Healthcare Facilities Management

Module 3: Operations & Maintenance

Student Workbook

Lesson 10 ~ O & M 2

FM College ProFM EDUCATION PARTNER

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OPERATIONS &
MAINTENANCE
2
KingKhalidMedicalCity


MODULE 04-B
O&M STRATEGY
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1

Use of P-F Curve and Interval

Strategy: Use of P-F Curve & Interval

Table 3 Estimates of Service Lives of Various System Components*

Equipment Item	Median Years	Equipment Item	Median Years	Equipment Item	Median Years
Air conditioners		Air terminals		Air-cooled condensers	20
Window unit	10	Diffusers, grilles, and registers	27	Evaporative condensers	20
Residential single or split package	15	Induction and fan-coil units	20	Insulation	
Commercial through-the-wall	15	VAV and double-duct boxes	20	Molded	20
Water-cooled package	15	Air washers	17	Blanket	24
Heat pumps		Ductwork	30	Pumps	
Residential air-to-air	15[b]	Dampers	20	Base-mounted	20
Commercial air-to-air	15	Fans		Pipe-mounted	10
Commercial water-to-air	19	Centrifugal	25	Sump and well	10
Roof-top air conditioners		Axial	20	Condensate	15
Single-zone	15	Propeller	15	Reciprocating engines	20
Multizone	15	Ventilating roof-mounted	20	Steam turbines	30
Boilers, hot water (steam)		Coils		Electric motors	18
Steel water-tube	24 (30)	DX, water, or steam	20	Motor starters	17
Steel fire-tube	25 (25)	Electric	15	Electric transformers	30
Cast iron	35 (30)	Heat exchangers		Controls	
Electric	15	Shell-and-tube	24	Pneumatic	20
Burners	21	Reciprocating compressors	20	Electric	16
Furnaces		Package chillers		Electronic	15
Gas- or oil-fired	18	Reciprocating	20	Valve actuators	
Unit heaters		Centrifugal	23	Hydraulic	15
Gas or electric	13	Absorption	23	Pneumatic	20
Hot water or steam	20	Cooling towers		Self-contained	10
Radiant heaters		Galvanized metal	20		
Electric	10	Wood	20		
Hot water or steam	25	Ceramic	34		

Notes: 1. ASHRAE makes no claims as to the *statistical* validity of any of the data presented in this table.
2. Table lists base values that should be adjusted for local conditions (see the section on Service Life).

Source: Data obtained from a survey of the United States by ASHRAE Technical Committee TC 1.8 (Akalin 1978).
*See Lovvorn and Hiller (1985) and Easton Consultants (1986) for farther information.
[b]Data updated by TC 1.8 in 1986.

Strategy: Use of P-F Curve & Interval

P-F Curve & Interval (Based on ASHRAE life)

- Initial capital replacement budget based on ASHRAE life
- Equipment condition assessed at appropriate frequency

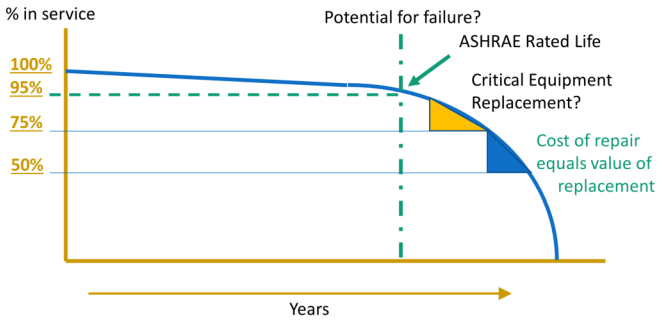
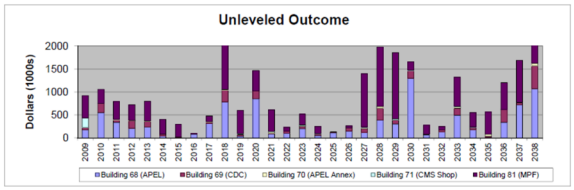
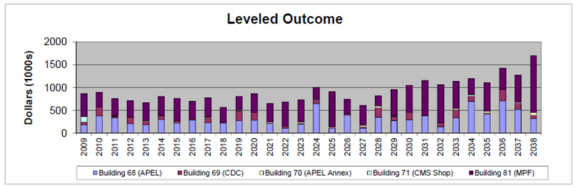


Chart showing replacement at year 15 of all 6 ahus versus replacement in 6 different years based on risk and usage.

Strategy: Use of P-F Curve & Interval

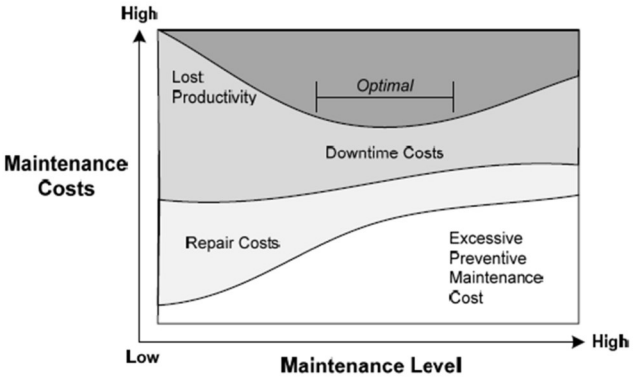




2

Reliability

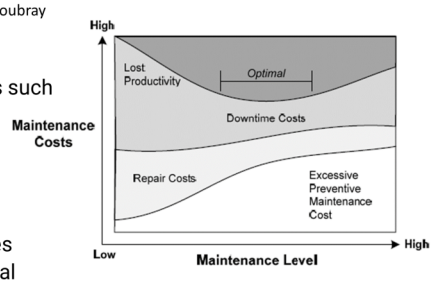
Maintenance Evaluation: Parameters



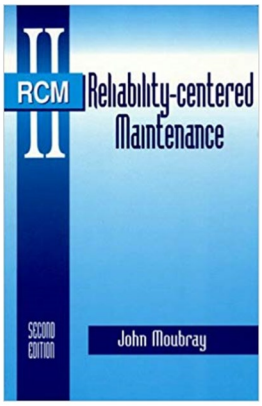
Reliability Centered Maintenance (RCM)

"A process to establish the safe minimum levels of maintenance" John Moubray

- Used to achieve improvements in fields such as:
- Establishment of safe minimum levels of maintenance
- Changes to operating procedures & strategies
- Establishment of capital maintenance regimes and plans



John Moubray's Book



Reliability-centered maintenance is a process used to determine - systematically and scientifically - what must be done to ensure that physical assets continue to do what their users want them to do. Widely recognized by maintenance professionals as the most cost-effective way to develop world-class maintenance strategies, RCM leads to rapid, sustained and substantial improvements in plant availability and reliability, product quality, safety and environmental integrity. The author and his associates have helped users apply RCM and its more modern derivative, RCM2, on more than 700 sites in 34 countries. These sites include all types of manufacturing (especially automobile, steel, paper, petrochemical, pharmaceutical, and food manufacturing), utilities (water, gas, and electricity), armed forces, building services, mining, telecommunications, and transport. This book summarizes this experience in the form of an authoritative and practical description of what RCM2 is and how it should be applied. This book will be of value to maintenance managers, and to anyone else concerned with the reliability, productivity, safety, and environmental integrity of physical assets. Its straightforward, plant-based approach makes the book especially well suited to use in centers of higher education.

Reliability Centered Maintenance (RCM)

SAE JA1011, Evaluation Criteria for RCM Processes

- which sets out the minimum criteria that any process should meet before it can be called RCM

Seven questions:

- What is the item supposed to do and its associated performance standards?
- In what ways can it fail to provide the required functions?
- What are the events that cause each failure?
- What happens when each failure occurs?
- In what way does each failure matter?
- What systematic task can be performed proactively to prevent, or to diminish to a satisfactory degree, the consequences of the failure?
- What must be done if a suitable preventive task cannot be found?

Reliability Centered Maintenance (RCM)

3 Principal Risks:

- to safety,
- to operations, and
- to the maintenance budget

5 Principal options among risk management strategies:

- Predictive maintenance tasks,
- Preventive Restoration or Preventive Replacement maintenance tasks,
- Detective maintenance tasks,
- Run-to-Failure, and
- One-time changes to the "system" (changes to hardware design, to operations, or to other things).

3

Criticality Analysis

Criticality Analysis: Why is it important?

Gathering input from operations, maintenance, engineering, materials management and EH&S representatives can replace individual perceptions of criticality with agreement and better understanding.

Examples of analysis characteristics for assets:

Mission impact	Spares lead-time
Customer impact	Asset replacement value
Environmental, Health, and Safety impact	Planned utilization rate
Ability to isolate/recover from single-point-failures	Preventive Maintenance (PM) history
Mean-Time-Between-Failures (MTBF) or "Reliability"	Corrective Maintenance (CM) history

Criticality Analysis: Healthcare example

Safety and Regulatory Impact		
Criteria		Rank
Potential loss of equipment could result in death	Federal Finding	10
Potential loss of limb, extremety or long term disability	State Finding	8
Potential for loss time at work, short term disability, professional medical assistance required at Emergency Room or Urgent Care Clinic	Local (AHJ), EPA Fines	6
Potential for OSHA recordable, professional medical assistance required by Primary Care Physician	Report Inside CLIENT or CBRE	4
Band Aid, in house basic first aid.	Report Inside Department	2
No effect	No Effect	1

Operational Impact		
Criteria		Rank
Building down or Major Function not available for >5 Days	Loss of or no existing redundancy	10
Critical funciton down or Major Function not available 1-5 Days	Spares and expertise in area, but not owned or available on site	8
Unit down or Major Function down 12-24 Hours	Spares and expertise owned and available on site	6
Floor down or Major Function down 8-12 Hours	Installed non-operational system available. Must be manually put on line	4
Room(s) down or Major Function 2-8 Hours	Installed and running or automatically put on line	2
No Major Function lost or < 2 Hours down	No effect	1

Operational/Repair Cost	
Criteria	Rank
>$100,000	10
$50,000 to $100,000	8
$10,000 to $49,999	6
$2,500 to $9,999	4
<$500	2
No effect	1

4

Reliability Excellence

Reliability Excellence for Critical Systems

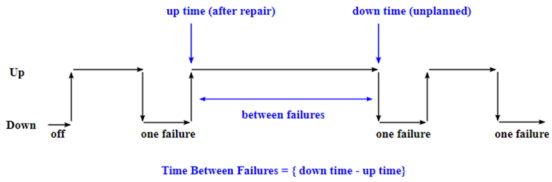
- Maintenance recognized as a contributing resource
- Active participation from all employees, including top level leadership
- Organizational culture embracing responsibility and continuous improvement
- Cooperation between maintenance, operations, and management
- Proactive application of total asset life cycle management practices
- Educated, trained, flexible workforce

Ralph Tileston, Life Cycle Engineering

Reliability KPIs: (MTBF)

Mean time between failures (MTBF) describes the expected time between two failures for a repairable system.

- For example, three identical systems starting to function properly at time 0 are working until all of them fail. The first system failed at 100 hours, the second failed at 120 hours and the third failed at 130 hours.
- The MTBF of the system is the average of the three failure times, which is 116.667 hours.



Reliability KPIs: (OEE)

Overall Equipment Effectiveness (OEE) encompasses availability, performance, and quality, and when used correctly is removing waste.

3 factors:

- A -> Availability = (MTBF-MTTR)/MTBF
- PE -> Performance Efficiency = RE x SE
- Q -> Refers to quality rate. Which is % of good parts out of total produced

$$OEE = A \times PE \times Q$$

MTTR : Mean time to repair
Rate efficiency (RE) : Actual average cycle time is slower than design cycle time because of jams, etc. Output is reduced because of jams
Speed efficiency (SE) : Actual cycle time is slower than design cycle time machine output is reduced because it is running at reduced speed

Reliability KPIs: (FCI)

Facility Condition Index (FCI) is used in facilities management to provide a benchmark to compare the relative condition of a group of facilities.

3 cost factors:

- DM -> Deferred Maintenance cost
- CR -> Capital Renewal cost (renovation cost)
- CRV -> Current Replacement Value

$$FCI = \frac{DM + CR}{CRV}$$

Case Study 1:

International Journal of Scientific World, 3 (2) (2017) 110-116

SPC

International Journal of Scientific World

Website: www.sciencepubco.com/index.php/IJSW
doi: 10.14419/ijsw.v3i2.8109
Research paper

A study on the reliability and performance of solar powered street lighting systems

Adebayo A. Fashina [1,2,9*], Salifu T. Azeko [3,4], Joseph Asare [1,5], Chukwuemeka J. Ani [1], Vitalis C. Anye [3,6], Egidius R. Rwenyagila [3,7], Bruno Dandoghessi [1], Omotoba Oladele [8], Murna Dyeris [8]

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Case Study 2:

Engineering, 2010, 2, 863-873
doi:10.4236/eng.2010.211109 Published Online November 2010 (http://www.scirp.org/journal/eng).

Scientific Research

Reliability-Centered Maintenance Methodology and Application: A Case Study

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Received September 15, 2010, revised September 27, 2010, accepted October 19, 2010

Adobe Acrobat Document

Case Study 3:

PM Improvements at Toyota Lift Truck Plant

Paul V. Arnold, Noria Corporation
Tags: preventive maintenance, lubrication programs, lubricant storage and handling, Case Studies, maintenance and reliability
Georgetown, Ky., is synonymous with Toyota. Each year, manufacturing leaders from across the country – and across industry sectors – make a pilgrimage to this 21,000-resident town to tour the car plant and learn lean principles, efficiency and asset care from the masters.

Considerably fewer plant professionals know that an equally educational Toyota experience exists in the southern Indiana city of Columbus (population 36,000). Toyota Industrial Equipment Manufacturing, or TIEM, may be the best-kept secret in Columbus ... and perhaps all of industry.

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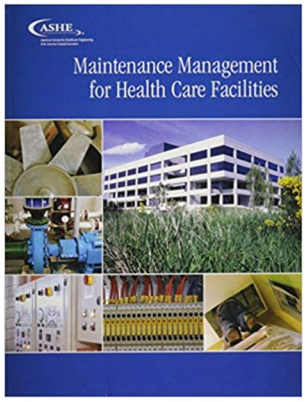
5

TJC Requirements to Modify Maintenance

Alternative Equipment Maintenance (AEM)



- Strategies of an AEM must not reduce the safety of equipment
- Based on accepted standards of practice
- Equipment with activities based on OEM must have 100% completion rates
- AEM scheduled frequencies for both high-risk and non-high-risk equipment must have 100% completion based on the Hospital's AEM program frequencies
- Written AEM Program with policy justification
- Good reference!

OEM Maintenance Standards Required

- Equipment subject to federal or state law or Medicare Conditions of Participation in which inspecting, testing, and maintaining must be in accordance with the manufacturers' recommendations, or otherwise establishes more stringent maintenance requirements
- Medical laser devices
- Imaging and radiologic equipment (whether used for diagnostic or therapeutic purposes)
- New medical equipment with insufficient maintenance history to support the use of alternative maintenance strategies

Source: The Joint Commission, Comprehensive Accreditation Manual for Hospitals Effective January 1, 2019

"Generally accepted Standards": Example

Generally Accepted Standards of Practice used by _____ in its AEM Program take into account the following publications by nationally recognized organizations/expert associations in establishing AEM activities and frequencies.

- American Society for Healthcare Engineering (ASHE) 2009 document: Maintenance Management for Health Care Facilities
- ANSI/NETA Standard for Maintenance Testing Specifications for Electrical Power Equipment and Systems
- NFPA 70B, Recommended Practice for Electrical Equipment Maintenance
- NFPA Standards such as NFPA 17A (standard for wet chemical extinguishing systems); NFPA 99 (standard for health care facilities); NFPA 99C (standard on gas and vacuum systems); NFPA 110 (standard for emergency and standby power systems).
- ANSI/ASHRAE/ACCA Standard 180-2008, Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems; including Addendum a dated 2012

Process for establishing AEM Program

Gather Information	Assessment	Documentation	AEM Program
			
• System • Room / Location	• Risks • Mitigation • Strategy	• Inventory • OEM? • AEM?	• Maintain • Document • Review

Example process for establishing AEM Program

UCSDMC

ENGINEERING/BUILDING INFRASTRUCTURE AND SYSTEMS INVENTORY

HOSPITAL NAME:

ENGINEERING DIRECTOR NAME:

EQUIPMENT/SYSTEM	MANUFACTURER	YEAR BUILT/ INSTALLED	SIZE	CAPACITY	TYPE	AREA/EQUIPMENT SERVED	ON E-POWER?	VENDOR/ Emergency number	COMMENTS
CHILLERS			*Tons*		*Screw, Rotary, Centrifugal, Steam AbsorptionEtc.*	*General Hospital, OR's, MOB, etc.*			*How much redundancy, if any?*
Chiller #1									
Chiller #2									
Chiller #3									
Chiller #4									
COOLING TOWERS			*Tons*		*Natural Draft, Forced Draft, Induced Draft*	*Chiller 1, etc.*			
Cooling Tower #1									
Cooling Tower #2									
Cooling Tower #3									
Cooling Tower #4									
FREE COOLING			*Tons*		*Plate/Frame, etc.*				
Free Cooling Heat Exchanger									
BOILERS/WATER HEATERS			*HP*	*Steam Pressure*	*Steam/Hot Water*				
MAJOR PUMPS (COOLING & HEATING SYSTEMS)			*HP*	*GPM*		*Chilled Water Supply (Lead), Condenser Pump, Return Pump, etc.*			

Microsoft Excel 97-2003 Worksheet

Source: UCSD Medical Center, University of California San Diego Health System

Example process for establishing AEM Program

NFPA 99-2012 Risk Assessment Tool

ASHE

Instructions for Using the ASHE NFPA 99 Risk Assessment Tool

Prior to implementing this risk assessment tool, the following steps should be taken:

1. Establish a multidisciplinary team with knowledge of the facility's space use, patient care services, clinical practices, and other areas as appropriate.
2. Familiarize the team with the risk category definitions found in chapters 4 (Fundamentals) and 12 (Emergency Management) of NFPA 99-2012 *Health Care Facilities Code*. These definitions are included in the category legends on each worksheet; mouse over the "Category Legends" box to see them.
3. Familiarize the team with the ways in which system and equipment operability can affect patient safety.

This risk assessment tool contains three worksheets (Systems, Equipment, and Emergency Management) as indicated on the worksheet tabs below.

Systems Worksheet - This worksheet is used to record the level of risk determined for the listed systems in a given area (room or space within a room) of the facility being evaluated. Indicate the risk level with an NFPA 99 risk category number (see the Category Legend for details).

Room Name: Enter the unique identification information for the room being evaluated (i.e., room name or number).
Room Number: Enter the room number, if applicable.
Space: Enter the unique identification information for the space in a room that is being evaluated (e.g., the charting area in a recovery area).
Chapter 5: Enter the risk category for the various components of the **medical gas and vacuum systems** in the room or space being evaluated.
Chapter 6: Enter the risk category for the **electrical system** in the room or space being evaluated.
Chapter 7: Enter the risk category for the various components of the **IT and communications systems** in the room or space being evaluated.
Chapter 8: Enter the risk category for the various components of the **plumbing systems** in the room or space being evaluated.

Chapter 9: Enter the risk category for the various components of the **HVAC systems** in the room or space being evaluated.
Chapter 10: Indicated on this worksheet for information only - to be assessed on the Equipment worksheet.

Chapter 12: Indicated on this worksheet for information only - to be assessed on the Emergency Management worksheet.
Note: Categories assigned in the chapter columns listed above are based on categories as outlined in Chapter 4 of NFPA 99-2012.

Equipment Worksheet - This worksheet is used to record the level of risk determined for all patient care equipment in the facility. Indicate the risk level with an NFPA 99 risk category number (see the Category Legend for details).

Equipment: Enter the name of the piece of equipment being assessed.
Equipment Tag #: Enter the unique identifying number for the piece of equipment being assessed. This information is optional, but should be considered when assessing non-movable equipment.
Category: Enter the risk category assigned to the equipment based on the categories outlined in Chapter 4 of NFPA 99-2012.
Notes: The comment area is provided for additional information about the reasons the risk category was assigned to the piece of equipment.
Note: NFPA 99-2012 Section 3.3.1.1) defines the equipment covered by the code as "appliances and equipment used in patient care rooms of health care facilities." This includes all equipment that may be used for patient care, such as defibrillators, ultrasound equipment, ventilators, weight scales, thermometers, and so on. Gas equipment includes items such as the oxygen regulator, non-rebreather masks, nebulizers, and nasal cannulas.

Emergency Management Worksheet - This tool is used to record the building category from NFPA 99 Table 12.3 (Application Matrix) assigned to each building.

Building: Enter the name or identifying information for the building.
Category: Enter the risk category assigned to each building based on the categories outlined in Table 12.3 (Application Matrix) in Chapter 12 of NFPA 99-2012.

Notes: This risk assessment tool has been developed to help health care facility staff comply with the risk-based, patient-focused approach required by NFPA 99: Health Care Facilities Code beginning with the 2012 edition. Rather than using the former occupancy-based approach, NFPA 99 now has the same requirements for a procedure no matter where it takes place, focusing on risks to patients and caregivers and on patient outcomes.

Source: American Society for Healthcare Engineering – ASHE.org

Example process for establishing AEM Program

Overview of System Failures —
A Guidance for Incident Commander/Hospital Command Center

Impacts	Primary Users (Who is Affected)	Key Actions (What Do You Need to Do)	Primary Partners
Normal Power Failure			
Lighting	• All facility	• Assess critical areas affected • Use flash lights/lanterns as needed • Caution for trip hazards • Minimal lighting on generators	POM
Medical Devices	• Clinical areas • Laboratory • Surgery, Cath Lab, L&D	• Critical devices in Red Plugs • Delay/cancel elective procedures • Consider relocating services to unaffected areas	Bio Med
Equipment	• All facility	• Critical equipment in Red Plugs • May need to unlock Pyxis/medication delivery • Manual activities	POM Pharmacy
Computers	• All facility	• Use Downtime Procedures as needed • If computer is on generator…	IT
Elevators	• All facility	• Check for trapped persons in elevators • Limit unnecessary elevator use • If 1&2 elevators are on generator	POM
Communications • Fax • DOD Lines • Nurse Call • Telephone Server • Pagers	• All facility	• Notification of failure • Inform of alternate plans • Cell phones, HAM, other backups • Runners • See Communication Failure below	POM Telecom
Insert Additional Items as Needed	•	•	

Source: California Hospital Association

Utilities AEM Policy - Example

SUBJECT/TITLE: **ALTERNATE EQUIPMENT MANAGEMENT (AEM) PROGRAM**

PURPOSE: In accordance with CMS/TJC regulations, UIHC has established an Alternate Equipment Maintenance (AEM) program for selected utility systems equipment to use other than manufacturers' recommendations for inspections / testing / maintenance (ITM).

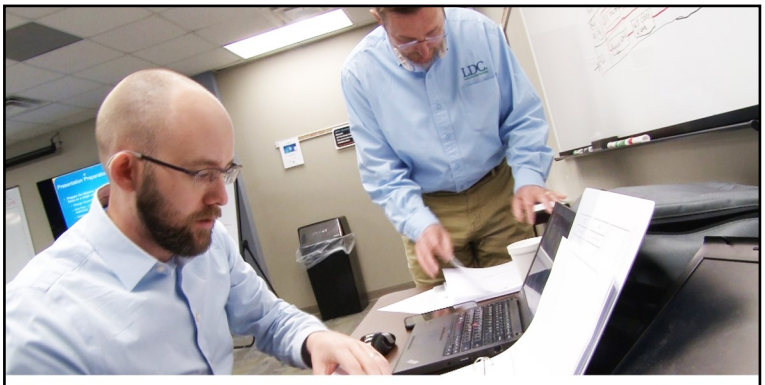
DEFINITIONS: Utility systems are defined by TJC as building systems that provide support to the environment of care, including electrical distribution and emergency power; vertical and horizontal transport; heating, ventilating, and air conditioning (HVAC); refrigeration; plumbing and mechanical systems including piped gases and vacuum systems.

High-risk utility system operating components – As stated within the Utility Management Plan, high-risk utility system operating components (equivalent to the CMS term Critical Components) are any devices or components of building utility systems for which there is a risk of serious injury or death to a patient or staff member if the device or component fails. High-risk equipment includes but is not limited to life support equipment. However it applies more broadly, encompassing other items that are technically not necessary to support life but that would put the patient or staff member at risk of serious injury or death if they fail. All high-risk operating components are so designated on the utility inventories.

Generally Accepted Standards of Practice – Generally Accepted Standards of Practice used by UIHC in its AEM Program take into account the following publications by nationally recognized organizations/expert associations in establishing AEM activities and frequencies.

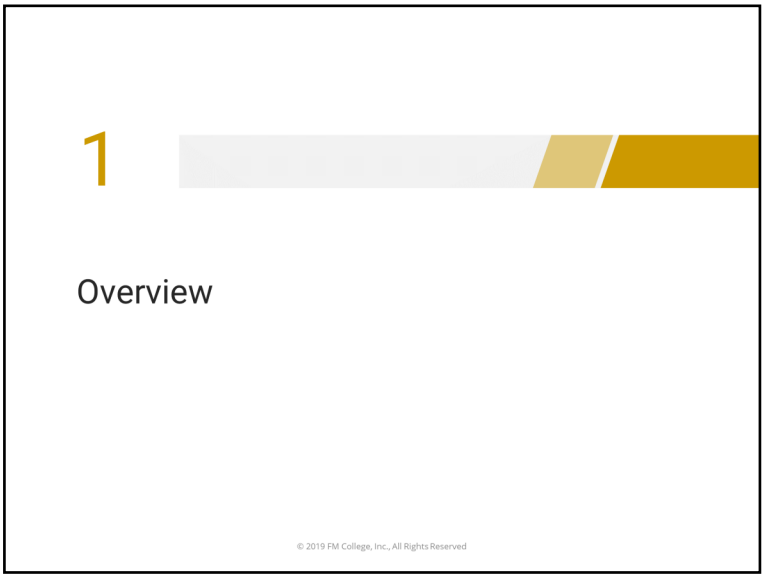
- American Society for Healthcare Engineering (ASHE) 2009 document: Maintenance Management for Health Care Facilities (hereinafter called the ASHE Book)
- ANSI/NETA (InterNational Electrical Testing Association) Standard for Maintenance Testing Specifications for Electrical Power Equipment and Systems
- NFPA 70B, Recommended Practice for Electrical Equipment Maintenance
- NFPA Standards such as NFPA 17A (standard for wet chemical

Source: University of Iowa Healthcare



MODULE 04-C

MAINTENANCE MANAGEMENT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Overview
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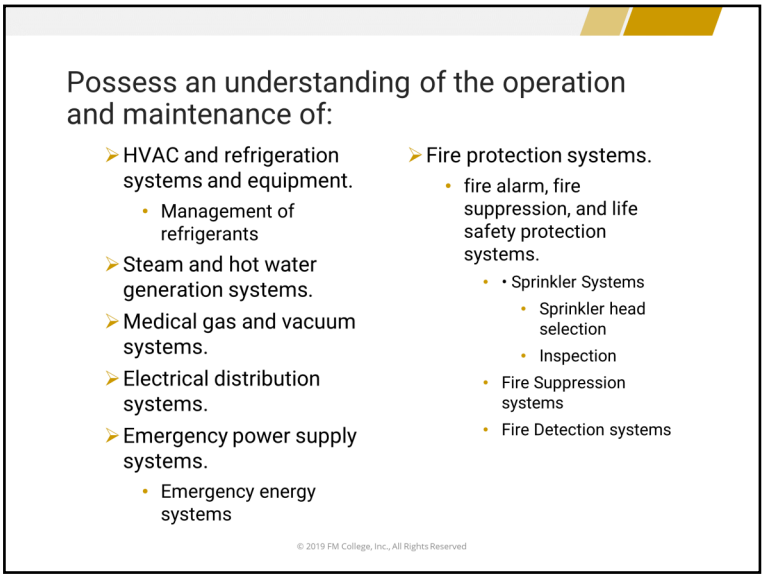
Possess an understanding of the operation and maintenance of:
HVAC and refrigeration systems and equipment.
Management of refrigerants
Steam and hot water generation systems.
Medical gas and vacuum systems.
Electrical distribution systems.
Emergency power supply systems.
Emergency energy systems
Fire protection systems.
fire alarm, fire suppression, and life safety protection systems.
• Sprinkler Systems
Sprinkler head selection
Inspection
Fire Suppression systems
Fire Detection systems
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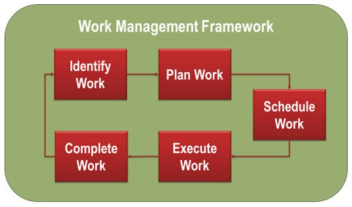
Possess an understanding of the operation and maintenance of:

- Water and sanitary systems.
  - Water Heating Systems
  - Water Hardness
  - Upfeed and Downfeed water distribution systems
  - Water supply maintenance problems
- Safety and security systems.
- Medical equipment.
  - Biomedical equipment technicians
- Building envelope systems (e.g., roof, windows, exterior walls).
  - Roof maintenance
  - Exterior walls and façade features
  - Windows and doors
  - Grounds maintenance

Coordinate a maintenance management program

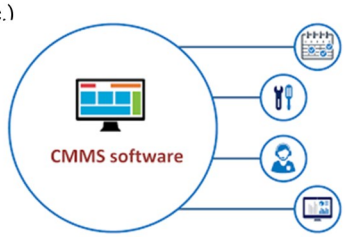
For:

- Buildings
  - ASHRAE recommendations for ventilation
  - Air filtration
  - Sick Building Syndrome
- Equipment
  - Maintenance Manual
  - Operations Manual
  - Sequences of operation
- Utilities
- Grounds



Coordinate a maintenance management program

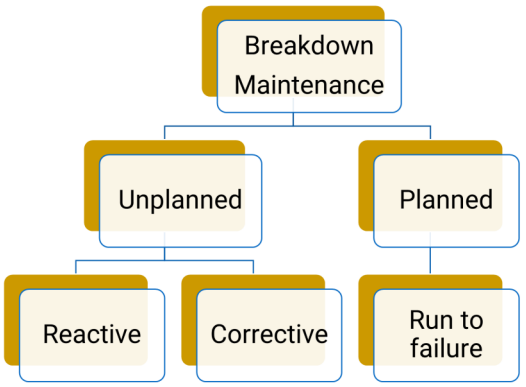
- Maintenance and Repair
- Maintenance history and machine history
- Repair costs
- Condition assessment
- Blueprints (updating, etc.)



2

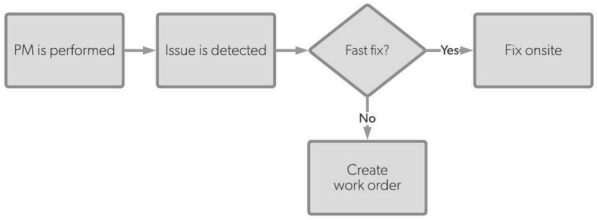
Corrective Maintenance

Types of Breakdown Maintenance



Corrective Maintenance: Definition

Corrective maintenance is a maintenance task performed to identify, isolate, and rectify a fault so that the failed equipment, machine, or system can be restored to an operational condition within the tolerances or limits established for in-service operations.



3

Preventative Maintenance

OEM Maintenance

Time-Based Corrective

D30 HVAC | **D3025 140** | **Boiler, Steam, Oil/Gas/Comb.**

PM Components	Labor-hrs.	W	M	Q	S	A
PM System D3025 140 3950						
Boiler, steam; oil, gas or combination fired, 500 to 1000 MBH						
1 Inspect fuel system for leaks or damage.	.098		√	√	√	√
2 Change fuel filter element and clean strainers; repair leaks, where applicable.	.910					√
3 Check main flame failure protection, positive fuel shutoff and main flame detection scanner on boiler equipped with spark ignition (oil burner).	.140		√	√	√	√
4 Check for proper operational response of burner to thermostat controls.	.186			√	√	√
5 Inspect all gas, steam and water lines, valves, connections for leaks or damage; repair as necessary.	.195			√	√	√
6 Check feedwater system and feedwater makeup control and pump.	.075		√	√	√	√
7 Check and lubricate burner, blowers and motors as required.	.109			√	√	√
8 Check operation and condition of safety pressure relief valve.	.052		√	√	√	√
9 Check combustion controls, combustion blower and damper modulation control.	.185					√
10 Check all indicator lamps and water/steam pressure gauges.	.091		√	√	√	√
11 Check electrical panels and wiring to burner, blowers and other components.	.117			√	√	√
12 Clean blower air-intake dampers, if required.	.069			√	√	√
13 Check condition of flue pipe, damper and exhaust stack.	.147			√	√	√
14 Check boiler operation through complete cycle, up to 30 minutes.	.889		√	√	√	√
15 Check water column sight glass and water level system; clean or replace sight glass, if required.	.127		√	√	√	√
16 Clean firebox (sweep and vacuum).	1.053					√
17 Check fuel level with gauge pole for oil burning boilers.	.046		√	√	√	√
18 Inspect and clean oil burner gun and ignition assembly where applicable.	.923					√
19 Clean area around boiler.	.151		√	√	√	√
20 Fill out maintenance checklist and report deficiencies.	.022		√	√	√	√
Total labor-hours/period			.949	2.514	2.514	5.585
Total labor-hours/year			7.593	5.028	2.514	5.585

	Description	Labor-hrs.	Cost Each 2019 Bare Costs Material	Labor	Equip.	Total	Total In-House	Total w/O&P
3900	Boiler, steam, O/G/C, 500 to 1000 MBH, annually	5.585	64	355		419	513.86	635
3950	Annualized	20.696	77.50	1,325		1,402.50	1,728.70	2,150

AEM Maintenance

Time-Based
Condition-Based
Predictive
RCM

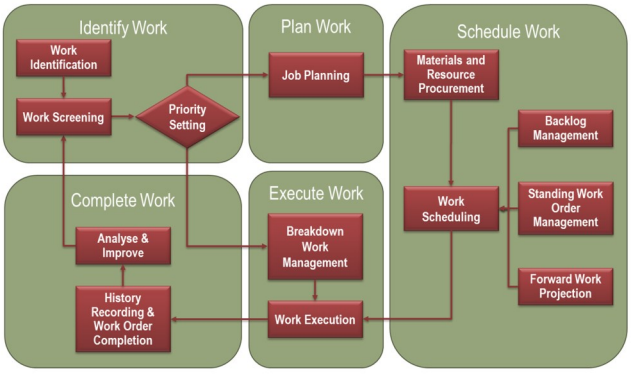
- Total Productive Maintenance
- Criticality / Risk
- FMEA
- Root Cause Analysis (RCA

100% Completed!

4

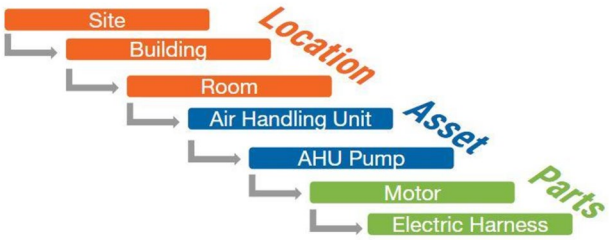
Program

Administer and direct all preventive maintenance programs



Develop preventive maintenance strategies and programs

- Buildings
- Equipment



Schedule predictive and reactive work

To various trade personnel and outside contractors:

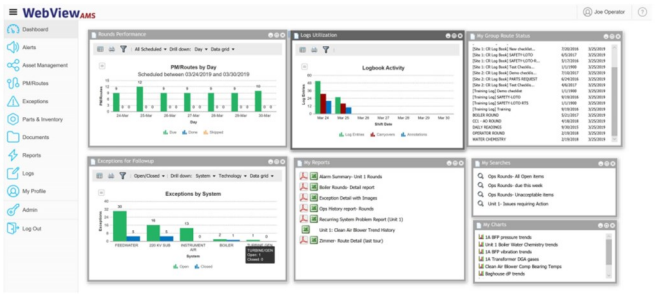
- Engineering technician
- Carpenter
- Electrician
- General maintenance
- Painter
- Plumber
- And others

Schedule predictive and reactive work

- Outsourcing maintenance activities
- Maintenance and repair staffing
- Problem resolution with vendors

Manage building maintenance repair parts and supplies inventory

Evaluate results of all maintenance and testing activities



Resolve equipment performance problems and recalls with vendors

- Recall registry with product/equipment suppliers
- Accurate inventory of installed equipment, make, model, etc.
- Recall log/data file system
- Contact information, etc.
- Warranty data
- Vendor notification for obsolescence
- Parts inventory updated as well

Vendor management and relationships

Established process for equipment/performance/recall management

5

Staff & Vendor Training

Develop and Manage a Staff Training Program

- Establish Job Safety Task Analysis program (JTA)
- New equipment and installation training
  - Video record if possible,
  - Documentation/manuals
  - Establish refresher training cycle
  - New employee program
  - Completion/pass records
- New Construction – as above as well
- Whenever a new employee/contractor is directed to perform a task for the 1st time, JTA must occur.
- Program and individual employee records documented

Staff Skills Improvement Programs

- On-line training resources for at least basic skills
- Scheduled training/instruction for license/certification maintenance/upgrades
- Employee development program individualized for each employee
- Documentation records
- Annual review


Employee Advancement Program
Support for:
Licenses
Degrees
Corporate leadership
Industry certifications
Etc.
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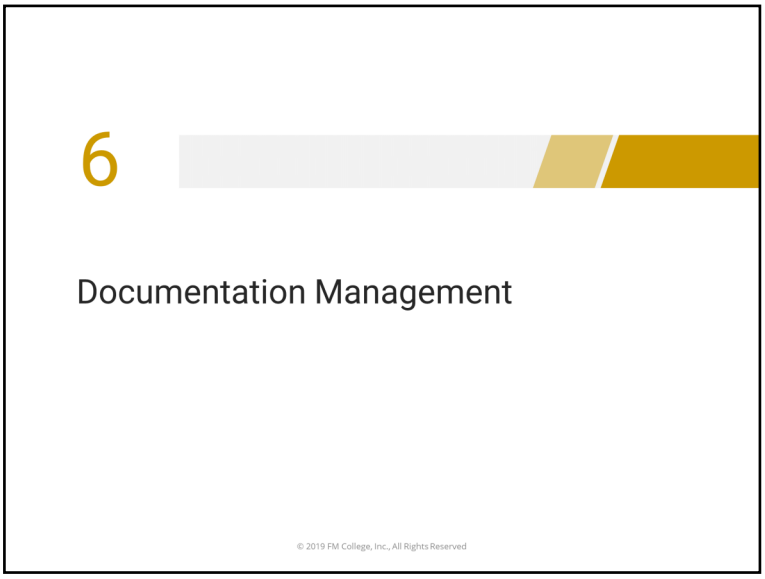
6
Documentation Management
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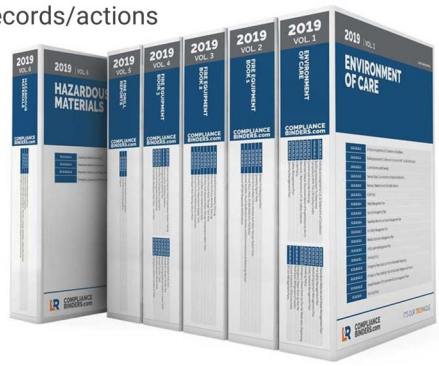
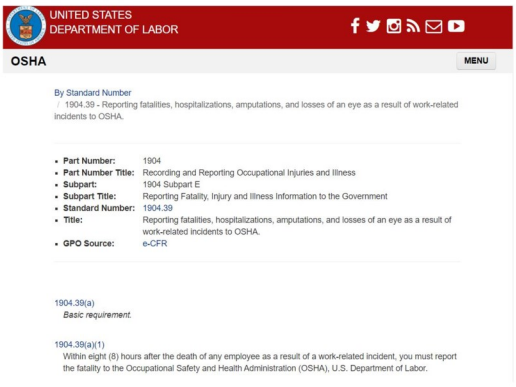
Regulation/Standards Records (TJC/JCI/AHJ)

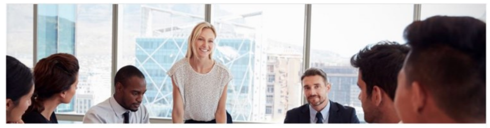
Inspections/records/actions



Safety/Health Records (OSHA, etc.)



Maintain updated CAD drawings for healthcare facilities



Are you seeing a true picture of your healthcare facilities?

Find clarity in your facility data to mitigate risk, optimize resources, and improve patient satisfaction.

Gain insights into key business functions…

Testing & Balancing (TAB) & Sequence of Operations Records (SOO) records/updates

RSA RSAnalysis

PAGE 19

AABC

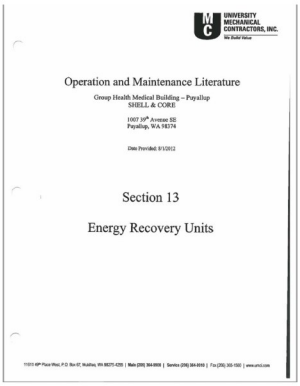
Air Balance Summary

Date: 7/1/2013

#	Room	Room Description	Sq. Ft.	Ceiling Ht.	Cu. Ft.	100% OSA	Room Type	Air Changes Req.	Air Changes Design	Air Changes Actual	Supply Design	Supply Actual	Return Design	Return Actual	Exhaust Design	Exhaust Actual	Differential CFM	Differential Code	Differential %	Relative Pressure	Pressure Relationship
	2131	OPERATING ROOM 1	465	9.5	4418	NO	Pos.	15	21.7	18.1	1600	1330	1500	860	NA	NA	470	DNL	64%	POS	0.0117
	2127	OPERATING ROOM 2	432	9.5	4104	NO	Pos.	15	23.4	20.9	1600	1430	1500	825	NA	NA	605	DNL	58%	POS	0.0139
	2125	OPERATING ROOM 3	413	9.5	3923	NO	Pos.	15	24.5	21.6	1600	1410	1500	1025	NA	NA	385	DNL	73%	POS	0.0034
	2122	OPERATING ROOM 4	434	9.5	4123	NO	Pos.	15	23.3	17.5	1600	1205	1500	930	NA	NA	275	DNL	77%	POS	0.0027
	2147	OPERATING ROOM 5	446	9.5	4237	NO	Neg.	15	19.1[2]	15.6[2]	1200	1075	NA	NA	1350	1105	30	DNL	102%	NEG	0.0039
	2123	SUB-STERILE OR 3/4[1]	163	9.5	1549	NO		10	15.5	15.9	400	410	400	410	NA	NA	0	DNL	100%	NEG	0.0036/0.0040[3]
	2128	SUB-STERILE OR 1/2[1]	136	9.5	1292	NO		10	18.6	19.3	400	415	400	370	NA	NA	45	DNL	89%	NEG	0.0100/0.0130[4]
	2153	CENTRAL SUPPLY	256	8.0	2048	NO	Pos.	4	6.6	6.2	225	210	225	210	NA	NA	0	DNL	100%	POS	0.0257[5]
	2119	EQUIPMENT STORAGE	402	9.5	3819	NO		4	6.3	6.4	400	405	400	405	NA	NA	0	DNL	100%	NA	NOT TESTED
	2152	CLEAN WORK ROOM	297	9.0	2673	NO		10	11.2	11.1	500	495	500	480	NA	NA	15	DNL	97%	NA	NOT TESTED
	2121	STERILE STORAGE	254	9.0	2286	NO		4	6.6	5.9	250	225	250	215	NA	NA	10	DNL	96%	NA	NOT TESTED
	2151	DECON.	142	9.0	1278	NO	Neg.	10	11.7[2]	11.7[2]	175	185	NA	NA	250	250	65	DNL	135%	NEG	0.0063
	2148	JANITOR	58	8.0	464	NO	Neg.	10	9.7[2]	11.6[2]	50	65	NA	NA	75	90	25	DNL	138%	NEG	0.0022
	DNL	CLEAN CORRIDOR	1038	9.0	9342	NO	Pos.	DNL	8.7	8.5	1350	1330	1750	1260	NA	NA	400	DNL	95%	POS	0.0231[5]
	2133	P.A.C.U.	1433	9.0	12,897	NO		6	9.9	9.6	2125	2055	1925	845	NA	NA	200	DNL	41%	POS	0.0188[5]
	2154	MENS LOCKER	347	9.0	3123	NO	Neg.	10	10.6	11.8	550	615	NA	NA	650	505	100	DNL	82%	NEG	0.0045[5]
	2155	WOMENS LOCKER	424	NT	3510	NO	Neg.	10	11.1	10.1	650	590	NA	NA	650	435	0	DNL	82%	NEG	0.0063[5]

Remarks
(1) RELATIVE TO OR'S.
(2) CALCULATED USING EXHAUST CFM.
(3) RELATIVE TO OR3/OR4.
(4) RELATIVE TO OR1/OR2.
(5) RELATIVE TO "DIRTY" CORRIDOR.

OEM Manuals


UNIVERSITY MECHANICAL CONTRACTORS, INC.

Operation and Maintenance Literature

Group Health Medical Building – Puyallup
SHELL & CORE

1007 39th Avenue SE
Puyallup, WA 98374

Date Provided: 8/1/2012

Section 13

Energy Recovery Units

7

Policy Management

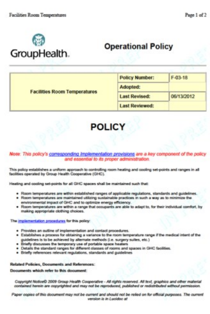
Manage departmental policies, procedures, goals, objectives, and standards of work performance

For the operation, maintenance and repair of:

- Medical equipment
- Buildings
- Building systems

Manage departmental policies, procedures, goals, objectives, and standards of work performance

Policy



Facilities Room Temperatures   Page 1 of 2

GroupHealth.   **Operational Policy**

Facilities Room Temperatures	Policy Number:	F-03-18
	Adopted:	
	Last Revised:	06/13/2012
	Last Reviewed:	

POLICY

Note: This policy's corresponding Implementation provisions are a key component of the policy and essential to its proper administration.

This policy establishes a uniform approach to controlling room heating and cooling set-points and ranges in all facilities operated by Group Health Cooperative (GHC).

Heating and cooling set-points for all GHC spaces shall be maintained such that:

- Room temperatures are within established ranges of applicable regulations, standards and guidelines.
- Room temperatures are maintained utilizing sustainable practices in such a way as to minimize the environmental impact of GHC and to optimize energy efficiency.
- Room temperatures are within a range that occupants are able to adapt to, for their individual comfort, by making appropriate clothing choices.

The implementation procedures for this policy:

- Provides an outline of implementation and contact procedures.
- Establishes a process for obtaining a variance to the room temperature range if the medical intent of the guidelines is to be achieved by alternate methods (i.e. surgery suites, etc.)
- Briefly discusses the temporary use of portable space heaters
- Details the standard ranges for different classes of rooms and spaces in GHC facilities.
- Briefly references relevant regulations, standards and guidelines

Related Policies, Documents and References:

Documents which refer to this document:

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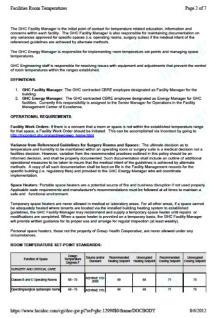
https://www.lucidoc.com/cgi/doc-gw.pl?ref=ghc:12989$0/frame/DOCBODY   8/6/2012

Manage departmental policies, procedures, goals, objectives, and standards of work performance

Implementation / Rules



Facilities Room Temperatures — Page 2 of 7

The GHC Facility Manager is the initial point of contact for temperature related education, information and concerns within each facility. The GHC Facility Manager is also responsible for maintaining documentation on any variances approved for specific spaces (i.e. operating rooms, surgury suites) if the medical intent of the referenced guidelines are achieved by alternate methods.

The GHC Energy Manager is responsible for implementing room temperature set-points and managing space temperatures.

GHC Engineering staff is responsible for resolving issues with equipment and adjustments that prevent the control of room temperatures within the ranges established.

DEFINITIONS:

1. **GHC Facility Manager:** The GHC contracted CBRE employee designated as Facility Manager for the building.
2. **GHC Energy Manager:** The GHC contracted CBRE employee designated as Energy Manager for GHC facilities. Currently this responsibility is assigned to the Senior Manager for Operations in the Facility Management Center of Excellence.

OPERATIONAL REQUIREMENTS:

Facility Work Orders: If there is a concern that a room or space is not within the established temperature range for that space, a Facility Work Order should be initiated. This can be accomplished via Incontext by going to http://incontext.ghc.org/asd/ewo/ewo_home.html

Variance from Referenced Guidelines for Surgery Rooms and Spaces: The ultimate decision as to temperature and humidity to be maintained within an operating room or surgery suite is a medical decision not a facilities decision. However, variation from the recommended practices outlined in this policy should be an informed decision, and shall be properly documented. Such documentation shall include an outline of additional operational measures to be taken to insure that the medical intent of the guidelines is achieved by alternate methods. A copy of all such documentation shall be kept on file in the Facility Management records for the specific building (i.e. regulatory files) and provided to the GHC Energy Manager who will coordinate implementation.

Space Heaters: Portable space heaters are a potential source of fire and business disruption if not used properly. Applicable code requirements and manufacturer's recommendations must be followed at all times to maintain a safe and functional environment.

Temporary space heaters are never allowed in medical or laboratory areas. For all other areas, if a space cannot be adequately heated where tenants are located via the installed building heating system to established guidelines, the GHC Facility Manager may recommend and supply a temporary space heater until repairs or modifications are completed. When a space heater is provided on a temporary basis, the GHC Facility Manager will provide written guidance for its proper use and arrange for regular inspection (at least weekly).

Personal space heaters, those not the property of Group Health Cooperative, are never allowed under any circumstances.

ROOM TEMPERATURE SET-POINT STANDARDS:

Function of Space	Design Temperature Degrees F	Source and/or Standard	Recommended Heating Setpoint	Unoccupied Heating Setpoint	Recommended Cooling Setpoint	Unoccupied Cooling Setpoint
SURGERY AND CRITICAL CARE						
Classes B and C Operating Rooms	68 - 75	ASHRAE 170-2008	69	68	71	75
Operating/surgical cystoscopic rooms	68 - 75	ASHRAE 170-	69	68	71	75

https://www.lucidoc.com/cgi/doc-gw.pl?ref=ghc:12990$0/frame/DOCBODY — 8/6/2012

Relevant standards and codes are usually referenced in this document as well as procedures, etc.

Note: Guidelines for "unique" issues may also be provided/ as a third level document

THANK YOU