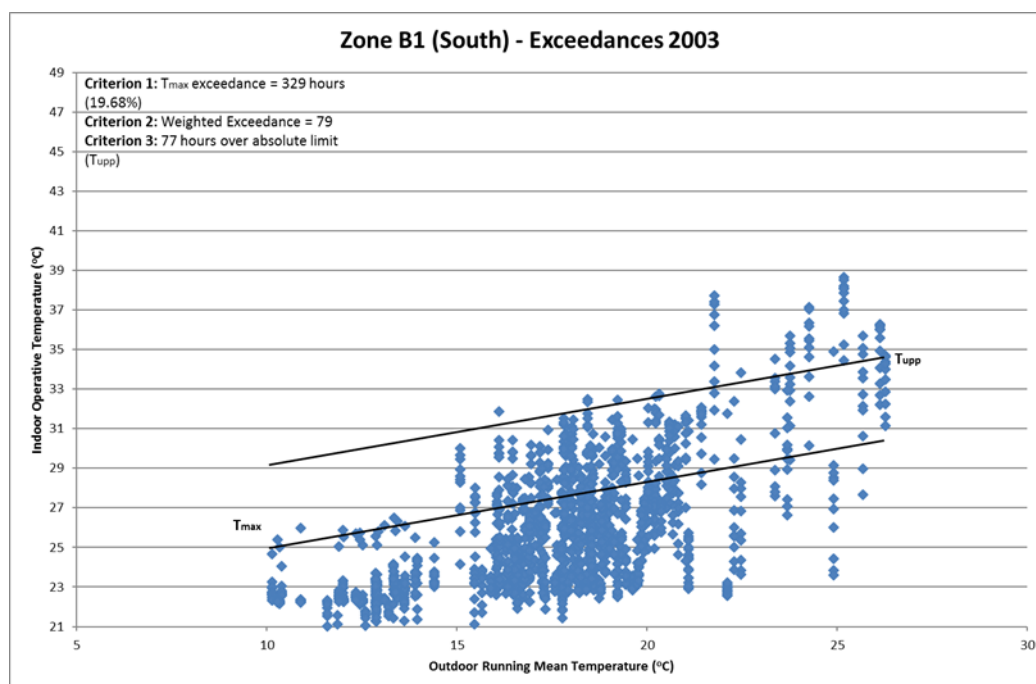
These results are shown graphically below:





TM49 DSY: 2003 LWC	
Zone B1 (South)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 19.68% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 222 The calculated W_e is 79 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 77 hours during the assessed summer period.
Summary	None of the 3 criteria has passed The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring.

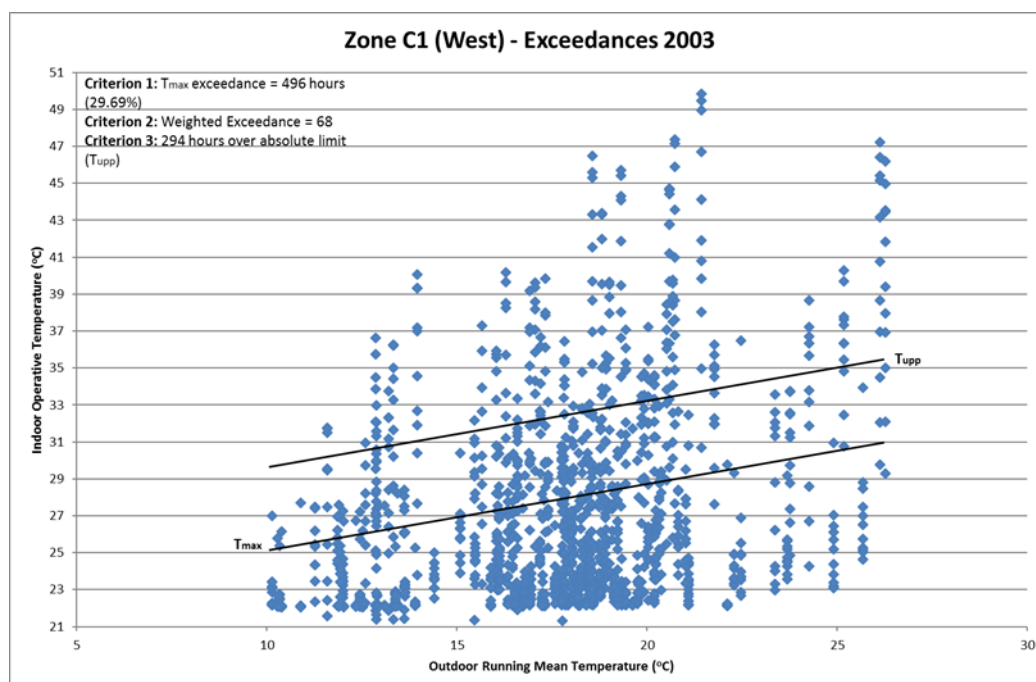
These results are shown graphically below:





TM49 DSY: 2003 LWC	
Zone C1 (West)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 29.67% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 222 The calculated W_e is 68 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 294 hours during the assessed summer period.
Summary	None of the 3 criteria has passed The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring.

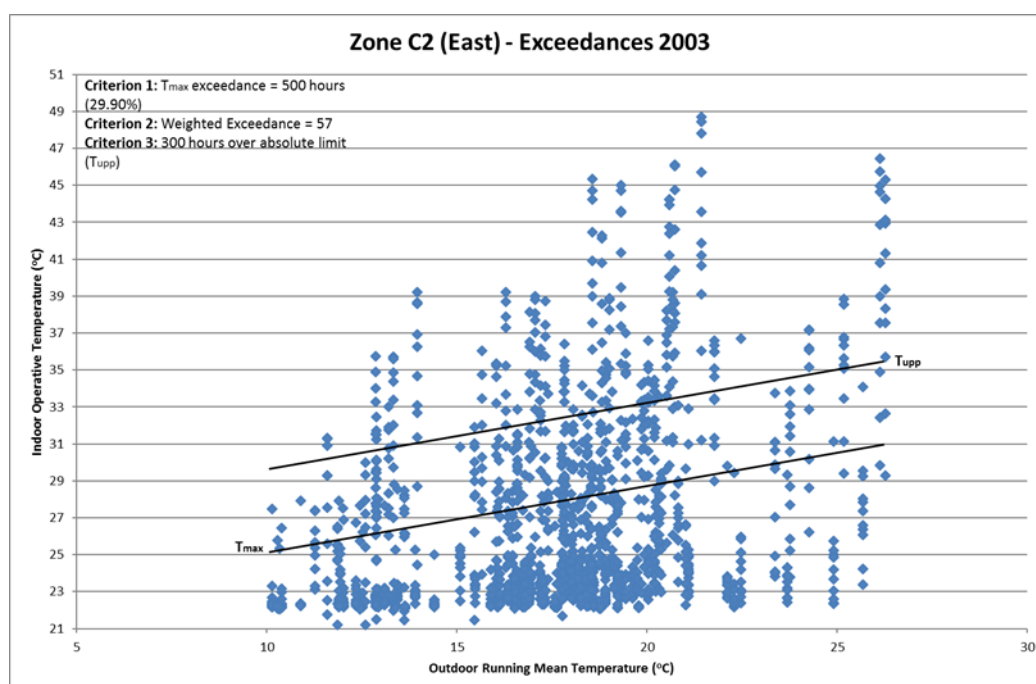
These results are shown graphically below:





TM49 DSY: 2003 LWC	
Zone C2 (East)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 29.90% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 222 The calculated W_e is 57 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 300 hours during the assessed summer period.
Summary	None of the 3 criteria has passed. The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring.

These results are shown graphically below:





TM49 DSY: 2003 LWC	
Zone C3 (South)	
Criterion 1	$\Delta T > 1K$ during some occupied hours The calculated resultant percentage of occupied hours where $\Delta T > 1K$ is 46.77% The limiting value of percentage of occupied hours is 3% hence this criterion is failed.
Criterion 2	The worst case day for $\Delta T > 1K$ is day 222 The calculated W_e is 110 The limiting value of W_e is 6 hence this criterion is failed.
Criterion 3	ΔT exceeds 4K for a total of 3.55 hours during the assessed summer period.
Summary	None of the 3 criteria has passed. The limiting criteria is a pass in 2 out of the 3 criteria Hence overheating is at risk of occurring.

These results are shown graphically below:



Based on the recommendations of TM52 each of the representative zones from all three buildings are shown to have a risk of overheating when operating in free running mode for the 2003 DSY.

Each zone has been shown to fail all 3 criteria and hence based on the recommendations of TM52 have a predicted risk of overheating during prolonged periods of high external ambient temperature when operating in free running mode for the 2003 DSY.

Therefore, additional measures need to be employed to reduce the predicted risk of overheating. See section 4.00 of this report for further details.



3.05 Mechanical Comfort Cooling Analysis

Using the dynamic software the PMV and the PPD has been established for the office area for each building for each of the three TM49 design summer years.

In accordance with TM52 the building would be regarded as at risk from overheating the if the PMV index is above 5% for more than 3% of the occupied hours.

3.05.01 Building A

3.05.01.01 Mechanical Comfort Cooling Analysis – TM49 DSY: 1976 LWC

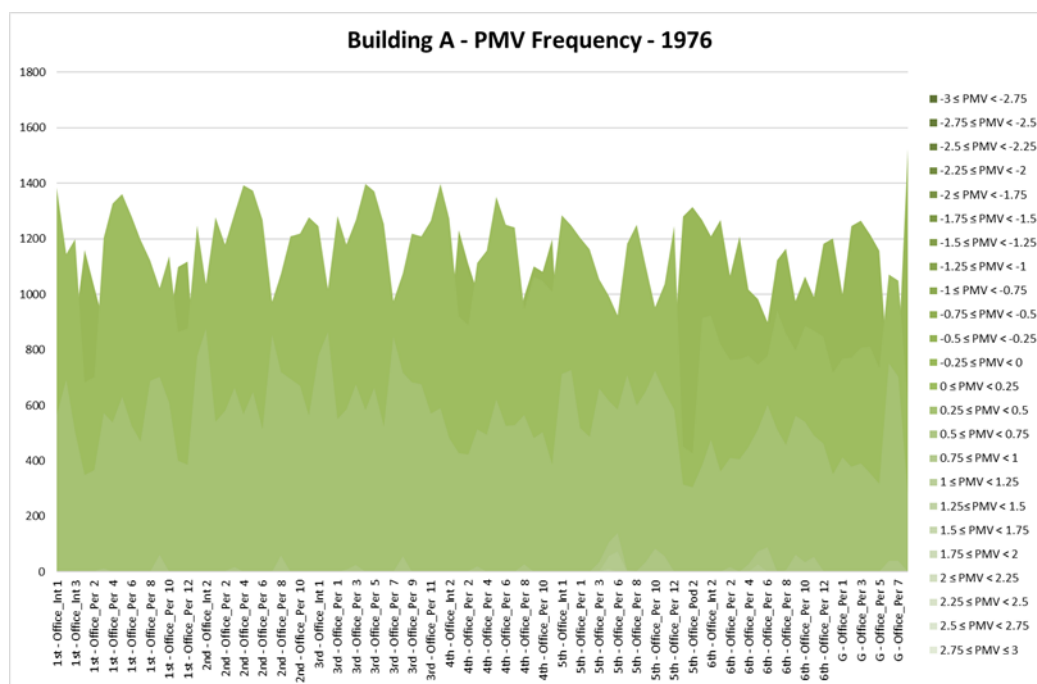
The table below shows the range of the thermal sensation scale and the average hours for the year which meets the criterion.

	-3 ≤ PMV < -2.75	-2.75 ≤ PMV < -2.5	-2.5 ≤ PMV < -2.25	-2.25 ≤ PMV < -2	-2 ≤ PMV < -1.75	-1.75 ≤ PMV < -1.5	-1.5 ≤ PMV < -1.25	-1.25 ≤ PMV < -1	-1 ≤ PMV < -0.75	-0.75 ≤ PMV < -0.5	-0.5 ≤ PMV < -0.25	-0.25 ≤ PMV < 0	0 ≤ PMV < 0.25	0.25 ≤ PMV < 0.5	0.5 ≤ PMV < 0.75	0.75 ≤ PMV < 1	1 ≤ PMV < 1.25	1.25 ≤ PMV < 1.5	1.5 ≤ PMV < 1.75	1.75 ≤ PMV < 2	2 ≤ PMV < 2.25	2.25 ≤ PMV < 2.5	2.5 ≤ PMV < 2.75	2.75 ≤ PMV ≤ 3
Average (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.9	471.6	915.9	1058.2	558.4	13.2	1.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	15.5	30.2	34.9	18.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Based on the results from a thermal comfort perspective the 100.0% of occupied hours fall between $-1.0 \leq PMV < 1.0$ frequency. Therefore based on the recommendations of ISO 7730 the occupants of the building are thermally satisfied.

This is graphically illustrated below.



The zones below the graph represent how the building has been split within the thermal model.

Applying the TM52 & CIBSE Guide A, 2015 edition risk of overheating criteria to the results indicates that the building is not at risk of overheating as the percentage of occupied hours that have a PMV of greater than 0.5 is 0.5% and is therefore below the prescribed tolerance of 3% of when a building would be regarded as overheating.

The PPD analysis results are indicated below.

	$0\% \leq$ $PPD <$ 10%	$10\% \leq$ $PPD <$ 20%	$20\% \leq$ $PPD <$ 30%	$30\% \leq$ $PPD <$ 40%	$40\% \leq$ $PPD <$ 50%	$50\% \leq$ $PPD <$ 60%	$60\% \leq$ $PPD <$ 70%	$70\% \leq$ $PPD <$ 80%	$80\% \leq$ $PPD <$ 90%	$90\% \leq$ $PPD <$ 100%
Average (hr)	3000.1	35.1	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	98.8	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

The results show that the office accommodation passes the TM52 criteria as percentage of PPD that is greater than 10% is 1.2%.

Therefore the mechanically comfort cooled building overheating risk analysis for the TM49 design summer year for 1976 at London Weather Centre indicates that the office accommodation is not at risk of overheating.



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3.05.01.02 Mechanical Comfort Cooling Analysis – TM49 DSY: 1989 LWC

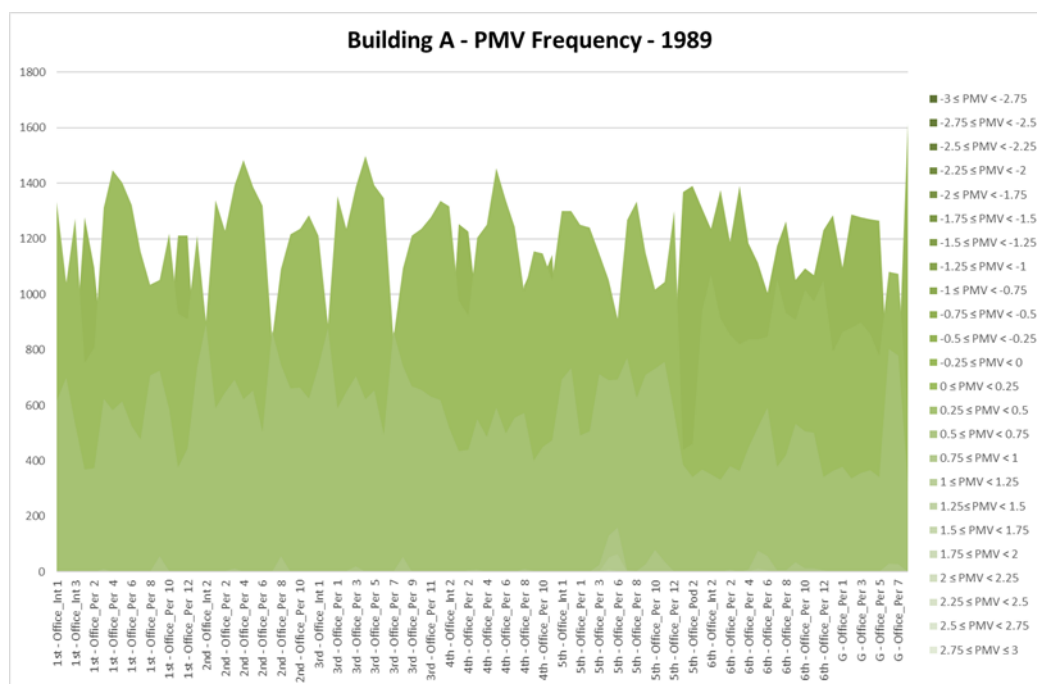
The table below shows the range of the thermal sensation scale and the average hours for the year which meets the criterion.

	-3 ≤ PMV < -2.75	-2.75 ≤ PMV < -2.5	-2.5 ≤ PMV < -2.25	-2.25 ≤ PMV < -2	-2 ≤ PMV < -1.75	-1.75 ≤ PMV < -1.5	-1.5 ≤ PMV < -1.25	-1.25 ≤ PMV < -1	-1 ≤ PMV < -0.75	-0.75 ≤ PMV < -0.5	-0.5 ≤ PMV < -0.25	-0.25 ≤ PMV < 0	0 ≤ PMV < 0.25	0.25 ≤ PMV < 0.5	0.5 ≤ PMV < 0.75	0.75 ≤ PMV < 1	1 ≤ PMV < 1.25	1.25 ≤ PMV < 1.5	1.5 ≤ PMV < 1.75	1.75 ≤ PMV < 2	2 ≤ PMV < 2.25	2.25 ≤ PMV < 2.5	2.5 ≤ PMV < 2.75	2.75 ≤ PMV ≤ 3
Average (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	434.0	911.9	1102.4	567.3	11.0	1.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	14.3	30.0	36.3	18.7	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Based on the results from a thermal comfort perspective the 100.0% of occupied hours fall between $-1.0 \leq PMV < 1.0$ frequency. Therefore based on the recommendations of ISO 7730 the occupants of the building are thermally satisfied.

This is graphically illustrated below.



The zones below the graph represent how the building has been split within the thermal model.

Applying the TM52 & CIBSE Guide A, 2015 issue risk of overheating criteria to the results indicates that the building is not at risk of overheating as the percentage of occupied hours that have a PMV of greater than 0.5 is 0.5% and is therefore below the prescribed tolerance of 3% of when a building would be regarded as overheating.

The PPD analysis results are indicated below.

	$0\% \leq PPD < 10\%$	$10\% \leq PPD < 20\%$	$20\% \leq PPD < 30\%$	$30\% \leq PPD < 40\%$	$40\% \leq PPD < 50\%$	$50\% \leq PPD < 60\%$	$60\% \leq PPD < 70\%$	$70\% \leq PPD < 80\%$	$80\% \leq PPD < 90\%$	$90\% \leq PPD \leq 100\%$
Average (hr)	3012.9	22.3	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	99.2	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

The results show that the office accommodation passes the TM52 criteria as percentage of PPD that is greater than 10% is 0.7%.

Therefore the mechanically comfort cooled building overheating risk analysis for the TM49 design summer year for 1989 at London Weather Centre indicates that the office accommodations is not at risk of overheating.



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3.05.01.03 Mechanical Comfort Cooling Analysis – TM49 DSY: 2003 LWC

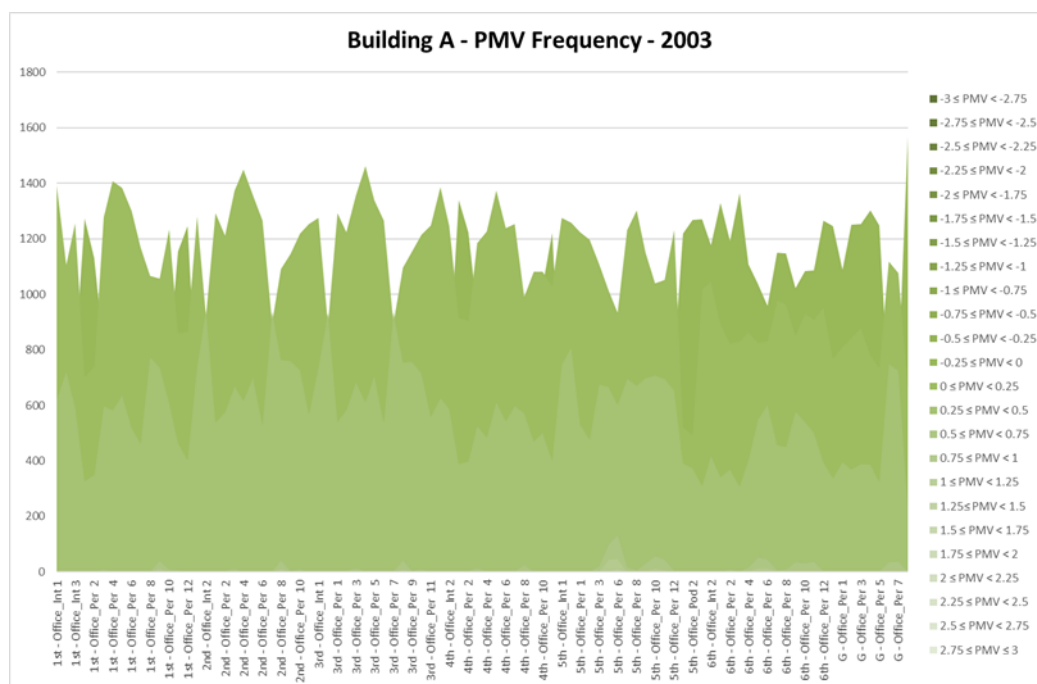
The table below shows the range of the thermal sensation scale and the average hours for the year which meets the criterion.

	-3 ≤ PMV < -2.75	-2.75 ≤ PMV < -2.5	-2.5 ≤ PMV < -2.25	-2.25 ≤ PMV < -2	-2 ≤ PMV < -1.75	-1.75 ≤ PMV < -1.5	-1.5 ≤ PMV < -1.25	-1.25 ≤ PMV < -1	-1 ≤ PMV < -0.75	-0.75 ≤ PMV < -0.5	-0.5 ≤ PMV < -0.25	-0.25 ≤ PMV < 0	0 ≤ PMV < 0.25	0.25 ≤ PMV < 0.5	0.5 ≤ PMV < 0.75	0.75 ≤ PMV < 1	1 ≤ PMV < 1.25	1.25 ≤ PMV < 1.5	1.5 ≤ PMV < 1.75	1.75 ≤ PMV < 2	2 ≤ PMV < 2.25	2.25 ≤ PMV < 2.5	2.5 ≤ PMV < 2.75	2.75 ≤ PMV ≤ 3
Average (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.8	452.1	903.1	1082.8	573.5	10.6	1.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	14.9	29.7	35.7	18.9	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Based on the results from a thermal comfort perspective the 100.0% of occupied hours fall between $-1.0 \leq PMV < 1.0$ frequency. Therefore based on the recommendations of ISO 7730 the occupants of the building are thermally satisfied.

This is graphically illustrated below.



The zones below the graph represent how the building has been split within the thermal model.

Applying the TM52 & CIBSE Guide A, 2015 issue risk of overheating criteria to the results indicates that the building is not at risk of overheating as the percentage of occupied hours that have a PMV of greater than 0.5 is 0.4% and is therefore below the prescribed tolerance of 3% of when a building would be regarded as overheating.

The PPD analysis results are indicated below.

	$0\% \leq$ $PPD <$ 10%	$10\% \leq$ $PPD <$ 20%	$20\% \leq$ $PPD <$ 30%	$30\% \leq$ $PPD <$ 40%	$40\% \leq$ $PPD <$ 50%	$50\% \leq$ $PPD <$ 60%	$60\% \leq$ $PPD <$ 70%	$70\% \leq$ $PPD <$ 80%	$80\% \leq$ $PPD <$ 90%
Average (hr)	3008.8	26.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	99.1	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0

The results show that the office accommodation passes the TM52 criteria as the percentage of PPD that is greater than 10% is 0.9%.

Therefore the mechanically comfort cooled building overheating risk analysis for the TM49 design summer year for 2003 at London Weather Centre indicates that the office accommodation is not at risk of overheating.



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3.05.02 Building B

3.05.02.01 Mechanical Comfort Cooling Analysis – TM49 DSY: 1976 LWC

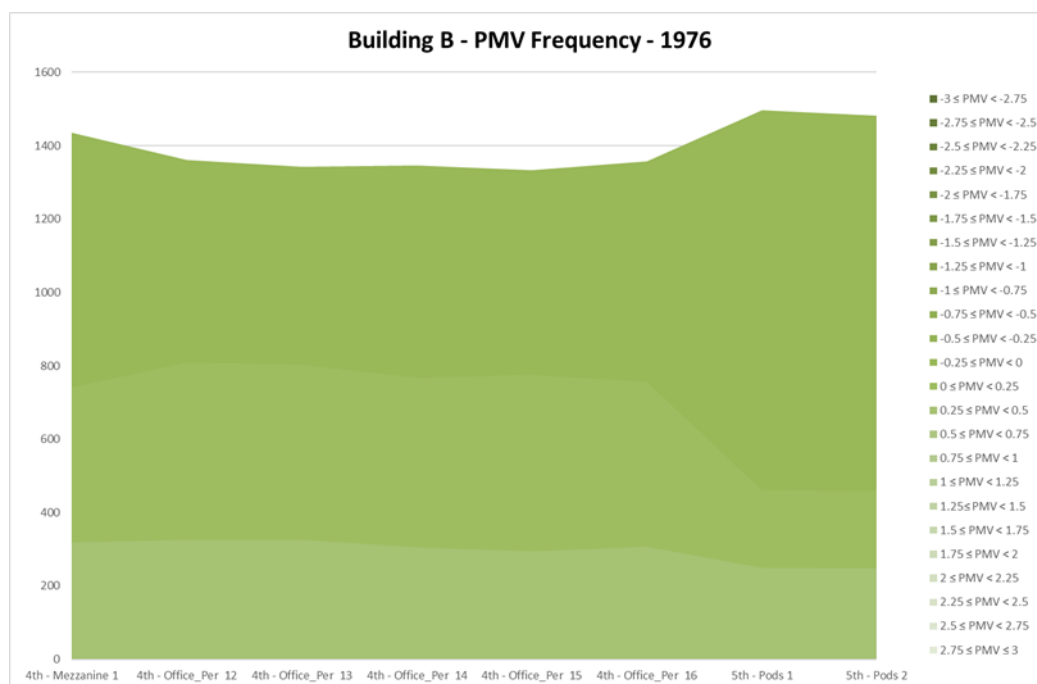
The table below shows the range of the thermal sensation scale and the average hours for the year which meets the criterion.

	$-3 \leq \text{PMV} < -2.75$	$-2.75 \leq \text{PMV} < -2.5$	$-2.5 \leq \text{PMV} < -2.25$	$-2.25 \leq \text{PMV} < -2$	$-2 \leq \text{PMV} < -1.75$	$-1.75 \leq \text{PMV} < -1.5$	$-1.5 \leq \text{PMV} < -1.25$	$-1.25 \leq \text{PMV} < -1$	$-1 \leq \text{PMV} < -0.75$	$-0.75 \leq \text{PMV} < -0.5$	$-0.5 \leq \text{PMV} < -0.25$	$-0.25 \leq \text{PMV} < 0$	$0 \leq \text{PMV} < 0.25$	$0.25 \leq \text{PMV} < 0.5$	$0.5 \leq \text{PMV} < 0.75$	$0.75 \leq \text{PMV} < 1$	$1 \leq \text{PMV} < 1.25$	$1.25 \leq \text{PMV} < 1.5$	$1.5 \leq \text{PMV} < 1.75$	$1.75 \leq \text{PMV} < 2$	$2 \leq \text{PMV} < 2.25$	$2.25 \leq \text{PMV} < 2.5$	$2.5 \leq \text{PMV} < 2.75$	$2.75 \leq \text{PMV} \leq 3$
Average (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.5	619.3	1394.6	697.4	297.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	20.4	45.9	23.0	9.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Based on the results from a thermal comfort perspective the 100.0% of occupied hours fall between $-1.0 \leq PMV < 1.0$ frequency. Therefore based on the recommendations of ISO 7730 the occupants of the building are thermally satisfied.

This is graphically illustrated below.



The zones below the graph represent how the building has been split within the thermal model.

Applying the TM52 & CIBSE Guide A, 2015 issue risk of overheating criteria to the results indicates that the building is not at risk of overheating as the percentage of occupied hours that have a PMV of greater than 0.5 is 0.0% and is therefore below the prescribed tolerance of 3% of when a building would be regarded as overheating.

The PPD analysis results are indicated below.

	$0\% \leq PPD < 10\%$	$10\% \leq PPD < 20\%$	$20\% \leq PPD < 30\%$	$30\% \leq PPD < 40\%$	$40\% \leq PPD < 50\%$	$50\% \leq PPD < 60\%$	$60\% \leq PPD < 70\%$	$70\% \leq PPD < 80\%$	$80\% \leq PPD < 90\%$
Average (hr)	3004.1	31.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	99.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

The results show that the office accommodation passes the TM52 criteria as the percentage of PPD that is greater than 10% is 1.0%.

Therefore the mechanically comfort cooled building overheating risk analysis for the TM49 design summer year for 1976 at London Weather Centre indicates that the office accommodation is not at risk of overheating.



Regents Wharf, London Overheating Risk Analysis Report

3.05.02.02 Mechanical Comfort Cooling Analysis – TM49 DSY: 1989 LWC

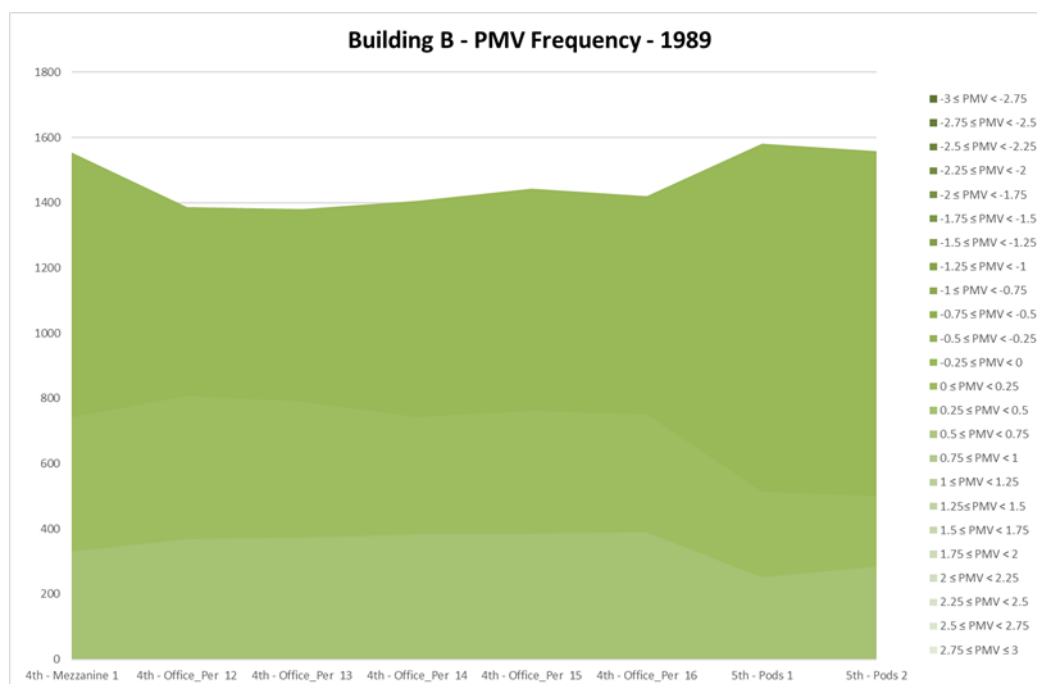
The table below shows the range of the thermal sensation scale and the average hours for the year which meets the criterion.

	-3 ≤ PMV < -2.75	-2.75 ≤ PMV < -2.5	-2.5 ≤ PMV < -2.25	-2.25 ≤ PMV < -2	-2 ≤ PMV < -1.75	-1.75 ≤ PMV < -1.5	-1.5 ≤ PMV < -1.25	-1.25 ≤ PMV < -1	-1 ≤ PMV < -0.75	-0.75 ≤ PMV < -0.5	-0.5 ≤ PMV < -0.25	-0.25 ≤ PMV < 0	0 ≤ PMV < 0.25	0.25 ≤ PMV < 0.5	0.5 ≤ PMV < 0.75	0.75 ≤ PMV < 1	1 ≤ PMV < 1.25	1.25 ≤ PMV < 1.5	1.5 ≤ PMV < 1.75	1.75 ≤ PMV < 2	2 ≤ PMV < 2.25	2.25 ≤ PMV < 2.5	2.5 ≤ PMV < 2.75	2.75 ≤ PMV ≤ 3
Average (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.4	509.0	1466.4	701.9	346.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	16.8	48.3	23.1	11.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Based on the results from a thermal comfort perspective the 100.0% of occupied hours fall between $-1.0 \leq PMV < 1.0$ frequency. Therefore based on the recommendations of ISO 7730 the occupants of the building are thermally satisfied.

This is graphically illustrated below.



The zones below the graph represent how the building has been split within the thermal model.

Applying the TM52 & CIBSE Guide A, 2015 issue risk of overheating criteria to the results indicates that the building is not at risk of overheating as the percentage of occupied hours that have a PMV of greater than 0.5 is 0.0% and is therefore below the prescribed tolerance of 3% of when a building would be regarded as overheating.

The PPD analysis results are indicated below.

	$0\% \leq PPD < 10\%$	$10\% \leq PPD < 20\%$	$20\% \leq PPD < 30\%$	$30\% \leq PPD < 40\%$	$40\% \leq PPD < 50\%$	$50\% \leq PPD < 60\%$	$60\% \leq PPD < 70\%$	$70\% \leq PPD < 80\%$	$80\% \leq PPD < 90\%$
Average (hr)	3021.3	14.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	99.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0

The results show that the office accommodation passes the TM52 criteria as the percentage of PPD that is greater than 10% is 0.5%.

Therefore the mechanically comfort cooled building overheating risk analysis for the TM49 design summer year for 1989 at London Weather Centre indicates that the office accommodation is not at risk of overheating.



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3.05.02.03 Mechanical Comfort Cooling Analysis – TM49 DSY: 2003 LWC

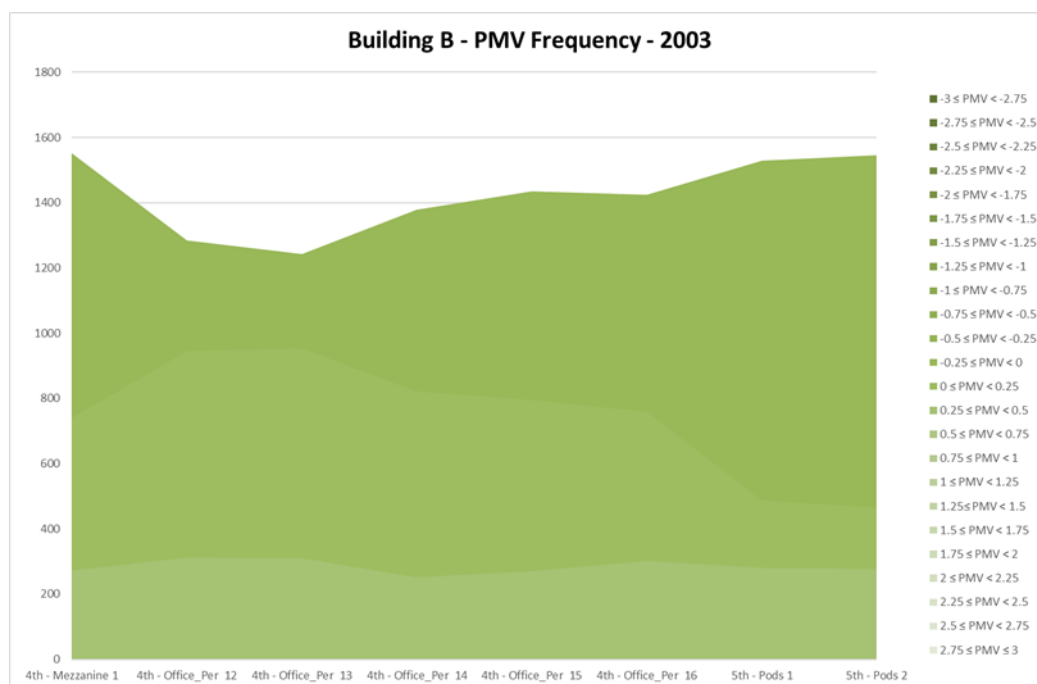
The table below shows the range of the thermal sensation scale and the average hours for the year which meets the criterion.

	-3 ≤ PMV < -2.75	-2.75 ≤ PMV < -2.5	-2.5 ≤ PMV < -2.25	-2.25 ≤ PMV < -2	-2 ≤ PMV < -1.75	-1.75 ≤ PMV < -1.5	-1.5 ≤ PMV < -1.25	-1.25 ≤ PMV < -1	-1 ≤ PMV < -0.75	-0.75 ≤ PMV < -0.5	-0.5 ≤ PMV < -0.25	-0.25 ≤ PMV < 0	0 ≤ PMV < 0.25	0.25 ≤ PMV < 0.5	0.5 ≤ PMV < 0.75	0.75 ≤ PMV < 1	1 ≤ PMV < 1.25	1.25 ≤ PMV < 1.5	1.5 ≤ PMV < 1.75	1.75 ≤ PMV < 2	2 ≤ PMV < 2.25	2.25 ≤ PMV < 2.5	2.5 ≤ PMV < 2.75	2.75 ≤ PMV ≤ 3
Average (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.6	562.8	1424.3	746.6	284.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	18.5	46.9	24.6	9.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Based on the results from a thermal comfort perspective the 100.0% of occupied hours fall between $-1.0 \leq PMV < 1.0$ frequency. Therefore based on the recommendations of ISO 7730 the occupants of the building are thermally satisfied.

This is graphically illustrated below.



The zones below the graph represent how the building has been split within the thermal model.

Applying the TM52 & CIBSE Guide A, 2015 issue risk of overheating criteria to the results indicates that the building is not at risk of overheating as the percentage of occupied hours that have a PMV of greater than 0.5 is 0.0% and is therefore below the prescribed tolerance of 3% of when a building would be regarded as overheating.

The PPD analysis results are indicated below.

	$0\% \leq$ <i>PPD</i> < 10%	10% \leq <i>PPD</i> < 20%	20% \leq <i>PPD</i> < 30%	30% \leq <i>PPD</i> < 40%	40% \leq <i>PPD</i> < 50%	50% \leq <i>PPD</i> < 60%	60% \leq <i>PPD</i> < 70%	70% \leq <i>PPD</i> < 80%	80% \leq <i>PPD</i> < 90%
Average (hr)	3014.4	21.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	99.3	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0

The results show that the office accommodation passes the TM52 criteria as the percentage of PPD that is greater than 10% is 0.7%.

Therefore the mechanically comfort cooled building overheating risk analysis for the TM49 design summer year for 2003 at London Weather Centre indicates that the office accommodation is not at risk of overheating.



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3.05.03 Building C

3.05.03.01 Mechanical Comfort Cooling Analysis – TM49 DSY: 1976 LWC

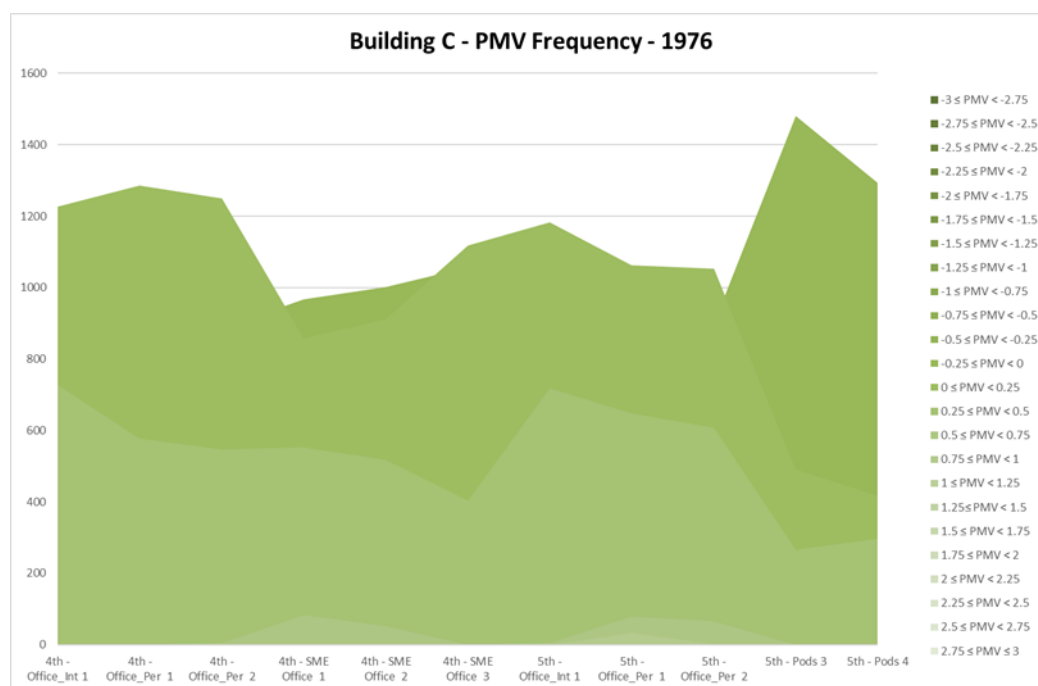
The table below shows the range of the thermal sensation scale and the average hours for the year which meets the criterion.

	$-3 \leq \text{PMV} < -2.75$	$-2.75 \leq \text{PMV} < -2.5$	$-2.5 \leq \text{PMV} < -2.25$	$-2.25 \leq \text{PMV} < -2$	$-2 \leq \text{PMV} < -1.75$	$-1.75 \leq \text{PMV} < -1.5$	$-1.5 \leq \text{PMV} < -1.25$	$-1.25 \leq \text{PMV} < -1$	$-1 \leq \text{PMV} < -0.75$	$-0.75 \leq \text{PMV} < -0.5$	$-0.5 \leq \text{PMV} < -0.25$	$-0.25 \leq \text{PMV} < 0$	$0 \leq \text{PMV} < 0.25$	$0.25 \leq \text{PMV} < 0.5$	$0.5 \leq \text{PMV} < 0.75$	$0.75 \leq \text{PMV} < 1$	$1 \leq \text{PMV} < 1.25$	$1.25 \leq \text{PMV} < 1.5$	$1.5 \leq \text{PMV} < 1.75$	$1.75 \leq \text{PMV} < 2$	$2 \leq \text{PMV} < 2.25$	$2.25 \leq \text{PMV} < 2.5$	$2.5 \leq \text{PMV} < 2.75$	$2.75 \leq \text{PMV} \leq 3$
Average (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	507.8	961.3	987.2	533.6	26.5	3.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	16.7	31.7	32.5	17.6	0.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Based on the results from a thermal comfort perspective the 100.0% of occupied hours fall between $-1.0 \leq \text{PMV} < 1.0$ frequency. Therefore based on the recommendations of ISO 7730 the occupants of the building are thermally satisfied.

This is graphically illustrated below.



The zones below the graph represent how the building has been split within the thermal model.

Applying the TM52 & CIBSE Guide A, 2015 issue risk of overheating criteria to the results indicates that the building is not at risk of overheating as the percentage of occupied hours that have a PMV of greater than 0.5 is 1.0% and is therefore below the prescribed tolerance of 3% of when a building would be regarded as overheating.

The PPD analysis results are indicated below.

	$0\% \leq \text{PPD} < 10\%$	$10\% \leq \text{PPD} < 20\%$	$20\% \leq \text{PPD} < 30\%$	$30\% \leq \text{PPD} < 40\%$	$40\% \leq \text{PPD} < 50\%$	$50\% \leq \text{PPD} < 60\%$	$60\% \leq \text{PPD} < 70\%$	$70\% \leq \text{PPD} < 80\%$	$80\% \leq \text{PPD} < 90\%$
Average (hr)	2985.3	49.2	1.5	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	98.3	1.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0

The results show that the office accommodation passes the TM52 criteria as the percentage of PPD that is greater than 10% is 1.6%.

Therefore the mechanically comfort cooled building overheating risk analysis for the TM49 design summer year for 1976 at London Weather Centre indicates that the office accommodation is not at risk of overheating.



Regents Wharf, London Overheating Risk Analysis Report

3.05.03.02 Mechanical Comfort Cooling Analysis – TM49 DSY: 1989 LWC

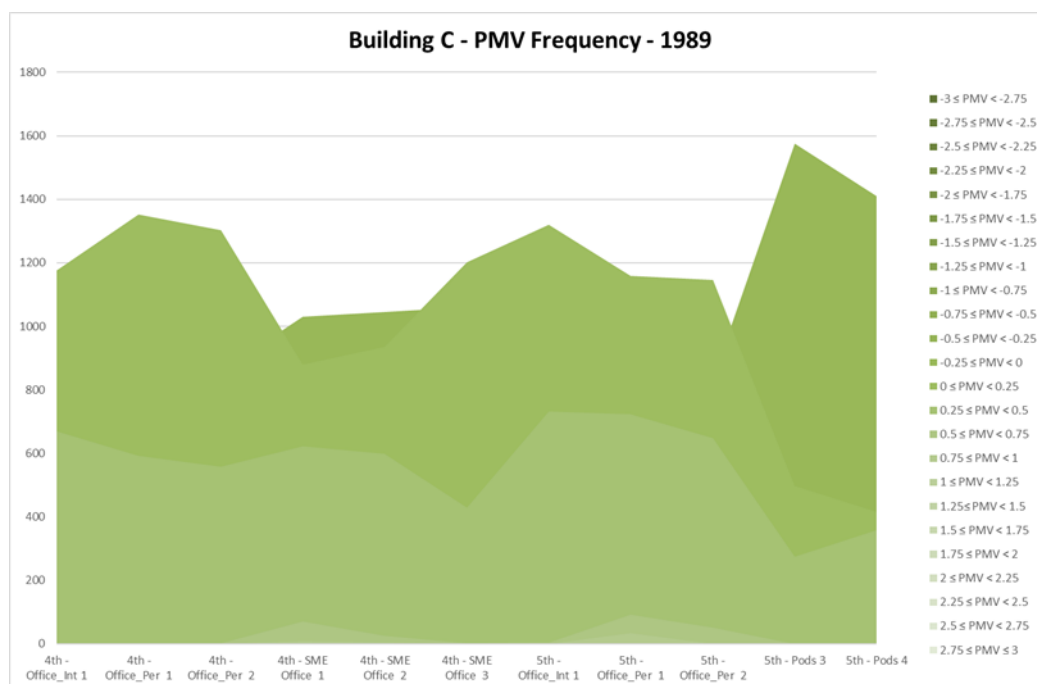
The table below shows the range of the thermal sensation scale and the average hours for the year which meets the criterion.

	-3 ≤ PMV < -2.75	-2.75 ≤ PMV < -2.5	-2.5 ≤ PMV < -2.25	-2.25 ≤ PMV < -2	-2 ≤ PMV < -1.75	-1.75 ≤ PMV < -1.5	-1.5 ≤ PMV < -1.25	-1.25 ≤ PMV < -1	-1 ≤ PMV < -0.75	-0.75 ≤ PMV < -0.5	-0.5 ≤ PMV < -0.25	-0.25 ≤ PMV < 0	0 ≤ PMV < 0.25	0.25 ≤ PMV < 0.5	0.5 ≤ PMV < 0.75	0.75 ≤ PMV < 1	1 ≤ PMV < 1.25	1.25 ≤ PMV < 1.5	1.5 ≤ PMV < 1.75	1.75 ≤ PMV < 2	2 ≤ PMV < 2.25	2.25 ≤ PMV < 2.5	2.5 ≤ PMV < 2.75	2.75 ≤ PMV ≤ 3
Average (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8	447.9	957.1	1035.2	563.9	22.1	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	14.8	31.5	34.1	18.6	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Based on the results from a thermal comfort perspective the 100.0% of occupied hours fall between $-1.0 \leq \text{PMV} < 1.0$ frequency. Therefore based on the recommendations of ISO 7730 the occupants of the building are thermally satisfied.

This is graphically illustrated below.



The zones below the graph represent how the building has been split within the thermal model.

Applying the TM52 & CIBSE Guide A, 2015 issue risk of overheating criteria to the results indicates that the building is not at risk of overheating as the percentage of occupied hours that have a PMV of greater than 0.5 is 0.8% and is therefore below the prescribed tolerance of 3% of when a building would be regarded as overheating.

The PPD analysis results are indicated below.

	$0\% \leq \text{PPD} < 10\%$	$10\% \leq \text{PPD} < 20\%$	$20\% \leq \text{PPD} < 30\%$	$30\% \leq \text{PPD} < 40\%$	$40\% \leq \text{PPD} < 50\%$	$50\% \leq \text{PPD} < 60\%$	$60\% \leq \text{PPD} < 70\%$	$70\% \leq \text{PPD} < 80\%$	$80\% \leq \text{PPD} < 90\%$
Average (hr)	3000.4	33.8	1.8	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	98.8	1.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0

The results show that the office accommodation passes the TM52 criteria as the percentage of PPD that is greater than 10% is 1.2%.

Therefore the mechanically comfort cooled building overheating risk analysis for the TM49 design summer year for 1989 at London Weather Centre indicates that the office accommodation is not at risk of overheating.



Regents Wharf, London Overheating Risk Analysis Report

3.05.03.03 Mechanical Comfort Cooling Analysis – TM49 DSY: 2003 LWC

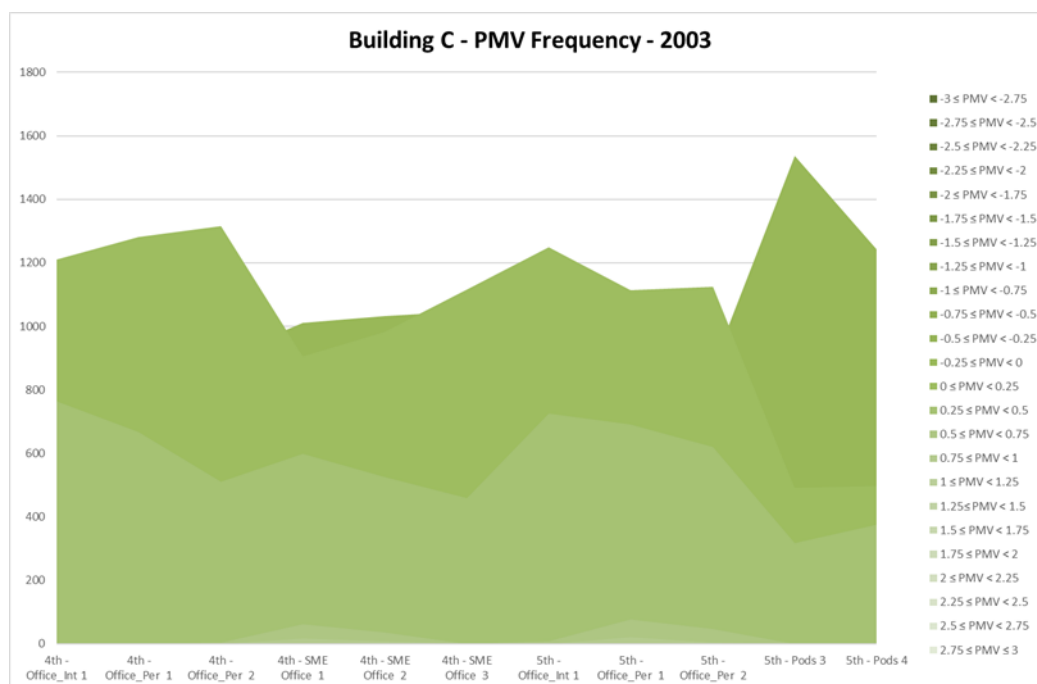
The table below shows the range of the thermal sensation scale and the average hours for the year which meets the criterion.

	-3 ≤ PMV < -2.75	-2.75 ≤ PMV < -2.5	-2.5 ≤ PMV < -2.25	-2.25 ≤ PMV < -2	-2 ≤ PMV < -1.75	-1.75 ≤ PMV < -1.5	-1.5 ≤ PMV < -1.25	-1.25 ≤ PMV < -1	-1 ≤ PMV < -0.75	-0.75 ≤ PMV < -0.5	-0.5 ≤ PMV < -0.25	-0.25 ≤ PMV < 0	0 ≤ PMV < 0.25	0.25 ≤ PMV < 0.5	0.5 ≤ PMV < 0.75	0.75 ≤ PMV < 1	1 ≤ PMV < 1.25	1.25 ≤ PMV < 1.5	1.5 ≤ PMV < 1.75	1.75 ≤ PMV < 2	2 ≤ PMV < 2.25	2.25 ≤ PMV < 2.5	2.5 ≤ PMV < 2.75	2.75 ≤ PMV ≤ 3
Average (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.5	467.7	938.1	1026.1	568.3	20.9	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	15.4	30.9	33.8	18.7	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Based on the results from a thermal comfort perspective the 100.0% of occupied hours fall between $-1.0 \leq PMV < 1.0$ frequency. Therefore based on the recommendations of ISO 7730 the occupants of the building are thermally satisfied.

This is graphically illustrated below.



The zones below the graph represent how the building has been split within the thermal model.

Applying the TM52 & CIBSE Guide A, 2015 issue risk of overheating criteria to the results indicates that the building is not at risk of overheating as the percentage of occupied hours that have a PMV of greater than 0.5 is 0.8% and is therefore below the prescribed tolerance of 3% of when a building would be regarded as overheating.

The PPD analysis results are indicated below.

	$0\% \leq PPD < 10\%$	$10\% \leq PPD < 20\%$	$20\% \leq PPD < 30\%$	$30\% \leq PPD < 40\%$	$40\% \leq PPD < 50\%$	$50\% \leq PPD < 60\%$	$60\% \leq PPD < 70\%$	$70\% \leq PPD < 80\%$	$80\% \leq PPD < 90\%$
Average (hr)	2996.5	37.8	1.6	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	98.7	1.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0

The results show that the office accommodation passes the TM52 criteria as the percentage of PPD that is greater than 10% is 1.3%.

Therefore the mechanically comfort cooled building overheating risk analysis for the TM49 design summer year for 2003 at London Weather Centre indicates that the office accommodation is not at risk of overheating.



3.06 Projected Climate Change Environment

As part of the Islington Council Environmental Design SPD it is required to take account of the projected variation in weather data that will occur during the building's life cycle as a result of climate change.

The Prometheus project at Exeter University has produced a number of future weather files specific to different locations across the UK, created using the UKCP09 weather generator. For this climate change analysis the future DSY weather files 2030_Islington_90_percentile and 2050_Islington_90_percentile were utilised in line with Islington Council requirements.

Using the dynamic software the PMV and the PPD has been established for the office area for each building.

In accordance with TM52 the building would be regarded as at risk from overheating the if the PMV index is above 5% for more than 3% of the occupied hours.

3.06.01 Building A

3.06.01.01 Mechanical Comfort Cooling Analysis – Islington 90th Percentile DSY: 2030

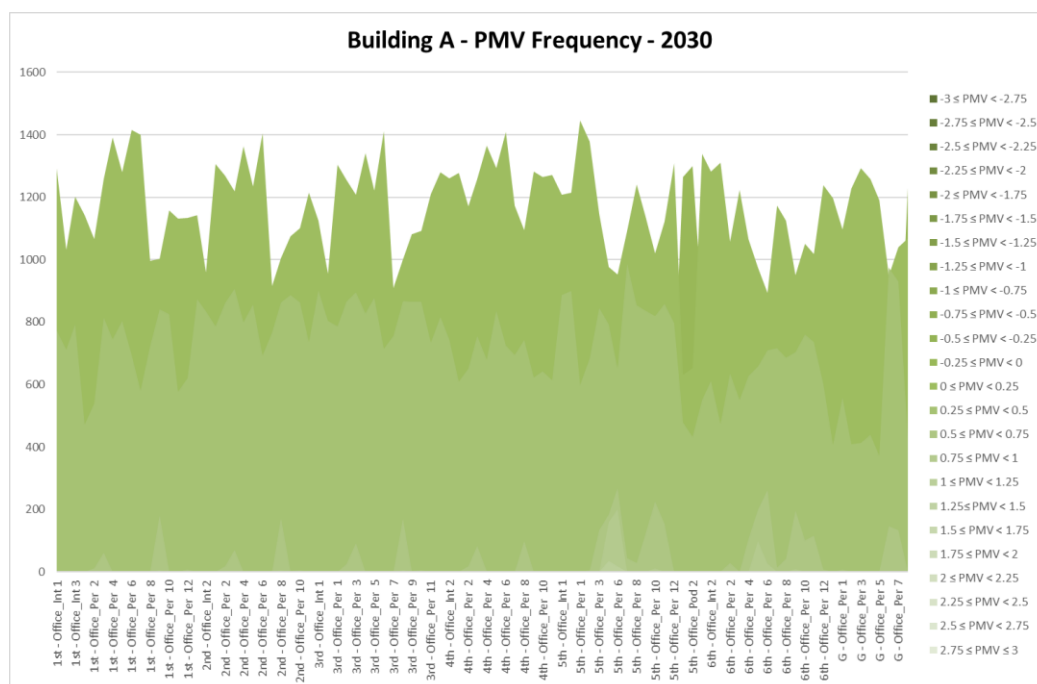
The table below shows the range of the thermal sensation scale and the average hours for the year which meets the criterion.

	-3 ≤ PMV < -2.75	-2.75 ≤ PMV < -2.5	-2.5 ≤ PMV < -2.25	-2.25 ≤ PMV < -2	-2 ≤ PMV < -1.75	-1.75 ≤ PMV < -1.5	-1.5 ≤ PMV < -1.25	-1.25 ≤ PMV < -1	-1 ≤ PMV < -0.75	-0.75 ≤ PMV < -0.5	-0.5 ≤ PMV < -0.25	-0.25 ≤ PMV < 0	0 ≤ PMV < 0.25	0.25 ≤ PMV < 0.5	0.5 ≤ PMV < 0.75	0.75 ≤ PMV < 1	1 ≤ PMV < 1.25	1.25 ≤ PMV < 1.5	1.5 ≤ PMV < 1.75	1.75 ≤ PMV < 2	2 ≤ PMV < 2.25	2.25 ≤ PMV < 2.5	2.5 ≤ PMV < 2.75	2.75 ≤ PMV ≤ 3
Average (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	373.1	727.8	1164.9	723.1	38.6	5.7	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	12.3	24.0	38.4	23.8	1.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Based on the results from a thermal comfort perspective the 100.0% of occupied hours fall between $-1.0 \leq PMV < 1.0$ frequency. Therefore based on the recommendations of ISO 7730 the occupants of the building are thermally satisfied.

This is graphically illustrated below.



The zones below the graph represent how the building has been split within the thermal model.

Applying the TM52 & CIBSE Guide A, 2015 edition risk of overheating criteria to the results indicates that the building is not at risk of overheating as the percentage of occupied hours that have a PMV of greater than 0.5 is 1.5% and is therefore below the prescribed tolerance of 3% of when a building would be regarded as overheating.

The PPD analysis results are indicated below.

	$0\% \leq$ $PPD <$ 10%	$10\% \leq$ $PPD <$ 20%	$20\% \leq$ $PPD <$ 30%	$30\% \leq$ $PPD <$ 40%	$40\% \leq$ $PPD <$ 50%	$50\% \leq$ $PPD <$ 60%	$60\% \leq$ $PPD <$ 70%	$70\% \leq$ $PPD <$ 80%	$80\% \leq$ $PPD <$ 90%	$90\% \leq$ $PPD <$ 100%
Average (hr)	2984.5	48.3	3.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	98.3	1.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

The results show that the office accommodation passes the TM52 criteria as percentage of PPD that is greater than 10% is 1.7%.

Therefore the mechanically comfort cooled building overheating risk analysis for the Islington 90th percentile design summer year for 2030 indicates that the office accommodation is not at risk of overheating.



Regents Wharf, London Overheating Risk Analysis Report

3.06.01.02 Mechanical Comfort Cooling Analysis – Islington 90th Percentile DSY: 2050

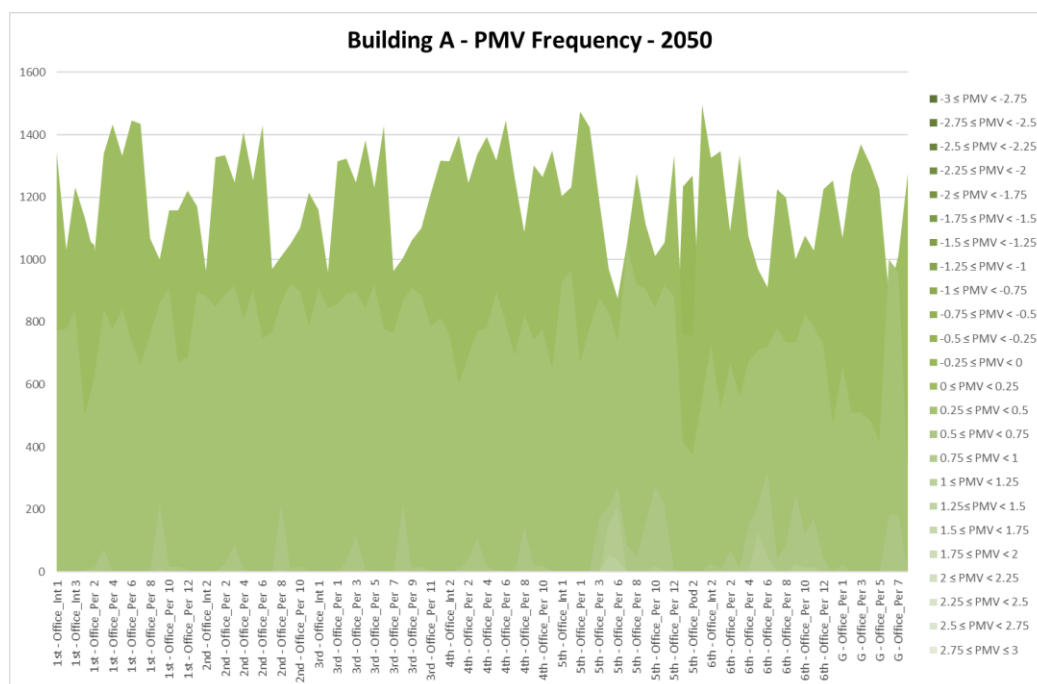
The table below shows the range of the thermal sensation scale and the average hours for the year which meets the criterion.

	$-3 \leq \text{PMV} < -2.75$	$-2.75 \leq \text{PMV} < -2.5$	$-2.5 \leq \text{PMV} < -2.25$	$-2.25 \leq \text{PMV} < -2$	$-2 \leq \text{PMV} < -1.75$	$-1.75 \leq \text{PMV} < -1.5$	$-1.5 \leq \text{PMV} < -1.25$	$-1.25 \leq \text{PMV} < -1$	$-1 \leq \text{PMV} < -0.75$	$-0.75 \leq \text{PMV} < -0.5$	$-0.5 \leq \text{PMV} < -0.25$	$-0.25 \leq \text{PMV} < 0$	$0 \leq \text{PMV} < 0.25$	$0.25 \leq \text{PMV} < 0.5$	$0.5 \leq \text{PMV} < 0.75$	$0.75 \leq \text{PMV} < 1$	$1 \leq \text{PMV} < 1.25$	$1.25 \leq \text{PMV} < 1.5$	$1.5 \leq \text{PMV} < 1.75$	$1.75 \leq \text{PMV} < 2$	$2 \leq \text{PMV} < 2.25$	$2.25 \leq \text{PMV} < 2.5$	$2.5 \leq \text{PMV} < 2.75$	$2.75 \leq \text{PMV} \leq 3$
Average (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	358.1	651.3	1195.3	768.4	53.6	7.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.8	21.5	39.4	25.3	1.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Based on the results from a thermal comfort perspective the 100.0% of occupied hours fall between $-1.0 \leq PMV < 1.0$ frequency. Therefore based on the recommendations of ISO 7730 the occupants of the building are thermally satisfied.

This is graphically illustrated below.



The zones below the graph represent how the building has been split within the thermal model.

Applying the TM52 & CIBSE Guide A, 2015 issue risk of overheating criteria to the results indicates that the building is not at risk of overheating as the percentage of occupied hours that have a PMV of greater than 0.5 is 2.0% and is therefore below the prescribed tolerance of 3% of when a building would be regarded as overheating.

The PPD analysis results are indicated below.

	$0\% \leq PPD < 10\%$	$10\% \leq PPD < 20\%$	$20\% \leq PPD < 30\%$	$30\% \leq PPD < 40\%$	$40\% \leq PPD < 50\%$	$50\% \leq PPD < 60\%$	$60\% \leq PPD < 70\%$	$70\% \leq PPD < 80\%$	$80\% \leq PPD < 90\%$	$90\% \leq PPD \leq 100\%$
Average (hr)	2967.8	63.6	4.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	97.8	2.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

The results show that the office accommodation passes the TM52 criteria as percentage of PPD that is greater than 10% is 2.2%.

Therefore the mechanically comfort cooled building overheating risk analysis for the Islington 90th percentile design summer year for 2050 indicates that the office accommodations is not at risk of overheating.



Regents Wharf, London Overheating Risk Analysis Report

3.06.02 Building B

3.06.02.01 Mechanical Comfort Cooling Analysis – Islington 90th Percentile DSY: 2030

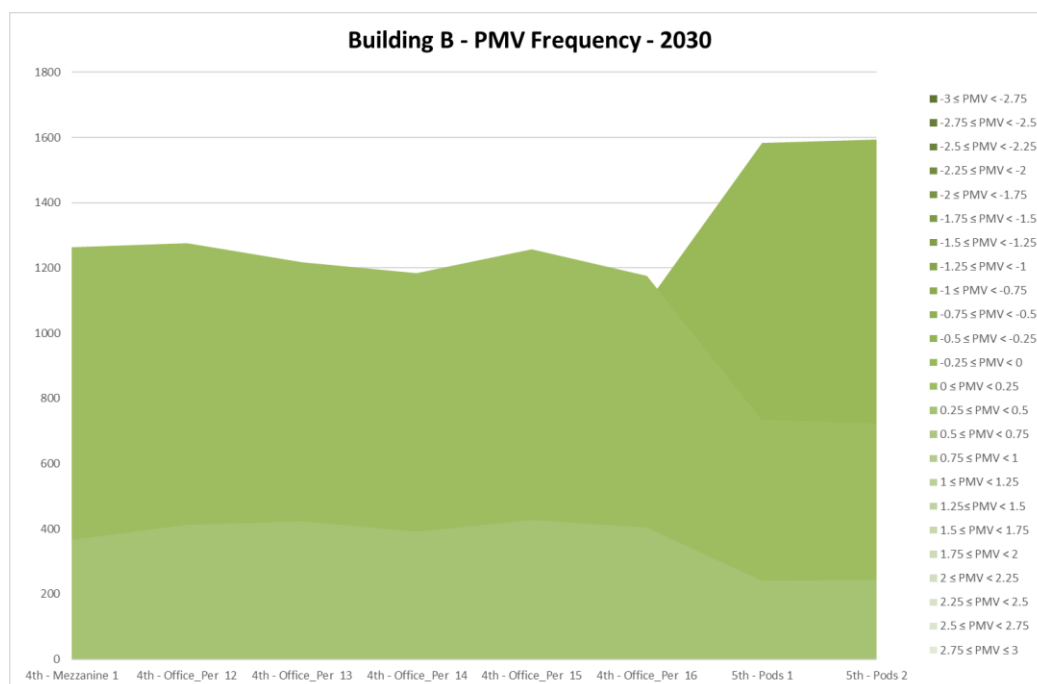
The table below shows the range of the thermal sensation scale and the average hours for the year which meets the criterion.

	$-3 \leq \text{PMV} < -2.75$	$-2.75 \leq \text{PMV} < -2.5$	$-2.5 \leq \text{PMV} < -2.25$	$-2.25 \leq \text{PMV} < -2$	$-2 \leq \text{PMV} < -1.75$	$-1.75 \leq \text{PMV} < -1.5$	$-1.5 \leq \text{PMV} < -1.25$	$-1.25 \leq \text{PMV} < -1$	$-1 \leq \text{PMV} < -0.75$	$-0.75 \leq \text{PMV} < -0.5$	$-0.5 \leq \text{PMV} < -0.25$	$-0.25 \leq \text{PMV} < 0$	$0 \leq \text{PMV} < 0.25$	$0.25 \leq \text{PMV} < 0.5$	$0.5 \leq \text{PMV} < 0.75$	$0.75 \leq \text{PMV} < 1$	$1 \leq \text{PMV} < 1.25$	$1.25 \leq \text{PMV} < 1.5$	$1.5 \leq \text{PMV} < 1.75$	$1.75 \leq \text{PMV} < 2$	$2 \leq \text{PMV} < 2.25$	$2.25 \leq \text{PMV} < 2.5$	$2.5 \leq \text{PMV} < 2.75$	$2.75 \leq \text{PMV} \leq 3$
Average (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	361.0	1204.8	1104.4	363.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	11.9	39.7	36.4	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Based on the results from a thermal comfort perspective the 100.0% of occupied hours fall between $-1.0 \leq PMV < 1.0$ frequency. Therefore based on the recommendations of ISO 7730 the occupants of the building are thermally satisfied.

This is graphically illustrated below.



The zones below the graph represent how the building has been split within the thermal model.

Applying the TM52 & CIBSE Guide A, 2015 issue risk of overheating criteria to the results indicates that the building is not at risk of overheating as the percentage of occupied hours that have a PMV of greater than 0.5 is 0.0% and is therefore below the prescribed tolerance of 3% of when a building would be regarded as overheating.

The PPD analysis results are indicated below.

	$0\% \leq PPD < 10\%$	$10\% \leq PPD < 20\%$	$20\% \leq PPD < 30\%$	$30\% \leq PPD < 40\%$	$40\% \leq PPD < 50\%$	$50\% \leq PPD < 60\%$	$60\% \leq PPD < 70\%$	$70\% \leq PPD < 80\%$	$80\% \leq PPD < 90\%$
Average (hr)	3031.8	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	99.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

The results show that the office accommodation passes the TM52 criteria as the percentage of PPD that is greater than 10% is 0.1%.

Therefore the mechanically comfort cooled building overheating risk analysis for the Islington 90th percentile design summer year for 2030 indicates that the office accommodation is not at risk of overheating.



Regents Wharf, London Overheating Risk Analysis Report

3.06.02.02 Mechanical Comfort Cooling Analysis – Islington 90th Percentile DSY: 2050

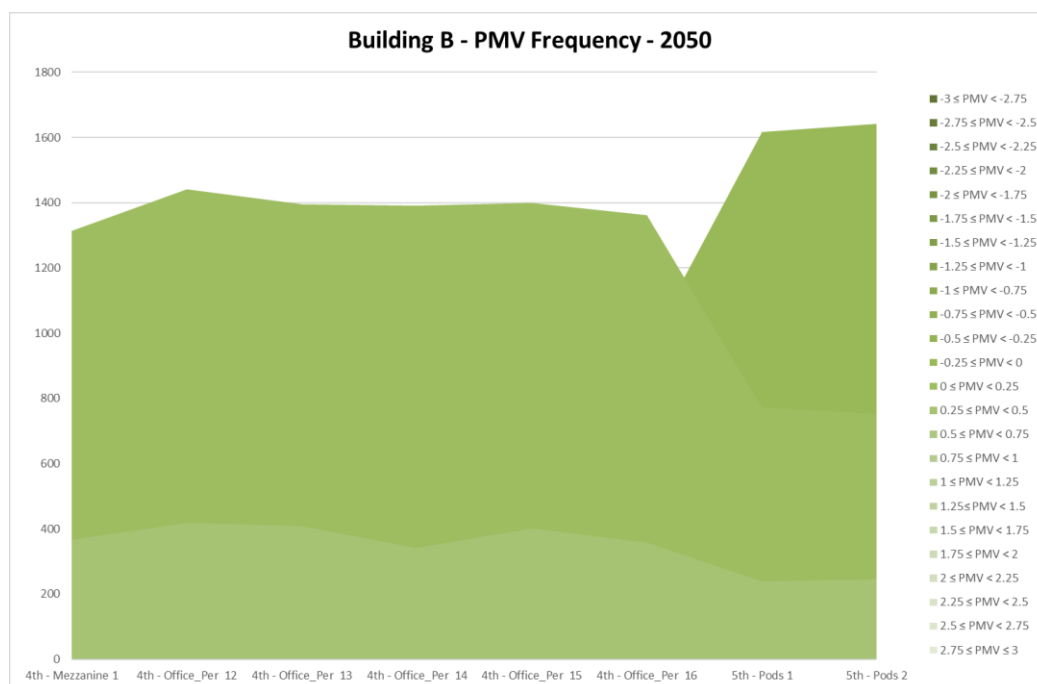
The table below shows the range of the thermal sensation scale and the average hours for the year which meets the criterion.

	$-3 \leq \text{PMV} < -2.75$	$-2.75 \leq \text{PMV} < -2.5$	$-2.5 \leq \text{PMV} < -2.25$	$-2.25 \leq \text{PMV} < -2$	$-2 \leq \text{PMV} < -1.75$	$-1.75 \leq \text{PMV} < -1.5$	$-1.5 \leq \text{PMV} < -1.25$	$-1.25 \leq \text{PMV} < -1$	$-1 \leq \text{PMV} < -0.75$	$-0.75 \leq \text{PMV} < -0.5$	$-0.5 \leq \text{PMV} < -0.25$	$-0.25 \leq \text{PMV} < 0$	$0 \leq \text{PMV} < 0.25$	$0.25 \leq \text{PMV} < 0.5$	$0.5 \leq \text{PMV} < 0.75$	$0.75 \leq \text{PMV} < 1$	$1 \leq \text{PMV} < 1.25$	$1.25 \leq \text{PMV} < 1.5$	$1.5 \leq \text{PMV} < 1.75$	$1.75 \leq \text{PMV} < 2$	$2 \leq \text{PMV} < 2.25$	$2.25 \leq \text{PMV} < 2.5$	$2.5 \leq \text{PMV} < 2.75$	$2.75 \leq \text{PMV} \leq 3$
Average (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	349.6	1109.4	1228.8	348.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.5	36.5	40.5	11.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Based on the results from a thermal comfort perspective the 100.0% of occupied hours fall between $-1.0 \leq \text{PMV} < 1.0$ frequency. Therefore based on the recommendations of ISO 7730 the occupants of the building are thermally satisfied.

This is graphically illustrated below.



The zones below the graph represent how the building has been split within the thermal model.

Applying the TM52 & CIBSE Guide A, 2015 issue risk of overheating criteria to the results indicates that the building is not at risk of overheating as the percentage of occupied hours that have a PMV of greater than 0.5 is 0.0% and is therefore below the prescribed tolerance of 3% of when a building would be regarded as overheating.

The PPD analysis results are indicated below.

	$0\% \leq \text{PPD} < 10\%$	$10\% \leq \text{PPD} < 20\%$	$20\% \leq \text{PPD} < 30\%$	$30\% \leq \text{PPD} < 40\%$	$40\% \leq \text{PPD} < 50\%$	$50\% \leq \text{PPD} < 60\%$	$60\% \leq \text{PPD} < 70\%$	$70\% \leq \text{PPD} < 80\%$	$80\% \leq \text{PPD} < 90\%$
Average (hr)	3035.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

The results show that the office accommodation passes the TM52 criteria as the percentage of PPD that is greater than 10% is 0.0%.

Therefore the mechanically comfort cooled building overheating risk analysis for the Islington 90th percentile design summer year for 2050 indicates that the office accommodation is not at risk of overheating.



Regents Wharf, London Overheating Risk Analysis Report

3.06.03 Building C

3.05.03.01 Mechanical Comfort Cooling Analysis – Islington 90th Percentile DSY: 2030

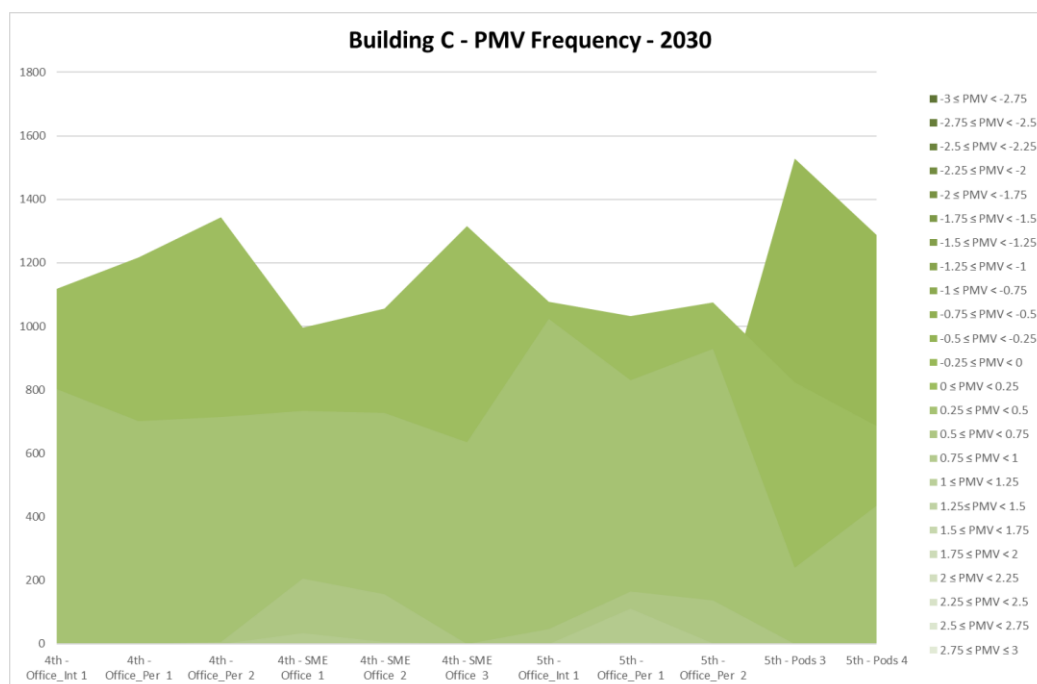
The table below shows the range of the thermal sensation scale and the average hours for the year which meets the criterion.

	-3 ≤ PMV < -2.75	-2.75 ≤ PMV < -2.5	-2.5 ≤ PMV < -2.25	-2.25 ≤ PMV < -2	-2 ≤ PMV < -1.75	-1.75 ≤ PMV < -1.5	-1.5 ≤ PMV < -1.25	-1.25 ≤ PMV < -1	-1 ≤ PMV < -0.75	-0.75 ≤ PMV < -0.5	-0.5 ≤ PMV < -0.25	-0.25 ≤ PMV < 0	0 ≤ PMV < 0.25	0.25 ≤ PMV < 0.5	0.5 ≤ PMV < 0.75	0.75 ≤ PMV < 1	1 ≤ PMV < 1.25	1.25 ≤ PMV < 1.5	1.5 ≤ PMV < 1.75	1.75 ≤ PMV < 2	2 ≤ PMV < 2.25	2.25 ≤ PMV < 2.5	2.5 ≤ PMV < 2.75	2.75 ≤ PMV ≤ 3
Average (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	389.7	791.6	1067.5	706.5	64.9	13.9	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.8	26.1	35.2	23.3	2.1	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Based on the results from a thermal comfort perspective the 100.0% of occupied hours fall between $-1.0 \leq \text{PMV} < 1.0$ frequency. Therefore based on the recommendations of ISO 7730 the occupants of the building are thermally satisfied.

This is graphically illustrated below.



The zones below the graph represent how the building has been split within the thermal model.

Applying the TM52 & CIBSE Guide A, 2015 issue risk of overheating criteria to the results indicates that the building is not at risk of overheating as the percentage of occupied hours that have a PMV of greater than 0.5 is 2.6% and is therefore below the prescribed tolerance of 3% of when a building would be regarded as overheating.

The PPD analysis results are indicated below.

	$0\% \leq \text{PPD} < 10\%$	$10\% \leq \text{PPD} < 20\%$	$20\% \leq \text{PPD} < 30\%$	$30\% \leq \text{PPD} < 40\%$	$40\% \leq \text{PPD} < 50\%$	$50\% \leq \text{PPD} < 60\%$	$60\% \leq \text{PPD} < 70\%$	$70\% \leq \text{PPD} < 80\%$	$80\% \leq \text{PPD} < 90\%$
Average (hr)	2948.2	81.2	6.6	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	97.1	2.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0

The results show that the office accommodation passes the TM52 criteria as the percentage of PPD that is greater than 10% is 2.9%.

Therefore the mechanically comfort cooled building overheating risk analysis for the Islington 90th percentile design summer year for 2030 indicates that the office accommodation is not at risk of overheating.



Regents Wharf, London Overheating Risk Analysis Report

3.06.03.02 Mechanical Comfort Cooling Analysis – Islington 90th Percentile 2050

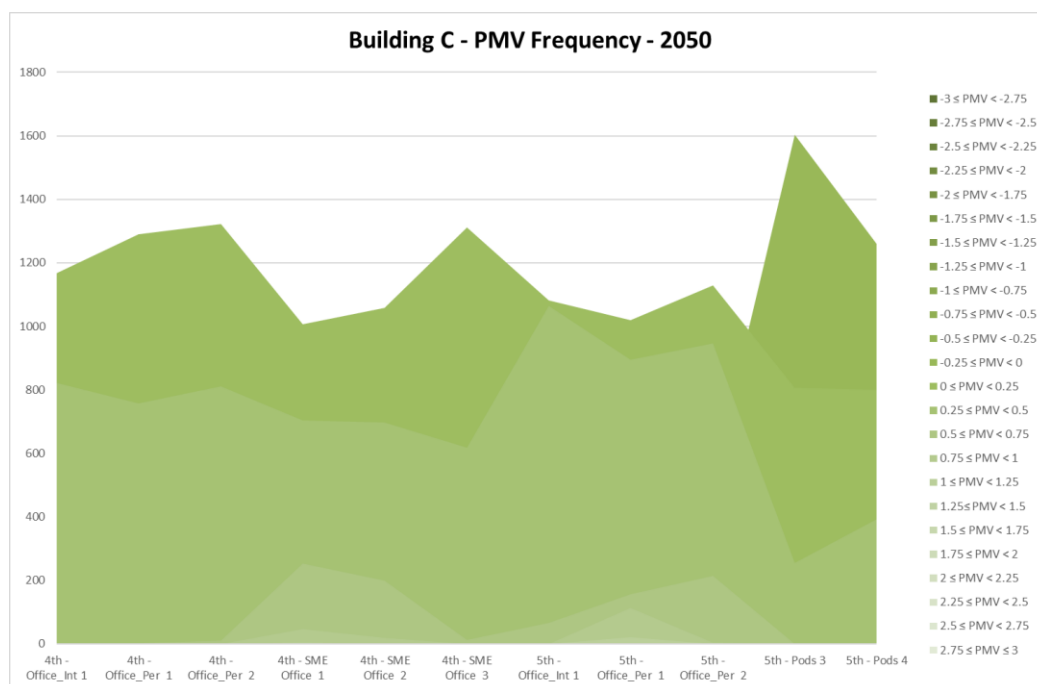
The table below shows the range of the thermal sensation scale and the average hours for the year which meets the criterion.

	$-3 \leq \text{PMV} < -2.75$	$-2.75 \leq \text{PMV} < -2.5$	$-2.5 \leq \text{PMV} < -2.25$	$-2.25 \leq \text{PMV} < -2$	$-2 \leq \text{PMV} < -1.75$	$-1.75 \leq \text{PMV} < -1.5$	$-1.5 \leq \text{PMV} < -1.25$	$-1.25 \leq \text{PMV} < -1$	$-1 \leq \text{PMV} < -0.75$	$-0.75 \leq \text{PMV} < -0.5$	$-0.5 \leq \text{PMV} < -0.25$	$-0.25 \leq \text{PMV} < 0$	$0 \leq \text{PMV} < 0.25$	$0.25 \leq \text{PMV} < 0.5$	$0.5 \leq \text{PMV} < 0.75$	$0.75 \leq \text{PMV} < 1$	$1 \leq \text{PMV} < 1.25$	$1.25 \leq \text{PMV} < 1.5$	$1.5 \leq \text{PMV} < 1.75$	$1.75 \leq \text{PMV} < 2$	$2 \leq \text{PMV} < 2.25$	$2.25 \leq \text{PMV} < 2.5$	$2.5 \leq \text{PMV} < 2.75$	$2.75 \leq \text{PMV} \leq 3$
Average (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	370.7	749.5	1090.2	723.8	82.7	16.5	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.2	24.7	35.9	23.8	2.7	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Based on the results from a thermal comfort perspective the 99.9% of occupied hours fall between $-1.0 \leq PMV < 1.0$ frequency. Therefore based on the recommendations of ISO 7730 the occupants of the building are thermally satisfied.

This is graphically illustrated below.



The zones below the graph represent how the building has been split within the thermal model.

Applying the TM52 & CIBSE Guide A, 2015 issue risk of overheating criteria to the results indicates that the building is not at risk of overheating as the percentage of occupied hours that have a PMV of greater than 0.5 is 3.3% and is therefore just above the prescribed tolerance of 3% of when a building would be regarded as overheating.

The PPD analysis results are indicated below.

	$0\% \leq PPD < 10\%$	$10\% \leq PPD < 20\%$	$20\% \leq PPD < 30\%$	$30\% \leq PPD < 40\%$	$40\% \leq PPD < 50\%$	$50\% \leq PPD < 60\%$	$60\% \leq PPD < 70\%$	$70\% \leq PPD < 80\%$	$80\% \leq PPD < 90\%$
Average (hr)	2926.5	99.1	10.0	0.4	0.0	0.0	0.0	0.0	0.0
Percentage (%)	96.4	3.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0

The results show that the office accommodation passes the TM52 criteria as the percentage of PPD that is greater than 10% is 3.6%.

Therefore the mechanically comfort cooled building overheating risk analysis for the Islington 90th percentile design summer year for 2050 indicates that the office accommodation has a very small risk of overheating.



4.00 OVERHEATING / THERMAL COMFORT STRATEGY

In accordance with the Islington Policy DM 7.5 highest priority measures the modelled scheme incorporates the following passive design features to reduce the risk of overheating:

- High performance glazing that has a 'U' value of 1.20 W/m²K and a 'g' value of 0.30
- LED lighting with daylight dimming to reduce internal casual heat gains
- Good thermal mass
- Exposed concrete soffits (new build)
- Good practice unregulated power loads

In accordance with the Islington Policy DM 7.5 the following passive/natural cooling measures have been adopted to supplement the passive cooling measures to further reduce the risk of overheating:

- Cross ventilation has been adopted in Buildings B and C utilising the natural fresh air ventilation via openable windows.

In accordance with the Islington Policy DM 7.5 the following mechanical ventilation measures have been adopted to supplement the passive cooling measures to further reduce the risk of overheating:

- Mixed mode cooling has been implemented in Building A via openable windows and cladding elements.
- Night purge cooling in Building A has been adopted using the underfloor mechanical ventilation system. Buildings B and C are unable to accommodate this type of system due to floor void restrictions and low soffit-ceiling heights.

A natural ventilation night time purge cooling strategy has not been adopted due to the security risk of open windows during the night whilst the building will not be occupied. Due to the form of the buildings it is not feasible to incorporate passive stack ventilation.

The proposed buildings with passive design measures have been thermally modelled. The TM52 free running overheating results for each of the three TM49 design summer years indicate that each assessed zone has a risk of overheating due to failing each of the three TM52 criteria for each of the three TM49 design summer years.

Therefore, additional mechanical ventilation comfort cooling measures have been incorporated to alleviate the small overheating risk. The additional measures are required to cater for the design weather data, the design internal heat gains plus the operational requirements / constraints of the future tenant.

The TM52 mechanical comfort cooling overheating risk analysis, the PMV and PPD results indicate that overheating in the comfort cooled office accommodation is not a risk. Hence the proposed mechanical heat recovery ventilation systems and the mechanical comfort cooling systems are appropriate.



5.00 CONCLUSION

The development has been thermally assessed to assess the risk of overheating and requirement for active cooling in accordance with the following:

- London Plan Policy 5.9
- Islington Policy DM 7.5
- Islington Environmental Design SPD sections 6.0.24 to 6.0.30

The proposed development has followed the Islington Policy DM7.5 requirements to maximise the provision of passive design measures to control heat gain and to deliver passive cooling. Further natural, mixed mode and mechanical night purge provisions have been adopted to supplement the passive cooling measures.

The thermal modelling carried out in accordance with the London Plan policy and Islington Environmental Design SPD has demonstrated a risk of overheating and requirement for active cooling.

The provision of openable windows will be maintained in each of the buildings to allow the future tenants the choice of operating the building in free running mode as the prevailing weather conditions allow.

This report accounts for all relevant design features and includes for the anticipated building usage. Should the final design and/or use of the building differ from the described, or should the actual weather differ from the accredited weather files, then 'out of range' temperature may occur beyond that predicted.