

Welcome to the 2nd Healthy Buildings Day. Can we build future solutions today?



Healthy Buildings Day 2016



2ND HEALTHY BUILDINGS DAY 2016

PROGRAMME



• 10:00 Welcome, moderator Katrina Sichel

Session 1: State of play

- A business perspective by Michael K. Rasmussen, SVP Brand the VELUX Group
- What are the knowns and the unknowns in science? Peter Holzer, Institute of Building Research & Innovation
- Point of departure interview with Commissioner Maroš Šefčovič

Session 2: Perspectives

- Risk factors and challenges in healthy buildings , Dr Isabella Annesi-Maesano, INSERM Research Director
- Affordable and healthy the RenovActive concept, Christophe Verbiest, Head of Buildings Works, Foyer Anderlechtois & Christian Fosseur, Director VELUX Belgium
- Testimonial of family living in an Active House, Langhelle Family, Active House Norway

▶ 12:00 Lunch and networking

> 13:00 Healthy Homes – the data

- Quiz time! What do we think we know? , Moderator Katrina Sichel
- Launch of Healthy Homes Barometer 2016, Prof. Dr. Dr. h. c. Bernd Wegener, Humboldt University & Ingrid Reumert, VP Stakeholder Communications & Sustainability VELUX Group
- Role of buildings for wellbeing, Andreas Hermelink, Principal Consultant, ECOFYS
- 13:45 Healthy break
- ▶ 14:15 7 parallel roundtable sessions

15:30 Plenary recap on conclusions & recap Moderators

2



- Risk factors and challenges in healthy buildings , Dr Isabella Annesi-Maesano, INSERM Research Director
- Affordable and healthy the RenovActive concept, Christophe Verbiest, Head of Buildings Works, Foyer Anderlechtois & Christian Fosseur, Director VELUX Belgium
- Testimonial of family living in an Active House, Langhelle Family, Active House Norway



Risk factors and challenges in healthy buildings , Dr Isabella Annesi-Maesano, INSERM Research Director

 Affordable and healthy - the RenovActive concept, Christophe Verbiest, Head of Buildings Works, Foyer Anderlechtois & Christian Fosseur, Director VELUX Belgium

Testimonial of family living in an Active House, Langhelle Family, Active House Norway













de la santé et de la recherche médicale



Dr Isabella ANNESI-MAESANO INSERM Research Director Directeur EPAR i-PLESP INSERM and UPMC Sorbonne Universités isabella.annesi-maesano@inserm.fr

Risk factors and challenges in healthy buildings

Outline

- We spend about 90 percent of our time indoors, which means the indoor environment is one of the factors that has an enormous influence on our quality of life and health.
- Exposure to indoor environment (air contaminants, comfort parameters...) can lead to respiratory and other health-related effects.
- Among characteristics of indoor environment, low light exposure is associated with diminished health and wellbeing, including reduced sleep quality, depressed mood and performance.
- Adverse effects experienced from the indoor environment will place a substantial burden on individuals and the economy.

The case of the schools

Rationale

- Almost 100 million students in EU-28
- School is compulsioory until adolescence
- During academic year, children spend up to 1/3 of their time at school the other 2/3 at home
- In mean 160-180 school days, 1280-1440 hours per year

What are the key questions?

How bad is school environment for children' and teachers' health in Europe?

Among others:

- ► How poor is air quality in European schools?
- What are the health consequences of poor air quality?







37 partners
23 countries
54 cities
311 classes
5175 children (264 in kindergartens)
1223 teachers





THE REGIONAL ENVIRONMENTAL CENTER for Central and Eastern Europe



highly exposed to air pollution in European schools

Chemical air pollution

Compared to WHO standards

- PM_{2.5}:
 - 13% exposed to > 25 μ g/m³ (24h value)
 - 85% exposed to > 10 μ g/m³ (annual value)
- Benzene:
 - 25% exposed to > 5 μ g/m³ (annuel value)
- Formaldehyde:
 - 60% exposed to > 10 μ g/m³ (annuel value)
- Radon:
 - 50% exposed to 100 Bq/m³ (WHO reference in 2010 for residentail dwellings in order to manage the cancer risk)



Children highly exposed to poor air quality in European schools

- CO₂ mean and median levels > 1000 ppm:
 - Schools in North and West with the highest percentage of classes with CO₂ <1,000 ppm
 - Schools in Central, Est and South with the highest percentage of classes CO₂ with > 1500 ppm
- Most (86%) ventilation assessments < 4 l/s per child due to:
 - Lack of ventilation or bad ventilation system
 - Crowding



Chemical air pollution significantly related to recent health events

Up of 40% of children suffering from at least 1 health symptom



Roma 23.II.2015





Daylight in classrooms impacts on school performance

The classroom window to floor area significantly impacted the performance in schoolchildren.

Other daylight variables also related.

The statistical significance was elevated with a not small effect in terms of explained variance,

What is the bottom line?

- Air quality in schools and comfort parameters are poor according to existing guidelines.
 - A high proportion of schoolchildren (and teachers) were exposed to particulate matter, gases, bio-contaminants in poor ventilated classrooms according to existing standards.
 - Exposed schoolchildren presented a variety of health effects (sick school syndrome), that were mitigated by ventilation and that improved at home.
- Daylight impacted school performance

Recommendations

Take specific actions that can really help keeping healthy the indoor environment

- avoid activities impacting on air quality
- bring healthier materials into building products.
 - improve ventilation
 - ensure daylight
 - privilege healthy neighbourhoods

••••

Bridging the gap between green and healthy nuildings

Pollution of indoor air has a high health and economic costs

in France 630 euros per second (counter) or nearly 20 billion euros annually





isabella.annesi-maesano@inserm.fr



Recent (< 3 m) health events in European schoolchildren



Prevalence (%)			
	Schoolchildren	Pre-school children	All
Symptom/Disease	(N=4,919)	(N=259)	
EYE lirritation	13.4	10.2	13.2
swollen	6.6	4.3	6.5
SKIN Hand rash	6.8	9.0	6.9
Face rash	5.7	5.1	5.6
Eczema	7.1	6.7	7.0
Hand itch	8.8	8.6	8.8
Face itch	4.9	3.5	4.8
AIRWAYS Runny nose	42.0	50.4	42.5
Blocked nose	46.6	56.8	47.1
Dry throat	20.6	25.0	20.9
Sore throat	35.8	42.0	36.2
Irritative cough	29.3	45.3	30.2
Shortness of breath	8.6	15.0	8.9
SYSTEMIC Headache	41.1	13.4	39.6
Nausea	17.8	10.7	17.5
Feel cold / feverish	41.2	44.5	41.3
Feel tired out of sorts	36.2	29.8	35.8
Symptom(s) improve when back at nome	25.9	33.2	26.2

Chemical air pollutants in European classrooms

	WHO guidel	lines for indoor air				
	[EU	-INDEX]			V	
Pollutants	[Fren	ch ANSES]	Mean	Median	Min-Max	CV%
Tonutunts	[Maximum allowable	[Maximum allowable concentration Netherlands]		Wiedluff	Will Winx	01/0
	[Guideline value]	Flemish Indoor Decree]				
	Short-term	Long-term				
Formaldehyde ¹	100 [30] [50] [120]	100 [10] [10] [10]	<u>15</u>	<u>12</u>	1.0 - 66	67
Benzene ¹	-	no safe level [10] [20] [10]	4	2	DL - 38	141
Naphthalene ¹	-	10	2	DL	DL - 31	223
Limonene ¹	[20]	[450]	38	9	DL - 672	211
NO_2^1	200 [200]	40 [40] [135]	14	11	DL - 88	73
$PM_{2.5}^{1}$	25	10 [10] [15]	<u>44</u>	<u>37</u>	4 - 250	78
Ozone ¹	100 (outdoors)	-	8	3	DL - 142	202
CO^2	100* [100]* [30]*	23**	1	DL	DL - 122	815
T3CE ¹	-	250	3	DL	DL - 126	419
T4CE ¹	-	167***	1	DL	DL - 81	436
Radon ³	-		<u>205</u>	101	DL - 9190	327

SD: Standard Deviation; Min : minimum ; Max : maximum ; CV: Coefficient of Variation; T3CE: Trichloroethylene;

T4CE:tetrachloroethylene;

¹µg/m³; ² ppm (parts per million); ³ Bq/m³; ⁴ % ⁵ ° C; ⁶ /hr *: 15 minutes; **: lifetime exposure with acceptable risk at 10⁻⁵ ***concentration associated with an excess lifetime risk of 1 per 1000 (non-smokers)



Formaldehyde, benzene, and PM in European classrooms by countries



Indoor biocontaminants in European classrooms

	↓			↓	
Biocontaminants	Mean	Median	Min	Max	CV%
Endotoxin ¹	10080.1	7114.0	496.0	59000.0	95.6
PenAsp cells ²	726149.3	63154.5	1143.0	24739120.0	382.0
Avers cells ²	378.0	0.0	0.0	55671.0	932.8
Tviri cells ²	301.2	10.0	0.0	72308.0	1440.6
Cherb cells ²	923.5	268.5	0.0	69322.0	466.2
Aaltr cells ²	39.2	8.0	0.0	4406.0	684.0
Strep cells ²	42252.7	16914.0	0.0	1268072.0	238.0
Myco cells ²	147504.4	51191.0	0.0	6401677.0	299.9
Cat allergen ³	86.5	0.0	0.0	1762.0	244.1
Dog allergen ³	103.5	0.0	0.0	1745.0	215.2
Horse allergen ³	80.3	0.0	0.0	2630.0	498.5
Derp1 allergen ³	4.9	0.0	0.0	337.0	751.5
Derf1 allergen ³	2.8	0.0	0.0	167.0	713.7

For allergic sensitisation:

- ° 1-2 μg Der p 1/ gr dust
- ° 2 µg Fel d 1 / gr dust
- [°] 2 μg Can f 1 /gr dust

For asthma exacerbations: [°] 10 µg Der p 1/ gr dust [°] 8 µg Fel d 1 / gr dust

° 10 µg Can f 1 /gr dust





Bio-contaminants related to health outcomes in European schoolchildren

	Schoolchildren
Endotoxin	Eye irritation, dry throat, irritative cough;
	Doctor diagnosed asthma, every
	runny/blocked nose, nasal allergy, night
	dry cough, cough episodes
Fungal species/groups	
Penicillium/Aspergillus/Paecilomyces	Symptoms improving when home;
spp. group	ever nasal allergy (\downarrow)
Aspergillus versicolor	Sore throat, feel cold/feverish
Trichoderma viride	
Alternaria alternata	Eye irritation (\downarrow)
Cladosporium herbarum	
Bacterial groups	
Streptomyces spp.	
Mycobacterium spp.	Ever runny/blocked nose





Irritative cough (<3 months) vs. Endotoxin (high / low)

countryName	RR (95% CI)	Events Exposed	Events. Unexposed	weight (I-V)	latitude	longitude
Portugal	1.05 (0.67, 1.64)	21/74	39/144	4.04	38	-9
United	1.91 (1.08, 3.39)	12/24	17/65	2.51	51	0
France	– 1.61 (1.19, 2.16)	37/65	57/161	9.30	48	2
Belgium -	- 1.10 (0.60, 2.02)	10/29	22/70	2.21	50	4
Italy	1.19 (0.81, 1.74)	36/108	37/132	5.62	41	12
Germany	0.93 (0.58, 1.51)	18/65	35/118	3.54	52	13
Malta -	- 1.26 (0.81, 1.97)	21/60	36/130	4.18	36	15
Austria	0.76 (0.35, 1.64)	8/62	18/106	1.38	48	16
Finland	1.64 (1.01, 2.66)	15/26	20/57	3.52	60	25
Gzech	1.81 (1.26, 2.61)	37/91	42/187	6.19	50	14
Slovakia	1.03 (0.66, 1.62)	17/49	45/134	4.02	48	17
Bosnia	- 1.55 (1.04, 2.30)	29/61	31/101	5.28	44	18
Hungary	0.89 (0.62, 1.29)	26/81	75/209	6.16	47	19
Albania	0.96 (0.63, 1.46)	23/107	61/272	4.56	41	20
Serbia	1.20 (0.82, 1.75)	30/87	46/160	5.72	44	20
Poland	1.13 (0.81, 1.57)	37/80	43/105	7.56	52	21
Greece	1.73 (0.99, 3.00)	16/44	20/95	2.70	37	23
Bulgaria -	0.73 (0.48, 1.12)	18/61	65/161	4.42	42	23
Estonia	1.05 (0.69, 1.59)	25/74	37/115	4.77	59	24
Lithuania —	1.04 (0.70, 1.55)	25/78	49/159	5.17	55	25
Romania	0.65 (0.41, 1.02)	19/93	57/180	3.96	44	26
Cyprus	1.44 (0.86, 2.38)	23/100	25/156	3.18	35	33
I-V Overall (I-squared = 42.6%, p = 0.019)	1.18 (1.08, 1.29)	503/1519	877/3017	100.00		
D+L Overall	1.17 (1.04, 1.32)					
.1 .2 .5 1	I I I 2 5 10					
Irritative cough decreased Irritati	e cough increased					





Comments

- Potential danger associated with new air pollutants of the VOC family or bio-contaminants rarely investigated before was observed.
- Sources of some pollutants and bio-contaminants (for ex. Cleaning products at the origin of limonene production) can be avoided or controlled.



- Risk factors and challenges in healthy buildings , Dr Isabella Annesi-Maesano, INSERM Research Director
- Affordable and healthy the RenovActive concept, Christophe Verbiest, Head of Buildings Works, Foyer Anderlechtois & Christian Fosseur, Director VELUX Belgium
- Testimonial of family living in an Active House, Langhelle Family, Active House Norway



RenovActive Christian Fosseur VELUX Belgium

STRIVE / FOR THE BEST

A decade of full-scale experiments

TT.

22



19

08 Sunlighthouse Vienna, Austria

Hamburg, Germany

10 Maison Air et Lumière Paris, France

11 CarbonLight Homes Kettering, UK

12 Osram Culture Centre Copenhagen, Denmark

13 Guldberg School Copenhagen, Denmark

14 Albertslund Solar Prism Albertslund, Denmark 15 Russian Active House Moscow, Russia

16 Solhuset Hoersholm, Denmark

17 ISOBO Aktiv Stavanger, Norway

18 Future Active House Trondheim, Norway

19 Smith Residence St. Louis, USA

1111

20 De Poorters Montfoort, the Netherlands

21 Healthy Home townhouses Stjoerdal, Norway

ands



05

03

04

25

VELUX®

01

15





- Statistics show that around 80 million Europeans live in damp and unhealthy buildings.
- Living in a good, mould-free indoor climate reduces the risk of developing asthma by 50%.
- Energy-efficient and healthy buildings should go hand in hand.

We are in Anderlecht, and the story of this house began in the twenties,





VELUX RenovActive provides an affordable and reproducible solution to renovate buildings
 Active House / Reproducible / Affordable



- three façade house dating back to the 1920s.
- The house belongs to a social housing company Foyer Anderlechtois.

VELU

- The floor area is extended from 80 m² to 95 m².
- The real change in the building will be a tremendous improvement of the indoor comfort, daylight and fresh air deep into the building.
- The ventilation system combines mechanical ventilation and natural ventilation.









Focus on energy, not comfort





Low energy building, district heating, C+ ventilation system

Usual scenario Foyer Anderlechtois





- Comfort:
 - Automated windows
 - Optimal daylight
 - Automated sun shading
- Energy:
- Hybrid ventilation system
- Green electricity
- Environment:
 - Re-use of materials
 - Rainwater recuperation





Light and air shaft



Level and quality of daylight



Sun shading



Extension



Insulation



Hybrid ventilation system







Christophe Verbiest Head of Building Works department Foyer Anderlechtois

The Foyer Anderlechtois

- Non profit organization, publicly financed
- Owns 3.740 dwellings
- Income threshold
- 3.200 families on waiting lists
- Average waiting time : 10 years







Our challenge.













The constraints.















The mission of the Foyer Anderlechtois

« Work as a social elevator for social housing beneficiaries »











Times have changed...







Our living environment too!









The reproduction case 86 houses in Anderlecht









Our properties













1. Use the staircase for air and light





RenovActive

VELUX



2. Increase and balance daylight levels









2. Increase and balance daylight levels







3. Combine natural and mechanical ventilation for optimal indoor air quality





And what we look forward to discover...

How does the stack effect limit overheating?





Thank you!

RenovActive /Construction team



- Architect: **ONO architectuur**
- Engineer: Daidalos Peutz
- Contractor: **Troubleyn**
- Consultant: MatriCiel

In partnership with:

•



SAINT-GOBAIN









- Risk factors and challenges in healthy buildings , Dr Isabella Annesi-Maesano, INSERM Research Director
- Affordable and healthy the RenovActive concept, Christophe Verbiest, Head of Buildings Works, Foyer Anderlechtois & Christian Fosseur, Director VELUX Belgium

Testimonial of family living in an Active House, Langhelle Family, Active House Norway



VELUX®

ND HEALTHY BUILDINGS DAY 2016



Welcome to the 2nd Healthy Buildings Day. Can we build future solutions today?



Healthy Buildings Day 2016



2ND HEALTHY BUILDINGS DAY 2016