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INFLUENCE OF NIGHT-TIME VENTILATION REDUCTION ON INDOOR AIR QUALITY IN DANISH BLOCKS OF FLATS

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Synopsis

The paper describes the main results from a research project performed by "The Mobile Laboratory of Indoor Climate Measurements" one of the five mobile laboratories of the Institute. The aim of the project was to investigate if undesirable consequences occurred in the indoor climate when using an energy saving method consisting of reducing the mechanical exhaust from the "wet rooms" to app. 40 per cent of the normal performance during 12 hours of day and night.

The paper describes the selection of dwellings for the investigation, measuring methods and instruments, and the increase in indoor air humudity by using the reduction in ventilating mentioned. The conclusion is that in those 3 buildings from the investigation increases in the relative humidities were stated in a third of the dissipations on the 360 humidity measurings which formed a part of the investigation. The highest air humidities were measured in bedrooms.

Therefore, there is no reason to believe that the energy saving method should cause any health risks in the 3 buildings from the investigation.

1. Background

For many years, ventilation in Danish blocks of flats has been mechanical exhaustion from the "wet rooms", kitchen, bath, and toilet. The outdoor air replacing the exhaust air comes through the open windows and inlet valves, and through leakages in the building envelope.

In the two latest building regulations, BR 77 and BR 82, it is a demand that the exhaustion can be adjusted to a minor effect than the normal. The rating appears from table 1. However, the ventilation must not be switched off completely in bath-rooms and in toilets, in which it must be secured that the volume flow exhausted cannot be less than 40 per cent of the rated volume flow.

As the exhaust from bath-rooms and toilets, and the exhaust from ktchens normally is carried out by the same ventilation plant it is in fact a question of keeping the mechanical exhaust from the whole building at a minimum of 40 per cent of the rated.

In the building regulations it is not specified how many hours of day and night the ventilation must be at maximum effect.

During the recent years, still more building societies have used this possibility of reducing the exhaust-ventilation to save energy for heating of outdoor air and save energy to the ventilation engines. It is typically in 12 of the 24 hours that the ventilation runs with reduced performance e.g. from 9.00 to 12.00 o'clock and from 22.00 to 7.00.

1. Aim of the research project

The purpose of the project was to investigate if the reduction in ventilation caused undesired changes in the indoor climate of the flats. The project investigates the changes that occurred in concentrations of water vapour and CO_2. This paper includes only the measurements of the air humidities.

2. Selection of test-flats

To form part of the project the flats had to fullfil 2 demands:

1) They had to be supplied with mechanical ventilation from the "wet rooms".
2) It had to be possible to reduce the performance of the mechanical exhaust automatically at pre-set times.

2 buidings in the City of Copenhagen, and 1 building app. 20 km south of Copenhagen were chosen. Data concerning the buildings is stated in table 2. All inhabitants of the buildings were informed about the project, and those who wanted to participate were requested to contact The Danish Building Research Institute. Thus, the inhabitants, who took part in the investigation, were not chosen at random but have wanted and taken initiative to participate in the investigation.

3. Method of investigation

The investigation in each of the 3 buildings took place during a fortnight starting a Tuesday. The measuring instruments were prepared Monday at The Danish Building Research Institute. During the first measure-week the ventilation in one half of the measured flats was at maximum effect 24 hours a day and in the other half of the measured flats at a reduced effect 12 of the 24

hours. In the second week of measuring the running conditions of the ventilation were reversed in the two types of buildings. In each of the 3 buildings the measuring programme included measurements in 20 flats. Air temperature and relative air humidity were measured continuously in all kitchens. Furthermore, the weekly average of the relative air humidity in kitchens, living-rooms, and bedrooms was measured. Besides that, continuous measuring of the CO_2-concentration, air temperature, and relative air humidity in bedrooms was carried out in 6 flats. In all 60 flats the exhausted volume flows were measured when the ventilation plants ran on full speed. In at least one flat belonging to each ventilation plant in the investigation the exhausted volume flows were measured when the ventilation plants were at reduced effect. By mounting of the measuring instruments in the flats the inhabitants were questioned e.g. about their habits concerning airing, clothes-washing and -drying in the flats as well as number of inhabitants in the flat. Except for the space the measuring instruments took up in the flats, and that some measuring instruments were noisy it was not in any way connected with changes in the inhabitants' weekdays to participate in the investigation. They were going to air, cook, have baths, wash and dry clothes just as they used to, and the times for our visit in the homes were decided by the inhabitants themselves. The investigation took place in the heating period, October 1983 - February 1984.

4. Measuring instruments

For continuous registration of air temperature and relative air humidity in kitchens we used thermohygrographs. The degree of accurancy is estimated at ± 1 °C and ± 10 per cent RH.

For measuring of the weekly average of the relative air humidity in kitchens, living-rooms, and bedrooms we used an instrument developed by The Danish Building Research Institute. It consisted of a wooden block at a size of 4.8 x 5.0 x 1.5 cm (beechwood). The measuring principle is that the wood humidity will be in balance with the relative humidity of air around the block, and the connection between the weight of the wooden block and the wood humidity will be unique. The wooden blocks were conditioned in app. 80 per cent relative air humidity at The Danish

Building Research Institute and they were weighed before they were transported to the flats in a plastic bag. After a week of exposure in the flats they were placed in plastic bags again, transported to The Danish Building Research Institute and weighed. The degree of accurancy is estimated at ± 5 per cent RH.

For measuring of the exhausted volume flows a thermic anemometer in a special measuring funnel was used. The degree of accurancy is estimated at ± 10 per cent.

5. Results

5.1 Relative air humidity

Tables 3-5 specify 1 week's average of the relative air humidities in kitchens, living-rooms, and bedrooms in all 60 flats measured scattered in the 3 buildings and the air temperatures in the kitchens. The results are divided into measure-week 1 and measure-week 2, and into reduced ventilation and maximum ventilation.

The highest relative air humidities were measured in the bedrooms. In living-rooms and kitchens the relative air humidity was practically at the same lower level.

Studying the average of the measurments for the single categories of rooms divided according to the running conditions (reduced and maximum ventilation) the relative air humidity in 15 out of 18 measure-weeks was highest in the flats with reduced ventilation compared to the flats with maximum ventilation.

5.2 Absolute air humidity

By using absolute air humidities instead of relative air humidities the humidity results can be free of influence from differences in air temperature indoors.

Tables 6-8 specify 1 week's average of the absolute air humidities in kitchens, living-rooms, and bedrooms in all 60 flats scattered in the 3 buildings and divided into measure-week 1 and measure-week 2, and into reduced ventilation and maximum ventilation.

The results of the absolute air humidities show on a whole the same picture as the results of the relative air humidities: The highest humidities are stated in the bedrooms and in the main

part of the measure-weeks higher absolute air humidities in the flats were measured in dwellings with reduced ventilation.

By watching the differences between absolute air humidity inside and outside, the influence from the humidity content in the outdoor air can be removed from the figures.

Table 9 specifies the conditions outdoors during the measure-weeks.

Tables 10-12 specify the weekly average of the difference between the absolute air humidities indoors and outdoors in kitchens, living-rooms, and bedrooms in all 60 flats scattered in the 3 buildings and divided into measure-week 1 and measure-week 2, and into reduced ventilation and maximum ventilation.

Table 13 specifies the difference between the absolute air humidities indoors and outdoors for all 3 buildings in one, divided into measure-week 1 and measure-week 2, and into reduced ventilation and maximum ventilation.

It can be calculated that the absolute air humidity content in flats with reduced ventilation in half of day and night was from 8-23 per cent higher than in flats with maximum ventilation day and night.

5.3 Calculated signification of the relative air humidity

The average humidity content in the outdoor air during the 6 months of winter in Denmark is 4.4 g/kg. By inserting this figure and an average air temperature indoors of 21 °C it is possible to calculate the relative air humidities in flats with reduced ventilation and maximum ventilation day and night.

	Flats with max. ventilation	Flats with reduced ventilation
Kitchen	40 p.c. RH	41 p.c. RH
Bedroom	43 p.c. RH	45 p.c. RH
Living-room	38 p.c. RH	40 p.c. RH

6. Conclusion

The highest air humidities were measured in the bedrooms.

The relative air humidity in an average bedroom rose from 43 per cent to 45 per cent when the mechanical exhaustion was reduced to app. 40 pct. in half of day and night.

This difference in relative air humidity is significantly less than the dissipation on all 360 measurings, which form the basis of these calculations. The dissipation was app. 5.3 per cent expressed in relative air humidity.

Therefore, from an air humidity point of view, it can be said that the energy saving method, to reduce ventilation in some of the day and night hours does not give any reason for health risks in the 3 buildings from the investigation.

7. Acknowledgments

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8. Reference

SBI-rapport xx, Periodically management of ventilationplant in blocks of flats. (In Danish.)
(In preparation.)

	l/s
Kitchens > 7 m^2	20
Kitchens < 7 m^2	15
Bath- og WC-rum	15
WC-rum	10

Table 1. Demand in the Building Regulation, BR 82.

Building	1. Lundtoftegade Nørrebro	2. Stjernen Frederiksberg	3. Avedøre Stationsby
Building year	1967	1973	1974
Number of flats	744	632	750
Area of flats	40-86 m^2	53-102 m^2	57-122 m^2
Number of storeys	4-12	6-8	4
Number of flats per ventilationplant	8-24	36-48	16
Bathrooms without windows	yes	yes	yes
Inlet valves	no	yes	no
Number of flats invited to take part in the project	200	632	750
Number of positive answers	39	48	33
Exhaust air terminal device in bathroom and WC-room	valve	valve	valve
Exhaust air terminal device in kitchen	valve	valve	valve and range hood

Table 2. Data from the 3 buildings.

Building 1

	1. week				2. week			
Flat number	relative air humidity kitchen	bedr.	liv.r.	temp. kitchen	relative air humidity kitchen	bedr.	liv.r.	temp. kitchen
1	* 37,3	40,5	35,0	24,0	44,0	44,5	44,0	23,5
2	* 44,5	42,5	40,5	23,0	49,0	47,5	44,5	23,5
3	* 40,5	40,5	40,0	22,5	46,5	48,5	47,5	22,5
4	51,5	49,8	47,5	23,0	* 59,5	56,0	56,0	23,0
5	33,0	34,3	35,0	26,0	* 37,3	40,5	38,8	25,0
6	37,8	37,8	37,3	24,0	* 40,0	42,5	38,5	24,0
7	34,3	40,5	34,3	23,0				
8	* 46,3	40,0	40,5	21,5	49,8	44,5	45,3	21,5
9	* 33,0	35,5	31,5	25,0	39,5	40,5	38,5	24,5
10	* 37,8	41,0	40,0	23,5	41,0	44,5	43,0	24,5
11	* 38,5	34,3	31,5	23,0	43,5	40,5	38,8	23,0
12	* 35,0	39,5	35,5	24,0	37,3	46,8	44,5	25,5
13	* 35,0	35,5	35,0	23,0	41,0	40,0	41,0	24,0
14	44,0	44,5	35,5	23,0	* 49,8	48,5	39,5	22,5
15	34,3	41,8	36,5	23,5	* 37,3	45,8	41,0	24,0
16	36,0	37,8	37,3	23,5	* 37,8	41,0	41,0	23,5
17	35,0	35,5	33,0	23,0	* 40,5	41,0	38,5	23,0
18	36,5	41,0	38,8	24,0	* 40,5	44,5	43,0	24,0
19	38,5	44,0	45,3	23,5	* 38,8	45,3	41,8	24,5
20	38,8	43,5	37,0	24,5	* 41,8	38,8	45,8	24,0
All. flats Average	38,4	40,0	37,4	23,5	42,9	44,3	42,7	23,7
dissipation	4,8	3,9	4,1	1,0	5,7	4,1	4,3	1,0
Flats with max. ventil.* Average	38,7	38,8	36,6		42,3	44,4	42,4	
dissipation	4,4	2,9	3,7		7,0	5,0	5,3	
Flats with red. ventil. Average	38,2	41,0	38,0		43,5	44,1	43,0	
dissipation	5,4	4,5	4,5		4,3	3,2	3,0	

Table 3. Relative air humidity and air temperature, building 1.

Building 2

	1. week				2. week			
Flat number	relative air humidity kitchen	bedr.	liv.r.	temp. kitchen	relative air humidity kitchen	bedr.	liv.r.	temp. kitchen
1	32,0	40,0	35,5	23,0	* 30,7	37,2	32,7	23,0
2	32,8	33,8	29,8	22,0	* 29,4	31,4	29,6	22,0
3	29,3	32,0	27,0	23,0	* 28,4	29,2	24,4	23,0
4	36,0	32,8	31,0	22,0	* 31,1	28,9	29,1	22,0
5	35,0	38,5	33,8	23,0	* 33,2	34,6	30,0	22,0
6	33,0	34,3	31,0	22,0	* 30,4	31,3	26,1	22,0
7	47,5	58,3	49,8	22,0	* 44,6	57,0	43,8	21,0
8	40,5	38,8	37,0	22,0	* 33,3	39,1	31,7	21,0
9	37,8	48,0	40,5	23,0	* 35,0	43,7	39,1	22,0
10	* 33,0	31,5	29,3	22,0	29,3	28,4	25,2	23,0
11	* 35,0	39,5	32,0	24,0	30,5	35,2	28,6	24,0
12	* 27,5	33,8	29,8	23,0	24,2	30,6	27,0	24,0
13	31,0	35,5	31,5	23,0	* 26,8	31,1	26,5	24,0
14	33,8	32,8	29,3	21,0	* 31,3	29,3	25,8	21,0
15	47,5	52,5	45,3	22,0	54,6	58,4	50,8	22,0
16	32,0	37,0	32,0	23,0	30,5	36,0	28,4	23,0
17	33,0	38,5	36,5	24,0	32,6	34,3	33,7	23,0
18	38,8	46,5	41,8	22,0	37,6	35,7	35,4	22,0
19	41,0	37,8	33,8	21,0	37,6	39,6	32,2	21,0
20	35,0	38,5	34,3	21,0	32,0	30,4	35,8	21,0
All flats								
Average	35,6	39,0	34,6	22,4	33,2	36,1	31,8	22,3
dissipation	5,3	7,2	5,9	0,9	6,7	8,5	6,9	1,0
Flats with max. ventil.*								
Average	31,8	34,9	30,4		32,2	35,7	30,8	
dissipation	3,9	4,1	1,4		4,7	8,5	6,0	
Flats with red. ventil.								
Average	36,2	39,7	35,3		34,3	36,5	33,0	
dissipation	5,3	7,4	6,1		8,7	8,9	7,7	

Table 4. Relative air humidity and air temperature building 2.

Building 3

	1. week				2. week			
Flat number	relative air humidity kitchen	bedr.	liv.r.	temp. kitchen	relative air humidity kitchen	bedr.	liv.r.	temp. kitchen
1	* 29,6	33,7	28,3	22,0	37,4	39,9	35,6	21,0
2	* 33,8	42,1	34,0	23,0	36,0	44,5	37,6	22,5
3	* 27,7	33,8	28,6	21,5	29,2	36,1	31,4	22,5
4	* 26,1	34,0	26,9	23,0	28,7	37,9	28,9	23,5
5	* 26,2	33,9	33,0	24,0	28,3	35,4	34,1	23,0
6	* 33,6	41,9	32,9	21,0	39,3	49,2	37,6	21,5
7	* 34,5	38,3	35,2	20,5	36,1	38,4	37,2	20,5
8	* 26,6	29,7	25,7	24,0	28,9	31,7	27,6	24,5
9	* 25,6	29,5	25,9	19,5	25,6	29,4	26,1	20,5
10	36,2	42,3	38,1	21,0	* 33,2	41,9	34,8	20,5
11	35,5	44,8	36,9	21,5	* 33,9	44,8	36,5	22,0
12	27,8	33,5	26,0	21,0	* 30,1	33,7	28,6	20,5
13	26,0	35,7	26,5	20,5	* 29,0	38,1	28,8	20,0
14	31,5	35,4	30,4	20,5	* 30,9	42,8	31,3	20,5
15	43,5	42,7	37,6	21,5	* 34,7	44,6	35,3	21,5
16	31,7	33,3	29,9	21,5	* 31,3	33,3	29,6	21,5
17	24,5	34,2	28,1	23,0	* 26,8	35,5	28,7	22,0
18	27,2	29,0	28,5	22,0	* 27,7	29,9	28,6	21,5
19 **	31,9	40,7	33,5	20,5	36,2	45,1	39,5	21,0
20 **	23,5	30,6	26,5	24,5	24,6	31,8	27,1	23,5
All flats								
Average	30,2	36,0	30,6	21,8	31,4	38,2	32,3	21,7
dissipation	5,0	4,9	4,2	1,4	4,2	5,7	4,2	1,2
Flats with max. ventil.*								
Average	29,3	35,2	30,1		30,8	38,3	31,4	
dissipation	3,7	4,6	3,7		2,7	5,5	3,3	
Flats with red. ventil.								
Average	31,5	36,8	31,3		32,2	38,1	32,9	
dissipation	6,1	5,3	4,9		5,0	6,1	4,5	

** No mechanical exhaust

Table 5. Relative air humidity and air temperature, building 3.

Building 1

	1. week			2. week		
Flat number	Absolute humidity g/kg kitchen	bedroom	living-room	Absolute humidity g/kg kitchen	bedroom	living-room
1	* 6,9	7,5	6,5	7,9	8,0	7,9
2	* 7,8	7,4	7,1	8,8	8,6	8,0
3	* 6,9	6,9	6,8	7,9	8,2	8,1
4	9,0	8,7	8,3	* 10,4	9,8	9,8
5	6,9	7,2	7,3	* 7,3	8,0	7,6
6	7,0	7,0	6,9	* 7,4	7,9	7,1
7	6,0	7,1	6,0			
8	* 7,4	6,4	6,4	7,9	7,1	7,2
9	* 6,5	7,0	6,2	7,5	7,7	7,4
10	* 6,8	7,4	7,2	7,8	8,5	8,2
11	* 6,7	6,0	5,5	7,6	7,1	6,8
12	* 6,5	7,3	6,6	7,6	9,5	9,0
13	* 6,1	6,2	6,1	7,6	7,4	7,6
14	7,7	7,8	6,2	* 8,4	8,2	6,7
15	6,2	7,5	6,6	* 6,9	8,5	7,6
16	6,5	6,8	6,7	* 6,8	7,4	7,4
17	6,1	6,2	5,7	* 7,1	7,2	6,7
18	6,8	7,6	7,2	* 7,5	8,3	8,0
19	6,9	7,9	8,2	* 7,4	8,7	8,0
20	7,4	8,3	7,1	* 7,8	7,2	8,5
All flats Average	6,91	7,21	6,73	7,77	8,07	7,77
dissipation	0,71	0,69	0,72	0,79	0,77	0,78
Flats with max. ventil.* Average	6,84	6,90	6,49	7,70	8,12	7,74
dissipation	0,51	0,57	0,53	1,05	0,79	0,92
Flats with red. ventil. Average	6,95	7,46	6,93	7,84	8,01	7,80
dissipation	0,86	0,71	0,82	0,39	0,79	0,64

Table 6. Absolute air humidity, building 1.

Building 2

	1. week			2. week		
Flat number	Absolute humidity g/kg kitchen	bedroom	living-room	Absolute humidity g/kg kitchen	bedroom	living-room
1	5,6	7,0	6,6	* 5,3	6,5	5,7
2	5,4	5,5	4,9	* 4,8	5,1	4,8
3	5,1	5,6	4,7	* 4,9	5,1	4,2
4	5,9	5,4	5,1	* 5,1	4,7	4,8
5	6,1	6,7	5,9	* 5,4	5,7	4,9
6	5,4	5,6	5,1	* 5,0	5,1	4,3
7	7,8	9,6	8,2	* 6,9	8,8	6,8
8	6,6	6,4	6,1	* 5,1	6,0	4,9
9	6,6	8,4	7,1	* 5,7	7,2	6,4
10	* 5,4	5,2	4,8	5,1	4,9	4,4
11	* 6,5	7,3	5,9	5,6	6,5	5,3
12	* 4,8	5,9	5,2	4,5	5,7	5,0
13	5,4	6,2	5,5	* 5,0	5,8	4,9
14	5,2	5,0	4,5	* 4,8	4,5	4,0
15	7,8	8,6	7,4	9,0	9,6	8,4
16	5,6	6,4	5,6	5,3	6,3	4,9
17	6,1	7,1	6,8	5,7	6,0	5,9
18	6,4	7,6	6,9	6,2	5,9	5,8
19	6,3	5,8	5,2	5,8	6,1	5,0
20	5,4	5,9	5,3	4,9	4,7	5,5
All flats						
Average	5,97	6,56	5,84	5,51	6,01	5,30
dissipation	0,82	1,24	1,02	0,99	1,30	1,02
Flats with max. ventil.*						
Average	5,57	6,13	5,30	5,27	5,86	5,06
dissipation	0,86	1,07	0,56	0,60	1,26	0,89
Flats with red. ventil.						
Average	6,04	6,64	5,94	5,79	6,19	5,58
dissipation	0,82	1,28	1,06	1,31	1,41	1,16

Table 7. Absolute air humidity, building 2.

Building 3

	1. week			2. week		
Flat number	Absolute humidity g/kg kitchen	bedroom	living-room	Absolute humidity g/kg kitchen	bedroom	living-room
1	* 4,8	5,5	4,6	5,8	6,2	5,5
2	* 5,9	7,3	5,9	6,1	7,5	6,4
3	* 4,4	5,4	4,6	5,0	6,2	5,4
4	* 4,5	5,9	4,7	5,1	6,8	5,2
5	* 4,9	6,4	6,2	5,0	6,2	6,0
6	* 5,2	6,5	5,1	6,3	7,8	6,0
7	* 5,2	5,7	5,3	5,4	5,7	5,6
8	* 4,9	5,5	4,7	5,5	6,0	5,3
9	* 3,6	4,1	3,6	3,8	4,4	3,9
10	5,6	6,6	5,9	* 5,0	6,3	5,3
11	5,6	7,1	5,9	* 5,6	7,4	6,0
12	4,3	5,2	4,0	* 4,4	5,0	4,2
13	3,9	5,4	4,0	* 4,2	5,6	4,2
14	4,7	5,3	4,5	* 4,6	6,4	4,7
15	6,9	6,8	6,0	* 5,5	7,1	5,6
16	5,0	5,3	4,7	* 5,0	5,3	4,7
17	4,3	6,0	4,9	* 4,4	5,9	4,8
18	4,4	4,7	4,7	* 4,4	4,8	4,6
19 **	4,8	6,2	5,1	5,6	7,1	6,2
20 **	4,5	5,8	5,0	4,5	5,8	4,9
All flats Average	4,89	5,82	4,96	5,06	6,14	5,19
dissipation	0,78	0,84	0,76	0,68	0,94	0,71
Flats with max. ventil.* Average	4,82	5,81	4,97	4,79	5,98	4,90
dissipation	0,64	0,89	0,77	0,51	0,90	0,61
Flats with red. ventil. Average	4,97	5,82	4,96	5,33	6,31	5,48
dissipation	0,93	0,84	0,79	0,74	1,00	0,71

** No mechanical ventilation.

Table 8. Absolute air humidity, building 3.

	Humidity content in outd. air g/kg Building		
	1	2	3
Measure-week 1	5,5	4,1	2,8
Measure week 2	6,2	3,2	3,5

Table 9. Humidity content in outdoor air.

Building 1

	1. week			2. week		
Flat number	Absolute humidity g/kg kitchen	bedroom	living-room	Absolute humidity g/kg kitchen	bedroom	living-room
1	* 1,4	2,0	1,0	1,7	1,8	1,7
2	* 2,3	1,9	1,6	2,6	2,4	1,8
3	* 1,4	1,4	1,3	1,7	2,0	1,9
4	3,5	3,2	2,8	* 4,2	3,6	3,6
5	1,4	1,7	1,8	* 1,1	1,8	1,4
6	1,5	1,5	1,4	* 1,2	1,7	0,9
7	0,5	1,6	0,5			
8	* 1,9	0,9	0,9	1,7	0,9	1,0
9	* 1,0	1,5	0,7	1,3	1,5	1,2
10	* 1,3	1,9	1,7	1,6	2,3	2,0
11	* 1,2	0,5	0	1,4	0,9	0,6
12	* 1,0	1,8	1,1	1,4	3,3	2,8
13	* 0,6	0,7	0,6	1,4	1,2	1,4
14	2,2	2,3	0,7	* 2,2	2,0	0,5
15	0,7	2,0	1,1	* 0,7	2,3	1,4
16	1,0	1,3	1,2	* 0,6	1,2	1,2
17	0,6	0,7	0,2	* 0,9	1,0	0,5
18	1,3	2,1	1,7	* 1,3	2,1	1,8
19	1,4	2,4	2,7	* 1,2	2,5	1,8
20	1,9	2,8	1,6	* 1,6	1,0	2,3
All flats						
Average	1,41	1,71	1,23	1,57	1,87	1,57
dissipation	0,71	0,69	0,72	0,79	0,77	0,78
Flats with max. ventil.*						
Average	1,34	1,40	0,99	1,50	1,92	1,54
dissipation	0,51	0,57	0,53	1,05	0,79	0,92
Flats with red. ventil.						
Average	1,45	1,96	1,43	1,64	1,81	1,60
dissipation	0,86	0,71	0,82	0,39	0,79	0,64

Table 10. Difference between absolute air humidity indoors and outdoors, building 1.

Building 2

	1. week			2. week		
Flat number	Absolute humidity g/kg kitchen	bedroom	living-room	Absolute humidity g/kg kitchen	bedroom	living-room
1	1,5	2,9	2,5	* 2,1	3,3	2,5
2	1,3	1,4	0,8	* 1,6	1,9	1,6
3	1,0	1,5	0,6	* 1,7	1,9	1,0
4	1,8	1,3	1,0	* 1,9	1,5	1,6
5	2,0	2,6	1,8	* 2,2	2,5	1,7
6	1,3	1,5	1,0	* 1,8	1,9	1,1
7	3,7	5,5	4,1	* 3,7	5,6	3,6
8	2,5	2,3	2,0	* 1,9	2,8	1,7
9	2,5	4,3	3,0	* 2,5	4,0	3,2
10	* 1,3	1,1	0,7	1,9	1,7	1,2
11	* 2,4	3,2	1,8	2,4	3,3	2,1
12	* 0,7	1,8	1,1	1,3	2,5	1,8
13	1,3	2,1	1,4	* 1,8	2,6	1,7
14	1,1	0,9	0,4	* 1,6	1,3	0,8
15	3,7	4,5	3,3	5,8	6,4	5,2
16	1,5	2,3	1,5	2,1	3,1	1,7
17	2,0	3,0	2,7	2,5	2,8	2,7
18	2,3	3,5	2,8	3,0	2,7	2,6
19	2,2	1,7	1,1	2,6	2,9	1,8
20	1,3	1,8	1,2	1,7	1,5	2,3
All flats						
Average	1,87	2,46	1,74	2,31	2,81	2,10
dissipation	0,82	1,24	1,02	0,99	1,30	1,02
Flats with max. ventil.						
Average	1,47	2,03	1,20	2,07	2,66	1,86
dissipation	0,86	1,07	0,56	0,60	1,26	0,89
Flats with red. ventil.						
Average	1,94	2,54	1,84	2,59	2,99	2,38
dissipation	0,82	1,28	1,06	1,31	1,41	1,16

Table 11. Difference between absolute air humidity indoors and outdoors, building 2.

Building 3

Flat number	1. week			2. week		
	Diff. between absolute humidity in-out, g/kg			Diff. between absolute humidity in-out, g/kg		
	kitchen	bedroom	living-room	kitchen	bedroom	living-room
1	* 2,0	2,7	1,8	2,3	2,7	2,0
2	* 3,1	4,5	3,1	2,6	4,0	2,9
3	* 1,6	2,6	1,8	1,5	2,7	1,9
4	* 1,7	3,1	1,9	1,6	3,3	1,7
5	* 2,1	3,6	3,4	1,5	2,7	2,5
6	* 2,4	3,7	2,3	2,8	4,3	2,5
7	* 2,4	2,9	2,5	1,9	2,2	2,1
8	* 2,1	2,7	1,9	2,0	2,5	1,8
9	* 0,8	1,3	0,8	0,3	0,9	0,4
10	2,8	3,8	3,1	* 1,5	2,8	1,8
11	2,8	4,3	3,1	* 2,1	3,9	2,5
12	1,5	2,4	1,2	* 0,9	1,5	0,7
13	1,1	2,6	1,2	* 0,7	2,1	0,7
14	1,9	2,5	1,7	* 1,1	2,9	1,2
15	4,1	4,0	3,2	* 2,0	3,6	2,1
16	2,2	2,5	1,9	* 1,5	1,8	1,2
17	1.5	3.2	2,1	* 0,9	2,4	1,3
18	1,6	1,9	1,9	* 0,9	1,3	1,1
19 **	2,0	3,4	2,3	2,1	3,6	2,7
20 **	1,7	3,0	2,2	1,0	2,3	1,4
All flats						
Average	2,09	3,02	2,16	1,56	2,64	1,69
dissipation	0,78	0,84	0,76	0,68	0,94	0,71
Flats with max. ventil.*						
Average	2,02	3,01	2,17	1,29	2,48	1,40
dissipation	0,64	0,89	0,77	0,51	0,90	0,61
Flats with red. ventil.						
Average	2,17	3,02	2,16	1,83	2,81	1,98
dissipation	0,93	0,84	0,79	0,74	1,00	0,71

** No mechanical ventilation.

Table 12. Difference between absolute air humidity indoors and outdoors, building 3.

Building 1, 2 and 3

	1. week			2. week		
Flat number	Diff. between absolute humidity in-out, g/kg kitchen	bedroom	living-room	Diff. between absolute humidity in-out, g/kg kitchen	bedroom	living-room
All flats						
Average	1,78	2,37	1,69	1,82	2,44	1,79
dissipation	0,81	1,08	0,92	0,90	1,10	0,87
Flats with max. ventil.*						
Average	1,65	2,18	1,52	1,65	2,36	1,62
dissipation	0,67	1,07	0,84	0,81	1,03	0,83
Flats with red. ventil.						
Average	1,85	2,48	1,79	2,02	2,54	1,99
dissipation	0,88	1,09	0,95	0,96	1,18	0,89

Table 13. Difference between absolute air humidity outdoors and indoors, all 3 buildings.