

Environmentally Preferable Janitorial Products: Issues and Opportunities

Decreasing the toxicity of cleaning products and practices

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Table of contents squib: Exposure to janitorial chemicals causes a surprising number of employee injuries. And the resulting medical costs and worker downtime cost employers millions of dollars per year. This article highlights the environmental and health challenges raised by commonly used janitorial cleaning chemicals, and offers some suggested P2 responses.

By Thomas Barron and Lara Sutherland

Both institutional and individual consumers are becoming more concerned with the safety and environmental qualities of janitorial products. Efforts to purchase "less toxic" or "green" cleaners are proliferating.

In this article we discuss occupational health consequences of using hazardous cleaners, and present several P2 ideas for janitorial products. In a follow-up article that will appear in the next issue of this journal, we will outline the lessons the authors have learned in setting up environmentally preferable purchasing programs for janitorial products.

The Impact of Janitorial Employment Patterns

An EPA-sponsored project being done by one of the authors in the San Francisco area has found that employment patterns significantly influence the chemical products that janitors use, their knowledge of safe work practices, and the injuries they suffer from misuse of those products. Similar patterns exist in the ways that janitorial products are purchased.¹

Understanding these various patterns allows the P2 professional to design effective strategies for convincing janitors to reduce their use of hazardous chemicals. These strategies have the greatest impact when individual P2 measures are woven into an overall program for purchasing environmentally preferable products.

Janitors and Where They Work

Based upon extensive and readily available data for Washington State, we estimate that about 75% of the 38,440 people who perform janitorial work in the state are employees of the company occupying the buildings that they clean. The other 25% are employees of janitorial contracting firms that clean buildings occupied by others. **Exhibit 1** shows that schools, restaurants, food stores, and health care facilities are among the industries with the most on-site janitorial employees.²

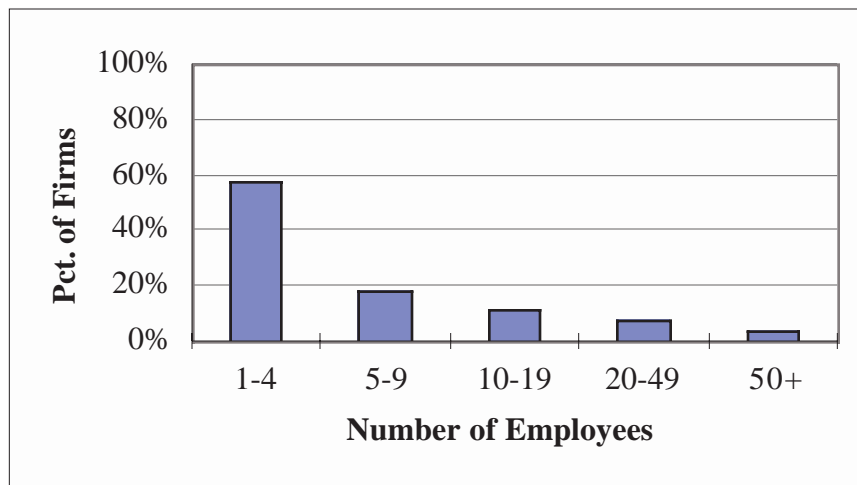
Exhibit 2 shows that janitorial contractors tend to be small, with over two-thirds of the firms employing fewer than ten people.³ Interviews with janitorial contractors in the San Francisco Bay Area show that these demographics affect how chemical products are selected, purchased, and used, and how employee safety training is accomplished.

**Exhibit 1
Businesses Employing Janitorial Workers**

Colleges and Schools	22.9%
Restaurants	2.7%
Food Stores	1.9%
Hospitals and Nursing Homes	1.9%
Hotels and Motels	1.6%
Other Organizations	44.5%
Total On-Site Employees	75.5%
Janitorial Contractors	24.5%
Total - On-Site Employees and Contractors	100.0%

Source: Data for State of Washington, 1996.

**Exhibit 2
Sizes of Janitorial Contracting Firms**



Chemical Products That Janitors Use

Janitors use a wide variety of chemicals in their work, including products for floor care, restroom maintenance, and general cleaning. Suppliers furnish these items ready to use (“RTU”) in trigger bottles and aerosol cans, or as liquid and solid concentrates that are to be mixed with water. Extrapolating from the diversity of chemicals found in use at the sites we have reviewed, we estimate that something on the order of 5,000 products are manufactured and sold for janitorial work in the United States.⁴

A single site or janitorial contractor typically uses anywhere from six to 50 different products, although this total can include a variety of seldom-used chemicals kept on hand “just in case” a special cleaning job requires them. **Exhibit 3** summarizes how these products are used.

The amounts of each chemical that a janitor uses each year vary according to the specific types of buildings being maintained. For example, hotels and airports often have extensive carpeted areas and busy public restrooms. Such buildings require more products for carpet and restroom maintenance than do offices or manufacturing plants. **Exhibit 4** summarizes the products used by a janitorial contractor servicing a typical office building with a million square feet, half of which is carpeted.⁵

The annual cost of chemical products consumed in maintaining a typical office building is approximately \$12,500, or about \$0.01 per square foot per year. Smaller buildings, or those with hard to clean features, may need up to ten times this amount of janitorial chemicals, or about \$0.10 per square foot.

Industry surveys conducted by the Janitorial Products P2 Project indicate that this cost is only about 5% of the salaries paid to the janitors who use the chemicals. As a consequence, health risks are stronger than potential cost savings as motivators for changing products or reducing their use. In addition, because chemical costs are such a small proportion of the total budget for janitorial services, an increased cost for less toxic chemicals is usually not significant enough to be prohibitive.

Exhibit 3
Janitorial Product Use

Tasks	How often	Examples of products used:
Vacuum / dust mop floors	Daily	Dust Mop Spray
Wet mop floors	Daily to Weekly	Water or Cleaner
Strip & refinish floors	Quarterly to Yearly	Stripper, Rinse, & New Finish
Vacuum carpets	Daily to Weekly	Spot Remover
Wet-clean or shampoo carpets	Monthly to Yearly	Spotter; Shampoo, etc.
Clean restrooms	Daily	Cleaner, Disinfectant, Bowl Cleaner
Clean windows	Quarterly to Infrequent	Glass Cleaner; Blind Cleaner
Clean furniture, displays, etc.	Daily to Never	Upholstery Cleaner; Wax
Other cleaning jobs	Upon Request	Metal Polish

Exhibit 4
Annual Product Usage*

Work Area	Product Usually Bought As		Estimated Amounts Used Per Year	
	Concentrate	RTU	Gallons/Yr	Cost/Yr
Hard Floor Care				
Sealer	x		50	\$500
Finish	x		350-400	\$4,000
Stripper	x		75-100	\$750
Baseboard Stripper		x	5-10	\$100
General Purpose Floor Cleaner	x		100	\$1,000
Dust Mop Spray		x	10-15	\$100
Carpet Care				
Pre-Spotter		x	10-15	\$200
Traffic Lane Cleaner	x		50	\$750
Shampoo	x		150	\$2,000
Chewing Gum Remover		x	10-15	\$150
Mildew Treatment	x		15	\$250
Restroom Cleaning				
Acid Bowl Cleaner		x	50-75	\$200
Non-acid Bowl Cleaner		x	50-75	\$200
Disinfectant Cleaner	x		200-250	\$1,000
Metal Cleaner		x	50	\$300
Glass Cleaner	x		100	\$300
Spray Deodorizer		x	50	\$275
Other Products				
Graffiti Remover		x	10-15	\$175
Wood Furniture Polish		x	50	\$200

*These estimates are for a 1,000,000 sq. ft. office building that is half carpeted and half vinyl tile.

Ingredients and Hazards

How hazardous are these janitorial products, and what ingredients are of the greatest concern? To answer these questions, we evaluated toxicology and environmental data from a number of sources, including:⁶

- material safety data sheets (MSDSs) for products;
- product instruction sheets;
- precautionary labels on containers;
- MSDSs for individual ingredients;
- toxicology and environmental fate studies for ingredients;
- output from relative risk ranking systems; and
- conversations with product suppliers.

As an aside, we strongly recommend that a certain level of care be taken when using these sources of information. As in any human enterprise, errors and differences of opinion appear in various published documents about the same subject. In our work we find it best to compare the results from all of the sources we discover about each product or ingredient. This approach might involve reading MSDSs for a number of different floor finish strippers and all of their individual ingredients before coming to conclusions about the risks from using a particular stripper product.

The Janitorial Products P2 Project in the San Francisco Bay Area reviewed specific chemicals being used by several dozen local businesses and government agencies. These reviews reveal that:⁷

- Six percent of the products should not be used because they contain ingredients, such as tetrachloroethylene, nitrilotriacetic acid, methylene chloride, xylene, HCFC-141, or CFC-12, that:
 - cause cancer;
 - are banned by the Montreal Protocol; or
 - cause global warming.

We advise sites to avoid or stop using these materials.

- Thirty-five percent of the reviewed products require extreme care in order to be used safely because they contain ingredients, such as hydrochloric acid, sodium hydroxide, acetone, ethanalamines, or glycol ethers, that:
 - can blind the unprotected user;
 - can cause severe skin damage and scars; or
 - can be absorbed through the skin or be inhaled and then may damage blood, liver, kidneys, the nervous system, or a developing fetus.

We advise sites that they either avoid or use extreme care when using the products in this grouping. The phrase “extreme care” means that workers should be fully trained, and without exception be required to wear protective gloves and goggles when mixing or using these products.

- Forty-six percent of the reviewed products require routine care during use because they contain ingredients, such as alcohols, citric acid, sodium metasilicate, heavy metals, and mild hydrocarbons, that:
 - may temporarily irritate eyes and skin;
 - will evaporate and affect the quality of air inside the building; or
 - may in some cases exceed the building’s allowable sewer discharge limits for zinc or hydrocarbons.

We advise sites to use care when applying these products, and suggest they verify that air and sewer requirements are being met.

Other common ingredients, such as dibutyl phthalate and some of the alkyl phenol ethoxylates, pose less of an acute health risk to the janitorial user, but persist as wastes in the environment and have shown evidence of affecting the hormone systems of animals. In our reviews, we suggest that sites with a concern for the environment in general change to other products that do not have these ingredients.⁸

Chemical Injuries Experienced

How serious a risk do these ingredients actually pose to janitors? In other words, what injuries do janitors experience, and what do these injuries cost?

Recent workers' compensation data for the state of Washington reveal that about 290 janitors per year submit claims for lost-time injuries from chemicals. As there are 38,440 janitors working in Washington state, this experience is equivalent to an accident rate of about eight injuries for every 1000 janitors.⁹ Of these injuries,

- 40% involve eye irritation or burns;
- 36% involve skin irritation or burns; and
- 12% involve inhalation of chemical fumes.

For reasons that we cannot yet explain, some types of janitors appear to have significantly more accidents. Workers' compensation claims for hotels, colleges, and hospitals in Washington range up to 70 injuries per year for every 1000 janitors, or nine times the state's average rate. We speculate either that the number of injuries in these industries is actually higher, or alternatively that more injuries are reported as claims by hotels, colleges, and hospitals.

Not many facts are known about unreported injuries. Some studies indicate that unreported injuries equal or exceed those that are claimed to workers' compensation.¹⁰ We believe, based upon interviews in the San Francisco Bay Area, that many small janitorial firms report only the most serious injuries as claims. As a consequence, we estimate that the total number of chemical injuries per year is actually on the order of 40 to 60 injuries per year for every 1000 janitors (i.e., closer to the level of 70 injuries per year mentioned above for hotels, colleges, and hospitals).

How significant are the reported claims? The Washington State data show that each incident requiring medical treatment took the worker off of the job for an average of 18 hours. Medical costs averaged \$375 per claim, while lost time for the worker and his or her supervisor are estimated as \$240 per claim, bringing the total to \$615 per claim. In 1997, the total cost of these reported claims and lost time was therefore about \$350,000 for all of Washington State.¹¹

Making a rough extrapolation to the national level, we estimate that reported claims and lost time for chemical injuries to janitors in the United States cost on the order of \$25 million per year.¹²

We found general confirmation of the importance of these costs by checking insurance premiums for industries that show high worker injury rates. As a result of actual underwriting experiences, janitorial contractors in Washington State pay workers' compensation premiums that are higher than those for either auto repair shops or metal finishing firms, as the following comparison shows:¹³

Workers' Compensation Premiums per \$1,000 of Salary

- Janitors \$9.61
- Auto Repair \$9.26
- Metal Finishing \$9.25
- Office Work \$9.08

What impact do these injuries and their costs have upon the people responsible for managing janitorial work? In other words, how important are worker health and safety among all the other issues that owners and managers must face?

Awareness of Health, Safety, and Environmental Issues

From interviews with janitorial contractors in the San Francisco Bay Area, we have learned that the primary factors considered by contractors when they purchase cleaning products are effectiveness, ease of use, and compliance with regulations. As shown by **Exhibit 5**, product safety often is rated lower in priority than these other issues. Somewhat different priorities are held by property and facility managers, the latter of whom rate safety as "very important."¹⁴

Exhibit 6 shows that the managers and janitorial contractors who were interviewed have differing levels of awareness about a number of health, safety, and environmental issues. These priorities and awareness levels are issues that the P2 professional must address.

Exhibit 5 Important Janitorial Product Issues

How important are the following issues for the cleaning products that you use?	Property Managers	Facility Managers	Janitorial Contractors
Minimizing Cost	Not*	Not	Somewhat
Maximizing Safety	Somewhat	Very	Some to Very
Maximizing Effectiveness	Somewhat	Somewhat	Very
Easy To Use	Not	Somewhat	Very
Vendor Support & Training	Not	Not	Some to Very
Compliance With Regulations	Some to Very	Very	Very
Minimizing Environmental Impact	Somewhat	Some to Very	Some to Very

* Not important unless it is the property manager who is buying the products for the janitorial contractor to use.

Exhibit 6 Awareness of Health & Safety Issues

How aware are you of the following issues?	Property Managers	Facility Managers	Janitorial Contractors
OSHA requirements for safe chemical handling?	Not Aware	Somewhat	Some to Very
Sanitary sewer discharge requirements?	Somewhat	Very	Some to Very
Stormwater protection requirements?	Somewhat	Very	Somewhat
Indoor air quality issues?	Some to Very	Some to Very	Some to Very
Workers' compensation costs for janitors?	Not	Not	Some to Very
Health or environmental risks of the following:			
Glycol ethers (such as Butoxyethanol)?	Not	Not	Somewhat
Perchloroethylene?	Not	Not	Somewhat
Alkyl Phenol Ethoxylates?	Not	Not	Not

Pollution Prevention Opportunities and Strategies

From the foregoing analysis we conclude that chemical injuries to janitors occur sufficiently often that improving worker safety through source reduction should be a central strategy of any pollution prevention outreach effort. However, it is also important to reflect worker and manager priorities. As the cost of janitorial products is not as important as their workability, one must emphasize new products and techniques that are both easy to use and as effective as earlier cleaning practices.

The following are examples of successful pollution prevention strategies for reducing the use of janitorial chemicals. These examples are based on a series of fact sheets published on the Internet by the Janitorial Products Pollution Prevention Project.¹⁵

- *Chemical Substitutions* - Changing from highly toxic to less toxic ingredients. A number of effective, easy-to-use, and low-toxicity janitorial products are now becoming available. Because earlier "green" products did not always meet janitors' expectations, extensive product trials are usually necessary to convince skeptical users to make a change.

Specific examples include changing from:

- a carpet shampoo with nitrilotriacetic acid to one made with ingredients that are not carcinogenic;
- a glass cleaner containing butoxyethanol to one formulated with isopropanol or non-hazardous ingredients;
- a general purpose cleaner with alkyl phenyl ethoxylates, ethanolamine, or butoxyethanol to one formulated with linear alcohol ethoxylates, citric acid, or non-hazardous ingredients.

- *Chemical Use Reduction* - Decreasing the amounts of products with toxic ingredients that janitors use. Some cleaning tasks must use hazardous products because there are no effective substitutes. In these instances, the pollution prevention message is to dilute the product as much as possible, and to use it only when absolutely necessary.

Floor finish strippers often contain ammonium hydroxide, ethanolamine, and butoxyethanol, making this product one of the most dangerous handled by janitors. Decreasing floor stripper use by 50% or more is possible by:

- scheduling floor renewal work according to wear patterns rather than simply following a calendar;
- diluting the stripper with as much water as possible (but not so much that the floor finish is removed unevenly);
- carefully and thoroughly applying the diluted stripper;
- using a rotating pad scrubber wherever possible; and
- thoroughly rinsing the stripped floor so as to neutralize the surface prior to applying the new floor finish.

Acid toilet bowl cleaners are another of the most hazardous janitorial products. Formulated with hydrochloric, phosphoric, or hydroxyacetic acid, these cleaners are very effective in removing hard water deposits and stubborn stains. However, this much cleaning power is not normally needed every day. Therefore a good pollution prevention strategy is to use two cleaners — a mild product for daily cleaning, and an acid cleaner that is only used when absolutely necessary. Adopting this strategy will usually decrease hazardous material use by over 80%.

- *Building Perimeter Strategies* - Managing the entry of dirt into the building is another way to accomplish source reduction. Cleanable floor mats, double-door entry chambers, and positive air pressure are all very effective in preventing foot-borne dirt from entering the building in the first place. Less soil in the building means less frequent cleaning, which in turn requires less chemical use.
- *Changing the Cleaning Process* - Modifying the techniques janitors use for applying their cleaning products can accomplish source reduction. Many environmentally preferable cleaning products work best when they are applied to the surface with some force, and are left in place long enough to loosen and lift the soil that is present.

Work sequencing therefore is important for the product to be used successfully. For example, the first thing a janitor should do in daily cleaning of a restroom is to apply mild cleaners to the sinks and toilet bowls. These cleaners should be left in place while the trash containers are emptied and paper dispensers are refilled. Then the janitor can quickly scrub and rinse the fixtures once the cleaners have been in place for a few minutes. This sequence takes no more time than cleaning the fixtures separately before removing trash and stocking paper supplies.

Other, longer-term pollution prevention strategies include designing buildings with easy-to-clean architectural features (such as keeping carpets out of locker rooms), taking care that features with incompatible cleaning needs are kept apart from each other (e.g., not

situating carpets and vinyl tiles together), and operating building air conditioning systems so as to minimize the movement of dust.¹⁶

The Next Step: Purchasing More Environmentally Friendly Janitorial Products

Each of the strategies discussed above is able on its own to decrease hazardous chemical use. However, the greatest reductions come from combining these individual ideas with an overall system that controls the purchasing of janitorial products. Such systems will be described in our follow-up article in the next issue of *P2: Pollution Prevention Review*.

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Notes

- 1 EPA Region 9 is sponsoring two parallel janitorial P2 projects in the San Francisco Bay Area. Results of this work are reported here, and also on the project web site at <http://www.westp2net.org/Janitorial/jp4.htm>.
- 2 These unpublished data were provided by John Haws of the Washington State Department of Employment Security. Mr. Haws may be reached at jhaws@esd.wa.gov. Various pre-sorted sets of data are available on the agency's web site, <http://www.wa.gov/esd/>.
- 3 Employment data for janitorial contracting firms are from "County Business Patterns," published annually by the U.S. Department of Commerce. These Washington State data are for 1996, and are available on the Internet at <http://www.census.gov/epcd/cbp/view/cbpview.html>.
- 4 This extrapolation reflects a consensus of janitorial contractors, facility managers, and product vendors who are part of the informal stakeholders group advising the Janitorial Products P2 Project in the San Francisco Bay Area.
- 5 Product usage shown here is based upon a series of written, telephone, and Internet surveys conducted by the San Francisco Janitorial Products P2 Project. The cost figures in the next paragraph are from the same surveys.
- 6 An excellent starting point for obtaining chemical data is the ChemFinder Internet site located at <http://chemfinder.camsoft.com/>. In addition, an increasing number of janitorial product suppliers are furnishing their MSDSs via the Internet.

Purdue University, EPA, and other agencies have developed risk ranking systems for assigning health and environmental scores to chemicals. So far these systems have

focused upon highly toxic compounds that rarely appear in modern cleaning products. Extending these systems to include the 500 or so most common cleaning product ingredients would be a worthwhile effort. However, because health and environmental risk data on these compounds are limited, the necessary laboratory work would take years to do.

- 7 For additional notes about ingredients and their risks, refer to the EPA-sponsored Janitorial Products P2 Project web site at <http://www.westp2net.org/Janitorial/jp4.htm>. In addition, refer to: Neun, D.J. (1995). Approaches to human risk assessment and risk management for cleaning products. *Journal of Toxicology - Cutaneous and Ocular Toxicology*, 14(2), 105-122.
- 8 Information on these compounds can be found by searching the Internet (e.g., <http://www.epa.gov/endocrine/>), or by referring to published sources such as Dickey, P. (1997). *Troubling bubbles: The case for replacing alkylphenol ethoxylate (APE) surfactants*, Seattle: Washington Toxics Coalition; and Gade, M. (1997). *Endocrine disrupters strategy*, Springfield: Illinois EPA.
- 9 An evaluation of the Washington State chemical injury data appears on the web site for the EPA-sponsored Janitorial Products P2 Project at <http://www.westp2net.org/Janitorial/jp4.htm>.
- 10 For estimates of unreported injuries, refer to Leigh, J.P., et al., (1997, July 28). *Archives of Internal Medicine*, 157(14), 1557-68, as cited by Brown, J.A., at <http://www.haz-map.com/iceberg.htm>. Additional discussion is provided by Markowitz, S.B., et al. (1989). *Occupational disease in New York State*. *American Journal of Internal Medicine*, 16(4), 417-35, as cited by the PubMed website at <http://www.ncbi.nlm.nih.gov>.
- 11 Three years of unpublished workers' compensation data for janitors were provided by Patricia Ames of the Washington State Department of Labor and Industries. She may be reached at ames235@lni.wa.gov. Various pre-sorted sets of data are available on the agency's web site, <http://www.wa.gov/lni>.

The number of chemical injuries per year was estimated by weighting the number of injuries per SIC code by the numbers of janitors in each SIC code, and then factoring in the unreported injuries mentioned by facility managers in the San Francisco Bay Area surveys.
- 12 This estimate uses County Business Pattern data obtained from the U.S. Department of Commerce. Also refer to Gardner, A. & Gottlieb, R. (1997). *The structure of the janitorial cleaning industry*, Los Angeles: Occidental College Pollution Prevention Education and Research Center.
- 13 Workers' compensation rates are from the Washington State Department of Labor and Industries, and are available on the Internet at <http://www.wa.gov/lni>.
- 14 These interviews were conducted in the San Francisco area using a five-page questionnaire. This survey form is available on the Internet at <http://www.westp2net.org/Janitorial/jp4.htm>.
- 15 Janitorial pollution prevention fact sheets are available on the Internet at <http://www.westp2net.org/Janitorial/jp4.htm>. Trade publications such as *Services*

Magazine, Sanitary Maintenance, and Maintenance Solutions also feature articles about reducing chemical use. Many of these publications have Internet editions.

- 16 Cleaning for health is a perennial topic of discussion in trade publications and on Internet list servers for the janitorial services industry. For example, refer to: Ryan, T. (1999, April). How to sell cleaning for health. *Services Magazine*, 22-25, Fairfax, Virginia: Building Service Contractors Association International. Another extensive reference is: Berry, M. (1994). *Protecting the built environment: Cleaning for health*, Cleaning Management Institute. Copies of the latter may be ordered at <http://www.facility-maintenance.com>.

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