Indoor Environment Quality
IEQ-14 Tenant Exhaust

Points Available	Points Claimed	CIR Submitted
1	1	Y

Credit Criteria
One point is awarded where it is demonstrated that all print/photocopy rooms are enclosed and have a dedicated and separate exhaust facility. The exhaust from the room(s) must not be connected to the return air duct and must comply with the requirements in AS 1668.2-2002.

Documents Provided

✓	CIR response allowing a partially enclosed room which achieves the air extraction rates required by the Technical Manual and as per AS 1668.2-2002. AND Supporting documentation demonstrating effectiveness of proposed solution. IEQ-14: 1
✓	As-built drawings that clearly show all print/photocopy rooms and associated ductwork. IEQ-14: 2

Discussion
- The attached CIR confirms that the project can claim 1 point for a tenant exhaust room that achieves the air extraction rates prescribed by AS 1668.2-2002 as per the Technical Manual.

CIR Response:

IEQ-14 'Tenant Exhaust'
CIR Ruling: The Credit Interpretation Request (CIR) to have a negatively pressured moderately enclosed room (i.e. a room which is contained by three or more walls, and has an opening that is larger than 1.2 x 2. metres) that is being exhausted per the Technical Manual as shown by a Computational Fluid Dynamics (CFD) model be deemed equivalent to an enclosed room is granted.

Please note: This CIR approves the use of CFD modeling to show that a negatively pressured moderately enclosed room can be exhausted as per the Credit Criteria and Compliance Requirements on the Technical Manual. It does not automatically grant the points for this credit.

IEQ-14: 1

Joe Karten

From: Briana Thompson (nee Eastham)
Sent: Friday, 27 June 2008 1:47 PM
To: Richard Palmer
Cc: Sonia DeAlmada; Joe Karten
Subject: GBCA Sydney Fitout (GS-412I)
Attachments: CIR IEQ-14.pdf; CIR IEQ-13.pdf

Dear Richard,

Please see below the responses to your Credit Interpretation Requests.

IEQ-14 'Tenant Exhaust'
CIR Ruling: The Credit Interpretation Request (CIR) to have a negatively pressured moderately enclosed room (i.e. a room which is contained by three or more walls, and has an opening that is larger than 1.2 x 2. meters) that is being exhausted per the Technical Manual as shown by a Computational Fluid Dynamics (CFD) model be deemed equivalent to an enclosed room is granted.

Please note: This CIR approves the use of CFD modeling to show that a negatively pressured moderately enclosed room can be exhausted as per the Credit Criteria and Compliance Requirements on the Technical Manual. It does not automatically grant the points for this credit.

IEQ-13 'Air Supply Ductwork'
Technical Clarification: A project may claim 1 point where a combination of both new and existing ductwork is used, provided that the project can demonstrate that all existing ductwork was cleaned cleaned before the new ductwork was added and that all ductwork was sealed upon completion of ductwork fitout works.

As the Case Manager for this project, please do not hesitate to contact me if you require further clarification.

Kind regards,

Briana Thompson

green building council australia

Briana Thompson (nee Eastham)
Technical Coordinator
Green Building Council of Australia
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Green Star Credit Interpretation Request (CIR) Form

Note: If Man-1 Credits are being applied for then this Form must be submitted by a Green Star Accredited Professional for the project.

Project Name: **GBCA Fitout (GS412I)**	Date: 11/06/2008
☐ Green Star – Office Design v1 ☐ Green Star – Office Design v2 ☐ Green Star – Office As Built v1 ☐ Green Star – Office As Built v2 ☐ Green Star – Office Interiors v1 ☒ Green Star – Office Interiors v1.1 ☐ Other_____	Submitter Name, Organisation and Position: **Richard Palmer, Advanced Environmental, Environmental Design Consultant** Are you an Accredited Professional? **Yes** Green Star Credit for which CIR is sought: **IEQ – 14**

What precludes the project from meeting the Credit Criteria?

To meet the criteria of the credit, the copy room must be sealed from the rest of the tenancy to ensure no pollutants escape from the space into the air of the occupied office space. In this tenancy, the copy room door does not cover the full opening to allow access for IT maintenance.

Interpretation Requested:

The room is maintained at a negative pressure (the exhaust extraction is 150 L/s more than the room air supply), bringing air from the occupied space to make up the difference.

The attached CFD modelling shows that this prevents air movement from the copy room space (containing contaminants) into the occupied space.

This demonstrates that the room is adequately sealed despite not having a closable door.

Does the proposed solution meet the Aim of the Credit?	**Yes**
Does the CIR propose alternative yet equivalent compliance with the Aim of the Credit?	**Yes**
Is the proposed solution a building attribute rather than subject to operations?	**Yes**

Documents Attached:

Proposed documents for the submission will be:

- Mechanical As Built drawings noting the supply and exhaust rates from the copy room.
- Report showing calculations for how the supply and exhaust rates result in a negative pressure in the copy room compared to the occupied space
- Results from CFD modelling which demonstrates pollutants in the copy room do not enter the office space.

GBCA Technical Manager Use:

Interpretation Number: _____	Does the application fulfil the aim of the credit? Y / N
Date CIR forwarded to the Advisory Panel:	
Date Recommendations are Due:	

Advisory Panel Respondent (initials):	
Conflicts of Interest Declared:	
GBCA Advisory Panel Response:	
Replied to Enquiry (initials):	Date:
Technical Clarifications & CIR Rulings updated on GBCA website:	Y / N GBCA Staff Responsible:
Text of CIR Ruling:	

GBCA Fit-Out
CIR – IEQ 14: Tenant Exhaust

11/06/2008
ADV0702600

Client

Green Building Council of Australia

Advanced Environmental

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Authorised for Issue

..... Project Leader

..... Date

EXECUTIVE SUMMARY

This report is an appendix to the credit interpretation request (CIR) for the IEQ-14 credit (Tenant Exhaust) in the Green Star Office Interiors v1.1 submission for the new GBCA fit-out at 179 Elizabeth St, Sydney.

The report is intended to provide evidence through computational fluid dynamic (CFD) modelling that the negative pressure maintained in the GBCA copy room is sufficient to prevent ozone and particulate emissions from the copiers and printers in the copy room from contaminating the working environment based on the current copy room design.

The modelling shows the following key outcomes:

- There is uniform air movement from the occupied space into the copy room across the opening area, indicating that contaminants do not move out of the enclosed area
- There is extremely low contamination levels at the opening on the contaminated side
- There is some contamination at high level on the contaminated side, although it does not significantly overlap the opening and the air at that area is moving into the copy room.

Based on these results, the copy room can be considered to be effectively sealed by making up air from the occupied space through the use of negative pressure.

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LIST OF FIGURES

Issue/Status	Revision	Date Issued	Author	Checked	Approved	Comment
		11/06/2008	RNP	MCP	RNP	

1 Introduction

This report is an appendix to the credit interpretation request (CIR) for the IEQ-14 credits (Tenant Exhaust) in the Green Star Office Interiors v1.1 submission for the new GBCA fit-out at 179 Elizabeth St, Sydney.

1.1 Report Intent

The report is intended to provide evidence through computational fluid dynamic (CFD) modelling that the negative pressure maintained in the GBCA copy room is sufficient to prevent ozone and particulate emissions from the copiers and printers in the copy room from contaminating the working environment based on the current copy room design.

1.2 Sources of information

The following sources of information have been used in this assessment:

- Mechanical As built drawings by JLW
- Architectural As built drawings by BVN
- Building Code of Australia

1.3 Limitations

The results of this study are based on the specific modelling parameters described in this report. The actual movement of contaminants will depend on a range of dynamic factors in the operation of the fit-out.

2 Methodology

2.1 Background

The GBCA fit-out intends to control the contamination of the workspace from copiers and printers by housing them in a dedicated copy room which is sealed by negative pressure.

To meet the specific criteria of the credit from the technical manual, the copy room must be sealed from the rest of the tenancy to ensure no pollutants escape from the space into the air of the occupied office space. In this tenancy, the copy room door does not cover the full opening to allow access for IT maintenance.

Following the first submittal of this CIR, it was agreed in a technical clarification meeting that the room did not have to be sealed. However the opening size would have to be limited to that of a standard doorway to prevent future applications for rooms which are not actually enclosed (such as only have 3 walls).

In this case, the opening is larger than a standard doorway, so a modelled solution is proposed to demonstrate that contaminants are contained in the copy room. The room is maintained at a negative pressure (the exhaust extraction is 150 L/s more than the room air supply), bringing air from the occupied space to make up the difference which prevents air movement from the copy room space (containing contaminants) into the occupied space.

As a precedent with respect to building sealing, the BCA section J3.1 (d) states that the deemed-to-satisfy provisions of this part apply to elements forming the envelope of a class 2 to 9 building, *other than a building where the mechanical ventilation system required by part F4 provides sufficient pressurisation to prevent infiltration.*

Compared to the copy room, the occupied space is pressurised sufficiently to prevent infiltration of contaminated air from the copy room, as demonstrated in the figure below:

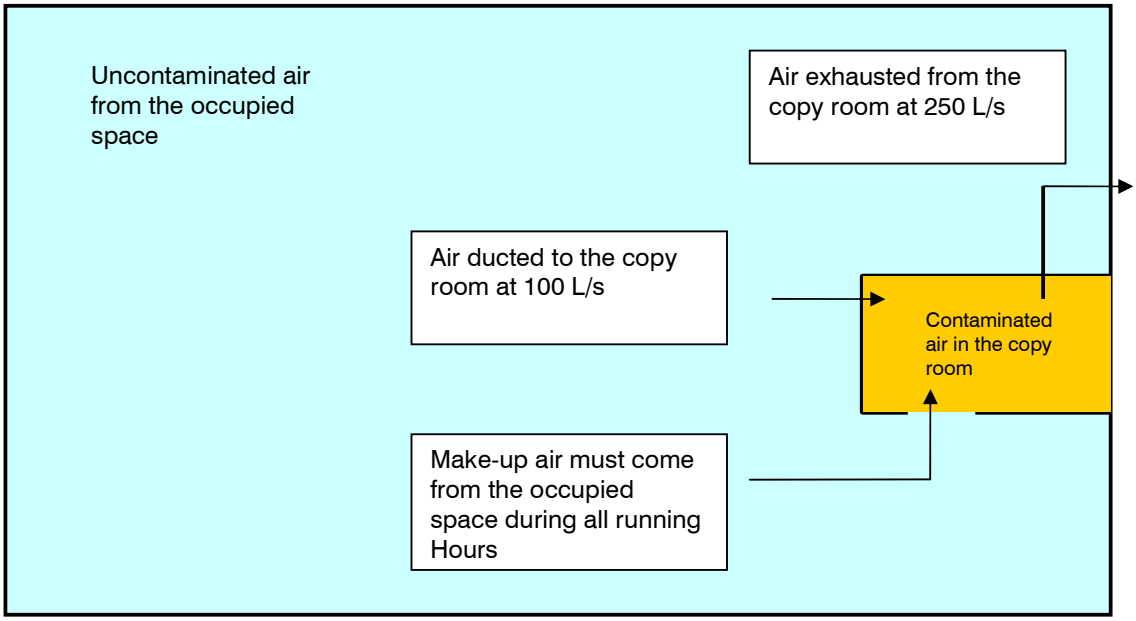


Figure 1: General air supply schematic diagram

2.2 Modelling Methodology

Phoenics computational fluid dynamic (CFD) software has been used to assess the performance of the negatively pressurised copy room.

CFD modelling is a finite element modelling technique that addresses the thermodynamic properties of fluids. In this case, the pressure, velocity and temperature of air in the space are being modelled. The software allows the diffusion of contaminants in the space (SMOK function) to be modelled.

Contamination in the space has been modelled as a proportion of the contamination at the source (100%)

The CFD modelling provides results for an equilibrium position based on the loads, air supply and exhaust for the space. It does not take into account movement or other influences that affect the air flow around the space.

The key mechanical design characteristics have been included in the model:

- Location and flow rates of supply and exhaust grills
- Location and design thermal loads of server racks, copiers and printers
- Contaminant location and emission for copiers and printers

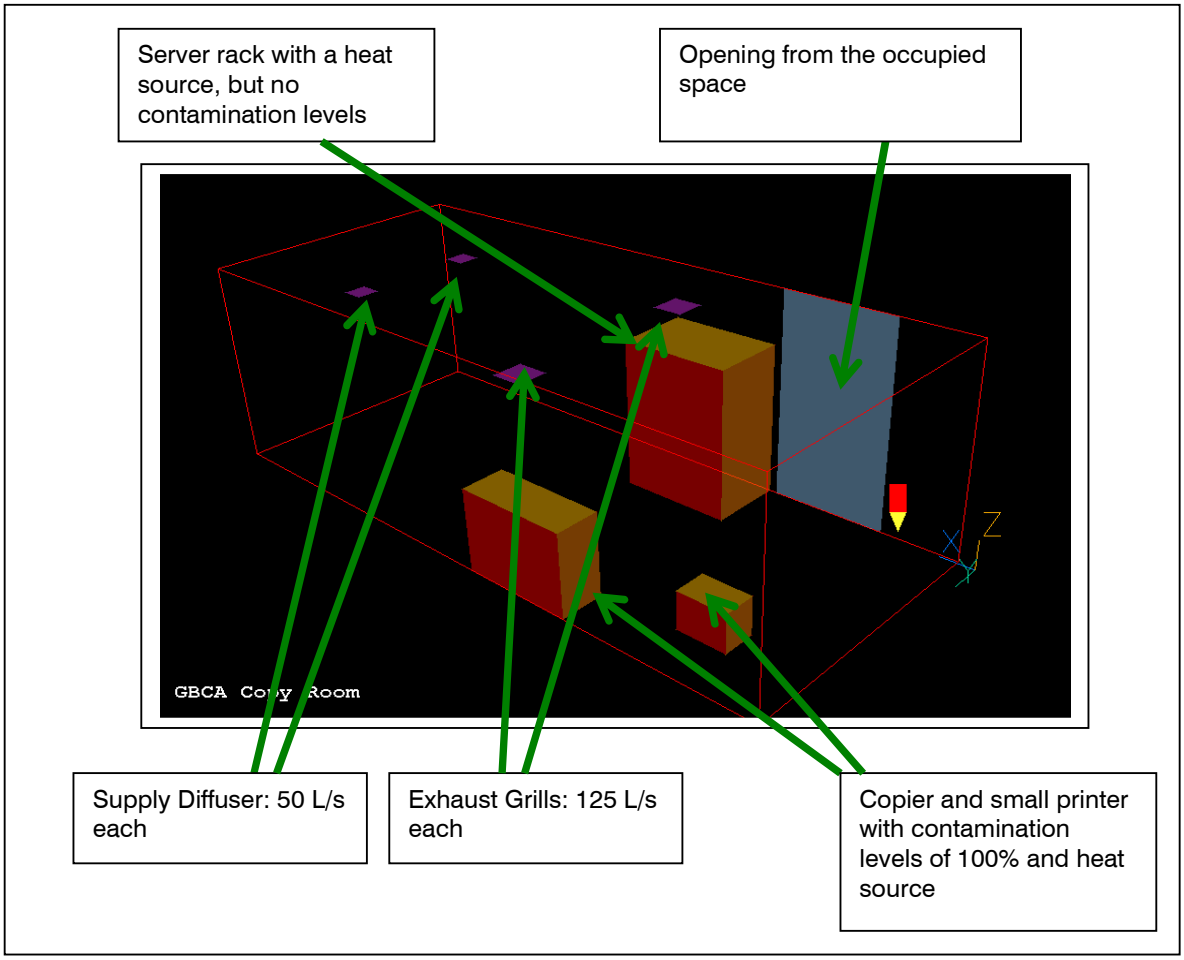


Figure 2: CFD Model geometry

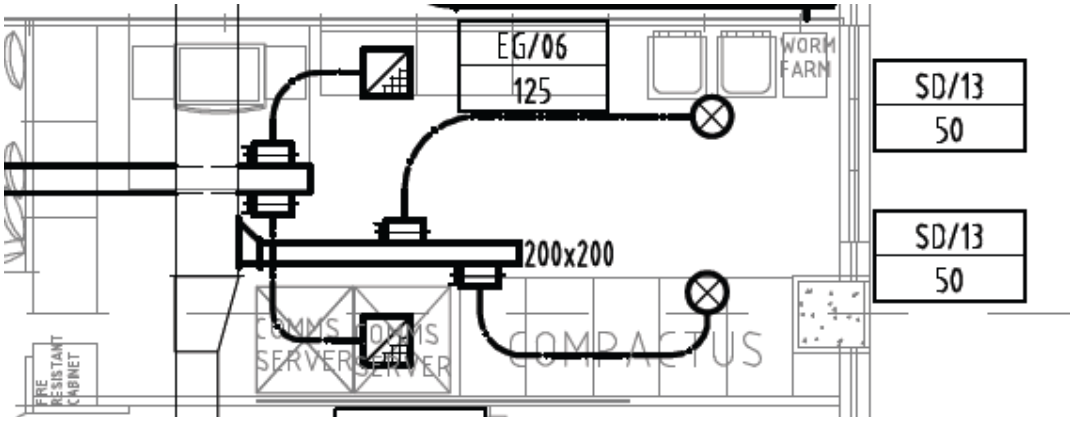


Figure 3: Mechanical drawing excerpt showing supply and exhaust tot eh copy room as well as printer and server location

The key outcomes of the modelling that will be used to demonstrate that contaminants are maintained with the space are:

- Concentration of contaminants at the printers and copiers
- Concentration of contaminants at the opening (the doorway)
- Air movement direction at the opening

The results for these are presented in the following section.

3 Results

3.1 Contamination Behaviour at the Copiers

The contaminant results at the copiers and printers are shown in the figure below. The white arrows note the direction and magnitude of the air-flow at each point as well.

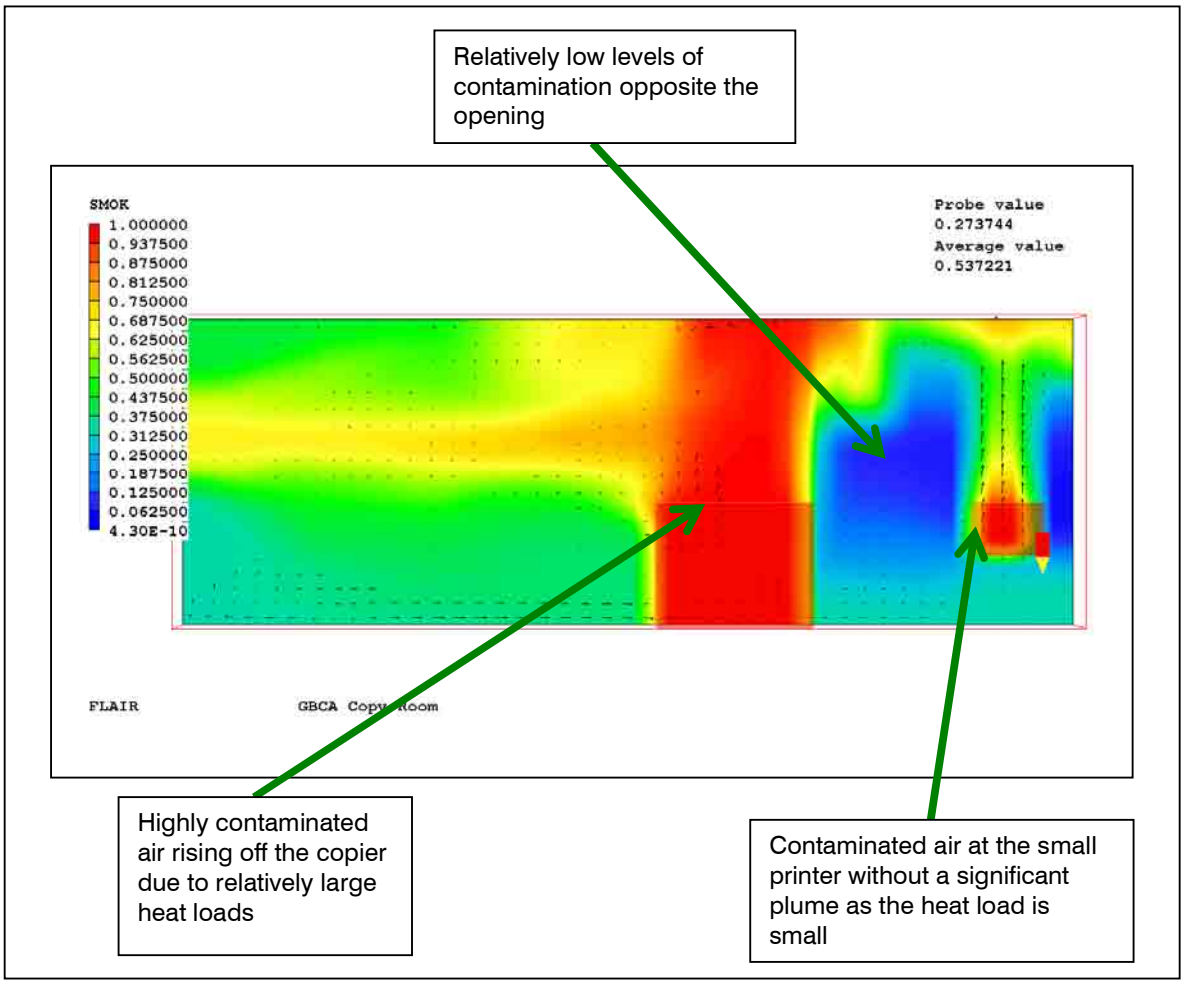


Figure 4: Contamination behaviour at the copiers

The highest concentration of contaminants is directly above the large copier, where a plume of hot air rises towards the ceiling and the exhaust vents. The plume is due to the relatively high localized equipment load.

The localised high concentration of contaminants at the small printer is not in a plume as the heat loads are much smaller.

The breathing zone opposite the door opening has significantly reduced levels of contamination due to the influx of uncontaminated air from the occupied space and the exhaust of contaminated air.

3.2 Contamination Behaviour at the Opening

The interface between the contaminated space in the copy room and the uncontaminated occupied office space is the defining aspect of this analysis. Critical outcomes are that the air on the contaminated side contains low levels of contamination and that the air is moving from the uncontaminated space into the contaminated space.

The overall flow of air is into the space as demonstrated in Figure 1 and the CFD modelling indicates whether there are any localised areas where contaminants could enter the occupied space.

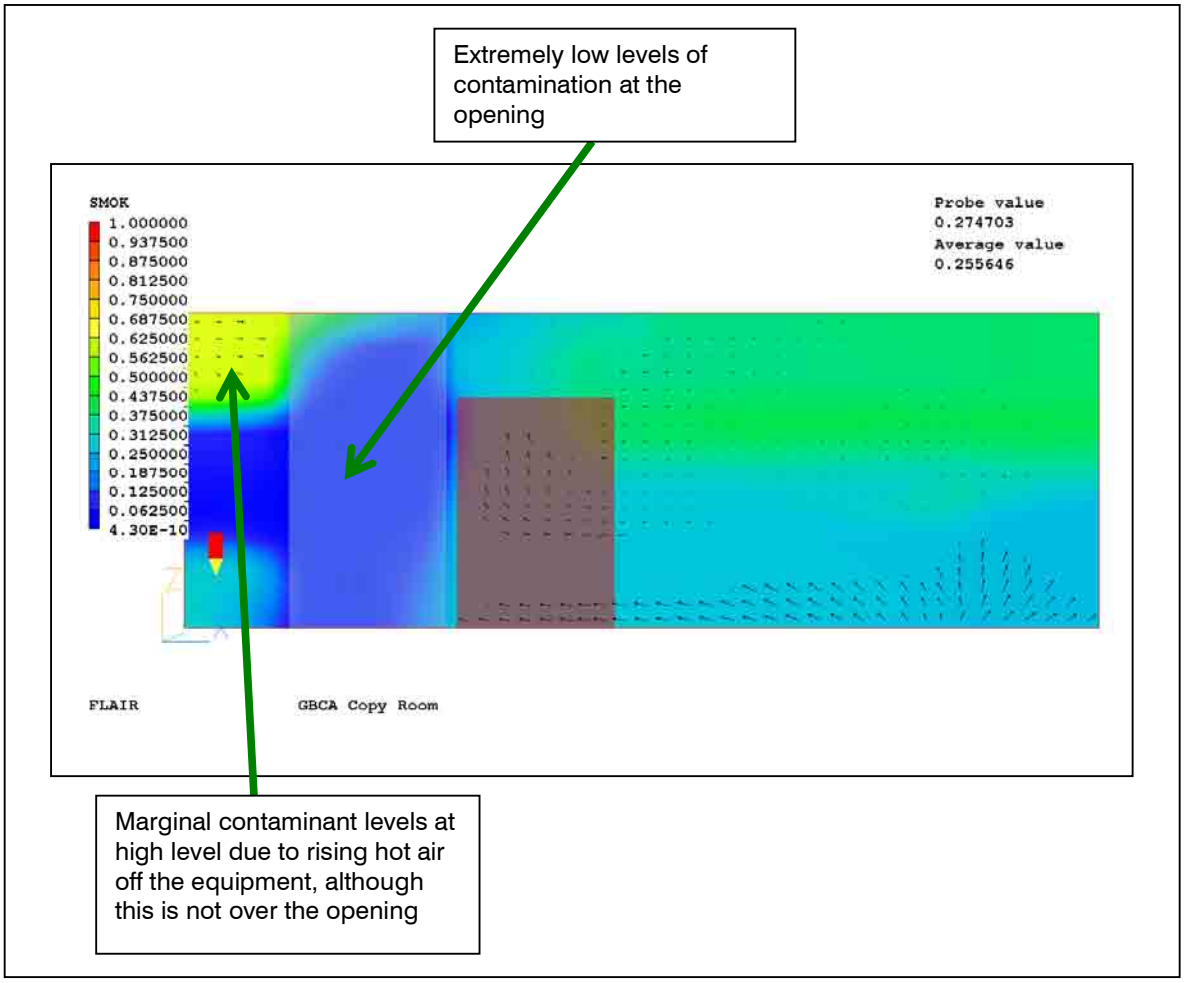


Figure 5: Contamination behaviour at the opening

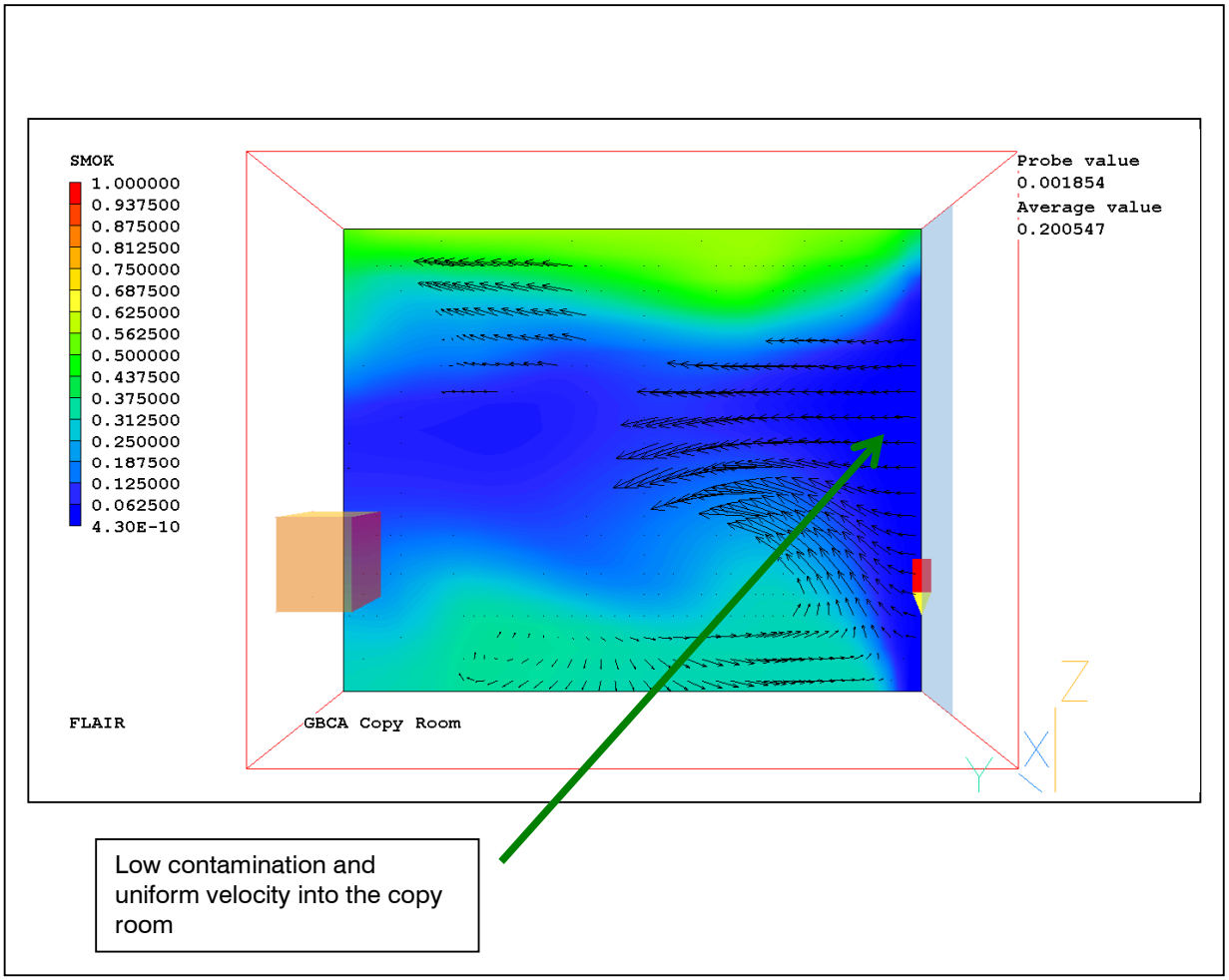


Figure 6: Contamination and velocity behaviour at the opening

The contamination behaviour at the opening shows the following characteristics:

- There is an extremely low level of contamination over the majority of the opening (dark blue area)
- There is a localised area of higher concentration at high level that does not significantly overlap with the opening
- There is uniform velocity into the copy room, even at the high level area where the contamination is greater than 25% of localised contamination at the copier

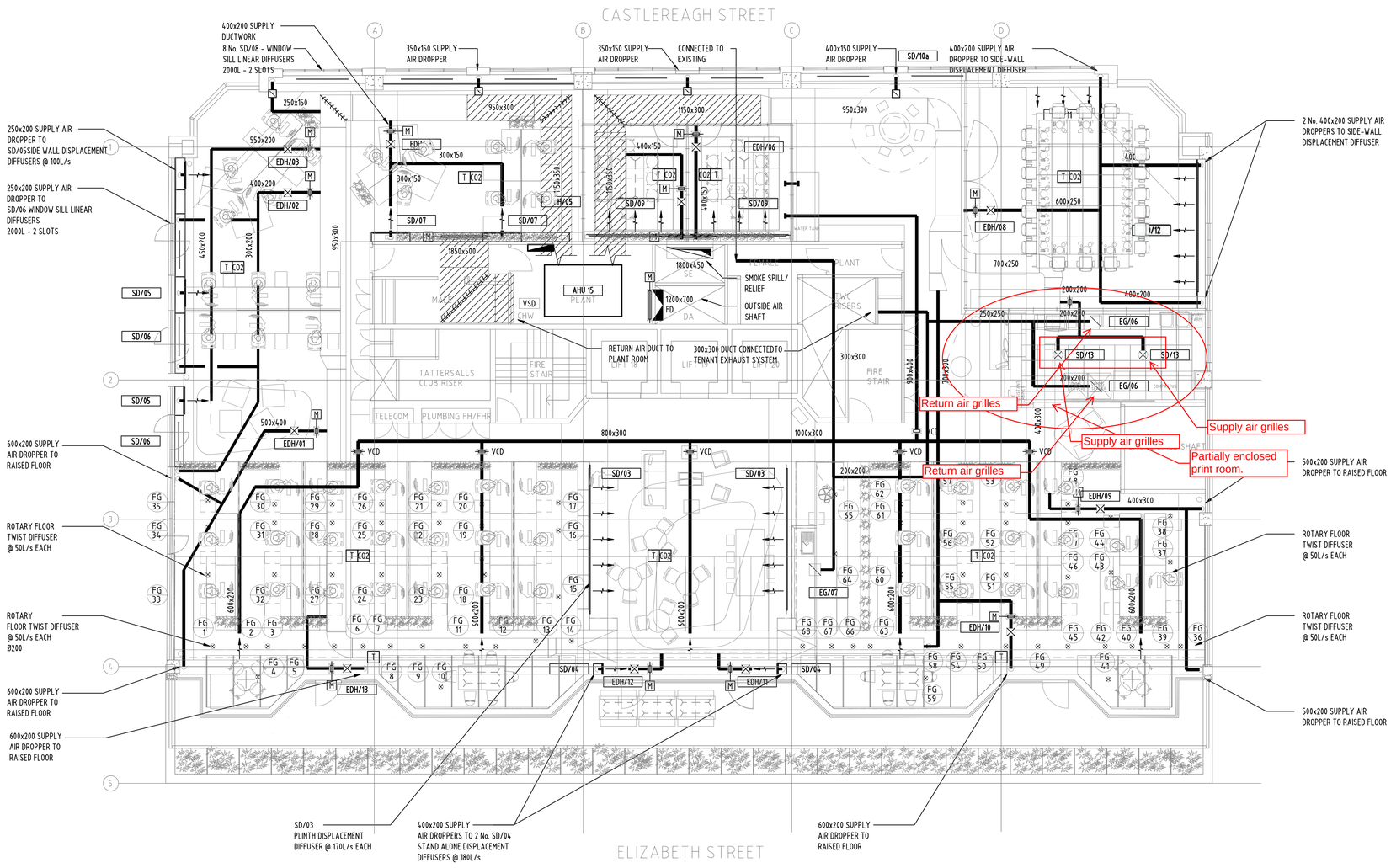
4 Conclusions

The modelling shows the following key outcomes:

- There is uniform air movement from the occupied space into the copy room across the opening area, indicating that contaminants do not move out of the enclosed area
- There is extremely low contamination levels at the opening on the contaminated side
- There is some contamination at high level on the contaminated side, although it does not significantly overlap the opening and the air at that area is moving into the copy room.

Based on these results, the copy room can be considered to be effectively sealed by making up air from the occupied space through the use of negative pressure.

IEQ-14: 2



AS BUILT

LEGEND

- AxB — RECTANGULAR DUCTWORK
- SUPPLY AIR DUCTWORK
- RETURN AIR DUCTWORK
- EXHAUST AIR DUCTWORK
- DROPPER
- SD/xx — STAND ALONE DISPLACEMENT DIFFUSER
- SD/xx — SIDE WALL DISPLACEMENT DIFFUSER
- SD/xx — SWIRL DIFFUSER
- ROTARY FLOOR DIFFUSER
- EG/xx — RETURN/EXHAUST AIR GRILLE
- FD — FIRE DAMPER
- VCD — VOLUME CONTROL DAMPER
- M — MOTORISED DAMPER
- EDH/xx — ELECTRICAL DUCT HEATER
- T — TEMPERATURE SENSOR
- CO2 — CO2 SENSOR
- DISTRIBUTION BOARD
- FG 48 — FLOOR DIFFUSER NO.

Rev	Description	By	Date
A	AS BUILT	ENRAVEL	11.03.2009

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HEAD OFFICE

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Project

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Drawing Title

DUCTWORK LAYOUT
L15

CAD File	Drawn -
Coordinated	Scale 1:100 @A1
Project Architect	Date 11-03-09
Project Director	
PTW Project No. -	Drawing Number ST 236-M01 A
JLW Project No. ST 236	Rev A