The Effect of Amalgam Separators on Mercury Loading to Wastewater Treatment Plants

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ABSTRACT

Mercury (Hg) release from dental offices has become an acute issue for the dental profession and has resulted in efforts by regulators to mandate both the use of Best Management Practices (BMPs) as well as the installation of amalgam separators. Concern has been expressed by some regarding the efficacy of amalgam separators in reducing the Hg loads to wastewater treatment plants (WWTPs). Data from several Publicly Owned Treatment Works (POTWs) serving areas with installed bases of separators suggest these devices can substantially reduce Hg burdens to WWTPs. The data consists of Hg levels in sewer sludge (biosolids) and in some cases includes Hg concentrations in WWTP influent and effluent. Data comes from various geographical locations, and suggest separators can have a positive effect in reducing the amount of Hg reaching WWTPs.

The Mercury (Hg) content of dental-unit wastewater has become increasingly important to the dental profession and regulations limiting its release into the environment are becoming more pervasive. Hg is a toxic element that persists in the environment and bioaccumulates in the food chain. It remains among the top 20 hazardous substances listed on the Agency for Toxic Substances and Disease Registry (ATSDR)/United States Environmental Protection Agency (EPA) priority list. An EPA conference on Hg in the Midwest[1] highlighted the need to keep Hg out of medical waste and out of the wastewater stream. Hg is present in rain, water, soil, and fish,[2] and the consumption of fish contaminated with Hg represents the single most important source of human

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exposure.[2-4] The recently implemented Great Lakes Water Quality Guidance criteria[5] call for an ambient Hg water level of 1.3 ng/liter (parts per trillion, ppt) for the protection of wildlife. Such guidelines have become a force for lowering the release of pollutants into WWTPs.

While dentistry has been identified as a source of anthropogenic Hg emissions to the environment, by far the largest anthropogenic releases come from combustion sources.[2] The burning of coal to produce electricity is responsible for 33 percent of U.S. Hg emissions.[2] Hg released from the combustion of coal is deposited into lakes, rivers and streams where microorganisms in the sediments, especially sulfate-reducing bacteria, transform it into methyl Hg. In this way, Hg from coal enters the food chain. The planned regulation of Hg releases from coal-fired power plants under the "Clear Skies Initiative" leaves dentistry as one of the few unregulated sources remaining.

The regulatory authority for the management of wastewater arises from the Clean Water Act (CWA), signed into law by President Nixon in 1972. This act created the National Pollution Discharge Elimination System (NPDES) which issues permits to entities that discharge into receiving bodies of water. POTWs are issued permits that impose discharge limits for a number of pollutants including Hg. POTWs retain the ability to set their discharge limits at or below those set forth in NPDES permits.

A survey conducted by the Association of Metropolitan Sewerage Agencies (AMSA) taken at the 1998 AMSA/EPA Pretreatment Coordi-nator's meeting showed the average local discharge limits for industrial discharge of Hg to be 0.0875 mg/liter (n=42, range=0.00002-to-2 mg/liter). Two agencies did not have local limits for Hg. One agency had a narrative pollution prevention standard for Hg, and one agency had a tiered Hg limit based on flow rates from facilities. The variability in local regulations governing wastewater has the potential to create confusion for dental treatment facilities attempting to conform to regulatory requirements.

The goal of sewage treatment is to separate harmful material from the water that carries it. WWTPs are designed to remove organic wastes, not toxic chemical pollutants including Hg and other heavy metals. WWTPs use microorganisms to digest organic wastes in an "activated sludge" process, and the microorganisms are vulnerable to effects of toxic chemicals. Chemicals that disrupt the microbial breakdown of organic wastes impair the operation of the plant. Sludge produced from WWTPs has economic value and in many facilities is sold for use as a soil conditioner or fertilizer. Sludge containing high concentrations of toxic material cannot be used for agricultural application and must be disposed of as hazardous waste, a costly and burdensome process.

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Human health concerns are the primary force driving lower discharge limits for Hg. Several large-scale longitudinal studies have shown that even chronic low-dose exposure may be harmful, especially to the fetus and the developing nervous systems of children.[6,7] The primary mode of exposure to humans is through the consumption of fish and the human brain is the organ most critically affected.[8-10] The number of states that have issued fish consumption advisories due to the Hg content of fish has risen from 27 in 1993 to 45 in 2002. Additionally, 19 states have issued statewide fish consumption advisories for all their lakes and rivers.[11] The Hg in fish is almost entirely in the form of methyl Hg which has a bioconcentration factor of 10 million. Moreover, Hg in the environment is able to bioconcentrate three-to-10 times across each trophic level of the food chain.[12] The EPA has determined the reference dose for methyl Hg to be 0.1 µg/kg body weight/day.13 A reference dose is defined as an estimate of a daily exposure to humans that is not likely to produce adverse effects on health when exposure occurs over a lifetime.

Historically, allowable Hg limits tend to be adjusted downward as analytical methods become more sensitive. Until recently, the method of choice for the analysis of Hg in water was EPA Standard Method 245.1.[14] This cold vapor atomic absorption spectrometry technique is based on the ultra-violet light absorption by Hg vapor (253.7 nm) to determine Hg levels. The typical detection limit for this method is 0.2 µg/liter (parts per billion, ppb). NPDES discharge limits for Hg were, until recently, based upon the detection limit of this standard method. In May 1999, the EPA Office of Water promulgated a new standard method for the analysis of Hg in wastewater. Method 1631 Revision E[15] is for the low-level measurement of Hg in filtered and unfiltered water by oxidation, purge and trap, desorption, and cold vapor atomic fluorescence spectrometry. Method 1631 allows for the determination of Hg at 0.5 ng/liter (parts per trillion, ppt), and has improved accuracy and precision at low Hg levels when compared to previous methods. In addition, it allows for Hg determinations at ambient water quality criteria levels for the first time. Method 1631 has four components: Sample preparation involves a chemical "cleaning" step (oxidation-reduction) to produce volatile elemental Hg in an aqueous solution. The Hg is purged from the aqueous solution onto a gold-coated sand trap. The trapped Hg is thermally desorbed into the cell of a cold-vapor atomic fluorescence spectrometer. The 400-fold decrease in the detection limit for Hg achieved with standard Method 1631 has resulted in dramatically lower discharge limits for POTWs. As a result, POTWs have "gone upstream" to look for ways to decrease the Hg levels that reach their plants. An unintentional consequence of this regulatory design is that local POTWs have become de facto regulators.

It is estimated that dental facilities in the United States used 40 metric tons of Hg in 1997.[16] As other industrial sectors cut back on the use of Hg, dentistry becomes a larger target for regulatory scrutiny. Although the number of amalgam restorations continues to decrease, driven largely by the desire for esthetic tooth-colored restorations, amalgam is still a very widely used restorative material: 66 million amalgam restorations were placed by U.S. dentists in 1999.[17] The Seattle Metro Study[18] and a later study by Barruci et al.[19] reported that 11 percent to 14 percent of the Hg load to local sanitary districts originates from dental clinics. Other studies have estimated the contributions to be as high as 80 percent.[20] Several studies have examined the environmental aspects of Hg release from dental-unit wastewater. Collaborative efforts by Naleway et al.[21] and Cailas et al.[22] were the first to systematically characterize the dental amalgam-wastewater stream. A related study demonstrated the presence of significant levels of dissolved (<0.45 µm) Hg in dental-unit wastewater, and established that dissolved Hg concentrations can be high enough to violate some local Hg discharge limits.[23]

Industrial wastewater-treatment technologies have been developed to address specific manufacturing applications.[24] However, the development and implementation of waste-treatment technologies for dental-operatory wastewater is a relatively new field. Developing effective, non-toxic, and cost-effective treatments has been difficult due to the small quantity of dental-operatory wastewater generated and its heterogeneous nature.

The International Organization for Standardization (ISO), a network of the national standards institutes of 148 countries, is a non-governmental organization

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and the world's largest developer of standards. The ISO developed standard for amalgam separators,[25] ISO 11143, is being used increasingly by POTWs as a minimum requirement of separator performance. ISO 11143 requires amalgam separators to remove at least 95 percent of amalgam particulate when the separator is subjected to the test method specified in the standard. The ISO test for amalgam removal efficiency uses 10.00 gram samples of amalgam particles made from three different particle size ranges. Sixty percent of the particles are 3.15 millimeters or smaller and larger than 0.5 mm; 10 percent of the particles are 0.5 mm or smaller and larger than 0.1 mm; and 30 percent of the particles are 0.1 mm or smaller. An important caveat to this standard is that certification is based on removal of particles and not on the concentration of Hg in the effluent. Therefore, the installation of an ISO certified separator does not necessarily mean a dental clinic will meet POTW discharge limits. The state of Minnesota and the Narragansett Bay Commission of Rhode Island have gone one step further by requiring separators to remove 99 percent of the ISO amalgam test sample. The American Dental Association has published an evaluation of 12 commercial separators utilizing the ISO 11143 protocol.[26] The separators in the ADA study have efficiencies ranging from 96.06 percent to 99.99 percent, and all have passed the ISO certification protocol. The EPA has developed a more rigorous standard, Protocol for the Verification of Hg Amalgam Removal Technologies[27] that uses a concentration-based criterion. However, only one vendor has used this protocol to certify their separator as of this date.

This paper has two objectives. First, to give an overview of the properties and composition of dental-unit wastewater and secondly, to gauge the effectiveness of separators in lowering Hg levels at WWTPs.

Characterization of Dental-Unit Wastewater

Wastewater produced in the dental office is a heterogeneous mixture of nearly all the materials used by dentists and their staffs together with tissue, blood, saliva, and microorganisms. Hg in dental-unit wastewater ranges from large sized amalgam particles to submicron Hg containing colloidal particulates. Particle size distribution experiments have shown that 90 percent of the Hg is located in particles larger than 10 microns.[21,22] Ninety-seven-point-three percent of the Hg in settled wastewater samples taken directly from the dental chair is in the form of elemental Hg (Hg^0) bound to particulate. Hg is also present in the following forms: ionic Hg (Hg^{+2}), dissolved elemental Hg (Hg^0) and monomethyl Hg (MeHg).[28,29] Mean concentrations from settled wastewater taken directly at the chair (**Table 1**) are: Total Hg 21.438 mg/liter (ppm), MeHg 277.74 ng/liter (ppt), Hg^0 24.06 µg/liter (ppb), Hg^{+2} 54.00 µg/liter (ppb) and Hg^0 bound to amalgam particulate 21.360 mg/liter (ppm).[28]

Table 1

Concentrations of different forms of mercury in chairside dental-unit wastewater samples. Hg(T) is total mercury, MeHg is monomethylmercury, Hg(°) is elemental mercury, Hg($^{+2}$) is ionic mercury, and Amalgam bound Hg(°) is elemental mercury bound to amalgam particulate.

Sample ID	Hg(T), mg/liter	MeHg, ng/liter	Hg(0) µg/liter	Hg(+2), µg/liter	Amalgam bound Hg(0), mg/liter	% Amalgam Bound Hg(0)
#1	43.081	444.54	17.22	144.96	42.918	99.62
#2	0.828	96.19	28.31	13.97	0.786	94.88
#3	79.751	583.58	21.34	84.22	79.645	99.87
#4	3.010	225.85	27.87	54.09	2.928	97.27
#5	1.005	167.40	22.43	12.14	0.970	96.54
#6	0.953	148.91	27.22	14.65	0.911	95.59
Mean	21.438	277.74	24.06	54.00	21.360	97.30
SD	33.08	192.76	4.46	53.08	33.04	2.07

(mg/liter equals parts per million,µg/liter equals parts per billion, and ng/liter equals parts per trillion.)

Table 2

Residual mercury levels and Toxicity Characteristic Leaching Procedure (TCLP) analysis of dental wastewater vacuum lines

Location	Pipe Type	Pipe Size ID	Residual Hg	TCLP Hg
Virginia	Copper	¾ inch	1.1 g/kg (n=5, SD=0.4)	0.019 mg/L (n=2, SD=0.002)
Maryland	PVC	2 inch	139 g/kg (n=4, SD=27)	0.304 mg/L (n=3, SD=0.087)
Maryland	PVC	1½ inch	8.1 g/kg (n=3, SD=0.132)	0.035 mg/L (n=4, SD=0.019)
Maryland	PVC	½ inch	N/A	0.129 mg/L (n=3, SD=0.068)
Illinois	PVC	1 inch	3.3 g/kg (n=9, SD=0.9)	0.089 mg/L (n=4, SD=0.029)

To help determine if a waste is hazardous, the EPA designed a laboratory analysis called Toxicity Characteristic Leaching Procedure (TCLP) which determines the mobility of analytes in an acetic acid buffer solution. The concentration of regulated analytes in the extract determines the toxicity characteristic of a sample, and therefore whether it is subject to disposal regulations under the Resource Conservation and Recovery Act (RCRA). The test was designed to predict whether landfill wastes might leach dangerous levels of chemicals into ground water. TCLP regulatory levels exist for 40 different toxic chemicals. The TCLP limit for Hg is 0.2 milligrams per liter, mg/liter.

In one documented case, concentrations of dissolved Hg species collected from the entire clinic were high enough to exceed POTW discharge limits.[23] Total Hg levels in the dental wastewater from this large 117-chair dental treatment facility averaged 3.905 mg/liter (n=6, SD=0.274) with dissolved Hg levels averaging 0.368 mg/liter (n=6, SD=0.64), almost 7.4 times higher than the POTW mandated discharge limit of 0.05 mg/liter. As a result, the clinic was disconnected from the sanitary district sewer lines and forced to collect its dental-unit wastewater in 55-gallon drums. The clinic spent $900 to dispose of each 55-gallon drum of dental wastewater as hazardous waste for an estimated annual cost to the facility of more than $150,000.

The average daily Hg loading to dental-unit wastewater is exceedingly variable and in one study was seen to average 0.484 grams per chair per day (n=25, SD=0.420). Mean Hg loadings from a dental chair at one clinic were seen to average over 2 grams of Hg per day. The high density of amalgam (the specific gravity of dental amalgam being 11.6) results in average settling velocities ranging from 16.56 to 65.7 cm/hour, with more than 90 percent of amalgam particulate settling in two hours.[22]

A critical consequence of this swift settling is deposition of amalgam particulate in the wastewater lines leaving the dental chair. Determination of residual Hg levels in dental vacuum lines (**Table 2**) demonstrated Hg levels averaging 29.6 grams/kg of pipe (range=0.710 grams/kg to 177 grams/kg, SD=55.4).[30] Toxicity Characteristic Leaching Procedure analysis (defined in EPA Method 1311 and used to help determine if a waste is hazardous[31,32]) demonstrated substantial levels of Hg leaching out of the lines (**Table 2**). Hg levels in the leachate of one sample were high enough to meet the criteria of hazardous waste and suggest that dental wastewater lines might serve as a reservoir of Hg that can leach over time. Oxidizing line cleaners used in some offices to disinfect wastewater lines can mobilize Hg from amalgam particulate[33,34] and this may be true for the Hg in amalgam sludge present in wastewater lines.

Amalgam Separator Studies

Data demonstrating the efficacy of amalgam separators in reducing Hg influent into WWTPs comes from studies at five different locations and are summarized below. The locations include: (1) Toronto, Ont., (2) Minneapolis/St. Paul, Minn., (3) Duluth, Minn., (4) Great Lakes, Ill. and (5) Denmark.

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Toronto, Ont.

Toronto lies on the northwestern shores of Lake Ontario and is the largest city in Canada. It became the fifth largest city in North America on Jan. 1, 1998, with the amalgamation of the six former municipalities into a metropolitan area with a combined population of more than 2.4 million. This "new" city has dental practices numbering more than 1,100. On July 6, 2000, the Toronto city council adopted a new sewer use bylaw. As originally passed, the bylaw required dental offices to submit a pollution prevention plan by Dec. 31, 2001, install and maintain amalgam separators by Jan. 1, 2002, and mandates an Hg discharge limit of 0.01 mg/liter effective June 30, 2002, (later extended to Nov. 1, 2002).

The Pollution Prevention Plan submission required in the bylaw is to include information on the type of separator to be installed, frequency of maintenance and service, plumbing schematics, standard operating procedure for handling the waste generated from the separator, and the storage, handling, disposal of scrap amalgam.

Since the installation of separators and the use of "Dental Amalgam Best Management Practices," there has been a 58 percent reduction in Hg levels in WWTP sludge in the four plants.[35] The total average monthly mass of Hg in the combined sludge at all four plants had been reduced from 17 Kg to 7 Kg per month. Plant by plant reduction rates varied from 44.8 percent to 74.3 percent. Data was obtained at a time when compliance with the bylaw was estimated to be 800 out of the 1,100 or so dental clinics.[35] Full compliance with the bylaw is estimated to produce a 79.9 percent reduction in the Hg in sewer sludge on a monthly basis.[35] Applying the Toronto Sewer District Hg removal rate data to the 133,000 dental clinics in the U.S. implies that universal implementation of amalgam separators would prevent the 22.1 tons of Hg from ending up in sludge at WWTPs.[35]

Minneapolis and St. Paul, Minn.

The Metropolitan Council of Environmental Services (MCES) is the POTW that serves the Minneapolis/St. Paul metropolitan area of Minnesota. MCES collects and treats wastewater at eight regional treatment plants, processing more than 300 million gallons of wastewater every day from more than two million residents in 103 communities. MCES WWTPs operate at 99 percent compliance with their permit requirements. In 2001, MCES collaborated with the Minnesota Dental Association (MDA) in two related studies: A community-wide dental Hg investigation and an evaluation of amalgam separators and dental

Table 3

Western Lake Superior Sanitary District (WLSSD) Hg data for years 1995 to 2003

The top half of the table is concentration data in nanograms (ng) per liter for wastewater and milligrams per kilogram for sludge. The bottom half of the table is load data in grams/day. (Data courtesy of Tim Tuominen, chemist for the WLSSD.)

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003
Influent Hg in ng/liter	180	160	150	160	120	100	90	80	106
Effluent Hg in ng/liter	20.6	15.3	11.2	10.1				1.9	2.3
% Removal	88.6	90.4	92.5	93.7				97.6	97.8
Sludge Hg in mg/kg dry	1.3	0.99	0.75	0.84	0.64	0.45	0.47	0.32	0.32
Separators installed		3				11	11	20	6
YEAR	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Influent Hg in grams/day	28	26	22	24	18	15	13	12	14
Effluent Hg in grams/day	3.1	2.2	1.5	1.3				0.27	0.30
% Removal	89.3	91.2	93.3	94.4				97.8	97.9
Sludge Hg in grams/day	44.6	44.5	24.0	29.5	22.2	16.3	10.9	11.35	10.7
Separators installed		3				11	11	20	6

Hg loading to sanitary sewer study.[36,37]

The community-wide studies evaluated Hg loading from dental clinics with and without amalgam separators. It took place in the cities of Hastings and Cottage Grove and included the participation of 24 of 25 dentists in these communities. Amalgam separators were in place for three months. The second study, evaluation of amalgam separators, took place in seven general dental practices and looked at five separator models. There were 87 cumulative weeks of testing with 275 days of wastewater monitoring. The community-wide study was able to demonstrate Hg reductions of 29 percent and 44 percent and is based on reductions of Hg in WWPT sludge when separators were installed at community dental practices.[36] The second study determined the discharge of Hg per dentist to be 234 mg/day. Separators removed substantial quantities of Hg from dental clinic wastewater ranging from 91 percent to 99 percent removal efficiencies, measured as Hg not already captured in the chairside traps.[37]

Duluth, Minn.

Duluth is a growing metropolitan area of 87,000 people located on the shores of Lake Superior. Duluth has a thriving seaport hosting more than 1,000 ships per year. The Western Lake Superior Sanitary District (WLSSD) serves the Duluth area and together with Seattle, was one of the first POTWs to look seriously at ways to limit the amount of Hg coming into their WWTPs. Duluth is home to roughly 50 general dental practices with a 100 or so dental professionals. The WLSSD program is voluntary and relies on the good will of dental professionals and staff, state (MDA) and local dental societies. The program began as an educational effort to train personnel in proper disposal of dental Hg from chairside traps and vacuum pump filters. Later, WLSSD installed amalgam separators in 35 of the regional dental practices. Additionally, a small business waste collection system was set up to recycle photographic fixer, all types of amalgam and lead foils from radiographic films. The fruits of the WLSSD effort (**Table 3**) include Hg reductions in WWTP influent from a high of 0.18 pounds per day in 1993 to less than 0.02 pounds per day in 2002.[38] Hg concentration in the treated wastewater leaving their plant decreased from 20.6 ng/liter in 1995 to 1.9 ng/liter in 2002.[38] Hg levels in biosolids decreased from over 2.5 mg/kg sludge to a low of 0.19 mg/kg sludge.[38] Credit for these dramatic decreases goes to Tim Tuominen, a chemist for the WLSSD, who has toiled diligently in this area for more than 10 years.

Great Lakes, Ill.

The Naval Training Center at Great Lakes, Ill., is home to the Navy's only recruit in-processing facility (boot camp) and trains more than 50,000 recruits per year. In addition, the base houses an advanced training center within the Service School Command. Many recruits hail from areas where access to dental care is limited, and some require extensive restorative work, most of which is completed utilizing amalgam. The base has five clinics and more than 200 dental treatment rooms and utilizes 5,063 double spill amalgam capsules per month, which amounts to approximately 27 kg of Hg per year.

Like many other large military installations, the base at Great Lakes has a history of environmental issues, Hg exceedances being just one. The base has assiduously worked to correct past inadequacies and continues to labor closely with its POTW, the North Shore Sanitary District (NSSD), which operates the wastewater treatment plant serving the base. An estimated 20 percent of the influent to the plant comes from the base. NSSD enforces an "end of pipe" discharge limit for Hg of 0.5 µg/liter (parts per billion, ppb). This limit is expected to drop to 0.1 µg/liter in the near future. In an effort to determine the cause of the Hg exceedances, Hg spikes in excess of POTW discharge limits, (up to 54 exceedances per year) upstream and downstream composite sampling was completed by the base engineering department. Sampling data showed Hg levels in excess of the 0.5 µg/liter discharge limit were frequently measured in manholes downstream of dental treatment facilities. NSSD then required the base to install Hg pretreatment systems (amalgam separators) in all clinics.

As required by the EPA, NSSD routinely monitors Hg levels in the sludge produced by its WWTPs. WWTP sludge is applied to land as a fertilizer and the sale of sludge can generate revenue for the POTW. The EPA sets limits for various pollutants in sludge, and POTWs are required to keep detailed data on the amount of pollutants, including Hg. Our research institute obtained the database of Hg levels for POTW sludge and compared them to the date when the amalgam separators were installed in naval base dental clinics. Since 1996, when the first system was installed at the largest clinic, there has been a 52 percent decrease in Hg levels. The Hg levels in the biosolids, when plotted in a graph, trend downward and may reflect the gradual dissolution of Hg in the sewer lines. Over the years, Hg exceedances have fallen from a high of 54 per year down to three.

While data showing the effect of amalgam separators on Hg loadings to WWTPs cannot yet be seen as categorical, it strongly suggests that separators can play an important role in decreasing the amount of Hg reaching POTW facilities.

Denmark

Denmark, a country roughly twice the size of Massachusetts, has been active in the environmental aspects of dental amalgam for many years. Dr. Dorthe Arenholt-Bindslev, a faculty member at the University of Aarhus Dental School, published one of the earliest papers to define the role on dental amalgam in Hg contamination of the environment.[39] Hg accumulation in Danish WWTPs has raised concern and led to the adoption of Hg reduction policies across all industries including dentistry. A Danish sampling study measuring Hg release from 20 dental offices demonstrated that in dental clinics without separators, a mean of 250 mg of Hg was being discharged per dentist per day.[40] Dental clinics with amalgam separators showed a mean Hg discharge to the sewer system of 35 mg of Hg per dentist per day — an 86 percent reduction.[40] Seventy-three percent of Danish counties responding to surveys reported that separators have been installed in all dental offices.[40] Twenty-eight percent of the responding counties had no plans to mandate separators, and 12 percent of the counties did not respond to the survey.[40] In half of the wastewater treatment plants surveyed in her study, a statistically significant decrease in the Hg levels in sludge from 14 percent to 80 percent was shown.[40] In a number of WWTPs, data showed a gradual decline in Hg loads in WWTP sludge.

Conclusion

While data showing the effect of amalgam separators on Hg loadings to WWTPs cannot yet be seen as categorical, it strongly suggests that separators can play an important role in decreasing the amount of Hg reaching POTW facilities. More definitive evidence may soon be available with the completion of an ongoing effort conducted by the Association of Metropolitan Sewerage Agencies (AMSA). AMSA is a trade organization representing the interests of wastewater treatment agencies that serve the majority of the sewered population in the United States. The AMSA Hg working group committee is undertaking a multi-center investigation of separator efficacy that is characterizing Hg levels in both the influent and effluent of wastewater treatment plants, and also is quantifying Hg levels in primary and secondary sewer sludge. The AMSA effort will help provide further evidence for the efficacy of amalgam separators.

In several areas of the country, state and local dental societies are working closely with local POTWs to control the release of heavy metals into sanitary sewer systems. The ADA has taken a proactive role with the publication of Best Management Practices for the dental office. Dentistry has a long and storied history of preventive care and service to the community. Fluoride, sealants, outreach and education are but a few examples of dentistry's contributions to society. This spirit of prevention and community service can now be seen extending to the environment. CDA

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