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PUBLIC INTEREST COMMENT

EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS FOR THE DENTAL CATEGORY

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INTRODUCTION

The Regulatory Studies Program of the Mercatus Center at George Mason University is dedicated to advancing knowledge about the effects of regulation on society. As part of its mission, the program conducts careful and independent analyses that employ contemporary economic scholarship to assess rulemaking proposals and their effects on the economic opportunities and the social well-being available to all members of American society.

This comment addresses the efficiency and efficacy of this proposed rule from an economic point of view. Specifically, it examines how the proposed rule may be improved by more closely examining the societal goals the rule intends to achieve and whether this proposed regulation will successfully achieve those goals. In many instances, regulations can be substantially improved by choosing more effective regulatory options or more carefully assessing the actual societal problem, taking into account the most current data available and practices actually in use.

SUMMARY

Under the authority of sections 101, 301, 304, 306, 307, 308, and 501 of the Clean Water Act (CWA) of 1972, the Environmental Protection Agency (EPA) is proposing new technology requirements for all new and existing dental practices that use dental amalgam—the main source of mercury discharges into publicly owned treatment works (POTWs). The proposed rule would require dental offices to use amalgam separators for capturing mercury and other metals before they are discharged into POTW. The EPA expects that compliance with the proposed rule would reduce the discharge of metals into POTW by at least 8.8 tons per year. Given that approximately 50 percent of dental amalgam consists of elemental mercury, the EPA estimates that the proposed rule would reduce mercury discharge into POTW by approximately 4.4 tons per year and into surface waters by approximately 860 pounds per year.

The EPA claims that this method for capturing mercury will reduce mercury exposure and improve human health. According to the EPA, "the negative neurological effects of eating fish contaminated with methylmercury are well

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documented."[1] Developmental effects on fetuses, infants, children, and women of childbearing age are of particular concern. However, "[n]early all (>99.6 percent) of dental mercury discharges are in solid form (elemental mercury bound to amalgam particulate)."[2] Much of the concern comes from the remaining forms: methylmercury and dissolved mercury, which can be converted to methylmercury by bacteria present in wastewater.[3]

Unfortunately, the EPA's methodology is flawed on a number of fronts.

First, the EPA fails to estimate the benefits of the proposed rule. Without a measure of net benefits, the EPA is unable to determine whether this rule results in a positive net benefit for human welfare. To improve the proposed rule, the EPA should perform a thorough analysis of how, given the current methylmercury exposure rates and body burden levels experienced by a typical US resident, this estimated reduction in mercury discharge into surface waters will reduce the potential harmful effects on neurological development and performance. To do so, the EPA should develop an empirical link between the decline in dental amalgam discharge and the levels of mercury present in commercially available fish. The EPA should then estimate by how much this reduction in methylmercury concentration levels in fish results in lower exposure to those consuming fish. Once the EPA estimates the reduction in exposure, the EPA can then estimate how these lower exposure rates affect IQ, life expectancy, and lifetime earnings. Recent surveys of the relationship between fish consumption and health effects, such as the FDA's "A Quantitative Assessment of the Net Effects on Fetal Neurodevelopment from Eating Commercial Fish," should be included.[4]

Second, the EPA fails to explicitly define a baseline of what would take place without any additional federal regulation. The EPA assumes that the annual dental amalgam discharge into surface waters will remain constant for the foreseeable future. That assumption is flawed. Many state and local governments continue to enact mandatory and voluntary programs to collect dental amalgam. Moreover, according to Beazoglou et al., the average annual decline in the number of dental amalgams inserted between 1992 and 2004 was 3.7 percent.[5] By constructing a dynamic baseline, the EPA could create a more realistic estimate of the net effect of the proposed rule.

Third, the EPA uses a 30-year-old study to estimate the rates at which mercury passes through POTWs. Recent studies suggest a higher fraction of mercury is collected by POTWs. In addition, the EPA assumes that, after passing through amalgam separators, further mercury discharge is removed by POTWs, yet it is likely that particles that pass through amalgam separators are also small enough to evade POTWs. Updating the two mercury pass-through relationships and the dynamic baseline shows that, without any regulatory action, 630 fewer pounds of mercury will be released to surface waters in 2030 than is currently estimated by the EPA. This updated methodology also suggests that the proposed rule will only remove 150 pounds of dental amalgam mercury from surface waters in 2030. The lower estimated effect of the proposed rule results in a pre-tax annualize cost-effectiveness that is higher than 25 of the most recent pretreatment standards.

In addition, the EPA could improve its cost estimates by using the number of amalgam procedures as its baseline. In this draft of the proposed rule, the EPA uses the number of dental chairs to estimate costs a dental office faces when purchasing and operating the appropriately sized separators. Yet it is much more likely that the appropriately sized separator for an office is based on the number of amalgam procedures performed by a dental office.

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1. *Wisconsin Mercury Sourcebook*, Wisconsin Department of Natural Resources, 1997; "Technical and Economic Development Document for the Proposed Effluent Limitation Guidelines and Standards for the Dental Category" (TEDD), EPA-821-R-14-006, EPA, 2014, 13-2, http://water.epa.gov/scitech/wastetech/guide/dental/index.cfm.
2. Ibid., 13-1.
3. American Chemical Society, "Dental Offices Contribute to Methylmercury Burden: Bacteria That Methylate Mercury Thrive in Wastewater Found Downstream from Dental Traps," *Environmental Science & Technology Online News*, March 12, 2008.
4. "A Quantitative Assessment of the Net Effects on Fetal Neurodevelopment from Eating Commercial Fish (as Measured by IQ and also by Early Age Verbal Development in Children)," Food and Drug Administration, 2014, http://www.fda.gov/downloads/Food/FoodborneIllnessContaminants/Metals/UCM396785.pdf.
5. T. Beazoglou, S. Eklund, D. Heffley, J. Meiers, L. J. Brown, and H. Bailit, "Economic Impact of Regulating the Use of Amalgam Restorations," *Public Health Rep* 122 (2007):657–63.

NO MEASURE OF HEALTH BENEFITS

The proposed rule fails to empirically estimate the health and environmental benefits generated from the reduction in mercury discharged. As such, the EPA claims that it is unable to determine whether the proposed rule generates net benefits for human welfare. The elemental mercury in dental amalgam tends not to be easily absorbed by humans through digestion; however, a variety of aquatic bacteria are able to convert elemental mercury into methylmercury.[6] The proposed rule fails to provide any evidence for how much of this elemental mercury is converted to methylmercury. There is no estimate of how this reduction in the discharge of mercury, in its various forms, lowers mercury concentrations in fish. And, finally, there is no estimate of how, for the typical mercury exposure and body burden of residents of the United States, the proposed rule improves the IQ, quality of life, or life expectancy of those who consume fish.

The analysis of the proposed rule could be vastly improved if the EPA attempted to estimate the fraction of amalgam that is released to surface waters that is converted to methylmercury and the rate of the conversion. The proposed rule would also need to show how this mercury then affects the bioaccumulation in fish and, finally, exposure levels to women of childbearing years and the resulting change in neurodevelopmental effects of their children.

When updating this benefits analysis, the EPA should account for more recent studies assessing the effects of methylmercury exposure. The FDA, in their survey of the relationship between health and fish consumption, "A Quantitative Assessment of the Net Effects on Fetal Neurodevelopment from Eating Commercial Fish," reveals that a number of studies have found no health effects from small increases in methylmercury exposure.[7] Moreover, because fish are also the source of many beneficial nutrients, the net effect of consuming fish that contain low levels of methylmercury can still be positive.

In addition to the EPA's recent comment on FDA's report on methylmercury, the EPA has invested an enormous amount of resources examining exposure and health effects of methylmercury.[8] Given the EPA's familiarity with the risks associated with methylmercury ingestion, there seems to be no plausible reason for not being able to estimate the benefits of reduced exposure to methylmercury.

MERCURY FROM DENTAL AMALGAM FALLING WITHOUT FEDERAL REGULATION

The EPA fails to define a formal baseline. In doing so, the EPA implicitly assumes that the current annual amount of dental amalgam discharged into POTWs will not change without the proposed rule. Yet, in the Technical and Economic Development Document (TEDD) for the Proposed Effluent Limitation Guidelines and Standards for the Dental Category, the EPA reports that twelve states and nine regions and municipalities have mandatory programs that seek to lower the discharge of mercury from dental procedures.[9] The EPA also reports that many communities that have introduced voluntary participation programs designed to reduce or capture dental amalgam have witnessed exceptionally high participation rates, including 8 of the 11 listed in Table 6-7 of the TEDD.[10]

In 2008, the EPA, along with the American Dental Association and the National Association of Clean Water Agencies, issued a memorandum of understanding (MOU) "to encourage dental offices to voluntarily install and properly maintain amalgam separators and recycle the collected amalgam waste."[11] Unfortunately, the "EPA did not evaluate the effectiveness of the MOU, rather [the] EPA decided that National Pretreatment Standards for

6. American Chemical Society, "Dental Offices Contribute to Methylmercury Burden: Bacteria That Methylate Mercury Thrive in Wastewater Found Downstream from Dental Traps," *Environmental Science & Technology Online News*, March 12, 2008.
7. "A Quantitative Assessment of the Net Effects on Fetal Neurodevelopment from Eating Commercial Fish (as Measured by IQ and also by Early Age Verbal Development in Children)," Food and Drug Administration, 2014, http://www.fda.gov/downloads/Food/FoodborneIllnessContaminants/Metals/UCM396785.pdf.
8. http://fn.cfs.purdue.edu/fish4health/HealthRisks/EPAResponse09.pdf and http://www.epa.gov/mercury/effects.htm
9. TEDD.
10. Ibid.
11. Ibid., 1-6.

dental facilities would accomplish the goals of the MOU in a more predictable timeframe."[12] Given the MOU and a number of local policies, the implicit baseline assumption of no change in the level of discharge into POTW from dental amalgam is unlikely.

Furthermore, the proposed rule acknowledges, but fails to include in its implicit baseline, the fact that the annual number of procedures using mercury amalgam have declined. Using claim and enrollment data from Delta Dental of Michigan, Ohio, and Indiana and from the American Dental Association Survey of Dental Services Rendered, Beazoglou et al. estimate that between 1992 and 2004 the mean percent decline in amalgams inserted per year was 3.7 percent.[13] Therefore, any dental amalgam discharge baseline should include the 3.7 percent annual decline in dental amalgam procedures.

Defining a dynamic baseline that includes both the annual reduction in amalgam procedures and the state and local polices reducing the discharge from these amalgam procedures will reduce the estimated net effects of this proposed rule. Table 1 reports the implicit EPA baseline, the dynamic baseline, and the difference between the two. If the United States continues to witness an average annual decline of 3.7 percent, 326 fewer pounds of mercury will discharged into POTW in the first year without any action by the EPA.[14] After just three years, the annual mercury discharge levels to POTW will have fallen more without regulation than the estimated reduction achieved through rule. Accounting for this baseline decline in mercury discharge would enable the EPA to construct a precise estimate of the beneficial effects of this proposed rule.

Table 1: EPA Implicit Baseline and Dynamic Baseline

Year	EPA Implicit Baseline: dental amlagam discharge into POTWs (lbs.)	Dynamic Baseline: dental amlagam discharge into POTWs* (lbs.)	EPA baseline minus dynamic baseline (lbs.)
2015	8,800	8,800	0
2016	8,800	8,474	326
2017	8,800	8,161	639
2018	8,800	7,859	941
2019	8,800	7,568	1,232
2020	8,800	7,288	1,512
2021	8,800	7,018	1,782
2022	8,800	6,759	2,041
2023	8,800	6,509	2,291
2024	8,800	6,268	2,532
2025	8,800	6,036	2,764
2026	8,800	5,813	2,987
2027	8,800	5,598	3,202
2028	8,800	5,390	3,410
2029	8,800	5,191	3,609
2030	8,800	4,999	3,801

*Using claim and enrollment data from Delta Dental of Michigan, Ohio, and Indiana and the American Dental Association Survey of Dental Services Rendered, Beazoglou et al. estimate that between 1992 and 2004 the mean percent decline in amalgams inserted per year was 3.7 percent.

12. Ibid.
13. T. Beazoglou, S. Eklund, D. Heffley, J. Meiers, L. J. Brown, and H. Bailit, "Economic Impact of Regulating the Use of Amalgam Restorations," *Public Health Rep* 122 (2007):657–63.
14. The reduction in dental amalgam discharged is calculated by multiplying the EPA's current estimate of 4.4 tons per year by 3.7 percent. This equals 0.1628 tons, or 325.6 pounds.

MEASURED REDUCTION IN MERCURY RELEASED TO THE ENVIRONMENT

The EPA overestimates the effects amalgam separators will have on the level of mercury released into the environment and underestimates the mercury removal rate of POTW.

The EPA states:

> Based on the 50 POTW Study, EPA estimates POTWs remove 90 percent of the 4.4 tons mercury from the wastewater. Thus, POTWs collectively discharge 880 pounds of mercury from dental amalgam to surface waters annually. Under this proposed rule, 99.0 percent of the solid mercury currently discharged annually to POTWs will be removed prior to the POTW. The POTWs then further remove 90 percent of total mercury from the wastewater. This reduces the total amount of dental mercury discharged from POTWs nationwide to surface water to 14 pounds of mercury annually. In other words, discharges of mercury to waters of the U.S. are expected to be reduced by 860 pounds per year.

If the EPA estimates a reduction of 860 pounds, this would result in a mercury discharge of 20 pounds into surface waters. On page 12-2 of the TEDD, the EPA uses a reduction of 863 pounds for its cost-effectiveness calculation. This would results in a discharge of 17 pounds. Given the EPA range of 14 pounds to 20 pounds and the three year time frame for implementation, Table 2 attempts to recreate the calculation as it is reported by the EPA.[15]

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15. Note the proposed rule first states that "[t]his reduces the total amount of dental mercury discharged from POTWs nationwide to surface water to 14 pounds of mercury annually." Then it states, "In other words, discharges of mercury to waters of the U.S. are expected to be reduced by 860 pounds." If this second sentence is true and discharges will decline from 880 to 860 pounds, then 20 pounds of discharge will be released to surface waters. In the TEDD, the EPA uses 863 pounds as the reduction amount when calculating the cost-effectiveness or a discharge level of 17 pounds Using a separator mercury removal rate of 98 percent combined with a 90 percent removal rate for POTWs generates the values closest to the 17 pounds reported in the TEDD.

Table 2: EPA Estimated Discharge Effect of Proposed Rule

Year	Baseline: dental amalgam discharge into POTWs (EPA implicit) (lbs.)	Dental amalgam discharge into surface water (EPA, POTW 90%) (lbs.)	Proposed Rule: dental amalgam discharge into POTWs (EPA with separators) (lbs.)	Proposed Rule: POTWs discharge into surface waters* (EPA) (lbs.)	Proposed Rule: Reduction in discharge into surface water (EPA) (lbs.)
2015	8,800	880	8,800	880	0
2016	8,800	880	8,800	880	0
2017	8,800	880	8,800	880	0
2018	8,800	880	176	17.6	862.4
2019	8,800	880	176	17.6	862.4
2020	8,800	880	176	17.6	862.4
2021	8,800	880	176	17.6	862.4
2022	8,800	880	176	17.6	862.4
2023	8,800	880	176	17.6	862.4
2024	8,800	880	176	17.6	862.4
2025	8,800	880	176	17.6	862.4
2026	8,800	880	176	17.6	862.4
2027	8,800	880	176	17.6	862.4
2028	8,800	880	176	17.6	862.4
2029	8,800	880	176	17.6	862.4
2030	8,800	880	176	17.6	862.4

*Note the proposed rule first states that "[t]his reduces the total amount of dental mercury discharged from POTWs nationwide to surface water to 14 lbs. of mercury annually." Then it states, "[i]n other words, discharges of mercury to waters of the U.S. are expected to be reduced by 860 lbs." If this second sentence is true and discharges will decline from 880 to 860 lbs., then 20 lbs. of discharge will be released to surface waters. In the TEDD, the EPA uses 863 lbs. as the reduction amount when calculating the cost-effectiveness or a discharge level of 17 lbs. Using a separator mercury removal rate of 98 percent combined with a 90 percent removal rate for POTWs generates the values closest to the 17 lbs. reported in the TEDD.

However, the EPA's estimate makes two important and, likely incorrect, assumptions. First, as noted by Vandeven and McGinnis, the size of the particles that are not removed by the separator are likely to also be small enough to evade capture by the POTWs.[16] Therefore, it is unlikely that the POTWs "further remove 90% of the total mercury from the wastewater." Adding an amalgam separator effectively only catches a fraction of the percentage that would pass through a POTW. If amalgam separators capture 98 percent and, according to the EPA, POTWs capture 90 percent, then adding a separator only captures an additional 8 percentage points. So instead of releasing 14 pounds of mercury into surface waters as reported in the NPRM quote above, the net result is a release of 176 pounds, or 2 percent, of the mercury amalgam produced. This results in a reduction of not 860 pounds but rather, as shown in Table 3, a realized reduction of 704 pounds.

Second, the EPA uses a 30-year-old study on POTW, known as the 50 POTW Study, to estimate that 90 percent of mercury discharged into POTW will be captured by the treatment process.[17] According to the National Association of Clean Water Agencies, "the removal efficiencies, physical parameters, process data, and, most importantly, analytical techniques, are often no longer valid."[18] More recent studies, though smaller in scale, have suggested much higher mercury capture rates. For instance, a study by the AMSA reviewed 15 POTW and found an average

16. J. Vandeven and S. McGinnis, "An Assessment of Mercury in the Form of Amalgam in Dental Wastewater in the United States," *Water, Air and Soil Pollution* 164 (2005): 349–66.
17. "Fate of Priority Pollutants in Publicly Owned Treatment Works," Environmental Protection Agency, 1982.
18. Susan Bruninga, Manager of Regulatory Affairs, National Association of Clean Water Agencies, Letter to Mary Smith, Director, Engineering and Analysis Division, Office of Science and Technology of the Office of Water, US Environmental Protection Agency, 2006.

Table 3: Alternate 1: Estimated Discharge Effect of Proposed Rule (adjusted for particle size)

Year	Baseline: dental amalgam discharge into POTWs (EPA implicit) (lbs.)	Dental amalgam discharge into surface water (EPA, POTW 90%) (lbs.)	Proposed Rule: dental amalgam discharge into POTWs (EPA with separators) (lbs.)	Proposed Rule: POTWs discharge into surface waters* (particle size) (lbs.)	Proposed Rule: Reduction in discharge into surface water (Alt. 1) (lbs.)
2015	8,800	880	8,800	880	0
2016	8,800	880	8,800	880	0
2017	8,800	880	8,800	880	0
2018	8,800	880	176	176	704
2019	8,800	880	176	176	704
2020	8,800	880	176	176	704
2021	8,800	880	176	176	704
2022	8,800	880	176	176	704
2023	8,800	880	176	176	704
2024	8,800	880	176	176	704
2025	8,800	880	176	176	704
2026	8,800	880	176	176	704
2027	8,800	880	176	176	704
2028	8,800	880	176	176	704
2029	8,800	880	176	176	704
2030	8,800	880	176	176	704

mercury capture rate of 95 percent.[19] Other studies of individual POTW have found higher rates ranging from 96 percent to 99 percent.[20] Given these higher rates, Vandeven and McGinnis use a 95 percent amalgam mercury capture rate.[21] If these recent studies more accurately describe the fraction of mercury currently captured by POTW collectively, then the EPA's estimate of 880 pounds of mercury released annually into surface waters is an overestimate. With a 95 percent capture rate only 440 pounds of mercury are released into surface waters annually.

Table 4 follows Vandeven and McGinnis and use a 95 percent amalgam mercury capture rate for POTW. This higher capture rate, without amalgam separators, results in a mercury discharge into surface waters of 440 pounds. Recognizing that amalgam separators likely remove finer mercury amalgam particles than POTW, the addition of separators likely lowers the surface water discharge to 176 pounds. Therefore, the net effect of amalgam separators is a 264-pound reduction, not the 860 pounds reported by the EPA.

19. "Mercury Source Control and Pollution Prevention Program" (Washington, DC: Association of Metropolitan Sewerage Agencies, 2002).
20. S. Balogh and L. Johnson, "Mercury Mass Balances at Two Small Wastewater Treatment Plants" (Minneapolis-St. Paul, MN: Metropolitan Council Environmental Services, 1998); S. Balogh and L. Liang, "Mercury Pathways in Municipal Wastewater Treatment Plants," *Water, Air, Soil Pollution* 80 (1995): 1181–90.
21. J. Vandeven and S. McGinnis, "An Assessment of Mercury in the Form of Amalgam in Dental Wastewater in the United States," *Water, Air and Soil Pollution* 164 (2005): 349–66.

Table 4: Alternate 2: Estimated Discharge Effect of Proposed Rule (adjusted for particle size and POTWs mercury removal rate)

Year	Baseline: dental amalgam discharge into POTWs (EPA implicit) (lbs.)	Dental amalgam discharge into surface water (POTW 95%) (lbs.)	Proposed Rule: dental amalgam discharge into POTWs (EPA with separators) (lbs.)	Proposed Rule: POTWsa discharge into surface waters* (particle size) (lbs.)	Proposed Rule: Reduction in discharge into surface water (Alt. 2) (lbs.)
2015	8,800	440	8,800	880	0
2016	8,800	440	8,800	880	0
2017	8,800	440	8,800	880	0
2018	8,800	440	176	176	264
2019	8,800	440	176	176	264
2020	8,800	440	176	176	264
2021	8,800	440	176	176	264
2022	8,800	440	176	176	264
2023	8,800	440	176	176	264
2024	8,800	440	176	176	264
2025	8,800	440	176	176	264
2026	8,800	440	176	176	264
2027	8,800	440	176	176	264
2028	8,800	440	176	176	264
2029	8,800	440	176	176	264
2030	8,800	440	176	176	264

Furthermore, as discussed above, the EPA fails to account for the reality that the mean percent decline in the number of dental amalgam procedures for a select number of states between 1992 and 2004 was 3.7 percent. Table 5 includes this dynamic baseline to show that in 2018 the reduction in the level of mercury discharged into surface waters brought about by the proposed rule is only 236 pounds. Assuming that this mean percent decline in the dynamic baseline is constant, the reduction in mercury caused by this proposes rule will only be 150 pounds for 2030. In other words, between 2015 and 2030, the annual level of mercury discharged into surface waters will have declined by 190 pounds without any additional regulatory action. Moreover, the dynamic baseline decline of the annual discharge into POTW of 3,800 pounds witnessed from 2015 to 2030 is four times larger than the EPA's estimated annual reduction in surface water discharge of 860 pounds and twenty-five times larger than the adjusted estimated reductions (Alt. 3) of 150 pounds in 2030 brought about by the proposed rule.

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Table 5: Alternate 3: Estimated Discharge Effect of Proposed Rule (adjusted for particle size, POTWs mercury removal rate, and dynamic baseline)

Year	Baseline: dental amalgam discharge into POTWs (dynamic) (lbs.)	Dental amalgam discharge into surface water (POTW 95%) (lbs.)	Proposed Rule: dental amalgam discharge into POTWs (EPA with separators) (lbs.)	Proposed Rule: POTWs discharge into surface waters* (particle size) (lbs.)	Proposed Rule: Reduction in discharge into surface water (Alt. 3) (lbs.)
2015	8,800	440	8,800	880	0
2016	8,474	424	8,800	880	0
2017	8,161	408	8,800	880	0
2018	7,859	393	157	157	236
2019	7,568	378	151	151	227
2020	7,288	364	146	146	219
2021	7,018	351	140	140	211
2022	6,759	338	135	135	203
2023	6,509	325	130	130	195
2024	6,268	313	125	125	188
2025	6,036	302	121	121	181
2026	5,813	291	116	116	174
2027	5,598	280	112	112	168
2028	5,390	270	108	108	162
2029	5,191	260	104	104	156
2030	4,999	250	100	100	150

COST-EFFECTIVENESS ANALYSIS

As noted above, the EPA provides no empirical benefits estimate. It does, however, perform a cost-effectiveness calculation. Although the cost effectiveness exercise provides a toxic weighted pound-equivalents (TWPEs) estimate of whether the costs associated with reducing mercury emissions from this rule is similar to other rules that seek to lower pollutant emissions, the exercise does not estimate the costs-effectiveness of achieving particular improved health and other environmental outcomes.

Given that the proposed rule reduces mercury discharge to surface waters by a maximum of 236 pounds in its first year—and not the 860 pounds reported in by the EPA—the EPA's cost-effectiveness analysis must also be reevaluated. The reduction of discharge is 27 percent of what is reported in the EPA's NPRM.[22] Following the methodology used by the EPA to estimate cost effectiveness, I recreated Table 12-3 and Table 12-4 from the NPRM using values that are 27 percent of those used in the NPRM.

22. This is the 236 pounds estimated by the author for 2018 divided by the 860 pounds estimated by the EPA. The proposed rule results in smaller discharge reductions in subsequent years.

Table 12-3 Adjusted: Total Incremental Pound-Equivalents Removed from Surface Water Discharges

Pollutant	Incremental Removals from Baseline (lbs/yr)	Toxic Weighting Factors	Incremental Removals from Baseline (lb-eq/yr)
Total mercury	233	32	27,283
Silver	195	4	3,212
Tin	89	0	27
Copper	45	0	29
Zinc	10	0	1
Total	30,551	0	0

Table 12-3 Adjusted shows that the total incremental pound equivalent is now 30,551 pounds for all metals including the 27,283-pound equivalent reduction in mercury. Using the pre-tax annualized costs reported in 12-4, this smaller reduction results in an estimated average cost-effectiveness measures of $753 and $687, in 1981 dollars. (See Table 12-4 Adjusted for the calculation.) According to the NPRM, "[a] review of approximately 25 of the most recently promulgated or revised categorical pretreatment standards found that PSES cost effectiveness ranges from approximately $1 per lb-equivalent (Inorganic Chemicals) to $380 per lb-equivalent (Transportation Equipment Cleaning) in 1981 dollars." The values of $753 and $687 place the proposed rule well outside the range of cost-effectiveness.

Table 12-4 Adjusted: PSES Cost-Effectiveness Analysis

Dental office distribution data source	Pre-Tax Total Annualized Costs ($1981)	Removals (lbs-eq)	Average Cost- Effectiveness ($198a1)
ADA National Survey	$23,000,000	30,551	$753
ADA Colorado Survey	$21,000,000	30,551	$687

SUGGESTED IMPROVEMENTS FOR HOW TO MEASURE COSTS

The proposed rule also uses an odd methodology to generate the estimated costs. To determine the costs associated with installing and operating a separator, the EPA first assumes the installation costs will be $250.[23] Then the proposed rule looks at the costs of purchasing and operating separators of various sizes. The size of separator appropriate for a given office is then assumed to be a function of the number of dentist chairs. The proposed rule then looks at two state-level surveys of dental offices to estimate the distribution of dentist chairs per office. Using the distributions of chairs per office, the EPA estimates the costs of purchasing and operating the properly sized separators by the number of chairs and then sums up these costs to estimate the overall costs realized by dental offices.

Yet the appropriate size of separator is likely to be more closely aligned with the number of amalgam procedures and not the number of dentist chairs. The EPA could improve its cost estimates by looking at the number of procedures involving amalgam.

Moreover, the EPA could also improve its cost measures if it looked at how dentists responded to state regulations, such as those in Massachusetts, of dental amalgam. For instance, did dentists use fewer chairs for mercury amalgam procedures after being required to use amalgam separators? How did these state regulations affect wait time? How did these regulations affect the cost of the procedures? Did dental offices merge in response to these requirements? What fraction of dentists switched to non-mercury alternatives? Did poorer patients find it more difficult to have dental work performed? A discussion of any of these would improve the proposed rule.

23. No citation is given for this value.

CONCLUSION

Under the authority of the Clean Water Act (CWA) of 1972, the EPA is proposing new technology requirements for all new and existing dental practices that use dental amalgam. Unfortunately, the EPA fails to provide a compelling case in support of the proposed rule, providing neither benefits nor good estimates of costs.

At a minimum, the EPA could improve its cost estimation by using the number of amalgam procedures as its baseline. In the draft of the proposed rule, the EPA uses the number of dental chairs to estimate costs a dental office faces when purchasing and operating the appropriately sized separators. Yet it is much more likely that the appropriately sized separator for an office will be based on how intensively its dentists uses dental amalgam.

To improve its analysis, the EPA should estimate the health and environmental benefits of the proposed rule. Without a measure of net benefits, the EPA is unable to determine whether this rule results in a positive net benefit for human welfare. The EPA should perform a thorough empirical analysis of how this estimated reduction in dental amalgam discharge into to surface water will improve neurological development and performance given the current methylmercury exposure and burden of residents of the United States.

The EPA should compare the effects of this rule with an improved dynamic baseline that accounts for the fact that many states and local governments continue to enact mandatory and voluntary programs to collect dental amalgam. The EPA should use a dynamic baseline much like the one suggested above that recognizes that the average annual decline in the number of dental amalgams inserted between 1992 and 2004 was 3.7 percent.[24]

The EPA should use more recent POTW mercury pass-through rate estimates instead of the 30 year-old estimate presented in the TEDD. Recent pass-through studies, along with the general recognition that particles that are not removed by separators will also likely be too small to be removed by POTW, show that the proposed rule will reduce mercury discharge by 236 to 264 pounds in its first year of implementation, not the 860 pounds estimated by the EPA.

Using these more recent estimates reveals that total annual costs of complying with the proposed rule is higher than the 25 most recent categorical pretreatment standards. Once these factors are taken into account, the proposed rule is not cost effective.

In closing the EPA would be well advised to consider holding off on issuing this dental amalgam rule until it is able to

1. estimate a quantitative measure of the health benefits associated with this rule;
2. create a dynamic baseline that includes updated mercury POTW pass-through rates and the declining use and release of dental amalgam;
3. compare the path of health improvements achieved under the proposed rule with the health improvements achieved under the dynamic baseline;
4. generate improved cost estimates; and
5. estimate the difference between the benefits, net of the dynamic baseline, with the improved cost estimates.

The improved analysis will likely reveal that voluntary action and state and local government policy are already solving much of the problem that this proposed rule seeks to address.

24. T. Beazoglou, S. Eklund, D. Heffley, J. Meiers, L. J. Brown, and H. Bailit, "Economic Impact of Regulating the Use of Amalgam Restorations," *Public Health Rep* 122 (2007):657–63.