

Effective Preventative Maintenance

WASBO Facilities Certification

Core Module 4

Dave Hoh
Director of Buildings & Grounds
Howards Grove


dhoh@hgtigers.com

920-226-4295

John Stangler
Director of Buildings & Grounds
Pewaukee School District

stanjoh@pewaukeeschools.org

262-695-5028

- ▶ The goal of this session is to present questions and ideas that will stimulate your thought process and shift the paradigm regarding your perception of a complete Preventative Maintenance Program.
 - ▶ We encourage and rely on interaction of the group to help us all learn from each other.
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What is the secret to an Effective PM Program?

Don't make any big mistakes

And

Don't make the same mistake twice!



“Jury – rig” is not a
synonym for repair!

“Repair” means to return to the original
operating state.

What will YOU Include in YOUR Preventative Maintenance Program?

Typical Systems

- ▶ HVAC – (Boilers, AHU, AC, RTU, VAV)
- ▶ Electrical – (Lighting, Switchgear, Motors, VFDs)
- ▶ Plumbing – (Water Heaters, Softeners, Pumps)

What else do you think should be included in a

COMPLETE

Preventative Maintenance
Program?

Is the operation side included in
your overall PM program?

Should it be?

What about these systems

Sites – Snow/Ice removal, lighting, landscaping, signage

Structural – Exterior envelope, windows, doors, masonry

Roofs Asphalt Concrete Fencing

Playgrounds Courtyards – outdoor classrooms

Irrigation Athletic Fields IPM Parking areas

Receiving Areas Vacant property owned by District

Is this overwhelming yet?

And more systems to consider

Fire Alarms – strobes, smoke/heat detectors, pull stations
extinguishers, Carbon Monoxide, Radon

Security Alarms Sprinkler/Fire suppression systems

Communications – telephones, radios, public address

Elevators/Lifts

Bleachers

Pools

Painting

Floor coverings

Gym floors

Lockers

Tech Ed shops

Kitchens

Art rooms

Health rooms

Auditoriums – stage, stage curtains, prop storage

Custodial equipment

Vehicles

Preventative Maintenance

is the foundation of a good

Maintenance Program

Preventative



Maintenance

Maintenance Spectrum

4 Levels

Emergency or Breakdown

Routine

Preventative

Predictive

Emergency or Breakdown Maintenance

- “Saves money”
- Uses the least expensive repair option to regain service

- In the long run is the most costly method

- 1) Defers repairs and allows damage to accumulate compounding problems, expense and downtime
- 2) Shortens life cycle of equipment
- 3) Breakdowns occur at any time
- 4) Raises questions of accountability

Routine Maintenance

- Planned and scheduled
- You control the timing of the work
- Allows budgeting for replacement

Lamp and ballast replacements
Classroom furniture repairs

Preventative Maintenance

The Catch – all Phrase

- Planned and scheduled
- Prioritized and assigned
- You control the timing of the work
- Improves/maintains energy efficiency
- Meets Life and Safety codes
- Recorded data assists in restoration or replacement decisions
- Data helps identify problems
- Allows planning a budget in advance for restoration, rebuilding and/or replacement
- Provides for highest level of accountability

Typically HVAC related

- Filters
- Belts
- Motors
- Pumps

What other items might fall under this category?

- Playgrounds
- Snow and ice removal
- Painting
- Parking areas
- Roofs
- Equipment

Predictive Maintenance

Usually uses computer software to forecast failure based on age, user demand and performance level.

- Replacements are anticipated
- Replacements are planned and scheduled
- Utilizes full life cycles
- Long range budgeting capability

Life Expectancy of Major Components

	Years		Years
HVAC			
<u>Heat Pumps</u>		<u>Chillers</u>	
Air Source	15	Reciprocating	20
Water Source	19	Centrifugal	23 – 25
		Absorption	23
<u>RTU</u>		<u>Pumps</u>	
Single Zone	15	Base Mounted	18
Multi-zone	15 – 17	Motor Starters	17
		Condensate	30
<u>Boilers</u>		<u>Electric Motors</u>	18
Hot Water	24 – 30	<u>Motor Starters</u>	17
Steam	30 – 35	<u>Electric Transformers</u>	30
Electric	15		
<u>Ductwork</u>	30	<u>Controls</u>	
<u>Fans</u>		Pneumatic	20
Centrifugal	25	Electric	16
Axial	20	DDC	15
Coils: DX, Water, Steam	20		

Life Expectancy of Major Components

Plumbing

Years

Water Heaters	20 – 30
Fixtures	50 – 75
Water Softeners	15 – 25

Electrical

Light Fixtures	20 – 25
Fire Alarm System	15 – 20
Distribution Equipment	30 – 40
Generator/Transfer Switch	25 – 30
Wiring Devices	20 – 25
Communications	10

Roofing

Years

Built-up Roofing	20 – 25
Shingles	10 – 15
Metal	50
Single Ply Membrane	15 – 20

Materials

Vinyl Tile	10 – 15
Vinyl Asbestos Tile	50 – 60
Carpeting	8 – 12
Terrazzo	100
Paint	3 – 5
Wall Covering	15 – 20
Ceramic Tile	100
Acoustical Ceilings	20

BENEFITS of a good MAINTENANCE PROGRAM

1. Lower operational costs
2. Permits for full life cycles
3. Improved energy efficiency
4. Meets life safety and code requirements
5. Assists in identifying problems before they become major problems and avoids downtime
6. Avoid damage and costly repair or pre-planned replacements
7. Protects your investment
8. Allows time for planning / budgeting for replacement
9. Provides the best learning and working environment
10. Data Collection:
 - A. Provides accountability to the public and administration
 - B. Resource to verify need for action
 - C. Justify budget requests

BARRIERS

- 1) Cost
- 2) Time
- 3) Lack of manpower
- 4) Staff training – \$\$\$\$\$
- 5) Lack of knowledge or inexperience with systems
- 6) Lack of support by Administration and Board of Education
- 7) Lack of general understanding and apathy to the benefits of complete PM program
- 8) Others – ?
- 9) Where do you start?
- 10) Set Goals, Collect Data and Keep Good Records

GOALS

What is the goal of an effective Preventative Maintenance Program?

Move from a reactive to proactive mode of operation.

Where to Start

Focus on:

- ❑ Life Safety and Litigation Risk Issues
 - Access – Security – Safety
- ❑ Building Code and Regulation Compliance
 - ADA – DOC
- ❑ Equipment Maintenance
 - Belts – Filters – Lubrication – Testing
- ❑ Energy Efficiency
 - District Policy – Track and Optimize Use
- ❑ Building Envelope
 - Roofs – Windows – Doors – Masonry

READY - SET - GO

Identify what needs to or should be included in your PM program

- Assemble pertinent operations information – does it match what you have in place?
- Find operation manuals – read them!
- Follow manufacturer’s recommended service schedule
- Develop a list of contacts for your equipment
- Schedule staff training for the equipment you have in place
- Set standards and level of expectations
- Establish safety protocols and make sure they are followed by all staff
- Develop a contingency plan for emergency situations
- Train staff how to respond to those emergencies
- Develop a list of contacts for those emergencies

What can you do in-house? What will you need to outsource?

Determine the work your staff can do within the building code regulations

- ❖ Boilers – heating plants – tracking hours of operation – energy use
- ❖ Condensers – AC – refrigeration units
- ❖ Electrical
- ❖ Plumbing
- ❖ Health Department – Kitchens and Food Service – Pools

Is your staff trained, licensed or certified for the work you do in-house?

Can you schedule staff to complete work outside of or during off hours?

Staff Training

Manufacturer – Supplier

- ✓ Operation manuals
- ✓ Operator training
- ✓ Cleaning and lubrication schedules

Preventative Maintenance Starts Here!



Green Bay Area Public School District

O&M Energy Efficiency Action Maintenance Frequency Air Compressors

Facility Name: _____

Employee Name: _____

Description	Tasks	Maintenance Frequency				
		Daily	Weekly	Monthly	Annually	Other
Air Compressor Maintenance	Inspect unit, drain condensate	X				
	Check pressure relief valve; inspect and clean filters		X			
	Replace air filter			X		
	Clean compressor			X		
	Unit shutdown inspection				X	
	Change compressor and crankcase oil				X	
Air Compressor Leak Detection and Repair	Inspect and repair air lines			X More often if needed		
	Ultrasonic acoustic inspection				X	

Green Bay Area Public School District

Maintenance Log Sheet Air Compressor

Air Compressor Maintenance

Facility Name: _____

Employee Name: _____

Location in Building: _____

Air Compressor Maintenance Tasks	Annual Date:																										
Weekly	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
Inspect motors, fans and pumps that drive air compressors (check box when complete)																											
Inspect air compressor																											
Drain condensate																											
Check pressure relief valve operation																											
Inspect / clean filters																											
Clean compressor																											
	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	
Inspect motors, fans and pumps that drive air compressors (check box when complete)																											
Inspect air compressor																											
Drain condensate																											
Check pressure relief valve operation																											
Inspect / clean filters																											
Clean compressor																											

Annual Tasks	Shutdown inspection	Change compressor and crankcase oil
Date		

Staff Training

Manufacturer – Supplier

- ✓ Operation manuals
- ✓ Operator training
- ✓ Cleaning and lubrication schedules
- ✓ Safety procedures
 - Machine postings
 - SDS
- ✓ Disposal of waste byproducts

Insurance carrier

- ✓ Safety and Right-to-Know training

Do you have in-house staff that can train other staff?

**Green Bay Area Public School District
Facilities and Related Services Department**

Engineer and Facility Technician Training Checklist

Employee Name	Trainer	Training Date
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Please complete the following steps as part of the Engineer and Facility Technician Training Program. Training in all areas noted below must be finished in order to have completed the Engineer and Facility Technician Training Program.

1. Employee must check off each area where they feel they are proficient and have a working knowledge of the responsibility.
2. Upon completion a Facilities Supervisor, trainer and employee must review the checklist in order to determine and discuss areas the employee must receive training.
3. Throughout the training period, employee must meet quarterly with a Facilities Supervisor to review status of areas of training.
4. Due to differences between buildings and equipment, training will be arranged by the Facilities Supervisor and the trades maintenance personnel.

System		Proficient/ Working Knowledge		Training Start Date	Training Completed Date	Verification Training Completed	
		Yes	No			Trainer Initials	Employee Initials
Boiler Operation Maintenance	All phases of boiler operation – gages, valves, fuel controls, fire controls						
	Mogul water checks – Ph, Alkalinity, Chloride – Treatment Procedures						
	Blow Down Procedures – Boiler Safety						
	Cleaning – Open, clean fireside, clean waterside – Close – Wash-out and wet storage procedures attached to annual boiler inspection schedules.						
Ventilating Systems	Control systems – Johnson/Siemens/Automated Logic						
	-Blow Down						
	-Compressor						
	-Thermostats						
	Fans - Univents						
	-Cleaning						
	-Lubrication – motors, damper linkages						
-Filter maintenance/changes							
Electrical System	Master Control Panel						
	Disconnects						
	Fusing/Circuit Breakers						

Custodial Staff in Your PM Program

Benefits

- 1) Frontline Information
- 2) Pulse of the building
- 3) Provide feedback on function
- 4) First on site response to emergency during open hours
- 5) Public relations
- 6) Buy-in and ownership
- 7) Cross training of staff

AUTOMATIC SCRUBBER - MAINTENANCE RECORD

Model _____ Year _____ Serial Number _____

Month	_____																										
Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
Check each battery cell(s) water level																											
Inspect Scrub Housing Skirts																											
Inspect and Clean Solution Filter																											
Clean Solution Trough on Cylindrical System																											
Lubricate Machine																											
Check Carbon Brushes																											

Month	_____																																					
Week	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52												
Check each battery cell(s) water level																																						
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Lubricate Machine																																						
Check Carbon Brushes																																						

Note: Do all areas that are not shaded. Initial and date when completed. This form may be copied for future use.

- | | | |
|---------------------|----------------------------------------|-------------------------------------------------|
| Daily Items: | 1. Check/Clean Tanks and Hoses | 5. Check/Clean the Vacuum motor foam filter(s) |
| | 2. Check/Clean/Rotate the Brushes/Pads | 6. Empty/Clean Strainer Basket in Recovery Tank |
| | 3. Check/Clean the Squeegee | 7. Clean Hopper on Cylindrical System |
| | 4. Check/Clean Vacuum Shut-Off Float | 8. Follow Battery Maintenance Schedule |

BATTERY - MAINTENANCE RECORD

Model _____ Year _____ Serial Number _____

Month	_____				_____				_____				_____				_____									
Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Check charging plug on both ends																										
Check all terminal connections																										
Check all cells for water and specific gravity																										
Charge to full																										
Clean battery case and terminals																										

Month	_____				_____				_____				_____				_____									
Week	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Check charging plug on both ends																										
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Charge to full																										
Clean battery case and terminals																										

Note: Do all areas that are not shaded. Initial and date when completed. This form may be copied for future use.

- Daily Items:**
1. Recharge after each use
 2. Check water level after recharging, fill to 1/2" below bottom of fill tube
 2. Ensure connections are tight and clean

Any used batteries should be charged according to the following:

	<u>Storage Temperature</u>	<u>Charge</u>
	Below 40 °F	Every 6 Months
	40°F to 60°F	Every 2 Months
	60°F and above	Once a Month

Building Systems

Outsourcing

Fire Alarms

Asbestos

Elevators

Windows

Hardware

Pools

Electrical

Security Systems

Hazardous Materials

Flooring

Doors

Roofing

Plumbing

HVAC

Site Components

Outsourcing

IPM

Snow Removal

Landscaping

Athletic Fields

Drainage

Lawns

Concrete

Playgrounds

Fertilizer / Herbicides

Fencing

Tree Removal

Irrigation Systems

Wetlands

Asphalt

Masonry

Bleachers

Provide Accountability

Develop and Prepare a Budget for PM Program

- ❖ Use data collected and feedback from staff to determine priorities
- ❖ Identify what needs to be done
- ❖ Explore possible outside funding sources
(i.e. grants, manufacturer rebates)
- ❖ Plan the work and identify who will do it

How to Measure Success

Documentation – Documentation – Documentation

- Account for staff time, tools, equipment and supplies required to complete the work
- Document actual expenditures vs estimated costs
- Share the credit where due

QUESTIONS?

THANK YOU



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