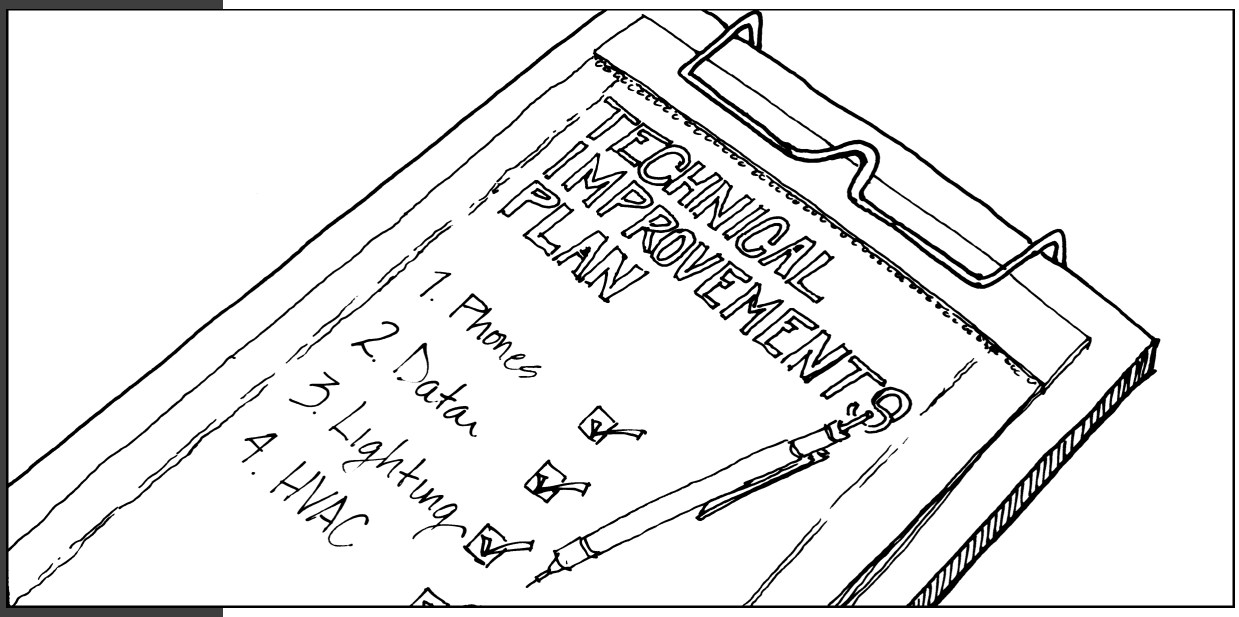
7.0 Maintenance and Operations Administrative Guidelines for School Districts and Community Colleges

Educational Facility Infrastructure Management

The infrastructure of educational facilities includes all building and grounds-related systems and equipment that are critical to everyday operations and support of the educational process. These systems, which include mechanical, electrical, plumbing, data, telecommunications, and lighting systems, serve as the "functional arteries" of any modern educational facility, and when properly maintained will help ensure a minimum of downtime and disruptions to educational activities. Maintaining these systems in an efficient manner presents a series of significant technical challenges for any maintenance administrator. The fact that most school districts and community colleges are comprised of old, recent, and new buildings, suggests that the requirements for maintaining different infrastructure components will vary widely. As educational buildings continue to evolve and incorporate technical innovations, virtually every aspect of school facility infrastructure is likely to be affected. In addition to basic checklist procedures, administrators and supervisors should put in place more specific guidelines and procedures for properly maintaining all aspects of a facility's infrastructure. Prudent planning and proactive measures today will allow administrators to better cope with the circumstances on the horizon.

7.1 Maintenance and Operations Administrative Guidelines for School Districts and Community Colleges

Technical Improvement Plans



Educational facility administrators have the complex responsibility of maintaining and operating educational facilities with a diverse range of technical requirements, from general infrastructure to advanced data systems. Increasingly, school facilities are becoming more dependent on technical systems that directly and indirectly support the educational process. The fact that these systems and infrastructure components vary in type and age, and are more likely to be upgraded or replaced as a result of technical advancements and changes in the instructional processes, requires a comprehensive and rational approach to introducing technical improvements throughout individual facilities.

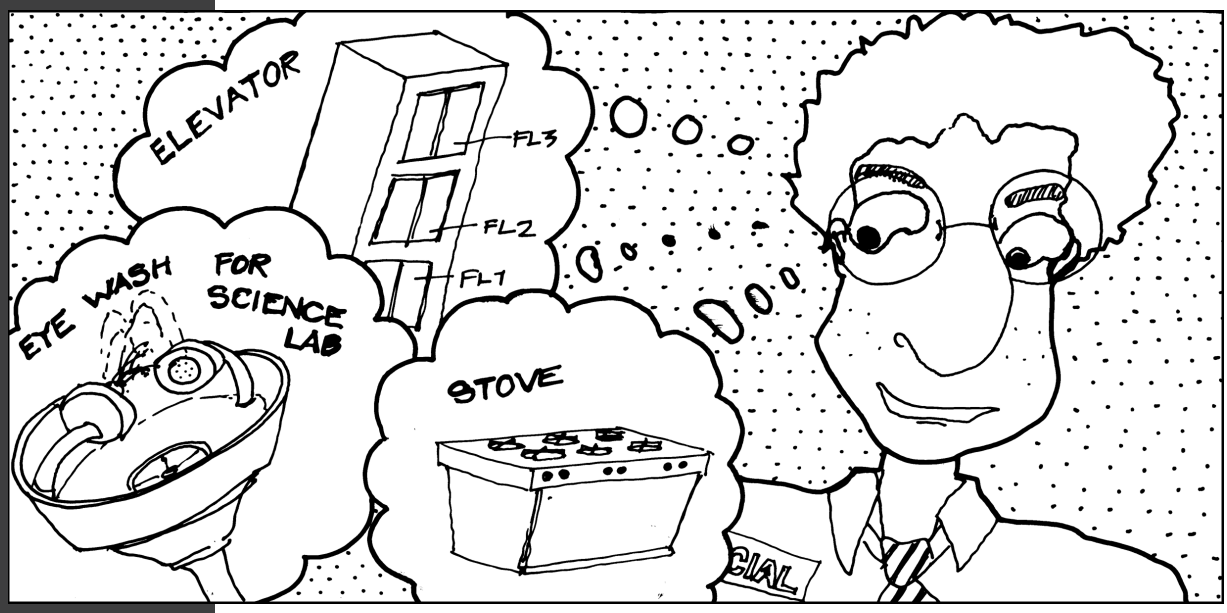
Technical improvement plans are work practices specifically aimed at making strategic refinements to a facility's infrastructure in order to realize such tangible benefits as: meeting current and future technical needs of the facility, increasing operational efficiency, keeping current with technological advances, extending the useful life of a system and, where possible, adding value throughout the physical plant. The maintenance activities of a technical improvement plan can be an integral part of any department's strategic development plan, transition plan for equipment upgrades/replacement, energy conservation

program, or modernization plan. The goal is to systematically introduce upgrades or enhancements to the facility over a specified period of time. These activities can also be undertaken as a part of routine preventive maintenance, overhaul maintenance, major repairs, and replacements. Ultimately, a major objective for implementing a technical improvement plan is to identify practical opportunities for enhancements that will have a positive and lasting effect on the physical plant, as well as the educational process.

One of the main factors in developing a technical improvement plan is to initiate a full inventory and conditions assessment of critical systems and equipment. Documenting information such as equipment type, manufacturer, age, current condition, service history, and other relevant data would serve a number of purposes and identify priorities for introducing technical improvements. This practice is becoming more commonplace in maintenance and operations departments as a way to modernize older facility components, as well as provide better maintenance for current types of equipment. Given the expanding size and age differences of educational physical plants at Florida's many school districts and community colleges, administrators should always maintain accurate data on the various types of equipment in their facilities and their operating condition at all times. At some facilities with buildings over 40 years old or at larger educational institutions, this process may be an arduous task. However, once completed, statistical and other types of useful information can be generated and used as the basis for prioritizing technical improvements, preventive maintenance programs, ordering spare parts, and generating service and work orders.

7.2 Maintenance and Operations Administrative Guidelines for School Districts and Community Colleges

Specialized Equipment



Educational facilities are increasingly being built or retrofitted with specialized equipment in classrooms, laboratories, media centers, and food service areas. In addition to specialized equipment that is integral with the building itself, new types of equipment are being installed in school buildings that directly support the educational process and may also require the services of the maintenance department to keep them in good working order. For facilities administrators and maintenance supervisors, these new features pose a number of new challenges. One of the major issues this situation creates is the increased responsibility for maintaining new building features. This usually generates the need for additional personnel with certain technical skills or the need to out source maintenance functions associated with certain types of equipment.

The following checklist identifies some of the procedures needed to ensure that certain specialized equipment is in continuously safe operation and is working properly:

Kitchen Equipment

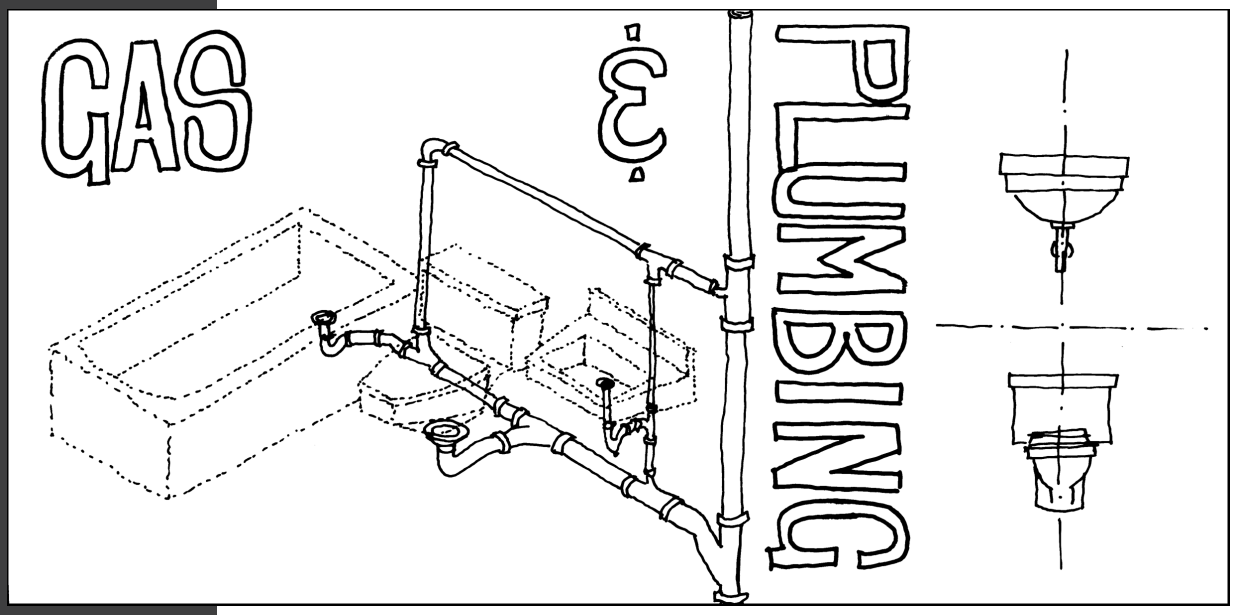
- Define the scope of maintenance required for all kitchen equipment and identify prospective outsourcing contractors who could provide maintenance and repair service.
- Ensure that regular preventive maintenance procedures and inspections are performed on kitchen hoods and fire protection systems.
- Verify that kitchen hood exhaust ducts are properly sloped for drainage, and clean the interior of the ducts at least twice a year.
- Verify all cooking elements are properly grouped under the kitchen hood.
- Maintain appropriate temperature levels for hot water used for dishwashing equipment.
- Service and maintain all other kitchen appliances and equipment to manufacturer's recommendation.
- Clearly identify all equipment, power, and gas shut-offs.
- Verify that all kitchen staff are familiar with standard safety procedures.

Elevators, escalators, accessibility lifts, dumbwaiters, etc.

- Provide annual inspections and service through out source contracts to ensure compliance with applicable codes and safety regulations.
- Verify regular inspections by governing agencies.
- Maintain and post all inspection certificates as required by law.
- Prohibit use of equipment rooms for storage or any other use not directly related to elevator systems.
- Ensure that the emergency call and response systems in the elevator cabs are working properly.

7.3 Maintenance and Operations Administrative Guidelines for School Districts and Community Colleges

Plumbing and Gas Systems



Schools and community colleges incorporate plumbing systems that are primarily composed of a water source, a distribution network, and pumps. Some also incorporate wells, on-site water storage/treatment, and provisions for fire protection. Although most components of plumbing and gas systems are embedded in the walls and floors of modern school facilities, administrators should not treat them with an "out of sight, out of mind" attitude. All school buildings rely on serviceable plumbing lines and fixtures to deliver fresh water for primary building functions such as toilet rooms, sinks, showers, drinking fountains, grounds irrigation, and fire suppression systems. Plumbing lines also facilitate the removal of "gray and black" wastewater and certain solids wastes from buildings. Lines designed as separate systems may carry individual chemicals such as acids and other abrasive chemicals. These lines require special attention, with inspections and/or monitoring conducted on a frequent basis. Where they exist, they should be clearly marked or tagged. Administrators and supervisors should take steps to ensure that these lines are never mistakenly connected with any other waste or supply line.

However, in the normal course of operations, pipes leak, burst and get clogged, fixtures break, and other circumstances occur that could adversely impact the educational process. Broken water supply lines and clogged drains can cause extensive damage to school buildings, fixtures, and equipment. Gas leaks can lead to even more serious hazards such as asphyxiation, explosions, and fires. To ensure that this system is functioning in a continuously reliable manner, maintenance administrators and supervisors should see that it receives the appropriate level of routine and preventive maintenance it requires. Basic guidelines for all gas usage associated with the education process or maintenance activities should also be established and disseminated. This will help to encourage proper use by students, staff, and other building occupants.

For those components of plumbing and gas systems that are visible, procedures should be established regarding their use and maintenance – this includes all fixtures, valves, controls, gauges, etc. A general checklist for ensuring the serviceability of plumbing features should include the following procedures:

- Verify that shut-off valves and back flow devices for all types of equipment are fully operational in each building.

- Verify that emergency shut-off valves for all gas-fired equipment utilized in kitchens, labs, heating, and water heating are in operating order.

- Verify that all piping is appropriately identified and marked.

- Identify potential problem areas where old or outdated service lines exist.

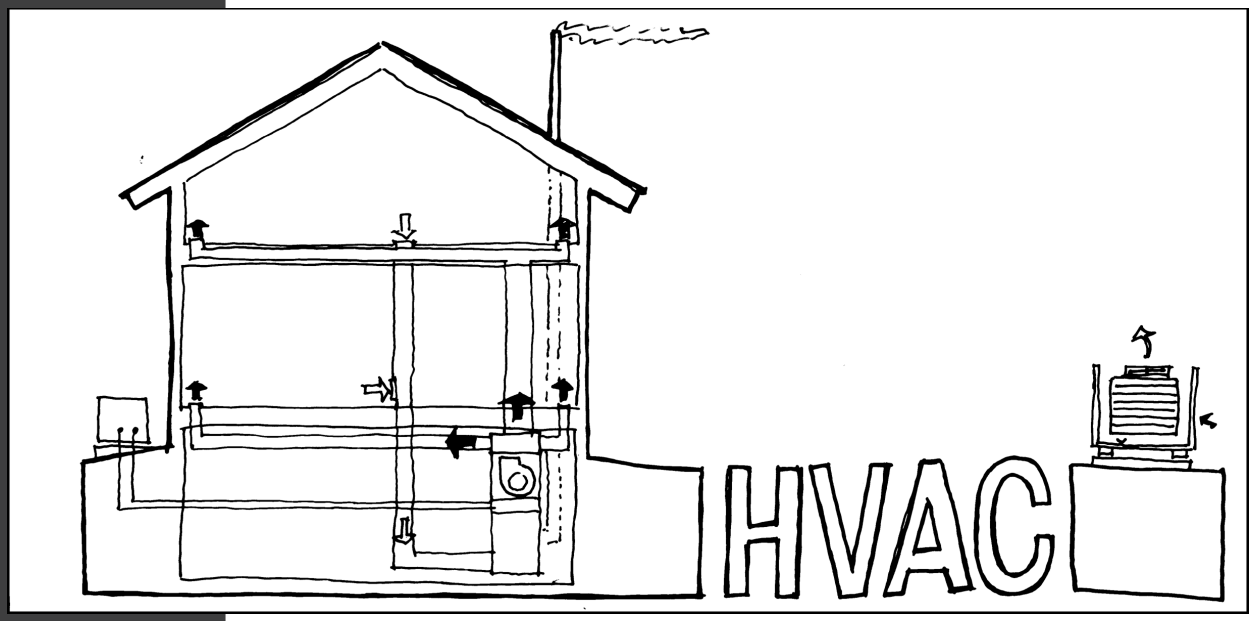
- Limit the quantity and temperature of hot water used in public areas.

- Periodically check for leaks and signs of problems associated with moisture from plumbing lines.

- Clean all sewer and storm drains on a frequent or an as-needed basis to ensure proper working order.

7.4 Maintenance and Operations Administrative Guidelines for School Districts and Community Colleges

HVAC Systems/Energy Management



Similar to many building types, the use and function of educational facilities is largely dependent on the working condition and serviceability of their heating, ventilation, and air conditioning systems. More and more, new educational facilities are designed as "sealed boxes," which means complete dependency on mechanical systems to provide thermal comfort for building occupants, as well as maintaining proper humidity levels and general indoor air quality (see section 9.6 Indoor Air Quality).

With varying regional climatic conditions throughout the state of Florida, different types of HVAC systems are required for educational facilities. At present there are a number of different types of systems in use, ranging from simple "through-wall" package units that are typically used for retrofits, to more complex central systems with multiple zones and chiller plants. In addition to being intricately familiar with the types of systems in use at their respective campuses (see Florida Department of Education Life Cycle Cost Guidelines, 1999), facility administrators should stay abreast of the latest technical advancements affecting different types of mechanical equipment. Given the age of some facilities, it is highly likely that some HVAC systems or major components will have to be modified, replaced, or

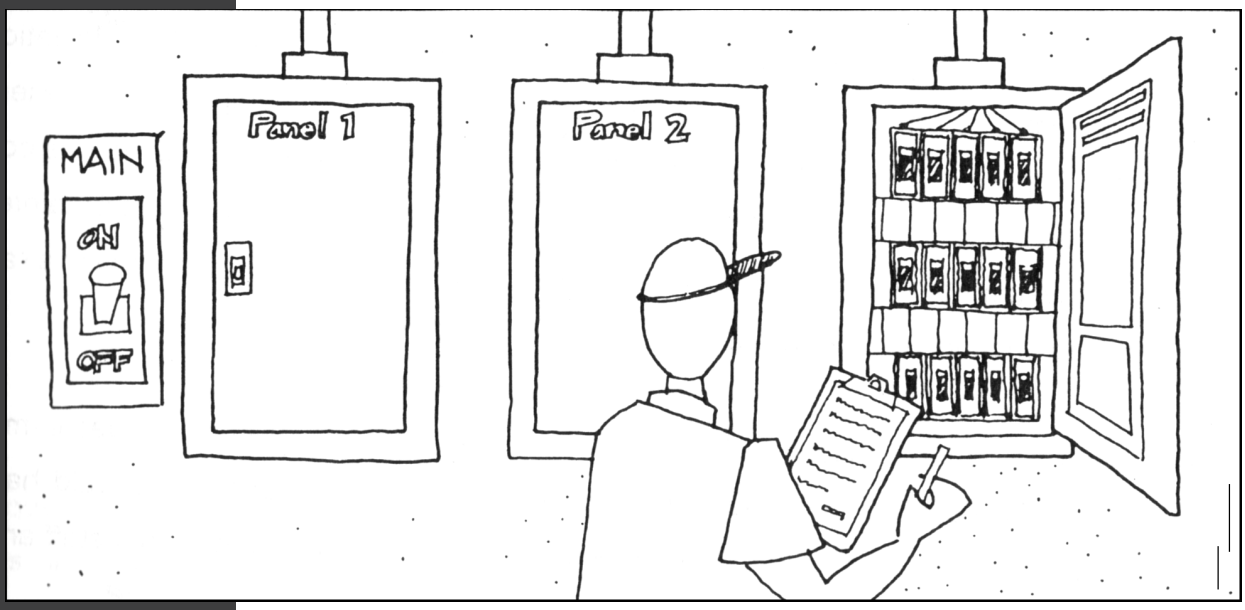
installed. Administrators should know well in advance the requirements for new equipment and how it will be integrated into a facility's HVAC plant.

Because of the varied mechanical systems in current use and the different sizes of school buildings and their extended hours of operation, a more complete checklist should be prepared by each district or community college for individual buildings. A general checklist of maintenance requirements for HVAC systems should include, among others, the following procedures:

- Maintain specified levels of fresh air intake to ensure proper system operations and reduce the potential for poor interior air quality.
- Replace or clean filters on a regular or scheduled basis in accordance with equipment manufacturer's recommendations.
- Clean condensate drains on regular basis to prevent clogs and leaks.
- Maintain thermostat levels as appropriate and limit access to controls.
- In an effort to conserve energy, adjust heating and cooling levels when building or spaces are not in use.
- Replace older duct work with an exterior insulated system when being replaced or rerouted.
- Provide ducted return air system whenever feasible during remodeling jobs.
- Closely monitor excessive air and water infiltration to control interior moisture levels.

7.5 Maintenance and Operations Administrative Guidelines for School Districts and Community Colleges

Electrical Systems



Electrical systems (main service, distribution, circuits, lighting, etc.) are essential infrastructure components in any modern school facility. When maintained in the proper manner, they support a variety of functions that are primary and secondary to the educational process. Although their initial installation costs and replacement costs are high, the total cost of school facility shutdowns or operational disruptions may prove even more costly as a result of inadequate maintenance. For normal and consistent operations of school buildings and grounds, electrical systems must be maintained in a manner that ensures around-the-clock reliability. At best, poorly maintained electrical systems become unsafe, short-lived, and incur high repair costs – at worst, they could lead to fires, injuries, and even fatalities.

Effective maintenance of electrical systems requires administrators to identify those components that should be monitored or serviced on a regular basis, develop a plan for preventive/predictive and operating maintenance, and document all service-related problems. Maintenance requirements of these systems will vary widely from building to building within a school district, but in every instance should be adequate for normal, uninterrupted school operations. Electrical systems should also be maintained to accommodate future

service upgrades, as well as increased demand. Given the diverse nature of Florida's school and community college buildings, maintenance managers may be faced with electrical systems that are either modern, recent, or outdated - or a combination of the three. Where outdated electrical systems exist, managers should alert school and college administrators of the limitations these conditions impose on accommodating new or future instructional equipment and other building features. School officials should address these conditions in as timely a manner as possible as part of a technical improvement plan. The installation, repair, replacement, and maintenance of electrical systems or electrical components at all school facilities should comply with all applicable codes (see section 10 Relevant Codes Standard and Regulations).

The following general checklist identifies some of the most critical areas/issues in maintaining school facility electrical systems. Maintenance and facilities managers should have clearly defined policies and procedures for addressing each one and make sure that staff and building occupants are advised as needed.

- Electrical safety: ensuring life safety and general facility safety, in terms of how electrical systems are used and maintained.

- Conduit, Wires, and Cables: confirming proper installation and replacement.

- Outlet Boxes: ensuring that ground fault circuit protection is properly installed in the right locations and is working properly.

- Electric Service: understanding the primary characteristics of electrical service, how power enters a facility, is distributed, and used.

- Emergency Service: ensuring that every component of an emergency system is serviceable and in constant working order.

- Transformers: safeguarding life and operational safety, maintaining proper ventilation requirements.

- Distribution Switchboards: keeping panels and breakers secure, in serviceable condition, and able to be upgraded.

- Grounding: ensuring protection against electrical shock to facility users and other facility harm caused by lightning.

- Interior Lighting Fixtures: maintaining appropriate levels of illumination for various purposes throughout the facility at all times.

- Lightning Protection: protecting against electrical surges that can threaten life, equipment, and school property.

- Miscellaneous electrical equipment: ensuring general serviceability and safe use of electrical equipment or appliances as the situation warrants.

- Personnel qualifications: providing certified in-house staff or contracted labor to adequately maintain every aspect of an educational facility's electrical infrastructure.

- Energy conservation: ongoing participation in some type of cost/resource reduction or conservation program.

- Computer-based power management: implementing a power management system to monitor, manage, and identify opportunities for conservation.

The frequency of maintenance tasks required for electrical systems in an educational facility depends on its age, the type of equipment it serves, and other operational demands. Other circumstances such as contact with contaminants, excessive dirt and debris, as well as unusual load demands by electrical equipment may also determine the maintenance requirements for a building's electrical system. Wear patterns for certain electrical components will also vary depending on similar circumstances.

Regardless of size, each school district and community college should have adequately trained electrical staff or contract service providers to properly maintain all electrical systems. General maintenance requirements for electrical systems in educational facilities, regardless of how minor, should be performed by qualified personnel on a systematic basis. Although specific conditions of the facility will dictate exactly what tasks are needed to keep a system in full operation, any electrical system

maintenance program should include a comprehensive set of preventive maintenance measures. In addition to these, electrical systems should also be subject to regular checklist procedures such as the following:

- Visually inspection of all critical electrical equipment and systems while they are in operation. Inspections should be performed at least once a year to ensure proper working order of system components.

- Verify that all electrical panels, disconnects, and related equipment are properly identified and labeled, and that all lockout tags are properly installed.

- Verify that GFCI receptacles are at all “wet” locations and that they are in working order.

- Ensure that all equipment and necessary system components are properly grounded.

- Verify the installation and operation of surge protectors for all sensitive electrical equipment and emergency systems.

- Ensure that floor receptacles are free of dirt and debris and in safe working condition.

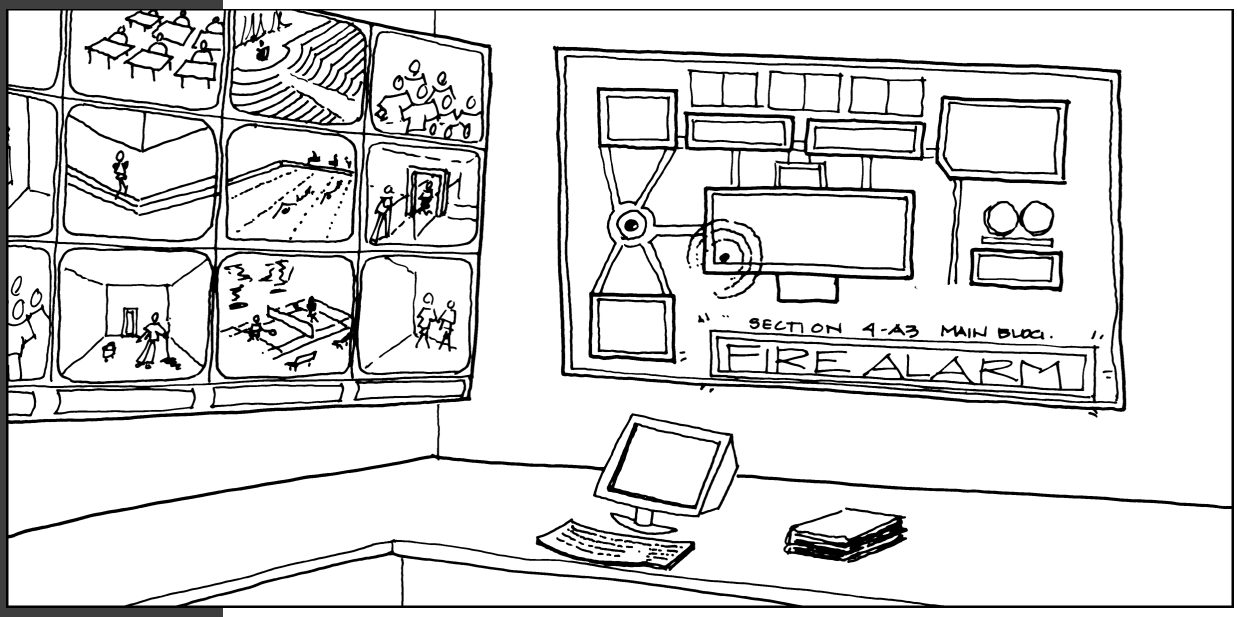
- Ensure that automatic or single point shut-off switches for frequently used equipment are clearly marked and functioning properly.

- Carefully note any code violations during inspections and bring them to the attention of department administrators/supervisors.

- Create a comprehensive list of noted deficiencies for inclusion on future work orders as required.

7.6 Maintenance and Operations Administrative Guidelines for School Districts and Community Colleges

Data, Communication, and Related Systems



Data, communication, and other technical systems are integral components of most modern school facilities. Even older facilities that predate many of these advances have been retrofitted to accommodate a variety of these functions. Typically comprised of telephone, cable television, computer, security, fire alarms, and intercom networks, these systems are usually more inconspicuous than any other infrastructure component in a modern educational facility. However, they are critical to normal operations and general life safety.

As the trend towards technological advancements continues to affect school facilities, administrators will likely inherit new maintenance responsibilities for a range of technical and electronic building systems. If they haven't done so already, it is recommended that maintenance departments establish good working relationships with all support entities involved with information technology. The impacts of this field alone are having a significant impact on wiring requirements in school buildings and will likely increase as more institutions seek to expand their involvement and use of the Internet and other forms of information technology. If these features are going to be successfully integrated into new and existing

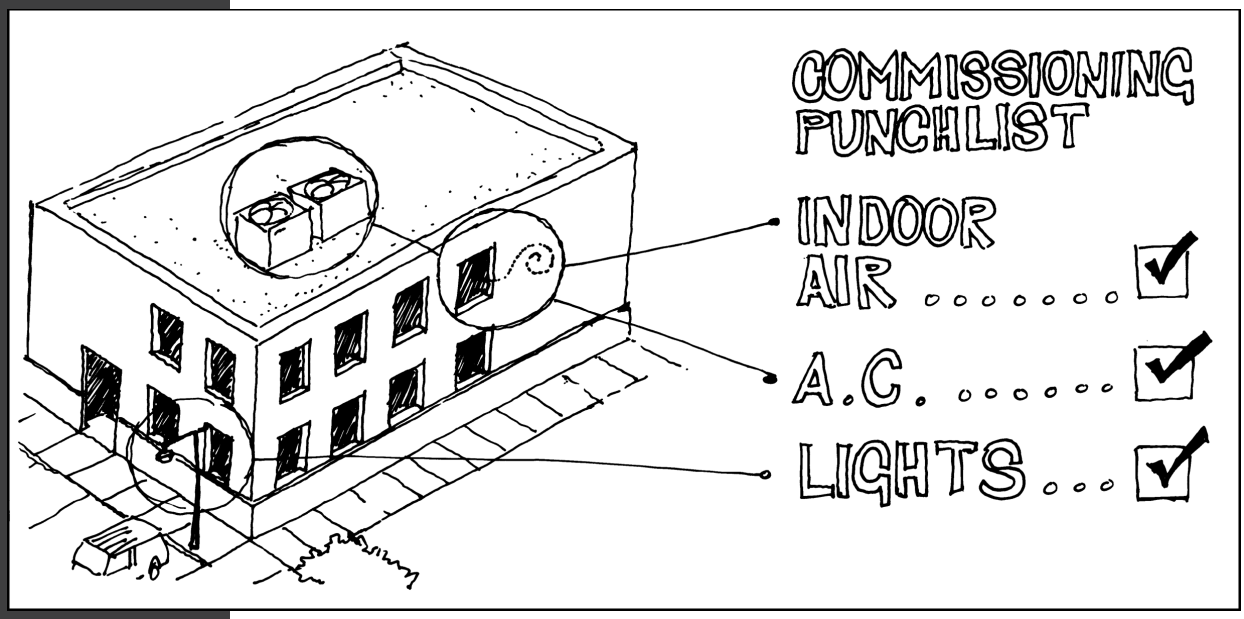
facilities, it will require closer coordination between the maintenance department, technical services departments, and outside contractors who install and maintain them.

The following list identifies some of the most critical areas/issues in maintaining school facility data, fire alarm, communication, and related systems. Maintenance and facilities managers should have clearly defined policies and procedures for addressing each one as it pertains to their physical plants.

- Verify that cables, wiring, and fixtures for data, communication, and alarm systems are installed properly and in compliance with applicable codes.
- Verify the installation and connection of uninterrupted power source and surge protection.
- Verify the security of all sensitive data and communications equipment.
- Conduct regular inspections of each system component to verify proper working condition.
- Maintain unobstructed access to all cable runs and equipment.
- Coordinate system testing on a yearly basis, or as required by installer, equipment manufacturer, or applicable code.
- Document all deficiencies, problems, or code violations and report them to proper administrators/supervisors.

7.7 Maintenance and Operations Administrative Guidelines for School Districts and Community Colleges

Building/Equipment Commissioning



One of the most problematic periods for new educational facilities is shortly before completion and prior to occupation. A number of new materials, an untested HVAC system, and a maintenance team that is unfamiliar with the building create the potential for numerous problems when combined with the urgency to put the facility into service. When possible, administrators should conduct a formal building commissioning process that includes several of the following procedures:

- Final HVAC system testing, balancing, and startup adjustments.
- "Airing out" building spaces to release airborne pollutants.
- Review of construction documents and equipment specifications to become familiar with actual building conditions and critical building systems.
- Introduction of the building to maintenance and operations staff.
- Preliminary identification of maintenance requirements.

To reduce the potential of future problems with building equipment and features that emit odors, irritants, pollutants such as volatile organic compounds (VOC's), and other harmful elements that could surface during new construction and renovations, these additional procedures should be followed:

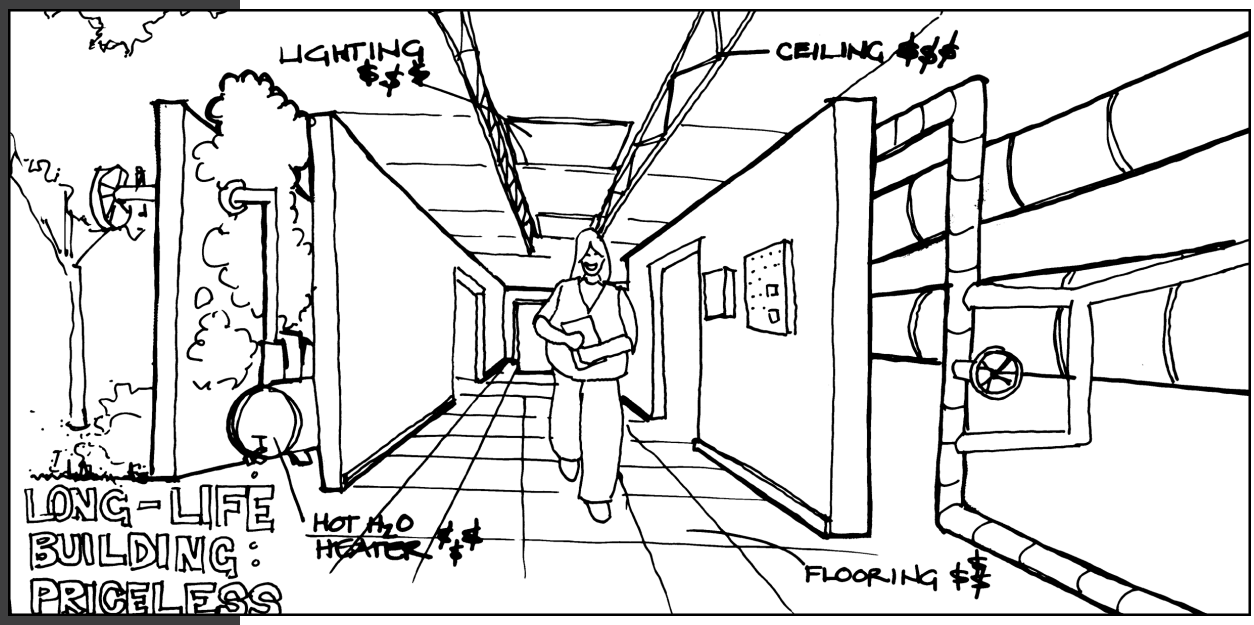
- Require material data sheets on all items utilized in construction to identify all potential sources of air quality contamination.

- Maintain material data sheets in the facilities management database or building manuals.

- Operate, test, and adjust other building equipment soon after installation to ensure proper working order.

7.8 Maintenance and Operations Administrative Guidelines for School Districts and Community Colleges

Life Cycle Costs of Materials and Building Systems



Discussions with architects of school facilities indicate that in most instances, finish materials, equipment, and other components are specified with regards to cost effectiveness, durability, and ease of maintenance. These practices are necessary to ensure that school facilities can withstand the varying levels of usage they will be subjected to and that the useful life of the building has been considered early on. If this were not the case, extensive maintenance and higher costs may result.

Facility managers and supervisors at Florida schools and community colleges will make countless decisions for replacing existing building features, systems, and equipment throughout a structure's useful life. They will also make similar decisions when faced with a variety of minor and major repairs, as well as when building additions and renovations are undertaken. In every instance, administrators should use life cycle cost (LCC) analysis in making decisions about which materials and systems to incorporate into their facility. This process, which can be combined with other decision-making criteria, is intended to provide an objective evaluation of materials and equipment alternatives by applying long-term economic considerations to help determine total or actual costs.

Although many school buildings in current use are much older, a 50-year service life is assumed practical for more recent structures. Essentially, the life cycle cost method takes into account initial costs, ownership costs, and functional costs of materials and systems during the total time they are in service to the facility. In its broadest application, life cycle cost strategies can be used for virtually any aspect of educational facility maintenance, including the replacement or modification of materials and systems, building envelope features, superstructure, interior features, and mechanical equipment.

For a more detailed study of life cycle cost methods and procedures, see the Florida Department of Education's "Life Cycle Costs Guidelines for Materials and Building Systems for Florida's Public Educational Facilities" published in 1999.

Salvaged Materials

It is often difficult or impossible to find exact replacements for older elements of a school building that become damaged or broken. If materials and features are not part of a regular inventory, staff will have to acquire them locally, or order them from private sector vendors - each of these procedures can influence the serviceability of a portion of the building, as well as overall worker productivity. The inability to make quick repairs because materials or building features are unavailable may also contribute to much larger and more expensive repairs later on. Administrators and supervisors should establish policies and procedures for maintaining a supply of salvaged parts and materials that can be used in lieu of new replacement parts where appropriate. This practice should in no way conflict with the need to introduce upgrades and enhancements, but could provide maintenance and operations departments with a greater flexibility in addressing building needs in a timely manner. Some of the items most likely to need repair and/or replacement include:

- Plumbing fixtures and trim
- Door hardware
- Window hardware
- Toilet room accessories
- Light fixtures
- Trim for chalk and marker boards
- Kitchen equipment
- Intercom speakers
- Other assorted parts and materials

Materials Management and Supplies

All contemporary educational facilities require an adequate and accessible reserve of supplies and materials in order to function properly. Depending on the type and number of buildings in a particular school district or community college, these resources may vary in nature. The more typical supplies that should be a part of an inventory or warehouse operation are those that are expended by school occupants and those used by maintenance and operations staff. For the most part, expendables include paper products, cleaning fluids, light bulbs, trash containers, filters, etc. Other types of equipment that may be kept in a maintenance and operations warehouse or inventory include equipment, spare parts, paint, hardware, tools, and building materials. To facilitate procurement, access, and distribution, these items are usually kept at a central or strategic location. In each instance, administrators should ensure that all inventory items, spare parts, and otherwise hazardous materials are kept in a safe and secure location. All affected staff members should be apprized of acceptable storage locations for certain types of materials, including warehouses, closets, and other spaces in public buildings, free-standing storage units, trucks, etc.

Maintaining a “critical spares” inventory is also a beneficial practice. This calls for stocking parts and equipment that are essential for school facility operations or having vendors who can provide these components in a short period of time. Where parts for critical building life safety systems are kept, administrators should ensure that new or reliable used components for emergency lighting, fire alarms, fire suppression systems, intercom systems, smoke and heat detectors, and any other visual or audible alarms are properly stored, secured, and easily accessible.

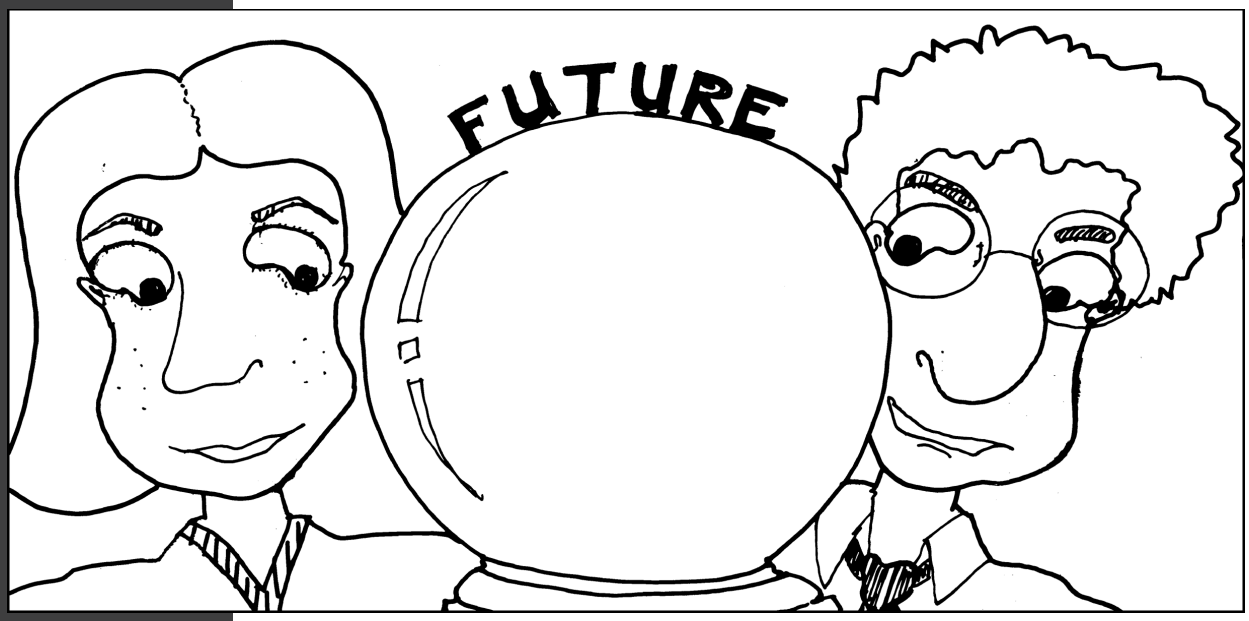
Standardization

It is strongly recommended that each school district or community college maintain reasonable standards and specifications to ensure compatibility with existing equipment and building features, and in some instances, reduce the number and variety of replacement parts and supplies. If this process is used, administrators and supervisors must comply with “sole-source” guidelines for procuring goods and services from private-sector vendors. This criteria is usually established by respective central administrations at individual school districts and community colleges. A sample list might include: emergency exit and door hardware, fire alarm and intercom systems, plumbing fixtures and trim, bathroom accessories, fire extinguishers and cabinets, playground and sports equipment, kitchen

equipment, and theatrical sound/lighting systems. In attempting to standardize certain building features, administrators should consider the economic benefits of this process compared to upgrades and enhancements introduced through new features and equipment.

7.9 Maintenance and Operations Administrative Guidelines for School Districts and Community Colleges

Future Trends in Facility Design, Construction, and Use That Will Affect Maintenance and Operations



Building Technology

In order to meet the challenges of the future, administrators should become knowledgeable about innovations in the educational process, how facilities will be designed and constructed, and how these situations will affect maintenance and operations activities in the coming years. New developments in building technologies, automation, and “intelligent buildings” systems are likely to have a significant impact on the way educational facilities will be used and maintained. While these technology advancements will make the maintenance and operations of school buildings a more technically complex endeavor, they will also make them easier to maintain, monitor, and operate. With the integration of more “computer-assisted” building functions, such as energy management, systems operations, and automated data/communication systems at all types of educational facilities, administrators will need to fully explore how these changes will affect the entire maintenance and operations organization.

Construction Materials and Processes

New developments in construction materials and processes will also affect the way in which maintenance and operations functions are delivered. It is anticipated that greater emphasis will be placed on holistic approaches to life-cycle cost analysis, integrating design, engineering, materials specifications, and construction economics issues more fully with considerations for maintenance, operations, building service life, and long-term educational benefits.

Relocatable Classrooms

The long-range use of relocatable or temporary classrooms will also be a trend that administrators will have to contend with. While there are efforts underway to discontinue their use, it is unlikely that these structures will disappear altogether from Florida's educational facilities. It is, however, safe to assume that these structures may be constructed in a different, more substantial manner. From a maintenance and operations standpoint, this may lead to improvements in their installation, upkeep, and service life. For additional information on this issue, see section 9.14 Relocatable Classrooms.

Electrical Industry Deregulation

The future may also usher in changes in the manner in which school districts and community colleges acquire electrical service for educational facilities. The anticipated deregulation of the electrical industry in Florida will mean that administrators will have the ability to select an electrical service from competing utility companies. School districts and community colleges will, more than likely, have the option of remaining with a particular electrical service provider or shop for electrical service from different producers, brokers, and marketers. Along with this, administrators will be able to "tailor" their type of services that are required at different types of educational facilities. While there is no consensus on the cost savings to be realized from a deregulated and competitive electrical utility industry, for schools and community colleges the potential for significant savings may result from aggregation. This approach will allow educational facilities to aggregate electricity loads, that is make joint purchases for multiple large electricity consuming facilities – resulting in a net energy savings from bulk pricing or large contract purchases. Administrators should begin monitoring and documenting energy consumption characteristics for each building within a facility to have a useful set of data for making future decisions about electrical utilities.

Facility Use Patterns

Innovations and refinements in the educational delivery process and greater use by the general public will also have an effect on educational facility maintenance and operations. Changes in educational facility use patterns will necessitate greater renovations, remodeling, and retrofits in existing facilities to accommodate new instructional practices and approaches. In addition to this, many facilities will realize increased usage by the general public for evening, weekend, and special events. Expanded use patterns will place significant demands on operations departments and the need for custodial and janitorial services.

School Safety

Given the range of security and safety-related events that have occurred in the recent past at educational facilities around the country, there is likely to be greater emphasis placed on these issues in the near future. School administrators, parents, and the general public will require all school staff members, including maintenance and operations personnel, to play a part in ensuring that schools are safe and secure environments for learning. Increasing concerns about the security of school property will lead to a more widespread use of practices associated with Crime Prevention Through Environmental Design (CPTED). This approach calls for designing and maintaining physical conditions to minimize, discourage, or eliminate the potential for crimes and other undesirable activities on school property. For maintenance and operations administrators, these practices may lead to the increased use of entrance control devices, camera surveillance equipment, intrusion/motion detectors, and new approaches to facility renovations and modifications. In some instances, concerns for school safety and security may also require “off-hour” monitoring by assigned security staff or by security personnel used on a contracted basis.

Energy Management, Resource Conservation, and Environmental Concerns

In addition to the intelligent building innovations mentioned above, another technical trend that will affect maintenance and operations is energy management. Increasingly, computers will be used to help manage energy consumption, air-conditioning and heating, lighting, and various other equipment functions. Hours of operation, levels of operation and equipment cycling all lend themselves to computerized management in order to lower overall energy consumption. Greater use of energy recovery systems is also anticipated to assist in recycling energy from equipment exhausts and returning it to the system. In addition to this, greater attention will be paid to building orientation and

siting for new facilities and additions in order to take advantage of natural or day lighting opportunities and reduce the amount of heat-gain to interior spaces. Many of these practices will be combined with others, such as the pre-treatment of outside air and better humidity control, in order to maximize the efficiency of mechanical equipment and enhance thermal comfort in various types of educational buildings. All of these trends will gain momentum as a way to cut costs, conserve resources, and provide greater efficiencies in physical plant operations.

Grounds Maintenance

Another trend that is gaining in acceptance at educational facilities is “xeriscaping.” This practice involves selecting and installing “drought-tolerant” plants and, in some instances, native plant species for school grounds. It also calls for the use of moisture-retaining mulch in some locations, as opposed to turf-grass which may require extensive irrigation. The use of xeriscaping is primarily intended as an alternative method of landscaping that relies less on the need for watering and chemical treatments for natural vegetation. From a grounds maintenance standpoint, xeriscaping also requires less overall plant maintenance and attention.