The importance of establishing infection and climate control strategies in Healthcare Facility construction

- Published data identifies over 90,000 deaths annually due to infections
- A significant portion is attributable to airborne pathogens exacerbated during demolition, construction and maintenance activities
- Primary cause - dust particles created during these activities act as transmitters of fungal spores throughout the facility.

Preventative measures to reduce the airborne transfer risk include:

- Enacting fundamental changes to current construction cleaning procedures
- Managing the internal environment during construction
- Developing new innovative methodologies using construction air handling equipment to control internal temperature and humidity
Challenges

Challenges faced are:

- Construction sites that are cluttered and debris ridden
- Intermittent clean-up procedures with final cleaning assigned at project close out
- Poor indoor air quality created by antiquated temporary facilities and equipment providing internal heating and cooling (direct fired combustion heaters, high velocity circulation fans, open or discontinuous external building envelope enclosures, etc.)

Site Photos of Inferior/Ineffective IC/IAQ Procedures

Past Practices

Past practices, procedures and temporary facility installations are no longer acceptable in today’s construction and renovation environment.

- Required implementation of accepted standards for healthcare construction include:
  - CSA Z8000-11 Canadian Health Care Facilities Construction Design and Construction Facility Engineering and Physical Plant (September 2011)
Implementation of Infection Control & IAQ Measures for Healthcare Facilities During Construction, Renovation or Maintenance

How can accepted standards be easily implemented during renovations of existing or construction of new health care facilities?

- Stringent policies and procedures prescribed in the accepted standards are often difficult to meet, and in some instances counterproductive.
- Integrating standards with other project parameters - CaGBC - LEED EQc.3.1/3.2 Construction IAQ Management Plan during construction/testing before occupancy.

The Challenge

Implement an integrated Indoor Air Quality Plan/Infection Control Plan that would incorporate the requirements of both CSA 317.13.07 and CaGBC LEED Credit 3.1 (Construction IAQ Management Plan During Construction), from enclosure of building envelope through to facility turn over.

Comprehensive Team Approach

Developing a Comprehensive Team Approach for Implementation of a Project IAQ Plan.

- Strike a project team to oversee the Infection Control Plan (IFC)
- Multi-disciplinary participants including:
  - Construction Manager
  - The Owner
  - The Client
  - The Design Team (A/M/E/C)
  - The End User (Operator)
  - Third Party (Infection Control Practitioners)
The goal of Implementation of and Integrated IC/IAQ Plan:

In developing the IC/IAQ plan, the preliminary goal is to limit the potential for further (post occupancy) generation of fungal spores and bacteria resulting from the construction process. The aim is to:

- Control dust generation
- Prevent dust from infiltrating occupied (or completed) areas
- Prevent generation of aerosols from contaminating water sources
- Prevent mold and bacteria growth
- Prevent dust infiltration into HVAC systems
- Maintaining ambient interior temperature and humidity controls and controlling or preventing dust and debris build up, a future source of nutrients for spores and bacteria is minimized.
- Turn-over of the completed facility would be sooner, with less need to address final deficiencies, such as, re-cleaning duct work, or addressing expansion or shrinkage of sensitive finish material installations.

IC/IAQ Implementation Risks

Risks

- Fungus and bacteria (such as Aspergillus and Legionella) which have a high mortality rate in immunodeficient persons.
- Construction activities that will generate dust and spread of fungal spores and other fungi and bacteria.
- Plumbing Systems interruptions that can introduce bacteria to water supply or allow water to sit and allow existing bacteria to grow.
- Water / humidity damage to construction materials that can allow microorganisms in the environment to thrive before and after installation.
- Contamination of duct work / mechanical equipment during construction which create a warm environment for microorganisms to grow or create a repository for such microorganisms.
The Approach to Developing and IC/IAQ Plan

- Construction, unfortunately, is a dirty process with continual generation of dust and accumulation of debris throughout the facility.
- Execution of work is phased or staged with degrees of activity and rates of completion varying throughout the facility, based on the scope of work, and assigned implementation plan.
- An integrated IC/IAQ Plan must be developed with construction phasing and staged implementation of the work in mind.
- The construction team, in the first instance, will develop the implementation of the IC/IAQ Plan.
- The contractor’s expertise, and implementation of the work, through required construction ‘means and methods’ will determine the initial implementation strategy.
- Subsequent review and acceptance of the IC/IAQ Plan by the IFC team is required, prior to on-site execution.

The Approach to Developing an IC/IAQ Plan

The Goal

Limit the future generation of fungal spores and bacteria as a result of construction practices and procedures by:

1. Controlling dust and debris accumulation.
2. Preventing dust from infiltrating into occupied (or completed) areas.
3. Preventing generation of aerosols from contaminating water source.
4. Preventing mould and bacteria growth.
5. Preventing dust infiltration into HVAC systems.
6. Maintaining ambient temperature and humidity controls.

Implementing the Infection Control (IFC) Plan

FORT SASKATCHEWAN COMMUNITY HOSPITAL IFC PLAN

The hospital was divided into three areas, the inpatient unit, health services, and diagnostic and treatment.

Air-lock vestibules were introduced between each of these areas, which allowed increased control of the indoor air quality of each area depending on which stage of construction it is at.
The Approach

The generation of the amount of dust and debris varies from extensively, in the rough-in phases, to limited, during the final finishing phase. Work throughout the construction site is never all at the same stage. Some areas are completed early and others due to the complexity or special requirements finish later.

Each phase had different measures instituted, reflecting the stage of construction. The 5 phases included:

- **PHASE 1A** – Rough-in of underground services, concrete poured and ready for studs.
- **PHASE 1B** – Rough-in of systems, steel stud and drywall partitions.
- **PHASE 2** – Installation of local systems/branch lines, millwork, painting
- **PHASE 3** – Installation of final finishes, accessories and equipment.
- **PHASE 4** – No longer considered a construction site, but rather as a Hospital

### Implementing the Infection Control / Indoor Air Quality (IC/IAQ)

<table>
<thead>
<tr>
<th>PHASE 1A</th>
<th>PHASE 1B</th>
<th>PHASE 2</th>
<th>PHASE 3</th>
<th>PHASE 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Smoking, No Food or Drinks (except water)</td>
<td>Daily Cleaning with Dustbane Sweeping Compound and HEPA filtered Vacuum</td>
<td>Monitor and Control Temperature and Humidity</td>
<td>Negative HEPA Filtered Work Air Vented to the Outside</td>
<td>Seal Duct Work</td>
</tr>
<tr>
<td>Walk-Off Mats at Entrance to Areas</td>
<td>Prevent Venting Separating Construction Areas</td>
<td>Before Walls Enclosed, Vacuum and Inspect All Stud Tracks Electrical Boxes.</td>
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</tbody>
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### IC/IAQ - Phase 1B

- Dust collectors when sanding drywall.
- Daily Cleaning with Dustbane Sweeping Compound and HEPA Filtered Vacuum
IC/IAQ Phase 2 - 4

Walk-off mats and boot cleaners at entrances and exits.

IC/IAQ Phase 2 - 3

Ends of duct work properly capped.

IC/IAQ Phase 2 - 3

Negative air intake.
After thorough cleaning, a second review of the ceiling plenum space was conducted to ensure residual dust was removed.
IC/IAQ Phase 4

Final infection control inspections before facility turnover.

Success of the Infection Control / Indoor Air Quality (IC/IAQ)

Improvements to Health and Safety

- By controlling or preventing dust and debris build-up, future source of nutrients for spores and bacterial would be minimized.
- The site was better organized and therefore safer.
- Reducing the risk created by spillage and left over food stuffs.

Improvements to Productivity/Profitability

- There were fewer issues with casework and millwork rejected from site.
- Mitigating shrinkage problems for drywall and flooring.
- The site was cleaner, and the trades enjoyed working there.
- Turn-over was achieved quicker with less issues particularly in regards to duct work cleanliness.
- Allowed for improved serviceability due to ability for segmented shutdowns for maintenance.

Success of the Infection Control / Indoor Air Quality (IC/IAQ)

Value as a Sustainable/long-term solution

- This approach was so successful, that the experience at FSCCH has had a significant influence on the current updating of CSA Z237.13.12.
- The new version, now published, (December 2012) incorporates many of the ‘lessons learned’ practices implemented on this project, improving healthcare construction procedures across the country.
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The IFC Team

Q & A