

KING FAHD MEDICAL CITY

Path-Away® Test Project




مؤسسة أجواء السعودية لتقنيات البيئة
SAUDI AJWAA ENVIRONMENTAL TECHNOLOGIES EST.




Purpose

The purpose of the project was to introduce the product and system for Path-Away® Solution as a natural based alternative for the control of Hospital Acquired Infections.

A decorative graphic consisting of several parallel white lines of varying lengths, slanted upwards from left to right, located in the bottom right corner of the slide.

Methodology

1. Air and surface samples were to be collected
 2. Fungi and/or bacteria were to be identified and quantified
 3. Backup samples for laboratory culture collected by hospital staff
 4. AHUs were to be decontaminated using Path-Away®
 5. Re-sampling was to be conducted to determine efficacy
 6. Most samples were sent to USA for analysis
- 
- A decorative graphic consisting of several parallel white lines of varying lengths, slanted diagonally from the bottom right towards the top right, located in the lower right quadrant of the slide.

Air Handling Units

Several AHUs were chosen based on areas served and size



Typical AHUs using chilled water

DX System. Brain 2



Chilled Water AHU's



Bag Filters

Metal Pre-Filters



Brain 2 AHU

Unit

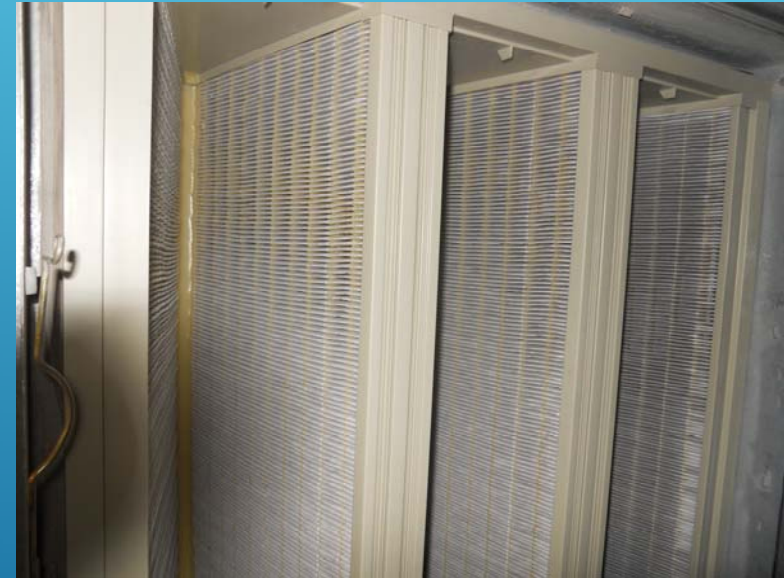


Pre Filters



Rust

HEPA Final Filters



DX Carrier unit for Brain 2 Operating Theatre

Before Disinfection



From Bag Filters

Some material inside
blower wheel



Air Sample Collection

We utilized a ZEFON Bio-Pump® and Zefon impact cassettes.

The pump was factory calibrated to draw 15 lpm and we drew a 10 minute sample for a total of 150 L of ambient air for analysis



AHU Unit Disinfection



Fogging bag filters

Fogging the cooling coil



Swab Samples From Filters Taken Before Any Fogging

1. PHA17AH01: *Chaetomium, Aspergillus, Penicillium*
2. PHA08CF01: *Alternaria, Penicillium, Aspergillus, Ulocladium*
3. G11AH01: *Cladosporium, Penicillium, Aspergillus, Periconia*
4. Brain 2 Pre Filter: *Aspergillus, Drechslera/Bipolaris, Penicillium*
5. Brain 2 HEPA Filter: *Penicillium, Aspergillus*

Particulate Analysis

In addition to analyzing for fungi, spores and/or bacteria we analyzed for non viable particulate matter including:

1. Synthetic fibers
2. Cotton fibers
3. Glass fibers
4. Skin cells
5. Hair
6. Insect parts
7. Pollen
8. Plant parts

Particulate Analysis Results

1. Synthetic fibers: Small amounts but all $<100/m^3$
2. Cotton fibers: Small amounts but all $<850/m^3$
3. Glass fibers: None found
4. Hair: None found
5. Insect parts: None found
6. Pollen: None found
7. Plant parts: None found
8. Skin cells: Ranged from 0 (Pedi Oncology) to 8747 (Ward 2).
I would not worry much about this wide range as it is not uncommon to see these numbers well over $10,000/m^3$.

Pre Path-Away® Samples

Outdoor

An outdoor sample was collected to determine local ambient counts at the time of sampling to establish a baseline from which to compare inside results.

<i>Pencillium</i>	7/m ³
<i>Aspergillus</i>	7/m ³
<i>Smuts, Periconia, myxomycetes</i>	13/m ³

Brain 2

Pre Path-Away®

Clean

Post Path-Away®

Clean

Outside Room 318

Outdoor

Penicillium	7
Aspergillus	7
Chaetomium	0
Cladosporium	0

PICU 2 / 318 Pre-Path-Away®

Penicillium	27*
Aspergillus	27*
Chaetomium	7*
Cladosporium	7*

PICU 2 / 318 Post-Path-Away®

100% Clean

Pediatric Oncology

Outdoor

Penicillium	7
Aspergillus	7
Periconia	13

Pedi Oncology Pre-Path-Away®

Penicillium	13*
Aspergillus	13*

Pedi Oncology Post-Path-Away®

100% Clean

Desk Area Ward 2

Outdoor

Penicillium	7
Aspergillus	7
Periconia	13

Desk Area Ward 2 Pre Path-Away®

Penicillium	7
Aspergillus	7
Alternaria	7*
Periconia	7

Desk Area Ward 2 Post Path- Away®

Basidiospores 100*

PICU Desk Area 1

Outdoor

Penicillium	7
Aspergillus	7
Periconia	13

PICU Desk Area 1 Pre Path-Away®

Penicillium	13*
Aspergillus	13*
Periconia	7
Cladosporium	13*

PICU Desk Area 1 Post Path-Away®

100% Clean

PICU Area 2

Outdoor

Penicillium	7
Aspergillus	7
Periconia	13

PICU Area 2 Pre Path-Away®

Penicillium	33*
Aspergillus	33*
Cladosporium	7*

PICU Area 2 Post Path-Away®

100% Clean

Outside ISO in Area 2

Outdoor

Penicillium	7
Aspergillus	7
Periconia	13

Outside ISO Pre Path-Away®

Penicillium	13*
Aspergillus	13*
Cladosporium	7*
Basidiospores	7*

Outside ISO Post Path-Away®

Basidiospores	7*
---------------	----

Cultured Swab Samples

This sample was collected from the surface of a cooling coil in an air handler.

It was a simple collection to determine if any bacteria were present and to try to see if they ended up in the breathable air space.

AHU #PHA080CF01 Cooling coil surface taken on exit air side

Bacillus species 250 CFU/in²

Cultured Samples

Pre Path-Away®

Door handle	175 CFU/in ² (Staphylococcus)
Bed PICU 1	2 CFU/in ²
PICU A #7	2 CFU/in ²

Post Path-Away®

Door handle	0 CFU/in ²
Bed PICU 1	2 CFU/in ²
PICU #7	0 CFU/in ²

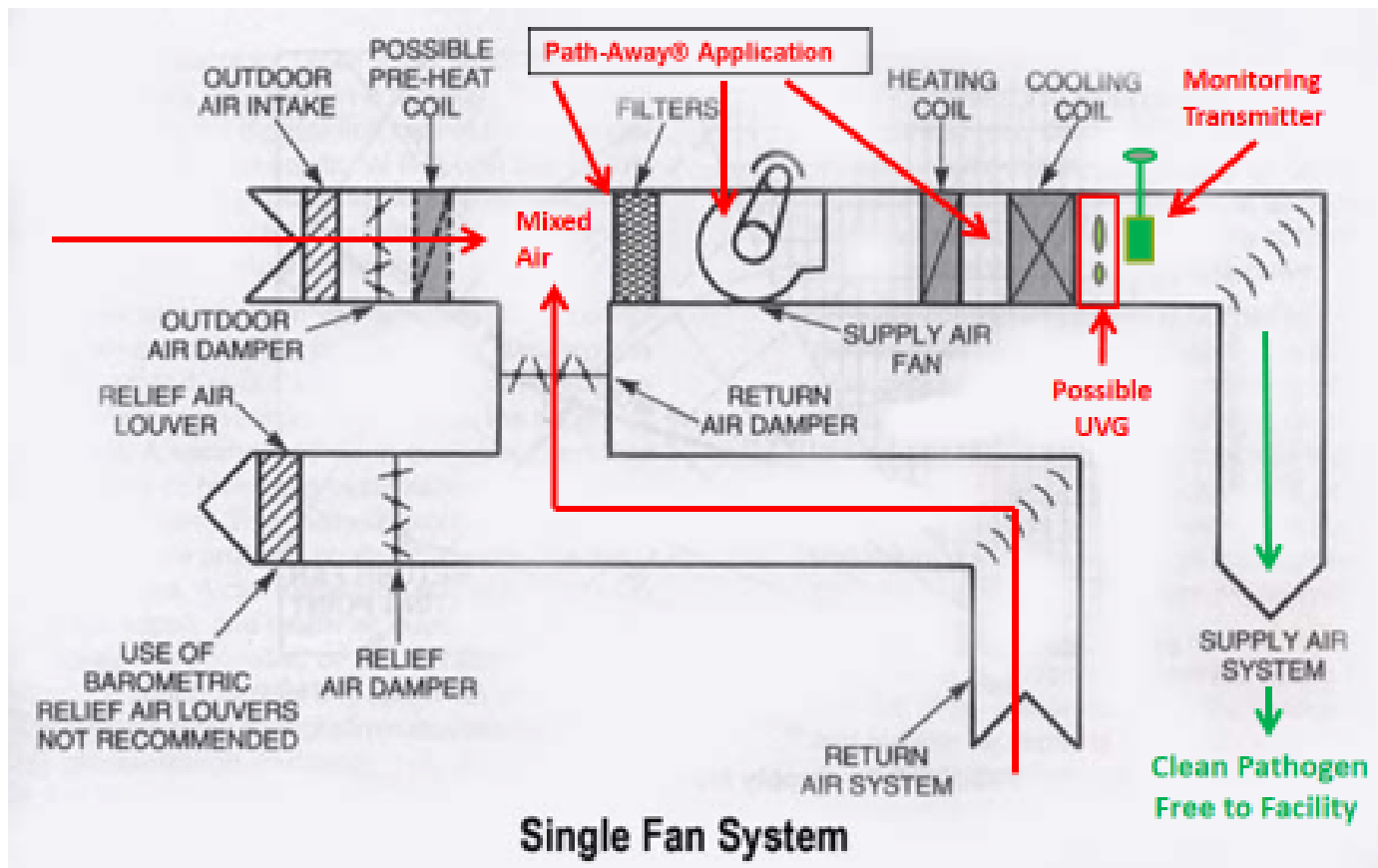
Conclusions

1. The hospital is a well run facility environmentally
2. This very limited assessment proves the efficacy of the product.
3. Product application can be adapted to automatic mode
4. You should consider replacing alcohol based hand products
5. The maintenance engineer has a good program
6. There are some issues that can be made better

Recommendations Facility

1. Review Infection Control Policy for HVAC systems
(Saudi Ajwaa can do this)
2. Implement HVAC fogging as part of weekly maintenance
3. Have Saudi Ajwaa do random sampling
4. Schedule regular duct cleaning
5. Install automatic systems on air handlers by priority

The M3 System®



Copyright 2014 GICCLLC / SAET

Recommendations For Hand Sanitizing

A survey recently published in a medical industry journal indicated that out of 231 Health care Workers who used Alcohol Based Hand Rub:

- 36.4% suffered dry skin
- 22.5% reported dry, red and chapped skin
- 15.6% reported eczema
- 12.1% reported contact dermatitis

Path-Away® is 100% alcohol free

Plan of Action



مؤسسة أجواء السعودية لتقنيات البيئة
SAUDI AJWAA ENVIRONMENTAL TECHNOLOGIES EST.



Copyright 2014 GICCLC / SAET

King Fahad Medical City Riyadh, KSA

19 March, 2014

This report contains preliminary information on samples collected on 9 March, 2014. Non-viable swab and air samples are included. Several samples were collected for analysis through culturing for bacteria. Those samples are not included in this report but will be supplied as an addendum when available.

This preliminary report also contains data on what are referred to as “OP” or “Other Particles” including:

I.	Synthetic fibers	93	ISO 1 and Pedi Oncology
II.	Cotton fibers	827	Ward 2
III.	Glass fibers	0	
IV.	Skin cells	8747	Ward 2
V.	Hair	0	
VI.	Insect parts	0	
VII.	Pollen	0	
VIII.	Plant parts	0	

The high numbers of skin cells are typical and really are small in comparison to what we normally see elsewhere. It should be noted that identification of these items is informational only but can help in identification of HVAC system filtration problems and recommendations for upgrades.

The initial overall impression of the facility is that it is a state of the art facility staffed by experts in their particular areas of responsibilities. The facility is undergoing renovation and additions in various areas. We did not have an opportunity to review or critique the current Infection Control and/or Environmental policies.

This initial assessment included several areas and departments serviced by designated HVAC units. The methodology employed was to pre-sample various areas by means of direct contact swab sampling and non-viable air impact sampling. Once the initial sampling was conducted the HVAC units servicing the designated areas were decontaminated by means of a manually operated micro-fogger using Path-Away® Anti-Pathogenic Solution. No review of drawings to indicate air distribution sizes or lengths was made available. Product amount was made based solely on the physical dimensions of the AHUs and coil size. Appropriate measure was taken to

Certifying The Quality of Your Indoor Environment

ensure enough product was applied but again, this was done manually without benefit of a plan review.

Findings Pre Path-Away® application

Air Samples

Outdoor baseline ambient:

1. Penicillium 7/m³
2. Aspergillus 7/m³
3. Smuts, Periconia, myxomycetes 13/m³
4. Cladosporium 0/m³
5. Basidiospores 0/m³

A. **Brain 2, pre theater room:** The sample was clean of any identifiable fungi.

B. **Brain 2, operating theatre:** The sample was clean of any identifiable fungi.

C. **Pedi oncology:**

- Hyphal elements 7 per cubic meter
- Penicillium/Aspergillus 13 per cubic meter * (indicates ambient+)

D. **Desk Area 1:**

- Cladosporium 13 per cubic meter *
- Hyphal elements 7 per cubic meter
- Penicillium/Aspergillus group 13 per cubic meter *
- Smuts,Periconia,myxomycetes 7 per cubic meter

E. **PICU B:**

- Cladosporium 7 per cubic meter
- Penicillium/Aspergillus group 33 per cubic meter *

F: **PICU A:**

- Hyphal elements 7 per cubic meter
- Penicillium/Aspergillus group 7 per cubic meter

G: **Ward 2:**

- Alternaria 7 per cubic meter
- Hyphal elements 7 per cubic meter
- Penicillium/Aspergillus group 7 per cubic meter
- Smuts,Periconia,myxomycetes 7 per cubic meter

H: ISO 1:

Basidiospores	7 per cubic meter *
Cladosporium	7 per cubic meter *
Hyphal elements	7 per cubic meter
Penicillium/Aspergillus group	13 per cubic meter *

Findings Post Path-Away® Application Air Samples

A: **Outside Room 318:** Clean with no indication of anything.

B: Outside ISO room at desk area:

Basidiospores7 per cubic meter *

NOTE: This location is approximately 7-10 meters from Sample H above. The *Basidiospore* count remained consistent while the others were eliminated completely.

D: **Pedi Oncology at desk:** Clean with no indication of anything.

E: **PICU at desk section 2:** Clean with no indication of anything.

G: **Brain 2 in theatre:** Clean with no indication of anything.

Direct Examination Only

Swab samples direct from AHUs.

These samples were collected inside the air handlers to identify any potential fungi. This information is critical for determination of filter efficiency and preventative maintenance scheduling for changing them.

1. AHU# PHA17AH01 Bag Filter Pre-Path-Away:

- Occasional Aspergillus conidiophores seen 1-5 per cover slip
- Moderate Penicillium/Aspergillus group spores seen 1 per 5 fields
- Few hyphal elements seen 5 per cover slip
- Occasional Chaetomium spores seen 1-5 per cover slip

2. Brain 2 Pre-Filter Pre Path-Away

- a. Few Penicillium/Aspergillus group spores seen 5 per cover slip
- b. Few hyphal elements seen 5 per cover slip
- c. Occasional Drechslera/Bipolaris group spores seen 1-5 per cover slip
- d. Occasional Aspergillus conidiophores seen 1-5 per cover slip

3. AHU# PHA08CF01 Pre-Path-Away

- a. Few Alternaria spores seen 5 per cover slip
- b. Few Ulocladium spores seen 5 per cover slip
- c. Few Penicillium/Aspergillus group spores seen 5 per cover slip
- d. Few hyphal elements seen 5 per cover slip

4. Brain 2 HEPA Pre-Path-Away

- a. Occasional clear brown spores seen 1-5 per cover slip
- b. Occasional Penicillium/Aspergillus group spores seen 1-5 per cover slip

5. General Oncology Filter AHU# G11AH01

- a. Few Cladosporium spores seen 5 per cover slip
- b. Occasional smuts,Periconia,myxomycetes spores seen 1-5 per cover slip
- c. Moderate Penicillium/Aspergillus group spores seen 1 per 5 fields
- c. Few hyphal elements seen 5 per cover slip
- d. Occasional clear brown spores seen 1-5 per cover slip

Swab Samples Cultured for Bacteria

- 1. Door handle ISO Pre Path-Away 175 CFU/in2 Staphylococcus
- 2. Door handle ISO Post Path-Away No Growth
- 3. PICU Bed #1 Pre Path-Away 2 CFU/in2
- 4. PICU Bed #1 Post Path-away..... No Change
- 5. PICU A #7 Pre Path-Away 2 CFU/in2
- 6. PICU A #7 Post Path-Away No Growth

Air Handler #AHUPHA080CF01 Cooling Coil Surface Exit Side

This sample was collected from the surface of the coil on the exit air side.

Two significant items were identified:

- | | | |
|--|-------------|----------------------------|
| 1. Bacillus species | 250 CFU/in2 | Potential Source |
| 2. Fermentative gram-negative rods | 2 CFU/in2 | Environmental |
| | | Environment/Moisture/Fecal |

NOTES:

- 1: All of the samples collected from filters, pre filters and bag filters indicated the presence of Fungi.
- 2: The typical fungi identified in the conditioned space mirrored that found in the AHUs.
- 3: The specialized unit in Brain 2 has filtration that appears to be 100% effective.
- 4: Filtration is effective but not 100% effective in elimination of fungi tracking to the conditioned patient areas.

Photos



Typical Chilled Water HVAC AHU's



Certifying The Quality of Your Indoor Environment

Brain 2 Unit. Carrier DX System



Bag Filters in AHU

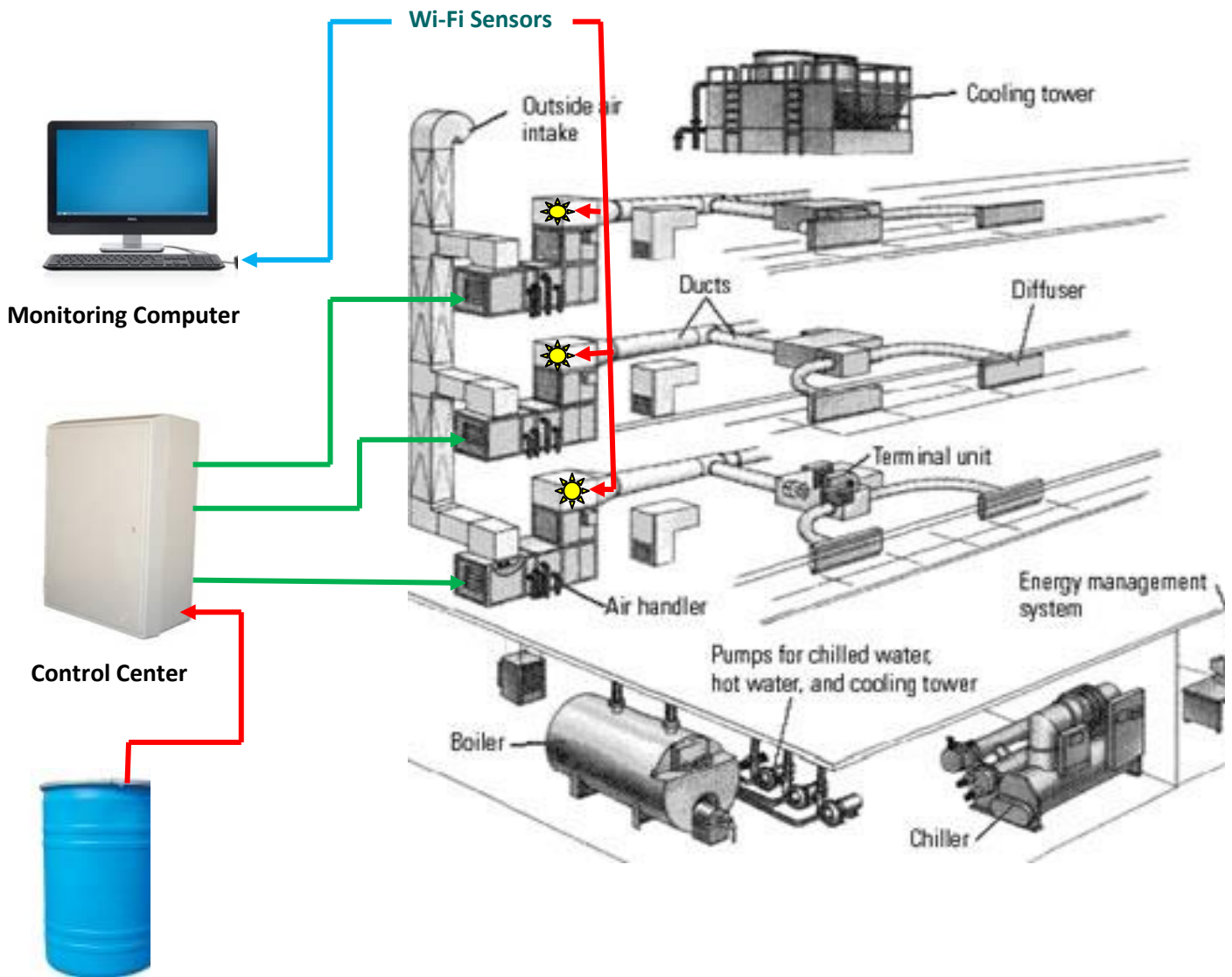


Mesh Pre Filters in AHU

Certifying The Quality of Your Indoor Environment

Path-Away® M-3 Anti-Pathogen

Protection and Early Warning System



Path-Away Anti-Pathogenic Solution

System description: Path-Away is fed to our central distribution control center. The center is a proprietary system that distributes product to many AHUs simultaneously with the ability to control the amount and frequency of Path-Away distribution. The Path-Away is micro-vaporized into the air stream. With multiple air changes per hour of room conditioned air, pathogens have multiple chances to come in contact with the anti-pathogenic solution and are eliminated. The system has the ability to monitor variables such as temperature, humidity, CO, CO2 and particulates. Adjustments can be made by Wi-Fi and all data is transmitted to a central computer location for recording and storing.

The control panel system as well as the Path-Away are proprietary, trademark protected products and are flexible for use in hospitals and medical facilities as well as office buildings, school, industrial buildings and food processing plants of any size.

We will assist with engineering and system installation and training.

Arthur V. Martin Associates
PO Box 49747
Charlotte, NC 28277
Attn: Art Martin

Date Collected: 03/09/2014
Date Received: 03/12/2014
Date Analyzed: 03/12/2014
Date Reported: 03/17/2014
Project ID: 14003834

Project : King Fahad Medical City. Riyadh, KSA
Condition of Sample(s) Upon Receipt: Acceptable

Page 1 of 11

Client Sample Number: **SW-1**

Lab Sample Number: **14003834-010**

Sample Location: **Door Handle Pre Path-Away**

Test Requested: **1006 Wipe, Total BACTERIAL Count w/IDs: SOP 2.3**

Results: **175 cfu/in²**

Area: **4 (in²)**

MRL: **25**

Organism(s) Isolated:	Raw Count	cfu/in ²	% Total	Possible Reservoirs
Coag-negative Staphylococcus species	7	175	100	Human
	7	175	~100%	

Client Sample Number: **SW-2**

Lab Sample Number: **14003834-011**

Sample Location: **Bed #1 PICU POST Path-Away**

Test Requested: **1006 Wipe, Total BACTERIAL Count w/IDs: SOP 2.3**

Results: **No Growth**

Area: **4 (in²)**

Client Sample Number: **SW-3**

Lab Sample Number: **14003834-012**

Sample Location: **PICU A #7 Pre Path-Away**

Test Requested: **1006 Wipe, Total BACTERIAL Count w/IDs: SOP 2.3**

Results: **2 cfu/in²**

Area: **4 (in²)**

MRL: **2**

Organism(s) Isolated:	Raw Count	cfu/in ²	% Total	Possible Reservoirs
Bacillus species	1	2	100	Environment
	1	2	~100%	

Client Sample Number: **SW-4**

Lab Sample Number: **14003834-013**

Sample Location: **Door Handle Post Path-Away**

Test Requested: **1006 Wipe, Total BACTERIAL Count w/IDs: SOP 2.3**

Results: **No Growth**

Area: **4 (in²)**

Arthur V. Martin Associates
PO Box 49747
Charlotte, NC 28277
Attn: Art Martin

Date Collected: 03/09/2014
Date Received: 03/12/2014
Date Analyzed: 03/12/2014
Date Reported: 03/17/2014

Project : King Fahad Medical City. Riyadh, KSA

Project ID: 14003834

Condition of Sample(s) Upon Receipt: Acceptable

Page 2 of 11

Client Sample Number: **SW-5**

Lab Sample Number: **14003834-014**

Sample Location: **PICU Bed #1 PRE-Path-Away**

Test Requested: **1006 Wipe, Total BACTERIAL Count w/IDs: SOP 2.3**

Results: **2 cfu/in²**

Area: **4 (in²)**

MRL: **2**

Organism(s) Isolated:	Raw Count	cfu/in ²	% Total	Possible Reservoirs
Bacillus species	1	2	100	Environment
	1	2	~100%	

Client Sample Number: **SW-6**

Lab Sample Number: **14003834-015**

Sample Location: **PICC A #7 Post Path-Away**

Test Requested: **1006 Wipe, Total BACTERIAL Count w/IDs: SOP 2.3**

Results: **2 cfu/in²**

Area: **4 (in²)**

MRL: **2**

Organism(s) Isolated:	Raw Count	cfu/in ²	% Total	Possible Reservoirs
Bacillus species	1	2	100	Environment
	1	2	~100%	

Client Sample Number: **SW-7**

Lab Sample Number: **14003834-016**

Sample Location: **AHU #PHA080CF01 Coil Pre-Path-Away**

Test Requested: **1006 Wipe, Total BACTERIAL Count w/IDs: SOP 2.3**

Results: **252 cfu/in²**

Area: **4 (in²)**

MRL: **250**

Organism(s) Isolated:	Raw Count	cfu/in ²	% Total	Possible Reservoirs
Bacillus species	1	250	99	Environment
fermentative gram-negative rod	1	2	<1	Env/Moisture/Fecal
	2	252	~100%	

Arthur V. Martin Associates
PO Box 49747
Charlotte, NC 28277
Attn: Art Martin

Date Collected: 03/09/2014
Date Received: 03/12/2014
Date Analyzed: 03/12/2014
Date Reported: 03/17/2014
Project ID: 14003834

Project : King Fahad Medical City. Riyadh, KSA
Condition of Sample(s) Upon Receipt: Acceptable

Page 3 of 11

Client Sample Number: **SW-8**
Sample Location: **AHU# PHA17AH01 Bag Filter Pre-Path-Away**
Test Requested: **1051-Tape, 24hr TAT Direct: SOP 3.7**

Lab Sample Number: **14003834-017**

Results:	Laboratory Observation
Occasional Aspergillus conidiophores seen	1-5 per cover slip
Occasional Chaetomium spores seen	1-5 per cover slip
Few hyphal elements seen	5 per cover slip
Moderate Penicillium/Aspergillus group spores seen	1 per 5 fields

Debris Rating 3

Comments: **Large amount of particulate observed.**

Client Sample Number: **SW-9**
Sample Location: **Brain 2 Pre-Filter Pre Path-Away**
Test Requested: **1051-Tape, 24hr TAT Direct: SOP 3.7**

Lab Sample Number: **14003834-018**

Results:	Laboratory Observation
Occasional Aspergillus conidiophores seen	1-5 per cover slip
Occasional Drechslera/Bipolaris group spores seen	1-5 per cover slip
Few hyphal elements seen	5 per cover slip
Few Penicillium/Aspergillus group spores seen	5 per cover slip

Debris Rating 3

Client Sample Number: **SW-10**
Sample Location: **AHU# PHA08CF01 Pre-Path-Away**
Test Requested: **1051-Tape, 24hr TAT Direct: SOP 3.7**

Lab Sample Number: **14003834-019**

Results:	Laboratory Observation
Few Alternaria spores seen	5 per cover slip
Few hyphal elements seen	5 per cover slip
Few Penicillium/Aspergillus group spores seen	5 per cover slip
Few Ulocladium spores seen	5 per cover slip

Debris Rating 3

Arthur V. Martin Associates
PO Box 49747
Charlotte, NC 28277
Attn: Art Martin

Date Collected: 03/09/2014
Date Received: 03/12/2014
Date Analyzed: 03/12/2014
Date Reported: 03/17/2014
Project ID: 14003834

Project : King Fahad Medical City. Riyadh, KSA
Condition of Sample(s) Upon Receipt: Acceptable

Page 4 of 11

Client Sample Number: **SW-11**

Lab Sample Number: **14003834-020**

Sample Location: **Brain 2 HEPA Pre-Path-Away**

Test Requested: **1051-Tape, 24hr TAT Direct: SOP 3.7**

Results:

Laboratory Observation

Occasional clear brown spores seen	1-5 per cover slip
Occasional Penicillium/Aspergillus group spores seen	1-5 per cover slip

Debris Rating 3

Client Sample Number: **SW-12**

Lab Sample Number: **14003834-021**

Sample Location: **General Oncology Filter AHU# G11AH01**

Test Requested: **1051-Tape, 24hr TAT Direct: SOP 3.7**

Results:

Laboratory Observation

Few Cladosporium spores seen	5 per cover slip
Occasional clear brown spores seen	1-5 per cover slip
Few hyphal elements seen	5 per cover slip
Moderate Penicillium/Aspergillus group spores seen	1 per 5 fields
Occasional smuts,Periconia,myxomycetes spores seen	1-5 per cover slip

Debris Rating 3

Arthur V. Martin Associates
PO Box 49747
Charlotte, NC 28277
Attn: Art Martin

Date Collected: 03/09/2014
Date Received: 03/12/2014
Date Analyzed: 03/12/2014
Date Reported: 03/17/2014
Project ID: 14003834

Project : King Fahad Medical City. Riyadh, KSA
Condition of Sample(s) Upon Receipt: Acceptable

Page 5 of 11

Non-Viable 24hr TAT Spore: SOP 3.8

Client Sample Number	20243461				20243448			
Sample Location	Outdoor				Brain 2 Pre Room- Path-Away			
Sample Volume (L)	150				150			
Lab Sample Number	14003834-001				14003834-002			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
Organism Name	-	-	-	-	-	-	-	-
Penicillium/Aspergillus group	1	7	35	-	-	-	-	-
smuts,Periconia,myxomycetes	2	13	65	-	-	-	-	-
	Debris Rating 3*				Debris Rating 2*			
Comments					No fungal spores seen.			
	Analytical Sensitivity: 7				Analytical Sensitivity:			
Total *See Footnotes	3	20	~100%	-	-	-	-	-

Arthur V. Martin Associates
PO Box 49747
Charlotte, NC 28277
Attn: Art Martin

Date Collected: 03/09/2014
Date Received: 03/12/2014
Date Analyzed: 03/12/2014
Date Reported: 03/17/2014

Project : King Fahad Medical City. Riyadh, KSA

Project ID: 14003834

Condition of Sample(s) Upon Receipt: Acceptable

Page 6 of 11

Non-Viable 24hr TAT Spore: SOP 3.8

Client Sample Number	20243427				20241762			
Sample Location	Brain 2 Operating Theatre Pre Path-Away				Pedi Oncology Pre Path-Away			
Sample Volume (L)	150				150			
Lab Sample Number	14003834-003				14003834-004			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
Organism Name	-	-	-	-	-	-	-	-
hyphal elements	-	-	-	-	1	7	35	-
Penicillium/Aspergillus group	-	-	-	-	2	13	65	-
	Debris Rating 2*				Debris Rating 3*			
Comments	No fungal spores seen.							
	Analytical Sensitivity:				Analytical Sensitivity: 7			
Total *See Footnotes	-	-	-	-	3	20	~100%	-

Arthur V. Martin Associates
PO Box 49747
Charlotte, NC 28277
Attn: Art Martin

Date Collected: 03/09/2014
Date Received: 03/12/2014
Date Analyzed: 03/12/2014
Date Reported: 03/17/2014
Project ID: 14003834

Project : King Fahad Medical City. Riyadh, KSA
Condition of Sample(s) Upon Receipt: Acceptable

Page 7 of 11

Non-Viable 24hr TAT Spore: SOP 3.8

Client Sample Number	20243470				20243486			
Sample Location	Desk Area 1 Pre Path-Away				PICU B Pre Path-Away			
Sample Volume (L)	150				150			
Lab Sample Number	14003834-005				14003834-006			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
Cladosporium	2	13	33	-	1	7	18	-
hyphal elements	1	7	18	-	-	-	-	-
Penicillium/Aspergillus group	2	13	33	-	5	33	83	-
smuts,Periconia,myxomycetes	1	7	18	-	-	-	-	-
	Debris Rating 3*				Debris Rating 3*			
	Analytical Sensitivity: 7				Analytical Sensitivity: 7			
Total *See Footnotes	6	40	~100%	-	6	40	~100%	-

Arthur V. Martin Associates
 PO Box 49747
 Charlotte, NC 28277
 Attn: Art Martin

 Date Collected: 03/09/2014
 Date Received: 03/12/2014
 Date Analyzed: 03/12/2014
 Date Reported: 03/17/2014
 Project ID: **14003834**
Project : King Fahad Medical City. Riyadh, KSA

Condition of Sample(s) Upon Receipt: Acceptable

Page 8 of 11

Non-Viable 24hr TAT Spore: SOP 3.8

Client Sample Number	20243466				20243458			
Sample Location	PICU A Pre Path-Away				Ward 2 Pre Path-Away			
Sample Volume (L)	150				150			
Lab Sample Number	14003834-007				14003834-008			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
Alternaria	-	-	-	-	1	7	25	-
hyphal elements	1	7	50	-	1	7	25	-
Penicillium/Aspergillus group	1	7	50	-	1	7	25	-
smuts,Periconia,myxomycetes	-	-	-	-	1	7	25	-
	Debris Rating 3*				Debris Rating 3*			
	Analytical Sensitivity: 7				Analytical Sensitivity: 7			
Total *See Footnotes	2	14	~100%	-	4	28	~100%	-

Non-Viable 24hr TAT Spore: SOP 3.8

Client Sample Number	20243440				20241610			
Sample Location	PICU Desk in Area 2 Pre-Path-Away				Outside Room 318 Post-Path-Away			
Sample Volume (L)	150				150			
Lab Sample Number	14003834-009				14003834-022			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
Organism Name	-	-	-	-	-	-	-	-
basidiospores	1	7	100	-	-	-	-	-
	Debris Rating 3*				Debris Rating 3*			
Comments					No fungal spores seen. Very light trace.			
	Analytical Sensitivity: 7				Analytical Sensitivity:			
Total *See Footnotes	1	7	~100%	-	-	-	-	-

Arthur V. Martin Associates
 PO Box 49747
 Charlotte, NC 28277
 Attn: Art Martin

 Date Collected: 03/09/2014
 Date Received: 03/12/2014
 Date Analyzed: 03/12/2014
 Date Reported: 03/17/2014

Project : King Fahad Medical City. Riyadh, KSA
Project ID: 14003834

Condition of Sample(s) Upon Receipt: Acceptable

Page 10 of 11

Non-Viable 24hr TAT Spore: SOP 3.8

Client Sample Number	20243424				20243450			
Sample Location	PICU #2 Area Outside #318 PRE-Path-Away				Brain 2 Post Path-Away			
Sample Volume (L)	150				150			
Lab Sample Number	14003834-027				14003834-028			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
Organism Name	-	-	-	-	-	-	-	-
Chaetomium	1	7	13	-	-	-	-	-
Cladosporium	1	7	13	-	-	-	-	-
colorless	2	13	24	-	-	-	-	-
Penicillium/Aspergillus group	4	27	50	-	-	-	-	-
	Debris Rating 3*				Debris Rating 1*			
Comments					No fungal spores seen. Very light trace.			
	Analytical Sensitivity: 7				Analytical Sensitivity:			
Total *See Footnotes	8	54	~100%	-	-	-	-	-

Arthur V. Martin Associates
 PO Box 49747
 Charlotte, NC 28277
 Attn: Art Martin

Date Collected: 03/09/2014
 Date Received: 03/12/2014
 Date Analyzed: 03/12/2014
 Date Reported: 03/17/2014

Project : King Fahad Medical City. Riyadh, KSA

Project ID: 14003834

Condition of Sample(s) Upon Receipt: Acceptable

Page 11 of 11

Footnotes and Additional Report Information

Debris Rating Table

1	Minimal (<5%) particulate present	Reported values are minimally affected by particulate load.
2	5% to 25% of the trace occluded with particulate	Negative bias is expected. The degree of bias increases directly with the percent of the trace that is occluded.
3	26% to 75% of the trace occluded with particulate	Negative bias is expected. The degree of bias increases directly with the percent of the trace that is occluded.
4	75% to 90% of the trace occluded with particulate	Negative bias is expected. The degree of bias increases directly with the percent of the trace that is occluded.
5	Greater than 90% of the trace occluded with particulate	Quantification not possible due to large negative bias. A new sample should be collected at a shorter time interval or other measures taken to reduce particulate load.

1. Penicillium/Aspergillus group spores are characterized by their small size, round to ovoid shape, being unicellular, and usually colorless to lightly pigmented. There are numerous genera of fungi whose spore morphology is similar to that of the Penicillium/Aspergillus type. Two common examples would be Paecilomyces and Acremonium. Although the majority of spores placed in this group are Penicillium, Aspergillus, or a combination of both. Keep in mind that these are not the only two possibilities.

2. Ascospores are sexually produced fungal spores formed within an ascus. An ascus is a sac-like structure designed to discharge the ascospores into the environment, e.g. Ascobolus.

3. Basidiospores are typically blown indoors from outdoors and rarely have an indoor source. However, in certain situations a high basidiospore count indoors may be indicative of a wood decay problem or wet soil.

4. The Smut, Periconia, Myxomycete group is composed of three different groups whose spores have similar morphologies. Smuts are plant pathogens, Periconia is a relatively uncommon mold indoors, and Myxomycetes are not fungi but slime molds. Although these organisms do not typically proliferate indoors, their spores are potentially allergenic.

5. The colorless group contains colorless spores which were unidentifiable to a specific genus. Examples of this group include Acremonium, Aphanocladium, Beauveria, Chrysosporium, Engyodontium microconidia, yeast, some arthrospores, as well as many others.

6. Hyphae are the vegetative mode of fungi. Hyphal elements are fragments of individual Hyphae. They can break apart and become airborne much like spores and are potentially allergenic. A mass of hyphal elements is termed the mycelium. Hyphae in high concentration may be indicative of colonization.

7. Dash (-) in this report, under raw count column means 'not detected (ND)'; otherwise 'not applicable' (NA).

8. The positive-hole correction factor is a statistical tool which calculates a probable count from the raw count, taking into consideration that multiple particles can impact on the same hole; for this reason the sum of the calculated counts may be less than the positive hole corrected total.

9. Due to rounding totals may not equal 100%.

10. Minimum Reporting Limits (MRL) for BULKs, DUSTs, SWABS, and WATER samples are a calculation based on the sample size and the dilution plate on which the organism was counted. Results are a compilation of counts taken from multiple dilutions and multiple medias. This means that every genus of fungi or bacteria recovered can be counted on the plate on which it is best represented.

11. If the final quantitative result is corrected for contamination based on the blank, the blank correction is stated in the sample comments section of the report.

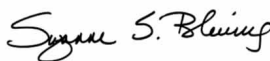
12. Analysis conducted on non-viable spore traps is completed using Indoor Environmental Standards Organization (IESO) Standard 2210.

13. The results in this report are related to this project and these samples only.

14. For samples with an air volume of < 100L, the number of significant figures in the result should be considered (2) two. For samples with air volumes between 100-999L, the number of significant figures in the result should be considered (3) three. For example, a sample with a result of 55,443 spr/m³ from a 75L sample using significant figures should be considered 55,000. The same result of 55,443 from a 150L sample using significant figures should be considered 55,400 spr/ m³.

Terminology Used in Direct Exam Reporting

Conidiophores are a type of modified hyphae from which spores are born. When seen on a surface sample in moderate to numerous concentrations they may be indicative of fungal growth.



Suzanne S. Blevins, B.S., SM (ASCP)
 Laboratory Director

**Certificate of Laboratory
Analysis**
EMLAP# 102977

Arthur V. Martin Associates
PO Box 49747
Charlotte, NC 28277
Attn: Art Martin

Client Project Name: King Fahad Medical City
Riyadh, KSA
Project 14003834

Date Collected 3/9/2014
Date Received 3/12/2014
Date Analyzed 3/12/2014
Date Reported 3/13/2014
Page 1 of 4

Particulate Analysis

Client Sample Number	20243461			20243448			20243427			20241762		
Sample Location	Outdoor			Brain 2 Pre Room - Path-Away			Brain 2 Operating Theatre Pre Path-Away			Pedi Oncology Pre Path-Away		
Sample Volume (liter)	150			150			150			150		
Lab Sample Number	14003834-001			14003834-002			14003834-003			14003834-004		
Spore Identification	Raw Ct.	Count/Sample	Count/m3	Raw Ct.	Count/Sample	Count/m3	Raw Ct.	Count/Sample	Count/m3	Raw Ct.	Count/Sample	Count/m3
Synthetic Fibers	1	1.0	7	1	1.0	7	1	1.0	7	14	14.0	93
Cotton Fibers	1	1.0	7	2	2.0	13	3	3.0	20	52	52.0	347
Glass Fibers	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Skin Cells	2	2.0	13	27	27.0	180	17	68.0	453	59	944.0	6293
Hair	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Insect Parts	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Pollen	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Plant Parts	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
	Debris Rating 3			Debris Rating 2			Debris Rating 2			Debris Rating 3		
Totals	4	4.0	27	30	30.0	200	21	72.0	480	125	1010.0	6733
Notes:												

*See "Footnotes and Additional Report Information" section for explanation of footnotes.

**Certificate of Laboratory
Analysis**
EMLAP# 102977

Arthur V. Martin Associates
PO Box 49747
Charlotte, NC 28277
Attn: Art Martin

Client Project Name: King Fahad Medical City
Riyadh, KSA
Project 14003834

Date Collected 3/9/2014
Date Received 3/12/2014
Date Analyzed 3/12/2014
Date Reported 3/13/2014
Page 2 of 4

Particulate Analysis

Client Sample Number	20243470			20243486			20243466			20243458		
Sample Location	Desk Area 1 Pre Path-Away			PICU B Pre Path-Away			PICU A Pre Path-Away			Ward 2 Pre Path-Away		
Sample Volume (liter)	150			150			150			150		
Lab Sample Number	14003834-005			14003834-006			14003834-007			14003834-008		
Spore Identification	Raw Ct.	Count/Sample	Count/m3	Raw Ct.	Count/Sample	Count/m3	Raw Ct.	Count/Sample	Count/m3	Raw Ct.	Count/Sample	Count/m3
Synthetic Fibers	8	8.0	53	10	10.0	67	4	4.0	27	8	8.0	53
Cotton Fibers	10	10.0	67	19	19.0	127	6	6.0	40	31	124.0	827
Glass Fibers	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Skin Cells	62	992.0	6613	74	592.0	3947	60	480.0	3200	82	1312.0	8747
Hair	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Insect Parts	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Pollen	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Plant Parts	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
	Debris Rating 3			Debris Rating 3			Debris Rating 3			Debris Rating 3		
Totals	80	1010.0	6733	103	621.0	4140	70	490.0	3267	121	1444.0	9627
Notes:												

*See "Footnotes and Additional Report Information" section for explanation of footnotes.

**Certificate of Laboratory
Analysis**
EMLAP# 102977

Arthur V. Martin Associates
PO Box 49747
Charlotte, NC 28277
Attn: Art Martin

Client Project Name: King Fahad Medical City
Riyadh, KSA
Project 14003834

Date Collected 3/9/2014
Date Received 3/12/2014
Date Analyzed 3/12/2014
Date Reported 3/13/2014
Page 3 of 4

Particulate Analysis

Client Sample Number	20243440			20241610			20243455			20243439		
Sample Location	PICU Desk in Area 2 Pre-Path-Away			Outside Room 318 Post-Path-Away			ISO 1 Post Path-Away			Outside ISO 2 at Desk Area		
Sample Volume (liter)	150			150			150			150		
Lab Sample Number	14003834-009			14003834-022			14003834-023			14003834-024		
Spore Identification	Raw Ct.	Count/Sample	Count/m3	Raw Ct.	Count/Sample	Count/m3	Raw Ct.	Count/Sample	Count/m3	Raw Ct.	Count/Sample	Count/m3
Synthetic Fibers	7	7.0	47	0	0.0	0	14	14.0	93	0	0.0	0
Cotton Fibers	24	24.0	160	0	0.0	0	6	6.0	40	0	0.0	0
Glass Fibers	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Skin Cells	45	720.0	4800	1	1.0	7	74	592.0	3947	1	1.0	7
Hair	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Insect Parts	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Pollen	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Plant Parts	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
	Debris Rating 3			Debris Rating 1			Debris Rating 3			Debris Rating 1		
Totals	76	751.0	5007	1	1.0	7	94	612.0	4080	1	1.0	7
Notes:												

*See "Footnotes and Additional Report Information" section for explanation of footnotes.

Arthur V. Martin Associates
PO Box 49747
Charlotte, NC 28277
Attn: Art Martin

Client Project Name: King Fahad Medical City
Riyadh, KSA
Project 14003834

Date Collected 3/9/2014
Date Received 3/12/2014
Date Analyzed 3/12/2014
Date Reported 3/13/2014
Page 4 of 4

Particulate Analysis

Client Sample Number	20241666			20243497			20243424			20243450		
Sample Location	Pedi Oncology at Desk Post Path-Away			PICU at Desk Section 2			PICU #2 Area Outside #318 Post Path-Away			Brain 2 Post Path-Away		
Sample Volume (liter)	150			150			150			150		
Lab Sample Number	14003834-025			14003834-026			14003834-027			14003834-028		
Spore Identification	Raw Ct.	Count/Sample	Count/m3	Raw Ct.	Count/Sample	Count/m3	Raw Ct.	Count/Sample	Count/m3	Raw Ct.	Count/Sample	Count/m3
Synthetic Fibers	0	0.0	0	0	0.0	0	10	10.0	67	1	1.0	7
Cotton Fibers	1	1.0	7	0	0.0	0	7	7.0	47	0	0.0	0
Glass Fibers	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Skin Cells	0	0.0	0	1	8.0	53	76	608.0	4053	2	2.0	13
Hair	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Insect Parts	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Pollen	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Plant Parts	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
	Debris Rating 1			Debris Rating 1			Debris Rating 3			Debris Rating 1		
Totals	1	1.0	7	1	8.0	53	93	625.0	4167	3	3.0	20
Notes:												

*See "Footnotes and Additional Report Information" section for explanation of footnotes.