

Cleaning for Health: Products and Practices for a Safer Indoor Environment

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INTRODUCTION

Over the past 10 years, awareness has grown of the effect of the indoor environment on an individual's sense of well-being. In particular, increasing attention has been paid to the issue of indoor air quality. High-quality indoor air results from good air circulation and exchange, proper temperature and humidity control, and control of airborne contaminants, odors, and dust.

In schools, hospitals, office buildings, and other institutions, paying attention to how a facility is cleaned can make a significant difference in the quality of indoor air and the chemicals to which workers and occupants are exposed. Good indoor air quality produces an environment that is healthy and comfortable. It is also good business, resulting in increased worker productivity, reduced absenteeism, and reduced medical and insurance costs. According to one analysis, US businesses could realize a productivity gain of \$30 to \$150 billion annually, and an increase in worker performance of 0.5 to 5 percent, by improving the indoor environment through better ventilation and cleaning.¹

By choosing cleaning methods, products, and equipment carefully, identifying and addressing contamination "hot spots," reducing the on-site storage of toxic chemicals, and introducing higher standards as to what constitutes a "clean" space, janitorial cleaning can perform a real environmental service.

This guide is designed to assist those who wish to improve the indoor environment and worker health by using proper cleaning and preventive methods and choosing the safest available cleaning products. It addresses:

- ▶ Common causes of poor indoor air quality and how to prevent it.
- ▶ Cleaning methods to improve the indoor environment.
- ▶ Health and safety risks of janitorial workers and how to reduce them.
- ▶ Health effects of common cleaning chemicals and disinfectants, and how to minimize use and exposure.
- ▶ What to look for and avoid in janitorial cleaning products.
- ▶ Existing programs that have evaluated the environmental attributes of cleaning products.
- ▶ Products determined to be "environmentally preferable."

The information contained in this guide is applicable to all building types and can be used by a wide variety of groups, including:

- ▶ Janitorial service companies and janitorial departments that wish to reduce their chemical use and improve indoor air quality in the buildings they serve.
- ▶ Building occupants and janitorial workers concerned about the cleaning chemicals to which they might be exposed.
- ▶ Institutional purchasers interested in purchasing less toxic janitorial products.
- ▶ Labor unions and other groups concerned about occupational safety, indoor air quality, and janitorial chemical use.

FINDINGS

1. Poor-quality indoor air can produce health effects in occupants ranging from headaches and dry eyes to nausea, dizziness, and fatigue.

Building design flaws, heating and ventilation problems, occupant activities, and chemical products that are improperly used, sealed, or stored can contribute emissions and contaminants to the indoor environment. These, in turn, may cause "building-related illness," a diagnosable illness attributable to airborne building contaminants, or "sick building syndrome," which causes symptoms associated with occupancy of a specific building but no specific illness is identified.

2. Janitorial workers experience relatively high injury rates, many of which are due to the toxic chemicals found in cleaning products, particularly floor and carpet maintenance products, disinfectants, and specialty cleaners. These chemicals can cause headaches, asthma, burns, permanent eye damage, major organ damage, and even cancer.

Of particular concern are disinfectants, all of which pose health and/or environmental risks. Their active ingredients are among the most toxic chemicals used in cleaning, and include quaternary ammonium compounds (quats), bleach, ethyl and isopropyl alcohol, formaldehyde, and phenolic compounds.

3. Improved cleaning methods and less toxic products can positively affect indoor air quality and worker health.

In one study, implementation of improved cleaning and preventive techniques, such as focused dust removal from all surfaces, use of large entryway mats, and damp-mopping instead of sweeping, reduced airborne bacteria by 37 percent, fungi by 62 percent, and dust by 52 percent.² Another study found that the use of hazardous chemicals could be reduced by 5.4 pounds per janitor per year, or 13 percent, if janitors used fewer chemicals, substituted less toxic chemicals, installed mats and vacuumed, and avoided aerosol products.³

4. Information is available to help entities choose less toxic products.

Information on toxic ingredients, volatile organic compound (VOC) content, and flash point (the temperature at which a volatilized product can ignite) is readily available for most products. This information can be used to compare different products and choose those that are least likely to ignite and have the smallest quantity of toxic chemicals and the least impact on indoor air quality. Many manufacturers are now providing other environmental information as well, such as biodegradability, skin and eye irritation data, aquatic toxicity, and full ingredient lists upon request.

5. Less toxic and equally effective products are available for almost all applications.

INFORM's survey of groups that have evaluated and purchased cleaning products with less toxic chemicals or other positive health and environmental attributes found that many have switched entirely to less toxic and low-VOC products. Many products in use are also biodegradable, free of chemicals listed on the federal Toxics Release Inventory, and free of carcinogens. (See Table 6 for a list of all the environmentally preferable products used by the surveyed groups, including disinfectants, general-purpose cleaners, degreasers, tub and tile cleaners, toilet cleaners, and glass/window cleaners.)

RECOMMENDATIONS

1. By cleaning for health first and appearance second, janitorial service companies and departments can improve indoor air quality while protecting the health of building occupants and workers.

Strategies such as preventing the introduction of dirt and dust into a facility, focusing on dust and airborne contaminant removal, preventing water damage, and using proper cleaning methods can reduce indoor air pollution and the toxicity and volume of products used. While occupants may complain that the lack of a "chemical" or "fragrant" smell indicates that bathrooms have not been adequately cleaned, they can be educated about the elements of effective cleaning and the importance of reducing the use of volatile, odorous products.

2. By evaluating products and purchasing the least toxic ones available, institutions can reduce the risk to workers and the environment while maintaining high-quality cleaning standards.

To make an informed decision about which products to use and which to avoid, buyers can read the material safety data sheets for all products, ask vendors about their products, and use the information provided by vendors to evaluate a product's environmental attributes. Products without toxic chemicals are available for most cleaning applications.

3. To reduce their environmental and health impacts, disinfectants should be used carefully and selected based on their efficacy and purpose.

Different disinfectants kill different organisms, so only products that contain the ingredients needed to kill the target organism should be used; the product label generally lists the types of organisms against which a disinfectant is effective. In addition, most disinfectants are only effective on clean surfaces, so surfaces should be cleaned before the disinfectant is applied. Label instructions should be followed precisely or the product may not be effective.

4. Educating janitorial workers in proper cleaning methods, the effective use of cleaning chemicals, and the health hazards of specific chemicals contained in the products they use can reduce exposures to toxic chemicals and other building hazards.

In some applications, even an environmentally preferable alternative product will still pose some type of health hazard or environmental risk (this can be the case when a disinfectant is required). Janitorial workers often handle highly toxic chemicals with little or no knowledge of their toxicity or how to prevent injury. Training them to handle hazardous products correctly, to avoid spraying or otherwise contaminating the air with cleaning products, and to dilute products correctly can reduce the risk of chemical injury and the amount of product required for the job.

5. Facilities interested in reducing their use of toxic cleaning products can take advantage of the many janitorial pollution prevention projects that have successfully implemented improved cleaning practices and evaluated and promoted environmentally preferable products currently on the market.

Groups that wish to implement their own programs can build on the successes of these projects and avoid the pitfalls of inadequate training or insufficient buy-in. Facilities planning to implement a janitorial pollution prevention project can contact the planners of previous projects, use existing evaluation schemes, or use the same products used in these successful programs.

Chapter 1

SICK BUILDINGS AND OTHER INDOOR AIR PROBLEMS

According to the US Occupational Safety and Health Administration (OSHA), “Indoor air pollution may be caused by physical, chemical or microbiological agents, and is aggravated by poor ventilation.”¹ The term “sick building syndrome,” according to the American Lung Association, refers to “situations in which occupants of large buildings experience acute health and comfort effects that appear to be linked to time spent in a building, but no specific illness or cause can be identified.” Occupants may experience these symptoms throughout the building or in a particular room or area. The American Lung Association describes “building-related illness” as a diagnosable illness whose symptoms “can be attributed directly to airborne building contaminants.”² In the case of both sick building syndrome and building-related illness, building occupants may experience headaches; irritation or dryness of the eyes, nose, throat, or skin; dizziness; nausea; and fatigue.³

Where Does Poor-Quality Indoor Air Come From?

Building design flaws

- ▶ “Tight” buildings with little natural ventilation. Since the 1970s, in response to rising energy costs, designs incorporate less natural air exchange through windows and building materials.
- ▶ Leaky buildings with poor control of heat and humidity, leading to high relative humidity. Condensation and pooling of water in and around refrigerators, humidifiers, air conditioners, drain pans, water fountains, toilets, and sinks are breeding grounds for molds, mildew, bacteria, and cockroaches.

Ventilation system design flaws

- ▶ Poor placement of vents in relation to workspaces and other places where people congregate.
- ▶ Inadequate air exchange or climate control, often in the interest of saving energy.
- ▶ Improperly located intake air vents, which can take up polluted air from the building’s loading dock, exhaust vent, or dumpster, or exhaust from a nearby building or restaurant, and circulate it throughout the system.
- ▶ Lack of an effective intake air filter, allowing contamination from a nearby highway or industrial facility to enter the system, regardless of intake air vent location.

- ▶ Overly dry air, common in many air-conditioned buildings, causing dry skin and mucous membranes.

Building renovations or other construction work in an occupied building

- ▶ New construction and interior design materials, such as insulation, pressed wood and plywood products, fabric finishes, adhesives, and carpet, may off-gas formaldehyde and other volatile organic compounds (VOCs), particularly when they are first installed. Dust, particulates, fungi, or other biopollutants released during renovations may drift into occupied areas or enter the ventilation system.
- ▶ Shifting of workspaces and cubicles so they no longer correspond to the location of vents. Dividing one room into two by creating a new wall may cut off ventilation to one of the rooms if the original room had only one vent.

Occupant activities

- ▶ The presence of pets (e.g., in a school or daycare center) increasing the concentration of allergens such as dander and excrement. Pet food and water dishes can become growth media for microbes.
- ▶ The presence of small children, bringing allergens and bacteria into the environment through dirty diapers. Activities such as playing in the sandbox can contribute particulates to the air that are irritating to the lungs and eyes.
- ▶ Smoking, which can seriously degrade indoor air quality.
- ▶ Vocational training, laboratory work, and art activities may involve products that release contaminants into the air.
- ▶ Use of equipment such as photocopiers releases ozone and VOCs; everyday office supplies, such as some brands of correction fluid, glue, and marker pens, emit toxic chemicals.

Improper storage or use of chemicals and other products that release VOCs and other toxicants

- ▶ Open-air use of chemicals that should only be used in a chemical hood (a ventilated, enclosed area that directs air flow from the user to outside the building).
- ▶ Failure to close containers of volatile chemicals during use (e.g., during art classes).

- ▶ Storage of chemicals in leaky containers or containers that do not close properly.
- ▶ Failure to close containers when products are not in use.

Cleaning services

- ▶ Insufficient cleaning of kitchens, bathrooms, and water drain pans, leaving nutrients for microbes and pests.
- ▶ Leaving food waste overnight, which can attract pests.
- ▶ Dusting, sweeping, and vacuuming techniques that release more dust than they clean.
- ▶ Improper storage and use of scented products and harsh cleaners that release VOCs, respiratory irritants, and other toxicants into the air.
- ▶ Improper use of concentrated cleaning chemicals (e.g., failure to dilute before use).

Other sources

- ▶ Sewer gas entering through rarely used drain traps where water has evaporated.⁴
- ▶ Carbon monoxide leaking from gas heaters and stoves.⁵
- ▶ In older buildings, exposed asbestos circulating through indoor air.
- ▶ Lead dust from exposed and chipping lead paint.
- ▶ Pesticides used indoors or drifting in from outside through windows or the ventilation system.
- ▶ Chemicals leaking through the building foundation from contaminated soil.
- ▶ Radon emanating from the earth below the building.⁶

For more information on specific emissions and contaminants in the indoor environment, see OSHA's 1994 Proposed Indoor Air Quality Standard in the *Federal Register* at http://www.osha-slc.gov/FedReg_osh_data/FED19940405.html.

Health Effects of Indoor Air Contaminants

Many indoor air pollutants, such as VOCs, formaldehyde, and ozone, can cause health problems for building occupants. According to OSHA, "Individuals with underlying pulmonary disease, such as asthma, are more susceptible than others to acute exposure to these indoor air contaminants and experience coughing and wheezing at low levels of exposure."⁷ Biological contaminants can cause respiratory irritation, infectious diseases, fever, flu, and

eye, nose, and throat irritation.⁸ Excessive VOCs can cause headaches and eye and respiratory irritation.⁹ Products of combustion in improperly vented furnaces and fireplaces can cause headaches, drowsiness, impairment of vision, and mental confusion. Formaldehyde, a chemical commonly found in furnishings and building products, can cause irritation of the skin, eyes, nose, throat, and respiratory system, as well as impaired respiratory function and cancer.¹⁰

Some pollution factors have a synergistic relationship, meaning that the interaction of two or more substances has a health effect greater than the sum of the individual effects. For example, synergism between chemical contaminants, such as ozone and VOCs, can aggravate asthma. And people with underlying pulmonary disease may be at "increased risk of pulmonary infections due to the synergistic effect between chemical and microbial contaminants," according to OSHA.¹¹

For specific respiratory and other symptoms associated with particular indoor pollutants, see the US Environmental Protection Agency's "Diagnostic Quick Reference" at <http://www.epa.gov/iaq/pubs/hpguide.html#Diag Quick Ref>.

For sources, impacts, controls, and detection of specific indoor air pollutants, see the National Agricultural Safety Database's "Questions About Indoor Air Quality" at <http://www.cdc.gov/niosh/nasd/docs4/sc98008.html>.

For indoor pollutants associated with asthma, see OSHA's Proposed Indoor Air Quality Standard, Table III-4, at http://www.osha-slc.gov/FedReg_osh_data/FED19940405.html.

Assessing Indoor Air Quality Problems

A janitorial service typically does not have the expertise to measure indoor air contaminants scientifically. This is a function properly performed by an industrial hygienist or environmental scientist using sophisticated equipment. However, in the course of their normal work, janitors may observe some of the signs of indoor air problems. Alerting the client or building management to these problems can be valuable in triggering remediation. The client may

choose to do scientific testing, hire a consultant, or correct what is likely to be a maintenance problem. Table 1 provides a checklist of typical maintenance

problems that may be contributing to poor indoor air quality, which janitorial staff can either point out to building management or address themselves.

Table 1. Indoor Air Pollution Source Checklist

Check	Question	Comments	Solution
Vents	Is there adequate air flow?	Hold a tissue to the vent. The tissue should flutter away if it is an exhaust vent, or be sucked in if it is an intake vent. Ensure that the system is on when performing this test.	If air flow is inadequate, report the problem to the building manager so the ventilation system can be serviced.
Vents	Is there excessive dust or slime near the vent?	This indicates contamination inside the ventilation system.	Some molds and fungi that cause slime can be hazardous to humans. Professional mediators should be consulted before attempting cleaning, and staff should consult the US EPA's "Mold Remediation in Schools and Commercial Buildings" at http://www.epa.gov/iaq/molds/index.html.
Vents	Are no vents visible in the room?	Vents blocked by furniture, pictures, or other items may be found behind tall bookcases, under tables, or even under rugs.	Move furniture and accessories to expose the vent(s).
Chemicals, Art and Activity Supplies, Janitorial Chemicals	Are any containers unsealed, open, or leaking?	Chemicals evaporating into the air from unsealed or leaking containers can cause indoor air pollution; two or more chemicals may interact to form more toxic or flammable combinations.	- If a container cannot be closed or sealed, transfer the contents to a labeled, sealable container, or place the original container inside a larger, sealable container. - If the product is outdated, dispose of it properly (determine if it must be disposed of as hazardous waste). - If building occupants are neglecting to close containers, explain to them the importance of keeping them closed.
Chemicals, Art and Activity Supplies, Janitorial Chemicals	Are all containers labeled?	Unlabeled containers may contain hazardous materials or cause materials mistaken for something else to be used improperly.	If unlabeled containers are suspected to contain hazardous materials, consult with an environmental health and safety specialist.
Chemicals, Art and Activity Supplies, Janitorial Chemicals	Are hazardous products being used without adequate ventilation?	Hazardous products used without adequate ventilation can build up in the air and cause health and safety problems.	All hazardous products should have material safety data sheets (MSDSs) stored on-site; exposure precautions described in MSDSs should be followed. Some chemicals should only be used in a chemical hood.

Check	Question	Comments	Solution
Pests	Could cracks and holes in walls or floors allow insects and rodents to enter?	Dander and excrement from pests can cause indoor air quality problems.	• Notify the building manager of cracks and holes so they can be repaired.
Pests	Are dead pests, pest droppings, dander, or other obvious signs of pests visible?	These signs in a particular area may indicate a localized pest problem.	• Check the surrounding area for food waste or other pest food sources and remove them. • Check for cracks and holes in walls or floors. • Consider implementing an Integrated Pest Management (IPM) program.
Water Problems	Are there stained or discolored walls, ceilings, or ceiling tiles?	This may indicate a leak in the roof or side of the building. Continual water leaks can cause mold and mildew, resulting in air quality and health problems.	• Notify the building manager to repair the damage to the outside and inside of the building to prevent future leaks.
Water Problems	Are there areas of condensation around windows, pipes, or indoor surfaces of exterior walls?	This moisture can cause mold and mildew growth. Areas of condensation may be inadequately insulated or may need to be dehumidified.	• Notify the building manager to adequately insulate or install a dehumidifier in problem areas.
Water Problems	Does water collect in refrigerator or air conditioner drain pans, around sinks, or around vents?	Pools of water can breed bacteria, mold, and mildew, and provide water for other pests.	• Clean and empty drain pans regularly. • Repair sink leaks. • Find the cause of moisture around vents and make the necessary repairs.
Asbestos	Loose or shredded insulation around pipes or in other areas may be asbestos, especially in older buildings.	Asbestos can cause serious lung damage and may only be removed by a licensed contractor.	• If asbestos is suspected, call a licensed asbestos professional for an evaluation immediately. An untrained person should never attempt to remove asbestos. • Seal off from occupants any loose or shredded insulation that is not asbestos.
Stuck Windows	Are windows stuck, painted, or nailed shut or open?	Many older buildings use windows for ventilation, which works only if windows can open and close.	• For both ventilation and fire safety reasons, most windows should be functional. Check with the building manager to ensure that windows are not intentionally sealed for safety or other reasons before arranging to open them. A carpenter or building maintenance worker can usually fix a stuck window.

Check	Question	Comments	Solution
Painted Surfaces	Is there any chipping paint?	Chipping paint may be a sign of water damage or old paint. It may also contain lead, which can cause serious permanent brain damage in children and fetuses.	• If chipping paint is blistering, speak to the building manager about inspecting for water damage and repairing the structure. • If children are present in the building, review building records or analyze the paint to determine if it contains lead. Lead paint should be abated only by a licensed professional.
Water-damaged Carpet	Is carpet continually exposed to water or moisture, or was it installed in a flooded room?	Water-damaged carpet may contain large quantities of mold and mildew that cannot be removed by normal cleaning methods and may contribute significantly to poor indoor air quality, allergies, and other health problems.	• Replace carpet or consult an expert in the remediation of water-damaged carpets.
Spilled Mercury	Has mercury (a silver liquid) been spilled on any surface?	Mercury is a serious environmental hazard and can become an occupational health risk if dealt with improperly. Mercury can linger for years in cracks, crevices, or pipes, evaporating and exposing occupants. Never put mercury in the trash or down the drain. (For more information on handling mercury, see the Sustainable Hospitals Mercury Information Package at http://www.sustainablehospitals.org/HTMLSrc/IP_Merc_BMP_Spills.html .)	• A trained professional should clean up spilled mercury with a mercury spill kit. Consult with the facility's environmental health and safety (EHS) officer or the local environmental protection office. In some localities, any chemical spill must be reported to the appropriate authorities. A site where past mercury spills were improperly cleaned up may still be contaminated. Mercury should never be vacuumed. • To prevent spills, take an inventory of the facility, noting switches, thermometers, and other items that may contain mercury. For assistance identifying mercury in your facility, see http://pasture.ecn.purdue.edu/~mercury/title.htm. Health care facilities should see http://www.epa.gov/region01/steward/necat/mercury/health.html.
Broken Fluorescent Light Bulbs	Are used fluorescent light bulbs placed in the trash? Are there any broken bulbs inside the facility?	Fluorescent light bulbs contain mercury vapor, which is dangerous when inhaled. Lamps labeled "low mercury" may not, in fact, contain a less hazardous amount of mercury than traditional bulbs. All fluorescent bulbs should be recycled by a recycling service and not placed in the trash.	• When a fluorescent light bulb breaks, immediately clear the room to prevent inhalation of mercury vapor. Consult with the facility's EHS officer or the local environmental protection office for instructions on what to do with broken fluorescent bulbs. Inform clients that do not have a hazardous waste disposal contractor that they should employ mercury recycling and hazardous waste disposal services for their spent fluorescent lamps.

Chapter 2

CLEANING METHODS FOR IMPROVED AIR QUALITY

Reducing Indoor Air Pollution Through Cleaning

By itself, a cleaning service cannot “cure” a sick building. Improving indoor air quality often requires a combination of approaches, including changes in maintenance, construction, and cleaning practices. No matter what a cleaning service does, a building will continue to have indoor air quality problems as long as:

- ▶ The HVAC (heating, ventilating, and air conditioning) system is inadequate, contaminated, or dirty.
- ▶ The relative humidity is under 30 percent or above 60 percent (depending on the season).¹
- ▶ Emissions from another part of the building enter the general air circulation
- ▶ There is significant off-gassing of volatile organic compounds (VOCs) from furnishings or building materials.

But a cleaning service can be an integral part of the solution to poor-quality indoor air. Even non-problem buildings can significantly benefit from an environmentally oriented cleaning program. A study of cleaning effectiveness and indoor air quality, performed by Research Triangle Institute (RTI) for the US Environmental Protection Agency (US EPA), found that “an organized cleaning program based upon environmental management principles and fundamental environmental protection guidelines contributed to improved indoor air quality through reduction of total suspended particles, total volatile organic compounds, and culturable bacteria and fungi.”²

In contrast to routine housekeeping, improved cleaning techniques can significantly improve indoor environmental problems. In the RTI study, improved cleaning resulted in the following reductions in biopollutants:³

- ▶ Total airborne bacteria (37 percent)
- ▶ Total airborne fungi (62 percent)
- ▶ Total non-floor surface bacteria (29 percent)
- ▶ Total non-floor surface fungi (25 percent)

- ▶ Total carpet-dust bacteria (84 percent)
- ▶ Total carpet-dust fungi (93 percent)
- ▶ Carpet-dust endotoxins (72 percent)

General Principles: Cleaning for Health

The following “Environmental Management Principles for Cleaning” come from the Research Triangle Institute study:⁴

Focus cleaning on specific objectives.

- ▶ Emphasize protecting health and maintaining or restoring valuable property.

Coordinate cleaning with other basic environmental management strategies.

- ▶ Control pollution at the source.
- ▶ Limit polluting activities.
- ▶ Ventilate buildings to dilute indoor contaminants.
- ▶ Design buildings and the ventilation system to optimize indoor air quality.

Follow fundamental environmental protection guidelines.

- ▶ Maintain safety for all workers and occupants.
- ▶ Clean for health first and appearance second.
- ▶ Clean to maximize extraction of pollutants (particles, gas, and biopollutants) from the occupied space.
- ▶ Minimize chemical, particle, and moisture residues.
- ▶ Minimize human exposure to pollutants.
- ▶ Clean to improve the total environment.
- ▶ Dispose of cleaning waste properly.

While these principles may, at first glance, seem obvious, they are actually a radical departure from the traditional idea that cleanliness means a sparkling, “whiter than white” appearance. Manufacturers of alternative products have reported that customers who use unscented products occasionally have problems when clients fail to smell the sharp odor of chlorine or the sweet smell of air “fresheners,” and need reassurance that their bathrooms are really clean. In fact, real cleaning is “the science of controlling contaminants.”⁵

Reducing Dust and Dirt Through Proper Cleaning and Preventive Measures

The Research Triangle Institute study determined that “[a]irborne biopollutants correlated with airborne dust mass” in the building being investigated.⁶ Similarly, it is well known that minimizing dust and dirt will reduce pollens and allergies. The less dust and dirt, the fewer chemicals and the less time needed to clean them. In the RTI study, improved house-keeping techniques reduced total airborne dust by 52 percent.⁷ The following are some simple but critical techniques for controlling dust and dirt:

Place entryway mats at every outside door. These should measure at least five steps long. Vacuum often, preferably in two directions (front-to-back and side-to-side), using vacuums with brushes, beater bars, and strong suction.⁸ Also place mats around sandboxes and cat litter boxes.

Vacuum or damp-mop instead of sweeping. Use a vacuum cleaner with a high-efficiency particulate air (HEPA) filter.⁹ Use high-efficiency microfiltration bags, which retain dust and particles in the 3 micron range or smaller. These bags cost more but save on labor by reducing dust circulation.¹⁰ Change bags before they are completely full. Ensure that every vacuum cleaner used with a HEPA filter was designed to be used with one (other machines leave too many gaps in the system for a HEPA filter to be useful).

For dusting, use a damp, folded cloth or cloth-covered feather duster. Use a wiping motion, rather than a flicking or sweeping motion, to ensure that dust remains on the cloth. Change cloths frequently.

If treated dust mops are used, obtain pre-treated mop heads from a laundry service or spray the mop heads outdoors. Dust-mop sprays contain petroleum products that can harm the user and building occupants.

Use a medium-speed buffing machine. This will usually generate fewer particles of chemicals and dirt than a high-speed buffer. Consider using a vacuum attachment to the buffing machine.

For more information on air cleaning machines, see the US EPA’s “Residential Air Cleaners” fact sheet at <http://www.epa.gov/iaq/pubs/airclean.html>.

Reducing Microbial Growth Through Proper Cleaning

The following are some basic steps that can help minimize the need for antimicrobial products:

A two-step process should generally be used with antimicrobials. Clean first, then apply the disinfectant. Wait the recommended time before rinsing (usually at least 10 minutes); perform other tasks while waiting for the antimicrobial to take effect. Most disinfectants are not cleaners, and are usually only effective on a clean surface.

Use disinfectants only when and where required. The RTI study claims that an ordinary detergent should remove more microbes than bleach alone.¹¹

Change mop heads and sponges daily. Change cleaning water even more frequently.

Carefully clean areas where water collects and condenses. These include refrigerator and air conditioner pans and air cleaner/humidifier machines.

Flush toilets and run sink and shower water at least once a week. This will keep the drains clean and the “p” trap full of water. Add an enzyme-type drain maintainer if clogging or drain odors are a problem.

Consider using a dehumidifier in humid areas. Talk to the building manager about installing this device to collect moisture.

For more information on air duct cleaning, see the National Air Duct Cleaners Association (NADCA), “Commercial Consumer Information,” at http://www.nadca.com/consumer_info/commercial_info.asp. NADCA publishes a standard for air duct cleaning that can be downloaded at <http://www.nadca.com/standards/standards.asp>.

For more information on reducing moisture, mold, and mildew, see the US EPA’s IAQ Coordinator’s Guide at <http://www.epa.gov/iaq/schools/tfs/guideh.html>, or the EPA’s “Mold Remediation in Schools and Commercial Buildings” at <http://www.epa.gov/iaq/molds/>.

For more information on reducing fungi, see the New York City Department of Health guidelines at <http://www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html>.

Special Treatment of Carpets

Carpets can be a source of biopollutants, dust, and VOCs. Initially, VOCs come from carpet treatment during fabrication and the adhesives used during installation. Later, pesticides and cleaning products (such as stain removers) that remain on carpets after use can slowly volatilize (rise up into the air). Here are some recommendations:

Prevent stains. Clean up spills promptly; start with clear, cold water and blotting cloths. For occupants willing to cooperate, make a spill kit available for times when the cleaning service is not around. Standard carpet spot cleaners can contain high levels of VOCs and carcinogens such as tetrachloroethylene.

Promptly clean and thoroughly dry carpets after they become saturated with water. Quick action following a leak or other cause may prevent carpet loss and the growth of mold and mildew. Do not attempt to clean a moldy carpet without protective equipment, protective clothing, respirators, and air filters. Special training may be required to adequately deal with a water-soaked carpet. Avoid carpet restoration products that contain tributyl tin.

Avoid excessive use of carpet shampoos and bonnet-cleaning products. Bonnet cleaning involves the use of a cotton, rayon, and/or polypropylene pad and a rotary shampoo machine. Although these chemicals are usually mild, overuse makes more frequent extraction cleaning necessary.

Deep-clean when necessary. Carpets need to be periodically deep-cleaned to extract dirt, biopollutants, moisture, and embedded cleaning agents. A wet vacuum water extraction machine after dry vacuuming may be used. The Carpet and Rug Institute recommends rapid drying of the carpet. Pre-sprays applied carefully and left on long enough can reduce the amount of chemicals needed.¹² Hazardous ingredients commonly used in extraction products include acid rinses (hydroxyacetic acid) and solvents (butoxyethanol). Avoid products with these ingredients, or use the most diluted mixture available.¹³

Avoid particularly toxic products. Some carpet restoration products contain tributyl tin, formaldehyde, and other toxic antimicrobials.¹⁴

For more information on carpet cleaning, see the Janitorial Products Pollution Prevention Project fact sheet at <http://www.westp2net.org/Janitorial/factsheets/carpetcleaning.htm>.

Chapter 3

HEALTH AND SAFETY CONCERNS OF JANITORIAL WORKERS

Like other service workers, janitors are vulnerable to a variety of dangers stemming from their exposure to the physical hazards, chemical hazards, and infectious agents generally present in the workplace. But janitors are exposed to greater chemical hazards than many other workers because of the work they do. Recently, the importance of reducing janitors' exposure to the hazardous chemicals contained in the tools of their trade has been gaining attention from environmentalists and regulatory agencies. A review of workers' compensation data from Washington State indicates that six out of 100 janitors are injured by chemicals every year; 20 percent of these injuries are serious burns to the eyes or skin.¹ These figures account for acute injuries only, not for carcinogenic risks or chronic health risks to the endocrine, neurological, respiratory, reproductive, and other systems of the human body.

The remainder of this chapter provides an overview of the elements of a general risk reduction strategy for biological, physical, and chemical hazards.

For information on worker rights to protection from workplace hazards under the Occupational Safety and Health Act of 1970, see <http://www.osha.gov/as/opa/worker/rights.html>.

For information on US Occupational Safety and Health Administration (OSHA) guidelines requiring employers to inform employees about workplace chemicals and hazards to which they are exposed ("hazard communication"), see <http://www.osha.gov/SLTC/hazardcommunications/index.html>.

For information on OSHA guidelines on managing bloodborne pathogens, see <http://www.osha-slc.gov/SLTC/bloodbornepathogens/index.html>.

For information on preventing allergic reactions to latex, see the National Institute for Occupational Safety and Health's (NIOSH's) web site on occupational latex allergies at <http://www.cdc.gov/niosh/latexpg.html>.

OSHA also provides many safety resources for small businesses, including free training and consultation services as part of the Small Business Assistance Program. Information is available at <http://www.osha-slc.gov/SmallBusiness/index.html>.

Training Requirements

It is often forgotten that janitors deal with a wide variety of chemicals and other hazards and should therefore be trained to avoid illness and injury. Table 2 lists the main categories of janitor training related to safety and health.

Hazard Prevention

Janitors encounter a wide variety of hazards in the course of their work. Table 4 on pages 16 to 17 lists the most common hazards and the precautions that should be taken to reduce them.

Chemical Safety for Janitors

In addition to the basics listed in Table 4, janitors should understand chemical safety, know how to get information about the products they work with, and feel free to speak with their supervisors if they suspect they are at risk.

How to get information about products used by janitors

Request material safety data sheets (MSDSs) from suppliers for all products used. Keep them in a central location accessible to all workers. MSDSs should also be accessible to emergency workers in case of fire or a chemical emergency in an area where chemicals are used.

Call the manufacturer's information telephone line for answers to any questions about chemical safety or use not available on the MSDS or product label. Ensure that telephone assistance is available in off-hours, preferably 24 hours a day, to accommodate janitors on all shifts.

Take advantage of any training provided by manufacturers or suppliers in the safe and effective use of products.

How to read a material safety data sheet

Some MSDSs contain inaccurate information or do not contain all the information needed to make an informed decision about a product. Generally, how-

Table 2. Summary of Training Needs for Janitorial Workers

Topic	Guides	For All Janitorial Workers	For Janitorial Workers in Health Care	For Janitorial Workers in Special Settings
Chemical Hazard Communication	OSHA	✓	✓	
Bloodborne Pathogen Standard	OSHA		✓	
Material Safety Data Sheet (MSDS) Interpretation	Various guides are available. Check with local occupational health agency.	✓	✓	
Infection Control Precautions	Infection control officer at facility		✓	Workers in other risky settings (e.g., prisons or shelters that serve people with HIV/AIDS, tuberculosis, and other infections) may require infection control training.
Proper Lifting and Ergonomic Precautions		✓	✓	
Radiation Safety	Radiation safety officer at facility			Workers in settings where X-rays or other radioactive diagnostics or therapies are performed should receive radiation safety badges and training.

ever, they are considered the most easily available source of product safety information. Table 3 on pages 14 to 15 explains how to interpret the major sections of an MSDS form. (The information in this section is adapted from the Janitorial Products Pollution Prevention Project web site, <http://www.westp2net.org/janitorial/jp4.htm>, and from training materials produced by the City of Phoenix.)

Working Safely with Janitorial Chemicals

One way to prevent chemical injury to janitorial workers is to reduce the toxicity of the products with which they work. In Richmond, California, the Janitorial Products Pollution Prevention Project found that the highest-risk janitorial products are generally those that are flammable or emit toxic fumes, are absorbed through the skin, or are corrosive to the eyes or skin.² The project team examined 250 janitorial products in use at 32 area facilities and reached the following conclusions:³

7 percent of the products should not be used. These contain ingredients that can cause cancer or can harm the environment by depleting the ozone layer or contributing to global warming.

56 percent of the products require extreme care. These contain ingredients that can cause blindness or severe skin damage, interfere with the endocrine system, or be absorbed through the skin or inhaled and subsequently cause damage to the blood, liver, kidneys, nervous system, or a developing fetus.

37 percent of the products require routine care. These contain ingredients that may temporarily irritate the eyes and skin, can evaporate and affect indoor air quality, or may exceed a building's allowable sewer discharge limits for zinc or hydrocarbons.

Information on some of these hazards is available on a product's MSDS. Learning about all hazards usually requires a phone call to the chemical supplier's customer service desk.

Precautions to Prevent Chemical Injury

Cleaning services can take some simple precautions to help janitors work safely with the chemicals they use:⁴

Implement a program of safety training. This should be an integral part of overall worker training for janitors.

Ensure that a safety manual is available on-site. This should be written in language workers can understand and should help if they have a question or in the event of a hazardous situation such as a spill.

Make all MSDSs available to workers on-site. Workers should read the MSDS before using a product.

Do not permit workers to mix products with incompatible ingredients. Workers should not use such products on the same surface or pour them down the sink sequentially. (The most common example of dangerous reactivity is between ammonia-containing and bleach-containing products, which combine to form deadly chloramine gas.) Products containing incompatible ingredients should be stored separately, or at least on different shelves and not one above the other. Information about incompatibility is available on the product MSDS.

Table 3. Overview of a Material Safety Data Sheet (MSDS)

MSDS Section	Information Provided	How to Use the Information
Product Identification	The product brand name and the manufacturer's name, address, and telephone number.	
Ingredients	Ingredients are listed by chemical and common name and by Chemical Abstract Service (CAS) number (which uniquely identifies every chemical). Not all ingredients are required to be listed. Chemicals subject to reporting requirements under Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986, also called the Toxics Release Inventory, or TRI, are required to be listed if they are present in quantities over 1% of the total product. Any carcinogen accounting for over 0.1% of the product must also be listed and labeled as a carcinogen. OSHA also requires manufacturers to list any other ingredients known to be hazardous, but how that is defined is left up to the manufacturer.	Since many chemicals have a number of different names, the CAS number indicates whether a particular chemical is actually present. Avoid products with carcinogens and ingredients subject to the reporting requirements of the Toxics Release Inventory (TRI). Ingredients in these categories will be labeled as such.
Health Hazards	Health hazards associated with handling the product.	Most cleaning products are irritating to the skin and eyes, but products that carry a risk of severe illness or injury should be avoided. Avoid products that can cause blindness, cancer, or harm to the reproductive system, and products that are highly corrosive to the skin. Compare the health hazards of one product with those of other products in the same category.
Special Protection	Any protective gear, such as gloves or masks, that workers should wear when using the product.	Make sure workers use the protection specified. Choose products that require the least amount of protection.

Instruct workers in the safe handling of concentrates. These are usually the most dangerous form of a chemical.

- ▶ Buy the safest possible products.
- ▶ Ensure that workers wear appropriate protective clothing, such as goggles, aprons, and respirators, as indicated on the product MSDS.
- ▶ Allow only properly trained supervisors, or a designated “chef,” to do the mixing.
- ▶ Ensure that eyewash stations are available where corrosive chemicals are used.
- ▶ Train employees in safe lifting methods to reduce the risk of dropping or spilling heavy containers of cleaning chemicals or equipment.

- ▶ Consider using a dispensing system, which will automatically dispense the correct amount of a concentrate without splashes or spills.

Reducing Chemical Use

According to the Janitorial Products Pollution Prevention Project, hazardous chemical use could be reduced by 5.4 pounds per janitor per year, or 13 percent, if janitors used all of the following pollution prevention methods: substituting less toxic chemicals, using fewer chemicals, installing floor mats and vacuuming, and using improved management techniques such as avoiding aerosol products.⁵

MSDS Section	Information Provided	How to Use the Information
Physical Data	This section lists the pH level of the product and its volatile organic compound (VOC) content (if any).	Alkaline substances (like lye) have a high pH; acidic substances (like vinegar) have a low pH. Both extremes can damage the skin, eyes, and other mucous membranes. Avoid products with a pH above 11 or below 2; a pH of 7 is neutral, so products with a pH between 5 and 9 are less likely to irritate the skin.
Fire Data	This section gives the product's flash point, the temperature at which it will give off enough flammable vapors to ignite if an ignition source is present. A product with a low flash point is more flammable and hence more dangerous.	Avoid products with a flash point below 140°F, and give preference to products with a flash point above 200° F. “No flash point” indicates that the product will not ignite.
Reactivity Data	This section should list the chemicals with which the product may react violently.	Do not store a chemical near another chemical with which it may react. Do not use a chemical at the same time or immediately after using a chemical with which it may react. Janitors are particularly at risk from the chemical reaction between chlorine (in bleach) and ammonia (in ammonia glass cleaners or quaternary ammonium disinfectants); this reaction produces chloramine gas, which is very dangerous.
Spill Response	This section should indicate what to do in the event of a spill and whether the product would be considered a hazardous waste.	For spills of products considered hazardous wastes, call in the facility's environmental health and safety officer or another qualified professional to assist in disposing of the spill legally. Do not wash it down the drain. Information on hazardous waste disposal regulations, which may vary in different states and municipalities, is available from your local water treatment facility or state environmental regulatory agency.
Special Precautions	Any other special precautions that should be taken around the product.	Make sure workers follow these directions when handling the product.
Other Sections	Other pertinent information.	

Direct chemical substitution

Substitution of less toxic products for hazardous products in the Janitorial Products Pollution Prevention Project accounted for about half the reduction in toxic chemical use, or 2.5 pounds per janitor per year. See Chapter 4, Antimicrobial Cleaning

Products, for more information on substituting less toxic chemicals and finding environmentally preferable products.

Using fewer hazardous chemicals

Using hazardous chemicals only when necessary and in as diluted a form as possible accounted for a

Table 4. Summary of Janitorial Hazards and Prevention

PHYSICAL HAZARDS	
Many injuries from physical hazards can be prevented by worker training.	
Slips and Falls	All workers should wear proper footwear with traction; movable, easy-to-see signs or blockades should be used to limit access to wet floors.
Ergonomic Injuries	Train all workers in proper lifting techniques and proper posture for handling floor buffers, buckets, and other heavy items. Prevent repetitive motion injuries by varying tasks or using ergonomically designed equipment.
Accidents with Machines	Train all workers in the proper use of machinery; allow only trained workers to use heavy machinery.
Falls While Climbing	Use only sturdy ladders for climbing. Do not use chairs, boxes, or shaky ladders. Under no circumstances allow workers to stand on chairs or desks that have wheels.
Radiation Exposure	At health centers where X-rays or other radioactive diagnostics or therapies are performed, provide workers with radiation safety badges and training.
INFECTIOUS HAZARDS	
General information about infection control should be part of worker training, especially for janitors working in health care facilities. Thorough hand-washing is the worker's most basic and important form of protection. Instruct workers to wash their hands before eating, drinking, smoking, using the bathroom, rubbing their eyes, or applying makeup. Licensed health care facilities should have an infection control manual and a staff person (an MD or RN) designated as the infection control officer. Make sure workers are familiar with the institution's infection control procedures and know the infection control officer to whom they can go with a question. Remind medical and nursing staff to inform janitorial staff of infection hazard situations.	
Tuberculosis	The facility's infection control officer should provide worker training on tuberculosis prevention.
Puncture Wounds	Training to prevent needle sticks or similar injuries, as well as injury reporting, may be required under state regulations or the <i>Code of Federal Regulations</i> , Chapter 29, Parts 1904 and 1910. Workers should be alert to improperly discarded needles and other sharps that may be found on the floor, on counters, in wastebaskets, in bedding, or elsewhere. Workers should pick up broken glass only with a brush or tongs — never with their hands, even when wearing gloves. In the event of a needle stick or sharps injury, workers should report to their supervisor and seek immediate post-exposure medical care to minimize the risk of infection from bloodborne pathogens.
RESPIRATORY HAZARDS	
Many chemicals found in the workplace, including cleaning products, can cause respiratory irritation. According to the American Lung Association (ALA), occupational asthma “may account for as many as 15% of all newly diagnosed U.S. cases of asthma in adults, and it is the most prevalent occupational lung disease in developed countries.” Exposure to substances in the workplace may also cause inflammation of the lungs, and continuing exposure may lead to irreversible pulmonary fibrosis, a process that makes breathing more and more difficult. Cleaning and building service jobs, the ALA confirms, “entail exposures to an array of noxious chemicals, as well as to maintenance systems that are often the source of biological contaminants associated with critical allergic reactions.” ⁶	

reduction in toxic chemical use of 1.5 pounds per janitor per year.

Minimize the use of floor strippers.

- ▶ Use a high-quality, durable floor finish.⁷
- ▶ Coat the floor with 6 to 12 coats of finish and never let the finish wear down to the floor. Instead, deep-scrub with a floor cleaner and re-coat when necessary.⁸
- ▶ Wet-mop regularly to preserve the finish.⁹
- ▶ Place doormats at entryways to minimize dirt and grit.¹⁰
- ▶ Schedule floor renewal work for specific areas of wear.¹¹
- ▶ When required, thoroughly rinse the stripped floor to neutralize the surface before new finish is applied. With many products, neutralization is not necessary; check with your vendor.¹²

RESPIRATORY HAZARDS, cont'd.	
Fungi and Mold	Do not permit untrained personnel to remediate serious fungus and mold contamination. Instead, consult the US EPA's IAQ Coordinator's Guide at http://www.epa.gov/iaq/schools/tfs/guideh.html or the EPA's guide to Mold Remediation in Schools and Commercial Buildings at http://www.epa.gov/iaq/molds . For more information on reducing fungi, see the New York City Department of Health's guidelines at http://www.ci.nyc.ny.us/html/doh/html/epi/moldrept1.html . Fix water-damaged building areas and maintain humidifiers so they do not become breeding grounds for molds.
Pet and Pest Dander, Dust Mites, and Dust	Reduce these hazards through damp dusting, damp mopping, and deep vacuuming; workers should wear a respirator when cleaning affected areas.
CHEMICAL HAZARDS	
Wherever possible, reduce chemical hazards by substituting less toxic products for traditional ones. When this is not possible, janitors should wear gloves and goggles and ensure that work areas are supplied with fresh air.	
Eye and Skin Injuries	Workers using or diluting janitorial cleaning products such as concentrates, acid toilet bowl cleaner, floor stripper, disinfectants, and other corrosive chemicals should wear protective equipment such as chemical splash goggles, chemical-resistant gloves, full-coverage clothing, and sturdy shoes covering the entire foot. If possible, substitute less corrosive or less concentrated products for more hazardous ones. Avoid products with ingredients that are absorbed through the skin (as indicated on the MSDS). To determine what types of gloves are needed to prevent contact with a specific ingredient, see the Chemical Resistant Gloves Guide at http://physchem.ox.ac.uk/MSDS/glovesbychemical.html .
Respiratory Irritation and Injury	Products containing large quantities of volatile organic compounds (VOCs) pose an inhalation risk, especially when used in enclosed areas. Workers should choose the product with the lowest VOC content that will get the job done. (VOC information is usually listed on the MSDS or can be obtained from the vendor.) Some chemicals that are not VOCs may also be respiratory irritants. Workers should use respirators or other precautionary equipment as indicated on the MSDS for all chemicals.
Latex Allergy	More and more people are becoming allergic to latex, which is found in many types of gloves and medical products. Severe latex allergy can result in respiratory arrest and death. Latex-free gloves and other accessories for janitors are available from almost all vendors. Janitors working in health care and other areas where latex products are used frequently should be aware of the possibility of allergy and report any sensitivity to an occupational health professional. Alternatives to most latex products are available.
Chemical Spill	Do not permit janitorial workers to attempt cleanup of significant chemical spills by themselves. Call the facility's environmental health and safety officer to ensure that cleanup is conducted properly by trained workers and that all laws regarding reporting and disposal are followed. To prevent spills, train workers in the proper handling of chemicals; workers should notify the building supervisor if chemicals used by others are stored in an unsafe manner. Buy products that are as safe as possible and in concentrated form to reduce the risk of injury from spills. Use automatic dilution equipment to reduce the risk of spills and splashes.

Add 10 percent extra water to ready-to-use products. Make sure, however, that the diluted cleaner can still get the job done.

Clean only when necessary. An arbitrary schedule can lead to more chemicals being used than necessary.

Use two cleaning products instead of one. Use the mildest for general use and the more toxic for occasional stubborn problems.¹³

THE JANITORIAL PRODUCTS POLLUTION PREVENTION PROJECT

The many references to the Janitorial Products Pollution Prevention Project (JP4) that appear throughout *Cleaning for Health* indicate the significant contributions of that project to this report. JP4 began in the late '90s with two projects in the San Francisco Bay Area. The first, in the city of Richmond, focused on individual custodians, small janitorial contractors, and neighborhood businesses; the second, in Santa Clara County, addressed government agencies, schools, manufacturing firms, large janitorial contractors, and other organizations.

Throughout 1998 and 1999, the JP4 team evaluated the hazards of specific cleaning products, interviewed janitors to find out what they actually know about the cleaning products they use, and studied workers' compensation data to determine the frequency and severity of injuries involving those products.

To help janitors, their supervisors, and environmental, health, and safety staff understand the potential health risks of the products they use and choose effective but safer alternatives, the project team created a series of extremely helpful tools, including information on the risks associated with more than 100 cleaning product ingredients, risk evaluation forms, and fact sheets recommending dozens of safer cleaning practices and products. In 2001, the Janitorial Products Pollution Prevention Project expanded to Southern California, where its product recommendations have resulted in a reduction in the use of 19,000 pounds of hazardous chemicals per year.¹⁴ For more information, visit the JP4 web site at <http://www.westp2.net.org/Janitorial/jp4.htm>, or contact Thomas S. Barron, lead consultant, at tsbarron@attglobal.net.

Use microfiber mops or cloths where appropriate. Often these do not require chemicals to clean sufficiently.

Improved management techniques

Improved management techniques in the Janitorial Products Pollution Prevention Project accounted for a reduction in hazardous chemical use of 1.4 pounds per janitor per year.

Place doormats at all entryways

- ▶ Use frequent strong-suction vacuuming to maintain them.

Reduce the amount of chemicals lost

- ▶ Practice good inventory control, rotate stock, and use up products that expire (such as those containing bleach and hydrogen peroxide) before the expiration date.
- ▶ Store acids and other corrosive products in secondary plastic containers to contain potential leaks.
- ▶ Eliminate aerosols. These usually contain large amounts of propane or other hazardous chemicals, some of which always remains in the container and is wasted.¹⁵ Aerosols also contribute to respiratory irritation. Use a dispensing cap to apply the product directly onto a cloth, or use a bucket.¹⁶

Chapter 4

ANTIMICROBIAL CLEANING PRODUCTS

According to the US Environmental Protection Agency's (US EPA's) Office of Pesticide Programs, antimicrobial cleaning products are "used to destroy or suppress the growth of harmful microorganisms" (bacteria, viruses, or fungi) on inanimate surfaces, but not in humans or animals.¹ Because many terms are used to describe antimicrobials, it is important to distinguish them by their properties. The antimicrobial products most commonly used to control microorganisms infectious to humans include the following.

Disinfectants. These are used "on hard inanimate surfaces and objects to destroy or irreversibly inactivate all forms of microbial life but not necessarily their spores" (the developmental reproductive form of a microbe).² All disinfectants do not kill all types of microbes and viruses. The label should name the microorganisms against which the product is effective. The EPA allows a product to be labeled a "general" or "broad-spectrum" disinfectant "if [it] is effective against both Gram-positive and Gram-negative bacteria."³ Disinfectant labels can indicate that a product is hospital- or medical-grade only if it meets the requirements for a general disinfectant and is also effective against the nosocomial bacterial pathogen *Pseudomonas aeruginosa*.⁴ Hospital-grade disinfectants do not necessarily kill tuberculosis or HIV, so facilities that need to use a tuberculocide to comply with the Occupational Safety and Health Administration's (OSHA's) bloodborne pathogen standard, or that need a disinfectant active against a particular virus or microbe, should check the product label for that information.

Sanitizers. According to US EPA, these products are "used to reduce, but not necessarily eliminate, microorganisms...to levels considered safe as determined by public health codes or regulations ...Non-food contact surface sanitizers include carpet sanitizers, air sanitizers, laundry additives, and in-tank toilet bowl sanitizers."⁵

Sterilizers. These products are "used to destroy or eliminate all forms of microbial life, including ...their spores." Sterilizers are used in health care settings, primarily on medical instruments that enter the body.⁶

Antiseptics. These products are used to destroy a variety of microbes, but because they are used in or on people or animals, they are not generally referred to as antimicrobials. Instead, they are considered drugs and are regulated by the US Food and Drug Administration (FDA), not by the EPA. Janitorial workers do not use these products in their work.

US EPA considers all antimicrobials (except those intended to treat animals or humans) as pesticides, and registers and regulates them under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). To obtain registration, an antimicrobial must not cause "unreasonable adverse effects to human health or the environment," and its labeling and composition must comply with FIFRA requirements.⁷ In addition, manufacturers must provide detailed information regarding the product's chemical composition and documentation of its effectiveness against specific microorganisms and any hazards associated with its use. It is important to remember, however, that despite these regulations, "unreasonable adverse effect" is open to interpretation, and many registered pesticides will have some adverse impacts on human health and the environment.

Verifying US EPA registration is most crucial in health care settings, since regulations usually require the use of an appropriate EPA-registered product in certain areas. A product's EPA registration number, and the organisms against which it is effective, will also be found on its label. You can check the status of a registered pesticide and obtain information on its efficacy at the California Environmental Protection Agency USEPA/OPP Pesticide Related Database Queries Page, at <http://www.cdpr.ca.gov/docs/epa/epamenu.htm>.

The use of antimicrobials is a hotly debated issue among public health professionals, some of whom are concerned that widespread use of these agents in consumer products, such as household dishwashing detergent, is contributing to the growth of strains of bacteria that are resistant to standard antibiotics. In addition, some environmentalists are concerned that antimicrobial chemicals can be toxic to users and to the environment in general, and that they are

overused in some settings. It is important to use antimicrobials where they are needed, but their use should always be evaluated carefully.

Common Active Ingredients and Health Effects

A limited number of antimicrobials are used in disinfectants, sanitizers, and sterilizers. The most common of these, and their uses and health effects, include the following.

Quaternary ammonium compounds. Collectively known as “quats,” these chemicals include the commonly used benzalkonium chloride (alkyl dimethylzylammonium chloride). They are effective as disinfectants or sanitizers on many types of bacteria and some viruses, and they are sometimes combined with other chemicals such as alcohols to form disinfectants that kill a wider range of microorganisms.⁸ The presence of blood or soil reduces the effectiveness of quats, so surfaces should be cleaned before use. Quats may also stain floor tile.⁹

Quaternary ammonium compounds can cause occupational asthma, allergies, or skin sensitization with repeated exposure. Although very concentrated solutions are corrosive, most ready-to-use preparations are not concentrated enough to corrode the skin.¹⁰ Benzalkonium chloride is listed on Environmental Defense’s Scorecard as a suspected gastrointestinal and liver toxicant, and other quaternary ammonium compounds may have the same attributes.¹¹ Users of products containing quats should wear goggles and gloves.

Phenols. Phenolic compounds are often effective against a wider range of organisms than quaternary ammonium compounds, and many are effective against tuberculosis (although users should always check the product label). Common phenolic compounds used in cleaners include ortho-phenylphenol, o-benzyl-p-chlorophenol, and p-tert-amylphenol. Some of these products can discolor and corrode plastic and some painted surfaces or cause rubber to deteriorate. They are usually more expensive than quats or chlorine bleach.

More significant are the health and environmental effects of phenolic compounds. The Janitorial Products Pollution Prevention Project considers their environmental impact to be “high.”¹² All these compounds can be very irritating to the eyes and

skin.¹³ Ortho-phenylphenol is listed as a carcinogen by the state of California,¹⁴ and p-tert-amylphenol can be absorbed through the skin.¹⁵ Janitorial staff should consult material safety data sheets (MSDSs) and other product literature and follow proper precautions when using products containing phenol or phenolic compounds.

Chlorine. Bleach (usually a 5.25 percent solution of sodium hypochlorite) is a commonly used disinfectant in medical, commercial, and household settings. Different dilutions are appropriate for different applications. On a clean surface, a dilution of 1:10 is effective against many viruses, molds, mildews, and bacteria, including many spores and tuberculosis. OSHA recommends a dilution of 1:10 to 1:100 for use as a tuberculocide.¹⁶ However, manufacturers often recommend higher concentrations, usually of 1:5.¹⁷

Bleach neutralizes rapidly, becoming less effective in the presence of organic matter such as soil, blood, and excrement, and thus requires that surfaces be cleaned before use (bleach is not a cleaner and does not remove soil from a surface). Bleach can deteriorate when stored at room temperature, even in a closed plastic container, losing half its potency after one month.¹⁸ Diluted solutions should be replaced after 24 hours to ensure effectiveness. Bleach is highly toxic when mixed with ammonia or ammonium quaternary compounds, forming chloramine gas. In addition, bleach can produce chlorine gas when mixed with or used in conjunction with strong acids, such as toilet bowl cleaners. It can also discolor fabrics and is corrosive to most metals.

Contact with concentrated hypochlorite can cause corrosive damage to the eyes, skin, nails, and mucous membranes. However, household bleach at a concentration of 5.25 percent is not corrosive unless exposure occurs over a long period. Breathing in the fumes of cleaners containing a high concentration of chlorine can irritate the lungs. This is particularly dangerous for people with heart conditions or chronic respiratory problems such as asthma or emphysema. Users handling concentrated solutions should wear safety goggles, masks, gloves, aprons, or other protective clothing.¹⁹ A plentiful supply of fresh air should be provided.

An additional concern is that chlorine bleach is often manufactured using a mercury cell process, leaving contaminant mercury in the product. Hospitals in Massachusetts have tested several brands of sodium hypochlorite and confirmed this. While the concen-

tration of mercury is not high enough to cause any worker health risks, the contaminant mercury, in some cases, is sufficient to trip the mercury limit allowed in water discharged down the drain to a water treatment facility.²⁰ Mercury is a potent neurotoxin responsible for many environmental and health problems, which have resulted in government agencies issuing advisories against the consumption of many types of fish.

Alcohols. The most common alcohols found in disinfectants are ethyl alcohol (ethanol) and isopropyl alcohol (isopropanol). Usually these are combined with phenolic compounds or ammonium quats in commercial products. Alone, alcohols are effective against some bacterial and fungal species.²¹ With other ingredients, their efficacy range may be increased; users should always check the product label. Very concentrated solutions of ethyl and isopropyl alcohol can have some significant safety and health effects. When concentrated, they are very volatile, flammable liquids that produce poisonous gases in a fire. Alcohols should be stored in a cool area, away from heat and sparking equipment.²² Ethyl and isopropyl alcohol are absorbed through the skin and can irritate the skin, eyes, upper respiratory tract, and throat. Because alcohols are central nervous system depressants, prolonged exposure in an enclosed or poorly ventilated area to products that are more than about 10 percent alcohol can also cause dizziness, headache, decreased pulse and blood pressure, vomiting, and collapse.²³ It is important to provide workers who handle concentrated alcohol solutions with ventilation and protective equipment and with solvent-resistant clothes and gloves, splash-proof goggles, and face shields.²⁴

Aldehydes. Glutaraldehyde and formaldehyde are most often used as sterilizers, but they are also found in some disinfectants, particularly those used in medical, agricultural, or manufacturing settings. Both these substances are very toxic and should only be used with protective equipment. They can cause severe skin, eye, and respiratory irritation, headache, nausea, and vomiting. Both chemicals can cause skin allergies or sensitization with repeated use.²⁵ Formaldehyde is a probable carcinogen according to the EPA and the International Agency for Research on Cancer.²⁶ Products containing these ingredients should be avoided.

Iodine. Iodine products, often sold in a polymer complex known as iodophor, can be effective against some bacteria, viruses, and tuberculosis. Always check the product label to determine which types of organisms the product kills. Iodophor should not be used in hot water, because it vaporizes at 120° F. Organic matter such as soil and blood reduces iodine's effectiveness, so surfaces should be cleaned before use. Iodine and iodophor solutions degrade over time; a brown or yellow color indicates that the solution is still active. Iodophor stains many surfaces and may tarnish silver and copper.²⁷

Iodine is classified by the Janitorial Products Pollution Prevention Project as having a "high environmental impact."²⁸ Concentrated solutions can cause severe skin irritation, burns, and allergy. Iodine vapor can irritate the eyes, nose, and throat. Breathing iodine can result in coughing, shortness of breath, and pulmonary edema (fluid on the lungs).²⁹ Since this chemical is effective against only a limited number of organisms and has a number of unhealthy and unpleasant effects, it should be avoided.

Oxidizers. Oxidizers such as hydrogen peroxide and peracetic acid (also known as peroxyacetic acid) are less common disinfecting ingredients than those described above. Some consider them to be "environmentally preferable" because they have fewer toxic by-products than quaternary ammonium compounds or chlorine.³⁰ For this reason, they are commonly used as disinfectants in food processing plants, where toxic residues could compromise food safety.

Peracetic acid is almost never used in janitorial cleaners and is much more toxic than hydrogen peroxide. It can be corrosive to the skin at concentrations below 10 percent and can cause irreversible eye damage at concentrations as low as 0.2 percent.³¹ Exposure to high levels of peracetic acid can cause liver and kidney damage and pulmonary edema.

While hydrogen peroxide is corrosive to the skin at concentrations over 50 percent and will cause irreversible eye damage at concentrations over 10 percent, most commercial janitorial cleaners do not contain over 10 percent hydrogen peroxide. Ready-to-use dilutions usually contain less than 2 percent hydrogen peroxide, which is not irritating to the skin (unless other irritating ingredients are present).³² At high concentrations, hydrogen peroxide can be irritating to the nose, throat, and lungs. It is also classified as "mutagenic," meaning it can damage

DNA; however, there is no evidence that external exposure to the concentrations of hydrogen peroxide found in cleaning products would cause this type of damage in humans. Serious health effects are most often seen in manufacturing settings where workers are subject to long-term exposure to high levels of these oxidizers in concentrated form, and would be unlikely to occur from exposure to common ready-to-use dilutions of janitorial products.

Concentrated solutions of hydrogen peroxide and peracetic acid are highly reactive and have low flash points. They are considered explosion hazards and must be stored carefully to avoid contact with combustible materials, with each other, and with other chemicals. Review the material safety data sheet for each product to find out if it is sufficiently concentrated to warrant special storage conditions. Like bleach, concentrates are best stored separately from other cleaning products.³³

Minimizing Disinfectant Use and Exposure

Some disinfectants are among the most toxic chemicals used in cleaning. Their environmental and health impacts can be reduced by using proper cleaning and worker protection techniques, making appropriate choices about which disinfectants are necessary under what circumstances, and substituting nontoxic or less toxic alternatives whenever possible.

Using disinfectants correctly at the right time

The following suggestions from the Janitorial Products Pollution Prevention Project can help janitorial services make informed choices about disinfectant use.³⁴

Select the right product. Use products that contain the specific US EPA-registered ingredients needed to kill the target organisms. The wrong disinfectant will be ineffective and a waste of time and money. The facility's infection control officer can inform the janitorial staff of the types of organisms found in the areas to be cleaned.

Plan how often to disinfect. Evaluate the amount of traffic in the building and identify the surfaces that people touch most often. Check disinfection guidelines published by the US EPA, the US Centers for Disease Control and Prevention (CDC), and other agencies.

Dilute products properly. Using disinfectants at full strength may be reassuring but is seldom warranted.

In addition to being wasteful, it is more dangerous to users. Make sure workers dilute disinfectants according to the manufacturer's directions. Typical dilutions are 1 part concentrated product to 125 to 500 parts water.

Clean before disinfecting. Disinfectants need to be in contact with the organisms they are meant to kill. A few disinfectants have an EPA registration based on tests done on a "dirty" surface. The label of such a product will say "effective in the presence of 5% body fluids" or use similar wording. All other disinfectants require that surfaces be pre-cleaned until they are free of dirt, grease, oil, and organic substances such as blood. The disinfectant must then be applied thoroughly and left in place for 10 minutes or more, depending on the manufacturer's recommendation. It may be necessary for workers to adapt their routine to accommodate the required contact time. For example, they could apply the disinfectant throughout a restroom and perform other tasks while waiting to rinse it off.³⁵

Most combination products intended to both clean and disinfect also require this two-step process. Since the cleaning step does not require a disinfectant, using two different products can reduce the amount of disinfectant used.

Diluting and storing disinfectants

The Minnesota Technical Assistance Program (MnTAP) makes the following recommendations to reduce workers' use of and exposure to disinfectants:³⁶

Dilute products correctly

- ▶ Determine the equipment needed to ensure proper dilution and easy use.
- ▶ Calibrate dispensing equipment carefully and often — at least every time a new container of disinfectant is opened.
- ▶ Calibrate equipment using water instead of the chemical product.
- ▶ When calibrating, check the equipment for leaks and malfunctions.
- ▶ Measure the concentrate before putting it in the dilution tank.
- ▶ Use pumps and spigots to decrease the likelihood of spills and contact with skin.
- ▶ Use the lowest concentration recommended by the manufacturer to achieve the necessary level of antimicrobial activity. All disinfectants achieve their maximum ability to disinfect at a specific concentration. Adding more will not increase

their effectiveness, but may increase the likelihood of injury, equipment damage, and environmental pollution.

- ▶ Use the smallest possible amount of solution to obtain the desired level of microbial control. This will minimize waste and also reduce the potential for microorganisms to acquire resistance to specific chemicals.
- ▶ Mix only the amount needed; do not mix a gallon if only a quart is needed.
- ▶ Make sure diluted disinfectants are labeled by name and date of dilution to keep track of their expiration.
- ▶ Check the manufacturer's instructions on determining the expiration date of diluted disinfectants and preventing inappropriate use and disposal.

Store and handle products correctly

- ▶ Keep containers closed when not in use.
- ▶ Store disinfectants on lower shelves in their original container.
- ▶ Store disinfectants in compatible containers (e.g., do not store corrosives in metal containers).
- ▶ Minimize the transfer of disinfectants from container to container.
- ▶ Clean up spills immediately. Ensure that spilled residues are managed properly — refer to the MSDS for this information.
- ▶ Use drip pans under spouts to catch and contain drips.
- ▶ Establish written procedures for disinfectant use based on current needs and equipment. Clearly post procedures and train all staff. Revise procedures and update staff when conditions change.
- ▶ Check containers regularly for leaks, breaks, rust, or other corrosion. If a leak or break occurs, transfer the product into another properly labeled container.

When to Use Disinfectants: The Experts Disagree

The use of disinfectants is growing in the US for a number of reasons. Recent outbreaks of *E. coli* bacteria contamination in food, a cultural aversion to germs, ignorance about the microbe removal power of nondisinfectant cleaners, and regulatory mandates in health care settings are all playing a role. Since disinfection can result in the substitution of a chemical hazard for a biological one, it should only be done when the biohazard outweighs the chemical hazard.

There is some disagreement about the need for routine disinfection of public spaces. According to the Centers for Disease Control and Prevention (CDC), thoroughly cleaning all hard surfaces that people frequently touch is the most important step in preventing the spread of disease.³⁷ However, some experts recommend that janitors also use a disinfectant to kill any bacteria and viruses that remain.³⁸ The Janitorial Products Pollution Prevention Project suggests an institutional-grade disinfectant for daily use on hard surfaces in high-traffic restrooms and food preparation areas. In addition, milder antimicrobials (sanitizers) “may be used on carpets or in toilet tanks where the goal is to reduce germs to a safe level (typically 0.1%), rather than completely eliminate them.”³⁹

Other experts disagree, recommending that the use of a disinfectant be carefully evaluated. They note that disinfectants poison the organism but do not clean hard surfaces. In contrast, a thorough cleaning not only kills most microbes but also removes the food and water they need to survive. The best approach is to ask whether disinfection is really necessary. For surfaces or equipment likely to come into contact with broken skin or mucous membranes, disinfection is appropriate. Otherwise, “general surface cleaning can be accomplished by washing with a detergent, rinsing, and thorough drying.”⁴⁰

The guiding principle is to prevent the accumulation of germs on surfaces we touch. Cleaning agents can often accomplish this goal by themselves; it is not absolutely essential to actually kill these organisms before removing them.

Dishwashing detergents and hand soaps intended for general restroom use often contain antimicrobial ingredients such as triclosan. In most cases, there is no need for these antimicrobials, and concern is growing that their widespread use is producing resistant strains of bacteria.⁴¹ Instead, thorough hand-washing provides the best everyday protection.

Cleaning services generally have to comply with the wishes of their clients and, in the case of health care and food service settings, with regulatory mandates. In these cases, identifying the safest products and learning to handle them properly becomes crucial.

Chapter 5

SELECTING SAFER JANITORIAL CLEANING PRODUCTS: WHAT TO AVOID AND WHAT TO LOOK FOR

When selecting janitorial cleaning products, the buyer should obtain the material safety data sheet (MSDS) and any other available technical data for every product and use this information to make an informed decision about which ones to use. There are three approaches to finding safer products:

1. Evaluate the risks of alternative products yourself.
2. Look for cleaning products that have been certified as environmentally preferable by Green Seal or a similar independent party.
3. Find out which products have been identified as environmentally preferable by major government agencies and buy those products yourself.

This chapter covers the technical issues that need to be considered in order to decide whether or not a product poses a risk to users, building occupants, and the environment in general.

VOC Content

As noted earlier, volatile organic compounds (VOCs) contribute to indoor air pollution and photochemical smog. Cleaning chemicals are not the most significant source of indoor VOCs, but according to Green Seal, the “green” product certification organization, “they are a significant source of VOCs to the workers who use them.”¹ The inhalation toxicity of cleaning products should therefore be an important factor in purchasing decisions.

TO FIND PRODUCTS WITH REDUCED VOC CONTENT

- ▶ Avoid aerosol products, which almost always contain more VOCs than non-aerosol equivalents.
- ▶ Ensure that the product is within the legal limit for VOC content (see Table 5).
- ▶ Compare the product with others in the same category and choose the one with the lowest VOC level.

The VOC level is usually listed on the MSDS. If not, the manufacturer should have a technical data sheet or other information that includes the VOC level. Massachusetts has found products in many categories with a VOC level of zero, and federal regulations limit the amount of VOCs permitted in particular categories of cleaning product (see Table 5).

Skin and Eye Irritants

Many conventional janitorial cleaning supplies contain chemicals that are either mildly or strongly irritating to the skin and/or eyes. Typically, these substances are either highly alkaline (with a very high pH of 11 or above) or highly acidic (with a very low pH of 2 or below). The pH level of a product is usually listed in the MSDS under “Physical Data.” Products with either a very high or a very low pH level should be avoided whenever possible. A pH of 7 is neutral, so products with a pH closer to 7 are usually less irritating.

TO FIND LESS IRRITATING PRODUCTS

- ▶ Check the pH on the material safety data sheet (MSDS) and select a product with a pH between 5 and 9 (closer to neutral).
- ▶ Check the “Health Hazard” and “Special Protection” sections of the MSDS, product label, or other manufacturer technical information. Avoid products that:
 - Are corrosive to the eyes, skin, or mucous membranes.
 - Can cause serious eye or mucous membrane damage.
 - Can burn the skin.

Also avoid products whose manufacturer states in the “Special Protection” section of the MSDS that users must wear special clothing such as Tyvek suits or that regular clothing will not protect the user.

- ▶ If the MSDS or other technical data sheets have information on eye, skin, or mucous membrane irritation ratings, choose products that are listed as “mild irritants” over those listed as “severe irritants.”

The Janitorial Products Pollution Prevention Project has published an extensive list of toxic chemicals potentially found in cleaning supplies that are irritating to the skin and/or eyes. It indicates the severity of the effects of each chemical, ranging from temporary irritation to burns and blindness. For fact sheets on specific chemicals that the project recommends should not be used, that it recommends should be used only with extreme care (and avoided if possible), or that it recommends should be used with routine care, see <http://www.westp2net.org/Janitorial/tools/riskevaluation.htm>.

Green Seal also looked at a wide variety of chemicals used in cleaning products and produced a matrix indicating which of these chemicals were highly or mildly irritating. This information can be found in Appendix A of Green Seal's *Survey of General-Purpose Cleaners, Bathroom Cleaners, and Glass Cleaners*, published in May 2000 as part of the organization's efforts to produce a standard for institutional cleaners. It is available from Green Seal, 1001 Connecticut Avenue, NW Suite 827, Washington, DC 20036; tel: 202-872-6400; fax: 202-872-4324; web site: <http://www.greenseal.org>.

Table 5. Allowable VOC Content of Cleaning Products*

Product Category	Federal Limit for VOC Dilution**	Green Seal Standard Limit†	Lowest VOC Level of Products Listed in Table 6†
Air fresheners, Single-phase	70%	—	—
Air fresheners, Double-phase	30%	—	—
Air fresheners, Liquids/pump sprays	18%	—	—
Air fresheners, Solids/gels	3%	—	—
Bathroom and tile cleaners, Aerosols	7%	—	—
Bathroom and tile cleaners, All other forms	5%	1%	0%
Dusting aids, Aerosols	35%	—	—
Dusting aids, All other forms	7%	—	—
Engine degreasers	75%	—	—
Fabric protectants	75%	—	—
Floor polishes/Waxes for flexible flooring materials	7%	—	—
Floor polishes/Waxes for nonresilient flooring	10%	—	—
Wood floor wax	90%	—	—
Furniture maintenance products, Aerosols	25%	—	—
General-purpose cleaners	10%	1%	0%
Glass cleaners, Aerosols	12%	—	—
Glass cleaners, All other forms	8%	3%	0%
Laundry prewash, Aerosols/solids	22%	—	—
Laundry prewash, All other forms	5%	—	—
Laundry starch products	5%	—	—
Oven cleaners, Aerosols/pump	8%	—	—
Oven cleaners, Liquids	5%	—	—

* Note that states or localities may have more stringent limits. This table refers to the VOC level allowed in the ready-to-use product. To calculate the VOC level from an MSDS for a concentrate, divide the VOC level on the MSDS by the recommended dilution factor.

** *Code of Federal Regulations*, Title 40, Chapter I, Part 59, "National Volatile Organic Compound Emission Standards for Consumer and Commercial Products."

† [—] signifies that no standard has been set or that no information is available on this type of product.

Toxic Chemicals

A wide variety of toxic chemicals are found in janitorial cleaning supplies intended for industrial and institutional facilities. Some of these chemicals are associated with human health effects and ecological impacts, including death, cancer, damage to major organs, and interference with normal reproduction and development, among other things. Consumers can identify toxic chemicals contained in cleaning products by reviewing product labels, MSDSs, and web sites — although these resources can sometimes be limited. However, even if the only information available about a product is its MSDS, this can often provide sufficient information to enable potential users to make a decision about its use.

TO DETERMINE WHETHER A PRODUCT CONTAINS A HIGHLY TOXIC CHEMICAL

- ▶ Check the “Ingredients” section of the material safety data sheet (MSDS). If an ingredient is identified as a carcinogen, do not use the product. Products without carcinogens are available for all uses.
- ▶ All MSDSs must list any ingredient subject to the reporting requirements under Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA), also called the Toxics Release Inventory, or TRI. Screen out products containing these ingredients, which have been identified as chemicals of concern to US EPA.
- ▶ If you have questions about the health or environmental impacts of specific product ingredients, check the Internet sources listed on this page, or contact the supplier.

For example, para-dichlorobenzene (para) is a persistent, bioaccumulative, toxic chemical (PBT) frequently found in deodorizing urinal blocks. Para can be harmful to workers who breathe large amounts of the deodorant vapors and can also contaminate surface water or water supplies when flushed into the sewer system. According to the Agency for Toxic Substances and Disease Registry, para has been found in 13 percent of surface drinking water samples in the US and in trout from the Great Lakes. It was also found in over 20 percent of the streams surveyed by the US Geological Survey in 1999 and

2000.² Alternatives exist, such as sulfonated or enzyme-based urinal blocks. Another option is experimenting with cleaning practices that eliminate the need for the blocks. With assistance from INFORM, Erie County, New York, conducted a pilot project to test several alternative deodorant blocks in its public facilities, and ultimately established a new janitorial contract specifying non-para-containing urinal blocks. Based on purchases from the previous year, the county estimates it prevented approximately one ton of para blocks from entering the sewer system.

Because most jurisdictions restrict the phosphate content of cleaners, most products on the market today do not contain high levels of phosphates, which can promote algae blooms in bodies of water. Not all cleaners are affected under these laws, however, including specialty cleaners such as trisodium phosphate (TSP). Other chemicals to avoid include ethylene diamine tetraacetic acid (EDTA) and nitrolotriactic acid (NTA). These chemicals are not normally biodegradable and can cause problems in water treatment plants by preventing the removal of metals from the wastewater.

Sources of additional information on toxic chemicals

For more information on the potential human health and ecological impacts of particular chemicals and products, see the following web sites:

<http://www.scorecard.org/chemical-profiles> offers easy-to-understand information about the hazards associated with thousands of toxic chemicals and links to many other sources.

<http://www.westp2net.org/janitorial/jp4.htm> provides fact sheets on janitorial pollution prevention and worker safety, information on particular chemicals used by janitors, and reports on the Santa Clara County and Richmond, California, Janitorial Products Pollution Prevention Projects.

<http://www.chemfinder.com> is a searchable database of basic information and toxicology links for almost any chemical.

<http://siri.uvm.edu/msds/> is a material safety data sheet archive, providing links to hundreds of MSDSs for products and individual chemicals.

<http://www.cdc.gov/niosh/81-123.html> offers a database of occupational health guidelines for chemicals considered hazardous by the National Institute of Occupational Safety and Health (NIOSH).

<http://www.atsdr.cdc.gov/toxfaq.html> offers a database of easy-to-read fact sheets on the hazards of a number of chemicals.

<http://ntp-server.niehs.nih.gov/> offers a database of information on many toxic chemicals selected by the National Toxicology Program (NTP), as well as the NTP's *Ninth Report on Carcinogens* (released in 2000), with results of studies updated every two years.

<http://www.state.nj.us/health/eoh/rtkweb/rtkhsfs.htm> offers fact sheets covering worker health and safety information on many hazardous chemicals.

<http://www.epa.gov/enviro/html/emci/chemref/index.html>, the US EPA's Master Chemical Integrator, is a single-location master list integrating the databases of chemicals monitored in all its major programs: Air, Water, Hazardous Waste, Superfund, and Toxic Release Inventory. Invaluable in negotiating the maze of EPA resources on the web.

Some of these databases, and many of the certification organizations and government-sponsored pilot projects studying the toxic effects of janitorial cleaning chemicals, may also cite universally accepted sources of information such as the International Agency for Research on Cancer (<http://www.iarc.fr>) and the National Library of Medicine's ToxNet database (<http://toxnet.nlm.nih.gov/>). However, the nonscientist may find the information contained at these sites difficult to understand.

Dyes

Another important issue is product dyes. Some manufacturers are willing to supply their products with or without colorants. There are factors to consider on both sides of the issue. Undyed products are free of chemical dyes, which often are environmental toxicants and sometimes are carcinogens. Yet many cleaning

companies prefer dyed products because they reduce the risk that janitors will mix up products, with dangerous results. One alternative is using colored bottles, or some other clear visual distinction between different products or different concentrations of the same product.

Packaging

In addition to differences in janitorial cleaning products themselves, amounts and types of packaging may differ among brands. To reduce packaging waste, many environmentally preferable cleaning products can be purchased in bulk or in concentrate form, and many come in containers that are reusable, refillable, recyclable, or made with recycled content. In addition, a growing number of products come in containers designed to minimize occupational exposure when their contents are transferred to another container before or during use.

TO LOCATE PRODUCTS WITH ENVIRONMENTALLY PREFERABLE PACKAGING

- ▶ Ask if the vendor will take back empty containers for reuse.
- ▶ Ask what kind of plastic (or other material) the containers are made of, and speak with the facility's recycling vendor or an appropriate local official to find out if these containers are recyclable in your area.
- ▶ Ask the vendor if the packaging incorporates recycled content.
- ▶ Avoid polyvinyl chloride (PVC) packaging, which is not recyclable and may contain metals and/or phthalates (these are persistent, bioaccumulative, toxic chemicals and possible reproductive toxins).
- ▶ Ask if the product comes in concentrate form.
- ▶ Ask if automatic dispensing equipment is available to reduce waste and minimize worker exposure to the concentrate.

Product literature should contain, at a minimum, information on: ³

- ▶ How to store, mix, and use the product.
- ▶ Any chemicals with which the product is incompatible.
- ▶ How to access the supplier's customer service department for answers to health, safety, or environmental questions.
- ▶ How to properly dispose of unused products, wastes, and containers.

Product Literature and Training Materials

Product literature should provide adequate information to enable potential consumers to make decisions about when and how to use the product. If the information needed to make these decisions is not available, the manufacturer may not be committed to providing a safe product.

Chapter 6

PRODUCT EVALUATION PROGRAMS

A growing number of janitorial cleaning products on the market claim to be “environmentally preferable.” Manufacturers may state that these products are biodegradable, phosphate-free, or nontoxic, or that they contain low levels of volatile organic compounds (VOCs) or ozone-depleting substances. To assist janitorial staff in identifying institutional cleaning supplies that are environmentally preferable, INFORM looked beyond the manufacturers’ claims and compiled information based on environmental evaluations and performance tests published by

not-for-profit certification organizations, government agencies, and private laboratories.

Environmentally preferable product (EPP) certification programs such as Green Seal in the United States and Canada’s Environmental Choice Program have analyzed the environmental attributes and/or performance of janitorial cleaning supplies for institutional and commercial applications. In addition, federal agencies, states, and local governments have conducted similar assessments on products being considered for purchase.

This chapter provides a summary of several programs that have evaluated the environmental attributes and performance of industrial and institutional cleaning products. Tables 6 and 7, in Appendices 1 and 2, present information on the particular products evaluated in these programs.

Green Seal

GS-37 standard

Environmental evaluation. Green Seal is a not-for-profit organization that establishes environmental standards for different product categories and certifies products that meet those standards.

In 2000, under commission from the Aberdeen Proving Ground military facility, Green Seal began to develop a new standard for industrial and institutional cleaning products, called the GS-37 Standard for Industrial and Institutional Cleaners. This standard covers general-purpose (sometimes also referred to as all-purpose), bathroom, and glass cleaners “intended for routine cleaning of offices, institutions, warehouses and industrial facilities,” not “households, food preparation operations, or medical facilities.” While the standard includes disinfectant bathroom cleaners, general-purpose disinfectants are outside its scope.

The Aberdeen/Green Seal Environmental Standard for Industrial and Institutional Cleaners was developed according to the criteria of the Global Ecolabeling Network (GEN) and guidelines set forth in the International Organization for Standardization’s ISO 14020 and 14024 standards regarding environmental

SETTING YOUR OWN STANDARD FOR CLEANING PRODUCTS

Over the past few years, many state and local governments in the US have set separate standards for the cleaners they purchase. These have been developed with varying degrees of expertise, and in response to different priorities and political pressures. For instance, some standards specify that the whole product should be tested for ready biodegradability, although the ready biodegradability test was designed to be used for a single ingredient. Some also prohibit mutagens and teratogens (chemicals that can damage DNA or produce birth defects), but do not specify a list or any means of determining whether a product contains such chemicals.

The fact that these entities are focusing on the environmental and health effects of their cleaners is encouraging. However, the plethora of differing standards has made it difficult for cleaning product manufacturers to develop product lines that meet them all. For this reason, INFORM recommends that purchasing entities consider using Green Seal’s GS-37 standard in their purchasing specifications, rather than attempting to develop standards of their own. GS-37 is the result of a consensus among manufacturers, users, government, environmentalists, and other stakeholders, and can serve as a benchmark for manufacturers that are developing less toxic cleaners. Groups concerned about environmental or health attributes not addressed by the Green Seal standard can insert additional specifications addressing those concerns, instead of developing an entirely new standard.

labeling. As required, the draft standard was produced by a stakeholder committee, revised several times, sent for public review to 125 experts, and posted for comment on Green Seal's web site. It was then further revised until a consensus was reached by industry, users, government, environmentalists, and other stakeholders. As of May 2002, Green Seal was evaluating five products for certification under the GS-37 standard.

According to US EPA, the resulting GS-37 standard "address[es] environmental impacts in a manner consistent with EPA's guidance on environmentally preferable purchasing." The agency recommends that federal purchasers consider this standard when making purchasing decisions relevant to cleaners.

To meet the GS-37 standard, a cleaning product:

- ▶ May not be toxic to humans in its undiluted form. The standard sets specific toxicity thresholds for oral, inhalation, and skin exposure, and prohibits products from containing "any ingredients that are known, probable, or possible carcinogens or that are known to cause reproductive toxicity."*
- ▶ May not be corrosive to the skin or eyes.
- ▶ May not be a skin sensitizer as measured by standard tests.
- ▶ May not be combustible (the product's flash point, or that of 99 percent of its ingredients by volume, must be above 150° F).
- ▶ May not, as used, contain substances that contribute significantly to the production of smog, ozone, or poor indoor air quality. The volatile organic compound (VOC) content of a product, as used, may not exceed:
 - 1 percent by weight for general-purpose and bathroom cleaners.
 - 3 percent by weight for glass cleaners.
- ▶ May not, as used, be toxic to aquatic life as measured by a specified test at certain concentrations.

* These ingredients include "[a]ny constituent of a product, which is intentionally added or known to be a contaminant, that comprises at least 0.01% by weight of the product."

** Many standards use the OECD definition of ready biodegradability, which defines a substance as readily biodegradable if a certain percentage of the sample (60 to 70 percent, depending on measurement method) will degrade within 28 days. Although some evaluation programs have used this protocol to test whole products (instead of single ingredients), this test is only appropriate for single-ingredient samples because it assumes that if 60 to 70 percent has

- ▶ May not, as used, contain more than 0.5 percent by weight of total phosphorus.
- ▶ Each organic ingredient (except for antimicrobials in bathroom cleaners) must be readily biodegradable, as defined by the Organisation for Economic Cooperation and Development (OECD).**
- ▶ May not contain alkylphenol ethoxylates (abbreviated in this report as APEs, and sometimes called APEOs); dibutyl phthalate (a persistent, bioaccumulative, and toxic chemical); heavy metals (including arsenic, cadmium, chromium, cobalt, lead, mercury, nickel, and selenium); or any ozone-depleting compounds. Any fragrances contained in the product must be identified on the material safety data sheet (MSDS).

The standard also discourages animal testing, and requires that:

- ▶ The product must be a concentrate.†
- ▶ The product's primary packaging must be recyclable, unless the manufacturer provides for the return and refilling of its packages.
- ▶ The product manufacturer, distributor, or a third party must offer training or training materials in the proper use of the product.
- ▶ The product label must include detailed instructions on the product's proper use and disposal, and on the use of personal protective equipment.

Performance tests. In order to be certified by Green Seal, vendors must demonstrate that their concentrated products work effectively when diluted with room-temperature water using universally accepted test methods specified in the standard.

Contact information. Mark Petruzzi, Director of Certification; tel: (202) 872-6400 ext 23; e-mail: mpetruzzi@greenseal.org; web site: <http://www.greenseal.org/>.

degraded within 28 days, the rest will follow soon thereafter. In mixtures, this test will not show whether *all* the ingredients have begun to degrade, and a mixture with a persistent ingredient could show a 60 percent degradation in 28 days because the persistent ingredient is left in the undegraded 40 percent. More information about this test is available in the individual standards or from the EPA at http://www.epa.gov/docs/OPPTS_Harmonized/835_Fate_Transport_and_Transformation_Test_Guidelines/Drafts/835-3110.txt.html.

† Concentrates are considered to be products with a dilution ratio of at least 1 part product to 8 parts water (1:8), by volume.

Green Seal's "Choose Green Report"

Environmental evaluation. The products listed in Tables 6 and 7 are from Green Seal's *Choose Green Report*, which was published in September/October 1999, before the GS-37 standard was established. In the *Choose Green Report*, Green Seal presents its assessment of over 60 industrial and institutional cleaners based on data provided by the manufacturers. Each of the listed products claims to meet the following criteria:

- ▶ Is not toxic to human or aquatic life.
- ▶ Contains VOC levels below 10 percent by weight of the diluted product.
- ▶ Is readily biodegradable.
- ▶ Works optimally in room-temperature water.
- ▶ Has a pH between 2.5 and 12.
- ▶ Is not made of petroleum or petrochemical compounds.
- ▶ Does not contain chlorine bleach.
- ▶ Is free of phosphates and derivatives.
- ▶ Does not contain ethylene diamine tetraacetic acid (EDTA) or nitrotriacetic acid (NTA).
- ▶ Does not contain phenolic compounds or glycol ether.
- ▶ Is free of arsenic, cadmium, chromium, lead, mercury, nickel, and selenium.

Contact information. Mark Petruzzi, Director of Certification; tel: (202) 872-6400 ext 23; e-mail: mpetruzzi@greenseal.org; web site: <http://www.greenseal.org/>.

Canada's Environmental Choice Program

Environmental evaluation. In 1988, Environment Canada (the Canadian equivalent of the US EPA) established the Environmental Choice Program (ECP). The ECP is administered by TerraChoice Environmental Services, Inc., a private consulting firm. ECP has established the ECP-57 guideline (a voluntary standard) for industrial and commercial cleaners. Products that meet one of ECP's guidelines are eligible to display the EcoLogo ecolabel. Products are reviewed by third-party laboratories to ensure that they meet the criteria contained in the guideline. Products must:

- ▶ Have zero ozone-depletion potential.
- ▶ Not contain VOCs in excess of 10 percent by weight.
- ▶ Not be formulated with APEs, aromatic solvents (benzene-based), butoxyethanol or chlorinated

organic solvents, more than 1 percent EDTA, more than 5 percent NTA, or any known or probable human carcinogen (according to the International Agency for Research on Cancer).

- ▶ Not be corrosive to the skin, or have a pH below 2 or above 13.
- ▶ Not have a flash point below 61°C (141.8°F).
- ▶ Be readily biodegradable.
- ▶ Not be toxic to aquatic life or contain more than 0.1 percent of an ingredient that is either very acutely toxic or acutely toxic and bioaccumulating (according to data acceptable to the Environment Choice Program).

Performance tests. The Environmental Choice Program states that all products must clean common hard surfaces effectively, as measured by the Canadian General Standards Board standard CAN/CGSB-2.11.94, Methods of Testing and Analysis of Soaps and Detergents, Method 20.3: Cleaning Efficiency. The standard is available at http://www.pwgsc.gc.ca/cgsb/catalogue/specs/002/002_011-e.html.

Contact information. Environmental Choice Program, Terra-Choice Environmental Services Inc., 2781 Lancaster Road, Suite 400, Ottawa, Ontario, Canada K1B 1A7; tel: (613) 247-1900, or toll-free (800) 478-0399; fax: (613) 247-2228; e-mail: ecoinfo@terrachoice.ca; web site: <http://www.environmentalchoice.com>.

State Programs

Commonwealth of Massachusetts

Environmental evaluation. Massachusetts, like several other states, has set up a state purchasing contract for environmentally preferable janitorial cleaning products. The Massachusetts Operational Services Division (OSD), the state's central purchasing agency, has awarded contracts to six vendors. To receive a contract, a cleaning product must meet the following criteria:

- ▶ It contains no ingredients on the Massachusetts Toxic Use Reduction Act list of chemicals (which is similar but not identical to the US EPA's Toxics Release Inventory).
- ▶ It contains no carcinogens appearing on lists established by the International Agency for Research on Cancer, the National Toxicology Program of the National Institutes of Health, and the Occupational Safety and Health Administration, and no chemicals defined as Class A, B, or C carcinogens by the US EPA.

- ▶ It contains no ozone-depleting ingredients.
- ▶ It complies with the VOC-content levels stipulated in Massachusetts law.
- ▶ It complies with the phosphate-content levels stipulated in Massachusetts law (currently, 0.5 percent of the weight of the product ingredients).

A cleaner that meets the above requirements is then evaluated according to other criteria, each of which has a point value depending on its relative importance. To pass this phase of the evaluation, a product must receive 50 out of 75 points:¹

- ▶ It contains no chemicals on the Massachusetts Right-to-Know Act chemical list or the US EPA's Resource Conservation and Recovery Act hazardous waste list.
- ▶ It is not considered ignitable, corrosive, reactive, or toxic according to the Resource Conservation and Recovery Act.
- ▶ It has low skin and eye irritation potential.
- ▶ It has a moderate pH (products with a pH of 4 to 9 receive the highest score).
- ▶ It has a high flash point (products with a flash point above 200°F receive the highest score).
- ▶ It has a VOC content lower than the legal requirement for the product category.
- ▶ It is readily biodegradable according to the OECD definition, but tested as a whole product.*
- ▶ It contains no APEs.
- ▶ It is below the legal limit for phosphates.
- ▶ Any dyes or fragrances used are approved by the US Food and Drug Administration for food use.
- ▶ It is approved by the US Food and Drug Administration.
- ▶ Its packaging is recyclable, made with recycled content, and returnable or refillable.
- ▶ It is available in nonaerosol form.
- ▶ It is available in concentrated form.
- ▶ Its manufacturer has made demonstrable efforts to minimize the environmental impact of its operations.

Performance tests. Massachusetts performed extensive user surveys of the janitorial cleaning products that meet the environmental criteria. The surveys explored product effectiveness, product attributes, overall satisfaction, and vendor satisfaction.

Contact information. Marcia Deegler, Environmental Purchasing Coordinator, Operational Services Division, Commonwealth of Massachusetts, One Ashburton Place, Room 1017, Boston, MA 02108; tel: (617) 720-3356; e-mail: Marcia.deegler@osd.state.ma.us; web site: <http://www.state.ma.us/osd/enviro/products/cleaning.htm>; Lara Sutherland, INFORM, Inc.; tel: (617) 864-3730; e-mail: sutherland@informinc.org.

State of Vermont

Environmental evaluation. In 2000, Vermont drafted criteria for selecting environmentally preferable cleaning products. At the end of a detailed assessment process that looked at environmental preferability, product efficacy, and cost, the Office of Purchasing and Contract Administration (PCA) awarded contracts to three vendors. To conduct the environmental assessment, PCA developed the MPAT (Manufacturers Product Assessment Tool), a spreadsheet that helps vendors score their products.

The MPAT scoring spreadsheets include “critical product exclusion criteria.” If a product fails to meet one or more of these criteria, it may be excluded from the contract because it will receive a score of zero for an entire section. There are three major sections in the MPAT: (1) health hazard potential, (2) potential for environmental impact, and (3) packaging and formulation. Products received scores between 0 and 60, and only the top-scoring products were considered for the state contract. Below is a list of the critical product exclusion criteria:

- ▶ No persistent, bioaccumulative, toxic chemicals.
- ▶ No carcinogens, mutagens, and teratogens, or additional substances that are highly toxic and/or suspected carcinogens beyond trace amounts.
- ▶ No ozone-depleting compounds.
- ▶ Low VOCs — no product shall contain VOCs in concentrations equal to or exceeding 5 percent of the product weight.
- ▶ No hazardous waste characteristics, as defined by the State of Vermont Hazardous Waste Management Regulations, Subchapter 2, sections 7-201 to 7-215.
- ▶ No phosphate or phosphonates in excess of a trace quantity, as required by Vermont State Title 10 § 1381.
- ▶ No combination cleaner/disinfectants.

* See the footnote on page 29 for an explanation of ready biodegradability.

The PCA employed a series of “non-critical product criteria” that were used to score the environmental preferability of different products above and beyond the critical product exclusion criteria:

- ▶ Vapor pressure
- ▶ Inhalation toxicity
- ▶ Ingestion toxicity
- ▶ pH, based on final pH of mixtures based upon manufacturer’s recommended formulation
- ▶ Presence of VOCs at a concentration of less than 5 percent by weight
- ▶ Skin absorption
- ▶ Combustible liquid
- ▶ Presence of fragrances and/or dyes
- ▶ Biodegradability
- ▶ Aquatic toxicity or fish bioconcentration factor (BCF)
- ▶ Percentage of product obtained from renewable resources

Performance tests. The state performed performance evaluations of the top-scoring products from the MPAT. Information gathered through a user survey helped the PCA decide which products to include in the state contract.

Contact information. Judy Jamieson, Purchasing Agent; tel: (802) 828-2217; e-mail: judith.jamieson@state.vt.us; web site: <http://www.bgs.state.vt.us/pca>.

Washington State

Environmental evaluation. Washington recently adopted new criteria and issued a contract for environmentally responsible cleaning products. The Office of State Procurement required that bidders include the results of independent laboratory tests confirming that all active and inert ingredients meet the criteria specified in the state’s list of mandatory product attributes:

- ▶ Products must not contain any chemicals on the US EPA’s Toxics Release Inventory or the Washington State Department of Ecology’s list of persistent, bioaccumulative, toxic chemicals.* In addition, products must not contain more than trace amounts of APEs.

- ▶ No ingredient may be toxic to aquatic life, as measured by test methods found in the *Code of Federal Regulations*, Chapter 40, Part 797, and as determined by criteria specified in the bid document.
- ▶ None of the product’s ingredients may be a known or probable carcinogen, mutagen, or teratogen according to the National Toxicology Program, the World Health Organization’s International Agency for Research on Cancer, or the US Occupational Safety and Health Administration. In addition, no product may contain more than trace amounts of paradichlorobenzene, 1,4-dioxane, sodium hypo-chlorite, NTA, or sodium EDTA.
- ▶ The product as a whole, or its individual ingredients, must meet the OECD’s definition of “readily biodegradable.”**
- ▶ The product must contain no ozone-depleting compounds, as specified by the Montreal Protocol.†
- ▶ The product must not contain VOCs in concentrations above 10 percent of the product’s weight.
- ▶ The product, when discarded, must not have to be handled as hazardous waste. In addition, the product must not:
 - Have a flash point under 140° F.
 - Have a pH of 2 or below or 12.5 or above.
 - Be explosive.
 - Fail the toxic characteristic leaching procedure (TCLP) test.

Washington also included secondary criteria that allowed bidders to earn points after meeting the mandatory criteria. The secondary criteria addressed:

- ▶ Packaging.
- ▶ Concentrates.
- ▶ Acute toxicity.
- ▶ Low VOC content.
- ▶ Skin and eye irritation.
- ▶ Renewable resource-based products.

* For this purposes of this contract, the state of Washington used the list of 27 persistent, bioaccumulative, toxic chemicals developed by the Province of Ontario Ministry of Environment. Since that time, Washington has determined that Ontario never used this list, and the state now uses a shorter list. More information on both lists is available at <http://www.ecy.wa.gov/programs/eap/pbt/pbtfaq.html>.

** See the footnote on page 29 for information on ready biodegradability.

† For the Montreal Protocol list of ozone-depleting substances to be phased out, see <http://www.unepie.org/ozonaction.html>.

Performance tests. Washington State included performance testing as part of its product selection process.

Contact information. Patricia Jatzak, Washington State Department of Ecology; tel: (360) 407-6358; e-mail pjat461@ecy.wa.gov; contract information is available at <http://www.ga.wa.gov/pca/contract/11399c.doc>; specific criteria available at <http://www.metrokc.gov/procure/green/statewa.pdf>.

State of Minnesota

Environmental evaluation. In 1997, the Minnesota Office of Environmental Assistance (MOEA) initiated the Janitorial Cleaners Project to screen and rate the performance and environmental characteristics of 33 categories of cleaning products on the state contract. Under MOEA's scoring system, products receive between 0 and 90 points for both environmental and performance criteria. To be included on the state contract, products needed a minimum of 60 points in each category. Minnesota analyzed an usually large number of products and created a list of more than 120 products that are on the current contract. Because of the large number of products that passed Minnesota's ranking system, Table 6 includes only those products that ranked highest (76 to 90 points) for environmental preferability. For a list of all products on Minnesota's current contract, see http://www.swmcb.org/EPPG/App_D.HTM. Minnesota's bid criteria for janitorial cleaning products are as follows:

- ▶ Physical properties: boiling point, vapor pressure, evaporation rate
- ▶ Product safety
 - Lethal dose for oral, skin, and inhalation exposure
 - Product ingredients included in the Minnesota Occupational Safety and Health Administration's current right-to-know standards as a regulated carcinogen
 - Flash point
 - pH
- ▶ Ecological stressors
 - Product ingredients listed by the Minnesota Toxics Indexing System as a concern for potential environmental impacts
 - Percentage of product derived from plant matter
 - Product ingredients listed in the Montreal Protocol as ozone-depleting
 - Concentration of phosphates and phosphonates

- ▶ Fragrances and dyes
 - Presence of synthetic fragrances
 - Presence of synthetic dyes
- ▶ Packaging
 - Concentrate or bulk formulation
 - Refillable packaging
 - Availability in aerosol and/or non-aerosol containers
 - Post-consumer recycled content less than, equal to, or greater than 20 percent

Performance tests. Minnesota's program included performance tests of each product that met the environmental performance standards. Products were rated on a scale of 0 to 90. Products required a score of at least 60 to be included on the state contract.

Contact information. Mike Liles, Minnesota Office of Environmental Assistance; tel: (651) 215-0220; e-mail: mike.lyles@moea.state.mn.us; web site: <http://www.moea.state.mn.us/lc/purchasing/cleaners.cfm>.

Local Government Programs

City of Santa Monica, California

Environmental evaluation. Starting with a 1993 pilot program, the City of Santa Monica conducted an exhaustive bid evaluation process for janitorial cleaning products used in its facilities. Evaluations were based on factors such as human health impacts, aquatic toxicity, biodegradability, VOC level, packaging, and corporate environmental responsiveness. The city's custodial products bid specifications are among the most stringent of any US project. Like those in Massachusetts, they include mandatory (pass/fail) requirements, combined with other criteria graded on a point-scoring system. To see Santa Monica's current bid specifications, go to <http://www.ci.santa-monica.ca.us/environment/policy/purchasing/bidpecs.htm>.

The following is a summary of Santa Monica's bid specifications.

- ▶ Pass/Fail Section: Failure to meet the standards of any of the pass/fail criteria listed below will lead to the automatic rejection of a product.
 - No ingredient shall require reporting under EPA's Superfund Amendments and Reauthorization Act (SARA Title III, Section 313). Floor care products and metal polishes are exempted from this mandatory criteria.
 - No cleaners shall contain disinfectants.

- No products shall be delivered in aerosol cans.
 - No ingredients can be classified as known or probable carcinogens, teratogens, or mutagens according to the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Prop. 65), CCR Title 22, Division 2, Subdivision 1, Chapter 3 Section 12000 *et seq.*; the National Toxicology Program (NTP); the International Agency for Research on Cancer (IARC), Group 1, 2A or 2B; or the Occupational Safety and Health Administration's (OSHA's) list of regulated carcinogens.
 - No products shall contain APEs above trace amounts.
 - No products shall contain ozone-depleting chlorinated compounds. Section 5600-5609 of the Santa Monica Municipal Code bans the use and sale of products containing chlorinated fluorocarbons.
 - Products must meet or exceed the California Code of Regulations (Article 2, Section 94509, Title 17) maximum allowable VOC levels for appropriate cleaning product categories.
 - All surfactants and other organic chemical ingredients must meet the OECD's definition of readily biodegradable.*
- Relative Ranking Section
- Whole product lethal doses as defined by the California Code of Regulations, Chapter 11, Article 3, Section 66261.24. If no whole product data is available, data must be provided for each ingredient present in the concentrate in more than trace amounts.
 - Product pH
 - Primary dermal irritation index (PDII) for whole product when possible, and in concentrate form
 - Eye irritation scores for whole product when possible, and in concentrate form
 - Flash point (in degrees Fahrenheit) of the product concentrate using any method outlined in Department of Transportation regulations CFR 173.120
 - Presence of added dyes, and whether or not they are considered food-grade
 - Presence of any added fragrances and whether or not they are considered food-grade (not including the natural fragrance that may result from active ingredients)
 - Whole product VOC percentage for product concentrate and minimum recommended dilution
 - Range of relevant dilutions from heavy-duty cleaning to daily use
- Type of material used in construction of the product container; if plastic, the numbered type (e.g., #1-7)
 - Measure of the aquatic toxicity of the product or its ingredients. Acceptable measures include EC50 criteria for fish, *Daphnia*, or algae, with certification letter from independent lab listing values and test used.
 - An effective employee training program is central to the successful use of environmentally preferable products. The City will look for vendors who can supply a quality training effort and be accessible to troubleshoot problem applications.
 - Other attributes of the product or manufacturer that will help to assess environmental preferability other than the ones listed in these specifications.

Some unique features of the Santa Monica's program include the following:

- All vendors must submit information double-sided on recycled and/or tree-free paper, without plastic dividers.
- No product may be delivered in aerosol cans, which are difficult and expensive to recycle.
- Acceptable VOC levels are more stringent than those of most other jurisdictions, and are set by the California Air Resources Board.**
- The biocide in disinfectants is exempt from the "readily biodegradable" requirement.
- Both animal and nonanimal tests on a product's skin and eye irritation potential are accepted.
- The product container must be labeled as to contents to maximize recycling.

Performance tests. Following the environmental review, performance evaluations led to the selection of top-ranking products for the city's janitorial contracts. Subsequent cost evaluations were also performed. In the first two years of the pilot, Santa Monica estimates that it saved approximately 5 percent by purchasing alternative instead of traditional cleaning products. This cost savings resulted, in part, from reduced packaging and shipping costs associated with concentrated products. Additional savings resulted from improved custodial training, which led to more efficient use of products.²

* See the footnote on page 29 for information on ready biodegradability.

** For more information on the California Air Resources Board, call 916-322-2990 or see <http://www.arb.ca.gov/html/brochure/consprod.htm>.

Contact information. Karl Bruskotter, Environmental Analyst, City of Santa Monica, Environmental Programs Division; tel: (310) 458-2255; web site: <http://www.ci.santa-monica.ca.us/environment/policy/purchasing/bidspecs.htm>.

San Francisco, California

Environmental evaluation. The Environmentally Preferable Purchasing Program (EP3) of the City and County of San Francisco was created by city ordinance in 1999. Its objective is to determine the feasibility of minimizing the purchase and use of hazardous chemical products by city departments and replacing them with alternatives that pose less risk to city employees and to the environment. At the time of this writing, the city is evaluating potential products through a pilot study involving chemicals used in janitorial, building, and fleet maintenance. This effort is focused on finding preferable products to replace 13 types of hazardous chemical products identified in an initial assessment of over 50 chemical products currently used by the city.

To evaluate cleaning products, the city developed and adopted a set of criteria and a scoring system in three major categories: (1) health and safety, (2) environmental impact, and (3) “other” criteria. This scoring system is being tested in the pilot study to determine its ability to identify environmentally preferable products and to exclude certain products. City employees are testing the screened products to confirm that they perform as well or better than existing products. The city intends to establish EP3 citywide if the results of the pilot study demonstrate that it is feasible to purchase and use environmentally preferable products in city operations.

The following is a summary of the criteria adopted by the City and County of San Francisco. These criteria will be used as a basis for developing bid specifications for contract procurement. To see the original document, go to http://www.sfrecycles.org/hazardous_waste/haz_waste_content/city_depts/hw_city_ep3_prod_eval_criteria.htm.

► Health and Safety Criteria

- Product contains no more than 0.1 percent by weight of any known, probable, or possible human carcinogen, mutagen, or teratogen
- Product contains no more than 0.1 percent of diethanolamine (does not apply to silica sand)
- Product contains no more than 1.0 percent by weight of any substance considered to be a known or probable neurotoxin or central nervous

system depressant (does not apply to ethyl alcohol) by the National Institute of Occupational Safety and Health (NIOSH) or the US EPA Integrated Risk Information System (IRIS)

- Eye irritation
- Skin irritation
- Skin absorption
- Corrosivity/pH
- Flammability/flash point

► Environmental and Community Impact Criteria

- Percentage of ozone-depleting substances
- Percentage by weight of any known, probable, or possible endocrine modifier
- Percentage of any greenhouse gas designated by the Kyoto Protocol of December 1997
- Ready biodegradability
- VOC content
- Percentage of a fragrance that is either a non-functional ingredient or a SARA 313 listed hazardous material
- Percentage of a coloring agent (dye) that is either a nonfunctional ingredient or a SARA 313 listed hazardous material

► Other Criteria

- Availability as a concentrate
- Availability in a nonaerosol container
- Refillable/ returnable/ locally recyclable container and packaging
- Recycled content of container and shipping package

Performance tests. The City and County of San Francisco are currently conducting pilot product testing by city employees to assess product effectiveness and workability. To obtain the results of the pilot tests as they become available, contact the individual below.

Contact information. Alex E. Dong, EP3 Manager; tel: (650) 593-4058 or (415) 355-3761; e-mail: P2Guy@Yahoo.com or alex.dong@sfgov.org.

City of Seattle, Washington

Environmental evaluation. In 2002, Seattle incorporated environmental criteria into requests for bids for janitorial products purchased for use by city janitorial staff. An interdepartmental team of city staff, including janitorial supervisors, property managers, and environmental analysts, developed the criteria and evaluated the bids.

The criteria are applied partly on a pass-fail basis and partly as relative scores, with a threshold score needed in the relative-score area for products to be

acceptable. Seattle also accepts products that meet applicable criteria from the State of Washington or Green Seal. For VOCs, Seattle set a maximum in the pass-fail criteria and also applied a relative score to “reward” lower-VOC products at various levels below the maximum. The city included aquatic toxicity, even though this information is not commonly available, because of the importance of aquatic species, particularly salmon, to the local environment and economy. Seattle sought readily available reference lists for each of the criteria, and included its own list of substances where general references were not readily available, such as for endocrine modifiers.

The pass-fail requirements address:

- ▶ Carcinogens and reproductive toxins
- ▶ Neurotoxins
- ▶ Flammability
- ▶ Corrosivity
- ▶ VOCs
- ▶ Endocrine modifiers
- ▶ Aerosol containers.

To receive further consideration, a product’s relative score must not exceed a specified allowable maximum. For each of the following, the levels of possible points are spelled out in the bid form.

- ▶ Eye irritation
- ▶ Skin irritation
- ▶ Skin absorption
- ▶ VOCs
- ▶ Eutrophication (phosphates)
- ▶ Overall acute toxicity
- ▶ Aquatic toxicity
- ▶ Combined disinfectant/cleaner
- ▶ Biodegradability
- ▶ Fragrances
- ▶ Dyes
- ▶ Concentrates
- ▶ Recyclable container and packaging.

Performance tests. Seattle’s 2002 janitorial products contracts include performance tests for those products that passed the two-part evaluation of safety and environmental features. These tests had not been completed when this document went to press. Products deemed acceptable by staff carrying out the performance tests will be subjected to pricing evaluations that take into account packaging, dispensing, and the use of concentrates.

Contact information. Shirli Axelrod, Seattle Public Utilities; tel: (206) 684-7804; e-mail: shirli.axelrod@ci.seattle.wa.us.

SCIENTIFIC CERTIFICATION SYSTEMS: VERIFYING MANUFACTURER CLAIMS

Scientific Certification Systems (SCS) is a neutral, third-party evaluation and certification company that verifies claims made by manufacturers about the environmental preferability of their products. The SCS green cross and globe logo is used on products with specific attributes such as certified recycled content (of various percentages), biodegradability, absence of ozone-depleting chemicals, and no or low VOC content, among others. The SCS program may be of interest to those who want to buy products with specific attributes and need third-party verification. Unlike Green Seal, SCS does not create overall standards for different types of products, such as industrial cleaners. Instead, SCS focuses on specific attributes. In the company’s cleaning product category, which includes a wide range of products, there are 48 items certified as biodegradable, two as having 50 percent recycled content, and two with 80 percent recycled content. A full list of cleaning products with SCS certification can be found at <http://www.scs1.com/cgi-bin/scs-certclaims.cgi?function=search&producttype=Cleaning+Products>.

Performance tests. SCS has not verified any claims about the performance of specific janitorial cleaning products.

Contact information. Call SCS at (510) 832-1415; web site: <http://www.scs1.com>.

Chapter 7

CASE STUDIES

US GSA/EPA Cleaning Products Pilot Project

In 1993, the Public Buildings Service of the US General Services Administration (GSA), the central purchasing agency for the federal government, established a Cleaning Products Pilot Project in collaboration with the US Environmental Protection Agency. The purpose of the project was to collect information on the environmental attributes of janitorial cleaners so that federal purchasing agents could make an “informed decision” about which products to buy. Under Executive Order No. 13101 and its predecessor No. 12873, federal agencies are encouraged to purchase environmentally preferable products — “products and services [that] have a lesser or reduced effect on human health and the environment when compared to other products and services that serve the same purpose.”

In 1997, US EPA published a table of cleaning products to help purchasers assess the environmental attributes of specific products. The table employed environmental criteria that were broader and fewer in number than those used in many other programs. Vendors were asked to report on key environmental and health-related attributes of their products, and the agencies used this information to educate government purchasers rather than exclude specific products. The product attributes used in the pilot project included:

- ▶ Skin irritation potential (negligible, slight, moderate, strong).
- ▶ Food-chain exposure based on the product’s bio-concentration factor (under 1000 was considered environmentally preferable).
- ▶ Air pollution potential, based on percentage of VOCs in the ready-to-use product.
- ▶ Addition of fragrances, generally considered unnecessary.
- ▶ Presence of dyes, sometimes used as a safety precaution.
- ▶ Reduced or recyclable packaging.
- ▶ Presence of features that minimize exposure to concentrates.

All of the products in the table also meet the Organisation for Economic Cooperation and Development’s (OECD’s) standard of “ready biodegradability,”* Neither the EPA nor GSA has conducted performance tests on these products. For the project report, go to <http://www.epa.gov/opptintr/epp/pdfs/cleaner.pdf>. The table listing environmental criteria is available at <http://www.fss.gsa.gov/environ/pdf/biodegradable-cleaners-degreasers.pdf>.

Contact information. US EPA’s Pollution Prevention Information Clearinghouse; tel: (202) 260-1023; web site: <http://www.epa.gov/opptintr/epp/pdfs/cleaner.pdf>. In addition, the GSA maintains a list of biodegradable cleaners and degreasers at <http://www.fss.gsa.gov/environ/pdf/biodegradable-cleaners-degreasers.pdf>.

US National Parks Service

Starting in 1998, the National Parks Service implemented a pilot project at Yellowstone National Park, one of the most frequented sites in the national parks system. The Parks Service operates several types of facilities at Yellowstone, including offices, visitor centers, restrooms, and maintenance buildings. In addition, it oversees concessionaire-operated facilities such as kitchens, restaurants, and medical buildings.

In order to help Yellowstone Park switch to environmentally preferable cleaning products, the project consultants developed a buying guide based on the criteria in Santa Monica’s bid specifications (see pages 33 to 35). From January to March 1999, Yellowstone Park implemented the program at selected facilities. The program was subsequently expanded to the rest of Yellowstone Park and to Grand Teton National Park.

* The OECD’s standard for “ready biodegradability” has been harmonized with the US EPA’s guidelines, which are available at http://www.epa.gov/docs/OPPTS_Harmonized/835_Fate_Transport_and_Transformation_Test_Guidelines. See the footnote on page 29 for more information on ready biodegradability

A copy of the case study report (entitled “Cleaning National Parks: Using Environmentally Preferable Janitorial Products at Yellowstone and Grand Teton National Parks”) is available from US EPA’s Pollution Prevention Information Clearinghouse, (202) 260-1023, and online at <http://www.epa.gov/opptintr/library/ppicdist.htm>.

Santa Clara County, California

The Janitorial Products Pollution Prevention Project is conducting an ongoing study of environmentally preferable janitorial cleaning supplies in Santa Clara County, especially products serving the needs of large organizations such as government agencies, schools, manufacturing firms, hotels, and large janitorial contractors. Project staff have reviewed the chemical content of products using toxicology data and material safety data sheets. A report on the project is available at <http://www.westp2net.org/Janitorial/projectresults.htm>.

Performance tests. The products have proven effective in on-the-job trials conducted by numerous cleaning professionals.

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ADDENDUM

Please note: The Appendices for this online report have been removed.

For up to date cleaning and janitorial product recommendations please go to:

Green Seal

<http://www.greenseal.org/findaproduct/index.cfm>

or

Environmental Choice

<http://www.environmentalchoice.com>

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