

*Template manual*

# **Green Operations & Maintenance Manual** for **[Project Name]**

**Best Practices for a Healthy and High-Performance Building**

**[INSERT PHOTOS/IMAGES OF PROJECT AND RELEVANT LOGOS,  
ETC.]**

**Green Operations & Maintenance Manual for **[Project Name]****

## MEMO

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### RE: Adapting and Customizing the Green O&M Manuals

A *Green Operations & Maintenance Manual* for [insert project name and city] has been developed for use by the development's management and maintenance staff, along with a *Healthy Home Guide* for the project's residents. Generic Template versions of each of those documents were created to be used as boilerplates for other project manuals. The templates include highlighted notes that are meant to assist other building owners and property managers in customizing the manuals for their own projects.

When preparing to use one of the template documents as a model, please review the entire document in order to identify the content that is or is not applicable to your own project. The template manuals do not provide comprehensive information on all building systems and materials, and the template cannot be used wholesale. Every project is unique and specific content will inevitably need to be removed, modified, and added to the template document to make it relevant to your project. As such, the manual covers aspects of Green Operations and Maintenance that are unique to this population and this type of housing. For example, [Insert project specific information]

To supplement the information provided in the manuals, management and maintenance staff should also refer to the manufacturer and product information provided by the project's General Contractor, including Owner's and Operating Manuals, product specifications, and warranty information for specific equipment and systems, as well as preventive maintenance schedules for routine pre- and post-warranty maintenance, and as-built drawings. The owner, property management, and maintenance staff should also reference and integrate this manual's green recommendations into any existing property management and building maintenance manuals and other key reference documents for this project.

Lastly, please bear in mind that the manual serves as only one part of a comprehensive Green O&M Plan and Program that should be established for the project. To implement a successful green O&M program, the manual must be used in conjunction with other ongoing strategies and activities, such as:

- 1) **On-site trainings** for staff and residents to ensure that the best practices are understood and carried out (this manual can be used to help guide the training curriculum). Have knowledgeable staff and residents educate new staff and residents who arrive. Also consider developing incentive programs to encourage the proper implementation of best practices.
- 2) **Signage**, where it would help to provide reminders or clarification on specific green practices, maintenance products to use or avoid, or special settings for equipment. (Whether permanent or temporary, the signage should be made from green materials, e.g., non-PVC, recycled content materials with low-toxic adhesives.)
- 3) **Green procurement/purchasing policies and service contracts** (e.g., for vendors/suppliers of cleaning supplies, paper goods, fluorescent lamps, paint and adhesives).
- 4) **Ongoing monitoring and commissioning of all building systems**, and adjustment of settings and controls, to ensure that systems are operating as intended and at optimized efficiency.

It would be beneficial to designate a member of the on-site management staff as the point person in charge of monitoring and coordinating all of the development's green operations and maintenance activities.

[Insert publication date]

# Green Operations & Maintenance Manual for [Project Name]

## *Best Practices for a Healthy and High-Performance Building*

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### [DESIGN NOTE:

Add page numbers to the table of contents when the document's design and formatting is finalized.]

## ACKNOWLEDGEMENTS

[This section to be prepared by the person in charge of customizing and adding content to this manual.]

This manual is based on and adapted from a manual that was originally prepared by M. Landman Communications & Consulting and published by Enterprise Community Partners for The Plaza Apartments, a building developed by the Public Initiatives Development Corporation.

## INTRODUCTION

### **[Project Name] and Green Communities**

[Insert paragraphs on the project and its sustainability goals and achievements, the developer and team, completion date, its participation in the Green Communities initiative, etc.]

## The Purpose and Organization of This Manual

A building that is designed and built using green strategies, materials and systems can only be a truly green building if it is also operated and maintained using green products and procedures. A building's energy and water efficiency, indoor air quality, durability and resource efficiency are determined as much by its operation and maintenance as its design. Furthermore, the cost of operations and maintenance (O&M) over a building's lifetime far exceeds the building's initial construction cost, so reducing O&M costs can lead to substantial savings for building owners. Clearly, O&M has substantial implications for the health and safety of a building's residents, the building's environmental impacts and its financial performance.

This manual should serve as a standard reference guide for [project name's] property management and maintenance staff. Its recommendations will be incorporated into the standard policies, procedures and practices of the building's property management and its contracts with maintenance companies and vendors.

While some of the best practice recommendations provided in this manual may seem to be basic common sense, many of them are not yet part of standard practice. Likewise, while some green materials and components require no maintenance at all, or their maintenance is the same as it would be for their conventional counterparts, other green components do require the use of different maintenance procedures or products.

**Part I** provides some general guidelines for best-practice building operations and maintenance procedures in the areas of indoor air quality management, green and healthy housekeeping, indoor pest prevention and control, waste reduction and recycling, energy and water conservation, and green groundskeeping.

**Part II** lists the green materials, finishes and systems used in [project name] and highlights a few of the components that property management and maintenance staff might not have worked with before, since they are not yet commonly used in most buildings. The highlighted product summaries list the products' green attributes and manufacturer and supplier information, and offer guidance on installation, care, maintenance, replacement, disposal and recycling of products.

The **Appendix** includes various reference documents that provide more in-depth guidelines on various topics, such as green cleaning standards and certified cleaning products, integrated pest management guidelines, public transit information and other useful resources.

The manual does not provide comprehensive information on all systems and materials used in the project. Management and maintenance staff should also refer to the manufacturer and product information provided by the general contractor, including owner's and operating manuals, product specifications and warranty information, preventive maintenance schedules for routine pre- and post-warranty maintenance, and as-built drawings. The green recommendations in this manual should also be integrated into any existing property management manuals, building maintenance manuals and other key reference documents for this project.

Lastly, please bear in mind that this manual serves as only one part of a comprehensive green O&M plan and program that should be established for the project. To implement a successful green O&M program, the manual must be used in conjunction with other strategies and activities, such as:

- **On-site trainings** for staff and residents to ensure best practices are understood and carried out. This manual can be used to help guide the training curriculum. Have knowledgeable staff and residents educate new staff and residents. Also, consider developing incentive programs to encourage the proper implementation of best practices.
- **Signage** where it would provide reminders or clarification on specific green practices, maintenance products to use or avoid, or special settings for equipment. Whether permanent or temporary, the signage should be made from green materials, e.g., non-PVC, recycled-content materials with low-toxic adhesives.

- **Green procurement/purchasing policies and service contracts** for vendors/suppliers of cleaning supplies, paper goods, fluorescent lamps, paint and adhesives.
- **Ongoing monitoring and commissioning of all building systems** and adjustment of settings and controls to ensure systems are operating as intended and at optimized efficiency.

We recommend that a member of the on-site management staff be designated as the point person in charge of monitoring and coordinating all of the building's green operations and maintenance activities.

## I. Green Operations and Maintenance Guidelines

This part of the manual provides guidelines for building operations and maintenance procedures that will contribute both to maintaining the health, safety and comfort of building residents and to protecting the environment. The following section covers indoor air quality management, green and healthy housekeeping, indoor pest prevention and control, waste reduction and recycling, energy and water conservation, and green grounds keeping procedures.

Preventive maintenance procedures play a central role in these guidelines. Keeping a building's systems and materials optimized and functioning as they were designed to function extends their useful life and is the most effective and economical way to keep a building environment healthy and resource efficient. Such maintenance strategies prevent the need for premature replacement or repairs, thereby saving money and time, reducing waste of materials and energy, and reducing disruption to building residents.

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### A. Indoor Air Quality Management

The EPA ranks indoor air pollution among the top five environmental risks to public health. Indoor air pollution can come from many sources, including off gassing from building materials, finishes and furnishings (such as paints, adhesives, flooring and carpeting, upholstery, and pressed wood products such as particleboard and medium-density fiberboard); cleaning products and solvents; cigarette smoke; combustion from fuel-fired appliances and equipment; water leaks and moisture intrusion or accumulation; outdoor air pollution (e.g., automobile exhaust); pests such as cockroaches; pesticides; and—ironically— even some types of “air fresheners.” Indoor pollution problems are also often caused by or exacerbated by inadequate ventilation. Indoor pollutants include volatile organic compounds (VOCs) such as formaldehyde, benzene, xylene and toluene (all known, probable or suspected carcinogens that contribute to outdoor smog as well as indoor air pollution); carbon monoxide; dust and particulates; and mold and mildew. Some pollutants produce noxious odors, whereas others have no odor.

Indoor air is often considerably worse to breathe than outdoor air. Poor indoor air quality (IAQ) is associated with a wide variety of health problems, from headaches and allergic reactions to asthma attacks and other respiratory problems, to life-threatening illnesses such as Legionnaire's disease. When repeatedly exposed over time to certain VOCs (such as formaldehyde), some people can develop heightened sensitivities to those chemicals.

Preventing IAQ problems by proper source reduction (i.e., pollution prevention) and by keeping all building materials clean and dry are the best ways to protect the health and well-being of the building's occupants. These measures are much easier than trying to correct IAQ problems after they have developed.

The following are some basic strategies for safeguarding indoor air quality:

- **Selection of less-toxic materials and products:** Use nontoxic or low-toxic cleaning products; zero-VOC or low-VOC paints, finishes, adhesives, caulks and carpet; and formaldehyde-free wood products. Groups such as Green Seal, Greenguard and Scientific Certification Systems (SCS) verify manufacturer claims that a product is low-emitting and certify products. See the following sections on housekeeping, indoor pest prevention and green groundskeeping for additional guidelines on toxics reduction. Also, refer to the relevant materials sections in Part II and the resource links provided below.
- **Entryway cleaning:** Sweep and mop the interior and exterior entryway mats, hallways and walkways to reduce the amount of dirt, dust, pollen and other particles and contaminants entering the building. Provide mats inside the entryways as well as outside the doors. Make sure mats are long enough to accommodate two full walking strides.
- **Smoking control:** Enforce the building's smoking policy. **[Insert current smoking policy or refer to appropriate Appendix]**

- **Moisture control:** If conditions are very humid, run fans or dehumidifiers. Fix water leaks and intrusions, mop up standing water and immediately dry any building materials that get wet to prevent mold, mildew and bacterial growth. Make sure that heating, ventilating and air conditioning (HVAC) components are not exposed to standing water or leaks, as biocontaminants can spread through the building through HVAC ducts. If carpets or other absorptive materials have been soaked for more than 24 hours, they will usually need to be removed and replaced. Do not install porous or absorbent materials (e.g., carpet, upholstery, pressed board products) in areas that are exposed to a lot of moisture—for example, use metal shelving rather than pressed board shelving in janitors' closets.
- **Mold control:** If you see discoloration (mold can be white, orange, green, brown or black) on surfaces; observe cracked or discolored grout, drywall or other building materials; and/or smell a musty odor, this may indicate a mold or mildew problem. Disinfect and dry all moldy areas immediately—mold grows and spreads quickly. If porous building materials are moldy (e.g., drywall, carpeting), remove them. Be sure to wear high-quality respiratory equipment and gloves, provide continuous and controlled ventilation (preferably with slight negative pressure in the contaminated area to bring clean air in) and put the contaminated materials in sealed bags before leaving the work area. If the mold problem appears to be serious, hire mold remediation specialists to assess and remediate the problem. Guides on mold control are cited in the links below.
- **Carpet cleaning:** Carpet acts as a haven for dirt, bacteria and mold. Vacuum carpets regularly, preferably using a vacuum with a high-efficiency particulate air (HEPA) filter. When cleaning carpets, use a non-chemical, low-water process, and use fans afterward to dry the carpeting quickly. Also, carpets should never be installed in kitchens, bathrooms, laundry rooms or other high-moisture areas.
- **HVAC/duct maintenance:** Perform routine system maintenance, filter replacement and duct cleaning throughout the building. (See the Energy and Water Conservation chapter of this manual.)
- **Ventilation system:** Regularly check and maintain the building's ventilation system to make sure it is working properly and meeting airflow specifications to deliver enough outside air to all areas of the building. Any toxic chemical products and supplies should be stored in a room that has negative pressure and that is vented directly to the outside. And all gas appliances (including furnace, clothes dryers, water heaters, etc.) must also be properly ventilated to the outside. **Some or all of the Ventilation section may not apply**
- **Natural ventilation:** Open windows from time to time, **weather permitting**, to get some outside air flowing through the rooms. When doing repairs, cleaning or installations that might involve any noxious chemicals or offgassing (including painting, gluing or applying finishes) or bringing new furniture into the building, open nearby windows during the work and leave them open for at least several hours after the work is complete.
- **Repair/rehab work:** When preparing to do any rehab work or major cleaning, maintenance or repair projects inside the building, inform building occupants about any work that may affect their health or comfort, and provide respiratory equipment if needed. Note that carpet removal can release a lot of dust, mold and allergens into the air.

If residents and occupants develop health problems—especially chronic respiratory problems—characterized by similar symptoms, bring in an IAQ specialist to do a thorough investigation and building assessment.

**For more information on protecting indoor air quality, refer to:**

- U.S. EPA's Indoor Air Quality information: [www.epa.gov/iaq/index.html](http://www.epa.gov/iaq/index.html)
- American Lung Association's Health House information: [www.healthhouse.org/index.asp](http://www.healthhouse.org/index.asp)
- *Building Air Quality: A Guide for Building Owners and Facility Managers*, EPA Reference 402-F-91-102, EPA/NIST, December 1991: [www.epa.gov/iaq/largeblids/graphics/iaq.pdf](http://www.epa.gov/iaq/largeblids/graphics/iaq.pdf) or [www.epa.gov/iaq/largeblids/baqtoc.html](http://www.epa.gov/iaq/largeblids/baqtoc.html).
- Chapter 3 of *IAQ Guidelines for Occupied Buildings Under Construction* (1995) from the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): [www.smacna.org/bookstore/](http://www.smacna.org/bookstore/)
- California High Performance Schools (CHPS) Low-Emitting Materials criteria, List of Compliant Products: [www.chps.net/manual/lem\\_table.htm](http://www.chps.net/manual/lem_table.htm)
- *A Brief Guide to Mold, Moisture, and Your Home*, EPA: [www.epa.gov/iaq/molds/moldguide.html](http://www.epa.gov/iaq/molds/moldguide.html)
- "Mold in My Home: What Do I Do?", California Department of Health Services Indoor Air Quality Fact Sheet, 2001: [www.cal-iaq.org/mold0107.htm](http://www.cal-iaq.org/mold0107.htm)

## ***B. Green and Healthy Housekeeping***

This section contains information on efficient and healthy cleaning procedures and techniques, housekeeping equipment, low-toxic cleaning products, storage and disposal of cleaning products, and purchasing criteria for disposable janitorial supplies. These recommendations should be reviewed and incorporated into the building management's official policies and contracts so that both in-house staff and outside contractors will comply with these practices.

Conduct periodic training sessions for all custodial/maintenance staff to inform them about the hazards, use, maintenance and disposal of cleaning chemicals and packaging as well as this building's green housekeeping and low-toxic cleaning practices. Provide trainings as often as necessary to account for personnel turnover. If it's an option, have product supplier representatives come in to give trainings on the use of their particular low-toxic products. Get feedback from maintenance staff on their experiences with using new products and adjust products or practices as necessary.

Also, offer informational sessions for residents on how to use green and healthy cleaning practices in their apartments.

### **Cleaning Procedures**

The following strategies and techniques help conserve materials or protect the health of custodial workers and the building's occupants.

- When using cleaning products, use the least amount necessary to do the job. Often a slight amount of "elbow grease" or use of the right equipment (e.g., microfiber cloths) can reduce the amount of cleaning product that is needed. For dusting, using a damp mop or damp cloth rather than a solvent treatment is usually adequate.
- Use only as much water as necessary.
- After cleaning any surface, wipe up any residue or excess moisture.
- Vacuum the entryway grates and/or mats frequently. Most contaminants and particulates are brought into a building through its entryways. Periodically clean underneath the mats as well.
- Consider ordering concentrated products to reduce packaging and chemical consumption. If concentrated products are used, use portion control devices—such as mechanical dispensers and appropriate dilution systems—to minimize worker contact with and exposure to toxic or hazardous chemicals. Make sure concentrated products are mixed according to instructions to avoid the use of dangerous or ineffective concentrations. The manufacturer should provide training or information on the proper dilution of its product.
- Do not mix multiple products. Some products can produce poisonous gases when combined.
- Janitor closets should contain safety gear, including eye protection, dust masks, respiratory masks, gloves and a first aid kit.
- Follow all cleaning/chemical handling instructions and safety precautions. Use protective gear when it's called for or when there is any risk of exposure to toxins.
- Avoid the use of aerosols and spray products as much as possible. When a spray bottle is used, select a coarse spray or stream setting rather than a fine mist setting. Mists spread vapors across a larger area.
- Adequately ventilate areas that are being cleaned and notify building occupants of any major cleaning or maintenance activities that could affect their health (e.g., floor stripping or coating) before such activities are carried out.

## Low-Toxic Cleaning Products

This section offers some criteria for selecting low-toxic cleaning products, a list of products and ingredients to avoid, information on certified green cleaning products, and suggestions on products and ingredients to consider using.

While the cleaning process and products can help remove harmful contaminants such as mold, bacteria and particulates, many conventional cleaning products can also cause health problems. The use of cleaning products that are toxic is especially problematic for individuals who have pre-existing health conditions such as asthma or allergies or who have chemical sensitivities or compromised immune systems. Some cleaning products can cause headaches, dizziness, skin irritation, respiratory irritation and asthma, eye irritation or worse; some contain cancer-causing substances, reproductive toxins, central nervous system toxins and endocrine system/hormone disruptors. Some cleaning products also contain substances that are toxic to aquatic life and other species and can contribute to smog production. The types of cleaning products that are most often toxic include disinfectants, graffiti remover, drain cleaner, toilet bowl cleaner, chlorinated scouring powder, carpet and upholstery shampoo, mold and mildew cleaner, furniture and floor polish, and oven cleaner, among others.

An increasing number of nontoxic cleaning products are now on the market, and many of them are just as effective as more conventional products. When selecting cleaning products, look for products that are labeled “low VOC” or “zero VOC,” “nontoxic” and “biodegradable.” Also, look for the following attributes:

- Water-based and/or plant-based rather than petroleum-based solvents
- A neutral or mild pH (closer to 7 than to 0 or 14) to avoid high acidity or alkalinity
- Less than 10 percent VOC concentration by weight when diluted; or less than 1 percent by weight for general purpose cleaners (per Green Seal); or less than 25 grams of VOC per liter of cleaning solvent (per the South Coast Air Quality Management District)
- Concentrated (for less packaging)
- Can be diluted in cold water
- Readily biodegradable (60 percent to 70 percent biodegradable within 28 days)
- Unscented (some people are allergic to certain fragrances)
- Recycled-content container/packaging and/or minimal packaging
- Recyclable packaging or reusable or returnable/refillable container

Use chlorine bleach and other disinfectants very sparingly. It is not necessary to use disinfectants for most cleaning jobs; sanitizers are usually sufficient. Disinfectants are inherently toxic, as they are meant to kill organisms. If you do use a disinfectant, use a diluted, intermediary-grade product. Peroxide-based products are a good alternative to chlorine bleach. Never use undiluted chlorine bleach or ammonia; both are caustic and can cause major respiratory irritation. Also, avoid antibacterial and antimicrobial agents except where required by health codes. These can cause germs to become resistant to antibiotics.

The attributes and ingredients that are preferable or to be avoided differ slightly for each type of cleaning product. Some products, for example, will naturally have a higher or lower pH than others. For a more complete list of issues to consider for specific product types (e.g., bathroom cleaner, disinfectant, floor finish, polish, degreaser, glass cleaner, graffiti remover, gum remover, lime and scale remover, solvent spot remover, wood and stone floor coatings).

The following are excerpted suggestions from *The Pennsylvania Green Building Operations and Maintenance Manual* for cleaning product selection.

### Cleaning Product Selection

A	Cleaning Product Considerations
1	All Purpose Cleaners
2	Bathroom Cleaners
3	Bathroom Disinfectants
4	Carpet Cleaners
5	Chrome Cleaners/Polish
6	Floor Finishes
7	Floor Strippers
8	Furniture Polish
9	General Degreasers
10	General Disinfectants
11	Glass Cleaners
12	Graffiti Remover
13	Gum Remover
14	Lime & Scale Remover
15	Solvent Spot Removers
16	Urinal Deodorizers
17	Wood Floor Finishes
B	Disposable Paper and Plastic Bags
C	Janitorial Equipment
D	Product Supplier Consideration

## A. Cleaning Product Considerations

Each category of cleaning products has a limited number of health and environmental attributes that might differentiate one product from another. The following list of product issues are for 19 individual products that cover the majority of janitorial requirements. This list is not intended to be complete, but is only intended to serve to identify some of the typical issues for each product type.

### 1. ALL PURPOSE CLEANERS

All Purpose Cleaners consist of a broad array of possible formulations. The following are some of the specific issues to compare for this product category:

- pH: Prefer those with a neutral pH (closer to 7) as compared to those with extreme pH (closer to 1 or 14)
- Biodegradability: Prefer those 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 (see ingredients to avoid).
- Dyes & Fragrances: Prefer those with no or low levels of dyes and fragrances compared to those products that are heavily dyed or fragranced. If dyes are necessary use those that are approved for foods and cosmetics (F&C).
- VOCs: Prefer those that have no or low VOC as compared to alternatives with higher levels. Consider detergent based products compared to those containing solvents.
- More Preferable Ingredients: surfactants containing terms such as lauryl, amides, and glycosides.
- Less Preferable Ingredients: Nonyl Phenol Ethoxylates, NTA, EDTA, glycol ethers, sodium hydroxide, potassium hydroxide, sodium metasilicate, phosphates.

### 2. BATHROOM CLEANERS

Bathroom Cleaners are often acids because of the need to remove mineral deposits from sinks, bowls and urinals. Frequently they are heavily dyed and strongly fragranced. 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). Bathroom cleaners may fall more in the range of pH 4 as compared to traditional products that may have a pH below 1.
- Dyes & Fragrances: Prefer those with no or low levels of dyes and fragrances compared to those products that are heavily dyed or fragranced. If dyes are necessary use those that are approved for foods and cosmetics (F&C).
- Biodegradability: Prefer those 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 (see ingredients to avoid).
- More Preferable Ingredients: surfactants containing terms such as lauryl, amides, glycosides, citric or acetic acid.
- Less Preferable Ingredients: nonyl phenol ethoxylates, NTA, EDTA, hydrochloric acid, phosphoric acid.

### 3. BATHROOM DISINFECTANTS

Bathroom Disinfectants are similar to general disinfectants, but typically may have an acidic pH (closer to 1) to remove hard water deposits in sinks, bowls and urinals. The selection issues include both those under general disinfectants and bathroom cleaners. Care in selection and use is important. The following are some of the specific issues to compare for this product category:

- See Bathroom Cleaners for similar attributes.
- Antimicrobial Ingredients: Prefer antimicrobial ingredients that have a lower potential for persistence in the environment and to accumulate in living tissue compared to those with a greater potential.
- More Preferable Active Ingredients: hydrogen peroxide.
- Less Preferable Active Ingredients: sodium hypochlorite (chlorine bleach), quaternary ammonium compounds, alcohols, phenolic compounds.

### 4. CARPET CLEANER

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

### 5. CHROME CLEANER/POLISH

Chrome Cleaner/Polish 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:

- VOC: Prefer those that have no or low VOC 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: (examples needed)
- Less Preferable Ingredients: petroleum distillates, ammonia.

### 6. 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.
- Less Preferable Ingredients: metal-crosslinked polymers.

### 7. 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 of the 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).
- VOC: Prefer those that have no or low VOC as compared to alternatives with higher levels.
- Bio-Based / Renewable Resources: Prefer those that containing naturally derived solvents as compared to those containing non renewable derived solvents.
- More Preferable Ingredients: d-Limonene (citrus solvent) and methyl esters.
- Less Preferable Ingredients: ethylene glycol mono butyl ether (butyl cellusolve), 2-butoxyethanol, ammonia, and sodium hydroxide.

#### 8. 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:

- VOC: Prefer those that have no or low VOC 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: citrus (lemon and orange) oils.
- Less Preferable Ingredients: petroleum distillates.

#### 9. 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 sources (e.g., 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 All-Purpose Cleaners
- VOC: Prefer those that have no or low VOC 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.
- 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.
- Less Preferable Ingredients: glycol ethers in general, ethylene glycol mono butyl ether (butyl cellusolve), and sodium hydroxide.

#### 10. GENERAL DISINFECTANTS

General Disinfectants are similar to cleaners (see all-purpose cleaners) with additional ingredients added to kill bacteria and other unwanted organisms, and bathroom disinfectants. Because disinfectants kill organisms they are toxic by definition. Some are persistent in the environment and accumulate in living tissue. Care in selection and use is important. The following are some of the specific issues to compare for this product category:

- See Bathroom Disinfectants for similar attributes.
- Antimicrobial Ingredients: Prefer antimicrobial ingredients that have a lower potential for persistence in the environment and to accumulate in living tissue compared to those with a greater potential.
- More Preferable Active Ingredients: hydrogen peroxide.
- Less Preferable Active Ingredients: sodium hypochlorite (chlorine bleach), quaternary ammonium compounds and phenolic compounds.

#### 11. GLASS CLEANERS

Glass Cleaners are cleaners that have ingredients added to reduce streaking and to evaporate quickly. Traditional glass cleaners can contain alcohol and other solvents (typically glycol ethers) or ammonia. The following are some of the specific issues to compare for this product category:

- VOCs: Prefer those that have no or low VOC 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)
- Biodegradability: Prefer those 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 (see ingredients to avoid).
- Dyes & Fragrances: Prefer those with no or low levels of dyes and fragrances compared to those products that are heavily dyed or fragranced. If dyes are necessary use those that are approved for foods and cosmetics (F&C).
- More Preferable Ingredients: surfactants containing terms such as lauryl, amides, and glycosides.
- Less Preferable Ingredients: ammonia, alcohols, propylene glycol, ethylene glycol and other glycol ethers.

#### 12. GRAFFITI REMOVER

Graffiti Remover used to be formulated with chlorinated solvents (e.g., methylene chloride) before they were banned due to their environmental impact. Many graffiti removers are packaged in aerosol containers which often contain hydrocarbon propellants (e.g., propane, butane), which are highly flammable and can contribute to indoor air quality problems.

- VOCs: Prefer those that have no or low VOC 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.
- Less Preferable Ingredients: methylene chloride, petroleum distillates, propane, butane, isobutene, and sodium hydroxide.

#### 13. GUM REMOVER

Gum Removers used to be formulated with chlorinated solvents (e.g., 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 section on General Degreasers).

- VOCs: Prefer those that have no or low VOC 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.
- Less Preferable Ingredients: freon, dichloro-difluoromethane, trichloro-fluoromethane.

#### 14. LIME & SCALE REMOVER

Lime & Scale Removers are acids because of the need to remove mineral deposits from sinks, bowls and urinals.

- 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.
- Less Preferable Ingredients: hydrochloric or phosphoric acid.

#### 15. SOLVENT SPOT REMOVERS

Solvent Spot Removers are necessary for spot removal particularly on carpets. Use detergent based spotters if possible (must be followed with extraction or other method to remove/absorb the detergent).

- See All-Purpose Cleaners
- VOCs: Prefer products that have no or low VOC compared to those with higher VOC 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.
- Less Preferable Ingredients: mineral spirits, 2-butoxyethanol

#### 16. 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.

- Biodegradability: Prefer detergents 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 (see ingredients to avoid).
- More Preferable Ingredients: surfactants containing terms such as lauryl, amides, glycosides,
- Less Preferable Ingredients: nonyl phenol ethoxylates, paradichlorobenzene

#### 17. 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 is the use of zero or low-VOC containing materials which will reduce indoor air quality concerns and the products durability which is important to protect the flooring and due to the product and applications cost. One final note, many janitorial firms lack specific expertise in application for these types of finishes. Thus, supplier support (e.g., training) is very important.

- Durability: Prefer durable finishes that require less maintenance (e.g., 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.
- Less Preferable Ingredients: xylene, stoddard solvent

### **B. Disposable Paper and Plastic Bags**

The issues associated with selecting paper products compared to cleaning products are significantly simpler. The issues of concern for paper are primarily focused at the manufacturing stage of the product. Whereas cleaners may have more than a dozen individual ingredients which can vary significantly from category to category and even amongst different products within the same category, paper is relatively similar. Paper has less emphasis on health issues during the products usage stage, or environmental impacts as a result of disposal.

The three basic issues of concern for paper include:

- Total recovered material (recycled content)
- Post-consumer recycled content
- Bleaching process

Environmentally preferable paper products should meet the following standards for each of the following product categories:

- Bathroom tissue—minimum 100% recovered materials and 20% post-consumer content.
- Toilet seat covers—minimum 100% recovered materials and 40% post-consumer content.
- Paper towels and general-purpose industrial wipes—minimum 100% recovered materials and 40% post-consumer content.
- Plastic trash bags—minimum of 25% post-consumer content.

Two further recommendations for the paper include the following:

- No use of de-inking solvents containing chlorine or any other chemicals listed in the Toxics Release Inventory in the manufacture of paper products.
- No use of chlorine or chlorine derivatives in bleaching processes for paper products.

Paper dispensers, for example those used in restrooms to dispense paper hand towels should be “touch free”, which reduces the potential for cross-contamination of bacteria and other potentially harmful pathogens.

### **C. Janitorial Equipment**

Finally, some considerations for equipment selection include the following:

- Vacuums with High Efficiency Particulate Air (HEPA) filtration capable of trapping 99.97% of all airborne particles that are collected by the vacuum. It is preferable to use vacuums with a beater bar to increase the amount of soil removal.
- Floor Machines with guards and filters

In selection of all equipment it is preferable to select those that are durable, energy-efficient and quiet, as compared to less durable, less efficient and noisier alternatives.

### **D. Product Supplier Considerations**

The final component in selecting products is consideration of the supplier. The product supplier will play an important role as part of the Stewardship Task Force and may be intimately involved in training. Furthermore, the standard operating practices of the supplier can impact inventory levels and thus the amount of materials, including those hazardous materials, which may be stored in the facility. Therefore, consideration should be given to suppliers’ ability to train cleaning personnel, expertise with green janitorial products and cleaning, in addition to price and other traditional considerations.

As a general rule, avoid products that are labeled “danger—poison.” Products with “warning” labels are also dangerous but less so, and products labeled “caution” are the least harmful of the three, although they can still be hazardous. Also, avoid products that are labeled “corrosive,” “severely irritating,” “highly flammable” or “highly combustible.” Avoid aerosols when possible as they often contain hydrocarbon propellants, which are flammable and can contribute to indoor air quality problems.

More specifically, **avoid using products that contain the following ingredients**, or make sure each ingredient makes up less than 0.01 percent by weight of the concentrated product:

- Acetone
- Alcohols
- Alkylphenols, alkylphenol ethoxylate, nonylphenol ethoxylate and other ethoxylates (endocrine-disrupting chemical sometimes used in liquid detergents)

- Ammonia or ammonium quaternary compound disinfectants (e.g., parasterol or benzalkonium chloride, benzethonium chloride, cetalkonium chloride, cetrimide, cetylpyridinium chloride, benzyldimethylstearylammmonium chloride)
- Benzyl alcohol
- Butane
- Butoxypropanol
- Chlorhexidine and chloramine-T
- Coconut diethanolamide
- Cyclohexanol
- Dibutyl phthalate, other phthalates
- Diethanolamine
- Diethylene glycol, and diethylene glycol monobutyl/monoethyl/monomethyl ether
- Dyes and perfumes/fragrances
- EDTA (ethylene diamine tetraacetic acid, or ethylene dinitrilo tetraacetic acid) and NTA (nitrilotriacetic acid)
- Ethylene glycol, and ethylene glycol monobutyl ether (butyl cellosolve)
- Fluorocarbons (e.g., HCFCs), which are ozone-depleting compounds
- Heavy metals such as lead, arsenic, mercury, cadmium, chromium, cobalt, nickel and zinc
- Hexylene glycol
- Hydrochloric acid
- Isobutene
- Methyl ethyl ketone
- Methylene chloride
- Monoethanolamine
- NTA
- N-hexane
- N-methyl pyrrolidinone
- Naphtha or naphthalene
- Perchloroethylene
- Phenolic compounds
- Phosphates (or at least no more than 0.5 percent by weight) in detergents
- Phosphoric acid
- Potassium hydroxide
- Propylene glycol, or propylene glycol monomethyl ether
- Sodium hydroxide
- Sodium hypochlorite
- Sodium metasilicate
- Stoddard solvent
- Toluene
- Triethanolamine
- Trichloroethylene
- Xylene
- 1,1,1-TCE
- 2-butoxyethanol

Most of a product's ingredients and properties, as well as safety and first aid information, are provided on its material safety data sheets (MSDS). Request and review the MSDS for all cleaning products used in the building, and keep current copies filed on site. Make sure staff are familiar with the MSDS format and know where the sheets are kept. The U.S. Occupational Safety and Health Administration (OSHA) requires all manufacturers to provide an MSDS with the first shipment of any hazardous chemical product, and requires users of the product to keep a copy on file and available for review by employees. Good online sources of safety data for many products are the National Institutes of Health's Household Products Database at [householdproducts.nlm.nih.gov/products.htm](http://householdproducts.nlm.nih.gov/products.htm), the Safety Information Resources, Inc. (SIRI) MSDS Index at [siri.org/msds/](http://siri.org/msds/), [msdssearch.com](http://msdssearch.com) and [msdsonline.com](http://msdsonline.com). Lethal dose thresholds, among

other properties and characteristics, should be disclosed on MSDS. A product is considered toxic to humans if its oral lethal dose (LD 50) is less than 2,000 mg/kg or its inhalation lethal concentration (LC 50) is less than 20 mg/L.

However, not all ingredients and hazards are disclosed on products' MSDS, and chemicals are sometimes known by several different names. Furthermore, manufacturers' product claims can sometimes be misleading or even deceptive. Fortunately, there are third-party certifiers that verify specific product claims. The nonprofit organization Green Seal has a green standard (GS-37) for industrial and institutional cleaners as well as a standard (GS-40) for industrial and institutional floor care products. Many cleaning products have undergone testing using those standards and have received Green Seal certification. Go to [www.greenseal.org/findaproduct/](http://www.greenseal.org/findaproduct/) to see a list of Green Seal–certified cleaning products. Scientific Certification Systems also certifies products' single-attribute claim of biodegradability ([www.scs-certified.com](http://www.scs-certified.com)). In addition, the EPA's Design for the Environment (DfE)'s Formulator Program has recognized a number of cleaning products. Links to the DfE product list and other useful resources are provided at the end of this section.

In addition to the less-toxic commercial cleaning products that are available, some common and inexpensive household substances can be used as effective and nontoxic alternative cleaning solutions for most basic cleaning jobs and for residents' cleaning needs. These substances include baking soda, white vinegar, salt, lemon juice, borax, dishwashing detergent and hydrogen peroxide. For example, baking soda, hot water and vinegar can clear drains, and borax and hydrogen peroxide can remove stains and mildew.

Building management should consider purchasing some low-toxic cleaning and pest control products to sell or give to residents to deter the use of toxic products in the residential units.

### **Storage and Disposal of Cleaning Products**

- Follow the storage instructions provided on each product's label.
- Store toxic/chemical cleaning products and any other hazardous materials away from residential areas, if possible, and in a safe, mechanically ventilated area with separate outside exhaust and negative pressure.
- Do not stockpile excess amounts of chemical products on site.
- Do not store different types of chemical products next to one another, as they could be reactive.

### **Disposable Janitorial Supplies**

- Reduce the purchase and use of disposable products. For example, use microfiber cloths rather than disposable towels where possible.
- When purchasing paper goods (paper towels, toilet paper, etc.) and trash bags, select products that have recycled content, preferably including some post-consumer content. Some products have 100 percent recycled content. Products that meet the EPA's Comprehensive Procurement Guidelines contain high levels of recycled content ([www.epa.gov/cpg/products/tissue.htm](http://www.epa.gov/cpg/products/tissue.htm) and [www2.ergweb.com/cpg/user/cpg\\_search.cfm](http://www2.ergweb.com/cpg/user/cpg_search.cfm)).
- Also, select paper products that are unbleached or made with a non-chlorine bleaching process.

### **Housekeeping Equipment**

Many of these suggestions are taken from the LEED rating system for existing buildings (requirements for IEQ credit 10.6).

- When purchasing a new vacuum cleaner, consider purchasing a HEPA (high-efficiency particulate air) vacuum. See the Carpet and Rug Institute's (CRI) Green Label listing of vacuums tested for their particulate removal performance (capturing at least 96 percent of particulates 0.3 microns in size) and for low noise levels (less than 70 dBA): [www.carpet-rug.org/drill\\_down\\_2.cfm?page=8&sub=9](http://www.carpet-rug.org/drill_down_2.cfm?page=8&sub=9)
- Other powered maintenance equipment, such as floor buffers and automatic scrubbers, should also be equipped with vacuums, guards, filters and/or other devices for capturing fine particulates, should have a noise level less than 70 dBA, and should be designed ergonomically to minimize vibration and use fatigue. Automated scrubbing machines should also have variable-speed feed pumps to optimize the use of cleaning fluids.
- Carpet cleaning equipment should be able to remove water so carpets can dry in less than 24 hours.
- Battery powered equipment should have environmentally preferable gel batteries.
- Mobile equipment should have rubber bumpers to reduce potential damage to walls.
- Make sure that all housekeeping equipment receives regular servicing and maintenance (including filter replacements) according to a preventive maintenance schedule.
- Upgrade to environmentally preferable equipment over time, as new equipment is needed.

**For more information on green and healthy cleaning, refer to:**

- Green Seal standard GS-37 for industrial and institutional cleaners: [www.greenseal.org/certification/standards/gs37.pdf](http://www.greenseal.org/certification/standards/gs37.pdf) and GS-40 for industrial and institutional floor care products: [www.greenseal.org/certification/standards/gs40.pdf](http://www.greenseal.org/certification/standards/gs40.pdf)
- List of Green Seal–certified cleaners and floor care products: [www.greenseal.org/findaproduct/](http://www.greenseal.org/findaproduct/)
- Greenguard Indoor Air Quality Certification of Cleaning Systems: [www.greenguard.org](http://www.greenguard.org)
- U. S. EPA Design for the Environment (DfE) Formulator Program, List of Formulator Partners and Recognized Products: [www.epa.gov/oppt/dfe/pubs/projects/formulat/formpart.htm](http://www.epa.gov/oppt/dfe/pubs/projects/formulat/formpart.htm)
- SCAQMD Clean Air Solvent (CAS) Certification Program, List of Certified CAS Products and Companies: [www.aqmd.gov/rules/cas/prolist.html](http://www.aqmd.gov/rules/cas/prolist.html)
- List of endocrine-disrupting chemicals: [www.ourstolenfuture.org/basics/chemlist.htm](http://www.ourstolenfuture.org/basics/chemlist.htm)
- List of persistent and bioaccumulative toxins: [www.epa.gov/epaoswer/hazwaste/minimize/chemlist.htm](http://www.epa.gov/epaoswer/hazwaste/minimize/chemlist.htm)
- INFORM's Cleaning for Health information: [www.informinc.org/cfh\\_00.php](http://www.informinc.org/cfh_00.php) and [www.informinc.org/cleanforhealth.php](http://www.informinc.org/cleanforhealth.php)
- U.S. EPA Environmentally Preferable Purchasing, Cleaning Products Pilot Project, Purchasing Decision Wizards: [www.epa.gov/opptintr/epp/pubs/cleaners/select/matrix.htm](http://www.epa.gov/opptintr/epp/pubs/cleaners/select/matrix.htm)
- U.S. GSA Federal Supply *Schedule 073 (Food Service, Hospitality, and Cleaning): Cleaning Equipment, Accessories, Janitorial Supplies, Cleaning Chemicals and Sorbents*, August 2004: [www.gsaelibrary.gsa.gov/ElibMain/ScheduleSummary?scheduleNumber=73](http://www.gsaelibrary.gsa.gov/ElibMain/ScheduleSummary?scheduleNumber=73)
- Janitorial products pollution prevention fact sheets (on toilet cleaning, hard floor care, carpet care, restroom cleaning, glass cleaning, metal cleaning and disinfectants), Western Regional Pollution Prevention Network: [www.wrppn.org/janitorial/factsheets.cfm](http://www.wrppn.org/janitorial/factsheets.cfm)
- “Cleaning Procedures” and “Cleaning Product Selection” chapters and the Green Cleaning Appendix within *The Pennsylvania Green Building Operations and Maintenance Manual*, Commonwealth of Pennsylvania w/ Green Seal and the Department of General Services’ Property Management: [www.dgs.state.pa.us/dgs/cwp/view.asp?Q=118184&A=363](http://www.dgs.state.pa.us/dgs/cwp/view.asp?Q=118184&A=363)
- Center for a New American Dream, Institutional Purchasing Program: [www.newdream.org/procure/index.php](http://www.newdream.org/procure/index.php)
- EnviroSpec: [www.envirospec.org](http://www.envirospec.org) (This organization is currently drafting a Janitorial Cleaner and Building Maintenance Product Screening Tool for the National Park Service.)
- The Ashkin Group, which consults, conducts workshops and disseminates information on green cleaning: [www.ashkingroup.com](http://www.ashkingroup.com)

### ***C. Indoor Pest Prevention and Control***

Both pests and pesticides can pose health concerns for building occupants. Pesticides are poisons, and they are often poisonous to humans as well as to pests. Studies have linked pesticides to cancer, birth defects and neurological and immune system disorders, as well as allergies. Pesticides should only be used as a last resort and sparingly. As a general rule, avoid products that are labeled “danger—poison” as those tend to be the most toxic.

#### **Pest Prevention Tips**

- Clean up any open, unsealed food, crumbs and liquid/spills from all floors and surfaces.
- Sweep floors and vacuum regularly (with a HEPA vacuum, if possible).
- Rinse bottles, cans and containers before putting them in the recycling bins. Clean out the recycling bins periodically to remove sticky residues.
- Make sure all door cracks or other openings in the trash rooms are sealed or caulked to keep any pests from entering (and to keep odors contained).
- Minimize clutter, paper files and storage supplies that can provide hiding places for pests.
- Make sure that kitchen cabinet penetrations as well as plumbing penetrations are filled and sealed.
- Fix all water leaks and dry any moisture-damaged materials.
- Do not overwater indoor plants. Wet soil and water left standing in the plant pots’ overflow dishes provide drinking areas for pests.

#### **Pest Management Protocols**

Building management should have a pest control professional (preferably someone who specializes in IPM or nontoxic pest control) perform regular pest inspections at the building.

If any toxic pesticide will be used in or around the building, the building management should notify residents and staff at least 72 hours before it is applied, or, for emergency applications, at least 24 hours before. Require or encourage occupants to stay away during the application, if possible, and to open their windows for extra ventilation. If necessary, parts of the ventilation system should be shut down during pesticide application to keep localized pesticides from spreading throughout the building.

If any pesticides are stored at the building, store them in a locked, ventilated (preferably outdoor) room. Do not stockpile a large surplus on site, and always keep products in their original containers.

#### **Bed Bug Prevention and Control**

Bed bugs are small, nocturnal insects that feed on blood. Adult bed bugs are about 1/4-inch long and 1/8-inch wide; younger ones are smaller (often about 3/16 of an inch long or the size of a pinhead). They have flat, reddish-brown bodies with six legs, and after feeding they become round and red. They give off a sweet, musty odor. Their eggs are white and very small, and their excrement appears as tiny brown or black spots. Bed bugs are typically found on mattresses, box springs and bed frames, clothing, bedding, furniture or any dark cracks, seams or crevices in walls and floors. They can travel through water pipes, wall voids and ducts, and can spread from room to room. Some people who are bitten by them get itchy welts on their skin. The bugs are not known to transmit any human pathogens.

#### ***Preventing the Introduction of Bed Bugs***

It is critical to prevent bed bugs from being brought into the building. These are some rules for prevention:

- Resident belongings such as clothing, bedding or furniture should be inspected carefully and washed before they are allowed into the building. Wash items in hot, soapy water and dry them on the hottest dryer setting. Freezing the materials at less than 0 degrees for several days is also known to kill bed bugs.
- When bedding is brought into the building for washing or is removed from a unit, seal the items (e.g., sheets, blankets, pillows and pillowcases) in a plastic bag before transporting them into or through the building to avoid spreading an infestation to other areas..
- Eliminate excess clutter in rooms, particularly near beds and clothes, to reduce the number of places where the bugs can hide.
- Educate staff and residents on how to prevent and safely get rid of bed bugs. Distribute information and hold educational sessions if bed bugs are a recurring problem in the building.

### ***Getting Rid of Bed Bugs***

- Wash all infested bedding and clothing with hot, soapy water and dry it on the hottest dryer setting, or freeze the materials at less than 0 degrees for several days. The owner might consider purchasing an on-site freezer for this purpose. Upon initial move-in, residents' belongings were frozen in a city maintenance truck parked outside the building.
- Use hot, soapy water or rubbing alcohol to wipe surfaces where the bugs are living.
- Vacuum cracks, crevices and other hiding places in walls, floors and furniture where adult bed bugs or eggs are found. Dispose of the vacuum contents in a sealed trash bag.
- If a mattress with bed bugs is torn and/or infested, it will probably need to be disposed of, as the bugs can live inside the mattress where they can't be reached. Do not treat mattresses with insecticides unless a specialist verifies that the treatment is nontoxic to humans. Wrap and seal any infested mattress before carrying it out of the apartment.
- Seal any cracks where the bugs are living.
- Eliminate excess clutter in rooms, particularly near beds and clothes, to reduce the number of places where the bugs can hide.
- If the infestation cannot be eliminated through the above methods and an insecticide must be used, use the least-toxic non-repellant insecticides. These include permethrin, cypermethrin and resmethrin. The bugs' eggs are not affected by insecticides, so the treatment will probably need to be applied several times to kill the hatchlings. There are also sticky traps designed for bed bugs. Baits for ants and cockroaches won't work for killing bed bugs.
- Educate staff and residents on how to prevent and safely get rid of bed bugs. Distribute information and hold educational sessions if bed bugs are a recurring problem in the building.

The preceding information on bed bugs is primarily based on guidelines from the San Francisco Department of Public Health's fact sheet on bed bugs as well as a report entitled *Bed Bugs: A Growing Problem*, by Harold J. Harlan, Senior Entomologist, NPMA, and Gail M. Getty, Entomologist, University of California, Berkeley

**For more information on pest management, refer to:**

- Department of the Environment's *Integrated Pest Management Training Manual*, in the Appendix (and at [www.sfenvironment.com/aboutus/innovative/ipm/manual.htm](http://www.sfenvironment.com/aboutus/innovative/ipm/manual.htm))
- San Francisco Reduced-Risk Pesticide List, also in the Appendix (and at [www.sfenvironment.com/aboutus/innovative/ipm/pest\\_list06/index.htm](http://www.sfenvironment.com/aboutus/innovative/ipm/pest_list06/index.htm))
- Contact the city's Department of Public Health or Department of the Environment if you have additional questions.

### ***D. Waste Reduction and Recycling***

The three R's of resource conservation are reduce, reuse and recycle. Reduce (i.e., prevent) as much waste as possible by avoiding the overuse of material. Reuse materials when possible. Recycle everything that is recyclable to allow waste materials to be made into other useful materials rather than go into a landfill. And to "close the loop," choose products that contain recycled content when available. In addition to reducing the amount of land needed for landfills, waste reduction helps conserve renewable and nonrenewable resources, and helps conserve energy and reduce pollution associated with the production and transportation of materials.

This section provides information on how to prevent waste; participate in the city's weekly curbside recycling program; recycle waste generated by building rehabilitation, renovation and maintenance projects; and dispose of hazardous waste properly.

#### **Waste Prevention**

Waste prevention is also sometimes referred to as source reduction or waste reduction. It is simply making choices or taking actions that prevent the generation of waste. Examples of waste prevention include:

- Use preventive maintenance to maximize the useful life of all building materials and equipment.
- Buy durable items so they will last a long time before needing to be thrown out and replaced.
- Avoid purchasing disposable materials when it is possible to use reusable products. For example, use long-life rechargeable batteries rather than disposable batteries, and reusable cloths rather than paper towels.
- Select and request items with less packaging or purchase items in bulk quantities (or liquid concentrates) with reduced packaging. Avoid products with unnecessary packaging such as individually wrapped items (i.e., packaging within packaging) whenever possible.
- Select products with recycled content (e.g., paper and office products, furniture, etc.).
- When ordering materials, ask if surplus/unused materials can be returned. Also, ask suppliers to take back and recycle or reuse their packaging materials.

## Weekly Recycling Program

### *Recyclable Materials*

Materials that can be recycled in [Insert municipality name] include:

- **Paper:** All types, including newspaper, cardboard (unwaxed), paperboard (e.g., cereal boxes without the lining bag), office paper, envelopes (plastic windows OK), junk mail, magazines and catalogs, milk cartons, paper egg cartons, phonebooks, wrapping paper, etc.
- **Aluminum** cans and foil
- **Glass** bottles and jars
- **Plastic bottles** (Numbers 1 through 7)
- **Plastic tubs** and lids (Numbers 2, 4 and 5 only)
- **Spray cans** (empty)
- **Tin** (steel) cans

All recyclables can be co-mingled in the same recycling bin. They do not need to be separated according to the different types of recyclable materials.

Materials that *cannot* be recycled include juice boxes, light bulbs, plastic bags, styrofoam, ceramic dishes, coat hangers, waxed cardboard, mirrors and window glass.

Please go to [http://www.sfrecycling.com/sf\\_blue\\_toter.htm](http://www.sfrecycling.com/sf_blue_toter.htm) to download and print the free posters/signs (or the webpage list), showing what items are and are not recyclable. Post the signs on or next to the recycling bin in each trash room and on all recycling bins in the common areas. Property managers could also distribute laminated signs to each resident to keep near the recycling bins in each unit. A sample poster is provided in the Appendix of this manual.

### *Collection of Recyclables*

For a building's recycling program to be successful, it is very important to make it as easy for occupants to recycle items as it is for them to throw items away. A recycling bin should be located next to every trash can, and each should be clearly labeled. This applies to all areas, including common areas such as the laundry room, community room and kitchen, as well as janitors' closets. If a trash can does not have a recycling bin next to it, recyclable items will be thrown away. Likewise, if a recycling bin does not have a trash can nearby, people will contaminate the recyclables with trash. All recycling bins in the building should be washed out often to remove sticky residues that might attract pests.

Property management should educate maintenance staff and residents about the building's recycling program. Management and maintenance staff should encourage residents to rinse out bottles and cans to avoid attracting pests and to put all of their recyclables into the blue bins, and should make sure the residents' waste and recycling cans are emptied into the appropriate receptacles in each floor's trash room every week. Housekeeping staff might need to go to each unit to collect trash and recyclables. If residents are not participating in the recycling program or are recycling improperly, the owner or building managers should consider creating an incentive program to reward residents who recycle properly and regularly.

### *Composting*

Once the building's recycling program is running smoothly, building managers should consider instituting a compost program. While management might not choose to ask residents to participate in the compost collection program (as it could prove difficult to get residents to collect their compost and doing so could be problematic from a pest control perspective), it should be relatively easy to collect landscape trimmings

from the courtyard plantings and compostable food waste from the commercial kitchen. The compost bin could be shared with the building's commercial/retail tenants as well.

### **Building Rehabilitation / Renovation Waste Management**

Scrap and debris from construction and demolition (C&D) work—including rehab-related work—makes up a large part of the waste stream that is dumped into landfills, and the majority of that waste is recyclable. Diverting such waste by having it recycled or donating it for salvage and reuse not only saves landfill space but also creates recycled alternatives to virgin materials and can save money on disposal fees.

This section covers local recycling and salvage options related to building rehab work as well as information on the proper disposal of hazardous wastes resulting from building maintenance.

#### **Waste Management Tips**

- Before starting a rehab project that will generate waste, identify the local recycling and salvage options and the pick-up or drop-off services.
- Include recycling requirements in contracts for subcontractors hired to do work at the building.
- Provide space for recycling/salvage containers on site, preferably for each type of recyclable material, and label each container with large signs in all languages spoken by the workers.

### ***Recycling Construction and Demolition Waste***

Items that may be recycled by facilities in most areas include appliances, cardboard, drywall, paint, carpet, scrap metal, wood and pallets, plate glass, landscape trimmings, asphalt and concrete, bricks and tiles, rubber scrap, roofing, dirt and hazardous materials, including electronics.

If you separate recyclables by material type (for “clean loads”), facilities should charge you lower dumping fees. Sometimes facilities will even pay for certain materials, including some metals. But many recycling facilities will also accept mixed waste and will sort the items. Do not put plastics, hazardous waste or food waste in with the mixed/co-mingled recyclables.

### ***Salvage Yards***

Many types of building materials are accepted by salvage yards. Examples of reusable building materials include (but are not limited to) furniture, flooring, electrical equipment, ducts, plumbing fixtures, light fixtures, doors and windows.

### **Hazardous Waste Disposal**

Hazardous waste materials must be dropped off at the appropriate facilities for safe disposal or recycling so they don't contaminate the community's air, water or soil.

Hazardous waste materials include:

- Paint, paint thinners, primers, stains and other finishes
- Toxic glues and adhesives
- Chemical cleaning supplies (cleaners, disinfectants, graffiti removers, polish, deodorizers, etc.)

- Fluorescent lamps/light bulbs
- Switches or thermostats that contain mercury
- PCB ballasts
- Pesticides, herbicides, chemical fertilizer
- Computers, TVs, and other electronic equipment
- Printer/copier ink/toner
- Batteries (all types)
- Medical/biohazard waste (including needles)
- Used motor oil
- Compressed gases

**Latex Paint Recycling**

Unused paint can be dropped off at [Insert specifics here].

Most hazardous materials can be dropped off at [add specifics here]

## ***E. Energy and Water Conservation***

This section provides an overview and general guidelines on preventive maintenance and green operations strategies. It also offers specific suggestions on water conservation and energy-efficient maintenance for mechanical systems and equipment (e.g., ducts and filters, heating systems, cooling towers) and for electrical components (e.g., photovoltaics and lighting). For more detailed or technical information, consult the equipment manufacturers' manuals and documentation as well as the resources listed throughout this section.

### **Energy Efficiency Strategies**

The U.S Department of Energy's Federal Energy Management Program (FEMP) defines operations and maintenance (O&M) as "the activities related to the performance of routine, preventive, predictive, scheduled and unscheduled actions aimed at preventing equipment failure or decline with the goal of increasing efficiency, reliability and safety." Inadequate testing and maintenance of mechanical and electrical systems (e.g., leaks or improperly adjusted controls) can lead to significant energy waste. Conversely, proactive and proper maintenance practices can lead to substantial energy savings. Many best practices can be implemented easily and at relatively low cost. According to FEMP, using a combination of many O&M best practices can "save an estimated 5 percent to 20 percent on energy bills without a significant capital investment.

Included in the Portland Energy Conservation, Inc., guide *Fifteen O&M Best Practices: For Energy-Efficient Buildings* are sections on tune-ups, automatic controls, scheduling, tracking and preventive O&M. Highlights of these sections are summarized here:

- *Perform O&M tune-up actions.* Conduct an O&M assessment. Then "implement the most cost-effective solutions that maximize building performance and minimize energy waste. Future energy-efficiency work can be funded from the savings generated by the low-cost O&M improvements."
- *Make full use of automatic controls to optimize efficient operation.* If an energy management system (EMS) is in place, make sure staff understand how to use it to its full potential. Also, "newer HVAC equipment may have sophisticated integral controls that can be programmed to accomplish energy-efficient strategies, such as chilled water reset." Make sure that the staff has a full set of documentation on installed systems, including controls strategies and sequences of operation. Train at least one person on staff to program and oversee the control systems.
- *Operate equipment only when needed.* "Review and monitor any on/off controls such as programmable and mechanical time clock settings, integral equipment controls, lighting photocells, sweeps and occupancy sensors for proper operation. Ensure unused or unrented tenant/occupant spaces have equipment and lights turned off."
- *Track actual performance against expected performance for major equipment.* "Obtain the necessary manufacturer performance test data and figures of merit (FOM) for all major plant equipment, such as chillers, cooling towers, boilers, air handlers and pumps. Or establish benchmarks for the equipment using field measurements. When equipment does not meet the expected performance criteria, it may indicate a need for improved or more frequent maintenance procedures (cleaning, lubricating, etc.) or different operating parameters."
- *Redefine preventive maintenance to include activities critical to energy-efficient building operation.* "Typically, the primary goal of the preventive maintenance plan is reliability and increased equipment life. Including procedures to check for efficient operation as part of the

plan should enhance this primary goal as well as eliminate unnecessary energy waste. Even if a piece of equipment or a system is meticulously maintained, if it is poorly operated using inadequate control strategies or improper scheduling, vast amounts of energy waste can occur. Also, poor equipment operation can lead to premature equipment failure (for example, short-cycling) and an increase in maintenance requirements. Review and adjust control strategies seasonally.” Develop O&M procedures for gathering data and forms for tracking equipment performance.

One of the most comprehensive and effective ways to keep systems at optimal efficiency is to have periodic commissioning (or recommissioning) done. Commissioning is a process that involves systematic performance checks and tests to ensure that all building systems are performing and interacting according to the design intent and at optimum efficiency. Going through this process often saves projects a significant amount of money and energy. A number of firms—typically mechanical engineering or consulting firms—specialize in commissioning. It is also useful to implement regular in-house monitoring, measurement and verification procedures. The LEED rating systems describe some of these procedures in detail.

### *Mechanical Equipment Operations and Maintenance*

The following are excerpted suggestions from *The Pennsylvania Green Building Operations and Maintenance Manual* for mechanical systems operation and maintenance.

#### Duct and Filter Maintenance

Here are some recommended strategies for keeping systems running efficiently:

- One of the most simple and effective methods of increasing an HVAC system’s airflow and efficiency is to inspect and replace system air filters on a regular basis. Clean air filters increase airflow through the system, resulting in improved system efficiency, indoor air quality and better occupant satisfaction.
- Maintain uniform airflow to increase filter performance and longevity.
- Place filters upstream of fans and cooling coils. This can help clean the intake air before it moves through these components and helps to improve their efficiency.
- Maintain low filter face velocity for an effective and energy-efficient filtering system. The recommended target for typical office, commercial and institutional HVAC systems’ face velocity is about 200 to 300 feet per minute. This maintains a low pressure drop while allowing sufficient flow for most applications. To get proper filtration at lower face velocity may require a larger filter surface area. This may increase initial filter purchase cost, but the filters will last longer at the lower airspeed, resulting in significant savings in both materials and labor costs.
- Minimize filter frames or casings to minimize pressure drops across the filters. When ordering, choose the filter materials with the least casing and framing materials to maximize the filter area.
- Choose a reusable filter medium, such as bag or wet filters, where possible. While the rigid, disposable dry filter type is the most prevalent, some systems can still utilize bag or wet filters or other reusable materials. However, if you choose reusable materials, it is important to have a strict maintenance schedule set up to minimize additional maintenance and labor costs.
- Locate and seal leaks in duct systems.

Descriptions of the various types of filters and their advantages and disadvantages are also provided in *The Pennsylvania Green Building Operations and Maintenance Manual*.

#### Heating System Maintenance

The following are tips from the *Public Housing Authority Energy Efficiency Toolbox*, developed by Global Green USA:

- Check for soot or corrosion that can be caused by incomplete combustion or inadequate venting of combustion gases.
- Lubricate all moving parts. Parts that lack lubrication cause friction in motors and increase the amount of electricity you use.
- Check the heat exchanger for water leaks.

For hot-water heating systems:

- Bleed air from hot-water radiators once or twice each heating season. Close the valve after all the air is discharged.
- Test the pressure-relief valve.
- Test the high-limit control.
- Inspect pressure tank, which should be filled with air, to verify that it's not filled with water.
- Clean the heat exchanger.

### General Energy Efficiency Tips

- Stay on top of the schedule for contractual maintenance services, and make sure that all building systems and equipment are serviced at the intervals called for by the manufacturers and service agreements.
- Make sure the building temperature is comfortable—not overheated or overcooled. The thermostat should be programmed for night setbacks to provide less heating (or cooling) at night. Also, make sure that the building’s water temperature is not set too high.
- Educate residents on how to set their thermostats properly, and make sure they are not overheating their units or leaving heat on when their windows are open.
- Turn off lights, computers and equipment when they’re not in use.
- As refrigerators get older, make sure they continue to operate well and aren’t running long after they are closed or turning on or off too frequently. Clean the coils at least twice a year, or show residents how to do so.
- Clean out dryer lint filters, ducts and vents periodically. Accumulated lint poses a fire hazard. Also, make sure that the outside exhaust vent is working and closes tightly to keep outside air from leaking in.
- When systems/equipment and appliances must be replaced or are added to the building, select those with high ENERGY STAR ratings ([www.energystar.gov/products](http://www.energystar.gov/products)). Or, even better, select one of the *most* energy efficient appliances as identified by the American Council for an Energy-Efficient Economy ([aceee.org/consumerguide/index.htm](http://aceee.org/consumerguide/index.htm)). ENERGY STAR rates a wide variety of building products in addition to appliances, including lighting, HVAC equipment, windows, doors, roofs, electronics and other equipment.

### *Electrical Equipment Operations and Maintenance*

#### Photovoltaics **IF APPLICABLE**

The rooftop photovoltaic (PV) panels should be washed off every three months with warm water and a mild dishwashing detergent and should be scrubbed with a soft brush once a year to remove dirt and bird droppings. Keeping the surface clean will help the panels perform as designed—dirt on the panels can reduce their electrical generating capacity.

Check periodically all wiring connections, look for any degradation of the wiring insulation and check the tightness of all nuts and bolts attaching the panels to their support structures. PV systems often last for 30 to 40 years; however, inverters might require replacement or servicing every 15 years or so. The battery in battery back-up systems typically needs to be replaced every five years. Please refer to the manufacturer’s manual or contact the manufacturer or supplier for more specific guidance.

The PV panels’ energy generation and building energy usage can be monitored through Fat Spaniel Technologies’ Web-enabled real-time energy monitoring program. ([www.fatspaniel.com](http://www.fatspaniel.com), 408.279.5262)

#### Lighting: Purchasing New Lamps

- When purchasing lamps or bulbs, look for products that are not only energy efficient but also long life and—for fluorescents and metal halides—low mercury. The longer the life, the less often you will have to purchase and recycle lamps or bulbs, saving both time and money. When selecting compact fluorescent lamps, look for the ENERGY STAR label as well as long-life and low-mercury features.

- Currently, the lowest-mercury lamps have less than 3.8 mg—sometimes as low as 1.5 mg—of mercury per 4-foot lamp. Philips Lighting currently makes the lowest-mercury fluorescent lamps, and Sylvania has recently started to make some very low-mercury lamps as well. To provide quality light, select lamps with a minimum color-rendering index (CRI) of 80.
- Provide efficient replacement lamps to the residents for their units. Discourage residents from using halogen torchieres in their units. Halogen lamps are serious energy wasters, and they pose a significant fire hazard.

### Lighting Maintenance

- Take care when unpacking, installing, moving or storing fluorescent and metal halide lamps. They can break easily if dropped, and they contain mercury, a hazardous material.
- Whenever you replace a lamp, inspect its ballast and clean the fixture and lens. Turn off the lights first. Clean fixtures with a soft, moist cotton cloth to prevent static, which attracts dust. Avoid using disposable materials such as paper towels. For lenses, clean both sides with a mild dishwashing detergent and allow to air dry. Lights cannot deliver the designed light levels if they are dirty. According to *The Pennsylvania Green Building Operations and Maintenance Manual*, a dirty lens can reduce a fixture's light output up to 50 percent.
- If you set up a routine replacement schedule to change out all lamps at once, take into account which lamps have long-life designations and how many hours they tend to last.
- Motion-sensor lighting is used in the building's offices, common areas and exterior lighting. Inspect the sensors regularly and make sure they are working properly (i.e., not allowing lights to stay on when they should be off).

**For more information on energy efficient O&M, refer to:**

- Energy Star Buildings: [www.energystar.gov/buildings/](http://www.energystar.gov/buildings/) and Energy Star products: [www.energystar.gov/products](http://www.energystar.gov/products)
- Flex Your Power (California's energy efficiency resource): [www.fypower.org](http://www.fypower.org)
- PG&E Energy-Efficiency Rebates for Multifamily Properties: [www.pge.com/res/rebates/lighting/multi\\_family\\_properties/](http://www.pge.com/res/rebates/lighting/multi_family_properties/)
- PG&E Energy-Saving Resources: [www.pge.com/res/rebates/energy\\_tools\\_resources/index.html](http://www.pge.com/res/rebates/energy_tools_resources/index.html)
- PG&E Pacific Energy Center: [www.pge.com/pec](http://www.pge.com/pec)
- *Public Housing Authority Energy Efficiency Toolbox*, developed by Global Green USA: [www.globalgreen.org/pha-energytoolbox/](http://www.globalgreen.org/pha-energytoolbox/)
- Portland Energy Conservation, Inc: [www.peci.org](http://www.peci.org). PECE's O&M Best Practices Series includes downloadable booklets on the following topics: *Fifteen O&M Best Practices for Energy-Efficient Building (1999)*; *Putting the "O" Back in O&M: Best Practices in Preventive Operations, Tracking, and Scheduling*; *Operation and Maintenance Service Contracts: Guidelines for Obtaining Best-Practice Contracts for Commercial Buildings*; *O&M Assessments: Enhancing Energy-Efficient Building Operation*; *Energy Management Systems: A Practical Guide*, and others.
- HVAC Maintenance chapter within *The Pennsylvania Green Building Operations and Maintenance Manual*, Commonwealth of Pennsylvania w/ Green Seal and the Department of General Services' Property Management: [www.dgs.state.pa.us/dgs/cwp/view.asp?Q=118184&A=363](http://www.dgs.state.pa.us/dgs/cwp/view.asp?Q=118184&A=363)
- *Operations and Maintenance Best Practices Guide*, Federal Energy Management Program (FEMP), downloadable from: [www.eere.energy.gov/femp/operations\\_maintenance/om\\_best\\_practices\\_guidebook.cfm](http://www.eere.energy.gov/femp/operations_maintenance/om_best_practices_guidebook.cfm)
- O&M Fact Sheets from the Federal Energy Management Program on topics such as lighting maintenance, saving water, in-house retro-commissioning, resource efficiency managers and reducing heating and cooling costs; downloadable from: [www.eere.energy.gov/femp/operations\\_maintenance/om\\_factsheets.cfm](http://www.eere.energy.gov/femp/operations_maintenance/om_factsheets.cfm)

## **Water-Saving Strategies**

In addition to some of the more obvious water conservation strategies that everyone can employ—not running faucets longer than is necessary, and running only full loads in dishwashers and clothes washers—property managers and maintenance staff can take a number of steps both indoors and out to reduce water use from building operations. The following are some useful water conservation tips from the ResourceVenture.org website:

***Read water meters monthly.***

Compare the results to the same month of the previous year. This will help you both to identify leaks as they occur and to monitor your conservation efforts.

***Check for leaks.***

A leaking toilet can waste more than 50 gallons of water each day, and a dripping faucet or showerhead can waste up to 1,000 gallons per week.

***Install faucet aerators.***

Inexpensive and simple to install, low-flow faucet aerators can reduce both your business' water consumption and your energy cost of heating the water by as much as 50 percent.

***Operate cooling towers and boilers according to manufacturers' specifications.***

Reduce excessive blowdown. Many cooling towers operate below the suggested levels of total dissolved solids (TDS) unnecessarily. Adjust boiler and cooling tower blowdown rate to maintain TDS at levels recommended by manufacturers' specifications.

***Discontinue or minimize using water to clean paved areas.***

Instead of hosing down entrances, sidewalks, parking lots and loading docks, sweep or use a blower to clean these areas.

Add language here about permeable concrete

***Review your landscaping practices.***

First, detect and repair all leaks in your irrigation systems. Make sure the sprinklers are watering the landscaping only—not the street or sidewalk. Water your landscape during the coolest part of the day to reduce evaporation. Ideally, you should have a system that automatically shuts off when it's raining, reads real-time ET for accurate irrigation run times and/or incorporates flow sensors that turn the system off in the event of leaks or broken heads.

Also, see the irrigation recommendations provided in the Green Groundskeeping section of this manual.

**For more information on water conservation strategies, refer to:**

- *Facility Manager's Guide to Water Management*, Arizona Municipal Water Users Association: [www.amwua.org/conservation/facility\\_managers\\_guide.htm](http://www.amwua.org/conservation/facility_managers_guide.htm) (The guide covers plumbing, landscaping, cooling towers and many other building water use topics.)
- California Urban Water Conservation Council: [www.cuwcc.org](http://www.cuwcc.org)
- Consumer Water Center Conservation Resources (American Water Works Association): [www.drinktap.org/consumerdnn/](http://www.drinktap.org/consumerdnn/)
- Water Wiser (American Water Works Association): [www.waterwiser.org](http://www.waterwiser.org)
- Resource Venture, Water Conservation Resources: [www.resourceventure.org/rv/issues/water/other-resources/index.php](http://www.resourceventure.org/rv/issues/water/other-resources/index.php)

## ***F. Green Groundskeeping***

This section provides sustainable landscaping and groundskeeping guidelines covering irrigation, plantings, integrated pest management, stormwater filtration and exterior lighting.

### **Irrigation [If applicable]**

- Make sure the irrigation system is not watering the plantings during or immediately preceding or following rainy days. Even on dry days, make sure the system is not overwatering the plants or oversaturating the soil. Re-program the system seasonally and as necessary to adjust to weather conditions. If issues arise, consider hiring an irrigation professional to do an irrigation audit.
- Make sure all spray and drip spouts are watering planted soil areas only and are not watering the pathways or wood deck.
- If and when the irrigation system needs to be replaced, install high-efficiency irrigation.
- Perform regular system checks and maintenance.

### **Plantings**

- If and when plantings need to be replaced, either replace with the original planting types or select native/adapted or drought-tolerant plantings. Use native plants as much as possible. See link below to an online gallery of California native plants.
- When major landscape maintenance work is done, property management or the landscape contractor should make sure all tree and plant clippings it hauls away are composted.

### **Integrated Pest Management**

Avoid the use of chemical fertilizers, herbicides and pesticides as much as possible. These products are often hazardous to humans. People are not only exposed to outdoor pesticides when they are outside—the chemicals can also be tracked into the building on people's shoes.

It's important to remember that not all bugs are harmful pests; some are actually beneficial to plants. As for true pests, there are many ways to prevent and control them without using toxic chemical pesticides or insecticides. .

### **Stormwater Filtration**

Check the drainage system periodically to make sure it is working and is not clogged by debris.

### **Exterior Lighting**

To minimize light pollution, make sure that all exterior light fixtures remain pointed down and are not overlighting the area beyond what is necessary for security purposes. Extremely bright lights can create glare and shadows, which can make seeing difficult and compromise security. If new fixtures are added, select full cut-off or downlit fixtures. Make sure exterior lights are not on during daylight hours and that motion sensors are working properly. Also make sure any daylight sensors, controls or time clocks are adjusted as necessary throughout the year as daylight hours change. Use energy-efficient, long-life, low-mercury bulbs. See the Energy and Water Conservation section for more information on lamp selection.

## II. Green Materials and Systems at [Project Name]

### A. List of Green Components

This list provides a general overview of many of [project name's] systems and materials, primarily those that are in some way green or have green maintenance implications. The list is not comprehensive and does not include every component in the building. Please also refer to the detailed product information provided by the contractor, including manufacturer documentation, as-built drawings, material schedules and specifications.

The list is organized into three major sections: Systems and Equipment; Exterior Materials; and Interior Materials, Finishes and Furnishings. Some notes on green product standards and selection/replacement criteria are provided for certain components.

#### SYSTEMS AND EQUIPMENT

This subsection lists many of the project's mechanical/HVAC, electrical (photovoltaics and lighting), and plumbing and irrigation systems, as well as appliances.

*[This section must be customized and developed for every project.]*

##### **Mechanical/HVAC**

**Heating system:**

**Ventilation system:**

Refer to the Appendix for the Mechanical Filter Replacement Schedule, which includes recommended filter change-out rates.

##### **Electrical (Photovoltaics and Lighting)**

**Photovoltaic panels:**

**Photovoltaic energy generation system inverter:**

**Lighting:**  
(interior and exterior)

See the electrical section of the Energy chapter for additional information.

**Automated lighting controls and motion sensors:**

***Plumbing and Irrigation***

**Irrigation system:**

**Irrigation controller**

**Toilets:**

**Faucets:**

**Showerheads:**

***Appliances***

**Refrigerators:**

**Rangehood fans/filters for electric stoves:**

**Clothes washers and dryers:**

## **EXTERIOR MATERIALS**

This subsection lists some of the project's site, roof, façade, windows and exterior door products and materials.

### ***Doors (Exterior)***

**Aluminum (painted) w/ glass:**

**Hollow metal (painted):**

### ***Façade***

**Panels:**

### ***Roof***

**Roof coating:**

See the Green Product Summary for roof maintenance information.

**Walking pads:**

### ***Site (Courtyard)/Landscaping***

**Decking:**

**Plantings:**

### ***Windows/Glazing***

**Aluminum storefront windows:**

## INTERIOR MATERIALS, FINISHES AND FURNISHINGS

This subsection lists most of the interior products, including insulation, interior doors, flooring, cabinetry/casework, paints and coatings, other wall finishes, adhesives and unit furnishings.

### *Adhesives, Sealants, Caulks*

**Low-VOC adhesives** for all interior applications. The following are a few examples of the low-VOC adhesives used in the construction of this building:

[Complete: carpet tile adhesive, flooring adhesive, joint sealers, etc.]

Avoid the indoor use of sealants that contain the following: butyl rubber, solvent-based acrylic, neoprene, methylene chloride and chlorinated hydrocarbons. Low-VOC sealants are often water-based and non-solvent-based.

### *Cabinetry/Casework and Countertops*

#### **Substrate (for cabinets, reception desk):**

Be sure to use a nontoxic or low-toxic/low-VOC adhesive for adhering the laminate or veneer to the substrate.

#### **Glass countertop (reception desk):**

### *Doors (Interior)*

[Complete]

### *Flooring*

#### **Bamboo:**

See the Green Product Summary in the following section for care and maintenance information.

#### **Carpet:**

This carpet meets the Carpet & Rug Institute's (CRI) Green Label IAQ testing standards. All replacement carpet and any carpet adhesive and cushion should meet the CRI Green Label Plus (or at least the regular Green Label) standards for indoor air quality.

#### **Ceramic tile:**

#### **Concrete (exposed):**

#### **Linoleum:**

See the Green Product Summary in the following section for care and maintenance information.

#### **Rubber:**

#### **Stone tile:**

### *Insulation*

**Cellulose:**

**Recycled cotton batt:**

**Fiberglass batt:**

**EPS board:**

### *Paints and Coatings*

**Interior wall paint:**

If any other interior wall paint will be used in the building in the future, make sure that it is another low-VOC (or no-VOC) paint that does not exceed the VOC limits set by the Green Seal GS-11 standard: 50 g/l for flat paint, 150 g/l for non-flat. All major paint manufacturers now have at least one line of low-VOC paint.

**[Other paints and coatings...]**

### *Other Wall Finishes*

**Ceramic tile:**

**Composite stone:**

### *Unit Furnishings*

**Furniture:**

**Window coverings:**

**[CUSTOMIZE AND INSERT THE VARIOUS REFERENCE DOCUMENTS  
SELECTED FOR THE APPENDIX]**

## **PUBLIC TRANSIT INFORMATION AND MAP**

If applicable insert information on local transit service and routes is available at:

## RESOURCES FOR MORE INFORMATION

Below are publications, organizations, agencies and websites that provide more information on green operations and maintenance, green affordable housing or other green building topics, including green materials. Also, review the various reference documents provided in the Appendix as well as the list of resources listed at the end of each section in Part I for information on specific topics (e.g., indoor air quality, healthy housekeeping, pest control, waste reduction and recycling, and green groundskeeping and landscaping).

### Green Operations & Maintenance Resources

*The Pennsylvania Green Building Operations and Maintenance Manual*, Commonwealth of Pennsylvania w/ Green Seal and the Department of General Services' Property Management  
[www.dgs.state.pa.us/dgs/cwp/view.asp?Q=118184&A=363](http://www.dgs.state.pa.us/dgs/cwp/view.asp?Q=118184&A=363)

California High Performance Schools (CHPS) *Best Practices Manual, Volume IV: Maintenance & Operations*, 2004  
[www.chps.net/manual/documents/M&OManual.pdf](http://www.chps.net/manual/documents/M&OManual.pdf)

*Creating a Green and Profitable Work Environment*, Florida Solar Energy Center and the Florida Department of Environmental Protection, 2003  
[www.dep.state.fl.us/waste/categories/p2/pages/GreenBuilding.htm](http://www.dep.state.fl.us/waste/categories/p2/pages/GreenBuilding.htm)

*Green Affordable Housing Operations & Maintenance Toolkit & Buyer's Guide*, Bay Area LISC Green Connection program, 2006  
[www.bayarealisc.org/bay\\_area/assets/asset\\_upload\\_file41\\_7772.pdf](http://www.bayarealisc.org/bay_area/assets/asset_upload_file41_7772.pdf)

*Guidelines for Green Building Housekeeping and Maintenance*, City of Austin, Sustainable Building Guidelines, Volume III.

LEED-EB: the Leadership in Energy and Environmental Design rating system for Existing Buildings, administered by the U.S. Green Building Council  
[www.usgbc.org](http://www.usgbc.org)

### Green Affordable Housing Resources

#### *Programs and Agencies*

Green Communities Program (Enterprise Community Partners/Natural Resources Defense Council)  
[www.greencommunitiesonline.org](http://www.greencommunitiesonline.org)

Enterprise Community Partners  
[www.enterprisecommunity.org](http://www.enterprisecommunity.org)

San Francisco Mayor's Office of Housing  
[www.sfgov.org/moh](http://www.sfgov.org/moh).

Global Green USA: Greening Affordable Housing Initiative  
[www.globalgreen.org/greenbuilding/GAHI.html](http://www.globalgreen.org/greenbuilding/GAHI.html)

Green Affordable Housing Coalition  
[www.greenaffordablehousing.org](http://www.greenaffordablehousing.org)

## *Guides*

*The Materials Handbook: Guidelines for Sustainable Affordable Housing*, Mayor's Office of Housing, City and County of San Francisco / Asian Neighborhood Design  
[www.andnet.org/materials.html](http://www.andnet.org/materials.html)

*Sustainable Design and Construction Guidelines*, San Francisco Redevelopment Agency, December 2005

*Public Housing Authority Energy Efficiency Toolbox*, Global Green USA, 2005  
[www.globalgreen.org/pha-energytoolbox/](http://www.globalgreen.org/pha-energytoolbox/)

*Multifamily Green Building Guidelines*, Alameda County Waste Management Authority, 2004  
[www.stopwaste.org/home/index.asp?page=291](http://www.stopwaste.org/home/index.asp?page=291)

*A Blueprint for Greening Affordable Housing: Developer Guidelines for Resource Efficiency and Sustainable Communities*, Global Green USA, 1999. A new edition is expected to come out in 2007.  
[www.globalgreen.org/publications/index.html](http://www.globalgreen.org/publications/index.html)

Affordable Housing Design Advisor: [www.designadvisor.org](http://www.designadvisor.org)  
(developed by HUD, AIA, Enterprise, LISC and others)  
[www.designadvisor.org](http://www.designadvisor.org)

## **General Green Building Resources**

### *Organizations and Informational Websites*

Build It Green  
[www.builditgreen.org](http://www.builditgreen.org)

U.S. Green Building Council  
[www.usgbc.org](http://www.usgbc.org)

Building Green / GreenSpec / Environmental Building News  
[www.buildinggreen.com](http://www.buildinggreen.com)

### *Programs and Agencies*

San Francisco Department of the Environment, Green Building Program  
The department also has programs that provide information on related issues such as recycling, toxics disposal and reduction, less-toxic purchasing, energy efficiency, less-toxic pest management, etc.  
[www.sfenvironment.com/aboutus/innovative/greenbldg/](http://www.sfenvironment.com/aboutus/innovative/greenbldg/)

San Mateo County RecycleWorks green building program  
[www.recycleworks.org](http://www.recycleworks.org)

Alameda County Waste Management Authority's StopWaste program  
[www.stopwaste.org](http://www.stopwaste.org)

California Integrated Waste Management Board, Green Building program  
[www.ciwmb.ca.gov/greenbuilding/](http://www.ciwmb.ca.gov/greenbuilding/)