INVITATION TO SUBMIT A RESEARCH PROPOSAL ON AN ASHRAE RESEARCH PROJECT

1864-TRP, Investigating the applicability of Standard 62.1's Ventilation Rate Procedure for Healthcare Rooms

Attached is a Request-for-Proposal (RFP) for a project dealing with a subject in which you, or your institution have expressed interest. Should you decide not to submit a proposal, please circulate it to any colleague who might have interest in this subject.

Sponsoring Committee: SSPC 170 Ventilation of Health Care Facilities
Co-sponsored by: TC9.6 Healthcare Facilities & SSPC 62.1 Ventilation for Acceptable Indoor Air Quality

Budget Range: $70,000 may be more or less as determined by value of proposal and competing proposals.

Scheduled Project Start Date: **April 1, 2024** or later.

All proposals must be received at ASHRAE Headquarters by 8:00 AM, EDT, December 15th, 2023. NO EXCEPTIONS, NO EXTENSIONS. Electronic copies must be sent to rpbids@ashrae.org. Electronic signatures must be scanned and added to the file before submitting. The submission title line should read: 1864-TRP, Investigating the applicability of Standard 62.1's Ventilation Rate Procedure for Healthcare Rooms , and *"Bidding Institutions Name"* (electronic pdf format, ASHRAE's server will accept up to 10MB)

If you have questions concerning the Project, we suggest you contact one of the individuals listed below:

For Technical Matters
Technical Contact
Ken Mead
CDC/NIOSH
M/S R-5
1090 Tusculum Ave
Cincinnati, OH 45226-1938
Phone: 859) 384-3764
Email: kcm3@cdc.gov

For Administrative or Procedural Matters:
Manager of Research & Technical Services (MORTS)
Michael R. Vaughn
ASHRAE, Inc.
180 Technology Parkway, NW
Peachtree Corners, GA 30092
Phone: 404-636-8400
Fax: 678-539-2111
E-Mail: MORTS@ashrae.net

Contractors intending to submit a proposal should so notify, by mail or e-mail, the Manager of Research and Technical Services, (MORTS) by December 1st, 2023 in order that any late or additional information on the RFP may be furnished to them prior to the bid due date.

All proposals must be submitted electronically. Electronic submissions require a PDF file containing the complete proposal preceded by signed copies of the two forms listed below in the order listed below. **ALL electronic proposals are to be sent to rpbids@ashrae.org.**

All other correspondence must be sent to ddaniel@ashrae.org and mvaughn@ashrae.org. Hardcopy submissions are not permitted. **In all cases, the proposal must be submitted to ASHRAE by 8:00 AM, EDT, December 15th, 2023. NO EXCEPTIONS, NO EXTENSIONS.**

The following forms (Application for Grant of Funds and the Additional Information form have been combined) must accompany the proposal:

(1) ASHRAE Application for Grant of Funds (electronic signature required) and
(2) Additional Information for Contractors (electronic signature required) ASHRAE Application for Grant of Funds (signed) and

ASHRAE reserves the right to reject any or all bids.

State of the Art (Background)

ASHRAE/ANSI/ASHE Standard 170, Ventilation of Healthcare Facilities, addresses ventilation requirements for healthcare spaces. Since the 1947 Hill-Burton Act, national standards for healthcare facilities have recognized an increased potential for and susceptibility to, airborne contaminants that impact occupant safety. Over time, the standards originated under Hill-Burton were published under various names and authorities. Since 2001, they are published by the Facility Guidelines Institute (FGI). ASHRAE began publishing ventilation standards for healthcare facilities in 2008. ASHRAE Standard 170 identifies healthcare spaces with specific ventilation requirements based upon room type & occupancy characteristics/activity, then prescribes a combination of ventilation attributes (outdoor air, total air, temperature, humidity, space pressurization, filtration, …) for each space type. Concurrent with the 2010 FGI Guidelines for Design and Construction of Health Care Facilities, FGI ceased specification of ventilation rates and adopted the 2008 ANSI/ASHRAE/ASHE Standard 170. The FGI-ASHRAE partnership continues to this date.

ASHRAE First Published Standard 62 in 1973. The current version is ASHRAE/ANSI Standard 62.1-2022, Ventilation and Acceptable Indoor Air Quality. Standard 62.1's purpose is to specify minimum ventilation (primarily outdoor air) rates and other measures intended to provide indoor air quality that is acceptable to the majority of human occupants and minimizes adverse health effects. Standard 62.1's scope applies to all nonvehicle structures/spaces intended for human occupancy, except residential application as defined in Standard 62.1. Since 2010, Standard 62.1 ceased specifically addressing healthcare unique spaces and has recognized the potential for their unique ventilation requirements. One Standard 62.1 design approach is the Ventilation Rate Procedure (VRP). The VRP prescribes ventilation rates based on space type, occupancy, and floor area.

The research discussed in this proposal seeks to determine if the VRP can be made to apply, with or without modification, to the OA delivery requirements of healthcare spaces addressed in Standard 170.

Justification and Value to ASHRAE

This proposed research activity is important to ASHRAE on many levels. First, it is a direct and immediate response to ASHRAE Research Project CO-RP3: A Literature Review of ASHRAE Standard 170 Support. This research project (completed June 2018) identified several healthcare-unique spaces in Standard 170 where the foundational support behind the prescribed ventilation rates, for air changes per hour of outdoor air, was either unknown or incomplete. The proposed research activity is focused to ascertain an analytical methodology to determine the (outdoor air) ventilation rate for two healthcare rooms, i.e., (General Purpose) Patient Room and (General Purpose) Exam Room. Consequently, this research will address an omission identified in RP CO-RP3. In regard to energy conservation, areas identified for adaptation into Standard 62.1's VRP are anticipated to provide opportunities for energy savings, primarily through reduced OA ventilation requirements. In addition to reduced operating costs through energy savings, other savings opportunities may also result, such as smaller air handling units that result in lower acquisition costs and smaller building footprint requirements. Lastly, there have been multiple requests to SSPC 170 over recent years to clarify where and why outdoor air requirements for healthcare facilities are different than those covered under traditional Standard 62.1 spaces. This evaluation of (General Purpose) Patient Room and (General Purpose) Exam Rooms may identify opportunities to better control space contaminants through less-expensive control technology than the traditional and energy expensive outdoor air dilution approach. This research activity provides an earnest research-based determination of the breadth of appropriate design options when addressing healthcare outdoor air requirements.

Objectives

The overall proposed research objective is to conduct a critical analyses of room types with prescribed ventilation requirements in Standard 170 to identify if they offer opportunity for energy savings from the design flexibility offered in the VRP, compared to the prescriptive Standard 170 design approach and without compromising patient, staff and visitor protective requirements.

The preliminary objective is for researchers to identify the health care spaces from Standard 170 Tables 7.1, 8.1 & 9.1 and to conduct literary and interview research activities in order to obtain a thorough understanding of the types and generation conditions of the health care-unique contaminants (including biological [i.e. infectious aerosols], chemical, physical) associated with each of the spaces. Rooms where

the ventilation is process-oriented, such as operating rooms and airborne infectious insolation rooms will not be addressed in this research.

The second objective will be to determine, on a space-by-space basis, whether Standard 62.1's equation 6.2.2.1 can be effectively applied in such a manner as to control the contaminants of concern identified in the preliminary objective. Such control might be achieved using the existing VRP equation or with new Ra/Rp variable determinations specifically identified for the health care spaces thus allowing a consistent use of the outdoor air ventilation design rate determination: $Vbz = Rp \times Pz + Ra \times Az$.

Scope:
Researchers must initially review the spaces in Standard 170's Tables 7.1, 8.1, and 9.1, seeking to identify the breadth of contaminants (biological, chemical, physical) reasonably associated with each of these spaces. Second, the researchers must attempt to characterize the generation parameters (e.g. source identification, frequency, duration) for each space:contaminant association. Some spaces will have multiple contaminants and varying generation rates, or, they may have contaminant generation characteristics which are not sufficiently understood to apply the VRP. Where generation characteristics are identified, acceptable exposure concentrations for these contaminants should be identified/proposed (if possible) for occupational, general population and immunocompromised patient exposures.
Next, the researchers need to investigate if/how OA contributes to controlling exposure to the identified contaminants. Researchers will also seek to identify alternative control methods (such as filtration or air cleaning) and evaluate the energy consequences and safety limitations of these alternative controls. For example, recirculation and high-efficiency particulate filtration of infectious aerosols may be a more appropriate contaminant control approach than that required by dilution via outdoor air.
Where OA plays a predominate role in safe and effective exposure control, either to room occupants or those exposed to transfer or recirculated room air, the researchers will evaluate each space:contaminant relationship using the VRP's equation 6.2.2.1, as applied to approximately similar spaces in Standard 62.1. Where the VRP's prescribed OA delivery falls short in achieving the required min. OA required for effective control, researchers will propose new Ra/Rp factors. For those spaces with more than one space:contaminant relationship, the researchers will specify the largest Ra/Rp factors associated with that space.

This project is currently envisioned as being divided into the following 6 tasks mirroring the two primary objectives. Bidders may suggest different divisions to the tasks as long as all work is included and milestones are still included and enforceable.

Tasks:

1) To initiate the Primary objective: Review the spaces in Standard 170's Tables 7.1, 8.1, and 9.1. Consult from a minimum representative sample of at least 3 facilities for each space type, with health care practitioners, infection preventionists, facility owners, and health care occupational safety and health professionals to identify the breadth of contaminants (biological, chemical, physical) reasonably associated with each of these spaces.
2) Characterize the generation parameters (e.g. source identification, frequency, duration), to the extent possible, for each space:contaminant association identified in Task 1. Some spaces will have multiple contaminants and varying generation rates, or, they may have contaminant generation characteristics which are not sufficiently understood to apply the VRP.
3) Where generation characteristics are identified, acceptable exposure concentrations and durations for these contaminants should be identified/proposed (if possible) for occupational, general population and immunocompromised patient exposures
4) To initiate the second objective, investigate if/how OA contributes to controlling exposure to the identified contaminants. For each identified space contaminant, benchmark the extent to which the current S170 prescriptive OA delivery requirement contributes to the dilution control of the

contaminant. Researchers should also seek alternative control methods (such as filtration and air cleaning) and evaluate the energy consequences and safety limitations of these alternative controls. Where OA plays a predominate role in exposure control, either to room occupants or those exposed to transfer or recirculated room air, evaluate each space:contaminant relationship using the VRP's equation 6.2.2.1, as applied to approximately similar spaces in Standard 62.1. Identify the extent to which seasonal variation might enhance or interfere with safe and effective contaminant control in those scenarios where OA plays a predominate role in exposure control.

5) Document any new Ra/Rp modifications required to eliminate the OA shortcoming where the VRP's prescribed OA falls short in achieving the required min. OA required for effective contaminant control. For those spaces with more than one space:contaminant relationship, specify the largest Ra/Rp factors associated with that space.
6) Final Report and articles as required by ASHRAE

Deliverables:

Each of the first 5 task will require a short summary report to be transmitted to the PMS by email, physical meeting, and/or by Zoom or phone call. Task reports shall be approved by the PMS before the next task begins unless the PMS approves a different, perhaps parallel, order of performance or the contractor suggests, and the PMS concurs with, another scheme in the proposal. PMS will review and respond to reports in accordance with established agreements between the PI and the PMS chair.

Input from the PMS should be sought if any roadblocks are found. Biweekly (every 2 weeks) updates to let the PMS know that progress is being made are required but may take the form of short emails with a bulleted list of recent accomplishments.

Verbiage prepared for each of the publications cited in the Applications of Results will be prepared and submitted either as part of the Final report or separately. In addition, a journal article for Science and Technology for the Built Environment or ASHRAE Transactions, as required by ASHRAE, will be prepared and submitted.

Progress, Financial and Final Reports, Technical Paper(s), and Data shall constitute the deliverables ("Deliverables") under this Agreement and shall be provided as follows:

a. Progress and Financial Reports

Progress and Financial Reports, in a form approved by the Society, shall be made to the Society through its Manager of Research and Technical Services at quarterly intervals; specifically on or before each January 1, April 1, June 10, and October 1 of the contract period.

The following deliverables shall be provided to the Project Monitoring Subcommittee (PMS) as described in the Scope/Technical Approach section above, as they are available:

Furthermore, the Institution's Principal Investigator, subject to the Society's approval, shall, during the period of performance and after the Final Report has been submitted, report in person to the sponsoring Technical Committee/Task Group (TC/TG) at the annual and winter meetings, and be available to answer such questions regarding the research as may arise.

b. Final Report

The final report will include at least:

a. Cover page
b. Table of Contents
c. Executive Summary

d. A narrative report that addresses the methods and results for each task and a discussion of limitations and ramifications of the research findings
e. Conclusions
f. Recommendations

A written report, design guide, or manual, (collectively, "Final Report"), in a form approved by the Society, shall be prepared by the Institution and submitted to the Society's Manager of Research and Technical Services by the end of the Agreement term, containing complete details of all research carried out under this Agreement, including a summary of the control strategy and savings guidelines. Unless otherwise specified, the final draft report shall be furnished, electronically for review by the Society's Project Monitoring Subcommittee (PMS).

Tabulated values for all measurements shall be provided as an appendix to the final report (for measurements which are adjusted by correction factors, also tabulate the corrected results and clearly show the method used for correction).

Following approval by the PMS and the TC/TG, in their sole discretion, final copies of the Final Report will be furnished by the Institution as follows:

-An executive summary in a form suitable for wide distribution to the industry and to the public.
-Two copies; one in PDF format and one in Microsoft Word.

c. *Science & Technology for the Built Environment* or ASHRAE Transactions Technical Papers

One or more papers shall be submitted first to the ASHRAE Manager of Research and Technical Services (MORTS) and then to the "ASHRAE Manuscript Central" website-based manuscript review system in a form and containing such information as designated by the Society suitable for publication. Papers specified as deliverables should be submitted as either Research Papers for HVAC&R Research or Technical Paper(s) for ASHRAE Transactions. Research papers contain generalized results of long-term archival value, whereas technical papers are appropriate for applied research of shorter-term value, ASHRAE Conference papers are not acceptable as deliverables from ASHRAE research projects. The paper(s) shall conform to the instructions posted in "Manuscript Central" for an ASHRAE Transactions Technical or HVAC&R Research papers. The paper title shall contain the research project number (1864-RP) at the end of the title in parentheses, e.g., (1864-RP).

All papers or articles prepared in connection with an ASHRAE research project, which are being submitted for inclusion in any ASHRAE publication, shall be submitted through the Manager of Research and Technical Services first and not to the publication's editor or Program Committee.

d. Data

Data is defined in General Condition VI, "DATA"

e. Project Synopsis

A written synopsis totaling approximately 100 words in length and written for a broad technical audience, which documents 1. Main findings of research project, 2. Why findings are significant, and 3. How the findings benefit ASHRAE membership and/or society in general shall be submitted to the Manager of Research and Technical Services by the end of the Agreement term for publication in ASHRAE Insights

The Society may request the Institution submit a technical article suitable for publication in the Society's ASHRAE JOURNAL. This is considered a voluntary submission and not a Deliverable. Technical articles shall be prepared using dual units; e.g., rational inch-pound with equivalent SI units shown parenthetically. SI usage shall be in accordance with IEEE/ASTM Standard SI-10.

Level of Effort

The estimated cost of the project is $70,000 and it is expected to take 15 months. It is anticipated that one and two thirds (1.67) professional-months of effort will be needed from the principal investigator and three (3) professional-months of effort from research assistants. Possibly allocated as 120 hours for each of tasks 1-3, 240 hours for task 4, 80 hours each for task 5 and the rest for the final report and paper.

Other Information to Bidders (Optional):

Project Milestones:

No.	Major Project Completion Milestone	Deadline Month
1	Submission of Task 1 and 2 reports to PMS	6
2	Submission of Task 3, 4 and 5 reports to PMS	12
3	Submission of Final Report to the PMS for Review	15

Proposal Evaluation Criteria

Proposals submitted to ASHRAE for this project should include the following minimum information:

No.	Proposal Review Criterion	Weighting Factor
1	Contractor's understanding of work statement as expressed in proposal.	15%
2	Qualifications of personnel included in proposal.	25%
3	Contractor's capability in terms of facilities.	15%
4	Qualifications of personnel for this project	25%
5	Probability of contractor's research plan meeting the objectives of the Work Statement	20%

References

1. ANSI/ASHRAE/ASHE Standard 170- 2021, Ventilation of Health Care Facilities
2. ANSI/ASHRAE Standard 62.1-2022, Ventilation and Acceptable Indoor Air Quality
3. FGI 2018 Guidelines for the Design and Construction of Hospitals
4. FGI 2018 Guidelines for Design and Construction of Outpatient Facilities
5. FGI 2018 Guidelines for Design and Construction of Residential Health, Care, and Support Facilities
6. Final Report "ASHRAE Research Project CO-RP-03: Academic Research to Support Facility Guidelines Institute & ANSI/ASHRAE/ASHE Standard 170",
7. English, T. R., P.E., Moeller, D., P.E., & Mills, F. (2015). Benchmarking the US healthcare ventilation standard with the UK healthcare ventilation standard. ASHRAE Conference Proceeding CH-15-C020.
8. Memarzadeh, F. 2000. "Thermal comfort, uniformity, and ventilation effectiveness in patient rooms: performance assessment using ventilation indices" ASHRAE Transactions 106.
9. Ninomura and Bartley, Jun 2001. New Ventilation Guidelines For Health-Care Facilities, ASHRAE Journal, 43, 29-33.
10. ASHRAE Strategic Plan, https://www.ashrae.org/about/strategic-plan/ashrae-strategic-plan
11. ASHRAE Research Strategic Plan 2010- 2018, https://www.ashrae.org/technical-resources/research/research-strategic-plan