Infection Control Commissioning – Special Ventilation Rooms in Healthcare Facilities

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Introduction

Industrial hygienists are often called to provide assistance in commissioning hospital facilities. This process validates ventilation systems necessary for infection control from common airborne infectious agents. This process has not been formalized yet commissioning is specified for life safety and other vital systems in hospitals. Infection control for airborne spread microbes involves ventilation parameters: filtration, air exchanges and pressure. In order to verify control of microbial contamination all of the ventilation parameters must be validated before microbial testing is initiated.

Objectives

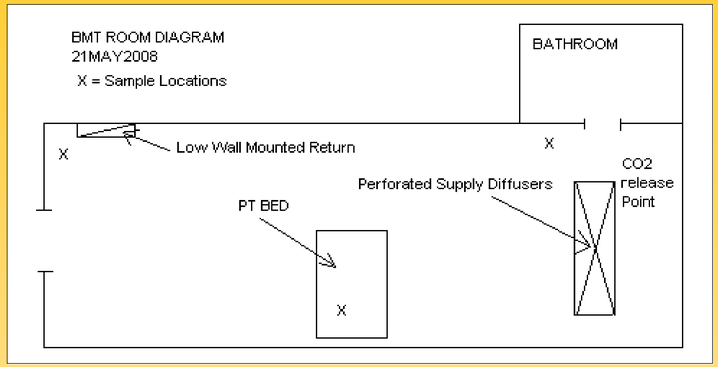
Learning objectives to be understood after reading this poster:

- Parameters will be identified for special ventilation rooms to be validated before occupancy in order to assure ventilation for infection control.
- Microbial sample methods for infection control will be identified.
- Microbial air and surface sampling interpretation of data will be provided.
- Independent test and balance sampling will be suggested to assure ventilation air exchanges will be demonstrated using carbon dioxide release.
- Particle transit time with droplet nuclei release sampling will be suggested to define supply and exhaust/return placement in patient rooms.

Interpretation

Air samples for fungi should demonstrate a rank order that demonstrates the lowest numbers from the comparison of spaces outside.

- This rank order applies to air and surface microbial counts
- Rank order for non cultured airborne particles (>0.5 µm) demonstrate lowest numbers in the best ventilation areas
- Air exchanges determined by carbon dioxide decay should be "close" to the test and balance room ventilation data
- The pressure differential should be greater than 2.5 Pascal's ideal at 7.0 Pascal's

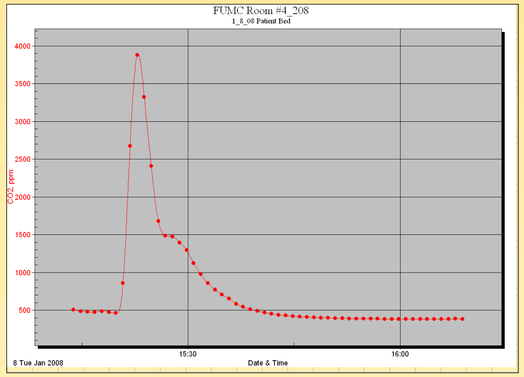


Commissioning Criteria Validation Methods and Parameters

Room	Volume	Supply	Return	TE	TR&E	XS	ΔP
5-507	1152	400	120	60	180	220	2.2
5-513	1248	410	155	95	250	160	5.1
5-514	1408	320	NA	85	NA	NA	4
5-519	1420	380	185	85	270	110	4.8

PE Air Changes CO2 vs. Test & Balance

Location	ACH	ACH	ACH	ACH (T&B)
Patient Bed	15.7	17.8	19.8	
Adj Hallway Door	14.8	15.5	16.1	
Adj Return Diffuser	15.7	16.4	17.2	
Average ACH =		16.6		20.8
Patient Bed	21.5	22.2	22.9	
Adj BR & AR Door	19.9	20.8	21.6	
Adj Return	16.8	18.2	19.7	
Average ACH =		20.4		19.6
Patient Bed	13.7	15.0	16.2	
Adj Hallway Door	13.7	14.4	15.2	
Adj Bathroom Door	14.0	14.6	15.2	
Average ACH =		14.7		13.7
Patient Bed	20.4	21.7	23.0	
Adj Hallway Door	17.5	19.5	21.6	
Adj Return in Room	18.5	20.2	21.8	
Average ACH =		20.5		16
Middle Room	13.1	13.5	13.9	
Adj Bathroom	13.2	13.5	13.8	
Adj Return	13.5	13.8	14.1	
Average ACH =		13.6		NA
Patient Bed	13.2	13.9	14.7	
Adj BR & AR Door	13.4	13.9	14.3	
Adj Return	12.6	13.0	13.4	
Average ACH =		13.6		NA



Commissioning Criteria Validation Methods and Parameters

Air Sampling *High Volume Sieve Impactor*	*Surface Sampling* *Contact (Rodac) Samples*	*ΔP* *Digital Pressure Gauge*	*Filtration* *(Particle Sampling)*	*ACH* *CO2 Monitor*
•500 Liters of Air •Incubation @ 25 and 37C •Appropriate Media •Aspergillus speciation •Inside/Outside Controls	•5 Samples/Room •4 Horizontal, 1Vertical •Rank Order Interpretation	•>2.5 Pascals •>.01 Inch WC	•>0.5µm particle reference •Indoor/Outdoor Ratio <1.0 •90% airborne particle reduction	•12-15 Air Changes Per Hour

Air Sample Results 25C

Location	CFU/M³	Primary Organisms	Plate count percentage
1 – 5-507	2	Cladosporium sp.	100
2 – 5-513		No Growth	
3 – 5-514	2	Aspergillus niger	100
4 – 5-519		No Growth	
5 – E309	2	Penicillium sp.	100
6 – E432		No Growth	
7 – E426		No Growth	
8 – E425		No Growth	
9 – 3162 (Inside Control)	6	Cladosporium spp. Aspergillus fumigatus	67 33
10 – 4167 (Inside Control)		No Growth	
11– Atrium (Inside Control)	180	Cladosporium spp. Penicillium spp. Curvularia sp Ulocladium sp. NSM	44 38 6 6 6
12 – Outside Control	460	Cladosporium spp. Alternaria spp. Penicillium spp. NSM Pithomyces sp.	69 13 9 7 2

Air Sample Results 37C

Location	CFU/M³	Primary Organisms	Plate count percentage
1 – 5-507		No Growth	
2 – 5-513		No Growth	
3 – 5-514		No Growth	
4 – 5-519		No Growth	
5 – E309		No Growth	
6 – E432		No Growth	
7 – E426		No Growth	
8 – E425		No Growth	
9 – 3162 (Inside Control)	2	Alternaria sp.	100
10 – 4167 (Inside Control)		No Growth	
11 – Atrium (Inside Control)		Trichoderma sp. Cladosporium spp.	" "
12 – Outside Control	40	Aspergillus niger Alternaria sp.	75 25

Contact Sample Results 25C

Location	CFU/plate	Primary Organisms	Plate count percentage
1 – E432 – Vinyl floor – Corner of room		No Growth	
2 – E432 – Vinyl floor – Under sink		No Growth	
3 – E432 – Vinyl floor – Adjacent door	3	Cladosporium spp. Drechslera sp.	67 33
4 – E432 – Bathroom floor – Adjacent sink	1	Eurotium sp.	100
5 – E432 – Wall – Adjacent door	9	Penicillium spp. Drechslera sp. Nigrospora sp.	78 11 11
6 – 3162 (Inside Control) – Floor – Corner of room	5	Cladosporium spp. Drechslera sp. Eurotium sp.	60 20 20
7 – 4167 (Inside Control) – Floor tile – Corner of room	8	Cladosporium spp. Alternaria spp. Epicoccum sp. NSM	38 38 12 12
8 – Atrium (Inside Control) – Floor tile – Adjacent reception desk	22	Cladosporium spp. Alternaria spp. Epicoccum sp. NSM	45 27 14 14
9 – Outside Control – Sidewalk	>50	Cladosporium spp. Alternaria spp. Fusarium spp. Epicoccum sp. Penicillium spp. NSM	* *

Contact Sample Results 37C

Location	CFU/plate	Primary Organisms	Plate count percentage
1 – E432 – Vinyl Floor – Corner of room		No Growth	
2 – E432 – Vinyl floor – Under sink		No Growth	
3 – E432 – Vinyl floor – Adjacent sink		No Growth	
5 – E432 – Countertop – Adjacent sink		No Growth	
6 – E432 – Phillips monitor – Back of panel	6	Cladosporium spp. Aspergillus niger NSM	33 33 33
7 – ED 1.012B Room 8 – (Inside Control) – Floor – Corner of room	2	Aspergillus niger Trichoderma sp.	50 50
8 – Atrium (Inside Control) – Floor tile – Adjacent reception desk	1	Aspergillus niger	100
9 – Outside Control – Sidewalk (concrete) – Adjacent Bus stop	8	Cladosporium spp. Aspergillus niger Aspergillus fumigatus NSM	25 25 25 25

Conclusion

- Validation of design specifications using instruments for determining air exchanges, pressure, and air filtration (especially in PE and Airborne Infection Isolation rooms).
- Comparison rank order microbial levels lowest in Protective Environment.
- Independent verification of air exchanges ensures test and balance accuracy.
- Baseline data parameters comprise Infection Control Commissioning Validation.