MINUTES

2ND EXPERT MEETING

SYRACUSE, NY, USA, SEPTEMBER 8-10, 2016

SYRACUSE CENTER OF EXCELLENCE, SYRACUSE UNIVERSITY, NEW YORK, USA

ATTENDANCE

2nd IEA EBC Annex 68 expert meeting - participants			Thursday, CHAMPS	Thursday, Annex 68	Friday	Saturday
Amar Aganovic	amar.aganovic@ntnu.no	Norwegian University of Science and Technology	x	x	x	x
Andreas Nicolai	andreas.nicolai@tu-dresden.de	TU Dresden	x	x	x	x
Beverly Guo	bguo@syr.edu	Syracuse University	x	x	x	
Carsten Rode	car@byg.dtu.dk	Technical University of Denmark	x	x	x	x
Dirk Weiss	dirk.weiss@tu-dresden.de	TU Dresden	x	x	x	x
Ed Bogucz	bogucz@syr.edu	Syracuse Center of Excellence	x	x	x	x
Esfand Burman	esfand.burman@ucl.ac.uk	University College London	x	x	x	x
Fitsum Tariku	fitsum.tariku@bcit.ca	British Columbia Institute of Technology	x	x	x	x
Gabriel Rojas	Gabriel.Rojas-Kopeinig@uibk.a	University of Innsbruck			Skype	
Guangyu Cao	guangyu.cao@ntnu.no	Norwegian University of Science and Technology		Skype	Skype	
Jakub Kolarik	jakol@byg.dtu.dk	Technical University of Denmark			x	y
Jelle Laverge	Jelle.Laverge@UGent.be	Ghent University	x	x	x	x
Jensen Zhang	jszhang@syr.edu	Syracuse University	x	x	x	x
John Grunewald	John.Grunewald@tu-dresden.de	TU Dresden	x	x	x	x
Karin Kompatscher	K.Kompatscher@tue.nl	Eindhoven University of Technology	x	x	x	x
Kristine Nore	kristine.nore@treteknisk.no	Norwegian Institute of Wood Technology			Skype	
Li Wang	leowang@iis.u-tokyo.ac.jp leowang19861986@hotmail.co	University of Tokyo	x	x	x	
Lixing Gu	gu@fsec.ucf.edu	Florida Solar Energy Center	x	x	x	x
Marc Abadie	marc.abadie@univ-lr.fr	University de La Rochelle	x	x	x	x
Maria (Carmina) Bocanegra-yanez	maria.bocanegra-yanez@strath.ac.uk	University of Strathclyde		Skype	Skype	Skype
Menghao Qin	mqin@nju.edu.cn	Nanjing University	x	x	x	x
N. Stuart Dols	stuart.dols@nist.gov	National Institute of Standards and Technology	x	x	x	
Nicole Poussineau	nicole.poussineau@saint-goba	Saint Gobain (France)	x	x	x	x
Pawel Wargocki	paw@byg.dtu.dk	Technical University of Denmark			x	x
Rui Zhang	rzhang20@syr.edu	Syracuse University	x	x	x	x
Shinsuke Kato	kato@iis.u-tokyo.ac.jp	Tokyo University	x	x	x	x
Thomas Witterseh	twi@dti.dk	Danish Technological Institute		x	x	x
Veronika Földváry	veronika.foldvary@gmail.com	UC Berkeley	x	x	x	
Ying Wang	Ying.wang2@saint-gobain.com	Saint Gobain (USA)	x	x	x	x
Zhenlei Liu	zliu138@syr.edu	Syracuse University	x	x	x	x

VENUE

SyracuseCoE Headquarters, 727 East Washington Street, Syracuse, NY 13210, USA

AGENDA

September 8:

8:30 am – 3:00 pm	13th International Forum and Workshop on Combined Heat, Air, Moisture and Pollutant Simulations (CHAMPS)
3:00 pm – 3:30 pm	Coffee break
3:30 pm – 5:30 pm	IEA EBC Annex 68 Overview presentations: plan and status for each subtask Subtask 1. Defining the metrics – Marc Abadie Subtask 2. Pollutant loads in residential buildings – Menghao Qin Subtask 3. Modeling – review, gap analysis and categorization – John Grunewald Subtask 4. Strategies for design and control of buildings – Guangyu Cao Subtask 5. Field measurements and case studies – Jelle Laverge
5:30 pm – 7:30 pm	Welcome reception
8:00 pm – 8:45 pm	Subtask leaders brief meeting

September 9:

8:30 am – 10:10 am	Annex meeting intro (Carsten Rode, 0:20) Subtask 1 (Marc Abadie, 1:20)
10:10 am – 10:40 am	Coffee break
10:40 am – 12:00 pm	Subtask 2 (Menghao Qin, 1:20)
12:00 pm – 1:00 pm	Lunch
1:00 pm – 2:20 pm	Subtask 3 (John Grunewald, 1:20)
2:20 pm – 2:40 pm	Coffee break
2:40 am – 4:00 pm	Subtask 4 (Jakub Kolarik, 1:20)
4:00 pm – 4:20 pm	Coffee break
4:20 am – 5:20 pm	Subtask 5 (Jelle Laverge, 1:00)
5:30 pm – 6:30 pm	Campus/BEES Lab. tour
8:00 pm	SU Football vs Louisville - Carrier Dome (w. simple food for purchase)

September 10:

8:30 am – 9:30 am	Annex common administration (Carsten Rode, 0:40) Subtask 1 – status on closing the work (Marc Abadie, 0:20)
9:30 am – 10:00 am	Coffee break
10:00 am – 11:30 pm	Annex 68 Session 7 (parallel) - Subtask 3 (possibly with Subtask 2) Tools hands-on session (John Grunewald, 1:30) - Subtask 4 (possibly with Subtask 5) Residential ventilation design – current practices, methodology and approach – stakeholder questionnaires and interviews (Jakub Kolarik, 1:30)
11:30 am – 12:30 pm	Simple lunch Subtask leaders convene (over lunch) for meeting wrap-up
12:30 pm	Adjournment

ACTION ITEMS FROM THE CURRENT MEETING

No.	Responsibility	Action Item	Deadline
		This section remains to be completed…	

ACTION ITEMS FROM PREVIOUS MEETINGS

No.	Responsibility	Action Item	Deadline
1	OA, STL-1, STL-5	Modification of Annex text to reflect measurements conducted in ST5 and the fact that no measurements will be conducted in ST4	27/9/2015
2	OA	Correction of table summarizing ST lead and co-lead	27/9/2015
3	All STL	Collect RID forms and upload to Sharepoint	1/11/2015
4	OA	Correct RID form – Staff months->man-months	ASAP
5	All	Upload signed national letters of participation	30/9/2015
6	OA	Upload graphical file with EBC logo	ASAP
7	All STLs	Revision of ST description in Annex text.	27/9/2015
8	All STL	Define one or more Common Exercises for participants to work with within their subtask	Before Syracuse meeting
9	All STL's and all	State of the art reports related to the subtasks	For Syracuse meeting
10	All	Contribute with free papers presenting own research of relevance for the Annex and its subtasks	For Syracuse meeting
11	OA	Present the project at Clima 2016, Aalborg, DK, May 2016	May 2016
12	MA + OA	Present the project and conduct a workshop on metrics at Indoor Air 2016, Gent, B, July 2016	July 2016
13	All STL's	Present the project and conduct a workshop at ASHRAE IAQ 2016, Alexandria, VA, USA, September 2016	Sept. 2016
14	JZ + OA	Organize CHAMPS workshop and 2nd working Phase Annex meeting in Syracuse, NY, USA	Sept. 2016
15	OA	Final revision of Annex text as per the EBC ExCo's request	Over summer 2016

LIST OF APPENDICES

No.	Appendix
A	Workshop Agenda and Admin. stuff
B	ST1 status review presentation
C	ST2 status review presentation

D	ST3 status review presentation
E	ST4 status review presentation
F	ST5 status review presentation

LIST OF ACRONYMS

AI	Action Item
ASAP	As Soon As Possible (in connection to AI)
BEPS	Building Energy Performance Simulation
ExCo	EBC Executive Committee
IAQ	Indoor Air Quality
OA	Operating Agent
RID	Research Item Description
ST	Subtask
STL	Subtask Leader

Day 1, Thursday, September 8, 2016

1. CHAMPS Workshop

The Annex 68 working started in subsequence of the CHAMPS workshop, which was conducted from 8:30 am to 3:00 pm in three sessions according to the programme:

1. Welcome and Introductions, Dr. Edward Bogucz, Executive Director, Syracuse COE, Syracuse University
2. Microclimate simulations for walkable cities, Dr. Tarek Rakha, Syracuse University
3. Recent advances in modelling city ventilation, Dr. Yuguo Li, University of Hong Kong
4. Building performance modelling and simulations - the need and approach for quality control, Dr. John Grunewald, Dresden University of Technology
5. Whole Building Energy and Environmental Systems simulation - from HAM to CHAMPS, Dr. Carsten Rode, Danish Technical University

1. Modelling and illustration of building and urban energy flows, Dr. Bess Krietemeyer, Syracuse University
2. Coupled effects of temperature, humidity and pollution control on energy and IAQ performance of buildings, Dr. Menghao Qin, Nanjing University
3. Indoor Environment Quality investigated by CFD, Dr. Karel Frana, Technical University of Liberec
4. Recent Advances in Co-simulation of High Performance Building Models and the Modelica Green Building Lib, Dr. Andreas Nicolai, Dresden University of Technology
5. Modelling the microenvironment around occupants – the role of semi-open spaces, Meng Kong, Syracuse University

1. Contribution ratio of indoor climate (CRI) approach to integrated energy and IAQ modeling– A high-speed simulation way of quasi-equilibrium state for periodic and spatial prediction of IEQ, Li Wang, Dr. Shinsuke Kato, University of Tokyo
2. Recent advances in CONTAM development and applications, Stuart Dols, NIST
3. Recent advances in EnergyPlus and applications, Dr. Lixing Gu, FSEC
4. State of the art in zonal modeling for room air distribution: dos and don't, Dr. Marc Abadie, University de La Rochelle

5. Building Energy Performance Simulation in Practice: Data Flow Organization between GUI, Data Interface, Solver and Results Visualization, Dr. Dirk Weiss, Dresden University of Technology
6. Modeling and Field Measurements for Assessing the Performance of Green Roofs, Dr. Cliff Davidson, Syracuse University

2. Annex 68 open meeting and start of working meeting

After thanking Ed Bogucz and Jensen Zhang from Syracuse Center of Excellence and Syracuse University for hosting the IEA EBC Annex 68 meeting, Carsten Rode gave an introduction to this part of the day (Starting 4:00 pm – half an hour after the programme). The purpose was to give a combined presentation and short status by each of the subtask leaders for members of the audience from the CHAMPS workshop who were external to the project as well as for Annex members. Carsten continued outlining the overall purpose and content of the Annex project:
The main goal of the project is to provide guideline for the design and operational strategy of residential buildings. The idea is to do gathering of existing knowledge and data on pollutant sources indoors, that would be combined by additional modelling of indoor air quality in low energy residential buildings. Furthermore, gaps of knowledge will be identified and steps taken to fill such gaps in certain selected cases.
Carsten Rode introduced the agenda for the upcoming two days. Furthermore, he introduced the Annex 68 project according to the so-called Annex text (from November 13, 2015), and the themes of the subtasks and the flow between them was presented. Most subtasks are planned to be active in all there years f the working phase of the project (2016-18), while Subtask 1 (Metrics) is supposed to have competed its mission by the end of 2016. The current status of the participants (by countries) is reported: 11 countries have signed a letter of national participation (B, CA, CH, CZ, DK, EE, F, N, NL, UK, US) while two more (A and D) are expected to sign soon.

Carsten Rode introduced Veronika Foldvary as scientific secretary of the meeting. Veronika introduced herself and her research background. She will be presenting her research on Friday in Subtask 4.

Carsten Rode presented the leaders of each of the subtasks, and speakers for the subsequent presentation of the Subtasks as follows:

- Subtask 1. Defining the metrics – Marc Abadie
- Subtask 2. Pollutant loads in residential buildings – Menghao Qin
- Subtask 3. Modeling – review, gap analysis and categorization – John Grunewald
- Subtask 4. Strategies for design and control of buildings – Guangyu Cao (co-lead, on Skype)
- Subtask 5. Field measurements and case studies – Jelle Laverge

Marc Abadie presented Subtask 1 "Defining the metrics".

The goals of the subtask are presented (6 months study):

- Identifying pollutants
- Quantify indoor air quality
- Identifying relationships between indoor air pollutants and its influencing factors such as temperature, relative humidity and air velocity.
-

Marc Abadie defined the work plan for Subtask 1 as follows:

- Gathering previous studies on the prioritization of pollutants in current building stock and low energy buildings.
- Presenting concentration levels in residences in current building stock and low energy buildings.
- Presenting exposure limit values (ELV) in current building stock and low energy buildings.

Based on the plan introduced above "short" list of pollutants for Annex 68 will be created. For identification of target pollutants literature review is used. This will help to setting up criteria for selection of compounds.

Selected pollutants were presented based on earlier studies such as:

- WHO (2005) – Outdoor air
- Index (2005)
- Kirchner et al (2006)
- WHO (2010,a) – Indoor air/dampness and mold
- WHO (2010, b) – Indoor air
- Logue et al (2011) – US Residences

According to the collected literature indoor air pollutant in low energy residential buildings were measured in France, USA, Belgium, China and Japan. The chronic exposure for France and USA are presented by comparing current residential stock and low energy buildings. Exposure limit values (ELV) are defined comparing epidemiological studies and experiments on animals. Both depends on material characterization. Previous studies showed that ELV long-term exposures were presented by the USA, Canada, Germany, Belgium, France, EU, and WHO. By now 17 pollutants of interest have been defined by Annex 68 by ELV for short-term and long-term exposure.
Marc Abadie presented the second main part of the subtask – proposing use of indoor air quality indices. The proposal indicates to use one final aggregation for the selected pollutants. Aggregation for ELV based approach: MAX. Aggregation for Daly based approach: SUM

Jelle Laverge asked the question: "Why is that big difference between the presented ELV and Daly indices in the pollutants´ concentration?". Marc Abadie finalized with the conclusions: to come up with indices to evaluate solutions for better indoor air quality in low energy residential buildings.
Questions asked by the audience:

- "What do you think, which pollutant from the presented ones has the worst impact on occupants´ health?" Prof. Carsten Rode is proposing to have later discussion because of the time limitation.
- "From where does the background of the ELV and Daly indices come?" Marc Abadie is answering shortly and referring to the French studies he already presented on the beginning of his subtask.

Menghao Qin introduced the second subtask "Pollutant loads in residential buildings"

He referred to laboratory measurements of fundamental emissions for materials and assemblies used in residential buildings. Data collection will be carried out, and interaction between pollution sources and sinks will be studied. Furthermore, chamber measurements on indoor air quality are planned to take place. The main activities and the road map of the task is presented that is based on literature survey, measurement tests and model improvement.

Current participants in the literature survey are Syracuse University, Technical University of Denmark, La Rochelle University, TU Dresden, Tsinghua University, The University of Toyo and Nanjing University.
The materials ´database comes from China, France, Syracuse, Texas and Fraunhofer Institute. The laboratory tests were introduced as using various levels of temperature, and relative humidity, and their combined effects.

The background of formaldehyde problems indoors was presented for various countries, by highest concentrations obtained for Beijing in summer season. The limitation of the existing studies will be updated by evaluation of the effect of temperature and relative humidity on formaldehyde concentration. The experimental test will be set up in small and large scale environmental chamber at Nanjing University. The measurements will take place at different levels of temperature, relative humidity and ventilation rates. Effect of temperature and relative humidity on formaldehyde emission will be analyzed.

Menghao Qin concluded with a presentation of an example of field measurement of indoor air quality (temperature, relative humidity, PM2.5, VOC, O_3) in China at three ventilation strategies: natural ventilation (window control and air cleaning), natural ventilation (infiltration and air cleaning) and mechanical ventilation (heat recovery). For now, the impact of temperature and relative humidity was studied only on formaldehyde.

John Grunewald introduced the third subtask "Modeling-review, gap analysis and categorization".

Many tools and models should be involved in the project but we do not have all these sources. He refers a need to establish common standards and policies on indoor air quality among the countries. The questions is "Should we try to develop a physical model platform? Maybe, Annex 68 could be the title of the platform. The idea of this project should be to provide useable outcomes for research and industry by the end of the project. We do not develop software, but software companies could benefit from the "platform" of the project.

John Grunewald asked the audience to consider the following questions (possibly follow up at the continuation at the working meeting tomorrow):

- What do you think about systematization of software tools identifying gaps and potentials? Think also about calibration and validation of the tools.
- Do you think developing a common standard (internationalization and regionalization) would be beneficial and useful for the future work and design?

Scope of the software tools should be to: balance spaces, life cycle, knowledge transfer (from research to practice). The CHAMPs platform should connect research and practice and it should be open to public.
John Grunewald communicated with the audience using questions as presented below and asking the audience to consider answers until tomorrow:

- "Do you think is this the right way to go?".
- "Or do you think is it too demanding?".
- "Why to create a new platform?"
- "Who will host the platform?"
- "How to maintain the platform?"
- "How to ensure the quality?"

From the audience came the idea to explore ASHRAE 1.40. Should we do contribution to ASHRAE 1.40?

Guangyu Cao presenting the fourth subtask "Strategies for design and control of buildings" on behalf of subtask leader Jakub Kolarik. The presentation was carried over Skype.

The general overview was presented: the idea is to apply the results of previous subtasks together with existing knowledge. We should account for requirements for indoor air quality – "How much do we need to ventilate?" - and ventilation systems.
The main activities of the task are the following:

- Literature review.
- Investigation of possible design strategies.

- Investigation of possible operational strategies.
- Preparation of the Annex 68 guide.

The idea would be to create a matrix by connection of the Subtask 4 with other subtasks. The main approach is to use performance based design approach to get a structure. Milestones defined for the end of the year are: Survey for stakeholders, housing developers and public authorities. A "to do" list and further deadlines were summarized.

Jelle Laverge introduced Subtask 5 "Field measurements and case studies".

The main activities were presented as follows:

- State of the art and measurement strategies are currently ongoing.
- Controlled measurements (validation cases for Subtask 3 and Subtask 4) shall start soon.
  A 3-stage approach will be used for measurements in the subtask:
  1. Simple (1 room, 1 source, mech. ventilation, isothermal)
  2. Moderate (multiple room, 2-3 sources plus some interaction, relative humidity change, radiation).
  3. Complex (1 week measurement, occupied full house).
- In situ measurements: "send us what you have"

Jelle Laverge presented an example of a study that was performed in Belgium. The study compares concentrations of indoor air pollutants in a residential building before and after its renovation.

The final objective of the subtask will be analysis of the outcomes of measurements and dissemination (by end of 2018).

3. STL meeting

A brief subtask leader meeting was held at the completion of the first meeting day (starting at 8.00 PM). Carsten Rode, Jelle Laverge, Marc Abadie, Jensen Zhang, Veronika Foldvary, Jakub Kolarik and Meghao Qin attended this meeting.
CR said that the following points were to be discussed at this STL meeting or later during the course of the working meeting the next coming days:

- Next meetings (Schedule the next three).
- Form and duration of future meetings.
- Common Exercises.
- Presentations.
- Milestones and deliverables, program.
- Exchange/collaboration between the Subtasks.
- ASHRAE IAQ/AIVC Conference, Alexandria Sept. 12-14, 2016.
- Future Conferences.
- Collaboration with other IEA Annexes.
- Annex participation (status).
- ExCo issues.
- Possible event in conjunction with AIVC Workshop in Brussels March 14-15.
- Discuss opportunity to have webinar on Annex 68 with AIVC.

- The main discussion was about the candidates for the next Annex 68 meeting: China (Shanghai), Germany (Dresden), United Kingdom, Belgium could be the possible locations.
- Dresden would be a good place for organizing a modelling workshop.
- The leaders are discussing possible opportunities for organizing an online webinars. The first possible webinar could happen in October.

- Follow up on most other subjects would be done in conjunction with the plenary administration part of Session 6, Saturday morning.

Day 2, Friday, September 9, 2016

The day by Carsten Rode's explanation to all participants about the list of points, which has been presented at the Subtask leaders meeting the evening before, and which should be dealt with during the course of the Annex meeting.

4. Subtask 1 - Defining the Metrics

Subtask leader Marc Abadie presents Subtask 1: Defining the metrics assisted by co-subtaskleader Pawel Wargocki.

The subtask is focused on two main steps:

- "Short" list of the pollutants for Annex 68.
- Metrics for Annex 68 (accounting energy conservation as well).

Example is presented from France: Kirchner et al. (2006): acute, chronic, carcinogenic effects and frequency). The study presents results from 570 houses, including 30 different parameters (only 10 compounds are presented on the slide).

Pawel Wargocki mentioned the importance of exposure limits. No scientific basis for addition of health risks related to acute effects (high concentrations, short time) and chronic effects (low concentration, long time).

Marc Abadie presented the list of selected pollutants that was already presented also Thursday. He summarized the objectives of the subtask: to give overview of exposure contaminants in residential buildings and to identify differences in concentrations.

Chronic exposure is presented for France, USA and Belgium comparing current building stock and low energy residential buildings. For Belgium also data from complaint- free houses are presented. Chronic exposures caused by toluene, benzene and xylene in China are presented comparing low energy buildings and existing building stock.

The audience proposed to present the building code of each country that defines low energy buildings, so the definitions of the term "low energy building" could be compared between the countries. Pawel Wargocki confirmed that this idea could be a good reference.

Marc Abadie asked participants to provide (collect) more data for Asia. Menghao Qin said that he could provide data for China that were measured in existing buildings.

Marc Abadie presented the exposure limit values (ELV): long-term exposure is presented for USA, Canada, Germany, Belgium, France, EU, WHO. A short list of pollutants (in total 18) of interest is shown. It was proposed to include cadmium on the list.

Indoor air quality indices are discussed: "The Annex 68 should come up with one index." The first step is defining of the sub-indices: example is presented from Sharma M. et al. (2012). The second step is creating aggregation of sub-indices. Example is presented from Sharma M. et al. (2012).

Indoor air quality indices are presented from literature: according to Kirchner, Jedor and Mandin (2006). The Daly approach is presented according to Logue et al. (2011). Ther are two main ways for defining the indices: Exposure limit values (ELV) based vs. Daly approach.

Jelle Laverge gave the comment: “At PM2.5 the Daly value is too huge compared to ELV values. How about using delta Daly value?” Pawel Wargocki´s resonse: “There is no difference in order of pollutants comparing ELV and Daly indices.

Marc Abadie presented the conclusions of the subtask: to come up with indices to evaluate solutions for better indoor air quality in low energy residential buildings. Additionally, marc Abadie is presenting the first draft of a dashboard of chronic and acute effects, including ELV and Daly approaches and energy consumption.

- Comments:
    - Pawel Wargocki: “I like both, ELV and Daly approaches, too. This is the stage when the building is unoccupied. How about occupied buildings? The occupants can bring with them whatever they want, but it is not our problem. We need to define at which level we are right now. Are we missing anything?”
    - Jakub Kolarik: “This could be done also for Danish houses.”
    - Jensen Zhang: Tshinghua should have also indoor air quality data.
- At 10.14 pm Prof. Carsten Rode is closing the first sessions.
- Marc Abadie is proposing to discuss the outcomes of the subtask during the lunch break.
- Jakub Kolarik: “How do we deal with this in the designing process?? This should be discuss further.”
- Pawel Wargocki: “The design is not responsible for occupants´ behavior. It is a different story from occupied condition of the building.”
- Jakub Kolarik: “Use of real data of energy consumption would be useful.”
- The discussion is finished at 10.23 am.
- 5 minute group discussion is following the session: Jakub Kolarik, Jelle Laverge, John Grunewald, Carsten Rode, Jensen Zhang and Marc Abadie are attending the discussion.

5. Subtask 2 - Pollutant Loads in Residential Buildings

Meghao Qin introduces the second Subtask: Pollutant Loads in Residential Buildings.

The subtask is focusing on formaldehyde concentration indoors and it dependence on indoor air temperature and relative humidity. The effect of temperature and relative humidity are learned from theoretical studies. However, many limitations were found on existing studies. From this reason the idea is to conduct more research on this field.

Various conditions of relative humidity and temperature for the planned experimental design, using differed range for temperature (7.0±0.5 ~ 35±0.5 °C) and relative humidity (25±5 ~ 80±5 %) and example of effect of relative humidity on formaldehyde are presented.

Experimental validation and conclusions are shown: correlation between concentrations of formaldehyde and air temperature and relative humidity was derived. More outcomes of the ongoing research will be delivered later. The goal is to create more accurate outcomes. As a conclusion, an example of field measurement of indoor air quality (temperature, relative humidity, PM2.5, VOC, O_3) in China at three

ventilation strategies is presented: natural ventilation (window control and air cleaning), natural ventilation (infiltration and air cleaning) and mechanical ventilation (heat recovery).

- Comments:
  - Jakub Kolarik: “The field study should be moved to Subtask 4 and 5. Feedback from the practical implication could be used on Subtask 4.”
  - Jensen Zhang: “See how the temperature impacts individual VOCs. Developing a model for different environmental conditions would be interesting.”
  - Jelle laverge: “Are you going to do literature review on sources coming from human emissions?”
  - Jensen Zhang: “Right now we are focusing on formaldehyde only.

6. Subtask 5 - (presented before ST3)

Jelle Laverge introduces the next subtask on “Field measurements and case studies”.

Case no. 1. Is presented: This case is based on the following conditions: 1 room, 2 ventilation rates (one low and one high), 1 source and isothermal. The measurement period is one week (online monitoring): 2 days – blank measurements, 2 days-using 0.3 ACH, 2 days – using 1ACH, 1 day – blank. Investigation of one target pollutant is the aim of the study.

Prof. Carsten Rode is interrupting the talk: “It would be good to get the same instrument for DTU as well.” Jelle laverge is giving an additional comment on the used instrument in the case study: “It is very accurate and it captures other concentrations as well.”

Case no. 2 is introduced: It is an intermediate study. The measurements of the second case study will be performed in two rooms located in student dormitory. The inlet will be from one room and the outlet will be at the connected room. The time period of the measurement, sensor types and their location should be discussed on the next meeting.

The case no. 3 is presented: It is a complex one, focusing on family house (test house). Information is needed on location and characteristics of building materials. Materials presented in the standards should be selected for further analyses so comparison of concentrations from experiments and standards could be done.

- Comments:
  - Gabriel Rojas (via Skype): “If you look at one room, 1ACH is a good choice, or it could be even higher.”
  - Carsten Rode: “These are relatively fast experiments. Is it possible to do frequent measurements using the presented instrument?” Jelle Laverge´s answer is “Yes.”
  - Kristine Nore (via Skype) is proposing a test house. Jelle Laverge is saying that since the proposed house has wooden constructions it could cause some issues at the pollutants´concentrations. Additionally, Kristine is proposing validation of the measurements at the first case by repeating the measurements more time.
  - Jensen Zhang: “For model validation we will need large range of data.”
  - Pawel Wargocki: “How the emissions will be controlled? Emission testing could be done by using glass aquariums. Furthermore, do you want to look at the pollutants alone or together?”

Jelle Laverge: “Regarding the aquarium study, it is a lab study and the point of this subtask to get data on building scale. In the first case we will look at the pollutants alone.”

7. Subtask 3 - Modelling - review, gap analysis and categorization

After the lunch break the Subtask 3 - CHAPMS in low energy residential buildings - is getting introduced by by John Grunewald. The Annex 68 modeling wise is very demanding that´s why agreement on common strategies should be discussed. This could the proposed CHAPMS model platform with the following targets:

- Systematization of software tools.
- Identification of gaps and potentials.
- Development of common standards.
- Calibration and validation of tools.
- Reference solutions.

John is introducing list of existing software as a “Version 0” (Energy+, Modelica, Nondrad, etc.). IAQ cannot be evaluated by the presented software, that´s why “Version 2” solution should be created. The “Version 1” would be based on the list of software presented in “Version 0” additionally including IAQ model and thermal zone model. “Version 1” that could be used in the CHAPMS platform needs to be discussed further. This idea could be a very good outcome of the Annex. We could collaborate with La Rochelle could be useful, they are good in thermal zone modelling.

John Grunewald´s presentation if followed by a presentation given by Jensen on “Prediction IAQ in low energy buildings: The role of standard testing, modeling and benchmarking.” The objective are to review and collection of existing models, and develop validated reference cases. The term of “Low energy house” should be defined first, from energy efficiency point of view as well as from potential IAQ problems point of view. The model should be developed that would allow to evaluate IAQ strategies. Furthermore, attention should be paid on source control, ventilation or air cleaning (purification): requirements on ventilation rate and acceptable air pollution level should be defined. In addition, it is important to deal with minimum ventilation rates in case of unknown pollutants.

The roles of the testing, modeling and benchmarking should be the following: physical, chemical, biological processes affecting indoor air quality; interactions between energy efficiency and indoor air quality strategies; performance evaluation.

The proposed framework for modelling and benchmarking is the following: defining reference buildings for benchmarking, single zone model, multi-zone whole building model.

Next steps are defined: defining baseline for internal and external pollution loads. This should be add to Subtask 2, simulating baselines of indoor IAQ conditions, identifying IAQ strategies for LERH through review of case studies and guidelines.

Rui Zhang, a PhD student of Jensen Zhang, presents her PhD work on Defining of a reference residential building. The building characteristics, such as floor plan, envelope characteristics, lighting power density, occupancy schedule and density, ventilation type, space conditioning and equipment loads are introduced. The infiltration rate is 0.22 ACH. The ACH by mechanical ventilation is 0.14 ACH. Set point is 76 °F (electricity) for cooling, and 71°F (natural gas) for heating, according to the Building America and the heating and cooling

devices are modelled by an ideal system - the Building America that has a simulation protocol presenting inputs of set-point. The simulation is performed for Syracuse climate.

- Comments:
    - Jelle Laverge: “Can this house be translated to European conditions?” Jensen Zhang says “Well, this house is representative for USA conditions. New model needs to be created for European conditions, following European guidelines.
    - Jakub Kolarik is referring to Jelle Laverges´ earlier publication on houses in different countries using similar ventilation strategies. Additionally, he is saying that “the main focus should be put on creating the presented idea of the platform by John.”

8. Subtask 4 - Strategies for Design and Control of Buildings

Jakub Kolarik is opening the fourth session on “Strategies for Design and Control of Buildings”. Veronika Foldvary and Thomas Witterseh are introduced by him, who will be giving a short presentation during the ongoing session. The importance of the connections between the subtasks, especial between Subtask 2, 3 and 4 is mentioned.

The overview and the time schedule of the tasks are presented:

- State of the art (2016)
- Design strategies (2016-2018)
- Possible operational strategies (2017-2018)
- Preparation of the Annex guide (2016-2019)

The work plan is presented, where template for this subtask is presented, filled by Denmark, Austria, United Kingdom and Norway. In addition, the update on ventilation requirements is shown. 19 countries and their building codes are included in this task. The most recent reports on this topic are from BPIE, HEALTHVENT WP5, TABULA and other background information.

There are gaps in collected data. Representative person for each of the countries should be asked about recent updates in their building codes and other ventilation guidelines. Review of official national guidelines are needed. Common exercises should be the following: interviewing stakeholders, using template for the interviews.

- Comments:
    - Jensen Zhang is giving a comment: “Guideline for ventilation strategies could be useful. Currently ASHRAE is developing an IAQ guide for residential buildings in the USA. This guideline is developed by practitioners.”
    - Jensen Zhang is asking the following question: “Do you want to interview the building occupants?” Jakub Kolarik´s answer is the following: It would be great if we could do that, but currently we do not have manpower for that task. However, it could be add as optional, if such a data exist already.
    - Jelle Laverge´s comment: “ Annex 60 has lot of information on this part. We should try to gather information from them.”

Veronika Foldvary is starting her 12 minutes presentation titled as “Assessment of indoor environmental quality in residential buildings before and after renovation.” The work is dealing with impact of renovation of existing residential buildings on indoor air quality and occupants´ satisfaction. The investigated buildings are located in Slovakia. Parameters, such as CO2, air exchange rate, NO2, (T)VOC and formaldehyde were investigated in this study. Correlation factors are shown between the physical and subjective parameters of indoor air quality.

Afterwards, Thomas Witterseh presents his presentation on using VOC sensors for IAQ monitoring. The objective of his project is evaluate and compare different sensors of (T)VOCs. The expected activities are presented as follows: Literature, market screening, laboratory (chamber) testing, Full scale testing – IAQ monitoring and comparison of VOC sensor outputs with results from “classic” sampling.

- Comments:
    - Jelle Laverge gives a comment: “It could be interesting to see how does the particular sensor behaves on the beginning and end of the measurement.
    - Prod. Carsten Rode is asking a question: “How many sensors do you plan to have in the investigation?” Thomas answer is “From 1 to 5.”.
    - Pawel Wargocki´s suggestion: “Pick up randomly 10 VOC meters and compare the outcomes.”

Prof. Carsten Rode is closing the Friday session at 4.30 pm.

Day 3, Saturday, September 10, 2016

The day by Carsten Rode’s explanation to all participants about the list of points, which has been presented at the Subtask leaders meeting the evening before, and which should be dealt with during the course of the Annex meeting.

9. Common administration

The session is leaded by Prof. Carsten Rode. All Annex members are asked to upload their presentations from the meeting into sharepoint.

Next meeting: 20-22. March, 2017 in Dresden, Germany :

- Discussion about “Common exercises” - ST2 - source/sink models, discussion between ST2 and ST3
    - One viewpoint was that it is not necessary for all ST, because these exercises often ending up with different results and it is difficult to draw common conclusions (John)
    - Despite the discussion/suggestion OA wants activity in all ST that will be going on from now and will be presented in Dresden next year
- Discussion about structure of the meetings – Subtask presentations -> 4 presentations per subtask should be at every meeting to report on progress
- Deliverables - we need to remember them, outlines have to be presented in autumn 2017!
- Webinar about our Annex for AIVC - postpone to spring, topic, ST1, Marc is too busy now

Discussion regarding Subtask 1 is leaded by Marc Abadie:

- Keep ELV and DALY for chronic effects? It was decided that both should be kept!

- Discussion about how to account for acute effect – suggestion was to look only at frequency of occurrence of peak concentrations. Another alternative is to treat acute effects as chronic effects?
  It was discussed that with respect to the ventilation strategy (ST4) is the % enough because acute ELV cannot be exceeded.
  Marc suggested µg/m3 h as a metric indicating not only whether ELV was exceeded, but also how much (surface under the concentration curve). Allowable value would be "zero"
  Discussion about how to define ELV for acute exposure - STEL numbers, odor threshold?
  Marc and Pawel will elaborate further on these topics.
- Structure of the final report: can be found on Marc's slides
- The report will include an example of using the metric, verification will be done in the other subtasks
- Pawel asked whether papers in scientific journals are accepted as final deliverables by ExCo. OA replied that there must be published report as an official deliverable.
- Timeline for the report (*should be approved by Marc*) draft 15 October, Nov 30 final draft, Dec 15 submission of report.
- Regarding ST4 – MS Excel tool developed by ST1 can be used now. ST4 will have a meeting Skype with Marc in the beginning of October to discuss details.

10. Session 7 – Parallel ST Sessions.

Subtask 3 Workshop – Tools session

- Participants: Marc Abadie, Esfand Burman, Karin Kompatscher, Nicole Poussineau, Shinsuke Kato, Andreas Nicolai, Jensen Zhang, Lixing Gu, Menghao Qin, Zhenlei Liu, Rui Zhang, Fitsum Tariku, Carsten Rode
- John Grunewald gave a presentation with introduction to Design Builder which is a central user interface tool to some of the other tools that are central in Work package 3.
  DesignBuilder is a commercial tool (from the UK). It does:
  - Zoning, definition of walls (with thickness)
  - Model data: Activity, constructions, openings, lighting, HVAC
  - Scheduels –also for setpointsBIM HVATool
  - Components – with database
  - Hierarchy and inheritance
  - Exports IDF-file (intended for EnergyPlus), but cannot read and IDF-file.
  - Design builder doesn't consider moisture or VOC emissions
- Dirk Weiss gave a presentation of the BIM HVACtool
  - The BIM HVACTool is a commercial tool from Tian Building Engineering (Germany)
  - Import can come from SketchUp, IFC, DXF and Rhino
  - Export is possible to OpenFOAM (CFD)
  - The BIM HVACTool does thermal simulation of buildings, flow simulation, system simulation and lighting simulation

Subtask 4 (possibly with ST5) - Workshop on: Residential ventilation design – current practices, methodology and approach – stakeholder questionnaires and interviews

- As no representative from ST5 was present the session was treated as ST4 meeting
- Participants: Jakub Kolarik, Thomas Whitteresh, Menghao Quin (partly), Jensen Zhang (partly), Pawel Wargocki (partly), Carmina Yannez (On skype), Amar Aganovic, Edward Bogucz, Ying Wang (Saint Gobain)
- It was decided to discuss particular activities in the subtask:

- Activity 4.1: We need contribution from China, Belgium and Czech Rep. – these are ST4 countries. We can offer other A68 participants to fill out the MS Excel template, but rather on voluntary basis and not as a second “common exercise”.
- China (Menghao) will contribute to review of standards and building codes based on a report that has been recently completed.
- Templates for stakeholder interview will be finished by the end of September and then distributed to all Annex participants. AIVC will be consulted regarding the gap between building code requirements and design practice (Jakub).
- Activity 4.2 was not discussed during the parallel session.
- Activity 4.3 – It was discussed that it would be beneficial to collect experience form existing low energy dwellings. It was not clear whether ST5 will address this issue (later clarified by Jelle that ST5 will welcome contributions on real cases but will primarily focus on cases that allow for validation of results from ST2 and ST3 – see ST5 presentation in Sharepoint), thus it was discussed that ST4 could try to collect examples from practice from the Annex 68 participants on a standardized form, which would prescribe which data should be provided to describe each “case study”.
    - Ed suggested LowE houses in Syracuse, there are low energy houses previously surveyed by SBi in Denmark, Amar mentioned possible case studies in Norway, Menghao mentioned a demo apartment from China (this is not permanently occupied – needs to be discussed further).
    - It was also discussed that case studies could include buildings where Innovative sensors/measurements/iHome applications are used.
    - Details will be discussed during next ST4 Skype meeting.