Designing and Operating High-Performing Healthcare HVAC Systems
Q&A Report:

Question Asked	Answer Given
Would heating a room to above 56 oC enough to kill the SARS-CoV-2 ?	I don't think there is any data or research available on this. What we are seeing some hospitals use are UVC lights and Hydrogen Peroxide Mist,
Why 170 didn't mention to pharmacy BSC room with HEPA?	170 has left the requirements for compounding Pharmacies to be defined by USP.,That would be USP 800 (for negative pressure compounding) and USP 700 for positive Pressure rooms
Dan, in operating room we need to have room humidity sensor and SA duct humidity sensor both and compare together?	You need both so that you can confirm both RH relative humidity and temperature are within spec. Preferably a high quality sensor with large digital readout that is easy to read
I've seen UV and filters used in combo to create a "capture-contain-neutralize" effect. Seems to offer good efficacy. Can you recommend the type/MERV of filter that would be best in this type of application?	I will have Dan comment more during the end but HEPA but I assume HEPA would over the best capture.
The pic w/ UV lights where it looks like mold is growing with UV installed is a "color mixing" issue. It is not "mold" rather it is the color effect of blueish/green visible light and the brown "rust" forming on the AHU surfaces. When I first saw a similar condition I thought it was very odd, so I checked into it. Multiple tests involving turning lamps on/off, as well as, microbial swabs proved it was not mold/fungi.	Thank you, good point
Earlier in the discussion Dan mentiond that wrap around heat pipes (WAHX) do not dehumidify. That is true but their purpose is not to dehumidify - they are designed to allow the primary cooling coil to do more dehumidification by moving a large amount of the sensible load to the heat pipe.	True, They help reduce load off the primary cooling coil which may allow the coil to achieve a lower leaving air temp (dewpoint) and be more effective at dehumdificaiton.
For Laboratory applications: Is there a way to reduce the required O/A for fume-hood make-up air? Is a DOAS system with process cooling or a chilled-beam system desirable for efficency? Thanks for the course!	If you have a chemical fume hood system with direct exhaust you must make up for that exhaust with outside air. Using a variable volume system that adjusts hood exhaust based on sash position and adjusts the room supply is a way to reduce the OA. We do often use DOAS systems to assist systems with high OA loads.

During COVID-19; is the practice of creating a negative OR room for operating on a COVID Patient an appropriate practice ?	We will review that in the last 30 minutes. What is recommended is keeping the OR as a positive space with a negative pressure temporary ante room at the entrance. We have a diagram we will review.
Can the speaker explain more about ventialtion system in the hospital have coroan patients? and how to make hospitals ready to receive corona patients	We will be covering that in the last 30 minutes of the course
the 12 ACH inside AII room is it used for exhuast air flow rate claculation or supply?	That is the exhaust air flow when it is a negative pressure room. That is the minimum. You will need enough offset to make the room negative so in rooms needing alot of supply air for cooling the ACH may be higher. Typically the exhaust air will need to be 150 to 300 cfm higher than the supply to achieve the negative pressure.
is it mendatory to provide uniterrupted power for fresh air unit and exahsut air unitsering an isolation room? or jsut UPS is required for exashut fan?	Required for the exhaust but not the supply. Of course good practice is to have the supply AHU on emergency power as well. In the US most states require hospitals to be able to operate the heating and cooling to critical spaces during a power outage
do we need redundncay 9 stanby fan/ahu) for supply air unit and exhaust air unit for AII rooom?	Not required but that would be good practice. We have done this on some hospitals.
when we say positve or negative pressure iside a room. what is the value in pacla for this differnce?	For operating rooms and isolation rooms it is 2.5 pascals or 0.01" water gauge.,For some rooms such as soiled utility, clean utility, etc there is not a specific number. Just needs to be measurable
is it mendatory to instal VAV for duct serving an assembly of AII rooms ? or we can repalce It by volume dampers?	It can be done with volume dampers. VAV boxes or venturi valves (set for constant volume) just help keep the system in balance on manifolded systems
Please review ASHRAE 170, AII exhaust requirements, with footnote U in consideration. By adding a HEPA filter, where can the exhaust be directed?	Currently ASHRAE 170 does not recognize using HEPA filters as an alternate to the roof/stack discharge. In states where 170 is code there is no option. This is however used in emergency situations such as temporatry COVID spaces.,For example many hosptials are exhausting their temporaty COVID spaces out the patient room window with HEPA filtration
where is pressure monitoring of OR's dictated in ASHRAE 170?	I will see if Dan knows the precise location. It does not have to specically be an electonic readout but most accredidation agencies such as Joint Commission require hospitals to check the pressure and log it on a regular basis. This can be done with an electronic monitor with data logging on the BAS

In reference to repsonse on exhasut. Thought there was an exception to exhasut a AI room through a local hepa if being converted from a standard patient room if exterior exhasut is not feasible.	For temporary (emergency operations) this is also being done. We have some diagrams we will be reviewing during the last 30 minutes.
Is the proposed revision to the filter requirements publicly available? If so, where?	Will hold this question for Dan. I think it may be avialable for review
Typical HVAC Evaporator coil cleaning involves a garden hose and a pump up sprayer with chemical. Most of our coils are 8-12 inches thick. The garden hose, pressure washer or steam wand will not penetrate that deep. What should I do to keep the coils clean? What problems can a foulded coil cause? Could it contribute to HAI's?	Deep coils can be an issue. There are some foaming products that can get in and dislodge material but I have witnessed coils that could not be cleaned and were showing massive pressure drop. I would certainly think that material lodged in the coil could be breeding ground. For designs a strategy to keep coil depths down is use multiple coils with space between. Such as use two 6 row coils with space between rather than a 10 row coil,DOAS systems to pre-treat the Outside air is another way to keep the main AHU coil capacity down and allow a new design to use fewer coil rows than can be cleaned more easily.
Can you address coil cleaning in the Q&A session? I know clients who are asking about the viabilty of what may be growing in the coils, especially with Covid-19.	Yes, I will bring that to Dan's attention.
If exhausting from an Isolation room to a HEPA fan filtration unit, Can the exhaust discharged from the HEPA unit go to a common exhaust fan	ASHRAE 170/FGI require dedicated exhaust fans for isloation rooms. This would not be compliant with the standard but we have seen this done when there were no other options. For emergency COVID isolation this is a common approach.
Outpatient Treatment and Procedure Rooms MERV 7 or 14 (Table not clear)	Only 7 required for Outpatient (on the incoming side), No final filter required
As part of that discussion, can we discuss specifically not just OR's but other procedural spaces (CT and IR rooms). Being asked to make these negative and I have the same apprehension in these spaces as I do OR's to do that because of SSI's/HAI's.	Yes, We will be discussing other spaces
Key thing I have found for OR Design over the years, as an owner I have been requesting Thermostat locations be above the operating table that controls the temp of the room. That way its where the doctor is standing that determine's the temp, not the area by a door, which could be far way in a larger OR. We place a secondary T-Stat at the door to help with manual control.	I've not run into that but it makes sense and sounds like a great idea. Thank you.

SLD Technology provide AirFRAME system providing modular structural, mechanical and electrical ceiling solution for DOR's and Hybrids	Yes, we are familiar with that system. Some other vendors offer solutions that can integrate the uni-strut supports but not the booms
sensible heat recovery can be considered for hospital application?	Absolutely, Many hosptials use heat pipes or gylcol loops for sensible heat recover. No carry over issues with these systems
Would it make sense for disinfection purposes to stop air movement in a room after a patient as left to allow aerosols to fall onto surfaces that can be cleaned? Or is it better to increase air change and dilute with clean air faster?	The most common pratice has been flushing the room with air exhanges.
How do you balance greater efficiency requirements increase the complexity of the system?	Good question. We will be covering this more at the end of the course. Our option is to keep the systems simple enough that they can be well maintained and operated without sacrifice to paitent and staff safety. That is priority one with energy being later. ,The current slides address your question in more detail
If you put your humidifier before the cooling coil, wont the coil remove that moisture again as it crosses the coil? I dont follow why you would put it before instead of after cooling coil.	You would not want to humdiify past the saturation point of your coil leaving temperature anyway. So if you are humdifing to that point it is too much. The coil acts as a "safety device" if the system malfunctions and over saturates the air. The fins on the coil also act as "eliminator blades" and help remove any excess moisture that does not get absorbed. This protects the final filters and duct from being wetted which can be a place for mold and mildew growth.
Any data that suggests the benefit of entering through the sterile core into ORs? Does not seem that two doors would have a large effect on keeping pressure.	I'm not aware of any avaialble data. Will hold this question for Dan at the end of the course.
THANK YOU FOR SUCH PRECIOUS COURSE HVAC FOR EMERGENCY ROOM AFTER THE COVID , I THINK ITS DESIGN VALUES WOULD CHANGE AND IT LOCATION INSIDE THE HOPITAL IS VERY CRITICAL	Agreed, I think this event will have us all thinking of what improvements we can make in our designs to be better prepared for pandemic events in the future.
How does FGI standards relate to ASHRAE. Most of my hospital clients reference FGI standards	ASHRAE 170 is adopted into FGI for the air exhange, temperature, humidity, and pressure requirements thus FGI and 170 are the same for those requirements
Has ASHRAE considered reccommending Aeroseal duct sealing technology for critical systems and facilities. From our experience it will reduce duct leakage by 95%	I am not familiar with and ASHRAE recomendation for this. I'm not familiar with Aeroseal technology. Will see if Dan is familiar with this. We do require SMACNA duct leakage testing on all the systems we design.

Particle air eveperation, what humidity was the study done at?	I am not sure. I will see if Dan can answer that question during the Q&A
Do you have data of SSI's broken down by Function of Space (operating rooms, delivery rooms, recovery, etc) ?	I don't know. I will hold that question for Dan at the end of the course.
Do you find that owners maintenance staff request for small enough fan motors so that they can maintain easily?	Yes, We have some that insist on a maxium of 7.5 hp so they can be easily lifted. The small motors are less efficient though so fan arrays with more fans and smaller HP will have a higher total BHP and electrical load.
What kind of water treatment for salt-based cooling system?	The desicant based systems such as Kathabar do have some make up water condition requirements but nothing too stringint. You have to pay attention to the manf requirents. On most of these systems I have designed we have not had to treat the makeup. ,I will add the treated air leaving the salt based systems can still have some of the corrosive salt. The systems use an eliminator seciton to remove this but stainless steel duct for the initial run of duct off these systems is good practice
What is your opinion of bipolar ionization bars in an AHU or in ductwork?	I am seeing this being used more and we have a few clients trying it. I think there still needs to be more independent research to confirm effectiveness.
What is the thought of pre-engineered air frame systems for OR's	Easier to construct as opposed to a site built system and can save space in tight ceiling spaces with integrated laminar flow diffuser plenums,
Do you have a recommendation for a blower door test for OR or isolation rooms to test for tightness	Most of our project have just relied on visual inspection but I have seen the commissioning agents use a blower door test which is a great way to insure tightness
Are you aware of any other dynamic technologies other than UV (as already mentioned) for health care purposes (especially viruses?	As someone else noted in an earlier question bipolar ionization is another method but needs more independent research.
Doesn't air need to be in "contact" with UV for a minimum amount of time to be effective for eliminating contaminants? i.e. isn't a "dwell" required? If so, how does putting UV into air handlers clean the air - unless only to keep the air handler clean to prevent mold, mildew, etc. from growing and then becoming entrained in the airstream?	Correct, to be effective in cleaning the air the velocity must be lower and the lamp intensity greater. Most UV setups are aimed at keaping the coil and AHU interior surfaces clean.

Renovations slide 71 - what about outdoor air needed to make up for exhausting directly outside? big impacts of sucking hospital negative depending on OA conditions	For a large construction zone that may need to be taken into consideration. For some of the smaller construction areas the amount of exhaust is small and does not have a big impact. You are correct though that this should be considered. OA may need to be adjusted. We are located in NC where outdoor dewpoints can be as much as 80 deg F during the summer. Infiltration from too much exhaust can be a big issue.
Is disinfection of the ductwork ever required, if so under what conditions?	I don't know that any quidelines require it but duct cleaning and keeping the duct clean during constrution is good pracitce. We ask that duct be sealed on the ends with plastic when on site prior to installation and then have a cleaning spec before it is put into use.,I am aware of some USP pharmacies where the duct was disinfected and cleaned after active mold particles were found in the lab,Current slide addresses keeping duct clean druing construction
What is your opinion of using "air valve" technology (venturi valve) rather than standard VAV Terminal boxes? My thoughts: Better control, no airflow sensors to get dirty, control of air entering/leaving a space	We like the venturi valves and have used those in OR systems, Labs, and USP pharmacies. great for exhaust side as well as supply.
Is airborne or just surface UV-C light systems especially considering current virus? Airborne requires 4 to 6x more lamps.	Airborne would be best for current virus but as noted this takes more lamps and lower velocity to achieve sufficient exposure. Most common setups in past are aimed at simply treating the coil surface