



Preventive Maintenance

- Fountain of Youth for HVAC
- Successful Learning Environment
- Bonus Strategies

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Action Planning Guide

As you listen to this presentation, use the chart in your Action Planning Guide to write down any key strategies to install the Six Technical Solutions in your district.



Indoor Air Quality (IAQ)

Title: Preventive Maintenance
Duration: 1 Hour
Date: April 24, 2012 (10:00-11:00)
Conference: Healthy Schools Environments Across Texas Conference
Location: Garland Special Events Center
Provider: USEPA Region 6
 Stacey Murphy
murphy.stacy@epamail.epa.gov

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Learning Objectives:

1. Know types of maintenance
2. Be able to use ASHRAE STD 180 to establish HVAC PM: Minimum level PM & frequency
3. Know benefits of HVAC PM including occupant comfort, IAQ, energy efficiency, reduced outages, and extended equipment life.

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Learning Objectives Cont:

4. Be able to communicate benefits and need for HVAC PM to your own organizations.
5. Learn two key additional strategies to leverage ASHRAE STD 180 HVAC PM
6. Recognize and communicate Integrated Team Approach opportunities for enhanced Preventive Maintenance.

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Howdy!



“Choosing not to do HVAC Preventive Maintenance is like never changing the oil in your car”

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Why Maintenance?

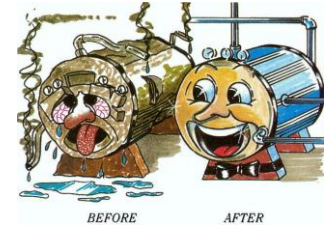
- Increases equipment life & reliability
- Reduces size & scale & number of repairs
- Lowers maintenance costs through better use of labor & materials
- Reduces emergency repairs & overtime
- Improved parts control
- Reduces energy costs by 5% to 20%
- For the public good (IAQ, Safety, Security, etc.)

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Types of Maintenance

- Emergency
- Reactive
- Deferred
- Routine
- Preventive
- Predictive



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Preventive Maintenance

- Series of actions performed that are designed to detect, preclude, or mitigate degradation of a system or its components
- Time-based maintenance



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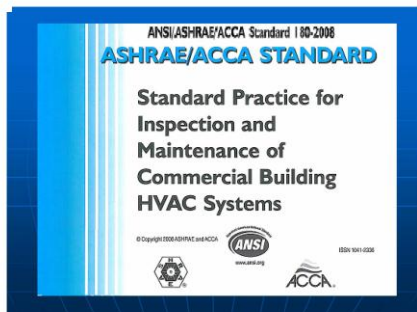
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HVAC PM

“Where to Start”?

- ASHRAE Standard 180
- Manufacturer’s Recommendations
- Local Conditions
- Master Plan
- Retro Commissioning

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HVAC PM

- Preventive Maintenance
 1. ASHRAE STD 180P
 2. STD. Practice for Inspection and Maintenance of Commercial Building HVAC Systems
 3. Intent of STD
 - Guide maintenance entire system
 - Minimum level PM & frequency
 - Code language
 - Occupant thermal comfort, IAQ, energy
 - New & existing buildings

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ASHRAE STD 180: HVAC PM

- “Owner responsibility to look at PM for extending life”



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Gas/Electric RTU's

Maintenance Activities	Frequency
Change air filter	Every 60 days
Check control system and devices for improper operation. Repair, adjust, or replace components to maintain proper operation.	Twice yearly
Check drain line. Clean as necessary to maintain proper operation.	Twice yearly
Check wiring and connections for tightness, signs of overheating or discoloration. Tighten as necessary.	Twice yearly
Check gas piping past gas stop for leaks and loose connections. Tighten or repair as necessary.	Twice yearly
Check motor contactor for pitting or other signs of damage.	Before beginning of cooling season
Check fan blades for balance and particulate buildup and fan motor for proper operation. Clean, repair, adjust, or replace as needed.	Twice yearly
Check refrigerant system pressure and oil levels using manufacturer approved subcooling methods. If outside recommended levels, find and repair cause, and then adjust to achieve proper levels.	Before beginning of cooling season

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Gas/Electric RTU's (Continued)

Maintenance/Activities	Frequency
Check integrity of panels and fasteners. Replace fasteners as needed to maintain equipment integrity.	Twice yearly
Lubricate field serviceable bearings	Twice yearly
Check combustion chamber, burner, and flue for deterioration, moisture problems, condensation, and combustion products. Clean, test, and adjust combustion process for proper operation.	Before beginning of cooling season
Check coil for dirt or evidence of biological growth. Clean as necessary	Before beginning of cooling season
Check evaporator coil fins for damage. Restore, if possible, or replace to maintain proper function.	Before beginning of cooling season
Check damper for proper operation. Repair, adjust, or replace as needed.	Twice yearly
Inspect air-cooled condenser surfaces. Repair or clean as needed.	Before beginning of cooling season
Check belts for tension, wear, cracks or glazing. Replace as needed.	Twice yearly
Visually inspect internal ductwork for integrity and, if applicable, ensure insulation has not degraded. Correct as needed.	Twice yearly

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Heat Pumps, Split System

Maintenance Activities	Frequency
Air Handlers	
Change air filters	Every 60 days
Check wiring and connections for tightness, signs of overheating, or discoloration. Tighten as necessary.	Twice yearly
Check p-trap and drain line. Clean as necessary to maintain proper operation.	Twice yearly
Check fan blades for particulate buildup and fan motor for proper operation. Clean, repair, adjust, or replace as needed.	Twice yearly
Check integrity of all panels and fasteners.	Twice yearly
Lubricate field serviceable bearings.	Annually
Check coil for dirt or evidence of biological growth. Clean as necessary.	Before beginning of cooling season
Visually inspect exposed ductwork for integrity and, if applicable, ensure insulation has not degraded. Correct as needed.	Twice yearly
Check heating coil for proper operation. Repair or replace as needed.	Before beginning of cooling season
Check control system for evidence of improper operation. Adjust, repair, or replace components as required.	Twice yearly

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Heat Pumps, Split System (Continued)

Maintenance Activities	Frequency
Condensing Units	
Check wiring and connections for tightness, signs of overheating, or discoloration. Tighten as necessary.	Twice yearly
Check motor contactor for pitting or other signs of damage. Repair or replace as needed.	Annually
Check condenser fan blades and motor for proper operation. Clean, repair, or replace as needed.	Annually
Inspect air-cooled condenser surfaces. Repair or clean as needed.	Annually
Check refrigerant system pressure and oil levels using manufacturer approved subcooling methods. If outside recommended levels, find and repair cause, and then adjust to achieve proper levels.	Before beginning of cooling season



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Air Distribution Systems

Maintenance Activities	Frequency
Visually inspect grilles, registers, and diffusers for dirt accumulation. Clean as needed to remove dirt.	Annually
Lubricate field serviceable bearings and linkages.	Annually
Check for proper damper operation. Adjust, repair, or replace as necessary.	Annually
Inspect for area of moisture accumulation and biological growth. If present, clean or disinfect as required.	Annually
Visually inspect accessible ductwork for insulation integrity. Repair or replace as needed.	Annually



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HVAC PM – STD 180 @ Region 10 ESC

- Base Year
 - 42 calls
 - \$87,088
- PM Year One
 - 27 calls
 - \$39,088
 - No Outages!



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HVAC Preventive Maintenance



“It’s the right thing to do”



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HVAC PM



- Homework**
- Mfr’s Instructions
 - ASHRAE 180 STD
 - Local Conditions
 - Master Plan
 - Retro-Commissioning



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Go To Bat for HVAC PM

- Hit A Home Run!**
- Extend Equipment Life
 - Comfort, IAQ, Energy
 - Fewer Service Calls
 - Higher Attendance



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HVAC PM “Plus”

- Northwest ISD
Dr. Charles Ashby**
- NISD Experience – Steele Accelerated H.S.**
- 18 yr. old package DX RTU’s
 - No budget for replacement
 - Accomplished ASHRAE STD 180
 - Cost \$16,000 parts plus NISD Technician for a Summer
 - Goal to Extend life of equipment for at least 2 years



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HVAC PM “Plus”

	Before	After (1 yr)
Electric Cost	\$90,000/yr	\$49,944/yr
Service Calls	25/yr	1/yr
Comfort Complaints	Numerous	0

- PM with STD 180
- Worked From Master Plan
- Included Retro-Commissioning



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Tyler ISD's Master Plan

- ☑ **Master Plans: Infrastructure**
 - Includes PM for HVAC
 - Interactive continuous master plans
- ☑ **Results**
 - Infrastructure in good condition
 - Good learning environment
 - Reduced operating costs
 - Energy efficiency
 - Extended life



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Tyler ISD PM - HVAC

"TISD is getting more life from the HVAC equipment than originally anticipated",
Tim Loper, Director of Facilities, Tyler ISD



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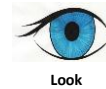


- ☑ **Master Planning**
 - Define
 - Benefits
 - Impact on IAQ
- ☑ **Retro-Commissioning**
 - Define
 - Benefits
 - Impact on IAQ



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PM Opportunities Beyond the Equipment Component



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Common Ground

- Great learning environment
- Sustainable environment
- Building performance
- Cost effective
- Avoiding contamination
- Avoiding damage
- Prevention & management
- Plan development
- Monitoring



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Integrated Team Approach

- Design
- Construction
- Operation
- Maintenance
- Custodial activities
- Building usage
- Safety/Security



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Common Goals

Prevent problems before they occur

BE PROACTIVE



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Examples of Common Ground

- Teamwork
- Communication



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Energy, Maintenance, IPM, IEQ & Safety



Secure Access Panels

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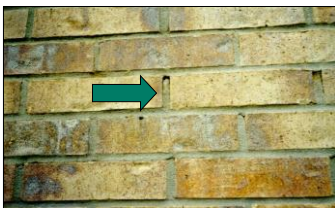
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Eliminate Excess Moisture

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Seal openings in building envelope

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Repair broken windows

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Maintain exterior ducts



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Make sure exterior doors close & have weatherstripping



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Keep birds & pests away from buildings & equipment



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Energy, Maintenance, IPM, IEQ & Safety

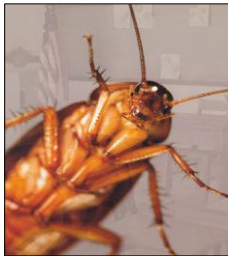


Eliminate standing water



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Basic Needs



- Food
- Water
- Shelter

“Eliminate”



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IPM & IEQ



Use mesh screens



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Avoid using mechanical rooms as storage

“Trojan horse syndrome”



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Avoid using or keep areas clean



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Lunch anyone?



Monitor



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A Bird's Eye View



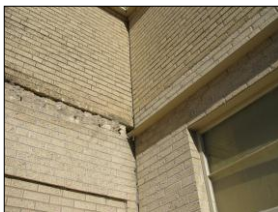
Report



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Maintain Integrity



Secure envelope



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Keep It Dry



Maintain



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Exclusion



Secure Envelope



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Prevent Access



Cover It Up



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Include It



Seal It Up



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Barrier Strips



Slope Away from Building



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Custodial – IPM – Maintenance

- Dry If You Do Damp If You Don't!
- Remember It's Not Clean Unless It's Dry!



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IPM & Maintenance



REPAIR WATER LEAKS



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IPM, Maintenance, IAQ, Security



**CONDUCT MASTER PLANNING
SURVEYS ON-SITE**

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Conclusions (How)

- ASHRAE STD 180 Start Place
- Add Mfg. Inst, Local Conditions
- Master Plan
- Retro-Commissioning
- Team Effort



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Conclusion (Why)

- Improve IAQ
- Improve Energy Efficiency
- Comfort Better
- Fewer Service Calls
- Extend Equipment Life
- Higher Attendance
- Save \$



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Action Plan (Mindset)

- View School As Whole
- Be Alert
- Observe
- Communicate (Team)



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Action Plan (In District)

- Gathering Status
- Determine If Have Formal Written PM-HVAC
- Define How Many Comfort & IAQ Complaints Last Year
- Determine If Have HVAC Master Plan
- Determine If Retro-Commissioning Accomplished
- Determine If Departments Work Together As A Team

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Action Plan (In District)

- Write-Up Benefit
 - Master Plan – HVAC
 - HVAC PM & STD 180
 - Retro-Commissioning
- Use Case Studies Shown
- Set Up Meeting With Administration To Recommend
 - Master Plan – HVAC
 - HVAC PM Plan
 - Identify Schools That Would Benefit From Retro-Commissioning

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Action Plan (In District)

- Follow-Up After Presentation/Meeting
- Set Goals
- Communicate –Team
- Communicate Success
- Be A Role Model



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Preventive Maintenance

- Conclusions
- Questions



THANK YOU
"Be A Role Model"

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