

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.





Brady Wetzel

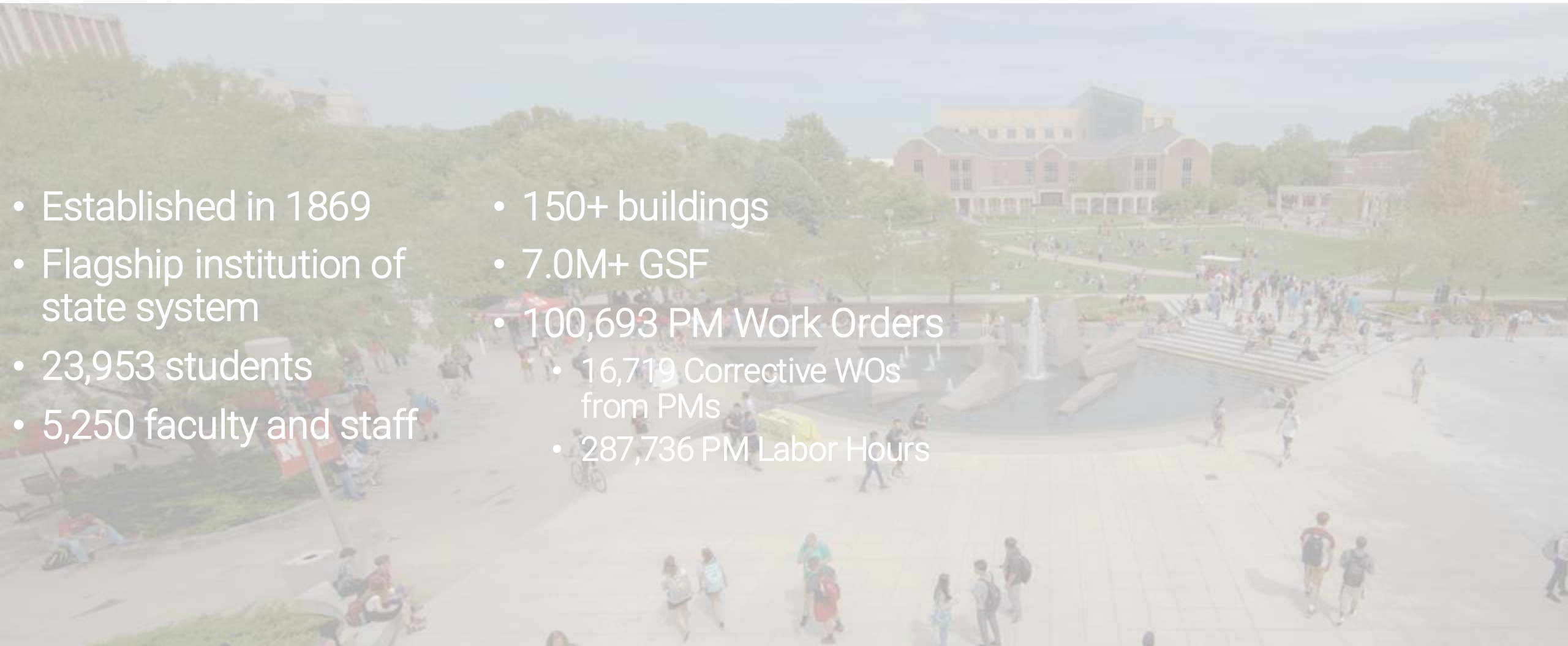
Supervisor, Maintenance
bwetzel2@unl.edu

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.



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

General Information

Code

PM

Budget Code

Active

☒

Description

Preventive Maintenance

Non-Designated

☐

Service Request

☐

PM

☒

Vandalism

☐

Project

☐



Priorities for PMs

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

×

PM Schedule Entry

Task Code

Task Description

Repair Center

Work Order Type

Work Order Subtype

Priority Code

Trade

Department

Account #

AHU-Q

Air Handling Unit - Quarterly

Physical Plant

Preventative Maintenance

3



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

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

Subtype

Active

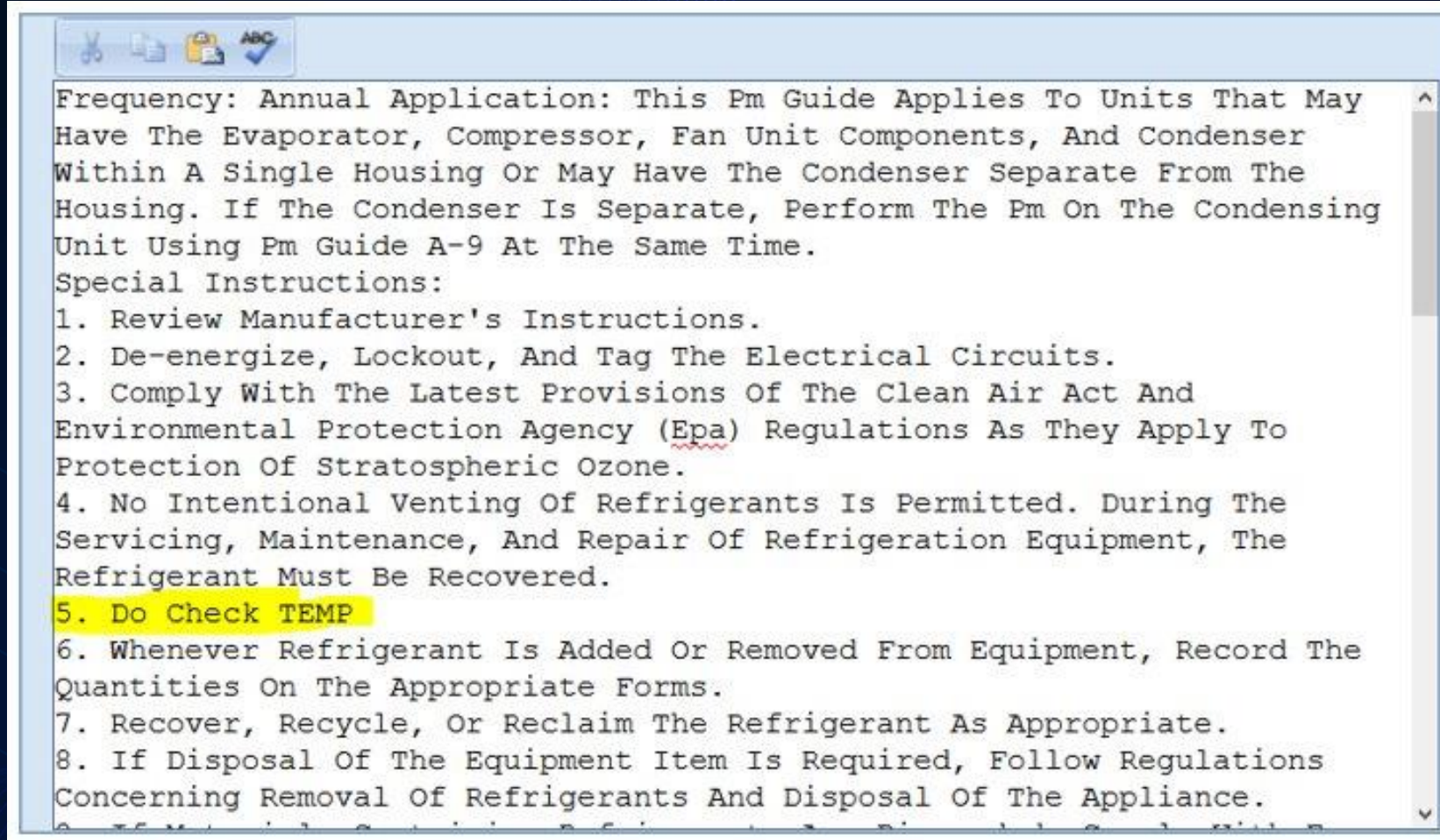
☒

Control

Both P & I



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														
Add PM Edit Selected Batch Add PM Delete Selected														
<input type="checkbox"/>					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

Task Description*Air Conditioning PM - Quarterly

Repair Center*Facilities Maintenance

Work Order Type*Preventive Maintenance

Work Order Subtype

Priority Code*3

Trade

Department

Account #

Technician

Contract Number

Warehouse Code

Active☒

Charge☐

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*3Month

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 ☒

Meter Based ☒

Calendar based PM


Calendar Schedule


Next PM Date* 12/01/2022 
Due Every* 3 Month 
Fixed DOW ☐

Season Start 
Season End 

Metered based PM

Meter Schedule

Meter Interval* 1,000.0000
Percent Margin* 5.0000
Assigned Meter* MCFA-AH2  ...
Meter Calculation When WO Completes ☐

Next PM Meter* 1,000.0000
Last PM Meter
Proj Next Date 

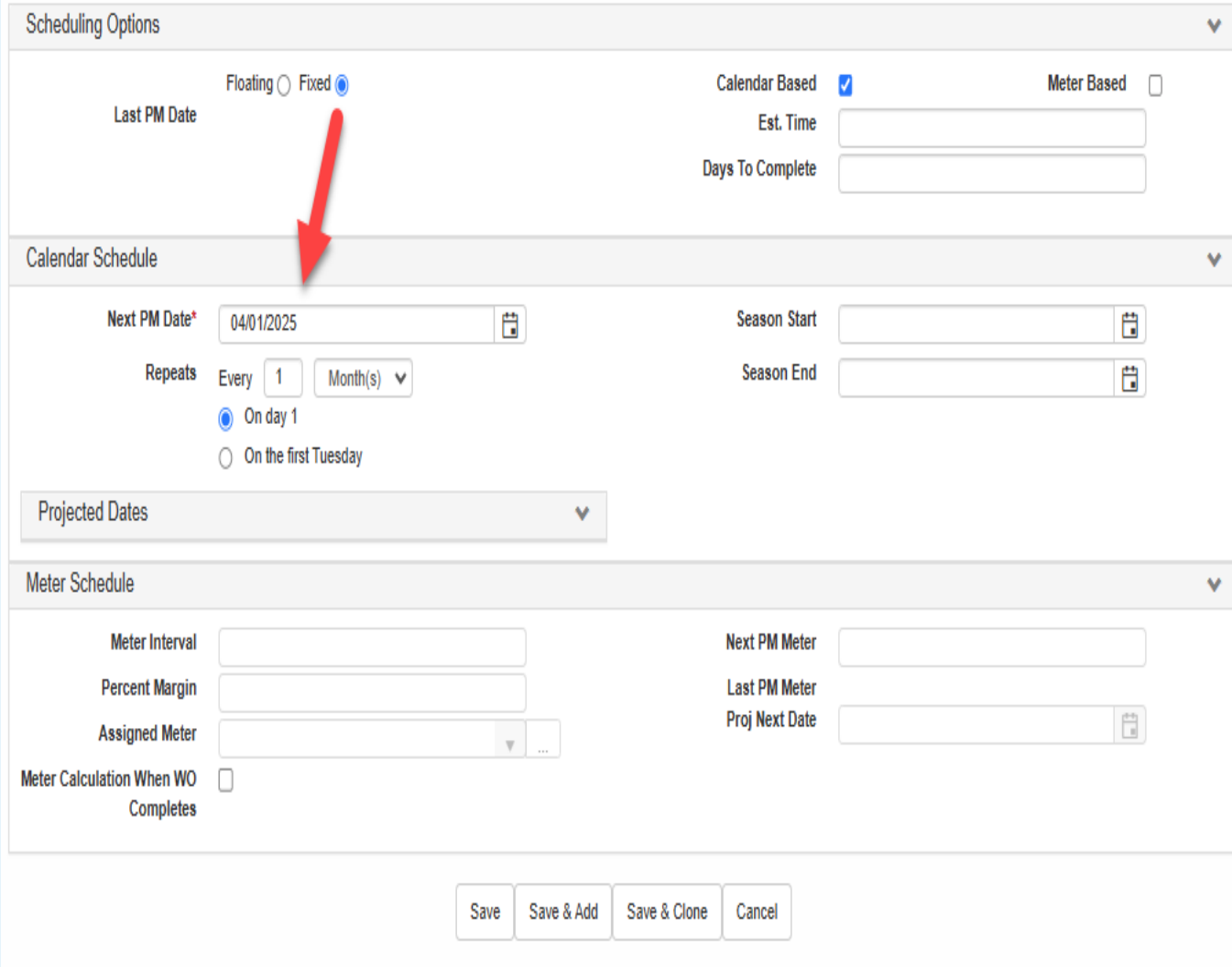


The “R” rule – new feature incorporated into PM scheduling







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 displays the PM scheduling interface with the following sections and fields:

- Scheduling Options:**
 - Radio buttons: Floating ☐ Fixed ☒ (A red arrow points to the 'Fixed' radio button)
 - Calendar Based ☒ Meter Based ☐
 - Est. Time:
 - Days To Complete:
- Calendar Schedule:**
 - Next PM Date*: 
 - Repeats: Every
 - ☒ On day 1
 - ☐ On the first Tuesday
 - Season Start: 
 - Season End: 
 - Projected Dates:
- Meter Schedule:**
 - Meter Interval:
 - Percent Margin:
 - Assigned Meter:  
 - Meter Calculation When WO Completes: ☐
 - Next PM Meter:
 - Last PM Meter:
 - Proj Next Date: 

Buttons at the bottom: Save, Save & Add, Save & Clone, 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**

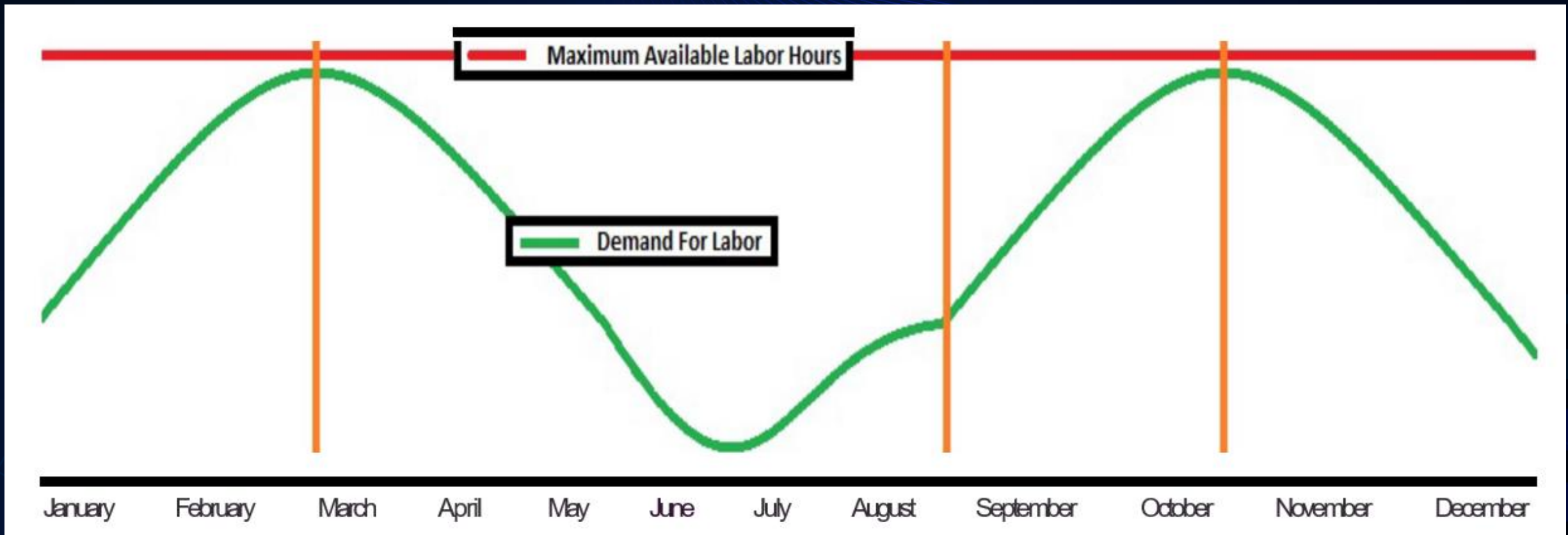


Load Balancing on an Annual Scale

Peak Cooling Prep

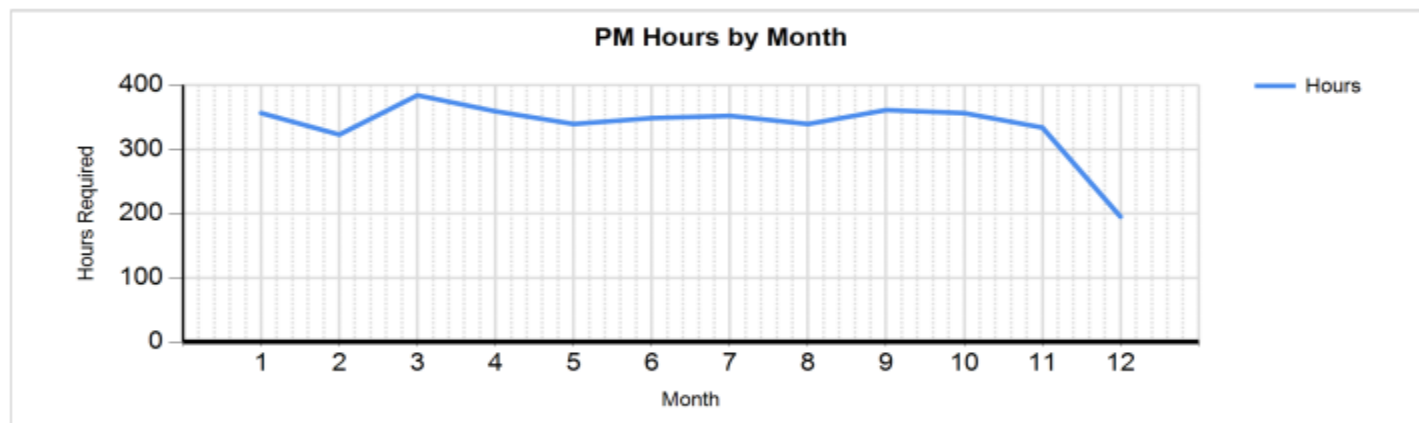
Fall Semester Start

Peak Heating Prep



Load Balancing

PM Load Balance Summary by Trade



HVAC	Month	Hours
	1	356.50
	2	323.00
	3	384.25
	4	359.25
	5	339.50
	6	348.75
	7	352.25
	8	339.50
	9	361.25
	10	356.50
	11	334.00
	12	195.25




Adding PM Batch Jobs

BATCH MANAGEMENT

WebTMA

Add Batch Job







Post Charges to Sub Ledger
Project Task Generation

 PM 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#
			PM Generation	Completed	09/08/2022 09:57 AM	09/08/2022 09:57 AM	09/08/2022 09:57 AM		
			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	
			PM Generation	Completed	09/08/2022 10:15 AM	09/08/2022 10:15 AM	09/08/2022 10:15 AM	Soap Repair Center	
			PM Generation	Schedule Pending (Automatic)	09/08/2022 04:34 PM				







Single vs Recurring



× Batch Job Entry


Cancel ☐

Start Date* 10/01/2022  05:00 

Started  

Completed  

Canceled  

Canceled By 

Recurring Batch Job ☐



Email



Notes



Cancel Next



× Batch Job Entry


Cancel ☐

Start Date* 10/01/2022  05:00 


Started  


Completed  

Canceled  

Canceled By 

Recurring Batch Job ☒

Interval 1 Months 

Until 

Email PMPerson@here.edu

Notes PMs generated this month

Cancel Next



PM Generation

× Batch Job Entry

Previous

Save

Cancel

Options

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

Select PM, Item, or Item Type

PM Types ☒ Single Item ☐ Single Type ☐

Area ☒

Asset ☒

Biomed Equipment ☒

Building ☒

Equipment ☒

Entity ☒

Facility ☒

Floor ☒

Group ☒

IT Equipment ☒

Tool ☒

Vehicle ☒

Toggle

Generation Options

Days Forward

Generate All ☒

Generation Type ☒ Automatic ☐ Manual ☐

Due Last Day of Month ☒

Select Location

All Locations

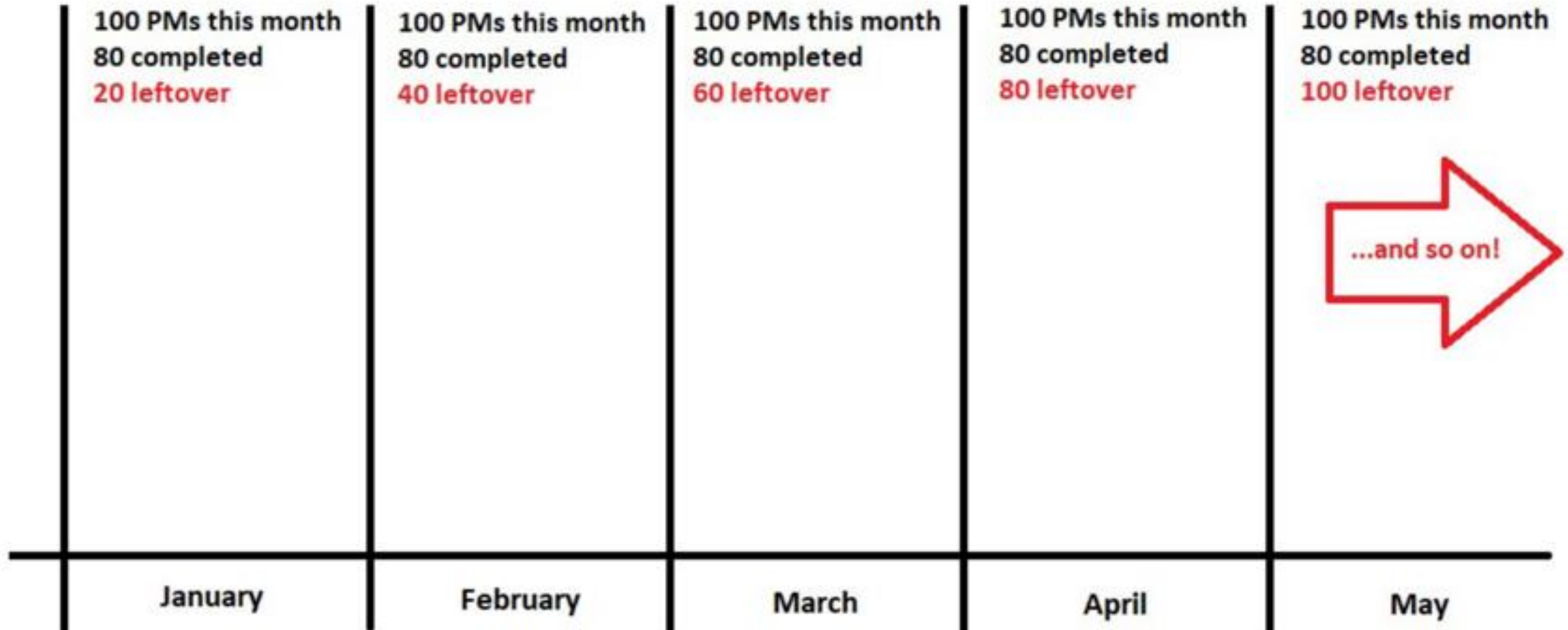
Name



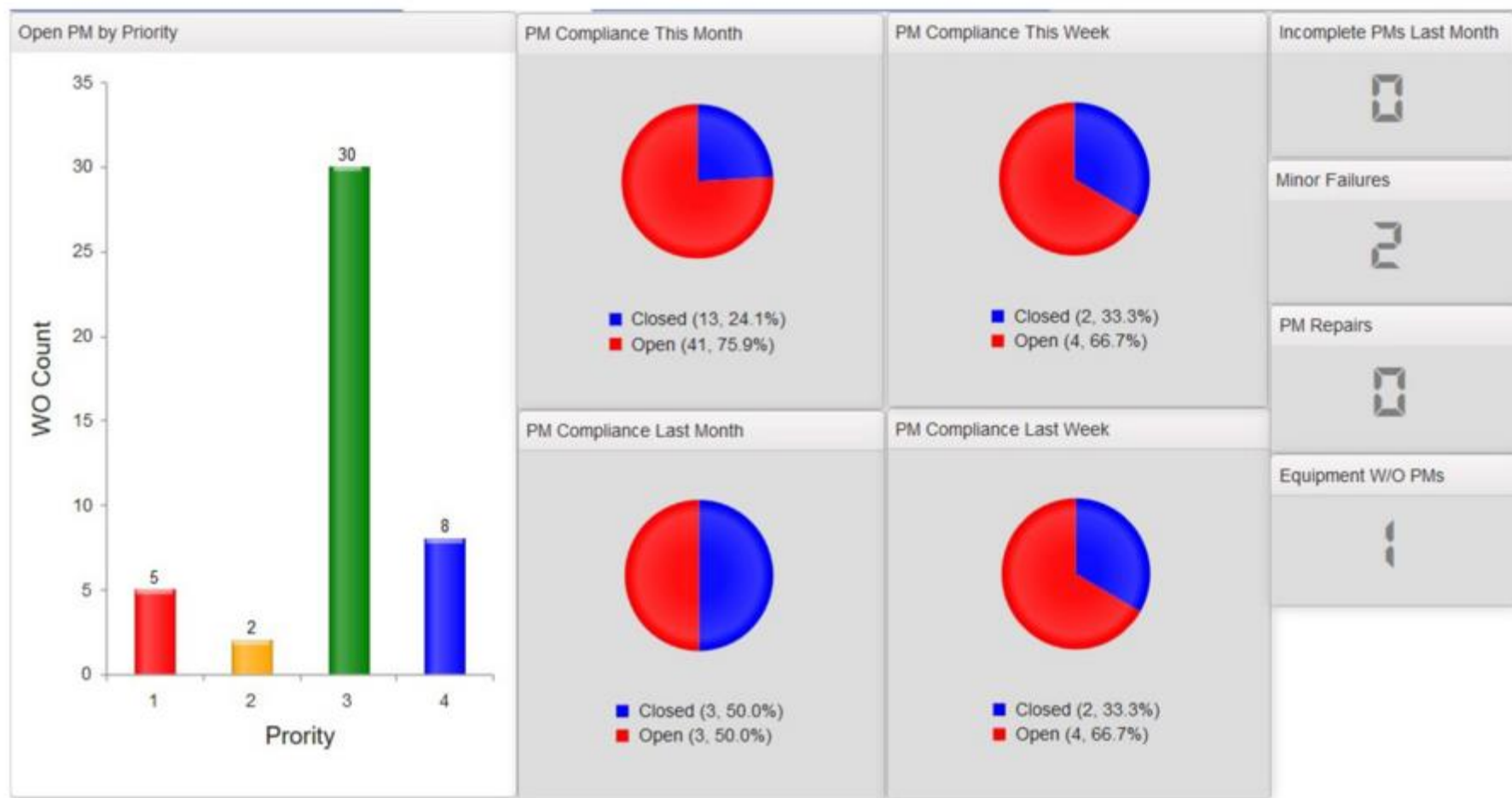
Let's look at Batch Management in



PM Compliance Concept



PM Compliance and Reporting



PM Compliance and Reporting

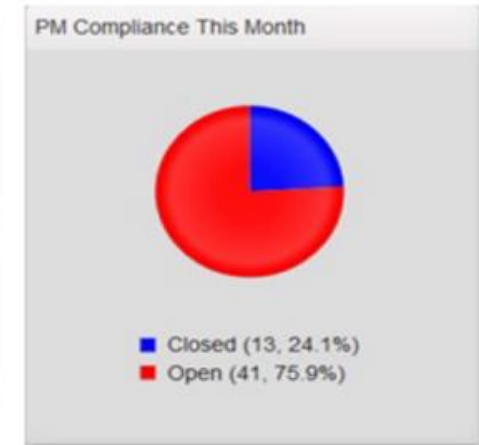
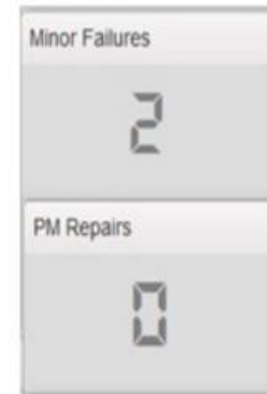
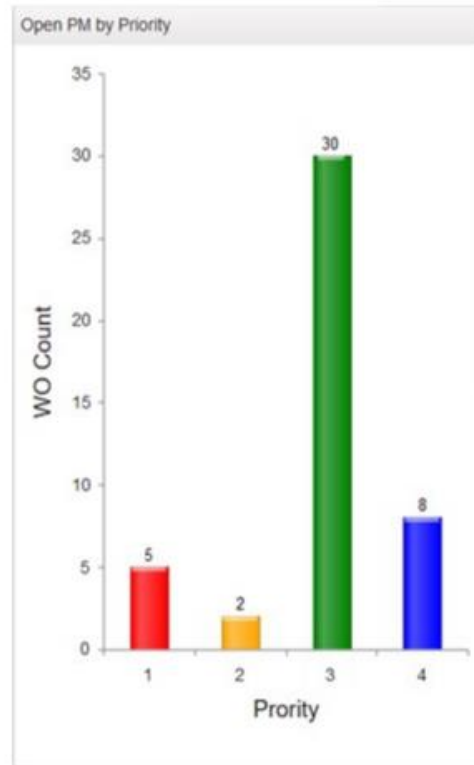
PM KPIs

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

Active ☒

Group Name Eaton Center AHUs

Lock-out Proc
Popup Message

Automatic ☐ Manual % ☐ No Distrib ☐

Items

#	Item Type	Item Code	Item Description	Distribution	Da
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

Building 002

Eaton Center

Group Eaton Center AHUs

Eaton Center AHUs

Requestor PM Scheduler

Phone #

Email

Notify Me ☒

Status

Status Note

Request Air Handling Unit - Quarterly

Finish Date

Closed Date



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

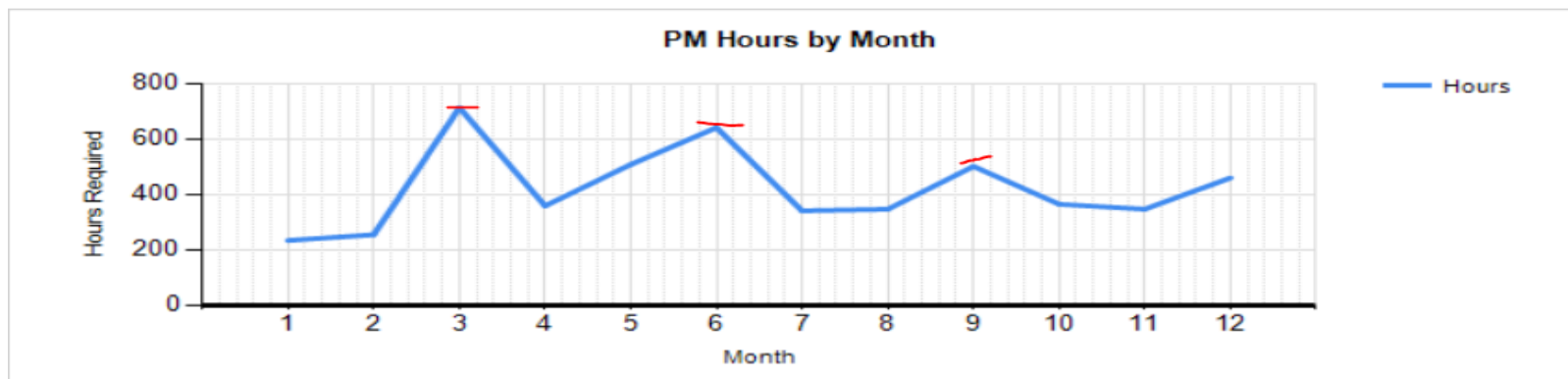
Techniques

- 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

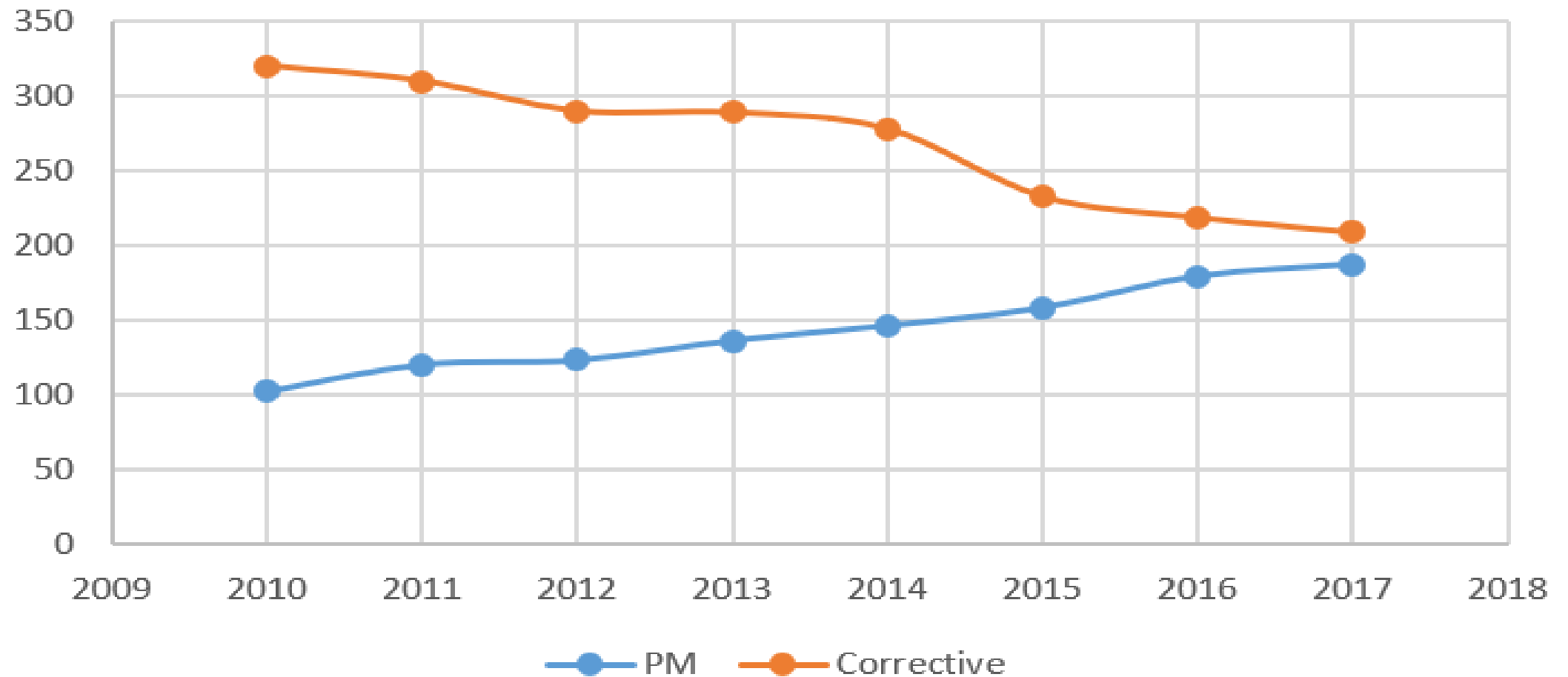
Compliance on Life Safety and Critical Assets

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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UC
25 YEARS
OF COMMUNITY, PARTNERSHIP, AND GROWTH