Shaping Tomorrow's Built Environment Today

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Kathleen Owen, Research Subcommittee Chair TC 2.1, kathleenowen@att.net
CC: Pawel Wargocki, Research Liaison Section 2.0, paw@byg.dtu.dk

FROM: Michael Vaughn, MORTS, mvaughn@ashrae.org

DATE: November 6, 2018

SUBJECT: Research Topic Acceptance Request (1869-RTAR), "Evaluation of Indoor Air Contaminants with respect to Development of a Revised Indoor Air Quality Procedure (IAQP) Design Compound and Design Target Lists for Standard 62.1"

During their fall meeting, the Research Administration Committee (RAC) reviewed the subject Research Topic Acceptance Request (RTAR) and voted to accept it with comments for further development into a work statement (WS) provided that the key comment(s) and question(s) below are addressed to the satisfaction of your Research Liaison, Pawel Wargocki, paw@byg.dtu.dk, or RL2@ashrae.net, in the work statement draft.

1. Modify the project objectives section to include the specific targets to be achieved.
2. Should the consultation also include relevant bodies in the medical profession to make sure that health aspects are not compromised?

The work statement draft must be approved by the Research Liaison prior to submitting it to RAC.

An RTAR evaluation sheet is attached as additional information and it provides a breakdown of comments and questions from individual RAC members based on specific review criteria. This should give you an idea of how your RTAR is being interpreted and understood by others. Some of these comments may indicate areas of the RTAR and subsequent WS where readers require additional information or rewording for clarification.

The first draft of the work statement should be submitted to RAC no later than **August 15, 2020** or it will be dropped from display on the Society's Research Implementation Plan. The next likely submission deadline for a new work statement on this topic is **May 15, 2019** for consideration at RAC's 2019 Annual meeting. The submission deadline after that for work statements is **August 15, 2019** for consideration at the RAC's 2019 fall meeting.

Project ID	**1869**	
Project Title	**Evaluation of Indoor Air Contaminants with respect to Development of a Revised Indoor Air Quality Procedure (IAQP) Design Compound and Design Target Lists for Standard 62.1**	
Sponsoring TC	TC 2.3, Co-sponsored by SSPC 62.1 & TRG4	
Cost / Duration	$70,000 - $80,000 / 6 Months	
Submission History	**1st Submission**	
Classification: Research or Technology Transfer	Basic/Applied Research	
RAC 2018 Fall Meeting Review		
Essential Criteria	**Voted NO**	**Comments & Suggestions**
Background: The RTAR should describe current state of the art with some level of literature review that documents the importance/magnitude of a problem. References should be provided. If not, then note it in your comments.		**4 -** The Authors missed one of the most comprehensive review reporting measured VOCs in different buildings reported in the literature by Brown (1994). Although that data may be irrelevant the approaches used to analyze the data by Brown can be used as guiding principles when performing literature review and analyzithe collected data. **9** - Use of Std 62.1 is explained with respect to design, alongside the role of indoor air 'contaminants' - more appropriately termed 'design compounds'. Relevant literature is cited.
Research Need: Based on the background provided is the need for additional research clearly identified? If not, then the RTAR should be rejected.		**9** - yes, a gathering of available data and a list of candidate design compounds needs to be established.
Relevance and Benefits to ASHRAE: Evaluate whether relevance and benefits are clearly explained in terms of: a. Leading to innovations in the field of HVAC & Refrigeration b. Valuable addition to the missing information which will lead to new design guidelines and valuable modifications to handbooks and standards. Is this research topic appropriate for ASHRAE funding? If not, Reject.		**9** - Will expand the use of 62.1 by evidence-based support to enable its iaq procedure to be more widely and confidently used
IF ABOVE THREE CRITERION ARE NOT ALL SATISFIED - MARK "REJECT" BELOW & CONTINUE REVIEW BELOW		
Other Criteria	**Voted NO**	**Comments & Suggestions**
Project Objectives: Based on the background and need, evaluate whether the project objectives are: 1. Aligned with the need 2. Specific 3. Clear without ambiguity 4. Achievable If not, then appropriate feedback should be provided.		**9** - These are clear, but should state who will be consulted. **10** - The objectives should be listed as the outcome of the research project, not as a list of tasks to be performed.
Expected Approach and Budget: Is there an adequate description of the approach in order for RAC to be able to evaluate the appropriateness of the budget? If not, then the RTAR should be returned for revision. Anticipated funding level and duration:		**4** - The project will review the measured compounds in buildings over the last 15 years and determine target levels. It is unclear why last 15 years was selected. It is unclear how the buildings where smoking was allowed in the past will be handled? Finally it is unclear how different measuring procedures used to determine concentrations will be dealt with? Finally there is no mention about the ventilation rates and adjustment of the concentrations by the measured/estimated ventilation rates. Furthermore no information is provided on which endpoints will be used to determine design targets and how design compounds will be selected: based on prevalence, potential effects etc. **9** - This is appropriate and includes the bodies to be consulted. **15** - This is a worthwhile goal but the write-up does not reflect a solid understanding of what has happened before. The estimate of 500 to 1000 papers strikes me as a total guess, not sure where it comes from. The background literature, including existing regulations and guidelines, needs to be looked at more carefully before this moves forward. **10** - The duration seems to be short. To review 1000 papers in 6 months involves finding and reading 15 papers per working day. **8** - see inadequate budges for the work proposed
References: Are the references provided?		
Decision Options	**Initial Decision?**	**Final Approval Conditions**
ACCEPT AS-IS		**7** - The RTAR is well written. The need and benefit to ASHRAE is well established. The budget may not be enough for the proposed scope; but, this can be clarified in the Work Statement. **9** - This is a clearly-presented case for building an evidence base upon which iaq can be 'designed'. Should the consultation also include relevant bodies in the medical profession to make sure that health aspects are not compromised? **10** - Modify the project objectives section to include the specific targets to be achieved. Consider extending the duration of the project. **8** - work proposed seem to be high for the proposed budget.
ACCEPT W/COMMENTS		
REJECT		

ACCEPT Vote - Topic is ready for development into a work statement (WS).
ACCEPT W/COMMENTS Vote - Minor Revision Required - RL can approve RTAR for development into WS without going back to RAC once TC satisfies RAC's approval condition(s)
REJECT Vote - Topic is not acceptable for the ASHRAE Research Program

Research Topic Acceptance Request Cover Sheet

Date: 8-14-18

(Please Check to Insure the Following Information is in the RTAR)

A. Title	X
B Executive Summary	X
C. Background	X
D. Research Need	X
E. Project Objectives	X
F. Expected Approach	X
G. Relevance and Benefits to ASHRAE	X
H. Anticipated Funding Level and Duration	X
I. References	X

Title:

Evaluation of Indoor Air Contaminants with respect to Development of a Revised Indoor Air Quality Procedure (IAQP) Design Compound and Design Target Lists for Standard 62.1

RTAR # 1869

(To be assigned by MORTS)

Research Classification:

Basic/Applied Research	X
Advanced Concepts	
Technology Transfer	

Results of this Project will affect the following Handbook Chapters, Special Publications, etc.:

Standard 62.1;
Fundamentals Handbook Ch 11 – Air Contaminants.
Systems Handbook Ch 29 – Air-cleaning for Particulate Contaminants
Applications Handbook Ch 46 – Air cleaning for Gaseous Contaminants

Responsible Committee: TC 2.3

Date of Vote: 8/1/18

For		11
Against	*	0
Abstaining	*	1
Absent or not returning Ballot	*	3
Total Voting Members		15

Abstaining - RTAR author

RTAR Authors

Lead: Gemma Kerr

Others: James Dennison, Dean Tompkins, Marwa Zataari, Hoy Bohanon, Wayne Thomann

Co-sponsoring TC/TG/MTG/SSPCs (give vote and date)

SSPC 62.1: 7/30/2018
19-0-2-1-22 (For-Against-Abstain-Not responding-Total)

TRG4: 14-0-0-1-15 8/14/18

Expected Work Statement Authors

Lead: Dean Tompkins, Marwa Zataari

Others: James Dennison, Gemma Kerr

Potential Co-funders (organization, contact person information):

None identified

	Yes	No
Has an electronic copy been furnished to the MORTS?	X	
Has the Research Liaison reviewed the RTAR?	X	

* Reasons for negative vote(s) and abstentions

2.3: abstention is one author thought she should vote due to being an author
62.1: Abstentions were Chair Not Voting and an RTAR author

RTAR # 1869

Title

Insert proposed project title

Evaluation of Indoor Air Contaminants with respect to Development of Revised Indoor Air Quality Procedure (IAQP) Design Compound and Design Target Lists for Standard 62.1

Executive Summary

Describe in summary form the proposed research topic, including what is proposed, why this research is important, how it will be conducted, and why ASHRAE should fund it (50 words maximum)

Using literature reviews and consultations, this project will assist in creating scientifically-based guidance for using Standard 62.1 IAQ Procedure. This will enable more frequent and effective usage. IAQP-designed HVAC systems can operate with lower energy than VRP-designed ones. ASHRAE should fund this to provide tools for designing low energy-use buildings.

Background

Provide the state of the art with key references (at the end of this document) substantiating it (300 words maximum)

ASHRAE Standard 62.1 (1) specifies two design methods for mechanically-ventilated buildings. The Ventilation Rate Procedure (VRP) prescribes building ventilation rates, while the Indoor Air Quality Procedure (IAQP), allows reduced ventilation rates provided air contaminant concentrations indoors are reduced to acceptable levels using source control and air-cleaning. IAQP design therefore has the potential to reduce building energy use significantly. However, the method has been little used because engineers typically do not know what air contaminants to consider during design (particularly volatile organics) or what concentrations are acceptable. Standard 62.1 presently provides no guidance in these areas.

Air contaminant concentrations indoors depend generally on the strengths of sources present in and around the building and on the rates at which emitted contaminants (particles and chemicals) are diluted/removed from indoor spaces. Typically many contaminants are present together in indoor air.

The US Green Building Council does not allow use of the IAQP in its LEED program (2) because of the lack of contaminant guidance. However, because of the energy savings potential, it has set up two IAQP pilot projects (3, 4). To guide design, these specify the contaminants to measure and acceptable concentration limits.

The Research and Education Subcommittee of SSPC 62.1(RES) recently decided that the term “air contaminants” is inappropriate for IAQP as many of these chemicals are simply common in indoor spaces, odorous/irritating, or otherwise unacceptable, rather than constituting a significant health risk. Therefore, a new term “design compounds” was chosen.

The IAQP revision presently underway (publication 2019) proposes a list of 16 Design Compounds (DCs) with associated indoor concentration limits (or targets) which address both prevalence and potential health or other risks. This list was prepared after a very limited review of information sources by RES. It will improve Standard 62.1 IAQP, but should not be considered the final version.

Research Need

Use the state of the art described above as a basis to specify the need for the proposed effort (250 words maximum)

Development of scientifically-based and defensible lists of Design Compounds (DCs) and concentration Design Targets (DTs) is essential if Standard 62.1 IAQP is to be widely used. These lists will enable IAQP to design HVAC systems that combine provision of good indoor air quality (IAQ) with low energy use.

This project is important because it will contribute to production of DC and DT lists for the 2022 edition of Standard 62.1 that are better scientifically than the ones in the 2019 edition.

Preparation of a robust DC list will involve carrying out extensive literature reviews and consultations to develop a list of all candidate DCs; acquiring as much data as possible on their prevalence and indoor concentrations; and analyzing the collected data to select the most appropriate DCs from the candidate list. Since it is not clear how much data is out there, a stepwise approach is likely to be the most cost effective. Therefore the scope of the research proposed here will be limited to developing a comprehensive database of candidate DCs and determining what useful prevalence and concentration data exist in accessible form.

Preparation of a scientifically-based DT list will require review of air contaminant concentration guidelines issued by government agencies and other cognizant authorities from the US and around the world. These need to be compiled to form a comprehensive database of candidate DTs. Note that only IAQ guidelines should be included, not occupational limits.

Project Objectives

Based on the identified research need(s), specify the objectives of the solicited effort that will address all or part of these needs (150 words maximum)

1. Perform a literature review to identify potential DCs and find data on air contaminant prevalence and concentration.
2. Perform consultations to assess availability of unpublished air contaminant prevalence and concentration data.
3. Acquire guideline concentration limits from cognizant authorities.
4. Prepare a detailed report on the literature reviews and consultations
5. Prepare a database of candidate DCs.
6. Prepare a database of candidate DTs.

Expected Approach

Describe in a manner that may be used for assessment of project viability, cost, and duration, the approach that is expected to achieve the proposed objectives (200 words maximum).
Check all that apply: Lab testing ( ), Computations ( ), Surveys ( ), Field tests ( ), Analyses and modeling (x), Validation efforts ( ), Other (specify) (literature review, consultations with authorities and laboratories)

The literature review may involve 500-1000 papers and many volatile organic compounds (VOCs). It will focus on the last fifteen years, though the USEPA BASE study (5) should be included. Reports should be requested from similar agencies in the US and elsewhere. In addition, consultations should be carried out with the US Green Building Council regarding LEED building data, with laboratories providing analyses for standard contaminant sampling methods used in buildings covered by Standard 62.1, and with laboratories conducting chamber studies on materials emissions. These will assist in identifying candidate DCs and the availability of building contaminant concentration data. The resulting candidate Design Compound database is expected to be large.

A separate review of IAQ guidelines is required to build the candidate Design Target database. It will cover government agencies throughout the world and other authorities determined cognizant by the PMS.

It is expected that approximately 6 months will be needed to cover reviews and consultations (Objectives 1-3), and preparation of the report and databases (Objectives 4-6).

Because this project represents only an initial step towards acceptable DC and DT lists, frequent discussions between contractor and PMS will be needed to guide timely preparation of proposals for further research.

Relevance and Benefits to ASHRAE

Describe why this effort is of specific interest to ASHRAE, its impact, and how it will benefit ASHRAE and the society. How does it align with ASHRAE Strategic Plans and Initiatives? How does it advance the state of the art in this area in general? Are there other stakeholders that should be approached to obtain relevant information or co-funding? (350 words maximum)

This project will advance the state of the art in HVAC design because it will help to improve the Standard 62.1 IAQP design process to the point where it will be much more widely used. It will also move IAQP closer to designing HVAC systems that provide both good IAQ and low energy use. Until now, few engineers have used the IAQP because of lack of guidance on what contaminants to assess during design (particularly volatile organics), and what level of contaminant control is appropriate.

This effort is important to ASHRAE because it supports three parts of the Research Strategic Plan for 2010-18 as follows:

- Goal 7 – Support development of tools, procedures and methods suitable for designing low energy buildings – because this project will help to provide a better Standard 62.1 IAQP design process that will encourage engineers to use it;
- Goal 2 – Progress towards Advanced Energy Design Guide (AEDG) and cost-effective net-zero-energy (NZE) buildings - because using IAQP design will reduce HVAC energy use;
- Goal 5 – Support the development of ASHRAE energy standards and reduce effort required to demonstrate compliance - because using IAQP design can reduce HVAC energy use.

This project will be of interest to the US Green Building Council (USGBC) because their Leadership in Energy and Environmental Design (LEED) system promotes design of low-energy use buildings. Also, although they do not sanction use of the IAQP in their current (Version 4) document, they do allow use of

two pilot credits that utilize the IAQP.

Anticipated Funding Level and Duration

Funding Amount Range: $ 70K - 80K

Duration in Months: 6

References

List the key references cited in this RTAR

[1] ASHRAE. 2016. ANSI/ASHRAE Standard 62.1-2016*, Ventilation for Acceptable Indoor Air Quality*. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., Atlanta.

[2] USGBC. 2015. *LEED for Building Design + Construction, version 4 (v4)*. US Green Building Council.

[3] USGBC. 2015. Pilot alternative compliance path 68: Indoor Air Quality Procedure. US Green Building Council.

[4] USGBC. 2018. Pilot credit 124: Performance-based indoor air quality design and assessment. US Green Building Council.

[5] Building Assessment Survey and Evaluation (BASE) Study. 1999. https://www.epa.gov/indoor-air-quality-iaq/building-assessment-survey-and-evaluation-study.

Feedback to RAC and Suggested Improvements to RTAR Process

Now that you have completed the RTAR process, RAC is interested in getting your feedback and suggestions here on how we can improve the process.