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**PUEBLO DENTAL MERCURY POLLUTION PREVENTION PROJECT  
FINAL REPORT**

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Prepared for:



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## EXECUTIVE SUMMARY

The Colorado Department of Public Health and Environment (CDPHE) contracted Tetra Tech EM Inc. (Tetra Tech) to implement a three-phase project focused on reducing mercury releases in wastewater from dental offices. Phase 1 of this project involved conducting a survey of dental professionals in Pueblo to establish a baseline of the information, resources, and equipment currently used by or available to dentists. The survey was also intended to identify the barriers to implementing best management practices (BMPs) and best available technologies (BATs) for mercury in dental offices. Phase 2 involved developing and implementing a targeted outreach program to provide dental professionals with information on BMPs and BATs for mercury and eliminate barriers to BMP and BAT implementation. Phase 3 involved conducting a follow-up survey of dental professionals in Pueblo to evaluate the effectiveness of the project.

The Phase 1 baseline survey results response rate among dentists was 69 percent and among practices was 78 percent. The results led to the following general conclusions:

- Most dentists use chairside traps (97.5 percent) and very few (2 percent) use amalgam separators.
- Some dentists recycle mercury-containing waste, but many dispose of mercury-containing waste as medical waste, in the trash, or through some other form of disposal.
- Survey responses suggest a general receptiveness to outreach efforts.

The Phase 2 outreach program was based on Phase 1 survey responses. It involved obtaining Colorado Dental Association support, forming a project advisory team, writing a dental mercury fact sheet and BMP insert, holding a dental mercury seminar and panel discussion, following up with dentists that did not attend the seminar and panel discussion, and writing a summary letter report.

For Phase 3, Tetra Tech mailed a follow-up survey to 67 dentists representing 56 practices in Pueblo. Twenty one dentists (31 percent) from 19 practices (34 percent) responded to the follow-up survey. Seventeen of the dentists that responded to the follow-up survey also responded to the baseline survey. The follow-up survey led to the following general conclusions:

- Surveys are a useful tool for obtaining feedback regarding direction of a project and results.
- Follow-up surveys should be conducted 6 months to 1.5 years after project implementation to gather actual project results in response to outreach.
- The level to which dentist felt informed increased during the course of the project.
- The willingness to install a free amalgam separator increased from the baseline to the follow-up survey.
- Ninety percent of the dentists in the follow-up survey indicated that they were already recycling all mercury-containing wastes or planned to as a result of the outreach efforts.
- The tools developed for the Pueblo dental mercury pollution prevention project are directly transferable to other Colorado communities.
- The level of adoption of dental mercury BMPs and BATs is limited in voluntary programs. For example, many dentists will not install amalgam separators unless it is required by law. However, offering to install amalgam separators free of charge did affect Pueblo dentists' interest in installing amalgam separators.

## **PUEBLO DENTAL MERCURY POLLUTION PREVENTION FINAL REPORT**

In August 2003, the Colorado Department of Public Health and Environment (CDPHE) contracted Tetra Tech EM Inc. (Tetra Tech) to implement a three-phase project focused on reducing mercury releases in wastewater from dental offices. This project was implemented on a pilot basis in Pueblo, Colorado, using supplemental environmental project funds. This project was also a preliminary effort to provide compliance assistance to publicly owned treatment works (POTWs) in Colorado. Some Colorado POTWs are charged with meeting new, lower discharge limits for mercury and with protecting Colorado's waterbodies and sensitive ecosystems. This document is a final report summarizing the project. The document discusses the environmental concerns associated with dental mercury, the project approach, project results summary, and conclusions and recommendations.

### **DENTAL MERCURY OVERVIEW**

Mercury is a heavy metal long known to be associated with serious health effects; it is a known neurotoxin, slows fetal and child development, causes irreversible brain damage, and harms one's ability to walk, talk, see, and hear (Mercury Study Report to Congress, Volume V: Health Effects of Mercury and Mercury Compounds, U.S. Environmental Protection Agency, 1997.) Mercury can be released into the environment from natural or man-made sources. When mercury enters a water body (for example, through air deposition or direct discharge), it can bioaccumulate in fish tissue in its most toxic form, methylmercury. Humans and wildlife are exposed to toxic mercury primarily through ingestion of contaminated fish. CDPHE has issued fish consumption advisories for several reservoirs in Colorado (including McPhee and Narraguinnep Reservoirs) as a result of unacceptably high mercury levels.

#### **Dental Mercury in Wastewater**

POTWs play a vital role in protecting Colorado's waterbodies and sensitive ecosystems by treating wastewater from households, industries, and businesses. Wastewater treatment processes remove solids and organic materials from the incoming wastewater and treat the solids, some of which may be applied to farmland soil. Metals, including mercury, are of concern to POTWs because they are not degraded or destroyed by the treatment processes. Mercury that enters POTWs in wastewater may either settle out into the biosolids or pass through the plant and be discharged to receiving waters. Although POTWs are not the most significant source of mercury to all Colorado reservoirs, POTWs have been identified as one of the sources that contribute to unacceptably high concentrations of mercury in fish.

Until recently, Colorado POTWs were not subject to permit limits for discharge of mercury because an effective method for monitoring low-level concentrations of mercury in either stream segments or POTW effluent did not exist. However, with the promulgation of the standard method for analysis of mercury in wastewater (Method 1631, Revision B, U.S. Environmental Protection Agency (EPA) Office of Water, May 1999), detection levels for mercury in parts per trillion are now possible and easy to detect. As a result, CDPHE initiated a process to review and revise mercury discharge limits for POTWs throughout the state. As new permits are issued, many POTWs will face significant challenges in meeting lowered discharge limits for mercury. These POTWs may pursue either voluntary or mandatory mercury control programs to reduce levels of mercury entering the POTW.

Studies conducted throughout the United States have shown that dental clinics are a measurable source of mercury that enters POTWs. Dental amalgam, commonly used for filling cavities in teeth, contains about 50 percent mercury. Other metals present in dental amalgam include copper, tin, silver, and zinc. In the process of placing or removing amalgam fillings, mercury and other metals are conveyed to sewage treatment plants. For example, in the report "An Evaluation of the Sources, Impacts, and Controls of

Mercury” (February 2002), Al Garcia of the Littleton-Englewood Wastewater Treatment Plant estimated that dental clinics contribute 9.26 pounds of mercury, or 62.2 percent of the total annual mercury loading, to the Littleton-Englewood Wastewater Treatment Plant in Colorado each year. A May 2002 research article published by the American Dental Association (ADA) cited a 1993 study by the California Water Pollution Control Association (CWPCA). The CWPCA study was based on wastewater samples taken at the connection to the sewer. The CWPCA study concluded that dentists discharge an average of 35 milligrams of mercury as amalgam into the sewer per day. According to the ADA article, the CWPCA study, a 1997 Massachusetts Water Resource Authority study and a 1991 Municipality of Metropolitan Seattle study, dentists could contribute from 8 to 14 percent of the total mercury load to wastewater treatment plants. Although the relative contribution of dental mercury amalgam to the national mercury pollution problem may be low compared to other sources (such as power plants), better detection technologies and stricter mercury discharge limits in POTWs result in the need to examine sources that discharge to the POTWs and dental amalgam remains a significant source for mercury to POTWs.

### **Bioavailability of Dental Mercury**

Most controversy and discussion on dental mercury focuses on whether the mercury released from dentists is “bioavailable.” Bioavailability is the ability of a substance to be absorbed by an organism.

The bioavailability of incinerated mercury amalgam is not debated. Incineration is generally believed to release the mercury in a bioavailable form that can settle directly into surface water or deposit on land surfaces and be transported to waterbodies by runoff. Medical waste and other forms of waste that may contain mercury, such as sludge from POTWs, may be shipped out of state for disposal and are incinerated in some states.

For mercury amalgam that is not incinerated or otherwise altered, ADA currently maintains that mercury amalgam released directly to the environment is not bioavailable. Conversely, the Association of Metropolitan Sewerage Agencies (AMSA) maintains there is too much uncertainty regarding the bioavailability of dental mercury to conclude definitively that it is not bioavailable.

Based on ADA’s position that mercury is not bioavailable if it is not incinerated, ADA published a set of best management practices (BMPs) for amalgam waste. According to Best Management Practices for Amalgam Waste released by the ADA in February 2003:

“Although mercury in the form of dental amalgam is very stable, amalgam should **not** be disposed of in the garbage, infectious waste “red bag,” or sharps container. Amalgam should also **not** be rinsed down the drain. These cautions are important because some communities incinerate municipal garbage, medical waste, and sludge from wastewater treatment plants. If amalgam waste ends up in one of these incinerated waste streams, the mercury can be released to the environment due to the extremely high temperatures used in the incineration process...The ADA strongly recommends recycling as a best management practice for dental offices.” (Italics added)

## Dental Mercury Reduction Technology

According to Phase 1 survey responses (see Project Approach), many dentists in Pueblo have chairside traps. Chairside traps collect particles, including dental amalgam, in a disposable or reusable filter. Disposable filters are recommended because of the difficulty in effectively removing amalgam particles from reusable traps without spilling them into the drain or garbage. Chairside trap filters are available with different size meshes for capturing particles. The higher the mesh filter number, the smaller particle size it will capture. For example, a 100 mesh filter will capture more and smaller particles than a 40 mesh filter. For this reason, higher mesh filters are recommended for mercury amalgam removal than lower mesh filters, but may require more frequent replacement or cleaning.

Amalgam separators remove mercury amalgam from dental wastewater by using one or multiple technologies including sedimentation, filtration, centrifugation, and ion exchange. The ADA studied 12 amalgam separators and published a report on their performance in the May 2002 edition of the Journal of the ADA (JADA)<sup>1</sup>. According to the JADA article, all 12 amalgam separators removed more than 96 percent of the mercury amalgam in wastewater, exceeding the ISO 11143 requirement of 95 percent amalgam removal efficiency. A recent dental mercury study in Minnesota showed that with amalgam separators in place at most dental offices, mercury levels in POTW sludge declined by as much as 29 to 44 percent<sup>2</sup>.

Dental care professionals have an opportunity to reduce mercury releases to the environment by using BMPs and best available technologies (BATs). Only one dentist in Pueblo who responded to the baseline survey indicated using an amalgam separator. Studies conducted in Boulder and Fort Collins, Colorado, and throughout the United States, show that dental professionals vary in use of BMPs and most dental professionals do not use BATs for mercury recovery. Based on these considerations, the dental sector is an ideal candidate for increased mercury pollution prevention (P2).

## PROJECT APPROACH

The dental mercury P2 project was divided into three phases. Phase 1 of this project involved conducting a survey of dental professionals in Pueblo to establish a baseline of the information, resources, and equipment currently used by or available to dentists. The survey was also intended to identify the real or perceived barriers to implementing BMPs and BATs for mercury in dental offices. Phase 2 involved developing and implementing a targeted outreach program to provide dental professionals with information on BMPs and BATs for mercury and eliminate barriers to BMP and BAT implementation. Phase 3 involved conducting a follow-up survey of dental professionals in Pueblo to evaluate the effectiveness of the project. The following sections summarize each phase of the project in more detail.

### Phase 1 Procedure

Phase 1 of this project was divided into four tasks intended to set the direction of the project. Each of these tasks and the work accomplished during the tasks are summarized in this section.

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<sup>1</sup> Laboratory Evaluation of Amalgam Separators. JADA, Volume 133, May 2002. pp 577.

<sup>2</sup> Take Preventive Action Now. Capture Amalgam so it Doesn't Release Mercury, Minnesota Dental Association and Minnesota Metropolitan Council, March 2003

### Task 1-1: Initiate Pilot Project and Obtain and Review Existing Dental Survey

A considerable amount of information regarding P2, BMPs, and BATs for dental mercury existed from various initiatives in Colorado and other states. As it began work on this project, Tetra Tech conducted Internet research to obtain information on existing dental mercury initiatives and related information.

Tetra Tech gathered information by:

- Reviewing existing surveys and other information from a recent dental mercury initiative conducted by Partners for a Clean Environment, a non-profit organization in Boulder, Colorado
- Conducting Internet searches for dental mercury BMPs and BATs (overall Internet searches, P2 web site searches, ADA web site searches, and technology internet sites)
- Identifying and contacting dentists and other dental mercury experts to discuss BMPs and BATs dentists have successfully implemented

After Tetra Tech completed its research and drafted a survey for Pueblo dentists (see Task 1-2), CDPHE and Tetra Tech held a kickoff meeting with project stakeholders. Meeting attendees included representatives from:

- CDPHE:
  - Sustainability Division
  - Oral Health Program
  - Water Quality Control Division
  - Air Pollution Control Division
- Pueblo City and County Health Department
- Colorado Mental Health Institute Dental Office
- Representatives from dental related organizations
- Private practice dentists from Pueblo

### Task 1-2: Create Survey for Pueblo Dentists

Based on its research in Task 1-1, Tetra Tech created a survey and cover letter for dentists and dental clinics in Pueblo. The survey required about 5 to 10 minutes for each dental office and clinic to complete and asked the respondents to address the following:

- Current use and disposal of mercury amalgam
- Use and maintenance of mercury removal equipment
- Mercury waste collection and mercury waste disposal procedures
- Barriers to using mercury P2, BMPs, or BATs
- Effective outreach methods

### Task 1-3: Execute Baseline Dental Survey

Tetra Tech sent the cover letter and survey to all dentists in Pueblo for which it identified an address. The final list included 59 dental offices and clinics and 70 dentists in Pueblo. The response goal for the baseline survey was at least 45 percent of dentists and dental clinics in Pueblo.

To meet or exceed this response rate, Tetra Tech:

- Attended a study group meeting of dentists, explained the project, and requested that attendees fill in the survey and provide any relevant feedback
- Sent surveys on CDPHE, City and County of Pueblo Health Department, and City of Pueblo letterhead by mail in envelopes with State of Colorado return address. Included with each survey were a cover letter and an addressed, postage-paid envelope that could be used to return the survey
- Telephoned all dental offices and clinics that had not returned the survey within 2 weeks of receipt. (Sixteen dentists or dental practices returned the survey without including their name)



#### Task 1-4: Write Baseline Dental Survey Summary Report

After Tetra Tech received the survey responses, it wrote a report that summarized the project and the results of the Phase 1 survey.

#### **Phase 2 Procedure**

Based on the research Tetra Tech completed for this project and on the analysis of the survey results, Tetra Tech concluded that the Pueblo dental community would be best served by a clear, easy-to-understand summary of dental mercury issues and BMPs and access to information regarding dental amalgam separators. This section discusses Tetra Tech's Phase 2 procedure.

#### Task 2-1: Obtain Colorado Dental Association (CDA) Support

Tetra Tech contacted CDA and requested to present the project overview and Phase 1 project results to the CDA executive committee. The purpose of the presentation was to gain support for the project. CDA agreed to sit on the advisory team (see Task 2-2), sponsor the fact sheet (see Task 2-3), speak at the seminar and panel discussion (see Task 2-4), and provide any other support it could for the project, such as distributing outreach materials to its membership.

#### Task 2-2: Form Advisory Team

At the beginning of the project, CDPHE and Tetra Tech held a kickoff meeting (see Task 1-1) with representatives from CDPHE, Pueblo City and County Health Department, dentists, and representatives from dental related organizations. These individuals, as well as the president of CDA became the project "Advisory Team," giving input to the direction of the project as necessary.

#### Task 2-3: Write Fact Sheet

Tetra Tech researched and wrote a concise 4-page fact sheet regarding dental mercury that was specific to Pueblo dentists. Subject matter for the fact sheet included:

- A brief summary of environmental health concerns associated with mercury and mercury amalgam
- Overview of regulations associated with mercury amalgam nation-wide and within Colorado
- Details regarding dental mercury amalgam separators, including a description of how amalgam separators work, what different types are available, why they are better at removing mercury amalgam than chairside traps, costs, vendor names, vendor contact information, and other references
- Details on recycling dental mercury amalgam, including vendor names and contact information, steps for recycling dental amalgam waste, and references
- BMPs for handling dental mercury, especially any endorsed by ADA
- References for additional information related to dental mercury

The fact sheet was reviewed by advisory team members, dental amalgam recyclers and dental amalgam separator vendors. Tetra Tech worked with a graphic artist to ensure that the fact sheet looked appealing and professional. In addition to the Pueblo-specific fact sheet, Tetra Tech wrote a generic fact sheet appropriate for a state- and nation-wide audience.

#### Task 2-4: Hold Dental Mercury Seminar and Panel Discussion

Tetra Tech organized and held a dental mercury seminar and panel discussion for dentists that covered relevant information on: (1) project overview and CDA perspective, (2) regulatory outlook for Colorado dentists, with emphasis on Pueblo dentists, (3) amalgam separators, and (4) dental amalgam recycling. The seminar and panel discussion was free and offered to all staff at all Pueblo dental offices and clinics.



Speakers included the CDA president and experts to discuss the regulatory outlook for Pueblo dental offices, amalgam separators, and amalgam recycling. Panel members included speakers, a Pueblo dentist who was also a CDA board member, the City of Pueblo pretreatment coordinator, and the CDPHE Oral Health Program director.

#### Task 2-5: Follow Up with Dentists

After the panel seminar, Tetra Tech sent the fact sheet to those dentists who did not attend the panel discussion and invited them to call a point of contact with any questions regarding the fact sheet or CDPHE's dental mercury project. Tetra Tech also sent a letter to the meeting attendees thanking them for their participation in the panel discussion and offering a point of contact for them with any questions regarding the fact sheet, items discussed at the panel discussion meeting, or CDPHE's dental mercury project. The follow-up letters also informed the dentists that they would be contacted for a follow-up survey for the project at a specified future time.

#### Task 2-6: Write Summary Report

Tetra Tech wrote a letter report that summarizes the results of Phase 2 of the project.

### **Phase 3 Procedure**

Phase 3 of this project was divided into three tasks intended to evaluate the effectiveness of the project. These tasks are summarized in this section.

#### Task 3-1: Create Survey for Pueblo Dentists

Tetra Tech created a follow-up survey and cover letter for dentists and dental clinics in Pueblo. The survey required about 5 to 10 minutes for each dental office and clinic to complete and asked the respondents to address the following:

- Attendance at and relevance of seminar and panel discussion
- Receipt and relevance of fact sheet and BMP insert
- Future planned action based on seminar, panel discussion, fact sheet, and BMP insert
- Extent to which the outreach materials were informative and influential

#### Task 3-2: Execute Follow-Up Dental Survey

Tetra Tech sent a cover letter and follow-up survey to 56 dental offices and clinics and 67 dentists in Pueblo. In addition, the mailing included a description regarding an offer for a free amalgam separator from ADA Technologies, Inc.

#### Task 3-3: Write Final Pueblo Dental Mercury Summary Report

After responses from the surveys were received, Tetra Tech wrote this report, which summarizes the entire dental mercury P2 project with a more detailed emphasis on the follow-up survey results.

## SUMMARY OF PROJECT RESULTS

This section briefly summarizes the results of each phase of the project. More complete descriptions of results from Phases 1 and 2 are included in the Phase 1 and Phase 2 summary reports. Table 1 summarizes the deliverables for the entire project.

**TABLE 1 PROJECT DELIVERABLE SUMMARY**

DELIVERABLE	DELIVERY DATE	RECIPIENTS
<b>PHASE 1</b>		
Baseline Survey	November 19, 2003	All Pueblo dentists
Baseline Survey Summary Report	February 10, 2004	CDPHE and advisory team
<b>PHASE 2</b>		
Phase 2 Implementation Plan	February 20, 2004	CDPHE and advisory team
Pueblo-Specific Fact Sheet and BMP Insert	May 20, 2004	All Pueblo dentists, CDPHE, and advisory team
State-Wide Fact Sheet and BMP Insert	August 6, 2004	CDPHE
Seminar and Panel Discussion Handout Materials	May 20, 2004	All Pueblo dentists attending seminar, CDPHE, and advisory team
Phase 2 Summary Report	June 9, 2004	CDPHE and advisory team
<b>PHASE 3</b>		
Follow-up Survey	June 25, 2004	All Pueblo dentists
Final Project Report	August 31, 2004	CDPHE

### Phase 1 Summary

The purpose of the Phase 1 survey was to establish a baseline of information among Pueblo dentists and also to understand the barriers preventing BMP and BAT implementation, thereby providing a basis for the direction of the second phase of the project. The survey was successful in accomplishing these goals. The following bullets summarize the primary findings from the Phase 1 dental mercury survey; these findings formed the basis of the Phase 2 approach.

- Response rate among dentists was 69 percent and among practices was 78 percent. The survey goal was to exceed 45 percent.
- Most dentists use chairside traps (97.5 percent) and very few (2 percent) use amalgam separators.
- Some dentists recycle mercury-containing waste (teeth, amalgam, amalgam capsules, screen, traps, and filters), but many dispose of mercury-containing waste as medical waste, in the trash, or through some other form of disposal. ADA recommends that all mercury-containing waste be recycled.
- Based on the higher than expected response rate and responses to questions regarding assistance and recognition, survey results suggest a general receptiveness to outreach efforts.

For a more complete analysis of the Phase 1 results, refer to the Phase 1 Summary Report.

## Phase 2 Summary

After obtaining CDA support and forming the advisory team, Tetra Tech researched and wrote a 4-page fact sheet and BMP insert on dental mercury. Tetra Tech solicited comments and revised the fact sheet and BMP insert based on feedback from the advisory team. The fact sheet includes:

- A brief overview of the project and issues associated with dental mercury and the environment
- The regulatory outlook for dental mercury issues
- A description of the performance of and vendors for mercury amalgam separators
- Tips for mercury amalgam recycling and vendors

In addition, the fact sheet includes an insert with a checklist of BMPs for dental mercury and a list of references for additional information.

Tetra Tech also organized a seminar panel and discussion that covered (1) a project overview and CDA perspective, (2) the regulatory outlook, (3) amalgam separators, and (4) amalgam recycling. Tetra Tech used the mailing list it developed for its baseline survey of Pueblo dentists, supplemented by a list of dentists in Pueblo from the Southeastern Colorado Dental Society, for distribution of a flyer promoting the seminar and panel discussion. Tetra Tech sent the flyer to 83 dentists in 64 offices on May 7, 2004. The meeting was attended by 25 people (30 percent of the dentists in Pueblo) from 22 offices (34 percent of the offices in Pueblo). Table 2 provides a summary of the total meeting attendance.

**TABLE 2 SEMINAR AND PANEL DISCUSSION MEETING ATTENDANCE**

<b>GROUP</b>	<b>NUMBER OF PEOPLE</b>
Dentist or office representatives (dental offices)	25 (22)
Presenters and panel members	7
Vendors	3
Additional attendees (CDPHE, Pueblo City and County Health Department, Tetra Tech, and City of Colorado Springs)	7
<b>Total Attendance</b>	<b>42</b>

## Phase 3 Summary

Tetra Tech mailed the follow-up survey to 67 dentists representing 56 practices in the Pueblo. Tetra Tech revised the mailing list used during Phase 1 to exclude those dentists that do not use mercury amalgam, or indicated in the baseline survey that they did not wish to participate in the voluntary dental mercury P2 project. Thirty one percent of the dentists (21 out of 67 dentists) and 34 percent of the practices (19 out of 56 practices) responded to the follow-up survey. Tetra Tech put the name of the dentist on each follow-up survey it sent out. To increase the response rate, Tetra Tech called each dentist that did not return the survey and requested that the office return the survey. Tetra Tech followed the same survey protocol and the same level of effort in the follow-up survey as it did for the baseline survey, but received a much lower response rate to the follow-up survey. Eighty one percent of the follow-up respondents also returned the baseline survey.

The follow-up survey occurred within weeks of the outreach efforts (distribution of fact sheet, BMP insert, and holding the seminar and panel discussion); therefore, the follow up-survey was not able to

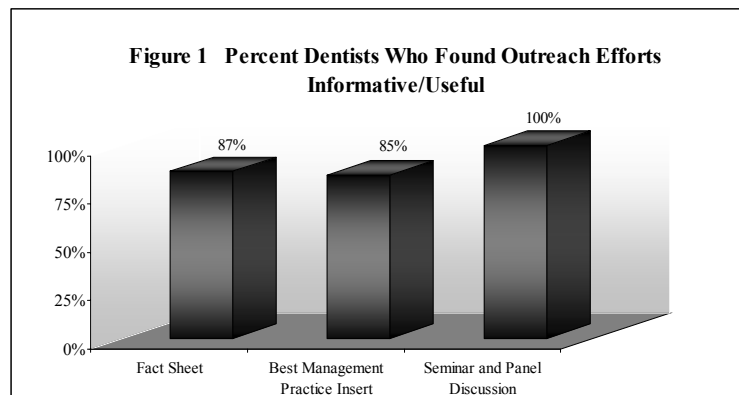
focus on actual changes in procedures among dental offices. Instead, the follow-up survey focused on the value and content of the outreach materials and the overall effectiveness of the outreach effort.

### Value and Content of Outreach Materials and Seminar/Panel Discussion

In the follow-up survey, dentists were asked to provide feedback regarding the value and content of the Phase 2 dental mercury fact sheet, BMP insert, and seminar and panel discussion. The dentists gave a yes/no response as to whether they found these specific materials and efforts to be useful and informative. The survey results (Figure 1) indicate that Pueblo dentists attending considered the seminar and panel discussion the most useful and informative. Figure 1 excludes surveys in which the dentist did not respond to the question, assuming that dentist did not participate in or read that particular outreach effort or material.

Most dentists indicated the fact sheet contained an appropriate depth and range of information. When asked to provide specific feedback on the content of the fact sheet, one dentist responded that the fact sheet could be improved with additional information on disposal or recycling options for used amalgam separators.

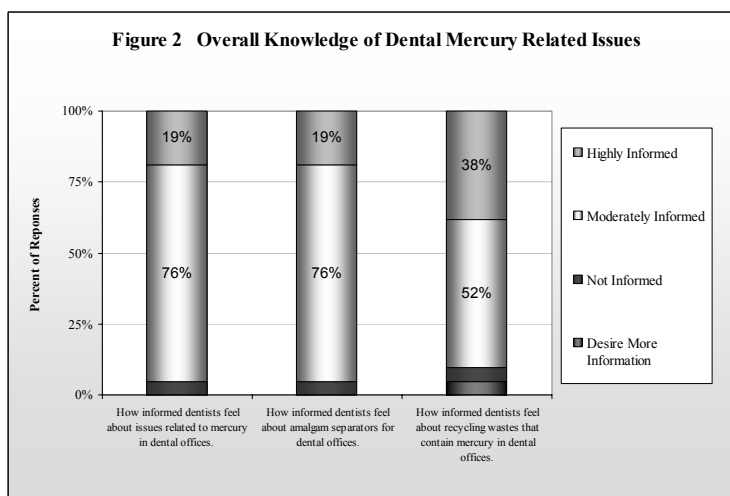
Most dentists indicated that the seminar and panel discussion presented information that was relevant and covered in appropriate detail. When asked to provide specific feedback on the content of the seminar and panel discussion, one dentist noted that a “definitive program” for addressing dental mercury waste was missing from the seminar discussion. This comment may reflect a weakness associated with the “voluntary” nature of this mercury P2 program.



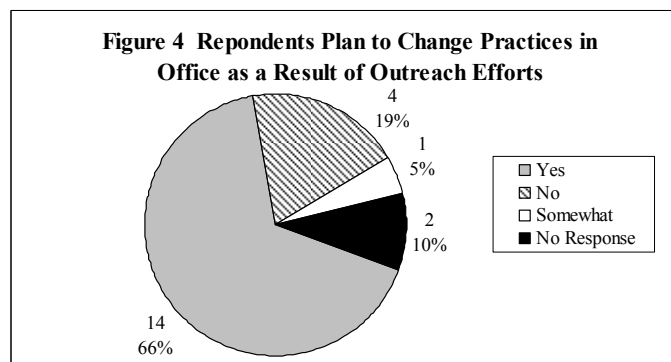
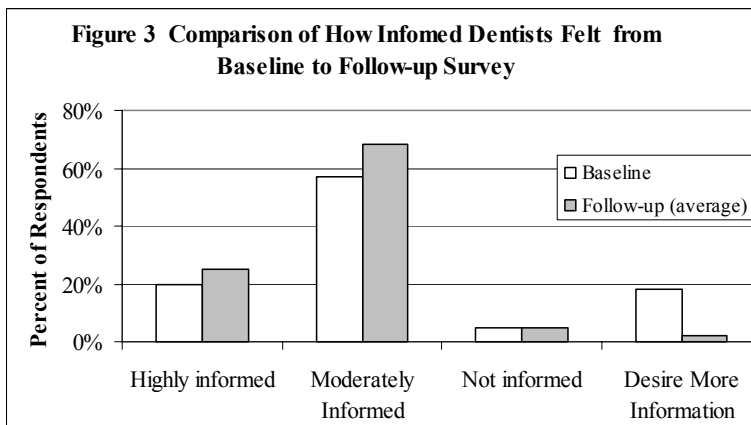
### Overall Effectiveness of the Outreach Effort

The overall effectiveness of the outreach effort was gauged based on each Pueblo dentist’s perceived “level of knowledge” and actual or anticipated changes in behavior following the outreach effort. Note, the only dentist who indicated he did not feel informed on any of the topics also responded that he did not receive the baseline survey or the fact sheet. Records show that this dentist responded to the baseline survey and was mailed a copy of the fact sheet and BMP insert. The follow-up survey response by this dentist points out that merely mailing information to dentists may not be an effective form of communicating dental mercury BMP and BAT information to all dentists.

When asked to rate how knowledgeable or informed they felt about dental mercury issues following the Phase 2 outreach effort, most dentists indicated that they felt moderately informed on the topics of general mercury issues, mercury amalgam separators, and mercury recycling (Figure 2).

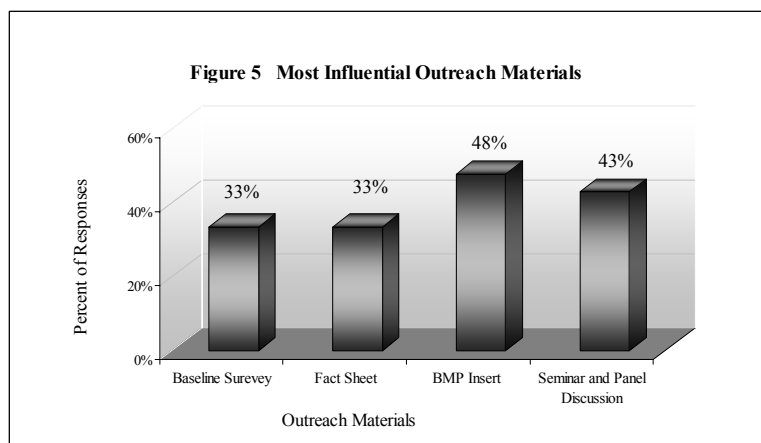


In the baseline survey, dentists were asked to rate how informed they were regarding BMPs and technologies for mercury P2 in dental offices. In the follow-up survey, this question was divided into three questions (See Figure 2). Figure 3 summarizes the change in response from the baseline to the follow-up survey. Overall, according to survey results (Figure 3), through the course of the project, dentists indicated they increased the level at which they were informed about BMPs and technologies for mercury P2 in dental offices.



To further assess the overall effectiveness of the outreach program, the survey also asked if anything in the fact sheet, BMP insert, or seminar and panel discussion would cause the respondents to change their mercury management or handling practices and procedures. Sixty-six percent of the respondents indicated they planned to change practices in their offices as a result of the outreach effort (Figure 4).

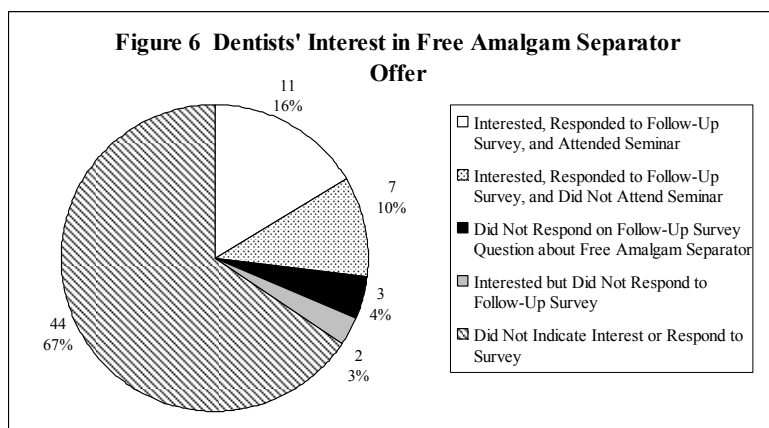
The survey asked dentists to specify which outreach effort(s) they found to be the most influential. The results from this question (Figure 5) indicate that among the project outreach efforts, dentists found the BMP insert to be most influential. Although dentists found the fact sheet and seminar and panel discussion to be most *informative* (Figure 1), dentists likely found the BMP insert to be most *influential* because the insert is a user-friendly guide that can be posted in the dental office and frequently referred to by the dentists and staff.



#### Installation of Amalgam Separators

The survey also assessed the program's overall effectiveness in encouraging dentists to install mercury amalgam separators. When asked whether they planned to install an amalgam separator within the next year, 19 of the 21 responding dentists indicated they planned to install a separator, although some dentists also responded that the cost and space could be barriers (one of the two dentists not planning to install an amalgam separator indicated he is retiring and closing his office). The level of interest in installing an amalgam separator may have been influenced by the free amalgam separator offer discussed in the following paragraph.

During Phase 2 of this project, ADA Technologies, Inc., a manufacturer of amalgam separators and one of the presenters at the seminar and panel discussion, offered several previously used (tested) amalgam separators to Pueblo dentists free of charge. In the follow-up survey, dentists were asked to indicate their interest in obtaining a free amalgam separator from ADA Technologies, Inc. The survey results showed that 86 percent (18 out of 21) dentists that responded to the survey indicated an interest in obtaining a free amalgam separator (the remaining 3 dentists did not respond to the question). Seminar attendance appeared to improve the interest in the offer. Forty-four Pueblo dentists did not respond to the survey or indicate interest in the free amalgam separator offer. Figure 6 summarizes Pueblo dentists' interest in the free amalgam separator offer.



### Change in Recycling Practices

Thirty-three percent of the dentists responding to the survey indicated they were already recycling amalgam waste, while 57 percent indicated that they planned to begin recycling amalgam waste (Two respondents did not answer this question). Those dentists planning to recycle amalgam waste indicated that the following types of materials would be recycled:

- contact amalgam
- non-contact amalgam
- extracted teeth
- empty amalgam capsules
- elemental mercury
- screens
- traps
- filters

### Transferability Statewide

Finally, the survey assessed the transferability of the outreach effort statewide. A large majority of the dentists (86 percent) responded that this outreach effort would be beneficial in other Colorado communities. Two dentists responded that they did not think it would be useful to dental offices in other areas of Colorado, but did not provide a reason and one dentist did not respond to the question.



## CONCLUSIONS

This section summarizes the conclusions of the Pueblo dental mercury P2 project.

### Use of Surveys for Feedback

Through this Pueblo dental mercury P2 project, Pueblo dentists were sent both a baseline and follow-up survey. The baseline survey was used to evaluate dentists' current awareness of mercury issues, and to identify the barriers to implementing mercury BMPs and BATs in dental offices. The follow-up was used to evaluate the effectiveness of the outreach project. The following bullets summarize conclusions about the use of surveys for feedback.

- The project surveys were useful tools for obtaining information from dentists to direct the project implementation and to assess the project effectiveness.
- Survey response rates increased when Tetra Tech called each dental office to encourage survey response. Other efforts or incentives might further increase survey response rates.
- Although the same survey protocol and same number of hours was used to follow up with dentists after the survey mailings, the follow-up survey response was significantly lower than the baseline survey response. In the baseline survey, 41 of 59 dentists (69 percent) responded, while in the follow-up survey 21 of 67 dentists (31 percent) responded. The reason for the decrease in response rate is unclear.
- In order to obtain measurable results from the project, a longer timeline after the completion of project implementation is recommended. The follow-up survey was conducted within weeks of the date when dentists received the fact sheet and attended the seminar and panel discussion. The program effectiveness, in terms of implementation of BMPs and installation of amalgam separators, would be better assessed through a follow-up survey conducted at least 6 months to 1.5 years after program implementation.

### Value, Content, and Effectiveness of Outreach Materials and Seminar/Panel Discussion

Pueblo dentists were given a dental mercury fact sheet and BMP insert, and, were offered the opportunity to attend a dental mercury seminar and panel discussion. The following bullets summarize conclusions about the value, content, and effectiveness of the outreach effort.

- Most dentists found the fact sheet, BMP insert, seminar and panel discussion to be useful and informative. The seminar and panel discussion were considered the most *informative* outreach components, while the BMP insert was considered the most *influential* outreach component.
- One dentist indicated that the seminar and panel discussion lacked a “definitive program,” which may reflect a weakness associated with the “voluntary” nature of this mercury reduction program.
- The level to which dentists felt moderately to highly informed increased up to 16 percent during the course of the project.
- More than 70 percent of the Pueblo dentists responding to the follow-up survey indicated that they planned to change their behavior with respect to handling mercury amalgam waste as a result of the outreach efforts.
- Ninety percent of the Pueblo dentists responding to the follow-up survey indicated that they are now, or will be, recycling mercury-containing amalgam and waste. This compares to the baseline survey results where only 46 percent of the respondents reported recycling scrap amalgam and only up to 12 percent reported recycling other mercury containing wastes.
- Eighty-six percent of the Pueblo dentists that responded to the survey indicated an interest in obtaining a free amalgam separator. Two additional Pueblo dentists that did not respond to the survey requested a free amalgam separator. This compares to the baseline survey where a total of only four dentists indicated that they would install an amalgam separator if it was provided free of charge.



### **Transferability of Outreach Effort to Other Colorado Communities**

Other communities may benefit from the outreach materials and other tools developed during the voluntary dental mercury P2 project in Pueblo. Most directly transferable is the fact sheet and BMP insert which Tetra Tech wrote in a manner that it is applicable to dentists state-wide. However, many other materials and tools could be used “as-is” or slightly modified to fit the needs of other Colorado communities. These items include:

- Baseline cover letter and survey
- Baseline summary report which examines the data from the baseline survey results
- Seminar and panel discussion announcement flyers
- Seminar and panel discussion slides and handout materials
- Follow-up cover letter and survey
- Final report which examines the data from the follow-up survey results

### **Value of the Voluntary Approach**

The results of the Pueblo Dental Mercury P2 project provide an indication of the value and effectiveness of voluntary programs, as opposed to regulatory programs, in effecting changes in behavior among dentists. In the Phase 1 survey, 46 percent of the Pueblo dentists stated that that a “legal requirement” would be the primary motivation for purchasing and installing a mercury amalgam separator, and only 4 dentists indicated that they would install an amalgam separator if it was provided free of charge. However, at the conclusion of the Phase 3 outreach effort, a total of 20 Pueblo dentists indicated that they were interested in obtaining and installing a free amalgam separator. Clearly, a law requiring the installation of amalgam separators would increase the number of amalgam separators installed. However, working with dentists on voluntary basis may eliminate the need to regulate amalgam separator installation. Further, if regulations do become necessary, voluntary start-up programs may enable dentists to play a more informed and significant role in the regulatory process.