Healing the Hospital
2013 NEBB Annual Conference
May 5, 2013
Three to four million hospital-acquired infections occur annually.
Up to 80,000 fatalities.
Costing $4 to $5 billion per year.
>16% of hospital acquired infections are airborne.
1/3 of all acute care hospital infections may involve airborne transmission at some point.

Hospitals & Energy

- In a typical hospital, heating represents 23% of total energy use.
- The low hanging fruit is mostly gone:
  - Nearly all hospitals have regular HVAC maintenance.
  - 93% use day-lighting or lighting conservation.
  - About 90% use CFLs.
- Opportunities still exist:
  - 73% of hospitals with the best energy performance utilize air balancing as an energy savings measure.
  - Balancing air systems and investing in efficient HVAC systems are some of the most cost effective measures.

*Energy Characteristics and Energy Consumed in Large Hospital Buildings in the United States in 2007*, EIA
*Healthcare Energy Project*, ASHE
Today

- Highlights from aerosol duct sealing in healthcare applications
- Process overview
- Best practices in the healthcare application
University of Ottawa Heart Institute

- Canada's largest cardio-vascular health centre
- Issue: Lab exhaust leaks causing radioactive isotope migration
- Result: 94% reduction in leakage

"The positive impact that Aerosealing the shaft had on system performance was clear and immediate."

Michele Emond, University of Ottawa
Nemours Children Hospital

- 630,00 sqft, 137 bed children’s hospital
- Issue: General exhaust leakage contributing to nosocomial infection rates
- Result: 85% reduction in leakage

“After sealing the leaks with Aeroseal, all floors are getting the ventilation they need. As a side benefit, we were able to dramatically reduce the speed of the exhaust fan, which has resulted in substantial energy savings for the clinic.”

Chuck Boynton, Carrier Corp
Roudebush VA Hospital
Veteran’s House

- New on-site housing at VA Hospital
- Issue: Supply and return leaks impacting ERV performance
- Result: 93% reduction in leakage

“Aeroseal proved to be the right solution for the problem. I’ve been in this business for quite a long time and I’ve seen quicky solutions come and go, but this one actually held water...or I should say ‘air’ as the case may be.”

Timothy Flynn, Roudebush VA
Arzanah Medical Complex

- New LEED Gold 220,000 sqft medical center
- Issue: Supply and return leaks exceeded spec’n
- Result: 94% reduction in leakage

“Aeroseal proved safe for use, even in a hospital environment. Aeroseal was so effective at eliminating leaks, that we decided to expand the project to include the building’s entire HVAC system.”

Gus Heber
Habtoor Leighton
AeroSeal Duct Sealing Overview
What Is Aeroseal?

- Patented technology
  - Aerosol mist
- Seals ducts from the inside out
  - Inaccessible or difficult to identify leaks
  - Duct wrap not removed
- Verifiable result
- Guaranteed performance
What is the Aeroseal Machine?

- Fan Box
- Injection Wand
- Control Box
- Heat Cylinder
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>Process invented</td>
</tr>
<tr>
<td>2001</td>
<td>Purchased by Carrier</td>
</tr>
<tr>
<td>2004</td>
<td>First commercial building sealed</td>
</tr>
<tr>
<td>2005</td>
<td>ASHRAE recognition</td>
</tr>
<tr>
<td>2008</td>
<td>EPA recognition</td>
</tr>
<tr>
<td>2010</td>
<td>Purchased by JMD</td>
</tr>
<tr>
<td>2011</td>
<td>USGBC recognition</td>
</tr>
<tr>
<td>2012</td>
<td>80,000th home sealed</td>
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</tbody>
</table>
Aeroseal Recognition

- Dept. of Energy: Energy 100 Award
- EPA: Laboratories for the 21st Century
- USGBC Urban Green Council: Ebie Award
- Cal. Energy Commission: PIERS Building Program certified
- NYSERDA: approved energy saving measure
- NYC Green Codes Task Force approved measure
# FEMP Recognition

## FEMP - New Technologies for the Federal Buildings - by Category & Rank

* See Ranking Criteria Tab

<table>
<thead>
<tr>
<th>Rank</th>
<th>Technology</th>
<th>Description</th>
<th>Overall Federal Building Energy Savings</th>
<th>Cost Effectiveness</th>
<th>Probability of Success</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Condensing Boilers</td>
<td>Commercial boilers that are high efficiency due to their design to extract heat from flue gas moisture.</td>
<td>5.0</td>
<td>3.0</td>
<td>4.5</td>
<td>86</td>
</tr>
<tr>
<td>6</td>
<td>Commercial ground source heat pumps</td>
<td>A ground source heat pump with loops feeding multiple packaged heat pumps and having a single ground source water loop. Unit capacity is typically 1-10 tons and may be utilized in an array of multiple units to serve a large load.</td>
<td>2.8</td>
<td>4.0</td>
<td>3.5</td>
<td>66</td>
</tr>
<tr>
<td>8</td>
<td>Duct Sealants</td>
<td>Aerosol sealant is injected into the duct work to seal leaks. Can save on heating, cooling and fan energy, depending on building.</td>
<td>1.6</td>
<td>5.0</td>
<td>4.3</td>
<td>63</td>
</tr>
<tr>
<td>13</td>
<td>Water Cooled Oil Free Magnetic Bearing Compressors</td>
<td>Magnetic bearing, oil free 60 to 80 ton chiller compressor (also 150 tons). Onboard VFD and micro processor. Also small, light, quiet, low startup draw.</td>
<td>1.0</td>
<td>4.0</td>
<td>5.0</td>
<td>54</td>
</tr>
<tr>
<td>17</td>
<td>Wrap Around Heat Pipes</td>
<td>Where humidity control is critical the typical way to do it is to over cool the air to condense out the excess moisture. Air is then too cold to supply to the space so the air must be reheated. Wrap around heat pipes wrap around the cooling coil to pre-cool the outside air before it hits the cooling coil allowing the cooling coil to do more work condensing out moisture. The heat pipe then re-heats the air on the backside of the cooling coil so it doesn't have to be re-heated with strip heaters or some other means.</td>
<td>0.5</td>
<td>5.0</td>
<td>4.5</td>
<td>53</td>
</tr>
</tbody>
</table>
Process

- Connect equipment
- Plug diffusers and grilles
- Isolate AHU from duct system
- Measure initial leakage
- Set up containment system
- Inject sealant
- Measure final leakage
Video Demonstration
Mobilization

- Internally inspect duct system for large leaks and as-built changes to system
- Clean duct as necessary
- Communicate to tenants
Preparation

- Insert custom fit foam rubber block into diffuser boot, grille or VAV box
- Seal wall penetrations near injection location with duct mask
Isolation

- Tent/tarp sensitive equipment or areas
- Place fans in occupied space
- Pressurize critical rooms
- Depressurize building cavities
- Prep BAS and fire/safety controls
Connect to System

- Isolate air handling system
- Attach Aeroseal to duct
Measure and Seal

- Measure pre-seal leakage
- Begin sealing
- Monitor occupied space
- Monitor progress on computer
- Measure post-seal leakage
FAQ’s – Sealant

- Vinyl Acetate Polymer
  - Base for chewing gum, hair spray and water-based paints
- Remains rubbery
- UL 723 listed for smoke and flame spread
- UL 181 tested for mold growth and erosion
- Independent laboratory analysis conclusion: low VOC
  - 2 hours to cure
- 3 year commercial application guarantee
FAQ’s – Application

- Seals up go 5/8” wide gap
- Do not have to clean the duct before sealing
- Does not coat the duct
- Seals lined and unlined ducts
- Do not have to remove most dampers/controls
- Must isolate VAV boxes and pneumatic controls
Healthcare Application Learnings

- Internal duct inspection necessary
  - High quality images make the difference
  - Smoke or IR testing to identify large holes
- Duct cleaning often necessary
- Preparation is key
  - Air flow during sealing
  - Containment systems
  - Monitoring during sealing
- Remove patients and staff in treatment area
  - Rule of thumb: diffuser or patient
  - Dust in duct can cause cross infection
  - Aerosolized sealant not compatible with patient care
Healthcare Application Learnings

- Simple paybacks of 2–4 years
- 18 month payback in an EPA study of lab application
- Rebalance duct and AHU after sealing

Annual Savings
12,000 CFM General Exhaust

- Infiltration
- Cooling Load
- Infiltration Heating Load
- Fan Energy
Summary: Inside Out Is Best

- Proven method for sealing air duct leaks
- Effective at improving ACH and improving space pressure
- Quick paybacks by reducing heating/cooling costs and fan energy
- Verifiable and guaranteed
Thank you