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FINAL REPORT

Controlling Pollution at Its Source: Wastewater and Stormwater Demonstration Projects

Project 98-WSM-2

The ultimate goal of any source control program is improvement of environmental conditions as a result of reductions in pollutant loadings. When these reductions are associated with residential and commercial sources, measurable changes may take place slowly. As the sources become more diverse and less amenable to traditional regulatory approaches, source control programs become more complicated and must rely increasingly on untested strategies. In addition, nonregulatory approaches rely heavily on public outreach and voluntary actions, which often yield results in small increments over a relatively long time frame. Therefore, effectiveness measurement tools that assess intermediate results are necessary to make sure programs are heading in the right direction.

The purpose of this project, which was conducted in two phases, was to identify, develop and test evaluation tools that are applicable to a range of commercial and residential source control programs. In the first phase, the project team developed a model framework for incorporating effectiveness measurement into a source control program, identifying appropriate tools by assessing existing efforts to measure program effectiveness (Water Environment Research Foundation 2000). During the project's second phase, which is the subject of this report, stormwater and wastewater agencies conducted demonstration projects for their pollution prevention programs, using the tools identified in Phase 1 to measure effectiveness. These include tools used during the planning process, as well as tools used to measure increased awareness, behavior change, and pollutant load reductions. The report provides a comprehensive look at these tools, in terms of tool selection, effectiveness and cost. Also discussed are overall projects regarding the feasibility of measuring the impact of a source control program.

Controlling Pollution at Its Source: Wastewater and Stormwater Demonstration Projects

by:

Betsy Elzufon

Larry Walker Associates

2001

Water Environment Research Foundation

ENVIRONMENTAL STEWARDSHIP THROUGH
INNOVATIVE SCIENCE AND TECHNOLOGY

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BENEFITS

- Demonstrates use of different types of surveys to measure increases in awareness and behavior change.
- Demonstrates use of a variety of tools to measure behavior change.
- Provides examples of assessing programs for planning purposes.
- Assesses use of water quality monitoring for measuring effectiveness.
- Provides cost information for effectiveness measurement tools.
- Demonstrates approaches to effectiveness measurement for agencies with limited resources.
- Provides information on advantages, disadvantages, and applicability of effectiveness measurement tools.

Keywords: Pollution prevention, source control, effectiveness measurement, evaluation, nonindustrial sources

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LIST OF ACRONYMS

BMP	Best management practice
DIYs	Do-it-yourselfers
HHW	Household hazardous waste
LACSD	Los Angeles County Sanitation Districts
LARWQCB	Los Angeles Regional Water Quality Control Board
SFWPPP	San Francisco Water Pollution Prevention Program
SUSMP	Standard Urban Stormwater Mitigation Plan
URMP	Urban Runoff Mitigation Plan
U.S. EPA	U.S. Environmental Protection Agency
WERF	Water Environment Research Foundation

EXECUTIVE SUMMARY

Source control programs targeting commercial and residential activities have been implemented around the country in an effort to reduce pollutant levels in stormwater and wastewater. Programs have been designed to identify pollutants of concern, pollutant sources, and strategies to control these sources. However, efforts to measure program effectiveness have met with limited success (Water Environment Research Foundation 1998). Program effectiveness refers to how successful a program has been with respect to increasing awareness, changing behavior, decreasing inputs of target pollutants to the environment, or improving ambient environmental conditions.

The ultimate goal of any source control program is improvement of environmental conditions as a result of reductions in pollutant loadings. When these reductions are associated with residential and commercial sources, measurable changes may take place slowly. As the sources become more diverse and less amenable to traditional regulatory approaches, source control programs become more complicated and must rely increasingly on untested strategies. In addition, nonregulatory approaches rely heavily on public outreach and voluntary actions, which often yield results in small increments over a relatively long time frame. Therefore, effectiveness measurement tools that assess intermediate results are necessary to make sure programs are heading in the right direction. The intermediate steps to environmental improvement through source control can be divided into the following stages of progression:

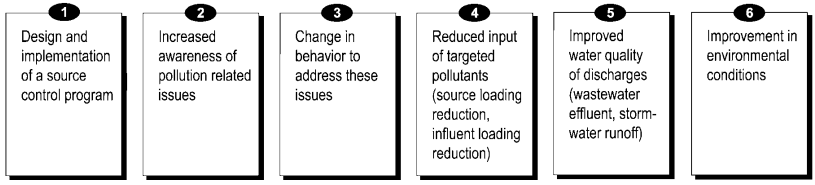


Figure ES-1. Steps to Environmental Improvement Through Source Control

If each stage of the process is assessed individually, changes may be measurable and easier to quantify. It is important to recognize the stage at which the source control program is operating to apply the appropriate effectiveness measurement method.

The purpose of this project, which was conducted in two phases, was to identify and develop evaluation tools applicable to a range of commercial and residential source control programs. In the first phase, the project team developed a model framework for incorporating effectiveness measurement into a source control program, identifying appropriate tools by assessing existing efforts to measure program effectiveness (Water Environment Research

Foundation 2000). During the project's second phase, which is the subject of this report, stormwater and wastewater agencies conducted demonstration projects for their pollution prevention programs, using the tools identified in Phase 1 to measure effectiveness.

The demonstration projects focused on source control programs that were primarily in the first three stages listed above: 1) developing a program, 2) increasing awareness, and 3) changing behavior. It was possible in some cases to assess further progress (e.g., measure reductions in pollutant loads) and begin to see a relationship between pollution reductions and the actions taken to increase awareness and change behavior. For a variety of reasons, it may be difficult for a source control program to assess its impact on the final stages of improving effluent quality and seeing environmental improvement. At a minimum, such assessments will require coordination with groups responsible for monitoring effluent and receiving waters.

ES.1 Demonstration Projects

Larry Walker Associates and Harris and Co. (the Project Team) worked with three wastewater pollution prevention programs and three stormwater programs in California. For each demonstration project, the agency and the project team each conducted different portions of the work. The agencies and demonstration projects are described below:

- ***San Francisco Water Pollution Prevention Program (SFWPPP) Mercury Reduction Project***—The City and County of San Francisco operates two wastewater treatment plants (the 74-mgd Southeast Water Pollution Control Plant and the 21-mgd Oceanside Water Pollution Control Plant) that serve a population of 790,000. The project team worked with SFWPPP to assess sources of mercury in wastewater. Based on the assessment, SFWPPP and the project team developed, implemented, and evaluated programs targeting mercury fever thermometers and dental offices. SFWPPP developed and conducted the thermometer outreach campaign, and SFWPPP and the project team jointly evaluated this campaign. The project team conducted the dental outreach effort and evaluation.
- ***Santa Monica Urban Runoff Pollution Prevention Program's New Development Program***—The city of Santa Monica is a primarily urban area with 85,000 residents located in the Santa Monica Bay Watershed in Southern California. The city is a co-permittee with the other cities in Los Angeles County on the county's National Pollutant Discharge Elimination System stormwater permit, which was issued in 1990. The project team worked with the Santa Monica Urban Runoff Pollution Prevention Program to assess the city's New Development Program, which seeks to control the discharge of pollutants—including solid wastes, petroleum-based compounds, and heavy metals—in urban runoff. Based on the assessment, the project team developed, conducted, and evaluated workshops for city staff and the building community.
- ***Woodland Pollution Prevention Program Oil and Grease Project***—The city of Woodland has a population of 47,000 and is located in California's Central Valley. Its water pollution control plant has an average daily flow of 5.7 million gal. Woodland has had ongoing collection-system problems due to oil and grease. The city's Pollution Prevention Program in 1996 targeted restaurants to address this issue. The project team worked with the Woodland Pollution Prevention Program to assess the restaurant program and other sources of oil and grease. As a result of this assessment, residential sources were determined to be significant, and the project team developed, implemented, and evaluated an outreach effort targeting residential handling of used cooking oil.

- ***Davis Pollution Prevention Program Pesticide Education Program***—The city of Davis is located in Northern California and has a population of 60,000. In support of the construction of a wetlands demonstration project, Davis characterized its stormwater runoff and identified organophosphate pesticides as potential pollutants of concern, with residential use determined to be the primary source of pesticides in the city's stormwater runoff. Davis developed the Healthy Gardens Program to educate residents regarding the impacts of pesticide use on stormwater runoff and wetlands. The project team worked with the city to evaluate this program through surveys (funded by a Pesticide Environmental Stewardship Grant) and stormwater monitoring conducted with funding from this project.
- ***Los Angeles County Used Oil Recycling Outreach Campaign***—Los Angeles County has a population of 10 million people and conducts an annual outreach campaign to encourage residents to recycle used motor oil. The project team worked with Los Angeles County to evaluate the 1999 campaign using intercept surveys, which are brief interviews conducted at fixed locations commonly visited by the target audience (e.g., auto parts stores for "do-it-yourselfers")
- ***Los Angeles County Sanitation Districts Lindane Reduction Project***—The Los Angeles County Sanitation Districts (LACSD) serves 5.3 million people and operates 11 treatment plants that treat a total of 525 mgd. In 1999, LACSD received a U.S. Environmental Protection Agency grant to conduct a pilot public outreach program to reduce the amount of lindane entering the sewer system. LACSD conducted the program and evaluated it using surveys and water quality monitoring. The project team supplemented these evaluation efforts by tracking prescription rates and over-the-counter sales of lindane-containing and nonlindane-containing remedies for head lice and scabies.

While the ultimate goal of source control is improving environmental conditions through reduced pollutant loadings, many source control programs have not reached that point. Therefore, the demonstration projects primarily focused on effectiveness measurement tools that are used during planning stages and to assess a program's impacts with respect to increased public awareness, behavior change, and, to a limited extent, pollutant load reductions. The tools that were used and the stages assessed are shown in Table ES-1.

Table ES-1. Demonstration Project Effectiveness Measurement Tools

Effectiveness Measurement Tool	Project	Timing for Project	Stage to Environmental Improvement
Estimated load reductions	Mercury Reduction Project	Planning	Program design and implementation
Existing program assessment	Oil and Grease Reduction Project; New Development Program	Planning	Program design and implementation
Intercept survey	Oil and Grease Reduction Project	Completion	Behavior change
Intercept survey	Used Oil Recycling Outreach Campaign	Completion	Awareness, behavior change
Kiosk survey	Healthy Gardens Program	Completion	Awareness, behavior change
Mail survey	Mercury Reduction Project (dental outreach)	Completion (brochure), planning (additional outreach)	Behavior change
Pharmacy sales tracking	Lindane Reduction Project	Implementation	Behavior change
Phone survey	Mercury Reduction Project (thermometer turn-in)	Planning/completion	Awareness
Phone survey	Lindane Reduction Project	Planning/completion	Awareness, behavior change
Phone/mail survey	Healthy Gardens Program	Completion	Awareness, behavior change
Site visits	Mercury Reduction Project (dental outreach)	Implementation	Behavior change
Thermometer turn-in rates	Mercury Reduction Project (thermometer turn-in)	Implementation	Behavior change
Water quality monitoring	Healthy Gardens Program	Implementation/completion	Reduced pollutant inputs
Water quality monitoring	Lindane Reduction Project	Implementation/completion	Reduced pollutant inputs
Workshop Tests	New Development Program	Completion	Awareness

Effectiveness measurement is conducted at three points in a project—during planning, during implementation, and on project completion. It is equally important at all three stages and takes on a different focus in each stage, as shown below:

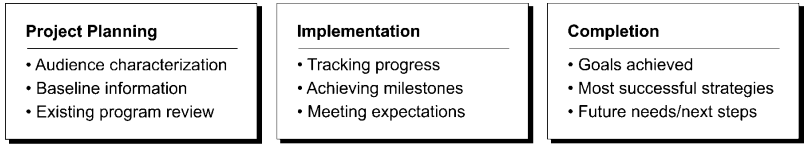


Figure ES-2. Using Effective Measurement

Tools were tested for their ease of use and range of applicability. In most cases, the tools worked as expected; however, in certain projects, more could have been learned from the effectiveness measurement. Testing effectiveness measurement tools during the demonstration

projects highlighted advantages and disadvantages of each, as summarized in Table ES-2. Lessons learned from the demonstration projects with respect to effectiveness measurement are discussed below.

Table ES-2. Advantages and Disadvantages of Effectiveness Measurement Tools

Effectiveness Measurement Tool	Applicability	Advantages	Disadvantages
Estimated load reductions	Planning — overall program	• Provides basis for identifying most effective strategies • Provides baseline information • Facilitates goal setting	• Data may be hard to obtain • Numerous assumptions • Nonquantitative, but may be misinterpreted as quantitative
Existing program assessment	Planning — specific program elements	• Less data needed than for load reduction • Facilitates goal setting, future evaluation	• Need information from a variety of sources • Nonquantitative
Water quality monitoring	Commercial or residential; reduction in pollutant inputs	• Measure of impact on water quality • Potential indicator of environmental improvement	• Results may only be measurable long term • May be expensive to obtain statistically valid results • May be difficult to attribute reductions to program under evaluation
Kiosk survey	Public education; awareness and behavior change	• Inexpensive • Assessment of outreach locations	• Nonquantitative
Sales tracking	Public education; consumer products; behavior change	• Good measure of behavior change	• Difficult to implement • Time consuming • May be difficult to attribute reductions to program under evaluation
Tracking turn-in rates	Residential; behavior change	• Inexpensive • Simple to implement • Easy to add to certain types of outreach	• Not broadly applicable
Phone survey	Residential; awareness or behavior change	• Quantitative • Audience characterization • Professional expertise available	• Expensive • May not be able to measure short-term changes
Intercept survey	Residential; awareness or behavior change	• Simple to implement • Easy to add to certain types of outreach	• Nonquantitative
Mail survey	Residential or commercial; awareness or behavior change	• Less expensive than phone surveys • Can be quantitative • High return rates • Good tool for follow-up	• May limit information that can be obtained • May not be able to measure short-term changes
Site visits	Commercial; source control, behavior change	• Easily included in inspection-based programs • Insights from direct interaction • Good for checking survey results	• Not broadly applicable • Time consuming • Nonquantitative
Workshop quizzes	Commercial; source control, group outreach	• Simple to implement • Inexpensive	• Not broadly applicable

ES.2 Evaluation of Framework and Planning Tools

Tools used specifically for planning were developed and used based on the framework for developing source control programs, as discussed above. The framework and the planning tools were tested for the SFWPPP Mercury Reduction Project, the Woodland Oil and Grease Reduction Project, and the Santa Monica New Development Program assessment. The framework as presented in the Phase 1 report (Water Environment Research Foundation 2000) and summarized above relies on the ability to assess sources of pollutants quantitatively and assign estimated loads to each source. This was practical only for the mercury-reduction project. Developing load estimates for pollutant sources is an approximation of the real situation and should be used only for planning purposes. A drawback of this approach is that these estimates may be misinterpreted as quantitative results.

The framework was modified for the Woodland and Santa Monica projects to assess existing program records to determine program needs. This approach is less quantitative and less likely to be misinterpreted.

Regardless of whether load estimates or information assessments were used, the framework process provided valuable insights about the programs that resulted in the development of useful source control programs for each agency. Using the framework required the agencies to review and compile what they already knew. It also allowed agencies to develop baseline information that made goal setting and future evaluation very straightforward.

This effort was time consuming for each project and would be even more time consuming for agencies that needed to gather or develop basic information. However, in each case, the

planning required by the framework was worthwhile and resulted in development of an effective source control plan.

ES.3 Evaluation of Tools Measuring Increased Awareness and Behavior Change

The tools that were used to measure program effectiveness in the demonstration projects during implementation and on project completion are discussed below.

ES.3.1 Surveys

Surveys can be conducted to be quantitative (i.e., able to determine statistical significance) or nonquantitative. Overall, surveys are more likely to show measurable changes if a campaign has been conducted long enough for its message to be recalled by the audience. Surveys may not be the best tools to measure the effectiveness of a brief outreach campaign or one element of a campaign. For example, in the SFWPPP project, a thermometer turn-in campaign lasting 1 month probably was too brief to raise public awareness to a measurable level. However, other tools showed that the campaign had made a promising start, accomplishing the collection of almost 5000 thermometers. On the other hand, the results of the 2-year pesticide outreach campaign in Davis were measurable due to the audience's repeated exposure to the Healthy Gardens Program message. Some features of different types of surveys used in the demonstration projects are discussed below.

- ***Phone surveys.*** Random, digit-dial phone surveys are the standard tool used by many outreach programs to characterize their audiences and assess their programs. When used to assess program effectiveness, it is essential to conduct a preprogram survey and to use identical questions in the follow-up survey. Many firms specialize in conducting this type of survey. While it is more expensive to hire a contractor to conduct a survey, the improved question design and data analysis available from an expert may be worth the cost.
- ***Mail surveys.*** These surveys can provide the same type of quantitative information as a phone survey and can be less labor intensive. Response rates will be highest if the survey is brief and easy to complete and a preaddressed, stamped envelope is included with the survey. If mailing addresses are randomly selected and the questions are the same as those used in a phone survey, results from the mail and phone surveys can be combined. Mail surveys that were used as follow-up to the dental site visits and new development workshops were simple to implement and provided useful information.
- ***Intercept surveys.*** These typically are nonquantitative surveys but provide useful insights about trends. They are conducted "face-to-face" as brief interviews at a location frequented by the target audience. Intercept surveys can easily be added to planned outreach activities conducted in a fixed location, such as at special events or outside a store. Preparation time for an intercept survey can be similar to that required by a phone survey, particularly if the agency uses a professional marketing and survey or polling service to design the survey and analyze the results. The advantage of an intercept survey is that it enables project members to come into contact with a focused audience; the disadvantage is that achieving a statistically reliable result would be labor intensive, in that the interview team would need to talk with 400 to 500 people.
- ***Kiosk survey.*** This is a nonquantitative survey, because participants are not randomly selected. However, the kiosk survey conducted in Davis provided results similar to the quantitative surveys conducted there. Also, rotating the location of the display

and survey receptacle provided useful information on locations conducive to people stopping long enough to be "educated." Tasks for implementing this tool included researching locations, obtaining permission to place the display, checking the display occasionally to reduce vandalism, and collecting the cards and analyzing the results. This effort was spread out over several weeks and required only a few hours a week to maintain.

ES.3.2 Sales Tracking

Sales tracking was a particularly difficult tool to use effectively. It is time consuming and the data collected may be inconsistent or incomplete, making the data too variable from store to store. This tool produces more reliable information if the agency has an established relationship or ongoing program with the participating stores (resulting in the store producing more consistent and complete sales data) and if the stores use electronic inventory methods.

ES.3.3 Tracking Participation Rates

Tracking participation rates takes advantage of a campaign that involves getting the target audience to do something. For example, SFWPPP tracked participation simply by counting the number of thermometers turned in. The information obtained can be augmented by asking one or two questions (for example, "Where did you hear about the program?"). Another way to use this tool is to offer coupons for something, then track how many coupons are redeemed or to track phone calls and requests for additional information. A similar type of tracking related to commercial programs is tracking permit compliance or best management practice (BMP) implementation rates. One advantage of using this tool is that it requires little additional cost beyond the cost of the source control program itself.

ES.3.4 Quizzes

Quizzes are simple to implement and incur almost no added cost. However, they are only useful for certain types of outreach, such as workshops or other strategies that bring the target audience together for a specific period. Quizzes provide more immediate feedback on the effectiveness of a single program element, compared to the information provided by surveys, which focuses on long-term or overall program effectiveness.

ES.3.5 Site Visits

Site visits are part of a source control strategy that can be used as an effectiveness measurement tool if the procedure for each visit is standardized and the same information is recorded at each location. This is a labor-intensive strategy, but the information that can be obtained through direct observation may be invaluable to understanding the target audience and planning future programs. This tool can provide good supplementary information that can corroborate the results provided by other tools, such as surveys. In addition, if the site visit is conducted properly, it may help establish a relationship with the target audience that could lead to future cooperation.

ES.4 Tools to Measure Reductions in Pollutant Inputs

Water quality monitoring is used as an approach for determining the effectiveness of source control programs in reducing pollutant inputs to the environment. Influent and trunkline monitoring were used to assess the lindane-reduction project, and stormwater runoff monitoring was used to assess the Healthy Gardens Program. However, there is not always a clear relationship between pollutant reductions and source control program activities. Apparent

reductions may be due to a variety of factors, including variability in limited data sets and impacts of other programs with similar messages.

Limited data sets may be addressed by collecting enough data to be representative at a high level of confidence. This can be expensive and it may be difficult to collect sufficient data under appropriate conditions to yield statistically valid (i.e., quantitative) results. Monitoring results that are not statistically significant may be used to evaluate trends and check the results of other evaluation tools to provide an overall assessment of an outreach program.

Attributing reductions to the program under evaluation may be addressed by using supplemental effectiveness measurement tools that address the other stages (i.e., awareness and behavior change). Information gained from different effectiveness measurement tools then can be aggregated. Another approach is to compare the of supplemental measurements to the monitoring results for a control area.

ES.5 Use of Information Gained From Different Tools

Using more than one effectiveness measurement tool for one program can help strengthen individual findings. In some cases, the information obtained from different tools can be combined to provide additional information. Comparison of the information derived from different measurement tools is discussed below for

- the SFWPPP thermometer turn-in campaign,
- the SFWPPP dental practices evaluation,
- the Davis Healthy Gardens Program, and
- the LACSD lindane-reduction project.

ES.5.1 SFWPPP Thermometer Turn-in Campaign

The thermometer turn-in campaign was evaluated by counting the number of thermometers turned in and conducting pre- and post-campaign phone surveys. The phone surveys indicated that no increase occurred with respect to awareness or behavior regarding the use of mercury thermometers. On the other hand, 3300 households (approximately 1% of all San Francisco households) turned in mercury thermometers, which represents a respectable start for an outreach campaign after 1 month. Tracking collection rates provided additional information regarding program effectiveness that could not be observed through the surveys. In addition, combining information from the survey, the collection rate, and the estimated load reduction allows improved analysis of the program. In all, 4699 thermometers were turned in. Assuming each thermometer contained 0.5 g of mercury, a total of 5.2 lb of mercury was collected. According to the survey results, between 2% and 3% of thermometer owners have disposed of mercury from a broken thermometer by pouring it down the drain. Therefore, it could be estimated that 2.5% of the thermometers turned in, or 0.13 lb of mercury, were kept out of the sanitary sewer as a result of this campaign. The load reduction that potentially could be achieved through a thermometer turn-in and outreach campaign was estimated at 1.2 lb. Therefore, approximately 10% of the estimated load reduction appears to have been achieved through this program. Considering that the program operated only 1 month, this could be considered a promising start.

ES.5.2 SFWPPP Dental Practice Evaluation

Practices used by San Francisco dentists were evaluated with respect to BMP implementation rates using a mail survey and onsite assessments. In both types of assessment, dentists

were asked if they recycled scrap amalgam, disposable traps, and vacuum-filter waste. As shown in Table ES-3, both assessments yielded the same overall response with respect to recycling scrap amalgam. However, there were substantial differences in the results provided by the two measurement tools with respect to the number of dentists recycling vacuum-filter and trap wastes. This discrepancy probably was due to a misconception among dentists that disposing of trap and filter waste as medical waste is considered recycling (i.e., medical waste typically is disposed of through incineration, rather than being recycled or reused). By conducting both forms of evaluation, more complete information about dental practices was obtained.

Table ES-3. Dentist Best Management Practice Implementation Rates

Percentage of Dentists Who:	Mail Survey Results	Site Visit Results
Recycle scrap amalgam (%)	75	74
Recycle trap waste (%)	59	16
Recycle vacuum-filter waste (%)	30	12

ES.5.3 Davis Healthy Gardens Program

The Davis Healthy Gardens Program was evaluated using phone, mail, and kiosk surveys and by monitoring stormwater runoff from a residential area. The water quality data, while showing a downward trend, was inconclusive because of the limited amount of data collected. On the other hand, the surveys indicated awareness of the Healthy Gardens Program and some behavior change as a result of the program. The survey results were useful in explaining which portions of the program were most effective. This type of information is important for future planning efforts. Another useful result of the Davis evaluation is the demonstration that the mail and phone survey results could be combined.

ES.5.4 LACSD Lindane Reduction Project

LACSD evaluated its lindane-reduction pilot program using surveys, water quality monitoring, and sales tracking. The water quality monitoring results showed lower lindane concentrations in the pilot areas than in the control area following implementation of the outreach program. The survey results confirmed that the outreach program was effective in changing the practices of healthcare professionals, which may explain the lower lindane concentrations in the wastewater. On the other hand, sales tracking produced inconclusive results. The use of more than one evaluation tool provided a more complete assessment of the program and allowed effectiveness to be measured even though one evaluation approach did not function as expected.

ES.6 Conclusions

Important findings of the project include the following:

- Planning is critical to conducting successful source control programs. The framework developed in Phase 1 and the planning tools discussed in Chapter 3 are useful for assessing sources, control strategies, and existing program structure and using this assessment to incorporate evaluation into a program from the beginning.
- When using water quality monitoring as an evaluation tool, consideration must be given to the statistical significance (i.e., quantity and variability) of the data. It also is

important to determine if the monitoring results can be related directly to source control program impacts.

- Using more than one evaluation approach has the advantage of providing a better characterization of the program and audience. It also provides protection from relying on one evaluation method that may yield inconclusive results.
- Ways to reduce evaluation costs include limiting the data collected to items directly related to evaluating the program (e.g., monitoring only for relevant constituents and including only survey questions designed to evaluate the program.).
- The results of outreach campaigns, particularly with respect to the general public, will only be measurable after sufficient time has been allowed for the public to be exposed repeatedly to the outreach campaign message. In other words, measurable increases in general awareness should not be expected after 1 month of outreach or limited distribution of outreach materials.
- Agencies have the greatest ability to measure the effectiveness of their source control programs with respect to program design, increased awareness, behavior change, and reduction in pollutant inputs using the tools described in this report. Making a connection between source control program activity and improvement in environmental conditions may require more sophisticated tools, such as modeling, and developing partnerships with other groups, such as discharge-monitoring staff, ambient monitoring programs, and watershed groups.

CHAPTER 1.0

INTRODUCTION

Municipal and other agencies around the country have implemented source control programs targeting commercial and residential activities in an effort to reduce pollutant levels in stormwater and wastewater. These programs generally are designed to identify pollutants of concern, pollutant sources, and strategies to control these sources. However, efforts to measure the effectiveness of such programs have met with limited success (Water Environment Research Foundation 1998). Program effectiveness refers to how successful a program has been with respect to increasing awareness, changing behavior, decreasing inputs of target pollutants to the environment, or improving ambient environmental conditions.

The ultimate goal of any source control program is improvement of environmental conditions as a result of reductions in pollutant loadings. When these reductions are associated with residential and commercial sources, measurable changes may take place slowly. As the sources become more diverse and less amenable to traditional regulatory approaches, source control programs become more complicated and must rely increasingly on untested strategies. In addition, nonregulatory approaches rely heavily on public outreach and voluntary actions, which often yield results in small increments over a relatively long time frame. Therefore, effectiveness measurement tools that assess intermediate results are necessary to make sure programs are heading in the right direction. The intermediate steps to environmental improvement through source control can be divided into the following stages of progression:

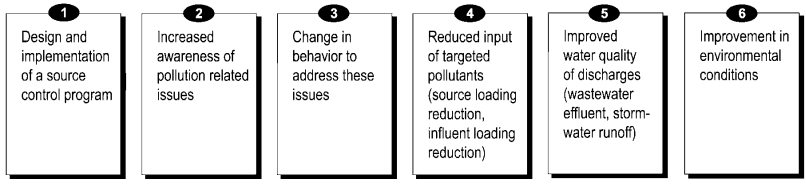


Figure 1-1. Steps to Environmental Improvement Through Source Control

If each stage of the process is assessed individually, changes may be measurable and easier to quantify. It is important to recognize the stage at which the source control program is operating to apply the appropriate effectiveness measurement method.

The purpose of this project, which was conducted in two phases, was to identify and develop evaluation tools that are applicable to a range of commercial and residential source control programs. In the first phase, the project team developed a model framework for

incorporating effectiveness measurement into a source control program, identifying appropriate tools by assessing existing efforts to measure program effectiveness (Water Environment Research Foundation 2000). During the project's second phase, stormwater and wastewater agencies conducted demonstration projects for their pollution prevention programs, using the tools identified in Phase 1 to measure effectiveness.

The demonstration projects focused on source control programs that were primarily in the first three stages listed above: 1) developing a program, 2) increasing awareness, and 3) changing behavior. It was possible in some cases to assess further progress (e.g., to measure reductions in pollutant loadings) and begin to see a relationship between these pollution reductions and the actions taken to increase awareness and change behavior. For a variety of reasons, it may be difficult for an agency to assess a source control program's impact on the final stages of improving effluent quality and seeing environmental improvement. At a minimum, such assessments will require coordination with groups responsible for monitoring effluent and receiving waters.

This report presents the results of the second phase of the project. The framework that was developed and the tools that were identified during Phase 1 formed the basis for conducting the Phase 2 demonstration projects. To provide perspective, the following section presents an overview of the Phase 1 results. A previous publication (Water Environment Research Foundation 2000) provides a more detailed description of Phase 1.

1.1 Summary of Phase 1 Results

This section describes the framework and effectiveness measurement tools identified in Phase 1 of the project and presents the conclusions and recommendation from Phase 1 regarding the demonstration projects.

1.1.1 Framework

The first step in measuring program effectiveness is to develop a source control program that incorporates effectiveness measurement from the beginning. During Phase 1, the project team developed a framework for doing this. The following sections summarize the process used to develop a source control program, as well as considerations at each step.

1.1.1.1 Identify the Issue

An effective source control program has a clearly defined issue. Define the issue by

- identifying a pollutant of concern or a wastestream, and
- establishing a baseline by determining pollutant loading or wastestream volume.

1.1.1.2 Identify and Assess Sources

Sources may be identified through monitoring, reviewing agency records, and reviewing the literature and other agency programs. Once each source is identified,

- determine the source's significance by estimating its contribution to the total pollutant load or wastestream volume, and
- assess the agency's ability to control the source, taking into account such factors as jurisdictional, political, and other relevant concerns.

1.1.1.3 Determine Available Control Strategies

To identify possible control strategies for each source,

- consider strategies the agency already is using to target similar sources,
- review strategies used by other agencies for this source, and
- brainstorm to develop new ideas that would work in the agency's service area.

1.1.1.4 Evaluate and Prioritize Control Strategies

To determine which control strategies are most likely to achieve measurable results, assess the following:

- ***Participation***—What portion of the targeted audience is likely to make the desired behavior change?
- ***Pollutant load***—What portion of the source's total pollutant load will be eliminated if the entire targeted audience makes the desired behavior change?
- ***Cost***—How much will it cost the agency to implement the program and how much will it cost the targeted audience?

Determine an estimated load reduction from the estimated participation and loading for each control strategy and compare it to the estimated cost of the control strategy to determine which strategies are most worthwhile.

1.1.1.5 Establish a Goal

A goal may be set at any point prior to program implementation. The goal is the desired outcome of the program and may be set based on several factors, including

- a reference condition (i.e., the condition that would exist without interference);
- a reduction that realistically can be achieved based on the estimated load reductions determined in the previous step;
- performance necessary to meet an intermediate goal (e.g., the rate of compliance with a regulatory request or the response rate to an outreach program); and
- the reduction necessary to meet a permit limit or environmental standard.

1.1.1.6 Implement and Evaluate the Program

Select implementation strategies based on the prioritization, and develop an implementation plan and schedule. Part of program implementation is selection of an effectiveness measurement tool to assess the program. Before choosing assessment tools, the agency should determine what information it is seeking about its program.

Elements fundamental to effectiveness measurement are put in place at the beginning of program implementation. For example, the agency should conduct baseline surveying or monitoring, establish a phone number to receive responses to a campaign, or add survey cards to outreach materials.

1.1.1.7 Evaluate Program Effectiveness

Based on the effectiveness measurement, the agency determines lessons learned from the program:

- Has the program's goal been achieved?
- What were the most effective aspects of this project?
- What changes need to be made to achieve better results?

1.1.1.8 Modify the Program

The results of the effectiveness measurement will help determine future directions for the program with respect to

- additional strategies to address this source if the desired results were not achieved,
- alternative sources to work with if no further reductions are possible from this project's source, and
- new issues to pursue if this pollutant or wastestream issue was addressed adequately by this program.

1.1.2 Effectiveness Measurement Tools

Table 1-1 shows the effectiveness measurement tools identified in Phase 1 and the stages to which they apply.

Table 1-1. Effectiveness Measurement Tools

Tool	Applicable Stages for this Tool
Estimated load reductions	Planning and program design
Surveys (e.g., quantitative, targeted, phone banking)	Increased awareness, behavior change
Group feedback (e.g., focus groups, workshops, pilot study)	Behavior change
Tracking responses	Behavior change
Tracking sales	Behavior change
Inspections and site visits	Behavior change
Participation rates	Behavior change
Environmental analysis (e.g., effluent and receiving-water monitoring, discharger sampling)	Pollutant load reduction, improved effluent and receiving-water quality
Modeling	Improved effluent and receiving-water quality
Cost-benefit analysis	Improved effluent and receiving-water quality

In addition to the stage of the process, selection of effectiveness measurement tools by source control programs is also influenced by

- the target audience (i.e., businesses, residents, schools, farms, etc.); and
- timing with respect to project planning and implementation (i.e., before, during, or after a project is conducted).

Effectiveness measurement tools most appropriate to a source control strategy may be chosen based on several considerations, as described below.

1.1.2.1 Programs Targeting Business Audiences

Tools commonly used for programs targeting business audiences include measurement of participation or compliance rates, effluent sampling, and site visits and inspections. Other tools that have been used successfully include cost-benefit analysis, estimated load reductions, and focus groups. Participation rates are a useful measure when the control strategy used is a

recognition or certification program. Effluent sampling is most effective when a specific business category is targeted. Treatment plant effluent or influent sampling is an effective indicator of program performance only if a single source (i.e., a business category) is responsible for the major portion of a pollutant's loading.

1.1.2.2 Programs Targeting Residential Audiences

Most control strategies used for residential audiences are based on educational outreach materials and methods of advertising this information to the public. Effectiveness measurement tools commonly used include quantitative and targeted surveys, tracking responses, and focus groups. Other tools that have been used successfully when adequate data are available include estimated load reductions, tracking sales, effluent toxicity, and modeling.

1.1.2.3 Assessment During Program Planning

Tools most commonly used during the planning process include estimated load reductions, focus groups, modeling, and quantitative surveys.

1.1.2.4 Assessment While a Project Is Being Conducted

Certain tools can be used to assess a program as it is being implemented. These include inspections and site visits, as well as participation rates for business-oriented projects and tracking responses or sales patterns for residential audience projects.

1.1.2.5 Assessment After a Project Is Completed

Influent or effluent-discharge sampling are conducted to assess the impact of an implemented project that targets a business audience. Targeted surveys are used to assess the impact of an outreach program targeting the residential sector, specifically with respect to whether workshops or education materials resulted in positive behavior changes. Quantitative surveys can also be used to assess the impact of residential outreach, specifically with respect to the overall impact of an advertising campaign.

1.1.3 Findings and Recommendations From Phase 1

This section discusses findings from Phase 1 of the project with respect to barriers to conducting evaluation and benefits realized from program evaluation. It also recommends ways to conduct the demonstration projects described in this report.

1.1.3.1 Why Do Agencies Fail To Evaluate Their Source Control Programs?

As shown in many of the case studies for this report, program evaluation can yield valuable information. Agencies that have institutionalized effectiveness measurement or conducted program assessment for a number of years use it to plan their programs, choose where to focus resources, and improve their programs. They also use assessment results to gain management support for their programs and obtain additional funding. They have been monitoring the effectiveness of their programs for so long that they "instinctively" know which strategies will work best in certain situations. Because their programs are so effective, they appear to have more resources available to them. While their resources may not be much greater than those available to programs of similar size, they are able to focus their efforts more effectively and get more "bang for their buck."

Even though conducting evaluations is beneficial, many agencies avoid effectiveness measurement for a variety of reasons. Some of these are discussed below.

"Evaluation is too expensive." Some tools, including surveys and monitoring that provide statistically valid results, are expensive. However, less expensive strategies are available.

These include tracking responses, measuring participation rates, and conducting targeted surveys. While the resulting information may not be scientific, it still can be very informative. If planned from the beginning, several inexpensive ways are available to modify a program to allow evaluation. Adding a response card or telephone number to a brochure, providing switchboard operators with a log sheet to track calls, and color-coding coupons or response codes can provide useful information at a minimal monetary investment.

Tools also are available that may be worth the expense because they serve the dual purpose of providing effectiveness measurement and helping to implement certain program elements. Focus groups and site visits and inspections can serve as educational opportunities in addition to providing effectiveness measurement.

"I don't have time or energy to do evaluation well, so it's not worth bothering with at all." Having the money but not the time is a terrible excuse. Surveys and monitoring studies can always be contracted to someone with the appropriate knowledge and experience. Of course, typically, agencies do not have excess money in their budgets. However, as noted, several simple tools exist that require minimal additional time investments to return valuable information. For example, when Palo Alto, Calif., tracked mercury thermometers that were turned into the household hazardous waste facility, the "add-on" evaluation method was to record the number of people turning in the thermometers and the total number of thermometers turned in each day. At the end of the year, the time required to enter the data, analyze it, and correlate it to outreach efforts was very small, less than 20 hours. If some time is spent initially, it often is possible to use existing program elements to assess effectiveness with only slight modifications or add-ons.

"I'm afraid that I'll find out my program is ineffective. It may look like we haven't done anything or wasted money and then we'll be required to do more." On the other hand, an agency could waste more time and money continuing to do the same thing that is having no impact beyond meeting a permit or other regulatory requirement. In addition, incorporating evaluation into a project from the beginning increases the likelihood that the program will have effective elements. The initial step in evaluating a program is establishing a baseline. Determining a starting point is neither positive nor negative. A well-defined starting point will help focus efforts effectively. Effective planning involves research that should focus a project on the appropriate pollutant source or target audience and help identify effective strategies for that source or audience.

Another approach to effectiveness measurement is to start small and measure the effectiveness of one element of a program as a pilot study. Therefore, success or failure will not become a critique of the overall effort. It is also important to realize that poor results for effectiveness measurement provide valuable information about what not to do in the future.

"I won't learn anything useful from evaluation." Many agencies that evaluate their programs do so because it is a requirement. In those cases, the most common use for the evaluation is to report it to management or regulatory authorities. Because they see no benefit to evaluation, the type of evaluation conducted may be only to track evidence of program implementation (e.g., the number of brochures distributed or the number of inspections conducted). There may be no useful information obtained as a result. For the information to be useful, evaluation needs to be incorporated from the beginning of a project. The first questions to be asked should be the following:

- Where are we starting from and what do we already know?
- What do I want to learn about my program?
- What do I want to achieve with this program?

"I don't know how to evaluate my program." Evaluation has not been institutionalized for source control programs. Therefore, evaluation tools have not been well defined or made uniformly available. The Phase 1 report for this project and this report address this issue by compiling a list of tools and examples of how they are used.

"My boss doesn't care about evaluation and I've never had to do it before, so why should I start now?" This is also a matter of evaluation not being institutionalized. Accountability with respect to program results needs to be incorporated into project planning in the same way as budgets and time schedules. The result may be a better program that will get a more positive response from the targeted audience, management, and regulatory authorities. Incorporating effectiveness measurement into a project from the planning stage will help to develop a more focused, results oriented program. A well planned and executed program may get more support from management even if they fail to realize that evaluation played a critical role. If the evaluation portion of the program is highlighted, it may encourage management to consider evaluation as an important program element in the future.

"The only meaningful measure of a program's impact is changes in pollutant levels in influent, effluent, or sludge." While the ultimate goal of a program may be to see measurable changes in influent, effluent, or sludge pollutant levels, intermediate stages to environmental improvement can be measured. In fact, environmental improvement may be a gradual process that is difficult to measure. Changes may be easier to observe at some of the intermediate stages. If scientific, quantitative results are desired, monitoring and surveys can be used. Monitoring of individual dischargers can be used to see more noticeable changes than may be observed by monitoring the influent. Surveys can be conducted to assess changes in awareness and behavior that ultimately will lead to environmental improvement. However, for these results to be statistically valid, the surveys or monitoring plans must be developed carefully and adequate data must be collected. While extremely useful, such strategies also may be costly.

"There are no well-defined indicators to measure stormwater program performance." Appropriate methods for measuring stormwater program performance are still being developed. One approach under development is the use of environmental indicators, parameters that can be used to approximate overall conditions in receiving waters and provide benchmarks for assessing the success of management efforts. These indicators can be divided into the following categories: water quality, physical–hydrological, biological, social, programmatic, and site-related. Once fully developed, water quality and biological indicators may be the most direct measures of environmental improvement for stormwater programs. Tools described in this report may work well for evaluating the intermediate steps of increased awareness and behavior change as they apply to stormwater programs.

1.1.3.2 Why Should Agencies Evaluate Their Programs?

Benefits realized from effectiveness measurement include gaining support and funding for a program, identifying the best outreach methods, targeting the program to the right audience, and keeping the program on track. Following are some examples from the Phase 1 report (Water Environment Research Foundation 2000):

- Agencies are able to justify their programs and gain support and additional funding based on effectiveness measurement results. An example from the Volunteer-led

Investigations of Neighborhood Ecology (VINE) program was the use of evaluation results to obtain funding to start a VINE program in a new city. An assessment of the program's adaptability convinced the potential donor that the program could be adapted for use in Baltimore, Md., and resulted in the donor funding the program.

- Agencies learn what methods work best to achieve different objectives. For example, pollution prevention program officials in Palo Alto and San Francisco learned that newspaper advertising is far less effective than utility-bill inserts for distributing coupons or communicating offers for free brochures, and that newspaper articles are more effective than newspaper advertisements. San Francisco also learned that street signs are effective for creating awareness of environmental issues.
- Agencies learn what audiences are most receptive to certain messages and how to target outreach campaigns. The King County, Wash., Green Gardening Campaign determined that suburban homeowners older than 30 and with incomes greater than $50,000 used the most pesticides in the Seattle–King County area. Focusing on this audience resulted in a successful, effective campaign. Similarly, another county attributed the success of its composting program to shaping the campaign based on the results of initial surveys regarding the community's attitudes and behavior with respect to composting.
- Agencies also may use effectiveness measurement to keep a program on track. When Palo Alto tracked thermometer turn-in rates, the rates increased when newspaper articles were published on the topic. Additional newspaper articles were published in response to turn-in rates slowing over the summer months, which then resulted in another peak in turn-in rates.

1.1.3.3 Recommendations for Demonstration Projects

The purpose of conducting demonstrations with stormwater and wastewater source control programs was to test the framework and tools presented in Phase 1 of the project. To obtain as much information as possible about source control program effectiveness measurement, the demonstration projects were developed based on the following recommendations:

- Follow the eight steps of the framework, utilizing one or more of the effectiveness measurement tools, as described above.
- Assess costs for each effectiveness measurement tool, with an emphasis on identifying low-cost approaches.
- Assess staffing requirements for each tool, with an emphasis on tools that can be used by agencies with small staffs.
- Make different target audiences and pollutants the subject of each project.
- Employ evaluation tools not previously used by the agency.
- Assess ease of use and applicability to other projects for each evaluation tool.

1.2 Demonstration Projects

Larry Walker Associates and Harris and Co. (the project team) worked with three wastewater pollution prevention programs and three stormwater programs in California. For each demonstration project, the agency and the project team each conducted different portions of the work. The agencies and the demonstration projects are described below:

- ***San Francisco Water Pollution Prevention Program (SFWPPP) Mercury Reduction Project***—The City and County of San Francisco operates two wastewater treatment plants—the 74-mgd Southeast Water Pollution Control Plant and the 21-mgd Oceanside Water Pollution Control Plant—that serve a population of 790,000. The project

team worked with SFWPPP to assess sources of mercury in wastewater. Based on the assessment, SFWPPP and the project team developed, implemented, and evaluated programs targeting mercury fever thermometers and dental offices. SFWPPP developed and conducted the thermometer outreach campaign, and SFWPPP and the project team jointly evaluated this campaign. The project team conducted the dental outreach effort and evaluation.

- ***Santa Monica Urban Runoff Pollution Prevention Program's New Development Program***—The city of Santa Monica is a primarily urban area with 85,000 residents located in the Santa Monica Bay Watershed in Southern California. The city is a co-permittee with the other cities in Los Angeles County on the county's National Pollutant Discharge Elimination System stormwater permit, which was issued in 1990. The project team worked with the Santa Monica Urban Runoff Pollution Prevention Program to assess the city's New Development Program, which seeks to reduce discharges of solid wastes, petroleum-based compounds, and heavy metals. Based on the assessment, the project team developed, conducted, and evaluated workshops for city staff and the building community.
- ***Woodland Pollution Prevention Program Oil and Grease Project***—The city of Woodland has a population of 47,000 and is located in California's Central Valley. Its water pollution control plant has an average flow of 5.7 mgd. Woodland has had ongoing collection-system problems due to oil and grease. The city's Pollution Prevention Program in 1996 targeted restaurants to address this issue. The project team worked with the Woodland Pollution Prevention Program to assess the restaurant program and other sources of oil and grease. As a result of this assessment, residential sources were determined to be significant and the project team developed, implemented, and evaluated an outreach effort targeting residential handling of used cooking oil.
- ***Davis Pollution Prevention Program Pesticide Education Program***—The city of Davis is located in Northern California and has a population of 60,000. In support of the construction of a wetlands demonstration project, Davis characterized its stormwater runoff and identified organophosphate pesticides as potential pollutants of concern, with residential use determined to be the primary source of pesticides in the city's stormwater runoff. Davis developed the Healthy Gardens Program to educate residents regarding the impacts of pesticide use on stormwater runoff and wetlands. The project team worked with city officials to evaluate this program through surveys (funded by a Pesticide Environmental Stewardship Grant) and stormwater monitoring conducted with funding from this project.
- ***Los Angeles County Used Oil Recycling Outreach Campaign***—Los Angeles County has a population of 10 million people and conducts an annual outreach campaign to encourage residents to recycle used motor oil. The project team worked with Los Angeles County to evaluate the 1999 campaign using intercept surveys, which are face-to-face interviews conducted at fixed locations commonly visited by the target audience.
- ***Los Angeles County Sanitation Districts Lindane Reduction Project***—The Los Angeles County Sanitation Districts (LACSD) serves 5.3 million people and operates 11 treatment plants that treat a total of 525 mgd. In 1999, LACSD received a U.S. Environmental Protection Agency grant to conduct a pilot public outreach program to reduce the amount of lindane entering the sanitary sewer. LACSD conducted the program and evaluated it using surveys and water quality monitoring. The project team supplemented LACSD's evaluation efforts by tracking prescription rates and over-the-counter sales of lindane-containing and nonlindane-containing remedies for head lice and scabies.

While the ultimate goal of source control is improving environmental conditions through reduced pollutant loadings, many source control programs have not reached that point. Therefore, the demonstration projects primarily focused on effectiveness measurement tools that are used during the planning stages and to assess a program's impacts with respect to increased public awareness, behavior change, and, to a limited extent, pollutant load reductions. The tools used that were used and the stages assessed are shown in Table 1-2.

Table 1-2. Tools Used in Demonstration Projects

Demonstration Project	Tools Used	Stages Assessed
Mercury Reduction Project	Estimated load reductions, surveys, participation rates, site visits	Program design, increased awareness, behavior change
New Development Program	Existing program assessment, workshop quizzes	Program design, increased awareness, behavior change
Oil and Grease Reduction Project	Existing program assessment, intercept survey	Program design, increased awareness, behavior change
Healthy Gardens Program	Surveys, stormwater outfall monitoring	Increased awareness, behavior change, pollutant load reduction
Used Oil Recycling Outreach Campaign	Intercept survey	Increased awareness, behavior change
Lindane Reduction Project	Surveys, sales tracking, influent monitoring	Increased awareness, behavior change, pollutant load reduction

1.3 Report Organization

This report presents the results of the demonstration projects and evaluates effectiveness measurement tools used in those projects for source control program assessment. In addition to describing the tools, the report also presents the costs associated with each tool and discusses the advantages and disadvantages of each. The remainder of the report is organized as follows:

- ***Chapter 2—Description of Demonstration Projects.*** This chapter summarizes the activities conducted in each demonstration project and presents an overview of the results from each project.
- ***Chapter 3—Planning Tools.*** Program planning is an important element of developing successful source control programs. This chapter describes tools used in the planning process to determine which source control strategies are most likely to be successful in achieving a program's goal. Included are discussions of estimated load contributions and potential reductions for the SFWPPP Mercury Reduction Project, as well as the assessments of existing information for the Woodland Oil and Grease Reduction Project and the Santa Monica New Development Program.
- ***Chapter 4—Tools to Measure Increased Awareness.*** Surveys are the primary tool for assessing increased awareness as a result of an outreach campaign. Both quantitative and targeted, nonquantitative surveys can be used to assess awareness. Since increasing awareness is one of the first steps taken to achieve a source control program's goals, surveys are commonly used. Surveys and other tools described in this chapter include phone surveys (for the SFWPPP Mercury Reduction Project's thermometer

turn-in campaign, the Davis Healthy Gardens Program, and the LACSD Lindane Reduction Project); mail surveys (for the Healthy Gardens Program); intercept surveys (for the Los Angeles County Used Oil Recycling Outreach Campaign and the Woodland Oil and Grease Reduction Project); and quizzes (for the Santa Monica New Development Program). Most of these surveys also assessed behavior change to some extent, as discussed in this chapter and in Chapter 5.

- ***Chapter 5—Tools to Measure Behavior Change.*** A variety of tools may be used to assess the effectiveness of source control programs with respect to behavior change. Tools described in this chapter include sales tracking (for the LACSD Lindane Reduction Project); surveys (the surveys discussed in Chapter 4 and those used in the SFWPPP dental outreach project and the Santa Monica workshop follow-up); tracking responses (used in the SFWPPP thermometer turn-in campaign); and site visits and interviews (for the SFWPPP dental outreach project).
- ***Chapter 6—Tools to Measure Pollutant Load Reductions.*** Reduction in pollutant inputs to the environment is assessed through environmental monitoring. Two of the demonstration projects used influent, trunk-line, and stormwater monitoring to assess effectiveness with respect to pollutant load reductions. While this is a critical step in the process, it is often difficult to obtain an adequate amount of data to characterize water quality and, therefore, assess the impact of a source control program on water quality. Water quality monitoring efforts described in this chapter include stormwater monitoring (for the Davis Healthy Gardens Program) and wastewater influent and trunk-line monitoring (for the LACSD Lindane Reduction Project).
- ***Chapter 7—Conclusions.*** This chapter assesses the framework and effectiveness measurement tools. Included are comparisons of information that can be obtained from the different tools, a summary of the costs of source control program elements and effectiveness measurement, a discussion of project findings regarding the feasibility of measuring a source control program's impact, and a brief discussion of the tools needed to assess the final steps in the environmental improvement process (i.e., improved effluent and receiving-water quality and improved ambient conditions).

CHAPTER 2.0

DESCRIPTION OF DEMONSTRATION PROJECTS

Agencies in six California municipalities conducted six demonstration projects as part of this Water Environment Research Foundation project, Tools To Measure Source Control Program Effectiveness. Three demonstration projects attempted to follow the framework developed in Phase 1 of the WERF project. This included identifying and assessing sources, planning and implementing programs based on these assessments, and evaluating the programs. The three demonstration projects that used this approach are

- the San Francisco Water Pollution Prevention Program (SFWPPP) Mercury Reduction Project,
- the Santa Monica Urban Runoff Pollution Prevention Program's New Development Program, and
- the Woodland Pollution Prevention Program Oil and Grease Project.

Three other projects evaluated specific effectiveness measurement tools. These are

- the Davis Healthy Gardens Program (water quality monitoring, surveys);
- the Los Angeles County Used Oil Recycling Outreach Campaign (intercept surveys); and
- the Los Angeles County Sanitation Districts (LACSD) Lindane Reduction Project (sales tracking, water quality monitoring).

This chapter summarizes the six demonstration projects.

2.1 SFWPPP Mercury Reduction Project

The purpose of the SFWPPP Mercury Reduction Project was to identify opportunities to reduce mercury contributions to San Francisco's wastewater. Project staff estimated load contributions for a variety of residential, commercial, and industrial sources, using data provided by San Francisco and values available in the relevant literature. Based on the results of this source identification study and previous work on mercury conducted by San Francisco, SFWPPP targeted mercury thermometers and dental activities as the best opportunities to reduce mercury.

The mercury thermometer outreach campaign revolved around encouraging residents to turn in mercury thermometers at city-sponsored collection events in May 2000. The events were publicized through utility-bill inserts, Val-Pak coupons, and a press conference held in

early May. On each Saturday during the campaign, residents could turn in mercury thermometers at designated fire stations around the city. Residents who turned in thermometers received digital thermometers as replacements. Project staff evaluated the campaign by using pre- and post-campaign random-digit-dial phone surveys, tracking the number of thermometers collected, and conducting brief interviews at collection sites.

Overall, program was successful, in that 4,699 mercury thermometers were collected in a 4-week period. Interestingly, one of the nine fire-station collection sites collected 40% of the thermometers. Based on interviews conducted at the collections, the most effective methods for advertising the program were newspaper articles and radio advertisements. Word of mouth also had a significant effect in the later weeks of the campaign. While a large number of thermometers were collected, the phone survey results indicated no measurable increase in awareness regarding environmental impacts of mercury. Pre- and post-campaign survey results regarding attitudes and practices relating to mercury thermometers were nearly identical.

Regarding dental activities, SFWPPP has worked with dentists during the last several years and, in 1997, developed and distributed a brochure describing best management practices (BMPs) for dental practices. SFWPPP wanted to assess the extent of BMP implementation and identify effective approaches to achieving mercury reductions in dental wastewater. The first step of this effort was to assess BMP implementation and the attitudes of dentists, based on a survey mailed to 900 San Francisco dentists.

Project staff used the results of the mail survey to plan the pilot outreach project (site visits). The survey results indicated dentists are aware of the environmental impacts of mercury and there is a trend toward using less amalgam in San Francisco dental offices. In addition, according to the survey results, most dentists recycle their scrap amalgam. However, more dentists could recycle the materials collected in chair-side traps and vacuum-system filters. Based on the survey results, SFWPPP developed an outreach campaign focusing on encouraging dentists to recycle all amalgam wastes, change traps and filters regularly, and keep a log of amalgam wastes generated. The outreach consisted of conducting site visits with the goal of assessing BMP implementation directly and asking dentists to commit to trying one new BMP. In return for their cooperation, dentists were provided with a basket of promotional items for their offices. Many dentists were disposing of their trap and filter waste as medical waste and were under the impression that this is the proper disposal method. SFWPPP encouraged dentists to recycle trap and filter waste with the same recycler that collects their scrap amalgam. Project staff conducted a follow-up survey a few months after the site visits to assess the impact of the visits. The results indicated that approximately 25% of the dentists who received site visits had implemented at least one new BMP.

2.2 Santa Monica New Development Program

The purpose of this project was to assess the implementation of certain elements of Santa Monica's New Development Program, specifically the process for implementing urban runoff mitigation requirements, and to identify future directions for the program. The city requires all new development projects to submit mitigation plans for reducing stormwater runoff from the developed site. Project staff audited the Santa Monica Urban Runoff Pollution Prevention Program's mitigation planning process by reviewing program records, interviewing city staff, and visiting project sites to determine if post-construction BMPs had been implemented.

Overall, the process appeared to be working, in that BMPs were being installed at the project sites in accordance with the submitted mitigation plan. However, the audit identified certain areas where the process could be improved, including improving city staff's knowledge of optimal site design and providing the building community with more information about mitigation plan requirements. In addition, the Los Angeles Regional Water Quality Control Board recently had approved more stringent standards for urban runoff. Based on the results of the program audit and the board's new requirement, the project staff recommended that workshops be conducted to provide city personnel and the building community with information regarding city and regional board requirements for new development.

The city conducted the recommended workshops in August 2000. Project staff assessed the workshops using pre- and post-tests to see if knowledge had improved among workshop attendees. Based on the test results, both the building community and city staff came into the workshops with a good understanding of stormwater issues. The workshops successfully communicated certain aspects of the regulatory requirements, educating participants about the difference between construction and post-construction BMPs and exposing participants to a wider variety of post-construction BMPs. A follow-up assessment conducted a few months after the workshops were held indicated that workshop participants were incorporating a variety of post-construction BMPs into development projects.

2.3 Woodland Pollution Prevention Program Oil and Grease Project

The city of Woodland has experienced a continuing problem with collection-system upsets due to oil and grease. In 1996, the city implemented a restaurant permit program to address collection-system problems involving oil and grease. In general, restaurants have implemented the permit requirements and have a 95% compliance rate. However, because collection-system upsets are still an issue, the city made an effort to identify other sources.

Project staff reviewed information on collection-system problems and the existing restaurant permit program to identify sources of current oil and grease problems. High-density housing and apartments were located immediately upstream of all but one of the highest-priority collection-system problem sites. Based on this assessment, the city, through this project, developed and conducted outreach targeting residents of apartments and houses in the geographic areas with the most collection-system problems.

The residential outreach program focused on providing giveaways of such items as can lids and potholders bearing messages about proper grease handling. The giveaways were conducted at local grocery stores in July 2000. Project staff conducted intercept surveys with 236 people during the giveaways. While a majority of participants said they put used kitchen grease and cooking oil in the trash, approximately 16% reported pouring the materials down the drain. In addition to the grocery store events, staff left promotional materials at apartment rental offices in the problem areas and asked apartment managers to track oil and grease problems at their complexes. A follow-up survey conducted in November 2000 to see if awareness had increased or practices had changed indicated no apparent change in the proportion of people improperly disposing of used cooking oil. The outreach program may have been too limited in scope to result in measurable improvements in awareness or behavior.

2.4 Davis Pollution Prevention Program Pesticide Education Program

In the mid-1990s, the city of Davis, through its stormwater monitoring program, identified pesticides (specifically diazinon and chlorpyrifos) as pollutants of concern in its urban runoff. It also determined that the largest source of pesticides in the city's runoff was residential pesticide use. Therefore, in 1998, the city implemented the Healthy Gardens Program, a residential outreach program promoting integrated pest management and proper use and disposal of pesticides. Program staff developed and distributed a variety of materials for the program, including

- movie theater slides;
- a fan brochure on pest management;
- signs around the city identifying the use of integrated pest management in public areas; and
- a sign at North Pond, a wildlife habitat and flood detention basin, describing the connection between stormwater runoff and wetland areas in Davis.

In 1999, under a U.S. Environmental Protection Agency (U.S. EPA) grant, the city used surveys to assess the effectiveness of the Healthy Gardens Program. It supplemented this effort by monitoring stormwater runoff for an outfall (the North Pond site) in Davis that drains a residential area. Data on pesticides in stormwater runoff were available for this outfall for three storms that occurred prior to the initiation of the pesticide outreach program (in 1996 and 1997) and for one storm event that occurred in 1998, after the Healthy Gardens Program began. In addition, during the 1999–2000 storm season, program staff monitored two storms that occurred at North Pond for diazinon, chlorpyrifos, and conventional pollutants. The results show a decrease over time in pesticide levels in stormwater runoff to North Pond. Because of the limited amount of stormwater data and the fact that such data are influenced by a variety of factors, it is not clear whether the decrease indicated is significant.

Surveys conducted by the city under the U.S. EPA grant indicate residents were aware of the Healthy Gardens Program, showed an increased awareness of the connection between pesticide use and water pollution, and had changed their behavior to reduce or eliminate pesticide use. In addition, North Pond was one of the most effective locations for communicating these messages, according to survey responses.

2.5 Los Angeles County Used Oil Recycling Campaign

For the last several years, Los Angeles County has promoted used-oil recycling and, more recently, oil-filter recycling through a variety of media and public education programs. The purpose of the WERF project was to assess the 1999 campaign. The Los Angeles County Department of Public Works launched a 2-month advertising campaign in October 1999 to promote used-oil recycling. The campaign targeted Latino and African-American men between 16 and 35 years of age. The advertising company hired by the Public Works Department developed billboards, bus-stop posters, theater slides, and radio public-service announcements.

In December 1999, campaign staff developed an intercept survey to test whether the target audience remembered advertising campaigns and determine what effect the campaigns had on their behavior. The target audience for this survey comprised individuals who change their motor-oil, oil-filter, and other automotive fluid themselves, a group generally known as "do-it-yourselfers" (DIYs). The project staff chose automotive stores as the survey location and

conducted concurrent surveys at four stores. The survey was designed to ask DIYs whether they had seen the recent campaign and if it had changed their behavior.

The survey results suggested conclusions similar to those drawn from surveys of other relatively mature used-oil recycling programs. Specifically, 90% of DIYs were "doing the right thing" by recycling their used oil and oil filters, and only 10% were improperly disposing of these materials. While sample sizes are too small to produce statistically reliable results, the data suggest that those who saw used-oil advertising during the 6-month campaign were less likely to dispose of their used oil and oil filters in the trash or down the storm drain than those who had not seen the campaign materials.

2.6 LACSD Lindane Reduction Project

The purpose of the LACSD Lindane Reduction Project was to supplement the county's efforts to assess the effectiveness of an outreach and education project discouraging the use of lindane as a remedy for head lice and scabies. Through a U.S. EPA grant, LACSD developed a public outreach program targeting healthcare professionals with the goal of reducing the amount of lindane entering the wastewater collection system. This was a pilot project designed to determine if such an effort would be effective. Therefore, LACSD measured effectiveness using surveys and water quality monitoring. Larry Walker Associates and Harris and Co. (the project team) supplemented this effort by tracking changes in lindane prescription rates and sales of over-the-counter alternatives.

LACSD initiated the outreach campaign in October 1999. Project staff conducted surveys and water quality monitoring before the campaign began and conducted follow-up monitoring periodically through May 2000. In addition, they also conducted a post-campaign survey to determine if practices and attitudes had changed on the part of the healthcare professionals. The project team collected the prescription and sales tracking information at pharmacies in Pomona (a control group area where no outreach was conducted) and in Burbank (the study area). A total of 17 pharmacies (10 in the study area and seven in the control area) provided tracking data.

During the course of the study, lindane wastewater levels decreased in the outreach areas and remained stable in the control area. Survey results indicated that fewer doctors were prescribing lindane and more pharmacists were mentioning its harmful effects to their customers. In addition, the ratio of lindane prescriptions to sales of nonlindane products remained higher in the control area than in the area where outreach was conducted.

CHAPTER 3.0

PLANNING TOOLS

Planning is the most important element of developing an effective source control program. Before implementing a program, it is critical to identify its goal or purpose, assess the sources of the pollution problem, and determine the strategies most likely to be successful in achieving the program's goal. This chapter describes two approaches that have proved extremely useful in pollution prevention program planning: estimating load reductions and assessing existing information.

3.1 Estimated Load Reductions

Estimating load reductions involves identifying sources of a pollutant, quantifying relative contributions of sources, determining and assessing potential source control strategies, and estimating the likely success of the identified strategies. The resulting analysis yields estimates of the reductions that may be achieved by targeting a certain source and implementing a given control strategy. While this process is by no means quantitative, it is useful in sorting out large and small sources and identifying appropriate strategies. The San Francisco Water Pollution Prevention Program (SFWPPP) Mercury Reduction Project used estimated load reductions to assess mercury sources. The process used and the type of information obtained from it for San Francisco are discussed below (Larry Walker Associates 2000d).

SFWPPP sought to reduce the quantity of mercury in the influent to its two water pollution control plants (the Southeast Water Pollution Control Plant and the Oceanside Water Pollution Control Plant). To plan the best approach to achieving these reductions, project staff developed estimated load reductions using the following steps:

- Identify and quantify sources.
- Determine and assess available control strategies.
- Estimate reductions that can be achieved.

3.1.1 Source Identification

The first step in the process was to identify and quantify the sources of mercury contributing to the influent loading at each water pollution control plant. Table 3-1 lists each mercury source identified by this study and its estimated annual contribution to the influent load. Project staff determined residential loadings using values developed by other agencies (Larry Walker Associates 1994, 1997) and adjusting these values to San Francisco based on population or number of households. Commercial and industrial mercury contributions to influent loading were determined based on wastewater monitoring data collected annually by SFWPPP.

Data on contributions from dental offices were based on monitoring conducted by SFWPPP. Details of the load calculations are presented elsewhere (Larry Walker Associates 2000d).

Table 3-1. Mercury Sources and Estimated Annual Loads

Mercury Source	Estimated Load	
	(lb/yr)	(%)
Residential		
Human waste	18.00	20.00
Laundry graywater	12.10	14.00
Thermometers	5.90	7.00
Contact-lens solutions	2.20	2.00
Used motor oil	0.23	0.26
Latex paints	0.09	0.10
Food waste	0.04	0.04
Total identified residential	**38.56**	**43.40**
Commercial/Industrial		
Dental facilities	26.20	29.00
Medical facilities	2.81	3.00
Educational institutions	2.70	3.00
Laundry	0.74	1.00
Food processing and manufacturing	0.30	0.34
Public transportation	0.07	0.10
Total identified commercial	**32.82**	**36.44**
Unidentified and other sources	**17.50**	**20.00**
Total influent loading	**88.88**	**100.00**

Project staff identified approximately 80% of the mercury sources for the San Francisco influent. The identified sources were divided fairly evenly between residential and commercial –industrial sources. The largest residential sources include human waste, laundry graywater, thermometers, and contact-lens solutions. The largest commercial sources include dental and medical facilities and educational institutions. It should be emphasized that the calculated loadings incorporate several assumptions and, therefore, are very approximate. For example, the estimated loading from improper disposal of broken thermometers is based on a survey result (Larry Walker Associates 1994) indicating that 1.8% of households dispose of mercury from thermometers by pouring it down the drain. However, the portion of this 1.8% that break a thermometer in a given year is unknown. Therefore, 5.9 lb/yr is a maximum value, while the actual loading from improper thermometer disposal possibly is much lower.

In addition to quantifying sources, a source's controllability is another important factor to consider. SFWPPP has established programs for permitted facilities and commercial businesses making these sources well within its ability to work with and control. Other sources, such as household products, may be addressed through education and outreach and are considered controllable to some extent. On the other hand, certain sources are considered to be essentially uncontrollable. These include soil, which reaches the water pollution control plants via

laundry, shower, and wash water; food discarded in garbage disposals; and human waste. The controllability of mercury sources is summarized in Table 3-2.

Table 3-2. Controllability of Mercury Sources

Source	Controllability (high---------low)	Information Needs
Dentists	---X----------	
Household products		
Thermometers	------X----------	
Contact-lens solution	------X----------	
Other products	----------?----------	What other household products contain mercury?
Laundry graywater	----------X-------	
Soil	----------X-	
Human waste	----------X-	
Permitted industries	-X----------	
Mercury-containing reagents	-X----------	
Mercury-containing equipment	-X----------	
Food waste	----------X-------	
Food	----------X-	
Garbage disposal	--------X----------	
Stormwater inflow: motor vehicles	----------X---	
Stormwater inflow: water supply	----------?----------	How does mercury get into the water supply?

3.1.2 Available Control Strategies

Strategies used to address mercury sources include building on existing programs and developing new strategies.

3.1.2.1 Existing Programs

Between 1994 and 1996, SFWPPP collected more than 100 wastewater samples from dental-related facilities and found them to be a significant source of mercury to the city's sewerage system. Based on the sampling results, SFWPPP developed a mercury outreach program in cooperation with the San Francisco Dental Society and the California Dental Association. The program encouraged implementation of best management practices (BMPs) for dental facilities. Brochures distributed to more than 1200 San Francisco dentists presented details about the BMPs.

Other existing programs in the area include a permanent household hazardous waste collection facility for San Francisco residents, a waste pick-up program for very-small-quantity generators of hazardous wastes, and other services for small businesses.

3.1.2.2 Developing New Strategies

In addition to the existing efforts targeting dental facilities and household hazardous waste, other potentially controllable mercury sources exist within the service area. Additional

measures also might be taken to control discharges from dental facilities. General control strategies and their application to specific sources in San Francisco are described below.

Source control strategies generally fall into four categories:

- technology-based strategies;
- local regulatory strategies;
- public and business outreach programs; and
- regional, national, and international strategies.

Technology-Based Strategies. Technology-based strategies involve a process modification or the use of equipment or chemicals to achieve reductions in mercury discharges. For example, installing household laundry graywater systems would effectively eliminate discharges of mercury in laundry graywater. The effectiveness of such strategies depends on the technology's ability to remove mercury from the source or the mercury discharge from the collection system, as well as sufficient cooperation and participation necessary to implement the strategy. Although graywater systems would eliminate laundry graywater as a source of mercury discharges, installing such systems would involve changes in the construction and design of houses, renovations of existing residences, and participation by planning and building officials, builders, developers, landscapers, and homeowners.

Local Regulatory Strategies. Local regulatory strategies include local ordinances and controls on specific industries or sources. These may include product bans or restrictions or enforced discharge limits and site visits for businesses. The feasibility of this strategy is limited by state and federal law (for example, the Federal Insecticide, Fungicide and Rodenticide Act prohibits many local restrictions on pesticides) and the ability of dischargers to control sources of the mercury in their discharges. The effectiveness of this type of strategy depends on the ability of SFWPPP to enforce the regulation.

Public and Business Outreach. In the Southeast and Oceanside treatment plants' service areas, the largest source of mercury is residential activity. Regulatory strategies generally are not applicable in the residential sector, and technology-based strategies are difficult to implement on a large, residential scale. Therefore, public education and outreach often are the most effective ways to implement source reduction in the residential sector. Outreach and education to businesses can be a cost-effective way of raising awareness and changing business habits for source control without the difficulties and time involved in implementing legislative or technology-based controls.

Public and business outreach can be accomplished in many ways. Brochures, point-of-purchase and event displays, and media advertisements all can present clear, concise information to a broad audience. School programs can create awareness in children, which they can pass on to their parents. Business outreach can take the form of education about alternative products and BMPs. Incentive programs in which businesses are recognized for following pollution prevention guidelines or providing educational materials to their customers are effective ways of educating both business owners and the public about environmental issues.

Regional and Other Strategies. Some mercury sources are not easy for SFWPPP to control, but program staff can approach other entities to advocate the reduction of mercury from these sources. Strategies falling into this category may include working with regional or national groups to reduce mercury levels in air emissions or advocating the reduction of mercury levels in clothing and other products.

Sources considered to be controllable by SFWPPP include

- dentists;
- residential sources, such as household products and food wastes;
- hospitals and other medical facilities; and
- residential and commercial laundries.

Dentists are the largest identified source for which SFWPPP has a high level of control, and SFWPPP has conducted outreach to dentists in the past. Follow-ups to this outreach could be conducted and focus on increasing implementation of selected BMPs. In addition, while working cooperatively with dentists is the recommended first step, it would be possible for SFWPPP to regulate dentists by requiring permits for dental wastewater discharges. Permits could be modified to require implementation of mercury-amalgam handling and disposal practices, propose a reduction in the use of amalgam, or include effluent limitations on the amount of mercury contained in wastewater. The regulatory program could include reporting and monitoring requirements, site visits, and penalties for violating permit requirements.

Household products, including thermometers and contact lens solutions, are responsible for approximately 9% of the mercury load to the treatment plants' influent. Mercury thermometers constitute one of the largest estimated sources of mercury from residents to the treatment plants, approximately 6 lb/yr. Therefore, an outreach campaign could be developed to encourage residents to turn in mercury thermometers and use digital or other mercury-free thermometers instead. Several contact-lens solutions available to consumers contain thimerisol, a mercury-containing preservative. Viable, cost-effective alternatives to these solutions are readily available to consumers.

Disposing of food waste down the drain results in mercury loads to the water pollution control plants. SFWPPP has no direct control over mercury levels in food. However, the program could encourage residents not to use garbage disposals to dispose of food waste and to compost such wastes instead. SFWPPP could assemble and distribute outreach materials on household composting of food waste for the public and provide references for more information. Such an outreach program should be conducted in conjunction with local solid-waste programs that encourage composting. SFWPPP should consider encouraging the use of kitchen storage containers or in-kitchen worm boxes as an element of the program. This would reduce the amount of mercury from food waste reaching the wastewater collection system by diverting the waste and its associated mercury to individual gardens. Diverting food waste from the pipeline could affect wastewater treatment operations at the water pollution control plants. SFWPPP would need to investigate potential operational consequences before initiating a large-scale program of this type.

Mercury from medical facilities, particularly hospitals and nursing homes, accounts for approximately 5.5% of the total mercury loading to the water pollution control plants. Control strategies for hospitals and medical facilities include instituting policies regarding mercury-containing equipment and cleaning wastewater collection lines.

Under a recent local resolution, the city is required to encourage all medical facilities within San Francisco to eliminate the purchase and use of mercury-containing products. To accomplish this, SFWPPP could provide information to hospitals and laboratories on alternatives to mercury-containing equipment and information that helps eliminate remaining barriers to the use of alternative equipment. While alternative equipment often is no more expensive than mercury-containing equipment, the capital expenditure needed to replace

existing equipment can be a significant barrier. Another barrier to the use of alternatives to mercury thermometers involves concern about the accuracy of alternative thermometers. SFWPPP could gather information on this and other pros and cons of alternatives to mercury-containing equipment. It could share information on these issues and the environmental impacts associated with mercury releases with managers at hospitals and laboratories.

Historical use of mercury may have caused a mercury buildup in sink traps and collection lines in hospitals and laboratory buildings. However, the magnitude of this source is uncertain. SFWPPP could support implementation of a demonstration project at a hospital or laboratory to determine the effectiveness of pipeline cleaning to remove mercury buildup. Mercury wastewater effluent concentrations should be measured before and after the cleaning to determine whether line cleaning is an effective tool for reducing mercury loads to the collection system.

Graywater (wastewater from washing machines, showers, and sinks) from residential and commercial laundries constitutes a significant load of mercury to the water pollution control plants, approximately 12.8 lb/yr. However, mercury sources in the graywater have not been identified. It may come from dirt, air deposition, or chemicals applied to cotton or finished clothing (Larry Walker Associates 1994). SFWPPP has no direct control over any of these sources. However, it can encourage actions that prevent the mercury-containing graywater from entering the pipeline. Graywater can be used to irrigate lawns, trees, bushes, and flowers. Graywater systems could be recommended and promoted to residents, contractors, and builders for use in feasible locations.

Although graywater systems can divert significant loads of mercury, several problems interfere with SFWPPP's ability to implement the use of these systems in the service area. One is that the San Francisco area provides very little opportunity for new construction. This means the program primarily would involve retrofits of existing houses. In addition, a certain amount of landscaped area is needed, and the systems are complicated to install and maintain.

To address such barriers, SFWPPP could work with local building departments to resolve issues surrounding graywater system use and develop a local supplement to the California Department of Water Resources *Graywater Guide*. SFWPPP could select appropriate geographic areas and building types in the service area to target for an educational program on graywater systems.

Drought or other water conservation restrictions could make graywater systems more financially attractive to homeowners. SFWPPP could prepare to work with local water utilities to promote the use of graywater systems in retrofits and new construction if water restrictions occur in the future.

3.1.3 Assessment of Source Control Strategies

Load reductions from each of the control strategies identified can be estimated by determining the potential effectiveness of each strategy. A strategy's effectiveness can be estimated on the basis of the level of participation expected and the maximum load reduction the strategy achieves. The Phase 1 report for this project described in detail the development of participation and loading factors (Water Environment Research Foundation 2000). This is summarized below.

3.1.3.1 Participation Factor

Ideally, implementing a control strategy results in eliminating the source the strategy was designed to address. In reality, however, only a percentage of the people and procedures

addressed by the control strategy will be changed. The participation factor estimates the amount of participation that can be achieved for a given control strategy.

Because available data on participation levels are limited, the participation factors used in this study and described here should be considered rough estimates. Surveys conducted by SFWPPP indicate that public education campaigns will increase awareness among 10% to 30% of the general public and result in behavior changes for 5% to 15%. Lower awareness and behavior change rates can be expected during the first year of a campaign, with numbers increasing over time and with repetition of the message. Data on participation in programs for businesses show approximately a 50% compliance rate for completely voluntary, education-based programs. When some sort of accountability—such as annual sampling or inspections, or a regulatory requirement—is included, compliance or participation rates can increase to 90%. Initial compliance rates (during a program's first year) will be between 30% and 50%, with rates increasing in the second and third years to 90% or more.

3.1.3.2 Loading Factor

The loading factor is the amount of mercury load reduction from a source that could be expected if there were 100% participation. The loading factor varies depending on the sources of mercury the strategy addresses. For example, all programs related to thermometers and contact-lens solutions have a loading factor of 100%, because control strategies aimed at these sources would effectively eliminate the source.

Loading factors were determined by estimating the amount of mercury coming from individual sources within a category. For example, sources of mercury from hospitals include mercury-containing equipment, mercury solutions, and mercury present in wastewater collection lines. SFWPPP examined each control strategy to determine the individual sources it addressed. Business outreach and public education strategies were assumed to address all individual sources. In the case of dentists, project staff determined that, based on current technologies, a maximum of 90% of the mercury could be removed from amalgam used at dentists' offices.

3.1.3.3 Estimated Load Reduction

Table 3-3 shows the estimated participation and loading factors and the resulting load reduction for each control strategy addressing the largest identified sources. If all strategies listed in Table 3-3 were implemented, it is estimated that a reduction of 26 lb could be achieved, corresponding to a 30% reduction in the influent loading. The simplest strategies to implement would be the thermometer outreach campaign, outreach to dentists, and outreach to medical facilities. An estimated 17% reduction in influent loading could be achieved by implementing these strategies.

Table 3-3. Estimated Mercury Load Reductions for San Francisco

	Estimated Load (lb/year)	Percent of Influent	Control Strategy	Partici-pation Factor	Loading Factor	Effective-ness Rating (2)	Estimated Reduction (lb/yr) (3)
Residential sources							
Human waste (1)	18	20%	Uncontrollable	0%	0%	0%	0
Laundry graywater	12.1	14%	Graywater systems	2%	100%	2%	0.2
Thermometers	5.9	7%	Outreach/ turn-in camp	20%	100%	20%	1.2
Contact-lens solution	2.2	2%	Public education	10%	100%	10%	0.2
	2.2	2%	Business outreach	30%	100%	30%	0.7
Other residential sources	0.36	0.40%	Public education	10%	100%	10%	0.036
Total identified residential	**38.6**	**43%**					**2.3**
Commercial/Industrial Sources							
Dental facilities	26.2	29%	Outreach-selected BMPs	50%	90%	45%	11.8
	26.2	29%	Regulatory program (4)	80%	90%	72%	7.1
Medical facilities	2.81	3%	Business outreach	80%	100%	80%	2.2
	2.81	3%	Pipeline cleaning	40%	30%	12%	0.3
Educational institutions	2.7	3%	Business outreach	70%	100%	70%	1.9
	2.7	3%	Pipeline cleaning	40%	20%	8%	0.2
Laundry	0.74	1%	Graywater systems	30%	100%	30%	0.2
Other commercial	0.4	0.44%	Business outreach	40%	100%	40%	0.2
Total identified commercial	**33**	**37%**					**24.0**
Unidentified and other sources	**17.5**	**20%**					
Total influent load	**89**						
Estimated reductions (% of influent)							
All strategies implemented	30%						
Dental outreach, thermometer turn-in, medical outreach only	17%						

[1] This source is uncontrollable, but dental control strategies that reduce use of dental amalgam may also reduce mercury loads from human wastes.
[2] Effectiveness equals the participation factor multiplied by the loading factor.
[3] Estimated reduction equals the effectiveness rating multiplied by the percent of total load.
[4] The calculated value for load reductions associated with regulating dentists equals 18.9 lb. However, that includes reductions assumed to have been achieved through outreach programs (11.8 lb). The resulting additional reduction for regulating dentists is 7.1 lb.

3.1.4 Information Obtained From Estimated Load Reductions

Several pieces of information useful in pollution prevention program planning can be obtained from estimated load reductions. First is identification of the most significant sources, which in this case include improper disposal of thermometers, human waste, laundry graywater, dental practices, and medical and educational facilities. Another important piece of information obtained from this analysis is which sources are amenable to controls. While human waste and laundry graywater are large sources, it is unlikely that there is an effective control strategy for either. Initial efforts should focus on other sources, including thermometers, dentists, and medical and educational facilities. Specifically, San Francisco chose to develop an outreach and turn-in campaign for mercury thermometers and to conduct outreach encouraging dentists to increase BMP implementation. Other information obtained from this exercise includes an estimate of how much of the total pollutant load can be accounted for by the identified sources. In this case, about 20% of the load may be attributed to unidentified sources. Finally, the reduction estimates give an agency a sense of how much it may achieve through source control. For example, for San Francisco, 17% is the absolute maximum reduction SFWPPP can expect to achieve by implementing the selected strategies. This allows the agency to set goals, compare program results to planning estimates, and assess whether source control alone will allow it to achieve the reductions necessary to meet regulatory requirements.

3.2 Existing Information Assessment

Some programs and pollutant issues do not lend themselves to the method described above because the sources are difficult to quantify, the necessary information is not readily available, or source identification is not applicable. However, most programs can benefit from an assessment of existing information. Once again, an essential first step in using this approach is to identify the specific pollutant issue of concern and determine the goal of the pollution prevention program. Assessment of existing information was used to plan pollution prevention strategies for the Woodland Oil and Grease Reduction Project and the Santa Monica New Development Program.

3.2.1 Woodland Oil and Grease Reduction Project Assessment

The Woodland Pollution Prevention Program Oil and Grease Reduction Project was initiated to identify and correct the source of oil and grease upsets in the collection system. For this purpose, project staff identified the collection-system sites with the most frequent problems, then traced backward to possible sources. Once various sources were identified, the team developed control strategies to forestall future problems, prioritized the strategies, implemented initial strategies, and evaluated the results (Larry Walker Associates 2000c). The steps in this process were similar to those followed for the estimated load reduction and included the following:

- Identify and assess sources.
- Determine available control strategies.
- Evaluate and prioritize strategies.
- Implement the program.

3.2.1.1 Identify and Assess Sources

In 1996, Woodland implemented a restaurant permit program to address oil and grease upsets in the city's wastewater collection system. Area restaurants generally have implemented the permit requirements and have a 95% compliance rate. The city also identified sources other than restaurants to address current collection-system issues.

City staff identified 21 specific problem locations in the collection system, then inspected areas within a few blocks of each site to identify the types of activities occurring upstream (i.e., those associated with single- or multiple-family residential neighborhoods, commercial or industrial areas, etc.). In addition, the staff reviewed callout records from January 1996 through August 1998 to quantify the issue, tabulating callouts coded as 0.33 ("clean plugged sewer main"), 0.32 ("clean plugged sewer service"), and 0.39 ("grease breaker"). For the period evaluated, 222 callouts were coded 0.32, 376 were coded 0.33, and 73 were coded 0.39. The staff mapped the locations of the 376 callouts coded as plugged sewer mains and found that 205 were associated with one of the problem sites.

Table 3-4 presents the results of the callout assessment and the site descriptions. The problem sites are listed in order of total plugged sewer-main callouts associated with each site. Eight sites had 16 or more of these callouts and, with one exception, all were in residential areas, located primarily near apartment buildings or high-density housing. The site with the most callouts was in an industrial area. Two of the top problem sites had restaurants immediately upstream in the collection system.

Table 3-4. Assessment of Woodland's Oil and Grease Problems

Site No.	Callouts in Response to Plugged Sewer Mains					Site Description
	1999	1998	1997	1996	Total	
9	8	4	7	6	25	Industrial
20		10	6	5	21	High-density housing
18	7	3	6	4	20	High-density housing, apartments, Pietro's, 929 Court
5	4	8	1	4	17	Residential
4	6	3	3	4	16	Apartments, school, roundtable
6	5	4	3	4	16	Restaurant (Lyons), 127 Main St., Woodland Manor Apartments, Purity Plaza
14	2	10		4	16	Apartments
17	10	3	2	1	16	Apartments, residential
12	3	1	3		7	Warehouses, 1180 Matmor – apartments
16	2	2		3	7	Residential
19	1	4	1	1	7	Restaurants
7	2	4			6	Mall, houses, Lyons restaurant, 164 Main St.
10	2		3	1	6	High-density housing
3		1		3	4	Apartments
8	1			3	4	Industrial
13	1	1	2		4	Restaurants, hotels, Denny's, 1568 E. Main St.
11	3				3	Warehouses, 555 Matmor
15	1	2			3	Hospital, school
21	1	1	1		3	Residential
1	1	1			2	Residential
2		2			2	Restaurants, high-density housing
Total	60	64	38	43	205	

3.2.1.2 Determine Available Source Control Strategies

The source assessment identified restaurants, apartments, and other residential areas as possible sources. Existing programs included the restaurant permit program, with a high compliance rate. Staff identified new strategies for restaurants, as well as strategies for apartments and other residential areas, including

- conducting additional outreach to restaurants,
- developing BMPs and distributing outreach materials to residents,
- educating apartment complex managers, and
- installing grease-collection bins at apartments.

3.2.1.3 Evaluate and Prioritize Strategies

Analysis showed that, due to the existing restaurant program, restaurants were a less significant source than residential areas. Therefore, the residential strategies were implemented first. Staff evaluated the option of installing grease-collection bins but considered it too expensive and difficult to maintain. They decided instead that outreach to and education of homeowners and apartment managers would be a better strategy.

3.2.1.4 Implement the Program

City staff implemented the program by producing promotional materials associated with cooking (potholders and can lids). These materials were imprinted with the slogan, "Grease goes from the pan to the can," and a comical illustration of a pan pouring grease into a can. Staff also distributed a card containing information on proper grease handling, as well as a flier printed in English and Spanish bearing the following message: "Cooking oils, grease and fat are great for frying and coating pots and pans. But, they also clog drain pipes and cause sewer pipes to back up. Keep your pipes running free! Cool down your cooking oil, grease and fat and pour them into a can—not down the drain. Trash the can—not your pipes. Also, please wipe out pots and pans with a paper towel before doing dishes—you will use less soap and decrease clogs." The cards also bore the City of Woodland Pollution Prevention Program logo, along with a phone number to call for more information. Staff distributed these materials at local grocery stores and three apartment complexes located in the problem areas. The outreach materials developed for the project are shown in Appendix B.

3.2.2 Santa Monica New Development Program Assessment

Santa Monica's Urban Runoff Pollution Prevention Program sought to improve its process for implementing mitigation requirements for new development projects. By city ordinance, each new development project must submit an Urban Runoff Mitigation Plan (URMP) that includes appropriate post-construction BMPs to reduce stormwater and urban runoff at project sites. To plan improvements for the New Development Program, city staff assessed the existing program with respect to how BMPs are implemented at new development sites and, overall, how well the current program was working (Larry Walker Associates 2000b). Based on the assessment, project staff developed a plan to improve the implementation process. The steps in this assessment included the following:

- Review the URMP process.
- Review records of submitted URMPs.
- Conduct site inspections.
- Assess the program and prioritize issues.
- Develop a plan to address the issues.

3.2.2.1 Review the URMP Process

The project team worked with Santa Monica staff to review the process by which URMPs are developed and submitted to the city. The team used this information to evaluate the current urban runoff mitigation planning process, which includes the following steps:

- A developer consults with the city planning office to determine the steps necessary to ensure that the development project complies with all city ordinances. The city

planning office will inform the project developer, among other things, if it is necessary to complete a URMP Worksheet and submit it with the development plans.

- Based on computations specified in the URMP Worksheet, if the estimated runoff from the property is greater than the specified maximum allowable runoff, urban runoff mitigation will be required.
- The developer submits the URMP Worksheet to the plan-check engineer in the Engineering Division of the Department of Environmental and Public Works Management for preliminary approval. If the engineer does not approve the worksheet, the developer must complete another one and resubmit it until it is approved. City staff indicated that initial worksheets submitted for single-family residences are approved about 85% of the time, and virtually all worksheets that were rejected the first time were accepted the second time. Worksheets for multiple-family and commercial projects were approved on first submission only 30% of the time. City staff say this is mostly due to the greater complexity of these projects, resulting from spatial constraints. (Unlike multiple-family and commercial plots, single-family residences do not take up the entire plot, so there is open space to work with.) Approximately 15% of multiple-family and commercial projects require more than two worksheet submissions.
- Once approved by the plan-check engineer, the developer must submit the URMP Worksheet to the Department of Environmental and Public Works Management's Engineering Division for final review and approval.
- The developer must call the city urban runoff coordinator before construction of the BMP is complete, so that it may be inspected. According to city staff, since 1999, more than 90% of all projects have been inspected.
- Assuming the BMP passes inspection and there are no other problems with the site, the city issues a Certificate of Occupancy.

3.2.2.2 Review Records of Submitted URMPs

Santa Monica staff supplied an urban runoff mitigation database containing information on mitigation projects in Santa Monica from 1993 through 1999. The database included information on 237 mitigation projects for which BMPs were identified. Table 3-5 summarizes the post-construction BMPs employed by the projects.

Table 3-5. Urban Runoff Mitigation Plan Review

Best Management Practice	Residential	Government	Commercial	Total
Subsurface/depression pit	80		1	81
Retention basin	33		7	40
Landscaping	14	4	13	31
Dry well	15	1	5	21
Permeable pavement	11	2	2	15
Gravel pit	10			10
French drain	8		1	9
Perforated pipeline to leach field	6		2	8
Gravel trench	2		5	7
End-of-pipe treatment			3	3
Catch basin	1		1	2
Parking-lot retention		1		1
Sump	1			1
Total	181	8	40	229

Table 3-5 lists 13 different post-construction BMPs. More than 70% of the plans reviewed used one of four BMPs (subsurface/depression pit, retention basin, landscaping, dry well). Although designed differently, subsurface pits, dry wells, and gravel pits are all used for the same purpose.

3.2.2.3 Conduct Site Inspections

The project team selected a representative group of post-construction BMP project sites from the urban runoff mitigation database to inspect. The project sites chosen were representative in terms of type of project (government, commercial, single family, multiple family), type of BMP (e.g., dry well, gravel pit, French drain), and geographical location.

The project team selected 13 project sites. Five were on commercial property, seven were on residential property (five single-family and two multiple-family residences), and one was on government property (a large project covering 26 blocks). In all, the sites employed nine different post-construction BMPs. The sites were geographically dispersed throughout the city.

The project sites were inspected to determine whether the BMPs had been implemented according to the mitigation plan filed with the city. Table 3-6 summarizes the inspection results.

Table 3-6. Best Management Practice (BMP) Assessment

Type	Description	BMP(s)	V[1]	M[2]	Notes
Government	Streetscape	Planted medians Permeable pavement	Y Y	Y Y	
Commercial	City college	Biofilters Parking lot retention	Y Y	Y Y	
Commercial	Restaurant	Dry well	Y	N	Dry well not at low point
Commercial	Office	Gravel beds Planters	Y Y	- Y	Construction incomplete Separated from parking lot by curb
Commercial	Auto service	Biofilter	Y	Y	
Commercial	Office	Permeable pavement	Y	Y	
Residential	Multiple family	Retention pond	Y	Y	
Residential	Multiple family	Permeable pavement	Y	Y	
Residential	Single family	Dry well	Y	-	Construction incomplete
Residential	Single family	French drain	N	-	Construction incomplete, BMP unobservable
Residential	Single family	Dry well	Y	Y	
Residential	Single family	Dry wells	Y	Y	
Residential	Single family	Sump French Drain	Y N	Y -	 No observable sign of BMP installation

[1]Verification - Was the BMP present?
[2]Maintenance - If the BMP was verified and completed, was it properly maintained?

Of the 17 BMPs inspected, 15 (88%) were verified. At two sites, the project team and city staff were unable to verify the existence of a BMP mitigation, but this does not necessarily mean that it did not exist. In both cases, the BMP mitigation project type was a residential, single-family dwelling surrounded by a fence. To avoid trespassing, the inspection was limited to what could be observed from the street. Additionally, with the exception of one BMP mitigation site, all of the completed BMPs seemed to be well maintained. However, two BMPs were not optimally designed or placed, limiting their effectiveness. Nevertheless, city staff approved these designs. Finally, in a purely subjective assessment, no BMP mitigation had a negative impact on the appearance of a site; all were either invisible or (in the case of planters, biofilters, and some types of permeable pavement) improved the site's aesthetics.

3.2.2.4 Assess the Program and Prioritize Issues

The project team evaluated the BMP mitigation planning process to identify issues and needs. The results showed that while the urban runoff mitigation process is generally effective, the efficiency of the process could be improved in some areas. Based on BMP mitigation site

inspections and interviews with city staff, the project team identified four potential areas for improvement:

- Educating city staff.
- Educating applicants.
- Redesigning the URMP Worksheet.
- Initiating onsite inspections.

Educating City Staff. City staff could be better educated regarding BMPs. This problem was apparent at two inspection sites where planners had approved BMPs that were poorly designed or placed. The most direct way of dealing with this weakness would be to develop an educational program (such as an in-house workshop or reference literature) for the city staff members with authority to approve URMPs. The program's purpose would be to familiarize the staff with current requirements regarding the necessity, simplicity, aesthetics, and effectiveness of various BMPs.

Educating Applicants. Applicants (architects and engineers) could be better educated about BMPs. This problem became apparent in interviews with the city plan-check engineers, who have the authority to approve URMP worksheets. Particularly in the commercial development sector, and to a lesser extent in the residential sector, the worksheets that applicants submitted were not approved the first time. As with the previous area for improvement, this issue could be handled most directly by developing an educational program targeting applicants. The program's purpose would be to enlighten the architects and engineers who design the BMPs regarding the specific BMPs and designs that will be approved. City staff indicated that in the commercial sector they deal with many of the same architects and engineers from project to project. A one-time educational program targeting these architects and engineers could improve the percentage of worksheets approved following their initial submission.

Redesigning the URMP Worksheet. The URMP Worksheet could be redesigned to be easier to follow. City plan-check engineers indicated that, of the worksheets that are rejected, a significant number were filled out improperly. Perhaps a more thorough description or a simplification of the worksheet would improve applicant performance in this area.

Initiating Onsite Inspections. Onsite inspections are needed to ensure that BMPs are constructed properly. In some cases, the city engineer approves an effective design, but the BMP is constructed in a way that is contrary to the design. This situation can be addressed only through onsite inspections. The city has increased its inspection rates, but educating staff regarding proper BMP design is also needed.

3.2.2.5 Develop a Plan To Address the Issues

Of the issues identified, the project team determined that the need to educate city staff and the building community should be assigned higher priority than the need to redesign the URMP Worksheet. In addition, the Los Angeles Regional Water Quality Control Board recently had approved more stringent standards for urban runoff that would impact the New Development Program. Therefore, project staff decided to develop and conduct workshops for city staff and the building community regarding stormwater regulatory requirements and post-construction BMPs for new developments.

3.2.3 Information Obtained From Existing Information Assessments

Using information obtained from assessing existing information sources may seem obvious. At one level, compiling information in one place provides a good overview of the program

and may be useful in identifying gaps and future program directions. The information will also be useful for establishing a baseline or starting point for future work, making future program evaluation simpler. With respect to facilitating evaluation, information assessment also can be used to identify types of information that may be collected easily, as well as simple steps that can be taken to improve the quality of information obtained in the future.

3.3 Assessment of Planning Tools

The planning tools described above in each case were useful in identifying major sources of pollutants of concern or, in Santa Monica's case, major program needs. Obtaining the information typically is straightforward but may be time consuming. The assessments described cost between $8,000 and $10,000. This expense is primarily associated with the staff time required to gather and analyze the information and assumes the information needed for these approaches can be obtained through the literature or agency records. If the type of information required to assess a program issue is not available electronically, this approach is more time consuming. Costs associated with water quality monitoring that may be necessary to develop some of the information used in the estimated load reduction approach are not included.

The estimated load reduction approach requires gathering a great deal of information about a service area, such as the numbers and types of businesses, and flows and concentrations associated with residential and business wastewater discharges. If this information is available, this tool can be extremely valuable for assessing a pollutant issue and determining the best strategies to address the issue. Information on numbers and types of businesses often is obtainable through pretreatment program industrial-user surveys, city business-license records, and telephone yellow-page directories. The information obtained through these types of records should be verified by physical inspections and site visits to commercial areas. Concentration and flow of wastewater discharges from nonindustrial activities may be more difficult to obtain. In some cases, other agencies may have monitored commercial or residential sources, and the data may be used as estimates of pollutant levels associated with these sources. Appendix A includes a list of resources providing good starting points for obtaining pollutant source data from other agencies. If applicable data are not available from outside sources, an agency may need to conduct its own monitoring in order to employ this technique. Water-use and billing records often are available and provide good estimates of wastewater flowrates. Otherwise, flow data may be obtained using estimates from other agencies.

Assessing existing information requires a clear description of the issue to be addressed and clear identification of the program's goal. Once this is accomplished, the type of information that would be useful to characterize the issue can be determined and the appropriate information gathered. For Woodland, the problem was that collection-system backups continued to be a problem despite a restaurant program with high compliance rates. The approach was to try to quantify where and how often backups were occurring. This required obtaining and reviewing collection-system records and organizing them by locations, followed by visiting those locations and recording what activities were occurring immediately upstream. For Santa Monica, the issue was to understand the New Development Program better by determining whether builders understood the process and were using appropriate post-construction BMPs to meet the city's requirements. Therefore, project staff reviewed city records with these issues in mind, which resulted in sorting projects by BMPs.

CHAPTER 4.0

TOOLS TO MEASURE INCREASED AWARENESS

The goal of reducing pollutant inputs to the environment often relies on residents or commercial activities voluntarily making a change. The first step to achieving this goal is to increase public awareness of the pollution issue. The survey is the primary tool used to assess increases in awareness. Surveys may take various forms, including telephone, mail, and intercept surveys. In addition to measuring an audience's awareness, these effectiveness measurement tools can gather information about members of the target audience, who they are, what they like, and how advertising has influenced them to change behavior. Whatever tool is selected, the process begins by determining what specific information should be collected to accomplish a project goal. The method used will vary depending on the research objectives. As Table 4-1 shows, each type of survey was used in at least one demonstration project to measure increased awareness.

Table 4-1. Awareness Surveys Used in Demonstration Projects

Survey type	Demonstration Project	Target Audience
Phone survey	Mercury Reduction Project (thermometer turn-in campaign)	Residents (thermometer owners)
	Healthy Gardens Program	Residents
	Lindane Reduction Project	Healthcare professionals
Mail survey	Healthy Gardens Program	Residents
Intercept survey	Used Oil Recycling Outreach Campaign	"Do-it-yourselfers"
	Oil and Grease Reduction Project	Residents

This chapter describes these surveys and their use in the demonstration projects. In addition to measuring increased awareness, several surveys attempted to measure behavior change. This also is discussed as part of the survey results.

Another tool related to surveys described in this chapter was used to assess the effectiveness of increasing awareness with respect to Santa Monica's New Development Program requirements. The project used workshops to educate city staff and members of the building community about these requirements. Workshop participants took tests before and after the workshop to assess their knowledge.

4.1 Phone Surveys

Phone surveys are often conducted to assess public awareness of environmental issues. Such surveys are considered quantitative (statistically valid) when they are conducted using a randomly selected group large enough to be statistically representative of the overall target audience. Three demonstration projects used phone surveys. In two cases, the Davis Healthy Gardens Program and the Los Angeles County Sanitation Districts (LACSD) Lindane Reduction Project, surveys were conducted under separate funding not associated with the overall project; however, they are directly relevant to the other effectiveness measurements conducted for the larger project.

4.1.1 Healthy Gardens Program Evaluation

As discussed in Chapter 2, the City of Davis used surveys and water quality monitoring to evaluate its pesticide education campaign, the Healthy Gardens Program (Larry Walker Associates 2000a).

To answer questions regarding residents' awareness of the environmental impact of pesticides and the availability of less-toxic alternatives, university students first conducted a telephone survey under the direction of a professor with expertise in survey administration and statistical analysis (see Appendix C for the text of the survey). The initial goal was to conduct 250 interviews. However, responses to the survey were lower than expected, with 120 interviews completed. The surveys also were time consuming (requiring between 5 and 10 minutes per call) and labor intensive. Therefore, the team devised a mail survey to supplement the phone survey, then combined the results. These are discussed in greater detail in the section on mail surveys, below.

Some questions included in the phone survey were not asked in the mail survey. These questions were used to assess overall changes in Davis residents' awareness regarding water pollution. The same questions had been asked as part of a water use survey conducted in 1996. Since that time, the city has engaged in a variety of efforts, including the Healthy Gardens Program, to increase public awareness of water pollution and watershed issues. The 1996 and 1999 responses to these questions are compared below.

4.1.1.1 Practices for Disposing of Hazardous Household Products

The survey team compared responses to general questions regarding disposal of various household products to responses to the same questions in the 1996 survey, with some interesting results. Both telephone surveys used open-ended questions to ask participants how they dispose of motor oil, house paint, pesticides, and cleaning products. A significant portion of survey respondents in both 1996 and 1999 indicated that they used the city disposal programs. However, in each case, the percentage that reported using the city program decreased between the two periods. With respect to used motor oil, in 1996, 47% of respondents reported using the city disposal programs; in 1999, only 38% reported doing so. At the same time, respondents who reported using a commercial garage to change their oil increased from 26% to 38%, and the number who reported not using motor oil increased from 3% to 13% between 1996 and 1999. There were slight decreases in the proportions of survey respondents who reported using the city disposal programs for house paint (from 50% to 45%) and pesticides (from 38% to 35%). There was an increase in the proportion of respondents who reported not using these items (from 3% to 26% for house paint and from 2% to 26% for pesticides)

4.1.1.2 Knowledge About Differences Between Wastewater and Stormwater

The team also compared answers to questions about the destinations of wastewater and stormwater in the 1996 and 1999 surveys. In response to the open-ended question, "When you take a shower, do laundry, or flush a toilet, where do you think the wastewater goes after it disappears down the drain in your house?" 37% of survey respondents in 1996 said it went to a wastewater treatment plant; in 1999, 82% of the respondents gave that response. With respect to the destination of stormwater runoff ("When you wash your car and the water runs into the gutter and storm drain, where do you think the water goes from there?"), 39% of the survey respondents in 1996 thought that stormwater also receives treatment; the proportion decreased slightly, to 34%, in 1999. However, the percentage of respondents who thought stormwater runoff goes to ponds in Davis increased from 3% to 14% between 1996 and 1999. In addition, the percentage saying that stormwater goes to the river, ocean, or other waterway increased from 14% to 29% between 1996 and 1999.

4.1.2 Thermometer Turn-In Campaign Evaluation

As discussed in previous chapters, after considering the results of its source analysis, the San Francisco Water Pollution Prevention Program (SFWPPP) decided to pursue a program to encourage residents to stop using mercury thermometers. In partnership with the Solid Waste Management Program, the Department of the Environment and the San Francisco Fire Department, SFWPPP initiated an extensive public education and outreach campaign designed to encourage residents to turn in mercury thermometers for recycling and thereby keep mercury out of San Francisco Bay and the ocean. Every Saturday in May, anyone who turned in a mercury thermometer at one of nine fire stations received a new digital thermometer. Outreach activities included the following:

- distribution of 400,000 water-bill inserts and Val-Pak direct-mail marketing pieces sent to San Francisco residents;
- a large media event held at a fire station near the San Francisco Bay Bridge, with prominent city dignitaries distributing new digital thermometers to more than 70 school children;
- a news advisory and press kits sent to 403 media outlets;
- local television news stories featuring the event on four channels, including local Spanish- and Chinese-language stations;
- print coverage by the city's two major daily newspapers and several ethnic and neighborhood newspapers;
- 30- and 60-second public service announcements;
- distribution of $2-discount coupons for a new, mercury-free thermometer;
- posters, brochures, and newsletter articles for reprint; and
- banners for collection events.

Most of the written materials were available in English, Chinese, and Spanish. The thermometer turn-in campaign was evaluated using a before-and-after phone survey (David Binder Research 2000). The following sections describe the procedure used, the survey results, and an assessment of the information obtained.

4.1.2.1 Procedure

A public opinion firm conducted two random-digit-dial phone surveys to assess knowledge and attitudes regarding mercury thermometers and determine the impact of the public awareness campaign. The two surveys each randomly polled 400 San Francisco residents and were identical in content. The first survey, conducted in March, was conducted prior to the

SFWPPP public awareness campaign regarding mercury reduction; the second survey was conducted in June, following the campaign (see Appendix C for the text of the surveys).

The following questions were asked in each survey:

- Do you own at least one thermometer?
- What type of thermometer do you use most of the time?
- Why do you use this type of thermometer?
- What would make you more likely to buy a digital thermometer instead of a mercury thermometer the next time you buy one?
- Have you ever broken a mercury thermometer?
- How have you or how would you dispose of a broken mercury thermometer?
- Have you received any information from the City of San Francisco regarding the use of mercury thermometers?

4.1.2.2 Survey Results

According to the survey results, about 69% of San Francisco households own thermometers. Of these, about half (52%) use mercury thermometers, while a somewhat lower portion (40%) use digital thermometers. Less than 10% of residents owning thermometers use either alcohol-based thermometers, "fever strips," or ear thermometers. These percentages were essentially the same (within two percentage points) for both the pre- and post-survey. The margin of error for both surveys is 4.9%.

Table 4-2 shows the demographic subgroups exhibiting above average usage of mercury thermometers.

Table 4-2. Groups Most Likely To Use Mercury Thermometers

	Precampaign (%)	Post-campaign (%)
Average mercury thermometer usage	52	52
Residents over 65	61	60
Women over 50	70	63
African-Americans	60	63

Table 4-3 shows the demographic subgroups most likely to use digital thermometers. The data show a significant increase between the precampaign survey and the post-campaign survey in the number of households with children that are most likely to use digital thermometers (from 48% to 61%).

Table 4-3. Groups Most Likely To Use Digital Thermometers

	Precampaign (%)	Post-campaign (%)
Average digital thermometer usage	39	40
Households with children	48	61
Residents under 40	46	46
Latinos	47	49

Table 4-4 shows the results of responses to an open-ended question regarding why residents who own thermometers chose the type of thermometer they currently use.

Table 4-4. Reasons for Using Thermometer Types

	Precampaign (%)	Post-campaign (%)
Ease of use	39	49
Cost	12	9
Accuracy	10	6
Safety	1	4
Unaware of other types	7	5

Table 4-5 illustrates how responses to the same question vary according to the type of thermometer the respondent uses. Table 4-5 presents the responses as averages of pre- and post-campaign responses because, except as noted, the responses were similar.

Table 4-5. Reasons for Owning a Thermometer (Average Responses, Pre- and Post-test)

Type of Thermometer Used	Cost (%)	Ease of Use (%)	Accuracy (%)	Unaware of Other Types (%)	Safety (%)	"One I've always had" (%)	Better for Environment (%)	Other (%)	Don't Know (%)
Mercury	15	33*	7	10	2	21	1	13	12
Digital	4	60	12	2	6	1	2	10	7
Other types	19	49	5	0	4	0	0	12	13
Total residents	11	45*	8	6	4	12	1	12	10

*Pre- and post-campaign survey results were significantly different.

Mercury thermometer owners were more likely than others to say they owned a mercury thermometer because it was the "one I've always had." Digital thermometer owners were more likely than others to say they owned a digital thermometer due to its ease of use and accuracy and less likely to cite cost as a factor. Mercury thermometer users would buy a digital thermometer the next time they need to purchase a thermometer if it cost less (24% to 29% of survey respondents), was more accurate (10%), or was easier to use (10% to 20%). Between 17% and 20% said they would not buy a digital thermometer under any circumstances.

Based on responses from the post-campaign survey, residents over the age of 50 have an above-average likelihood of saying they definitely will not change the type of thermometer they use (30%), while those under 50 are much less likely to provide this response (10%).

About two-fifths of San Francisco households (39% in the post-campaign survey and 42% in the precampaign survey) say they have broken a mercury thermometer in the past. Larger households, those with four or more members, are more likely to have broken a mercury thermometer (45% in the post-campaign survey). When asked how they would dispose of a mercury thermometer if it broke, well over half of the respondents (60% in the post-campaign survey and 58% in the precampaign survey) said they would throw the entire thermometer and its liquid in the garbage. Another one-fourth of the respondents (25% and 26% in the post- and precampaign surveys, respectively) say they do not know what they would do, while about 10% offer several other disposal alternatives, including between 2% and 3 % who say they would wash it down the drain.

In response to the final nondemographic question in the survey, 4.4% of San Francisco the respondents say they have received information from the city regarding the use of mercury thermometers, a 3.8% increase over the first survey and within the surveys' margin of error.

4.1.2.3 Information Obtained

The phone surveys provided an assessment of thermometer owners' attitudes, knowledge, and practices regarding mercury thermometers. The responses characterized the type of people most likely to own mercury thermometers and what might convince them to buy mercury-free thermometers. It also indicated that 2% to 3% of thermometer owners are likely to dispose of mercury from a broken thermometer down the drain. While this is a small portion, it is sufficient to have an impact on wastewater mercury loadings. The portion of the total population disposing of mercury thermometers this way, as used in the estimated loading reduction described in Chapter 3, is 1.8%. This is consistent with 2% to 3% of thermometer owners (thermometer owners comprise 69% of San Francisco's population). Using 1.8% resulted in the loading from improper disposal representing a maximum of 7% of the total annual wastewater influent mercury loading (depending on the portion of the 1.8% that break a thermometer in a given year).

The findings from both surveys, which are remarkably similar, suggest that while the public awareness campaign successfully took almost 5000 mercury thermometers out of circulation from approximately 3300 households, public awareness among the citywide population regarding mercury thermometers did not increase significantly. This finding is logical, considering there are approximately 335,000 household in San Francisco. Therefore, 3300 households responding to the public awareness campaign and turning in mercury thermometers represents less than 1% of total households in San Francisco. Coincidentally, this is consistent with the survey responses to the question regarding whether residents had received information from the city about mercury thermometers. It is likely that a much larger, longer public awareness campaign is necessary to change public awareness and opinions in such a large population.

Furthermore, the relatively unchanged level of public awareness regarding mercury thermometers observed in this project provides important information for structuring future public awareness projects. It suggests that in a focused public awareness campaign, polling (phone surveys) may be more valuable in identifying a target audience for the campaign than in gauging an overall change in awareness among a large population as the result of one brief campaign. Surveys may be more effective in measuring the effects of long-term outreach efforts.

4.1.3 LACSD Lindane Reduction Project Survey

LACSD conducted a pilot project to determine if an outreach campaign could reduce wastewater influent levels of lindane. Project staff used a variety of tools, including a phone survey, to measure the campaign's effectiveness.

4.1.3.1 Procedure

LACSD conducted pre- and post-outreach surveys of the target audiences—doctors, pharmacists, daycare centers, and school nurses—to quantify changes in behavior as a result of the campaign and determine which outreach materials the audiences found most useful. Project staff conducted the pilot project in two cities in Los Angeles County, Long Beach and Burbank. Therefore, for the survey, the staff contacted approximately 30 people (15 in each city) to represent each type of target audience. When possible, the same persons surveyed prior to the outreach program were surveyed after the program's conclusion.

4.1.3.2 Survey Results

The most important information came from the doctors surveyed, as lindane is only available by prescription. If doctors do not prescribe lindane, then it will not be present in the wastewater collection system. Of the 27 doctors contacted for the pre-outreach survey, 22 (81%) said they prescribed lindane, while 13 (57%) of the 23 doctors contacted for the post-outreach survey said they did so. Pharmacists also indicated a behavior change caused by the outreach program. In the pre-outreach survey, only half of the pharmacists said they would mention to doctors that lindane is harmful to humans and the environment, while in the post-outreach survey, 14 of 15 said they would mention this information.

The survey results also indicate a strong change in awareness among the target audiences with respect to lindane's harmful properties. In the pre-outreach survey, 69% of the target audience respondents were aware that lindane is highly toxic to humans and 32% were aware that it pollutes the environment. In the post-outreach survey, 95% were aware that lindane is highly toxic to humans and 95% were aware that it pollutes the environment. All of the doctors, pharmacists, and school nurses indicated awareness in the post-outreach survey that lindane is highly toxic to humans and pollutes the environment; the only respondents unaware of these facts were a few daycare providers.

The surveys were also used to assess the outreach material designed for the project. Of those surveyed, 76% stated that they used the outreach materials. Nurses were most likely to use the outreach materials, with 86% stating they had used them. Daycare providers were least likely to use the materials, with only 67% stating they had used them. The projects' flyers were the most commonly used items; 46 of those surveyed said they had used them. The LiceMeister combs were also found to be useful, with 29 survey respondents saying they used them. Thirteen respondents said they used the posters, six reported using the refrigerator magnets, four said they used the videos, and three reported using the Rolodex cards.

The surveys further indicated that the hotline and Web site for the project were not much used by the target audience. Only one school nurse and one daycare provider said they had called the hotline. Two school nurses indicated they had visited the project's Web site.

4.1.3.3 Information Obtained

The phone surveys conducted for the lindane-reduction project were not based on a randomly selected sample, in that an attempt was made to contact the same people for the precampaign survey and the post-campaign survey. On the other hand, the survey team contacted a significant portion (more than 10%) of the target audience. Although the surveys were not strictly quantitative, they provided a good characterization of the target audience and valuable information for the project. LACSD used the precampaign survey results to guide planning of the campaign, especially with respect to messages. Comparison of pre- and post-campaign survey results showed significant changes in practices regarding lindane by doctors and pharmacists, and a significant increase in awareness regarding lindane's health and environmental impacts. In addition, LACSD was able to identify the most effective outreach items (flyers, combs, posters) and the least effective methods (the hotline and Web site).

4.2 Mail Surveys

Mail surveys can be quantitative like phone surveys but are less labor intensive and therefore may be less expensive than phone surveys. In addition, they can be used to supplement the results of a phone survey, as was done for the Davis Healthy Gardens Program.

To supplement the phone survey, the Healthy Gardens Program evaluation used a written survey containing questions identical to a portion of the phone survey questions. The purpose of the surveys was to answer the following questions:

- Do Davis residents recognize the logo and title of the program?
- Do they remember the message of the program?
- Do they understand the connection between pesticide use and pollutants found in local waterways?
- Where have they seen this information displayed?
- Have they made any changes in their gardening or pest control practices as a result of the program?

4.2.1 Procedure

The survey was printed on two sides of a single page, with questions on one side and examples of the outreach materials on the other (see Appendix C for the text of the survey). The survey and a preaddressed, stamped return envelope were mailed to 500 randomly selected Davis residents. Within 2 weeks after the surveys were mailed, 198 people (40%) responded.

The survey's objectives were to determine the impact of the Healthy Gardens Program on Davis residents' awareness of pesticide water pollution and their behavior associated with pesticide use, and to determine the most effective methods of providing pesticide information. A total of 340 surveys were completed (142 telephone and 198 mail surveys). For most questions, there was no significant difference between responses to the telephone and mail surveys, so the responses were combined.

4.2.2 Survey Results

This section summarizes the survey findings.

4.2.2.1 Sources of Pesticide Information

When asked where respondents received information about pesticide use, the largest portion (36%) of 208 respondents indicated they received information from the University of California–Davis, through extension education or environmental classes, or both. The second most frequently mentioned sources of pesticide information were local nurseries and pesticide retailers (mentioned in 16% of responses). In addition, a significant portion of respondents (14%) reported receiving information from gardening magazines, many of them specifically mentioning *Sunset* magazine.

4.2.2.2 Recall of Receiving Pesticide Information From the City

Approximately 23% of 269 survey respondents remembered receiving information about pesticide use from the city or community, primarily through the city's newsletter and pamphlets.

4.2.2.3 Recall of Healthy Gardens Program

Of the 180 respondents who answered questions regarding their recall of Healthy Gardens Program elements, 47% recalled the program and most frequently mentioned the North Pond signs (13%) and movie theater slide (11%). The ladybug logo and demonstration signs were recalled almost as frequently (9% each).

4.2.2.4 Where Program Information Was Seen

Of the 88 people who remembered seeing Healthy Gardens Program material, 24% recalled seeing it at North Pond and 19% remembered seeing it at the farmers' market. Another 16% mentioned seeing the material at the Davis movie theaters and local stores, while 10% mentioned seeing it in the newspaper. There was no relationship between where people live in Davis and which program elements or locations were mentioned. This is true even for North Pond, which was mentioned equally by people living in all areas of Davis, not only in North Davis, where the pond is located.

4.2.2.5 Knowledge of the Program Message

Of 180 survey respondents, 18% knew that the Healthy Gardens Program message was to reduce pesticide use and prevent pesticides from entering local waterways.

4.2.2.6 Behavior Changes Resulting From the Program

In addition to raising awareness, another goal of the Healthy Gardens Program was to encourage residents to reduce pesticide use and handle pesticides properly. Of 105 mail survey respondents, 17% indicated that information they had received from the city caused them to change their gardening or pesticide-use practices, while 4% of 69 telephone survey respondents responded in this way.

4.2.2.7 Awareness of Pesticides as a Water Pollution Source

Davis residents did not seem to be very aware of the relationship between pesticide use and water pollution. Respondents said they rarely used pesticides, rarely think about water pollution, and rarely use integrated pest management. In addition, few respondents seem to know what integrated pest management is, based on responses to a question asking for a definition of the concept. Respondents indicated that they think about water pollution when applying pesticides "sometimes," as opposed to "rarely."

4.2.3 Information Obtained

Davis used the results of the telephone and mail surveys to assess the impact of its outreach efforts. The results indicated an awareness of the program and some behavior change as a result of the program. In addition, the survey provided information regarding the types of outreach and locations that work best in Davis. The city has used these results to plan outreach in subsequent years of the program.

4.3 Intercept Surveys

Intercept surveys involve conducting short interviews from a fixed location, typically a place where the target audience is likely to be found. Intercept surveys are not quantitative and are limited to whoever visits the selected survey location. Even so, useful information regarding the target audience can be obtained through this approach. As with other types of surveys, planning is important and focuses on how to conduct and frame the survey.

4.3.1 Considerations in Developing and Conducting Intercept Surveys

4.3.1.1 Appropriate Venue

Once the target audience is known, the question becomes, "Where can they be found?" Project staff should take some time to brainstorm this, listing all possible venues. Once reviewed and fleshed out, some locations will show greater promise, for one reason or another. If the survey area is large, it may be important to conduct the survey concurrently at different locations, keeping the type of venue the same (e.g., auto parts stores). This maintains consistency between the surveys and enables development of a profile describing the target audience. From a logistical standpoint, it may be necessary to complete request forms or secure appropriate permits to conduct the survey at the location chosen.

4.3.1.2 Appropriate Timing

When is the best time to reach the target audience? The answer will include the day of the week and the time of day. Holidays, sporting events, and local observances and events affect turnout.

4.3.1.3 Appropriate Survey Staff

It is important to select individuals to conduct the survey who are personable and approachable. This involves the issue of what makes people comfortable talking to a stranger. Individuals who face a language barrier are more comfortable talking with someone who speaks their language. Others are more approachable by someone the same age or "appropriately" attired. Someone recognizable, such as a person who is "out and about" in the community and knows many in the neighborhood, will make potential respondents comfortable and may even motivate them to approach the project staff member, rather than waiting to be approached.

4.3.1.4 Survey Type

The type of survey used will be a function of the target audience and conditions of the survey location. Surveys can be oral or written. To ensure responses, survey questions should be focused. Questions that cannot be answered with a simple yes or no should be accompanied by a list of possible answers from which the respondent can choose.

4.3.1.5 Coding Surveys

If the same survey is administered in multiple locations, it may be necessary to distinguish among the surveys conducted at different locations. Coding the survey can accomplish

this. The coding need not be complicated and can be as simple as using different colored paper for different locations.

4.3.1.6 Survey Language

If different members of the target audience speak different languages, it is important to make the survey available in the predominant languages. Commercial services exist that can provide the appropriate translations. It also may be useful to use surveyors who can speak the languages involved.

4.3.1.7 Motivation

It may be worthwhile to consider incentives to motivate the target audience to participate in the survey. These need not be expensive. In some instances, products that remind people of best management practices (BMPs) are appropriate, including such items as magnets, pens, and bookmarks; other times, an incentive such as a lottery ticket can be effective.

4.3.1.8 Conducting the Survey

Factors to consider when conducting the intercept surveys include

- establishing a survey location that allows the greatest contact with the target audience;
- if appropriate, using screening questions to ensure that the target audience is being surveyed;
- asking people to complete the survey (if the questions are few and uncomplicated, the survey may be completed without asking the person if they wish to participate);
- for written surveys, remembering to retrieve the survey before the respondent leaves; and
- remembering to thank respondents and present them with the predetermined incentive.

The following sections discuss how these principles were used to conduct intercept surveys for the Woodland and Los Angeles County projects.

4.3.2 Woodland Oil and Grease Reduction Project

Woodland developed an outreach program to encourage residents to throw used cooking oil in the trash instead of pouring it down the drain. Project staff developed outreach materials, which they distributed at grocery stores and apartment complexes, and conducted intercept surveys to measure the campaign's effectiveness (Larry Walker Associates 2000c). The staff conducted surveys during an event in July, when the outreach materials were first distributed, then conducted follow-up surveys in November to determine if any change in behavior had occurred.

4.3.2.1 Procedure

Project staff scheduled four events to distribute outreach materials to Woodland residents. Two grocery stores, the Woodland Super Saver and Food-for-Less, were chosen based on their proximity to problem sites, and two dates (one weekday evening and one weekend morning) were scheduled for each. The surveyors sat behind a card table in front of a poster printed with the program information and slogan and handed out potholders, can lids, and fliers to interested shoppers. At least one Spanish-speaking surveyor was present at each event. An identical procedure was used to conduct the follow-up interviews in November. Table 4-6 summarizes responses to the events.

Table 4-6. Intercept Survey Respondents

Event	Location	Total Surveyed	From Woodland
July 2000	Supersaver	137	118
	Food-for-Less	151	118
	Total	288	136
November 2000	Supersaver	120	101
	Food-for-Less	149	110
	Total	269	211

In each case, more people were interviewed on the weekend morning than on the weekday evening.

4.3.2.2 Survey Results

Project staff developed seven survey questions to determine how often people living in Woodland cook with oil or grease and how they dispose of the material after cooking. One question was designed to determine whether the respondent lived in a house or an apartment, and if in an apartment, whether it was one of three known to have relatively frequent grease clogs. People who did not live in Woodland were not included in the survey, but were thanked and given the handouts. The same procedure was used for the follow-up event, except people were also asked if they had seen the outreach materials previously. Table 4-7 summarizes the results.

Table 4-7. Grocery Store Intercept Survey Responses

Question	Answer Choices	First Event (June)		Second Event (November)	
1. Woodland resident?	Yes	236		214	
	No	52		55	
2. Cook with oil? (times per week)		Range: 0–21	Average: 4.9	Range: 0–20	Average: 4.2
3. Recognize materials?	Yes	N/A		9	
	No	N/A		180	
	No answer	N/A		25	
4. Disposal method (includes multiple answers)	Down drain	46		62	
	In trash	150		76	
	In a can/jar	15		78	
	Feed pet	2		6	
	Other	27		36	
5. House or apartment?	House	158		149	
	Apartment	71		59	
	Target apartments	9		8	
6. Number in household?		Range: 1–22	Average: 3.9	Range: 1–8	Average: 3.7
7. Number in household under 18?		Range: 1–18	Average: 1.6	Range: 0—6	Average: 1.4

The majority of respondents (69% in June, 59% in November) said they put their oil and grease in a can and dispose of it in the trash. However, a significant portion (19% in June, 24% in November) said they dispose of their oil and grease down the drain. No decrease occurred from June to November in the proportion of respondents indicating disposing of oil down the drain. Rather, the proportion of those reporting disposing of oil improperly increased, while the proportion of those reporting proper disposal decreased. This is consistent with the small number of respondents (9 out of 214) who recalled the outreach materials.

Beyond the basic information provided by the survey responses shown above, the survey allowed additional characterization of the target audience. Project staff used the responses to determine if a relationship exists between disposal practices and size of household, frequency of cooking with oil, and type of housing. There was no obvious correlation between disposal practices and the number of times per week respondents reported cooking with oil or the number of people in their households. However, as shown in Table 4-8, the results of both the June and November surveys indicate that people who live in apartments are more likely to dispose of oil down the drain.

Table 4-8. Oil Disposal in Houses Versus Apartments

Housing Type	Event	Total Surveyed	Number Disposing Down the Drain	Percentage Disposing Down the Drain
Apartments	June	71	19	27
Houses	June	158	25	16
Apartments	November	57	25	44
Houses	November	145	34	23

4.3.2.3 Information Obtained

The objectives of the grocery store intercept surveys were to characterize the target audience and assess the effectiveness of the outreach campaign. The survey results indicated that a significant portion (19% to 24%) of the residents in the areas evaluated dispose of used cooking oil improperly by pouring it down their sink drains. In addition, the results indicated that apartment dwellers are more likely than people living in houses to pour oil down the drain. While the intercept surveys are not strictly quantitative, the fact that the results were similar during two separate survey events would make one more confident in using these results to guide future program planning. Specifically, it appears that a significant portion of residents near the problem areas dispose of oil and grease improperly and targeting apartment complexes for future outreach is an appropriate approach. With respect to outreach effectiveness, there was no indication that people had changed their practices to dispose of used cooking oil in the trash, and only 4% of those surveyed recognized the outreach materials. This is not surprising, because even though the right audience was targeted, the amount of outreach was limited. Future campaign efforts should include additional exposure to the message, perhaps through radio or newspaper articles and additional communication to apartment complexes.

With respect to the outreach approach, using a Spanish-speaking person turned out to be advantageous. In several instances, people only agreed to participate after they were spoken to in Spanish. This is useful information for Woodland when planning future outreach efforts.

4.3.3 Los Angeles County Used Oil Recycling Outreach Campaign

For the last several years, Los Angeles County has been promoting used-oil recycling and, more recently, oil-filter recycling through a variety of media and public education programs. The county selected an intercept survey to obtain information about whether the general public remembered the advertising campaigns and determine what effect the campaigns had on people's behavior (Flint 2000). In this instance, the intercept survey was focused to determine whether respondents who saw or heard advertising in the last six months had altered their recycling and disposal behavior within that period.

4.3.3.1 Procedure

To measure the campaign's effectiveness, a marketing research specialist developed a questionnaire for an intercept survey designed to determine whether the target audience saw and remembered any of the advertising campaign elements. The target audience for this survey was individuals who change their motor-oil, oil-filter, and other automotive fluids themselves—i.e., "do-it-yourselfers" (DIYs). The initial list of potential venues for the survey included car shows, speedways, monster car rallies, local car shows, and automotive stores. After considering the possible venues, project staff chose auto parts stores, evaluated locations throughout the county, and decided to conduct surveys concurrently at four stores. Staff determined that the best day and time to reach DIYs was Saturday morning and that bilingual males from two age groups (18 to 30 and 30 to 40) should conduct the survey. Staff prepared a

written questionnaire in English and Spanish, which was printed using four different colors of paper to distinguish among the four survey locations.

A bilingual community relations specialist contacted and made arrangements to conduct the intercept study in four Kragens Auto Supply stores throughout Los Angeles County. She and three bilingual (English–Spanish) colleagues spent approximately 3 hours in each store on Dec. 11, a Saturday and the busiest day of the week for this type of store and the target audience. To encourage store customers to participate, the survey team offered two lottery tickets to each person who completed the questionnaire. The team collected a total of 188 completed surveys (99 in English and 89 in Spanish). Table 4-9 presents the screening and sampling data for each survey location.

Table 4-9. Intercept Survey Screening and Sampling Results

Location	Number Approached	Number Refusing	Number Screened	Total DIYs		Total DIYs surveyed
				Number	Percent	Number
Lakewood	106	30	76	61	80	57
Culver City	56	10	46	39	85	37
Burbank	112	45	67	52	77	46
West Covina	54	1	53	51	96	48
Total	328	86	242	203	84	188

DIYs = "Do-it-yourselfers."

The survey team approached 328 potential respondents. Of these, 86 refused to answer any questions. Among those who agreed to answer screening questions, 203 (84%) were identified as DIYs. Once identified as DIYs, a small number at each location refused to complete the interview. Overall, the survey team obtained 188 completed interviews. The incidence of DIYs in the population averages about 25%. As Table 4-9 shows, the incidence of DIYs at the auto parts stores covered by the surveys is extremely high (84%).

One limitation of intercept surveys is that they are not quantitative. The survey sample (N=188) is not representative of all Los Angeles County DIYs targeted by the advertising campaign. Rather it is a sampling of those who were visiting an auto parts store to purchase auto supplies or perhaps recycle used-oil or oil filters on the day the survey was conducted. While the results are not representative, they nonetheless mirror certain expectations concerning DIYs based on past used-oil recycling research—in particular, the demographic profile of DIYs and their used-oil recycling and disposal habits.

In addition, there are limitations to surveying people about advertising recall. Respondents typically have limited ability to recall exactly where or what they heard or saw. In the absence of specific recollection, they usually answer based on the medium they use most (e.g., television or newspapers). Also, because used-oil recycling, storm drain pollution prevention, and general recycling messages have been disseminated throughout Los Angeles County for some time using a variety of media, respondents may have been exposed to messages from several campaigns. In the absence of vivid recall, there is no way to distinguish among the campaigns respondents saw or heard. The analytical measure used in this survey is whether respondents who saw or heard advertising during the last 6 months have altered their recycling and disposal

behavior during that time. It is an imprecise measure that, nonetheless, is the best available, given the methodology and sample size for this study.

4.3.3.2 Results

Survey participants provided information regarding disposal of used oil, oil filters, transmission fluids, and radiator fluid. The following points summarize the survey's findings:

- Ninety percent of Los Angeles County DIYs surveyed properly dispose of their used oil; 69% take it to a used-oil collection center, 13% take it to a household hazardous waste (HHW) collection event, and 9% put it out at the curb for collection.
- Ten percent of those surveyed said they dispose of their used oil improperly by storing it (4%), pouring it down the street gutter catch basin (3%), or putting it in the trash (3%).
- Ninety percent of those surveyed said they properly dispose of their used oil filters; 63% take them to a used-oil collection center, 17% take them to a HHW collection event, and 10% put them out at the curb for collection.
- Eight percent of those surveyed said they dispose of used oil filters improperly by putting them in the trash (5%) or storing them (3%). Two percent said they "didn't know" or did not say how they disposed of used oil filters.
- Forty-four percent of DIYs surveyed indicated that they change their own transmission fluid. Seventy-four percent of those dispose of it properly by taking it to a used-oil collection center (59%) or HHW collection event (15%).
- About 19% of those who change their own transmission fluid said they dispose of it improperly by putting it in the trash (11%), storing it (5%), or pouring it on the ground (1%), on weeds (1%), or down the storm drain (1%).
- Forty-two percent of DIYs surveyed indicated they change their own radiator fluid. Sixty-five percent of those dispose of it properly by taking it to a used-oil collection center (50%) or HHW collection event (15%).
- Twenty-nine percent of those who change their own radiator fluid said they dispose of it improperly by putting it in the trash (14%), storing it (5%), or pouring it on the ground (4%), on weeds (3%), or down the storm drain (3%).

The survey also questioned respondents regarding their recall of the advertising campaign and the impact of the campaign on their disposal practices. The following summarizes the survey's findings from answers to these questions:

- Thirty-nine percent of the DIYs surveyed said they recalled seeing or hearing advertising within the previous 6 months about how to dispose of used oil, while 61% said they did not.
- Among those who said they saw or heard something, 30% said they saw it on television, 30% said they saw it at an auto parts store, 8% said they saw it in the newspaper, 11% said they saw a billboard, 10% said they heard something on the radio, and 5% mentioned the storm drain stencils.

The used-oil campaign materials did not appear on television, nor were they placed in auto parts stores or newspapers. However, the high incidence of DIYs who visit auto parts stores (which also tend to be used-oil collection centers) makes them an ideal and cost-effective location for placing such advertising.

Among those who recalled seeing or hearing used-oil advertising in the previous 6 months, 22% said the message was to "take oil to a recycling center or specific recycling

location," while 14% recalled a "recycling" message generally, and 10% said the message was "Don't dump in the storm drain." Other messages mentioned were: "Dumping in the drain pollutes the ocean" (5%); "Don't pollute—protect the environment" (5%); "Recycle to avoid pollution" (3%); "People dig holes to put oil in the ground" (3%); "proper disposal" in general (1%); and "Don't throw oil in the trash" (1%). The nature of the messages mentioned suggests respondents were recalling advertising from a variety of programs.

The survey's sample size was too small to produce statistically significant differences in used-oil and used-oil-filter recycling behavior between those who had seen or heard advertising and those who had not. However, the data imply that those who saw advertising are less likely to dispose of their used oil or oil filters in the trash or to pour oil down the storm drain than those who had not.

Survey results also provided information on the target audience:

- The DIYs surveyed resemble the profile of DIYs identified in prior research. They tend to be young (median age of 32), male (69%), and predominantly Latino (52%). Many speak Spanish. Their median annual household income is $22,300.
- Those who dispose of used oil improperly have slightly lower incomes and tend to be slightly younger than DIYs generally.
- DIYs who change their own transmission and radiator fluids are even more likely to be Latino, have a slightly lower household income, and tend to be younger than DIYs generally.
- Fifty-nine percent of the DIYs surveyed said they owned one car; 20% owned a van; 22% owned a truck; 4% owned a recreational vehicle; 7% owned a motorcycle; and 1% owned a boat. Twenty-five percent said they owned two or more vehicles.
- Taking into consideration all of the vehicles they own, 33% of DIYs said they perform three oil changes a year, 30% said they perform four, and 11% said they perform two. Another 4% said they change oil 6, 8, or 10 or more times a year. The median number of oil changes performed each year was three.

4.3.3.3 Information Obtained

The information obtained from this survey includes assessments of the target audience's behavior, their recall of the advertising campaign, a characterization of the target audience, and directions for planning future campaigns.

The survey results suggest conclusions similar to those drawn from surveying other relatively mature used-oil recycling programs. Specifically, 90% of DIYs are "doing the right thing" by recycling their used oil and oil filters. Only 10% are improperly disposing of used oil and oil filters. While sample sizes are too small to produce statistically reliable results, the data suggest that those who saw used-oil advertising during the 6-month campaign were less likely to dispose of their used oil and oil filters in the trash or down the storm drain than those who had not seen the ads. In addition, only a portion of oil-change DIYs also change their own automotive fluids, and these DIYs are particularly likely to be Latino. Improper disposal was more prevalent among those who change and dispose of transmission and radiator fluids. Many who said they properly dispose of used oil and oil filters reported disposing of other automotive fluids improperly.

Altogether, the results suggest that the used-oil and used-oil-filter recycling "market" has been effectively penetrated with the proper disposal message. Some marginal gains may be achieved by continuing this focus. However, consideration should be given to shifting to a

used-oil and used-oil-filter recycling message maintenance strategy, while refocusing the campaign to proper disposal of other used automotive fluids. The result that many DIYs dispose of used oil properly and other fluids improperly suggests lack of awareness. Therefore, there is a need for greater emphasis on communicating the toxicity, health, and environmental impacts of automotive fluids and how to dispose of them properly. Messages in English and Spanish should target the Latino community in particular.

4.4 New Development Workshop Quizzes

Santa Monica's Urban Runoff Pollution Prevention Program is assessing the city's process for implementing runoff mitigation requirements for new development projects. The intent of these requirements is to reduce the quantity of urban runoff and improve its quality. By city ordinance, each new development project is required to implement BMPs to reduce urban runoff at project sites. As discussed in Chapter 3, the assessment of the city's New Development Program identified four areas for potential improvement in the BMP mitigation planning process:

- City staff could be better educated regarding BMPs.
- Applicants (architects and engineers) could be better educated regarding BMPs.
- The Urban Runoff Mitigation Plan (URMP) Worksheet (a form used to calculate the BMP sizing) could be redesigned to be easier to follow.
- City inspections should be conducted to ensure that BMPs are constructed properly.

One conclusion of the assessment was that the city should hold two workshops to address the first two items. Two workshops were held, one for city staff and another for the building community (see Appendix B for the workshop agendas). The goal of both workshops was to educate participants regarding the requirements of the city ordinance, as well as pending requirements for the Los Angeles Regional Water Quality Control Board's Standard Urban Stormwater Mitigation Plan (SUSMP), and to improve participants' understanding of options and proper design for BMPs. To achieve these goals, several presentations were made:

- A Regional Water Quality Control Board representative spoke about the SUSMP requirements at both workshops.
- City staff spoke about city ordinance requirements and provided background on stormwater new development programs.
- City staff spoke about post-construction BMPs at the city staff workshop.
- An expert on urban design spoke about post-construction BMPs at the building community workshop and led an onsite design participatory exercise.

While the content covered in the two workshops was similar, there were two differences. City staff covered post-construction BMPs in the city staff workshop and an outside expert on urban design covered this topic for the building community. In addition, the city staff workshop lasted a half day, while the building community workshop lasted a full day and included the interactive exercise on post-construction BMP design.

To assess the effectiveness of these workshops, project staff tested participants before and after they attended the workshop regarding their awareness of urban runoff issues and knowledge of pertinent state and city runoff mitigation requirements and BMPs.

4.4.1 Procedure

Project staff distributed pretests as workshop participants registered and collected them at the beginning of the workshop. Staff then administered post-tests at the end of the workshop and collected them as participants were leaving. The tests were identical, except that the post-test included a section added for evaluating the workshop. Scores were compared to determine if, and to what extent, the workshops were successful in attaining the goals (see Appendix C for the content of the tests).

4.4.2 Test Results

The following sections describe the workshops and results of the effectiveness measurements.

4.4.2.1 City of Santa Monica Staff Workshop

An estimated 90 city employees were invited to the workshop and 30 participated. Participants included staff from the following organizational units: Water Division, Building and Safety, Transportation, Library, Engineering, Industrial Waste, Parks and Recreation Open Space Management, Beach Maintenance, Solid Waste, Police (Animal Control), and Big Blue Bus Maintenance. Each workshop included four presentations and each presentation was followed by a question and answer period.

The pre- and post-tests included nine questions. Two questions (1 and 9) were open-ended, while the remainder were multiple-choice items. Table 4-10 presents responses to questions 1 through 8 for the pre- and post-tests (22 pretests and 23 post-tests were collected).

Table 4-10. City Staff Workshop Results

	Area Tested by This Question	Pretest (% correct, out of 22)	Post-test (% % correct, out of 23)	Percentage Difference
1. Name a pollutant typically found in urban runoff.	Stormwater knowledge	95	96	0
2. An activity that will result in urban runoff pollution in a residential neighborhood.	Stormwater knowledge	95	83	–12
3. How much of the first inch of rainfall must be captured by post-construction BMPs and prevented from running untreated to storm drains?	City ordinance	14	22	8
4. Which of the following projects are NOT defined as "new development" as specified by the Urban Runoff Pollution Control Ordinance?	City ordinance	5	9	4
5. What is the penalty for failure to implement an approved Urban Runoff Mitigation Plan?	City ordinance	18	52	34
6. According to the SUSMP, how much of the runoff volume from a one inch storm event must be captured by post-construction BMPs and prevented from running untreated to storm drains?	SUSMP	23	65	42
7. What is the latest date by which the SUSMP requirements must take effect?	SUSMP	45	48	2
8. Which of the following projects will NOT be required to implement the SUSMP?	SUSMP	50	48	–2

SUSMP = Standard Urban Stormwater Mitigation Plan

Questions 1 and 2 focus on general knowledge of stormwater and urban runoff issues. Workshop participants were well informed in this area, with most people identifying at least one urban runoff pollutant and recognizing sources of runoff pollution. The most often cited pollutant was "oil and grease," which was mentioned by more than half the workshop participants in both the pre- and post-tests. The workshop appeared to be successful in making participants aware of the variety of pollutants present in urban runoff. For example, 22% more participants mentioned metals and 13% more participants mentioned pesticides on the post-test than on the pretest.

Questions 3 through 8 focused on requirements of the city ordinance and SUSMP. There was very little change between the pre- and post-tests in the number of correct responses to questions 3, 4, 7, and 8. However, the number of participants answering correctly regarding the penalty for failing to implement a URMP and the amount of runoff that must be captured under the SUSMP requirements increased significantly between the pre- and post-test. More than half the respondents answered questions 5 and 6 correctly on the post-test, an improvement of 34% for Question 5 and 42% for Question 6 over the pretest.

Both tests also included two open-ended questions. Participants were asked on the pretest to list BMPs they have recommended for projects in the past. On the post-test, they were asked to list the new BMPs they learned about in the workshop and would now recommend for projects. Table 4-11 summarizes the responses to these questions for both tests.

Table 4-11. Identification of Post-construction BMPs

	Pretest (based on 22 tests)	Post-test (based on 23 tests)
Total responses to Question 9	5	13
Responses listing post-construction BMPs	3	11
Number of different BMPs mentioned	2	9

BMPs = best management practices.

There was a substantial increase in the proportion of people responding to Question 9 on the post-test compared to the number answering the related question on the pretest. The proportion correctly listing a post-construction BMP (as opposed to a construction or nonstructural BMP) and the number of BMPs mentioned also increased. Table 4-12 lists the BMPs mentioned and the number of times each was mentioned. Several participants listed more than one BMP in response to Question 9. The most frequently mentioned BMPs in the post-test were dry wells, permeable paving, and retention basins.

Table 4-12. BMPs Listed by City Staff

BMP	Number of Times Mentioned on Pretest	Number of Times Mentioned on Post-test
Dry wells	2	4
Percolation, permeable paving	0	3
Retention basins	1	2
Berms	0	1
Contain runoff to landscaping	0	1
Detention basin	0	1
Catch basin	0	1
Natural filtration	0	1
Swales	0	1

BMPs = best management practices.

Participants rated the workshop highly. Using an incremental scale of 1 to 5 (disagree to agree), participants were asked to rate the workshop. Table 4-13 presents the average rankings.

Table 4-13. City Staff Workshop Evaluation

	Average Ranking
I have a better understanding of stormwater regulations.	4.0
I have more information on post-construction BMPs.	4.0
I will use the information I learned for future projects.	4.1
I would recommend this workshop to colleagues.	4.1

BMPs = best management practices.

4.4.2.2 Building Community Workshop

Eighty-one participants representing 45 companies and municipalities attended the building community workshop. Participants included staff from nearby municipalities and from engineering, architecture, and landscape architecture firms.

Fifty-seven pretests and 44 post-tests were collected. The results are presented in Table 4-14. The disparity between the number of pre- and post-tests collected is due to the fact that a large number of participants left the workshop after lunch. The tests are identical to those used for the city staff workshop.

Table 4-14. Building Community Workshop Results

	Area Tested by This Question	Pretest (% correct, out of 56)	Post-test (% correct, out of 44)	Percentage Difference
1. Name a pollutant typically found in urban runoff.	Stormwater knowledge	89	91	2
2. An activity that will result in urban runoff pollution in a residential neighborhood.	Stormwater knowledge	86	89	3
3. How much of the first inch of rainfall must be captured by post-construction BMPs and prevented from running untreated to storm drains?	City ordinance	16	14	-2
4. Which of the following projects are NOT defined as "new development" as specified by the Urban Runoff Pollution Control Ordinance?	City ordinance	80	93	13
5. What is the penalty for failure to implement an approved Urban Runoff Mitigation Plan?	City ordinance	13	45	33
6. According to the SUSMP, how much of the runoff volume from a one inch storm event must be captured by post-construction BMPs and prevented from running untreated to storm drains?	SUSMP	43	86	44
7. What is the latest date by which the SUSMP requirements must take effect?	SUSMP	34	45	12
8. Which of the following projects will NOT be required to implement the SUSMP?	SUSMP	46	61	15

SUSMP = Standard Urban Stormwater Mitigation Plan.

The overall results for the building community workshop were similar to those of the city staff workshop. Questions 1 and 2 focused on general knowledge of BMPs. Similar to the city staff workshop, most building community workshop participants could identify at least one urban runoff pollutant and recognize sources of runoff pollution. The most often mentioned

pollutant was "oil and grease," which was cited by more than half of workshop participants in both the pre- and post-tests. There was a substantial increase in those answering "metals" in the post-test, compared to the pretest (9% in the pretest, 18% in the post-test).

Questions 3 through 8 focused on requirements of the city ordinance and SUSMP. There was very little change in the proportion of correct responses to Question 3 between the pretest and post-test. For questions 4, 7, and 8, there was a 12% to 15% increase in the number of correct responses on the post-test. Similar to the city staff workshop results, the greatest increases in correct answers between the pre- and post-test were for the questions regarding the penalty for failing to implement a URMP Plan and the amount of runoff that must be captured, according to SUSMP requirements. Almost half the respondents answered Question 5 correctly on the post-test, an improvement of 34% over the pretest. The proportion of respondents answering Question 6 correctly increased to 86% on the post-test, a 44% improvement.

The open-ended questions asked participants on the pretest to list BMPs they have used for projects in the past and, on the post-test, to list BMPs they learned about in the workshop and would now recommend or use for projects. Table 4-15 summarizes the responses to these questions.

Table 4-15. Identification of Post-construction BMPs

	Pretest (based on 56 tests)	Post-test (based on 44 tests)
Total responses to Question 9	19	27
Responses listing post-construction BMPs	11	25
Number of different BMPs mentioned	16	13

BMPs = best management practices.

More people responded to Question 9 on the post-test than on the pretest. In addition, the proportion of people correctly listing a post-construction BMP (as opposed to a construction or nonstructural BMP) was higher on the post-test than on the pretest. The number of BMPs mentioned decreased, however. Table 4-16 lists the BMPs mentioned and the number of times each was mentioned. Several participants listed more than one BMP in response to Question 9. Swales, fossil filters, dry wells, and permeable pavement were mentioned most often.

Table 4-16. Best Management Practices Listed by Building Community

Best Management Practice	Number of Times Mentioned on Pretest	Number of Times Mentioned on Post-test
Swales	1	14
Fossil filters, catch basin inserts	2	7
Dry wells	1	6
Permeable pavement	1	6
Infiltration basins, trench	3	4
Upgrade catch basins	0	2
Continuous deflective separation treatment unit	0	2
Retention basin	0	1
Detention basin	0	1
Catch basin	0	1
French drains	1	1
Ponds, track control	0	1
Stormceptor	1	1
Sedimentation tank	0	1
Landscaped, vegetated areas	2	0
Gravel filter, storage beds	2	0
Oleophilic booms	1	0
Biofilters	1	0
Storm filter	1	0
Basin filter	1	0
Covered service, trash areas	2	0

Participants rated the workshop highly. Using an incremental scale of 1 to 5 (disagree to agree), participants were asked to rate the workshop. Table 4-17 presents the average rankings.

Table 4-17. Building Community Workshop Evaluation

	Average response
I have a better understanding of stormwater regulations.	4.2
I have more information on post-construction BMPs.	4.3
I will use the information I learned for future projects.	4.2
I would recommend this workshop to colleagues.	4.4

4.4.3 Information Obtained

The results of the workshop tests provided information to Santa Monica regarding general knowledge of urban runoff, awareness of pertinent regulations, and understanding of post-construction BMPs. In addition, based on responses to different questions, it was possible to see which parts of the workshop worked best.

Based on responses to questions 1 and 2, both the building community and city staff seem to have come to the workshop with a general understanding of runoff issues. The pretest scores indicate that members of the building community entered the workshop with greater knowledge of BMPs, the city ordinance, and SUSMP than the city staff. This may be due, in part, to the departments represented in the city staff workshop. Over half the participants were from departments (such as Parks and Open Space, Library, Police Department, and Solid Waste) that do not regularly deal with construction and post-construction BMP issues. In contrast, participants in the building community workshop deal with post-construction BMP requirements as part of each job and, therefore, the information presented has a direct bearing on their work.

With respect to increased understanding of regulatory requirements, both groups showed the most improvement on the same two items: the penalty for failing to implement a URMP and the amount of runoff that must be captured, according to SUSMP requirements). These two points were clearly presented effectively in both workshops. This may be because of the manner in which they were presented. The information about the penalty for failing to implement a URMP (Question 5) was brought up during the question and answer period in both workshops, so it may have "stood out." The runoff volume to be captured under the SUSMP (Question 6) was mentioned in two presentations and brought up in the question and answer period. The proportions of correct responses to Question 7 (the date by which SUSMP requirements take effect) were the same for the pre- and post-tests for the city staff workshop. However, correct answers to this question increased by 12% for the building community workshop. This change may be due to the difference in how this information was presented. No special attention was brought to this point in the city staff workshop, but the point was emphasized in the building community workshop, because the deadline recently had been extended and the speaker elaborated on the topic for this reason. Concepts that may not have been as clearly communicated include certain city ordinance and SUSMP requirements that were not emphasized or only mentioned by one speaker.

Both groups also demonstrated an increased understanding of post-construction BMPs, based on responses to Question 9. In both cases, the proportion of people answering this question increased from pretest to post-test, as did the proportion of people correctly identifying post-construction, rather than construction, BMPs. The most frequently mentioned BMPs in the workshop post-tests were swales, fossil filters, dry wells, and permeable pavement for the building community, and dry wells, permeable pavement, and retention basins for city staff. It is interesting that swales were mentioned on one-third of the post-tests from the building community workshop and on only one post-test from the city staff workshop. This may be because this a BMP was discussed by the urban design expert, who only spoke at the building community workshop. The most frequently used BMPs, based on the assessment of city records discussed in Chapter 3 (and listed in Table 3-5), were subsurface pits, retention basins, dry wells, depression pits, landscaping, and permeable pavement. The fact that the most often mentioned BMPs in the post-test are different than those used in Santa Monica, according to the assessment described in Chapter 3, may indicate workshop participants learned about BMPs not previously used.

Some of the differences in test scores between the building community and city staff may be associated with the interactive exercise conducted by the urban design expert for the building community workshop. As a result of this exercise, the building community workshop participants were provided with more information than the city staff workshop participants.

The workshops were most successful in attaining the goal of increasing participants' knowledge regarding the requirements of the SUSMP and post-construction BMPs. The workshops could have done better in communicating city ordinance requirements, however. "Customer satisfaction" was good for both workshops, based on the high ratings (greater than 4.0) given by participants. Some elements that contributed to the workshops' success include providing folders with copies of the presentations, conducting the interactive activity at the building community workshop, and providing refreshments. In particular, providing a break from formal presentations and an opportunity for audience participation seems to increase workshop effectiveness. Including the pre- and post-test did not detract from the workshop and worked best when the pretest was handed out at registration and collected before the workshop began. The workshop could have been improved by having a moderator that was familiar with all topics and kept the day flowing smoothly. The half-day staff workshop had some advantages over the all-day builders' workshop, where several people left after lunch. It is possible that 6 hours is too long to expect people to stay. Another problem with the builders' workshop is that about one-third of the people who registered did not attend. If a fee had been charged, perhaps a higher percentage of those registered would have attended.

4.5 Assessment of Tools for Measuring Increased Awareness

Phone surveys used to measure awareness typically cost between $15,000 and $20,000. The phone surveys conducted to evaluate the thermometer turn-in campaign cost $7,000 each. The phone survey conducted for the Davis Healthy Gardens Program evaluation cost $5,000. One of the best ways to limit the cost of a phone survey is to limit the number of questions asked and, therefore, the time it takes to complete each survey. This means planning the questions asked carefully to accurately reflect what information the survey is intended to provide. Part of the planning process is to start by identifying project goals, including what information is being sought, then designing questions that will provide those answers.

The mail surveys are similar in expense to the shorter phone surveys ($5,000 to $10,000). They are somewhat simpler to implement and may be a good approach to conducting a survey without hiring a consultant. Mail surveys work best if they are easy to complete (mostly check boxes with some brief answers) and brief (one page printed on both sides or less). Including a preaddressed, stamped envelope also will help increase the response rate. Based on the experience in Davis, mail surveys can be conducted to provide quantitative results that are comparable to random-digit-dial phone survey results. However, phone surveys may be more limited than mail surveys in terms of the number of questions that can be asked. In Davis, one set of questions (those regarding general awareness of hazardous waste disposal and the difference between wastewater and stormwater) had to be eliminated to make the survey brief and easy to complete.

Intercept surveys also can be conducted by agency staff and can be much less expensive if conducted that way. The Woodland intercept surveys cost about $4,000 to conduct and analyze. The Los Angeles County intercept surveys cost approximately $13,000 to conduct and analyze, including $7300 for the consultant. Intercept surveys are not random and, therefore, not statistically valid. However, they still can provide useful information about a target audience.

The workshop quizzes were a relatively simple and inexpensive add-on to the workshops. The cost to conduct the quizzes was about $4600 and associated with staff time to develop the quizzes and analyze the result. Quizzes are not applicable to a wide range of source control strategies, because they take advantage of the workshop format.

While the surveys discussed in this chapter can be conducted by agency staff at less expense, there are advantages to hiring a trained professional. Professional polling companies are better trained to design questions that will be answered objectively and to conduct statistical analysis of survey results. The decision to "do it yourself" or hire a consultant may depend on available staff time and the complexity of the information being gathered.

All the tools discussed in this chapter were extremely useful in characterizing the target audience and helping plan future outreach. With respect to measuring increases in awareness, better results were seen for campaigns that were able to provide the target audience with repeated exposures to the campaign message. These included the Los Angeles County Used Oil Recycling Campaign, the Davis Healthy Gardens Program, and the LACSD Lindane Reduction Project. The Los Angeles County campaign is repeated annually and includes a variety of outreach methods. Similarly, the Healthy Gardens Program was evaluated after a year of outreach in Davis. The LACSD project was conducted over a shorter term but relied on repeated communications with its target audience. Smaller efforts that were assessed after a shorter period showed no significant increase in awareness. This was true for the Woodland Oil and Grease Reduction Program and the SFWPPP thermometer turn-in campaign. The outreach in Woodland was limited to four grocery store events and distribution of materials at three apartment complexes. Repetition of the message needs to occur through additional outreach for a measurable change in behavior to occur. Similarly, in San Francisco, the thermometer turn-in campaign was assessed after 1 month of outreach. This may be too short a time frame to see a measurable increase in awareness occur.

The workshop quizzes were an exception with respect to successfully assessing a smaller effort. This is probably because the quizzes were designed to assess the effectiveness of only one program element, rather than an overall campaign.

CHAPTER 5.0

TOOLS TO MEASURE BEHAVIOR CHANGE

A variety of tools may be used to measure source control program effectiveness with respect to behavior change. Some of these were used in the demonstration projects and include the following:

- tracking prescription rates for the Los Angeles County Sanitation Districts (LACSD) Lindane Reduction Project,
- conducting "kiosk" surveys for the Davis Healthy Gardens Program,
- tracking turn-in rates for the San Francisco Water Pollution Prevention Program (SFWPPP) thermometer turn-in campaign,
- conducting surveys (dental practices, workshop follow-up), and
- conducting site visits for the dental outreach program.

Each of these tools capitalized on a specific feature of the source control program being evaluated. This chapter describes how the tools were developed.

5.1 Lindane Reduction Project Pharmacy Sales Tracking

As discussed in Chapters 4 and 6, LACSD measured the effectiveness of its lindane-reduction pilot project using surveys and wastewater monitoring. These measures of effectiveness were supplemented by the project described in this report. Larry Walker Associates and Harris and Co. (the project team) assessed the effectiveness of the LACSD outreach campaign by working with pharmacies to track the sales of lindane-containing and alternative products used to control head lice and scabies.

5.1.1 Procedure

LACSD provided a list of pharmacies located in a study area where outreach was conducted (Burbank) and a list of pharmacies in a control area where no outreach was conducted (Pomona). The project team contacted these pharmacies and asked them to participate in the assessment.

In Pomona, 16 pharmacies were asked to participate in the study; 13 initially agreed and provided baseline data. Of these, eight pharmacies successfully completed the study. The attrition rate was due to many factors: two pharmacies asked to be dropped from the study; one was destroyed in a fire; one logged the data incorrectly, keeping a cumulative tally of prescriptions filled during the entire study period instead of on a month to month basis; and two did not provide any usable data.

In Burbank, 10 pharmacies successfully completed the study. Of the 17 pharmacies originally asked to participate, 14 initially agreed and provided baseline data. Of these, two later asked to be dropped from the study and two did not provide any usable data.

In an effort to determine baseline prescription and sales rates, the participating pharmacies were asked to estimate the number of lindane-containing prescriptions they had filled during the past year. They also were asked to estimate their sales of head-lice combs and nonprescription head-lice and scabies control products. While other prescription products used for head lice and scabies control—including malathion, permethrin, and crotamiton—were not included in the baseline estimates, they were included in the project's sales tracking effort.

The pharmacies were asked to track the number of prescriptions filled between October 1999 and March 2000 for prescription medications containing lindane, malathion, permethrin, and crotamiton. They also were asked to track the sales of head-lice combs and other over-the-counter treatments. The tracking effort began at the same time as the outreach campaign. Monthly log sheets were provided for each month of the study.

5.1.2 Assessment Results

The following sections present the results of the baseline estimates and prescription and sales rates assessments.

5.1.2.1 Baseline Estimates

Table 5-1 shows the baseline estimates for lindane, head-lice combs, and over-the-counter treatments for the control area (Pomona) and the outreach area (Burbank). Lindane prescription estimates are for 1 oz of 1% lindane. In some cases, the pharmacists stated they could not estimate these values; in those cases, the baseline estimate was assumed to be equal to the mean baseline estimate of the pharmacies that responded. Table 5-1 shows the total estimates for the pharmacies that completed the study.

Table 5-1. Estimates of Prescriptions Filled and Products Sold per Month

	Control area (total for eight pharmacies)	Outreach area (total for nine pharmacies)
Lindane prescriptions	410	11
Head-lice combs	15	6
Over-the-counter remedies	78	11

The estimates in the control area were much higher than the estimates in the study area. Although this is consistent with the sales data collected during the study, estimates for both the control and outreach areas are much higher overall than actual sales, based on the sales data collected.

5.1.2.2 Prescriptions and Sales Rates

Table 5-2 summarizes the number of prescriptions filled and other products sold for head lice and scabies control during the study period.

Table 5-2. Products Sold for Head Lice and Scabies Control (Units/Month)

		October	November	December	January	February	March
Lindane	Control	119	48	147	69	63	64
	Outreach	24	22	14	9	10	28
Nit combs	Control	5	4	4	0	3	7
	Outreach	0	1	0	0	2	0
Over-the-counter	Control	3	5	4	6	9	11
	Outreach	0	0	0	0	3	2
Malathion	Control	0	0	0	0	0	0
	Outreach	2	4	1	1	1	1
Permethrin	Control	18.3	11.3	9.3	19	10	8
	Outreach	6.3	6.3	3.3	2.3	4.3	11
Crotamiton	Control	0	0	0	4	2	1
	Outreach	3	2	1	0	1	2

Figure 5-1 shows lindane prescription rates during the course of the study for the control and outreach areas. The number of prescriptions was normalized by assuming that a prescription was a 1-oz prescription. Therefore, if a prescription was reported as 8 oz, it was counted as eight prescriptions. Most prescriptions were for 1- or 2-oz containers. Figure 5-2 shows nonlindane prescription and sales rates during the course of the study for the control and outreach areas.

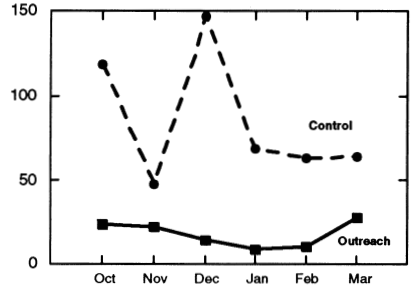


Figure 5-1. Lindane Prescription Rate

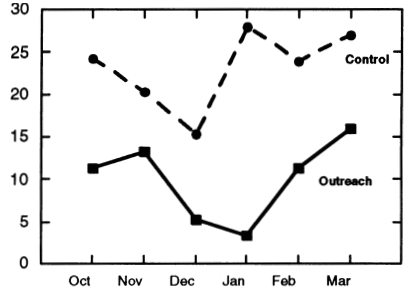


Figure 5-2. Nonlindane Prescription/Sales

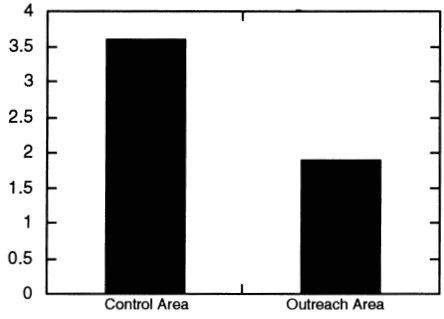


Figure 5-3. Ratio of Lindane/Nonlindane Sales

The objective of the outreach campaign was to increase the rate of nonlindane remedies sold and decrease the rate of lindane prescriptions filled. Therefore, the ratio of lindane to nonlindane remedies should be lower in the outreach than in the control area. Figure 5-3 compares this ratio for the control and outreach areas. The ratio was higher in the control area than in the outreach area during the course of the study.

5.1.3 Information Obtained

Lindane prescription rates and the ratio of lindane to nonlindane product sales decreased slightly during the study period (see figures 5-1, 5-2, and 5-3). In addition, nonlindane product sales increased slightly over time. There is no apparent difference in sales patterns between the control and outreach areas. However, the average lindane to nonlindane sales ratio was greater in the control than in the outreach area over the course of the study. Ideally, sales patterns would have been monitored for a few months prior to the start of the outreach campaign. While it was hoped that using a control area would be adequate, the results from this effectiveness measurement tool might have been clearer if precampaign data had been available.

The desired behavior change for this study was for doctors to switch from recommending lindane products to recommending nonlindane products. While the sales tracking results are inconclusive, the assessment based on wastewater data and survey results indicate that the behavior change occurred.

The sales tracking method was labor intensive, and it was difficult to persuade the pharmacists to record or provide the information. The data were highly variable and difficult to interpret.

Other approaches to sales tracking can make the method more effective. The Bay Area Regional Integrated Pest Management Partnership used sales tracking of a variety of pesticides as one measure of effectiveness of its "Our Water, Our World" promotion (Regional Integrated Pest Management Partnership 2000). The program focused on training store personnel and conducting store promotions of outreach materials that encourage using less-toxic pest-control methods. Of the 115 stores participating throughout the San Francisco Bay Area, sales tracking was attempted with stores that had fully implemented the "Our Water, Our World" program and that also had electronic inventories. Sales data were obtained for 1998 and 1999 from 20 stores meeting these two criteria. The data showed decreases in sales of diazinon and increases in sales of less-toxic pest controls. The factors missing from the lindane-reduction project were

an established relationship with the pharmacies that was separate from the sales tracking effort and the requirement for electronic inventories. Even with these two elements present, the Bay Area effort appears to have also been time consuming and relied on the efforts of several agency staff to keep track of a few stores each.

5.2 Davis Kiosk Surveys

The 1998 Davis Healthy Gardens Outreach Campaign was developed to heighten public awareness of the effects of pesticides on local waterways and wetlands. To achieve the program's objectives, staff distributed information about alternative pest-control practices at several locations in and around Davis, including Redwood Barn, Davis Lumber, local movie theaters, the public works department, the City Hall, and the farmers' market.

One approach to determining which public outreach materials and outreach locations were effective was to take advantage of the various locations in Davis where outreach had taken place. A short survey was printed on cards and distributed at these locations during May and June 1999. The survey was not intended to be quantitative but rather to indicate trends. It also was intended to assess both increased awareness and behavior change. It is discussed here because a unique feature of the approach—placing a display at various locations in Davis—was useful to some extent in assessing behavior by helping to identify locations where people go to get information on pesticides and environmental issues.

5.2.1 Procedure

To conduct the survey, project staff prepared a survey card with a $2 coupon toward the purchase of beneficial insects or organic pest controls attached. One side of the card was printed with 11 questions, while the other side provided delivery instructions for the card, an informational phone number, and blank spaces for a name, mailing address, and phone number. The cards were placed next to a poster showing five examples of the Healthy Gardens Program material. People were asked to complete the survey, then leave it in a plastic suggestion box placed nearby. The box was untended at all survey sites except the farmers' market, where a representative of the Davis Pollution Prevention Program was present (Appendix C includes a picture of the display and an example of the survey card).

The survey included questions on gardening (questions 1–4), the Healthy Gardens promotion (questions 5–7), behavior change (Question 8), and basic demographic information (questions 9–11):

1. Do you garden or work in your yard (every weekend, occasionally, or never)?
2. Do you use a garden service (yes or no)?
3. Do you use pesticides (yes or no)?
4. If you use pesticides, do you remember the name (blank provided)?
5. Have you seen any of the items shown on this display before (yes or no)?
6. If yes, which items on the display have you seen before (four blank spaces were provided for write-in answers)?
7. If you have seen any of the items on the display, where have you seen them (mark all that apply: on the Internet, before a movie, in the newspaper, on television, at a local store, at the North Pond, at City Hall, at Davis Farmers' Market)?
8. After seeing or reading the Healthy Gardens Program information: (check one: I use less or don't use pesticides at all; I have not made any changes regarding pesticide use; I have never seen the program information before).

9. Are you over 21 (yes or no)?
10. Full-time Davis resident (yes or no)?
11. Which area of Davis do you live in (choose between: North, East, South, West, Central, outside Davis)?

A total of 124 people turned in survey cards, although one of these was left blank except for the name and address. Table 5-3 shows the survey site locations, time periods, and number of surveys collected at each site.

Table 5-3. Survey Collection Results

Survey location	Time Period	Number of Surveys Collected	Number of Surveys per Day	Percentage of Total Surveys
Yolo County Library, Davis	May 1–31	21	0.68	17
City Hall	May 3–9	6	0.86	5
Redwood Barn, Davis	May 10–18	5	0.55	4
Farmers' market (Wednesday)	May 19	30	30	24
Farmers' market (Saturday)	May 22	13	13	10.5
Davis Lumber	May 24–30	4	0.57	3
Signature theaters	May 31–June 6	3	0.43	2.5
North Pond	June 3–13	42	3.82	34
Total		124		100

The Wednesday and Saturday farmers' markets had the fastest rate of survey collection and the North Pond site collected the largest number of surveys. These three sites are the most prolific.

5.2.2 Survey Results

The survey results are presented in the following sections:

- Gardening Practices
- Recall of Healthy Gardens Program
- Behavior Change
- Demographic Information

5.2.2.1 Gardening Practices

Table 5-4 lists the responses to the gardening questions.

Table 5-4. Gardening Questions

Number of survey responses							Total
1) Do you garden or work in your yard?	Every weekend:	74	Occasionally:	40	Never:	7	121
2) Do you use a garden service?	Yes:	15	No:	108			123
3) Do you use pesticides?	Yes:	61	No:	62			123
4) If you use pesticides, do you remember the name?							
Common name	Active ingredient				Number of survey responses		
Snail/slug poison, Deadline	Metaldehyde				13		
Ortho rose systemic	Diazinon				8		
Roundup	Glyphosate				5		
Insecticidal soap	Potash soap				3		
Raid	Permethrin and tetramethrin				2		
Pyrethrins	Pyrethrins, piperonyl butoxide, rotenone				2		
Sevin	Carbaryl				2		
Other pesticides					10		
Total					45 pesticides used, 41 people responded		

Most people responding to the survey were gardeners. Many were frequent gardeners and most said they do all their own gardening. These people comprise the Healthy Gardens Program target group. Approximately half the survey participants use pesticides. Table 5-5 shows the types of gardeners using pesticides or a garden service.

Table 5-5. Comparison of Gardening Frequency and Pesticide Use

	Frequent Gardeners	Occasional Gardeners	Nongardeners	No Response	Total
Pesticide users	39	20	0	2	61
Garden service users	9	5	1	0	15

Responses in Table 5-5 indicate that frequent gardeners use pesticides more often than occasional gardeners.

5.2.2.2 Recall of Healthy Gardens Program

Approximately half the survey participants recalled seeing the Healthy Gardens outreach materials. About one-third of those who recalled the materials reported seeing the logo, the North Pond sign, the guides, and the movie theater slide. The smaller "demonstration site" signs were recalled less frequently. On average, survey participants recalled seeing 1.6 items each. Table 5-6 summarizes the responses regarding the outreach materials.

Table 5-6. Which Items on the Display Have You Seen Before?

Program Material Survey Respondents Recalled Seeing	Number of Times Mentioned	Percentage of Respondents Who Recalled Seeing Specific Program Materials (n=59)
Ladybug logo	22	37
North Pond maps (at North Pond)	22	37
Pesticide management guide fans	21	36
Frog slides (before movies)	16	27
Hybrid roses posters (at City Hall)	7	12
Unspecified	12	20
Total	100	

Table 5-7 summarizes responses regarding where respondents had seen the outreach materials. Each person seeing the Healthy Gardens information recalled seeing it at an average of 1.9 locations.

Table 5-7. Where Have You Seen Those Items?

Where Respondents Recalled Seeing Program Materials	Number of Times Mentioned	Percentage Recalling Where They Saw Program Materials (n=63)
North Pond	31	49
Farmers' market	19	30
Before movies	17	27
Local stores	16	25
Newspaper	12	19
City Hall	7	11
Internet	5	8
Television	4	6
Other	6	10
Total	117	

Table 5-7 indicates the information was seen most often at North Pond. Several people also recalled seeing the information at the farmers' market, before movies, in the local stores, and in the newspaper. Sightings on the Internet, at the City Hall and on television were less frequent.

The target audience for the Healthy Gardens Program is Davis residents who garden and use pesticides. Responses regarding gardening practices and pesticide use (questions 1–3) were compared to responses regarding recall of the Healthy Gardens information (questions 5–7) to determine if the target audience was reached. Of the 114 respondents who indicated they garden frequently or occasionally, 55% saw the Healthy Gardens information. Out of a total of 79

pesticide users (answering yes to Question 3), 60% saw the information (answering yes to Question 5).

5.2.2.3 Behavior Change

Out of 124 surveys, 104 people responded to the behavior change question (Question 8) regarding whether their pesticide use practices had changed, as shown in Table 5-8.

Table 5-8. Behavior Change

Number of survey responses		
8) After seeing the Healthy Gardens information:	I use less or don't use pesticides at all	29
	I have not made any changes	32
	I have never seen the information	43
	Total	104

The purpose of asking Question 8 was to determine if the Healthy Gardens Program had been effective in changing people's behavior with respect to pesticide use. Approximately 28% of the survey respondents apparently changed their behavior as a result of seeing the program materials.

5.2.2.4 Background and Demographic Information

Most of the people surveyed were over age 21 and full-time Davis residents. About 40% of the survey participants lived in North Davis, while the others were almost evenly distributed throughout the rest of the city. Of the 124 people surveyed, 13 did not live in Davis.

Table 5-9 shows the number of surveys collected at each location from each area of Davis. In general, survey responses at each location were evenly distributed with respect to the respondents' place of residence in the city. The one exception is North Pond, where more than 80% of the responses came from people living in North Davis, where North Pond is located.

Table 5-9. Where Survey Participants Live

Survey Location	Respondents Living in:						
	North	South	Central	East	West	Outside	Total
Yolo County Library	4	3	2	1	7	4	21
Redwood Barn	1	0	1	2	1	0	5
Davis Lumber	0	2	1	0	0	1	4
North Pond	34	2	3	0	0	2	41
Signature theaters	0	0	1	2	0	0	3
Farmers' market	7	6	6	11	7	6	42
City Hall	2	0	0	3	1	0	6
Total	48	13	14	18	16	13	121

5.2.3 Information Obtained

The objective of the card survey was to determine the following:

- Success of the Healthy Gardens Program in creating awareness (Do people remember seeing the program materials?).
- Success of the Healthy Gardens Program in changing behavior (Did the Healthy Gardens Program reach the target audience, and did the program cause people to change their pesticide use practices?).
- Elements of the program that worked best (Which types of outreach were most effective, and which locations in Davis are best for communicating the Healthy Gardens Program message?).
- Plans for the future (What should we do next in the Healthy Gardens Program, and what works best for outreach on environmental issues in Davis?).

It should be emphasized that these survey results are not statistically valid, because the survey respondents are self-selected and therefore do not necessarily represent a true cross-section of Davis residents. In addition, for assessing differences based on geographic location, the number of respondents is too low to provide statistically meaningful results. Nevertheless, some interesting trends were observed that, when used in combination with results from the quantitative survey discussed in Chapter 4, should be useful to the city for planning future outreach efforts.

Approximately half (59) of the survey respondents recalled seeing the Healthy Garden Program materials. In general, people remembered seeing more than one item (an average 1.6 items seen per person) at more than one location (an average 1.9 locations seen per person). It appears that the target audience was reached, as most of the survey respondents (95%) were gardeners and approximately 66% of the survey respondents reported using pesticides. Therefore, the survey reached the target audience. In addition, 55% of the gardeners recalled the information and 60% of the pesticide users recalled the Healthy Gardens Program. The program's impact on pesticide use was addressed by Question 8, which offered respondents three choices to complete the sentence, "After seeing the Healthy Gardens information, I … ." Approximately 28% of the people answering this question indicated that they now use fewer or no pesticides.

The three outreach items most often recalled by survey participants were the program's ladybug logo, the North Pond map, and the pesticide management guides. Almost as many people remembered the movie theater slide. However, the hybrid roses sign was recalled less frequently.

The issue of which locations are best for outreach was assessed by evaluating where survey participants reported seeing the materials and the number of card surveys collected at the various survey locations. Almost half of the 63 survey respondents who recalled seeing the Healthy Gardens materials recalled seeing them at North Pond. This is consistent with the North Pond map being one of the most commonly recalled outreach items and North Pond being the location where the most surveys were collected. Other locations recalled by more than 20% of respondents who saw the materials include the farmers' market (30%), "before movies" (27%), and at local stores (25%). This is consistent with the result that the pesticide management guide (distributed at local stores and the farmers' market) and the movie theater slide were two of the more commonly remembered outreach items. Locations recalled less often include the newspaper (19%), City Hall (11%), the Internet (8%), and television (3%).

With respect to the number of surveys collected at different locations, the Wednesday and Saturday farmers' markets had the highest rate of surveys collected per day, with 42 collected in 2 days. For the rest of the sites, surveys were collected for a week. The farmers' market was the only location where a person sat with the display and surveys. The North Pond Site had the second highest number of surveys (41). The farmers' market and North Pond may be sites where people are more likely to spend the time it takes to complete a survey or, similarly, to obtain more detailed information about a topic. In addition, the farmers' market may be more conducive to people thinking about gardening and integrated pest management, and the North Pond site may be more conducive to people thinking about the environment and local water resources.

While the survey results are not statistically valid, the results suggested future directions for the programs with respect to what types of information interest Davis residents and what types of outreach methods to use in the future.

The survey results suggest that gardeners and pesticide users are aware of the program and may be interested in receiving more specific information from the city about alternative pest-control methods. While more specific information is available on the Healthy Gardens Web site, through the demonstration signs, and in the pesticide management guide, awareness of the Web site and the demonstration signs is limited. Future promotional efforts could highlight these program elements.

Two items that were reasonably effective were the movie theater slide and the North Pond sign. In addition, the farmers' market was a good location for distributing Healthy Gardens information. As the city develops new programs, it should consider capitalizing on its local wildlife habitats to help residents make the connection between their actions and resulting impacts on the environment. In addition, the city should make use of unique local attractions, such as the farmers' market and local movie theaters, to impart information.

5.3 Thermometer Collection Tracking

During the San Francisco Water Pollution Prevention Program (SFWPPP) thermometer turn-in campaign described in Chapter 4, participants were asked to provide their ZIP codes and indicate where they had heard about the turn-in events. In addition, the number of thermometers turned in by each participant was tracked. While this information was not collected from every station, approximately 2,200 people were surveyed. On average, each person turned in 1.4 thermometers. Based on this, approximately 3,300 people participated to turn in 4,699 thermometers. Therefore, the intercept surveys were conducted for approximately two-thirds of the participants in the program

SFWPPP collected 4,699 thermometers at nine fire stations, far more than the original goal of 1250. Almost 40% of the thermometers were collected at one station in the "Chinatown" area. Table 5-10 shows the number of thermometers collected at the different stations during the campaign.

Table 5-10. Thermometers Collected at Each Station

Station	May 6	May 13	May 20	May 27	Total collected
Chinatown	175	483	530	650	1838
Richmond	145	276	282	170	873
Sunset	150	90	181	255	676
Ocean	125	175	105	143	548
Marina	150	77	66	42	335
Hayes Valley	19	55	26	17	117
Mission	40	20	44	6	110
Noe Valley	30	27	35	17	109
Bayview	16	7	27	43	93
Total	850	1210	1296	1343	4699

Overall, 42% of those surveyed said they had heard about the program through the newspaper, while 26% said they heard about it on the radio. The next most often mentioned method was "word of mouth" (18%). Five percent of respondents mentioned television and 3% cited utility-bill inserts. Street posters, the fire stations, and Val-Packs each was mentioned by 2% or fewer respondents. At stations where more than 100 people were surveyed, some geographic differences were found with respect to how people had heard about the program. (Responses from stations where fewer than 100 interviews were conducted may not be representative of the geographic area.) A higher than average percentage of respondents at the Chinatown station (42%) reported hearing about the program on the radio. In the Marina district, the vast majority said they had read about the program in the newspaper (74%), with far less than average proportions mentioning "word of mouth" (4%) and the radio (10%). Table 5-11 shows the proportion of responses at each fire station in terms of how respondents reported hearing about the program.

Table 5-11. Reported Source of Program Information, by Location

	Total Queried (n)	Newspaper (%)	Word of Mouth (%)	Radio (%)	Fire Station (%)	Television (%)	Street Poster (%)	Val-Pack (%)	Utility Bill (%)
Chinatown	1003	35	19	39	2	4	2	0	1
Richmond	393	49	17	21	0	5	4	3	6
Sunset	239	54	19	11	3	8	2	0	5
Ocean	195	48	16	20	3	5	3	2	7
Marina	136	74	4	10	3	4	0	2	4
Mission	67	45	34	7	3	3	1	1	6
Noe Valley	60	57	17	5	7	10	3	0	5
Bayview	49	14	43	14	2	14	6	0	6
Hayes Valley	35	60	0	17	0	14	0	9	0

When reviewing the responses by week, some changes were seen over time with respect to where people had heard about the program. During weeks 1 and 2 of the campaign, 64% and 53%, respectively, reported reading about the program in the newspaper. For the final two weeks of the campaign, these proportions dropped to 24% and 29%, respectively. Those who said they heard about the campaign on the radio constituted 6% of the responses in the first

week. This proportion increased to 25%, 40%, and 30% in the second, third, and fourth weeks, respectively. Word-of-mouth responses accounted for 14% and 9% of the responses in weeks 1 and 2, respectively, but increased to 27% and 24% , respectively, in the final two weeks. Table 5-12 summarizes this information.

Table 5-12. Reported Source of Program Information, by Week

Date	Total Queried (n)	Newspaper (%)	Word of Mouth (%)	Radio (%)	Fire Station (%)	Television (%)	Street Poster (%)	Val-Pack (%)	Utility Bill (%)
May 6	439	64	14	6	4	5	0	1	4
May 13	731	53	9	25	1	6	2	1	3
May 20	465	24	27	40	2	3	1	0	4
May 27	619	29	24	30	1	5	6	2	2
Overall	2254	42	18	26	2	5	2	1	3

This effectiveness measurement tool was a simple add-on to an existing element of the outreach campaign. It provided SFWPPP with information on effective outreach methods (newspaper articles, radio), as well as insight into what types of approaches work best in different San Francisco neighborhoods.

5.4 Surveys

As mentioned in Chapter 4, surveys can also be used to measure behavior change. In addition to assessing awareness levels, several surveys attempted to assess behavior changes resulting from an outreach program. The information obtained about behavior changes is discussed in Chapter 4 and summarized below. In addition, SFWPPP used a mail survey to assess implementation rates of dental best management practices (BMPs) as a result of outreach and education efforts. Santa Monica also used a mail survey to assess the impact of the New Development Program workshops on the building community's use of post-construction BMPs.

5.4.1 Behavior Change Assessment Through Surveys

Behavior change was assessed using surveys for the Davis Healthy Gardens Program, the LACSD Lindane Reduction Project, the Woodland Oil and Grease Reduction Project, and the Los Angeles County Used Oil Recycling Outreach Campaign:

- The phone and mail survey used in the Healthy Gardens Program project assessed whether the program had been effective in getting people to use less pesticides. Results indicated that some change had occurred (between 4% and 17% of survey respondents had reduced their pesticide use).
- Phone surveys conducted before and after the LACSD lindane-reduction outreach campaign were used to determine if healthcare professionals had changed their practices with respect lindane prescriptions. The results indicated that, following the campaign, doctors were prescribing lindane less often and pharmacists were mentioning the harmful effects of lindane to their customers more often.
- For the Woodland Oil and Grease Reduction Project, intercept surveys were conducted before and after an outreach campaign to determine if residents were less likely to pour used cooking oil down the drain. The results indicated that no behavior change had occurred.
- For the Los Angeles County Used Oil Recycling Outreach Campaign, intercept surveys were used to determine the proportion of the target audience disposing of used

vehicle fluids properly. Results indicated that, for the most part, used oil and used oil filters were disposed of properly. However, a lower proportion of "do-it-yourselfers" disposed of used transmission and radiator fluids properly. The results implied that survey participants who recalled the campaign were more likely to dispose of used vehicle fluids properly than those who did not recall the campaign.

5.4.2 SFWPPP: Dentists' BMPs

As a result of the source analysis described in Chapter 3, SFWPPP decided to assess previous outreach efforts targeting dentists and use this information to develop additional outreach for this group (Larry Walker Associates 2000e). In March 1999, SFWPPP mailed a two-page survey to all San Francisco dentists. The purpose of the survey was to

- assess the effectiveness of the brochure, "Never Down the Drain," developed by SFWPPP and distributed to dentists in 1997;
- determine the extent to which practices are implemented that are intended to minimize the discharge of dental amalgam; and
- assess attitudes and practices associated with the use of non-amalgam fillings.

5.4.2.1 Procedure

The survey was printed on both sides of a single sheet of paper and was designed to be brief and easy to complete. SFWPPP mailed the surveys, along with a stamped, preaddressed envelope and an introductory letter signed by the SFWPPP manager and the president of the San Francisco Dental Association. Two medical buildings in San Francisco house large numbers of dental offices: one building, at 450 Sutter St., includes about 70 dental offices; the other, at 490 Post St., contains about 40 such offices. SFWPPP was considering these locations for focused outreach, making survey responses from these buildings of particular interest. Project staff used postage stamps with different designs on the return envelopes for surveys sent to these buildings so that the responses could be tabulated separately, if desired.

Surveys were mailed to 843 San Francisco dentists, and 231 surveys were completed and returned, for a 27% return rate. Of the 231 responses, 83% were from dentists practicing general dentistry, 2% were from pediatric dentists, and 1% were from dentists practicing endodontics. On average, respondents practicing general dentistry reported seeing 64 patients per week, endodontists reported seeing 92 patients per week, and pediatric dentists reported seeing 93 patients per week. The remaining 14% of the responses were from dentists whose practices require them to handle very little amalgam, including periodontists, orthodontists, and oral surgeons. Appendix C includes the text of the letter that accompanied the survey and a survey response summary.

5.4.2.2 Survey Results

The following sections discuss the survey results with respect to brochure effectiveness, BMP implementation, and use of non-amalgam fillings.

Brochure Effectiveness. The brochure "Never Down the Drain" contains information about hazardous wastes and water pollutants that are generated by activities conducted in dental offices. The two wastes of primary interest are mercury-containing dental amalgam and silver-containing photoprocessing and X-ray wastes. The brochure provided information on proper handling and disposal of these materials. In response to a question asking where dentists get information about managing dental wastes, more than 80% said that they obtained this type of information from either the California Dental Association or the San Francisco Dental Society. In comparison, 31% said they obtained the information from a government

agency and 38% indicated they obtained the information from a brochure. (Many dentists checked more than one answer.) Other responses to this question included journals (47%), seminars (54%), and conferences (38%).

When asked if they specifically remembered the "Never Down the Drain" brochure, 60% answered yes. To determine if the information presented in the brochure was useful, an open-ended question ("What did you learn from the brochure and what practices have you implemented from the brochure?") was asked.

Of the 136 survey respondents who remembered seeing the brochure, 35% indicated they were implementing all the practices in the brochure, although a substantial portion (20% of those who had seen the brochure) said they had been implementing all the BMPs mentioned before receiving the brochure. The practices listed most often in response to this question were proper disposal of hazardous wastes (21 responses), cleaning traps regularly (11 responses), recycling amalgam scrap (seven responses), and limiting the amount of amalgam prepared or using pre-encapsulated amalgam (six responses). Another eight respondents who had seen the brochure indicated amalgam is not used in their offices. Three of these respondents are in fields that do not typically place fillings, but the other five are general dentists.

While BMP implementation is discussed in more detail below, the brochure's impact also may be assessed indirectly by comparing the proportion of survey respondents who reported implementing each BMP based on whether or not they had seen the brochure. For example, 67% of all respondents reported recycling scrap amalgam. However, of those respondents who said they had seen the brochure, 72% reported recycling scrap amalgam. By comparison, 58% of those respondents who said they had not seen the brochure reported recycling amalgam. Table 5-13 presents data on BMPs for which more than a 10% difference in implementation rate exists between those who had seen the brochure and those who had not. These results suggest that information from the brochure encouraged dentists to implement these BMPs. Increased implementation of the BMPs for amalgam recycling and limiting the amount of amalgam prepared after reading the brochure is consistent with the responses to the question about what had been learned from the brochure.

Table 5-13. Best Management Practice Implementation Rates, by Brochure Recall

Best Management Practice	Implementation Rate, Respondents Who Saw Brochure (%)	Implementation Rate, Respondents Who Did Not See Brochure (%)
Limit amount of amalgam prepared	79	67
Recycle scrap amalgam	72	58
Store broken or unused amalgam with other scrap amalgam	60	48
Store scrap amalgam in airtight container	76	65
Recycle amalgam collected from pump filter	31	20

BMP Implementation. The brochure recommended 17 BMPs for managing amalgam and other hazardous wastes. The survey asked respondents to indicate which of these practices they used in their offices. The results are summarized in Table 5-14. The most frequently implemented BMPs (88% to 90%) are those regarding general knowledge of material safety data sheets and applicable waste disposal requirement. Approximately 75% of the respondents provide annual training, use disposable traps, limit the amount of amalgam prepared, use pre-encapsulated

amalgam, and store amalgam in airtight containers. About 66% recycle scrap amalgam and change filters and traps regularly. About half of the respondents report storing broken or unused amalgam with other scrap amalgam, separating disposable traps from other waste, and disposing of pump-filter amalgam as hazardous waste. Less than a third of the respondents keep a log of amalgam waste, recycle pump-filter amalgam, or use reusable amalgam traps. Only 7% report using amalgam separators and 25% have never heard of amalgam separators.

Table 5-14. Overall Best Management Practice Implementation Rate

Best Management Practice	Percentage of Respondents	Number of Respondents
Employees know where the MSDS's are located.	90	208
Employees are aware of the different disposal requirements for different types of dental wastes.	88	203
We use disposable traps.	77	178
Employees receive annual training regarding pollution prevention and hazardous waste management.	76	175
We limit the amount of amalgam prepared to fill the cavity (i.e. one or two spills).	75	173
We use pre-encapsulated dental amalgam.	73	169
We store amalgam scrap in a designated airtight container.	73	169
We recycle scrap amalgam.	67	155
We change the central vacuum-pump filter regularly (average of 11.3 x/year).	66	152
We dispose of traps regularly (average of 3.5 x/month).	65	150
We collect and store broken or unused amalgam capsules with other scrap amalgam.	56	129
Disposable traps are separated from other wastes.	55	127
The amalgam collected in the pump filter is disposed of as hazardous waste.	47	109
We keep a log of generation and disposal of scrap amalgam.	29	67
The amalgam collected in the pump filter is recycled.	27	62
We use re-usable amalgam traps.	26	60
We have never heard of amalgam separation or separators.	25	35
We use an amalgam separator.	7	16

MSDS = material safety data sheet.

As noted previously, 35% of the survey respondents who recalled the brochure indicated that they were implementing all the BMPs recommended in the brochure. This corresponds to 21% of all survey respondents. Based on the responses regarding specific BMPs implemented, 12% of survey respondents indicated they were implementing at least 15 of the 17 recommended practices. In addition, 46% reported implementing between 11 and 14 of the BMPs. On average, survey respondents indicated they were implementing 10 BMPs. Respondents who said they were implementing all practices in response to the question regarding what they had learned from the brochure reported implementing, on average, 12 BMPs.

Non-amalgam Filling Usage. Replacing amalgam fillings with alternative materials is one approach to reducing mercury in wastewater discharges. Therefore, the survey explored attitudes towards non-amalgam fillings. The survey questionnaire asked respondents how often their patients inquire about non-amalgam fillings and how often the respondent recommends non-amalgam fillings to patients. Responses to these questions were similar. Overall, more

than half (56%) of the respondents recommend amalgam fillings often or always. Only 8% said they never or rarely recommended non-amalgam fillings, while 26% indicated they sometimes recommend non-amalgam fillings. The remaining 10% did not answer these questions.

These questions did not ask how often dentists recommend non-amalgam fillings for situations traditionally requiring amalgam, such as large or posterior fillings. However, responses to the open-ended question about the circumstances under which the respondent would discourage the use of non-amalgam fillings partially addresses this. About 60% (141) answered this question. Approximately 27% of those who answered this question indicated there are no circumstances under which they would discourage the use of a non-amalgam filling. This is consistent with the fact that 26% answered "always" to the question about how often they recommended non-amalgam fillings. The most common reasons mentioned for not using non-amalgam fillings are large cavities (23%) and cavities in the back of the mouth (18%). Other issues mentioned in more than 5% of the responses include cost, poor oral hygiene or cavity prone, and poor moisture control.

When asked what would make dentists more likely to recommend non-amalgam fillings, more than half the respondents answered improved durability (56%) and improved aesthetics (53%). Being easily covered by insurance (32%) and improved ease of handling (30%) were the next most common responses. Environmental impact (24%) and decreased costs (20%) were cited less often.

Finally, dentists were asked how many fillings they placed and removed each week. Of the 231 respondents, 23% reported placing no fillings in their practice. Of the 173 who reported placing fillings, 95% were general dentists and the remaining 5% were divided evenly among endodontists, pediatric dentists, and "other" types of practice.

On average, these 173 offices reported removing 17 amalgam fillings per week. Interestingly, dentists reported placing, on average, more non-amalgam fillings (21 per week) than amalgam fillings (11 per week). Of the survey respondents who place fillings, 18% reported placing only non-amalgam fillings and 47% reported placing more non-amalgam than amalgam fillings. Slightly more than 1% reported placing only amalgam fillings, while 14% reported placing more amalgam than non-amalgam fillings. The remaining 12% indicated they place an equal amount of amalgam and non-amalgam fillings.

5.4.2.3 Information Obtained

SFWPPP used the results of this survey to plan a pilot outreach program. In addition, these results, in combination with results from onsite interviews with dentists, will be used to plan future programs for dentists.

The results indicate that dentists look to their professional societies far more than to government agencies for information on environmental topics. Therefore, whenever possible, efforts to work with dentists should be coordinated with professional societies.

The reported BMP implementation rates indicate that dentists are aware of many of the recommended waste management practices. However, more dentists could implement practices associated with recycling amalgam. Based on BMP implementation rates, SFWPPP decided to focus future outreach to dentists on reinforcing messages regarding recycling amalgam wastes, changing traps and filters regularly, and maintaining a log of scrap-amalgam generation and disposal.

With respect to non-amalgam as an alternative material, a large portion (at least half) of the respondents said they are comfortable with using non-amalgam for most applications. In addition, several reported using no amalgam. Based on this result, it may be possible for SFWPPP to work with dentists on increasing their use of non-amalgam fillings.

5.4.3 Santa Monica New Development Workshop Follow-Up

The workshop quizzes used for the Santa Monica New Development Program discussed in Chapter 4 did not assess behavior but rather increased awareness. However, the city conducted follow-up to assess the workshop's impact with respect to the building community's use of post-construction BMPs. Project staff mailed a survey to 46 members of the building community who registered for the workshop. According to workshop attendance records, approximately 26 of the people receiving the survey attended the workshop and 20 did not. The survey asked what type of post-construction BMPs had been included in recent projects. Fifteen builders who participated in the workshop and six who had not participated responded to the survey. Of the 15 who attended the workshop, 11 said they had recently begun development of a project that included at least one post-construction BMP. The BMPs used included landscaping, permeable paving, dry wells, cisterns, oil–water separators, infiltration trenches, French drains, swales, and catch basin inserts. Of the six who did not attend the workshop, one reported having recently begun a development project that included post-construction BMPs—catch basin inserts, swales, and infiltration trenches. Table 5-15 compares these responses to BMPs included in development plans submitted to Santa Monica in fall 2000 (after the workshop).

Table 5-15. Post-construction Best Management Practices

Post-construction Best Management Practice	Number Included in Development Plans Submitted to City, Fall 2000	Number Mentioned in Workshop Participants' Responses
Dry wells	36	1
Depression basin	4	0
Planter, landscaping	4	3
French drain	2	1
Gravel bed	1	0
Catch basin insert	1	3
Interceptors	0	2
Permeable paving	1	2
Cistern	0	1
Retention basin	0	1
Swale	0	1
Total	49	15

Workshop participants apparently are using a greater variety of post-construction BMPs than those indicated in development plans submitted to Santa Monica.

5.5 Dental Site Visits

The results of the dental practices survey described in Chapter 4 were used to plan targeted outreach to individual dentists for SFWPPP. The project team planned a pilot study as the initial step of this targeted outreach and focused on a large medical–dental building in

downtown San Francisco. The building, at 450 Sutter St., contains mostly medical and dental offices. About 200 dentists practice in 110 offices at this location. Of these, 74 offices house general or endodontic practices. Of the 231 responses to the mail survey, 48 were from the Sutter location.

The mail survey results for 450 Sutter were similar to the overall survey responses, making them an apparently representative group. Approximately two-thirds of the survey participants from the Sutter building reported storing amalgam scrap properly and recycling it. With respect to chairside traps, 37 dentists (77%) reported using disposable traps and 14 (29%) reported using reusable traps. With respect to amalgam collected from the vacuum-pump filters, 27% reported recycling this material, while 48% reported disposing of it as hazardous waste. Only 21% indicated that they keep a log of scrap-amalgam generation and disposal.

The outreach goal at 450 Sutter was to increase the proportion of dentists who recycle traps and other amalgam wastes and to increase the proportion who keep a log or written record of amalgam disposal. The outreach was conducted using scheduled site visits at general dentistry and endodontic practices. Interviews conducted as part of the site visit were also used for evaluation.

5.5.1 Procedure

Site visits were scheduled over 3 days at 34 of the 74 general dentistry and endodontic practice offices at 450 Sutter. When initially contacted, several offices indicated the building handled all hazardous waste disposal. Upon investigation, it was learned that the building offers a service to pick up photographic wastes but does not currently handle disposal of amalgam. Adding an amalgam pick-up service is in the planning stages, according to building management.

The survey team conducted interviews at each office with the dentist or staff person responsible for hazardous waste management, reviewing the extent to which BMPs were being implemented and asking the interviewee specifically about how often traps and filters are changed and how the waste amalgam is handled. The team also asked interviewees if they would be willing to start recycling amalgam collected from traps or filters, maintain a log book of waste generation, or evaluate an amalgam separator. Interviewers left promotional materials targeting these practices with the dentist or staff member. These materials included pens, post-it notes, a logbook, BMP brochures, and apples. Pictures of the promotional materials are shown in Appendix B. The pens and post-it notes contained the following messages:

- Recycle mercury containing amalgam waste.
- Change traps and filters regularly.
- Keep a logbook of recycled mercury waste

5.5.2 Site Visit Results

The first topic covered during each site visit was the handling of scrap amalgam. Most offices reported handling this material properly, with 74% recycling the scrap amalgam and 15% reporting they use no amalgam in the practice. On the other hand, 6% report that amalgam goes down the drain in their offices.

With respect to chairside traps, most dentists use disposable traps (76%), while the remainder use reusable traps. Handling of traps varies, with 38% reporting they dispose of traps with their medical ("red-bag") waste, 38% saying they throw the traps in the trash, and 16% saying they recycle trap material with scrap amalgam. Again, 6% reported rinsing trap

material down the drain. Most dentists were not aware there is a difference between medical waste disposal and hazardous waste disposal. Project staff discussed these differences, as well as proper trap disposal, during the site visits.

Vacuum-filter sludge was handled in a similar manner to the chairside traps. Most offices disposed of this material as medical waste (38%) or in the trash (26%). Some offices recycled the vacuum sludge with the scrap amalgam (12%) and some rinsed it down the drain (15%). When asked about the type of filter used on the vacuum system, most interviewees indicated they used the standard vacuum-system filters, but two or three offices had added larger, finer filters to these systems.

Office staff were also asked about the rate of composite-filling use. Most offices reported using more composites than amalgam in their practices. Approximately 40% said more than 90% of the fillings they place are composite fillings. Another 30% reported rates between 60% and 80%, while the remainder said 50% or fewer of the fillings they place are composites.

During the site visits, project staff suggested certain additional BMPs, including recycling trap and filter waste with the scrap amalgam, asking vendors about finer filters for the vacuum system, and keeping a log of wastes generated in the office. Most offices were willing to try at least one of these suggestions.

In addition to being an effectiveness measurement tool, the site visits were a source control strategy. Project staff conducted a follow-up survey in January to determine if the site visits had been effective in increasing BMP implementation rates. A copy of the follow-up survey is included in Appendix C. The survey asked dental offices if they had begun using one of the following practices in the last 6 months:

- Recycling scrap amalgam.
- Recycling chairside trap waste.
- Recycling vacuum-filter waste.
- Keeping a log of amalgam waste.

Table 5-16 summarizes response rates for the 105 follow-up surveys mailed to dentists.

Table 5-16. Site Visit Follow-Up

Dentist survey group	Mailed to:	Responses from:
450 Sutter, received site visit	34	14
450 Sutter, no visit	31	5
490 Post, another dental medical building, no visits	40	13
Total	105	32

Of the 14 dentists who received a site visit, four indicated they had started at least one new practice in the last 6 months. On average, each of these four dentists implemented 2.8 new practices. Responses were proportionately lower from dentists at 450 Sutter who had not agreed to a site visit. Of the five responses from dentists at 450 Sutter who had not received a site visit, none indicated having started a new practice within the last 6 months. Of the 13 dentists from 490 Post, three indicated they had started a new practice in the last 6 months. On average, each of the three dentists implemented 1.3 new practices.

5.5.3 Information Obtained

Site visits are time consuming both with respect to the time required to schedule them and the time required to conduct them. This method combines outreach and effectiveness measurement, making the time investment more worthwhile.

Because dentists' offices are small, each visit was brief (10 to 15 minutes), but the information obtained was extremely valuable. A site visit provides a much clearer assessment than a survey response about the attitude in each office toward environmental issues. In addition, there may be misconceptions that can only be identified through a physical inspection. One important item in this regard is that the automatic response regarding disposal of chairside traps is that they are disposed of as hazardous waste, which sounds like an appropriate disposal method. However, during the site visits, it became clear that what dentists think of as "hazardous" is "biohazardous" or medical waste. Medical waste is incinerated or sterilized and disposed of as solid waste. Neither practice is an acceptable disposal method for mercury. This only became clear as a result of the site visit interviews. Site visits may confirm information obtained elsewhere. These site visits confirmed a trend that had been observed toward decreased use of amalgam. As noted above, a significant portion of those interviewed reported using very little amalgam in their practices.

While the number of responses to the follow-up survey was small, the site visits apparently were effective with respect to encouraging dentists to implement new BMPs. The dentists visited onsite implemented more new BMPs, on average, than the dentists at 450 Sutter who had not received site visits or those at 490 Post, who were never contacted. Also, based on the response rate of dentists from the two locations, some dentists apparently are open to making changes and, therefore, more easily reached. These easily reached dentists agreed to site visits at 450 Sutter and responded to the follow-up survey at both the Sutter and the Post locations. A much lower proportion of dentists who would not schedule site visits responded to the follow-up survey than the other two groups.

5.6 Assessment of Tools To Measure Behavior Change

In general, the tools used to measure behavior change were developed to take advantage of a unique feature of the source control strategy they were being used to evaluate. Therefore, they may not be as widely applicable as surveys or water quality monitoring. The exception to this is using a mail survey to assess BMP implementation. A mail survey may be used to assess a variety of programs. However, even this tool clearly took advantage of certain features of the outreach program, specifically the illustrations and BMPs listed in the brochure distributed to dentists. In general, the behavior change measurement tools are examples of how to add something simple to allow evaluation and how a program may be developed if evaluation is kept in mind from the beginning.

The costs associated with effectiveness measurement tools are not much more than the cost of the outreach itself for tools such as the thermometer tracking, workshop tests, and site visits. Costs are associated with compiling and analyzing the information collected using these tools. The cost of the sales tracking was associated with staff time to contact and collect information from the pharmacies, then analyze the information collected. The cost of the kiosk survey also was primarily associated with staff time to place the kiosk, collect the cards, and analyze the information on the cards. The cost of the mail survey included costs to produce and mail the survey, in addition to staff time needed to compile and analyze the survey results. Table 5-17 shows the estimated costs of using each of the tools described in this chapter.

Table 5-17. Costs of Behavior Change Measurement Tools

Effectiveness measurement tool	Cost
Sales tracking	$9,000
Kiosk survey	$8,000
Workshop tests	$4,600
Thermometer collection analysis	$1,000
Dental practice mail survey	$10,000
Site visit analysis	$3,100

The workshop tests, thermometer collection, and site visit analyses were fairly simple tools to include in their respective source control programs. The dental mail survey required much effort to develop, produce, and distribute but in many respects was simpler to use than a comparable phone survey. The workshop follow-up survey was simpler to implement than the dental survey because it was mailed to fewer people (about 90 workshop participants) than the dental survey (about 900 dentists). While implementing the kiosk survey also was more involved, this tool was fairly straightforward to use. However, as discussed above, the sales tracking technique was difficult to implement and yielded inconclusive results in the demonstration project.

CHAPTER 6.0

TOOLS TO MEASURE POLLUTANT LOAD REDUCTIONS

The ultimate goal of any pollution prevention program is to improve the environment. Source control programs can directly measure the reduction in pollutant inputs to the environment by measuring changes in pollutant concentrations in treatment plant influent, collection-system trunk lines and, in the case of stormwater, urban runoff. Due to data variability and expense, this approach has limitations. In addition, reductions in pollutant inputs may or may not provide an indication of ambient changes.

Two projects used water quality monitoring for effectiveness measurement:

- the Davis Healthy Gardens Program; and
- the Los Angeles County Sanitation Districts (LACSD) Lindane Reduction Program.

This chapter describes the results of these monitoring efforts.

6.1 Healthy Gardens Program Stormwater Monitoring

As part of its Pollution Load Reduction Program, the city of Davis since 1996 has monitored stormwater runoff at three outfalls and two receiving-water locations. One of these locations is North Pond, a flood detention basin that also serves as a wildlife habitat. The pond drains an area that has only residential land uses. The data collected at North Pond were used to assess the effectiveness of the Healthy Gardens Program.

Data on pesticides in stormwater runoff were available for this outfall for three storms that occurred in 1996 and 1997, prior to the initiation of the pesticide outreach program, and one storm that occurred in 1998, after the program had been initiated. To supplement the existing data, the city monitored two additional storms at North Pond during the 1999–2000 storm season for diazinon, chlorpyrifos, and conventional pollutants. An automatic sampling station permanently installed at North Pond collected flow-based composite samples. Clean sampling techniques were used to collect the samples.

Table 6-1 summarizes the results of the two monitoring events.

Table 6-1. North Pond Monitoring Summary, 1999–2000

Date	Rainfall (in.)	Diazinon (µg/l)	Chlorpyrifos (µg/l)
May 8, 1999	0.26	0.37	0.048
Feb. 17, 2000	0.07	0.26	0.002

These results were compared to monitoring data collected at this site between 1996 and 1998 (see Figure 6-1). The results show a decrease in pesticide levels in stormwater runoff to North Pond over time. Because stormwater data are influenced by a variety of factors, it is not clear if the decrease is significant. It is interesting that the rainfall levels show the same pattern as the pesticide levels. However, data on total suspended solids collected during the same period show a very different trend, as shown in Figure 6-1b.

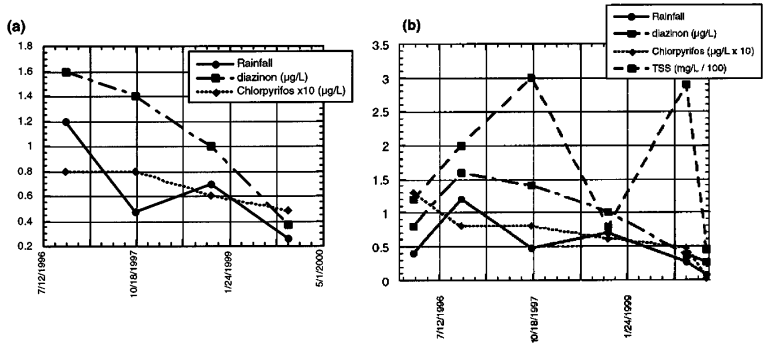


Figure 6-1. City of Davis North Pond Assessment
(a) North Pond Assessment First Flush Events (b) North Pond Assessment
TSS = Total suspended solids

6.2 LACSD Lindane Reduction Project Influent Monitoring

As discussed in previous chapters, LACSD used several approaches to measure the impact of the lindane-reduction outreach campaign in the pilot areas. One indicator of the program's impact was the change in lindane concentrations in the wastewater collection system, as the purpose of the project was to reduce these concentrations. To determine the impact of the program in the Long Beach outreach area, LACSD collected samples from a trunk line in Long Beach. The trunk line carries approximately 4 mgd of wastewater and services to about 40,000 residents. Sampling was performed in Long Beach in August 1999 to establish a baseline and again in January, March, June, and October 2000 to see if lindane concentrations had changed. Each sampling episode consisted of seven 24-hour composite samples taken during a 1-week period. To determine the impact of the outreach program in Burbank, LACSD sampled influent to the Burbank Water Reclamation Plant. The baseline was established from 18 influent samples taken between February 1997 and September 1999. Post-outreach concentrations

were determined by an intensive sampling episode consisting of seven consecutive 24-hour composite samples taken during a 1-week period in March 2000.

Sampling was also performed at a control location, on LACSD's Pomona Water Reclamation Plant influent, to determine if changes in lindane concentrations in the outreach areas also occurred in areas where no outreach was performed. No direct outreach was done upstream of the Pomona plant, although area residents may have been exposed to some of the mass media outreach. The Pomona facility treats 13 mgd of wastewater and serves approximately 130,000 residents. Initial sampling was performed at the Pomona plant in September 1999 to establish a pre-outreach baseline, and again in December 1999 and February and May 2000 to determine if concentrations changed. Each sampling episode consisted of seven 24-hour composite samples taken during a 1-week period.

The sample data are summarized in Figure 6-2. Median lindane concentrations remained essentially constant in the control area, at 30 to 35 parts per trillion, but dropped by half in the Long Beach outreach area, from 30 to 15 parts per trillion. Average lindane concentrations also were reduced by half in the Burbank outreach area, from 17 to 8 parts per trillion.

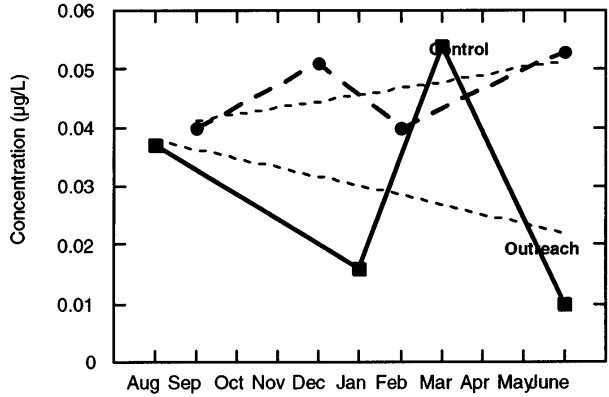


Figure 6-2. LACSD Wastewater Lindane Levels (1999-2000)
LACSD= Los Angeles County Sanitation Districts

6.3 Assessment of Monitoring To Measure Pollutant Reductions

Monitoring can be relatively expensive and sufficient data often are not available to provide statistical certainty. For example, Davis spent $7,000 to collect and analyze two samples from one site for the pesticide assessment. LACSD spent about $10,000 to analyze 56 wastewater samples for lindane, not including costs associated with collecting the samples. Approaches to addressing the uncertainty of water quality results are sampling more frequently or supplementing water quality monitoring with other types of evaluation. Other types of evaluation were used for all the projects described above.

In addition, for the LACSD project, monitoring frequency was good, in that more samples were collected. For one sampling location, Burbank, there was 2 years' worth of sampling data

were available for use as a baseline. Each post-outreach event at each sampling location consisted of collecting seven composite samples during a 1-week period. In this case, confidence levels for the results are much higher than for the Davis project, for which six samples were collected during a 4-year period. This highlights an advantage of wastewater monitoring over stormwater monitoring: Wastewater can be sampled routinely, whereas stormwater sampling is event driven.

Overall, water quality monitoring is a potentially valuable tool if programs are designed properly and adequately funded.

CHAPTER 7.0

CONCLUSIONS

Numerous tools exist to assess the effectiveness of source control programs. As stated in previous chapters, the progressive stages involved in achieving source control program goals are

- program design and implementation,
- increased awareness,
- behavior change,
- reduction in pollutant inputs,
- reduction in effluent loadings, and
- changes in environmental conditions.

Different tools are used to assess progress in each of these stages. In the demonstration projects described in this report, most of the tools used to assess program effectiveness were aimed at progress made in the first three stages and, to some extent, in the fourth stage. The tools used to assess source control program effectiveness in the final three stages may require collaboration and a sharing of resources with other groups. For example, assessing the impact on effluent quality resulting from source control efforts may require working with personnel responsible for monitoring treatment plant operations. Similarly, determining the impact of source control on environmental conditions may require forming partnerships with watershed groups involved in ambient monitoring programs and using modeling or other tools.

Effectiveness measurement tools typically are employed at three points in a project: during program planning, during implementation, and on project completion. Effectiveness measurement during planning focuses on audience characterization, development of baseline information, and review of the existing program. Evaluation during implementation focuses on tracking information and ensuring that milestones are achieved and selected strategies are operating as expected. Evaluation on project completion focuses on determining if the project's goals were achieved and which elements worked best. The project timing and stages for demonstration project effectiveness measurement tools are shown in Table 7-1.

Table 7-1. Demonstration Project Effectiveness Measurement Tools

Effectiveness measurement tool	Project	Timing for project	Stage to environmental improvement
Estimated load reductions	Mercury Reduction Program	Planning	Program Design and implementation
Existing program assessment	Oil and Grease Reduction Project, New Development Program	Planning	Program design and implementation
Intercept survey	Oil and Grease Reduction Project	Completion	Behavior change
Intercept survey	Used Oil Recycling Outreach Campaign	Completion	Awareness, behavior change
Kiosk survey	Healthy Gardens Program	Completion	Awareness, behavior change
Mail survey	Dental outreach campaign	Completion (brochure), planning (additional outreach)	Behavior change
Pharmacy sales tracking	Lindane Reduction Project	Implementation	Behavior Change
Phone survey	Thermometer turn-in campaign	Planning, completion	Awareness
Phone survey	Lindane Reduction Project	Planning, completion	Awareness, behavior change
Phone–mail survey	Healthy Gardens Program	Completion	Awareness, behavior change
Site visits	Dental outreach campaign	Implementation	Behavior change
Thermometer turn-in rates	Thermometer turn-in campaign	Implementation	Behavior change
Water quality monitoring	Healthy Gardens Program	Implementation, completion	Reduced pollutant inputs
Water quality monitoring	Lindane Reduction Project	Implementation, completion	Reduced pollutant inputs
Workshop tests	New Development Program	Completion	Awareness

The demonstration projects tested effective measurement tools for their ease of use and range of applicability. In most cases, they worked as expected. In some cases, more could have been learned from the effectiveness measurement. Table 7-2 summarizes the advantages and disadvantages of the various tools used in the demonstration projects.

Table 7-2. Advantages and Disadvantages of Effectiveness Measurement Tools

Effectiveness Measurement Tool	Applicability	Advantages	Disadvantages
Estimated load reductions	Planning – overall program	• Provides basis for identifying most effective strategies • Provides baseline information • Facilitates goal setting	• Data may be hard to obtain • Numerous assumptions • Nonquantitative, but may be misinterpreted as quantitative
Existing program assessment	Planning – specific program elements	• Less data needed than for load reduction • Facilitates goal setting, future evaluation	• Need information from a variety of sources • Nonquantitative
Water quality monitoring	Commercial or residential; reduction in pollutant inputs	• Measure of impact on water quality • Potential indicator of environmental improvement	• Results may only be measurable long term • May be expensive to obtain statistically valid results • May be difficult to attribute reductions to program under evaluation
Kiosk survey	Public education; awareness and behavior change	• Inexpensive • Assessment of outreach locations	• Nonquantitative
Sales tracking	Public education; consumer products; behavior change	• Good measure of behavior change	• Difficult to implement • Time consuming • May be difficult to attribute reductions to program under evaluation
Tracking turn-in rates	Residential; behavior change	• Inexpensive • Simple to implement • Easy to add to certain types of outreach	• Not broadly applicable
Phone survey	Residential; awareness or behavior change	• Quantitative • Audience characterization • Professional expertise available	• Expensive • May not be able to measure short-term changes
Intercept survey	Residential; awareness or behavior change	• Simple to implement • Easily added to certain types of outreach	• Nonquantitative
Mail survey	Residential or commercial; awareness or behavior change	• Less expensive than phone surveys • Can be quantitative • High return rates • Good tool for follow-up	• May limit information that can be obtained • May not be able to measure short-term changes
Site visits	Commercial; source control, behavior change	• Easily included in inspection-based programs • Insights from direct interaction • Good for checking survey results	• Not broadly applicable • Time consuming • Nonquantitative
Workshop quizzes	Commercial; source control, group outreach	• Simple to implement • Inexpensive	• Not broadly applicable

7.1 Evaluation of Framework and Planning Tools

Tools used specifically for planning were developed and used based on the framework for developing source control programs, as discussed in Chapter 1. The framework and the planning tools were tested for three projects: the San Francisco Water Pollution Prevention Program (SFWPPP) Mercury Reduction Project, the Woodland Pollution Prevention Program Oil and Grease Reduction Project, and the Santa Monica New Development Program assessment. The framework, as presented in the Phase 1 report (Water Environment Research Foundation 2000) and summarized in Chapter 1 of this report, relies on the ability to assess sources of pollutants quantitatively and assign estimated loads to each source. This was only practical for the mercury reduction project. Developing load estimates for pollutant sources is an approximation of the real situation and should be used only for planning purposes. A drawback of this approach is that these estimates may be misinterpreted as quantitative results.

The framework was modified for the Woodland and Santa Monica projects to assess existing program records to determine program needs. This approach is less quantitative and less likely to be misinterpreted.

Regardless of whether load estimates or information assessment were used, the framework process provided valuable insights about the programs that resulted in the development of useful source control programs for each agency. Using the framework requires an agency to review and compile what they already know. It also allows agencies to develop baseline information that make goal setting and future evaluation straightforward.

This effort was time consuming for each project and would be more time consuming for agencies that need to gather or develop the basic information. However, in each case, the planning required by the framework was worthwhile and resulted in development of an effective source control plan.

7.2 Evaluation of Tools Measuring Increased Awareness and Behavior Change

This section discusses the tools used to measure program effectiveness in the demonstration projects during implementation and on project completion.

7.2.1 Surveys

Surveys can be conducted to be quantitative (statistically valid and reliable) or nonquantitative. Overall, surveys are more likely to show measurable changes if a campaign has been conducted long enough and its message repeated enough times for it to be recalled by the audience. Surveys may not be the best tools to measure the effectiveness of a brief outreach campaign or one element of a campaign. For example, a 1-month thermometer turn-in campaign probably was too brief to raise public awareness to a measurable level. Other tools showed that the campaign had made a promising start (i.e., collection of almost 5000 thermometers). On the other hand, the results of the 2-year pesticide outreach campaign in Davis were measurable due to repeated exposure of the audience to the Healthy Gardens Program message. Selected features of different types of surveys used in the demonstration projects are discussed below.

7.2.1.1 Phone Surveys

Random-digit-dial phone surveys are the standard tool used by many outreach programs to characterize their audiences and assess their programs. When used to assess program

effectiveness, it is essential to conduct a preprogram survey and use identical questions in the follow-up survey. Many firms specialize in conducting this type of survey. While it is more expensive to use a contractor, the improved question design and data analysis available from an expert may be worth the cost.

7.2.1.2 Mail Surveys

Mail surveys can provide the same type of quantitative information as a phone survey and can be less labor intensive. Response rates will be highest if the survey is brief and easy to complete and if a preaddressed, stamped envelope is included with the survey. If addresses are randomly selected and questions are the same as those used in a phone survey, results from the two surveys can be combined. Mail surveys used as follow-up to the dental site visits and new development workshops were straightforward to implement and provided useful information.

7.2.1.3 Intercept Surveys

Intercept surveys are nonquantitative but provide useful insights about trends. They are conducted as "face-to-face" interviews at a location frequented by the target audience. They can be easily added to planned outreach conducted in a fixed location, such as a special event or outside a store.

7.2.1.4 Kiosk Surveys

Kiosk surveys are nonquantitative, because the participants are not randomly selected. However, the kiosk survey conducted in Davis provided results similar to the quantitative surveys that also were conducted there. In addition, by rotating the location of the display and survey receptacle, useful information on locations conducive to people stopping long enough to be "educated" was obtained. Tasks for implementing this tool included researching locations, obtaining permission to place the display, checking the display occasionally to reduce vandalism, and collecting the cards and analyzing the results. This effort was spread out over several weeks so it only required a few hours a week to maintain it.

7.2.2 Sales Tracking

Sales tracking was a particularly difficult tool to use effectively. It is time consuming and the data collected may be inconsistent or incomplete. This tool produces more reliable information if the agency has an established relationship or ongoing program with the participating stores (resulting in the store producing more consistent and complete sales data) and if the stores use electronic inventory methods.

7.2.3 Tracking Participation Rates

Tracking participation rates takes advantage of a campaign that involves getting the target audience to do something. For example, SFWPPP used this tool by simply counting the number of thermometers turned in. The information obtained can be augmented by asking one or two questions (for example, "Where did you hear about the program?"). Other ways to use this tool include offering coupons for something, then tracking how many coupons are redeemed, or tracking phone calls and requests for additional information. A similar approach related to commercial programs is tracking permit compliance or implementation rates for best management practices (BMPs). Another advantage of tracking participation rates is that it requires little additional cost beyond that of the source control program itself.

7.2.4 Quizzes

Quizzes are simple to implement and require almost no added expense. However, they are only useful for certain types of outreach, such as workshops or other strategies that bring

the target audience together for a specific event. Quizzes provide more immediate feedback on the effectiveness of a single program element than information provided by surveys on long-term or overall program effectiveness.

7.2.5 Site Visits

Site visits are a source control strategy that can be used as an effectiveness measurement tool if the procedure for each visit is standardized and the same information is recorded for each visit. This is a labor-intensive strategy, but the information that can be obtained through direct observation may be invaluable to understanding the target audience and planning future programs. Site visits can provide good supplementary information that can corroborate results provided by other tools. In addition, if the visit is presented properly, it may help establish a relationship with the target audience that could lead to future cooperation.

7.3 Tools To Measure Reductions in Pollutant Inputs

Water quality monitoring is an approach for determining the effectiveness of source control programs in reducing pollutant inputs to the environment. Influent and trunk-line monitoring were used to assess the Los Angeles County Sanitation Districts (LACSD) Lindane Reduction Project, and stormwater runoff monitoring was used to assess the Davis Healthy Gardens Program. However, there is not always a clear relationship between pollutant reductions and source control program activities. Apparent reductions may be due to a variety of factors, including variability in limited data sets and the impacts of other programs with similar messages.

Limited data sets may be addressed by collecting enough data to be representative at a high level of confidence. This can be expensive and it may be difficult to collect enough data under appropriate conditions for the results to be statistically valid. Monitoring results that are not statistically valid may be used to evaluate trends and check the results of other evaluation tools to provide an overall assessment of an outreach program.

Attributing reductions to the program under evaluation may be addressed by using supplemental effectiveness measurement tools that address the other stages (i.e., awareness and behavior change). Information gained from different effectiveness measurement tools then can be aggregated.

7.4 Use of Information Gained From Different Tools

Using more than one effectiveness measurement tool for one program can help strengthen individual findings. In some cases, the information obtained from the different tools can be combined to provide additional information. Comparison of information derived from different measurement tools is discussed below for

- the SFWPPP thermometer turn-in campaign,
- the SFWPPP dental practices evaluation,
- the Davis Healthy Gardens Program, and
- the LACSD Lindane Reduction Program.

7.4.1 SFWPPP Thermometer Turn-In Campaign

The thermometer turn-in campaign was evaluated by counting the number of thermometers turned in and conducting pre- and post-campaign phone surveys. The phone surveys

indicated no increase occurred with respect to awareness or behavior regarding the use of mercury thermometers. On the other hand, 3300 households (approximately 1% of all San Francisco households) turned in mercury thermometers, which represents a respectable start in an outreach campaign after 1 month. Tracking collection rates provided some additional information regarding program effectiveness that could not be obtained through the surveys. In addition, combining information from the survey, the collection rate, and the estimated load reduction allows improved analysis of the program. A total of 4699 thermometers were turned in. Assuming each thermometer contains 0.5 g of mercury, 5.2 lb of mercury were collected. According to the survey results, between 2% and 3% of thermometer owners have disposed of mercury from a broken thermometer down the drain. Therefore, it could be estimated that 2.5% of the thermometers turned in, or 0.13 lb of mercury, were kept out of the sanitary sewer as a result of this campaign. As noted in Chapter 3, the estimated potential load reduction achievable through a thermometer turn-in and outreach campaign was 1.2 lb. Therefore, approximately 10% of the estimated load reduction seems to have been achieved through this program. Considering that the program lasted only 1 month, this could be considered a promising start.

7.4.2 SFWPPP Dental Practice Evaluation

Practices used by San Francisco dentists were evaluated with respect to BMP implementation rates using a mailed survey and onsite assessments during site visits. In both assessments, dentists were asked if they recycled scrap amalgam, disposable traps, and vacuum-filter waste. As shown in Table 7-3, information obtained from the mail survey and the site visits yielded essentially the same result with respect to recycling scrap amalgam. However, there were substantial differences in the results obtained by the two methods with respect to the number of dentists who recycle vacuum-filter and trap wastes. This discrepancy was probably due to a misconception among dentists that disposal of trap and filter waste as medical waste is an acceptable practice. Using both forms of evaluation yielded more complete information about dental practices.

Table 7-3. Dentist Best Management Practices Implementation Rates

Percentage of dentists who:	Mail survey (%)	Site visit (%)
Recycle scrap amalgam	75	74
Recycle trap waste	59	16
Recycle vacuum-filter waste	30	12

7.4.3 Davis Healthy Gardens Program

The Healthy Gardens Program was evaluated using phone, mail, and kiosk surveys and by monitoring stormwater runoff from a residential area. As noted previously, the water quality data, while showing a downward trend, were inconclusive due to the limited amount of data collected. On the other hand, the surveys indicated awareness of the Healthy Gardens Program and some behavior change as a result of the program. The survey results were useful in explaining which portions of the program were most effective. This type of information is important for future planning efforts. Another useful result of the Davis evaluation is the demonstration that the mail and phone survey results could be combined. It was helpful to be able to modify the evaluation method partway through the program.

7.4.4 LACSD Lindane Reduction Project

LACSD evaluated its lindane-reduction pilot program using surveys, water quality monitoring, and sales tracking. The water quality monitoring results showed lower lindane concentrations in the pilot areas than in the control area after the outreach program was conducted.

The survey results confirmed that the outreach program had been effective in changing the practices of healthcare professionals, which may explain the lower lindane concentrations in the wastewater. On the other hand, the sales tracking produced inconclusive results. Using more than one evaluation tool provided a more complete assessment of the program and allowed effectiveness to be measured even though one evaluation approach did not perform as expected.

7.5 Pollution Prevention Planning and Tools Selection

In addition to testing how well effectiveness measurement tools work, the demonstration projects provided information that can be used in planning source control programs. This information includes development of participation factors (i.e., the portion of a target audience that will respond to a source control program), costs associated with pollution prevention programs, and costs associated with evaluation.

Table 7-4 presents the participation factors, based on the results of the effectiveness measurements conducted for the demonstration projects.

Table 7-4. Participation Factors

Control strategy	Audience	Participation rate (%)
Outreach to encourage turn-in of mercury thermometers	General public	1 (initial response)
Outreach to discourage use of prescription lindane	Medical professionals	43
Outreach to encourage education of customers about harmful effects of lindane	Pharmacists	90
Awareness of pesticide education program	General public	50
Behavior change to use less pesticides	General public	4–17
Outreach to increase awareness of difference between stormwater and wastewater	General public	50
Outreach to encourage recycling of scrap amalgam	Dentists	75
Outreach to encourage recycling of other amalgam wastes	Dentists	15–30
Outreach to encourage recycling of used oil	"Do-it-yourselfers"	90
Workshop attendance	Building community	5
Mail survey response rates	Dentists	20–25
Mail survey response rates	General public	40

Table 7-5 shows the costs associated with the pollution prevention programs conducted for the demonstration projects, as well as the amount spent on evaluation. Based on demonstration project expenditures, effectiveness measurement costs between $5000 and $20,000 and typically accounts for 5% to 20% of total project costs. Factors influencing these costs include whether agency staff or a contractor does the work and the number of evaluation methods used.

Table 7-5. Pollution Prevention Program Costs

Demonstration Project	Program Costs*	Evaluation Costs	Evaluation Tools Used
SFWPPP thermometer outreach campaign	$75,000*	$17,000*	Phone surveys, tracking
SFWPPP dental outreach campaign (1997 Brochure production and 2000 site visits)	$75,000*	$14,000	Mail surveys, site visits
Woodland Oil and Grease Reduction Project (residential outreach)	$12,000	$4000	Two intercept surveys
Santa Monica New Development workshops	$27,000	$5000	Quizzes
Davis Healthy Gardens Program	$50,000*	$22,000*	Phone survey, mail survey, kiosk survey, water quality monitoring
LACSD Lindane Reduction Pilot Project	$160,000*	$19,000*	Water quality monitoring, sales tracking
Los Angeles County Used Oil Recycling Campaign	$360,000*	$13,000	Intercept survey

* Includes agency (non-Water Environment Research Foundation grant) costs.
SFWPPP = San Francisco Water Pollution Prevention Program.
LACSD = Los Angeles County Sanitation Districts.

Costs of the effectiveness measurement tools used in the demonstration projects are shown in Table 7-6. Lower-cost tools typically are those that are simple "add-ons" to existing outreach, such as the quizzes, the site visit analysis, and tracking the number of thermometers collected.

Table 7-6. Cost of Effectiveness Measurement Tools

Effectiveness Measurement Tool	Cost	Percent of Project Cost	Basis	Target Audience Size
Intercept survey, used-oil recycling	$14,000	5	One event, 188 surveys	About 2 million "Do-it-yourselfers"
Intercept survey, oil and grease reduction	$4000	20	Two intercept survey events, 560 interviews	46,000 residents
Mail surveys, dental outreach campaign	$10,000	10	843 surveys mailed, 231 completed	843 dentists
Mail surveys, Healthy Gardens Program	$5000	10	500 surveys mailed, 200 completed	55,000 residents
Mercury source identification and pollution prevention plan, Mercury Reduction Project	$8500	NA	95 mgd at two wastewater treatment plants	790,000 residents
New Development Program assessment	$10,000	NA	Phase 1 stormwater program	85,000 residents
Oil and Grease Reduction Project assessment	$7600	NA	6-mgd wastewater treatment plant	47,000 residents
Phone surveys, thermometer turn-in campaign	$7000	10	400 phone interviews	790,000 residents
Phone surveys, Healthy Gardens Program	$5000	10	120 phone interviews	55,000 residents
Sales tracking, Lindane Reduction Project	$9000	6	18 pharmacies reporting on six months of sales	33 pharmacies
Site visit analysis, dental outreach campaign	$3000	20	35 site visits (pilot project)	843 dentists
Thermometer collection tracking, thermometer turn-in campaign	$5000	7	2200 surveys, 3300 people turned in 4700 thermometers	335,000 households
Workshop quizzes, New Development Program	$5000	15	Two workshops, 78 pre-tests, 67 post-tests	About 1000 builders and developers, 110 workshop participants
Water quality monitoring, Healthy Gardens Program	$7000	14	Two stormwater samples	55,000 residents
Water quality monitoring, Lindane Reduction Project	$10,000	7	56 wastewater samples	170,000 residents, about 500 healthcare professionals

7.6 Conclusions

Some important findings from this project include the following:

- Planning is critical to conducting successful source control programs. The framework developed in Phase 1 and the planning tools discussed in Chapter 3 are useful for assessing sources, control strategies, and existing program structure and using this assessment to incorporate evaluation into a program from the beginning.
- When using water quality monitoring as an evaluation tool, consideration must be given to the statistical significance (i.e., quantity and variability) of the data. It is also important to determine whether the monitoring results can be related directly to source control program impacts.
- Using more than one evaluation approach has the advantage of providing a better characterization of the program and its audience. It also provides protection from relying one evaluation method that may yield inconclusive results.

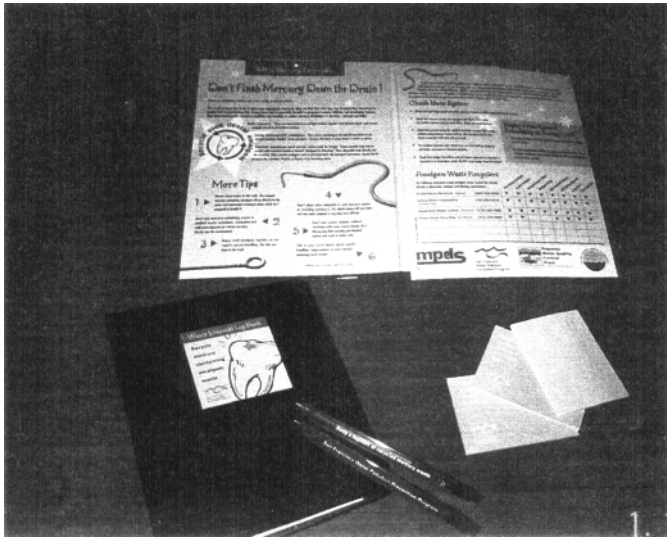
- Ways to reduce evaluation costs include limiting the data collected to items directly related to evaluating the program (for example, conduct monitoring for only the relevant constituents and include survey questions only designed to evaluate the program).
- Results of outreach campaigns, particularly with respect to the general public, will be measurable only after sufficient time has passed to allow repeated exposure of the public to the outreach campaign message. Measurable increases in general awareness should not be expected after only 1 month of outreach or limited distribution of outreach materials.
- Source control programs have the greatest ability to measure the effectiveness of their programs with respect to program design, increased awareness, behavior change, and reduction in pollutant inputs using the tools described in this report. Making the connection between source control program activity and improvement in environmental conditions may require more sophisticated tools, such as modeling, and developing partnerships with other groups (e.g., watershed groups, ambient monitoring programs, and discharge monitoring staff).

POLLUTANT SOURCE DATA RESOURCES

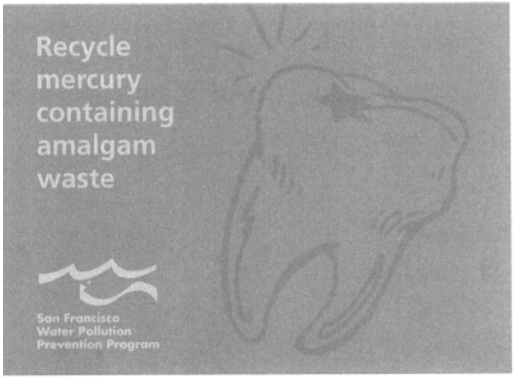
Where to get information on sources—some starting points

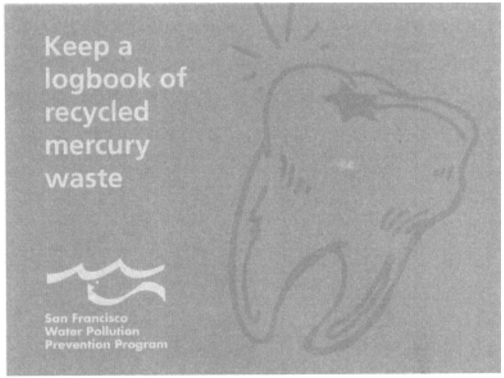
- Bay Area Pollution Prevention Group, Selina Louie: stl@rb2.swrcb.ca.gov.
- Bay Area Stormwater Management Agencies Association: http://www.basmaa.org.
- California Water Environment Association Industrial and Hazardous Waste Committee: http://www.egroups.com/group/cweaihw.
- Center for Watershed Protection: http://www.cwp.org.
- EIP Associates. "Mercury reduction menu." 2000. Prepared for the Bay Area Pollution Prevention Group, April, 13.
- King County (Wash.) Local Hazardous Waste Management Program: http://www.metrokc.gov/hazwaste.
- Massachusetts Water Resources Authority: http://www.mwra.state.ma.us.
- Palo Alto (Calif.) Regional Water Quality Control Plant: http://www.city.palo-alto.ca.us/cleanbay.
- Stormwater Managers Resource Center: http://www.stormwatercenter.net.
- Water Environment Research Foundation. 1998. *Residential and commercial source control programs to meet water quality goals.* Project 95-IRM-1. Alexandria, Va.: Water Environment Research Foundation.
- Water Environment Research Foundation. 2000. *Tools to measure source control program effectiveness.* Project 98-WSM-2. Alexandria, Va.: Water Environment Research Foundation.
- Western Lake Superior Sanitary District: http://www.wlssd.duluth.mn.us.

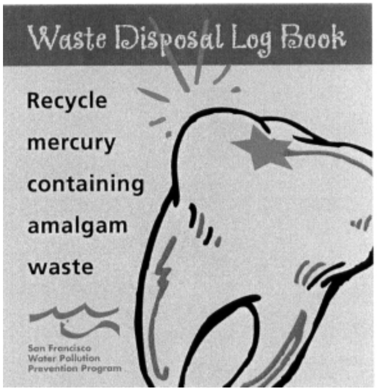
DEMONSTRATION PROJECT OUTREACH MATERIALS

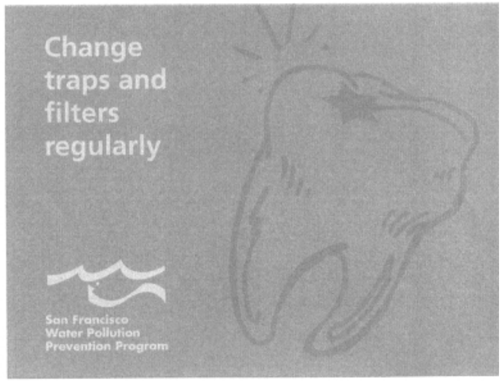


Outreach Materials Developed for Dental Site Visits
Flyer designed by Bay Area Pollution Prevention Group


Recycle
mercury
containing
amalgam
waste
San Francisco
Water Pollution
Prevention Program


Keep a
logbook of
recycled
mercury
waste
San Francisco
Water Pollution
Prevention Program


Waste Disposal Log Book
Recycle
mercury
containing
amalgam
waste
San Francisco
Water Pollution
Prevention Program


Change
traps and
filters
regularly
San Francisco
Water Pollution
Prevention Program

Outreach Materials for Woodland Oil and Grease Reduction Program

grease goes from the PAN...

... to the CAN!

Cooking oils, grease and fat are great for frying and coating pots and pans. BUT, they also clog drain pipes and cause sewer pipes to back up. **Keep your pipes running free!** Cool down your cooking oil, grease and fat and pour them into a can - not down the drain. Trash the can - not your pipes.

Also, please wipe out pots and pans with a paper towel before doing dishes - you will use less soap and decrease clogs.

CITY OF WOODLAND
POLLUTION PREVENTION PROGRAM

FOR MORE INFORMATION CALL THE CITY OF WOODLAND POLLUTION PREVENTION PROGRAM AT 530-406-5107

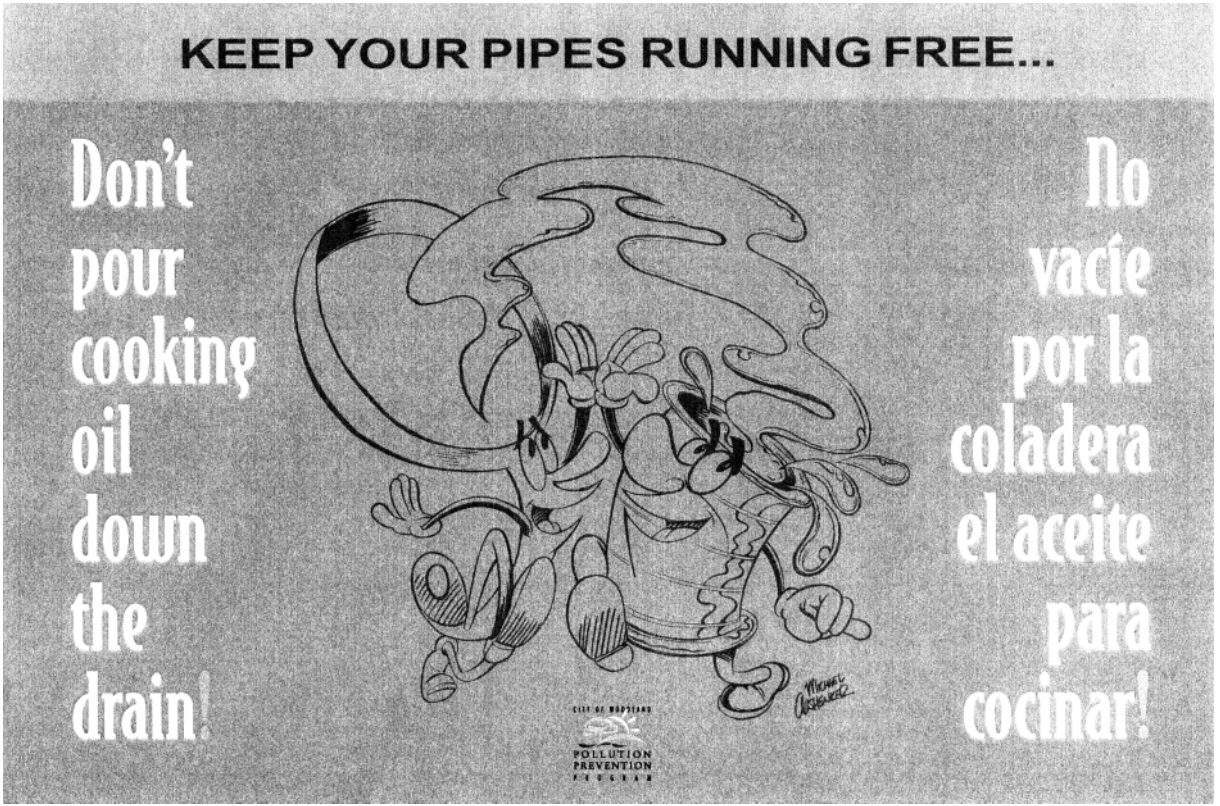
la grasa va de la SARTEN...

.... a la LATA!

Los aceites para cocinar y la grasa son excelentes para freír y para dar recubrimiento a sartenes y cacerolas, PERO, también tapan las tuberías del desagüe y ocasionan congestionamiento en la tubería del drenaje. **Conserve sus tuberías libres de obstrucciones!** Enfríe su aceite y grasa para cocinar y vacíelos a una lata - no a la coladera. Tire la lata y no sus tuberías a la basura.

También, limpie las cacerolas y las sartenes con una toalla de papel antes de lavar los platos – así, usted usará menos jabón y disminuirá la posibilidad de que se tape la tubería.

CITY OF WOODLAND
POLLUTION PREVENTION PROGRAM


KEEP YOUR PIPES RUNNING FREE...
Don't pour cooking oil down the drain!
No vacíe por la coladera el aceite para cocinar!
CITY OF MODESTO
POLLUTION PREVENTION PROGRAM

City of
Santa Monica™

Conserve Today.
Preserve Tomorrow.
Santa Monica
A Sustainable Community

CONTROLLING URBAN RUNOFF: SANTA MONICA STYLE
A Workshop on City Policies & Practices

August 22, 2000
City Hall Council Chambers

9:00 - 9:35 WHAT CAN YOU EXPECT FROM THIS WORKSHOP
Speaker: Tony Antich

9:35 - 10:05 RWQCB REGULATIONS
Speaker: Xavier Swamikannu

10:05 - 11:35 CITY OF SANTA MONICA
Speakers: Neal Shapiro and Bill Buol

10:05 - 10:35 CITY OF SANTA MONICA'S EXPECTATIONS
Speaker: Neal Shapiro

10:35 - 11:35 TECHNICAL DETAILS OF BMPs
Speaker: Bill Buol

11:35 - NOON WRAP-UP AND POST TEST
Speaker: Tony Antich

City of
Santa Monica

Conserve Today.
Preserve Tomorrow.
Santa Monica
A Sustainable Community

CONTROLLING URBAN RUNOFF: SANTA MONICA STYLE
A Workshop on City Policies & Practices

August 31, 2000
Los Angeles County Department of Public Works

9:30 – 10:00 CHECK-IN, REGISTRATION

10:00 – 10:25 WORKSHOP INTRO
Speaker: Neal Shapiro, City of Santa Monica
CITY OF SANTA MONICA'S INVOLVEMENT
Speaker: Tony Antich, City of Santa Monica

10:25 – 10:55 REGIONAL WATER QUALITY CONTROL BOARD REGULATIONS
Speaker: Xavier Swamikannu, Regional Water Quality Control Board

10:55 – 11:45 CITY OF SANTA MONICA
10:55 - 11:20 DESCRIPTION OF RUNOFF & SANTA MONICA'S APPROACH
Speaker: Neal Shapiro, City of Santa Monica
11:20 - 11:45 THE ENGINEER'S PERSPECTIVE
Speaker: Bill Buol, City of Santa Monica

11:45 – 12:45 TOM RICHMAN & ASSOCIATES
Speaker: Tom Richman & Associates: BMPs in Your Development:
MISSION ISPOSSIBLE

12:45 – 1:30 LUNCH BREAK

1:30 - 3:00 HANDS-ON ACTIVITY WITH TOM RICHMAN & ASSOCIATES

3:00 – 3:15 BREAK

3:15 - 3:45 BREAKOUT PRESENTATIONS

3:45 – 4:00 WRAP-UP AND POST-TEST
Speaker: Neal Shapiro, City of Santa Monica

DEMONSTRATION PROJECT SURVEYS

Example Phone Survey

FINAL RESULTS
MERCURY REDUCTION CAMPAIGN
Sample Size=400, Margin of Error=4.9%
Interview Dates: June 15-23, 2000

Respondents: Residents of San Francisco

Today we are conducting a study about the use of household thermometers that take the temperature of people when they may be ill.

1. Do you own at least one thermometer?

   YES 100

2. What type of thermometer do you use most of the time – is it...(READ CHOICES)

   A digital thermometer.....40
   A mercury thermometer, which is glass with silver liquid inside 52
   An alcohol-based thermometer, which is glass with a red liquid inside 3
   A disposable "Fever Strip" 1
   An Ear thermometer, which is applied to the ear 3

   Or another type of thermometer (WHICH?)_____<1
   DON'T KNOW/ NO ANSWER.....1

3. Why do you use this type of thermometer instead of another type of thermometer?

   DO NOT READ CHOICES BUT CODE INTO THE FOLLOWING CATEGORIES; PROMPT IF NECESSARY (ROTATE CHOICES): ONE ANSWER ONLY

   COST 9
   EASE OF USE 49
   SAFETY.....4
   BETTER FOR ENVIRONMENT 1
   ACCURACY.....6
   APPEARANCE.....1
   SIZE .....<1
   DIDN'T KNOW THERE WERE OTHER TYPES 5

   OTHER _____15
   DON'T KNOW.....10

4. What would make you more likely to buy a digital thermometer instead of a mercury thermometer the next time you buy one?

   DO NOT READ CHOICES BUT CODE INTO THE FOLLOWING CATEGORIES; PROMPT IF NECESSARY (ROTATE CHOICES) ONE ANSWER ONLY

   COST 29
   EASE OF USE 8
   SAFETY 6
   BETTER FOR ENVIRONMENT 1
   ACCURACY 13
   APPEARANCE 1
   SIZE 0
   MORE INFORMATION ABOUT IT 2
   NOTHING, WOULD NOT BUY DIGITAL 18
   OTHER _____ 8
   DON'T KNOW 14

5. Have you ever broken a mercury thermometer?

   YES 40
   NO 59
   DON'T KNOW 1

6. How have you or how would you dispose of a broken mercury thermometer?

   DO NOT READ CHOICES BUT CODE INTO THE FOLLOWING CATEGORIES; PROMPT IF NECESSARY (ROTATE CHOICES) ONE ANSWER ONLY

   THROW WHOLE THING IN THE TRASH 59
   POUR MERCURY DOWN THE DRAIN, AND GLASS IN TRASH 3
   CALL LOCAL HEALTH AUTHORITIES 6
   TAKE IT TO A HOSPITAL 2
   WOULDN'T DISPOSE OF IT 2

   ANOTHER WAY _____ 4
   DON'T KNOW 24

7. Have you received any information from the City of San Francisco regarding the use of Mercury Thermometers?

   YES: "What kind of Information?" _____ 5
   No 93
   DON'T KNOW 2

Now we would like to ask you a few questions about you and your household. This information is strictly confidential and will help us better understand the information we collect from this survey.

8. What is your age? **[Enter below. Code "99" for refused]**

Under 30	19
30-39	22
40-49	19
50-64	20
65+	16
Refused	4

9. What is your Zip Code? **[Enter below. Code "99999" for refused or don't know]**

Southeast	15
Southwest	20
Northwest	17
East-Central	26
Northeast	16
Refused	6

10. Which of the following ethnic groups describes you? You can stop me when I've read your group. **[READ LIST]**

Caucasian/White	60
Latino/Hispanic	9
Black/African-American	8
Chinese	6
Japanese	1
Filipino	3
Other Asian	4
Native American	1
Other	4
[don't read] REFUSED	4

11. Including yourself, how many people live in your household?

1	23
2	32
3	18
4	14
5 or more	11
Refused	2

12. How many of these people are children under the age of 18?

0	68
1	17
2	9
3 or more	4
Refused	2

That's all the questions I have. Thank you for your time. Good-bye.

RECORD GENDER:

13.	Female	57
	Male	43

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION

WILLIE L. BROWN, JR., *MAYOR*
JOHN P. MULLANE JR. *GENERAL MANAGER*

E. DENNIS NORMANDY
PRESIDENT
VICTOR G. MAKRAS
VICE PRESIDENT
FRANK L. COOK
ANN MOLLER CAEN
ASHOK KUMAR BHATT

SAN FRANCISCO
WATER DEPARTMENT

HETCH HETCHY
WATER AND POWER

SAN FRANCISCO
CLEAN WATER PROGRAM

March 24, 2000

Dear San Francisco Dentist,

The City's Public Utilities Commission (PUC) has worked with the San Francisco Dental Society, the California Dental Association, and the American Dental Association to help San Francisco dentists implement water pollution prevention strategies. In May of 1997, the PUC's Water Pollution Prevention Program distributed a brochure describing recommended practices for managing dental office waste materials.

The Water Pollution Prevention Program is evaluating its past outreach efforts with the dental community in San Francisco by conducting a survey to determine the implementation of pollution prevention strategies. The City and the San Francisco Dental Society would like to make sure that this assessment accurately reflects current practices in San Francisco. Therefore, we would appreciate your assistance with this project by filling out the enclosed survey. Once completed, please return the survey in the enclosed pre-addressed, stamped envelope.

Should you have any questions regarding the survey, please contact Daniel Rourke of the San Francisco Water Pollution Prevention Program at 415-695-7363. Thank you for assisting the PUC's Water Pollution Prevention Program.

Sincerely,

Steven C. Medbery
Bureau Chief
System Planning, Environmental
and Compliance

Dan E. Gustavson, DDS
President
San Francisco Dental Society

SPEAC 3801 THIRD STREET SUITE 600 SAN FRANCISCO, CA 94124
PHONE (415) 695-7310 FAX (415) 695-7377 or (415) 695-7388

ENVIRONMENTAL COMPLIANCE (415) 695-7384
PRETREATMENT PROGRAM (415) 695-7310

San Francisco Water Pollution Prevention Program
Dental Practice Survey

The San Francisco Water Pollution Prevention Program is conducting research into a variety of mercury sources. Please help us to characterize certain aspects of dental practices that may help us to gain an accurate understanding of your field. We would appreciate it if you would fill out the following questionnaire and return it in the enclosed pre-addressed envelope.

1. What are the specialties practiced in this dental office?
   - ❑ General
   - ❑ Pediatric
   - ❑ Endodontics
   - ❑ Orthodontics
   - ❑ Periodontics
   - ❑ Oral Surgery
   - ❑ Other _____

2. How many patients do you see in this office per week on average? _____

3. Where do you get information about managing dental waste (e.g., brochures, seminars, trade fairs)?
   - ❑ California Dental Society
   - ❑ San Francisco Dental Society
   - ❑ Journals (title) _____
   - ❑ Government agencies
   - ❑ Seminars
   - ❑ American Dental Society
   - ❑ Conferences
   - ❑ Brochures
   - ❑ Other _____

Have you seen this brochure before?

❑ yes ❑ no

If yes, what did you learn from the brochure and what practices from the brochure have you used in your office?

_____

_____

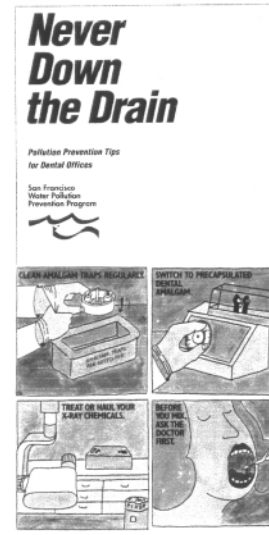
_____

_____

_____

_____

_____



Survey continues on back...

Please check off all the practices from the following list that are employed in your office:

- ❑ Employees receive annual training regarding pollution prevention and hazardous waste management.
- ❑ Employees know where the MSDS's are located.
- ❑ Employees are aware of the different disposal requirements for different types of dental wastes.
- ❑ We use pre-encapsulated dental amalgam.
- ❑ We limit the amount of amalgam prepared to fill the cavity (ie. one or two spills).
- ❑ We recycle scrap amalgam.
- ❑ We collect and store broken or unused amalgam capsules with other scrap amalgam.
- ❑ We store amalgam scrap in a designated airtight container.
- ❑ We keep a log of generation and disposal of scrap amalgam.
- ❑ We use disposable traps.
- ❑ Disposable traps are separated from other wastes.
- ❑ We use re-usable amalgam traps.
- ❑ We dispose of traps ____ times per month.
- ❑ We change the central vacuum pump filter _____ times per year.
- ❑ The amalgam collected in the pump filter is recycled.
- ❑ The amalgam collected in the pump filter is disposed of as hazardous waste.
- ❑ We use an amalgam separator.
- ❑ We have never heard of amalgam separation or separators.

We would also like to know how non-amalgam fillings impact your practice.

4. How often do your patients ask about non-amalgam fillings?

   ❑ never ❑ rarely ❑ sometimes ❑ often ❑ always

5. How often do you recommend non-amalgam fillings?

   ❑ never ❑ rarely ❑ sometimes ❑ often ❑ always

6. In what situations (clinical or other) would you discourage the use of non-amalgam fillings?

   _____

   _____

7. What factors would make you more likely to recommend non-amalgam fillings?

   - ❑ Improved durability of filling
   - ❑ Improved ease of handling
   - ❑ Concern about environmental impact of amalgam
   - ❑ Decreased cost of non-amalgam filling
   - ❑ Easily covered by insurance
   - ❑ Aesthetics
   - ❑ Other _____

8. In this office, on average, how many:

   a. amalgams are removed each week (i.e. root canals, extractions, crowns, cavities, etc).? _____
   b. amalgams are placed each week? _____
   c. non-amalgam fillings are placed each week? _____

Could we contact you if we needed additional information to gain a more complete picture of dental practices in San Francisco? If so, please provide us with the following information:

Dental office address: _____ Phone: _____

Contact Name: _____ Title: _____

SAN FRANCISCO PUBLIC UTILITIES COMMISSION
1155 Market St., 4th Floor, San Francisco, CA 94103 • Tel. (415) 554-3155 • Fax (415) 554-3161

WATER
HETCH HETCHY
WATER & POWER
CLEAN WATER

Dear San Francisco Dentist,

During the past year, the Public Utilities Commission Water Pollution Prevention Program (WPPP), the California Dental Association and San Francisco Dental Society have been working together to assess the pollution prevention practices you and other dentists in San Francisco use in your practices. The results of the surveys were encouraging because the survey respondents are implementing many of the recommended practices. We would like to complete our assessment by having you answer a few questions by simply marking off a few boxes.

Please, take a few minutes to answer the questions below and return this in the pre-addressed stamped envelope provided. Should you have any questions, please contact Daniel Rourke of the WPPP at 415-695-7363. Thank you once again for your continuing support of the PUC's Water Pollution Prevention Program.

Sincerely,

Steven Medbery
Bureau Chief,
Bureau of Environmental Regulation and Management

Please, indicate which pollution prevention practices are used in your office:

	Practice is used in this office	Practice was started in last 6 months
We recycle scrap amalgam with a certified waste hauler	❑ Yes ❑ No	❑ Yes ❑ No
We recycle disposable chair side traps with scrap amalgam	❑ Yes ❑ No	❑ Yes ❑ No
We recycle waste from reusable traps with scrap amalgam	❑ Yes ❑ No	❑ Yes ❑ No
We recycle vacuum filter waste with scrap amalgam	❑ Yes ❑ No	❑ Yes ❑ No
We keep a logbook of recycled amalgam waste	❑ Yes ❑ No	❑ Yes ❑ No

Santa Monica BMP Workshop Pre-test

1. Name a pollutant typically found in urban runoff?_____

2. An activity that will result in urban runoff pollution in a residential neighborhood
   a) watering your lawn the proper amount
   b) washing motor oil leaks off your driveway
   c) washing your car on your lawn
   d) holding a charity carwash in the street

3. The current Santa Monica Urban Runoff Pollution Control Ordinance requires that applicants for new development must submit an Urban Runoff Mitigation Plan detailing the reduction in runoff from the project. How much of the first inch of rainfall must be captured by post-construction BMPs and prevented from running untreated to storm drains?
   a) 0.20 inches
   b) 0.33 inches
   c) 0.50 inches
   d) 0.75 inches
   e) 0.85 inches

4. Which of the following projects are NOT defined as "new development" as specified by the Urban Runoff Pollution Control Ordinance?
   a) interior remodel
   b) increase of 50% or greater in the size of a single family home
   c) addition of one or more dwelling units in a multi-family structure
   d) improvement to a non-residential property which is valued at 50% or more of the value of the existing improvements on the site
   e) none of the above

5. What is the penalty for failure to implement an approved Urban Runoff Mitigation Plan?
   a) $50/day
   b) $100/day
   c) $250/day
   d) $500/day
   e) $1,000/day

6. On January 26, 2000, the Los Angeles County Regional Board approved a Standard Urban Storm Water Mitigation Plan (SUSMP) for Development Planning and Construction (Board Resolution No. R-00-02). According to the SUSMP, how much of the runoff volume from a one inch storm event must be captured by post-construction BMPs and prevented from running untreated to storm drains?
   a) 0.20 inches
   b) 0.33 inches
   c) 0.50 inches
   d) 0.75 inches
   e) 0.85 inches

7. What is the latest date by which the SUSMP requirements must take effect?
   b) September 8, 2000
   c) October 8, 2000
   d) November 8, 2000
   e) December 8, 2000

8. Which of the following projects will NOT be required to implement the SUSMP?
   a) a development or redevelopment project that creates or adds at least 5,000 ft^2 of impervious surfaces
   b) a development or redevelopment project that creates or adds 50% or more impervious surface
   c) development of a single family dwelling (<5,000 ft^2) on a hillside
   d) a redevelopment project making improvements to 50% or more of the existing structure
   e) none of the above

9. What post-construction BMPs have you used or recommended in the past and why did you choose those particular BMPs?

Santa Monica BMPs Workshop Post-test

1. Name a pollutant typically found in urban runoff?_____
Correct answers: heavy metals, pesticides, oil and grease, pathogens, sediments, trash

2. An activity that will result in urban runoff pollution in a residential neighborhood
    a) watering your lawn the proper amount
    b) washing motor oil leaks off your driveway
    c) washing your car on your lawn
    d) holding a charity carwash in the street

Answer: b and/or d

3. The current Santa Monica Urban Runoff Pollution Control Ordinance requires that applicants for new development must submit an Urban Runoff Mitigation Plan detailing the reduction in runoff from the project. How much of the first inch of rainfall must be captured by post-construction BMPs and prevented from running untreated to storm drains?
    a) 0.20 inches
    b) 0.33 inches
    c) 0.50 inches
    d) 0.75 inches
    e) 0.85 inches

Answer: a

4. Which of the following projects are NOT defined as "new development" as specified by the Urban Runoff Pollution Control Ordinance?
    a) interior remodel
    b) increase of 50% or greater in the size of a single family home
    c) addition of one or more dwelling units in a multi-family structure
    d) improvement to a non-residential property which is valued at 50% or more of the value of the existing improvements on the site
    e) none of the above

Answer: a

5. What is the penalty for failure to implement an approved Urban Runoff Mitigation Plan?
    a) $50/day
    b) $100/day
    c) $250/day
    d) $500/day
    e) $1,000/day

Answer: b

6. On January 26, 2000, the Los Angeles County Regional Board approved a Standard Urban Storm Water Mitigation Plan (SUSMP) for Development Planning and Construction (Board Resolution No. R-00-02). According to the SUSMP, how much of the runoff volume from a one inch storm event must be captured by post-construction BMPs and prevented from running untreated to storm drains?
   a) 0.20 inches
   b) 0.33 inches
   c) 0.50 inches
   d) 0.75 inches
   e) 0.85 inches

Answer: d

7. What is the latest date by which the SUSMP requirements must take effect?
   a) August 8, 2000
   b) September 8, 2000
   c) October 8, 2000
   d) November 8, 2000
   e) December 8, 2000

Answer: c

8. Which of the following projects will NOT be required to implement the SUSMP?
   a) a development or redevelopment project that creates or adds at least 5,000 ft^2 of impervious surfaces
   b) a development or redevelopment project that creates or adds 50% or more impervious surface
   c) development of a single family dwelling (<5,000 ft^2) on a hillside
   d) a redevelopment project making improvements to 50% or more of the existing structure
   e) none of the above

Answer: e

9. List any post-construction BMPs that you learned about in this workshop that you might now use or recommend.

_____

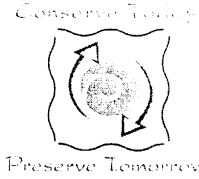
_____

_____

After attending this workshop:	Disagree				Agree
I have a better understanding of Stormwater regulations	1	2	3	4	5
I have more information on post-construction BMPs	1	2	3	4	5
I will use the information I learned in this workshop for future projects	1	2	3	4	5
I would recommend this workshop to colleagues	1	2	3	4	5

City of
Santa Monica℠

City of Santa Monica
California



Santa Monica
A Sustainable Community

Urban Runoff Management
Environmental & Public Works
Management Department

1685 Main Street, Room 116
Santa Monica, CA 90401
(310) 458-8223 Fax 576-3598
neal-shapiro@santa-monica.org

January 10, 2001

Dear Builder, Developer, Architect, City Planner:

Over the past year, the Santa Monica Urban Runoff Management Program has been assessing its New Development Program and the building community's understanding of the Urban Runoff mitigation requirements. As a result of this effort, the City presented a workshop on August 31, 2000, "Controlling Urban Runoff: Santa Monica Style". Our records indicate that you either registered for or attended this workshop.

To assist us in future planning efforts we would appreciate if you would complete the survey on the other side of this letter regarding your recent projects. Please, return the survey to us by January 25, 2001 in the enclosed pre-addressed, stamped envelope. Thank you for working with the City to reduce and improve the quality of urban runoff pollution.

Sincerely,

Neal Shapiro

Neal Shapiro
Urban Runoff Management Coordinator
Environmental & Public Works Mngt

Please, complete the following information about your company's use of post-construction BMPs and return the completed form in the enclosed pre-addressed stamped envelope.

I attended the August 31st workshop	❑ Yes ❑ No
My company has recently begun a development or redevelopment project in Santa Monica	❑ Yes ❑ No
The following Post-construction BMP was included in the project design:	
My company has recently begun a development or redevelopment project elsewhere in Los Angeles County	❑ Yes ❑ No
The following Post-construction BMP was included in the project design:	
My company has recently submitted an Urban Runoff Mitigation Plan in Santa Monica	❑ Yes ❑ No
The following Post-construction BMP was included in the project design:	

LOS ANGELES COUNTY MOTOR OIL QUESTIONNAIRE

This survey is being conducted on behalf of Los Angeles County Public Works Department. Please take a moment to fill out this questionnaire by circling the number next to your answer. The answers you give will be treated as strictly confidential. Our representative will be giving you two free lotto tickets as a token of our appreciation for your time when you complete your questionnaire. If you have any questions, please ask one of our staff. Thank you for your help.

1. In the last six months, do you recall seeing or hearing any advertising about how to dispose of used oil? 5-

Yes ***(Answer Questions 2 and 3)***.....**1**
No ***(SKIP to Question 4)***.....**2**

2. Please write down exactly where you saw or heard something._____

_____

3. Please write down exactly what you recall seeing or hearing. _____

_____

4. What is your home Zip Code? ***(write in five digit ZIP Code)***_____ 6-10

5. What City do you live in? ***(write in city or area name)*** _____ 11:12

6. What is your age? Are you:

18 to 24 years old.....**1** 13
25-30 years old.....**2**
31-40 years old.....**3**
41-50 years old.....**4**
51-65 years old.....**5**
Over 65 years old.....**6**

7. How many of each of the following vehicles do you own? **RECORD NUMBER OR ZERO (0) FOR EACH VEHICLE**

Car.....____ 14
Van.....____ 15
Truck.....____ 16
Recreational Vehicle (RV).....____ 17
Motorcycle.....____ 18
Boat.....____ 19

8. Taking into consideration all of the vehicles you own, how many times a year do you perform a motor oil change? **RECORD ONE NUMBER FOR ALL VEHICLES COMBINED**

(write number of oil changes here) _____ 20:21

9. How do you usually dispose of the used oil after you perform an oil change? ***(circle one answer only)*** 22-

Store it.....**1**
Put it out at the curb for collection.....**2**
Pour it in the ground.....**3**
Pour it on weeds.....**4**
Put it in the trash.....**5**
Pour it down the street gutter catch basin.....**6**
Take it to a used oil collection center (gas station/auto parts store).....**7**
Take it to a Household Hazardous Waste Collection event.....**8**

Other **PLEASE RECORD HOW YOU DISPOSE OF YOUR OIL ON THE LINE BELOW**.....**9**

_____ 23-

10. About how long have you been disposing of your used oil in that way? ***(circle one answer only)*** 24-

One month.....**1**
Two months.....**2**
Three months.....**3**
Four months.....**4**
Five months.....**5**
Six months.....**6**
More than six months but less than one year.....**7**
One year or more.....**8**

11. How do you usually dispose of the used oil filter after you perform an oil change? ***(circle one answer only)*** 25-

Store it 1
Put it out at the curb for collection 2
Put it in the trash 3
Take it to a used oil collection center (gas station/auto parts store) 4
Take it to a Household Hazardous Waste Collection event 5
Other **PLEASE RECORD HOW YOU DISPOSE OF YOUR OIL ON THE LINE BELOW** 6

_____ 26-

12. How do you usually dispose of used transmission fluid after you perform a fluid change? ***(circle one answer only)*** 27-

Store it 1
Pour it in the ground 2
Pour it on weeds 3
Put it in the trash 4
Pour it down the street gutter catch basin 5
Take it to a used oil collection center (gas station/auto parts store) 6
Take it to a Household Hazardous Waste Collection event 7
I don't change my own transmission fluid 8
Other **PLEASE RECORD HOW YOU DISPOSE OF YOUR TRANSMISSION FLUID IN THE LINE BELOW** 9

_____ 28-

13. How do you usually dispose of used radiator fluid/coolant after you perform a fluid change? ***(circle one answer only)*** _____ 29-

Store it 1
Pour it in the ground 2
Pour it on weeds 3
Put it in the trash 4
Pour it down the street gutter catch basin 5
Take it to a used oil collection center (gas station/auto parts store) 6
Take it to a Household Hazardous Waste Collection event 7
I don't change my own radiator fluid/coolant 8
Other **PLEASE RECORD HOW YOU DISPOSE OF YOUR RADIATOR FLUID HERE ON THE LINE BELOW** 9

_____ 30-

14. Have you ever called a toll-free number for information about used oil recycling? 31-

Yes 1
No 2

15. What was the total annual income for your household before taxes in 1998? 32

$15,000 or less 1
$15,001-$25,000 2
$25,001-$40,000 3
$40,001-$60,000 4
$60,001-$75,000 5
Over $75,000 6

16. With what ethnic background do you identify yourself? 33-

Hispanic/Latino/Chicano 1
Asian/Pacific Islander 2
Black/African-American 3
Caucasian 4
Other 5

Gender: Are you....? 34-

Male 1
Female 2

THANK YOU FOR COMPLETING OUR SURVEY.
OUR STAFF HAS TWO LOTTERY TICKETS FOR YOU TO THANK YOU FOR YOUR TIME.

Phone Survey

City of Davis
Healthy Gardens Program Survey

Loc ID_____

1. Do you live in a house with a yard or garden and or do you have a garden plot available to you? _____Yes _____ No

   a. If yes, do you or someone in your household garden? _____Yes _____ No

2. How do you dispose of the following leftover/used household products?

   a. Motor oil_____

   b. House paint_____

   c. Pesticides/fertilizers_____

   d. Cleaning products_____

3. When you take a shower, do laundry, or flush a toilet, where do you think the wastewater goes after it disappears down the drain in your house?_____

   _____

4. When you water your yard and the water runs into the gutter and storm drain, where do you think the water goes from there?_____

   _____

5. Which of the following get some form of treatment before being released into the environment?

   _____ Wastewater/sewage _____ gutter water into the storm drain

* If they do not garden skip to question 25

	No Never	Rarely	Sometimes	Often	Yes Always
6. How often do you or someone in your household work in the yard or garden?	0	1	2	3	4
7. How often do you hire someone else to take care of your yard or garden	0	1	2	3	4
8. How often do you use pesticides in your garden or yard?	0	1	2	3	4
9. How often do you think of water pollution when you garden?	0	1	2	3	4
10. How often do you think of water pollution when applying pesticides?	0	1	2	3	4

   a What pesticides do you use? (e.g., Diazinon, Roundup, and/or Dursban).

   _____

11. What is your definition of IPM or Integrated Pest Management?

    _____

	No Never	Rarely	Sometimes	Often	Yes Always
12 How often do you use IPM in your garden or yard?	0	1	2	3	4
13. Do you think that residential use of pesticides is a primary source of contamination in urban storm-water runoff?	0	1	2	3	4

14. Have you ever received information about reducing pesticide use (herbicides & insecticides)? _____Yes _____ No

a If yes, how or where did you receive the information?

_____

_____

15. Have you ever received information about reducing pesticide use from the city or community? _____Yes _____ No

a If yes, how or where did your receive the information?

_____

_____

16. Have you heard of or recognize a Healthy Gardens Program with a "ladybug" and or a "Frog" logo? _____Yes _____ No

a. If so, where or how did you hear about the program?

_____

_____

17. Where did you see information about the program displayed? (e.g., Program Web Site, local news paper, local store, movie theater, City signs, North Pond, channel 6, children's tattoos).

_____

_____

18. What was the message of the Healthy Gardens Program?

_____

_____

19. Did you, or someone in your household, attend a Healthy Gardens Program workshop?

_____Yes _____ No If yes, where/when? _____

20 Did you, or someone in your household, stop at the Healthy Gardens Program display at the Farmer's Market or Redwood Barn Nursery? ___Yes _____ No If yes, when and how often? _____

_____

21. Did you or a member of your household, pick- up a free Pesticide Management Guide from the Healthy Garden's Program. _____ Yes _____ No, If so, where did you obtain the material?

_____

22. Since you have lived in Davis, have you changed your gardening practices or use of pesticides in your garden or yard?

_____ Yes _____ No

23. Where do you get information about pesticide management and gardening?

24. Did information from the Healthy Garden's Program cause you to change your practices?

_____ Yes _____ No

b. What practices did you change as a result of the program?_____

_____

_____

25. We would like to collect demographic information from Davis residents. Please ask callers to complete the following information:

_____Own? _____Rent/lease? Area of Davis _____North _____South _____East _____West

Gender _____ Age_____ Years in residence _____

Student _____Yes _____ No Full-time Davis Resident _____Yes _____No

Highest year of education (circle one) 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

HS AA BS MS Ph.D.

Marital status _____Single _____Married Number living in home _____

Adults _____ Children _____

Annual household Income _____ < 15,000 _____ 15,001-25,000 _____ 25,001-40,000

_____ 40,001-60,000 _____ 60,001-90,000 _____ >90,001

26. Other comments:_____

_____

Thank you for your participation in this important survey.

City of Davis Healthy Gardens Program Survey

1. Do you live in a house with a yard or garden or do you have a garden plot available to you? ❒ Yes ❒ No
2. Have you heard of Integrated Pest Management (IPM) practices? ❒ Yes ❒ No

If so, what is your definition of IPM? _____

	No Never	Rarely	Some-times	Often	Yes Always
3. How often do you or someone in your household work in the yard or garden?	0	1	2	3	4
4. How often do you hire someone else to take care of your yard or garden?	0	1	2	3	4
5. How often do you use pesticides in your garden or yard?	0	1	2	3	4
6. How often do you think of water pollution when you garden?	0	1	2	3	4
7. How often do you think of water pollution when applying pesticides?	0	1	2	3	4
8. How often do you use IPM in your garden or yard?	0	1	2	3	4

9. Have you ever received information about reducing pesticide use from the city or community? ❒ Yes ❒ No
10. Has the information triggered you to change your gardening or pesticide use practices? ❒ Yes ❒ No
11. Which of these items shown on the attached sheet have you seen before?
    - ❒ Frog Slide ❒ Pesticide Management Guide ❒ IPM Demonstration Signs (ie. roses)
    - ❒ Ladybug Logo ❒ North Pond Wetlands Sign ❒ Other _____ ❒ None
12. If you have seen any of the items on the attached sheet, where have you seen them?
    - ❒ On the Internet ❒ On Television ❒ At City Hall ❒ Have not
    - ❒ Before a Movie ❒ At a Local Store ❒ At Davis Farmers Market seen any of
    - ❒ In the Newspaper ❒ At the North Pond ❒ _____ the items.
13. What was the message of the Healthy Gardens Program?

    _____
14. Where do you get information about pesticide management and gardening?

    _____

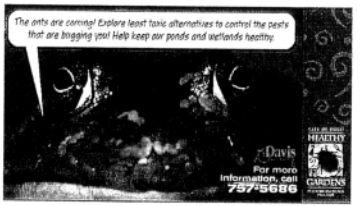
Please help us by also filling out the following optional information:

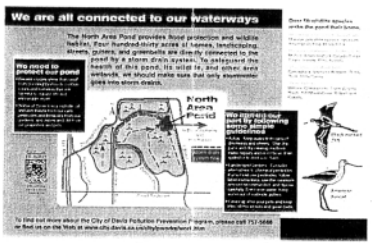
15. Age_____ Education Level ❒ High School ❒ AA ❒ BS/BA ❒ Masters ❒ Ph.D.
16. Annual household income ❒ < $ 15,000 ❒ $ 15,001-$ 25,000 ❒ $ 25,001-$ 40,000 ❒ $ 40,001 - $ 60,000 ❒ $ 60,001-$ 90,000 ❒ > $ 90,000
17. Full-time Davis resident? ❒ Yes ❒ No Number of Years in residence _____
18. Do you ❒ Own ❒ Rent/Lease your home?
19. Number of people living in household ❒ Adults _____ ❒ Children _____
20. Which area of Davis do you live in? ❒ North ❒ South ❒ Central ❒ East ❒ West ❒ Outside Davis

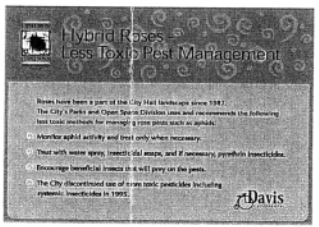
Thank you for your participation in this important survey!

Have you seen us before?

CITY OF DAVIS
HEALTHY
GARDENS
PESTICIDE OUTREACH PROGRAM







Please help us by answering the questions on the reverse side of this page!

Davis

We'd like your feedback!

1. Do you garden or work in your yard? ☐ Every weekend ☐ Occasionally ☐ Never
2. Do you use a garden service? ☐ Yes ☐ No
3. Do you use pesticides? ☐ Yes ☐ No
4. If you use pesticides, do you remember the name? _____
5. Have you seen any of the items shown on this display before? ☐ Yes ☐ No
6. If yes to number 5, which items on the display have you seen before?
   ☐ _____ ☐ _____
   ☐ _____ ☐ _____
7. If you have seen any of the items on the display, where have you seen them?
   ☐ On the Internet ☐ On Television ☐ At City Hall
   ☐ Before a Movie ☐ At a Local Store ☐ At Davis Farmers Market
   ☐ In the Newspaper ☐ At the North Pond ☐ _____
8. After seeing or reading the Healthy Gardens Program information:
   ☐ I use less or don't use pesticides at all.
   ☐ I have not made any changes regarding pesticide use.
   ☐ I have never seen the program information before.
9. Are you over 21? ☐ Yes ☐ No
10. Full-time Davis resident? ☐ Yes ☐ No
11. Which area of Davis do you live in? ☐ North ☐ South ☐ Central ☐ East ☐ West ☐ Outside Davis

Thank you for participating in the City of Davis "Healthy Gardens Program" Evaluation.

Please answer the questions on the reverse side of this card, tear off and keep your coupon, and either drop the completed form into the drop box or mail to: Jacques DeBra, City of Davis, Public Works Department, 23 Russell Boulevard, Davis, CA 95616. If you have any questions regarding this program, please call (530) 757-5686.

If you would like more information on the Healthy Gardens Program, please fill out the information below.

CITY OF DAVIS HEALTHY GARDENS PESTICIDE OUTREACH PROGRAM

Name: _____
Street address: _____
City: _____
State: _____
Zip/Postal Code: _____
Phone: _____

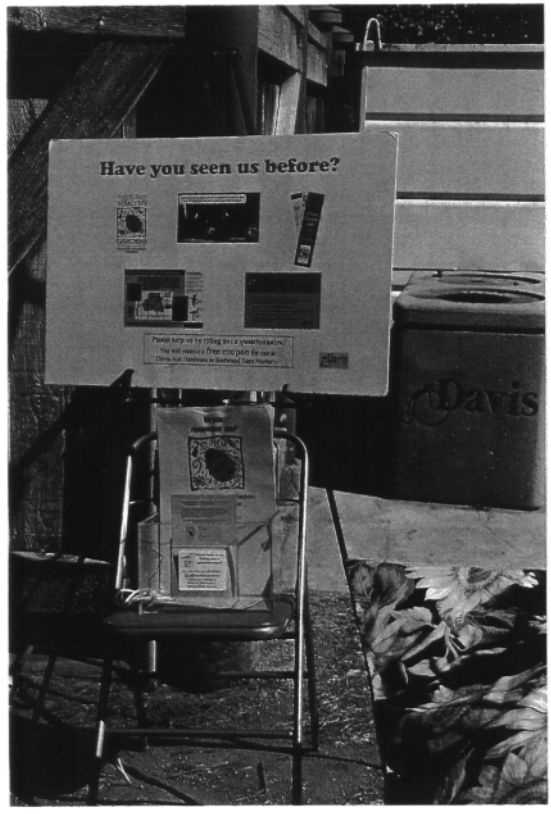
Thank you for your help!

$ 2.00 OFF!

This coupon is good for $2.00 off beneficial insects or organic pest controls at Davis Ace Hardware, 3rd and G Street, Davis or Redwood Barn Nursery, 1607 Fifth Street, Davis.

OFFER EXPIRES 07/31/09

Davis Kiosk Survey Card



Davis Kiosk Survey Display

Woodland Grocery Store Intercept Survey

REFERENCES

BBPR Inc. 2000. *Lindane usage reduction pilot project, 1998 Pollution Prevention Leadership Grant Program final report*. Prepared for the Sanitation Districts of Los Angeles County and the U.S. Environmental Protection Agency.

David Binder Research. 2000. Results from recent surveying on mercury thermometers. Memorandum to San Francisco Public Utilities Commission. San Francisco, Calif.: David Binder Research.

Flint Marketing Communications. 2000. *Los Angeles County used oil and oil filters recycling program evaluation survey.* Prepared for the Water Environment Research Foundation.

Larry Walker Associates. 1994. *Residential metals study.* Prepared for the Central Contra Costa (Calif.) Sanitary District. Davis, Calif.: Larry Walker Associates.

Larry Walker Associates. 1997. *Mercury pollution prevention plan.* Prepared for the Palo Alto (Calif.) Regional Water Quality Control Plant. Davis, Calif.: Larry Walker Associates.

Larry Walker Associates. 2000a. *School education and model assessment – final report.* NFIPME ID No. 71. Prepared for the City of Davis, Calif., and the Pesticide Environmental Stewardship Program. Davis, Calif.: Larry Walker Associates.

Larry Walker Associates. 2000b. *BMP implementation for new development sites.* Prepared for the City of Santa Monica, Calif., and the Water Environment Research Foundation. Davis, Calif.: Larry Walker Associates.

Larry Walker Associates. 2000c. *Woodland oil and grease program assessment.* Prepared for the City of Woodland, Calif., and the Water Environment Research Foundation. Davis, Calif.: Larry Walker Associates.

Larry Walker Associates. 2000d. *Mercury pollution prevention plan.* Prepared for the San Francisco (Calif.) Water Pollution Prevention Program and Water Environment Research Foundation. Davis, Calif.: Larry Walker Associates.

Larry Walker Associates. 2000e. *Attitudes and practices of San Francisco dentists.* Prepared for the San Francisco (Calif.) Water Pollution Prevention Program and Water Environment Research Foundation. Davis, Calif.: Larry Walker Associates.

Regional IPM Partnership. *Our Water, Our World promotion – final report 1999.* Palo Alto, Calif.: Regional IPM Partnership.

Water Environment Research Foundation. 1998. *Residential and commercial source control programs to meet water quality goals.* Report No. 95-IRM-1. Alexandria, Va.: Water Environment Research Foundation.

Water Environment Research Foundation. 2000. *Tools to measure source control program effectiveness.* Project 98-WSM-2. Alexandria, Va.: Water Environment Research Foundation.

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