How To Select And Use Safe Janitorial Chemicals

Project Completion Report

Pollution Prevention
Incentives For States

U.S. EPA Region IX
California EPA
County of Santa Clara

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Preface

This report is an account of a pilot project to evaluate pollution prevention opportunities in the janitorial industry. The project was a collaboration of many individuals, businesses, and agencies whom the authors wish to acknowledge for their valuable contribution. The project would not have been a success without their support.

"Although the work described in this report has been funded in part by the United States Environmental Protection Agency through Grant Number NP-999-729-01-0 to the State of California, it has not been subjected to the Agency's required peer and policy review and therefore does not necessarily reflect the views of the Agency, and no official endorsement should be inferred."

Report Prepared By

Thomas Barron, PE
Pollution Prevention Consultant
3351 Beechwood Drive
Lafayette, CA 94549
(925) 283-8121 • tsbarron@attglobal.net

Carol Berg
County of Santa Clara
1735 North First Street
San José, CA 95112
(408) 441-1195 • carol.berg@pln.co.santa-clara.ca.us

Linda Bookman
Environmental Consultant
936 Schiele Avenue
San José, CA 95126
(408) 275-0141 • linda@bookman.org

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Abstract

This report is an account of an 18-month Pollution Prevention Incentives for States project undertaken in Santa Clara County, California. The report describes both how the team performed its work and the results that it obtained. Additional information about janitorial pollution prevention appears in the accompanying volume of Appendices, on the project website, and in the completion report prepared for the related outreach effort for small janitorial organizations in Richmond, California.

Needs Assessment - Workers' compensation data adapted from Washington State show that janitors are injured fairly frequently by the chemicals that they use:

- Six out of every hundred janitors in Santa Clara County injure themselves with chemicals every year;
- 27,000 janitors working in the county experience a total of about 1,200 injuries each year;
- 20% of these injuries are serious burns to the eyes or skin; and
- Medical treatment and lost job time for these chemical injuries in Santa Clara County is about $750,000 per year.

Making a rough extrapolation of these estimates to the national level, the team believes that medical expenses and lost time for chemical injuries to janitors throughout the United States total about $75 million per year.

The Santa Clara team identified pollution prevention information that janitors working in large organizations do not have, and found out that assistance could best be delivered via fact sheets, training workshops, and on-site product reviews and assistance.

Because safety is a key issue for janitors, the team emphasized hazards associated with specific high-risk cleaning work, techniques for safe storage and mixing, and methods for janitors to learn on their own the health consequences of specific chemical ingredients.

Janitorial Product Use - The average janitor uses an estimated 28 gallons of chemicals per year, weighing 234 pounds. Hazardous ingredients comprise about 25% of the total, or 58 pounds. The Santa Clara team focused its efforts upon chemicals appearing in 19 key products that are used for care of hard floors, carpets, restrooms, windows, and miscellaneous tasks. The cost for these products is estimated as $250 per worker, which is only about 1% of the annual salary of $20,000 typically earned by that same worker.

The project team worked with 47 organizations, two-thirds of which were janitorial contractors. These organizations employ about 6,800 people, representing about 25% of the janitors working in Santa Clara County. Each year the employees of the 47 firms use a combined total of 1,140 chemical products that contain an estimated 400,000 lbs. of hazardous materials.

Pollution Prevention – Safety and environmental improvement are both accomplished by changing from products with highly-toxic ingredients to ones that are less hazardous. 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.

Managing the entry of dirt into the building is another way of accomplishing source reduction. Less soil in the building means less frequent cleaning, which in turn requires less chemical usage. Daily vacuuming also helps accomplish this goal.

Other, longer-term pollution prevention strategies include designing buildings with easy-to-clean architectural features (e.g., keep 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 air conditioning systems so as to minimize the movement of dust.

Forecast Results - Exhibit A shows that use of hazardous janitorial chemicals at the 47 participating organizations could decrease by 131,306 lbs. per year if all of the recommendations the team made during site visits, workshops, and other local outreach efforts were to be followed. About 25%, or 29,260 lbs. of this potential annual reduction are actually expected to occur.

Exhibit A

Forecast Reduction In Use Of Hazardous Materials (Santa Clara County)

		Hazardous Materials (lbs per year)		
		Amounts	Forecast Reductions	
	Janitors	Used Before	Potential	Expected
Contractors				
Assisted Sites	4,629	221,593	88,637	16,606
Others	3,324	159,122	63,649	5,962
Total	7,953	380,714	152,286	22,568
Site Employees				
Assisted Sites	2,228	106,673	42,669	12,654
Others	16,650	797,026	318,811	47,275
Total	18,878	903,699	361,480	59,930
Combined Totals				
Assisted Sites	6,857	328,266	131,306	29,260
Others	19,974	956,148	382,459	53,237
Total	26,831	1,284,414	513,765	82,497
				Already Reduced: About 15,000 lbs/yr

If the other contractors and individuals doing janitorial work in Santa Clara County were to make similar changes, the total use of hazardous janitorial chemicals throughout the county could decrease by 513,765 lbs. per year. Motivated by a continuing outreach effort, 82,497 lbs. of this potential reduction might actually occur.

For more information visit the project website: <http://www.westp2net.org/janitorial/jp4.htm>

1. Introduction

This report is an account of an 18-month Pollution Prevention Incentives for States project undertaken in Santa Clara County, California. The project team was comprised of staff from a number of organizations, including:

- US EPA Region IX (San Francisco);
- Cal/EPA – Department of Toxics Substances Control;
- County of Santa Clara – Pollution Prevention Program;
- Technical consultants;
- Stakeholders from the janitorial industry; and
- Forty-seven organizations and their suppliers that participated by having detailed, on-site reviews done of their janitorial products.

The report describes both how the team performed 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 in the accompanying volume of Appendices, on the project website, and in the completion report prepared for the related outreach effort for small janitorial organizations in Richmond, California.

2. Summary

The Santa Clara project team reached all six objectives established in September 1998:

1. Determine attitudes and needs of facility managers and janitors with respect to the chemicals that they use;

2. Conduct a series of on-site product reviews to identify cleaning and maintenance chemicals that have health, safety, or environmental issues;

3. Develop checklists, fact sheets, and other references that facility managers may use to evaluate their janitorial chemicals;

4. Find effective products for sites to try as environmentally preferable substitutes for hazardous chemicals that they have been using;

5. Conduct pollution prevention outreach education via workshops, on-site assistance, and demonstrations; and

6. Estimate the amount by which annual hazardous materials use is reduced by janitors that the project team worked with.

2.1 Needs Assessment

The Santa Clara team began its outreach effort with a needs assessment that identified pollution prevention information that janitors do not have, and found out that assistance could best be delivered via fact sheets, training workshops, and on-site product assistance.

Because safety is a key issue for janitors, the team decided to emphasize hazards associated with specific high-risk cleaning work, techniques for safe storage and mixing, and methods for janitors to learn on their own the health consequences of specific chemical ingredients.

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);

- Are flammable (chewing gum freezer; metal polish);

- Give off toxic fumes (metal polish; graffiti remover); or

- Are poisonous (metal polish; graffiti remover; degreasers).

2.2 Chemical Injuries To Janitors

In addition to reviewing products and conducting surveys, the Santa Clara project team also identified the frequency and severity of accidents that janitors actually experience with chemicals. Workers' compensation data adapted from Washington State suggest that:

- Six out of every hundred janitors in Santa Clara County injure themselves with chemicals every year;
- 27,000 janitors working in the county experience a total of about 1,200 injuries each year;
- 20% of these injuries are serious burns to the eyes or skin; and
- Medical treatment and lost job time for these chemical injuries in Santa Clara County is about $750,000 per year.

Making a rough extrapolation of these estimates to the national level, the team believes that medical expenses and lost time for chemical injuries to janitors throughout the United States total about $75 million per year.

2.3 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 that a janitor uses vary according to the types of buildings the firms maintain. For example, hotels and airports often have extensive carpeted areas and busy public restrooms. Such high-traffic buildings require more products for carpet and restroom maintenance than do offices or manufacturing plants.

The average janitor uses an estimated 23 gallons of chemicals per year, weighing 194 pounds. Hazardous ingredients comprise about 25% of the total, or 48 pounds. The cost for these products is estimated as $250 per worker, which is only about 1% of the annual salary of $20,000 typically earned by that same worker.

2.4 Janitorial Pollution Prevention Measures

Every janitor that employs all of the chemical substitutions and other pollution prevention measures identified by the Santa Clara team will reduce his or her hazardous materials use by 40%, or 19 lbs. per year.

Chemical Substitutions – Pollution prevention can be accomplished by changing from products with highly-toxic ingredients to ones that are less hazardous. For example, converting from:

- Glass cleaner containing butoxyethanol to one formulated with isopropanol or other less-hazardous ingredients (Potential annual hazardous materials use reduction: 0.75 lbs per user);

- General purpose cleaners with alkyl phenyl ethoxylates, ethanolamine, or butoxyethanol to ones formulated with linear alcohol ethoxylates, citric acid, or other less-hazardous ingredients (Potential reduction: 0.3 lbs per user); and

- Metal polishes with either tetrachloroethylene or volatile organic compounds. to ones with low-volatility hydrocarbons or non-toxic ingredients (Potential annual reduction: 0.2 lbs per user).

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.

Examples of chemical use reduction include starting a program of tracking product quantities, changing floor stripping techniques, and using two products instead of one to clean toilet bowls. The potential hazardous materials use reduction from these steps is conservatively estimated as 10 lbs per year for each janitor.

Monitoring the use of any product usually leads to less of it being consumed. Firms that begin to track floor stripper or toilet cleaner quantities report realizing reductions of 10% to 20%. However, this monitoring must be continued for the change to be permanent. The potential hazardous materials use reduction from such administrative procedure changes is conservatively estimated as 1.0 lbs per year for each janitor.

Floor strippers often contain ammonium hydroxide, ethanolamine, and butoxyethanol, making this product one of the most dangerous handled by janitors. These strong ingredients are needed to dissolve and remove modern, highly-resistant polymer floor finishes. However, minimizing 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 applying the diluted stripper with a rotating pad scrubber; and

- Thoroughly rinsing the stripped floor so as to neutralize the surface prior to applying the new floor finish.

The potential hazardous materials use reduction from these changes is 40 lbs per year for each janitor actively involved with floor finish work, or 4.0 lbs per year spread across all of the workers in the typical janitorial contracting firm.

Acidic porcelain 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 potentially decrease hazardous material use by an 1.8 lbs per user per year.

Other Pollution Prevention Measures - The ideas presented so far have been ones with a direct impact on chemical use. In other words, switching to less hazardous products causes the amount of hazardous materials used by janitors will go down. Several "indirect" methods can significantly reduce chemical usage as well.

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 usage.

Daily vacuuming with strong suction, tight filter, rotating brush machines removes up to half or more of the soil that falls onto carpets. 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 also be needed along walls and carpet edges where soil tends to accumulate.

Other, longer-term pollution prevention strategies include designing buildings with easy-to-clean architectural features (e.g., keep 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 air conditioning systems so as to minimize the movement of dust.

Chemical use reductions for floor mats, vacuuming procedures, and other indirect strategies is on the order of 2 lbs. per average janitor per year.

2.5 Pollution Prevention Outreach Materials

Janitors participating in the needs assessment convinced the Santa Clara team to concentrate its local outreach efforts in five key areas. Items produced for each area appear in the Appendices and on the project website.

1. ***Fact Sheets*** with information about safer ways to clean.

2. ***Tools*** for people to use in evaluating the chemical products they use, including forms, checklists, ingredient hazard tables, and guidance on how to find internet sites that feature chemical data.

3. ***Commentaries*** about how to successfully change from strong chemicals to environmentally preferable ones. This category includes success stories and

articles written by the project team, as well as materials furnished by other agencies.

4. ***Workshops*** for training janitorial professionals about product health, safety, and environmental issues. The project held three major workshops to share project results with janitors, facility managers, and agency staff. These sessions emphasized evaluating product risks, finding environmentally preferable products, trying out sample products, and safely managing chemicals.

    - July 1999 Industry Workshop - Attendance: ±60. Time: 4 hours. Sponsored by the County of Santa Clara and the University of California, Santa Cruz, Extension Service.

    - September 1999 Industry Workshop - Attendance: ±25. Time: 90 minutes. Sponsored by the Pacific Association of Building Services Contractors.

    - October 1999 Agency Workshop - Attendance ±45. Time: 2 hours. Sponsored by the Western Regional Pollution Prevention Network.

    Workshop results and other feedback were universally positive, indicating that the materials presented were both informative and important to the attendees.

5, Free On-site Assistance in reviewing janitorial chemicals, recommending alternatives, and providing samples of environmentally preferable products.

Based upon repeated requests from sites and contractors, the Santa Clara team decided to find, test, and distribute samples of environmentally preferable products. This effort took four months, and resulted in the identification of about 20 products for use as samples.

Following the initial trials, the project team delivered samples as pre-packaged kits consisting of three or more alternative products, a 2-quart plastic bucket featuring a safety message in both English and Spanish, MSDSs, other product literature, gloves, goggles, and product evaluation forms.

In hindsight, the Santa Clara team believes that industry outreach efforts for future projects could be improved by preparing and presenting more materials in Spanish and other languages spoken by janitorial workers. In addition, with addresses now readily available on the internet, it is possible to mail outreach materials directly to owners and managers of janitorial companies.

2.6 Agency Outreach Efforts

The project scope required the Santa Clara team to share its findings, methodology, and outreach materials with other government agencies. This goal was accomplished via 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, e-mail was used to tell local agencies in the San Francisco area about

workshops and other events. Finally, the project arranged for links to its website to be added to the websites maintained by the National Association of Counties and other organizations with an interest in environmentally preferable purchasing.

- Direct Mailings - Project events, publications, and other resources were announced in a number of postal mailings. For example, newsletters were sent locally via the County of Santa Clara's P2 mailing list, and 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, such as the 1998 and 1999 Western Regional Pollution Prevention Network meetings in San Diego and Monterey.

It is estimated that the project reached a total of about 1,500 agency staff through these efforts. About 250 individuals attended workshops and technical presentations that the Santa Clara team made. Three hundred others received announcements mailed directly to them. The balance received e-mail messages, visited the project website, read articles published about the project, or learned of the project through personal referrals.

Several agencies have advised the Santa Clara team that they are using materials and lessons learned from the project. For example, Sonoma County is beginning an effort to shift a dozen local agencies into purchasing environmentally preferable janitorial products. The City and County of San Francisco is undertaking a similar program for its departments. In addition, several hundred agency staff have shown their interest in janitorial pollution prevention by visiting the project website and downloading the fact sheets and working tools that it provides.

2.7 Results

The project team assisted 47 sites and companies employing 6,900 janitors in Santa Clara County. As shown by Exhibit 2-1, the amount of hazardous materials these janitors use is 328,266 lbs. per year. Implementing all pollution prevention opportunities at the 47 organizations could reduce hazardous materials use by 131,306 lbs. per year. For example:

- City of San José - As a result of project-sponsored product trials, janitors working in the City of San Jose Main Library changed to safer alternative cleaners that reduce the use of:
  - Butoxy Ethanol (poisons blood, liver, and kidneys);
  - Sodium Hydroxide (corrosive to eyes and skin);
  - Alkyl Phenol Ethoxylates (affect hormone systems); and
  - Hydrochloric Acid (corrosive to eyes and skin).

  The project team estimates that changing away from products with these ingredients has decreased the Main Library's hazardous chemical usage by about 1300 lbs. per year.

- Stanford University - Heather Perry, Environmental Health and Safety Coordinator for Student Housing Services at Stanford University contacted the

Santa Clara Project to learn more about safety and health related risks regarding products used by the janitors in her department. Of the 50 or so items reviewed, Ms. Perry arranged for the cleaning crews to completely stop using a dozen products with serious health and/or environmental risks. Among those eliminated were products with ozone depleting substances, cancer causing ingredients and reproductive hazards.

Although it was easy to make these initial changes, further product adjustments will prove to be more challenging. The project team estimates that by switching to all of the suggested alternative products, Stanford janitors will reduce their hazardous materials usage by about 4,200 lbs. per year.

Based upon these and other reductions seen so far, the Santa Clara team conservatively estimates that 29,260 lbs. per year of the potential 131,306 lbs. per year of hazardous materials reduction will probably occur at the 47 participating sites. About half of this expected amount has already been accomplished. More of the potential total could be attained were continued outreach undertaken with the 47 sites to encourage them to make all of the changes available.

If future outreach efforts were to reach all 26,831 of the janitors working in Santa Clara County, the amount of hazardous materials reduction could be 513,765 lbs. per year. An estimated 82,497 lbs. per year of this total would probably occur.

Exhibit 2-1
Forecast Reduction In Use Of Hazardous Materials (Santa Clara County)

		Hazardous Materials (lbs per year)		
		Amounts	Forecast Reductions	
	Janitors	Used Before	Potential	Expected
Contractors				
Assisted Sites	4,629	221,593	88,637	16,606
Others	3,324	159,122	63,649	5,962
Total	7,953	380,714	152,286	22,568
Site Employees				
Assisted Sites	2,228	106,673	42,669	12,654
Others	16,650	797,026	318,811	47,275
Total	18,878	903,699	361,480	59,930
Combined Totals				
Assisted Sites	6,857	328,266	131,306	29,260
Others	19,974	956,148	382,459	53,237
Total	26,831	1,284,414	513,765	82,497
				Already Reduced: About 15,000 lbs/yr

2.8 Recommendations

The Santa Clara team offers the following ideas and recommendations to other agencies, facility managers, janitorial contractors who wish to reduce their usage of hazardous chemicals.

2.8.1 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 Santa Clara team (see ¶3.6 and 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 (See ¶3.8).

- Communicate effectively. Identify the languages spoken by janitorial workers in the area, and tailor outreach materials accordingly (See ¶6.1).

- 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 ¶3.7).

- 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 ¶3.6).

- 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 Santa Clara project was 2 lbs. per person per year, which is 10% out of the total hazardous materials reduction of 23 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.

- 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 ¶6.8).

2.8.2 Recommendations To Facility Managers 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 ¶3.2.1).
- Identify the highest risk products currently being used, and change those first (See ¶4.3).
- 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 ¶5.2.1).
- 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 ¶6.7).
- Be sure that vendor representatives are available and involved during trails of their products. Be prepared to modify cleaning procedures slightly to get the most out of the new chemical products (See ¶6.7.4).

2.8.3 General Recommendations

The Santa Clara 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 Santa Clara 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 Santa Clara project team learned what janitors already know about health, safety, and environmental aspects of chemical products, and then identified useful roles that the team could take to increase their awareness of these issues. In essence, the needs assessment process helped set priorities and then focused the team's resources. Section 4 continues the discussion with a profile of janitorial chemical use that the on-site interviews revealed.

3.1 Needs Assessment Goals

The goals of the needs assessment were to identify the pollution prevention information and other useful assistance that janitors do not have, and to find out how this help could best be delivered. In addition, the project wanted to identify those needs that are already being met, and to determine the technical assistance role the team should play.

To answer these questions the project team interviewed agency staff working on other projects, interviewed janitorial contractors, and met with other interested stakeholders. The results of these contacts helped the team direct its efforts into developing pollution prevention materials most useful to janitors, which the team delivered along existing outreach channels.

Industry feedback convinced the project team that it should focus upon preparing fact sheets, holding training workshops, and offering on-site product reviews. The team decided that these outreach efforts should supplement rather than duplicate existing vendor data, trade press articles, internet sites, and other information sources that janitors already use. Therefore, materials that the team proposed to develop emphasized hazards associated with specific high-risk cleaning work, techniques for safe storage and mixing, and methods by which janitors could learn, on their own, the health consequences of specific chemical ingredients.

The Santa Clara team confirmed the scope and potential usefulness of these proposed materials by presenting its needs assessment results and subsequent outreach plans to a group of stakeholders that included janitorial contractors, agency staff, and chemical suppliers. As described in Section 5, the team incorporated comments received from these advisors into the outreach program that it undertook.

3.2 Input From Other Projects

Early in the needs assessment process it was discovered that several government agencies had already established health, safety, and environmental requirements for janitorial chemicals and were purchasing products accordingly. The Santa Clara project team conducted telephone and in-person interviews with representatives from these agencies to learn how these requirements were established, how they were being used, and which commercially-available products satisfied these criteria.

3.2.1 City of Santa Monica

In November and December of 1998, two meetings were held with Ms. Debbie Raphael and Mr. Brian Johnson of the City of Santa Monica Environmental Programs Division. By that date their agency had been working for more than 5 years on specifying and purchasing environmentally preferable products. The lessons from this effort that most impacted the Santa Clara Project are listed below: [3-1, 3-2]

- It is important to initially focus upon products that pose the highest risks, and that janitors will therefore be the most willing to shift away from. Cooperative relationships established in this process lead to easier acceptance of other changes proposed later.

- Lasting changes take a long time to accomplish (i.e., years rather than months).

- In order for these lasting changes to occur, people throughout the organization must participate, and all must believe that the changes are in their best interest. It is extremely helpful to have a proclamation or directive from the mayor's office which endorses the conversion.

- Not many janitorial product suppliers have previous experience responding to technical bid requests, where they must submit detailed health, safety, environmental, and performance data for their chemicals. Managing this unfamiliarity with technical submittals requires extra time and staff efforts compared to routine purchasing.

- It would have been helpful and perhaps saved time to prequalify individual suppliers and their products before the actual bidding process. That way bid invitations could have been sent to a smaller, more manageable number of potential suppliers.

- A mandatory pre-bid conference is essential.

- Environmental staff need to get personally involved with agency janitors and their work. Personally cleaning city facilities leads to a first-hand understanding of chemical products and the ways in which they are used.

- Extensive product training is important because many environmentally preferable products are used differently than stronger chemicals. Janitors will usually not get the cleaning results they want unless they are properly trained.

Santa Monica staff provided the project team with lists of suppliers who responded to the City's request for bids, as well as ratings summaries for products that were evaluated. These ratings characterized the health, safety, and environmental aspects of each product, and established the cleaning applications for each product was best suited.

3.2.2 State of Minnesota

In December 1998, the Santa Clara project team conducted telephone interviews with Ms. Kelly Luck and Ms. Joan Bressler who are responsible for state-wide purchasing of environmentally preferable products. Ms. Luck is with the Minnesota Office of Environmental Assistance, while Ms. Bressler is a purchasing representative with the State Materials Management Division. [3-3]

Ms. Luck suggested a number of ideas about criteria used to screen alternative products with respect to their environmental, health, and safety risks:

- Criteria can either be “pass/fail” or “relative”. The former generally take less time to evaluate, but are more arbitrary. On the other hand, relative scores take longer to develop but provide more accurate results.

- In order to be at all useful, relative scores require accurate, quantitative data about each product and its ingredients. For example, if numerical eye irritation test scores are known for a product, one can easily assign a relative score for that health hazard. Only knowing that a product causes “mild eye irritation” makes it more difficult to assign a relative score.

- It took the State’s working group about 10 weeks to develop a set of criteria and approaches for scoring the products. Much effort went into assigning relative weights to the various criteria that were used. For example, “Should a product’s potential for causing skin irritation be weighted the same as its potential for depleting atmospheric ozone?”

Ms. Bressler offered these ideas from her perspective as a purchasing agent:

- Tracking product usage is a big effort, particularly in situations like those in Minnesota where 15 suppliers are providing about 300 products in 30 categories. The state’s strategy has been to ask the suppliers themselves to track product orders and report annually to the State on amounts shipped.

- Prequalification interviews were used to narrow the bid solicitation to firms that had a reasonable chance of supplying products meeting the State’s technical specifications.

- Minnesota placed purchase orders for any product scoring 67% or above in both the screening criteria and performance tests. Individual agencies in the State could then order any product from any supplier.

Minnesota has posted on the internet a number of articles about this project. For example, one fact sheet addresses “Choosing Environmentally Preferable Cleaners”, suggesting among other things that buyers select products that:

- Do not contain carcinogens, poisons, or flammable ingredients;

- Are low in phosphate content;

- Have organic ingredients that are readily biodegradable;

- Have a neutral pH; and
- Do not have fragrances and dyes.

3.2.3 Commonwealth of Massachusetts

In December 1998, the project team contacted Ms. Lara Sutherland and Mr. Eric Friedman who are involved with environmentally preferable purchasing for the Commonwealth of Massachusetts. Ms. Sutherland is with the Office of Technical Assistance, and Mr. Friedman is with the Operational Services Division. [3-4]

Massachusetts advanced the cause of environmentally sensitive procurement by issuing its bid request entirely via the internet rather than printing paper copies. Questions arising during the bid process were posted to the project web site as well. For legal reasons, however, supplier responses had to be accepted in paper form.

As part of the process, the agency held a mandatory conference to explain its requirements for technical information it wished submitted with each bid. Agency staff consider that the time taken for this meeting was well spent, noting however, that many of the submitted bids at first lacked the complete detail necessary to evaluate the suitability of proposed products.

Ten sites conducted field trials for products that scored high in the health, safety, and environmental screening. The agency believes that involvement of vendor representatives helped the test crews learn how to use each product, which contributed to the success of these trials.

3.3 Trade Press

In the 1997-99 timeframe Maintenance Solutions, Cleaning & Maintenance Management, and similar trade publications featured several dozen general articles dealing with safe and effective use of chemicals. Several of these articles mentioned the challenges that suppliers encounter when introducing new products, such as demonstrating product effectiveness, creating sufficient demand, and achieving competitive pricing.

In addition, several articles appeared on related concepts such as indoor air quality, employee training, use of protective gear, and product dispensing systems. The focus and depth of these articles clearly showed an industry readership that is becoming increasingly aware of chemical product issues, and that is seeking information to relate these issues to their daily practices.

Articles written for building professionals revealed a different picture. One article in the Journal of Architectural Engineering shows that ease of cleaning ranked next to lowest in a list of 22 important issues architects usually consider in designing their projects. [3-5] This low priority contrasts sharply with the views of building users who ranked cleaning as most important of the 22 issues. [3-6]

3.4 Internet Discussion Groups

Throughout the project, the team used existing internet discussion groups to follow janitorial industry trends, pose key questions for industry input, and interact with other projects that were involved with janitorial product safety. The three groups that provided the greatest help were:

1. Cleaning & Maintenance Email Forum - A discussion group with participants from janitorial contracting firms, facility managers, chemical suppliers, and janitorial industry consultants. Web address: <forum@listserv.facility-maintenance.com>

2. P2Tech - A collection of agency, industry, and consulting people interested in pollution prevention topics and tools. Web address: <p2tech@great-lakes.net>

3. Environmentally Preferable Products Procurement - A discussion group that includes purchasing officials, environmental staff, and technical consultants sharing a common interest in products that have recycled content, which are themselves recyclable, or that contain low risk chemical ingredients. Web address: <eppnet@lilith.webrover.com>

3.5 On-Site Product Reviews

As part of the initial needs assessment process, the Santa Clara project team reviewed about 250 janitorial products in use at approximately a dozen local facilities (e.g., schools, cities, industrial sites, hospitals, and businesses). In these initial reviews the team concluded that: [3-7]

1. Six percent of the encountered products should not be used because they contain ingredients that:

   - Are carcinogenic;
   - Are banned by the Montreal Protocol; or
   - Cause global warming.

2. Thirty-five 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. Forty-six 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.

3.6 Local Needs Assessment Surveys

As shown by Exhibit 3-1, the Santa Clara team contacted about 100 property 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. [3-8]

The data in Exhibit 3-1 show the number of people contacted versus the number responding. In this table, "facility managers" are employees of firms that occupy the site that was surveyed. On the other hand, "property managers" are employees of off-site management companies that administer leases for a landlord. Opinions expressed to the Santa Clara team during these interviews are discussed below.

Exhibit 3-1
Needs Assessment Contacts Made

	Phone	Mail	e-mail	In Person
Janitorial Contractors	5/5	25/5	500/12	4/4
Facility Mgrs./Staff	23/16	250/10	0/0	16/16
Property Managers	4/4	25/4	0/0	2/1
Hotels & Motels	15/6	0/0	0/0	8/8
Product Suppliers	5/5	0/0	0/0	4/3
Totals:	52/36	300/19	500/12	34/32

The table shows attempts made / actual contacts.

Exhibit 3-2 introduces several key points that the Santa Clara project team discovered in its needs assessment surveys. Generally speaking, product effectiveness and worker safety are key issues for people who actually use janitorial products. Product cost, being only 1% or so of janitorial service fees, is far less important than safety, effectiveness, and ease of use.

Exhibit 3-2
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

Exhibit 3-3 addresses the awareness that interviewees showed for general health, safety, and environmental issues. While perhaps being concerned in general, off-site property managers tend to leave the specifics of chemical use to building tenants and their janitorial contractors. Exceptions to this finding may arise in multi-use facilities where property managers get involved with resolving conflicts over the indoor air quality needs of adjacent tenants.

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

How aware are you of the following issues?	Property Managers	Facility Managers	Janitorial Contractors
OSHA requirements for chemicals?	Not	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:			
Glycol ethers (such as Butoxyethanol)?	Not	Not	Somewhat
Perchloroethylene?	Not	Not	Somewhat
Alkyl Phenol Ethoxylates?	Not	Not	Not

As presented in Exhibit 3-4, property managers, facility managers, and janitorial contractors that were surveyed told that they learn from a number of sources about health, safety, and environmental issues related to cleaning products.

People whom the Santa Clara team spoke to identified several areas in which local government agencies could play an important role in providing them with information. Exhibit 3-5 on the next page summarizes these suggestions.

Exhibit 3-4
Sources of Product and Safety Information

Sources of Information	Property Managers	Facility Managers	Janitorial Contractors
Trade Associations	Important	Important	Some
Conferences/Trade Shows	Some	Some	Some
Magazines	Important	Important	Important
Vendors	Not Important	Important	Important
Peers	Important	Important	Some
Internet	Not Important	Important	Some

Exhibit 3-5
How Can Local Government Help Janitors?

	Property Managers	Facility Managers	Janitorial Contractors
Host Workshops	Useful	Useful	Some Use
Publish Chemical Fact Sheets	Not Useful	Useful	Useful
Publish Success Stories	Some Use	Useful	Useful
Make Training Videos	Not Useful	Some Use	Some Use
Certify Cleaning Products	Some Use	Some Use	Very Useful
Organize Mentoring Program	Not Useful	Some Use	Some Use
Provide On-Site Assistance	Useful	Very Useful	Very Useful
Operate a Hot Line	Some Use	Some Use	Very Useful
Promote Better Labels	Useful	Very Useful	Very Useful
Provide Spanish Language Items	Useful	Useful	Very Useful
Conduct Product Demos	Not Useful	Some Use	Some Use
Provide Product Samples	Some Use	Useful	Some Use

3.7 Chemical Injuries That Occur

In addition to reviewing products and conducting surveys, the Santa Clara project team also reviewed workers' compensation data from several states to identify the frequency and severity of accidents that janitors actually experience with chemicals.

These data suggest that six out of every hundred janitors in Santa Clara County injure themselves with chemicals every year. With an estimated 27,000 janitors working in the county, that rate extends to a total of about 1,200 injuries happening each year. About 20% of these injuries are serious burns to the eyes or skin. The cost of medical treatment and lost job time for these chemical injuries in Santa Clara County is believed to be about $750,000 per year.

3.7.1 Sources of Workers' Compensation Injury Data

The Santa Clara team researched occupation and injury data from three primary sources:

1. Federal Level - Bureau of the Census, OSHA, and Bureau of Labor Statistics;

2. State Level - California, Colorado, Minnesota, New Jersey, New York, Texas, and Washington; and

3. Local Level - Interviews with facility managers and their janitorial contractors.

Most of these sources offer only partial evaluations of injuries that janitors experience, and few have estimates of their cost. This situation arises because in most states there are many public and private organizations that provide workers' compensation insurance, making it very difficult to assemble complete summaries. Also, data reported at the national level generally combine janitors with other service industries.

3.7.2 Injury Estimates for Washington State

The most comprehensive picture emerged for Washington State, where the Department of Labor and Industry and the Department of Employment Security have compiled complete sets of detailed janitorial employment and injury data. The Santa Clara team obtained electronic copies of these data for the period 1995 - 1997. [3-9]

The workers' compensation data for the State of Washington reveal that about 290 janitors per year submit claims for lost time injuries from chemical exposure. As there are reported to be 38,440 janitors working in Washington State, this experience is equivalent to an annual claim rate of about 0.8 injuries per hundred janitors. [3-10]

- 43% of these injuries involve eye irritation or burns;
- 36% involve skin irritation or burns; and
- 12% involve inhalation of chemical fumes.

For reasons that are not yet clear, some types of janitors appear to have significantly higher rates of injury claims. As shown by Exhibit 3-6, workers' compensation claims for hotels, colleges, and hospitals in Washington State range up to 7 injuries per year for every hundred janitors, or nine times the state's average rate. It is speculated that either the number of accidents in these industries is actually higher, or alternatively that more injuries are reported as claims by hotels, colleges, and hospitals.

Exhibit 3-6
Annual Janitor Chemical Exposure Injuries in Washington State

SIC	Industry	Workers [1] No.	Workers [1] %	Injuries [2] No.	Injuries [2] %	Injuries [2] Per Worker
7340	Janitorial Contractors	11,394	29.6%	59	20.4%	0.005
7010	Hotels & Motels	618	1.6%	44	15.3%	0.072
8220	Colleges	1,570	4.1%	25	8.5%	0.016
5810	Restaurants	1,502	3.9%	17	5.8%	0.011
6510	Property Management	961	2.5%	15	5.1%	0.015
8640	Civic Organizations	570	1.5%	9	3.1%	0.016
8210	Schools	6,552	17.0%	7	2.5%	0.001
8060	Hospitals	313	0.8%	4	1.5%	0.014
8050	Nursing Homes	438	1.1%	4	1.3%	0.008
5410	Food Stores	836	2.2%	3	0.9%	0.003
8330	Job Corps Training	360	0.9%	2	0.8%	0.006
7990	Amusement Services	581	1.5%	2	0.8%	0.004
3720	Aerospace Mfg.	501	1.3%	0	0.1%	0.001
7210	Laundry Services	667	1.7%	0	0.1%	0.000
- - -	All Other	11,577	30.1%	98	33.7%	0.008
		38,440 Workers		289 per year		0.008 Average

Sources

[1] John Haws, Washington State Dept. of Employment Security <jhaws@esd.wa.gov>
[2] Patricia Ames, Washington State Dept. of Labor & Industry <ames235@lni.wa.gov>

Exhibit 3-7 shows that chemical-related injury claims in Washington State most frequently involve irritation or burns to the eyes and skin. Ingestion of chemicals rarely occurs, with only one incident in three years. The project team assumes that the distribution of injuries in Santa Clara County is similar.

Exhibit 3-7
Types of Chemical Injury Claims in Washington State

Eye - Burns	10.8%
Eye - Irritation	32.5%
Skin - Burns	9.3%
Skin - Irritation	27.1%
Ingestion - Toxic	0.1%
Inhaled - Toxic	1.0%
Inhaled - Irritation	11.4%
Other - Toxic	3.2%
Other - Unspecified	4.4%
	100.0%

How significant are the reported claims? The Washington State data in Exhibit 3-8 show that an average incident requiring medical treatment resulted in an average absence of 18 hours (i.e., a total of 657 lost days for 289 claims). Medical costs averaged $375 per claim, while lost time for the worker and his or her supervisor is estimated as $240 per claim, bringing the total to $617 per claim. In 1997, the total cost of these reported claims and lost time was $178,248 for all of Washington State. [3-11]

Exhibit 3-8
Annual Costs of Janitorial Chemical Exposure Injuries In Washington State

SIC	Business Type	Injuries [1]	Medical	Lost Days	Labor [2]	Total Cost
7349	Janitorial Contractors	59	$14,017	56	$8,060	$22,077
7011	Hotels & Motels	44	$34,000	379	$33,007	$67,007
8221	Colleges	25	$11,639	15	$2,673	$14,312
5812	Restaurants	17	$3,433	7	$1,560	$4,993
6510	Property Management	15	$2,954	2	$1,060	$4,014
8640	Civic Organizations	9	$1,508	0	$540	$2,048
8211	K-12 Schools	7	$2,100	4	$787	$2,887
8060	Hospitals	4	$1,500	11	$1,093	$2,593
8050	Nursing Homes	4	$5,500	12	$1,200	$6,700
---	All Others	105	$31,670	171	$19,947	$51,617
	Totals	289	$108,321	657	$69,927	$178,248
					Average total cost per claim:	$617

Notes:
[1] Annual injury and cost data from Washington State Dept. of Labor & Industry.
[2] Estimated labor cost: $10/hr for custodian & $15/hr for supervisor.

The team 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 noticeably higher than those for either auto repair shops or metal finishing firms. [3-10]

- Janitors $9.61/$1,000 of Salary
- Auto Repair $9.26
- Metal Finishing $9.25
- Office Work $9.08

3.7.3 Injury Estimates For California And Santa Clara County

Reported Injuries - The project team extrapolated from the Washington State data to develop an estimate of janitorial injuries in its area. As shown by Exhibit 3-9, janitors in Santa Clara County are believed to submit 202 workers' compensation claims for chemical injuries every year. The medical expenses and lost time costs of these claims are estimated as $124,418 per year.

Exhibit 3-9
Estimate of Chemical Injury Claims in Santa Clara County

	Workers	Claimed Injuries Number	Claimed Injuries Costs
Washington			
Contractors	11,394	59	$36,390
Employees	27,046	230	$141,858
Total	38,440	289	$178,248
All of California			
Contractors [1]	77,656	402	$248,014
Employees [2]	184,332	1,568	$966,834
Total	261,988	1,970	$1,214,848
Santa Clara			
Contractors [1]	7,953	41	$25,400
Employees [2]	18,878	161	$99,017
Total	26,831	202	$124,417

Sources:
[1] Bureau of the Census - 1996 County Business Patterns.
[2] Ratio of Employees/Contractors assumed to be same ratio as Washington State.

Adjusted Injury Estimate - According to insurance analysts that the Santa Clara team contacted, not many facts are known about unreported injuries. Some studies indicate that unreported injuries equal or exceed those that are claimed to workers' compensation. [3-11] Based upon interviews with janitors in the San Francisco Bay Area, the team believes that some firms report as claims only the most serious injuries that their employees experience.

As a consequence, the team estimates that the total number of injuries in Santa Clara County is six times the number of reported claims. Therefore, it is estimated that about 1,200 chemical injuries actually occur in Santa Clara County each year. Exhibit 3-10 shows that the total cost of these injuries is on the order of $750,000 per year. [3-12]

Exhibit 3-10
Adjusted Estimate of Total Chemical Injuries in Santa Clara County

		Annual Injuries and Costs					
		Reported		Unreported [3]		Total	
	Workers	No.	Cost	No.	Cost	No.	Cost
Washington							
Contractors	11,394	59	$36,390	295	$181,948	354	$218,338
Employees	27,046	230	$141,857	1,150	$709,289	1,380	$851,146
Total	38,440	289	$178,247	1,445	$891,237	1,734	$1,069,484
All of California							
Contractors [1]	77,656	402	$248,014	2,011	$1,240,069	2,413	$1,488,083
Employees [2]	184,332	1,568	$966,834	7,838	$4,834,169	9,406	$5,801,003
Total	261,988	1,970	$1,214,848	9,849	$6,074,238	11,819	$7,289,086
Santa Clara County							
Contractors [1]	7,953	41	$25,400	206	$126,999	247	$152,399
Employees [2]	18,878	161	$99,016	803	$495,083	964	$594,099
Total	26,831	202	$124,416	1,009	$622,082	1,211	$746,498

Sources:
[1] US Dept. of Commerce, Bureau of the Census - 1996 County Business Patterns.
[2] Employees/Contractors assumed to be same ratio as Washington State.
[3] Ratio of unreported injuries are estimates by Santa Clara team.

3.8 Project Stakeholder Input

The Santa Clara team invited a number of industry, agency, supplier, and citizens' group representatives to participate as stakeholders to guide the project. Exhibit 3-11 lists the numbers of people whom the team invited, as well as those that actually participated. Stakeholders not attending project meetings in person generally offered their advice via telephone, e-mail, and FAX.

Stakeholder provided their input to the team in three main areas:

1. Cleaning chemicals and their use;
2. Review of the needs assessment and proposed outreach activities; and
3. Critical review of draft outreach materials.

Each of these areas is described in the following paragraphs.

Exhibit 3-11
Project Stakeholders

	Invited	Participating as Stakeholders In Person	Remotely
Janitorial Contractors	5	1	3
Custodian Employees	1	1	0
Product Suppliers & Distributors	5	3	1
Chemical Manufacturers	5	2	2
Facility Managers	2	1	0
Facility Safety Staff	1	1	0
Agency Staff - Federal	2	2	0
Agency Staff - State	4	2	2
Agency Staff - Local	5	4	1
Citizens' Groups	3	0	0
Totals:	33	17	9

3.8.1 Industry Input

The industry stakeholders and respondents to the project's various surveys provided technical information about a number of janitorial chemical issues, including:

- Concentrated Chemical Products (Handling, mixing, use, & disposal)
- Dispensing Systems (Types, benefits, costs, & best places to use)
- Toxicology of Certain Common Ingredients
- Environmental Fates of Certain Common Ingredients
- Alternatives to Certain Toxic Ingredients
- Alternative Approaches to Health & Safety Training
- Typical Product Distribution & Purchasing Patterns
- New Janitorial Chemical Trends
- Typical Product Usages and Costs (e.g., gal./sq. ft. and $/sq. ft.)
- Effective Techniques for Demonstrating New Products

This input provided the project team with both technical content and editorial guidelines for writing fact sheets and other materials, and included suggestions on how to successfully deliver these items to janitors.

3.8.2 Stakeholder Review Meeting

In December 1998 the Santa Clara team held a half-day meeting with about a dozen project stakeholders. The meeting featured discussions of both the recently completed needs assessment and the team's proposed outreach efforts.

As an orientation, the project team published a 100-page briefing book that provided discussion questions, example outreach materials, and general background reading. The briefing book asked the advisory group members to be prepared to share their experience and knowledge, give guidance at key decision points, and comment upon example outreach materials.

In particular, advisors were each asked to highlight areas where the project team:

- Missed something;
- Did something to bias their results;
- Should talk to someone else who had important information;
- Could do something to increase its chances for success; and
- Seemed unaware of key issues in their area of interest.

During the four-hour meeting the stakeholder group commented upon needs assessment findings in the following areas:

- Janitorial product usage (types, amounts, & ingredients)
- Profiles of typical janitorial product users & practices
- Health, safety & environmental issues
- Opportunities to reduce use of toxic chemicals
- Existing training and outreach efforts within the industry

The stakeholder group also suggested improvements to the example fact sheets, workshop plans, and other outreach activities that the project team proposed. As a result, the team decided to focus its outreach program into:

- Janitorial product guides & P2 fact sheets
- Janitorial pollution prevention success stories;
- On-site demonstrations of alternative products; and
- Facility manager workshops.

Additional stakeholders participated electronically, sending their comments and feedback to the team via FAX and e-mail.

3.9 Footnotes To Section 3

[3-1] Information about the City of Santa Monica's efforts to accomplish environmentally preferable purchasing appears on the internet as an EPA-sponsored case study at <http://www.epa.gov/opptintr/epp/santa.pdf>. The City's purchasing specification is available at the Santa Monica website: <http://www.ci.santa-monica.ca.us/environment/policy/purchasing/bidspecs.htm>.

[3-2] Other information about the City of Santa Monica's program is summarized in an article co-authored by Ms. Debbie Raphael that will appear in the Spring 2000 issue of Pollution Prevention Review.

[3-3] Information about the Minnesota program for purchasing environmentally preferable products is available at <http://www.moea.state.mn.us/lc/cleaning.cfm>.

[3-4] Information about the Massachusetts Environmentally Preferable Products Purchasing Program is at: < http://www.state.ma.us/osd/enviro/enviro.htm>. Other information about the Massachusetts program is summarized in an article co-authored by Ms. Lara Sutherland that will appear in the Spring 2000 issue of Pollution Prevention Review.

[3-5] Arditi, David, and M. Nawakorawit, "Designing Buildings For Maintenance: Property Managers' Perspective," Journal Of Architectural Engineering, Vol. 5, No. 4, p107-116, 12/99, ASCE. Copies are available at <http://www.asce.org>.

[3-6] Arditi, David, and M. Nawakorawit, "Designing Buildings For Maintenance: Designers' Perspective," Journal Of Architectural Engineering, Vol. 5, No. 4, p117-132, 12/99, ASCE. Copies are available at <http://www.asce.org>.

[3-7] Somewhat different percentages emerged as chemical use at other sites was evaluated throughout the project. The combined recommendations for 1,137 products being used by 47 organizations are:

- Stop Using 15%
- Use With Extreme Care 44%
- Use With Care / OK 41%

[3-8] The form developed for these local surveys is in the Appendices, and is available at the project's website: <http://www.westp2net.org/Janitorial/tools/siteform.pdf>.

[3-9] Unpublished employment pattern data were provided by Mr. 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.esd.wa.gov>.

Three years of unpublished workers' compensation data for janitors were provided by Ms. Patricia Ames of the Washington State Department of Labor and Industry. 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>.

[3-10] These percentages add to 91%. The balance of injuries are listed in the injury database as "unspecified", or were judged as incorrect because of inconsistencies. A fact sheet describing this evaluation of the Washington State chemical injury data appears at <http://www.westp2net.org/Janitorial/jp4.htm>.

[3-11] Estimates of reported versus un-reported injuries are few. Leigh suggests that the actual number of workplace injuries is about twice the total reported by the Bureau of Labor Statistics. In addition, the latter total includes both injuries reported as workers' compensation claims and other reported injuries that occur. Therefore, we estimate that the total actual injury rate for janitors is 6 times the number of submitted workers' compensation claims.

For a discussion of unreported injuries, refer to Leigh, J.P. et al., Arch. Internal Medicine, v157, 7/27/97, pg. 1557-1568, as cited by J.A. Brown, MD, at <http://www.haz-map.com/iceberg.htm>. Additional information is provided by Markowitz, S.B. et al., Occupational Disease in New York State, Am Journal of Internal Medicine, 1989:16(4), pg 417-435 as cited by the PubMed website at <http://www.ncbi.nlm.nih.gov>.

[3-12] Workers' compensation rates are from the Washington State Dept. of Labor and Industry, and are available on the internet at <http://www.wa.gov/lni>.

[3-13] 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. This estimate also uses County Business Pattern data obtained from the US Dept. of Commerce.

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. 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.

The average janitor uses an estimated 28 gallons of chemicals per year, weighing 234 pounds. Hazardous ingredients comprise about 25% of the total, or 58 pounds. The Santa Clara team focused its efforts upon chemicals appearing in 19 key products that are used for care of hard floors, carpets, restrooms, windows, and miscellaneous tasks. The cost for these products is estimated as $250 per worker, which is only about 1% of the annual salary of $20,000 typically earned by that same worker.

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.

Extrapolating from the diversity of chemicals found in use at the sites it reviewed, the Santa Clara team estimates that something on the order of 5,000 products are manufactured and sold for janitorial work in the United States.

A single site or janitorial contractor typically uses up 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 4-1 summarizes how these products are used.

Exhibit 4-1
Janitorial Chemical 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
Remove carpet spots	Daily to Weekly	Spot Remover
Wet-clean or shampoo carpets	Monthly to Yearly	Pre-spray, Shampoo, etc.
Clean restrooms	Daily	General Cleaner, Disinfectant, Toilet Bowl Cleaner
Clean windows	Quarterly to Infrequent	Glass Cleaner; Blind Cleaner
Clean furniture, display cabinets, etc.	Daily to Never	Upholstery Cleaner; Furniture Polish; Glass Cleaner
Other cleaning jobs	Upon Request	Metal Polish

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. Custodians working for a site also buy from a variety of sources, but may keep more supplies on hand. For example, some school districts purchase each fall enough supplies for an entire year.

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

4.2.1 Product Sources

Custodians and large janitorial contractors working in Santa Clara County report that they purchase most of their chemical supplies from local distributors. Some sites purchase supplies directly from manufacturers, particularly hotels and other wide-spread organizations that have national accounts. In the case of hotel and 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., including linens, flatware, and food). Combined together these sources account for an estimated 90% of the janitorial chemicals purchased by large users in Santa Clara County.

Janitorial contractors and custodians occasionally purchase supplies from grocery stores, discount warehouses, and other local outlets. Based upon its user interviews, the Santa Clara team estimates that large sites purchase ten percent or less of their supplies in this manner.

The project team also found that many facilities have an inventory of no longer used "orphaned" products, including items that were retired when a new manager or a new janitorial contractor was retained. An early change many new managers make upon taking responsibility for a site is to introduce the chemical products that they are familiar with.

In addition, the project team found that most sites it interviewed had a variety of sample products obtained through the years from sales representatives. Usually these samples were only partly used, and then were kept on hand "in case of need."

4.2.2 Product Quantities and Costs

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 Santa Clara team discovered that contractors with widespread and diverse maintenance responsibilities will generally use more products in greater quantifies than those engaged in one type of work, or responsible for just a few buildings. However, in almost any situation close management of chemical inventories and thorough staff training greatly reduce the amounts of janitorial products consumed.

Exhibit 4-2 summarizes the amounts of 19 key maintenance products that are used at four facilities interviewed in depth for the project. These chemicals include items for:

- Hard floors;
- Carpets;
- Restrooms; and
- Miscellaneous (e.g., graffiti & furniture).

Exhibit 4-2
Annual Use of 19 Janitorial Products at Four Surveyed Sites

Site:	1	2	3	4	Averages
Sq. Ft. Maintained:	1,000,000	800,000	4,600,000	426,000	1,706,500
Building Types:	General	Offices	University	General	
Janitors:	50	48	126	67	73
Sq.Ft./Person:	20,000	16,667	36,508	6,358	19,883
Total Quantity (gal)	1,510	1,330	2,182	1,189	1,553
Gallons/1,000 Sq. Ft.	1.51	1.66	0.47	2.79	1.61
Gallons/Person	30	28	17	18	23
Total Chemical Cost	$12,450	$13,350	$38,350	$10,721	$18,718
Cost/1,000 Sq. Ft.	$12.45	$16.69	$8.34	$25.17	$15.66
Cost/Person	$249	$278	$304	$160	$247

Details of these estimates appear in Appendix D.

Together these 19 types of products represent a large fraction of the total chemical use at most full service janitorial contractors. The annual cost of the example 19 janitorial chemicals averages about $250 per worker, which is only about 1% of the annual salary of $20,000 typically earned by that same worker. [4-1]

Window washers, carpet cleaners, and other specialty contractors have different chemical use patterns unique to the kinds of work that they perform. In addition, the mix of products varies according to the types of buildings being maintained, along with the relative amounts of hard floor, carpets, and glass in them. [4-2]

Exhibit 4-3 shows that the 26,800 janitors working in Santa Clara County use a total of about 620,000 gallons of chemical products each year. The annual cost of these chemicals is about $7 million, while the salaries paid to the janitors using them is about $540 million.

Exhibit 4-3
Estimate of Annual Janitorial Chemical Use in Santa Clara County

		Annual Chemical Use		
		Per Person (gal)	Total (gal)	Cost
Contractors	7,953	23	184,843	$2,043,921
Employees	18,878	23	438,760	$4,851,646
Total	26,831		623,603	$6,895,567

Chemical use is evaluated further in Section 7, and in Appendix G.

4.3 Highest Risks Products

As shown in Exhibit 4-4, the highest risk janitorial products are generally ones that:

- are corrosive to the eyes and skin;
- are flammable;
- give off toxic fumes; or
- are poisonous.

4.4 Highest Risk Ingredients

Exhibit 4-5 provides examples of common ingredients in janitorial products that pose the greatest health hazards to the user, building occupants, and the environment in general.

The best sources for more information about these ingredients are Material Safety Data Sheets (MSDSs) for the janitorial products, or MSDSs for the toxic ingredients themselves. The Santa Clara team published on the project website a safety summary for each of 100 common ingredients found in many janitorial products. These summaries appear in the Appendices.

Exhibit 4-4
Highest Risk Janitorial Products

Product	Hazards Often Seen?	How Frequently Used?
Acid Toilet Bowl Cleaner With Hydrochloric Acid	Corrosive to eyes and skin; Can cause blindness	Very
Metal Cleaner With Perchloroethylene	Poisonous; Causes Cancer; Flammable	Somewhat
Carpet Spotter With Perchloroethylene	Poisonous; Causes Cancer; Flammable	Very
General Purpose Cleaner With Butoxyethanol, Sodium Hydroxide, & Ethanolamine	Corrosive to eyes and skin; Poisonous; Flammable	Very
Floor Finish Stripper With Butoxyethanol, Sodium Hydroxide, & Ethanolamine	Corrosive to eyes and skin; Poisonous	Very
Baseboard Stripper With Butoxyethanol, Sodium Hydroxide, & Ethanolamine	Corrosive to eyes and skin; Poisonous	Somewhat
Graffiti Remover With Methylene Chloride or Perchloroethylene	Poisonous; Causes Cancer; Flammable	Somewhat
Glass Cleaner With Butoxyethanol	Flammable; Poisonous	Very
Disinfectant With Bleach, Phenol, Quats., or Hydrogen Peroxide	Corrosive to eyes and skin; Poisonous	Very

Exhibit 4-5
Highest Risk Ingredients

Type	Examples	Problems
Acids	Hydrochloric Acid; Phosphoric Acid; Hydroxyacetic Acid	Corrosive - May cause blindness Damages skin Sewer discharge pH too low
Caustic	Sodium Hydroxide; Sodium Metasilicate; Potassium Hydroxide	Corrosive - May cause blindness Damages skin Sewer discharge pH too low
Solvents	Perchloroethylene	Causes cancer
	Butoxyethanol; Ethanolamine; Toluene	Poison - Absorbs through skin & poisons liver, kidneys, and a pregnant woman's fetus
	HCFC-141	Environmental - Destroys the ozone layer; causes global warming
Surfactants	Alkyl Phenol Ethoxylates	Environmental - Persists in the environment; bioaccumulates; affects animal hormone systems
Disinfectants	Bleach (Sodium Hypochlorite)	Corrosive - Can burn eyes & skin
		Reacts - Bleach mixed with acid or ammonia causes poison gas
	Paradichlorobenzene (Urinal Blocks)	Causes cancer
	Quaternary Ammonium Chloride (concentrated)	Corrosive - Can burn eyes & skin

4.5 Footnotes To Section 4

[4-1] This rough estimate of $20,000 is based upon a salary of $10 per hour and 2,000 work hours per year. The team did not try to refine upon these numbers, as the point was only to show that chemical costs are relatively small compared to labor costs.

[4-2] The subjective estimate that 19 key products comprise two-thirds or more of the average firm's total annual chemical purchase is based upon interviews that the project team conducted with about three dozen sites and contractors. Forecasts that appear elsewhere in the report are conservatively based upon just these 19 products.

5. Pollution Prevention Opportunities

This section of the report provides examples of successful pollution prevention strategies for reducing the use of nineteen key janitorial chemicals. These examples are detailed further in a series of fact sheets which are published on the project's website and in the Appendices. Section 6 describes how this information was used in the outreach efforts that the project team undertook.

As mentioned in Section 4, the average janitor who is involved with chemicals uses an estimated 28 gallons of products per year, weighing 234 lbs. in their concentrated form. Hazardous ingredients comprise about 25% of this total, or 58 pounds. Water added on-site to dilute the products for use is not included in these estimates.

If that same average janitor employed all of the chemical substitutions and other pollution prevention measures described here for the nineteen key products, it is likely that his or her hazardous materials usage would decrease by 23 lbs. 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 switching from:

- Carpet shampoo with nitrilotriacetic acid or carpet spotter with tetrachloroethylene to ones made with ingredients that are not carcinogenic (Potential annual hazardous materials use reduction: 0.3 lbs per user); [5-1]

- Glass cleaner containing butoxyethanol to those formulated with isopropanol or other less-hazardous ingredients (Potential annual hazardous materials use reduction: 0.75 lbs per user);

- General purpose cleaners with alkyl phenyl ethoxylates, ethanolamine, or butoxyethanol to those formulated with linear alcohol ethoxylates, citric acid, or other less-hazardous ingredients (Potential annual hazardous materials use reduction: 0.3 lbs per user); and

- Metal polishes with tetrachloroethylene or volatile organic compounds. to ones with low-volatility hydrocarbons or non-toxic ingredients (Potential annual hazardous materials use reduction: 0.2 lbs per user).

The potential hazardous materials use reduction, resulting from these and similar changes toward less toxic products, is conservatively estimated as 11 lbs per year for each janitor, or about half of the total amount of reduction that is believed feasible.

5.2 Chemical Use Reduction

Some cleaning tasks must use hazardous products because there are no effective substitutes. In such instances the pollution prevention strategy is to have the janitor dilute each product as much as possible, and to use it only when absolutely necessary.

Examples of chemical use reduction include starting a program of tracking product quantities, changing floor stripping techniques, and using two products instead of one to clean toilet bowls. The potential hazardous materials use reduction from decreasing product consumption is conservatively estimated as 10 lbs per year for each janitor. Examples amounting to about 85% of this estimate are described below.

5.2.1 Monitoring Chemical Use

The simple act of monitoring a product usually leads to less consumption. Firms that begin to track floor stripper or toilet cleaner quantities report reductions of 10% to 20%. However, this monitoring should be continuous for the change to be permanent. The potential hazardous materials use reduction from such administrative procedural changes is conservatively estimated as 1.0 lbs per year for each janitor.

5.2.2 Reducing Floor Finish Stripper Use

Floor strippers often contain ammonium hydroxide, ethanolamine, and butoxyethanol, making this product one of the most dangerous handled by janitors. However, these hazardous ingredients are needed to dissolve and remove the modern, highly resistant, polymer floor finishes. Minimizing floor stripper usage by 50% or more may be achieved 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.

The potential hazardous materials use reduction from these changes is 40 lbs per year for each janitor actively involved with floor finish work, or 4.0 lbs per year spread across all of the janitorial workers in the typical contracting firm. [5-1]

5.2.3 Reducing Acid Toilet Bowl Cleaner Use

Porcelain 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, such potent 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 potentially decrease hazardous material usage by 1.8 lbs per user per year.

5.2.4 Reducing Carpet Cleaner Use

Carpet maintenance products often contain ethanolamine, butoxyethanol, or alkyl phenol ethoxylates. Minimizing the use of these chemicals by up to 50% is possible by:

- Stain Removal - Reacting immediately to spills and spots before they have time to become semi-permanent stains. However, thorough training in spill clean-up is very important because using the wrong techniques or chemicals can smear the spilled substance or set the spot permanently. It is usually best to start with clear, cold water and blotting cloths, and then switch to stronger chemicals only if necessary.

- Maintenance Cleaning - Rotary bonnet cleaners and carpet shampoos usually are fairly mild products. However, it's easy to misuse or over-apply these maintenance cleaners, which may make it necessary to do hot water extraction more often or more extensively. Either way, the use of excess or inappropriate chemicals leads to more effort and expense.

- Deep Cleaning - With some exceptions, presprays used with hot water extraction systems are also fairly mild products. Careful application, thorough agitation, sufficient contact time, and extraction before drying all serve to help these products do their job, and reduce the amounts of chemicals that would otherwise have to be used in reworking a poorly cleaned carpet. Training and experience are needed to prepare the janitor for using these products effectively.

- Hazardous ingredients used in hot water extraction products include acid rinses (e.g., hydroxyacetic acid), solvents (e.g., butoxyethanol), and detergents (e.g., alkyl phenol ethoxylates). The best strategy is to choose products without these problem ingredients, use products with the least amounts, or dilute the cleaners to the highest level suggested by the manufacturers.

- A few restoration products contain tributyl tin, formaldehyde, and other ingredients that are meant to kill microorganisms, but at the same time are highly toxic to humans. Some of these ingredients, such as tributyl tin, are banned from use in the San Francisco Bay Area because of their potential to cause harm in the environment. [5-2]

The potential hazardous materials use reduction from these changes is forecast as 17 lbs per year for each janitor actively involved with carpet maintenance work (or 1.7 lbs per year spread across janitors of all types in the typical contracting firm).

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 accumulates on the 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, or result in a discharge to the sewer system.

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 their expiration date.

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

Dispensers - Automatic dispensers might make sense if a janitorial crew uses lots of chemicals, and is working in a building with custodial closets. A well-designed dispensing system may save money, and can make chemical mixing safer for employees. However, mixing units sometimes have problems, particularly when filled with seldom used chemicals, so it is important evaluate the site's needs carefully before selecting a dispenser. Because of its simplicity and ease of maintenance, a manual dispensing system is usually best.

Safe Mixing - Floor strippers and other products with strong chemicals pose the greatest risks when workers handle them in concentrated form. 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 well-maintained, 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, since many chemical accidents occur when workers lift full containers to pour the 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 must be abandoned in the container if the nozzle plugs or breaks off.

5.3.4 Other Prevention Techniques

Some building managers prohibit colored soft drinks, coffee, and other items that will easily stain carpets. Such a tight policy makes the building occupants unhappy at best. A compromise is to either have hard floors instead of carpets in food service rooms, or to place sacrificial carpet mats in these areas.

It helps to think of carpets as large, flat air filters. Most large particles and airborne soil will eventually end up attached to carpets. Unless something is done, significant amounts of carpet soil will come from kitchen fumes and other forms of building use. Properly maintained vents that exhaust outdoors can capture most materials that will otherwise fall out onto the carpets.

5.3.5 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 something on the order of a 2% to 4% reduction in the use of floor, glass, and general purpose cleaners might reasonably be expected. Factoring in typical chemical ingredients found in these products, the team estimates that installing indirect dust and soil control measures can decrease annual hazardous materials use by 0.5 lbs. per janitor. 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 about 1.5 lbs. per year.

5.4 Changing The Cleaning Process

Modifying the techniques janitors use for applying their cleaning products can accomplish source reduction. In fact, 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 (e.g., keep 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.

5.5 Footnotes to Section 5

[5-1] These potential amounts of hazardous materials use reduction are based upon MSDSs for representative products that the project team encountered during on-site assistance visits.

For example, consider a carpet shampoo containing 20% nitrilo triacetic acid (NTA), an ingredient which causes cancer:

Total product amount per user (gal)	1.62
(lbs)	13.5
Est. Composition (% NTA)	20%
(lbs NTA/user)	2.7
Annual Hazmat Reduction (%)	100%
(lbs/user/yr)	2.7

However, NTA only appears in about 10% to 15% of carpet shampoo products. To account for this situation, the team discounted the potential impact expected from this kind of change to an estimated 0.34 lbs per user per year (i.e., 12.5% of 2.7 lbs.).

This estimate and all of the others prepared by the Santa Clara team, are stated in terms of lbs. of hazardous material usage reduction per average janitor, which in the case of carpet shampoo is 0.34 lbs. per year per average worker.

Janitorial contractors frequently told the Santa Clara team that they had dedicated “utility crews” that handled floor finish and carpet shampoo work. Each such crew of 2 or 3 people moved to various sites each day to do their work. The team estimates that janitors on these special crews comprise 10% of the total number of janitors. Therefore, the amount of hazmat reduction per dedicated carpet cleaning worker is 3.4 lbs. per year, or ten times that which is stated above for the average janitor. These statistics exclude secretaries, warehouse people, and other workers who do not actually use any chemicals.

[5-2] Information about tributyl tin appears on the web at: <http://ace.ace.orst.edu/info/extoxnet/pips/tributyl.htm>.

6. Outreach Activities

This section of the report describes the fact sheets, tools, workshops, on-site assistance, and other methods that the Santa Clara project used to send its pollution prevention messages to janitors and facility managers.

Janitors participating in the needs assessment convinced the team to concentrate its local outreach efforts in five key areas. Samples of items produced for each area appear in the Appendices.

1. ***Fact Sheets*** with information about safer ways to clean with hazardous chemicals.

2. ***Tools*** for people to use in evaluating the chemical products they use, including forms, checklists, ingredient hazard tables, and guidance on how to find internet sites that feature chemical data.

3. ***Commentaries*** about how to successfully change from strong chemicals to environmentally preferable ones. This category includes success stories and articles written by the project team, as well as materials furnished by other agencies.

4. ***Workshops*** for training janitorial professionals about product health, safety, and environmental issues.

5. ***Free On-site Assistance*** in reviewing janitorial chemicals, recommending alternatives, and providing samples of environmentally preferable products.

In addition, the team wrote trade press articles, made public presentations, and created a project website to share its findings with others located outside of Santa Clara County.

6.1 Fact Sheets

As work progressed, the team learned that janitors desire specific information that helps them perform 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.

Exhibit 6-1
Fact Sheet Topics

Topics	Fact Sheets Produced	Rationale
High Risk Ingredients	Ingredients to • Avoid • Avoid if Possible • Use w/ Extreme Care • Use w/ Care	Chemicals were grouped according to their hazards and likelihood of a janitor or building occupant being exposed during normal use.
Specific Ingredient Hazards	Butoxyethanol Dibutyl Phthalate Diethanolamine Hydrochloric Acid Monoethanolamine Nitrilotriacetic Acid Nonyl Phenol Ethoxylate Octyl Phenol Ethoxylate Tetrachloroethylene Triethanolamine	These are fairly high risk ingredients that the Santa Clara team wanted to emphasize.
Highest Risk Cleaning Activities	Toilet Cleaning Hard Floor Care Carpet Care Restroom Cleaning Glass Cleaning Metal Cleaning Disinfectants	These tasks expose users to the highest risk of chemical injury.
Translations	Limpieza Segura Y Efectiva Para Los Inodoros (Safe and Effective Toilet Cleaning)	This translation was done by Montoya Communications for the Environmental Justice project in Richmond, CA.

These fact sheets appear in the Appendices.

6.2 Hazard Evaluation Tools

The Santa Clara team produced a number of tools for its own use in evaluating the health, safety, and environmental hazards posed by janitorial products. In addition, the team has written several commentaries on how to go about evaluating and reducing product hazards, and has searched for similar items published by other projects. Many of these items appear on the project website and in the Appendices.

6.2.1 MSDS Collection

The team collected and analyzed about 1,500 MSDSs for janitorial products used by sites in the San Francisco area. About 10 percent of these data sheets were obtained from product manufacturer's web sites on the internet. Others were obtained by FAX or mail. Most of the latter arrived within a few days, although some suppliers took significantly longer to fulfill requests. [5-1] In addition, a few distributors and suppliers refused to furnish a MSDS at all unless it was with a product shipment. In other words, these firms would not provide an advance MSDS to someone wanting to evaluate a product for potential use.

Collecting several MSDSs for each of the janitorial work categories allowed the Santa Clara team to compare hazard evaluations offered by different suppliers for similar products. In that way it was possible to identify suppliers that seemed to over- or under-state hazards, or whose MSDSs routinely did not provide information that the project needed.

The team contacted several of these latter firms to discuss the policy that each used in compiling their MSDSs, finding that some chemical manufacturers:

- Tried to write MSDSs that covered various different ways in which their products might be formulated (because such changes were expected to occur frequently whenever feedstock chemicals from different suppliers were used);
- Had a policy of supplementing the rather general hazard warnings on their MSDSs with additional information on labels and use instructions; or
- Believed that detailed hazard communication was best done through on-site training designed to accommodated language needs, reading difficulties, and other barriers to understanding the complexities of chemical risks.

6.2.2 Ingredients Database

The Santa Clara team thought it important to more fully understand the health, safety, and environmental impacts of those chemical ingredients that appear most often in the janitorial products that it encountered. Therefore, the team collected MSDSs, toxicology studies, and general literature on a selection of these chemicals, and created an ingredients database as an aid to evaluating alternative products. This supplementary information was secured from a number of sources, including those listed in Exhibit 6-2.

As shown in Exhibit 6-3 , the team believes that about a dozen of these common ingredients should be avoided altogether because of their potential to cause cancer or other serious harm to the user, building occupants, or the environment in general. Other ingredients should only be used by fully-trained workers who are extremely careful to wear protective gear such as gloves and goggles. Refer to Appendix for more details.

Exhibit 6-2
Sources of Chemical Ingredient Data

Information	Sources	How Obtained
MSDSs	Ingredient Manufacturer	Call a firm that makes basic chemical ingredients, or check their web site. [1]
Risk Ratings	US EPA	http://www.epa.gov/ngispgm3/iris/ http://www.epa.gov/epahome/search.html
	Environmental Defense Fund	http://www.scorecard.org/chemical-profiles/
	Purdue University	http://www.ecn.purdue.edu/CMTI/
Health Studies	US Gov't.	http://mail.odsnet.com/TRIFacts/ http://www.cdc.gov/niosh/homepage.html
	New Jersey Right-to-Know	ftp://alternatives.com/library/envchemh/

[1] The following web sites are examples of chemical ingredient data sources:
http://chemfinder.camsoft.com/
http://hazard.com/msds/
http://www.jtbaker.com/msds/
http://ccshst08.cs.uoguelph.ca/cntc/

6.2.3 Evaluation Guides and Worksheets

In addition to the ingredients database, the project team also created several checklists and worksheets to help in its reviews of chemicals being used by janitorial contractors. Exhibit 6-4 lists the six guides and worksheets that proved to be of the greatest help to the team, and that were therefore published on the project website for general use. Copies of each form are in the Appendices.

6.3 Commentaries

In preparing for its outreach workshops, the Santa Clara team collaborated with the project advisors to write a series of discussions about health and safety issues that janitors face. In addition, the team prepared case studies of three sites that are changing to environmentally preferable cleaning products. These commentaries are listed in Exhibit 6-5 , and are available on the project website. Examples are included in Appendix F.

Exhibit 6-3
Ingredients To Be Avoided

CAS Number	Ingredient Name	Problems [1]
00100-51-6	Benzyl Alcohol	Cancer / Corrosive / Skin Poison
00075-45-6	CFC-22; Chloro difluoro methane	Illegal
68603-42-9	Coconut Oil Diethanolamine	Cancer
00111-42-2	Diethanolamine	Cancer
00075-68-3	HCFC-141	Illegal
00120-40-1	Lauric Acid Diethanolamine	Cancer
00078-93-3	Methyl Ethyl Ketone	Skin Poison
00091-20-3	Naphthalene	Cancer / Corrosive / Skin Poison
18662-53-8	Nitrilotriacetic Acid	Cancer
00106-46-7	Para dichloro benzene	Cancer / Inhale Poison
00127-18-4	Tetrachloroethylene; or Perchloroethylene “PERC”	Cancer / Skin & Inhale Poison
00108-88-3	Toluene	Skin Poison
00688-73-3	Tributyl Tin	Illegal / Poison

[1] A “Skin Poison” can absorb through intact skin and poison the janitor’s liver, kidneys, and other internal organs. An “Inhale Poison” causes harms when a worker breathes the fumes. “Corrosive” means that the chemical can permanently destroy eyes and skin. “Illegal” means that this ingredient cannot be used for janitorial products in the San Francisco area. See Appendix E for more information.

Exhibit 6-4
Worksheets That Were Prepared

Tools	Why Prepared	How Prepared
Finding Chemical Data	Health & safety staff asked how the team found chemical data.	Summary of major internet sites and other resources that provide data.
High Risk Products List	Site staff often asked what products were the most dangerous to them.	This list features the most common hazardous products, emphasizing ones with a likelihood of exposure during use.
Product Risk Evaluation Form	Site managers needed a summary of the evaluation made of each product, and a clear set of recommendations.	After several editions it was decided to use a simple, open-space form to identify each product, its major issues, and the team’s specific recommendations.
Product Test Evaluation Form	Site managers needed feedback on trials of alternative products.	Editions used by Massachusetts and other agencies were adapted.
Risk Evaluation Criteria	Health & safety staff asked for a list of the most important product issues.	Product evaluation criteria used by MA, MN, Phoenix, and Santa Monica were adapted.
Site Survey Form	Project team needed a checklist for recording product use, work techniques, and key issues.	A 5-page survey form evolved from simpler editions.

Exhibit 6-5
Commentaries That Were Prepared

Topic	Why Prepared	How Prepared
Adding Labels to Your Containers	Health & safety staff request	By the project team, with input from project advisors
Buying Environmentally Preferable Products	Health & safety staff request	By the project team, with input from project advisors
City of San Jose Case Study	To show how product trials can be organized	By the project team
Conducting Effective Product Trials	To show how product trials can be organized	By the project team
How Often Are Janitors Injured?	To relate how serious janitorial injuries are	Based upon data from the State of Washington
Minimizing Use of Janitorial Products	To provide useful P2 advice for specific products	By the project team, with input from project advisors
Polaris Building Maintenance, Inc.	To highlight a contractor that worked with its chemical supplier	By the project team
Safe Storage and Mixing	Because of storage problems observed at some sites	By the project team with input from the City of Phoenix
Selecting Protective Equipment	A message that always bears repeating	By the project team
Stanford University Housing Case Study	To show how product trials can be organized	By the project team
Environmental Criteria & Vendor Certification Form	To show how product criteria can be expressed in a bid package	Written by the Washington State Department of Ecology EPP Project
What's Needed Next	To highlight need for better MSDSs and labels	By the project team

6.4 Training Workshops

The Santa Clara team held three major workshops to share project results with about 130 janitors, facility managers, and agency staff. These sessions comprised:

- July 1999 Industry Workshop - Attendance: ±60 Time: 4 hours.

  Emphasis upon evaluating product risks, finding environmentally preferable products, trying out sample products, and safely managing chemicals. The 125-page workbook for this session was published in a 3-ring binder with tabs, and also as a downloadable document on the project website. This session was sponsored by the County of Santa Clara and the University of California, Santa Cruz, Extension Service.

- September 1999 Industry Workshop - Attendance: ±25 Time: 90 minutes.

  Same topics as the July 1999 session, except that product trials were left out because the time was too short. For this event the earlier workbook was re-published with plastic comb binding. This session was sponsored by the Pacific Association of Building Services Contractors.

- October 1999 Agency Workshop - Attendance ±45 Time: 2 hours.

  Emphasis upon how a regulatory agency can organize its own P2 outreach effort for janitorial chemicals. The workshop was based upon a dramatization of a 10-page case study about Contra Costa County Health Department. Participant comments were incorporated into the final edition of this study that appears on the project website and in Appendix F. This session was sponsored by the Western Regional Pollution Prevention Network.

Workshop evaluation forms and other feedback were universally positive, saying that the materials presented were both informative and important to the attendees. From lessons learned here, the Santa Clara team suggests that other agencies that organize workshops in the janitorial industry should:

- Be sure that the audience includes a well-rounded mix of janitors, facility managers, health & safety specialists, and agency staff.

- Include in the audience several representatives of vendors who offer environmentally preferable products.

- Have as much of the presentation be interactive as possible, emphasizing small group problem solving and “hands-on” work with product samples.

- The materials included in the Santa Clara workbook take 8 hours to cover fully. If the available time is shorter, some of the materials will have to be skipped.

6.5 Articles

Two articles were prepared for publication in Pollution Prevention Review, and one extensive interview was held for an article written by the editors of Cleaning & Maintenance Management Magazine. The P2 Review articles were done in collaboration with Ms. Debbie Raphael and Ms. Lara Sutherland, project advisors from the City of Santa Monica and the Commonwealth of Massachusetts, respectively. [6-2]

6.6 Conference Presentations

The Santa Clara team made presentations about the project and janitorial product safety at five conferences. Handouts published for several of the sessions appear on the project website.

- October 98 - Western Regional Pollution Prevention Network conference in San Diego. Presented in conjunction with Mr. Brad Norton and Ms. Debbie Raphael.
- January 99 - California Association of Public Purchasing Officials conference in Sacramento.
- February 99 - California Water Environment Association conference in Berkeley.
- May 99 - California Household Waste Conference held at the Granlibakken Center, Tahoe City.
- September 99 - US EPA Region 9 Pollution Prevention Week Seminar Series, San Francisco.

6.7 Sample Kits

Based upon repeated requests from sites and contractors, the Santa Clara team decided to find, test, and distribute samples of environmentally preferable products. This effort took four months, and resulted in the identification of about 20 products for use as samples. These samples were packaged in plastic buckets with pre-printed safety messages, and then distributed via workshops, mailings, and in-person deliveries to about three dozen firms in Santa Clara County.

6.7.1 Identifying Alternative Products

The team first contacted purchasing agents and technical staff of the City of Santa Monica, the State of Minnesota, and the Commonwealth of Massachusetts. These agencies provided the names of several suppliers from whom they purchase janitorial chemicals. Before placing these purchase orders, each of these agencies had reviewed product MSDSs and other technical information received from bidders, and then field-tested several different products from each supplier.

Next, the team surveyed janitorial firms in the San Francisco Bay Area, and also contacted internet discussion groups to learn of other chemical suppliers that might offer environmentally preferable products. In making follow-up calls to each of these firms, the team obtained information on various cleaning products, and then evaluated each for health and safety issues.

6.7.2 Screening Alternative Products

First, the team reviewed product literature and eliminated products based on toxicology information. It is important to note that many suppliers market "green" products that did not meet the team's working standards. For example, one vendor submitted an entire line of products that did not pass this first step. As shown by Exhibit 6-6, this evaluation involved reviewing MSDSs, and also contacting the suppliers with questions about any unlisted ingredients that they use in formulating their products. A detailed discussion of these product evaluation criteria appears in Appendix E.

Exhibit 6-6
Product Evaluation Criteria

Health & Safety Impacts	Question used?
Carcinogenic / Prop. 65	Yes
Reproductive Hazard - Mutagen	Yes
Reproductive Hazard - Teratogen	Yes
Endocrine Modifier	Yes
Corrosivity / pH	Yes
Flammability / Flash Point	Yes
Reactivity	Yes
Eye Irritant	Yes
Skin Irritant	Yes
Inhalation Irritant	Yes
Ease of Skin Absorption	Yes
Ease Of Inhalation / Vapor Pressure	Yes
Overall Toxicity (LD50)	Yes
Environmental Impacts	
Ozone Depleting Substance	Yes
Global Warming Substance	Yes
Hazardous Waste	Yes
Stormwater Pollutant	No
Sanitary Sewer Pollutant	Yes
Persistence / Biodegradability / Bioaccum.	Yes
Indoor Air Quality	Yes
Phosphates	No
Volatile Organic Compounds	Yes
Other Impacts	
Has Added Fragrance	No
Has Added Dye	No
Bulk Concentrate / Mixing System	No
Safe Container	No
Refillable Container	No
Container Made Of Recycled Material	No
Non-Aerosol Container	No

6.7.3 Organizing The Product Trials

As a next step, the Santa Clara team simplified its field trials by limiting tests to the following seven product types:

- General purpose cleaner
- Toilet bowl cleaner
- Bath and tile cleaner
- Window / glass cleaner
- Graffiti remover
- Metal polish; and
- Disinfectant.

The team contacted suppliers whose products passed the first screening, and invited each to submit its environmentally preferable products which they offer for these seven cleaning functions. Specifically, they were asked to submit product samples, product MSDSs, product instruction sheets, and bottle labels for each product.

Upon receiving the samples, the team gave the products to professional janitorial crews to evaluate its cleaning effectiveness. Three groups volunteered to do the hands-on product evaluations:

- City of San José - Main Library crew (5 members)
- City of San José - Maintenance Yard crew (2 members); and
- County of Santa Clara - Hall of Justice crew (4 members).

6.7.4 Lessons Learned From Product Trials

Five key lessons were learned about conducting successful trials of environmentally preferable janitorial products.

1. Select the Right Test Crew - When selecting where to test new products it is important to chose a crew with consistent work attendance record, with experienced/senior employees, and one which has focused cleaning responsibilities. The San Jose City Main Library Crew was helpful because one of their regular job functions was to be the test crew for all new products for the City. The County Hall of Justice team was helpful because they had a well respected senior staff member.

2. Establish Crew Buy-In and Involvement - Before testing any products, have a team meeting with the test crew and emphasize why you are testing alternative products. Our testing was successful in large part because each test crew knew that their

upper management was looking for safer alternatives to current products. They also knew they were being asked to participate in a way that would directly influence the decision.

The following are examples of questions one must ask to help find ways to effectively involve the crew in the test process. Some of these questions are simple, but their answers can provide valuable information.

What products are you currently using? Answering this early on will help determine exactly what sample replacement products to offer for trial.

How much product are you using on average? Cleaning crews vary in the amount of product used, so you need to know how much product you need to give your test crew.

Example: Each member of the County of Santa Clara Hall of Justice cleaning crew uses a 32 oz bottle of glass cleaner each day, where it takes a month for the entire San Jose City Main Library crew to empty a 32 oz bottle of glass cleaner. This information will determine how much product to give the tester so they may conduct a fair evaluation. The County crew received a 32-oz bottle per product / per person while the 5-person City crew shared a 32-oz bottle.

- What is your daily cleaning routine? Answering this question will be helpful in establishing when a change to the routine is needed to successfully adopt a new product.

  Example: One crew member was understandably resistant to testing any products that would take more time for cleaning. This custodian complained that she hardly had enough time to complete her current cleaning tasks.

  Upon verbally walking through her daily routine it was discovered that she could spray the new surface cleaner in the bathroom, spend 10 minutes emptying trash cans on her floor, and then return to wipe up the cleaner (rather than spraying and waiting idly while the product worked).

- What are your toughest cleaning challenges? These are the people who will be using the products you change to, so their buy-in is essential. If you can find a safer product to tackle their toughest problem, then that buy in will be accelerated.

  Example: One crew member complained about the oily residue left on metal from their current metal cleaner. His evaluation for one of the alternatives read "This is the best product I've ever used on stainless. It works super in the elevators." He was sure to share that experience with the rest of his crew and his buy-in was affirmed.

3. Introduce Your Test Phase Timeline & Hold Regular Meetings - Share with the test crew your suggested timeline for the hands-on test phase. Include plans for reviewing their test evaluations and discussing problems/questions that arise.

The San José testing process included a weekly meeting where new products were given to the test crew and a discussion was held about the previous weeks' successes and failures. This discussion sometimes consisted of identifying barriers to the test process, and other times consisted of sharing mutual support of successful products.

Establishing the timeline provides a necessary structure for you and the test crew to work within, and can reinforce the spirit of a team collaborating on a project.

4. Give the Test Crew Products and Instructions - Because our test phase involved numerous products for one cleaning function, it was easier to test products according to cleaning function rather than according to vendor. For example, the cleaning crew first tested all glass cleaners, then all general purpose cleaners, etc.

   Along with the product samples themselves, the crews were given a copy of each product MSDS and instruction sheet for reference. In addition each member of the crew received an evaluation form to give feedback on each product tested. A sample evaluation form is in Appendix .

5. Do Hands-On Testing Yourself - Whenever possible, join the test crew for some of their cleaning. Nothing emphasizes the importance of the project more than “getting in the dirt” yourself and testing the products with the janitors that you expect to begin using the products.

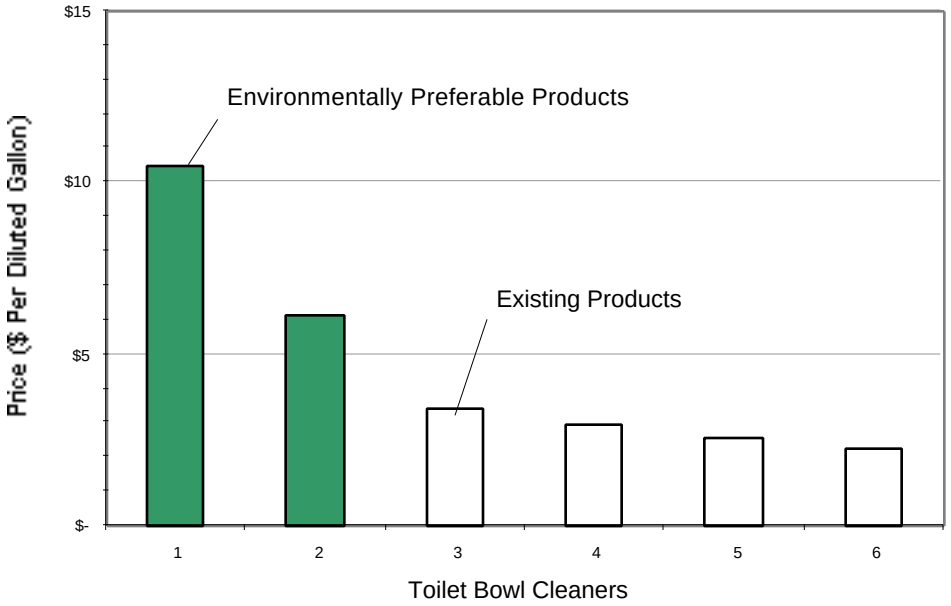
6.7.5 Sample Kit Distribution

Following the initial trials, the project team delivered samples as pre-packaged kits consisting 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, gloves and goggles, and product evaluation forms. Samples were distributed to about three dozen end users.

6.7.6 Product Costs

The project team compared prices of products that sites were already purchasing with those of the environmentally preferable alternatives used in the field trials. Exhibit 6-7 shows that, with some exceptions, prices for both kinds of products are similar. In other words, many environmentally preferable janitorial products cost no more than the standard chemicals that a site is already using. These comparisons are based upon a one-gallon quantity of product that either comes ready-to-use, or that the site has diluted for use.

Exhibit 6-7
Comparison of Product Prices



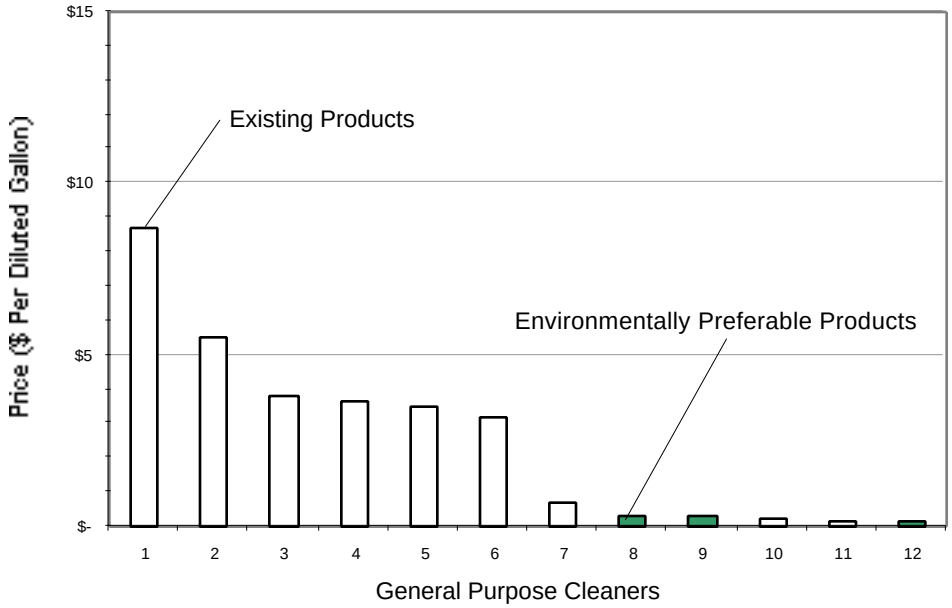
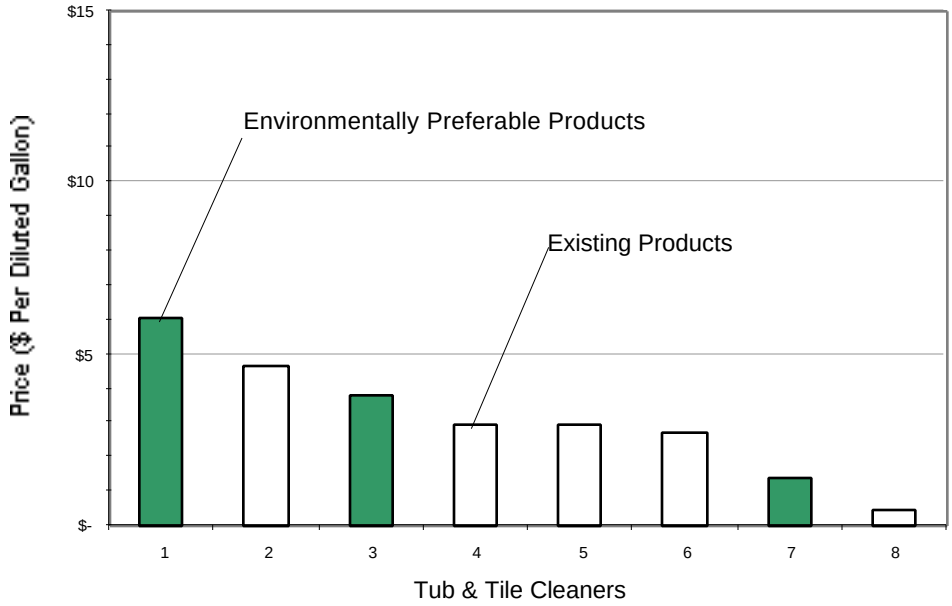
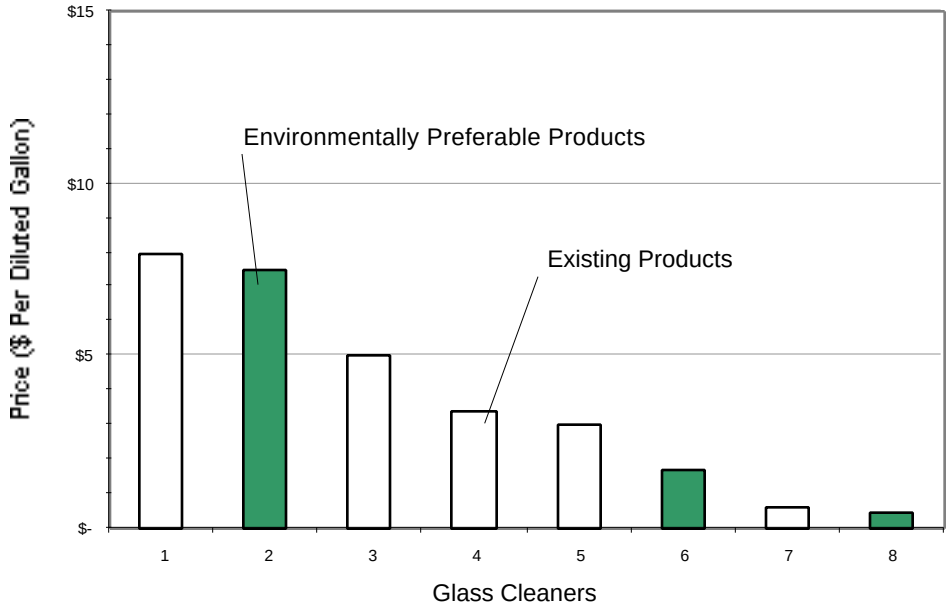


Exhibit 6-7 (Continued)
Comparison of Product Prices





6.8 Product Reviews

During the project the Santa Clara team reviewed health, safety, and environmental aspects of janitorial chemicals being used by 47 agencies, businesses, and contractors. As shown by Exhibit 6-8, a total of 1,137 products were evaluated in this process, of which about 20% were duplicates which were reviewed previously at another site.

Exhibit 6-8
Product Reviews

Types	No. of Sites	No. of Products
Schools & Colleges	7	158
Janitorial Contractors	13	324
Industrial Facilities	19	633
Other – Cal/EPA Offices	2	22
Totals:	47	1,137

As summarized below, the janitorial product reviews were adapted to meet the needs of each site.

- Usually each site copied and mailed its product MSDSs for the team to review in advance. The site visit, when it finally occurred, focused on discussing the review and identifying alternative products for the site to consider.
- About 30% of the reviews were accomplished with a single, 1-hour site visit.
- About 60% of the reviews involved two site visits – one to pick up the MSDSs and the second to discuss results.
- About 10% of the reviews were done remotely without ever visiting the site. A phone meeting served to explain the team's review to the site staff.

In addition, these reviews took varying amounts of time depending upon the effort needed to obtain updated MSDSs, research details with manufacturers, and prepare a summary report. Later reviews were much shorter if they involved a product that had already been encountered.

- Average Review: 15 minutes per new product to screen ingredients and properties, draft brief report to summarize results;
- Lengthy Review: 2 hours (research impacts of new ingredients, update MSDS, call manufacturer to obtain complete info); or
- Previously Seen: 5 minutes to find & copy the earlier report.

Exhibit 6-9 shows that more products with higher hazards were encountered as the work progressed. Most of this shift in hazard levels is circumstantial, although the team did begin using the "Extreme Care" category somewhat more readily as the work progressed. [6-3]

Exhibit 6-9
Product Review Results

Hazard Level	Needs Assessment [1]	All Reviews Combined [2]
"Stop Using"	6%	15%
"Use Extreme Care"	35%	44%
"Use Routine Care"	46%	41%

[1] Percentages of 250 products reviewed at first 12 sites.
[2] Percentages of 1,137 products reviewed at 47 sites, including the first 12.

The Santa Clara team offers the following lessons learned to any other agency that wishes to offer on-site assistance to local businesses:

- Plan to spend a significant amount of time advertising the importance of janitorial product safety, both in general and to specific sites whom you approach.
- Obtain and use introduction letters from both local government officials and local industry trade associations.
- Announce the availability of your on-site assistance via trade association, POTW, and utility bill newsletters.
- Because business people usually listen to their customers, deliver your message to building owners and managers who employ janitorial contractors.
- Emphasize issues that janitors care about, i.e., the personal health and safety benefits from changing to environmentally preferable products.
- Encourage sites to take their time, making small step-by-step changes in the products that they use. Also, advise sites to get thorough technical training from the new product suppliers.
- Lead by example by having your own agency change to environmentally preferable products for its janitorial work.

6.9 Project Website

Very early in the project it had been decided to use the internet as the primary way of both publishing the team's outreach materials, and providing visitors with links to similar sites operated by other projects. Initially the team had thought to use the County of Santa Clara's internet

server. However, it proved easier as the work proceeded to instead use space that became available on the EPA-sponsored Western Regional P2 Network website.

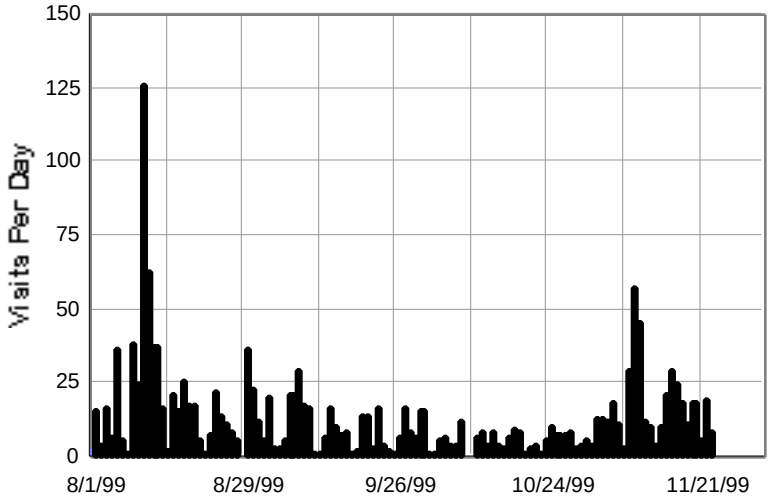
Construction of the project's web pages began in early-1999 with creation of a home page and five directory pages, each of which provided links to fact sheets, tools, and other specific items that the project team published. At this writing the overall website has expanded to eleven directories that together contain about 50 subsidiary pages, as well as links to about 25 sites sponsored by other agencies and projects.

The team also used the project web site to announce each of its workshops and the availability of both free product reviews and samples. As each event occurred, its page on the website changed from an announcement to a record. For example, the announcement of the July 1999 workshop was replaced by a copy of the workbook published for that session.

Exhibit 6-10 shows that an average of about 15 new users per day visit the website. A total of over 1,500 people visited the website during August through November 1999, the fourth through seventh months of its operation. The peak visits occurred in mid-August following announcement of the site on the P2Tech, EPPNET, and Facility Maintenance e-mail discussion groups.

The website activity tally in Exhibit 6-10 only counts the first visit by each person; repeat visits are not recorded. Also, the web counter statistics show that about 20% of the visitors are government agency staff. The balance are assumed to be janitors, facility managers, and others with an interest in workplace safety. [6-4]

Exhibit 6-10
Daily Project Website Visits (August – November 1999)



Through November 1999, the project team responded to about 50 e-mail and telephone inquiries from janitorial contractors custodians, and agency staff who wanted to know more about environmentally preferable products.

Feedback from site visitors has been generally very positive, with a number of industry people saying that they intend to download and use the project's fact sheets and other materials in the health and safety training given to their janitorial staff. For example:

- "Thank you so much for sending the packet on janitorial chemicals/products. As I mentioned I am currently researching all available information on the subject for a Guide to Custodial Products in Schools which will be used as an education/advocacy tool. The articles, etc. you sent will be quite useful to my work. Thanks again for your help." - MW

- "I am very interested in your samples of bath and tile cleaner. You see, I own a ceramic tile store and I am always looking for new products to suggest to my customers." - ME

- "I am always looking for something to make our job easier and safe at the same time. If this is as good as you say I can't wait to try it. Cleaning houses is a tuff job and I want what cleans the best. I look forward to trying your products." - RM, Laurinburg, N.C.

Similar comments have been made by agency staff who plan to use the site's technical materials to promote environmentally preferable purchasing at their organizations. For example: [6-5]

- "I very much appreciate your website. Good information and easy to navigate. I would love to get more information on the green product samples you distributed and how users responded to the survey. Thank you very much!" – MS, Springfield, MO

- "We are a research site for the US Dept. of Energy. We are interested in substituting safer and greener cleaning chemicals for the harsh ones we are currently using. Would you be willing to share product information about the cleaning products that worked for you? We need to find substitutes for:
  toilet bowl cleaner
  floor stripper
  glass and hard surface cleaner
  all purpose cleaner
  metal cleaner
  carpet cleaner.
  Thank you for any suggestions you can offer! We really appreciate your web-site." – BT, Morgantown, WV

6.10 Agency Outreach

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

- 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, e-mail was used to tell local agencies in the San Francisco area about workshops and other events. Finally, the project arranged for links to its website to be added to websites maintained by the National Association of Counties and other organizations with an interest in environmentally preferable purchasing.

- Direct Mailings - Project events, publications, and other resources were announced in a number of postal mailings. For example, newsletters were sent locally via the County of Santa Clara's P2 mailing list, and 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 Western Regional Pollution Prevention Conference in Monterey. This event focused upon ways for an agency to incorporate janitorial P2 into its industry outreach program. The case study used for this session appears 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 250 individuals attended workshops and technical presentations that the Santa Clara team made. Three hundred others received announcements mailed directly to them. The balance received e-mail messages, read articles published about the project, or learned of the project through personal referrals.

Feedback received to date indicates that most agency information needs are being satisfied by the fact sheets, tools, and other materials posted on project website. Publication of this completion report will provide the overview and summary that some agency staff have requested.

6.11 Footnotes To Section 6

[6-1] The longest that a requested MSDS took to arrive was just over six months.

[6-2] The first article is: Barron, Thomas, and L. Sutherland, "Environmentally Preferable Janitorial Products: Issues and Opportunities", Pollution Prevention Review, Fall 1999. The second article, which will appear in the Winter 2000 edition of P2 Review, is by T. Barron, D. Raphael, and L. Sutherland. The interview article appearing in Cleaning and Maintenance Management is available on the internet at <http://www.cmmonline.com/GetArticle.asp?Article=360901>.

[6-3] Completing the previously mentioned survey of actual injury data and eventually finding safer alternative products led the team to rate glass, metal, and general purpose cleaners containing 2-butoxyethanol and isopropanol more strictly than had been done initially.

[6-4] Anyone visiting the project website from an internet service provider with a ".gov" suffix is assumed to be connected with an agency.

[6-5} One example of an agency using the project's outreach materials is King County, Washington. This agency shared the Santa Clara project website with its stakeholders via the internet: <http://www.metrokc.gov/procure/green/bul42.htm>.

7. Results Forecast

This section of the report estimates the amount of hazardous chemicals that janitors in Santa Clara County use, and forecasts the amount by which this use will decrease if recommendations from the project are implemented.

The project team worked with 47 organizations, two-thirds of which were janitorial contractors. These organizations employ about 6,800 people, representing about 25% of the janitors working in Santa Clara County. Each year the employees of the 47 firms use 1,140 chemical products that contain an estimated 400,000 lbs. of hazardous materials.

It is estimated that the use of hazardous janitorial chemicals at these 47 organizations could decrease by about 130,000 lbs. per year if all of the recommendations the team made during site visits, workshops, and other local outreach efforts were to be followed. About 25%, or 30,000 lbs. of this potential annual reduction are actually expected to occur.

If the other contractors and individuals doing janitorial work in Santa Clara County were to make similar changes, the total use of hazardous janitorial chemicals throughout the county could decrease by about 620,000 lbs. per year. Motivated by a continuing outreach effort, about 70,000 lbs. of this potential reduction might actually occur.

7.1 Hazardous Materials Use Before Project

The project team estimates that the 26,800 janitors in Santa Clara County use about 750,000 gallons of concentrated and ready-to-use chemical products every year. At an average of 8.34 lbs. per gallon, these chemicals weigh a total of just under 6,270,000 pounds.

As shown by Exhibit 7-1, the amount of hazardous materials in this annual total is estimated to be about 1,284,000 pounds, or 48 lbs. per person per year. [7-1]

Exhibit 7-1
Estimate of Janitorial Chemical Use In Santa Clara County

	Janitors	Total Product (lbs per year)	Hazardous Materials (lbs per year)
47 Reviewed Firms	6,857	1,601,880	328,266
Other Sites	19,974	4,665,841	956,148
Total	26,831	6,267,721	1,284,414
			(47.8 lbs per person)

7.2 Potential Impact Of The Project's Suggestions – Example Sites

Three examples are presented here to illustrate typical sites that are changing their chemical use as a result of product reviews the Santa Clara project conducted. A summary of chemical changes expected at all 47 reviewed sites follows these examples. [7-2]

- Site No. 1 is a manufacturing firm that occupies a campus of several buildings, which have a total area of 725,000 square feet.

  A janitorial contractor with a staff of 30 people maintains these facilities. The contractor uses 26 different chemical products in this work. It is estimated that 5,815 lbs per year of chemicals are consumed at the site, excluding water added for dilution. The amount of hazardous materials in these products is 1,436 lbs per year.

  Exhibit 7-2 highlights five product changes that the review team suggested be made. A potential 574 lb per year decrease in hazardous materials use could result if the site made all five changes.

  In a follow-up contact, the site indicated that the two product changes marked with an asterisk have been made so far, resulting in an actual hazardous materials decrease of 134 lbs. per year. The other changes are being considered, but will probably not be made soon.

Exhibit 7-2
Hazardous Materials Reduction Forecast – Site 1

	Number of Products	Change/Keep	Hazmat Decr. (lb/yr)
Stop Using	0	0/0	0
Avoid if Possible	7	5/2	574 lbs. Potential
Carpet Cleaner		Change	0 lbs. Actual
Floor Stripper		Keep	0 lbs. Actual
Glass Cleaner*		Change	22 lbs. Actual
Carpet Shampoo		Change	0 lbs. Actual
GP Cleaner*		Change	112 lbs. Actual
Acid Tile Cleaner		Change	0 lbs. Actual
Floor Cleaner		Keep	0 lbs. Actual
Use With Care	12	0/12	0
OK	1	0/1	0

As used here, the phrase "Change/Keep" refers to the number of products that the team suggested the site change versus those that the team thought the site should continue to use. This distinction is made because some janitorial tasks, most notably floor finish stripping, cannot as yet be accomplished with mild products.

- Site No. 4 is a school district with a staff of 31 custodians who maintain 1,100,000 square feet of school and administrative buildings. The district uses 33 chemical products, which weigh a total of 6,000 lbs per year excluding dilution water. An estimated 1,484 lbs of this annual total are hazardous materials.

  The review team recommended a number of product changes, which if implemented would potentially decrease the district's hazardous materials use by 594 lbs per year. As shown by Exhibit 7-3, about 10% of this amount, or 58 lbs per year, have actually been accomplished to date (i.e., products marked with an asterisk).

Exhibit 7-3
Hazardous Materials Reduction Forecast – Site 4

	Number of Products	Change/Keep	Hazmat Decr. (lb/yr)
Stop Using	2	2/0	58 lbs. Potential
Graffiti Remover*		Stop	20 lbs. Actual
Gum Remover*		Stop	38 lbs. Actual
Avoid if Possible	9	4/5	536 lbs. Potential
Acid Bowl Cleaner		Change	0 lbs. Actual
Carpet Spotter		Change	0 lbs. Actual
Graffiti Remover		Change	0 lbs. Actual
5 Dispenser Chem.		Keep	0 lbs. Actual
Glass Cleaner		Change	0 lbs. Actual
Use With Care	9	0/9	0
Various Floor Care & GP Cleaners			
OK	9	0/9	0
Various Soaps & Mild GP Cleaners			

Because this school district happens to purchase a full year's supplies at one time, additional hazardous materials decreases will occur next fall when a change is made to different toilet and glass cleaners.

- Firm No. 37 is a full service maintenance contractor that employs 32 janitorial workers at sites in Santa Clara County (i.e., additional company employees work elsewhere). These 32 janitors use 6,200 lbs per year of chemicals, which include 1,530 lbs per year of hazardous materials.

  In its review, highlighted in Exhibit 7-4, the project team recommended changes that would decrease hazardous materials use by 613 lbs. per year. As of December 1999, an estimated 125 lbs. per year of this reduction are believed to have occurred.

These totals do not include lubricants, paints, pesticides, and similar chemicals that other contractor employees at the site use for building and landscape maintenance.

Exhibit 7-4
Hazardous Materials Reduction Forecast – Firm 37

	Number of Products	Change/Keep	Hazmat Decr. (lb/yr)
Stop Using	5	5/0	200 lbs. Potential
Bleach		Stop	0 lbs. Actual
2 Stain Removers		Stop	50 lbs. Actual
Acid Toilet Cleaner		Stop	0 lbs. Actual
Spot Remover		Stop	25 lbs. Actual
Avoid if Possible	18	5/13	413 lbs. Potential
2 Gum Removers			0 lbs. Actual
Glass Cleaner			50 lbs. Actual
GP Cleaner			0 lbs. Actual
14 Other Products			0 lbs. Actual
Use With Care	9	0/9	0
OK	6	0/6	0

7.3 Potential Impact Of The Project's Suggestions – All Sites

Overall, the project team recommended that the 47 reviewed organizations stop using 160 products, and continue using 470 additional chemicals only if extreme care could be assured. In about half of the former cases the sites have already stopped using the product in question. However, only 6% of the latter changes have been made to date.

Predominantly, the products that the team recommended sites to stop using included:

- Carpet shampoo containing nitrilotriacetic acid (5 sites);
- Urinal blocks containing paradichlorobenzene (10 sites);
- Carpet spotter spray containing tetrachloroethylene (15 sites);
- Aerosol spray baseboard stripper (5 sites); and
- Graffiti remover containing methylene chloride (10 sites).

Products that the team recommended that sites avoid if possible (or continue to use only with extreme care) included:

- Acidic toilet bowl cleaner containing hydrochloric acid (25 sites);
- Glass cleaner with butoxyethanol (15 sites); and
- Aerosol furniture polish with flammable propellants (20 sites).

Exhibit 7-5 shows that these changes, if fully implemented, would reduce hazardous materials use at the 47 firms by 131,300 lbs. per year. Based upon follow-up interviews, it is expected that the 47 organizations will actually follow only about 30% of these suggestions in the short term.

Factoring in the specific on-site situations involved, the expected total reduction in hazardous materials usage is estimated as 29,260 lbs. per year. The team estimates further that about half of this decrease has already been accomplished.

Exhibit 7-5
Hazardous Materials Reduction Forecast – 47 Reviewed Sites

Recommendation	Total Potential Changes	Expected Changes	Actual Changes
"Stop Using Product"	160 Products	100 Products	80 Products
"Avoid If Possible, Otherwise Use Extreme Care"	470 Products	90 Products	30 Products
Forecast Hazardous Materials Reduction	131,300 lbs per year (19 lbs per janitor per year)	29,260 lbs per year (4.3 lbs per janitor per year)	±15,000 lbs per year (±2 lbs per janitor per year)

The project team also believes that persistent follow-up would increase the expected amount of reduction that each of the 47 firms accomplishes, attaining perhaps 65,000 lbs per year or 50% of the potential total in the long term.

7.4 Forecast Of County-Wide Hazardous Materials Reductions

Were future pollution prevention outreach efforts to reach all 26,831 of the janitors working in Santa Clara County, the potential amount of hazardous materials reduction would be 513,800 lbs. per year, as shown in Exhibit 7-6. The amount of reduction that would be expected to actually occur is believed to be about 82,500 lbs. per year, which is equivalent to 3.1 lbs. per janitor per year.

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 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 7-6
Hazardous Materials Reduction Forecast – Santa Clara County

	Potential Changes	Expected Changes
47 Reviewed Organizations (6,857 Employees)	131,300 lbs per year (19 lbs per janitor per year)	29,300 lbs per year (4.3 lbs per janitor per year)
Other Organizations (19,974 Employees)	382,500 lbs per year (19 lbs per janitor per year)	53,200 lbs per year (2.7 lbs per janitor per year)
Total (26,831 Employees)	513,800 lbs per year (19 lbs per janitor per year)	82,500 lbs per year (3.1 lbs per janitor per year)

7.5 Footnotes To Section 7

[7-1] Details of these estimates appear in Appendix G. Briefly, the team made its extrapolations in three steps:

1. The ratio of 25% hazardous materials weight to total product weight was based upon the 19 janitorial products that the team studied in detail.

2. This ratio was used to estimate the amount of hazardous ingredients encountered in 1,137 products used by 47 organizations that were reviewed.

3. The reviewed organizations employ about 25% of all janitors employed in Santa Clara County. The estimate of annual County-wide hazardous materials use is an extrapolation based upon this ratio.

[7-2] Refer to Appendix G for similar information about changes expected at other sites that the Santa Clara team visited.