ventilation issues arising from post occupancy studies on new build and refurbishment projects

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introduction

- post occupancy evaluations of;
- gilmour's close, edinburgh
- the glasgow house

gilmour's close

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Scottish Funding Council
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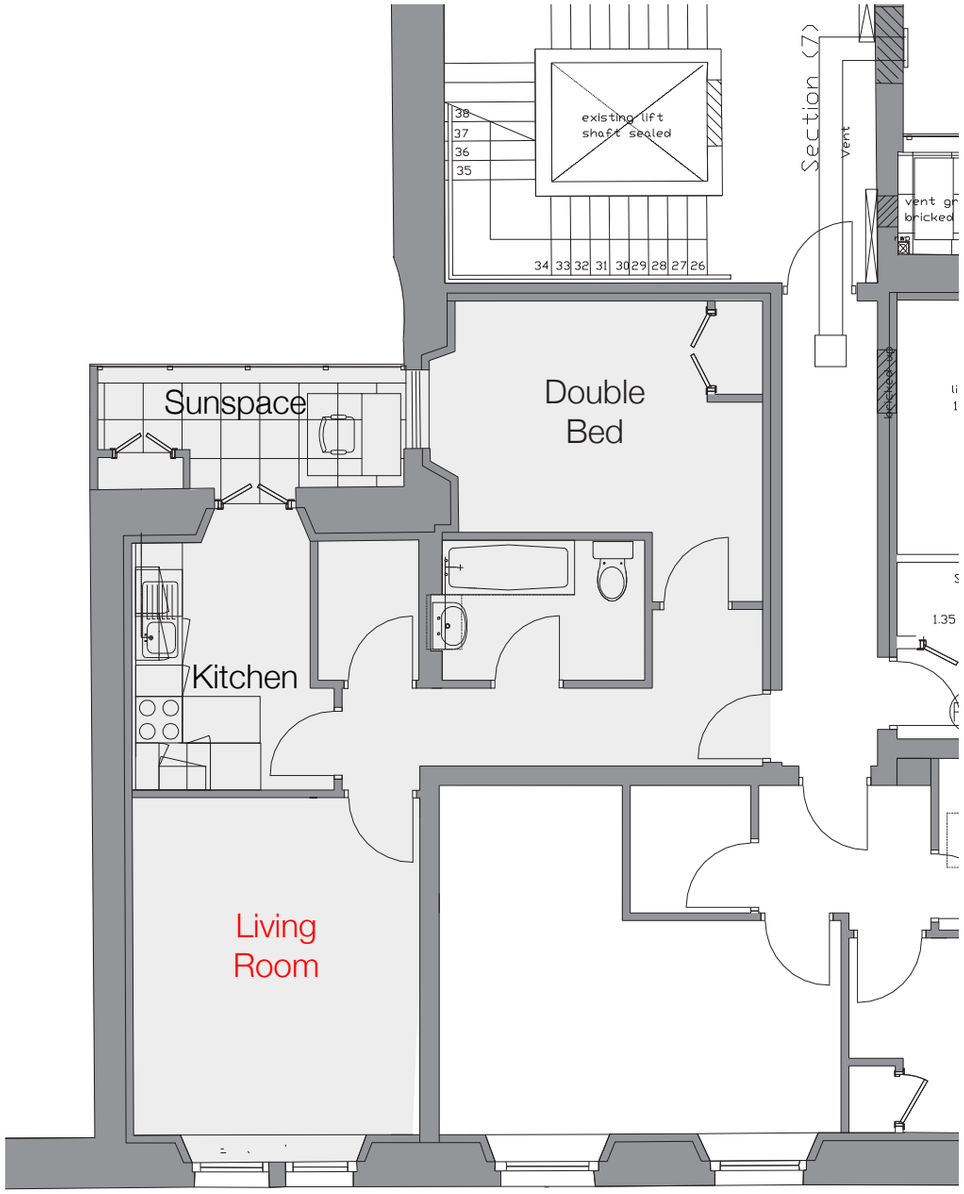
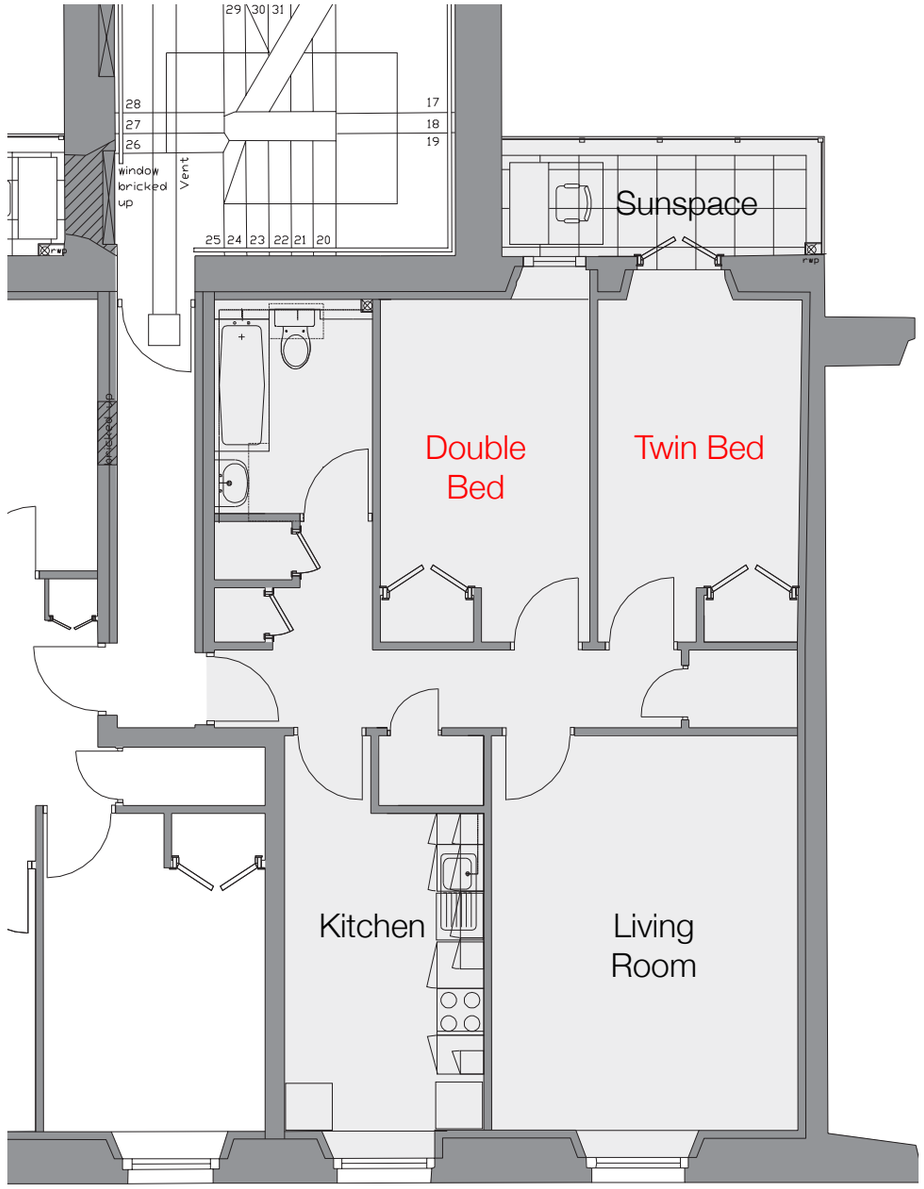
- a 19th century masonry tenement
  - adaptive rehabilitation
- design of low energy housing
- social rented and supported tenures
- incorporation of thermally efficient envelope, MVHR, GSHP & sunspaces
- POE of 5 dwellings & 1 office

subject dwelling arrangement

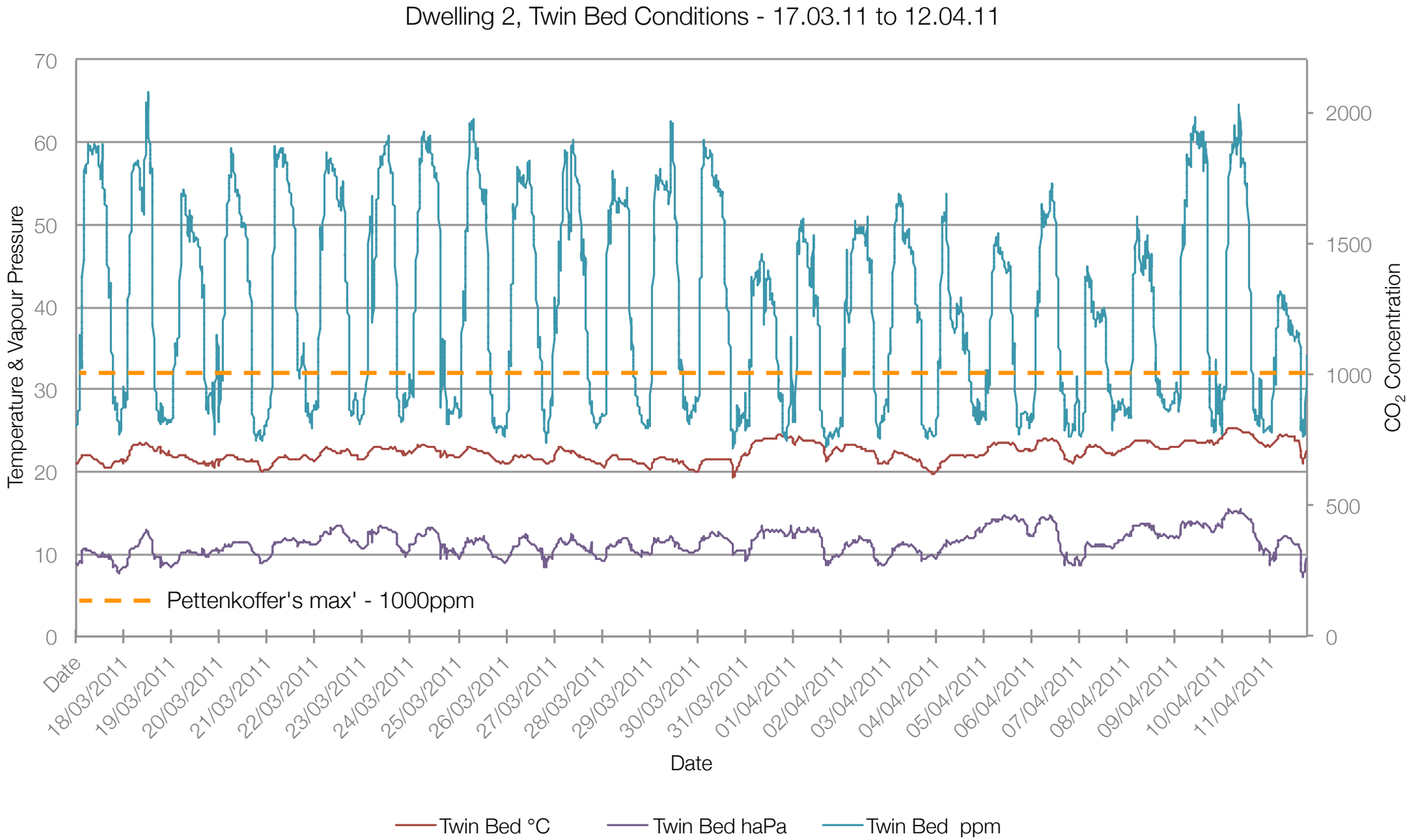
Dwelling 5



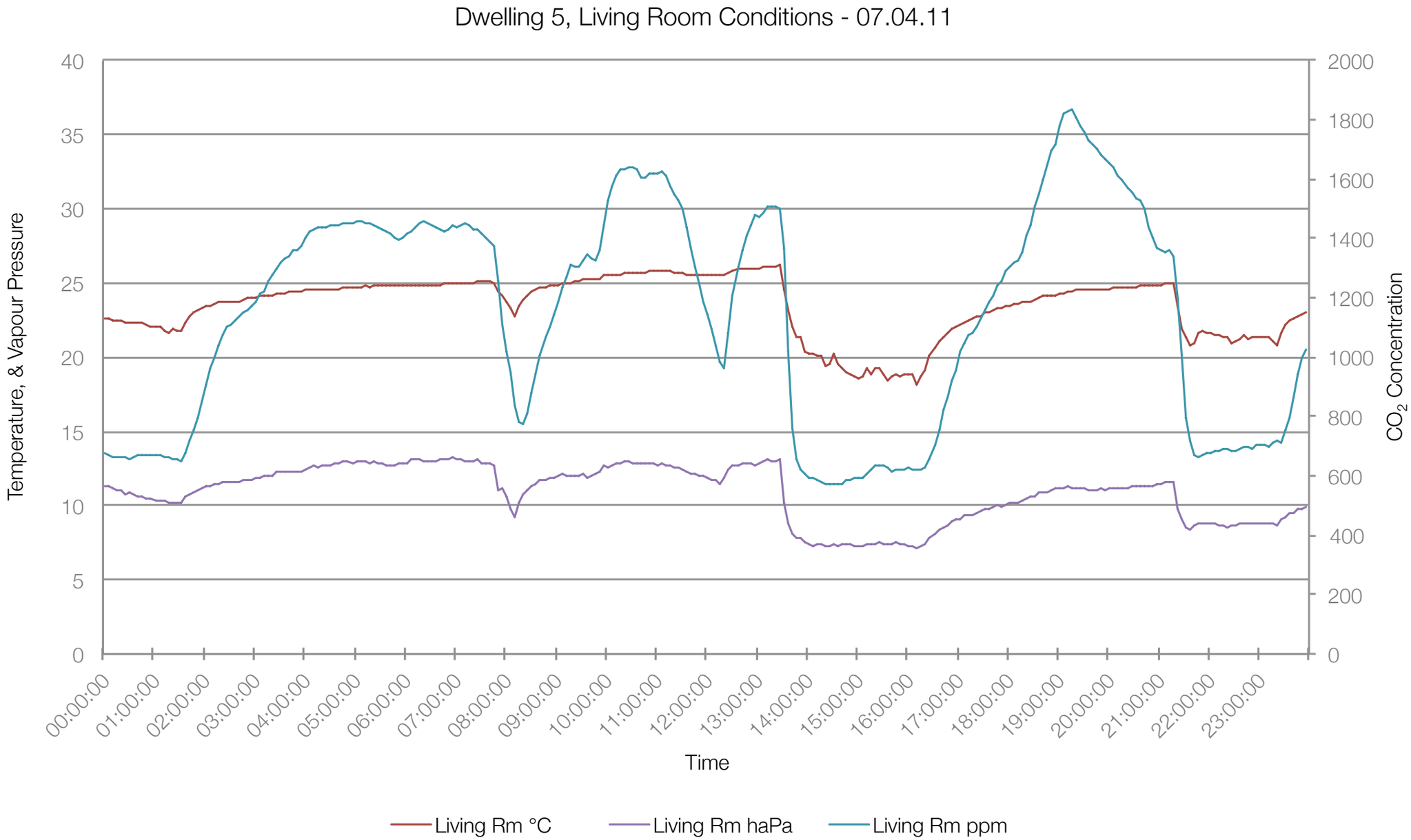
Dwelling 2



findings - air delivery issues



findings - IAQ daily profile



findings - air delivery issues

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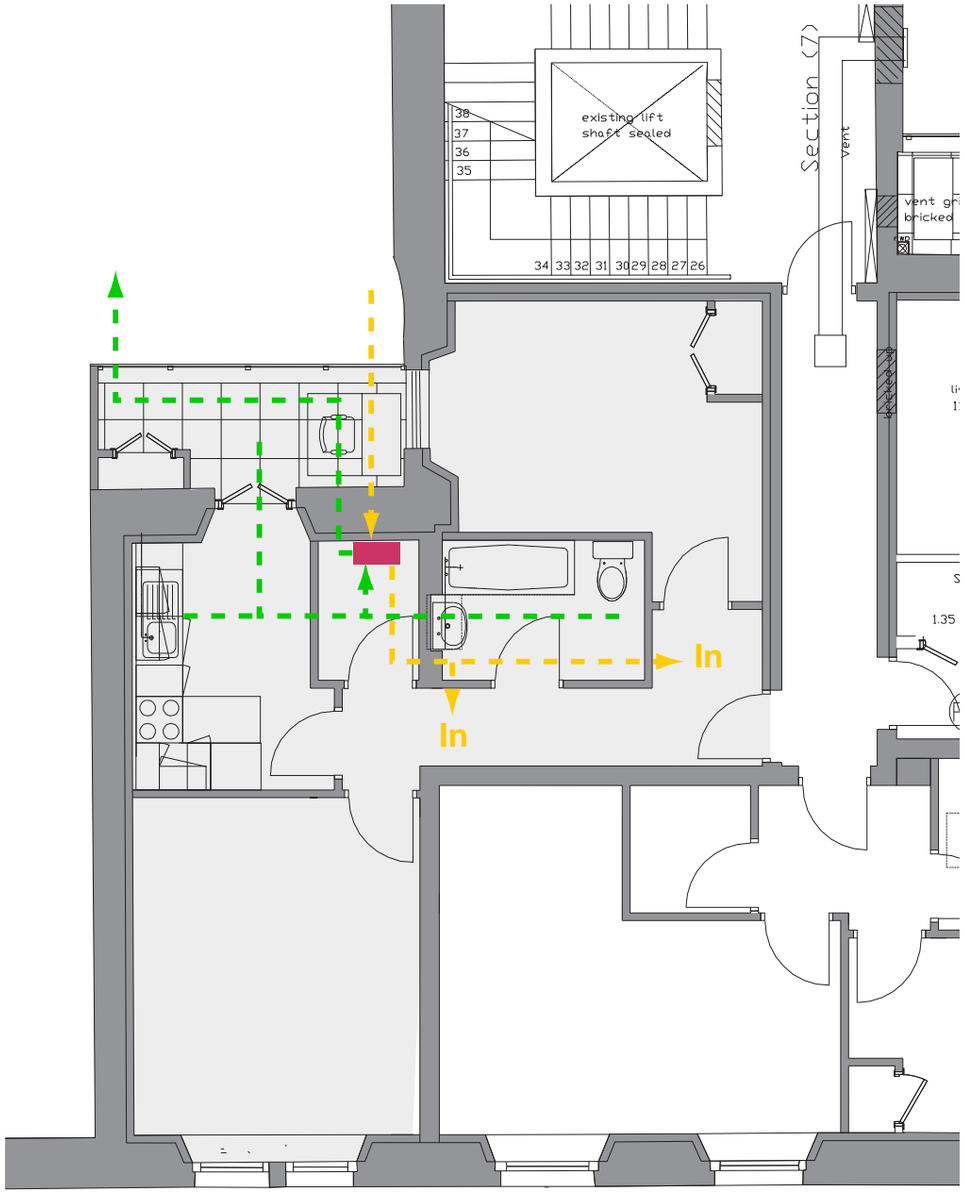

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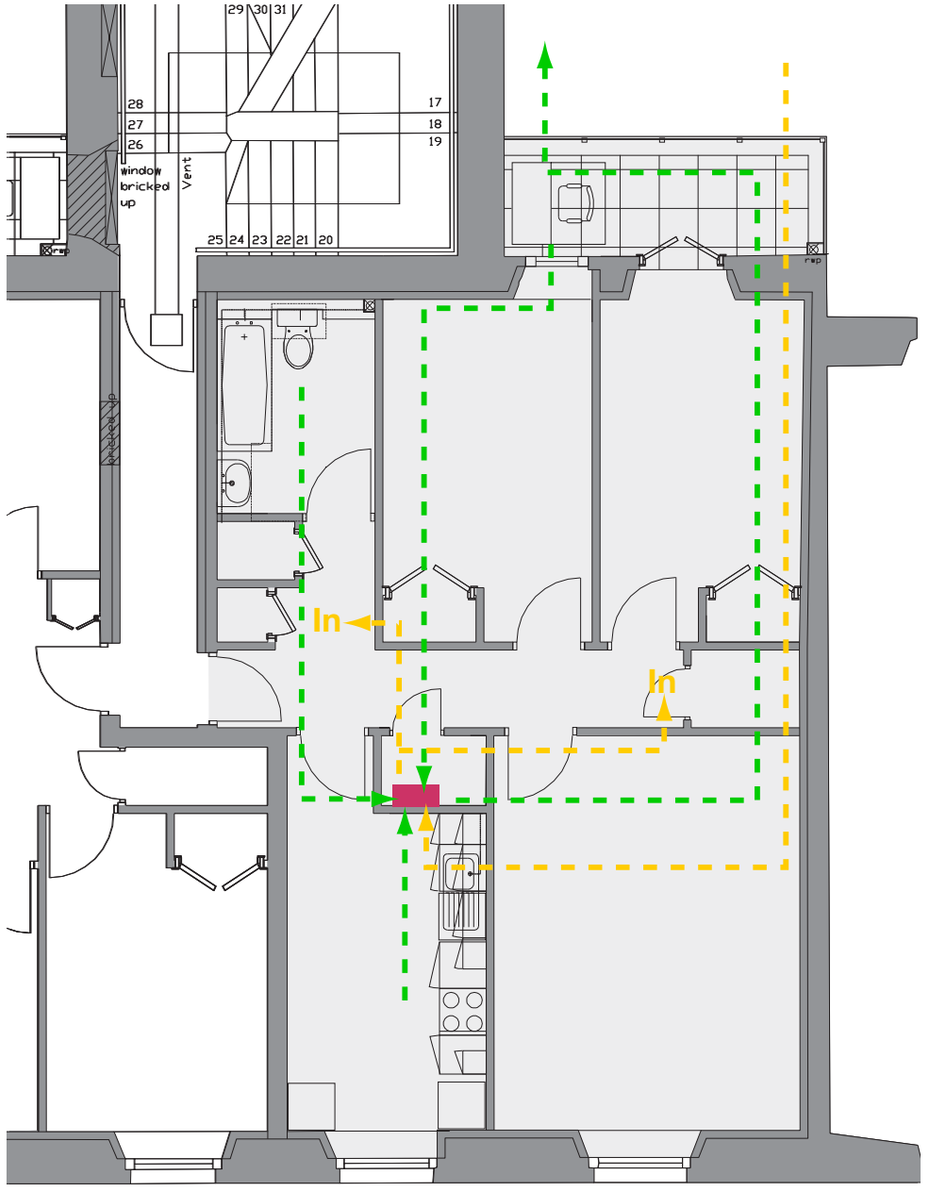
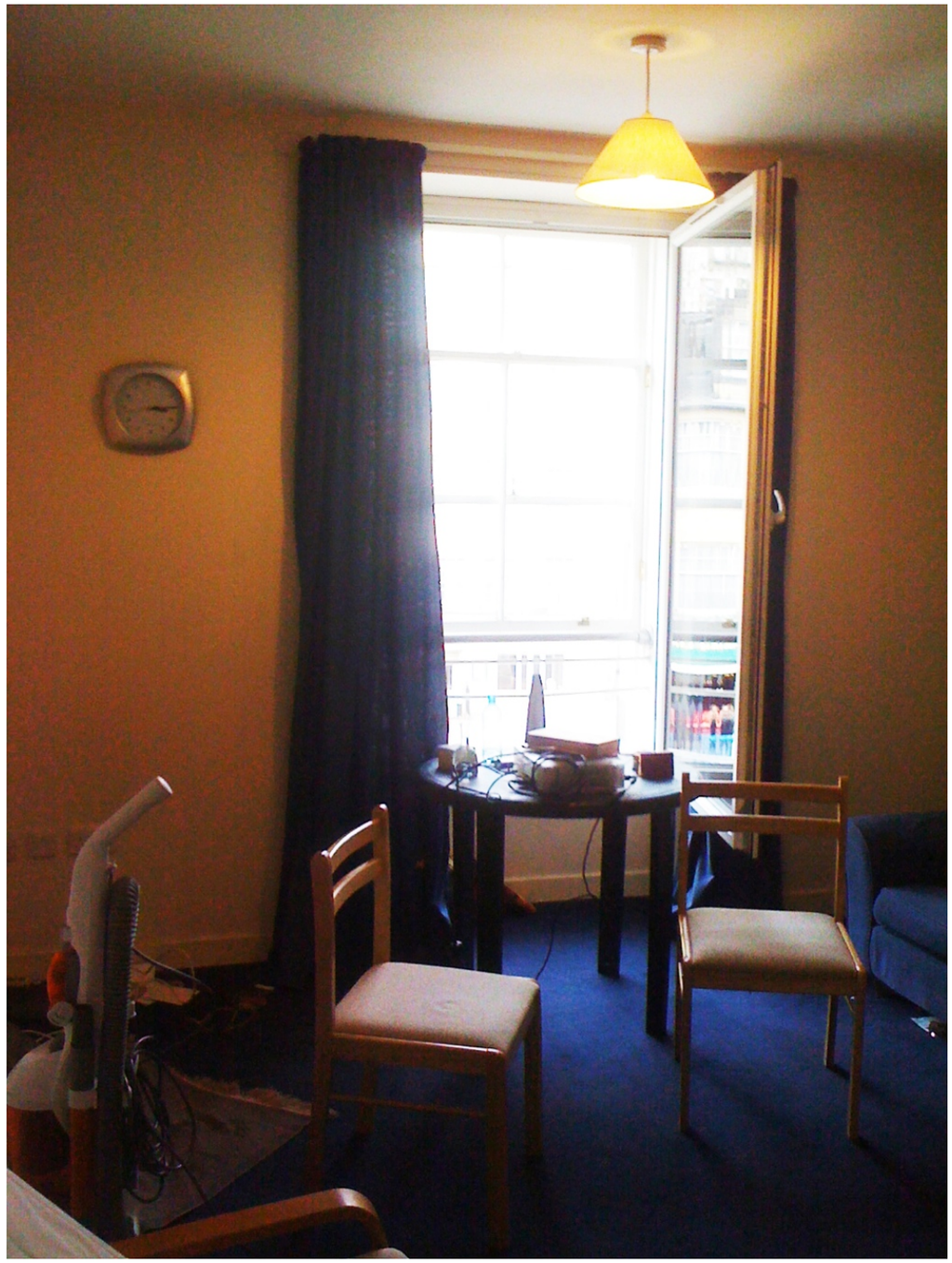


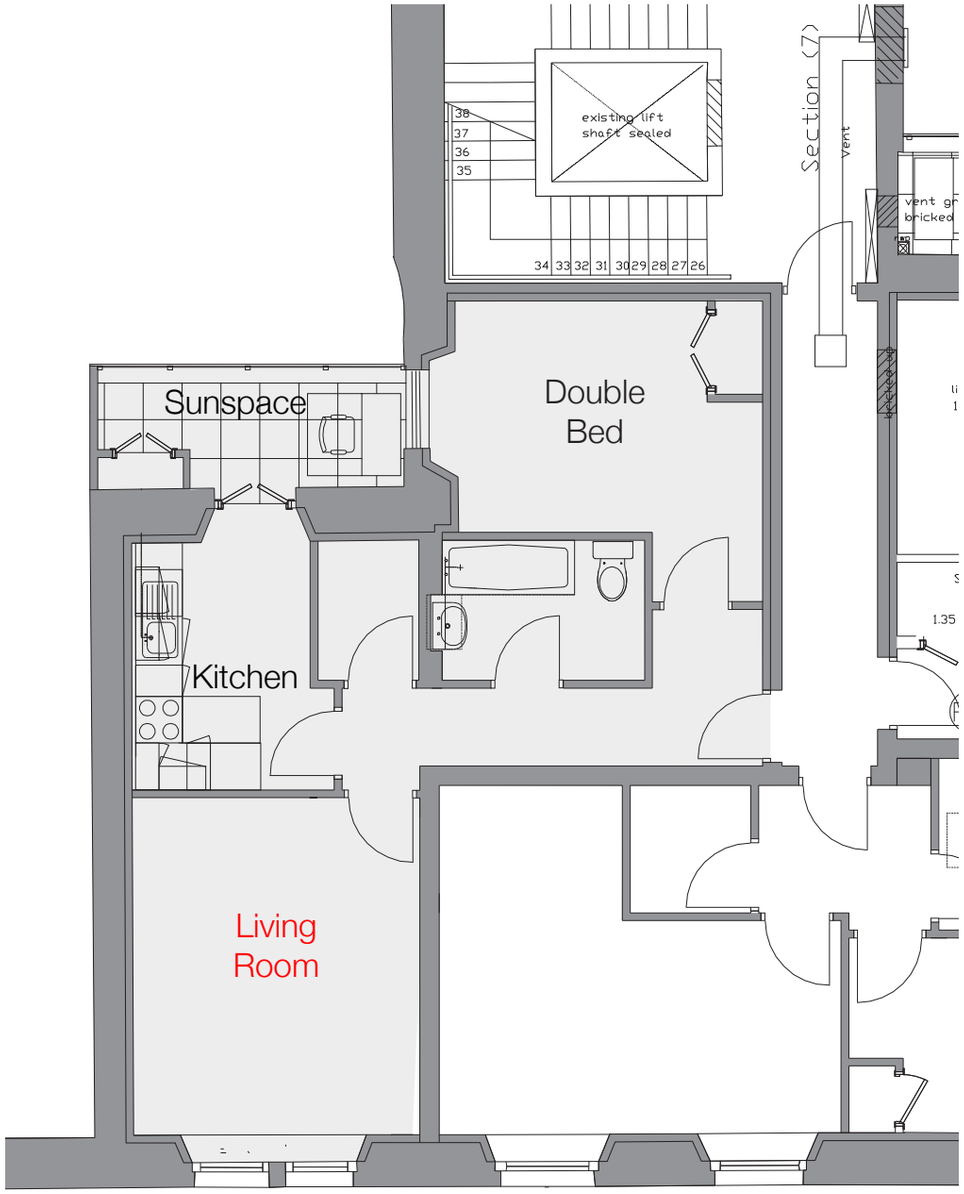
identified issues - IAQ and user behaviour

- limitation of MVHR system in dealing with pollutants
- ventilation strategy not functioning well in practice
- user behaviour in response
- incurred (double) energy penalty



subject dwelling arrangement

Dwelling 5



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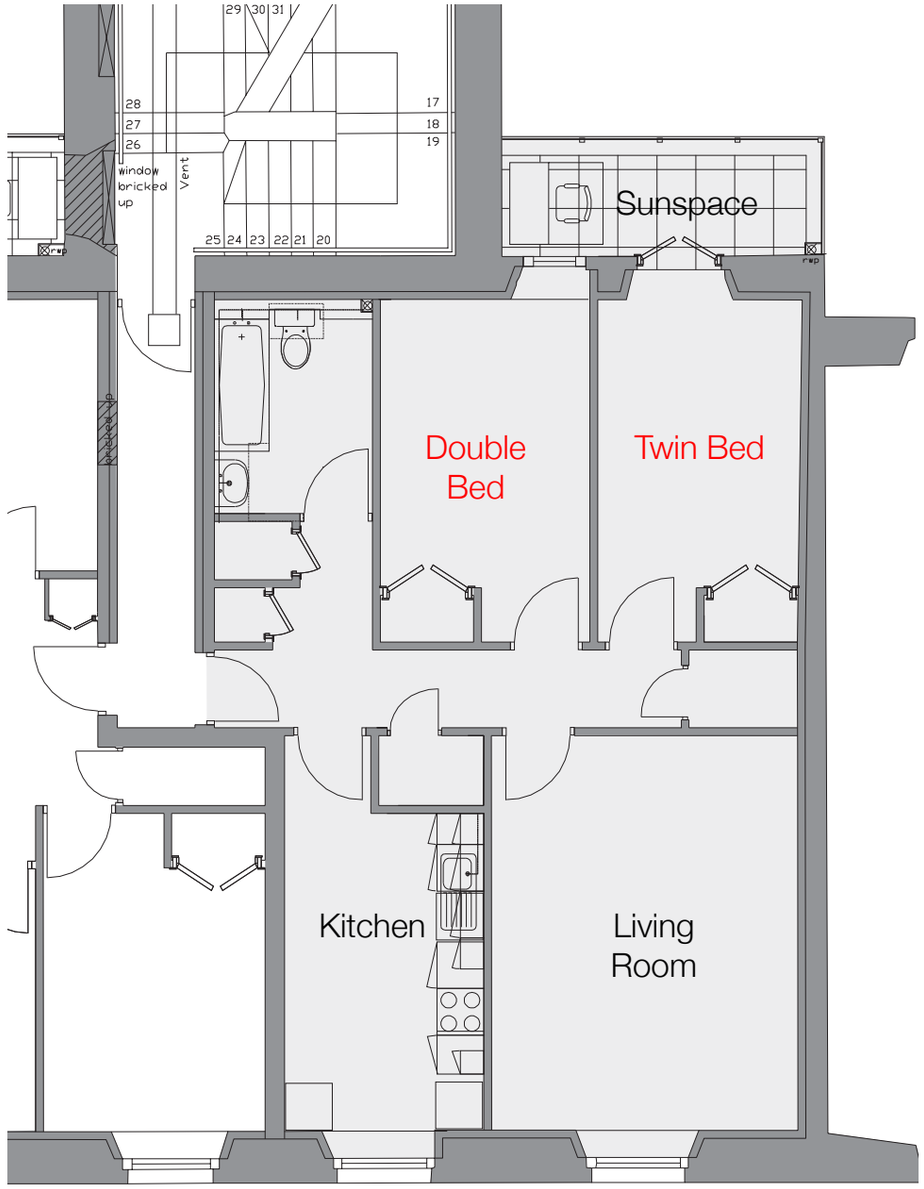
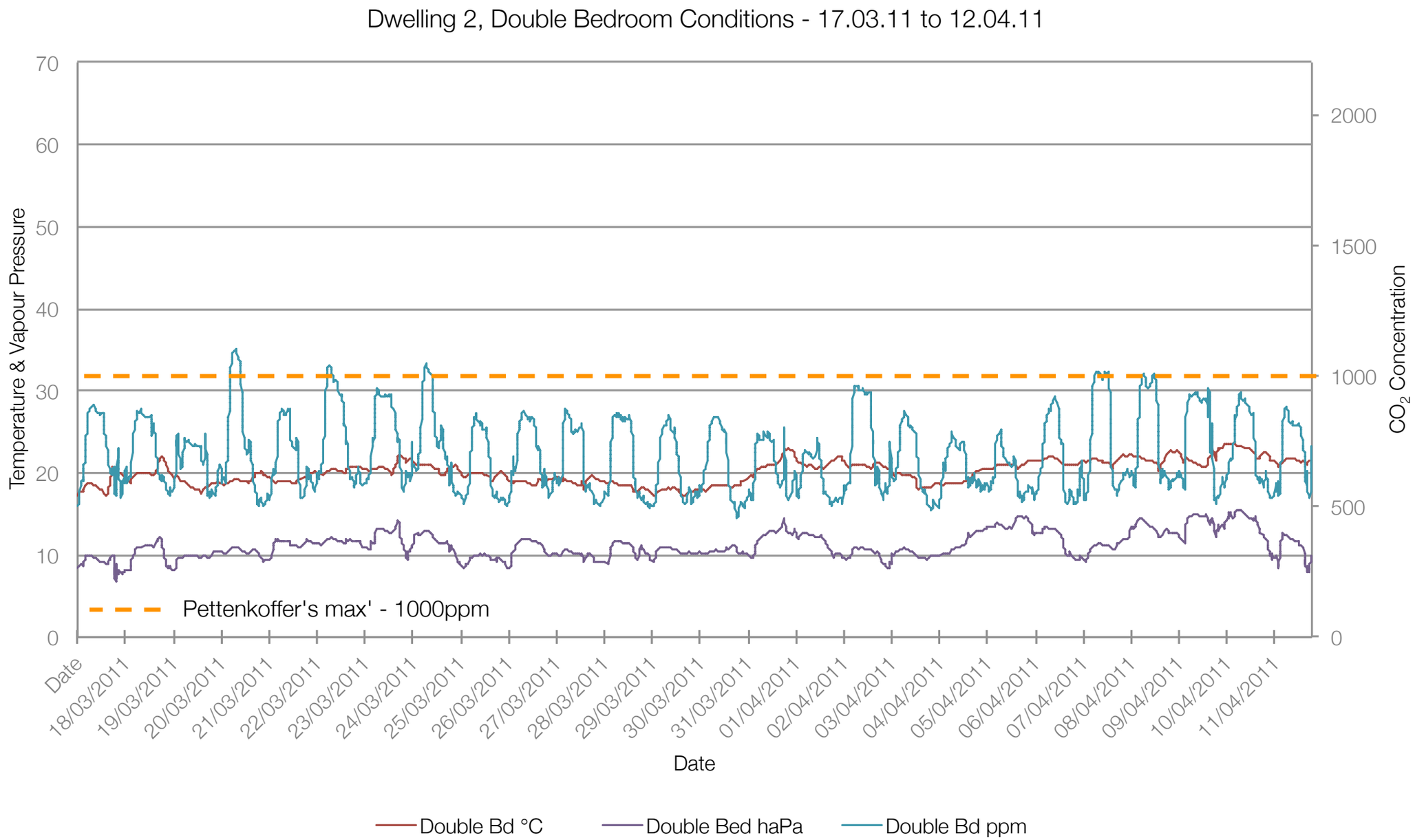


findings - sunspace benefits



sunspace benefits

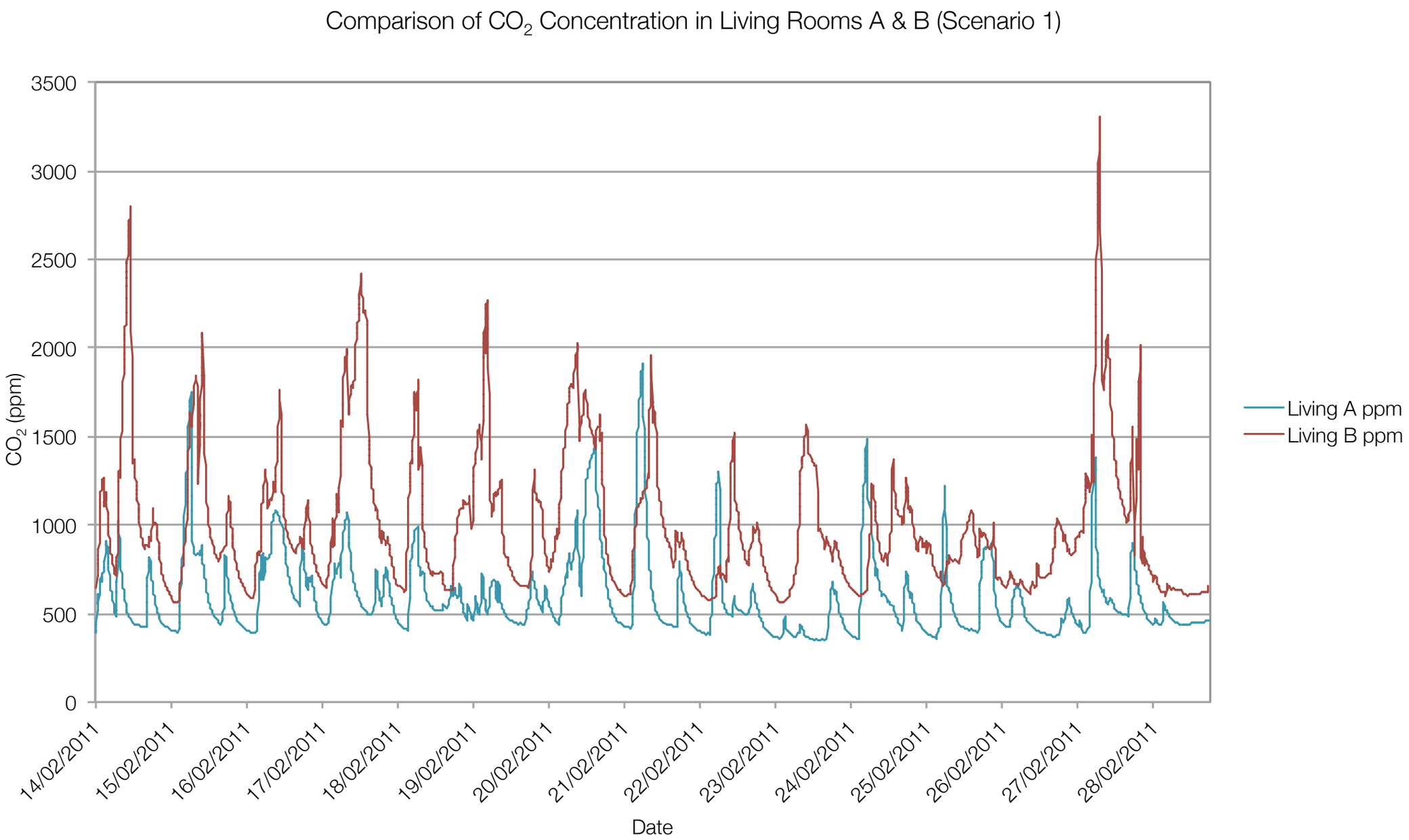
- benefits of ventilation relationship to sunspace when considered as a buffer zone
- reduction of energy penalty in relation to occupant controlled ventilation

the glasgow house

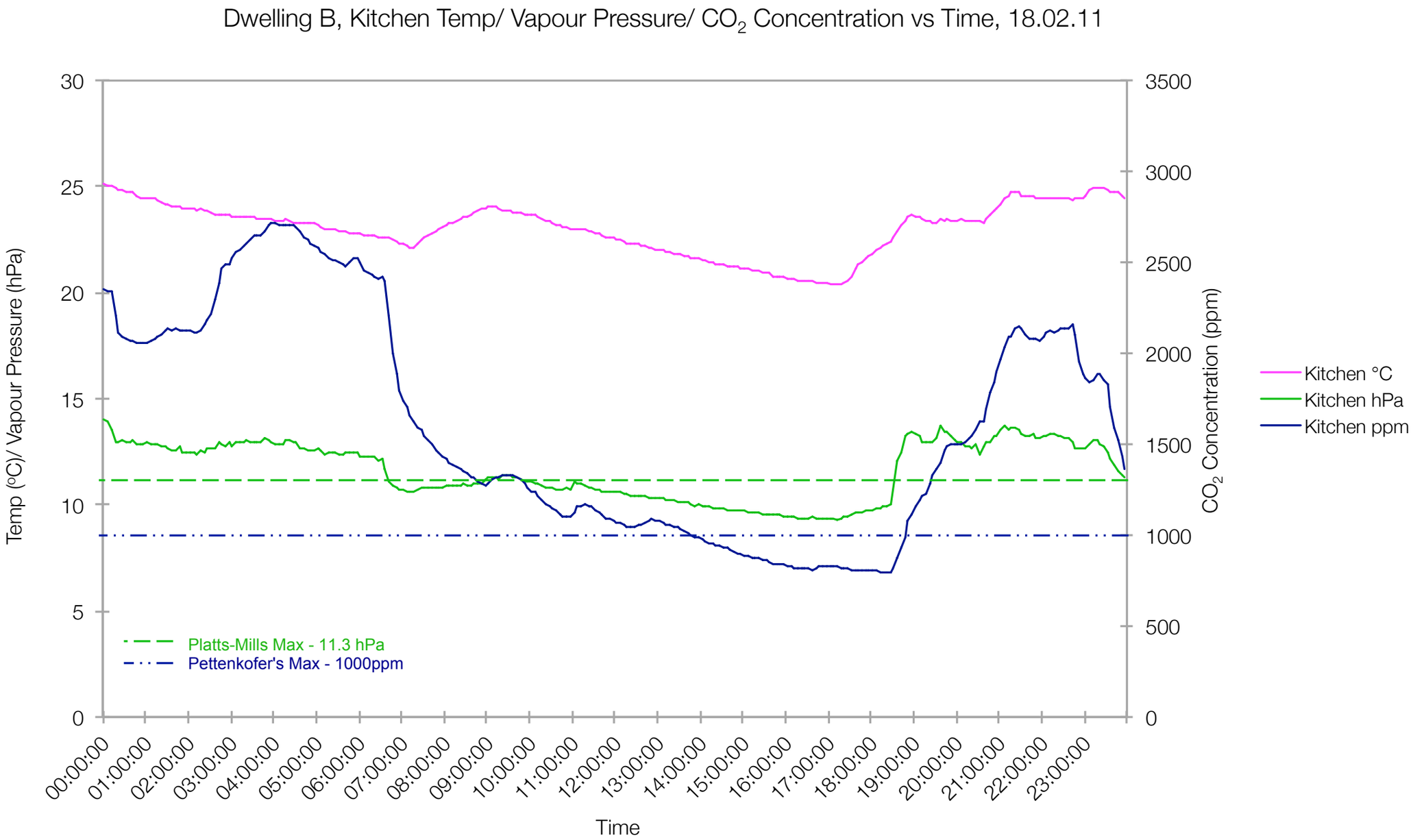
the glasgow house

- exemplar test dwellings
- incorporating thermally efficient envelope, MVHR, sunspaces & air tightness of $3m^3/h/m^2$
- 4 test 'residents' per dwelling
- circa 2 week occupation
- defined occupancy script
- monitoring of physical parameters & behaviour

findings - CO_2 level comparison (scenario 1)



findings - IAQ daily profiles



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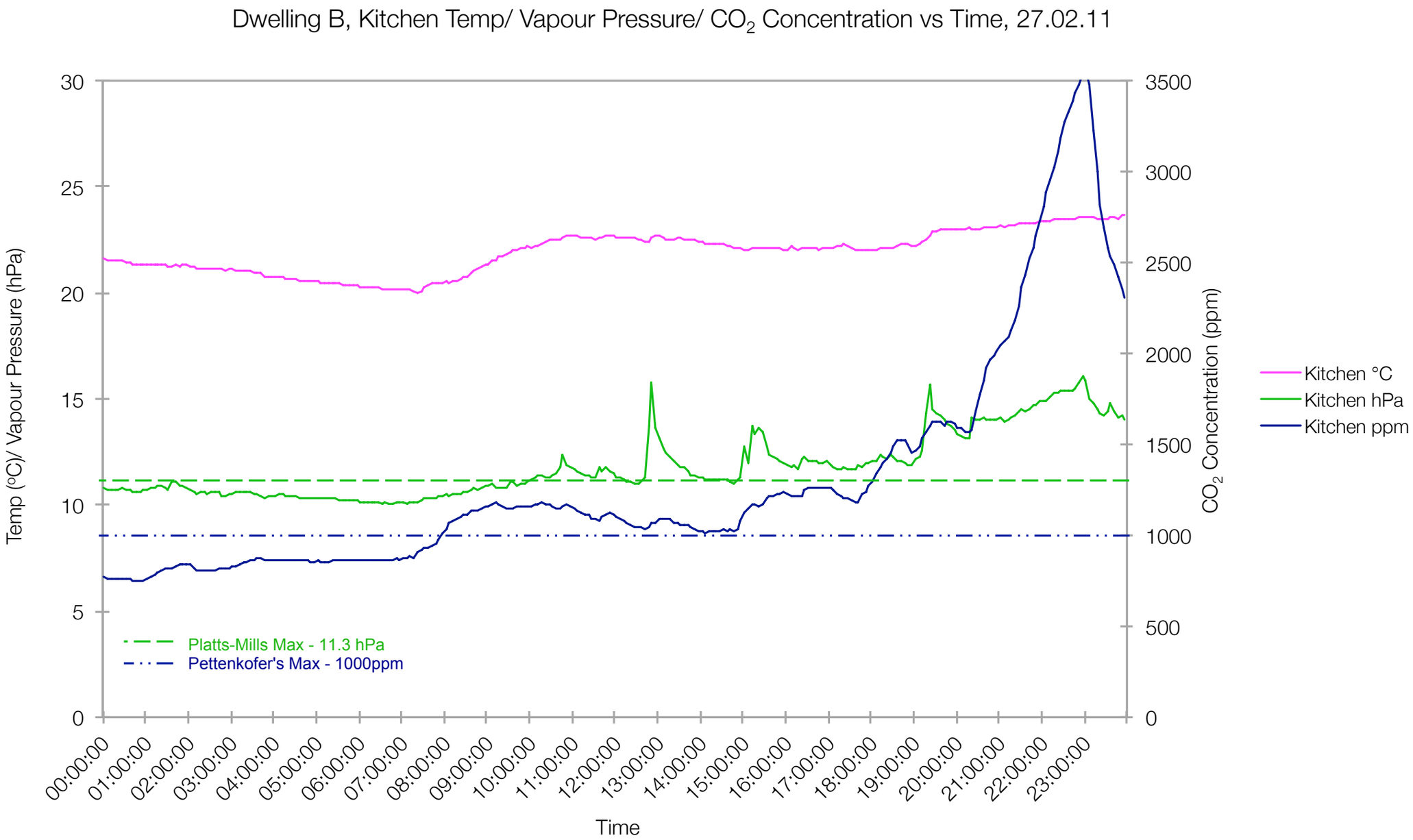
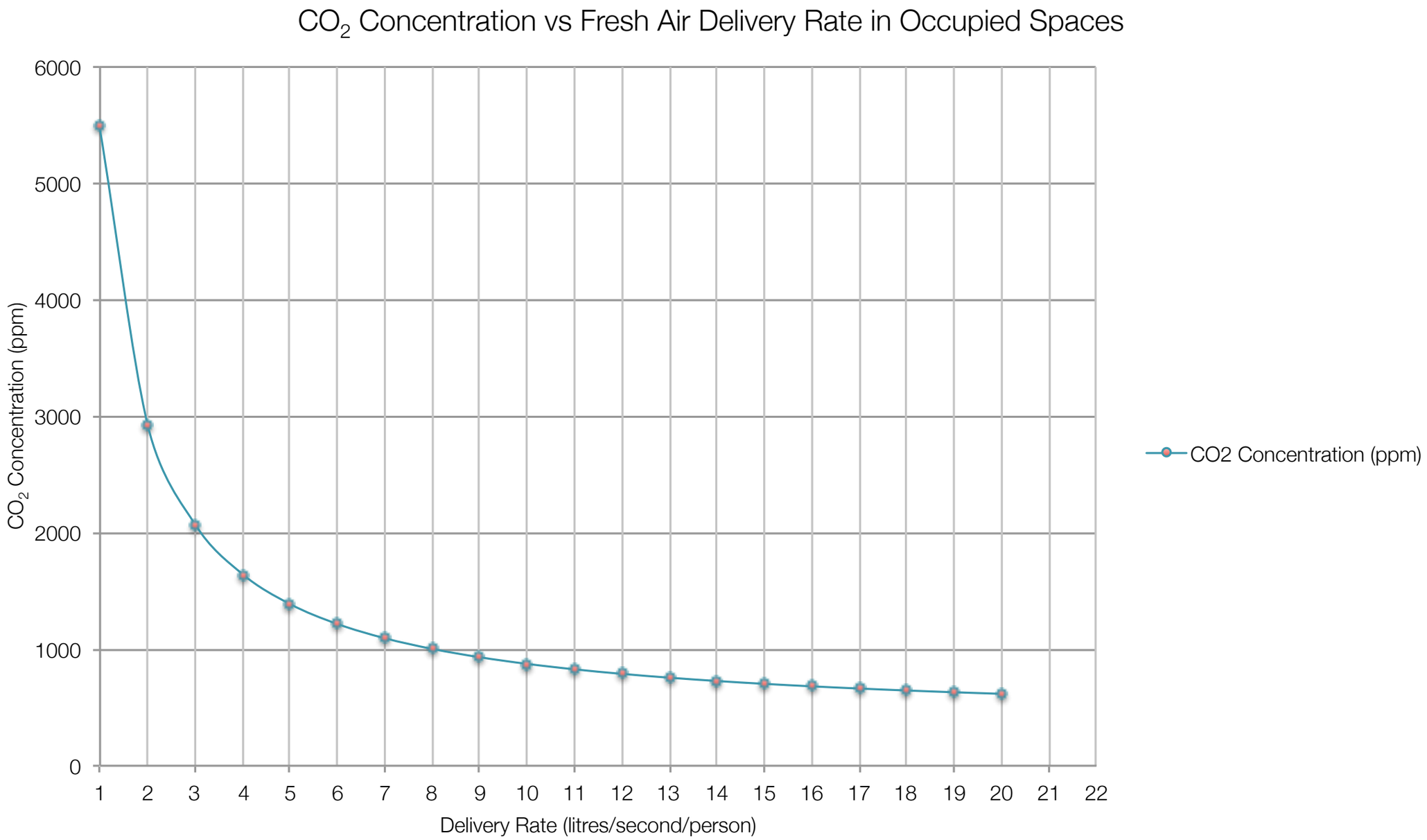


air delivery rate - relationships



findings - measured air delivery rate

Date	Position	Vel	Flow	Flow (100mm duct)	Flow (100mm duct)	T	H	Boost On
		m/s	l/s	l/s/person (4 occupants)	l/s/person (7 occupants)	deg C	%rh	
30/03/2011	Living A	1.11	8.72	2.18	1.25	20.3	43.1	n
30/03/2011	Utility/ WC A	1.44	11.31	11.31		22.4	41	n
30/03/2011	Utility/ WC A	2.38	18.69	18.69		21.7	42.4	y
30/03/2011	Kitchen A	2.91	22.86	5.71	3.27	20.6	45.1	y
30/03/2011	Kitchen A	3.32	26.08	6.52	3.73	20.4	44.9	y (wc)
30/03/2011	Kitchen A	2.32	18.22	4.56	2.60	20.2	45.9	n
30/03/2011	Bathroom A	1.68	13.19	13.19		21.7	40.9	n
30/03/2011	Bathroom A	2.62	20.58	20.58		21.9	40.9	y
30/03/2011	Bed 2 A	0.94	7.38	3.69		20.9	42.9	n
30/03/2011	Bed 1 A	1.09	8.56	4.28		20.6	43.5	n
30/03/2011	Single Bed A	0.92	7.23	7.23		20.4	43.5	n
30/03/2011	Attic room A	1.5	11.78	5.89		20.4	44	n
30/03/2011	Living B	0.81	6.36	1.59	0.91	19.8	44.5	n
30/03/2011	Kitchen B	0.8	6.28	1.57	0.90	19.9	42.2	n
30/03/2011	Kitchen B	1.28	10.05	2.51	1.44	20	41.8	y
30/03/2011	Utility WC B	1.02	8.01	8.01		20.4	41.5	n
30/03/2011	Utility WC B	1.57	12.33	12.33		20.8	40	y
30/03/2011	Kitchen B	1.3	10.21	2.55	1.46	20.4	39.9	y (wc)
30/03/2011	Bathroom B	2.32	18.22	18.22		20.9	39.1	y
30/03/2011	Bathroom B	3.36	26.39	26.39		20.8	38.7	n
30/03/2011	Bed 1 B	1.19	9.35	4.67		19.9	45.7	n
30/03/2011	Bed 2 B	0.93	7.30	3.65		19.6	45.6	n
30/03/2011	Single Bed B	0.81	6.36	6.36		19.7	45.9	n
30/03/2011	Attic Room B	1.9	14.92	7.46		18.9	47.6	n

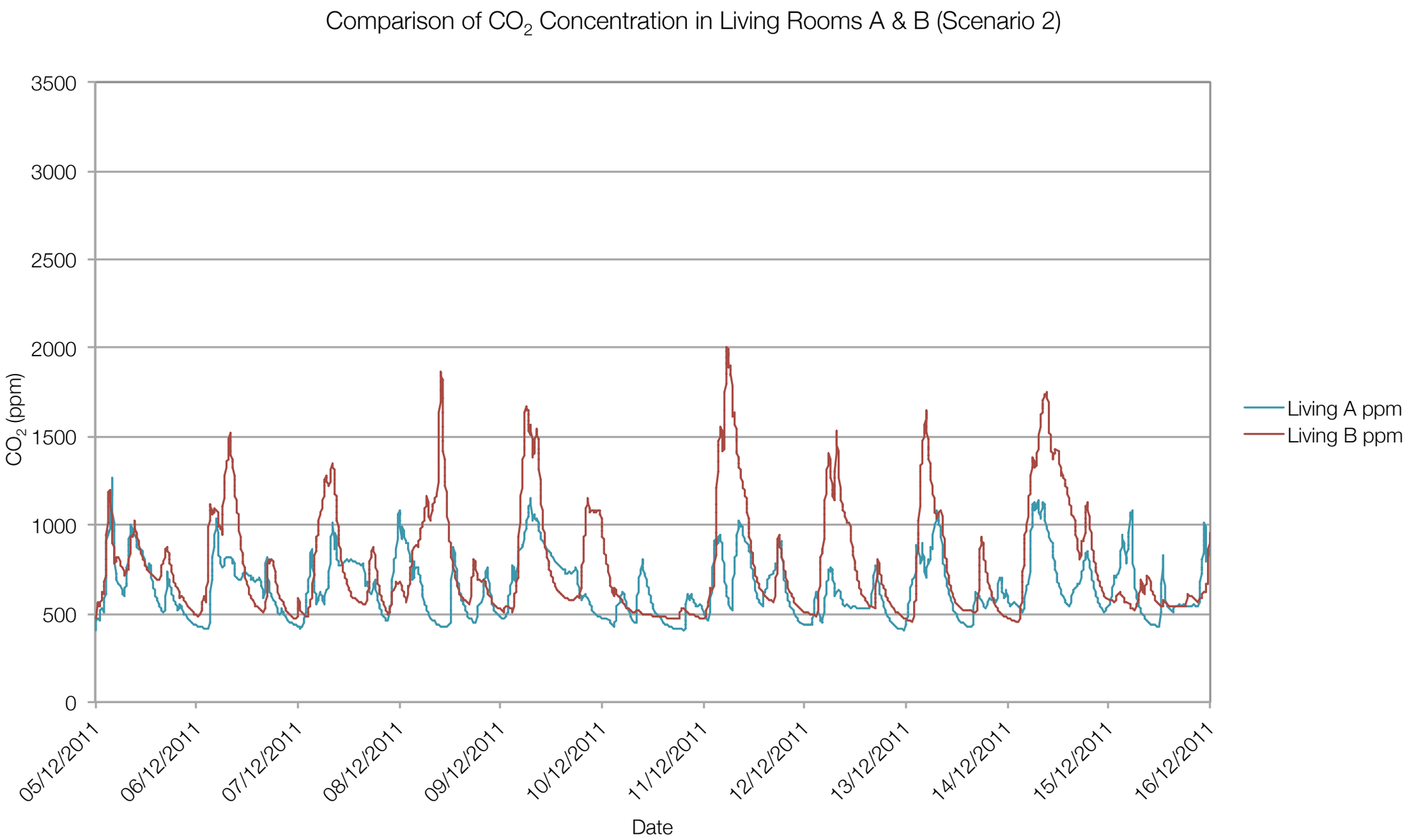
identified issues - specification and installation

- limiting factor of extract volume
- quality of installation and commissioning process
- length of delivery runs vs acoustic separation
- operational rate of system generally in relation to demand
- efficacy of boost or response to demand brought into question

identified issues - maintenance

- key consideration of position for maintenance vs occupant ability to override controls

findings - CO_2 level comparison (scenario 2)



MEARU - further studies

- strong case for continued investigation and analysis
- Technology Strategy Board 2 year post occupancy evaluations
- glasgow house (further scenarios)
- scottish housing expo
- bloom court, livingston

sealing tight *AND* ventilating right?

- airtightness alone not a solution
- failure to consider IAQ undermines energy strategy - window opening
- gaps in understanding of the relationship between thermal performance and IAQ
- gaps in legislation for ventilation and energy use

sealing tight *AND* ventilating right?

- increasing complexity of technologies
- holistic thinking by architects - skills and remuneration
- specification, maintenance, education and control
- need for POE - learning from practice and research

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