Preventive Maintenance Tips to Improve Aesthetics, Indoor Air Quality & Profits
Clean It Or Breathe It!™
Dave Ableman got his BS Chemical Engineering from Carnegie Mellon University & subsequently attended Babson for an MBA. With 30+ years of professional experience, an award-winning and respected consultant, speaker, trainer and author, he is Vice President of Operations at Protek and helps guide the IFMA Boston Sustainability Committee.
Owner’s Goals For Healthy Buildings

Of owners who know the impact of their investments on healthier buildings.

Managers can build support in the C-suite by showing that their departments play a central role in making facilities more efficient and reliable, increasing sustainability, and improving occupant safety and comfort.

-Dan Hounsell, Editor-in-Chief, Facility Maintenance Decisions
Themes

► Increase Profitability
► Decrease (Energy) Costs
► Optimize People/Planet/Profit
► Preventive Maintenance
► Sustainability
Founded in 1961

Refurbishing Services:
- Wood Refurbishment (including Walls)
- Leather Conditioning
- Upholstered Furniture (including Workstations)
- Reupholstering
- Drapery Cleaning
- Wall Washing & Painting
- Electrostatic Refinishing
How Facility Managers Improve Triple Bottom Lines

A White Paper For Leveraging Onsite Refurbishment

Prepared for PROTEK by David Ableman

Before

[Images of wooden furniture before and after refurbishment]

After

[Images of leather furniture before and after refurbishment]

[Images of upholstered furniture before and after refurbishment]

PROTEK
CLEAN IT OR BREATHE IT!™
Experts with Trained and Certified Technicians

The ONLY Duct Cleaning Shop with Union Members on Staff

ALL Air Ductwork Components:
- Air Handling Equipment, Coils, Blowers, Fans, VAVs, etc.

Cleaning Specialized Ductwork
- Kitchen Exhausts
- Dryer Vent Systems (Apartment Complexes, Laundromats, etc.)
- Lab Hoods

Decontaminating Biohazards:
- Mold, Bacteria, etc.
- Sanitizing & Eliminating Odors (e.g. Smoke, Pet Urine, Human Byproducts, etc.)
Substantial evidence shows that indoor environmental exposure to allergens, such as dust mites and molds, play a large role in triggering asthma symptoms.

Asthma and allergies constitute about 14.2 million lost work days.

Asthma alone is estimated to cost $5.1 billion due to sick days and lost productivity.

Asthma rates in children under the age of 5 have increased 160% over a 14 year period.

Sources: National Institutes of Health
A Major Underlying Cause
A Major Underlying Cause

Dust Mites and their Feces Dust are responsible for about 25% of all allergy diseases.
Refurbishing Benefits

- Save Clients about 90% (vs. buying new)
- Promote Sustainability
- Proven to Increase Productivity
- Extend the Life and Value of Furnishings
PROTEK in Action
Conference Room Tables

Gouge was 9” long and 1/8” deep!
Door Frames & Doors
Elevator Interior Panels & Kickplates
Woods and Leathers
Electrostatic Refinishing
“First, it looks 100% better than I expected. Second, you saved me about 90%.”
-Executive Vice President, Jones Lang LaSalle

“We highly recommend PROTEK!”
-Director Of Operations, Foley Hoag

Adams National Historical Park Houses  Foley Hoag
Bank of New York Mellon  Hill Holiday
Boston Scientific  Jones Lang LaSalle
Brigham & Women’s Hospital  KPMG Peat Marwick
Campanelli Construction  The Fairmont Copley Plaza
Problems From Poor IAQ

15 to 30% of US Office Buildings have significant IAQ issues (National Contractors Association)

► Frequent Guest & Employee Complaints
  ▶ Poor ventilation, odors, & discomfort are reported as a top 3 guest complaint.

► Bad Publicity, especially on Social Media

► Strained relationships among staff and administration

► Absenteeism / Lower Productivity / Diminished Morale

► Increased Risks (SBS/BRI)

► Accelerate the deterioration and reduce the efficiency of the physical plant and equipment
In 2000, indoor air pollution cost the nation “tens of billions” of dollars per year.

**Top 5 environmental risks to public health**

- People spend about 90% of their time indoors.
- Indoor Air Pollution may be 2 to 5 times (up to 100 times) higher than outdoor levels.
  - Unexplained Allergy Related Illness
  - Mold
  - Insect Bodies or Rodent Droppings
  - Duct Obstruction

**Failure** to prevent or respond promptly to IAQ can increase long-term health problems including pervasive:

- Headaches, Mental fatigue and sleepiness
- Irritations of eyes, nose and throat
- Skin irritation & rashes
- Dry mucous membranes and dry skin
- Coughing & Airway infections
- Allergic reactions, and
- Life-threatening conditions from bacteria and molds, etc.

“There is some benefit in cleaning debris from ducts, furnaces, central air conditioners and ventilation.”
“Senior management acknowledges that even small improvements in office worker productivity derived from facility maintenance projects are clearly worth it.”

“When office workers are satisfied with their environmental conditions, when they can work in greater comfort and control…the cost of employment per worker will drop, and the cost of facilities operation will decrease.”

In the West, prior to 2000, up to 30% of newly-built office buildings had IAQ problems.

Today, “in the developed world IAQ is a main cause of allergies, other hypersensitivity reactions, airway infections, and cancers.”

Risk from indoor air pollutants dwarfs that from other sources including outdoor air and water.

Household air pollution is world’s largest environmental-health risk, estimated to be responsible for 4.3 million deaths in 2012 (7.7% of total mortality).

Particulate matter, or PM, is the term for particles found in the air, including dust, dirt, soot, smoke, and liquid droplets.

Particles less than 10 micrometers in diameter (PM$_{10}$) pose a health concern because they can be inhaled into and accumulate in the respiratory system.

New standards address PM$_{2.5}$

MUCH GREATER Health Risk – can lodge deeply in the lungs.
EPA states that the **Quality** is based on:
- Introduction and distribution of adequate ventilation air
- Control of airborne contaminants
- Maintenance of acceptable temperature and relative humidity

By **Mass**, we consume >10x more indoor air than water.

VOCs such as formaldehyde → But **SVOCs** (semi-volatile Organic Compounds) weren’t even thought of as a health-risk 10 years ago. New evidence shows significant health risk.

**Harvard Study**: Workers in environments with cleaner IAQ scored up to **61% higher** on cognitive assessments.

Related research valued that improvement at $6,500 per employee per year.

Canadian study proved poor IAQ costs Canada billions each year in diminished productivity, increased absenteeism and medical costs.

“In a study of 813 buildings supporting over 750,000 occupants, over 75% of IAQ problems were traced to operating faults and/or poor maintenance; **over 12% were due to contamination inside the ductwork**, with dust and allergic fungi comprising 60% of the pollutants.”

Financial Benefits of Good IAQ

► Improved Desirability & Value to Hotel Guests
► Increased Revenues
  ► Occupancy Rates
  ► Room Rates
► Decreased Energy Costs
► Increased Staff Productivity
► Decreased Contamination Risk
► Extend the Useful Life of Capital Assets

“Insurance companies may increase costs to mitigate their risks, and/or decrease costs to those who have proven IAQ risk reduction.”
WELL Building Standard

A progressive NEW standard, WELL is a performance based rating system that takes a holistic approach to healthy indoor environmental design, and the impact to human wellness in the built environment.

THE SEVEN CONCEPTS OF THE WELL BUILDING STANDARD

01 Air
02 Water
03 Nourishment
04 Light
05 Fitness
06 Comfort
07 Mind
Your breath contains up to 100 times the ppm of CO$_2$ vs. outdoor air.

Higher concentrations lead to an increased respiratory rate, cardiac arrhythmias and impaired consciousness.

Concentrations >10% may cause convulsions, coma and death.

- **Outdoors**: 390-450 ppm
- **Offices**: 800 – 1000 ppm
- **Stuffiness**: 1000-2500 ppm
- **OSHA**: 5000 ppm
- **Extreme/Dangerous**: 30,000-50,000 ppm
Well-maintained systems reduce energy use by an average of 15% to 20%.

Experience with ENERGYSTAR® qualified buildings demonstrates that well-maintained HVAC systems of average efficiency save more energy than high-efficiency HVAC systems that are poorly maintained.
American Society of Heating, Refrigerating, and Air-Conditioning Engineers

- Older HVAC: Electro-mechanical and Analog controls
- Newer Controllers Enable:
  - Improved energy savings and a **healthier environment**
  - Demand Control Ventilation (DCV)
  - Simplified diagnostics and verifiable operation
  - Traceable operation and maintenance
  - **More profit** per unit of labor
- **ASHRAE Standard 90.1 2010 goal** – Reduce energy cost by 30% vs. 2004 version
  - Higher efficiencies
  - More energy conserving controls
  - Energy recovery is required in more applications
  - Economizers are required in more climates. Using economizers: Each cooling system that has a fan shall include either an air or water economizer to meet the requirements of Sections 6.5.1.1 through 6.5.1.4.
- **Section 6.4.3.9: DCV** must be provided for each zone with spaces > 500 ft² and the average occupant load > 40 people/1000 ft² of floor area where the HVAC system has:
  - An air-side economizer,
  - Automatic modulating control of the outdoor air damper, or
  - A design outdoor airflow > 3,000 cfm
Implement Demand Control Ventilation (DCV): Integrate CO₂ sensors with your ventilation systems to enable automatic opening of dampers when levels exceed a set-point (typically 1000-1200 ppm), or reduce outdoor air intake below design rates when the actual occupancy of spaces are less than design occupancy.
Hotels rooms are unoccupied 72% of the time
American Hotel & Lodging Association (AHLA)

- Dynamically vs. statically controlled systems can eliminate:
  - Environmental factors
  - Occupant tampering
  - Recalibration concerns

- Replace “static” exhaust and supply grilles
  - Saves energy
  - Automatically adjusts to changes in pressure
  - Allows fan operation at lower pressure which simplifies building pressurization control
  - Eliminates cross-contamination (IAQ)
  - Reduces drafts

Energy Efficiency & Odor Control
Replace Old Units

**Heat Recovery Ventilators:** Transfer heat energy from warm air to cold air.

**Energy Recovery Ventilators:** Transfer heat energy from warm air to cold air and moisture-latent energy from moist air to dry air.
Determining Optimal Ventilation

Ventilation in the breathing zone, $V_{bz}$ (CFM)
- $V_{bz} = \text{Ventilation for people (Vp)} + \text{Ventilation for building sources (Va)}$
- $V_p = \text{Occupant Component factor (Rp)} \times \text{Max. \# of occupants (Pz)}$
- $V_a = \text{Building Component factor (Ra)} \times \text{Area of space (Az)}$

Sample values for Rp:
- For office work, $Rp = 5 \text{ CFM per person}$
- For most classrooms, $Rp = 10 \text{ CFM per person}$

Sample values for Ra:
- For office spaces, conference rooms and lobbies, $Ra = 0.06 \text{ cfm/ft}^2$
- For class rooms and museums, $Ra = 0.12 \text{ cfm/ft}^2$
- For laboratories and art classrooms, $Ra = 0.18 \text{ cfm/ft}^2$

Example:
- $V_{bz} = Rp \times Pz + Ra \times Az$
- $= (10 \text{ CFM/person}) \times (15 \text{ persons}) + (0.12 \text{ CFM/ft}^2) \times (1024 \text{ ft}^2)$
- $= 150 \text{ CFM} + 123 \text{ CFM} = 273 \text{ CFM}$
An Ounce of Prevention

The U.S. spends $2.5 trillion on health care every year. Only $251 is spent per person on prevention.

HVAC Tips

► Comply with ASHRAE standards
► Maintain uniform temperature and humidity conditions that are within comfort standards (lower temperatures are preferred vs. higher).
► Regularly change medium efficiency (MERV of 5-13) filters
► Clean drain pans
► Use dry insulation
► Ensure no contaminant sources near any intake vent openings
Tips to Protect Yourselves

► Preventive Maintenance:
  ► Maintain HVAC System
  ► Control Moisture to Avoid Dampness and Mold
  ► Clean Thoroughly
  ► Select Products and Materials with Low Emissions
  ► Control Pests
  ► Control Sources

► Adhere to Codes & Standards:
  ► ASHRAE 90.1 – Energy Standard for New Buildings. Provides minimum requirements for the energy-efficient design of buildings
  ► ASHRAE 90.2 - Energy Standard for Residential
  ► ASHRAE 62.1 – Ventilation Standard for Buildings. Includes specification for the minimum ventilation rates and indoor air quality that is acceptable to human occupants
  ► ASHRAE 100 - Energy Standard for New Buildings
  ► ASHRAE 189 – Green Building Standard
  ► IBCC – International Building Code
  ► IECC – International Energy Conservation Code
  ► IGCC – International Green Construction Code
Particulate buildup over time increasingly:

- **Restricts Airflow**
- **Reduces Heating/Cooling Efficiency** (by insulating coils)

For typical indoor centrifugal fans, **1/16 inch of dirt** on the blades can impact the airflow of the fan as much as **15%**

Primarily concern is buildup on **Coils** and between **Fins**, though also adversely impacts Turning Vanes, Dampers, VAVs, Booster Fans/Blowers, Registers/Diffusers and Grilles, as well as Ductwork, Fresh Air Intakes, Exhaust Fans, and even Sound Attenuators, etc.

**4 Data Points**, pre- and post-cleaning:

- Incoming temperature and humidity before coils
- Outgoing temperature and humidity after coils
- Airflow across coils (CFM)
- Current & Voltages at fan motor and compressor
Tools to Assess Savings

- Thermometer – Temperature
- Hygrometer – Relative Humidity
- Manometer – Air Pressure
- Clamp Meter – Current & Voltages

- Psychrometer – Change in Enthalpy
- Anemometer – Air velocity
- Clamp Meter – Current & Voltages
Helps:

► Increase Building Value by:
  ► Improving Comfort and Worker Productivity
  ► Improving Building Desirability
► Reduce Liability by reducing likelihood of Building Related Illnesses / Sick Building Syndrome issues
► Increase Tenant Retention by Increasing Employee Productivity while simultaneously Decreasing Absenteeism
► Reduce Carbon Footprints
► Decrease Energy Costs by 10-15%
► Saves Money over time by Decreasing Loads and Wear and Tear, which Prolongs System Life

Summary – Improving IAQ:
Conclusion

- Proper maintenance of indoor air is more than a "quality" issue; it encompasses safety and stewardship of your investment in your most important (and costly) assets: your people and your facilities, in that order.
- Take a proactive approach to increasing productivity while at the same time saving energy and money.
- **Good** for both Top Lines **AND** Bottom Lines.
Question…

Who wants to some pictures?
Kitchen Exhausts
Kitchen Exhausts
New Duct Doesn’t Need Cleaning! Right?

“We need to re-wrap the duct since we are getting inspected tomorrow.”

- Foreman to Mechanical Team
New Duct Doesn’t Need Cleaning! Right?
College Restrooms

[Images of damaged restrooms]
College Restrooms
Would you do this?
Dave Ableman
781-963-8813
Dableman@ProtekCorporation.com
“Great job! Great price! Thanks!”
-Paul Roche, Facilities Mgr, IBEW Local 103

“Best team I’ve seen in 20 years...left the place cleaner than they found it!”
-Dave Kimball, Owner, Kimball Air Systems

“Your work is 3 times cleaner than the last crew”
-Keith Larsen, Principal, Heritage Group

“The Air Smells Cleaner!”
-John Fahey, Project Manager, Hamel & McAllister

“Great Scope! And I thought I wrote a good Scope.”
-Constantine Stamos, Lead Estimator, J. F. White Contracting

Biogen
Boston Scientific
Consigli Construction
Hynes Restaurant Group

Lombardo’s Function Hall
New Balance
Pilgrim Nuclear Power Station
Walsh Mechanical