

US EPA ARCHIVE DOCUMENT

# Be Healthy Clean Safely

## Project Completion Report

Environmental Justice Through  
Pollution Prevention  
U.S. EPA Region IX  
Local Government Commission  
City of Richmond



April 2000

## Preface

"Be Healthy • Clean Safely" is the slogan adopted by the project to communicate the importance of making careful choices about janitorial chemicals.

This report describes an EPA-sponsored pilot project that evaluated pollution prevention opportunities available to small contractors and individual custodians working in the janitorial industry in Richmond, California. The project was a collaboration of many individuals, businesses, and organizations whom the author wishes to thank for their valuable contribution. The project would not have been a success without their support. Particular acknowledgement is given to the staff of the Local Government Commission, Richmond Chamber of Commerce, West County Toxics Coalition, and City of Richmond.

Frequent mention is made in the report of the project website. Hosted by the Western Regional P2 Network, this website is at <<http://www.westp2net.org/janitorial/jp4.htm>>. This site was originally produced by Linda Bookman, and is currently maintained by Peter Johnsen.

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## 1. Introduction

"Be Healthy • Clean Safely" is an account of an 18-month Environmental Justice Through Pollution Prevention project undertaken in Richmond, California. The project team comprised staff from a number of organizations, including:

- US EPA Region IX (San Francisco);
- Local Government Commission;
- City of Richmond;
- Technical consultants;
- Stakeholders from the janitorial industry; and
- 32 organizations and their suppliers that participated by having reviews done of their janitorial products.

The report describes both how the team did its work and the results that it obtained. Following a summary in Section 2, the report discusses:

- the needs assessment that was done;
- patterns discovered in janitorial chemical use;
- pollution prevention opportunities available to janitors;
- outreach efforts that were undertaken; and
- expected reductions in hazardous materials use that this outreach caused.

Additional information about janitorial pollution prevention appears on the project website, and in the completion report prepared for the related outreach effort for large janitorial organizations in nearby Santa Clara County, California. The project website is located at the following URL: <<http://www.westp2net.org/Janitorial/JP4.htm>>.



## 2. Summary

The project team assisted 32 sites and companies employing 81 janitors in the City of Richmond. As shown by Exhibit 2-1, these janitors use 3,480 pounds of hazardous materials per year.

Implementing all of the identified pollution prevention opportunities at the 32 organizations could reduce this hazardous materials use by 436 pounds per year.

However, environmentally preferable product alternatives are not yet available in the local stores where most Richmond custodians and janitors purchase their chemicals. In addition, users of alternative products often require vendor training in order to successfully perform their cleaning work. At present such training is typically not available via retail outlets. Because of these barriers, the team expects only 131 pounds per year of this potential reduction to actually occur.

Exhibit 2-1  
Forecast Reduction In Annual Use Of Hazardous Materials

	Current Use	Potential Changes	Expected Changes
32 Reviewed Organizations (81 Employees)	3,480 lb (43 lb per janitor)	436 lb (5.4 lb per janitor)	131 lb (1.6 lb per janitor)
Other Organizations (711 Employees)	30,573 lb (43 lb per janitor)	3,841 lb (5.4 lb per janitor)	661 lb (0.9 lb per janitor)
Total (792 Employees)	34,053 lb (43 lb per janitor)	4,277 lb (5.4 lb per janitor)	792 lb (1.0 lb per janitor)

If future outreach efforts were to successfully reach all 792 of the janitors working in Richmond, the amount of hazardous materials reduction could be 4,277 pounds per year. The project team expects that 10% of this total, or 792 pounds per year, would actually occur.

### 2.1 Needs Assessment

The project team interviewed janitors, custodians, business owners, and chemical suppliers to identify what pollution prevention information and assistance janitors do not have, and to find out how this help could be delivered. In addition, the project wanted to know which of these needs are already being met, and what technical assistance role the team should take on.

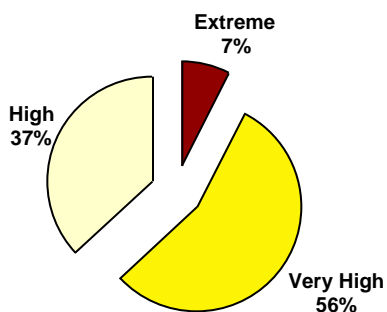


The highest risk janitorial products are generally ones that:

- are corrosive to the eyes and skin (e.g., acid toilet bowl cleaner; floor finish stripper; concentrated disinfectant);
- are flammable (e.g., aerosol deodorant; chewing gum freezer; metal polish);
- give off toxic fumes (e.g., dust mop spray; metal polish; graffiti remover); or
- absorb through skin (e.g., metal polish; graffiti remover; heavy-duty degreasers).

Exhibit 2-2 illustrates how frequently chemicals with these hazards are being used by the 32 sites that the team interviewed in Richmond. Examples of “extreme hazards” include ingredients that cause cancer, are corrosive, or that are highly flammable.

Exhibit 2-2  
Relative Hazards From Use Of Cleaning Chemicals



[Basis: 267 janitorial products being used at 32 sites in Richmond, CA]

Individual janitors that the team interviewed are aware of general health, safety, and environmental issues, but may not know technical details such as the toxicity of specific ingredients. Janitorial contractors say that they learn about health, safety, and environmental issues mostly from reading labels and store displays, and from discussions with their peers.

With some exceptions, most local stores featuring janitorial supplies do not offer environmentally preferable products. Store managers the team spoke to were not interested in featuring such items because they perceived them to have lower profit margins than do other chemicals. This perception is based upon the idea that environmentally preferable products initially require more sales effort and training assistance, both of which decrease profits.

About half of the interviewed custodians, janitors, and business owners use the internet for obtaining information, for example by downloading material safety data sheets (MSDSs) from supplier websites.

People to whom the Richmond team spoke identified several areas in which local government agencies could play an important role in furnishing them with information. The most frequently requested services were providing on-site assistance, distributing free samples of preferable products, and hosting a hot line for people to call with health and safety questions. The Richmond team pilot tested the first two of these services during the present project.

## 2.2 Janitorial Chemical 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 at the site with water.

The amounts of each chemical product that a janitor uses each year vary according to the specific types of buildings he or she maintains. For example, stores and restaurants often have extensive carpeted areas and busy public restrooms. Such high-traffic buildings require more products for carpet and restroom maintenance than do offices.

The average small janitorial contractor or individual custodian uses an estimated 21 gallons of chemicals per year, weighing 172 pounds. Hazardous ingredients comprise about 25% of this total, or 43 pounds. Water added on-site to dilute the products for use is additional.

Custodians and small janitorial contractors working in Richmond purchase their chemical products from institutional suppliers, warehouse clubs, and retail sources. A few sites purchase supplies directly from manufacturers, particularly hotels and other wide-spread organizations that have national accounts. In the case of restaurant chains, janitorial chemicals are often obtained from the same general catering service that furnishes the site with all of its operating supplies (i.e., such things as linens, flatware, and food).

## 2.3 Janitorial Pollution Prevention Measures

Were the average janitor to employ all of the chemical substitutions and other pollution prevention measures that the team discovered, it is forecast that his or her hazardous materials use could decrease by 13%, or 5.4 pounds per year. Exhibit 2-3 and the following bullets summarize these reductions.

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Exhibit 2-3  
Potential Hazardous Materials Use Reduction Per Janitor

<u>P2 Measure</u>	<u>Potential Reductions</u>
Chemical Substitutions	2.5 lbs/yr
Chemical Use Reduction	1.5
Use of Floor Mats & Vacuuming	0.4
Avoid Aerosols; etc.	<u>1.0</u>
	5.4 lbs/yr

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- Chemical Substitution - Changing from products with highly-toxic ingredients to ones that are less so has the potential to decrease hazardous material use by 2.5 lb per year for each janitor, or about half of the total amount of reduction that is believed feasible.

The largest barrier to accomplishing this potential is that local retail stores, warehouse clubs, and institutional distributors either do not yet offer or do not emphasize less toxic products.

- Chemical Use Reduction - Some cleaning tasks must use hazardous products because there are no effective substitutes. In these instances the best pollution prevention strategy is to have the janitor dilute each product as much as possible, and to use it only when absolutely necessary. The potential hazardous materials use reduction from decreasing product consumption is conservatively estimated as 1.5 lb per year for each janitor.
- Indirect Measures - Several “indirect” methods can significantly reduce chemical use as well.
  - Placement and routine vacuuming of floor mats are very effective in preventing foot-borne soils from entering the building in the first place. Less soil in the building means less frequent cleaning, which in turn requires less chemical use.
  - Care with storage and mixing reduces spills and waste.
  - Changing from aerosol containers to trigger bottles has two benefits: propellant chemicals are not needed, and chemicals no longer must be discarded when spray nozzles fail.

The project team estimates that chemical use reductions for floor mats and vacuuming procedures are something on the order of 0.4 pound per average janitor per year.

Having good inventory control, practicing safe product mixing, and converting from aerosol cans to trigger spray bottles could reduce the average janitor’s hazardous materials use by an additional 1.0 pounds per year.

## 2.4 Pollution Prevention Outreach Efforts

Janitors participating in the needs assessment convinced the team to concentrate its local outreach efforts in three key areas.

1. Fact Sheets with information about safer ways to do cleaning tasks that require use of hazardous chemicals.
2. Speeches, Flyers, & Newsletters to educate business owners and the general public about health, safety, and environmental issues arising from cleaning products.
3. On-site Assistance in reviewing janitorial chemicals, recommending alternatives, and providing samples of environmentally preferable products.

As shown by Exhibit 2-4, direct mailings were sent to 196 firms, 96 of which hold janitorial business licenses in the City. The other 100 others firms were identified by internet directories as operating a cleaning service within 10 miles of Richmond.

The team also approached about 500 stores, offices, restaurants, shops, and other businesses belonging to the Richmond Chamber of Commerce. The first goal of this effort was to provide safety and environmental information to custodians and other employees doing janitorial work at the businesses. A second goal was to use business owners and managers as an indirect way of contacting the janitorial contractors that service the businesses.

The project team also explored a number of more general ways of communicating its cleaning chemical safety messages. These efforts reached an additional 1,175 members of the Richmond community, about 10% of whom are either janitors themselves or hire janitorial services for their business, community center, or church. The greatest ratio of responses to people contacted was for members of the City's Neighborhood Councils, which are volunteer community action groups involved with the environment, public health, safety, and other issues.

Exhibit 2-4  
Project Outreach Activities

<u>Audience</u>	<u>Outreach Activity</u>	<u>Contacts</u>	<u>Responses</u>
Janitorial Contractors			
	Direct Mailings	196	10
	Product Reviews	6	6
	Sample Products	36	5
Businesses			
- Chamber of Commerce	Newsletter/Flyer	500	10
- West County Toxics Coalition	Newsletter/Flyer	1100	50
- West County Toxics Coalition	Sample Products	10	1
- Water Pollution Control Plant	Product Reviews	20	2
- Direct Site Contacts	Product Reviews & Sample Products	45	43
General Public			
	Environmental Faire	300	10
	Neighborhood Councils	125	15
	Radio Interview	500	1
	Retail Coupons	Not Yet Implemented	0
	Store Customer Mailings	Not Yet Implemented	0
Totals		2,838	153

## 2.5 Agency Outreach Efforts

Several city and county agencies participated in the project, and continue to act as local knowledge resources now that the team has completed its initial pilot effort. These agencies include:

- Richmond Public Works Dept.
- County Health Dept.
- Richmond City Staff
- Richmond Public Library

In addition, the Richmond team was tasked by the project scope to share its findings, tools, and other outreach materials with other government agencies. This goal was accomplished by e-mail announcements, direct mailings, technical articles, and professional conferences.

It is estimated that the project reached a total of about 1,500 agency staff people via these various routes. About 200 individuals attended technical presentations that the Richmond team made. The balance received e-mail messages, read articles published about the project, or learned of the project through personal referrals.

## 2.6 Results

The project team worked directly with 32 organizations, two-thirds of which are janitorial contractors. These organizations employ 81 people, representing about 10% of the janitors working in Richmond. Each year the employees of the 32 firms use 268 chemical products that contain an estimated 34,053 pounds of hazardous materials.

As shown in Exhibit 2-1, above, the use of hazardous janitorial chemicals at these 32 organizations would decrease by a total of 436 pounds per year if all of the recommendations the team made during site visits and other local outreach efforts were to be followed. About 30%, or 131 pounds of this annual reduction are expected to actually occur.

Three example cases serve to illustrate the changes in chemical use that janitors can accomplish. First, a custodian who maintains a community church has decreased his use of hazardous chemicals by an estimated 3.3 pounds per year by:

- reducing the number of chemicals bought, and locking them in storage cabinets so that building occupants no longer have free access to products (1.1 lbs/yr);
- replacing extremely hazardous products with milder ones (2.1 lbs/yr); and
- using well-vacuumed floor mats at exterior doors (0.1 lbs/yr).

Second, Exhibit 2-5 summarizes the potential decrease in janitorial product hazardous materials that eighteen custodians working for City of Richmond could attain by implementing suggestions that the project team made.

**Exhibit 2-5**  
**Reduction In Hazardous Materials Use – Richmond Custodial Staff**

	Lbs per year	
<b>Used Before Project</b>		
Hazardous Materials Use	863.0	
Per 1,000 Square Feet	3.5	
Per Janitor	48.0	
<b>Estimated Reductions</b>		
Stop Using Products	49.3	
Change Products	49.3	
Reduce Product Use	22.2	
Potential Total Reduction	120.8	(14%)

Third, a small janitorial contractor with three employees reduced its hazardous materials use by 8.3 lbs per year, primarily by no longer relying exclusively upon acid toilet bowl cleaner. This contractor now uses non-acid bowl cleaner for daily restroom maintenance, and only applies the more hazardous product when stubborn stains need to be removed. The other 0.8 lbs/yr of anticipated hazardous materials reduction will come from changing to less-toxic glass cleaners and restroom deodorant products.

If all the other janitorial contractors and individuals doing custodial work in the City of Richmond were to make similar changes, the total use of hazardous janitorial chemicals throughout the county could theoretically decrease by 4,277 pounds per year. Motivated by a continuing and persistent local outreach effort, 792 pounds of this potential reduction might actually occur.

## 2.7 Recommendations

The Richmond team offers the following ideas and recommendations to other agencies, business owners, and janitorial contractors who wish to reduce their usage of hazardous chemicals.

### 2.7.1 Recommendations To P2 Outreach Providers

Agencies that wish to begin a pollution prevention outreach program for janitors should:

- *Do what's important.* Conduct a needs assessment to identify issues and priorities that janitors in their area have. An initial list of questions can be drawn from those used by the Richmond team (see the project website).

- *Get advice.* Form an industry stakeholder panel, and use the collective experience of the members to guide the needs assessment and outreach process.
- *Communicate effectively.* Identify the languages spoken by janitorial workers in the area, and tailor outreach materials accordingly (See ¶6).
- *Lead by example.* Reduce the amounts of hazardous chemicals used by janitors who maintain the agency's own offices.
- *Understand the problem.* Estimate the numbers and costs for chemical injuries that occur to janitors in the area. These statistics are useful for showing how important it is to change to less hazardous products (See project website).
- *Emphasize personal safety.* Safety is one of the most important personal values expressed by janitors. Therefore, focus primarily upon the theme of increasing worker safety by having janitors change to less hazardous products. Environmental improvement will occur automatically as changes are made to safer products (See ¶3).
- *Set goals and measure results.* Set a goal for the amount by which hazardous materials usage by each individual doing janitorial work is to be reduced. The short-term goal for the Richmond project was 1 lb per person per year, which is about 20% out of the total hazardous materials reduction of 5.4 lbs per person that could reasonably be expected from an on-going outreach effort (See ¶5).
- *Follow existing routes.* Plan to do a significant amount of outreach via building owners, store managers, construction contractors, and other customers that janitorial contractors serve. In addition, share your project and its outreach plans with local citizens' action groups. If the volunteer participants of these groups can be enlisted in support of your project, then your message will reach and motivate far more people.
- *Target the audience.* Use internet and business license databases to compile lists of janitorial contractors, and used targeted mailings to announce workshops and other project events. Involve janitorial trade associations in arranging these events.
- *Use effective tools.* On-site P2 assistance and free product samples are the most popular and impactful forms of outreach effort. Plan to include these elements in any outreach program (See ¶6).

### 2.7.2 Recommendations To Businesses And Janitorial Contractors

Sites or businesses that wish to shift toward environmentally preferable janitorial products should include the following steps to assure a smooth transition:

- Involve people throughout the organization (See the project website).

- Identify the highest risk products currently being used, and change those first (See ¶4).
- Get rid of old products that are no longer used.
- Begin tracking how much of each product is being used. This step alone will reduce consumption (See ¶5.2).
- Organize a special crew to test new products, and work closely with the members of that crew as they do their initial product trials (See website).
- Be sure that vendor representatives are available and involved during trials of their products. Be prepared to modify cleaning procedures slightly to get the most out of the new chemical products (See website).

### 2.7.3 General Recommendations

The Richmond team discovered three major problem areas that it believes need to be addressed jointly by environmental professionals, janitorial product suppliers, and the chemicals manufacturing industry.

Better MSDSs - To be truly useful for making health and environmental decisions, material safety data sheets need to voluntarily list all ingredients in the product, not just those mandated by regulations. The relative quantity of each ingredient also needs to be stated, although providing a range such as “15% to 20%” is sufficient for most purposes.

In addition, printed MSDSs need to be clearly written, well organized, and legible. About a tenth of all MSDSs that the team evaluated either could not be read because of small or distorted print, or were difficult to use because some of the information was in non-standard locations.

Finally, the team encourages all product suppliers to post their MSDSs on the internet. Direct and instant access is far better than waiting weeks or months to receive a requested data sheet.

Better Technical Information – The team recommends that vendors begin providing more information to janitors who wish to use their products. For example, product literature should emphasize:

- How to store, mix, and use products;
- How to avoid incompatibilities with other products;
- How to easily access the supplier’s customer service system with health, safety, and environmental questions; and
- How to properly dispose of unused product, wastes, and containers.

Better Product Labels – The Richmond team encourages nation-wide development of standard janitorial product labels like those now being used for food packaging. Key information to display



includes explicit identification of dangers that the product poses, a list of toxic ingredients, recommended personal protective equipment, and guidance for proper emergency response. Containers should also explain where to obtain more information.

### 3. Needs Assessment

This section of the report describes how the project team learned what individual custodians and small janitorial contractors working in Richmond need to know about health, safety, and environmental aspects of their chemical products, and then identified useful roles that it could take to increase janitors' awareness of these issues. Next, Section 4 presents a profile of janitorial chemical use that the needs assessment interviews revealed.

#### 3.1 Needs Assessment Goals

What pollution prevention information and assistance do janitors need? How can this help be delivered? In addition, which of these needs are already being met, and what technical assistance role should the team should take on?

To answer these questions the Richmond project team interviewed businesses, spoke with janitorial contractors, and met with other interested stakeholders. The results of these contacts helped the team direct its efforts in developing pollution prevention materials most needed by janitors.

Industry feedback convinced the project team that it should provide on-site product safety reviews and distributing free samples of environmentally preferable cleaners.

#### 3.2 On-Site Product Reviews

As part of the initial needs assessment process, the Richmond project team reviewed about 250 janitorial products in use at 32 local facilities (e.g., schools, stores, offices, industrial sites, and various other businesses). In these initial reviews the team concluded that:

1. Seven percent of the encountered products should not be used because they contain ingredients that:
  - Cause cancer;
  - Are ozone depleting substances banned by the Montreal Protocol; or
  - Cause global warming.
2. Fifty-six percent of the products require extreme care in order to be used safely because they contain ingredients that:
  - Can blind the unprotected user;
  - Can cause severe skin damage and scars;
  - May interfere with the hormone system of humans and animals; or
  - Can be absorbed through the skin or be inhaled and then may damage blood, liver, kidneys, the nervous system, or a developing fetus.

3. Thirty-seven percent of the products require routine care during use because their ingredients:
  - 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.

### 3.3 Local Needs Assessment Surveys

The Richmond team contacted 32 store managers, facility managers, janitors, and other individuals to gauge their awareness of chemical health and safety issues related to janitorial products. The team also asked for opinions as to how it in particular and government agencies in general could best help the janitorial industry with these issues.

Exhibit 3-1 introduces several key points that the project team discovered in its needs assessment surveys. Generally speaking, product effectiveness and worker safety are key issues primarily to people who actually use janitorial products. Product cost, although less important than effectiveness, is an important issue to small janitorial contractors who purchase their own supplies.

Exhibit 3-1  
Important Janitorial Product Issues

How important are the following issues for the cleaning products that you use?	% of Respondents To Whom Issue Is Important
Minimizing Cost	57%
Maximizing Safety	100%
Maximizing Effectiveness	95%
Easy To Use	86%
Vendor Support & Training	29%
Compliance With Regulations	57%
Minimizing Environmental Impact	62%

Exhibit 3-2 shows that interviewees are aware of general health, safety, and environmental issues, but may not be aware of the technical details such as the toxicity of specific ingredients. Janitorial contractors reported being most concerned with indoor air quality, an issue that affects building occupants as well as workers.

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**Exhibit 3-2**  
**Awareness of Health, Safety & Environmental Issues**

How aware are you of the following issues?	% of Respondents To Whom Issue Is Known
OSHA requirements for chemicals?	32%
Sanitary sewer discharge requirements?	42%
Stormwater protection requirements?	42%
Indoor air quality issues?	68%
Workers' compensation costs for janitors?	21%
Health or environmental risks of:	
Glycol ethers (such as Butoxyethanol)?	21%
Perchloroethylene?	5%
Alkyl Phenol Ethoxylates?	0%

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As presented in Exhibit 3-3, store managers, facility managers, and janitorial contractors say that they learn about health, safety, and environmental issues mostly from reading store displays and from discussing these concerns with their peers. About half of the interviewed janitors use the internet for obtaining information, for example by downloading material safety data sheets (MSDSs) from supplier websites.

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**Exhibit 3-3**  
**Sources of Product and Safety Information**

Sources of Information	% of Respondents Using Each Source
Trade Associations	0%
Conferences/Trade Shows	6%
Newspapers	39%
Radio / TV	44%
Store Displays	68%
Magazines	47%
Vendors	39%
Peers	56%
Internet	47%

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People to whom the Richmond team spoke identified several areas in which local government agencies could play an important role in furnishing them with information. The most frequently requested services were providing on-site assistance, distributing free samples of preferable products, and hosting a hot line for people to call with health and safety questions. Exhibit 3-4 summarizes these suggestions.

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Exhibit 3-4  
How Can Local Government Help Janitors?

	% of Respondents Desiring This Assistance
Host Workshops	6%
Publish Chemical Fact Sheets	50%
Publish Success Stories	11%
Make Training Videos	17%
Certify Cleaning Products	33%
Organize Mentoring Program	0%
Provide On-Site Assistance	84%
Operate a Hot Line	83%
Promote Better Labels	28%
Provide Spanish Language Items	39%
Conduct Product Demos	53%
Provide Product Samples	89%

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## 4. Profile of Janitorial Chemical Use

This section of the report discusses the types and amounts of chemicals that janitors use in their work, and describes how these products are commonly purchased.

The average small janitorial contractor or individual custodian uses an estimated 21 gallons of chemicals per year, weighing 172 pounds. Hazardous ingredients comprise about 25% of this total, or 43 pounds.

Next, Section 5 presents a number of pollution prevention opportunities for reducing chemical use, while Section 7 forecasts the amounts of reduction that the project expects to accomplish through its efforts.

### 4.1 Janitorial Work Performed and Products Used

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.

A single site or janitorial contractor may use anywhere from four to 30 different products. Exhibit 4-1 summarizes how these products are applied.

Exhibit 4-1 Janitorial Chemical Use		
Tasks	How Often	Examples of Products Used
Vacuum / dust mop floors	Daily	None
Wet mop floors	Daily to Weekly	General Purpose Cleaner
Strip & refinish floors	Quarterly to Yearly	Usually by specialty contractors
Remove carpet spots	Daily to Weekly	Spot Remover
Wet-clean carpets	Monthly to Yearly	Usually by specialty contractors
Clean restrooms	Daily	Bathroom Cleaner; Bowl Cleaner
Clean windows	Quarterly to Infrequent	Glass Cleaner
Clean furniture, displays, etc.	Daily to Never	Furniture Polish; Glass Cleaner

### 4.2 Product Purchasing

The typical janitorial contractor buys its chemical products from a number of sources, and keeps an inventory sufficient to cover about a month’s consumption. The amount carried in service vehicles or stored at sites is usually somewhat less. Custodians working for a site also buy from a variety of sources, and typically purchase 2 – 3 months of supplies at a time.

The amounts of each chemical product that a janitor uses each year vary according to the specific types of buildings he or she maintains. For example, stores and restaurants often have

extensive carpeted areas and busy public restrooms. Such high-traffic buildings require more products for carpet and restroom maintenance than do offices.

#### 4.2.1 Product Sources

As shown in Exhibit 4-2, custodians and small janitorial contractors working in Richmond purchase their chemical products from institutional suppliers, warehouse clubs, and retail sources. Some sites purchase supplies directly from manufacturers, particularly hotels and other wide-spread organizations that have national accounts. In the case of restaurant chains, janitorial chemicals are often obtained from the same general catering service that furnishes the site with all of its operating supplies (i.e., such things as linens, flatware, and food).

Exhibit 4-2  
Where Janitorial Chemicals Are Purchased

Source	Number of Firms	Percent of Firms
Distributors & Caterers	21	66%
Warehouse Club	7	22%
Retail / Grocery Store	10	31%
Promotions; Mail Order	1	1%

Note: Adds to more than 100% because several respondents buy from more than one source.

#### 4.2.2 Product Quantities

The amount of chemicals that a janitorial firm purchases depends upon a number of factors, including the:

- number, size, and diversity of sites it maintains;
- types of buildings and their traffic levels;
- length of services contract with the facility;
- floor covering, wall types, and other architectural details;
- chemical distribution & storage within the company; and
- mixing and use instructions given to employees.

The Richmond team discovered that a contractor with widespread and diverse maintenance responsibilities will generally use more products in larger amounts than will another contractor doing just one kind of work, or working in just a few buildings. None of the interviewed contractors use a formal system for tracking chemical usage.

Exhibit 4-3 summarizes the amounts of 19 key maintenance products that are being used at facilities interviewed for the project.

Exhibit 4-3  
Annual Use of Janitorial Products at 32 Participating Organizations

	<u>Largest</u>	<u>Smallest [1]</u>	<u>Average</u>	<u>Total</u>
Area Maintained (SF):	250,000	1,500	30,200	967,000
No. of Janitors:	18	0.1	2.54	81
Area./Person (SF):	13,900	15,000	11,938	11,938
<u>Total Amount of Chemicals [2]</u>				
(gal/yr)	414	0.6	52	1,669
(Lbs/yr)	3,453	5.0	435	13,921
Lbs/1,000 SF/yr	13.8	3.3	14.4	14.4
Lbs/Person/yr	192	50.0	172	172
<u>Amount of Hazardous Materials</u>				
Total (Lbs/yr)	863	1.3	109	3,480
Lbs/1,000SF/yr	3.5	0.8	3.6	3.6
Lbs/Person/yr	48.0	12.5	43.0	43.0

[1] One employee spends 1/10 of her time maintaining this small retail business. The table shows the equivalent amounts were a full time person dedicated to janitorial work.

[2] Excludes water added at the sites to dilute a concentrated product for use.

SF = Square Feet of Building Maintained.

Exhibit 4-4 shows that the 792 janitors working in the City of Richmond use an estimated total of 136,211 lbs of chemical products each year. These products contain an estimated 34,053 lbs of hazardous materials. These totals assume that the 81 janitors who participated in the project are representative of all 792 people who do janitorial work in the City. <sup>[4-1]</sup>

Exhibit 4-4  
Estimate of Annual Janitorial Chemical Use in Richmond

	Workers	Per Person (lbs)	Annual Chemical Use Total (lbs)	Haz Mat (lbs)
Participants	81	172	13,921	3,480
Others	<u>711</u>	172	<u>122,290</u>	<u>30,573</u>
Total	792		136,211	34,053

Chemical use is evaluated further in Section 7.



### 4.3 Footnotes To Section 4

[4-1] The project team estimated the number of janitors working in Richmond via the following steps. Additional details appear in the final report issued for the companion project undertaken in Santa Clara County, which is available at <<http://www.westp2net.org/Janitorial/JP4.htm>>.

[1] The 1997 County Business Patterns Report (US Dept. of Commerce) shows that 2,413 people work for janitorial contractors in Contra Costa County. These data are available on the internet at: <<http://www.census.gov>>.

[2] Data analyzed for the Santa Clara County project (updated to 1997) show that contractor employees are typically 30% of the total number of janitorial workers. A similar ratio is assumed for Contra Costa County.

	<u>Santa Clara</u>	<u>Contra Costa</u>
Contractor Employees	9,176	2,413
Site Employees	<u>21,781</u>	<u>5,728</u>
Total	30,957	8,141

[3] The population of Richmond is 87,425, or just under 10% of the total number of people living in Contra Costa County. Using this ratio, it is estimated that 792 janitors work in Richmond.

	<u>Contra Costa County</u>	<u>All Richmond</u>
Population	899,107	87,425
Contractor Employees	2,413	235
Site Employees	<u>5,728</u>	<u>557</u>
Total Janitors	8,141	792

[4] The project team surveyed chemical use with contractors and other organizations that employ 81 janitors, or just over 10% of the janitors in all of Richmond.

	<u>32 Surveyed Sites</u>	<u>All Richmond</u>
# Janitors/Custodians	81	792
SF of Building Space	967,000	Unknown
Product Use		
lb/yr - total	13,921	136,211
lb/yr/person - total	172	172
lb/yr - Hazardous Materials	3,480	34,053
lb/person/yr - Haz Mat	43	43

US EPA ARCHIVE DOCUMENT

## 5. Pollution Prevention Opportunities

This section of the report provides examples of successful pollution prevention strategies for helping small janitorial contractors and individual custodians reduce their use of cleaning chemicals. These examples are detailed further in a series of fact sheets that are published on the project's website. Section 6 describes how this information was used in the outreach efforts the project team undertook in the Richmond community.

As mentioned in Section 4, the average janitor who is involved with chemicals uses an estimated 172 lbs of product per year. Hazardous ingredients comprise about 25% of this total, or 43 pounds. Water added on-site to dilute the products for use is additional.

Were that same average janitor to employ all of the chemical substitutions and other pollution prevention measures described here, it is forecast that his or her hazardous materials use could decrease by 13%, or 5.4 pounds per year.

### 5.1 Chemical Substitutions

Chemical substitution involves changing from products with highly-toxic ingredients to ones that are less hazardous. A number of effective, easy-to-use, and low-toxicity janitorial products are now becoming available. Specific examples include changing from:

- Glass cleaner containing butoxyethanol to one formulated with isopropanol or other less-hazardous ingredients;
- General purpose cleaners with alkyl phenyl ethoxylates, ethanolamine, or butoxyethanol to ones formulated with linear alcohol ethoxylates, citric acid, or other less-hazardous ingredients; and
- Toilet bowl cleaners with hydrochloric acid to ones with less-corrosive ingredients, such as citric acid.

The potential hazardous materials use reduction from these and similar changes toward less toxic products is conservatively estimated as 2.5 lb per year for each janitor, or about half of the total amount of reduction that is believed feasible.

The largest barrier to accomplishing this potential is that local retail stores, warehouse clubs, and institutional distributors either do not yet offer or do not emphasize less toxic products. In addition, local janitors tend not to use mail order sources for their products – exactly the route by which many vendors are making their environmentally preferable items available.

## 5.2 Chemical Use Reduction

Some cleaning tasks must use hazardous products because there are no effective substitutes. In these instances the best pollution prevention strategy is to have the janitor dilute each product as much as possible, and to use it only when absolutely necessary. Janitors who buy their own chemicals and are concerned by costs are generally receptive to ideas for reducing their use of cleaning products.

Examples of chemical use reduction include:

- starting a program of tracking product quantities;
- adding extra water to dilute ready-to-use cleaning products;<sup>[5-1]</sup>
- cleaning when there is a need rather than according to an arbitrary schedule; and
- using two products instead of one to clean.<sup>[5-2]</sup>

The potential hazardous materials use reduction from decreasing product consumption is conservatively estimated as 1.5 lb per year for each janitor.

Additional information about these techniques appears on the project website, and in the companion report prepared for the janitorial pollution prevention project in nearby Santa Clara County.

## 5.3 Indirect Pollution Prevention Strategies

The pollution prevention measures presented so far have been ones with a direct impact on chemical use. In other words, change this product for that one, and the amount of hazardous materials used by janitors will go down. Several “indirect” methods can significantly reduce chemical use as well.

### 5.3.1 Building Perimeter Controls

Managing the entry of dirt into the building is another way of accomplishing 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.

### 5.3.2 Vacuuming

Daily vacuuming with strong suction, tight filter, rotating brush machines removes up to half or more of the soil that falls onto carpets. How much effort does it take to attain this level of cleaning? Routine vacuuming, with up to four back and forth strokes of the wand across the carpet, is sufficient for low traffic areas. Up to ten wand strokes may be needed at outside

doorways and other high traffic areas. Supplemental vacuuming will be needed along walls and carpet edges where soil tends to accumulate.

### 5.3.3 Storage and Mixing

The project team discovered that janitors can use the following techniques to make their chemical storage and mixing safer, and at the same time reduce the amounts of hazardous materials lost through discards and spills.

*Incompatible Products* - Products with incompatible ingredients should be stored separately. For example, it is important to keep glass cleaner with ammonia away from tub & tile cleaner containing bleach. "Away from" means in a separate room, in a separate cabinet, or on separate shelves (but not one over the other).

*Strong Ingredients* - If space is available, the site should store products with acids or other strong ingredients in plastic tubs or containers so that any leaks will not harm the storage rack or janitorial closet.

*Stock Rotation* - It is useful to rotate the stock of stored products so that the oldest ones are used first. Some janitorial products (for example, bleach) have a shelf life. The idea is to use all such products before this time expires.

*Spill Kits* - Janitorial crews should keep spill clean-up kits in each building or work vehicle, and should know how to use them.

*Safe Mixing* - Products with strong chemicals pose the greatest risks when workers are handling the concentrate. To reduce these risks during mixing a janitorial contractor should:

- train its employees in safe work procedures;
- have a supervisor do all mixing;
- insist that protective gloves and goggles are worn when an employee is handling concentrated products;
- be aware of Cal/OSHA regulations that require a 15-minute full-flow eye wash station be provided in any area where workers are exposed to corrosive chemicals; and
- teach all employees about safe lifting methods, because many chemical accidents occur when a worker lifts a full container to pour its contents into a work bucket.

*Avoid Aerosol Products* – Aerosol containers include up to 20% of propane or another pressurized hydrocarbon that acts as a propellant. In addition, something on the order of 5% of the active ingredients often must be abandoned in the container when the nozzle plugs or breaks off.

### 5.3.4 Forecast Impact of Indirect Measures

Estimating chemical use reductions for floor mats, vacuuming procedures, and other indirect strategies is difficult at best. The project team judges that these reductions are something on the order of 0.4 pound per average janitor per year. Having good inventory control, practicing safe product mixing, and converting from aerosol cans to trigger spray bottles would reduce the average janitor's hazardous materials use by an additional 1.0 pounds per year.

### 5.4 Footnotes to Section 5

- [5-1] After using one-tenth to one-quarter of a water-based cleaning product in a trigger bottle, the janitor refills the bottle with water thereby extending its use. Thereafter the bottle is used until it is empty. This practice can reduce overall chemical use by an estimated 15%, and hazardous materials use by 2% to 3%.
- [5-2] For example, using two different toilet cleaners can reduce the use of acid-containing products by an estimated 80%. As shown below, using a non-acid cleaner four out of every five cleanings produces a net hazardous materials reduction of about 50%:

	<u>Before</u>	<u>After</u>	<u>Change/Week</u>
<u>Acid Cleaner</u>			
Lbs Total/week	0.25	0.05	
Pct. Haz.	25%	25%	
Lbs Haz/Week	0.06	0.01	- 0.05
 <u>Non-Acid Cleaner</u>			
Lbs Total/week	0.00	0.20	
Pct. Haz.	10%	10%	
Lbs Haz/Week	0.00	0.02	+ 0.02
 <u>Combined Total</u>			
Lbs Haz/Week	0.06	0.03	- 0.03
			50% Net Reduction

The reduction for a full year is 52 times that for one week, or a total of 1.56 lbs.

## 6. Outreach Activities

This section of the report describes the fact sheets, presentations, on-site assistance, and other methods used to send pollution prevention messages to janitors and businesses in Richmond. Janitors participating in the needs assessment convinced the team to concentrate its local outreach efforts in three key areas.

1. *Fact Sheets* with information about safer ways to do cleaning tasks that require use of hazardous chemicals.
2. *Speeches, Flyers, & Newsletters* to educate business owners and the general public about health, safety, and environmental issues arising from cleaning products.
3. *On-site Assistance* in reviewing janitorial chemicals, recommending alternatives, and providing samples of environmentally preferable products.

In addition, the team made presentations to a number of government agencies having an interest in cleaning chemical issues.

### 6.1 Fact Sheets

As work progressed, the team learned that janitors want specific information that helps them do their work more safely. Shifting to safer products usually (but not always) has the added benefit of moving toward environmentally preferable chemicals as well. Exhibit 6-1 lists the fact sheets that the project team published to address this need.

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Exhibit 6-1  
Fact Sheet Topics

Topics	Fact Sheets Produced
Highest Risk Cleaning Activities	Toilet Cleaning Hard Floor Care Carpet Care Restroom Cleaning Glass Cleaning Metal Cleaning Disinfectants
Translations	Limpieza Segura Y Efectiva Para Los Inodoros (Safe and Effective Toilet Cleaning)

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Copies of these fact sheets are downloadable from the project website.

## 6.2 Presentations, Flyers, and Newsletters

The Richmond team distributed fact sheets, made presentations, and wrote articles to publicize the importance of janitorial product health and safety issues. These efforts reached an estimated 2,800 individuals in four distinct audiences.

### 6.2.1 Janitorial Contractors

Direct mailings were sent to 96 firms holding janitorial business licenses in the City, and to 100 others firms identified by internet directories as operating a cleaning service within 10 miles of Richmond. These mailings included:

- An endorsement letter from Mayor Corbin;
- Offers of free on-site chemical reviews and product samples;
- Fact sheets; and
- Announcement of the project website.

About five percent of these firms contacted the project with questions or requests for samples. These contacts were either by phone or e-mail.

### 6.2.2 Business Owners

The team approached about 650 stores, offices, restaurants, shops, and other businesses in the City of Richmond. The first goal of this effort was to provide safety and environmental information to custodians and other employees doing janitorial work at the businesses. A second goal was to use business owners and managers as an indirect way of contacting the janitorial contractors that service the businesses.

Most of these contacts were accomplished via newsletters articles, flyers, and fact sheets sent to members of the Richmond Chamber of Commerce. Additional mailings reached business owners who are members of the West County Toxics Coalition, a local citizens' action group that participated in the project.

About two percent of these businesses contacted the project team with telephoned or FAXed questions, or requested on-site reviews of their cleaning chemicals. Additional sites were visited as part of the sample distribution program described in Section 6.3, below.

### 6.2.3 Local Agency Staff

Several city and county agencies participated in the project, and continue to act as local knowledge resources now that the team has completed its initial pilot effort. These agencies include:

- Richmond Public Works Dept. – Staff of the City's main wastewater treatment plant obtained MSDSs and other cleaning product data from about 20 sites that discharge to the sewer system. These staff members also attended training sessions and visited the project website to become knowledgeable in janitorial chemical issues. They now handle routine questions that dischargers pose to them about these chemicals and their effects upon the sewer system.
- County Health Dept. – Hazardous materials staff of the Contra Costa County Health Department undertook similar training, and in addition co-sponsored a workshop on janitorial chemicals with the project team at the 1999 Western Regional P2 Conference in Monterey. Building upon a review of cleaning chemicals at the County hospital, the hazardous materials staff are also evaluating similar products used at other County operations.
- Richmond City Staff – The Mayor and City Manager assisted the project team by providing written endorsement of the project, having staff arrange meetings, and promoting the adoption of environmentally preferable cleaning products by City custodians.
- Richmond Public Library – Fact sheets, other written materials, and information about the project website were provided to the head librarian so that the general public could more easily access local information about cleaning product safety. In addition, project fact sheets and flyers were placed on the City Hall environmental information kiosk.

These agencies were able to connect the project team with about 25 businesses and facilities that had questions about their janitorial chemicals.

#### 6.2.4 General Public

The project team also explored a number of more general ways of communicating its cleaning chemical safety messages. These efforts reached about 900 members of the Richmond community, about 10% of whom are either janitors themselves or hire janitorial services for their business, community center, or church.

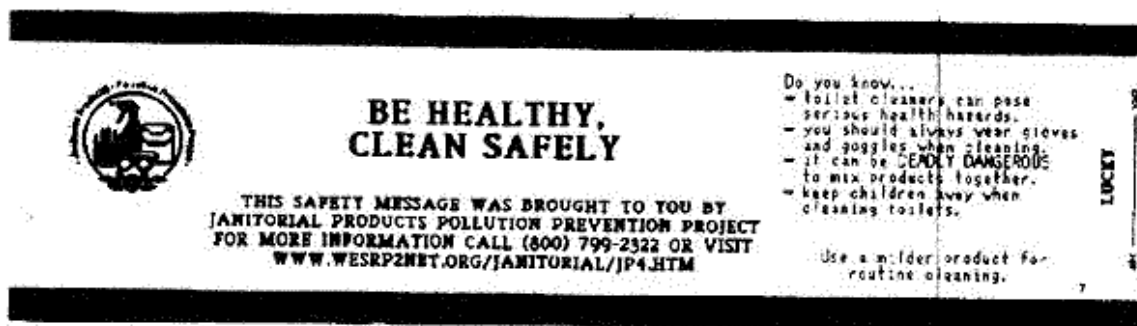
- Environmental Faire – The project sponsored a booth at a community environmental fair that was held in mid-1998. Three hundred people visited the booth and received flyers, fact sheets, and verbal information about cleaning chemical issues. About 10 people visiting the booth were owners or employees involved with cleaning their businesses in Richmond. Several other booth visitors took information to give to family members who did part- or full-time cleaning work.
- Neighborhood Councils – Citizens' action groups exist for 17 neighborhoods throughout Richmond. The project team made brief presentations on cleaning chemical safety to about 125 people at six of these organizations. In each session the environmental and safety impacts of common cleaning chemicals were emphasized. About fifteen of the attendees were local business owners responsible for arranging cleaning services.



- Radio Interview – The project took part in a half-hour interview on “Father Time”, a home health and safety program broadcast on a public access FM station in Richmond. From previous listener surveys, the producer estimates that his audience ranges from 500 to 4,000 people, depending upon the season, other events going on simultaneously, and the show’s discussion topics. From these demographics it is estimated that the project’s message reached 500 people via this broadcast.
- Retail Store Outreach – A major grocery store chain with two locations in Richmond tentatively agreed to sponsor public service messages on point-of-sale coupons, direct mailings to customers via its purchase tracking system, and shelf displays. Although not fully implemented during the project, the team believes that these three approaches are important ways of sending environmental and safety messages to retail purchasers of cleaning chemicals.
  1. Grocery stores with computerized check-out systems routinely print coupons whenever a customer purchases a product in one of several special categories. Individual categories may be ‘rented’ by a manufacturer of products of that type. For example, anyone purchasing laundry soap, regardless of brand, will receive a coupon from ABC Soap Company, the firm ‘renting’ that coupon category.

The project team developed the public service announcement shown by Exhibit 6-2. Once activated, this coupon would be printed for each customer who purchases any brand of acid toilet bowl cleaner.

Exhibit 6-2  
Product Purchase Coupon – Toilet Bowl Cleaners



2. Some grocery stores issue a ‘rewards card’ to customers so that their repeat business may earn discounts. Specific buying data accumulated by this system are confidential. However, the store chain with whom the project spoke indicated that it is willing in principal to send public service materials via a ‘blind’ mailing in which the addressees are not revealed. The team envisions sending a fact sheet about safe toilet cleaning to individuals who purchase more than one container of acid toilet bowl cleaner per month.

3. In addition, the team discussed the feasibility of placing posters, flyers, and coupons on store shelves where cleaning chemicals are displayed. Because of the longer time needed to obtain approvals from corporate headquarters, these efforts have not yet produced results at any of the four retail and warehouse stores that were contacted.

Together all of these public messages about cleaning product safety elicited responses and requests for additional information from about two dozen individuals, or 3 percent of the 900 people that were contacted via the project's general outreach efforts.

### 6.3 On-Site Assistance

On-site assistance included reviews of existing products and providing janitors and custodians with samples of environmentally preferable items to try as substitutes.

#### 6.3.1 Product Reviews

During the project the Richmond team reviewed health, safety, and environmental aspects of janitorial chemicals being used by 32 agencies, businesses, and contractors. As shown by Exhibit 6-3, a total of 268 products were evaluated in this process.

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Exhibit 6-3  
Product Reviews at 32 Richmond Sites

Results	Products	Percent of Total
Stop Using	20	7%
Extreme Care / Avoid	149	56%
Use With Care	<u>99</u>	37%
Total	268	

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These results are similar to recommendations made for products encountered during the Santa Clara County project.

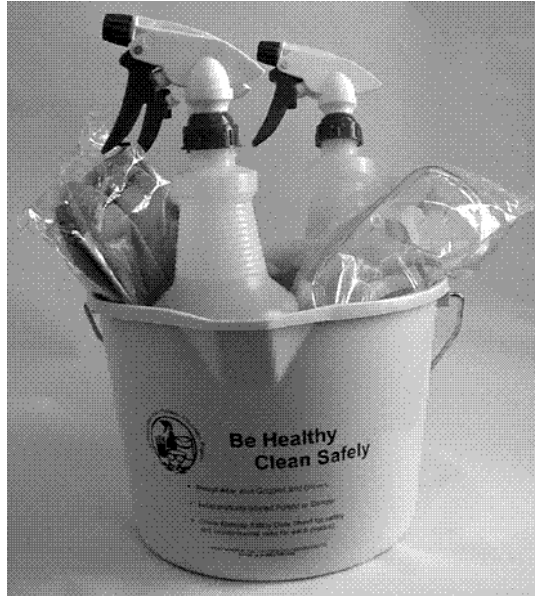
#### 6.3.2 Sample Kits

The Richmond team obtained samples of environmentally preferable products that the Santa Clara project had previously found and tested. The team packaged these samples in plastic buckets and then distributed them via mailings and in-person deliveries.

The pre-packaged kits consisted of three or more alternative products, a 2-quart plastic bucket featuring a safety message in both English and Spanish, MSDSs and other product literature, safety gloves and goggles, and product evaluation postcards.

As shown by Exhibit 6-4, product samples were distributed to 89 end users.

Exhibit 6-4  
Sample Kit Distribution



Number of Sample Products Distributed

<u>Types</u>	<u>No. of Recipients</u>	<u>No. of Products</u>
Schools & Churches	3	12
Janitorial Contractors	36	108
Stores, Offices, & Facilities	<u>48</u>	<u>168</u>
Total	89	288

## 6.4 Agency Outreach

The Richmond team was tasked by the project scope to share its findings, tools, and other outreach materials with other government agencies. This goal was accomplished by e-mail announcements, direct mailings, technical articles, and professional conferences.

- E-mail Announcements - The team posted e-mail messages about the project to several regional and national list servers to which agency P2 staff subscribe. In addition, the project placed all of its fact sheets and other materials on a website.
- Direct Mailings - The project website was announced through-out the state to members of the California Association of Public Purchasing Officials.

- Pollution Prevention Conferences - The project's approach to janitorial pollution prevention was featured at a number of conferences and presentations, such as the 1999 Household Hazardous Waste Conference, and the 1999 Western Regional Pollution Prevention Conference in Monterey. The latter event focused upon ways for an agency to incorporate janitorial P2 into its industry outreach program. The handouts and case study used for these sessions appear on the project website.

It is estimated that the project reached a total of about 1,500 agency staff people via these various routes. About 200 individuals attended technical presentations that the Richmond team made. Fifty others received materials that were mailed directly to them. The balance received e-mail messages, read articles published about the project, or learned of the project through personal referrals.



## 7. Results Forecast

This section of the report estimates the amount of hazardous chemicals that janitors in the City of Richmond use, and forecasts the amount by which this use will be reduced as a result of the project.

The project team worked directly with 32 organizations, two-thirds of which are janitorial contractors. These organizations employ 81 people, representing about 10% of the janitors working in Richmond. Each year the employees of the 32 firms use 267 chemical products that contain an estimated 3,480 pounds of hazardous materials.

It is estimated that the use of hazardous janitorial chemicals at these 32 organizations could decrease by about 436 pounds per year if all of the recommendations the team made during site visits, workshops, and other local outreach efforts were to be followed. About 30%, or 131 pounds of this annual reduction are actually expected to occur.

If the other contractors and individuals doing janitorial work in the City of Richmond were to make similar changes, the total use of hazardous janitorial chemicals throughout the county could decrease by about 4,277 pounds per year. Motivated by a continuing and persistent local outreach effort, about 792 pounds of this potential reduction might actually occur.

### 7.1 Hazardous Materials Use Before Project

As discussed in Section 4.2.2, the project team estimates that the 792 janitors in Richmond use about 16,332 gallons of concentrated and ready-to-use chemical products every year. At an average of 8.34 pounds per gallon, these chemicals weigh a total of 136,211 pounds. The amount of hazardous materials in this annual total is estimated to be about 34,053 pounds, or 43 pounds per person per year.<sup>[7-1]</sup>

### 7.2 Potential Impact Of The Project's Suggestions

The project team recommended that the 32 reviewed organizations stop using 20 products, and only continue using 148 additional chemicals if extreme care could be assured.

Exhibit 7-1 shows that these changes, if fully implemented, would reduce hazardous materials use at the 32 firms by 436 pounds per year. Based upon a limited number of follow-up interviews, it is expected that the 32 organizations will actually follow only about 30% of these suggestions in the short term. Factoring in the specific on-site situations involved, the expected reduction in hazardous materials use is 131 pounds per year.

**Exhibit 7-1**  
**Hazardous Materials Reduction Forecast – 32 Reviewed Sites**

Recommendation	Total Potential Changes	Expected Changes
"Stop Using Product"	20 Products	10 Products
"Avoid If Possible, Otherwise Use Extreme Care"	148 Products	52 Products
Hazardous Materials Reduction	436 lb per year (5.4 lb per janitor per year)	131 lb per year (1.6 lb per janitor per year)

The project team believes that persistent on-site follow-up and reinforcement of the project's messages with coupons and in-store displays would increase the actual amount of reduction that each of the 32 firms accomplishes, attaining perhaps 50% of the potential total in the long term.

### 7.3 Forecast Of City-Wide Hazardous Materials Reductions

Were future pollution prevention outreach efforts to reach all 792 of the janitors working in Richmond, the hypothetical amount of hazardous materials reduction would be as shown in Exhibit 7-3. This hypothetical estimate assumes that organizations who didn't participate in the project would have the same potential hazardous materials use reduction as the reviewed firms did, but that these other sites would actually implement only about half of the relative number of changes suggested to them. In other words, the firms that didn't participate in the project are assumed to have the same numbers of potential chemical changes, but are less prone to making them.

**Exhibit 7-2**  
**Hazardous Materials Reduction Forecast – All of Richmond**

	Potential Changes	Expected Changes
32 Reviewed Organizations (81 Employees)	436 lb per year (5.4 lb per janitor per year)	131 lb per year (1.6 lb per janitor per year)
Other Organizations (711 Employees)	3,841 lb per year (5.4 lb per janitor per year)	661 lb per year (0.9 lb per janitor per year)
Total (792 Employees)	4,277 lb per year (5.4 lb per janitor per year)	792 lb per year (1.0 lb per janitor per year)

## 7.4 Footnotes To Section 7

[7-1] The team made its extrapolations in three steps:

1. The ratio of 25% hazardous materials weight to total product weight was based upon the janitorial products that the team studied in detail.
2. This ratio was used to estimate the amount of hazardous ingredients encountered in 267 products used by 32 organizations that were reviewed.
3. The reviewed organizations employ about 10% of all janitors employed in Richmond. The estimate of annual City-wide hazardous materials use is an extrapolation based upon this ratio.