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December 21, 2007

Water Docket  
Attention **Docket ID No. EPA-HQ-OW-  
2006-0771**  
Environmental Protection Agency  
Mailcode: 4203M  
1200 Pennsylvania Ave., NW.  
Washington, DC 20460

Re:	The American Dental Association's Comments on EPA's Study Of A Pretreatment Requirement For Dental Offices ( <u>Docket ID No. EPA-HQ-OW-2006-0771</u> )
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Dear Sir or Madam:

The American Dental Association ("ADA") greatly appreciates the Environmental Protection Agency's ("EPA") willingness to meet with representatives of the ADA and give the ADA the opportunity to review and comment on EPA's Proposals: To Study A Pretreatment Requirement For Dental Offices.

The ADA is the largest dental professional association, representing over 155,000 dentists in the United States ("U.S."), including 71.8% of the active dentists. The vast majority of dentists utilize the services of their local publicly owned treatment works ("POTW"). The issuance of a pretreatment rule governing the discharge from dental offices would directly and significantly impact dentists and their patients. Additionally, dentists are concerned about the impact of environmental pollutants on their communities. As you know, the ADA included amalgam separators as part of the ADA Best Management Practices ("BMPs") in October 2007. In accordance with its BMPs, the ADA believes professional dentists should operate his or her dental office in a manner that maximizes the amount of amalgam that is captured for recycling.

The ADA opposes mandatory separators, but strongly supports the use of voluntary separators to achieve the mutual goals of EPA and the ADA. The ADA will exert its best efforts to educate dentists about its new BMPs in general, and separators in particular. The ADA would be willing to form a partnership with EPA to implement a nationwide voluntary

separator program. This partnership could include EPA issuing guidance to treatment plant operators on the options that are available to address dental office wastewater. In fact, the ADA has long urged and continues to urge EPA to issue national guidance. We want to emphasize that we are *not* asking EPA to issue a mandate to local treatment plants. Rather, we suggest a guidance from EPA explaining that, in EPA's view, a voluntary separator program is *an* appropriate option to pursue.

A voluntary program is preferable for the following reasons.

First, the long-term goals of both EPA and the ADA are the same use of amalgam separators. Even in the short- and medium-term, there is little incremental difference in the amount of amalgam collected and recycled using a voluntary separator program compared to a mandatory plan (see attached Comments and particularly Attachment 1). Thus, a voluntary program would be just as effective as a mandatory approach.

Second, a voluntary program is more cost-effective and would avoid wasteful administrative costs involved in enforcing regulations.

Third, history demonstrates that a voluntary program (in conjunction with current mandatory and recommended separator programs already promulgated) should result in more than 65% of the dentists in the US installing separators.

Fourth, a voluntary program would be more appropriate to attain mercury reduction from a professional group such as dentists than a "command-and-control" approach. Nearly all US dentists are small business owners, and EPA policy strongly favors a voluntary program when small businesses are involved.

Fifth, a mandatory separator requirement would have little or no effect on the concentration of mercury in the treatment plant's effluent entering surface water or deposition of mercury into surface water from land applied or landfilled amalgam. There is no debate that the vast majority of mercury that is causing methylmercury concentrations in fish to exceed the water quality standard of 0.3 ppm is from air deposition or unique local sources, not amalgam.

Sixth, because of the dental community's disproportionately low contribution to methylmercury in fish, and given that the concern about mercury in the US is based almost exclusively on levels of methylmercury in fish, a voluntary separator program would be more consistent with the Clean Water Act's statutory scheme and overall EPA policy.

Seventh, EPA has little to lose by working with the ADA on a voluntary approach first. If a voluntary effort turns out to be ineffective, then nothing would preclude EPA from promulgating additional, even mandatory, requirements. Similarly, nothing in this proposal

precludes states or municipalities from enacting state or local amalgam separator statutes or regulations. Thus, mandatory requirements should not be the initial approach.

Eighth, dentistry is a learned profession. This means that dentists have a higher calling to self regulate. We believe it is important to respect the nature of dentistry as a profession before imposing regulatory mandates. The ADA's new policy supporting the use of separators demonstrates the profession's existing commitment to take action on its own.

The ADA remains committed to implementing its 2007 Best Management Practices for amalgam waste including the use of separators and looks forward to working with EPA to promote mercury reductions in the environment, but we urge EPA to use a voluntary separator program to do so.

Since others may comment on this study and new information may become available, we request that EPA agree to accept new information submitted after the December 31, 2007 public comment period deadline.

If you have any questions, please call or e-mail me.

Yours truly,



William J. Walsh

WJW/

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**COMMENTS OF THE AMERICAN DENTAL ASSOCIATION  
CONCERNING THE ENVIRONMENTAL PROTECTION  
AGENCY DENTAL OFFICE SCOPING STUDY**

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## **I. INTRODUCTION**

The following are the American Dental Association's ("ADA")<sup>1</sup> comments on the Environmental Protection Agency's ("EPA") preliminary study of the need for a pretreatment rule requiring mandatory use of amalgam separators by dental offices to reduce the discharge of amalgam into sewerage treatment systems ("mandatory amalgam separators") or, in the alternative, achieving the same goal through implementation of the ADA voluntary Best Management Practices for Amalgam Wastes (2007) ("ADA 2007 BMPs"), which includes the voluntary use of amalgam separators. The ADA strongly supports reliance on the on-going implementation of the ADA 2007 BMPs and, for several reasons that are discussed in these Comments, believes that mandatory amalgam separators would be unreasonable and impractical.

Section II summarizes the ADA approach, already underway, and explains why a voluntary program is both effective and preferable for professionals such as dentists, particularly given that amalgam wastewater is only responsible for a small fraction of the total mercury that enters surface waters each year.

Section III describes the benefits of these two options. The benefit of each alternative must be compared to baseline conditions, which includes a growing number of states and localities (see Attachment 3) that already have either mandatory or voluntary separator programs.

Section IV explains the reasons that a mandatory separator requirement would be inconsistent with current law and policy and is not cost-effective.

Much of EPA's analysis is sound, but in several instances either more information is needed or an assumption needs to be updated.<sup>2</sup> Rather than repeat information already in the record from the ADA's prior submissions, this Comment focuses on the few areas where there may be disagreements between the ADA and EPA.

## **II. A VOLUNTARY AMALGAM SEPARATOR PROGRAM WILL BE EFFECTIVE, AVOID WASTEFUL TRANSACTION COSTS, AND IS MORE APPROPRIATE TO ATTAIN MERCURY REDUCTION FROM A PROFESSIONAL GROUP, SUCH AS DENTISTS**

### **A. Introduction**

EPA is considering the use of a pretreatment rule to require mandatory installation of amalgam separators in all dental offices that place amalgam restorations. ADA has issued revised BMPs for amalgam wastes that, among other things, recommend the use of amalgam separators (i.e., a voluntary professional standard of practice).

Subsection (B), below, describes the ADA proposed voluntary separator approach. Section (C) explains why the dental community would be an ideal candidate for a voluntary mercury reduction program. Subsection (D) summarizes the steps already taken by the dental community. Subsection (E) provides an example of a successful public-private partnership with ADA. Subsection (F) provides some examples of successful, voluntary, amalgam separator programs. Subsection (G) discusses EPA's policy favoring voluntary approaches. Subsection (H) discusses the increased transaction costs and legal hurdles of using a mandatory versus a voluntary program.

### **B. The ADA Proposal for Voluntary Separators**

The ADA urges EPA to implement its desired goal (i.e., the reduction of mercury discharges from sewerage treatment plants into surface water) through a voluntary program to promote the implementation of ADA's BMPs.

First, the goal of this program would be to convince the dentists in the US to adopt the 2007 ADA BMP (which includes use of amalgam separators). Thus, the goal of a voluntary and mandatory separator program is essentially the same.

Second, the ADA will use the considerable resources at its disposal (discussed below), in conjunction (we hope) with the EPA, state, and local governments, to educate the dental community on the merits of using separators and to take action (where possible with amalgam manufacturers and similar stakeholders) to eliminate institutional, conceptual or economic barriers to the use of amalgam separators.

Third, tools exist to monitor the progress of a voluntary separator program. For example, the ADA (and, as appropriate, State and local dental associations) could work with EPA, state regulators, and municipalities to track the use of amalgam separators and the amount of amalgam collected and recycled. In addition, the amalgam separator manufacturers (which recycle amalgam) and any non-separator amalgam recyclers are also equipped to monitor a voluntary program. The ADA would be willing to consider supplementing this tracking information, if needed, (as well as re-enforcing its message to dentists to install amalgam separators) by surveying the ADA membership on the degree of amalgam use and other amalgam waste disposal practices.<sup>3</sup>

Fourth, the type of program that is most likely to be successful is one that imposes the least transaction costs on both the dental community and the sewerage treatment agencies. For example, it would be unproductive and *cost-ineffective* to require permits or monitoring of dental office discharges.

Fifth, a voluntary amalgam separator program avoids the inequities and inefficiencies caused by the use of a rigid, command and control, “one-size fits all” approach that requires the mandatory use of separators (typically within a very short time frame) even in locations where the methylmercury levels in fish are well below EPA’s 0.3 ppm limit<sup>4</sup> and in



areas where 99.9% of the methylmercury is likely to be attributable to air emissions or the residue from historic mining activities (*see* Section III).<sup>5</sup>

Sixth, implementation of the BMPs could be enhanced through guidance issued by the Office of Pretreatment, which provides direction to EPA Regional Offices, States, and municipalities.

Seventh, since this offer seems to have been misunderstood by some in the past, we reiterate (hopefully clearly) that a voluntary partnership with the ADA would not bar EPA from making a determination in the future that use of mandatory separators is necessary to fulfill EPA's statutory mandate. Similarly, the ADA understands that an EPA decision not to issue a pretreatment rule does not bar States from taking action pursuant to state law or policies. However, the current situation provides both EPA and the ADA with an ideal opportunity to jointly promote good amalgam waste management practices and ensure that virtually all of the amalgam waste is recycled.

Finally, the ADA's voluntary, best management approach would result in installation of separators even in areas where the methylmercury levels in fish and mercury concentrations in biosolids are below regulatory limits. In other words, the dental community is prepared to embrace a sustainable (action beyond compliance) approach to increase recycling of amalgam.

### **C. The Nature of the Dental Community**

The dental community consists of highly educated professionals. Virtually all dentists are small business owners who value both their independence and their profession – improving the public's dental health.

As with most professionals, indeed more so, dentists rely upon their professional associations – the ADA at the national level, the state dental association at the state level, and the

local dental association in their own community – for information and assistance in solving problems and addressing issues that arise in the operation of their business.<sup>6</sup> Nationally, the ADA is a trusted source of information to its 155,000 member dentists. The ADA is also widely recognized as a source of reliable information by the public (e.g. its Seal of Acceptance program for consumer dental products) and by non members. The ADA has the capacity, and utilizes it, to regularly communicate with every dentist in the nation, both ADA members and non members.

Environmental issues have only become significant to the dental community since the late 1990s. At that time, most dentists were unfamiliar with the environmental jargon, overarching regulatory schemes, and the direct command and control approach that are common in the interaction between the regulators and regulated. This regulatory scheme (which is familiar to most in industry) was and, to some extent, remains less familiar to dentists than other aspects of their professional life.

In the ADA's opinion, one of the lessons learned from some of the early, less successful interactions between sewerage treatment plant officials and the dental community is that any program (voluntary or mandatory) should take into account the nature of the dental community. The ADA is uniquely suited to help in this endeavor.

#### **D. The Dental Community Has Already Taken Significant Steps**

The ADA has: (1) initiated an amalgam national advocacy initiative to alert the dental community about the issues and to offer a positive solution, with similar efforts at state and local levels;<sup>7</sup> (2) issued the 2003 ADA BMPs which recommended collection of 81% of the amalgam discharges, recycling of that amalgam, and ending the use of bulk amalgam; (3) met repeatedly with EPA and state regulators (commenting on guidance and proposing partnerships); (4) tested the effectiveness of separators in collecting amalgam prior to the discharges to sewers;

(5) provided information on the cost of separators and a practical guide for dentists wishing to select separators (this ongoing effort was just recently updated<sup>8</sup>); (6) implemented a long-term dental amalgam wastewater education program (i.e., seminars, training sessions, and other outreach events); (7) performed research on the effectiveness of separators in reducing discharges of mercury to surface water;<sup>9</sup> (8) successfully worked with other stakeholders, including EPA, to adopt an American National Standards Institute (“ANSI”) voluntary standard for dental amalgam recycling, storage, and management;<sup>10</sup> (9) in October 2007 revised the ADA BMPs to include amalgam separators; and (10) has led research on developing and implementing nonamalgam material for use in dental restorations.<sup>11</sup> Further, the ADA is in constant communication with its members through its web site (www.ADA.org), the ADA News (which is also sent several times per year to every dentist in the nation (approximately 175,000 dentists), not just ADA members), the Journal of the American Dental Association (a peer-reviewed journal) and similar vehicles. The ADA is also actively exploring feasible methods of eliminating barriers to the purchase of separators and assisting dentists to purchase separators voluntarily and recycle amalgam as cost-effectively as possible. A number of state dental societies have done so as well.

In short, the dental community is a cohesive network of professionals who are ready, willing, and able to cooperate with EPA to ensure that a voluntary mercury reduction program is a success.

#### **E. Public-Private Partnerships with ADA Have Worked In The Past**

The ADA has partnered with federal regulatory agencies in the past to much success.<sup>12</sup> For example, in April 2004, the Occupational Safety and Health Administration (OSHA) and the ADA formed an Alliance (which was renewed on May 18, 2006) through which OSHA and ADA agreed to “provide ADA members and others with information, guidance, and

access to training resources that will help them protect employees' health and safety, particularly in reducing and preventing exposure to ergonomic hazards.”<sup>13</sup>

The Alliance has succeeded in educating dentists concerning OSHA standards through outreach by ADA and OSHA- or ADA-developed materials, training programs, workshops, seminars, and lectures. Specifically, the ADA and OSHA have worked together to develop a Hand Pain Tip Sheet for Dentists, and is working on additional Alliance-related projects. The ADA reaches out to U.S. dentists regarding these efforts in a variety of ways, including use of ADA's website.<sup>14</sup>

Other examples of effective public-private partnerships include the Dry Cleaning Work Group, the development of a regulatory guidebook by National Association of Homebuilders and the Occupational Safety and Health Administration, and voluntary amalgam reduction efforts like the Pueblo Dental Mercury P2 project.<sup>15</sup>

#### **F. Voluntary Amalgam Separator Programs --- Success Stories**

Partnerships between the state or local dental association and state environmental agency have been effective in promoting voluntary compliance. One source estimates that 65% of dentists involved in voluntary programs will install separators, based on a range of participation rates from 38% to 100%.<sup>16</sup> The States of Minnesota, Washington, and Massachusetts created voluntary programs that have worked to promote amalgam separator use.

The Minnesota Dental Association (MDA) and the Metropolitan Council of Environmental Services (MCES) launched the Voluntary Dental Office Amalgam Separator Program in 2001. According to the MDA, 85% of eligible dentists in the state (dentists not exempt under a voluntary program) have committed to installing amalgam separators. Seventy-two percent of these committed dentists have already installed a separator or are exempt.<sup>17</sup>

In Washington, a Memorandum of Understanding (MOU) was signed by the Washington State Dental Association and the Washington Department of Ecology in August 2003. The MOU advocated and supported BMPs, which included installation of amalgam separators. In August 2004, at the end of the first year of the MOU period, a survey reported that 34% of dentists installed separators.<sup>18</sup> One year later in August 2005, another survey reported that 80% of dentists had installed separators.<sup>19</sup> The survey also indicated that another 16% of dentists committed to installing separators by November 2005, bringing separator compliance up to 96%.<sup>20</sup> The Department of Ecology's compliance inspectors also contacted 441 dentists and found only 31, or 7%, who had not installed separators.<sup>21</sup>

In 2004, the Massachusetts Department of Environmental Protection (MA DEP) worked with the Massachusetts Dental Society to establish a voluntary program for dentists to install amalgam separators.<sup>22</sup> The plan called for 50% of Massachusetts Dental Society's member dentists to participate by January 2005, 90% by January 2006, and 100% by January 2007, with regulations to follow if these goals are not met. Due to the cooperation of the Massachusetts Dental Society, the program was extremely successful and by April 2005, the MA DEP reported that 75% of dentists installed separators, vastly exceeding the goals of the first year.<sup>23</sup> In April 2006, MA DEP promulgated regulations mandating that all dental facilities install separators, but those dentists who complied with the voluntary program were rewarded with an exemption from the regulation (i.e. record keeping and reporting) until 2007, or 2010, depending on how early the dentist complied.

Voluntary programs have also been used successfully at various stages in Wichita, Kansas; Duluth, Minnesota; Minneapolis/St. Paul, Minnesota; Madison, Wisconsin; Palo Alto, California; and the East Bay Municipal Utility District ("EBMUD").

In April 2000, the City of Wichita, Kansas initiated a Mercury Code of Management Practices (CMP). Phase 1 was an effort to encourage voluntary use of technologies beyond the chair side trap and vacuum filter, e.g., a separator. Phase 2 of the program would have required mandatory separators if it had been needed, but the implementation of the mandatory approach was contingent on the success of the voluntary effort. In fact, because “60% of dental community voluntarily complied with program initially,” the City decided not to implement Phase 2.<sup>24</sup> Currently, without a mandatory separator requirement, “98% of the 200 dental offices in the City have complied with the Mercury CMP Program. . . . The cooperation of the dental community . . . contributed to this enormously successful program, and will set a standard for other cities.”<sup>25</sup>

In 1992, the Western Lake Superior Sanitary District (“WLSSD,” i.e., Duluth) and the Northeast District Dental Society formed a public-private partnership that provided education on how to recycle amalgam waste, trained all dental offices, made presentations at local dental society meetings, and prepared written materials.<sup>26</sup> As an incentive, the WLSSD purchased and installed separators, but the largest long-term cost (recycling the amalgam) is borne by the dentists. Duluth phased its installation of separators from 2001 to 2003 (by which time 51 of 52 separators were installed).<sup>27</sup> Factors contributing to the success of the program included the leadership of the local dental society, peer-to-peer interaction with area dentists, including explaining the need to properly manage amalgam waste to prevent mercury from entering the environment and demonstrating the proper methods for doing so, financial incentives to install amalgam separators, and a discount waste disposal option through WLSSD’s “Clean Shop” Program.

In 2003, the Metropolitan Council of Environmental Services (MCES) and the Minnesota Dental Association (MDA) launched a program to identify Minneapolis and St. Paul dental clinics that used amalgam to encourage them to install separators. 700 clinics in the Twin Cities metropolitan area participated in the program. To date, more than 99% of the clinics eligible for the program have installed separators.<sup>28</sup>

Thus, state and local voluntary separator programs have been successful in many (although not all) municipalities. The key for a successful effort is developing a cooperative relationship with the dental associations, rather than an adversarial approach.

#### **G. EPA Policy Favoring Voluntary Approaches**

EPA Office of Pretreatment's overall policy is to "encourage and reward voluntary reductions."<sup>29</sup> In 2003, EPA was confronted with a similar situation and proposed to use a Pollution Prevention (P2) Alternative to a pretreatment rule for the Metal Products and Machinery Point Source Category. This rule provided "voluntary incentive[s] for ... indirect dischargers that agreed to perform specific best management/pollution prevention practices."<sup>30</sup>

In the past, the EPA Office of Wetlands, Oceans, and Watersheds has published guidance favoring the use of BMPs to implement applicable water quality standards.<sup>31</sup> For example, in 1997, EPA published a technical support document for the Voluntary Advanced Technology Incentives Program, which sought to encourage paper mills to make substantial environmental progress beyond the base level compelled by law.<sup>32</sup>

#### **H. Conclusion**

The ADA will continue its efforts to implement its BMPs and would working with EPA to implement a nationwide voluntary separator program. The long-term goals of both EPA and the ADA are the same – to promote the use of amalgam separators. Even in the short- and medium-term, there is little incremental difference in the amount of amalgam collected and

recycled using a voluntary separator program compared to a mandatory plan (see Section III (D) below). Thus, a voluntary program would be just as effective as a mandatory approach. Indeed, such a voluntary program, backed by the ADA and (we would hope) by EPA would provide a consistent and more credible joint message and magnify the resources available.

This sort of voluntary program has demonstrably worked in many states and localities and the ADA has been involved in other successful voluntary compliance programs. In fact, EPA policy strongly favors a voluntary program, especially when small businesses are involved. A voluntary program is also more cost-effective and would avoid wasteful transaction costs involved in enforcing regulations.

Finally, EPA has little to lose by working with the ADA on a voluntary approach first. If a voluntary effort turns out to be ineffective, then nothing would preclude EPA from promulgating additional, even mandatory, requirements. Thus, mandatory requirements should not be the initial approach.

### **III. THE BENEFIT OF VOLUNTARY SEPARATORS VERSUS MANDATORY SEPARATORS**

#### **A. Introduction**

The heart of the decision facing EPA is whether the benefits of using a mandatory versus voluntary separator program is worth the costs – particularly given the demonstrable and similar environmental benefits achievable through use of a voluntary approach.

#### **B. Amalgam Use Has Decreased**

This submission includes new data on the continued decrease in the use of amalgam. Amalgam use has declined to one third of the 1979 level and 20.5% below the 1999 level (which was the basis of the 2005 Vandeven and McGinnis analysis).

The trend is as follows:



**1979:** 157 million restorations used dental amalgam.<sup>33</sup>

**1990:** 96 million restorations used dental amalgam out of 200 million (48%).<sup>34</sup>

**1999:** 66 million restorations utilized amalgam.<sup>35</sup>

**2005:** **52.5 million (31.6% of all restorations)** utilized amalgam.<sup>36</sup>

It is projected that there will be approximately 46.7 million amalgam restorations in 2008 (only 20.5% of all dental restorations) based on past trends.<sup>37</sup>

In summary, the amount of amalgam used has dramatically decreased over the last several decades and continues to decline.<sup>38</sup> This decline should be taken into account in the assessment of the fate of dental amalgam.

### **C. Amalgam Is a De Minimis Contributor to Releases to the Environment**

The concern about mercury in the US is based, almost exclusively, on the concern about the levels of methylmercury in fish. Neither the Clean Water Act nor any other statute gives EPA the legal authority to limit, no less ban, the discharge of mercury into sewerage treatment plants, if: (1) the methylmercury concentration in fish does **not** exceed the EPA water quality standard of 0.3 ppm or the total mercury concentration in biosolids does **not** exceed the biosolids limits (57 ppm, or 17 ppm for exceptional quality biosolids) or (2) if the mercury discharge to the treatment plant does not cause the exceedance of these limits.<sup>39</sup>

The vast majority of mercury that is causing methylmercury concentration in fish to exceed the water quality standard of 0.3 ppm is from air deposition or unique local sources, not amalgam.<sup>40</sup> The United States' official position is that when the dominant sources of mercury are "not sources that can be regulated under" the Clean Water Act (e.g., from air emissions or historic mining sources), the fact that a water quality standard is not met "does not represent a 'violation of the CWA.'"<sup>41</sup>

Similarly, the deposition of mercury into surface water from land applied biosolids or landfilled biosolids or amalgam is also minor.<sup>42</sup> According to the 2006 EPA Mercury Road Map, “based on existing information,” releases of mercury to the land (such as land application of biosolids) “are generally not considered to be as environmentally harmful as releases to air because the mercury may be less mobile and less likely to reach surface waters and fish.”<sup>43</sup>

Thus, the contribution of mercury originating from dental office amalgam wastewater has little or no effect on the concentration of mercury in the treatment plant’s effluent entering surface water or in the methylmercury level in fish. The ADA’s voluntary amalgam separator program will further reduce this impact. This underlying reality argues for the flexibility inherent in a voluntary approach.

#### **D. Incremental Collection of Amalgam**

##### **1. The Conceptual Model**

The incremental benefit of mandatory amalgam separators is the additional amount of mercury collected by the mandatory separator rule compared to the amount of mercury collected by a voluntary separator program (such as the ADA efforts to implement the 2007 ADA BMPs as discussed by this submission). Thus, for example, there is no incremental benefit in states or localities that have already enacted mandatory separator requirements, where separators have already voluntarily been installed, and for the amount of amalgam collected by separators that would otherwise be collected by existing programs (such as regulatory programs that were based on the pre-2007 BMPs, which did not include separators, but did include several other amalgam collection measures).

There is no benefit to a federal pretreatment requirement if existing law, guidance or practice already collects the amalgam in the dental office.

## 2. Corrections to the EPA Analysis

### a. Introduction

The ADA generally agrees with EPA's assessment of the amount of mercury discharges from dental offices to surface water, except for the following.

### b. The Size of Particles Entering the Separator in a Dental Office

EPA's analysis assumes that distribution of amalgam particles entering separators in a typical dental office is the same distribution as used in the ISO test and therefore use the capture efficiency from those tests (99%). The 2005 Vandeven & McGinnis article, however, notes:

In order to determine the incremental capture efficiency of the amalgam separators tested by the ADA under ISO Standard 11143, the fate of a 100-mg representative ISO amalgam sample was considered. As discussed previously, it was estimated that 80% of the dental facilities in the United States are equipped with both chair-side traps and vacuum filters, for which average capture efficiencies of 68% and 40%, respectively, were identified in the open literature. In those dental facilities equipped with both a chair-side trap and vacuum filter, an estimated 68 mg of the ISO amalgam sample would be captured in the chair-side trap, with approximately 32 mg passing on to the vacuum filter. The incremental capture of the vacuum filter, at 40%, would retain approximately 13 mg of the 32 mg of amalgam that passed the chair-side trap. Therefore, an estimated 81 mg of the original amalgam sample would be captured from the combination of the chair-side trap and vacuum filter. The remaining 19 mg of the amalgam sample would pass on to the amalgam separator, which would capture some portion of the 19 mg. According to the ADA sampling results, if the entire 100 mg sample were run through the amalgam separator at the average 99% ISO capture efficiency, the separator would not have captured 1mg of the sample. This 1mg would consist of the smallest and most difficult amalgam particles to capture, and, having passed the chair-side trap and vacuum filter, would be part of the 19 mg left under this illustration. Therefore, the ADA data indicate that, in a typical dental facility equipped with both a chair-side trap and vacuum filter, the average amalgam separator would capture 18 mg of the 19 mg of amalgam that reached the device, for an incremental capture efficiency of approximately 95%. Similarly, in the estimated 20% of dental facilities that are only equipped with chair-side traps, approximately 68 mg of the ISO amalgam sample would be captured in the chair-side trap, with about 32 mg passing on to the amalgam separator. In these dental facilities, the separator would capture 31 mg of

the 32 mg that reached the device, for an incremental capture efficiency of approximately 97%.<sup>44</sup>

Attachment 1 (the new ENVIRON analysis) provides more details and explanation. Thus, EPA should use an incremental capture efficiency for separators of 96.4%.

c. **The Percent Capture by Treatment Plants**

EPA has proposed to use 90% removal of mercury in amalgam from offices without separators by sewerage treatment plants, instead of the 95% used in the Vandeven & McGinnis article. As we understand it, EPA would apply one removal efficiency for all amalgam entering the sewerage treatment plant (known as a publicly owned treatment works or “POTW”).

The 2005 Vandeven & McGinnis article states:

an average incremental capture efficiency for the use of amalgam separators of approximately 95% was used in the cost-effectiveness analysis. At this efficiency, amalgam separators would reduce the estimated discharge of 6.5 tons (5.9 metric tons) of mercury in the form of amalgam to POTWs in the United States to approximately 0.3 tons (0.3 metric tons). As noted, this 0.3 tons would consist of the smallest and most difficult amalgam particles to capture. Amalgam separators primarily employ the same physical processes to remove amalgam particles as the processes utilized at POTWs to remove particulates (i.e., sedimentation and centrifugation), and can generally be expected to remove the same types of amalgam particles. Indeed, the amalgam capture efficiencies identified for both POTWs and separators from the open literature are both approximately 95%. Therefore, it is unlikely that a significant amount, if any, of the 0.3 tons of mercury in the form of amalgam particles not captured by amalgam separators would subsequently be captured by the downstream POTWs (i.e., the 0.3 tons of mercury in the form of amalgam not captured by the separators would consist of the same 0.3 tons that is already estimated not to be captured by POTWs).<sup>45</sup>

Attachment 1 provides an update of the scientific basis for using a sewerage treatment plant mercury removal rate of at least 95% for amalgam discharged from offices without separators.<sup>46</sup>

The reasons for the difference in the estimated 90% mercury removal in EPA's 1982 sewerage treatment plant study and the current estimate of a 95% or more removal rate for amalgam particles from dental offices without separators are as follows.

First, the National Association of Clean Water Agencies ("NACWA") studies cited in the 2005 Vandeven & McGinnis peer-reviewed paper are more recent and scientifically sound, especially with the use of much lower detection limits.<sup>47</sup>

Second, it is widely recognized that "[m]unicipal wastewater treatment plants (POTWs) are capable of removing 95% of the mercury that enters their systems."<sup>48</sup> In fact, many sewerage treatment systems report a greater than 99% removal efficiency.<sup>49</sup>

Third, the data in EPA's 1982 study was collected in the late 1970s and there were several methodological limitations of this study, including the lack of representativeness of the sample<sup>50</sup> and the high detection limits (resulting in limitations on the ability to calculate a reliable removal efficiency), among others.

Fourth, in the late 1970s, the mercury levels in influent, biosolids, and effluent was much higher than it is presently, probably reflecting the higher levels of mercury discharges in the 1970s.<sup>51</sup> This is likely to result in a lower removal rate because dissolved mercury is not captured by the features of a sewerage treatment plant that collects amalgam particles.

Amalgam, on the other hand, is a solid particle that is much heavier than water and is ideally suited to be captured by the components of a sewerage treatment plant.<sup>52</sup>

In summary, the ADA urges EPA to use at least 95% treatment plant mercury removal efficiencies for amalgam discharged from offices without separators and a range of 0% to 30% for the small levels of amalgam residuals discharged from offices with separators in its final study.

d. **Percentage of Separators in a Voluntary Program**

EPA's methodology to derive the number of separators that have been installed or are required or recommended to be installed is a reasonable approach, but the final estimate of the percentage of separators should be updated to include municipalities and other states that have adopted such programs since EPA's estimate was performed.

EPA estimates that 30% of the dentists have or will install separators, or have or will install them due to regulatory guidance recommending it or because of a regulation or law (approximately 16.2% of the population of dental offices).<sup>53</sup> EPA then estimates that if only 20% of the dental offices in states not covered by statutes, regulations or recommendations (i.e., the other 82.8% of the nation's dental offices) voluntarily installed separators, the rate of separator usage in this group would be approximately 16.8% of the population of dental offices.<sup>54</sup> A total of approximately 33% of dental offices currently have separators or are obligated to install separators, so EPA rounded this estimate down to 30%.

EPA also estimates that currently 65% of the dentists comply with the pre-2007 voluntary BMPs that do not include separators.<sup>55</sup> The ADA anticipates that as more dentists comply with the 2007 ADA BMP, the remaining dentists will be more likely to comply with at least the pre-2007 ADA BMPs.

Both the percentage of dental offices that use a separator and the percentage of dental offices that at least use the pre-2007 ADA BMPs are not static numbers. The ADA strongly believes that existing information demonstrates that over the long term (years, not decades), the percentage of dental offices that install amalgam separators will be considerably higher than 20% in States with mandates and nationally higher than 30% for the following reasons.

First, using the same 20% usage for states not covered by statutes, regulations or recommendations, the estimate of separator usage is approximately 43.0%,<sup>56</sup> higher than EPA's estimate of 30%. Attachment 3 updates the EPA summary of the status of various state and municipal statutes, regulations, and guidance's that require or recommend the use of separators. This Update includes additional states and several municipalities that have required or recommended separators.

Second, even the estimate in Attachment 3 does not include all local separator statutes.

Third, a growing number of new states and municipalities are requiring amalgam separators, so the rate of use is certain to increase over the next several years.

Fourth, the degree of voluntary installation of amalgam separators is likely to be higher than the 20% assumed by EPA because the ADA 2007 BMPs now include separators. Many state and local dental associations have been educated and are working cooperatively with local and state authorities, and the continued wide spread regulatory activity and education efforts have convinced many dentists of the benefits of installing separators.

A voluntary program is not a "does nothing" program. The ADA will reach out to every dentist in the country, seek partnerships with federal and state regulators and separator manufacturers, institute training programs and seminars; and continue to support research and testing, among other things. As discussed in Section II (D), the ADA has already made progress toward the goal of amalgam separators and other best management practices.

In summary, a voluntary program is likely to exceed EPA's projections of 65% of dentists using the pre-2007 BMPs and 30% of the dentists using separators, given the ADA's continued and extensive efforts to promote the use of the ADA BMPs.

e. **The Effectiveness of Separators**

Amalgam separators are effective in increasing the amount of amalgam that is recycled, which the ADA agrees is a benefit. Also, concentrations of mercury generally decrease in biosolids after installation of separators. The most important question is whether there are releases to the environment that are substantially contributing to the levels of methylmercury in fish (as discussed in Subsection (B) above).

There is no real evidence that separators will decrease mercury levels in treatment plant effluent. A visual review of the data (Attachment 2) indicates that there is no clear pattern of decreases in treatment plant effluent following the installation of amalgam separators, and some data may suggest an increase in the effluent. Neither the individual presentations that interpreted this municipal data nor the NACWA study correlated the change in effluent mercury concentration over time with separator installations. Some of the treatment plants were implementing mercury reduction well before the NACWA study was initiated.<sup>57</sup>

**3. The Incremental Difference in Amalgam Collected**

The benefit of a mandatory separator program is, of course, the incremental amount of mercury collected by a mandatory separator program compared to a voluntary separator program. ENVIRON has updated its assessment of the fate and transport of mercury from dental amalgam and applied these results and EPA's assumptions concerning the percentage of separator being used or required and the percentage compliance with the pre-2007 ADA BMPs (Attachment 1).

Since the ADA does not have independent information upon which to base an estimate of the likely future rate of separator installation and future degree of compliance with the recycling component of the ADA's 2003 BMPs, only choice is to perform a sensitivity analysis calculating the amount of amalgam-related mercury that would enter surface water using



percentages of amalgam separator use and recycling that range from the baseline (i.e., EPA's assumptions) to 100% (the equivalent of a mandatory separator requirement. For example, EPA concluded that 30% of the dentists are either obligated to install separators or will do so voluntarily in the near future. Similarly, EPA assumed that of the dentists who have not installed separators, only 65% recycle amalgam, i.e., they either disposed of amalgam in medical waste incinerators or in landfills.

ENVIRON performed a sensitivity analysis using as a baseline EPA assumption that 30% use of separators and 65% compliance with recycling among the dentists not using separators.<sup>58</sup> ENVIRON then calculated the amount of mercury entering surface water for the baseline use of separators (30%), as well as 50%, 75%, 90%, and 100% use of separators in order to calculate the likely decrease in the impact when more than 30% of the dentists install separators. ENVIRON used the same model on the fate and transport of mercury from dental wastewater as is described in the 2005 Vandeven & McGinnis article, except that the amount of amalgam entering the plant is as estimated by EPA in the administrative record and the calculation includes the impacts from emissions from medical incinerators and landfills). ENVIRON notes, however, that the amount of amalgam entering sewer systems is lower than estimated by EPA because the number of amalgam restorations has decreased from 1999 to the present (Attachment 1).

Emissions from land application are de minimis so they are not included in the calculation (*see* Attachment 1 for details). For each calculation concerning the increased benefit if more dentists used separators, ENVIRON calculated the benefit, if, as expected, more than 65% of the dentist comply with these recycling BMPs (see Table 1 below). This analysis is consistent with EPA analysis in the administrative record.

**Table 1: Relative Annual Amount of Mercury Entering Surface Water from Amalgam Wastewater (Tons per year)**

<b>Compliance with pre-2007 BMPs</b>	<b>65%</b>	<b>65%</b>	<b>80%</b>	<b>80%</b>	<b>90%</b>	<b>90%</b>	<b>100%</b>
<b>Destination of non-recycled mercury</b>	<b>Medical and Biosolids incinerator</b>	<b>Landfill</b>	<b>Medical and Biosolids incinerator</b>	<b>Landfill</b>	<b>Medical and Biosolids incinerator</b>	<b>Landfill</b>	<b>NA</b>
<b>0% of dental facilities using separators</b>	0.532	0.423	0.483	0.421	0.451	0.420	0.419
<b>30% of dental facilities using separators</b>	0.425 – 0.447	0.348 – 0.371	0.391 – 0.413	0.347 – 0.370	0.368 – 0.391	0.347 – 0.369	0.346 – 0.368
<b>50% of dental facilities using separators</b>	0.353 – 0.391	0.299 – 0.336	0.329 – 0.367	0.298 – 0.336	0.313 – 0.351	0.298 – 0.335	0.297 – 0.335
<b>75% of dental facilities using separators</b>	0.264 – 0.320	0.237 – 0.293	0.252 – 0.308	0.237 – 0.293	0.244 – 0.300	0.236 – 0.293	0.236 – 0.292
<b>90% of dental facilities using separators</b>	0.211 – 0.278	0.200 – 0.267	0.206 – 0.273	0.200 – 0.267	0.203 – 0.270	0.200 – 0.267	0.199 – 0.267
<b>100% of dental facilities using separators</b>	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.175 – 0.250

Range Of Assumptions Concerning Use of Separators and Compliance with Pre-2007 BMPS for Those Not Using Separators (Assuming 31.25 tons discharged in dental wastewater – ERG’s Calculation)(All Options Include Releases from Biosolids Incineration)

The result of these calculations is that there is little difference in the amount of amalgam collected if only 30% of the population of dental offices installed amalgam separators compared to 100%. For example, the total release of mercury into surface water (from sewerage treatment plant effluent, air emissions from biosolids incineration and medical incinerators) decreases from 0.53 tons if no separators (are used and only 65% of the dentists without separators use pre-2007 BMPs) down to 0.25 tons if 100% of dentists use separators.

As the number of dentists that use separators, or at least follow the pre-2007 ADA BMPs, increases, the difference in the amount of amalgam collected compared to 100% separator use decreases. For example, if 75% of dentists use separators and the compliance rate with the pre-2007 ADA BMPs among the 20% of the dentists who do not use separators is 75%, and the amalgam is landfilled, the amount of mercury entering surface water would be 0.29 tons

– compared to 0.25 tons if 100% of the dentist use separators. That is a reduction of 0.043 tons, a relatively small amount by any measure.

Table 1 provides a sensitivity analysis. The difference in the amount of amalgam collected becomes demonstrably small.

#### **E. Disposal of Collected Amalgam**

There is no national information of which we are aware of that provides a historical estimate of how dentists dispose of the amalgam waste and whether the disposal followed the recommendations in the ADA's 2003 BMPs.<sup>59</sup> In this submission, the terms “pre-2007-BMPs”<sup>60</sup> and “2007 BMPs”<sup>61</sup> are used to distinguish the BMPs that were in existence prior to the October 2007 BMPs, which added amalgam separators. The ADA developed the BMP program to increase the rate at which proper disposal occurred.

The ADA has been promoting use of the pre-2007 BMP for four years. The ADA sponsors training sessions, has prepared videos, and sends information to dentists throughout the country. In addition, most state dental associations have implemented the amalgam BMPs and perform their own educational efforts. Furthermore, local municipalities, States, and EPA have initiated mercury reduction education over the last several years, most, if not all of which, include amalgam handling components.

Moreover, the ADA initiated the development of, and worked with EPA to craft an ANSI/ADA specification which describes procedures for storing, and preparing amalgam waste for delivery to recyclers or their agents for recycling.<sup>62</sup> In addition, the ANSI standard gives requirements for the containers for storing and/or shipping amalgam waste.

Each of these efforts has the same goal --- to inform dentists of the best approach to collecting and disposing of amalgam wastewater and providing dentists with the tools needed to implement BMPs.

The ADA, EPA, the University of Missouri and others performed a study of the effectiveness of the use of the ADA pre-2007 BMPs.<sup>63</sup> The study concluded that implementing the ADA Pre-2007 BMPs (even imperfectly) resulted in a measurable and significant reduction in mercury load to the influent wastewater of the treatment plants, as one might expect.<sup>64</sup> Furthermore, the use of the ADA pre-2007 BMPs did not result in a measurable change in mercury load to effluent treatment water, similar to preliminary NACWA data (*see* discussion below). Finally, the education and training provided to area dental offices in this study resulted in an overall increase in the use and understanding of BMPs. The ADA, state and local dental associations believe that more work can and will be done.

In summary, in the past, the ADA believes that there has been a significant increase in the percentage of the dental community that complies with the ADA Pre-2007 BMPs. In the ADA's view, the rate of compliance with the ADA pre-2007 BMPs will continue to increase. The ADA is dedicated to continuing its efforts to ensure that all dentists use at least the ADA pre-2007 BMPs (*see also* discussion of the ADA 2007 BMP, below).

**F. Defining the Benefit/Effectiveness of Separators by the Amount of Amalgam Collected**

The appropriate measure of "effectiveness" and benefit for the pretreatment rule is the change, *if any*, in mercury concentrations in fish tissue caused by installation of amalgam separators. The relative impact from installation of separators can be measured by the reduction: (1) in the mercury concentration in sewerage treatment plant effluent, combined with, (2) reductions of the mercury deposition to surface water from airborne deposition of mercury that originated from dental office discharges (e.g., as a result of incineration of biosolids, land application of biosolids or landfilling of biosolids or grit chamber waste). Conceptually, these are the only potential impacts separators can have on the environment.

It is important to understand that because both mandatory and voluntary separator programs have the same ultimate goal; it follows that the benefit should be the same in the long-term.

However, EPA must evaluate the benefit and cost of a mandatory versus a voluntary separator program. A mandatory program creates transaction costs for EPA and unfunded mandates for state regulators and municipalities. For example, if permits are used, the municipality must have personnel develop and issue the permits, perform inspections, and if there is a failure to compliance, initiate an enforcement action. Similarly, if formal mercury minimize plans are required, these must be created, dentists identified, and similar inspections performed. In some jurisdictions, municipalities may either perform sampling or require the dentists to sample. The states must review such programs and ultimately EPA must oversee the state and local implementation.

With approximately 100,000 dental offices to be regulated, the limited resources at every level of government will be strained to the breaking point, with little or no incremental environmental benefit compared to a voluntary program. Much of these costs (and the impact of regulatory resources) would be unnecessary if EPA accepted a voluntary program.

One of the key disagreements that the ADA has with EPA's analysis is that it attempts to define the benefit from (and effectiveness of) amalgam separators in terms of the total amount of amalgam collected (i.e., the cost of amalgam separators is divided by the amount of amalgam that the separators prevent from going into sewerage treatment plants, as opposed to going into the environment). That is, EPA has presumed that *all* amalgam collected in a dental office directly translates into an equivalent reduction of mercury in the environment. This assumption is not precautionary,<sup>65</sup> it is simply wrong.

Treatment plants collect over 95% of amalgam and most of the mercury in the biosolids and grit chambers do not re-enter the environment, according to EPA's own studies. Put another way, it is improper to "double count" a benefit that has already accrued to the treatment plants.

EPA's logic (i.e. that every particle of amalgam collected on the front-end by separators would, absent separators, find its way to surface waters and that this contribution would be significant) is inconsistent with its prior regulatory evaluations of mercury releases from landfills, incinerators, and land application of biosolids. To base a regulatory action on such an assumption would violate general principles of administrative law.<sup>66</sup>

It is incorrect to assume that all of the mercury in biosolids from dental amalgam is released to the environment. EPA itself has concluded that releases of mercury to land (such as application of biosolids) "are generally not considered to be as environmentally harmful as releases to air because the mercury may be less mobile and less likely to reach surface waters and fish."<sup>67</sup> EPA has not announced plans to modify its mercury biosolids limit based on the risk from the release of mercury from biosolids. (Of course, should it do so, as we have pointed out elsewhere, nothing would prevent EPA from revisiting the issue addressed here.)

Furthermore, it is inconsistent to make this assumption for dental amalgam, but not assume that mercury collected by the pollution controls on coal-fired electric generating facilities, hazardous waste incinerators, municipal incinerators, and medical wastes incinerators are also released. Similarly, any mercury (from any source) landfilled or land applied would need to be considered released to the environment. In fact, all metals would need to have the same assumption made. Such an assumption is unsupported by the facts and, when only applied to dental amalgam, is arbitrary and capricious. Rather, EPA must make a case-by-case

assessment of the actual amount of mercury released and, if the amount of mercury released triggers regulatory action, a specific rulemaking initiated.

As discussed below, ENVIRON has calculated the amount of mercury entering surface water as a result of discharges of amalgam wastewater from dental offices and the values (even updated) are relatively low) (see Attachment 1). Even this grossly overstates the actual environmental benefit from separators. The regulatory history of concern over amalgam demonstrates that the regulatory action was not required until EPA set the mercury water quality standard at 0.3 ppm and found that fish in many locations contained methylmercury at concentrations exceeding the 0.3 ppm limit.<sup>68</sup> In other words, the only reason that controls were sought on dental office discharges is concern that amalgamated mercury might be the cause of the methylmercury levels in fish. However, the vast majority of mercury in amalgam leaving the dental office remains intact as amalgam particles in biosolids.<sup>69</sup> Thus, the likelihood that dental offices are contributing to the methylmercury exceedances in fish is far less than other sources that release elemental or other more bioavailable types of mercury.

Finally, the available data on separator effectiveness reviewed in Attachment 2 indicates that, even though mercury levels in influent and biosolids should decrease after separators are installed, there are no observable decreases in the concentration of mercury in effluent following the installation of amalgam separators. As noted in Attachment 2, more thorough statistical evaluation of the data would be necessary to evaluate the effect of separators on the effluent.

## **G. Conclusion**

In summary, there is very little difference between the benefits derived from a mandatory versus a voluntary separator program.

## **IV. COSTS AND COST-EFFECTIVENESS**

EPA requested in its federal register notice information on the cost of alternatives. The cost of using an amalgam separator consists of: (1) the cost of purchasing or leasing the separator; (2) the cost of installing the separator; (3) the cost of recycling the amalgam collected by the separator; and (4) any miscellaneous costs (e.g., such as the labor cost of having an employee handle the collection and recycling of the additional amalgam).

The ADA included separators in its BMPs, primarily because separators allow for more amalgam waste to be recycled, which the ADA believes is a best management practice, not because the incremental reduction in mercury entering surface water has a significant adverse impact on the environment. There is a distinction between the basis and technical support needed to adopt a professional guideline (such as the 2007 ADA BMPs) and the level of legal and scientific support needed to justify the promulgation of a rule mandating a requirement rigidly applicable to every dental office in the nation. In the voluntary approach, citizens, small businesses (such as dentists), or corporations may go beyond compliance with the requirements.

However, if the government imposes mandatory requirements, typically cost and cost-effectiveness is examined and some actions may not meet the legal test for imposing mandatory requirements. Thus, neither EPA nor the dental community need be concerned about cost in deciding to adopt a voluntary program. Even if where to disagree with the ADA on its legal authority, EPA could adopt a voluntary program to achieve its mercury reduction goal.



Thus, the ADA provides the following cost information because it is relevant to whether there is legal support for a mandatory separator program.

ENVIRON reviewed the literature on costs and has concluded that EPA's information is reasonable (although installations in large cities and in larger dental facilities may cost more than the \$180 used in the EPA calculations (Attachment 1)).<sup>70</sup> EPA estimates that the annual recycling costs are \$600 per year.<sup>71</sup> Although this appears reasonable for the present cost of recycling, recycling costs are likely to increase over time as recycling may not be available. As imports and exports of mercury are banned, the impact is likely to be either a decrease in the amount needed to be recycled, which could depress recycling costs, but would end up requiring long term storage. In either case, the long-term cost of collecting amalgam is likely to increase over time.

The cost of the various voluntary and mandatory amalgam separator programs is provided in Table 2. Again, for simplicity, we used most of the assumptions proposed by EPA (even the undercounted installation cost) (which are generally not significantly different from the values used by Vandeven & McGinnis, except for installation costs).

**Table 2: Costs of implementation  
(Millions)**

	65% BMP	80% BMP	90% BMP	100% BMP
<b>0% of dental facilities using separators</b>	\$9.8	\$12.1	\$13.6	\$15.1
<b>30% of dental facilities using separators</b>	\$34.7	\$36.3	\$37.4	\$38.4
<b>50% of dental facilities using separators</b>	\$51.3	\$52.8	\$53.2	\$54.0
<b>75% of dental facilities using separators</b>	\$72.1	\$72.7	\$73.0	\$73.4
<b>90% of dental facilities using separators</b>	\$84.6	\$84.8	\$84.9	\$85.1
<b>100% of dental facilities using separators</b>	\$92.9	\$92.9	\$92.9	\$92.9

Assume \$770.85/year for separators and \$150/year for BMPs for 100,843 dentists, and \$180 installation costs (ERG, 2007) that use amalgam. See Attachment 1.

The cost-effectiveness of collecting amalgam with a separator is the same whether 30% or 100% of the dentists use separators because cost-effectiveness is the cost per pound of amalgam removed from the environment.

Cost-effectiveness is typically used in regulatory decision making and it is raised here because it highlights the fact that some regulatory alternatives (regardless of the cost) do not significantly improve the likelihood of achieving the regulatory goal.

The original 2005 Vandeven & McGinnis peer reviewed article calculated a cost-effectiveness of \$380 million to \$1.14 billion per ton mercury for the incremental reduction in mercury collected if amalgam separators are installed compared to full compliance with the 2003 ADA BMPs. The treatment of costs in that calculation is preferable. However, ENVIRON also calculated the cost-effectiveness of amalgam waste separators as approximately \$319 million to \$461 million per ton mercury using the amount of mercury released to surface water described above, EPA's cost and present value assumptions, and assuming 100% use of the pre-2007 ADA BMPs. As another check on the sensitivity of the cost-effectiveness calculation, ENVIRON

calculated an approximately \$232 million to \$294 million per ton mercury using using the amount of mercury released to surface water described above, the EPA cost assumptions, EPA present value, and 65% use of the pre-2007 ADA BMPs, assuming non-recycled mercury is sent to medical incinerators.<sup>72</sup>

The new estimate differs from the Vandeven & McGinnis calculation because: (1) ENVIRON considered potential emissions from landfills and medical waste incinerators; (2) ENVIRON used an installation cost of \$180 (as proposed by EPA); and (3) ENVIRON used EPA's more precise present value calculation.

The new ENVIRON cost-effectiveness calculation differs from EPA's calculation because: (1) ENVIRON uses the amount of mercury entering surface water (not the amount of amalgam collected by separators) as the benefit; and (2) the ENVIRON analysis uses a range of 0% to 30% removal efficiency for the tiny percentage of residuals from amalgam separators that are captured by sewerage treatment plants and 95% for removal of discharges from dental offices without separators. Regardless of which cost-effectiveness figures are more appropriate, mandatory separators are not cost-effective from a regulatory perspective. However, nonetheless, regardless of cost-effectiveness based on releases to surface water, the ADA has adopted amalgam separators as part of their 2007 BMP because it increases the amount of amalgam that is recycled.

The ADA believes there is no need to use toxicity weighting factors at this stage in the cost-benefit analysis because it is more informative to compare the unweighted mercury reductions from mandatory amalgam separators with unweighted mercury reductions from a voluntary program.

Since the methylmercury levels in fish are unlikely to be significantly reduced if mandatory separators are installed, the cost-benefit is effectively much higher (i.e., no matter how high the costs, there is no benefit --- no significant reduction in the methyl mercury concentration in fish tissue).

Finally, an amalgam separator mandatory regulation would be inconsistent with the Small Business Regulatory Enforcement Flexibility Act (SBREFA) because it would force the dental community, a collection of SBREFA small businesses, to “bear a disproportionate share of regulatory costs and burdens” of dealing with the mercury problem.<sup>73</sup>

In summary, a voluntary program, of course, need not meet the regulatory cost-effectiveness or other cost tests.

## **V. CONCLUSION**

EPA must decide whether the benefits of using a mandatory versus voluntary separator program is worth the costs – particularly given the demonstrable and similar environmental benefits achievable through use of a voluntary approach. A voluntary effort to implement the ADA voluntary Best Management Practices would be the best approach to the shared goal – ensuring that dental offices use separators.

The ADA respectfully requests EPA to use a voluntary separator program.

## ENDNOTES

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<sup>1</sup> The ADA is the largest dental professional organization in the United States, representing over 155,000 dentists including approximately 70% of the active dentists in the US. *See* ADA Internet site at <http://www.ada.org/ada/about/index.asp>.

<sup>2</sup> Much of the support for the EPA calculations is provided in the ADA's February 20, 2007 submission in this proceeding (EPA-HQ-OW-2006-0771-0003) (These comments are found in the administrative record in this matter at EPA-HQ-OW-2006-0771-0003. They consist of a cover letter, comments, and various appendices. The pages were numbered by EPA in the upper right hand corner) ("ADA Prior Comments EPA-HQ-OW-2006-0771-0003") and the 2005 Vandeven/McGuinness Article (EPA-HQ-OW-2006-0771-0222), An Assessment Of Mercury In The Form Of Amalgam In Dental Wastewater In The United States. Jay A. Vandeven and Steve L. McGinnis, *Water, Air, and Soil Pollution* (2005) 164: 349–366, Springer 2005 ("2005 Vandeven/McGinnis Article"). This paper is cited, but not provided in the administrative record. The authors have informed the ADA that this paper may be reproduced in the administrative record because permission has been granted.

<sup>3</sup> Such a survey should only occur after the voluntary program has been implemented for a sufficient time to measure tangible results.

<sup>4</sup> For example, the mean level of methylmercury in tissue from fish in Wyoming (based on EPA studies) is 0.095 ppm, below the water quality standard of 0.3 ppm in fish tissue. *See* ADA Prior Comments EPA-HQ-OW-2006-0771-0003 at 36; 62; 70-71; 90-92; 182-183 (February 20, 2007). These concentrations are consistent with the results of sampling reported in 2007 that concluded that "[f]ish tissue mercury concentrations in Western U.S. streams and rivers were found in a fairly narrow range (90% = 0.02 to 0.2 µg/g [ppm])," which "strongly suggests a broad diffuse source of mercury from atmospheric deposition." EPA, Proceedings of the 2007 National Forum on Contaminants in Fish at 16 of 54, available at <<http://www.epa.gov/waterscience/fish/forum/2007/pdf/section2b.pdf>>.

<sup>5</sup> ADA Prior Comments EPA-HQ-OW-2006-0771-0003 at .31,50, 101-102, 111, 152, 213-216.

<sup>6</sup> The dental community is organized in what is called the tripartite system. When a dentist pays membership dues, this payment provides a dentist with membership in the ADA, the state dental association, and the local dental association. These three levels operate autonomously. Thus, the ADA cannot dictate policy preferences to either the state or local dental associations.

<sup>7</sup> *See* <http://www.ada.org/prof/resources/positions/statements/amalgam4.asp>.

<sup>8</sup> ADA, Professional Product Review, Vol. 2, Issue 4: The Bottom Line, Dental Amalgam Separators, Product Review at 1 ([http://www.orallongevity.ada.org/members/resources/pubs/ppr/0710\\_ppr.pdf](http://www.orallongevity.ada.org/members/resources/pubs/ppr/0710_ppr.pdf) and Dentists, Industry Experts Discuss Amalgam Separators, *id.* at 5.

<sup>9</sup> *See* 2005 Vandeven/McGinnis Article, as updated by Attachment 1 to these ADA comments.

<sup>10</sup> *See* <http://www.epa.gov/epaoswer/osw/conservation/action-plan/appndx-b.htm>.

<sup>11</sup> *See generally* <http://www.ada.org/prof/resources/topics/amalgam.asp>.

<sup>12</sup> *See* OSHA's Alliance Milestones and Successes webpage, which lists 54 alliances with OSHA, available at [http://www.osha.gov/dcsp/success\\_stories/alliances/success\\_stories.html#ada](http://www.osha.gov/dcsp/success_stories/alliances/success_stories.html#ada). ADA has consistently achieved milestones and successes that were posted to this webpage since the formation of the Alliance in 2004.

<sup>13</sup> U.S. Department of Labor's OSHA webpage, available at <http://www.osha.gov/dcsp/alliances/ada/ada.html>.

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<sup>14</sup> See 2007 Alliance Annual Report – OSHA and ADA, May 14, 2007, available at [http://www.osha.gov/dcsp/alliances/ada/ada\\_annual\\_report\\_2006-2007.html](http://www.osha.gov/dcsp/alliances/ada/ada_annual_report_2006-2007.html). OSHA’s Bloodborne Pathogens Standard, promulgated in 1991, and is codified at 29 CFR 1910.1030.

<sup>15</sup> Colorado, Department of Public Health & Environment, Pressing Concerns: A Complete Guidebook to Environmental Compliance for Colorado Dry Cleaners at preface letter and p. i (Developed with the Support of EPA, Region VIII Small Business Administration, and Rock Mountain Fabricare Association, 1998), available <http://www.cdphe.state.co.us/el/ecac/DCGuide/A-cover-background.pdf>.

<sup>16</sup> *Options For Dental Mercury Reduction Programs: Information for State/Provincial and Local Governments: A Report of the Binational Toxics Strategy* at 39, available at <http://www.epa.gov/region5/air/mercury/dentaloptions3.pdf>. See also Memorandum to Jan Matuszko, U.S. EPA. Subject: Dental Amalgam Best Management Practices: Summary of Effectiveness, Current Use and Cost - DCN 04852 at 5 (estimating that 65% of dentists operating within voluntary programs will implement the BMPs given that participation rates in voluntary programs vary from 38% to 100%).

<sup>17</sup> See [http://www.ada.org/prof/resources/pubs/epubs/update/update\\_0504.pdf](http://www.ada.org/prof/resources/pubs/epubs/update/update_0504.pdf). In 2004, the Minnesota program won the annual Governor’s Award for Excellence in Waste and Pollution Prevention, MnGREAT! (Minnesota Government Reaching Environmental Achievements Together. <http://www.pca.state.mn.us/oea/mngreat/2004/MnGREAT2004-Web.pdf>

<sup>18</sup> *Memorandum of Understanding Dental Compliance Follow-up Report, Washington State Department of Ecology, Publication Number 06-04-011, July 2006* at 3.

<sup>19</sup> *Id.* at 3.

<sup>20</sup> *Id.* at 7.

<sup>21</sup> *Id.*

<sup>22</sup> <http://www.mass.gov/dep/service/about08.htm>.

<sup>23</sup> *New England Zero Mercury Campaign Report Card on Dental Mercury Use and Release Reduction* at 11, available at [http://www.mercurypolicy.org/new/documents/NEZMC\\_Report\\_Card\\_on\\_Dental\\_MercuryFINAL.pdf](http://www.mercurypolicy.org/new/documents/NEZMC_Report_Card_on_Dental_MercuryFINAL.pdf).

<sup>24</sup> Wichita Silver and Mercury BMP Program, Jamie G. Belden, Pretreatment Specialist, Power Point Presentation, available <[www.kansas.gov/uaa/sbcs/presentations/belden%20jamie%20p2%20case%20studies.pdf](http://www.kansas.gov/uaa/sbcs/presentations/belden%20jamie%20p2%20case%20studies.pdf)> at 12 of 34.

<sup>25</sup> See <http://www.wichitagov.org/CityOffices/WaterAndSewer/SewageTreatment/SilverMercury.htm>.

<sup>26</sup> *Options For Dental Mercury Reduction Programs: Information for State/Provincial and Local Governments: A Report of the Binational Toxics Strategy* at 23.

<sup>27</sup> See <http://proteus.pca.state.mn.us/publications/reports/mercury-wlssd-2001.pdf>;  
<http://proteus.pca.state.mn.us/publications/reports/mercury-wlssd-2002.pdf>;  
<http://proteus.pca.state.mn.us/publications/reports/mercury-wlssd-2003.pdf>.

<sup>28</sup> MCES October 2007 Newsletter, available at <http://www.metrocouncil.org/directions/water/water2007/mercuryOct07.htm>.

<sup>29</sup> EPA Pretreatment Factors Memorandum at 6 of 45 and see ADA Prior Comments EPA-HQ-OW-2006-0771-0003, at 27-30; 106-107; 117-118; 133-134; and 201.

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<sup>30</sup> EPA, Effluent Limitations Guidelines and New Source Performance Standards for the Metal Products and Machinery Point Source Category, 68 Fed. Reg. 25,685 (May 13, 2003), available at: <http://www.epa.gov/fedrgstr/EPA-WATER/2003/May/Day-13/w4258.htm>.

<sup>31</sup> For example, EPA “is considering a voluntary approach to listing waters impaired by mercury from atmospheric source” (because of “the complexities involved in addressing waters impaired due to atmospheric mercury deposition”) which allow a state to “demonstrate[e] that it has begun to make some progress in reducing the mercury loadings” and “identify[y] regulatory and non-regulatory controls. Memorandum from Diane Regas, Director, Director of EPA’s Office of Wetlands, Oceans, and Watersheds, to EPA Regions, Office of Wetlands, Oceans and Watersheds, Re: Information Concerning 2008 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions at 11-12 of 21 (October 12, 2006), available at [http://www.epa.gov/owow/tmdl/2008\\_ir\\_memorandum.pdf](http://www.epa.gov/owow/tmdl/2008_ir_memorandum.pdf) (“October 12, 2006 Reporting and Listing Information Memo”). This memorandum provides guidance on how to use “alternative pollution control requirements” that “may obviate the need for a TMDL,” *i.e.* “[o]ther pollution control requirements (*e.g.*, best management practices) required by local, State, or Federal authority” are stringent enough to implement applicable water quality standards (WQS) (*see* 40 CFR 130.7(b) (1)) within a reasonable period of time.” *Id.* This guidance provides “EPA’s expectation . . . that a linkage analysis (*i.e.*, cause-and-effect relationship between a water quality target and sources) be included in the . . . demonstration.” *Id.* This approach is consistent with the overarching Office of Management and Budget’s (“OMB”) directive that federal agencies “consider alternative regulatory approaches.” OMB, Circular A-4, Regulatory Analysis at 7 (September 17, 2003), available at <<http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf>>.

<sup>32</sup> EPA Technical support document for the Voluntary Advanced Technology Incentives Program, November 11, 1997 (DCN 14488), available at <http://www.epa.gov/waterscience/guide/pulppaper/jd/tsd.pdf>.

<sup>33</sup> 1993 US Public Health Service Dental Amalgam Health Review at 1 and I-44.

<sup>34</sup> 1993 PHS Dental Amalgam Health Review at 1 and I-44.

<sup>35</sup> ADA 1999 Survey, cited in the 2005 Vandeven/McGinnis Article”).

<sup>36</sup> ADA, Economic Impact of Regulating Amalgam, Public Health Reports. September–October 2007 /Volume 122. at 657, 659-660, available at <[http://www.ada.org/prof/resources/topics/amalgam\\_economic\\_impact.pdf](http://www.ada.org/prof/resources/topics/amalgam_economic_impact.pdf)> (Attachment 3).

<sup>37</sup> The rate of amalgam use has declined 3.7% per year over the last 12 years prior to 2005. *Id.* Thus, if this rate has continued in the three years since 2005, the 2008 rate of amalgam use should be approximately 46.67 million amalgam restorations (approximately 20.5% of the restorations).

<sup>38</sup> EPA has rightly concluded that the “choice of dental treatment rests solely with dental professionals and their patients” and EPA “does not intend to second-guess these treatment decisions.” Letter from Tracey Mehan, Assistant Administrator of the Office of Water to William Walsh (on behalf of the ADA) at 1 (May 13, 2003). Nonetheless, at the meeting between EPA and ADA in the fall of 2007, EPA requested information on the cost of banning amalgam as a dental restorative material. A recent, peer reviewed article concluded that a ban “will increase dental expenditures about \$8.2 billion in the first year and \$98.1 billion from 2015 through 2020 and would result in 15.4 million fewer needed restorations,” thereby decreasing utilization of dentists while increasing untreated disease. ADA, Economic Impact of Regulating Amalgam, Public Health Reports. September–October 2007 /Volume 122. at 657, 660, 657, available at [http://www.ada.org/prof/resources/topics/amalgam\\_economic\\_impact.pdf](http://www.ada.org/prof/resources/topics/amalgam_economic_impact.pdf). In most cases, insurance and Medicare/Medicaid would not cover these increased costs.

<sup>39</sup> These legal arguments were made in much more detail in ADA’s February 2007 Comments; *see* EPA-HQ-OW-2006-0771-0003, at p.36- 43; 64; 75; 89-92; 95-97; 119-120; 144-146; 171-176.; 228-233.

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<sup>40</sup> See ADA Prior Comments EPA-HQ-OW-2006-0771-0003, at 29-32; 50-52; 54-55; 62; 69-70; 101-102; 111-113;136-137; 152-153; 187-190; 210-222; 227.

<sup>41</sup> ADA Prior Comments EPA-HQ-OW-2006-0771-0003, at 38 and 232-33.

<sup>42</sup> ADA Prior Comments, EPA-OW-2006-0771 at 54-55; 204-208; 213-215.

<sup>43</sup> EPA's Road Map, Addressing Mercury Releases at 28 (July 2006), available at [http://epa.gov/mercury/pdfs/I\\_HgReleases.pdf](http://epa.gov/mercury/pdfs/I_HgReleases.pdf). The mercury in amalgam is bound into the mixture and the mercury in the amalgam in biosolids is less likely to be released into the air. The study cited by EPA in the administrative record is limited and measured mercury from all sources, not just mercury from amalgam and, therefore, was not a measure of the likelihood of mercury in amalgam being released from soil.

<sup>44</sup> 2005 Vandeven/McGinnis Article at 360-361.

<sup>45</sup> 2005 Vandeven/McGinnis Article at 361.

<sup>46</sup> Attachment 1 also discusses the support for the use of between 0% to 30% removal for the very small amount of amalgam discharged when separators are present.

<sup>47</sup> See Attachment 1.

<sup>48</sup> <http://dnr.wi.gov/org/caer/cea/mercury/potw.htm>. "The physical processes used in POTWs remove about 95% of the mercury received in wastewater." Statement Of Ephraim King Director, Office Of Science And Technology U.S. Environmental Protection Agency Before The Subcommittee On Domestic Policy Of The Committee On Oversight And Government Reform United States House Of Representatives (November 14, 2007), available at : <http://oversight.house.gov/documents/20071115094710.pdf> at 3 of 7.

<sup>49</sup> Madison Metropolitan Sewerage District, Mercury Pollutant Minimization Program at Appendix C (PMP).

<sup>50</sup> The samples "were not meant to be a statistically valid representation of all POTWs in the country." EPA, Fate of Priority Pollutants in Publicly Owned Treatment Works: Final Report, Volume 1 at 7 (EPA 440/1-82/303, September 1982).

<sup>51</sup> EPA, Fate of Priority Pollutants in Publicly Owned Treatment Works: Final Report, Volume 1 at 36, 39, 41, 47, 49, 52, 57, (EPA 440/1-82/303, September 1982).

<sup>52</sup> See Attachment 1.

<sup>53</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Separators: Summary of Removal Efficiencies, Current Use and Cost Effectiveness (DCN 04851) at 5 (September 26, 2007).

<sup>54</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Separators: Summary of Removal Efficiencies, Current Use and Cost Effectiveness (DCN 04851) at 5 (September 26, 2007).

<sup>55</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Summary Information on Current Dischargers of Mercury in the Form of Dental Amalgam from Dental Offices to Publicly-Owned Treatment Works (DCN 04853) at 5 (September 26, 2007).

<sup>56</sup> The 43.0% figure is derived as follows. There are 28.7% of the dental offices nationwide that are now or in the future subject to state and local statutes, regulations or guidance requiring separators (Attachment 3). Another 14.3% dental offices are expected to voluntarily install separators (using EPA's assumption that 20% of the dentists not subject to mandatory requirements will voluntarily install separators ((100%-28.7) times 0.2 = 14.3%)). Thus, 28.7% plus 14.3% = 43.0%.



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A final regulatory approach is still being developed in Louisiana, but it appears that pre 2007 BMPs will be required there. Act 126 of the 2006 Louisiana Legislature (available at <http://www.legis.state.la.us/billdata/streamdocument.asp?did=395483>) requires practices within the industry to capture unused dental amalgam product and waste dental amalgam removed from fillings. It and authorizes the Louisiana Department of Environmental Quality ("LDEQ") to prepare and publish best management practice guidelines for dental offices and laboratories to facilitate. The LDEQ's February 2007 guidance on pollutant minimization plans ("MMPP," available at <http://www.deq.louisiana.gov/portal/Portals/0/organization/Hgminimizationplan2-07.pdf>) references the pre-2007 ADA BMP. It is, therefore, anticipated that the pre-2007 ADA BMPs will be required for the 1,586 dentists in Louisiana. As a result, dentists in Louisiana should be fully in compliance with the pre-2007 BMPs (not the 65% estimated by EPA). Note that Attachment 1 includes calculations assuming that all dentists in states and municipalities without separator requirements could have up to 35% of the dentists not complying with the pre-2007 ADA BMPs. In the case of Louisiana that is an underestimate.

<sup>57</sup> The ADA is unable to determine when the separators were installed in the case of each treatment plant, making it difficult ascertain the true "effect" of the installations. Most, if not all of the reports and presentations reviewed by the ADA, did not take into account confounding factors. For example, some chemicals like sodium hypochlorite, which can have very high concentrations of mercury (e.g., Clorox® and Comet® can have microgram per kilogram levels of mercury), could be contributing significant amounts of mercury to treatment plant effluents. Also, the trends in mercury concentration in effluent must be understood in the context of the overall mercury reduction programs implemented by the municipality. For example, most treatment plants that have historic data show a more dramatic decrease in the mercury concentration in influent, biosolids, and in effluent *prior* to the installation of separators. Both prior to and during the installation of separators, other significant mercury reduction program have been instituted nationwide. For example, the majority of dental offices that initially implemented the pre-2007 ADA Best Management Practices are contributing to significant reductions that are now intermingled with any reductions from the separators. Thus, any analysis of the impact of separators must take into account these other confounding factors.

The NACWA analysis includes attempts to correlate the number of dentists per million gallons of treatment plant flow. This analysis is not based on accepted statistical methods (as far as can be determined from the publicly available information). More importantly, the mere existence of a high number of dentists per million gallons of flow does not fairly indicate a given dental community's contribution to mercury in treatment plant effluent. Indeed, a number of dental offices in a community are highly correlated with high population and an urban setting. Thus, the mercury in the influent and effluent may be more a function of the larger number people, the greater use of mercury-containing products, and a greater likelihood of industrial and other nondental commercial contribution. The ADA believes that the data as now analyzed is helpful but a more detailed statistical analysis of the existing data (perhaps with an attempt to correlate the timing of the institution of BMPs, amalgam separators) would probably be useful.

<sup>58</sup> Since the mandatory requirements for using separators also include mandatory use of recycling, the sensitivity analysis assumes the dentists who install separators recycle their amalgam.

<sup>59</sup> ADA web site, available at [http://www.ada.org/prof/resources/topics/amalgam\\_bmp.asp](http://www.ada.org/prof/resources/topics/amalgam_bmp.asp)), also see Attachment 1 to these Comments.

<sup>60</sup> See ADA Internet site, available at [http://www.ada.org/prof/resources/pubs/epubs/csa/communique\\_1106.htm](http://www.ada.org/prof/resources/pubs/epubs/csa/communique_1106.htm) >. The pre-2007 BMP is in the administrative record.

<sup>61</sup> ADA 2007 BMPs can be found at [http://www.ada.org/prof/resources/topics/topics\\_amalgamwaste.pdf](http://www.ada.org/prof/resources/topics/topics_amalgamwaste.pdf)) and are in the administrative record in this matter.

<sup>62</sup> ANSI/ADA Specification 109: Procedures for Storing Dental Amalgam Waste and Requirements for Amalgam Waste Storage/Shipments Containers. This standard has been submitted by the ADA as part of the Administrative Record.

<sup>63</sup> University of Missouri, Extension, Brief Summary Report: Maximizing Voluntary Reductions In Dental Amalgam Mercury, Reduction in Mercury Discharges (EPA # E0000127, PI-98765101-0, November 2007), which was previously submitted to EPA on the record. This is the executive summary). The J. Bowman, Power Point Presentation to the National Association of Clean Water Agencies ("NACWA"), The American Dental Association: BMPs and More (2007) (also in the administrative record) includes plots of the data on the effectiveness of the pre-2007 BMPs).

<sup>64</sup> Also, use of the pre-2007 BMPs did not result in a measurable change in biosolid mercury levels. This particular result is unexpected and may be due to study limitations.

<sup>65</sup> Of course, the Clean Water Act has not been amended to adopt the precautionary principle, no less this extreme assumption.

<sup>66</sup> There are evaluations by authors who are affiliated with EPA, but no EPA regulatory determination has required reduction of such a small level of mercury releases. For example, EPA has not proposed to lower the biosolids limits and EPA has not required emissions controls on many air emission sources. ADA Prior Comments EPA-HQ-OW-2006-0771-0003, at 41-42; 51-52; 112-113.

<sup>67</sup> EPA's Road Map, Addressing Mercury Releases at 28 (July 2006), available at <[http://epa.gov/mercury/pdfs/I\\_HgReleases.pdf](http://epa.gov/mercury/pdfs/I_HgReleases.pdf)>. The mercury in amalgam is bound into the mixture and the mercury in the amalgam in biosolids is less likely to be released into the air. The study cited by EPA in the administrative record is limited and measured mercury from all sources, not just mercury from amalgam and, therefore, was not a measure of the likelihood of mercury in amalgam being released from soil.

<sup>68</sup> In fact, analytical techniques had to be developed to allowed measurements of nanogram per liter ("ng/L" or "ppt") levels of mercury in effluent.

<sup>69</sup> For example, Stone reports that 99.636% of the mercury in amalgam is bound into the amalgam particle and only 0.0013% is methylmercury. See Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Summary of Information on Current Discharges of Mercury in the Form of Dental Amalgam from Dental Offices to Publicly-Owned Treatment Works (DCN 04853) at 2 (September 26, 2007).

<sup>70</sup> For example, SolmeteX.(one of the largest suppliers of amalgam separators) indicates that the cost of installation is \$250. <http://www.wwdmag.com/Mercury-From-the-Dentists-Chair-to-Public-Treatment-Works-article8496>. Also, "Cost of amalgam separators can vary, but are relative to the size of the dental operation. Prices listed on the ... table [listed below] are based on information gather by PACE from manufacturers in September of 2005."

**Table of estimated annual cost for amalgam separators: PACE Resource Sheet 2006**

	Small (1-4 chairs)	Medium (5-12 chairs)	Large (+12 chairs)
<b>Purchase</b>	<b>\$200-1200</b>	<b>\$666-2200</b>	<b>\$2500-8800</b>
<b>Installation</b>	<b>\$100-200</b>	<b>\$125-260</b>	<b>\$200-1000</b>
<b>Maintenance</b>	<b>\$0-200</b>	<b>\$0-200</b>	<b>\$0-200</b>
<b>Replacement</b>	<b>\$50-750</b>	<b>\$75-750</b>	<b>\$500-2100</b>
<b>Estimated annual cost</b>	<b>\$185-940</b>	<b>\$257-974</b>	<b>\$1740-4060</b>

City of Boulder Dental Wastewater Mercury Reduction –Program Overview, Attachment 1 – WRAB August 21, 2006 at 4, available at [http://www.bouldercolorado.gov/files/Utilities/Industrial%20Pretreatment/amalgam\\_program\\_overview.pdf](http://www.bouldercolorado.gov/files/Utilities/Industrial%20Pretreatment/amalgam_program_overview.pdf).

<sup>71</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Separators: Summary of Removal Efficiencies, Current Use and Cost Effectiveness (DCN 04851) at 3-4 (September 26, 2007).

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<sup>72</sup> Values are \$335 million to \$481 million if you assume non-recycled mercury is sent to landfills. See Attachment 1.

<sup>73</sup> ADA believes that the dental industry is comprised almost entirely of SBREFA small businesses under 13 CFR § 121.201.

## ATTACHMENT 1

### Introduction

This attachment is a discussion of ENVIRON's limited update of the scientific assessment ("SA") published in 2005<sup>1</sup>, including estimates of inputs to surface water from two potential emissions sources not previously addressed: medical incinerators and landfills. A sensitivity analysis is presented showing how varying levels of compliance with ADA's 2004 Best Management Practices ("BMPs") and use of amalgam separators affects the amount of mercury discharged to surface water. Absolute costs and cost-effectiveness associated with the various levels of BMP compliance and separator use are also estimated and discussed.

### Mercury fate

The primary purposes of this update are to 1) refine the analysis by including more recent data and study results; and 2) to account for potential mercury emissions from two sources that were previously not discussed, but that may receive mercury amalgam waste—medical incinerators and landfills. In our earlier assessment, we did not specifically state the ultimate disposal location of amalgam collected in chair-side traps ("traps") and vacuum pump filters ("filters"). However, amalgam captured in these two devices comprises the large majority of amalgam removed from dental wastewater, and thus the fate of this mercury should be assessed. In 2004 ADA published BMPs that emphasized recycling of amalgam collected from all sources in dental offices, such as scrap amalgam and particulate amalgam caught in traps and filters<sup>2</sup>. We assess here the fate of mercury that is handled in two ways that are not in accordance with BMPs (i.e., disposal of waste amalgam in regular trash, which is ultimately disposed in landfills, and disposal in biohazard bags, which are incinerated).

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<sup>1</sup> Vandeven, J.A. and McGinnis S.L. 2005. An assessment of mercury in the form of amalgam in dental wastewater in the United States. *Water, Air, and Soil Pollut.* 164: 349–366 ("2005 Vandeven/McGinnis Article").

<sup>2</sup> ADA. Best Management Practices For Amalgam Waste. 2004. Chicago, IL

This assessment relies heavily on results from our previous assessment and on the results from recent assessments by EPA and others. We have incorporated new data where applicable to further refine our assessment. Our general approach is the same as that taken in our previous SA—we used statistics from the literature where possible, and made estimates to the extent necessary. Inherent in this process was the necessity to make several assumptions, which are discussed below.

#### Amount of mercury discharged from dental offices

We assumed that a total of 31.25 tons of mercury are discharged annually from dental offices. This is the amount of mercury which ERG estimated to be discharged, based primarily on results from our previous SA and also on updated statistics regarding the number of dentists<sup>3</sup>. We assumed this discharge amount for ease of comparison with ERG's study, though current data suggest that the actual amount is slightly lower—probably closer to our previous estimate of 29.7 tons or perhaps even lower. The additional amount of 1.55 tons is due almost entirely to the greater number of dentists actively practicing<sup>4</sup>.

It is important to note, however, that though we believe the number of active dentists did indeed increase as ERG stated, the number of removals per dentist has likely decreased from our earlier estimate of 710 and 440 removals per general dentist and specialist per year, respectively. A lower removal rate is likely because amalgam placements have been decreasing for several years, including estimated decreases of 29% from 1990 to 1999<sup>5</sup>, 30% from 1990 to 1996<sup>6</sup>, and 20.5% from 1999 to 2005<sup>7</sup>. Based on an amalgam

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<sup>3</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Separators: Summary of Removal Efficiencies, Current Use and Cost Effectiveness (DCN 04851) (September 26, 2007).

<sup>4</sup> ADA. 2007. Survey and Economic Research on Dentistry, Frequently Asked Questions: How many dentists are there in the U.S.? <http://www.ada.org/ada/prod/survey/faq.asp#howmany>.

<sup>5</sup> Berthold, M. 2002. Restoratives: Trend data shows shift in use of materials. *Am. Dental Assoc. News* 33(11) 10-11.

<sup>6</sup> Sznoppek, J. and Goonan, T. 2000. The materials flow of mercury in the economies of the United States and the World. United States Geological Survey Circular 1197. Denver, Colorado.

<sup>7</sup> ADA, Economic Impact of Regulating Amalgam, Public Health Reports. September–October 2007 /Volume 122. at 657, 659-660. [http://www.ada.org/prof/resources/topics/amalgam\\_economic\\_impact.pdf](http://www.ada.org/prof/resources/topics/amalgam_economic_impact.pdf)

lifetime of approximately 8-9 years<sup>8</sup>, the number of amalgam restorations in place and available for removal is likely lower, due to the lower number of placements in 1999 as compared with 1990. Further, recent data from a municipal study show that removal rates are substantially lower, approximately 169 removals per dentist per year<sup>9</sup>. Nevertheless, we have used ERG's estimate of 31.25 total tons of mercury discharged from dental offices so as to facilitate comparisons between ERG's estimates and our own.

#### Capture efficiency of chair-side traps and filters

We assumed that chair-side traps and filters capture 78% of mercury in amalgam discharged in dental office wastewater, in accordance with our previous SA. ERG assumed the same chair-side trap and filter capture efficiencies as we did in the SA (i.e., 68% efficiency for chair-side traps alone and 81% efficiency for chair-side traps and filters), though they calculated the amount of mercury not captured from the two sources separately. Though their calculation method varied slightly from our previous method, the results were not significantly different from ours for that portion of the flow with chair-side traps alone or chair-side traps and filters.

#### Capture efficiency of amalgam separators

For purposes of this calculation, we assumed that amalgam separators capture 99.2% of particles exhibiting a size distribution of that presented in ISO11143, which is the median efficiency of separators as presented by ERG<sup>10</sup>. However, there is an important but subtle difference between the results presented by ERG and results from our current analysis. ERG has overestimated the incremental capture efficiency of amalgam separators downstream of chair-side traps and filters.

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<sup>8</sup> *Ibid.*

<sup>9</sup> Barron, T. 2005. Mercury source analysis for 2004. Internal Review Draft. Prepared for San Francisco PUC. July. [http://sfwater.org/Files/Reports/Hg\\_Tech\\_Memo\\_1d.pdf](http://sfwater.org/Files/Reports/Hg_Tech_Memo_1d.pdf). The report showed 184 removals per dentist among those that actively remove amalgams and 169 removals per dentist if all dentists are considered.

<sup>10</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Separators: Summary of Removal Efficiencies, Current Use and Cost Effectiveness (DCN 04851) (September 26, 2007).

As stated earlier, the effective capture efficiency of chair-side traps and filters is 78%, which is weighted by the efficiencies of each and their respective usage rates. These devices capture the largest amalgam particles in dental wastewater, resulting in a downstream particle size distribution that no longer matches that of ISO11143, but is weighted more toward smaller particles. Given that separators operate using one or more of centrifugation, sedimentation, and filtration to remove amalgam particles, the smallest are the most difficult to capture. Once the chair-side traps and filters remove the largest particles, the remaining distribution consists of smaller, more difficult to capture, particles. Therefore, the efficiency of separators downstream of traps and filters will be slightly lower than the efficiency in capturing particles from the ISO11143 distribution. In this case, the total efficiency of a trap+filter+separator train is 99.2%—the same efficiency as a separator alone. The incremental efficiency,  $E_I$ , is calculated using the following equation:  $99.2\% = 78\% + 22\% \times E_I$ . Using this equation, we calculated the incremental efficiency to be approximately 96.4%<sup>11</sup>. ERG overestimated efficiency by assuming that 99.2% of amalgam particles not captured by traps and filters are captured by separators.

Another way to look at the numbers is to calculate the efficiency of separators regardless of whether traps or filters are upstream. ERG stated that of 31.25 tons of mercury discharged from dental facilities, 26.21 are currently captured and that installation of separators would result in capture of an additional 4.93 tons, for a total of 31.14 tons per year. However, if the overall efficiency of any system that includes separators is 99.2%, the maximum amount that can be removed is  $31.25 \text{ tons} \times 99.2\% = 31.0 \text{ tons}$ , not 31.14, as ERG has stated. Though the difference is small, it is significant, especially when considering the cost per ton removed.

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<sup>11</sup> Note that in our previous SA, we estimated the incremental efficiency of separators downstream of chair-side traps and filters to be 95%, based on results from studies by MCES and MDA (Metropolitan Council Environmental Services and Minnesota Dental Association. 2001. Evaluation of Amalgam Removal Equipment and Dental Clinic Loadings to the Sanitary Sewer. Minneapolis-St. Paul, Minnesota) and ADA (Fan, P.L., Batchu, H., Gasparac, W., Sandrik, J., and Meyer, D. 2002. Laboratory evaluation of amalgam separators. J. ADA. Vol 113, 577–584). Thus the current study assumes a slightly higher incremental efficiency than we previously used.

Assuming that 100% of dental offices install separators with a median efficiency of 99.2%, 0.25 tons of the initial 31.25 will not be captured and will be discharged to surface waters. Therefore, the amount of mercury discharged in POTW effluent even if all dental offices had separators would not drop significantly from the 0.3 tons of dental mercury that Vandeven and McGinnis estimated is currently being discharged from POTWs. The lack of a decrease in POTW effluent mercury concentrations after separator installations has been documented in the literature. Despite this lack of evidence demonstrating a decrease in effluent concentration after separator installation, NACWA (formerly AMSA) reported that one study from POTWs in the City of Wichita, Kansas preliminarily showed 29% reduction in effluent mercury concentrations when separators were installed<sup>12</sup>. Though several other studies contradict this conclusion, we have included in our sensitivity analysis a scenario in which effluent mercury concentrations decrease by 30%.

#### Capture efficiency of POTWs

As stated in the previous SA, approximately 95% of mercury entering a POTW will be removed and not discharged with effluent. The high efficiency of POTWs in removing mercury from wastewater is supported by results from a number of studies showing that mercury capture efficiencies for POTWs ranging from 95% to 99%. A 2002 AMSA study included a review of 15 POTWs ranging in capacity from 4 million gallons per day (MGD) to 375 MGD<sup>13</sup>. AMSA found the average mercury capture efficiency to be 95%. Balogh and Liang (1995)<sup>14</sup> and Balogh and Johnson (1998)<sup>15</sup> found capture efficiencies for three POTWs to be 96%, 98%, and 99%.

The high effectiveness of POTWs in capturing amalgam makes scientific sense as well. Amalgam particles are much denser than water and thus settled out and are removed with

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<sup>12</sup> The anecdotal decrease in effluent concentrations was relayed by personal communication from C. Hornback to ENVIRON.

<sup>13</sup> Association of Metropolitan Sewerage Agencies (AMSA). 2002. Mercury Source Control and Pollution Prevention Program. Washington, D.C.

<sup>14</sup> Balogh, S. and L. Liang. 1995. Mercury pathways in municipal wastewater treatment plants. *Water, Air, Soil Pollut.* 80:1181–1190.

<sup>15</sup> Balogh, S. and Johnson, L. 1998. Mercury mass balances at two small wastewater treatment plants. Metropolitan Council Environmental Services (MCES), Minneapolis-St. Paul, Minnesota.



other particulates entering POTWs. The density of amalgam particles is approximately  $11 \text{ g/cm}^3$ , depending upon the particular composition. For example, amalgam can be composed of tin, copper, silver and mercury, with densities of approximately  $7.3 \text{ g/cm}^3$ ,  $9 \text{ g/cm}^3$ ,  $10 \text{ g/cm}^3$ , and  $13.5 \text{ g/cm}^3$ , respectively. The composition of one amalgam type is 30% silver, 50% mercury, 5% copper and 15% tin, resulting in an amalgam with a density of approximately  $11 \text{ g/cm}^3$ . Amalgams with other compositions would have similar densities.

Based on the above analyses, it is reasonable to conservatively estimate that POTWs remove 95% of influent mercury. As the processes used to remove particles in a POTW are similar to those in separators, the smallest particles that escape capture in separator will likely not be captured in a POTW. For this reason we have assumed that for wastewater treated with separators, the mercury not captured will also not be captured in POTWs. In other words, for the portion of flow from facilities with separators, POTWs will not capture any additional mercury, and for the portion of flow from facilities without separators, the capture efficiency is 95%.

#### Implementation of BMPs

As stated earlier, a primary focus of this update is to assess the fate of mercury captured in chair-side traps and vacuum pump filters—in particular that portion which is not recycled. In 2004 ADA published BMPs for amalgam waste in an effort to reduce the amount of mercury entering the environment. These BMPs provide guidance regarding proper use and storage of mercury and proper disposal of amalgam waste. The BMPs state that amalgam waste should always be recycled and should not be placed in biohazard containers, infectious waste containers (red bags) or regular garbage. In the current analysis, mercury collected in chair-side traps and filters that was handled according to BMPs was assumed to be recycled and not enter the environment, including surface waters. Mercury not handled according to BMPs was assumed to either be sent to medical incinerators or to landfills. The amount of mercury emitted from either one was estimated based on emission rates from the literature.

### Emissions from medical incinerators

ADA's 2004 BMPs specifically state that amalgam waste should not be disposed in biohazard containers, infectious waste containers (red bags). This is primarily because this type of waste is typically incinerated, thus converting mercury from a bound (amalgamated) form into a volatile, mobile form. We assumed that 96% of mercury from amalgam waste sent to a medical incinerator was captured by pollution control equipment, based current regulations regarding emissions from medical waste incinerators<sup>16</sup>. Mercury captured in medical incinerator pollution control equipment was assumed to be handled according to applicable regulations and not released to the environment. We assumed that all dental offices with amalgam separators would recycle mercury captured in separators.

As in our previous assessment, we assumed that 33% of mercury emitted from medical incinerators would enter United States surface waters, based on a 1997 USEPA estimate<sup>17</sup>. The resulting amounts of mercury entering surface waters are shown in Table 1 and are discussed further below.

### Emissions from landfills and land-applied biosolids

We estimated the amount of mercury that would be disposed in solid waste landfills assuming various levels of compliance with 2004 BMPs, which advise dentists not to dispose any amalgam waste in regular garbage. Total annual mercury emissions in the U.S. have been estimated at <0.1 tons per year in 1994–1995 and 0.2 tons per year in 1996<sup>18</sup>. The total mercury directed to landfills or collected as hazardous waste was estimated to be 295 metric tons (330 U.S. tons) in 1996<sup>19</sup>. Therefore, we conservatively estimated the emission rate to be 0.2 tons emitted/330 tons disposed = 0.0606%. In other words, 0.0606% of mercury from dental offices that is disposed in landfills is emitted to

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<sup>16</sup> Proposed regulations requiring that hospital/medical/infectious waste incinerators (HWIMI) capture 96% of mercury emissions were published in Federal Register, Volume 72, No. 24, February 6, 2007.

<sup>17</sup> United State Environmental Protection Agency. 1997. Mercury study report to Congress. EPA-452/R-97-003.

<sup>18</sup> United Nations Environment Programme (UNEP). 2002. Global Mercury Assessment. Geneva, Switzerland. At page 98. December. This document cites to <http://www.chem.unep.ch/mercury/Report/Final%20Assessment%20report.htm>

<sup>19</sup> Ibid. page 99.

the air. As with other emissions to air, we assume that 33% of total mercury emissions from landfills reach U.S. surface water.

Based on EPA statements, we further assumed that mercury in land-applied biosolids would be bound as amalgam and would not be available for leaching to surface water or volatilization to the atmosphere in significant amounts<sup>20,21</sup>.

#### Emissions from incinerated biosolids

We assumed that capture of mercury in from sewage sludge incinerator (SSI) emissions to be the same as presented in the previous SA, i.e., 79% capture efficiency, based on AP-42 emission factors<sup>22</sup>. As in the 2005 SA, we assumed that 33% of mercury emitted from SSIs to the atmosphere is deposited in U.S. surface waters<sup>23</sup>.

#### **Estimated costs**

A fundamental issue related to a regulation regarding mandatory installation of amalgam separators is the cost with implementing such a regulation. This section discusses our methods for estimating costs of implementation of BMPs and use of separators.

To estimate costs incurred by dentists in implementing BMPs, ENVIRON obtained estimates for recycling waste that includes amalgam (e.g., scrap amalgam, traps and filters with amalgam, etc). ENVIRON spoke with several mercury recyclers, separator manufacturers and distributors to ask if they recycle amalgam waste or have estimates of the cost associated with recycling. Various methods for recycling amalgam waste exist. Some recyclers sell a recycling service in which the recycler will send the dentist an

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<sup>20</sup> ADA Prior Comments, EPA-OW-2006-0771 at 54-55; 204-208; 213-215.

<sup>21</sup> EPA's Road Map, Addressing Mercury Releases at 28 (July 2006), available at <[http://epa.gov/mercury/pdfs/I\\_HgReleases.pdf](http://epa.gov/mercury/pdfs/I_HgReleases.pdf)>. The mercury in amalgam is bound into the mixture and the mercury in the amalgam in biosolids is less likely to be released into the air. The study cited by EPA in the administrative record is limited and measured mercury from all sources, not just mercury from amalgam and, therefore, was not a measure of the likelihood of mercury in amalgam being released from soil.

<sup>22</sup> United States Environmental Protection Agency. 1995. Compilation of air pollutant emission factors, AP-42, Fifth edition, Volume I: Stationary Point and Area Sources. Washington, D.C.

<sup>23</sup> United State Environmental Protection Agency. 1997. Mercury study report to Congress. EPA-452/R-97-003.

empty bucket to contain amalgam waste and a return shipping label. The dentist then fills the bucket with amalgam waste and ships it back to the recycler. ENVIRON asked if the recyclers were able to estimate a representative amount of time dentists take to fill a certain size (e.g., one gallon) recycling bucket. They reported that the times vary widely from as short as one month to as long as a year. Costs per bucket generally ranged from just under \$100 per bucket to over \$300, depending upon the service and on the size of the bucket. Based on our conversations with these manufacturers and distributors, we estimated that a conservative (low) cost to be approximately \$150 per year.

We assumed that the annual cost of owning and operating an amalgam separator to be \$770.85, based on recent work by ERG. This cost is in general agreement with results from our conversations with amalgam separator manufacturers and distributors. Using the annual cost of \$770.85 for ownership and operation of an amalgam separator and \$150 per year for implementation of BMPs, we calculated the cost of implementing various scenarios, ranging from 65% compliance with BMPs and dental offices with separators installed to 100% compliance with BMPs and all dental offices with separators installed.

In addition to estimating absolute costs associated with complying with BMPs and using separators, we estimated the cost per ton of mercury prevented from entering surface waters for the two scenarios of effectively 0% reduction in effluent mercury and 30% reduction in effluent mercury. The results of this analysis are summarized in Table 1 and discussed further below.

## **Results**

### Estimated amounts of mercury entering surface water

Table 1 summarizes the amounts of mercury that would reach surface waters in the U.S. under the various scenarios. Several observations are worth highlighting. First, it is important to note the very small quantities of mercury that are being considered in this analysis. Even in the worst case scenario in the table (65% implementation of BMPs and 0% of facilities with separators), the amount of mercury released to surface waters is

relatively small (0.532 tons, compared with a total of 31.25 tons discharged from dental offices).

Second, the results from the present analysis are in agreement with those of our earlier SA. For example, in the case of 100% separator installation, 0.25 tons of mercury reach surface waters, which is similar in magnitude to the 0.3 tons estimated in the earlier SA. Also, for the case with 100% compliance with BMPs (i.e., no mercury captured in traps and filters reaches surface water), the result converges to 0.419 tons, similar to the value of 0.4 tons estimated previously.

Third, the amount of mercury that is prevented from entering surface waters after installation of separators is very small. In the extreme case where 35% of those without separators are out of compliance with BMPs and send their amalgam waste to medical incinerator, 0.282 tons of mercury are prevented from entering surface waters if 100% of dentist offices have separators.

#### Estimated costs of implementation of BMPs and use of separators

Our estimates of the costs associated with implementing BMPs and installing and maintaining amalgam separators are summarized in Table 1. At the low end, assuming no separators are installed and 65% of dental offices are complying with BMPs, the total cost is approximately \$9.8M. At the other extreme, where 100% of dental offices are complying with BMPs and also have separators installed, the total cost is approximately \$92.9M. Using ERG's estimate of \$770.85 per dental office and 100,843 dental offices, the total cost would be approximately \$77.7M. Adding the cost of implementing BMPs at all dental offices would result in \$92.9M, which matches our result.

However, our current estimate of the cost of separator use per ton of mercury captured varies significantly from ERG's. ERG calculated the cost of capturing amalgam to be approximately \$11M per ton, based on total cost of \$54.4M to remove approximately 4.93 tons of mercury. We estimate that the cost would range from \$319M to \$461M per ton. ERG's analysis falls short in at least two ways.

First, ERG overestimated the effectiveness of separators by assuming that the efficiency of separators in capturing particles passing through chair-side traps and/or filters is the same as the efficiency in capturing particles from the entire size range of particles in the ISO11143 distribution. This is an incorrect assumption. ERG stated that only 0.1 tons would be discharged to surface waters. However, even if 99.2% efficiency can be achieved, the smallest amount of mercury that can be discharged to surface water is 0.25 tons, even if all dental offices installed and used separators. Thus, the greatest amount removed would be 4.79 tons, not 4.93 tons. This works out to approximately \$11.4M per ton.

Second, and more importantly, ERG did not consider the effectiveness of POTWs in reducing mercury discharge to surface waters, but rather assumed that installing separators would decrease the amount of mercury released to surface waters by full 4.93 tons. In reality, only 0.419 tons would ultimately reach surface water with no separators installed, and only approximately 0.169 tons from biosolids incineration emissions and POTW effluent would actually be prevented from entering surface waters by installing separators. According to our current calculations, an additional 0.118 tons would be captured if the remaining 70% of dental offices currently without separators installed them. Based on total costs of approximately \$54.4M for 70% of dentists to install separators<sup>24</sup>, the estimated cost would be \$461M per ton captured.

#### Comparison with previous results

In our previous SA, we estimated the annual cost for all 95,066 dental offices to install and operate separators to range from \$76M to \$114M and the cost per ton to range from \$380M to \$1.14B. At the low end, we used as a basis the scenario in which 30% of 0.3 tons (i.e., 0.1 tons) in effluent would be prevented from entering surface water. The net reduction, including 0.1 tons from incinerated biosolids, was 0.2 tons. Therefore, the low cost per ton was calculated to be  $\$76\text{M}/0.2 \text{ ton} = \$380\text{M}/\text{ton}$ .

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<sup>24</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Separators: Summary of Removal Efficiencies, Current Use and Cost Effectiveness (DCN 04851) (September 26, 2007).

At the high cost end, we estimated that only 0.1 tons of mercury would be prevented by installing separators. Using the higher annual cost value of \$1200, 95,066 dental offices and 0.1 tons, the resulting cost per ton prevented from entering surface water is \$1.14B.

The differences between our previous study results and the present results are due primarily to two factors. First, the higher end cost used previously is higher than the baseline cost used here (\$1200 as opposed to \$770.85). Second, the higher incremental capture efficiency used here (96.4% currently as opposed to 95% previously) results in greater mercury capture, which results in lower cost per ton for a given absolute cost.

## **Conclusions**

We performed a limited update of our previous assessment by 1) using more recent data and 2) estimating emissions from medical incinerators and landfills that may receive amalgam waste. Results were summarized as a sensitivity analysis for various scenarios in Table 1. In addition, we estimated the absolute cost of implementing 2004 BMPs and installing and using amalgam separators. Finally, we calculated the cost per ton of preventing mercury from entering surface waters by installing and using amalgam separators. Those costs ranged from \$319M to \$461M per ton.

**Table 1**  
**Annual amount of mercury entering surface water and costs**  
**associated with varying levels of compliance with 2004 ADA BMPs and use of amalgam separators**  
**(tons; assuming 31.25 tons discharged in dental wastewater)**

Percent compliance with pre-2007 BMPs (1)	65%	65%	80%	80%	90%	90%	100%	100%
Destination of non-recycled mercury	Medical incinerator	Landfill	Medical incinerator	Landfill	Medical incinerator	Landfill	NA	NA
<b>Baseline estimate of mercury reaching surface waters (2)</b>								
0% of dental facilities using separators	0.531	0.420	0.483	0.420	0.451	0.419	0.419	0.419
30% of dental facilities using separators	0.447	0.369	0.413	0.369	0.391	0.368	0.368	0.368
50% of dental facilities using separators	0.391	0.335	0.367	0.335	0.350	0.335	0.334	0.334
75% of dental facilities using separators	0.320	0.293	0.308	0.292	0.300	0.292	0.292	0.292
90% of dental facilities using separators	0.278	0.267	0.273	0.267	0.270	0.267	0.267	0.267
100% of dental facilities using separators	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
<b>"30% effluent mercury reduction" scenario (3)</b>								
0% of dental facilities using separators	0.531	0.420	0.483	0.420	0.451	0.419	0.419	0.419
30% of dental facilities using separators	0.424	0.347	0.391	0.346	0.368	0.346	0.346	0.346
50% of dental facilities using separators	0.353	0.298	0.329	0.297	0.313	0.297	0.297	0.297
75% of dental facilities using separators	0.264	0.236	0.252	0.236	0.244	0.236	0.236	0.236
90% of dental facilities using separators	0.211	0.200	0.206	0.199	0.203	0.199	0.199	0.199
100% of dental facilities using separators	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175
<b>Baseline costs of implementation (4)</b>								
0% of dental facilities using separators	\$9,832,193	\$9,832,193	\$12,101,160	\$12,101,160	\$13,613,805	\$13,613,805	\$15,126,450	\$15,126,450
30% of dental facilities using separators	\$34,740,918	\$34,740,918	\$36,329,195	\$36,329,195	\$37,388,046	\$37,388,046	\$38,446,898	\$38,446,898
50% of dental facilities using separators	\$51,346,735	\$51,346,735	\$52,481,218	\$52,481,218	\$53,237,541	\$53,237,541	\$53,993,863	\$53,993,863
75% of dental facilities using separators	\$72,104,006	\$72,104,006	\$72,671,247	\$72,671,247	\$73,049,409	\$73,049,409	\$73,427,570	\$73,427,570
90% of dental facilities using separators	\$84,558,368	\$84,558,368	\$84,785,265	\$84,785,265	\$84,936,529	\$84,936,529	\$85,087,794	\$85,087,794
100% of dental facilities using separators	\$92,861,277	\$92,861,277	\$92,861,277	\$92,861,277	\$92,861,277	\$92,861,277	\$92,861,277	\$92,861,277
<b>Cost effectiveness baseline scenario (total cost per tons removed by separators) (5)</b>								
0% of dental facilities using separators	NA	NA	NA	NA	NA	NA	NA	NA
30% of dental facilities using separators	\$295,087,979	\$487,076,408	\$346,449,196	\$475,806,776	\$394,397,282	\$468,239,592	\$460,628,692	\$460,628,692
50% of dental facilities using separators	\$295,087,979	\$487,076,408	\$346,449,196	\$475,806,776	\$394,397,282	\$468,239,592	\$460,628,692	\$460,628,692
75% of dental facilities using separators	\$295,087,979	\$487,076,408	\$346,449,196	\$475,806,776	\$394,397,282	\$468,239,592	\$460,628,692	\$460,628,692
90% of dental facilities using separators	\$295,087,979	\$487,076,408	\$346,449,196	\$475,806,776	\$394,397,282	\$468,239,592	\$460,628,692	\$460,628,692
100% of dental facilities using separators	\$295,087,979	\$487,076,408	\$346,449,196	\$475,806,776	\$394,397,282	\$468,239,592	\$460,628,692	\$460,628,692
<b>Cost effectiveness - "30% effluent mercury reduction" scenario (total cost per tons removed by separators) (6)</b>								
0% of dental facilities using separators	NA	NA	NA	NA	NA	NA	NA	NA
30% of dental facilities using separators	\$232,985,219	\$338,253,352	\$262,116,168	\$329,992,739	\$287,198,126	\$324,458,188	\$318,901,501	\$318,901,501
50% of dental facilities using separators	\$232,985,219	\$338,253,352	\$262,116,168	\$329,992,739	\$287,198,126	\$324,458,188	\$318,901,501	\$318,901,501
75% of dental facilities using separators	\$232,985,219	\$338,253,352	\$262,116,168	\$329,992,739	\$287,198,126	\$324,458,188	\$318,901,501	\$318,901,501
90% of dental facilities using separators	\$232,985,219	\$338,253,352	\$262,116,168	\$329,992,739	\$287,198,126	\$324,458,188	\$318,901,501	\$318,901,501
100% of dental facilities using separators	\$232,985,219	\$338,253,352	\$262,116,168	\$329,992,739	\$287,198,126	\$324,458,188	\$318,901,501	\$318,901,501

**Notes:**

1. We assumed that 100% of dental offices with separators installed were in compliance with BMPs. The "Percent compliance with BMPs" refers to the percentage of dental offices that are in compliance with BMPs, yet do not have a separator installed. For example, where 100% of dental offices have separators installed, 100% are also in compliance with BMPs.
2. The baseline assessment scenario is the same as that in our previous SA. This assumes that POTWs capture 0% of that portion of mercury entering separators but which is not captured.
3. This scenario is the same as the baseline, except that it includes an assumption that mercury entering separators but is not captured is actually reduced by 30%, compared to the baseline scenario. This is in accordance with a scenario presented in our earlier SA.
4. This baseline cost estimate assumes \$770.85/year for separators and \$150/year for BMPs for 100,843 dental offices (ERG, 2007) that use amalgam. \$770.85 is the estimated annual cost for owning and operating an amalgam separator, as calculated by ERG, 2007. The cost includes \$1,200 capital cost, spread over 10 years at 7% interest plus \$600 annual operation and maintenance.
5. Cost effectiveness was calculated by taking the cost of the dental community owning and operating separators and dividing it by the estimated amount of mercury prevented from entering surface water. For example, the baseline cost for the scenario with 30% separators and 65% BMP compliance is  $(30\%)(100,843)(\$770.85 + \$150) + (100\% - 30\%)(100,843)(65\%)(\$150) = \$34,740,918$ .
6. Cost effectiveness for the "30% effluent mercury reduction" scenario was calculated the same way it was in the baseline scenario, except that the cost was divided by the estimated amount of mercury prevented from entering surface water assuming an additional 30% reduction in effluent concentrations.



## **ATTACHMENT 2: A REVIEW OF THE AVAILABLE DATA ON THE EFFECTIVENESS OF AMALGAM SEPARATORS**

### **I. INTRODUCTION**

The ADA has collected data on whether amalgam separators reduce effluent mercury from a number of publicly available sources (including information from the National Association of Clean Water Agencies (“NACWA”) study). These results are summarized below. A more systematic review of this data is necessary before definitive conclusions can be drawn,

### **II. EXECUTIVE SUMMARY**

Although the database cannot be viewed as definite, several general observations can be made.

First, clearly, installation of amalgam separators shifts the primary point at which amalgam is removed from the sewerage treatment plant, where professional environmental engineers handle the material, to the dental office (where technical experience with mercury is more limited).

Second, in general, the levels of mercury in biosolids (see Table 1: Comparison of average biosolids concentrations and EPA biosolid limits in the main ADA comments) and the effluent (see Figures 1 through 13, below) are relatively low. The mercury concentrations in treatment plant effluent, in particular, are often barely above the detection limit. The low concentrations and the inherent variation in mercury concentrations in effluent make determination of trends difficult. Given the extremely low levels of total mercury in the treatment plant effluent, the fluctuations may simply be analytical variation or variation in background levels of mercury.

Third, the data does support the effectiveness of the treatment plant in removing mercury from influent.

Fourth, the data indicates that total mercury levels in biosolids and treatment plant influent can decrease as a result of the installation of amalgam separators. The issue (discussed in the body of these comments) is whether further reductions of mercury levels in biosolids that are already well below EPA biosolid limits significantly reduces the release of mercury into the environment, specifically the release into surface water.

Fifth, a visual review of the effluent data indicates that there is no clear pattern of decreases in treatment plant effluent following the installation of amalgam separators, and some data may suggest an increase in the effluent. Neither the individual presentations that interpreted this municipal data nor the NACWA study correlated the change in mercury concentration over time with separator installations.

Sixth, the mercury concentrations in treatment plant effluent, in particular, is often near to the detection limit. The low concentrations and the inherent variation in mercury concentrations in effluent make determination of trends difficult. Given the extremely low levels of total mercury in the POTW effluent, the fluctuations may simply be analytical variation or variation in background levels of mercury.

In summary, there are no downward trend in the mercury concentration of effluent easily observable after installation of amalgam separators. However, a more detailed statistical analysis of the existing data (with an attempt to correlate the timing of the institution of the pre-2007 Best Management Practices (“BMPs”) for amalgam waste, amalgam separators, another mercury reduction activities at the sewerage treatment facilities) would probably be useful.

### **III. THE MEASURE OF EFFECTIVENESS**

The issue of whether amalgam separators are effective depends on what measure one uses to define “effectiveness.” There is no debate that amalgam separators installed in dental offices would prevent more than 6 tons of amalgam from *entering* sewerage treatment plants annually. As a result, the concentration of mercury in sewerage treatment plant influent and biosolids (where the vast majority of mercury from amalgam is collected) will decrease after separators are installed, so long as other sources are much higher than the dental office contribution, thereby masking any decrease.

However (as discussed in Attachment 1 to the ADA Comments), the net benefit to the environment is far less than this 6 tons because sewerage treatment plants remove more than 95% of amalgamated mercury. Also, typically, the protecting the environment does not include the interior workings of industrial plants or municipal wastewater treatment plants (see discussion in the ADA Comments).

The ADA considers that the appropriate measure of “effectiveness” for the pretreatment rule is the reduction of the mercury concentration in the effluent from sewerage treatment plants discharged into surface water and the deposition of mercury into surface water (from mercury that originated in the discharge of amalgam wastewater into sewerage treatment systems).. The available data on separator effectiveness reviewed in this Attachment indicates that (1) the amount of mercury in the influent and biosolids decrease after separators are installed (consistent with the principles of mass balance) and such a decrease should and usually is measurable<sup>1</sup>, and (2) there is no observable decreases in the concentration of mercury in effluent following the installation of amalgam separators.

The purpose of the Clean Water Act and sewerage plants is to prevent releases to surface water. Regulatory action was not required until the Environmental Protection Agency (“EPA”) set the mercury water quality standard of 0.3 milligrams of mercury per kilogram of fish (“mg/kg” or “ppm”) and analytical techniques allowed measurements of nanogram per liter (“ng/L” or “ppt”) levels of mercury in effluent and it was found that fish in many areas contained mercury concentrations in excess of 0.3 ppm. Thus, the proper measure of amalgam separator “effectiveness” is the change, if any, in mercury concentrations in sewerage plant *effluent (i.e., the discharge to the surface water in which the fish reside)*. As discussed below, the raw data on the impact of amalgam separators on the mercury concentration in sewerage treatment plant effluent is unclear and likely to small.

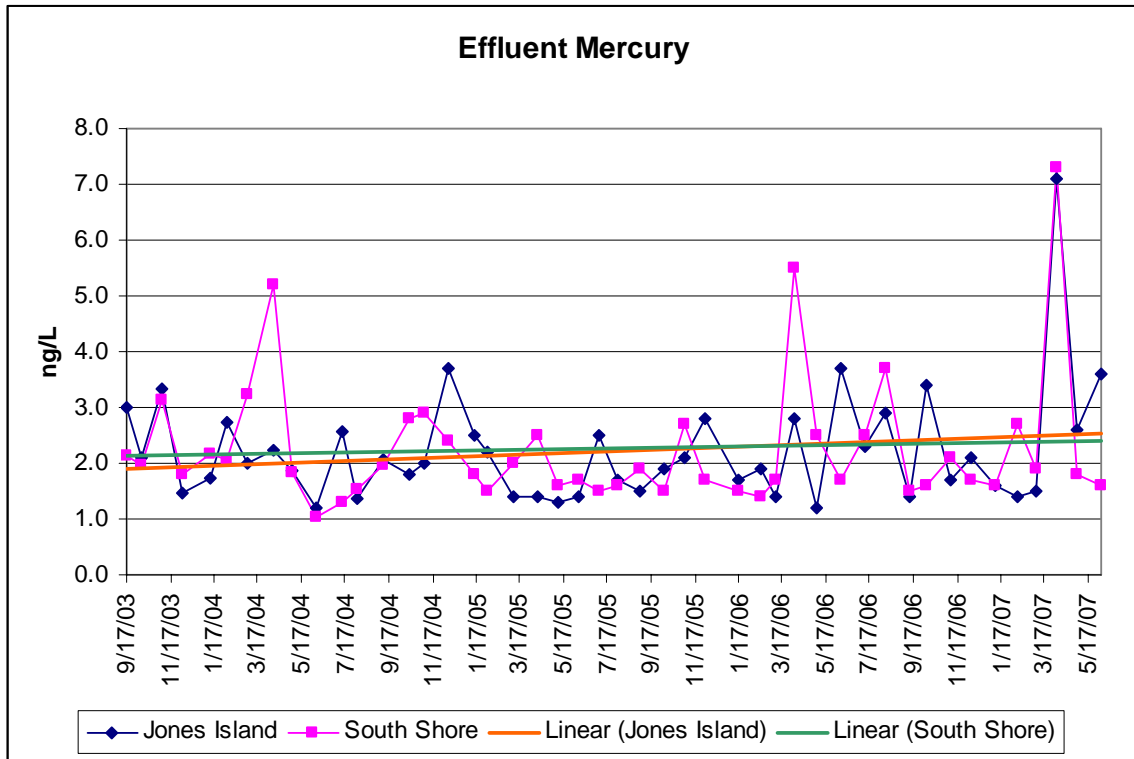
#### **IV. MILWAUKEE, WI**

After working cooperatively with the Greater Milwaukee and Wisconsin Dental Associations and individual dentists to refine the elements of this program, the District adopted rules in January 2004 requiring the installation of amalgam separators.<sup>2</sup> This was the first municipality in the Great Lakes region to require separators for amalgam.<sup>3</sup>

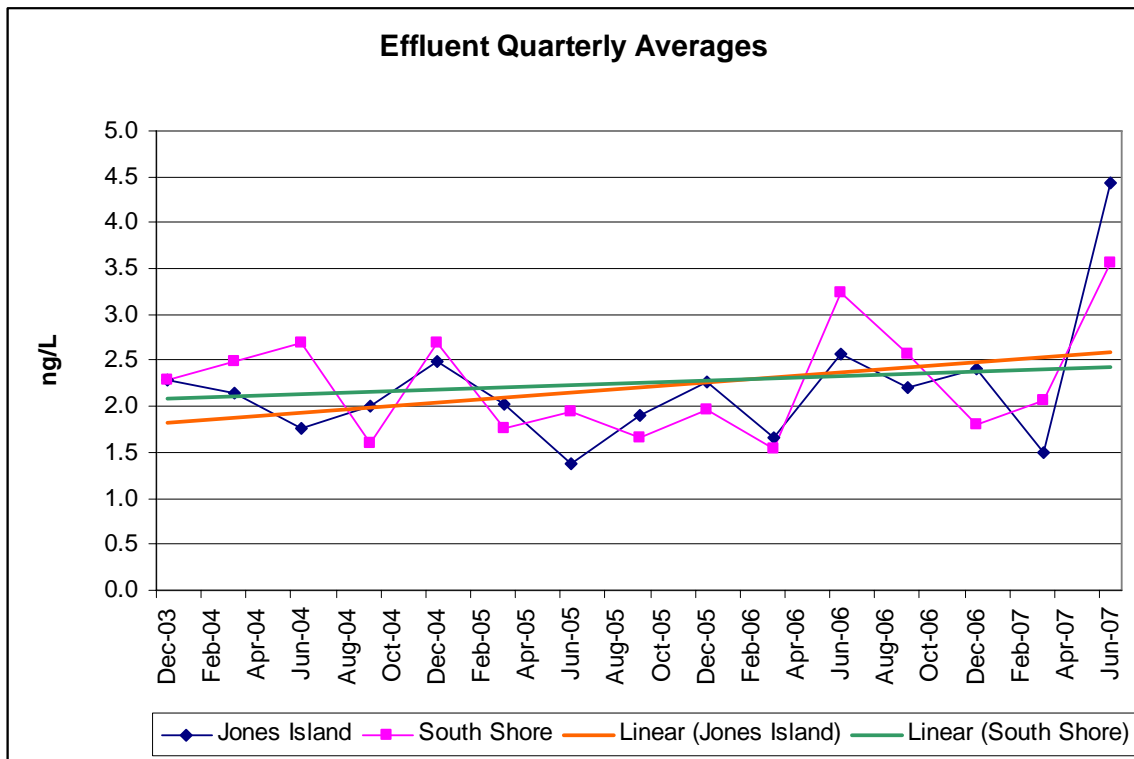
The municipality acknowledged that the sources being controlled (including dental offices) were “not the only cause for pollutant reductions. Other causes include: the movement of heavy manufacturing to areas with lower costs; the implementation of new, more efficient manufacturing processes; and the increasing amount of self-policing that is occurring as facilities implement environmental management systems.”<sup>4</sup>

The Appendix to this Attachment contains the Milwaukee Metropolitan Sewerage District's August 2007 analysis of its influent, biosolid, and effluent concentrations. Below are the relevant plots of the concentration of mercury in effluent versus time from this Appendix.<sup>5</sup>

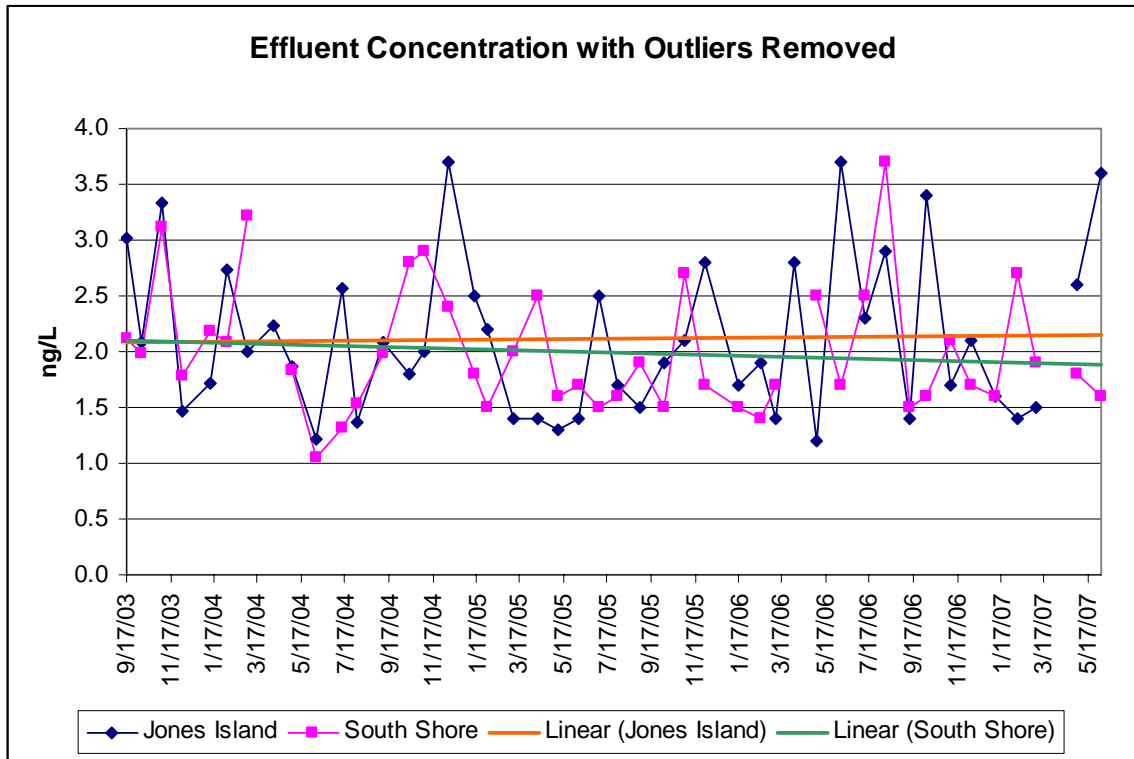
**Figure 1: Milwaukee Metropolitan Sewerage District Mercury Concentration in Effluent**



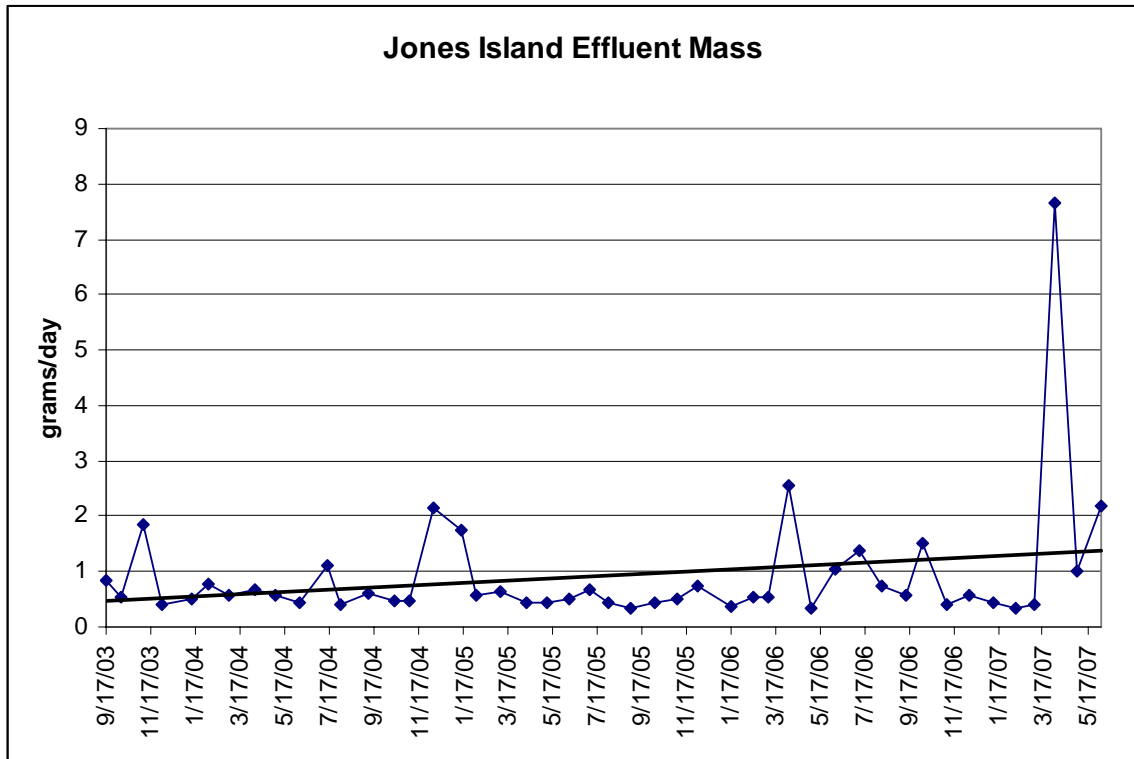
**Figure 2: Milwaukee Metropolitan Sewerage District Quarterly Average Mercury Concentration in Effluent**



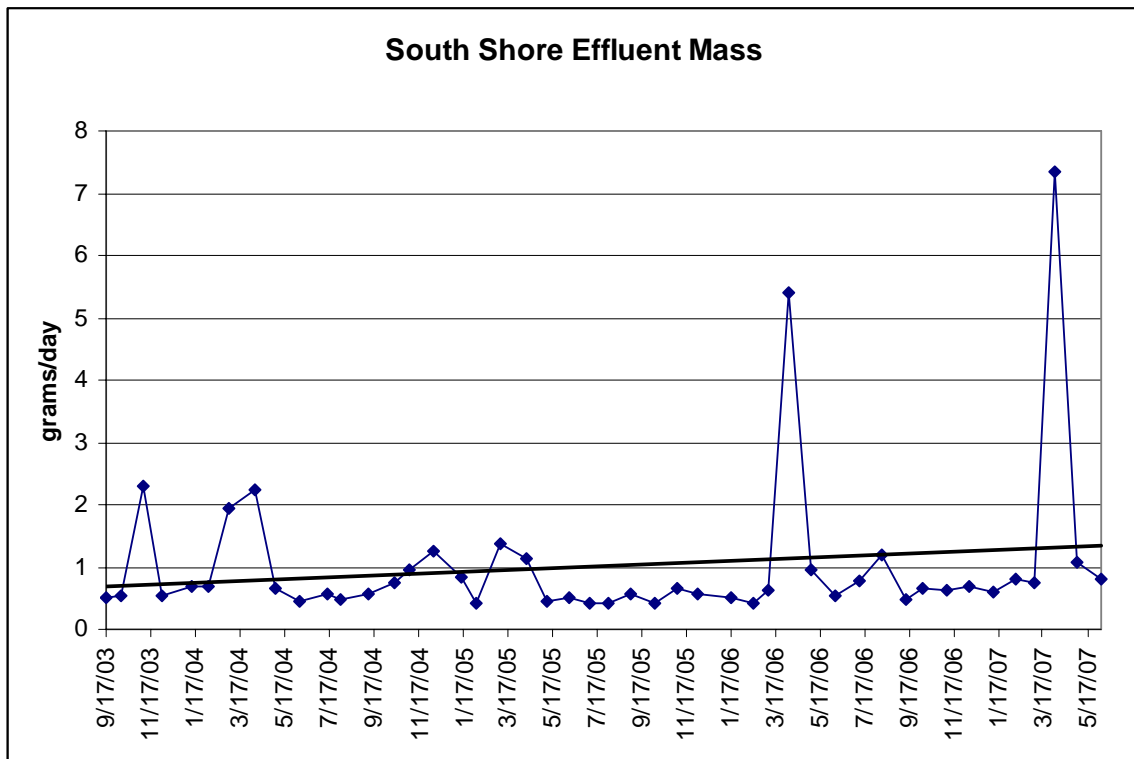
**Figure 3: Milwaukee Metropolitan Sewerage District Mercury Concentration in Effluent with Alleged Outliers Removed**



**Figure 4: Milwaukee Metropolitan Sewerage District Mercury Mass in Effluent**



**Figure 5: Milwaukee Metropolitan Sewerage District Mercury Mass in Effluent**





Both a visual observation of the data and the admittedly limited statistical tests performed on the data indicate that “[e]ffluent concentrations do not correlate with influent concentrations” and for both Jones Island and South Shore, “the trend line shows a slight increase in effluent concentration with decreasing influent concentration.”<sup>6</sup>

## V. WICHITA, KANSAS

The City of Wichita, Kansas initiated a phased program that resulted initially in 60% of dental community voluntarily complying with the program.<sup>7</sup> The program was implemented in October 2001. Presently, 99% of dentists have complied.<sup>8</sup>

**Figure 6: Wichita Loading and Date of Separator Implementation<sup>9</sup>**

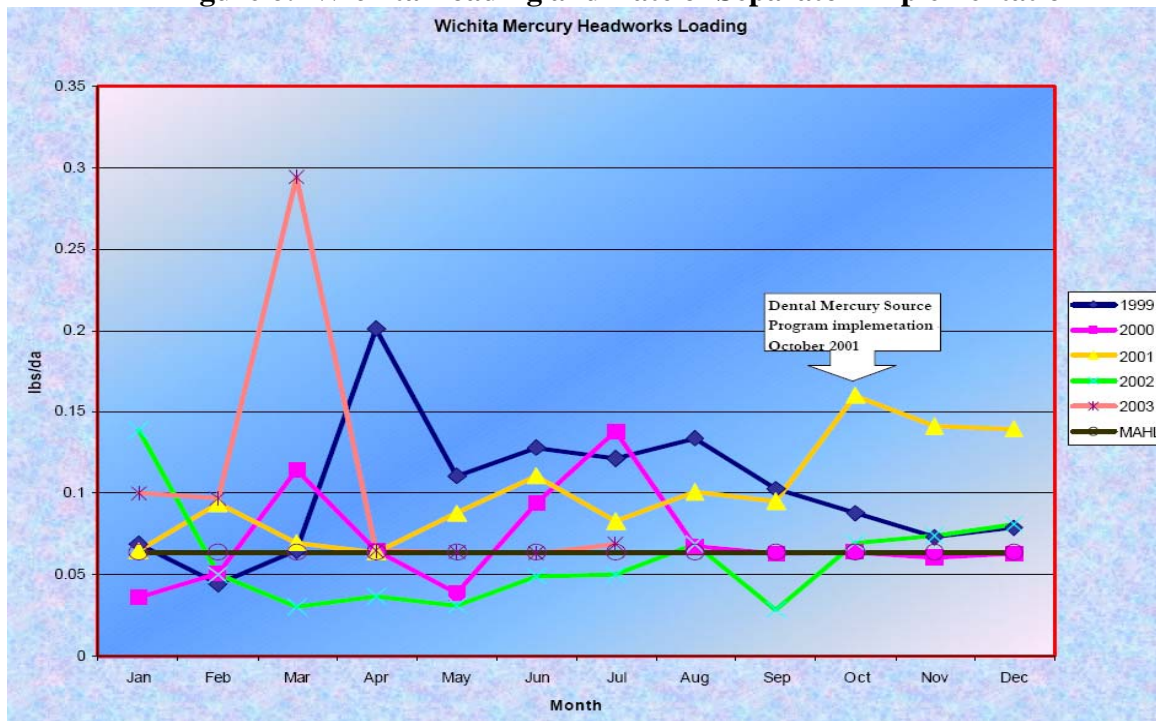
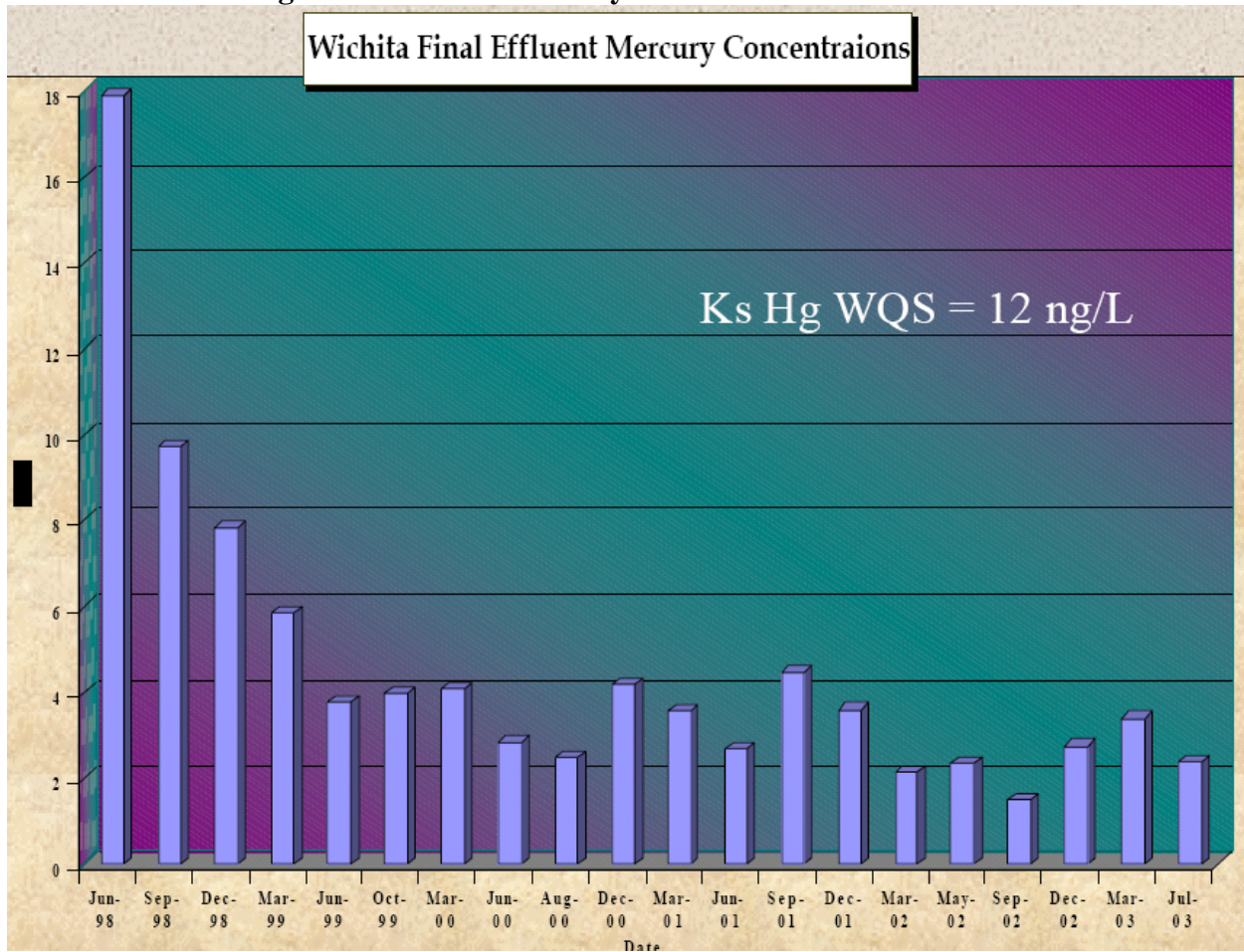


Figure 7: Wichita Mercury Concentration in Effluent<sup>10</sup>



The data actually shows an increase in average mercury concentration from 2002 (2.17 ng/L) to 2003 (2.77 ng/L) and that the largest decrease actually occurred from 2001 (3.57 ng/L) to 2002 (2.17 ng/L) after requiring BMPs.

Despite this cooperation from the local dental community, no clear pattern of a decrease in the mercury concentration in influent to or effluent from the treatment plant is discernible.<sup>11</sup>

## VI. DULUTH SEWERAGE TREATMENT PLANT

Separators in Duluth, Minnesota were installed from roughly June 1999 through December 2004. Although a pattern of a slight mercury decrease in sludge is discernible, no such pattern is clear in the treatment plant effluent.

**Figure 8: Duluth Mercury Concentration in Sludge and Date of Separator Installation<sup>12</sup>**

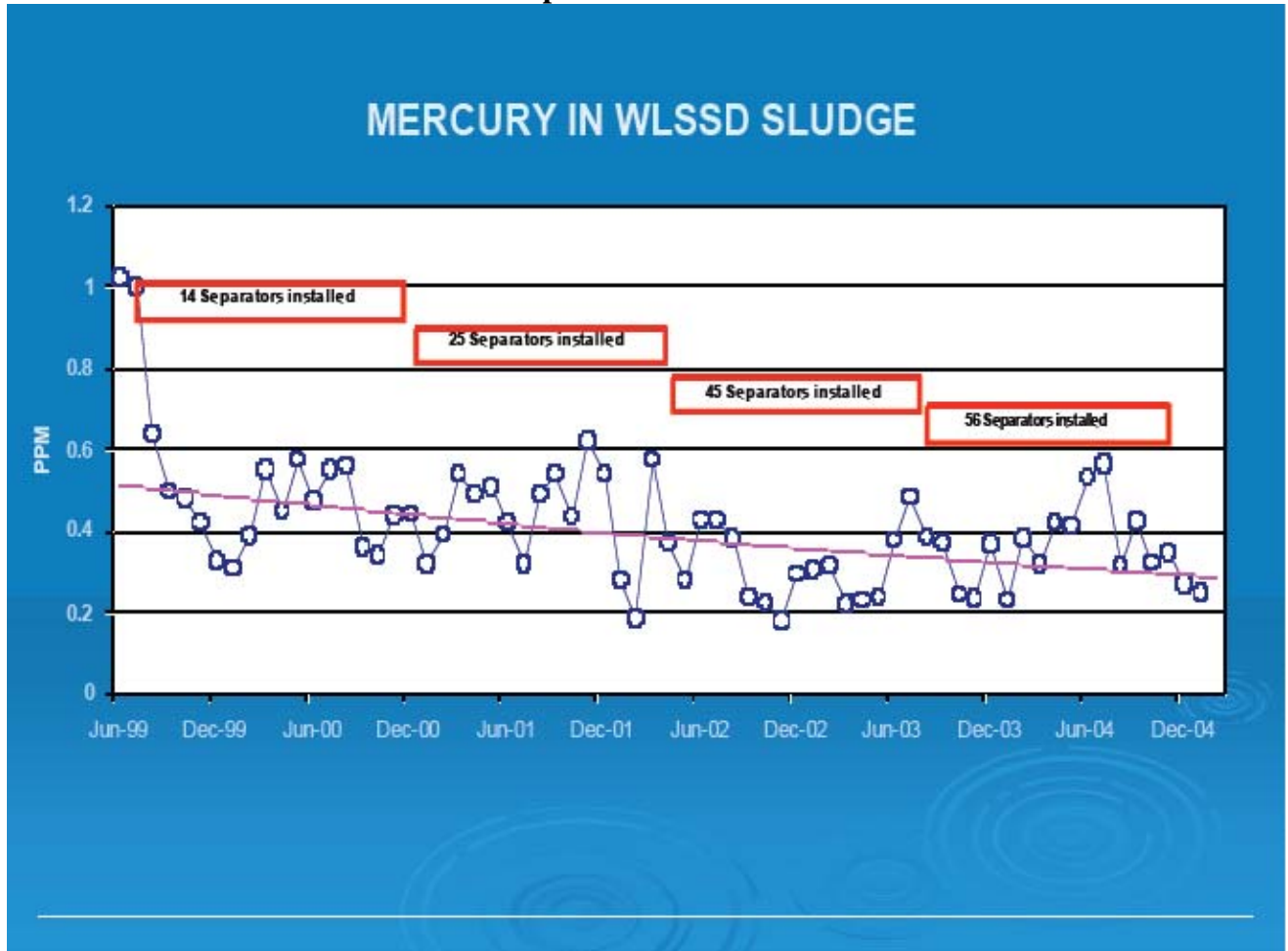
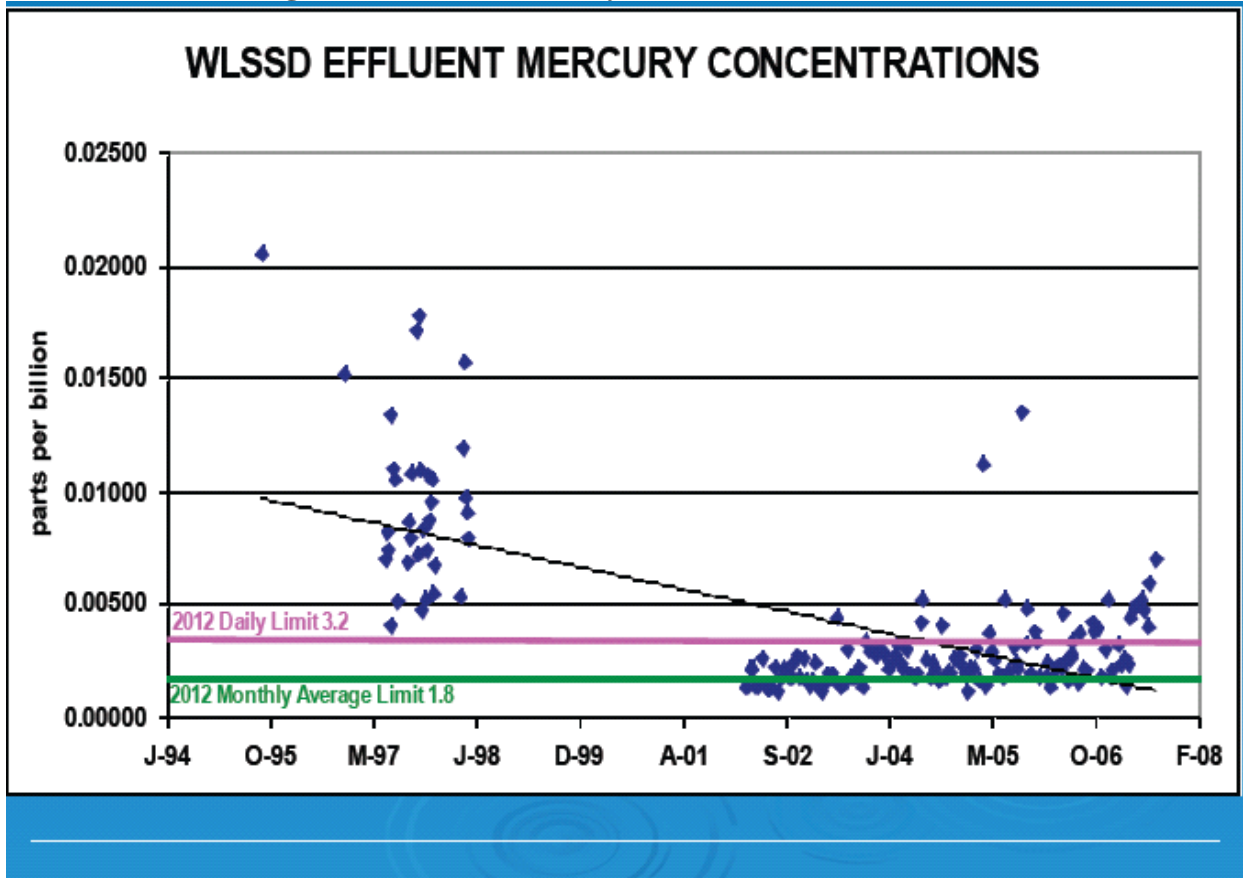


Figure 9: Duluth Mercury Concentration in Effluent<sup>13</sup>



## VII. MADISON, WISCONSIN

As of 2005, 23 of the 103 dentists in Madison had installed separators.<sup>14</sup> The regulatory goal was to have all general practice dentists install separators by December 31, 2008.<sup>15</sup> Table 1 (below) provides, among other things, the mercury concentration in the effluent from 2004 to 2006.

**Table 1: Madison, Wisconsin Mercury Concentration in Effluent<sup>16</sup>**

**Appendix C**

**Nine Springs Wastewater Treatment Plant  
Influent, Effluent and Biosolids Mercury Concentrations  
(March 2004\* to September 2006)**

<b>Month</b>	<b>Year</b>	<b>Influent (ppt)</b>	<b>Effluent (ppt)</b>	<b>% Removal</b>	<b>GBT Biosolids (mg/kg dry wt.)</b>
March	2004	253	2.16	99.1	1.0
April	2004	211	1.58	99.3	1.1
May	2004	314	2.89	99.1	1.2
June	2004	210	1.55	99.3	1.9
July	2004	213	2.64	98.8	1.7
August	2004	209	1.72	99.2	1.5
September	2004	164	1.54	99.1	1.5
October	2004				1.4
November	2004	176	2.80	98.4	1.6
December	2004	142	1.92	98.6	1.2
	<b>2004-Ave</b>	<b>209</b>	<b>2.11</b>	<b>99.0</b>	<b>1.4</b>
January	2005	227	1.95	99.1	1.5
February	2005	173	2.20	98.7	1.1
March	2005	149	2.04	98.6	1.1
April	2005	75	2.32	96.9	2.2
May	2005	246	1.97	99.2	1.1
June	2005	136	1.10	99.2	1.8
July	2005	161	2.17	98.7	2.5
August	2005	149	1.98	98.7	1.5
September	2005	236	1.89	99.2	1.5
October	2005	133	6.54	95.1	1.3
November	2005	160	2.68	98.3	1.5
December	2005	126	2.28	98.2	1.4
	<b>2005-Ave</b>	<b>164</b>	<b>2.43</b>	<b>98.4</b>	<b>1.5</b>
January	2006	110	4.96	95.5	1.0
February	2006	209	1.86	99.1	1.0
March	2006	136	1.86	98.6	1.0
April	2006	117	1.47	98.7	1.1
May	2006	98	2.42	97.5	0.9
June	2006	192	2.65	98.6	1.1
July	2006	128	1.82	98.6	1.3
August	2006	276	1.37	99.5	1.0
September	2006	181	2.93	98.4	1.1
	<b>2006-Ave</b>	<b>161</b>	<b>2.37</b>	<b>98.3</b>	<b>1.1</b>

\* Low level testing of effluent by EPA Method 1631 began in March, 2004

The 2004, 2005, and 2006 data show no trend yet, although it may be premature.<sup>17</sup>



## VIII. MINNEAPOLIS AREA

The Minneapolis Metropolitan Council on Environmental Services (“MCES”) launched its voluntary separator program in January 2003. 99% of general practice dental clinics in the Minneapolis area installed separators (724).<sup>18</sup> The average concentration of mercury in the MCES Metro Plant effluent over time (through 9/5/07) is:<sup>19</sup>

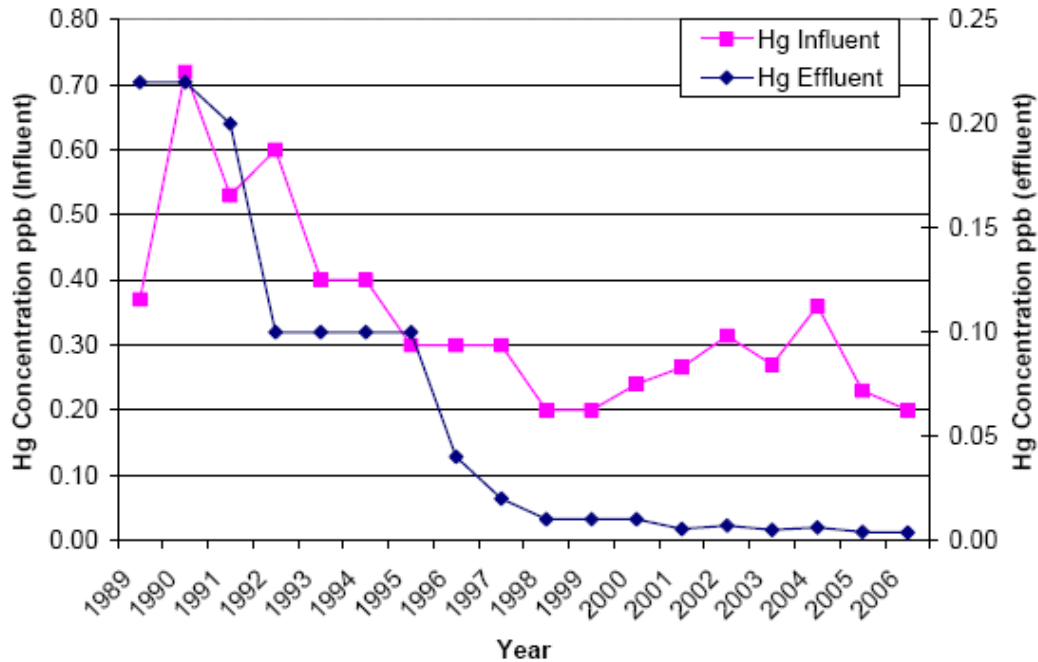
1994:	11 ng/l
2003:	8.4
2004:	5.2
2005:	5.0
2006:	6.2
2007:	3.1

The ADA has not found information on the rate at which amalgam separators were installed in the MCES system. Additionally, there were strong efforts to implement best management amalgam waste handling practices and other mercury reduction/pollution prevention efforts prior to and after January 2003. This complicates interpretation of the data on average total mercury concentrations (particularly the decreases between 1994 and 2003 and between 2003 and 2004 and the further decrease from 2006 to the first part of 2007). Specifically, the decrease in 2007 through August strongly suggests that other mercury reduction efforts are at play given the likelihood that most of the separators have been installed for some time. Therefore, it is difficult to determine whether the changes in concentration are related primarily to the use of separators.

## IX. PALO ALTO/BAY AREA

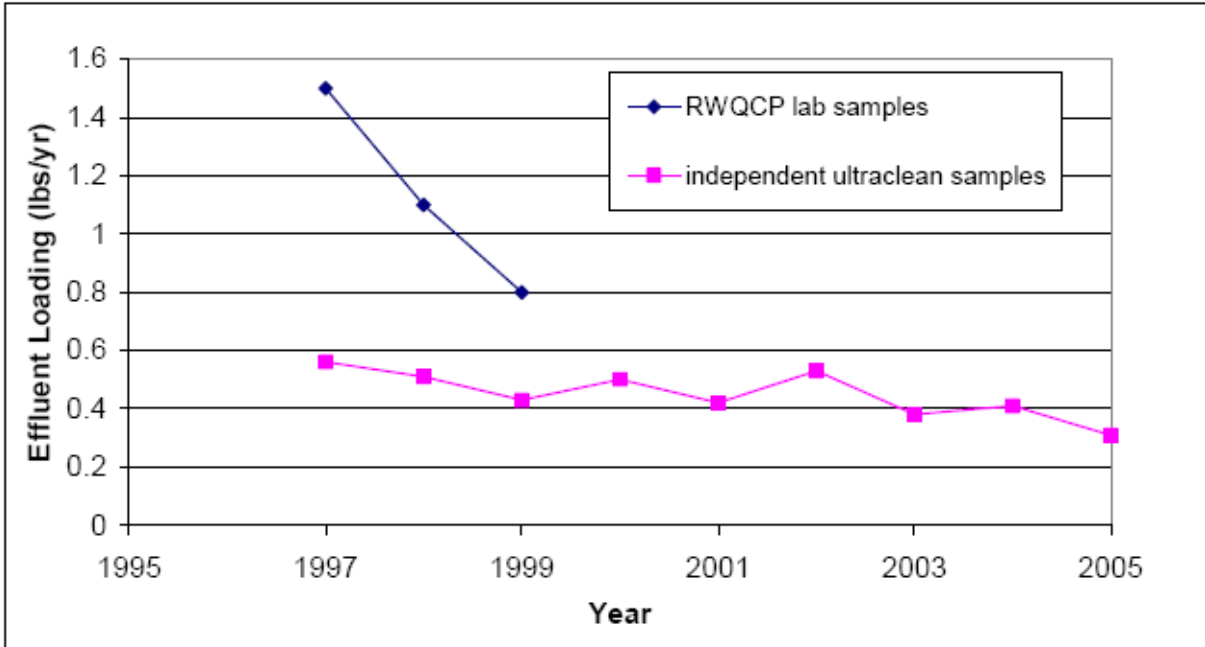
The Regional Water Quality Control Plant (“RWQCP”) covers dischargers located in Palo Alto, the East Palo Alto Sanitary District service area, Los Altos, and the town of Los Altos Hills. The due date for amalgam separator installation in this area was March 31, 2005.<sup>20</sup> By April 30, 2005, 96 percent of the 132 dental offices had certified that their amalgam separators were installed.<sup>21</sup> Figure 10 below plots the mercury concentrations in the plant’s influent and effluent.

**Figure 10: Palo Alto (i.e., Regional Water Quality Control Plant (RWQCP)) Mercury Concentration in Effluent<sup>22</sup>**



**Figure 4-11: RWQCP Mercury Influent and Effluent Concentrations: 1989-2006**

**Figure 11: Palo Alto Mercury Concentration in Effluent  
Different Scale**



**Figure 5. RWQCP Mercury Effluent Loading: 1997-2005**  
(effluent loading prior to 1997 are not show, as loads were calculated using primarily non-detect data points)

Two things are immediately apparent from the Palo Alto data. First, the largest decrease in mercury effluent occurred from 1995 to 2000, *prior* to the installation of separators (see Figures 10 and 11). Second, given the scales of Figures 10 and Figure 11, little change is observable. Nevertheless, the raw data should be examined more carefully with appropriate statistical tools to better understand separator effectiveness in Palo Alto.

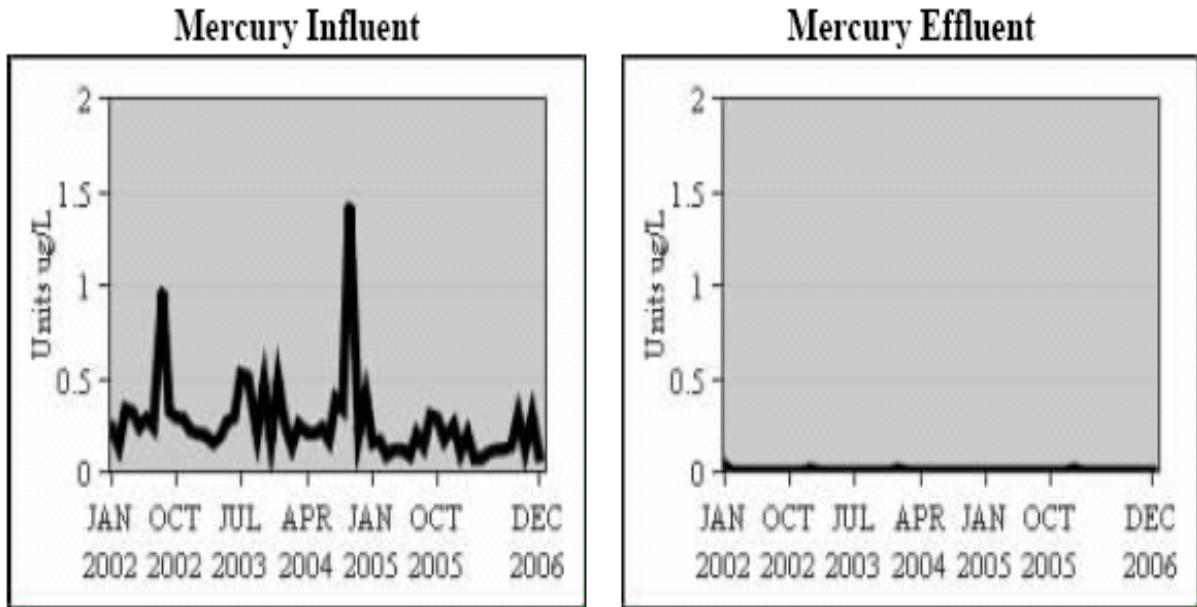
**X. EAST BAY MUNICIPAL UTILITY DISTRICT**

In the East Bay Municipal Utility District (“EBMUD”), separators were installed between January 2004 and September 2005.<sup>23</sup> More than 96% of permitted dental facilities have installed amalgam separators.<sup>24</sup> Figure 12 shows the mercury concentrations in the influent and effluent from the plant.





**Figure 12: EBMUD Comparison of Mercury Concentration in Influent and Effluent<sup>25</sup>**



Given the scale, no increase or decrease can be observed, although there is no noticeable decrease.

## **XI. OTHER SEWERAGE TREATMENT PLANTS**

This brief review of the mercury concentration in effluent data available on line did not uncover other effluent data. In some cases (such as Narragansett Bay<sup>26</sup>), there are tables showing mercury concentration data for effluent for limited periods of time.<sup>27</sup> In the case of Narragansett Bay, voluntary separators were installed from 2004 through the end of 2005, but the weekly mercury concentration in effluent data for 2005 suggests no downward trend. However, more information and a statistical analysis would be needed to reach a scientifically sound conclusion concerning the trends..

## **XII. NACWA SEPARATOR EFFECTIVENESS STUDY**

Samples of influent wastewater, treated effluent, and biosolids were collected and analyzed for total mercury concentrations, and some influent and effluent samples were analyzed for dissolved mercury concentrations. In addition, flow rates, total suspended solids, and turbidity were measured.

The only publicly available summary of the study is a Power Point presentation that generally plots effluent mercury against the different sewerage treatment plants or the number of dental offices per million gallons of flow (i.e., this presentation did not plot the mercury concentrations in effluent before, during, and after installation of separators).<sup>28</sup>

Although the ADA reviewed a written copy of the report, the ADA has not seen or reviewed the raw data. The ADA conclusions are as follows:

First, the NACWA study adds significantly to the body of knowledge on the effectiveness of separators and collects the data in one location.

Second, some of the treatment plants were implementing mercury reduction well before the NACWA study was initiated. As a result, we suspect that some of the data gathering may have limitations that might not exist in a prospective study.

Third, the ADA is unable to determine when the separators were installed in the case of each treatment plant, making it difficult ascertain the true “effect” of the installations. In other words, an “effect” (i.e., a change in a treatment plant’s effluent mercury ), by definition, must be causally linked to the timing of the separator installations.

Fourth, the draft report reviewed by the ADA did not take into account that some chemicals like sodium hypochlorite, which can have very high concentrations of mercury (e.g., Clorox® and Comet® can have microgram per kilogram levels of mercury), could be contributing significant amounts of mercury to treatment plant effluents.

Fifth, the trends in mercury concentration in effluent must be understood in the context of the overall mercury reduction programs implemented by the municipality. For example, most treatment plants that have historic data show a more dramatic decrease in the mercury concentration in influent, biosolids, and in effluent *prior* to the installation of separators. Both prior to and during the installation of separators, other significant mercury reduction program have been instituted nationwide. For example, the majority of dental offices that initially implemented the pre-2007 ADA Best Management Practices are contributing to significant reductions that are now intermingled with any reductions from the separators. Thus, any analysis of the impact of separators must take into account these other confounding factors.

Sixth, the NACWA analysis includes attempts to correlate the number of dentists per million gallons of treatment plant flow. The information available on the plants is very limited. The data suggests that two of the twelve plants (treatment plants A and L) had higher concentrations of mercury in the effluent compared to the other plants. It is not discernible from the Power Point, whether any or all of this data was taken before, during or after separators were installed. Some figures suggest a higher mercury concentration with a increase in the number of dentists per million gallons of flow. However, the higher concentrations on these figures seem to be associated with treatment plant L and A, which were anomalous.

Finally, this analysis is not based on accepted statistical methods (as far as can be determined from the publicly available information). More importantly, the mere existence of a high number of dentists per million gallons of flow does not fairly indicate a given dental community's contribution to mercury in treatment plant effluent. Indeed, a number of dental offices in a community are highly correlated with high population and an urban setting. Thus, the mercury in the influent and effluent may be more a function of the larger number people, the

greater use of mercury-containing products, and a greater likelihood of industrial and other nondental commercial contribution.

Finally, some of the samples were composites and others were grab samples, which may make comparisons more difficult.

### **XIII. CONCLUSION**

Although amalgam separators do increase the amount of amalgam that is recycled, the data does not demonstrate the effectiveness of amalgam separators in reducing the amount of mercury that is released to the environment. Aside from the lack of clear data on effluent effects, most of the data is from nonpeer reviewed reports and presentations, which is insufficiently robust to demonstrate whether mercury concentrations in sewerage treatment plants significantly decrease, increase or remain the same after the installation of amalgam separators in dental offices. The ADA urges EPA and/or NACWA to perform a more systematic statistical analysis of this data (and any other data that is available).

**APPENDIX TO ATTACHMENT 2:**  
**MILWAUKEE METROPOLITAN SEWERAGE DISTRICT MERCURY**  
**DATA SUMMARY**

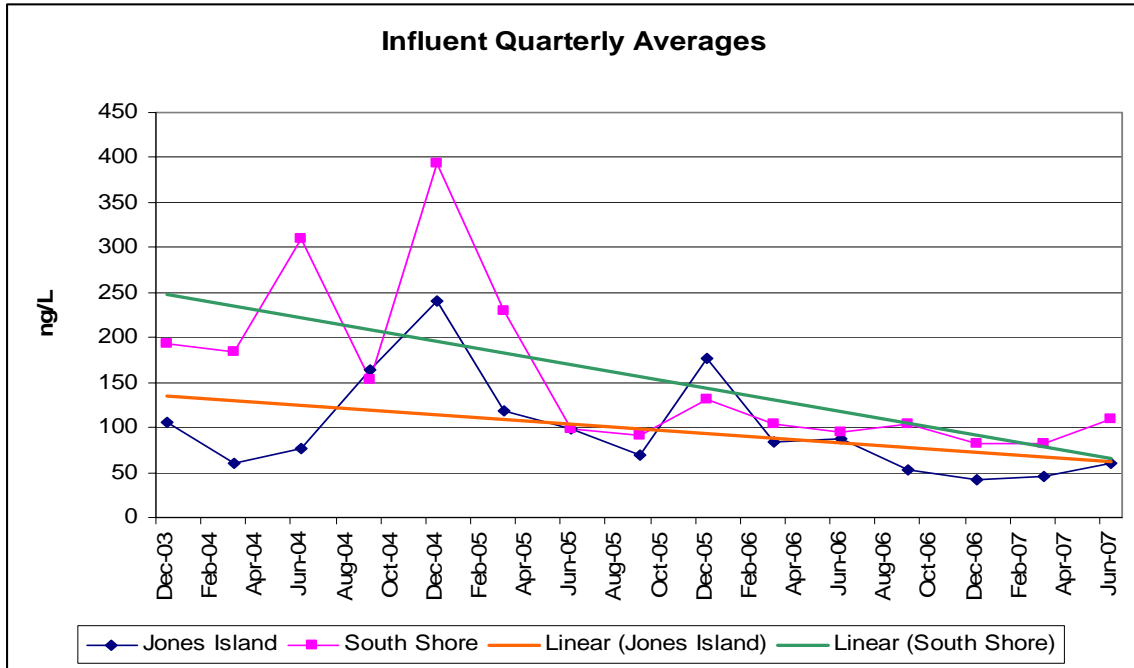
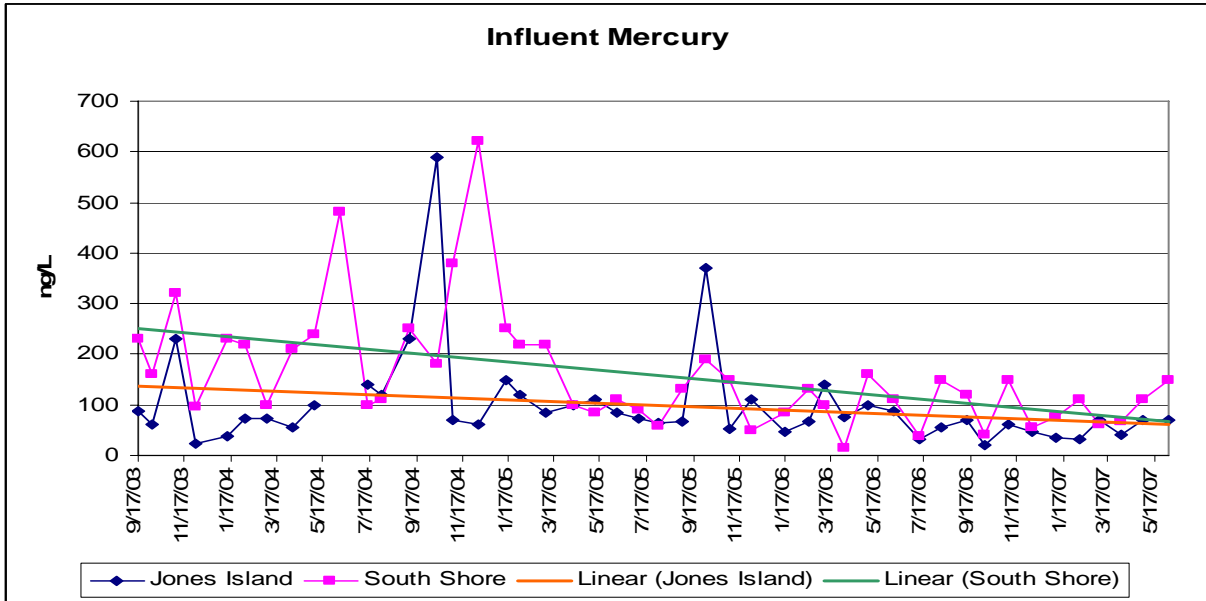
# Milwaukee Metropolitan Sewerage District Mercury Data Summary

August 31, 2007

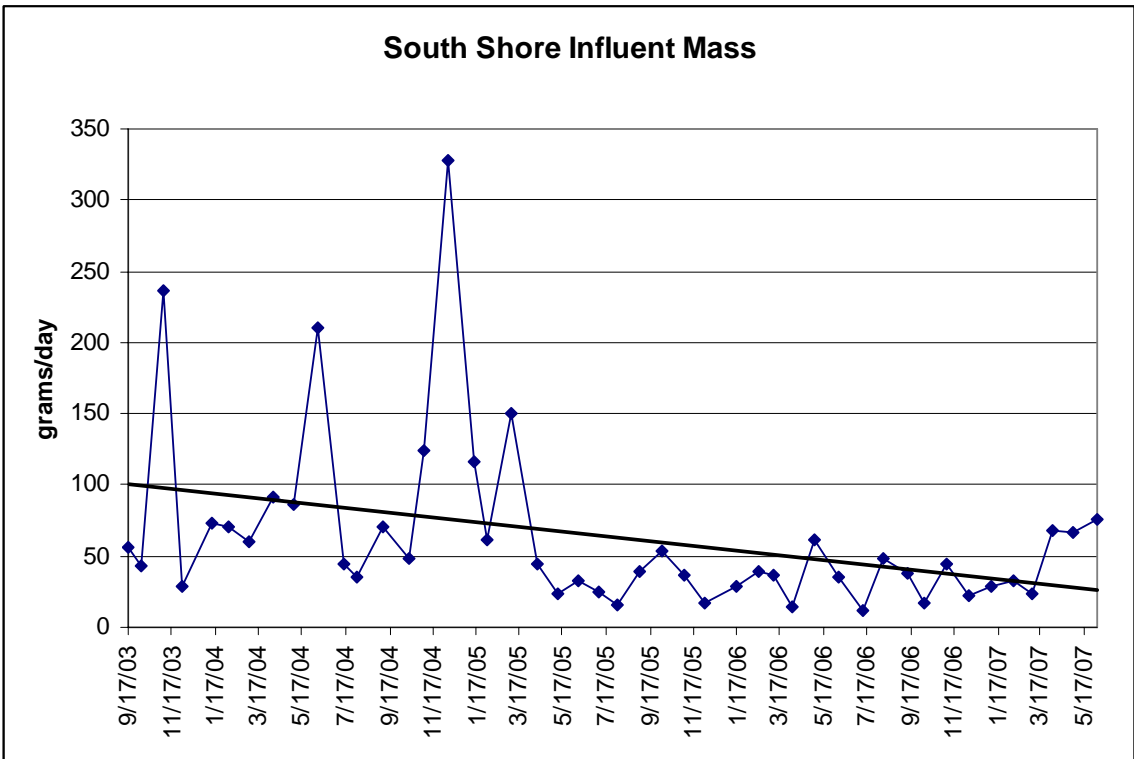
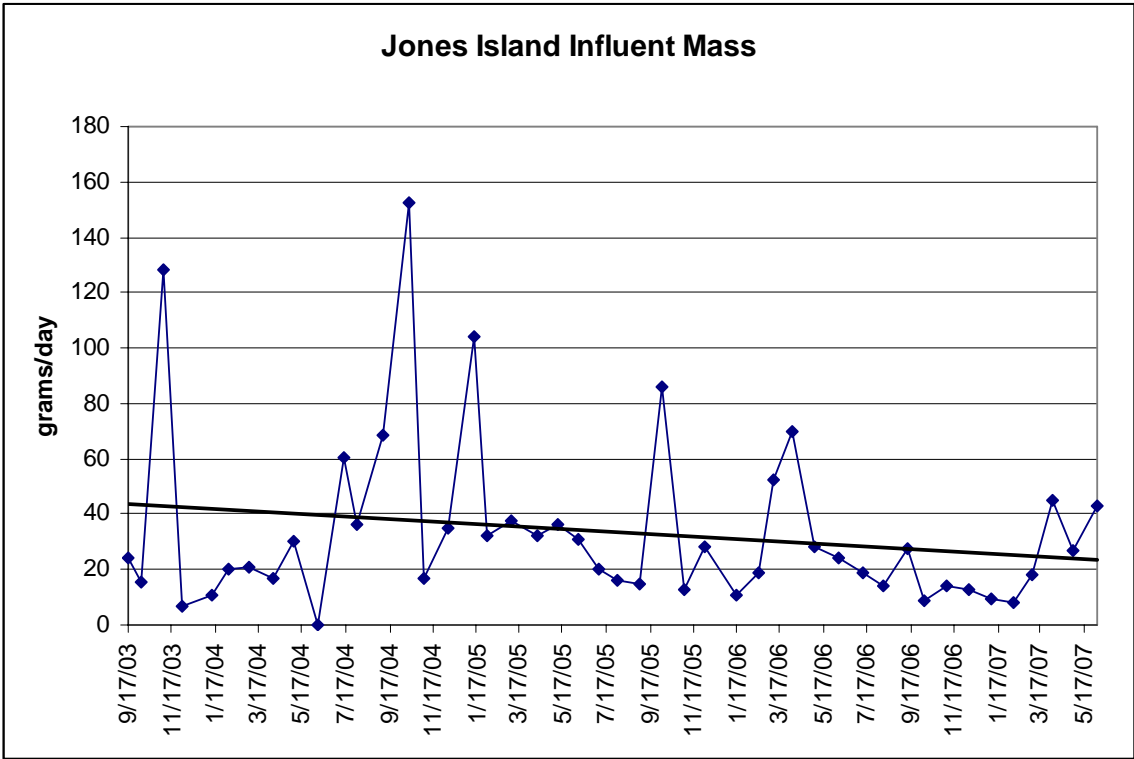
Sample results show mixed outcomes, as shown in the following graphs. Influent and Milorganite show desirable results. At both Jones Island and South Shore, influent mercury concentrations and masses are decreasing. For both Jones Island and South Shore, a Kendall Trend Test identifies decreasing trends at a 95% confidence level. Milorganite concentrations are decreasing, but a Kendall Trend Test identifies a decreasing trend at only a 90% confidence level. In contrast, at both Jones Island and South Shore, effluent mercury concentrations and masses are increasing. Even when outliers are eliminated, the trend is increasing or stable. For the purpose of this analysis, outliers were defined as results more than two standard deviations from the average. Agri-Life concentrations are stable.

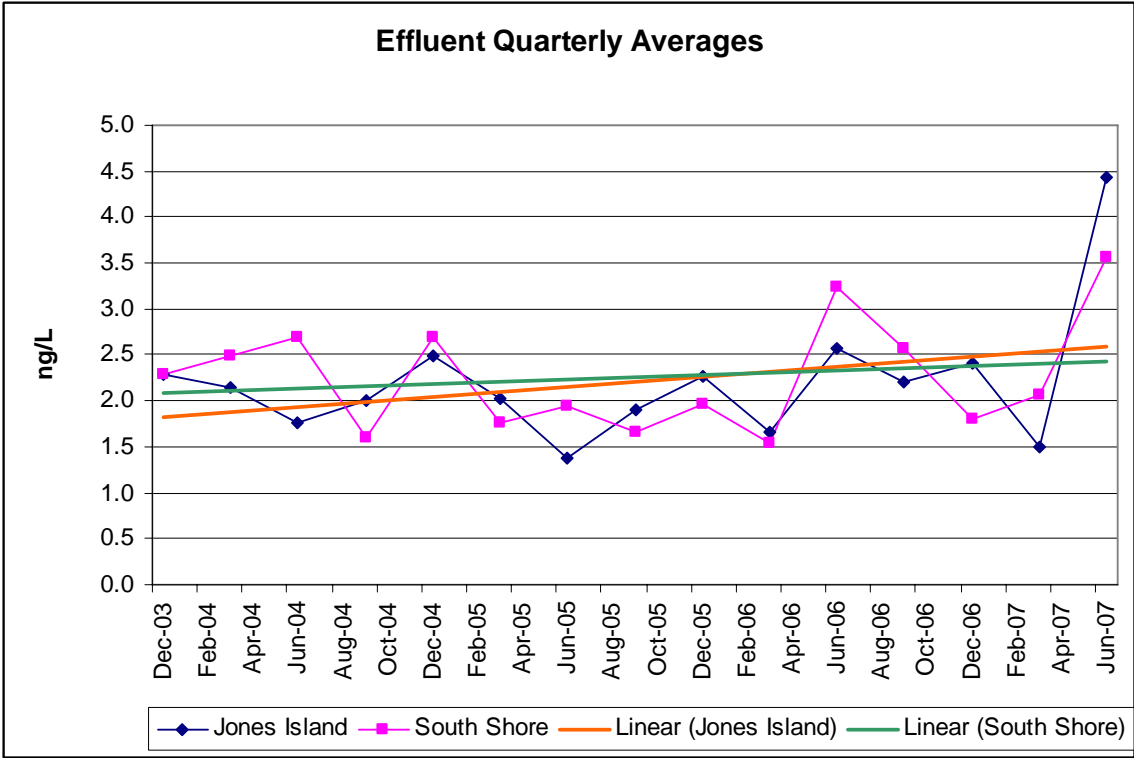
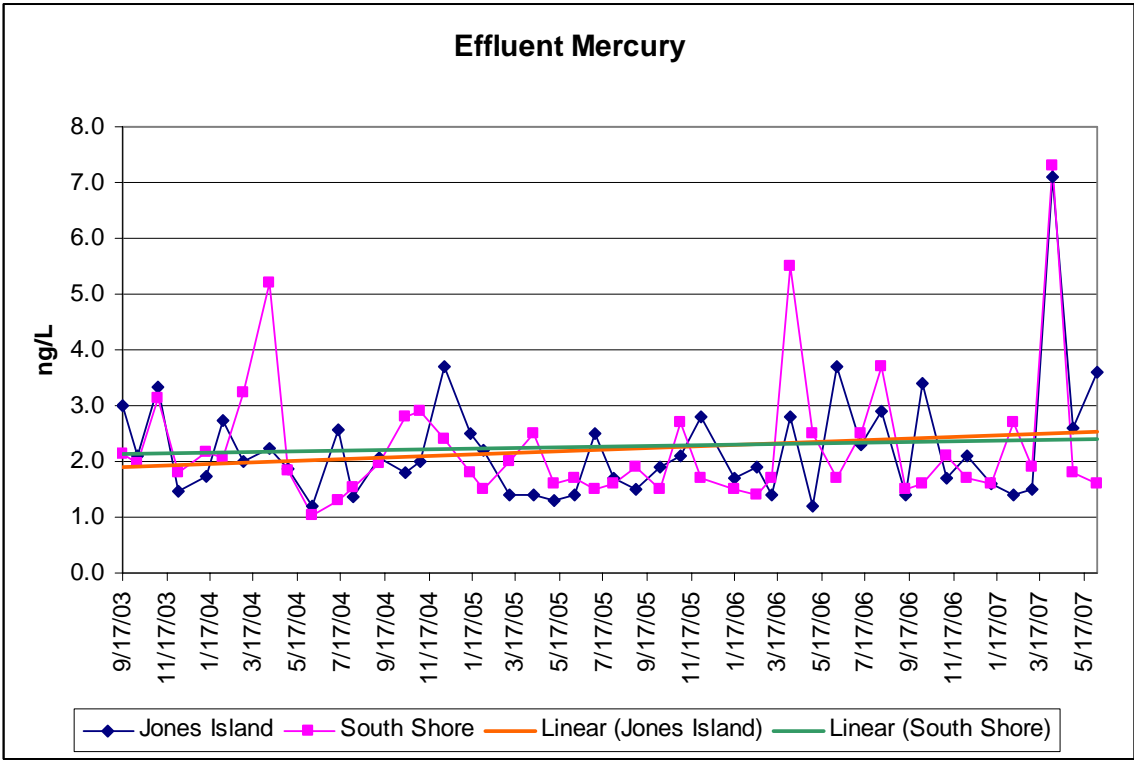
Effluent concentrations show a correlation with flow and total suspended (TSS) concentrations. A possible explanation is that mercury performance is related to TSS performance and TSS removal tends to decrease as flows increase. In contrast, influent concentration does not correlate with flow.

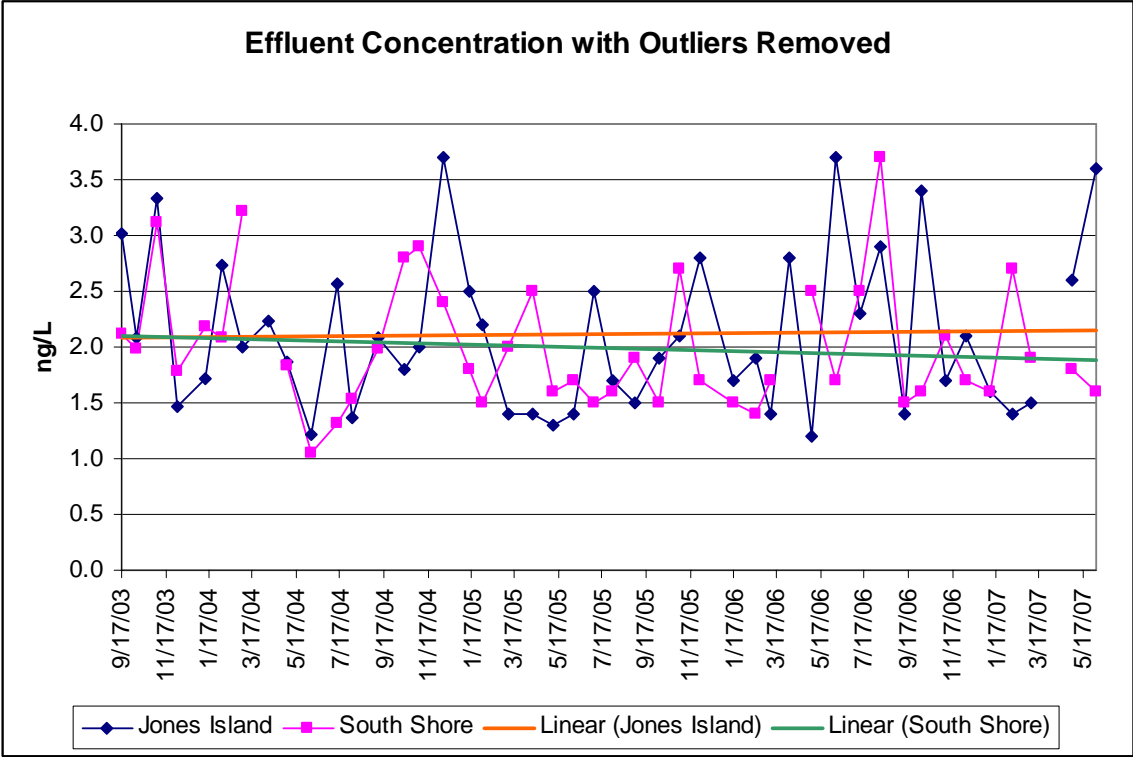
Effluent concentrations do not correlate with influent concentrations. For both Jones Island and South Shore, the trend line shows a slight increase in effluent concentration with decreasing influent concentration.

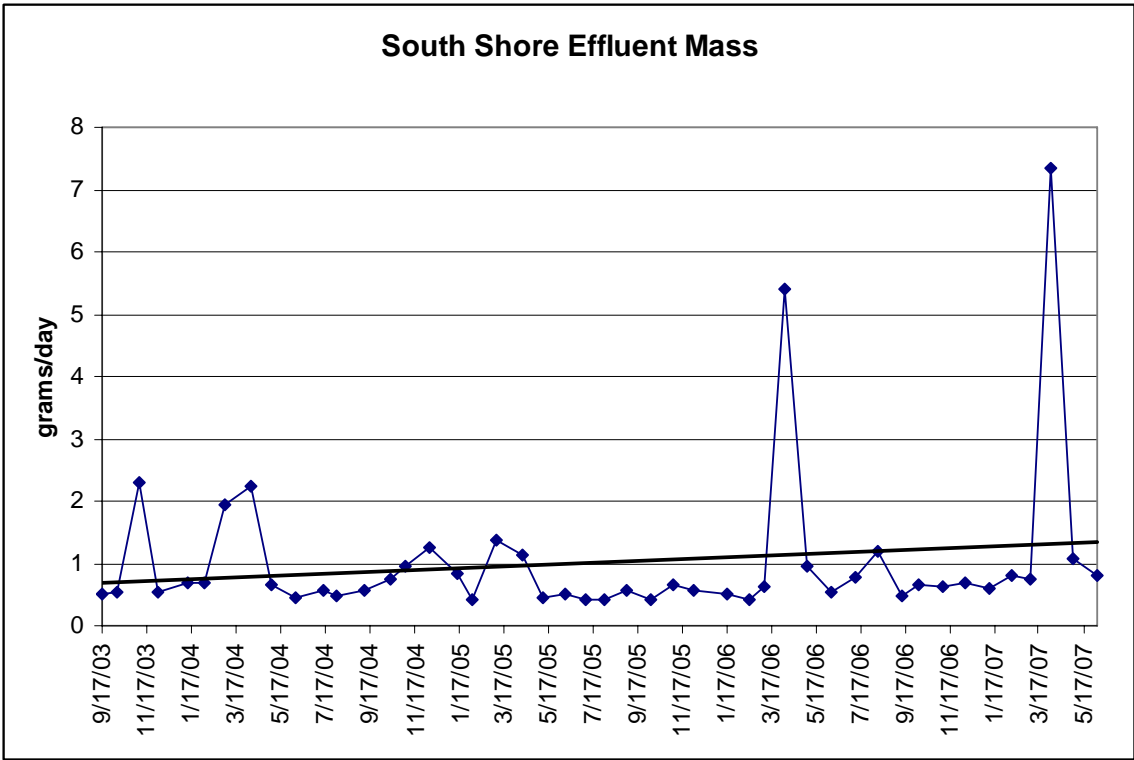
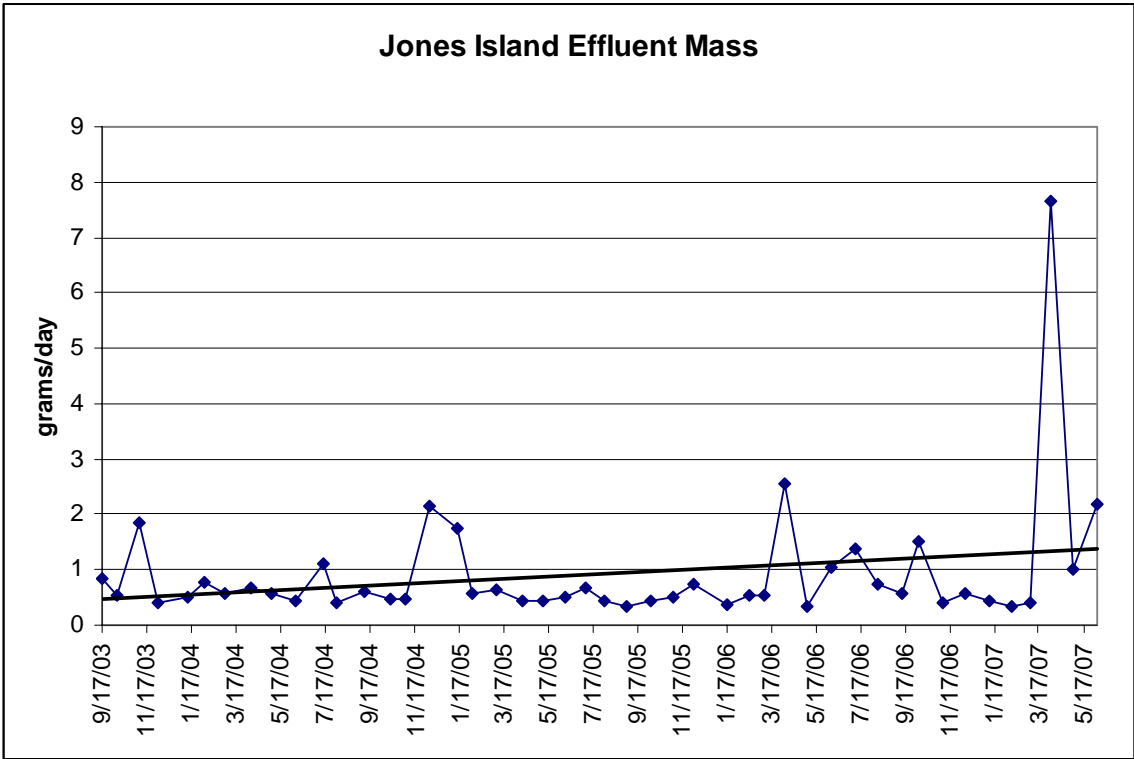


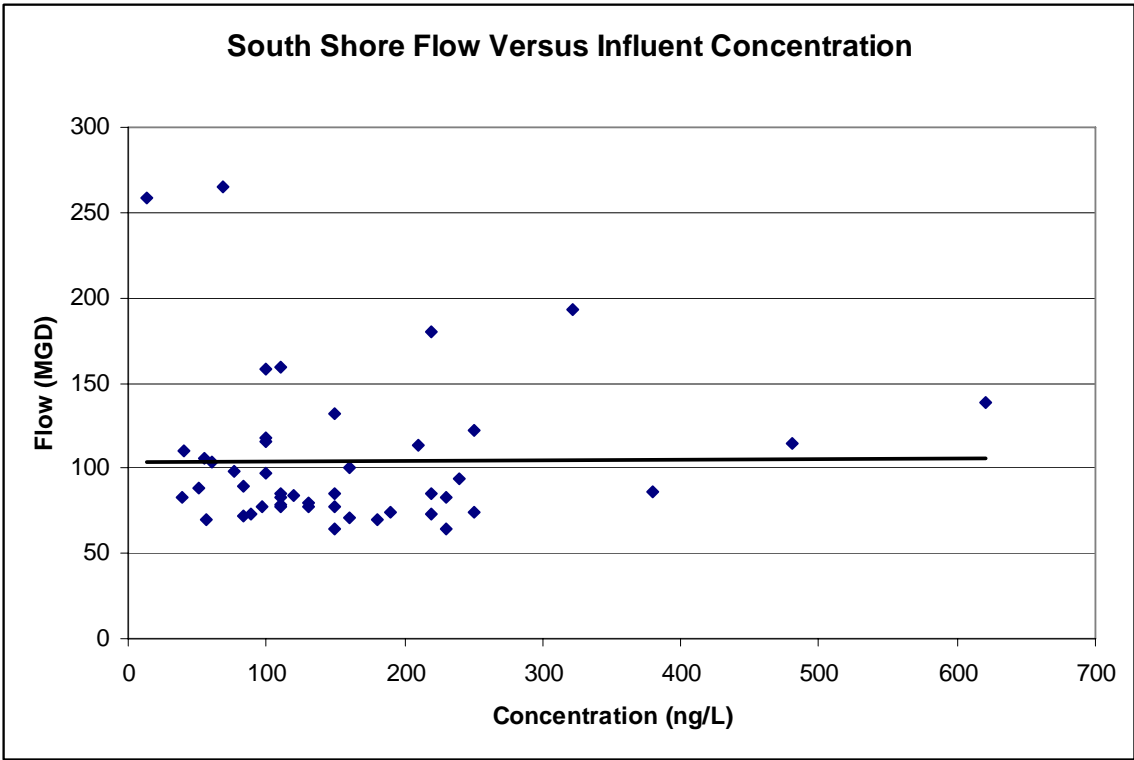
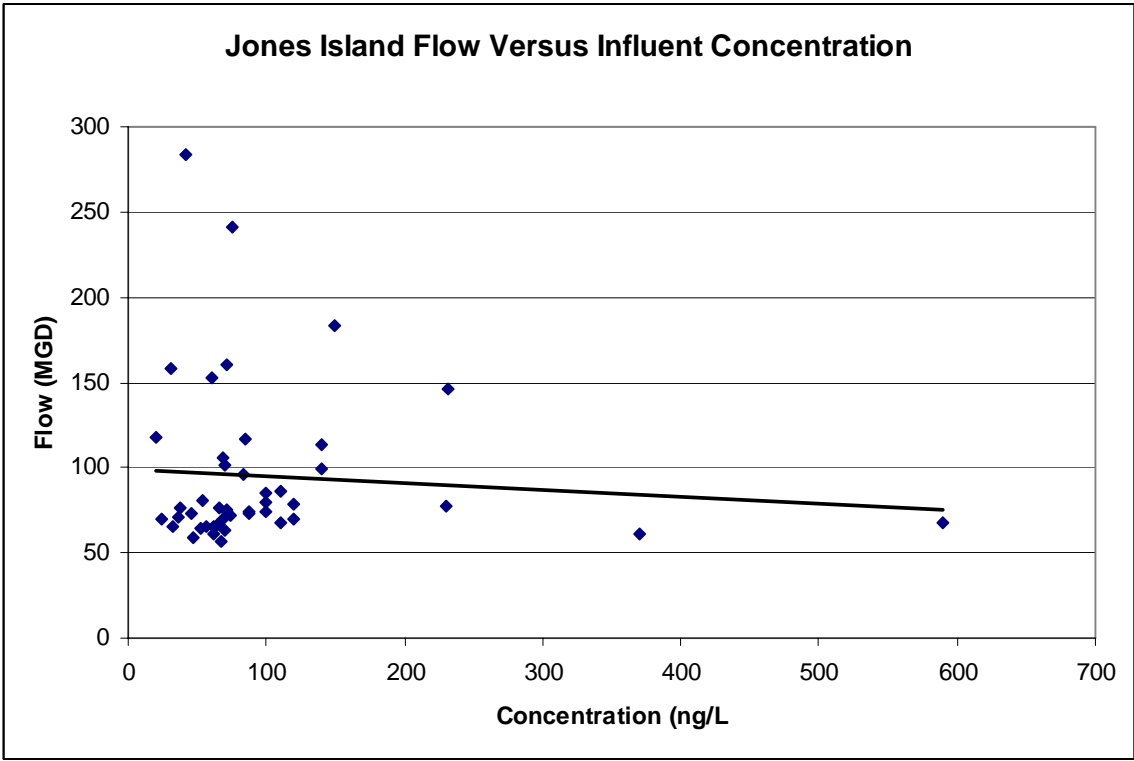


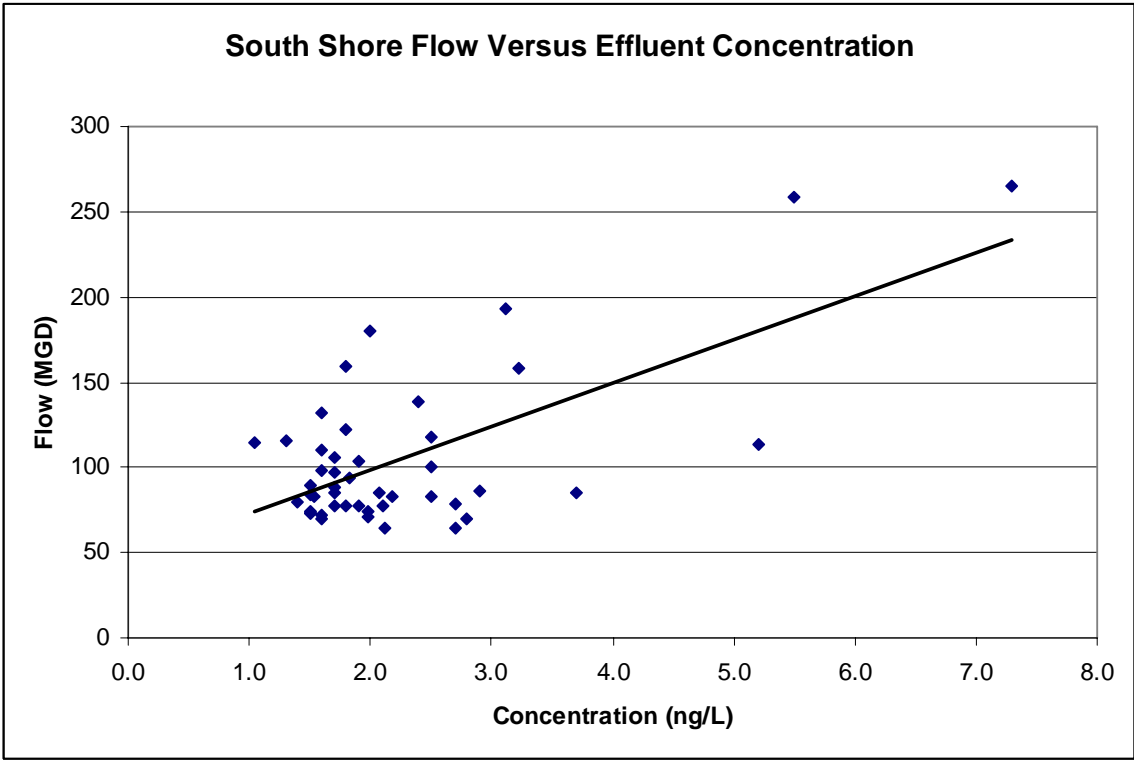
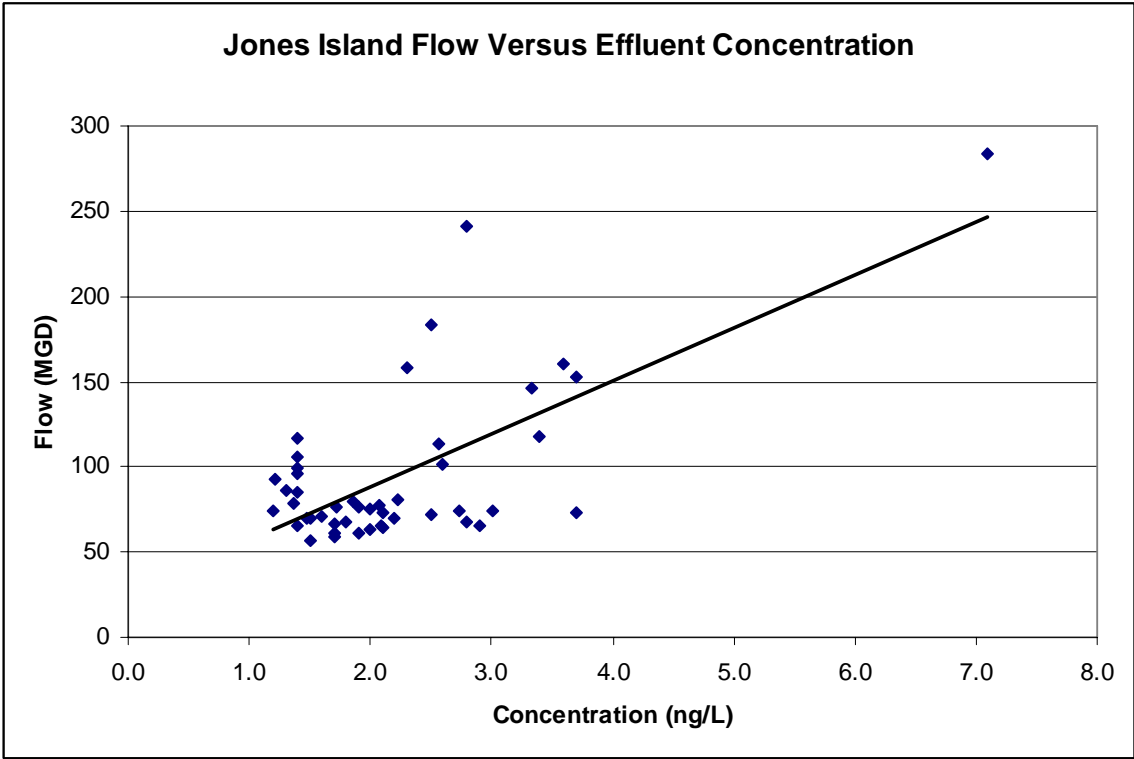


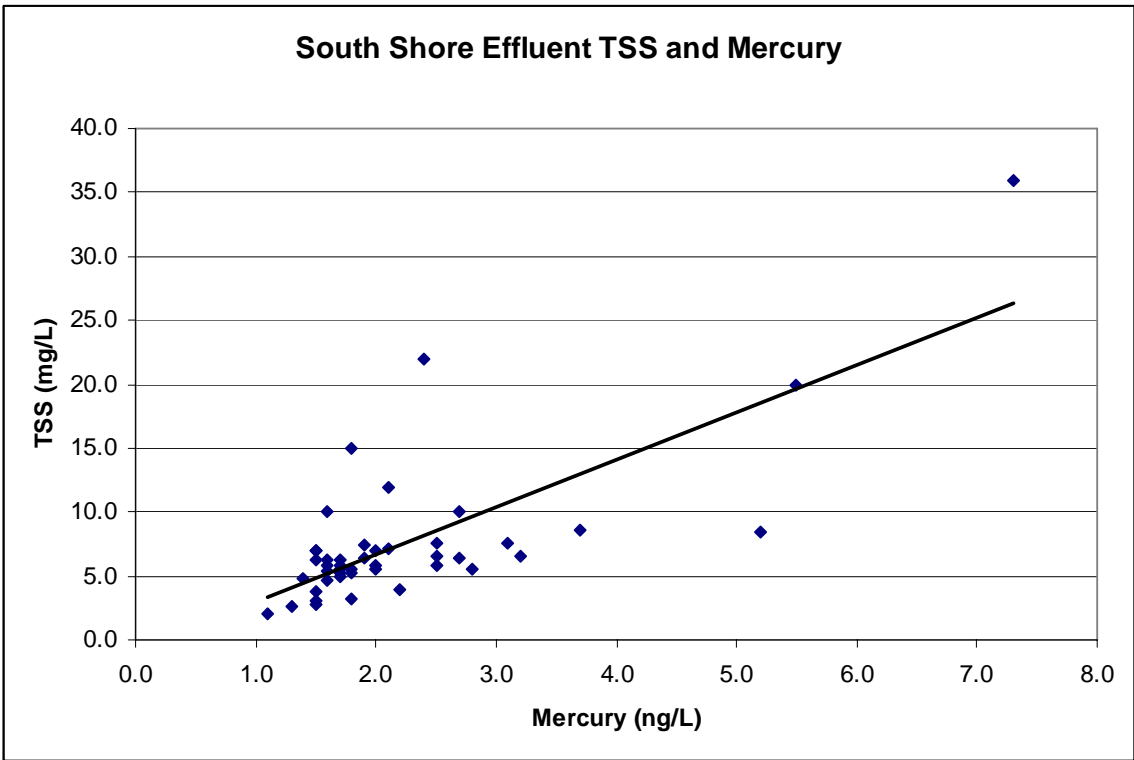
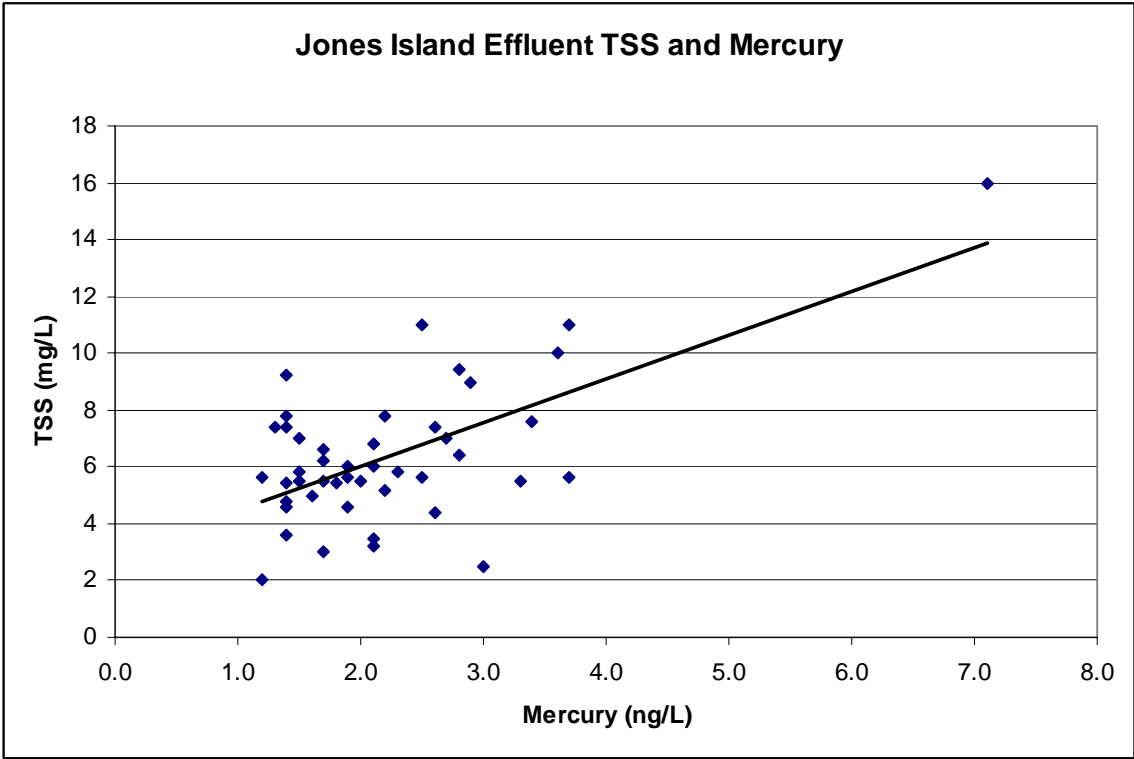




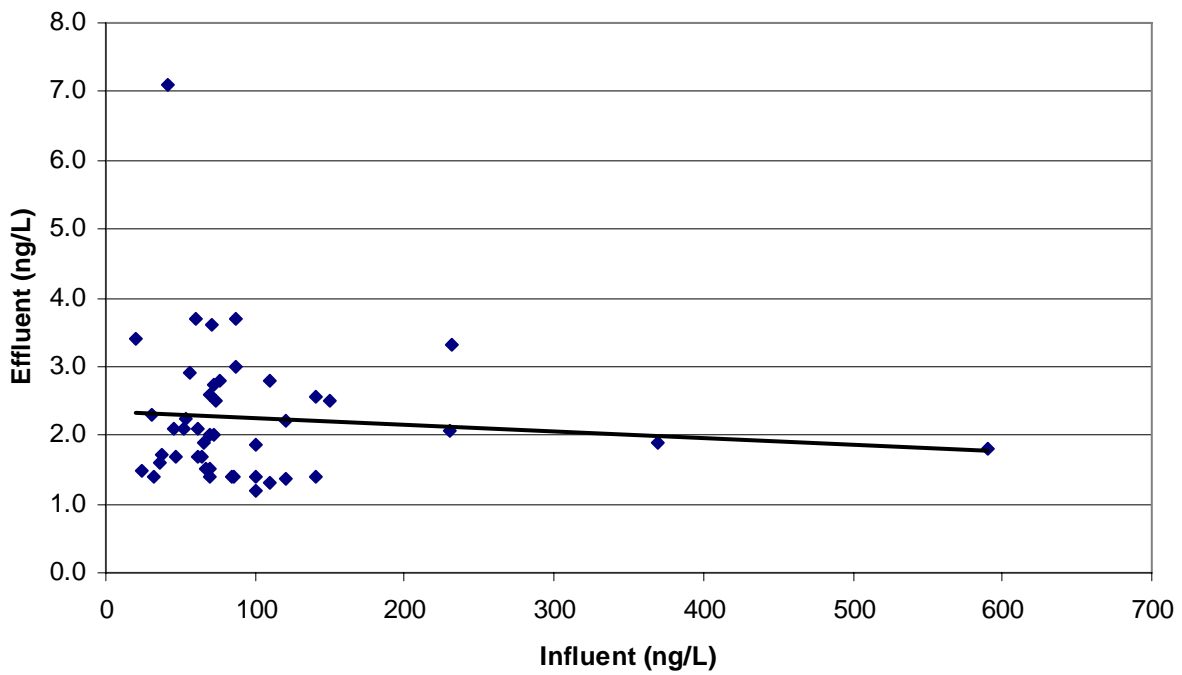




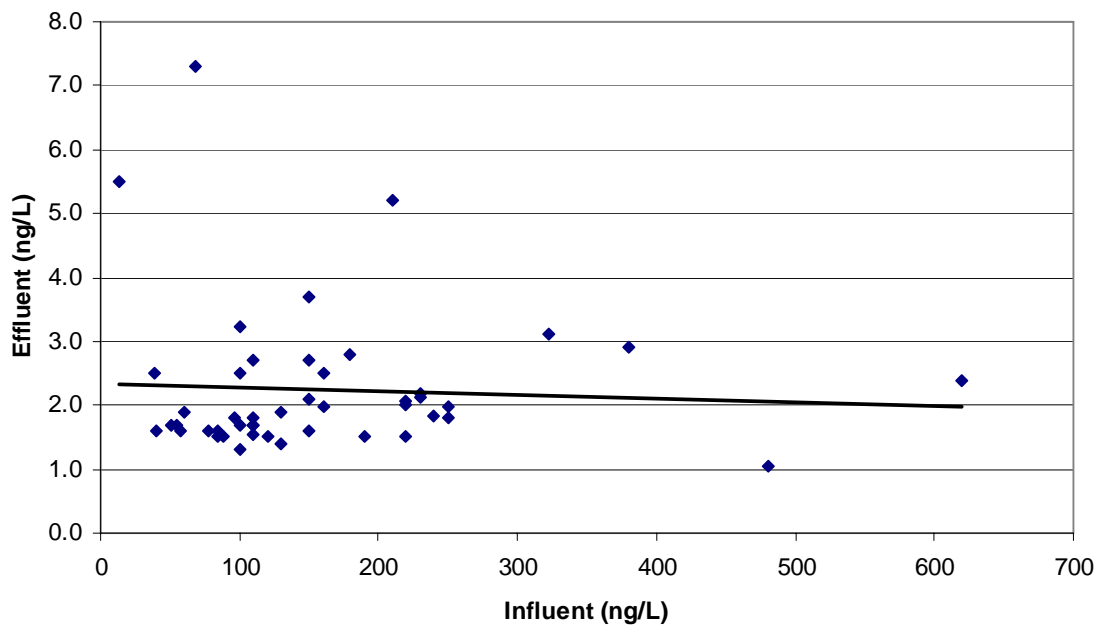




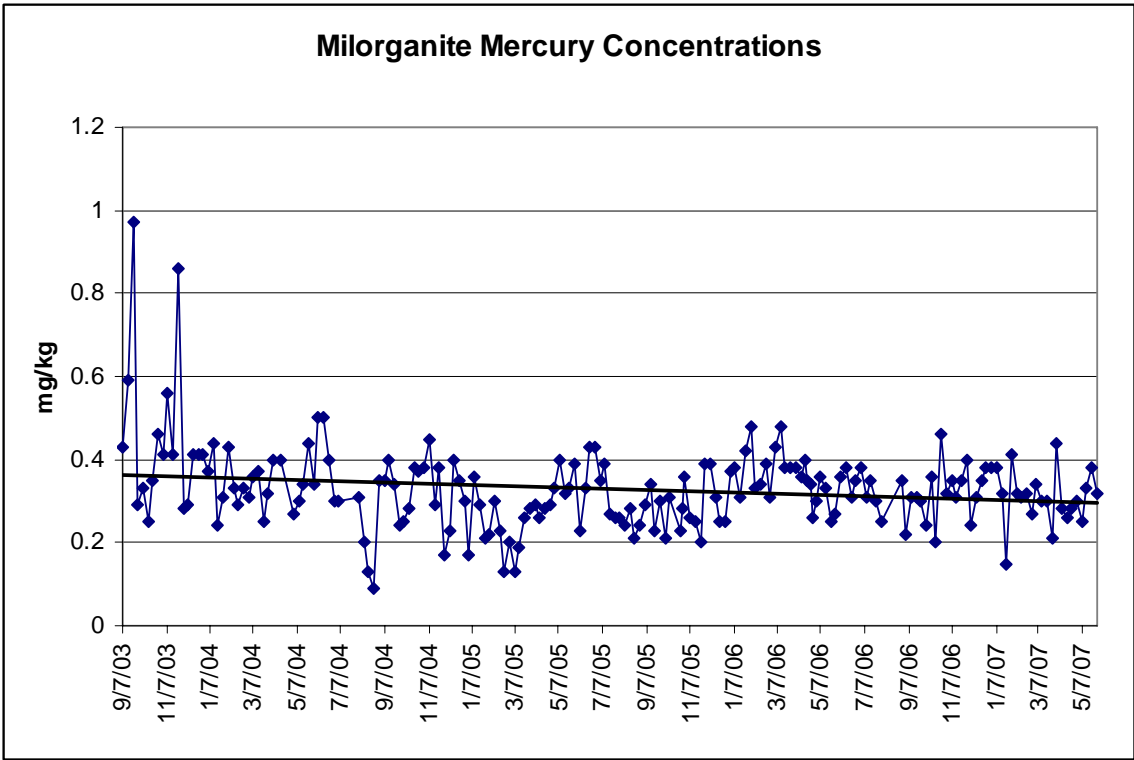
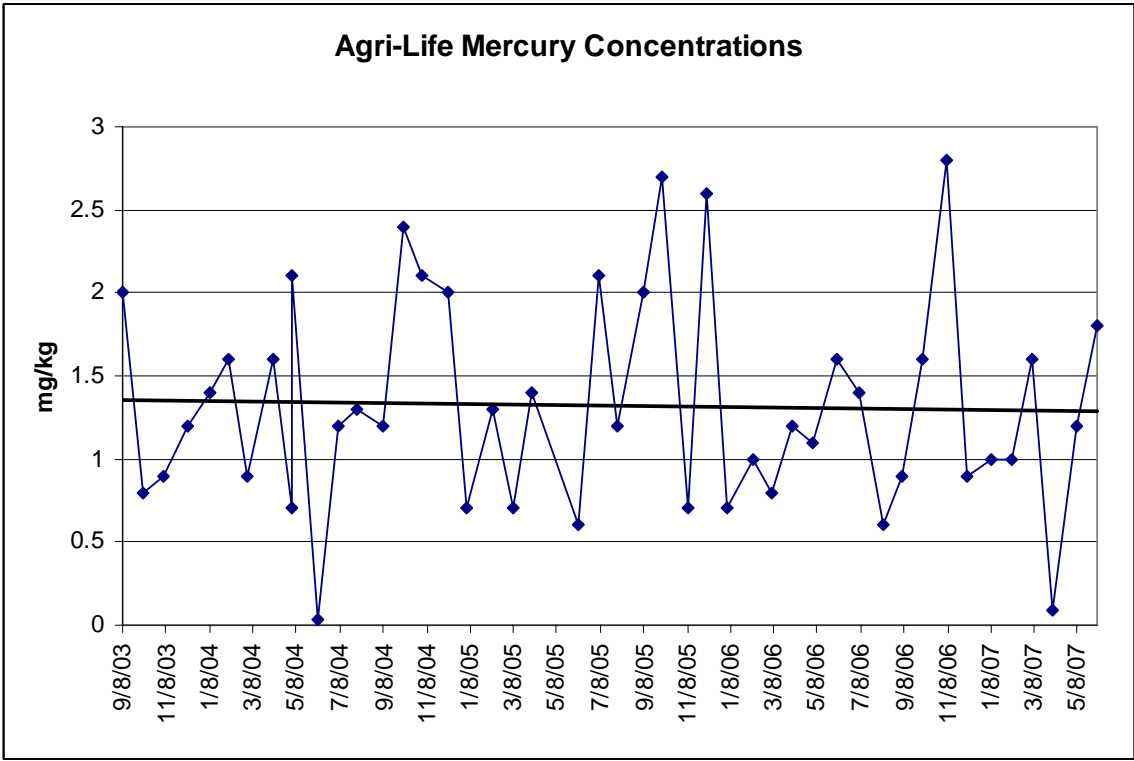
### Jones Island Influent Versus Effluent



### South Shore Influent Versus Effluent







## ENDNOTES TO ATTACHMENT 2 TO THE ADA COMMENTS

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- <sup>1</sup> There may be treatment plants where the concentration of mercury from other sources are so elevated that they may mask any reduction in mercury concentrations in influent or biosolids.
- <sup>2</sup> Milwaukee Metropolitan Sewer District, Source Reduction Effectiveness Analysis at 6 (May 2005), available at [http://www.mmsd.com/docs/wastewatertreatment/05-067\\_Source\\_Red\\_Eff\\_Analysis\\_Report.pdf](http://www.mmsd.com/docs/wastewatertreatment/05-067_Source_Red_Eff_Analysis_Report.pdf).
- <sup>3</sup> Milwaukee Metropolitan Sewer District, Source Reduction Effectiveness Analysis at 6 (May 2005), available at [http://www.mmsd.com/docs/wastewatertreatment/05-067\\_Source\\_Red\\_Eff\\_Analysis\\_Report.pdf](http://www.mmsd.com/docs/wastewatertreatment/05-067_Source_Red_Eff_Analysis_Report.pdf).
- .
- <sup>4</sup> Milwaukee Metropolitan Sewer District, Source Reduction Effectiveness Analysis at 6 (May 2005), available at [http://www.mmsd.com/docs/wastewatertreatment/05-067\\_Source\\_Red\\_Eff\\_Analysis\\_Report.pdf](http://www.mmsd.com/docs/wastewatertreatment/05-067_Source_Red_Eff_Analysis_Report.pdf).
- <sup>5</sup> Milwaukee Metropolitan Sewerage District, Mercury Data Summary at 4 to 6 (August 31, 2007) (Appendix 1 to this Attachment).
- <sup>6</sup> Milwaukee Metropolitan Sewerage District, Mercury Data Summary at 2 (August 31, 2007) (Appendix 1 to this Attachment).
- <sup>7</sup> Wichita Silver and Mercury BMP Program, Jamie G. Belden, Pretreatment Specialist, Power Point Presentation, available <[www.kansas.gov/uaa/sbcs/presentations/belden%20jamie%20p2%20case%20studies.pdf](http://www.kansas.gov/uaa/sbcs/presentations/belden%20jamie%20p2%20case%20studies.pdf)> at 12 of 34.
- <sup>8</sup> Wichita Silver and Mercury BMP Program, Jamie G. Belden, Pretreatment Specialist, Power Point Presentation, available <[www.kansas.gov/uaa/sbcs/presentations/belden%20jamie%20p2%20case%20studies.pdf](http://www.kansas.gov/uaa/sbcs/presentations/belden%20jamie%20p2%20case%20studies.pdf)> at 12 of 34.
- <sup>9</sup> Wichita Silver and Mercury BMP Program, Jamie G. Belden, Pretreatment Specialist, Power Point Presentation, available <[www.kansas.gov/uaa/sbcs/presentations/belden%20jamie%20p2%20case%20studies.pdf](http://www.kansas.gov/uaa/sbcs/presentations/belden%20jamie%20p2%20case%20studies.pdf)> at 18 of 34.
- <sup>10</sup> Wichita Silver and Mercury BMP Program, Jamie G. Belden, Pretreatment Specialist, Power Point Presentation, available <[www.kansas.gov/uaa/sbcs/presentations/belden%20jamie%20p2%20case%20studies.pdf](http://www.kansas.gov/uaa/sbcs/presentations/belden%20jamie%20p2%20case%20studies.pdf)> at 18 of 34.
- <sup>11</sup> An Assessment of Mercury in the Form of Amalgam in Dental Wastewater in the United States. Jay A. Vandeven and Steve L. McGinnis, Water, Air, and Soil Pollution (2005) 164: 349–366, Springer 2005 (“2005 Vandeven/McGinnis Article”).
- <sup>12</sup> Mercury in Municipal Wastewater. Tim Tuominen, WLSSD, Rebecca Flood, MCES (September 19, 2007) available at <<http://www.mn-ei.org/policy/images/HgTMDLmeetinginfo/WastewaterTreatment.pdf>> at 16 of 35.
- <sup>13</sup> Mercury in Municipal Wastewater. Tim Tuominen, WLSSD, Rebecca Flood, MCES (September 19, 2007) available at <<http://www.mn-ei.org/policy/images/HgTMDLmeetinginfo/WastewaterTreatment.pdf>> at 17 of 35.
- <sup>14</sup> Madison Metropolitan Sewerage District, Mercury Pollutant Minimization Program at 4 (PMP), available at <<http://www.madsewer.org/ProgramsAndInitiatives/Mercury/MercuryPMP.pdf>>.
- <sup>15</sup> Madison Metropolitan Sewerage District, Mercury Pollutant Minimization Program at 4 (PMP), available at <<http://www.madsewer.org/ProgramsAndInitiatives/Mercury/MercuryPMP.pdf>>.
- <sup>16</sup> Madison Metropolitan Sewerage District, Mercury Pollutant Minimization Program at Appendix C (PMP).
- <sup>17</sup> Madison Metropolitan Sewerage District, Mercury Pollutant Minimization Program at Appendix C (PMP) ), available at <<http://www.madsewer.org/ProgramsAndInitiatives/Mercury/MercuryPMP.pdf>>.

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- <sup>18</sup> Mercury in Municipal Wastewater. Tim Tuominen, WLSSD, Rebecca Flood, MCES (September 19, 2007) available at <<http://www.mn-ei.org/policy/images/HgTMDLmeetinginfo/WastewaterTreatment.pdf>> at 27 of 35.
- <sup>19</sup> Mercury in Municipal Wastewater. Tim Tuominen, WLSSD, Rebecca Flood, MCES (September 19, 2007) available at <<http://www.mn-ei.org/policy/images/HgTMDLmeetinginfo/WastewaterTreatment.pdf>> at 31 of 35.
- <sup>20</sup> Clean Bay Pollution Prevention Plan 2007: The Pollution Prevention Plan for the City of Palo Alto's Regional Water Quality Control Plant at 35 (February 2007), available at <<http://www.city.palo-alto.ca.us/civica/filebank/blobdload.asp?BlobID=7149>> at 49 of 231.
- <sup>21</sup> City of Palo Alto, Advanced Mercury Source Control Study, 2004 Annual Report of Activity at page 3 of 22 (February 2005), available at <<http://www.city.palo-alto.ca.us/civica/filebank/blobdload.asp?BlobID=3741>>.
- <sup>22</sup> Clean Bay Pollution Prevention Plan 2007: The Pollution Prevention Plan for the City of Palo Alto's Regional Water Quality Control Plant at 34 (February 2007), available at <<http://www.city.palo-alto.ca.us/civica/filebank/blobdload.asp?BlobID=7149>> (48 OF 231 of the pdf).
- <sup>23</sup> EBMUD Wastewater Department, 2006 Pretreatment and Pollution Prevention Report at 3-18 (2006), , available at [http://www.ebmud.com/wastewater/industrial\\_&\\_commercial\\_permits\\_&\\_fees/pollution\\_prevention\\_program/annual\\_report/ww\\_pollution\\_prevention\\_annualreport\\_2006.pdf](http://www.ebmud.com/wastewater/industrial_&_commercial_permits_&_fees/pollution_prevention_program/annual_report/ww_pollution_prevention_annualreport_2006.pdf) (page 37 of 142 in the pdf) and BUD, Mercury Control at Dental Facilities – A Cost-Effective Model, NACWA 2006 National Pretreatment and Pollution Prevention Workshop at 16 of 18, available at <<http://archive.nacwa.org/getfile.cfm?fn=2006pret-b.horenstein.ppt>>. Unfortunately, the Power Point presentation does not illustrate the effluent data.
- <sup>24</sup> EBMUD Wastewater Department, 2006 Pretreatment and Pollution Prevention Report at 6-7 (2006), available at <[http://www.ebmud.com/wastewater/industrial\\_&\\_commercial\\_permits\\_&\\_fees/pollution\\_prevention\\_program/annual\\_report/ww\\_pollution\\_prevention\\_annualreport\\_2006.pdf](http://www.ebmud.com/wastewater/industrial_&_commercial_permits_&_fees/pollution_prevention_program/annual_report/ww_pollution_prevention_annualreport_2006.pdf)>.
- <sup>25</sup> East Bay Municipal Utility District (“EBMUD”) Wastewater Department, 2006 Pretreatment and Pollution Prevention Report at 3-18 (2006), available at <[http://www.ebmud.com/wastewater/industrial\\_&\\_commercial\\_permits\\_&\\_fees/pollution\\_prevention\\_program/annual\\_report/ww\\_pollution\\_prevention\\_annualreport\\_2006.pdf](http://www.ebmud.com/wastewater/industrial_&_commercial_permits_&_fees/pollution_prevention_program/annual_report/ww_pollution_prevention_annualreport_2006.pdf)>.
- <sup>26</sup> Installation of separators resulted, according to the Narragansett Bay Commission resulted in 17% and 23% reductions in influent mercury at Field’s Point and Bucklin Point respectively. Narragansett Bay Commission, Protecting the Environment with Passion and Integrity, ANNUAL REPORT | 2005 (2006), available at <[http://www.narrabay.com/Documents/PDFs/NBC\\_Annual\\_Report\\_FY05.pdf](http://www.narrabay.com/Documents/PDFs/NBC_Annual_Report_FY05.pdf)>.
- <sup>27</sup> Narragansett Bay Commission, Environmental Monitoring and Data Analysis, 2005 Monitoring Data at 40-42 and 47-49 of 111 (October 2006), available at <<http://www.narrabay.com/Documents/EMDA/Attachments%20All.pdf>> at 42-44 and 49-51 of 111.
- <sup>28</sup> Some of the preliminary results of the NACWA study were presented at the NACWA 2007 Pretreatment meeting. *See* Managing Mercury, Other Metals, and More, Elizabeth Toot-Levy – Moderator, Northeast Ohio Regional Sewer District, available at <<http://www.nacwa.org/images/stories/public/07pret/2007pret-e.toot-levy.pdf>>..

**TABLE OF MANDATORY AND RECOMMENDED SEPARATOR REQUIREMENTS**

<b>JURISDICTION</b>	<b>DATE</b>	<b>ACTION</b>	<b>Dental Offices</b>	<b>Population</b>
<b>MANDATORY SEPARATORS --- STATES</b>				
<b>Connecticut</b>	Legislation: 2003.	Although there is no specific mention of separators in the law, the state Department of Environmental Protection interprets the requirement that dentists follow “Best Management Practices” as requiring the installation of amalgam separators.	1,732 <sup>1</sup>	3,504,809
<b>Maine</b>	Legislation: 2003.	Expressly requires dentists to install separators.	478 <sup>2</sup>	1,321,574
<b>Massachusetts</b>	Regulations	Separators installed after 2006 to achieve 98 percent removal efficiency. Separators voluntarily installed before the effective date of the regulations need to only achieve the ISO standard of 95 percent removal efficiency.	3,050 <sup>3</sup>	6,437,193

**TABLE OF MANDATORY AND RECOMMENDED SEPARATOR REQUIREMENTS**

<b>JURISDICTION</b>	<b>DATE</b>	<b>ACTION</b>	<b>Dental Offices</b>	<b>Population</b>
<b>MANDATORY SEPARATORS --- STATES</b>				
<b>New Hampshire</b>	Legislation: 2002 Regulations: 2005	requires installation of separators (“environmentally appropriate disposal equipment for amalgam waste to trap and dispose of mercury” Implementing.	560 <sup>4</sup>	1,314,895
<b>New Jersey</b>	Regulation: October 1, 2007 [N.J.A.C. 7:14A-21.12(a)].	Separator required within two years ISO 11143 test protocol to perform at 98% or more efficiency, Draft regulations (July 2007): separators for offices that discharge waste into septic and private waste water systems. Exempts orthodontists, periodontists, endodontists, or oral and maxillofacial surgeons/radiologists/pathologists. DEP comments: prosthodontists are not exempt.	4,546 <sup>5</sup>	8,724,560
<b>New York</b>	Regulations: Effective in 2006.	Requires installation of separators achieving a 99 percent removal efficiency; Separators voluntarily installed before the effective date of the requirement are expected to achieve the ISO standard of 95 percent removal efficiency.	9,017 <sup>6</sup>	19,306,183
<b>New Mexico</b>	Bill pending, not enacted as of Dec. 2007	Requires separators	593 <sup>7</sup>	1,954,599

**TABLE OF MANDATORY AND RECOMMENDED SEPARATOR REQUIREMENTS**

<b>JURISDICTION</b>	<b>DATE</b>	<b>ACTION</b>	<b>Dental Offices</b>	<b>Population</b>
<b>MANDATORY SEPARATORS --- STATE</b>				
<b>Oregon</b>	Leg. 2007 (SB 704)	Requires adherence to the Oregon Dental Association's BMP and amalgam separators (ISO standard of 95 percent removal efficiency). Dental offices constructed after January 1, 2008 separator installed when open; Existing offices: Either January 1, 2008 or, if they receive certification from the local wastewater that they are in compliance with the BMPs by the end of 2007, they can delay installing a separator until January 1, 2011. All mercury-containing dental waste must be stored in a labeled vapor-proof container and may not be incinerated.	1,825 <sup>8</sup>	3,700,758
<b>Rhode Island</b>	Leg.: 2006.	Department of Environmental Management (DEM) to develop "best management practices requiring an amalgam removal efficiency of at least 99 percent" [i.e., separators]. Another section of the same law requires installation of a separator that conforms to ISO standard 11143.	412 <sup>9</sup>	1,067,610
<b>Vermont</b>	Leg.: 2005	Requires installation of separators with a removal efficiency of 95 percent.	263 <sup>10</sup>	623,908

**TABLE OF MANDATORY AND RECOMMENDED SEPARATOR REQUIREMENTS**

<b>JURISDICTION</b>	<b>DATE</b>	<b>ACTION</b>	<b>Dental Offices</b>	<b>Population</b>
<b>MANDATORY SEPARATORS --- MUNICIPALITIES</b>				
<b>Duluth, MN</b> Western Lake Superior region <b>(Duluth, Cloquet, Hermantown, Proctor, Carlton, Scanlon, Thomson and Wrenshall, and the surrounding townships).</b>		Sewer authority paid for and installed separators. To date, all of them have apparently done so <sup>11</sup> .	57 <sup>12</sup>	84,167
<b>Fort Collins, and Boulder, CO</b>	Ordinance <sup>13</sup>	Requires separators effective July 1, 2005.		<b>Fort Collins:</b> 129,467 <sup>14</sup> <b>Boulder:</b> 117,520 <sup>15</sup>

**TABLE OF MANDATORY AND RECOMMENDED SEPARATOR REQUIREMENTS**

JURISDICTION	DATE	ACTION	Dental Offices	Population
<b>MANDATORY SEPARATORS --- MUNICIPALITIES</b>				
<p><b>Madison Metropolitan Sewerage District, WI</b></p> <p><b>Fitchburg Cottage Grove Blooming Grove</b></p> <p><b>Madison Dane Blooming Grove – Waunona SD No. 2</b></p> <p><b>Middleton DeForest Blooming Grove #10 Monona Male Bluff Town of Burke</b></p> <p><b>Verona McFarland Burke No. 1</b></p> <p><b>Shorewood Hills Burke No. 2</b></p> <p><b>Waunakee Burke No. 6</b></p>	<p>Mercury Pollutant Minimization Program (PMP) September 30, 2007</p>	<p>As of 2006: 22.3% voluntary separators. 100% compliance with the amalgam separator installation requirement by December 31, 2008</p> <p>Mercury concentration in effluent from 2004 to 2006 relatively constant</p>		<p>223,389<sup>16</sup></p>
<p><b>Milwaukee Metropolitan Sewerage District</b></p>	<p>Ordinance</p>	<p>Requires amalgam separators</p>	<p>500<sup>17</sup></p>	<p>1.1 million people in a 420 square-mile service area<sup>18</sup></p>



**TABLE OF MANDATORY AND RECOMMENDED SEPARATOR REQUIREMENTS**

<b>JURISDICTION</b>	<b>DATE</b>	<b>ACTION</b>	<b>Dental Offices</b>	<b>Population</b>
<b>MANDATORY SEPARATORS --- MUNICIPALITIES</b>				
<b>Palo Alto, East Palo Alto, Los Altos, Los Altos Hills, and Mountain View, CA</b>	Ordinance	Separators installed by 2005  100% Compliance (EPA-HQ-OW-2006-0771-0463(	132 <sup>19</sup>	<b>Palo Alto:</b> 57,809 <sup>20</sup> <b>East Palo Alto:</b> 32,784 <b>Los Altos Hills:</b> 8,308 <b>Mountain View:</b> 70,090
<b>San Francisco and surrounding Bay Area communities, CA--The cities are: East Palo Alto, Los Altos, Los Altos Hills, Mountain View, Palo Alto, Richmond Annex, and the Union</b>	Ordinance	A San Francisco ordinance provides that dentists must obtain a permit and either monitor their dental office wastewater or install a separator to be deemed in compliance.	520 eventually will install separator 339 of the 520 (65.2%) have installed an amalgam separator <sup>21</sup>	<b>San Francisco:</b> 744,041 <sup>22</sup> <b>East Palo Alto:</b> 32,784 <b>Los Altos:</b> 27,483 <b>Los Altos Hills:</b> 8,308 <b>Mountain View:</b> 70,090 <b>Palo Alto:</b> 57,809 <b>Richmond Annex:</b> 102,120
<b>Sanitary District (Fremont, Newark and Union City)</b>	Ordinance	A San Francisco ordinance provides that dentists must obtain a permit and either monitor their dental office wastewater or install a separator to be deemed in compliance.		

**TABLE OF MANDATORY AND RECOMMENDED SEPARATOR REQUIREMENTS**

<b>JURISDICTION</b>	<b>DATE</b>	<b>ACTION</b>	<b>Dental Offices</b>	<b>Population</b>
<b>MANDATORY SEPARATORS --- MUNICIPALITIES</b>				
<b>East Bay Municipal Utility District (Alameda Albany Berkely El Cerrito Emeryville Kensington Oakland Piedmont)</b>	Our wastewater system serves approximately 640,000 people in an 83-square-mile area of Alameda and Contra Costa counties along the Bay's east shore, extending from Richmond on the north, southward to San Leandro.		312 <sup>23</sup>	<b>Alameda:</b> 70,699 <b>Albany:</b> 15,965 <b>Berkeley:</b> 101,555 <b>El Cerrito:</b> 22,600 <b>Emeryville:</b> 8,751 <b>Kensington:</b> 4,936 <b>Oakland:</b> 397,067 <b>Piedmont:</b> 10,540

**TABLE OF MANDATORY AND RECOMMENDED SEPARATOR REQUIREMENTS**

<b>JURISDICTION</b>	<b>DATE</b>	<b>ACTION</b>	<b>Dental Offices</b>	<b>Population</b>
<b>MANDATORY SEPARATORS --- MUNICIPALITIES</b>				
<b>KING COUNTY, WA (Alderwood, Algona, Auburn, Bellevue, Black Diamond, Bothell, Brier, Carnation, Cedar River, Coal Creek, Cross Valley, Highlands Sewer District, Issaquah, Kent, Kirkland, Lake Forest Park, Lakehaven, Mercer Island, Muckleshoot Indian Tribe, Northeast Sammamish, Northshore, Olympic View, Pacific, Redmond, Renton, Ronald Sammamish Plateau, Seattle, Skyway, Soos Creek, Tukwila, Valley View, Vashon, Woodinville</b>	Ordinance	Requires dentists to adhere to numerical limits for discharge and be subject to fines for violations or to install an amalgam separator and be deemed in compliance.	1,500 <sup>24</sup>	1,826,732 <sup>25</sup>

**TABLE OF MANDATORY AND RECOMMENDED SEPARATOR REQUIREMENTS**

<b>JURISDICTION</b>	<b>DATE</b>	<b>ACTION</b>	<b>Dental Offices</b>	<b>Population</b>
<b>MANDATORY SEPARATORS --- MUNICIPALITIES</b>				
<b>Solon, Ohio</b>	Ordinance	Requires dentists to install separators		22,257 <sup>26</sup>
<b>Wichita, KS</b>	Ordinance	Requires a two-phase program. Phase I is the purchase and installation of certain equipment, filters, etc; beyond the ordinary traps and filters; Phase II would have required installation of separators in 2004 if City didn't achieve expected reductions from Phase I. In 2003, about <b>80%</b> of dentists did install separators during Phase I, so there was no need to implement Phase II.	200 <sup>27</sup>	357,698 <sup>28</sup>
<b>Narragansett Bay area, Rhode Island</b>		Amalgam separators are considered part of BMPs by Narragansett Bay Commission	State rule means all dental offices are covered (see Rhode Island entry)	360,000 <sup>29</sup>
<b>Los Angeles, CA</b>	Ordinance	Requires BMPs	1,200 <sup>30</sup>	3,849,378 <sup>31</sup>
<b>NE Ohio (NEORS)</b>	Administrative orders to 1,100 service area dentists.(April 1, 2002,)	Requires BMPs Recommends separators	1,100 <sup>32</sup>	4,500,000 <sup>33</sup>

**TABLE OF MANDATORY AND RECOMMENDED SEPARATOR REQUIREMENTS**

<b>JURISDICTION</b>	<b>DATE</b>	<b>ACTION</b>	<b>COMPLIANCE</b>	<b>Population</b>
<b>MANDATORY --- MUNICIPALITIES</b>				
				<b>Sum of Population Covered by a Mandatory Separators</b>  <b>47,956,089</b>
				<b>Total Percent of the US Population</b> <b>16%</b>

**TABLE OF MANDATORY AND RECOMMENDED SEPARATOR REQUIREMENTS**

<b>JURISDICTION</b>	<b>DATE</b>	<b>ACTION</b>	<b>DENTAL OFFICES</b>	<b>Population</b>
<b>STATE/MUNICIPAL RECOMMENDED PROGRAM</b>				
<b>Colorado-</b>	Colorado-Colorado Dental Association agreement	Recommends separators	2,366 <sup>34</sup>	4,753,377
<b>Wisconsin</b>	Wisconsin—Dane County. Wisconsin Dental Association and Dane County Dental Society agreement	Recommends separators	2,023 <sup>35</sup>	5,556,506
<b>Washington State (outside of King County)</b>	Memorandum of Understanding <sup>36</sup>	Separator installation rates increased to 80% from 2003 to 2005 <sup>37</sup>	2,102 <sup>38</sup>	4,569,066
<b>Minneapolis-St. Paul, MN</b>	MCES-State Dental Association agreement	Recommends separators 99% compliance	724 <sup>39</sup>	372,833 and 273,535

**TABLE OF MANDATORY AND RECOMMENDED SEPARATOR REQUIREMENTS**

<b>JURISDICTION</b>	<b>DATE</b>	<b>ACTION</b>	<b>DENTAL OFFICES</b>	<b>Population</b>
<b>STATE MERCURY REDUCTION PROGRAM --- UNCERTAIN</b>				
				<b>Sum of Population Covered by guidance 11.232 million</b>
				<b>Total Percent of the US Population 3.7%</b>
<b>SUMMARY STATE/MUNICIPAL RECOMMENDED OR VOLUNTARY PROGRAM</b>				
			<b>Total number of dental offices = 122,918</b> <b>Dentist that use amalgam ~36,798</b>	<b>Sum of Population Covered by Mandatory and Voluntary Separators 63,481,406</b>
			<b>Total percent of dental offices covered by Mandatory or Recommended Separators</b> <b>28.7%</b>	<b>Total Percent of the US Population Covered by Mandatory and Recommended Separators</b> <b>21.1%</b>

<sup>1</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Best Management Practices: Separators: Summary of Effectiveness, Current Use and Cost (DCN 04852) at Appendix 1 (September 26, 2007).

<sup>2</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Best Management Practices: Separators: Summary of Effectiveness, Current Use and Cost (DCN 04852) at Appendix 1 (September 26, 2007).

<sup>3</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Best Management Practices: Separators: Summary of Effectiveness, Current Use and Cost (DCN 04852) at Appendix 1 (September 26, 2007).

<sup>4</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Best Management Practices: Separators: Summary of Effectiveness, Current Use and Cost (DCN 04852) at Appendix 1 (September 26, 2007).

## TABLE OF MANDATORY AND RECOMMENDED SEPARATOR REQUIREMENTS

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<sup>5</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Best Management Practices: Separators: Summary of Effectiveness, Current Use and Cost (DCN 04852) at Appendix 1 (September 26, 2007).

<sup>6</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Best Management Practices: Separators: Summary of Effectiveness, Current Use and Cost (DCN 04852) at Appendix 1 (September 26, 2007).

<sup>7</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Best Management Practices: Separators: Summary of Effectiveness, Current Use and Cost (DCN 04852) at Appendix 1 (September 26, 2007).

<sup>8</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Best Management Practices: Separators: Summary of Effectiveness, Current Use and Cost (DCN 04852) at Appendix 1 (September 26, 2007).

<sup>9</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Best Management Practices: Separators: Summary of Effectiveness, Current Use and Cost (DCN 04852) at Appendix 1 (September 26, 2007).

<sup>10</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Best Management Practices: Separators: Summary of Effectiveness, Current Use and Cost (DCN 04852) at Appendix 1 (September 26, 2007).

<sup>11</sup> Amalgam Waste Management - Issues and Answers, available at <<http://www.p2pays.org/ref%5C04/03853.pdf>>.

<sup>12</sup> Mercury in Municipal Wastewater. Tim Tuominen, WLSSD, Rebecca Flood, MCES (September 19, 2007) available at <<http://www.mn-ei.org/policy/images/HgTMDLmeetinginfo/WastewaterTreatment.pdf>> at 15 of 35. 140 separators were installed in these offices. Id. at 16 of 35.

<sup>13</sup> [http://www.ci.boulder.co.us/files/Utilities/WRAB/August%2021,%202006/item2\\_attacha.pdf](http://www.ci.boulder.co.us/files/Utilities/WRAB/August%2021,%202006/item2_attacha.pdf).

<sup>14</sup> <http://fcgov.com/utilities/pdf/water-supply.pdf>

<sup>15</sup> [http://www.bouldercolorado.gov/files/Utilities/Projects/wwtp\\_mp\\_2007.pdf](http://www.bouldercolorado.gov/files/Utilities/Projects/wwtp_mp_2007.pdf) at 13 of 225.

<sup>16</sup> <http://www.madsewer.org/CommunitiesServed.htm>

<sup>17</sup> <http://www.mmsd.com/news/detail.cfm?id=10>.

<sup>18</sup> <http://www.mmsd.com/about/index.cfm>

<sup>19</sup> City of Palo Alto, Advanced Mercury Source Control Study, 2004 Annual Report of Activity at page 3 of 22 (February 2005), available at <<http://www.city.palo-alto.ca.us/civica/filebank/blobload.asp?BlobID=3741>>.

<sup>20</sup> <http://factfinder.census.gov>

<sup>21</sup> <http://www.sfenvironment.org/downloads/library/pdf1e.pdf>.

<sup>22</sup> <http://factfinder.census.gov>

<sup>23</sup> East Bay Municipal Utility District, 2006 Pretreatment and Pollution Prevention Report at 5-11 (2007), available at <[http://www.ebmud.com/wastewater/industrial\\_&\\_commercial\\_permits\\_&\\_fees/pollution\\_prevention\\_program/annual\\_report/ww\\_pollution\\_prevention\\_annualreport\\_2006.pdf](http://www.ebmud.com/wastewater/industrial_&_commercial_permits_&_fees/pollution_prevention_program/annual_report/ww_pollution_prevention_annualreport_2006.pdf)>.

<sup>24</sup> Management of hazardous dental wastes in King County, 1991-2000 at 4 (2005), available at <<http://www.govlink.org/hazwaste/publications/HazDentalWasteMgmt.pdf>>.



## TABLE OF MANDATORY AND RECOMMENDED SEPARATOR REQUIREMENTS

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<sup>25</sup> <http://dnr.metrokc.gov/wtd/mwpaac/index.htm>

<sup>26</sup> <http://factfinder.census.gov>

<sup>27</sup> <http://www.wichitagov.org/CityOffices/WaterAndSewer/SewageTreatment/SilverMercury.htm>

<sup>28</sup> <http://factfinder.census.gov>

<sup>29</sup> <http://www.narrabay.com/factsFigures.asp>.

<sup>30</sup> Dental Offices and Clinics Program: Project Overview (2005), available at <[http://www.lacity.org/SAN/ens-2h\\_dental.pdf](http://www.lacity.org/SAN/ens-2h_dental.pdf)>.

<sup>31</sup> <sup>31</sup> <http://factfinder.census.gov>

<sup>32</sup> Regional Sewer District, Keith J. Linn, NEORS Environmental Specialist, Dental Mercury at the Northeast Ohio at 14 of 36 (December 2, 2002), available at <<http://www.epa.gov/region5/air/mercury/meetings/Linn.pdf>>.

<sup>33</sup> Cite

<sup>34</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Best Management Practices: Separators: Summary of Effectiveness, Current Use and Cost (DCN 04852) at Appendix 1 (September 26, 2007).

<sup>35</sup> Memorandum from Derek Singer, ERG, to Jan Matuszko, EPA, Subject: Dental Amalgam Best Management Practices: Separators: Summary of Effectiveness, Current Use and Cost (DCN 04852) at Appendix 1 (September 26, 2007).

<sup>36</sup> Washington State, Department of Ecology, Memorandum of Understanding, Dental Compliance Follow-up Report (July 26, ), available at <<http://www.ecy.wa.gov/pubs/0604011.pdf>>.

<sup>37</sup> Washington State, Department of Ecology, Memorandum of Understanding, Dental Compliance Follow-up Report at 1 (July 26, ), available at <<http://www.ecy.wa.gov/pubs/0604011.pdf>>.

<sup>38</sup> Washington State, Department of Ecology, Memorandum of Understanding, Dental Compliance Follow-up Report at 9 (July 26, ), available at <<http://www.ecy.wa.gov/pubs/0604011.pdf>>.

<sup>39</sup> Mercury in Municipal Wastewater. Tim Tuominen, WLSSD, Rebecca Flood, MCES (September 19, 2007) available at <<http://www.mn-ei.org/policy/images/HgTMDLmeetinginfo/WastewaterTreatment.pdf>> at 27 of 35.