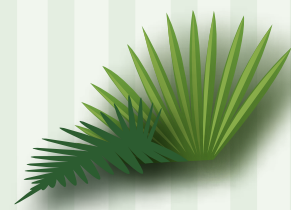


# *Creating a Green and Profitable Work Environment*



An informative guide to "green" cleaning and maintenance practices which provide efficient, productive and healthy operation of commercial buildings in Florida.

2003



# *Creating a Green and Profitable Work Environment*

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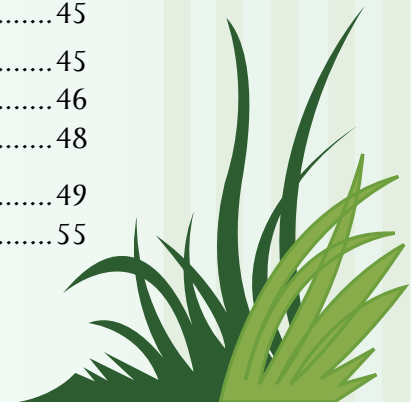
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## 4.0 Identify Opportunities I – Cleaning and Maintenance and Indoor Air Quality

### Chapter Highlights:

- Workplace indoor environmental quality (IEQ).
- Measured (IEQ) improvements through green cleaning and maintenance.
- Cleaning product properties and selection.
- Material Safety Data Sheet (MSDS) information.
- Techniques and equipment for green cleaning and maintenance.
- Cleaning/Janitorial equipment properties and selection.
- Integrated pest management.
- Effective trash control and recycling.

Cleaning and maintenance activities are rarely viewed as contributors to indoor air quality problems, however many national organizations have reported on occupant health and productivity impacts related to such activities. Organizations such as the US Environmental Protection agency and the US Department of Energy estimate that indoor air quality problems account for anywhere between 3 percent - 20 percent losses in worker productivity equating to billions of dollars lost annually. Productivity losses can result from absenteeism due to sickness, as well as degraded performance caused by allergies, headaches, fatigue, and odors. All such symptoms have been shown to be related to various indoor pollutants such as dust, volatile organic compounds (VOCs), and biological pollutants such as mold.

A study was conducted at the Frank Porter Graham Child Development Center on the University of North Carolina, Chapel Hill Campus that revealed significant reductions in dust, VOCs, and biological pollutants through the implementation of green cleaning techniques. The study was a collaborative effort of the US EPA, Research Triangle Institute, University of North Carolina, a building service contractor, and commercial cleaning industries and suppliers. Results from the studies are summarized in Table 1.

Green cleaning and maintenance principles as related to improving indoor air quality generally focus on an evaluation of products to find safe, effective alternatives to potentially hazardous formulas, and minimizing the amount of product required for a particular job. Principles are also aimed at re-evaluating techniques and equipment to develop safe, effective cleaning and maintenance practices.

Table 1. Results from green cleaning study conducted at UNC.

Air Pollutant	% Change with Improved Housekeeping
Dust	– 52%
VOC	– 49%
Total Bacteria	– 40%
Total Fungi	– 61%

Source: Adapted from PA Green Building Operations and Maintenance Manual



## 4.1 Products

### Section Recommendations:

- Learn about potentially harmful cleaning product ingredients.
- Scrutinize cleaning products for hazards .
- Learn the usefulness of MSDS information and keep records up to date.
- Train staff on all aspects of product dilution, safety, equipment, storage, and disposal.
- Consider concentrated products.
- Consider paper and plastic products with recycled content.
- Scrutinize other maintenance products such as caulks, solvents, paints, adhesives, and sealants for VOC content.

A key aspect of a green cleaning and maintenance program is the selection of cleaning products. It is important that products selected be effective for the job at hand, for maintaining a clean building is necessary to ensure employees remain healthy and productive, and visitors are safe. Ineffective products will often counteract the benefits of a green cleaning program, through the use of more product, and requiring longer durations to complete the job at hand. However, it is important to realize that while some cleaners are effective at performing their intended task, they can often contribute to indoor air quality and environmental problems due to the nature of various ingredients. Some ingredients pose harm to the environment when disposed of, while others may be derived from non-renewable resources.

### 4.1.1. Harmful Product Properties

The toxicity of a product to humans as well as aquatic life is one of the most important properties to investigate when selecting a particular cleaner or other chemical. Not all ingredients of a particular product are toxic, but those that are may damage organs and tissues, and inhibit systemic functions of plants and animals alike. Pathways of exposure for humans include oral intake, inhalation, and absorption through the skin. Those suffering from short-term exposure may experience skin and respiratory irritation, and long-term exposure can result in more permanent damage. Exposure to a toxic product may result from direct product use, as well as contact with residuals left behind.

Most often such cleaning products are concentrated, and dilute mixtures are prepared by cleaning staff before actual use. Incorrect mixtures involving multiple products can lead to harmful exposure through the production of poisonous gas.

Exposure to such concentrated products can make maintenance staff more susceptible to the inherent dangers of such products than other employees.

Such products with toxic ingredients, whether in concentrated or diluted form, can also pose harm to the environment, for residuals are often washed down drains, and disposed of with product packaging



Figure 2. A key aspect of a green cleaning and maintenance program is the selection of cleaning products.

Sherril Shields, FSEC

and with cleaning implements such as rags, mops, etc. Therefore, biodegradability is another important aspect to consider. A product's biodegradability is a measure of the time required for relatively large molecules to be broken down in the environment. A readily biodegradable product or ingredient would begin to break down immediately into relatively benign compounds such as salts, water, and carbon dioxide. Products that are slow to degrade in the environment pose a threat to the environment, including plant and animal life, through accumulation.

*Avoid cleaning products that are:*

- *Toxic to humans and the environment*
- *Slow to degrade in the environment*
- *Corrosive*
- *High in VOCs*

The corrosiveness of a particular product is also a consideration, for extremely acidic and alkaline properties may cause skin irritations, burns, and can stain and otherwise damage certain surfaces. This property can be determined by the pH of a product, and the preference is to use products with a neutral pH, close to 7. The pH of a product can range from 0 indicating the most acidic, to 14, indicating the most alkaline. There are other factors that contribute to the corrosiveness of a product, and will be indicated on a product Material Safety Data Sheet, as discussed in a subsequent section.

Volatile Organic Compounds (VOCs) contained in products often contribute to many indoor air quality problems due to the fact that they evaporate very easily. Immediate reactions such as coughing and sneezing from the odor of a cleaner are often caused by VOCs. VOCs can further react in an indoor environment when exposed to other drivers such as sunlight, and cause further problems. Exposure to high levels of VOCs

can cause symptoms such as eye and throat irritation, nausea, vomiting, and headaches. It is important to note that cleaning products are not the only source of VOCs in a building. Other sources include particleboard contained in cabinets and furniture, carpets, and paints. Cleaning products selected should have the lowest percent VOC content available

when diluted for use. Although fragrances are often formulated with cleaning products, they are often covering offensive odors caused by extreme VOC

levels. The fragrances themselves can cause exposure effects in some individuals, and should be avoided.

#### **4.1.2. Where to Find Information Regarding Properties**

In order to investigate the health, safety, and environmental aspects of a particular cleaner or one of its ingredients, one must know where to find such information. Container and product labels begin to describe proper use of the product through directions for use and ingredient lists. However, due to space constraints, some information may be left off the label. Also, labels tend to get damaged and become unreadable. A more reliable and complete source of information is the product material safety data sheet (MSDS). The US Department of Labor's Occupational Safety and Health Administration (OSHA) requires all manufacturers to issue an MSDS with the first shipment of any hazardous chemical product, and requires that users of the product keep a copy on file and available for review by employees. All new cleaning and maintenance employees should be given training regarding the location of

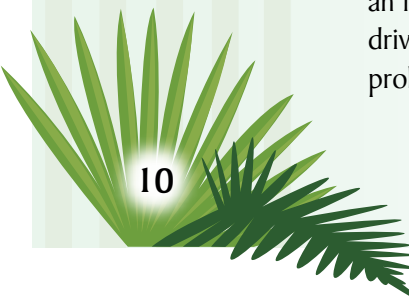
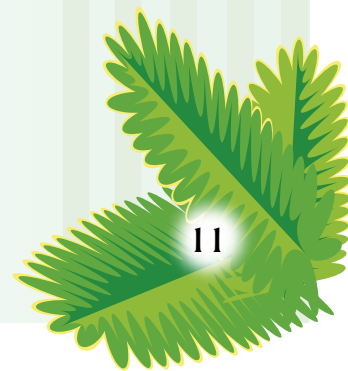


Table 2. Pertinent MSDS information.

MSDS Section	Description
Chemical Product and Company Information	Provides an overall product summary, including manufacturer address, MSDS date, emergency phone numbers, and a brief description of any hazard.
Composition and Ingredients	Provides information about each component of the product including its percent by weight (PCT) and Chemical Abstract Services registry number (CAS). Also contains whether component is listed in SARA 313 (Superfund and Reauthorization Act or "Community Right to Know Law." If listed, and more than the specified amount is used, use must be reported to USEPA every year. The Threshold Limit Value (TLV) and the Permissible Exposure Limit are the maximum airborne concentration for an 8-hour exposure as recommended and regulated, respectively.
Hazard Identification	Provides an emergency overview and ratings of the product from the Hazardous Materials Information System and the National Fire Protection Association. This section also outlines physical or health hazards posed by the product including risks to eyes, skin, lungs, risk of absorption through skin, and risks of poisoning and other long term effects.
First Aid	Provides medical attention required in the event of exposure.
Fire Data	Lists all flammability concerns, what media to use to extinguish a fire, and any safety precautions necessary to fight a fire.
Accidental Release Measures	Describes personnel qualified to respond to an emergency involving a spill and outlines containment and clean-up techniques, as well as any necessary evacuation procedures.
Handling / Storage	Provides general guidelines for safe handling of product as well as all storage requirements.
Exposure Controls / Protective Equipment	Outlines safe practice for use such as eye wash station nearby and any necessary protective gear such as eye, skin, and inhalation protection.
Physical / Chemical Properties	Lists information such as physical state, color, odor, solubility, boiling point, melting point, specific gravity, pH, and corrosivity.
Stability / Reactivity	Lists storage conditions, including moisture and temperature requirements as well as compatibility with substances stored nearby.
Toxicological Information	Summarizes data gathered from research with animals, including lethal dosages and concentrations (LD50), effects on reproduction, skin toxicity data, carcinogenicity, and mutation data.
Ecological Information	Assesses the material's environmental impact on aquatic and terrestrial plants and animals and the potential for the material to persist in the environment.
Disposal Considerations	Outlines any dilution guidelines, container information, and national environmental regulations required to safely and legally dispose of the product.
Transportation Information	Lists proper shipping name, hazard class, ID number, and packing group.
Regulatory Information	Outlines all known regulatory guidelines spelled out by OSHA, SARA, Clean Water Act, RCRA, and known state regulations.
Other Information	States the product's intended use and lists reference materials.

the MSDS and proper interpretation of the sheets. A safety training for all cleaning and maintenance employees should be conducted for all new chemical products in the workplace. This safety training should also

include training on proper product disposal, and a review of pertinent hazardous waste regulations (see "Resources and References" section of this chapter.) MSDS sheets over two years old should be updated with current versions.



MSDS sheets are divided into various sections that present various types of health, safety, and environmental information. A description of such sections and important information contained within is presented in Table 2 on the previous page. It is important to note that some of this information may not be listed on a product's MSDS, and that it may be listed in sections other than those identified. It is also important to note that an MSDS may not list an ingredient if present in extremely small quantities. If information of interest cannot be found on the MSDS, or if there are concerns regarding listed or unlisted product ingredients, call the manufacturer customer service. If the service desk cannot answer your questions, ask to speak with someone in the research or production departments.

The MSDS information for a particular product should provide all information necessary to select cleaners based on their potential to cause indoor air quality problems, exposure effects, and environmental harm. Specifics regarding preferable and non-preferable ingredients are listed for common cleaners in Appendix B, which has been adapted from the Green Seal Standard GS-37 and the Pennsylvania Green Building Operations and Maintenance Manual. Even after a safer alternative has been identified it is extremely important that its instructions for use be followed at all times, including use of protective gear, proper dilution ratios, spill cleanup procedures, and disposal information.

#### 4.1.3 Other Product Properties

Along with a cleaner's potential to cause human and environmental harm, there are other issues to consider when selecting a green cleaner. For instance, many cleaners are designed to be effective for multiple cleaning purposes. Occasionally this may require varying dilution ratios or

utilizing different cleaning implements, but a **multipurpose** cleaner can replace several different cleaners, which simplifies purchasing, tracking, disposal, and employee training. Training remains important however, for improper dilution may damage certain surfaces, leave floors slippery increasing the risk of falls, and may increase the time to complete a particular activity especially if the incorrect tools and techniques are employed.

**Concentrated** products are also beneficial, for as a result of a greater percentage of active ingredients, the amount of packaging needed is reduced. This results in reduced cost of product from packaging and shipping concerns, and helps free up storage space. **Reduced packaging** will also help to minimize solid waste generated by the facility. Concentrated products may be less desirable from a disposal standpoint than non-concentrated products, so care should be taken to ensure that the entire quantity purchased will be successfully used by the facility before the product expires. Trials should be undertaken to ensure the product meets all needs and expectations before bulk quantities are purchased. Concentrated and non-concentrated products alike may be available in **reusable containers**, which will also reduce solid waste generated by the facility. All cleaners should be purchased with **locally recyclable packaging** where available such as high-density polyethylene (HDPE) plastic. Preference should be given to manufacturers that supply products in recycled packaging containing post consumer content. More details on recycling are given in a later section of this guide.

Waste minimization concerns can also be extended to supplies other than cleaning products. Recycled content should be specified when purchasing bathroom/ facial tissue, paper napkins/towels, general purpose

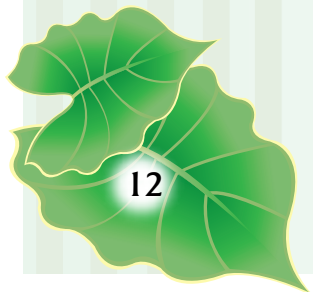




Table 3. Recycled content standards for a few common items.

Product	Percent Recovered Materials	Percent Post-Consumer Content
Bathroom Tissue	20 - 100%	20 - 60%
Paper Napkins	30 - 100%	30 - 60%
Paper Towels	40 - 100%	40 - 60%
General Purpose Industrial Wipes	40 - 100%	40%
Facial Tissue	10 - 100%	10 - 15%
Plastic Trash Bags	N/A	10 - 100%

Source: USEPA Comprehensive Procurement Guidelines

wipes, and plastic trash bags. Table 3 lists specific information for specifying recycled content for common paper and plastic items. The table should be read as: X% recovered fiber, including Y% postconsumer fiber NOT X% recovered fiber plus Y% postconsumer fiber. When purchasing paper products a few other issues to consider are no use of de-inking solvents containing chlorine or any other chemicals listed in the US EPA Toxics Release Inventory, and no use of chlorine or chlorine derivatives in the bleaching process.

It is important to note that cleaning products are not the only culprits for causing detrimental health, safety, and environmental effects. Other maintenance products used on the interior of the building such as caulks, solvents, paints, adhesives, and sealants should be selected on the basis of similar concerns to cleaning products, primarily with respect to their VOC content. Items certified as having “zero VOC content” or “low VOC content”, which for paints represents products with less than 150 grams/liter of VOC, prior to tinting should be selected.

## 4.2 Techniques & Equipment

### Section Recommendations:

- Follow the “10 Commandments of Housekeeping.”
- Consider using portion control equipment.
- Prevent soil from entering the building.
- Practice effective soil removal on floors as well as elevated surfaces.
- Scrutinize cleaning equipment (vacuums, floor machines, etc.) for proper function and ability to capture fine particles.
- Consider non-chemical cleaning techniques.
- Control moisture to control mold and mildew.
- Develop effective disinfection/sanitation routines.
- Control gaseous pollutants for health and comfort.

Proper selection of products is not the only strategy to employ in a green cleaning and maintenance program. There are general techniques and philosophies that should be incorporated where appropriate when dealing with cleaning and maintenance functions, routines, and equipment. Stephen P. Ashkin of the Ashkin Group has developed the



“10 Commandments of Housekeeping” that detail these strategies. Additional information from other sources has been inserted here using Mr. Ashkin’s framework.

**1) Clean to protect health first, and appearance second.** It is not what is seen that is the real area of concern in the indoor environment. Even clean-appearing buildings can be extremely unhealthy. Thus, focus on cleaning for health and in most cases appearance will be addressed at the same time.

**2) Clean and maintain the building as a whole, not just as separate components.** Cleaning and maintenance in one area of a building can have a major impact on other areas. For example, the fumes from the stripping and recoating of a floor in one area can contaminate adjacent areas or even the entire building via the HVAC system. Appropriate actions must take place to ensure health and safety throughout the entire building. If possible, schedule work involving odorous or hazardous chemicals for periods when the building is unoccupied, and ventilate during and after the use of such chemicals.

**3) Schedule routine maintenance, yet plan for accidents and emergencies.** Scheduled maintenance that is frequent and thorough is the most efficient and effective method for building maintenance and cleaning. Concise plans and records are a must. In addition, specific procedures need to be developed to address accidents as small as spills and leaks, and emergencies as large as hurricanes, floods, etc.

**4) Scrutinize outside contractors.** Pest control services and roofing contractors may not be as concerned or even aware of the impact of their activities on building occupants. The building owner or manager

should pay particular attention to the type of products that “outsiders” are using and recognize that the HVAC system may need to be adjusted to mitigate potential problems. Outside contractors should commit to upholding any building environmental policy in place.

**5) Minimize human exposure to harmful contaminants and cleaning residues.** Workers should always use the appropriate personal protective equipment, areas where work is taking place should have adequate ventilation, work schedules should be established to minimize exposure to building occupants, and the products used should be the most benign to accomplish the task. For major cleaning operations, building occupants should be informed as to the maintenance that is to take place and to any other specifics that may impact their health.

**6) Minimize chemical, particle, and moisture residue when cleaning.** The products that are used for building maintenance due to their ability to quickly and efficiently remove oils, soils, living organisms, etc. can also contribute to a building’s problem if used incorrectly. Use the minimum quantity of cleaning agent necessary to perform a task and ensure that all residues are removed. More information on techniques and equipment related to this strategy follows.

**7) Ensure worker and building occupant safety at all times.**

**8) Minimize the amount of pollutants entering the building, while maximizing the amount of pollutants extracted.** It is significantly more effective in terms of both time and money to keep contaminants out of the building than to try to remove them once they have entered. This is true for not just airborne pollutants, such as vehicular exhausts, but for

dirt and dust from pedestrian traffic, as well as biopollutants from roof leaks and standing water. More information related to these strategies follow.

**9) Dispose of cleaning waste in environmentally safe ways.** Cleaning wastes themselves can contribute to indoor environmental problems when stored or disposed of improperly. Reactive products can give off toxic fumes and even water-based wastes can become the ideal breeding grounds for disease-causing organisms.

**10) Focus on people.** A successful cleaning and maintenance program requires constant efforts in operation and training. Cleaning as an industry faces high personnel turnover rates. Thus, ongoing training is necessary. Furthermore, an indoor air quality coordinator should be designated and trained to provide a focal point and to create feedback loops between occupants and building management.

#### 4.2.1 Cleaning Product Portion Control Equipment

Use of portion control systems and equipment provide a number of benefits for the facility and janitorial and maintenance staff. Sophistication of equipment can vary, from units that allow controlled dispensing of concentrate or pre-prepared mixtures, to units that feature potable water hookups and automatic dilution of concentrate. Such systems enhance staff safety by minimizing physical contact with concentrated cleaning chemicals and preventing product misuse through labeling. Stand-alone measuring devices and assurance of sometimes complicated dilution ratios are also minimized. Such features facilitate staff training, and time required to prepare solutions. As previously mentioned, the use of concentrates alleviates some environmental

concerns such as the need for packaging and waste disposal. Many units control spillage with overflow drip trays. Dilution control equipment should be periodically checked for the accuracy of dilution.

Implementation of portion control systems has shown to increase the efficiency of maintenance and cleaning operations through a 30%-65% reduction in product usage, by providing a safer and simpler working environment, and by improving inventory control and space utilization.

#### 4.2.2 Soil Control

By reducing the amount of soil such as dust, dirt, sand, pollens, and grease that enters a building, and by reducing the amount of collected material that escapes from poorly constructed or maintained vacuuming equipment and dust cloths and mops, it is possible to maintain a clean building with significantly less effort. In addition, proper soil control can have a positive physical as well as psychological effect on the occupants. Complaints of illness and discomfort have been associated in buildings with high dust levels, and other particles such as pollens can cause various allergic reactions.

*The cleaning industry estimates that approximately 85% of all soils and particles that housekeeping and maintenance staff remove from a building have been tracked in from the outside through entryways.*

The cleaning industry estimates that approximately 85% of all soils and particles that cleaning and maintenance staff remove from a building have been tracked in from the outside through entryways.

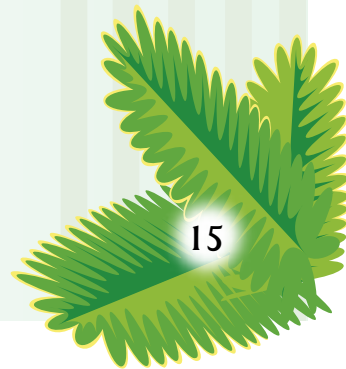




Figure 3. Periodic pressure washing of the building exterior and walkways is one way to minimize the amount of soil tracked into the building.

Therefore, the first priority in soil control is to examine the outside of the building for potential sources, and determine ways to control or reduce them. It is important to pay similar attention to entryways other than the main building entrance. Back doors, loading docks, garages, etc. all present routes from the outside of the building to the inside, although foot traffic is much lighter than main entrances. Poorly drained parking lots and entrances can collect soils left behind after standing water evaporates.

Drainage patterns can be improved, or particular attention can be paid to manually removing soils on a regular basis. Periodically hosing off and/or pressure washing hard surface areas adjacent to entryways can help control the problem. Plant material in the vicinity of entranceways is another source of soil that can be tracked or blown in the building by wind. Plants that do not have a tendency to drop berries, leaves, flowers, or excessive amounts of pollen should be chosen. Ensure plant beds bordering entryways and walkways contain

*An effective walk-off mat needs to be at least 10-12 feet in length such that each foot of a walking person hits the mat at least twice.*

material such as mulch or gravel to minimize erosion of the soil. Irrigation and rain events can cause loose soil to deposit on walkways where it can be tracked into the building. Although organic mulch does help retain water, inorganic mulch may be a better choice for maintenance concerns since organic mulch requires 1-2 upgrades per year to maintain aesthetics. More information and resources on plant selection and the use of mulch is given in the Building Water Use section.

Other strategies can be employed to minimize soils that do remain in the entryway area from being brought into the building. Such strategies primarily involve implementing an element to remove soils from the bottom of shoes. On the exterior of the entryway textured approaches such as stone, bricks and textured concrete perform better than smooth surfaces. Inside the entryway, architectural gratings perform a similar function. In lieu of renovations, high quality walk-off mats can be placed inside as well as outside of the entryway. An effective walk-off mat needs to

be at least 10-12 feet in length such that each foot of a walking person hits the mat at least twice. Since mats are not an infinite sink for soils, they

should be well vacuumed / cleaned at least daily. The undersides of the mats should be periodically cleaned as well. Soils can enter a building through windows as well as doors, therefore window coverings will also require frequent cleaning. Mini blinds (blinds with less than 2 inch horizontal surfaces) should be avoided due to their difficulty to clean.

Maintaining a positive pressure within the building through proper ventilation can also reduce the ability for particulate matter to

drift or blow in through openings. More information on this strategy is presented in the Mold, Mildew, and Moisture control section.

### 4.2.3 Soil Removal

Once soils have made it into a building, it is important that equipment and techniques be employed to effectively remove the soils, rather than move them from one location to another. Certain common dusting techniques (both floor dusting with dust mops and hand dusting) only stir up accumulated soils, making them airborne, rather than capturing them. Such soils eventually land on the same original surface, or another surface, and are not effectively removed from the building.

Frequency and degree of soil removal should be scheduled according to the amount of foot traffic/occupancy taking place in the particular building area. High traffic areas such as floors in entrances, lobbies, stairwells, and elevators typically require daily cleaning and in many cases require cleaning several times per day. Focus should be put on traffic lanes for efficiency, which often represent 25% of the entire floor area. In the case of walk-off mats, the first 6-9 feet often trap most of the soil that is tracked in. Particular attention should also be paid to mail/copy/computer rooms, for the elevated amount of paper use produces a large amount of particulate matter. In such areas, various inks and toners inevitably end up on light switches and door knobs, so special attention should be paid to ensure such soils are not transmitted to other areas of the building.

#### 4.2.3.1 Floors

For floors, a vacuum cleaner with a hard surface floor attachment or a micro-fiber flat mop are preferred over a chemically treated dust mop. If a dust mop treatment is used, choose a water based product and be sure



Eric Martin, FSEC

Figure 4. Walk off mats like this one may not be long enough to be effective.

to follow the manufacturer's instructions for safety, as well as effectiveness. Highly soiled carpets, carpeted walk-off mats, and carpets in high traffic areas such as lobbies will require vacuuming in both directions.

Regardless of the vacuuming application, vacuums themselves should be selected on the basis of five issues of importance: **Airflow** – should be greater than 90 cubic feet per minute (cfm). **Static lift** – a measure of the suction capability, should be greater than 80 inches of water. **Filtration** – models with high efficiency particle arresting (HEPA) filters are recommended. Such filters are extremely efficient (99.97%) at capturing the small particles ( $\geq 0.3$  microns) that ordinary vacuum cleaners allow to escape with air that is vented from the unit. Models equipped with HEPA filtration do carry a price premium however, so models with filtration approaching the HEPA level are also acceptable. **Durability** – equipment should be selected from manufacturers that offer a

warranty of at least four years. **Ergonomics** – equipment should be easy to handle (push) and have flexible options to make it easier to maneuver around furniture. This will help prevent back and other injuries that result in lost work to janitorial staff.

Properly operating equipment should not give off odors as the equipment is operating. Every attempt should be made to empty canisters / replace disposable bags outdoors, to prevent captured debris from being released back into the indoor environment.

Small particle collection capability, is also important for other floor cleaning machines such as buffers and burnishers, which can create considerable dust during use. Models equipped with active vacuum attachments for particle capture are recommended.

#### 4.2.3.2 Elevated Surfaces

In order to effectively remove the soils on elevated surfaces, while minimizing chemical dust treatments, the preferable implement is a lint-free, micro-fiber, damp dust cloth that is neatly folded to permit periodic unfolding and refolding to expose dust free surfaces. Once all sides are soiled, the cloth must be rinsed out. Hand held feather dusters may also be wrapped with a damp dust cloth. Vacuum or otherwise remove dust from heating, cooling, and ventilation grilles and vents periodically, especially in mail/copy/computer rooms. The ceiling and wall surfaces adjacent to the grilles and vents should also be cleaned to remove

visible dust. Light fixtures should also be regularly cleaned not only for soil control, but also to maintain efficiency. Details regarding light fixture cleaning are given in the Building Energy Use section.

## 4.2.4 Biological Control

### 4.2.4.1 Mold, Mildew, and Moisture Control

One of the biological contaminants of concern for indoor air quality problems is mold and mildew. There are four critical requirements for mold growth: available spores, available food, appropriate temperatures, and considerable

moisture. The removal of any one of these requirements will minimize mold growth, however three of the four are impractical, and nearly impossible to control.

Ranging in size from 3 to 40 microns (human hair is 100-150 microns), mold spores are ubiquitous – they are literally everywhere. There is no reasonable, reliable and cost-effective means of eliminating them from environments that humans inhabit. So, trying to control mold growth through the elimination of mold spores is not feasible. If all three other requirements are met, almost any substance that contains carbon atoms (organic substance) will provide sufficient nutrients to support mold growth. Even the oil from your skin that is left when you touch an otherwise unsuitable surface, like stainless steel, or the soap residue left from a good cleaning will provide sufficient nutrients to support the growth of some molds. And

*The only requirement for mold growth that is controllable is the presence of considerable moisture. When considerable moisture accumulates in buildings or on building materials, mold growth will often occur, particularly if the moisture problem remains undiscovered or unaddressed.*



many of the most common materials found in buildings like wood, paper and organic fibers are among the most preferred nutrients of mold. Thus, eliminating mold food from your environment is a virtually impossible task. Unfortunately, most molds grow very well at the same temperatures that humans prefer. In addition, anyone who has cleaned out their refrigerator quickly realizes that temperatures close to freezing are not cold enough to prevent mold growth and temperatures that are much warmer than humans prefer, like those of the tropics, will grow abundant quantities of mold. Therefore, it is not feasible to control mold growth in a building environment through the control of temperature. The only requirement for mold growth that is controllable is the presence of considerable moisture. When considerable moisture accumulates in buildings or on building materials, mold growth will often occur, particularly if the moisture problem remains undiscovered or unaddressed.

Moisture problems can have many causes, and many can be addressed by examining the exterior of the building. Roofs need to be regularly inspected, not only for the presence of problems that may lead to leaks such as split seams, separated layers, and failed flashings, but also for problems that may cause water to accumulate such as accumulated debris and blocked drainage systems. If gutters are present, inspections should be conducted to ensure they are clear and functioning properly, and that downspouts discharge at least three feet from the building to ensure moisture does not accumulate near the foundation of the building.

At ground level, maintenance staff should ensure that plants are not within two feet of the building, for they may require irrigation systems to deliver water too close to the

foundation. Regardless of plant placement, any irrigation system should be maintained such that sprays and rotors are not directed to hit the building. Visible leaks such as plumbing leaks and leaks in the building envelope such as from roofs and around windows, water accumulation, and water damaged materials need to be responded to within 24-48 hours to prevent mold growth. Frequently eliminate moisture accumulation in wet areas such as restroom and shower areas, and clean up all spills as quickly as possible. Besides leading to mold growth, such accumulation can lead to dangerous slippery conditions. Walls and floors of wet areas need to be sanitized periodically to prevent accumulation of mold and mildew. This is especially true in tiled areas, for such contaminants can easily grow in porous grout, which is difficult to clean. Air



Steven C. Spencer, FSEC

Figure 5. Flat roofs like this one are prone to water accumulation.

conditioner condensate drain pans should be regularly inspected for overflow and blockage problems, and drain lines should be checked for proper operation. Other floor drains in restrooms and other wet areas should also be checked for proper operation. Amends should be made in janitorial closets or other areas of the building for cleaning staff to clean equipment and dilute cleaning products without making a large mess that needs to

be cleaned up such as floor drains and large slop sinks. Care should also be taken on the placement of plants inside the building to ensure moisture does not accumulate on carpeting. Plants can also transpire a significant amount of water in the vapor form.



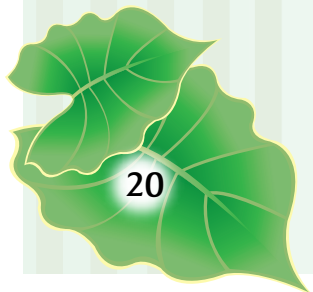
Neil Moyer, FSEC

Figure 6. Water can enter a building envelope in the vapor form, and become trapped behind an impermeable barrier, such as vinyl wallpaper.

Although many efforts are carried out to control water in its liquid form, water also enters and is present in buildings in a vapor form. Some of the water intentionally introduced in restrooms and at sinks in eating areas, as well as unintentionally by leaks and spills, evaporates and joins water vapor that is exhaled by building occupants. Water vapor can also enter the building through the movement of humid outside air. Generally outside air is intentionally introduced into commercial buildings for ventilation purposes, however space conditioning systems are designed to handle this moisture load. Many buildings however suffer from unintentional movement of outside air into the building through unintended pathways such as cracks and crevices in the building envelope. To some degree, this happens naturally, and building materials can often safely absorb certain amounts of moisture,

and subsequently dry out. Problems occur when pressure driving forces cause excessive infiltration of this air through the building envelope. This is often caused by an unbalanced space conditioning system causing the building to become negatively pressurized while the system is operating. Ideally, most areas of a building (aside from certain hazardous storage areas) should be under positive pressure with respect to the outside environment. Three common causes of negative pressure are improper balancing of ventilation and exhaust systems (fume hoods in laboratories, exhaust hoods in kitchens, etc.), supply duct leakage, and insufficient pathways for return air. Excessive infiltration of outside air through unintended paths in the building envelope can eventually lead to hidden mold and mildew problems inside of building assemblies such as walls and floors, as building materials are not permitted to dry. Impermeable coverings such as vinyl wallpaper and vinyl flooring contribute to the problem by not letting moisture escape. Water vapor can also condense on surfaces inside of assemblies that are excessively cold.

When designed properly, space-conditioning systems are designed to maintain a comfortable humidity level inside the building. Due to equipment age, malfunction, or maintenance issues, problems can arise, often unexpectedly. Interior relative humidity should be monitored in all areas of the building, as an indicator of problems. Sophisticated monitoring equipment need not be employed, simply a hand held relative humidity monitor. On a regular basis, maintenance staff should measure and record relative humidity in all areas of the building, during both occupied and unoccupied conditions. Problems can also ensue during unoccupied conditions, when the space conditioning systems are turned off, but ventilation air continues to be supplied. If





relative humidity levels greater than 60 - 65% are observed for prolonged periods of time, an inquiry into the cause of the elevated humidity should be conducted. Prolonged periods of time may be considered as an entire work day, or an entire unoccupied period such as an evening, weekend, or holiday. Specific strategies regarding the testing, adjusting, and balancing of the HVAC system are given in a later section that can lead to more effective and efficient system operation.

If mold problems are discovered, and remediation is required, consult the US EPA Document "Mold Remediation in Schools and Commercial Buildings", listed in "Resources and References" section of this chapter, for specific tips and strategies.

#### **4.2.4.2 Sanitization/Disinfection**

Another source of biological contamination can be generated and transmitted by occupants of the building. This makes proper disinfection/sanitization an important aspect of a green cleaning and maintenance program. Most buildings do not need to be disinfected. Sanitizing is sufficient in most situations, and can be done with less toxic products. However some critical areas found in hospitals and other regulated buildings/industries do require disinfection.

In the restrooms, floors should be mopped with a sanitizer on a regular basis, paying close attention to areas around toilets and urinals. All other surfaces that come into contact with occupants should also be sanitized such as fixture handles, soap dispensers, countertops, door knobs, towel dispensers, and light switches. Trash cans and recycle bins should also be sanitized. Food preparation and eating areas are also of concern, and similar procedures apply, including to refrigerators, countertops, and tables. Undersides of tables should be

periodically cleaned as well. Items that come into contact with many hands throughout general areas of the building should also be periodically sanitized including door knobs, light switches, hand railings, and telephones. Floors and sinks in janitorial closets and other chemical storage areas should also be regularly sanitized.

In order to minimize the need for frequent sanitization of a multitude of surfaces, devices that operate without needing to be touched can be installed. Such devices minimize pollutant transmission, minimize cleaning time, and maximize durability. Examples include infrared fixtures and light switches, and touch-free towel dispensers/hand dryers.

#### **4.2.5 Control of Gaseous Pollutants**

Another aspect of a green cleaning and maintenance program is to control gaseous pollutants that may enter the building from outside, or are generated within. Although the HVAC system has filters and other equipment to help minimize particulate transfer throughout the building, gaseous pollutants are easily transferred via this mechanism. During the exterior inspection, special attention needs to be paid to the location of areas where outside air is introduced into the building such as ventilation air inlets and windows. Such air inlets should not be in the vicinity of motor vehicle exhausts, such as near shipping/receiving and loading docks. Trash should also not be stored in the vicinity of such air inlets. Sources of gaseous pollutants from areas neighboring the building such as streets and industrial facilities are certain to drift in open doors and windows from time to time, however maintaining a positive pressure inside the building can help to minimize this. This strategy is discussed more in the Building Energy Use section of this guide.

Drain traps can also cause gaseous pollutant problems when water in the trap evaporates due to infrequent use. A building under negative pressure exacerbates the problem, for soil or sewer gas can be drawn indoors through a dry trap. Staff should ensure that traps do not run dry from evaporation by pouring water down drains that are seldom used such as floor drains present solely for overflow purposes, and rarely used sinks and toilets.

*Integrated pest management (IPM) is a process for achieving long term, environmentally sound pest suppression through the use of a wide variety of technological and management practices.*

As previously discussed, various ingredients of cleaning products can cause irritation and trigger allergic reactions among building occupants. When using products dispensed from spray bottles such as glass cleaner and carpet cleaner, it is recommended that directed streams/coarse sprays are used rather than fine mists to minimize the amount of material that is atomized. Such techniques will also minimize over-spray. Areas where such chemicals are stored should ideally be under negative pressure with respect to the rest of the building, and be directly vented to the outdoors.

### *4.3 Pest Control*

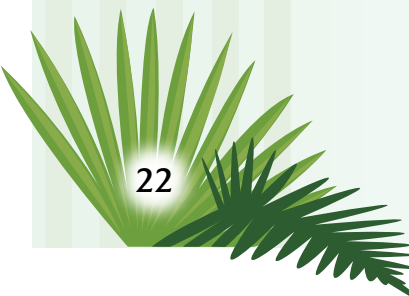
Section Recommendations:

- Develop and implement an Integrated Pest Management (IPM) Plan for the building.
- If using an outside contractor, select one skilled in IPM and designate an in-house coordinator.

Pest control in any building must accomplish certain objectives: it must protect both the health and safety of occupants, minimize pest damage to structures and personal property, and improve the quality of the work environment by avoiding annoyance and disruption of work caused by pests. Relying solely on pesticides to solve pest problems will eventually fail at accomplishing these objectives. Pesticides are a class of semi-volatile

organic compounds and include a variety of chemicals in various forms. Improper selection and use of pesticides can often do as much harm as good. Pesticide resistance can often lead to loss of control and resurgence in pest numbers. Also, with an improper application of pesticide, there is the potential to contaminate the work environment and expose occupants to pesticide residues. Pesticides can cause discomfort in the workplace due to lingering odors and their potential to trigger allergic reactions in some individuals. Extreme exposure can lead to pesticide poisoning and is especially problematic for children and pregnant women.

Integrated pest management (IPM) is a process for achieving long term, environmentally sound pest suppression through the use of a wide variety of technological and management practices. Control strategies in an IPM program extend beyond the application of pesticides to include structural and procedural modifications that reduce the food, water, harborage, and access used by pests. IPM can reduce the use of chemicals and provide economical and effective pest suppression. IPM does



not involve the complete elimination of the use of pesticides, nor does it involve solely substituting “good” pesticides for “bad” pesticides. IPM attempts to achieve a balance of both chemical and non-chemical methods to control pest problems. Whether pest control is handled in house or by an outside contractor, IPM principles are an important part of a green cleaning and maintenance program. There are essentially five main aspects of IPM that include:

- Monitoring and prevention of pest populations.
- Application of pesticides only “as needed” after prevention and physical controls have been implemented.
- Selecting the least hazardous pesticides for control of targeted pests.
- Precision targeting of pesticides to areas not contacted or accessible to the occupants.
- Notification of occupants as to when and where pesticide application is to take place.

Monitoring and keeping records of pests and pest control activities is an important part of an IPM program. Pest activity should be monitored through the use of traps or visual inspection, and logs kept of such activity. This practice will assist with the determination of pest threshold levels that will indicate when control actions are required. Logging such actions will reveal when a particular strategy needs to be modified or changed in order to maintain effective control, and to prevent duplication of efforts. As discussed in the Set Facility Policy and Goals section, occupants will play a role in pest monitoring, and will need to know details of how to respond.

Non-chemical strategies should be employed before the use of pesticides to both prevent and control pest problems. Such strategies

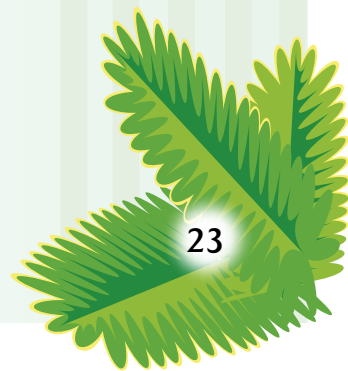
are most likely to be permanent, and prevent recurrence of problem. Non-chemical strategies are also the easiest to carry out safely and effectively for pesticides may require protective gear that maintenance staff may find cumbersome to wear and may neglect its importance. Such strategies are often the most cost-effective to implement for they often represent a one time fix, and hence cost, rather than a recurring expense. Along with purchase cost, pesticides often carry costly licensing and other fees for both use and disposal.

Some important non-chemical aspects of an IPM program include:

**Education** – Occupant education is a cost effective strategy aimed at changing people’s behaviors such as how they dispose of wastes and recyclables, and how they store food. Providing education about the details of the general IPM program will ensure occupants know how to respond/report problems and will ensure that they take part in the program, such as by providing assistance with monitoring, rather than counteract the program, such as by bringing in pesticide sprays from home. Providing info on the benefits of the IPM program and the dangers of pesticide-only conventional programs can facilitate their involvement.

**Pest habitat modification** – Pests need food, water, shelter to survive. If any one of these can be removed/reduced, the environment will support fewer pests.

**Building modification** – This technique involves incorporating pest resistant structural materials, fixtures, and furnishings. Examples include moving trash receptacles away from the building and use of wire shelving to reduce insect habitat. Mounting various furnishings on casters facilitates cleaning



activities. Cleaning of gutters and redirecting downspouts helps keep moisture away from foundation.

**Sanitation** – Frequent and effective sanitation practices can reduce available food for insects.

**Eliminating sources of water for pests** – Leaks should be fixed immediately, surfaces should be kept dry overnight, and standing water should be eliminated.

**Eliminating pest harborage and access** – Examples include caulking cracks and crevices, screening vent pipes, eliminating clutter, and removing dense vegetation near the building.

**Modification of landscaping activities** – Healthy plants are less prone to problems. Often incorrect plants are chosen for a particular application, put in the wrong place, or improper care is given to plants. Certain plants can attract beneficial insects that assist with pest control. Creating and maintaining Florida Friendly Landscapes by incorporating principles of the Florida Yards and Neighborhoods program promotes healthy plants and IPM, and details of the program are listed in the Building Water Use section of this guide.

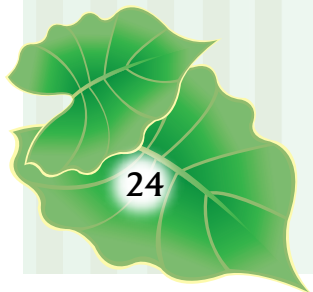
**Applying physical controls** – As mentioned in a previous section vacuuming should be conducted with effective filtration to effectively remove food for pests as well as eggs and larva. Some equipment has special attachments that assist with spot based insect control. Trapping is generally used for monitoring purposes but can also assist with control. Place traps out of reach of occupants to prevent them from being disturbed.

When pesticides are used, certain aspects must be considered to complement the IPM strategy:

**Choose the least toxic pesticides and application techniques** – As with cleaning chemicals, toxicity and other information can be found on a pesticide's MSDS. Pesticides should be effective against their target pest yet should also be the least disruptive to other non-target organisms. In landscape settings, one must avoid killing off the natural enemies of pests that aid with control. Often pesticides are more toxic to natural controls than target organisms. Chosen pesticides should also have a low acute and chronic toxicity to mammals, and should also biodegrade rapidly in the environment. Some products that meet these requirements include:

- Insect growth regulators – Growth regulators are synthesized insect hormones that prevent juvenile insects from maturing to adults and reproducing. Humans and other mammals are not affected.
- Desiccating dusts – Materials such as diatomaceous earth are made from natural materials and kill insects by dehydrating them.
- Pesticidal soaps and oils – Such products are primarily designed for use in the landscape and are made from refined natural products that are effective yet decompose rapidly in the environment. Although not harmful to mammals, they can be harmful to fish.

Application methods and forms of pesticides need to be scrutinized as well as the product formulation and ingredients. Aerosol sprays contribute to the over use of product and produce fine mists that are easily dispersed throughout the building environment. Baits on the other hand can be applied to a controlled area effectively and are not readily volatile, and therefore do not affect air quality.



**Time treatments accordingly** - Treatments need to be timed properly so pesticides are applied during susceptible stages of target pests and resistant stages of beneficial insects providing natural controls. Monitoring is key to determining appropriate timing. Treatments must also be timed in accordance with operation of the building's HVAC system.

**Use spot treatments** – Treatments should be applied only where needed. It is rarely necessary to treat an entire building or landscape area for a pest problem. Cost and occupant exposure to pesticides can be minimized by spot treating.

When using a pesticide, ensure that the pesticide is registered for use in Florida and ensure you are aware of all laws regarding its use. Some pesticides are only permitted to be applied by sufficiently trained individuals. Read the label and follow all restrictions and directions for use, dilution, protective equipment, storage, handling, and disposal. Only mix and dilute pesticides outdoors or in a well-ventilated area. Ensure application equipment is appropriate for the target area. Keep records of pesticide applications and pesticide MSDS sheets.

Building occupants should be notified as to when and where pesticide application will occur before the actual application. Many individuals are sensitive to various products, especially children and those with pre-existing conditions. This strategy will enable such individuals to take any necessary precautions.

When selecting an outside pest contractor, one should look for a contractor skilled and knowledgeable about IPM. Qualified contractors should offer services that include:

- Development of a pest-monitoring program that includes inspection of

building areas and identification of pests and pest threshold levels.

- Making pest control recommendations that emphasize maintenance and sanitation.
- Applying pesticides only when necessary, such as when thresholds are exceeded.
- Using the least toxic chemical and applying only when the building is unoccupied or otherwise prepared.
- Providing hazard and toxicity information for all chemicals used.

When utilizing an outside pest control contractor, an individual from the cleaning or maintenance staff should act as an in-house IPM coordinator. The coordinator should be in charge of keeping records and assisting with proper monitoring and should meet with the contractor on a regular basis to keep them abreast of day-to-day activity. The coordinator will also ensure that recommendations made by the contractor to assist with IPM are carried out.

## *4.4 Trash and Recycling*

Section Recommendations:

- Coordinate trash storage/removal with IPM activities.
- Place generously sized trash receptacles in accessible areas.
- Develop an in-house recycling plan in accordance with local infrastructure.
- Maximize effectiveness of recycling through staff training and education.

Along with issues that affect the sanitary nature of the workplace and protecting the health of occupants, excessive accumulation of trash can cause odor and aesthetic problems in the workplace. Also, as discussed in the previous section, improper trash management can attribute to a pest control problem, and proper management is key to a successful

integrated pest management program. In many cases it is totally unnecessary to remove trash from all areas on a daily basis, however it should be pulled and disposed of before weekends and holidays, so it is not left in the building over extended periods of time. If trash is found to contribute to a pest control problem, certain measures should be taken, possibly on a temporary basis, while attempting to gain control of the pest problem. Items include daily removal, more frequent sanitation of receptacles, and using tightly covered containers. Similar amends should also be made for outside trash storage such that it also does not attract pests, and outside receptacles may need to be relocated away from the building.

Recycling is a key component to a green cleaning and maintenance overall solid waste program, and should be incorporated to some degree. In order to determine sorting strategies such as which materials to separate and what types of containers to use, it is important to check with local solid waste departments, haulers and recyclers, and facility managers to determine what strategies the local infrastructure supports/recommends. If it is discovered that a potential exists to cost effectively separate and make available a high volume of a particular recyclable that the local infrastructure does not support, the opportunity should be presented to appropriate individuals such that future amends can be made to support the recycling of the item.

Eric Martin, FSEC



Figure 7. The blue enclosure in the background allows trash dumpsters to be kept away from the facility.

In order to minimize the amount of time cleaning staff spend managing trash, workspaces and common areas should have minimal obstructions to trash receptacles and trash shoots. Generously sized trash receptacles should be placed in high traffic and high occupancy areas such as restrooms to minimize the frequency of trash removal from these areas. Undersized receptacles are prone to frequent overflow, which aside from health aspects, will cause a negative aesthetic concern.

To maximize the effectiveness of the recycling effort training and ongoing communication with all building occupants are critical. Policies should be put in place by building management that set goals and procedures for occupants, visitors, and other individuals to follow. Management should provide adequate containers, but such individuals should be made aware of the types of items that the building recycles, as well as procedures for doing so. Procedures may vary according to local recycling infrastructure and presence of other issues such as a pest control problem. For example, individuals may be asked to rinse soda cans and glass bottles before placing them in an appropriate bin, and a procedure may be put in place to report full or overflowing containers. The importance of proper separation should be emphasized, for improperly sorted materials will often end up destined for the landfill rather than being recycled. Management and janitorial staff can stress such messages by developing friendly reminders such as informative signs near trash and recycling receptacles.

Common waste items generated within commercial buildings with the potential to be recycled include:

Clear glass	Fluorescent Lamps and ballasts
Colored glass	Toner and ink jet cartridges
White office paper	Batteries
Mixed (colored) office paper	Computer floppy and compact discs
Newspaper	Carpet
Cardboard	Leftover paint
Telephone books	Ceiling tiles
Metal	Computer and other office equipment
Plastic	Oil and other fluids

## 4.5 Resources and References

### Cleaning Product Selection and Specification

“Guidelines for Green Building Housekeeping and Maintenance.” City of Austin, Sustainable Building Guidelines, Vol III.

“Center for a new American Dream”  
[www.newdream.org/procure/products/clean.html](http://www.newdream.org/procure/products/clean.html)

“Pennsylvania Green Building Operations and Maintenance Manual.” Commonwealth of Pennsylvania.  
[www.dgs.state.pa.us/dgs/lib/dgs/green\\_bldg/greenbuildingbook.pdf](http://www.dgs.state.pa.us/dgs/lib/dgs/green_bldg/greenbuildingbook.pdf)

“Green Seal’s standard for Industrial and Institutional Cleaners” (GS-37).  
[www.greanseal.org/standards/industrialcleaners.htm](http://www.greanseal.org/standards/industrialcleaners.htm)

### MSDS Information

[www.msdssearch.com](http://www.msdssearch.com)  
[www.msdsprovider.com](http://www.msdsprovider.com)  
[www.msdsonline.com](http://www.msdsonline.com)

### Hazardous Waste Regulations

Florida Department of Environmental Protection. [http://www.dep.state.fl.us/waste/quick\\_topics/publications/shw/hazardous/hwsum97.pdf](http://www.dep.state.fl.us/waste/quick_topics/publications/shw/hazardous/hwsum97.pdf)

Recycled Content Standards  
US Environmental Protection Agency  
Comprehensive Procurement Guidelines.  
[www.epa.gov/epaoswer/non-hw/procure/index.htm](http://www.epa.gov/epaoswer/non-hw/procure/index.htm).

### Housekeeping and Maintenance Techniques and Equipment for Enhanced Indoor Air Quality.

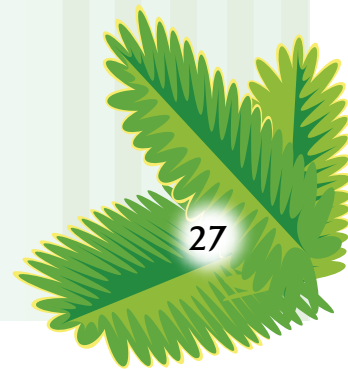
“Guidelines for Green Building Housekeeping and Maintenance.” City of Austin, Sustainable Building Guidelines, Vol III.

“Pennsylvania Green Building Operations and Maintenance Manual.” Commonwealth of Pennsylvania.  
[www.dgs.state.pa.us/dgs/lib/dgs/green\\_bldg/greenbuildingbook.pdf](http://www.dgs.state.pa.us/dgs/lib/dgs/green_bldg/greenbuildingbook.pdf)

“The Impacts of Cleaning on Indoor Air Quality.” Stephen P. Ashkin, Rochester Midland Corporation.

“Green & Clean: The Designer’s Impact on Housekeeping and Maintenance.” Stephen P. Ashkin, Rochester Midland Corporation.

“The Financial Case for Cleaning.” Stephen P. Ashkin, Rochester Midland Corporation.



“Mold Remediation in Schools and Commercial Buildings.” US Environmental Protection Agency, Office of Air and Radiation, Indoor Environment Division. EPA 402-K-01-001.

**Integrated Pest Management Planning, Techniques, and Contract Specification**

“Integrated Pest Management for Schools: A Catalog of Resources.” Clay W. Scherer and Philip G. Koehler, Eds., Department of Entomology and Nematology, Institute of Food and Agricultural Sciences, University of Florida.

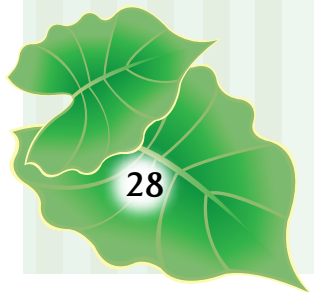
[http://schoolipm.ifas.ufl.edu/school\\_ipm.pdf](http://schoolipm.ifas.ufl.edu/school_ipm.pdf)

University of Florida Institute of Food and Agricultural Sciences - County Extension.

<http://extension.ifas.ufl.edu/>

“IAQ Tools for Schools.” US Environmental Protection Agency. [www.epa.gov/iaq/schools/tools4s2.html](http://www.epa.gov/iaq/schools/tools4s2.html)

“Guidelines for Green Building Housekeeping and Maintenance.” City of Austin, Sustainable Building Guidelines, Vol III.





## Appendix B: Cleaning Product Considerations

For information regarding selection and procurement of general purpose cleaners, bathroom cleaners, and glass cleaners, please refer to Green Seal's Standard for Industrial and Institutional Cleaners (GS-37) available at: [www.greenseal.org/standards/industrialcleaners.htm](http://www.greenseal.org/standards/industrialcleaners.htm).

### *General Purpose Cleaners*

General purpose cleaners include, among other things, products used for routine cleaning of hard surfaces including impervious flooring such as concrete or tile. It does not include cleaners intended primarily for removal of rust, mineral deposits, or odors. It does not include products intended primarily to strip, polish, or wax floors, and it does not include cleaners intended primarily for cleaning toilet bowls, dishes, laundry, glass, carpets, upholstery, wood, or polished surfaces. This category also does not include sterilizers, disinfectants, or sanitizers or other products required to be registered under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

### *Bathroom Cleaners*

Bathroom cleaners include products used to clean hard surfaces in a bathroom such as counters, walls, floors, fixtures, basins, tubs, and tile. It includes products that are required to be registered under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), such as disinfectants and sanitizers, but does not include products specifically intended to clean toilet bowls.

### *Glass Cleaners*

Glass cleaners include products used to clean windows, glass, and polished surfaces. This category does not include any products required to be registered under FIFRA.

The following list of cleaning product considerations has been adapted from the Pennsylvania Green Building Operations and Maintenance Manual. The list is not intended to be complete, but presents some typical issues for the majority of cleaning products used within commercial buildings that are not covered by the Green Seal Standard GS-37.

### *Carpet Cleaner*

See General Purpose Cleaners. In addition, select carpet cleaners that when dry are not sticky or tacky. This minimizes resoiling and extends the time between cleaning.

### *Chrome Cleaner/Polish*

Chrome cleaner/polish frequently uses petroleum distillates, which are poisonous and derived from a non-renewable resource. The following are some of the specific issues to compare for this product category:

- VOCs: Prefer those that have no or low VOCs as compared to alternatives with higher levels.
- Bio-Based/Renewable Resources: Prefer products that use oils derived from renewable resources as compared to oils from non-renewable resources.
- More Preferable Ingredients: none identified

### *Floor Finishes*

Floor finishes must be durable and appropriate for the prescribed maintenance method, but they typically contain heavy metals. Importantly, floor finishes must be compatible with the stripping solution. The following are some of the specific issues to compare for this product category:

- **Durability:** Prefer finishes that are more durable (require less maintenance such as buffing, restoring, and recoating) than less durable finishes that require more frequent maintenance.
- **Heavy Metals:** Prefer non-metal cross-linked polymers as compared to those containing heavy metals. Another significant benefit of non-metal polymer formulas is that frequently they can be removed with less hazardous floor strippers.
- **More Preferable Ingredients:** metal-free polymers.

#### *Floor Strippers*

Floor strippers typically have extreme pH, solvents, and ammoniated compounds necessary to remove metal cross-linked floor finishes. Floor strippers must be compatible with the floor finish. The following are some specific issues to compare for this product category:

- **pH:** Prefer those with a pH closer to neutral (in the range of 10 to 12) as compared to those with extreme pH (closer to 14).
- **VOCs:** Prefer those that have no or low VOC as compared to alternatives with higher levels.
- **Bio-Based / Renewable Resources:** Prefer those containing naturally derived solvents as compared to those containing non-renewable derived solvents.
- **More Preferable Ingredients:** d-Limonene (citrus solvent) and methyl esters.

#### *Furniture Polish*

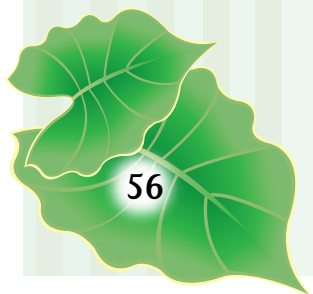
Furniture polishes frequently use petroleum distillates, which are poisonous and derived from a non-renewable resource. The following are some of the specific issues to compare for this product category:

- **VOCs:** Prefer those that have no or low VOCs as compared to alternatives with higher levels.
- **Bio-Based/Renewable Resources:** Prefer those that use oils derived from renewable resources as compared to oils from non-renewable sources.
- **More Preferable Ingredients:** citrus (lemon and orange oils)

#### *General Degreaser*

General degreasers are typically heavy-duty cleaners that include solvents for removing oil-based soils. Traditional solvents are typically derived from a non-renewable source such as petroleum, can be flammable, have a high degree of VOCs which can cause respiratory irritation and contribute to environmental pollution, and some have severe health impacts. The following are some of the specific issues to compare for this product category:

- See General Purpose cleaners
- **VOCs:** Prefer those that have no or low VOCs as compared to alternatives with higher levels.
- **Bio-Based / Renewable Resources:** Prefer those that use oils derived from renewable resources as compared to oils from non-renewable resources.
- **Flashpoint:** Prefer products that have a high flashpoint compared to those with a low flashpoint.



- More Preferable Ingredients: d-Limonene (derived from citrus fruits) and methyl esters from soy and corn.

#### *Graffiti Remover*

Graffiti remover used to be formulated with chlorinated solvents such as methylene chloride before they were banned due to their environmental impact. Many graffiti removers are packaged in aerosol containers which often contain hydrocarbon propellants such as propane or butane, which are highly flammable and can contribute to indoor air quality problems. The following are some of the specific issues to compare for this product category:

- VOCs: Prefer those that have no or low VOCs as compared to alternatives with higher levels. Consider detergent based products compared to those containing solvents.
- Flashpoint: Prefer products that have a high flashpoint compared to those with a low flashpoint.
- pH: Prefer those with a neutral pH (closer to 7) as compared to those with extreme pH (closer to 1 or 14).
- More Preferable Ingredients: n-Methyl-2-Pyrrolidone, d-Limonene.

#### *Gum Remover*

Gum removers used to be formulated with chlorinated solvents such as Freon before they were banned due to their environmental impact. Dry ice and carbon dioxide are preferable replacements. Degreasers can be used in some situations (see General Degreasers). The following are some of the specific issues to compare for this product category:

- VOCs: Prefer those that have no or low VOCs as compared to alternatives with higher levels. Consider detergent based products compared to those containing solvents.

- Flashpoint: Prefer products that have a high flashpoint compared to those with a low flashpoint.

- pH: Prefer those with a neutral pH (closer to 7) as compared to those with extreme pH (closer to 1 or 14).

- More Preferable Ingredients: dry ice, carbon dioxide.

#### *Lime & Scale Remover*

Lime & scale removers are acids because of the need to remove mineral deposits from sinks, bowls, and urinals. The following are some of the specific issues to compare for this product category:

- pH: Prefer those with a more neutral pH as compared to those with extreme pH (closer to 1). Environmentally preferable lime and scale removers may fall more in the range of pH 4 as compared to traditional products that may have a pH below 1.

- More Preferable Ingredients: citric or acetic acid.

#### *Solvent Spot Removers*

Solvent spot removers are necessary for spot removal particularly on carpets. Use detergent base spotters if possible, which must be followed with extraction or other method to remove/absorb the detergent. The following are some of the specific issues to compare for this product category:



- See General-Purpose Cleaners.
- VOCs: Prefer products that have no or low VOCs compared to those with higher VOCs content.
- Flashpoint: Prefer products that have a high flashpoint compared to those with a low flashpoint.
- More Preferable Ingredients: d-Limonene (derived from citrus fruits) and methyl esters from soy and corn.

#### *Urinal Deodorizers*

Urinal deodorizers are traditionally blocks placed in urinals to reduce odors. Preferably these deodorizers should be eliminated altogether through more frequent cleaning and other methods of deodorizing. However, if urinal deodorizers are still required preference should be given to those with the safest ingredients. The following are some of the specific issues to compare for this product category:

- Biodegradability: Prefer ingredients that are readily biodegradable as compared to those that are slower to degrade. Unfortunately, many older formulations use excellent performing ingredients that have been found to have serious environmental and health concerns.
- More Preferable Ingredients: surfactants containing terms such as lauryl, amides, and glycosides.

#### *Wood & Stone Floor Coatings*

Wood & stone floor coatings have traditionally been solvent-based products. While extremely durable to protect flooring materials that are very expensive to replace, these coatings can be quite hazardous during the drying and curing period. The two primary issues to consider during product selection include the use of zero or low-VOC containing materials which will reduce indoor air quality concerns and the product's durability which is important to protect the flooring. Many janitorial firms lack specific expertise in application for these types of finishes, thus supplier support, such as training, is very important. The following are some of the specific issues to compare for this product category:

- Durability: Prefer durable finishes that require less maintenance and recoating than less durable finishes that require more frequent recoating.
- Flashpoint: Prefer products that have a high flashpoint compared to those with a low flashpoint.
- More Preferable Ingredients: water or epoxy based finishes.

