Q1: WHAT KIND OF PERSONAL PROTECTIVE EQUIPMENT (PPE) SHOULD BUILDING ENGINEERING STAFF WEAR WHEN CHANGING FILTERS OR ACCESSING AIR HANDLING UNITS (AHUS) OR SPACES WHERE POTENTIALLY CONTAMINATED AIR MAY BE RELIEVED?

A: Recommend wearing the same PPE as a healthcare worker (N95 mask, vinyl gloves, disposable coverall and shoe covers). After maintenance is complete, double bag and dispose of PPE, change clothes, shower and wash hands thoroughly.

See "Filtration and Air-Cleaning Systems to Protect Building Environments", NIOSH 2003 for additional guidance.

Q2: WHAT KIND OF PPE SHOULD BUILDING ENGINEERING STAFF WEAR WHEN ACCESSING CLINICAL AREAS FOR MAINTENANCE?

A: Follow clinical guidance. Refer to American Society of Health Care Engineers (ASHE) and clinical staff for requirements. Measures may be taken to protect patients from potential infection by staff in non-COVID-19 wards. In wards with patients infected with COVID-19 and where the virus may be present (e.g. soiled utility corridors and rooms), staff should be protected from infection by using PPE.

Q3: WHAT TEMPERATURE, RH TO RUN SPACE OR BUILDING AT?

A: Normal operating temperature set points should be maintained based on the existing licensing requirements for the space use and occupancy. Consider maintaining relative humidity between 40%-60% RH. ASHRAE Research Project CO-RP-03 reports that scientific literature generally reflects the most unfavorable survival for micro-organisms when the RH is between 40%-60%.

Q4: WHAT ARE SOME GENERAL PARAMETERS FOR AIR CHANGES PER HOUR (ACH), TEMPERATURE, FILTRATION, AND RELATIVE HUMIDITY FOR NON-COVID-19 EMERGENCY SURGE SPACES OUTSIDE OF A LICENSED HOSPITAL?

A: Minimum 2ACH Outdoor air and 2 ACH Total air, though higher total air is desired (basis is patient room from FGI 1997).

For large volume spaces with high ceilings, such as conference centers, air changes may be calculated based on a ceiling height of 10 feet; however, for supply air temperatures above room temperature, minimum OA and total ACH may be calculated as 2ACH Outdoor divided by 0.8 ACH, or 2.5. Total air,

(ASHRAE 62.1 ventilation effectiveness) and supply air temperatures kept no more than 15 degrees F above room temperature to minimize stratification and short circuiting of air within the space.

No less than MERV 13 and MERV 14 preferred for systems that are not serving specialized environments that may require even higher efficiency filtration.

Temperature 70 – 75 degrees

Humidity – Recommend 40-60% RH

Refer also to Minnesota Department of Health, Methods for Temporary Negative Pressure Isolation

Q5: WHERE MIGHT IT BE NECESSARY TO INCREASE FILTRATION LEVEL IN HEALTHCARE SETTING?

A: In areas with confirmed or potential COVID-19 patients, the healthcare facility may deem it desirable to increase the filtration rate for the HVAC systems serving those areas. The system filters should be rated for the maximum filter efficiency available while not adding more restriction in the HVAC systems to cause reductions in system airflow to the point that the system can no longer maintain indoor temperature and humidity set points or desired pressure relationships. HVAC Filters rated at MERV 14 or above are better and should be considered if the HVAC system can accommodate them. Isolation wards, temporary vestibules, and COVID-19 positive patient rooms specifically may benefit from HEPA filtration.

Q6: HOW TO OR WHAT TO CONSIDER WITH VAPORIZED HYDROGEN PEROXIDE GENERATORS?

A: Seal the HVAC system to the room being treated. Following decontamination, Vaporized Hydrogen Peroxide (VHP) system should be set up to clear all VHP from the space. Arrange for confirmation of complete space purge before reoccupying. VHP may be better utilized for equipment rather than room sterilization. There are additional considerations aside from those related to the HVAC system. Consult the system manufacturer for additional considerations.

Q7: GUIDANCE FOR MASK DISINFECTION OR OTHER MANUFACTURING FACILITIES

A: Technology for the Decontamination and Re-use of N95 respirators has been established by the Food and Drug Administration. Specific details can be found at this link.

A variety of approaches have been experimented with and while there is debate about the complete effectiveness, a shortage of PPE creates a need to re-use masks. This guidance from the Anesthesia Patient Safety Foundation provides information about the CDC's official guidance on the short term and long-term reuse of N95 masks.

Q8: WHAT IS THE PROPER AMOUNT OF OUTSIDE AIR TO SPACES WHERE INFECTIONS EXIST OR ARE KNOWN TO HAVE OCCURRED?

A: Ventilation rates should be increased and maintained 24/7 especially in buildings where known infections exist or are known to have occurred. The minimum ventilation rates during occupied periods should be at least meet the recommendations of ASHRAE 62.1. The maximum amount of outside air can be as high as 100% depending on outdoor air conditions (temperature, humidity, pollution content), indoor conditions trying to be maintained (temperature and humidity), capacity of the HVAC system to condition (filter, cool and dehumidify) the outside air or outside air/return air mixture to conditions that will maintain the desired indoor conditions. Applying a combination of increased filter efficiency and increased ventilation rates may be the best way to achieve better indoor air quality and help dilute COVID-19 or other infectious aerosol concentrations indoors. Facility operators and building owners should consult a local HVAC engineer or service professional to help them make these kinds of operational changes to their HVAC systems. As with anything, when making changes to existing systems, make small changes at a time and only one or two changes at a time and monitor the system and indoor conditions to confirm that no unexpected consequences or detrimental conditions, such as pressurizing a contaminated space relative to an adjacent uncontaminated one, appear so that the systems can be returned to pre-modification conditions if needed before any damage is done.

Q9: WHAT IS THE PROPER LEVEL OF NEGATIVE PRESSURE FOR ISOLATION AND HOW CAN THIS BE MEASURED UN-SCIENTIFICALLY?

A: Healthcare facilities should follow the recommendations in ASHRAE Standard 170-2017. Specific guidance is provided for the various spaces in a hospital including for Airborne Infection Isolation Rooms (AIIRs) can be found in Table 19.1 of Standard 170-2017. Standard 170 provides good guidance for any building that is housing, isolating, and caring for people infected with COVID-19. The principals specified in Standard 170 consider several criteria: whether the space should be kept at a positive or negative pressure with respect to the other space around it in the building, the number of air changes per hour for ventilation or outside air and the total number of air changes an hour the HVAC system capable of providing to the space. Spaces where COVID-19 infected people are being cared for or where they are self-quarantined should be kept at a negative pressure with respect to the other spaces around it in the building. Unscientific ways to determine whether the space is negative to its surrounding spaces is include, but not limited to:

Use of a lightweight streamer tied to the end of a pencil such as a piece of string or ribbon. Crack the door that enters the room from the corridor or other space while standing in the room where the COVID-19 person is staying. Hold the streamer up to the crack in the door and if the streamer moves in the direction of the room or toward you, the room is negative with respect to the other space. If the streamer moves toward the crack in the door or toward the space outside where you are standing, the room is positive and airflow in the room should be adjusted so that is negative by increasing the return or exhaust air in the room and possibly blanking off a portion of the supply air to the room. Make small changes at a time and monitor the space to make sure temperature and humidity conditions do not

become uncomfortable of other unexpected or undesired conditions do not occur. Consult a local HVAC engineer or HVAC service professional when needed.

Q10: AIR DOORS OR AIR CURTAINS?

A: Temporary vestibules or ante rooms with HEPA filtration may be useful for containment at the entry to COVID-19 patient wards, at the entry to COVID-19 patient rooms, and for utilizing an operating room for a CVOID-19 patient. See specific information under the Healthcare Guidance section of the ASHRAE COVID-19 website.

Q11: Should we use a negative operating room for procedures involving COVID positive patients?

A. The CDC provides guidance on performing surgery on an infectious patient, such as one with TB. Below is an excerpt from Guidelines for Preventing the Transmission of Mycobacterium tuberculosis in Health-Care Facilities, 1994

a. Operating rooms

- Elective operative procedures on patients who have TB should be delayed until the patient is no longer infectious.
- If operative procedures must be performed, they should be done, if possible, in operating rooms that have anterooms. For operating rooms without anterooms, the doors to the operating room should be closed, and traffic into and out of the room should be minimal to reduce the frequency of opening and closing the door. Attempts should be made to perform the procedure at a time when other patients are not present in the operative suite and when a minimum number of personnel are present (e.g., at the end of day).
- Placing a bacterial filter on the patient endotracheal tube (or at the expiratory side of the breathing circuit of a ventilator or anesthesia machine if these are used) when operating on a patient who has confirmed or suspected TB may help reduce the risk for contaminating anesthesia equipment or discharging tubercle bacilli into the ambient air.
- During postoperative recovery, the patient should be monitored and should be placed in a private room that meets recommended standards for ventilating TB isolation rooms.
- When operative procedures (or other procedures requiring a sterile field) are performed on patients who may have infectious TB, respiratory protection worn by the HCW must protect the field from the respiratory secretions of the HCW and protect the HCW from the infectious droplet nuclei generated by the patient. Valved or positive- pressure respirators do not protect the sterile field; therefore, a respirator that does not have a valve and that meets the criteria in Section II.G should be used.

Please see the Healthcare Guidance PDF under the "Specific How-To and Unique Areas" section for the Operating on COVID-19 positive patient link that will provide some additional guidance, including the creation of a temporary vestibule should your ORs not have them.

It would be prudent to perform the surgery when the other areas served by the same AHU are unoccupied and to provide HEPA filtration at the return grilles or at the AHU, even if there is a slight reduction in overall AHU airflow capacity. Alternatively, should your climate permit, you can switch the AHU into an “economizer mode” with 100% outside air and 100% relief. Exercise caution in cold climates not to freeze coils and in warm climates not to allow condensation to occur within the space.

Q12: Are recirculating type room units such as PTACs or Fan Coils safe to use for COVID patients?

A. Placing COVID-19 positive patients in rooms with recirculating units is not ideal but can be done if precautions are taken above and beyond what is done for central HVAC systems. Assuming that pressurization and proper ventilation are managed separately from the recirculating unit, the primary concerns are the air patterns within the room which may cause difficulty in pressurization and protection of occupants.
Please see the Healthcare Guidance PDF under the "Specific How-To and Unique Areas" section for the Cautions on Recirculating Room Units" link for additional guidance.

Q13: Are Energy Recovery devices safe to use when exhaust air has been drawn from areas containing COVID patients?

A. We are not aware of studies documenting risk from contamination of wheels by SARS-CoV-2, but it is certainly something worth investigating. AiCARR, the Italian HVAC society has recommended disabling wheels during the epidemic in its guidance. If used, HEPA filtration of the exhaust air is recommended to prevent potential contamination of the energy recovery media as well as mitigate the potential for any cross over.

Please see the Healthcare Guidance PDF under the "Suggested Approaches" section for the Deactivate or by-pass heat recovery wheels link for additional guidance.

Q14: What type of system cleaning or preparation is recommended when reverting from serving COVID patients to non-COVID patients?

A. CDC/NIOSH has not posted guidance on the decontamination of HVAC systems (to include air filtration systems) potentially exposed to SARS-CoV2. To date, we have not identified confirmatory evidence to demonstrate that viable virus is contaminating these systems. Should such systems actually become contaminated with viable virus, the most likely scenario is believed to be that the virus would lose its viability naturally within hours-to-days, and thus, there is no guidance advocating proactive system shutdown for decontamination and/or filter exchange. Therefore, you do not need to disinfect the HVAC system, perform duct cleaning, or clean toilet exhaust fans.
Please see the Filtration and Disinfection section of the webpage for additional resources.

Q15: What air changes and precautions should be taken for COVID patients in diagnostic areas such as Endoscopy?

A. Due to changing regulations over the years, these rooms may be operating in a positive or negative condition. Verify current operating conditions prior to using rooms.

Currently, ASHRAE Standard 170 requires 6 total ACH for Gastrointestinal Endoscopy procedure rooms. There is no pressure requirement. Airflow may not be recirculated within the room.

If the procedure is an aerosol generating procedure, regardless of whether it is on a COVID-19 positive patient or not, it is recommended to perform the procedure in an airborne infection isolation room or a bronchoscopy room. ASHRAE Standard 170 requires 12 total ACH for Bronchoscopy rooms. The room must be negative, 100% exhaust, and no recirculation within the room.

Please see the Healthcare Guidance PDF under the "Specific How-To and Unique Areas" section for the Gastrointestinal Endoscopy link for additional guidance.