

Preventive Maintenance Concepts – Basic / Advanced





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Invested 10 years as Preventative Maintenance Coordinator at a state university developing a robust PM program.

Reduced HVAC corrective work orders 84% over a 4-year period. Reduced operational costs and service interruptions across the board while improving equipment and asset care.





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Supervise and helped implement the Preventive Maintenance Zone at University of Nebraska. Was on the team that implemented TMA in 2013 at the University of Nebraska. Maintain a robust TMA database with over 22,000 pieces of equipment and over 300 PM tasks.



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University of Nebraska-Lincoln

- Established in 1869
- Flagship institution of state system
- 23,953 students
- 5,250 faculty and staff
- 150+ buildings
- 7.0M+ GSF
- 100,693 PM Work Orders
- 16,719 Corrective WOs from PMs
- 287,736 PM Labor Hours

Preventative Maintenance Concepts

Basic



Topics

1. Purpose of PMs
2. Identifying PM items
3. PM Prerequisites
4. Task Functions (Task Sheets, Master Checks, General Inspection)
5. PM Schedules
6. Load Balancing
7. PM Compliance and Reporting



PURPOSE OF PMS

- Maintain the life expectancy of key equipment
- Ensure mission-critical equipment or areas are operational
- Reduce corrective/ reactive maintenance
- Reduce repair/ replacement cost
- Manage routine/ renewal tasks



IDENTIFYING PM ITEMS



- 01 Life Safety
- 02 Mission-Critical Items
- 03 Expense Items
- 04 Anything that will reduce operational costs



PM Prerequisites

1. Work Order Type
2. Priority
3. Trade
4. Maintenance-Worthy Items (MWI)
5. Meter (if meter based)
6. Load Balancing
7. Task Codes



Work Order Types

WORK ORDER TYPES

+ Add  Edit  Copy  Delete  First  Prev  Next  Last  Print

Identity	Repair Centers	Cost
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General Information

Code	PM	Active	<input checked="" type="checkbox"/>
Budget Code		Description	Preventive Maintenance
<input type="radio"/> Non-Designated <input type="radio"/> Service Request <input type="radio"/> PM <input checked="" type="radio"/> Vandalism <input type="radio"/> Project			

Options Controls



Priorities for PMs

Code ↑	Description
1	Emergency
2	Urgent
3	Routine
4	Scheduled
5	Deferred

PM Schedule Entry

Task Code AHU-Q
Task Description Air Handling Unit - Quarterly
Repair Center Physical Plant
Work Order Type Preventative Maintenance
Work Order Subtype
Priority Code 3
Trade
Department
Account #



Task Sheet vs Master Checks



Task Sheet

- Convenient for copying OEM specifications
- Simple to create
- Easily editable
- Basic
- Designed to tell the tech what to look for and do, no feedback needed
- Un-trackable trends in data

Master Checks

- Trackable trends
- Track reading
- Track Pass/Fails
- Track the tech that recorded the values
- Can generate corrective WO upon failing check



Master Check

MASTER CHECK

[+ Add](#) [Edit](#) [Copy](#) [Delete](#) [First](#) [Prev](#) [Next](#) [Last](#) [Print](#)

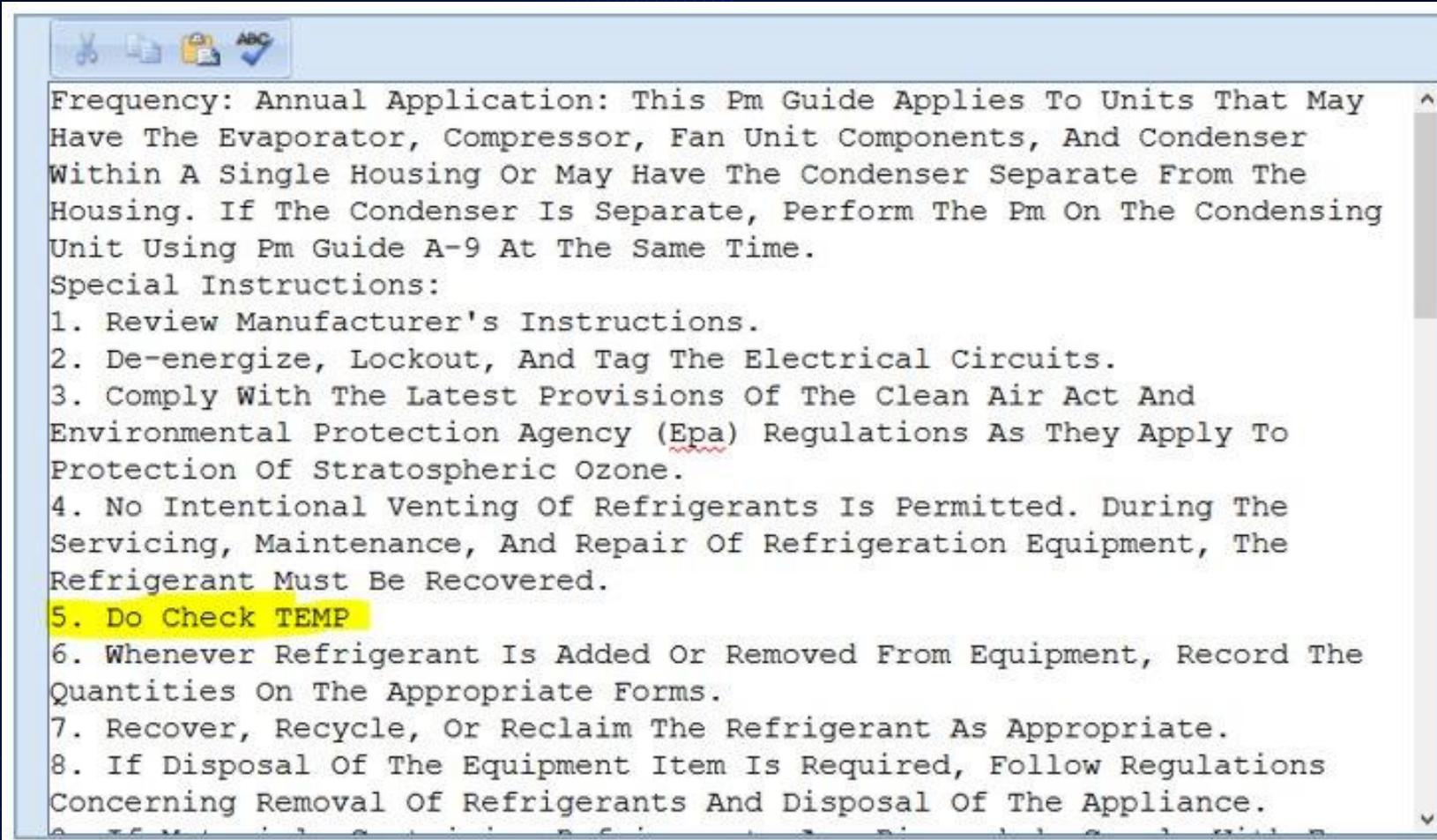
[Identity](#) **Repair Centers**

General Information

Code	AHU-10	Active	<input checked="" type="checkbox"/>
Description	AHU - Check filter for debris / dirt. Test and ensure filter allows air to pass at 30 CFPM. Replace filter if below 30 CFPM.		
Type	PHY	Control	Both P & I
Subtype			



Task Sheet with Master Check



Frequency: Annual Application: This Pm Guide Applies To Units That May Have The Evaporator, Compressor, Fan Unit Components, And Condenser Within A Single Housing Or May Have The Condenser Separate From The Housing. If The Condenser Is Separate, Perform The Pm On The Condensing Unit Using Pm Guide A-9 At The Same Time.

Special Instructions:

1. Review Manufacturer's Instructions.
2. De-energize, Lockout, And Tag The Electrical Circuits.
3. Comply With The Latest Provisions Of The Clean Air Act And Environmental Protection Agency (Epa) Regulations As They Apply To Protection Of Stratospheric Ozone.
4. No Intentional Venting Of Refrigerants Is Permitted. During The Servicing, Maintenance, And Repair Of Refrigeration Equipment, The Refrigerant Must Be Recovered.
5. Do Check TEMP
6. Whenever Refrigerant Is Added Or Removed From Equipment, Record The Quantities On The Appropriate Forms.
7. Recover, Recycle, Or Reclaim The Refrigerant As Appropriate.
8. If Disposal Of The Equipment Item Is Required, Follow Regulations Concerning Removal Of Refrigerants And Disposal Of The Appliance.



PM Item vs PM Task



Assign PM Task to Item

- Simple
- Functional
- Limited

Assign Item to PM Task

- Simple
- Functional
- Efficient
- Informative
- Load Balanced



PM Schedule

PM Schedule															
						Task Type	Task Code	Task Description	Average Time	Unit	Interval	Trade	Repair Center	Next PM Date	Last PM Date
<input type="checkbox"/>						Preventative	HV010-A	Air Conditioning PM - Annual		1	Year	HVAC	Facilities Maintenance	01/01/2023	

PM Schedule Entry

Save | Save & Add | Save & Clone | Cancel

Task Code* HV010-Q	Technician	Contract Number
Task Description* Air Conditioning PM - Quarterly	Warehouse Code	Active <input checked="" type="checkbox"/>
Repair Center* Facilities Maintenance	Charge <input type="checkbox"/>	
Work Order Type* Preventive Maintenance		
Work Order Subtype		
Priority Code* 3		
Trade		
Department		
Account #		

Scheduling Options

Last PM Date: Fixed Floating

Calendar Based Meter Based

Est. Time
Days To Complete

Calendar Schedule

Next PM Date* 10/01/2022
Due Every* 3 Month
Fixed DOW

Season Start
Season End

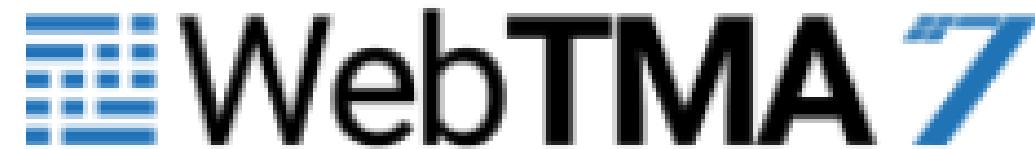
Meter Schedule

Meter Interval
Percent Margin
Assigned Meter
Meter Calculation When WO Completes

Next PM Meter
Last PM Meter
Proj Next Date



Let's look at scheduling a PM in



Fixed vs Floating

Floating PMs

- Meters
- Mowing

Fixed PMs

- Everything else



Calendar vs Metered



Calendar based PM

Calendar Based

Meter Based

Calendar Schedule

Next PM Date*

Due Every* Month

Fixed DOW

Season Start

Season End

Metered based PM

Meter Schedule

Meter Interval*

Percent Margin*

Assigned Meter*

Meter Calculation When WO
Completes

Next PM Meter*

Last PM Meter

Proj Next Date

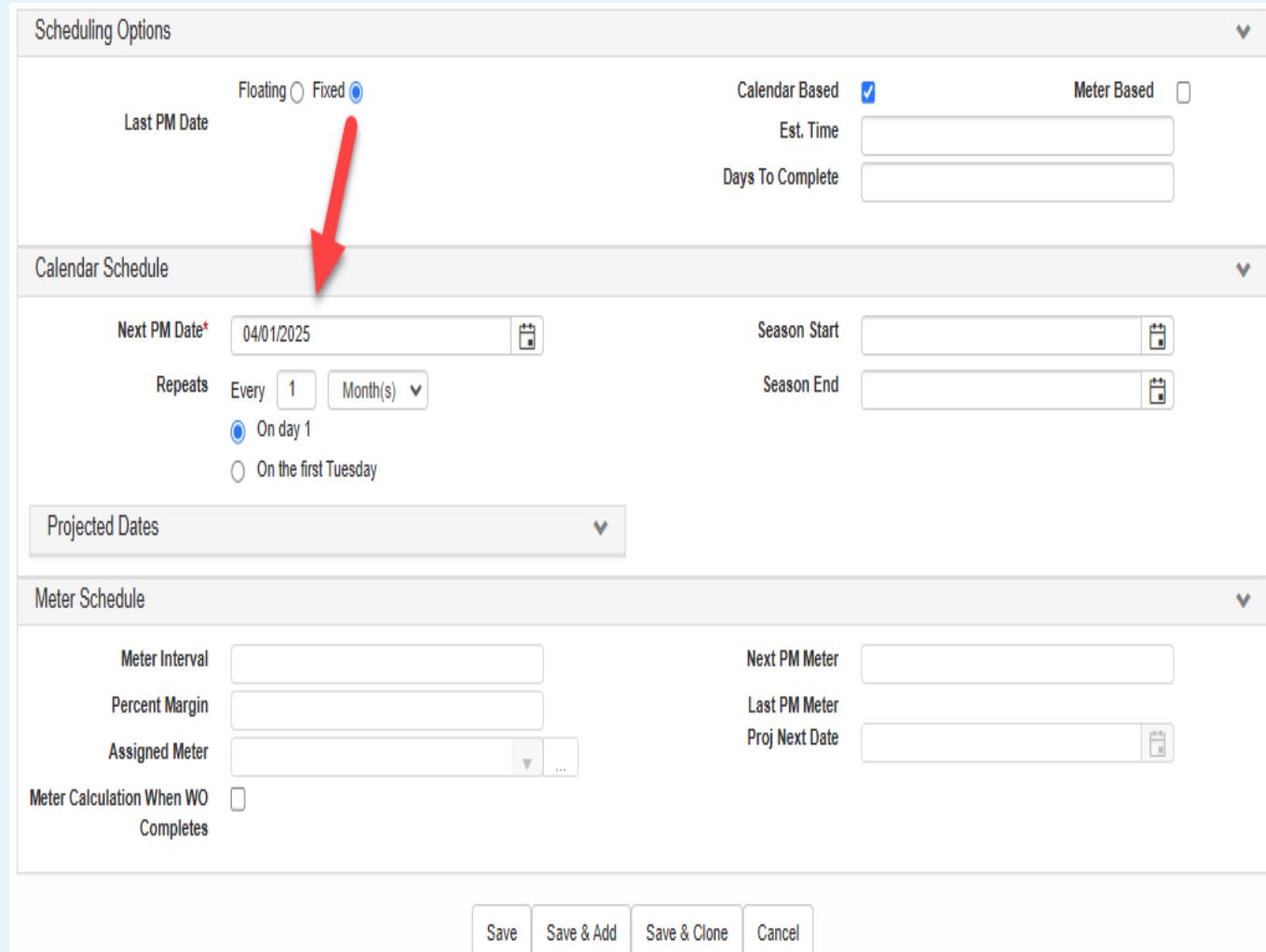


The “R” rule – new feature incorporated into PM scheduling

Current Improvements to PM scheduling being offered

- For Fixed PM schedules
- Allows you to set the schedule for the beginning of the month or the first weekday of the month depending on the day you choose
- Eliminates the *Fixed DOW* checkbox while still integrating the functionality and simultaneously allowing you to schedule more than one fixed day of week per schedule to reduce the number of PM schedules per Task or Item
- Interval display example: *Every 4 weeks on a Tuesday*
- Displays forecasting for user confirmation while using

Fixed PM scheduling looks and works a bit differently now



The screenshot shows the 'Scheduling Options' section of a software interface. The 'Fixed' radio button is selected. A red arrow points to the 'Calendar Schedule' section, which includes fields for 'Next PM Date' (set to 04/01/2025), 'Repeats' (set to 'Every 1 Month(s) On day 1'), and 'Projected Dates'. Below this is the 'Meter Schedule' section, which includes fields for 'Meter Interval', 'Percent Margin', 'Assigned Meter', and 'Meter Calculation When WO Completes'. At the bottom are buttons for 'Save', 'Save & Add', 'Save & Clone', and 'Cancel'.



The “R” rule – only to improve

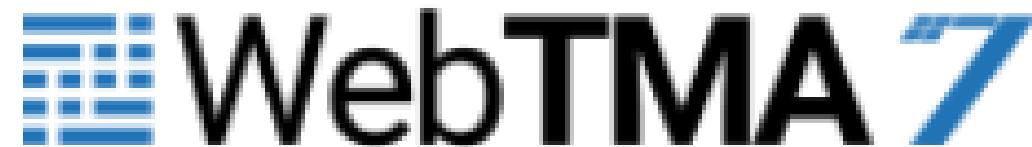


Additional enhancements coming throughout the year

- Cannot edit an existing schedule and convert to an R rule, must delete existing schedule and re-enter as an R rule
- Will not currently show up on existing canned PM Schedule reports in Report Manager – a better solution for PM forecasting coming



Let's look at R rule PM scheduling in



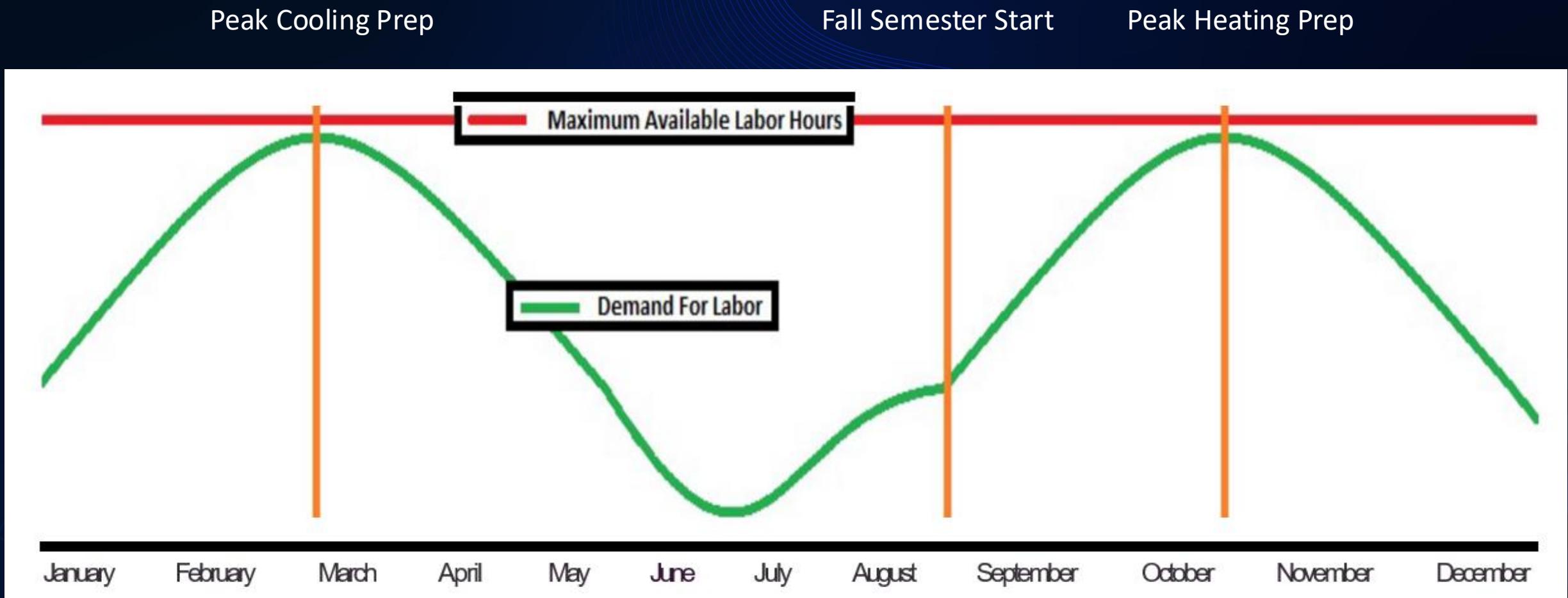
Load Balancing – University Example

PM Seasonal Items

- **Spring PMs for Cooling Systems**
 - Cooling Systems
- **Fall PMs for Heating Systems**
 - Heating Systems
- **Pre-Fall PMs**
 - Residential / Housing Buildings and Areas
- **Non-Seasonal Items**

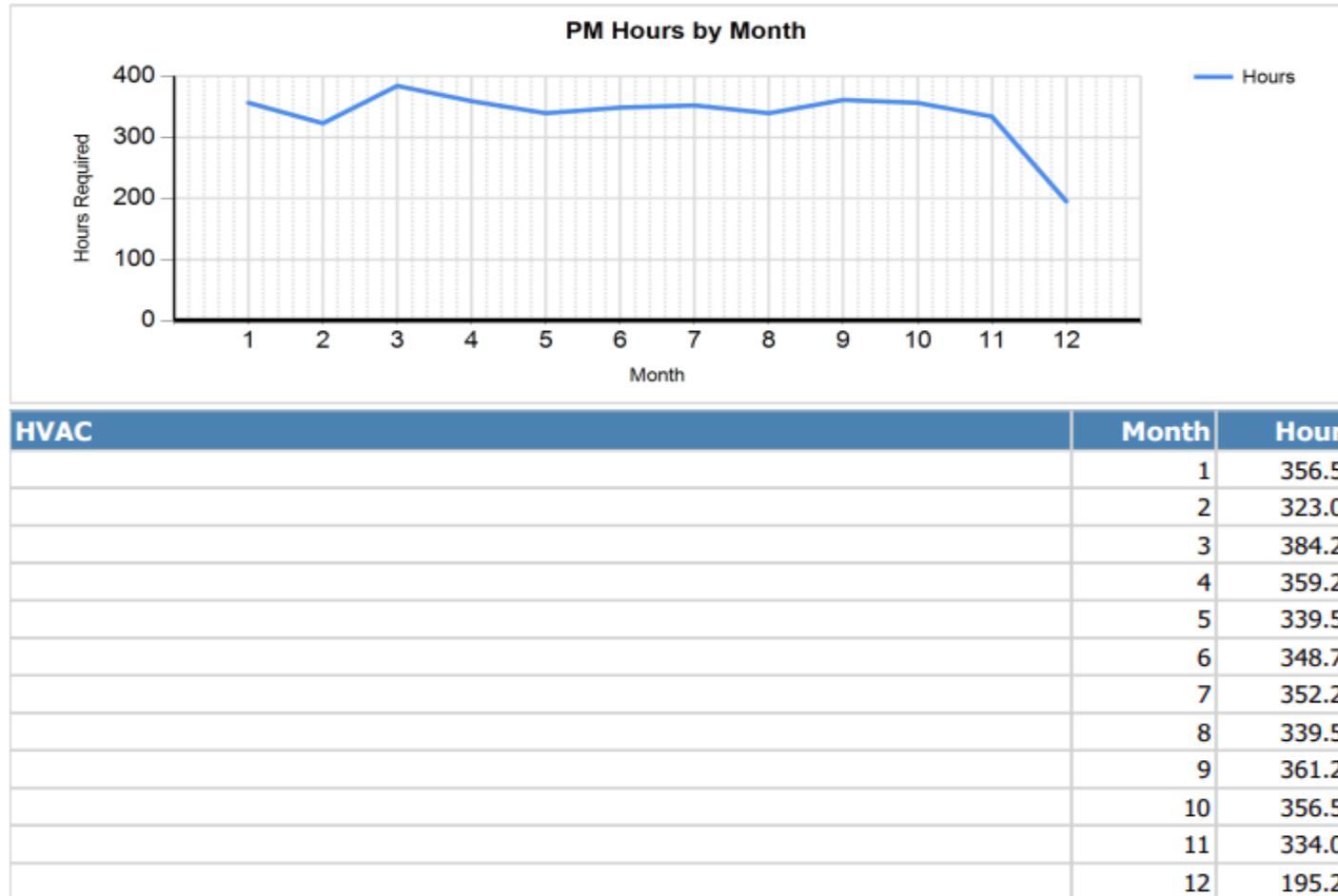


Load Balancing on an Annual Scale



Load Balancing

PM Load Balance Summary by Trade



Adding PM Batch Jobs

BATCH MANAGEMENT

WebTMA

Add Batch Job

Post Charges to Sub Ledger  PM Generation
Project Task Generation Import Weather
 Capital Planning Processes
Generate Lease Invoice
Custodial Inspection Generation

General Information

New Browse Selection Refresh

			Batch Job Type	Status	Start Date	Actual Start	Completed	Repair Center	WO# / SO#
<input checked="" type="checkbox"/>			PM Generation	Completed	09/08/2022 09:57 AM	09/08/2022 09:57 AM	09/08/2022 09:57 AM		
<input checked="" type="checkbox"/>			PM Generation	Completed	09/08/2022 09:57 AM	09/08/2022 09:58 AM	09/08/2022 09:58 AM	Randy Oakes Repair Center	
<input checked="" type="checkbox"/>			PM Generation	Completed	09/08/2022 10:15 AM	09/08/2022 10:15 AM	09/08/2022 10:15 AM	Soap Repair Center	
<input checked="" type="checkbox"/>			PM Generation	Schedule Pending (Automatic)	09/08/2022 04:34 PM				



Single vs Recurring

Batch Job Entry

Cancel	<input type="checkbox"/>
Start Date*	10/01/2022 <input type="button" value="Calendar"/> 05:00 <input type="button" value="Clock"/>
Started	<input type="button" value="Calendar"/> <input type="button" value="Clock"/>
Completed	<input type="button" value="Calendar"/> <input type="button" value="Clock"/>
Canceled	<input type="button" value="Calendar"/> <input type="button" value="Clock"/>
Canceled By	<input type="button"/>
Recurring Batch Job	<input type="checkbox"/>
Email	<input type="text"/>
Notes	<input type="text"/>

Batch Job Entry



Cancel	<input type="checkbox"/>
Start Date*	10/01/2022 <input type="button" value="Calendar"/> 05:00 <input type="button" value="Clock"/>
Started	<input type="button" value="Calendar"/> <input type="button" value="Clock"/>
Completed	<input type="button" value="Calendar"/> <input type="button" value="Clock"/>
Canceled	<input type="button" value="Calendar"/> <input type="button" value="Clock"/>
Canceled By	<input type="button"/>
Recurring Batch Job	<input checked="" type="checkbox"/>
Interval	1 <input type="button" value="Months"/> <input type="button" value="Calendar"/>
Until	<input type="button" value="Calendar"/>
Email	PMPerson@here.edu
Notes	PMs generated this month



PM Generation

Options

- Generate All
- Due Last Day of Month
- Days Forward
- Manual vs Automatic

Batch Job Entry

Previous Save Cancel

Select PM, Item, or Item Type

PM Types Single Item Single Type

Area	<input checked="" type="checkbox"/>	Equipment	<input checked="" type="checkbox"/>	Group	<input checked="" type="checkbox"/>
Asset	<input checked="" type="checkbox"/>	Entity	<input checked="" type="checkbox"/>	IT Equipment	<input checked="" type="checkbox"/>
Biomed Equipment	<input checked="" type="checkbox"/>	Facility	<input checked="" type="checkbox"/>	Tool	<input checked="" type="checkbox"/>
Building	<input checked="" type="checkbox"/>	Floor	<input checked="" type="checkbox"/>	Vehicle	<input checked="" type="checkbox"/>

Generation Options

Days Forward: 28

Generation Type: Automatic Manual

Generate All Due Last Day of Month

Select Location

All Locations

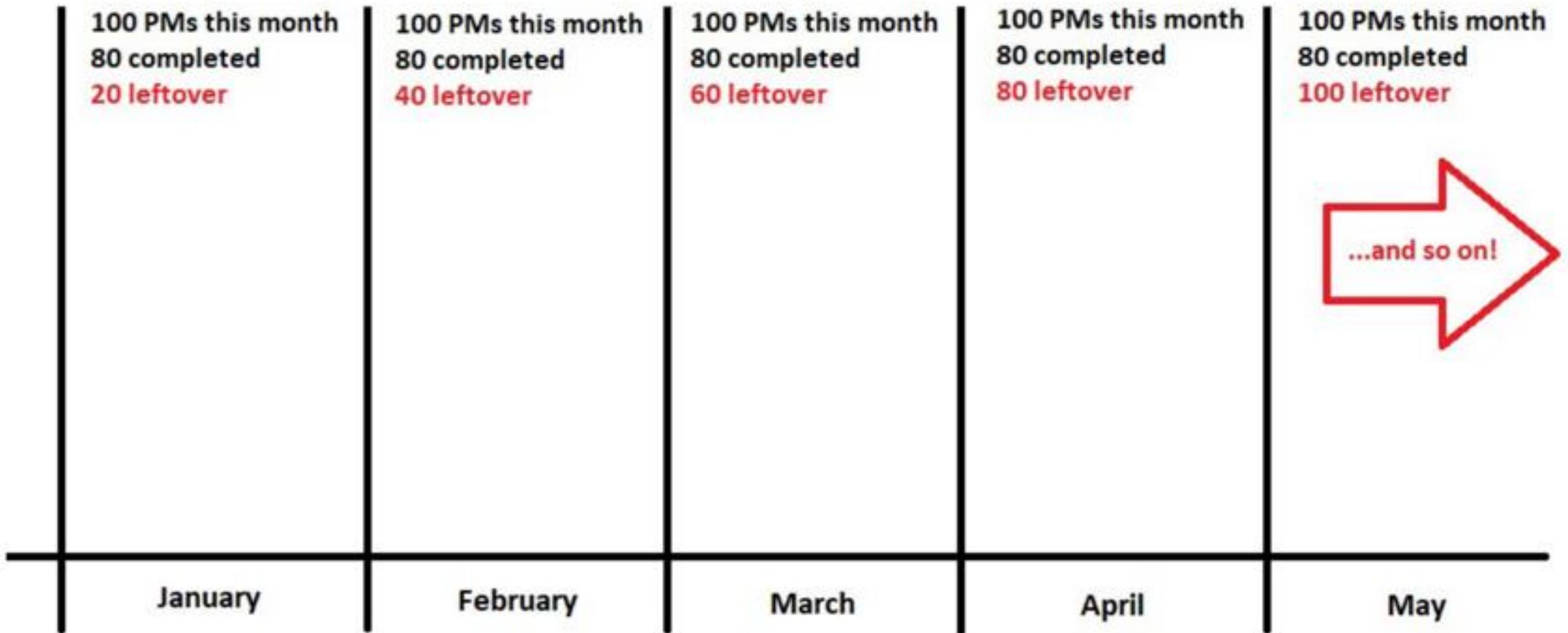
Name



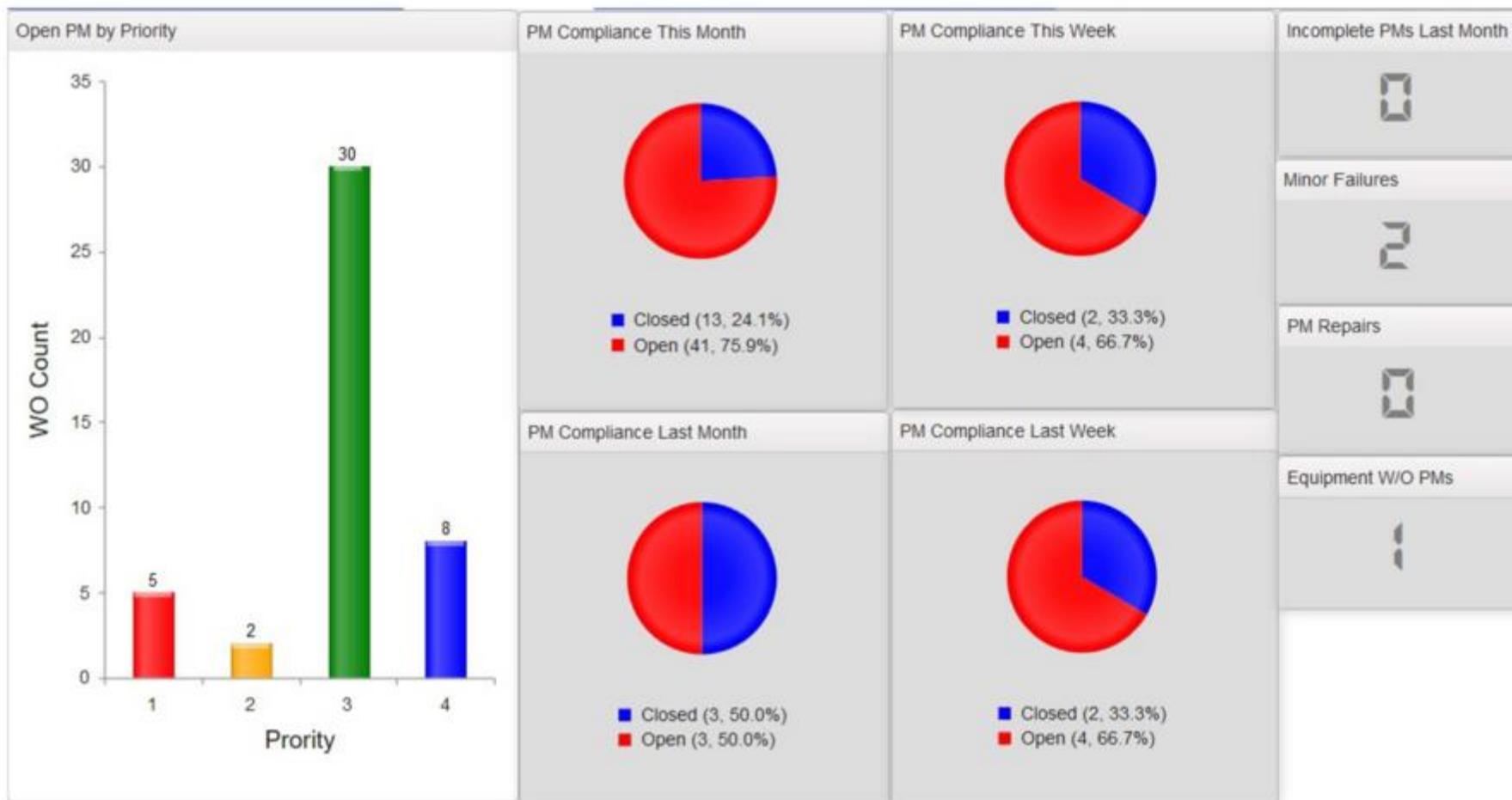
Let's look at Batch Management in



PM Compliance Concept



PM Compliance and Reporting



PM Compliance and Reporting

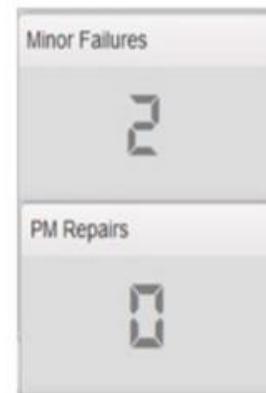
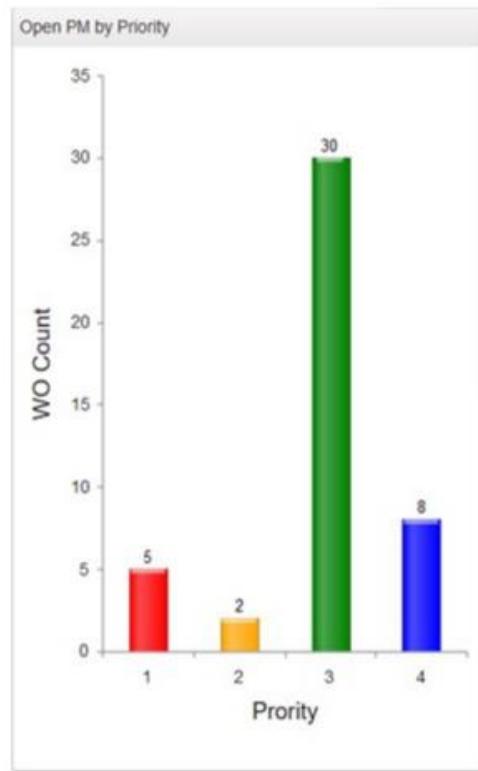
PM KPIs

PM Compliance

PMs by Priority

Major Failures

Minor Failures



Let's look at a PM Dashboard Tab in



Preventative Maintenance Concepts

Advanced



Topics

1. Groups vs Individually Tagged PMs
2. Stabilizing PM Tasks
3. Advanced Load Leveling Techniques
4. PM Rollover
5. PM KPIs
6. Maintaining Compliance



Group vs Individually Tagged PMs

PROS

- Reduce paper by reducing the number of work orders
- Time saving by reducing the number of transactions

CONS

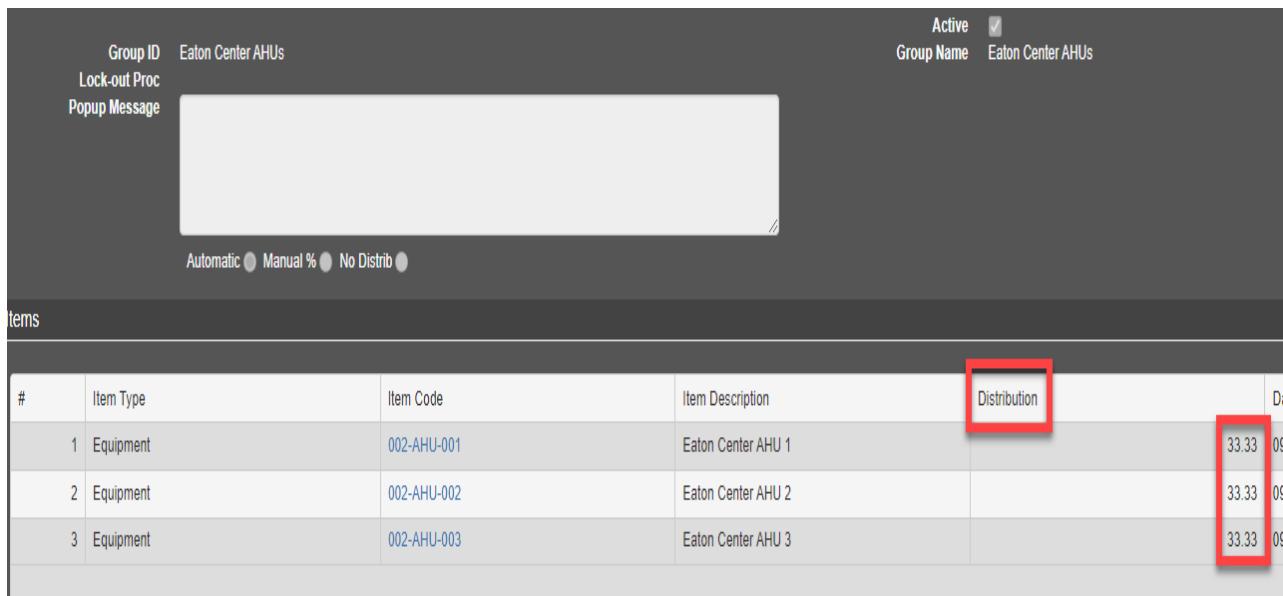
- MWIs may not always be consistent
- Masks cost rollup
- Masks PM compliance / progression
- Impossible to track the true completion

Consider the benefits compared to the tracking and accountability



Groups vs Individually Tagged PMs

- **Building**
- **Cost separation**



Group ID: Eaton Center AHUs
Lock-out Proc:
Popup Message:
Automatic Manual % No Distrib

Active Group Name: Eaton Center AHUs

#	Item Type	Item Code	Item Description	Distribution	Date
1	Equipment	002-AHU-001	Eaton Center AHU 1	33.33	09/
2	Equipment	002-AHU-002	Eaton Center AHU 2	33.33	09/
3	Equipment	002-AHU-003	Eaton Center AHU 3	33.33	09/

General Information

<u>Building</u>	002 <input type="checkbox"/> Eaton Center
<u>Group</u>	Eaton Center AHUs <input type="checkbox"/> Eaton Center AHUs
<u>Requestor</u>	PM Scheduler
<u>Phone #</u>	
<u>Email</u>	
<u>Notify Me</u>	<input checked="" type="checkbox"/>
<u>Status</u>	
<u>Status Note</u>	
<u>Request</u>	Air Handling Unit - Quarterly
<u>Finish Date</u>	
<u>Closed Date</u>	



Stabilizing PM Task

Start with OEM specs

Evaluate performance

Adjust Schedules based on use and environment

- Interior vs Exterior
- Office vs Lab or Server Room
- OEM vs Your Organization

“
SUCCESS
DOESN'T
HAPPEN
IT'S PLANNED
FOR
”



Advanced Load Leveling Techniques

Reports

- PM Load Balance Summary
- PM Load Balance Detail

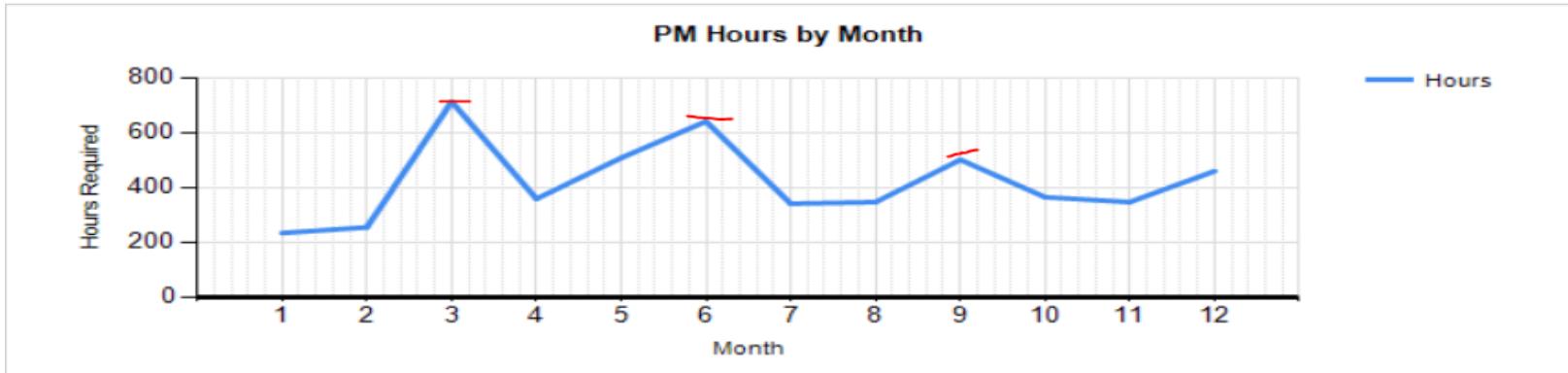
Techniques

- Add seasonal items then fill in the valleys
- Group by location (some months may have more time)
- Plan for time off and holidays



Advanced Load Balancing Techniques

PM Load Balance Summary by Trade



MEP/HVAC	Month	Hours
	1	232.85
	2	253.35
	3	712.35
	4	357.45
	5	507.34
	6	640.60
	7	339.72
	8	345.62
	9	500.47
	10	363.62
	11	345.83
	12	459.10



PM Rollover

- 1 Do NOT allow PMs to cross Compliance period
- 2 Batch Close Last Periods PM Work Orders
- 3 Auto Batch Close Option



Grading your PM Program

Evaluation Period (Analytics)

Major and Minor Failures

Correctives vs PMs

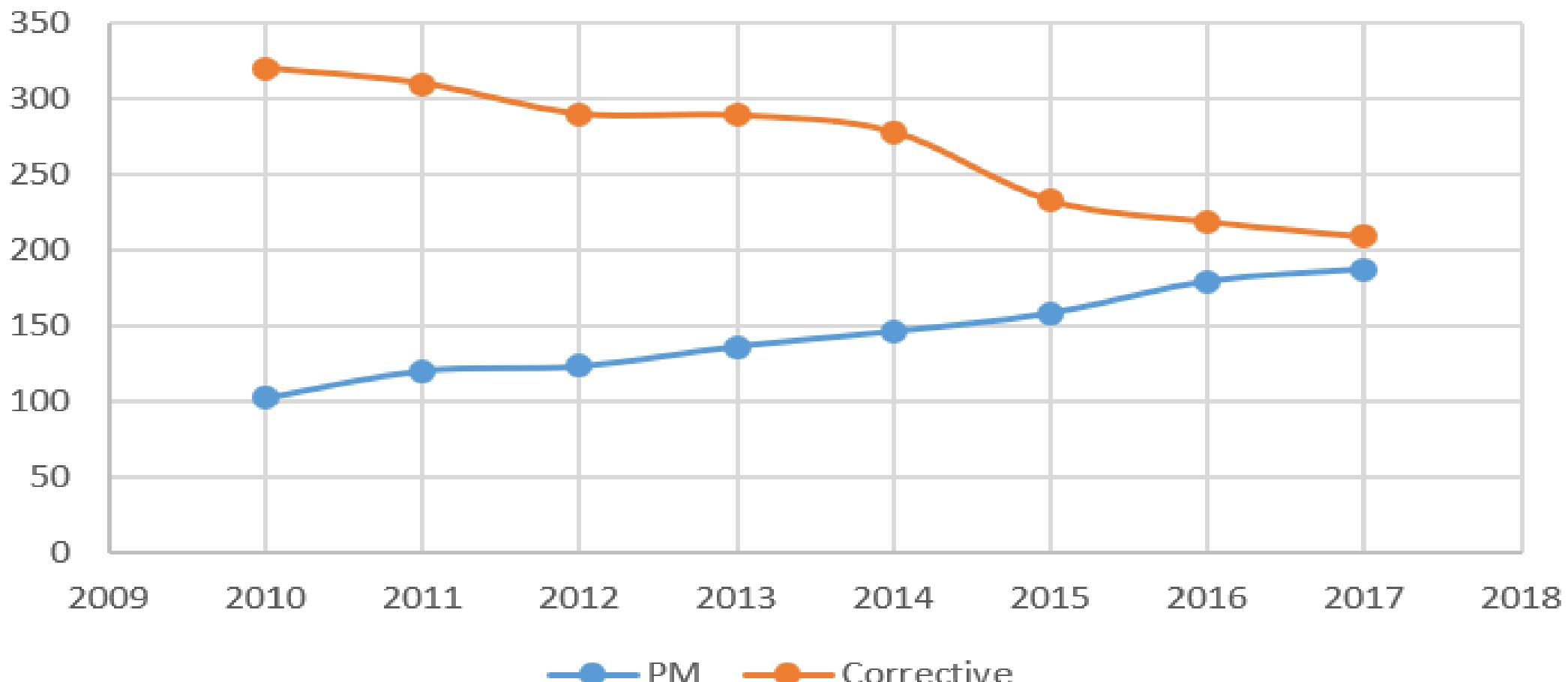
Compliance on Life Safety and Critical Assets

Overall Compliance Score

Efficient Time Management



PM vs Corrective



Maintaining Compliance

- 1 Dedicated Techs or PM Crews
- 2 Do not repair as you go
- 3 Rotate Employees



Thank You!

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