Medical Center Physical Plant (/ppdmc/)

Utilities Systems Management Plan 2020

PPD 04-40

Purpose

The Utilities Systems Management Plan supports a safe patient care environment by managing risks associated with the operations and maintenance of the utility systems.

Scope

The Utilities Systems Management Plan is designed to support a safe, controlled, and comfortable healing environment within all University of Kentucky HealthCare (UKHC) facilities by establishing programs to ensure the operational reliability of utility systems and assessing and managing the risks associated with utility system failures.

UKHC designs and installs utility systems throughout the facilities according to the National Fire Protection Association (NFPA) codes to meet patient care and operational needs. The building systems (gas, vacuum, electrical and electrical equipment) are designed to meet NFPA 99 (2012) Categories 1-4.

Organization and Responsibility

The Director of Physical Plant Division Medical Center (PPDMC) has overall responsibility for establishing and maintaining the Utility Systems Management Program. Plant Maintenance Engineers, other PPDMC Engineers and Maintenance Technicians work under the direction of the Director of PPDMC.

The PPDMC is responsible for overall maintenance of the facility, major utility systems, and management of contractors who provide a variety of services. Service requests are received, prioritized, and maintained by PPDMC.

UKHC Information Technology and University Communications Operations are responsible for the maintenance of the major communications systems used within the Hospital.

Hospital Service Directors and Managers have responsibility for orientation and educating new staff about the utility systems that are used in their respective area(s). Staff must know how to report user error, system failures, and any emergency operating procedures. This is typically accomplished by entering a request for a repair work order.

UKHC has established a Utility Management Subcommittee of the Environment of Care (EOC) Committee to act in an advisory capacity to UKHC.

The Utilities Management Subcommittee evaluates the Utilities Management Plan annually for relevancy of existing criteria and necessity of new criteria. The Chair of the UM Subcommittee reports the results of this evaluation to the EOC Committee for approval.

The Chairperson of the EOC committee reports information about the Utility Management Plan to Hospital Administration.

Utility Systems Inventory and Risk Criteria

A complete physical inventory of all mechanical and electrical systems located in Hospital buildings are kept in the SAP application. This inventory includes all subsystems of major equipment and components of the following:

- essential electrical distribution system (emergency power)
- normal electrical distribution system
- elevators
- HVAC (AHU’s, Boilers, Chillers, etc.)
- plumbing
- steam
- piped medical gases and vacuum
- communications systems, including overhead paging and nurse call
- IAQ components
- Tube Station

As part of the acceptance process for new utility systems or upgrade of existing utility systems UKHC requires the installer to demonstrate that the system and its critical operating components are designed by and meet the requirements for NFPA 99 (2012) and are fit for service by passing acceptance test(s) prior to initial

use. Due to the wide variation of systems and components, there is no standardized acceptance testing. The specific parameters of performance must be determined for each system by utilizing manufacturer recommendations.

After UKHC and PPDMC has accepted the system or component from the installer, the Preventive Maintenance Engineer performs an evaluation to determine if the system should be included within the Utility Systems Management Program inventory in accordance with PPD 04-25 - PREVENTIVE MAINTENANCE PROGRAM (http://ppdmc.uky.edu/Shared/Policy/PolicyPage.aspx?site=staff&category=4&number=25).

Each component of the inventory is assigned an equipment maintenance value determined by assessing the equipment function, physical risk, and maintenance requirements (See Appendix 1). All components with an equipment maintenance value equal to or greater than 11 are included in the Utilities Management Program.

Day-to-day use of the Plant Maintenance (PM) Database allow additions, deletions, and other changes to the Utility Systems Management Program inventory to be accomplished in a timely manner, usually no more than a few weeks. This ongoing process of making changes allows the overall accuracy of the Utility Systems Management Program inventory to be maintained at a very high level at all times.

Predictive, Preventive, Corrective, and Reactive maintenance strategies are used to maintain the components of the utilities system. Preventative, interval-based inspections are performed on all equipment that has an Equipment Maintenance number of eleven (11) or greater. Corrective maintenance needs are identified by the PM inspection and by observation of the maintenance staff. Reactive and corrective maintenance procedures are followed in response to equipment failures or malfunctions as reported to PPDMC by various sources such as phone calls, work orders, and alarms in the BAS System (Tridium). The maintenance supervisors prioritize work orders and schedule the respective action in a timely manner.

Maintenance, Inspection and Testing

UKHC inspection, testing, and preventative maintenance are performed on schedules as established by the manufacturer or Alternative Equipment Maintenance Program (AEM). This includes all operating components on the utility systems inventory.

The performance improvement standard that has been established in the Utility Systems Management Program for equipment identified as "High-Risk", by having a PR rating of 10, is to complete 100% of scheduled maintenance (PM)

work orders in a twelve month or greater time period (i.e. Emergency Generators, Medical Gas, Medical Air).

Equipment classified as “Non-High Risk”, having a PR rating of 5 or less, will have a completion standard of 100%.

The Plant Maintenance Database is used to generate work orders for each programmed event. Maintenance supervisors schedule and assign work orders. Technicians perform assigned work orders and return completed work orders to their supervisor. The completed work order is used to update the database to reflect that the work has been performed. Completed work orders are retained even though information entered into the database is used for historic documentation. Some scheduled work is performed by outside contractors. The responsible Supervisor obtains documentation of the contractor’s work and any required certifications.

Distribution Maps & Labeling

PPDMC maintains a variety of historical documents that graphically illustrate each of the utility systems. New utility systems and major updates to existing utility systems are required to be developed by an architectural or engineering firm and provided to the PPDMC in computerized format.

Day-to-day use of both historical documents and updated computerized drawings allow additions, deletions, and other changes to the layout of utility systems or the location of high-risk or emergency controls to be accomplished in a timely manner, usually no more than a few days. This ongoing process of making changes allows the overall accuracy of the utility system layout to be maintained at a very high level at all times.

A variety of techniques such as legends, symbols, labels, numbers, color-coding, etc., are utilized on documents to identify high risk or emergency controls and their locations. The process of providing identification on the historical documents or computerized drawings is completed with a corresponding physical identity on the actual device. This process is intended to provide technicians with highly accurate information before controls are activated for scheduled maintenance and before controls are activated in an emergency.

Utility Outages

Planned Outages

When a disruption of service is needed, PPDMC staff provide electronic notification to all parties that may be affected and include the date of the planned outage, areas affected, and potential concerns. This is done after a thorough investigation of the system and its components or equipment that may be affected by the PPDMC outage team.

Unplanned outage

When an unplanned disruption of service occurs emergency procedures are activated within PPDMC to facilitate a response such as clean up and repair crews for a sanitary sewer pipe breakage or electricians for power disruption to provide or restore lighting and service.

Clinical department Directors and Managers are responsible for establishing and maintaining emergency procedures related to their use or application of utility systems in patient care or treatment where a failure, interruption, or malfunction of the utility system could result in a negative patient outcome.

PPDMC has policies and procedures to provide emergency backup or redundant systems such as contracts, access to water, generators, etc. All emergency shut off controls for the Utility Systems components are labeled clearly, visibly and permanently throughout the facility. Where alternate sources, redundancies, or back-up protection is not available, the emergency procedure indicates steps to be taken until the utility system can be restored to normal. Emergency procedures contain specific information related to the location of essential or emergency controls to shut-off utility systems, the conditions under which the controls may be activated, and which staff are permitted to operate the controls. Emergency procedures contain specific information related to how to report failures to utility systems and how to obtain emergency repair services. Emergency procedures in clinical departments also include specific information related to emergency clinical interventions when a utility system fails.

Each Manager within PPDMC is responsible for providing their department staff with an orientation to the content of emergency procedures that relate to their job responsibilities. Additional department level training is provided on an annual basis as part of the continuing education process or on an as-needed basis whenever emergency procedures are revised.

Minimizing Pathogenic Biological Agents

See Also PPD 03-01- INFECTION CONTROL (http://ppdmc.uky.edu/Shared/Policy/PolicyPage.aspx?site=staff&category=3&number=1)

See Also Enterprise Water Management Plan

PPDMC works collaboratively with Infection Prevention and Control (IPAC) and Healthcare Safety to ensure a safe and functional environment from pathogenic biological agents such as waterborne organisms and mold that may be related to water leaks or construction.

Campus PPD provides maintenance for the cooling tower that serves UK Chandler Hospital and PPDMC provides maintenance to the Good Samaritan Hospital chiller plant. The water is treated with a biocide and algaecide or an electric charge. In addition, the cooling towers are located away from fresh air supply intakes.

Indoor Air Quality (IAQ)

PPDMC maintains ventilation equipment to minimize the risk of airborne contaminants that could cause infection to patients, visitors, and staff.

When maintenance or construction activity in patient care areas may cause disbursements of particulate matter (dust), which may carry fungal spores that have the potential to infect patients, PPDMC personnel contact the IPAC staff for an Infection Control Risk Assessment (ICRA) and directions on what is needed to control the dust. This occurs in all areas of the Healthcare facility not just high-risk areas.

The ventilation system in critical care areas are designed to control airborne contaminates (such as biological agents, gases, fumes, dust) and is maintained to provide appropriate pressure relationships, air-exchange rates, filtration efficiencies, temperature and humidity.

These parameters are monitored electronically through Tridium and reported back to PPDMC Dispatch office as well as locally by the staff responsible for those areas.

In non-critical areas ventilation is monitored electronically through Tridium and reported back to PPDMC Dispatch office. Issues may also be reported by staff in the area via work order.

Medical Gas System

Medical Gas systems are considered "High-Risk Equipment". All components of the medical gas systems are included in the equipment inventory and assigned equipment maintenance numbers. This includes piping, master signal panels, area alarms, shut off valves, flexible connectors, and outlets. When new medical gas systems are installed, or existing medical gas systems are modified, the installation is tested and certified as prescribed in NFPA 99 (2012). Medical gas piping is clearly marked for all gasses.

Operational Plans

Operational plans address critical operating components of each utility system where a specialized need for these plans exists. Examples of specialized needs include: normal startup procedure, normal operation procedure, normal shutdown procedure, emergency start-up procedure, emergency operation, or emergency

shutdown. Examples of conditions where the specialized utility procedures are applied include: operation of emergency power generators, operation of back-up medical air systems, medical gas problem, and electrical power failure.

PPDMC has developed policies and standards to be used as operational plans and these plans are located on their departmental website. Each Plant Maintenance Engineer is responsible for reviewing their operational plans every three years.

Reporting, Notifications and Communications

The Utility Systems Management Program utilizes a variety of reporting forms to capture different types of information. Examples of reports are Monthly Utilities Reports and Utilities Incident Notifications which are sent by email.

The Chair of the UM Subcommittee provides a summary report on all utility system incidents to the Utilities Management Subcommittee. The utility system incident analysis is intended to provide an opportunity to identify trends or patterns that can be used to determine if changes to the Utility Systems Management Program could control or prevent future occurrences. Summary information related to incidents and analyses are reported to the Utilities Management Subcommittee, who can provide that information to the EOC Committee. Feedback from the analysis of utility system incidents is used by each Manager in PPDMC to further develop and improve the Utility Systems Management Program.

The incident notification and investigation process are not used to measure Utility Systems Management Program performance because of the unpredictable nature of incident data and the general inability to control variables such as human behavior. The most important long-term measure of effectiveness of the incident reporting and investigation process is linked to the organization goal of reducing those incidents that result in a loss.

Orientation and Education Program

PPDMC employees are introduced to utility systems during PPDMC new employee orientation. In departmental orientation employees are given specific instruction relative to their jobs regarding:

Utility system capabilities, limitations, and special applications.

Emergency procedures in the event of system failure.

Locations and instructions for use of emergency shutoff valves.

Reporting utility systems problems and failures (notifying PPDMC Dispatch via their MyUK Portal).

PPDMC staff are required to attend University Orientation, UKHC Orientation and to participate in annual safety education and training.

Plant Maintenance Engineering staff have an individual Professional Development Plan, educational requirements, and continuous job-specific training in order to maintain a high degree of knowledge and readiness to support and operate the complex and expanding utility systems in a safe and reliable manner.

Performance Monitoring and Improvement

Management Program performance and improvement standard process:

The UM Subcommittee is responsible for establishing and developing performance improvement standards, which objectively measure the Utility Systems Management Program. Human, equipment, and programmatic characteristics are evaluated by the subcommittee with the goal of improving the organizational performance of the Utility Systems Management Program. Established performance improvement standards are communicated, as needed, to appropriate staff at departmental meetings.

The Chair of the UM Subcommittee reports as requested on performance improvement standard data to the Utilities Management Subcommittee, who in turn provides that data to the EOC Committee in the annual evaluation of the Utility Systems Management Program. The UM Subcommittee is also responsible for reviewing established performance improvement standards annually.

Annual Evaluation

The annual evaluation of the Utility Systems Management Program is used as an opportunity to further develop or revise utility system education programs, utility system related policies and procedures, and utility system performance improvement standards.

The evaluation includes program objectives, scope, performance, and effectiveness and is based on established criteria.

Specifically, the plan is evaluated to determine whether it meets:

- Identified institutional needs
- Established performance standards
- Joint Commission standards

The Utilities Management Subcommittee utilizes a variety of source documents such as: Utilities Reports, Preventative Maintenance (PM) Schedule, PM Summary, Equipment Inventory, or statistical information summaries to complete the evaluation. The findings of the annual evaluation are documented in a written

narrative report. Included with the report are any recommendations for improvements to the Utility Systems Management Program that have been developed by the Team.

The evaluation is presented to the EOC Committee for review and approval. Receipt of the annual report is documented in EOC Committee minutes. Review by the EOC Committee includes a discussion of findings and recommendations. After the discussion of findings and recommendations has been completed and the report has been approved by the EOC Committee, the annual evaluation is distributed to UKHC Administrative Leadership and posted to appropriate healthcare intranet sites.

Appendix 1

Equipment Ratings

Initial decisions regarding equipment inclusion will be based upon the equipment's function and/or purpose, the risks associated with failure or malfunction, and maintenance requirements.

1. Every piece of equipment is assigned an equipment maintenance (EM) number. The EM number is the sum of three individual values: Equipment Function (EF) + Physical Risk (PR) + Maintenance Requirements (MR). The EF rating is a number between 1 and 10 designed to rank the importance of the system's function in the health care organization. The PR rating, a number between 1and 10, evaluates the physical risk that could result from a malfunction of various categories of equipment. The amount of maintenance required (the MR rating) on any piece of equipment is evaluated by referring to both the actual equipment repair history and the manufacturer's recommendations. A number from 1 to 5 is then assigned.

2. If the EM number is equal to or greater than 11, the item will be included as part of the preventive maintenance program. These ratings are subjective and open to debate, but they do provide an excellent starting point for designing an equipment function, risk, and maintenance requirement rating.

3. If the PR rating is 10, it is automatically classified as "High-Risk Equipment" because failure could cause immediate death.

Table 1. Sample Equipment Function (EF) Ratings

Rating	System Type	Examples
10	Utility Service:	Electricity, natural gas, water, emergency generators (EPSS) Electrical equipment (i.e. transfer switches, transformers).
9	Safety/Life Safety:	Fire Alarm systems (i.e. pull stations, smoke detectors, sprinklers)
8	Environmental:	Heating, ventilation and air conditioning equipment, lighting
7	Patient Support:	Medical gases, vacuum systems, dietary equipment, ice machines, refrigerators, communication (i.e. Nurse Call)
6	Building Control:	Air compressors, pneumatic controls
5	Public Support:	Water cooler, televisions, vending machines
4	Miscellaneous:	Office equipment

Table 2. Physical Risk (PR) Ratings

Rating	Potential Risk Associated with Failure
10	High Risk. Immediate Death
5	High Risk. Latent Death (Long term effects could produce fatality)
4	Serious Risk
3	Moderate Risk
2	No significant or only minor risk
1	No Risk

Table 3. Maintenance Requirements (MR) Ratings

Rating	Maintenance Requirement	Equipment Examples

5	Extensive: (more than 25 hours per yr.)	Centrifugal chiller; ETO sterilizer
4	Above average: (15-25 hours per yr.)	Cooling tower; reciprocating chiller; Steam boiler; steam sterilizer
3	Average: (11-14 hours per yr.)	De-aerator tank; industrial compressor
2	Below average: (6-10 hours per yr.)	Control air compressor; fan coil unit
1	Minimal: (5 or less hours per yr.)	Compressed air dryer unit; centrifugal pump; exhaust / return fan

Applying the rating systems:

The following paragraphs list three examples to illustrate the use of these rating systems:

1. An emergency generator would have an equipment function (EF) rating of 10 because it is “utility service equipment" (see Table 1), a physical risk (PR) rating of 10 because it is "High-Risk Equipment" (see Table 2), and a maintenance equipment (ME) rating of 5 if it requires more than average maintenance (see Table 3). Thus, the emergency generator EM total rating would be 25 (EM = 10+10+5 = 25). The EM total rating is greater than 11, so it would be included in the preventive maintenance program and with a PR rating of 10, it would be classified as "High-Risk Equipment", requiring a 100% PM completion standard to be met.

2. A steam boiler would have an equipment function (EF) rating of 8 because it is listed as environmental equipment (see Table 1, a physical risk (PR) rating of 4 because it could cause serious injury if a malfunction occurs (see Table 2)), and a maintenance equipment (ME) rating of 4 because it requires more than average maintenance (see table 3). Thus, the boiler's EM total rating would be 16 (EM = 8+4+4 = 16). The EM total rating is greater than 11, so it would be included in the preventive maintenance program. As “Non-High-Risk Equipment” (PR<10) the completion standard for PM is 100%.

3. A control air compressor unit could have an equipment function (EF) rating of 6, a physical risk (PR) rating of 1, and a maintenance requirement (MR) rating of 2, for a total EM rating of 9 (EM = 6+1+2 = 9). Since it has a rating lower than 11, the air compressor may or may not be slated for preventive maintenance.

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