

Green Future: OM-1

Property Management Operations & Maintenance Manual and Training

SAMPLE: Template Green Operations & Maintenance Manual

This document is based on a guide that was prepared by M. Landman Communications & Consulting on behalf of Enterprise Community Partners, for The Plaza Apartments in San Francisco.

Adjust to include at least each Green Future item.

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 FROM THE DEVELOPER, ETC.]

Best Practices for a Healthy and High-Performance Building

This manual is 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.

[Insert disclaimer language, if desired.]

[Insert publication date]

Green Operations & Maintenance Manual for [Project Name]

MEMO

RE: Adapting and Customizing the Green O&M Manuals

A *Green Operations & Maintenance Manual for The Plaza Apartments* in San Francisco 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. The Plaza Apartments is a nine-story, urban infill building comprised of studio units for a formerly homeless population. As such, the manual covers aspects of green O&M that are unique to this population and this type of housing. For example, The Plaza Apartments do not feature garbage disposals or a parking lot or garage(s), and residents do not have yards/landscaping to maintain, so those topics are not addressed in the template, though they might need to be addressed in other projects' manuals. Other circumstances to consider are that The Plaza Apartments residents do not pay their own utility bills, they have non-programmable thermostats and radiant heaters in their units, and they have a common laundry room; and the section on preventing and controlling bed bug infestations may not be relevant for all buildings. Furthermore, the information provided on local services (such as recycling and hazardous waste drop-off options, product suppliers, etc.) is specific to San Francisco and would need to be modified in manuals for projects that are located in other areas.

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:

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.

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.)

Green procurement/purchasing policies and service contracts (e.g., 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 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.

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.]

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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. For an example, see The Plaza Apartments manual's introduction.]

In mid-2005 when construction was underway, San Francisco Mayor Gavin Newsom announced that the City and County of San Francisco would in the future apply green guidelines to *all* of the city's affordable housing projects. As part of Enterprise's national Green Communities program, the Mayor's Office of Housing, the SFRA and Enterprise created the first citywide Green Communities Collaborative for local affordable housing developers and project teams. Enterprise created its Green Communities program in partnership with the Natural Resources Defense Council; The American Institute of Architects; the American Planning Association; national green building practitioners and other corporate, financial and philanthropic organizations, including the Tides Foundation. The program is a five-year, \$555-million commitment to build more than 8,500 environmentally healthy homes for individuals and families with low incomes by providing grants, financing, tax credit equity and technical assistance to affordable housing developers. As the city's most sustainably designed affordable housing project to date, The Plaza Apartments serves as a model for the San Francisco Green Communities projects currently being designed.

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. We hope that 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 groundskeeping 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.

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 offgassing 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: Regularly clean out the entryway grates and 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. Do not allow residents, staff or visitors to smoke in any of the common areas or outside near the building's entryways, windows or air intakes.

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: This building has automatic continuous-ventilation fans and vents in all resident units. 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.

Natural ventilation: Open windows from time to time 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, refer to Chapter 3 of *IAQ Guidelines for Occupied Buildings Under Construction* from the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) (see the website reference below) for instructions on protecting ducts, containing dust and mitigating other IAQ risks. If possible, isolate the part of the HVAC system serving the work areas from the rest of the system. 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

American Lung Association's Health House information: 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/largebldgs/graphics/iaq.pdf or www.epa.gov/iaq/largebldgs/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/

California High Performance Schools (CHPS) Low-Emitting Materials criteria, List of Compliant Products:

www.chps.net/manual/lem_table.htm

A Brief Guide to Mold, Moisture, and Your Home, EPA: 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

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 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 custodial 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 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. A study in the January 2001 *American Journal of Industrial Medicine* found that California janitorial workers experience the highest rates of occupational asthma, more than twice the rate for any other occupation. 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), see the Cleaning Product Selection chapter in *The Pennsylvania Green Building Operations and Maintenance Manual*, developed by the Pennsylvania Department of General Services and Green Seal. Where possible, using a safe multipurpose cleaner for a variety of functions will simplify product research, purchasing, tracking and disposal as well as employee training.

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, benzyldimethylstearyl ammonium 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, the Safety Information Resources, Inc. (SIRI) MSDS Index at siri.org/msds/, msdssearch.com and 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/ to see a list of Green Seal-certified cleaning products. Scientific Certification Systems also certifies products' single-attribute claim of biodegradability (www.scscertified.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.

For any containers of unused chemical cleaning products that are not going to be used, call the city's hazardous waste program to arrange for drop-off at the SF recycling and disposal hazardous waste facility. See the Hazardous Waste section in this manual's Waste Reduction and Recycling chapter.

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 and 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

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.

If propane floor equipment is used, select a machine with a high-efficiency, low-emissions engine.

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 and

GS-40 for industrial and institutional floor care products: www.greenseal.org/certification/standards/gs40.pdf

List of Green Seal-certified cleaners and floor care products: www.greenseal.org/findaproduct/

Greenguard Indoor Air Quality Certification of Cleaning Systems: www.greenguard.org

City of San Francisco Precautionary Purchasing Criteria, Institutional Cleaners Specifications and Technical Specifications for Procurement of Janitorial Cleaners: www.sfenvironment.com/aboutus/innovative/epp/ (San Francisco's Department of the Environment is developing a contract for green cleaning products. Contact the department for an update on its availability.)

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

SCAQMD Clean Air Solvent (CAS) Certification Program, List of Certified CAS Products and Companies:

www.aqmd.gov/rules/cas/prolist.html

List of Prop 65 chemicals "known to the State of California to cause cancer or birth defects" :

www.oehha.ca.gov/prop65/prop65_list/Newlist.html

List of endocrine-disrupting chemicals: www.ourstolenfuture.org/basics/chemlist.htm

List of persistent and bioaccumulative toxins: www.epa.gov/epaoswer/hazwaste/minimize/chemlist.htm

INFORM's Cleaning for Health information: www.informinc.org/cfh_00.php and 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

U.S. GSA Federal Supply Schedule 073 (*Food Service, Hospitality, and Cleaning*): *Cleaning Equipment, Accessories, Janitorial Supplies, Cleaning Chemicals and Sorbents*, August 2004: www.gsa.eplibrary.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

“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

Center for a New American Dream, Institutional Purchasing Program: www.newdream.org/procure/index.php

EnviroSpec: 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

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.

Integrated Pest Management

There are many ways to prevent and control pests without using toxic chemical pesticides or insecticides. San Francisco’s Department of the Environment has an Integrated Pest Management (IPM) Program, which provides guidance and resources on safe ways to control and eliminate pests. IPM emphasizes the use of physical barriers, biological controls and other natural forms of pest control to minimize the use of pesticides to the greatest possible degree. City departments are mandated by city ordinance to use IPM practices.

Please see the Department of the Environment’s *Integrated Pest Management Training Manual*, provided in the Appendix. It provides specific information on the benefits of IPM and methods for controlling a variety of pests, including cockroaches, ants, rodents, flies, fruit flies, fleas and pigeons. If a pesticide must be used, refer to the San Francisco Reduced-Risk Pesticide List in the Appendix to select an approved less-toxic pesticide (also check for updates of the list). To supplement those resources, this section of the manual provides general information on pest management as well as specific information on the prevention and control of bed bugs, given that they have been a problem in this building in the past.

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.

As a general rule, used mattresses and bed frames should not be allowed into the building.

All of the mattresses provided for residents are encased in a permanent plastic covering to prevent infestations. On a periodic basis and whenever there is resident turnover in a unit, each mattress should be checked to make sure its plastic covering is not torn.

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)

San Francisco Reduced-Risk Pesticide List, also in the Appendix (and at 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.).

Select products that are recyclable and are accepted by the San Francisco curbside recycling program whenever possible.

When ordering materials, ask if surplus/unused materials can be returned. Also, ask suppliers to take back and recycle or reuse their packaging materials.

For more information:

The California Integrated Waste Management Board's website has a wealth of information on waste prevention and recycling, including a database of recycled-content products (www.ciwmb.ca.gov/RCP/), a Waste Prevention Information Exchange directory (www.ciwmb.ca.gov/WPIE/) and the CalMAX California Materials Exchange (www.ciwmb.ca.gov/CalMAX/search.asp).

Weekly Recycling Program

Recyclable Materials

Materials that can be recycled in San Francisco 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 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

The building has two large 96-gallon recycling carts for municipal curbside pick-up of the co-mingled recyclables. They are kept in the first-floor trash room. There are also smaller recycling containers in the trash rooms on each floor for collecting recyclables from the residents. These bins are emptied into the larger containers. Each resident also has, in addition to a trash can, a small blue recycling can in his or her unit. These should be emptied into the trash room recycling bins at least once a week.

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.

San Francisco’s Department of the Environment is currently developing an ordinance to require C&D waste diversion and recycling. Once that ordinance is in place, more information and options should be available within the city, and the process of recycling construction and renovation waste should become easier.

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.

In San Francisco, many building materials can be recycled at SF Recycling & Disposal/Sanitary Fill Company at 501 Tunnel Avenue (415.330.1400, www.sfrecycling.com), including mixed C&D waste, mixed inerts (e.g., rocks and concrete), cardboard, untreated wood, pallets, metal, yard trimmings, asphalt and concrete, and bricks. Sunset Scavenger and Golden Gate Disposal and Recycling are local recycling companies affiliated with SF Recycling & Disposal. There are also many other recycling facilities in the Bay Area, including the Blue Line Transfer in South San Francisco and the San Bruno Garbage Company in San Bruno, both of which accept almost all types of materials.

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.

Carpet Recycling

Collins & Aikman (C&A) Floorcoverings has a carpet take-back program. In fact, the company will take any manufacturer’s carpet back and fully recycle it into new carpet. (Patcraft and several other carpet manufacturers will do this as well.) Contact your local C&A representative, call C&A’s headquarters at 800.241.4080 or 800.248.2878, or contact the L.A. Fiber Company at 323.589.5637 for assistance. Or for Patcraft’s carpet recycling program, call 800.241.4014. There is usually a fee associated with having carpet recycled—according to the Carpet America Recovery Effort (CARE), the cost is often 5 cents to 25 cents per pound of old carpet, and carpet typically weighs about 4 to 5 pounds per square yard. The cost is determined by the proximity of the carpet to recycling facilities and by the type of fiber.

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.

San Francisco salvage yards include Building Resources at 701 Amador Street (415.285.7814, www.buildingresources.org) and Caldwell Building Wreckers/Salvage at 195 Bayshore Boulevard (415.550.6777, www.caldwell-bldg-salvage.com). There are many others in the Bay Area, including Urban Ore in Berkeley. For more listings and information, see the resources referenced below.

You can also post items to donate through the California Materials Exchange (CalMAX): www.ciwmb.ca.gov/calmax/, 877.520.9703.

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 (see the brochure from SF Environment in the Appendix)
- 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 the SF Recycling & Disposal facility on Tunnel Avenue. You could also consider donating it to local nonprofit organizations or to paint companies to reuse or recycle. For information on various donation options, go to <http://www.sfenvironment.com/directories/paint2.htm>. San Francisco residents can also drop off small amounts of extra paint at any Cole Hardware store in San Francisco. Cole Hardware also accepts household and rechargeable batteries, fluorescent light bulbs, empty printer cartridges and copper and brass scrap metal. This program is meant for individual residents, not for the recycling of large quantities.

Most hazardous materials can be dropped off at the SF Recycling & Disposal facility on Tunnel Avenue. Maximum quantities are 27 gallons per month or 220 pounds per month. An appointment is required for some materials, but not for universal waste such as fluorescent lamps. Disposal fees vary by type and volume of waste, but generally range from \$1 to \$5 per gallon. For larger quantities of hazardous waste (more than 27 gallons or 220 pounds per month), you must hire a private waste firm for disposal. Individual residents can drop off small amounts of hazardous waste at the same facility free of charge and without an appointment; they only need to bring proof of residence.

For information on which materials can be dropped off, which ones require an appointment and where they can be taken (or who can pick them up), please call 415.554.4333 or 415.330.1425, or check the SF Department of Environment Toxics Disposal and Recycling website: www.sfenvironment.com/aboutus/toxics/.

For more information on recycling, refer to:

City of San Francisco Recycling information: www.sfreycles.org, 415.554.7329 or 415.355.3700
SF Recycling services: www.sfreycling.com, 415.330.1425 or 415.330.1400
San Mateo RecycleWorks, *Construction Site Recycling: A Guide for Building Contractors*, downloadable from www.recycleworks.org/con_dem/

StopWaste/Alameda County Waste Management Authority, *Builders Guide to Reuse & Recycling*, (which lists haulers and recyclers for all types of building materials, is downloadable from www.stopwaste.org/home/index.asp?page=292
To find more information on recycling options for any area in the country, go to www.earth911.org

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. Depending on the facility, these savings can represent thousands to hundreds of thousands of dollars each year."

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*. Refer to the Appendix for The Plaza Apartments' Mechanical Filter Replacement Schedule, which includes recommended filter change-out rates.

Cooling Tower Operation

The critical issue to consider with cooling towers is their use of chemical biocides, along with their energy and water use. *The Pennsylvania Green Building Operations and Maintenance Manual* summarizes the potential hazards concisely: "The most common biocides used in cooling water treatment typically contain significant amounts of chlorides and/or chromates. Both of these compounds can be toxic in low concentrations when released into the environment (through blowdown water getting into the sewage system, for example). In addition, water from blowdown can contain corrosion inhibitors, a high amount of sulfides (if the water is treated for pH), and concentrated amounts of salt (from evaporation)." Some of the tips offered for how to minimize pollution impacts related to cooling tower use follow:

Obtain an MSDS on the chemical additives to help you understand the chemicals present. Avoid the use of chromate-based, chloride-based and phosphate additives where possible. Give preference to additives that are propylene-based over ethylene-based products.

Keep chemical usage to a minimum by tracking and closely monitoring the amounts used and the system's water conditions. Minimize excess blowdowns. Use make-up water only as needed to conserve water and reduce the need for treatment chemicals.

Consider using ozone and/or automatic tube-cleaning systems as non-chemical biocide alternatives. Information on the various advantages and disadvantages of these alternatives is 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). 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). 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

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, 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).

Lighting Disposal/Recycling

In the state of California, the Department of Toxic Substances Control requires all mercury-containing lamps to be recycled. Both fluorescent and metal halide high-intensity discharge (HID) lamps contain mercury and are considered universal hazardous waste. It is illegal to dispose of them as regular trash. Neon signs and exit signs that contain compact fluorescents also contain mercury. See the Fluorescent Lamp Recycling flyer from SF Environment in the Appendix. For more information, call 415.330.1425 or 415.355.3700.

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

Energy Star Buildings: www.energystar.gov/buildings/ and Energy Star products: www.energystar.gov/products

Flex Your Power (California's energy efficiency resource): www.fypower.org

PG&E Energy-Efficiency Rebates for Multifamily Properties: www.pge.com/res/rebates/lighting/multi_family_properties/

PG&E Energy-Saving Resources: www.pge.com/res/rebates/energy_tools_resources/index.html

PG&E Pacific Energy Center: www.pge.com/pec

Public Housing Authority Energy Efficiency Toolbox, developed by Global Green USA:

www.globalgreen.org/pha-energytoolbox/

Portland Energy Conservation, Inc: 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

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

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

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.

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 (The guide covers plumbing, landscaping, cooling towers and many other building water use topics.)

California Urban Water Conservation Council: www.cuwcc.org

Consumer Water Center Conservation Resources (American Water Works Association):

www.drinktap.org/consumerdnn/

Water Wiser (American Water Works Association): www.waterwiser.org

Resource Venture, Water Conservation Resources:

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

Make sure the courtyard's 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 California 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.

The city will issue a green compost bin to the building for landscape debris as well as food waste collection. Consider requesting this bin from the city.

Compost and mulch can be used to keep soil healthy and eliminate or minimize the use of fertilizers.

More information:

California Native Plants Gallery, Theodore Payne Foundation for Wildflowers & Native Plants:

<http://www.theodorepayne.org/gallery/glossary.htm>

Bay-Friendly Landscape Guidelines, Alameda County Waste Management Authority (ACWMA):

<http://stopwaste.org/home/index.asp?page=188>

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. San Francisco's Department of the Environment has an Integrated Pest Management (IPM) Program that provides guidance and resources on safe ways to control and eliminate pests. IPM emphasizes the use of physical barriers, biological controls and other natural forms of pest control to minimize the use of pesticides to the greatest possible degree. City departments are mandated by an ordinance to use IPM practices.

Please see the Department of the Environment's *Integrated Pest Management Training Manual* in the Appendix. It provides specific information on the benefits of IPM and on methods of managing a variety of pests, including cockroaches, ants, rodents, flies, fruit flies, fleas and pigeons. If a pesticide must be used, please refer to the San Francisco Reduced-Risk Pesticide List in the Appendix to select an approved less-toxic pesticide. Check for recent updates of the list at:

http://www.sfenvironment.com/aboutus/innovative/ipm/pest_list06/index.htm.

Stormwater Filtration

Rain or stormwater that hits the building site drains into a simple filtration system under the wood patio decking in the courtyard so that it can be absorbed and filtered into the ground rather than run off the site. 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.

For more information on best practices for the maintenance of outdoor lighting, refer to the Lighting Maintenance chapter, Section D: Outdoor Lighting and Exterior Lighting Maintenance, in *The Pennsylvania Green Building Operations*

and Maintenance Manual, Commonwealth of Pennsylvania w/ Green Seal and the Department of General Services' Property Management:
<http://www.dgs.state.pa.us/dgs/cwp/view.asp?Q=118184&A=363>

II. Green Materials and Systems at [Project Name]

The first part of this section lists the green materials, finishes and systems used in The Plaza Apartments. In the second part of the section, a few components are described in more detail on Green Product Summary sheets. These are for materials or components that property management and maintenance staff might not have worked with before, as they are not yet commonly used in most buildings. There are product summaries on the building's roof coating, linoleum flooring and bamboo flooring. The summaries include the products' green attributes, manufacturer and supplier information, care and maintenance (including cleaning) guidance, as well as tips on disposal, recycling, replacement and installation.

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. For an example of the types of information that could be provided in this section, see the green O&M manual for The Plaza Apartments.]

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.

[CUSTOMIZE]

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:

[FILL IN: 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. Adhesives and sealants should not exceed the VOC limits set by the South Coast Air Quality Management Board (SCAQMD) and the Bay Area Air Quality Management District (BAAQMD):

SCAQMD Rule 1168: www.aqmd.gov/rules/rulesreg.html

BAAQMD Regulation 8, Rule 51: www.baaqmd.gov/dst/regulations/index.asp

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)

[FILL IN]

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:

B. Green Product Summaries with Maintenance Guidelines

GREEN PRODUCT SUMMARY

Roof Coating

Manufacturer/brand: **Johns Manville**
Product line/style: **TopGard 5000** acrylic elastomeric coating, white

Manufacturer Contact Info:

Johns Manville
Denver, CO
1.800.654.3103

Email:

www.jm.com, www.jmcoolroofs.com

Local Suppliers/Contractors:

Alcal Roofing, Hayward; Enterprise Roofing, Concord; Alliance Roofing, San Jose

TopGard 5000 is a 100-percent-acrylic, elastomeric reflective coating applied over TopGard Base Coat. It is used over both modified and built-up roofing systems for commercial/industrial roofs. On The Plaza Apartments building, it was used over a Johns Manville 4GIC built-up roof.

According to the Cool Roof Rating Council (www.coolroofs.org), “By reducing typical roof surface temperatures by 50°F or more, cool roofs provide a number of potential immediate and long-term benefits to building owners and managers.” These include lower utility bills for cooling (by reducing the building’s heat gain), greater occupant comfort, a lessened heat island effect for the surrounding community, lower roof maintenance costs and longer roof life. According to *The Pennsylvania Green Building Operations and Maintenance Manual*, a light-colored reflective roof coating will help “extend the life of the roof by reflecting the UV rays in sunlight that break down many roofing materials.” Coatings typically last approximately 10 years.

Green Attributes

Energy efficient: Meets or exceeds the emissivity and reflectivity (i.e., high albedo) requirements of California Title 24 as certified by the Cool Roof Rating Council, LEED roof requirements and ENERGY STAR reflectivity requirements

Durable: Acrylic is very durable and provides seamless waterproofing; exceeds ASTM D6073 requirements for tensile strength, elongation, wet adhesion and weatherability

Mold-resistant: Zero growth rating for fungi resistance

CARE & MAINTENANCE

The Johns Manville website states: “Due to normal wear and tear, some degradation of roof reflectivity can be expected, particularly within the first few years. Low-slope roofs may accumulate more dirt and debris because they’re not as easily washed by rain. Good maintenance procedures can minimize degradation and maximize energy savings.”

The Lawrence Berkeley Laboratory’s Heat Island Group has studied the effects of weathering and accumulation of dirt (primarily black carbon) on the reflectivity of high-albedo roof coatings and has found that albedo decreased the most during a roof’s first year. However, they also found that washing the roof with a mild soap and water restored the initial reflectivity values.

Global Green USA's *Public Housing Authority Energy Efficiency Toolbox* states: "To maintain the reflectance of the roof, keep it free of dirt, soot and microbial growth. Lawrence Berkeley Laboratory recommends washing the roof annually. Providing good drainage is also essential to keeping the roof reflectance high. A good drainage system will reduce the moisture build-up on your roof that causes algae growth."

The Pennsylvania Green Building Operations and Maintenance Manual recommends the following roof maintenance procedures:

Perform routine roof inspections monthly, and perform a roof inspection after severe weather. In addition, "qualified staff should thoroughly inspect the roof twice a year (once in the spring and once in the fall) to identify problems such as any split seams, separated layers, failed flashings, clogged drains and surface punctures. The inspections should include an examination of the building interior areas directly below the roof."

Keep roofs clean and free of debris. Remove any vegetation at the roots, and patch up any holes in the roof membrane. Also, "grease from exhaust fans, oil leaking from HVAC units, and air pollutants can damage roof materials."

Keep drainage systems clear.

Keep roof access limited to authorized personnel to minimize foot traffic.

The manual also suggests painting the rooftop equipment with white or light-colored paints (when the equipment needs to be painted) in order to extend the "cool roof" benefits beyond the roof surface itself.

REPLACEMENT/INSTALLATION TIPS

The product is available in 5-gallon pails, 55-gallon drums and 275-gallon totes.

Request the manufacturer's literature for installation instructions.

GREEN PRODUCT SUMMARY

Linoleum Flooring

Manufacturer/brand: **Forbo**

Product: **Marmoleum**

Pattern: Van Gogh in apartment units

Type: Acoustic with polyolefin foam in apartment units

Locations in the building: Apartment kitchens, the nurse's office and the community room closets

Manufacturer Contact Info:

Forbo Flooring

Hazleton, PA

1.800.842.7839 or 1.866.Marmoleum

Email: info@FL-NA.com

www.themarmoleumstore.com

Local Suppliers:

FloorCraft, Linoleum Larry's, Abbey Carpet (all in San Francisco)

This product, also known as natural linoleum, is different from vinyl flooring, which is sometimes generically referred to as linoleum. It is available in sheets or tiles. Natural linoleum is an environmentally preferable and more durable alternative to vinyl flooring. Vinyl flooring contains polyvinyl chloride, or PVC. Dioxin is a by-product of PVC production, so it is extremely toxic in the manufacturing process and if burned. It should be noted that natural linoleum can offgas aldehydes

from the linseed oil, and that odor has been known to bother some people. Natural linoleum is currently manufactured in Europe, so its transportation is energy intensive. However, the energy used in its manufacturing is relatively low.

Green Attributes

Made of natural, biodegradable, renewable materials: Linseed oil, pine rosin, wood flour, cork flour and limestone, with a jute backing; contains no heavy metals or PVC

Durable: Typically lasts 30 to 40 years compared to only 10 to 15 years for vinyl flooring; material is very resilient and hardens over time; the pattern/color is dyed all the way through for even wear

Recycled content from factory production waste

Low toxic: Has met the stringent California Section 01350 emissions testing standards (Forbo's sheet linoleum passed this test for use in the California East End Building 225 in Sacramento); its adhesives are also low-VOC and 100 percent solvent-free.

Low maintenance: Natural linoleum does not need to be waxed (see below)

Mold resistant: Linseed oil naturally kills bacteria and mold

Anti-static: Natural linoleum repels dust and dirt

CARE & MAINTENANCE

Care

Keep linoleum flooring dry most of the time. It can degrade over time if it is subject to standing water or continuous moisture. If additional protection is needed, the flooring can be sealed or re-sealed. Use Marmoleum Floor Finish or equivalent. See Forbo's Caring for Your Marmoleum sheet in the Appendix for instructions on finishing.

Some colors of linoleum—particularly blue and gray shades—will occasionally get a yellow cast on the surface due to oxidation of the linseed oil. This is only temporary and will disappear when the area is exposed to light.

Cleaning

Linoleum is low-maintenance flooring. Do not strip and wax it like vinyl flooring. Instead, for regular maintenance, simply sweep or dry mop it with a dust mop, electrostatic cloth, broom or vacuum. And occasionally, when the floor needs a deeper cleaning, wipe it with a damp cloth or mop using a mild detergent diluted in water, or one tablespoon of vinegar per 5 liters or 8.5 pints of water. Do not use ammonia or other highly alkaline or high-pH products. Forbo's nontoxic Marmoleum Concentrated Floor Cleaner is formulated specifically for these floors. Do not use a lot of water for mopping. And never use furniture polish or silicone products on the linoleum.

Repairing Scratches/Removing Adhered Dirt and Stains

Areas of the floor that have scratches, cuts or adhered dirt should be buffed with a soft nylon brush, nylon cleaning pad or scrubbing sponge. For larger areas or ingrained dirt, use a small rotary floor machine or wet vacuum cleaner system. Then apply a light coat of the finish/sealer.

For persistent stains (e.g., from glue, varnish, ink, wine), remove the surface finish, rub the stained area with a nylon cleaning pad and undiluted Marmoleum Concentrated Floor Cleaner; leave that on for 2 to 3 minutes, then rinse with clear water. Repeat as necessary and, when dry, apply a small amount of polish.

DISPOSAL/RECYCLING

Natural linoleum is made of nontoxic and biodegradable materials, so it can safely be disposed of in landfills. There is currently no alternative to landfill disposal or incineration for this product.

REPLACEMENT/INSTALLATION TIPS

Hire an installer—preferably a manufacturer-certified installer—who has experience with installing natural linoleum, as the procedure requires skill and the proper tools. It is a different procedure from vinyl flooring installation. Also, linoleum expands somewhat over time, making the seams tighter, so installation should account for this expansion.

The installation instructions provided in *The Materials Handbook* from the Mayor’s Office of Housing and Asian Neighborhood Design are as follows: “Linoleum should be allowed to acclimate to the environment in which it will be installed for at least one week prior to installation. A smooth substrate is very important, as any irregularities in the subfloor will telegraph through the finish floor. If installing in an existing building with an irregular surface, it may be necessary to first cover the existing surface with quarter-inch plywood. Linoleum can be installed over a slab or gypcrete, but the subsurface must be tested for water content. If it is too wet, the linoleum may buckle. Full glue-down application with water-based low-VOC adhesives is recommended.” Forbo’s adhesives (T940 and L910) meet California’s stringent SCAQMD VOC standards. “Be sure to use adhesives specifically manufactured for linoleum as opposed to glues made for other sheet products such as vinyl. Linoleum expands and will form bubbles unless fully glued down in place. Heat-sealed seams should be specific in damp areas to prohibit water intrusion, though be aware that the heat welding will create a visible seam. Glued seams, by contrast, are virtually invisible.”

If a sealer/finish will be applied, use Forbo’s low-VOC polyurethane Marmoleum Floor Finish. See the Appendix for Forbo’s instructions on applying the finish.

Due to the offgassing of the linseed oil in linoleum, it is a good idea to let the newly installed flooring air out for a few days with windows opened before the room is occupied. It is also a good idea to wait at least five days for the adhesive to cure fully before wet mopping the newly installed floor or moving heavy furniture on it.

More information is available on Forbo’s website. A downloadable *Marmoleum Care Guide* is available at www.themarmoleumstore.com.

GREEN PRODUCT SUMMARY

Bamboo Flooring

Manufacturer/brand: **Nikzad Import, Inc.**
Product: **Prefinished bamboo strips**
Vertical grain, Carbonized Light color, Aluminum oxide finish

Locations in the building: First-floor and elevator lobbies; community room

Manufacturer Contact Info:

Nikzad Import
Los Angeles, CA
1.866.322.6266 or 323.733.1444
Email: customerservice@nikzad.com
www.nikzad.com

Bamboo is a fast-growing grass that can typically be harvested in a three- to five-year cycle. It is made into many types of materials, including flooring. It is very strong and durable as well as aesthetically pleasing. Most bamboo for flooring is grown in Asia, so its transport to North America results in significant embodied energy. There are not yet certification standards for the sustainable harvesting of bamboo. Some bamboo flooring manufacturers use resin binders that contain formaldehyde, but others (including Nikzad) do not.

Green Attributes

Rapidly renewable: Bamboo is a fast-growing grass with a short harvest cycle.

Durable and strong: Bamboo is extremely hard, as hard as or harder than many hardwoods, including red oak and maple. It typically lasts 30 to 50 years.

Low-toxic: Formaldehyde-free binders. Nikzad's Urethane adhesive is also low-odor and complies with California's VOC limits.

Low-maintenance: Bamboo flooring does not need to be waxed (see below).

CARE & MAINTENANCE

Nikzad warrants all of its laminated bamboo planks to be free from defects for a lifetime. The company will replace any defective planks and finish material. The company also offers a two-year wear-through warranty for commercial application of its flooring finish, with certain exclusions. See Nikzad's website or contact the company.

Care

Do not wax the bamboo flooring. Some manufacturers recommend applying an additional coating of urethane every year for high-traffic commercial areas or every two to three years for medium- traffic areas.

Keeping the room temperature moderate and stable and maintaining relative humidity at around 50 percent will help minimize contraction and expansion of the flooring, which should keep it from cracking.

Keep the flooring dry as much as possible. Wipe up spills immediately and place walk-off mats at entrance doors. Avoid rubber or other non-ventilated mats. The use of mats should also reduce the amount of abrasive materials (pebbles, glass pieces, etc.) tracked onto the flooring from outside. To keep the floor from being dented, put protectors under furniture feet and use wide casters on caster-wheeled chairs.

If the floor gets nicked or scratched, bamboo flooring can typically be sanded, buffed and resealed, just like hardwood floors.

Cleaning

Sweep or vacuum bamboo floors frequently to avoid the build-up of abrasive particles.

When mopping the floor, use a damp—not wet—mop only, or use a padded cleaning head on a vacuum cleaner. Cleaning with water is usually enough, but if a floor cleaner is necessary, most non-alkaline cleaners used on hardwood floors can also be used on bamboo floors. Select a mild, nontoxic product (see the Green and Healthy Housekeeping chapter for criteria). Again, do not use wax on bamboo flooring. If you do use a floor-cleaning product, be careful to spread it evenly over the flooring surface, and don't let it pool.

If an oily substance such as asphalt residue is tracked onto the flooring, clean it up quickly, as it can cause stains. Do not use abrasive materials such as steel wool or scouring powder on bamboo flooring, as they could damage its finish.

Many of these recommendations were gathered from another bamboo flooring manufacturer and other sources, not directly from Nikzad. See the product documentation provided by the contractor, or contact the company for more specific instructions.

DISPOSAL/RECYCLING

Bamboo is a natural, biodegradable material, so it can be safely disposed of in a landfill. However, first consider giving it to a reclaimed/salvaged wood company or donating it elsewhere for reuse. Alternatively, if the finish and adhesive are removed, it could also be burned for heat/energy.

REPLACEMENT/INSTALLATION TIPS

Select tongue-and-groove or nail-down flooring to minimize or eliminate the need for an adhesive. If an adhesive must be used, select a low-VOC adhesive. Nikzad's Urethane adhesive is low odor and complies with California's VOC limits.

The installer should conduct as much sawing and sanding as possible outside the building to minimize air quality impacts.

For detailed installation instructions, go to www.nikzad.com/bambooinstallation.php

Sources: Nikzad website; BuildDirect University (builddirect.com), and Duro-Design bamboo website

APPENDIX

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Linoleum (Marmoleum) Maintenance Guide from Forbo
Integrated Pest Management (IPM) Training Manual from SF Environment
Reduced-Risk Pesticide List (2006) from the City and County of San Francisco
Recycling Collection poster/sheet from the City and County of San Francisco
Hazardous Wastes information sheet from SF Environment
Fluorescent Lamp Recycling brochure from SF Environment
Public Transit Information and Map
Resources for More Information

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

PUBLIC TRANSIT INFORMATION AND MAP

Information on local transit service and routes is available at:

www.511.org (or call 511)

and

www.sfmuni.com (or call 415.673.6864)

For MUNI's Accessible Services information for seniors and persons with disabilities, call 415.701.4485.

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

California High Performance Schools (CHPS) *Best Practices Manual, Volume IV: Maintenance & Operations*, 2004
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

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

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

Green Affordable Housing Resources

Programs and Agencies

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

Enterprise Community Partners
www.enterprisecommunity.org

San Francisco Mayor's Office of Housing
www.sfgov.org/moh

Global Green USA: Greening Affordable Housing Initiative
www.globalgreen.org/greenbuilding/GAHI.html

Green Affordable Housing Coalition
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

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/

Multifamily Green Building Guidelines, Alameda County Waste Management Authority, 2004
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

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

General Green Building Resources

Organizations and Informational Websites

Build It Green

www.builditgreen.org

U.S. Green Building Council

www.usgbc.org

Building Green / GreenSpec / Environmental Building News

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/

San Mateo County RecycleWorks green building program

www.recycleworks.org

Alameda County Waste Management Authority's StopWaste program

www.stopwaste.org

California Integrated Waste Management Board, Green Building program

www.ciwmb.ca.gov/greenbuilding/